

ATI Piston Actuator with Fisher™ NS2 Yoke

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Figure 1. ATI Actuator Assembly



Introduction

Scope of Manual

This manual provides installation, adjustment, maintenance, and parts list information for the Fisher ATI actuator (figure 1). Refer to separate instruction manuals for information regarding the control valve and accessories.



Do not install, operate, or maintain an ATI actuator with Fisher NS2 Yoke without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

ATI Piston Actuator

June 2023

Instruction Manual

D104304X012

Table 1. ATI Piston Actuator Specifications

SPECIFICATION	UNITS	ACTUATOR SIZE 80A	ACTUATOR SIZE 80C
Nominal Effective Piston Area	cm ²	2452	3425
	Inch ²	380	531
Acceptable Valve Stem Diameters	mm	31.8	
	Inch	1.25	
Maximum Allowable Output Thrust (Spring Force)	N	69,162	154,746
	lbf	15,549	34,790
Nominal (Maximum) Travel	mm	101.6 (114.3)	
	Inch	4.0 (4.5)	
Maximum Casing Pressure for Actuator Sizing	bar	5.52	
	psig	80	
Maximum Casing Pressure	bar	10.3	
	psig	150	
Temperature Range (FKM Seals)	°C	-29 to 204	
	°F	-20 to 400	

**Table 2. Actuator Mounting Bolt Torque Values
Using Nuclear Grade Anti-Seize Lubricant**

ACTUATOR SIZE	ACTUATOR MOUNTING STUD BOLT TORQUE	
	N•m	ft•lbf
ATI Actuator with Fisher NS2 80A Yoke	258	190
ATI actuator with Fisher NS2 80C Yoke ⁽¹⁾	929	685
1. Will require a calibrated torque-wrench up to 1,000 ft•lbf.		

Description

The Spring Return Extend (SRE) ATI Actuator with Fisher NS2 Yoke is a reverse-acting, spring-opposed piston actuator that is used for operation of PV69 DS100 control valve. The Spring Return Retract (SRR) ATI Actuator with Fisher NS2 Yoke is a direct-acting, spring-opposed piston actuator that is used for operation of PV14 DS104 control valve.

The NS2 actuator yoke construction and special yoke-to-bonnet bolting provides a high structural resonant frequency that is seismically qualified for PV69 AP1000, CAP1000, and CAP1400 nuclear applications, as well as PV14 DS104 CAP1400 nuclear applications.

Specifications

Tables 1 and 2 provide specifications for the ATI Actuator with Fisher NS2 Yoke discussed in this instruction manual. All torque values given are ±5% unless otherwise specified. See the actuator nameplate for specific information for your actuator.

Educational Services

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Maximum Pressure Limitations

The piston of the ATI actuator is pressure operated. This air pressure provides energy to compress the spring, to stroke the actuator, and move the piston away from or towards the valve. The following explanations describe the maximum pressure limits for an actuator. Refer to table 1 for maximum values.

WARNING

To avoid personal injury or parts damage, do not exceed the Maximum Pressures listed in table 1.

Exceeding any of the maximum pressures can result in uncontrolled movement of parts, damage to actuator parts and the control valve, and loss of control of the process. Use pressure-limiting or pressure-relieving devices to prevent casing pressure from exceeding these limits.

- **Maximum Casing Pressure for Actuator Sizing:** This is considered the standard full operating pressure. A full stroke of 4.0 inches of the valve is expected at this pressure. If a full stroke is not achieved, consult the troubleshooting section of this manual.
- **Maximum Casing Pressure:** If the Maximum Casing Pressure is exceeded, damage to the actuator might result.

Principle of Operation

The ATI actuator positions the valve plug in response to varying pneumatic loading pressure on the actuator. For the SRE actuator, the actuator stem moves up as the loading pressure is increased on the bottom of the piston. As the loading pressure is decreased, the spring forces the actuator stem down. For the SRR actuator, the actuator stem moves down as the loading pressure is increased on the top of the piston. As the loading pressure is decreased, the spring forces the actuator stem up.

The piston actuator has been selected to meet the requirement of the application and, in service, the actuator will produce full travel of the valve with the piston pressure as indicated on the nameplate.

Lifting Guidelines

WARNING

Failure to follow these lifting guidelines and accepted lifting and rigging practices could result in property damage and personal injury or death.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Only personnel trained in proper lifting and rigging practices shall perform valve/actuator assembly lifting, rigging and installation. Because each lift will be unique, the method of lifting the valve assembly, the correct location for attaching and lifting the valve assembly, and what the valve assembly will do when lifted shall be considered for each lift.

Lifting and rigging equipment used to lift, install or remove a valve assembly or component must be properly selected and sized for the weight and configuration of the valve assembly or component being lifted. The weight of the complete valve assembly, including attached accessories, must be taken in consideration for this purpose. The lifting and rigging equipment must be properly maintained and inspected for damage before each use.

If the valve is supplied with an actuator or handwheel, do not use the actuator or handwheel to lift the complete valve assembly. Lifting lugs attached to the actuator must not be used to lift the complete valve assembly unless clearly marked as being rated to support the complete valve assembly weight.

Lifting lugs or other lifting equipment attached to the valve or actuator must never be used to lift or support the weight of attached piping.

NOTICE

Care must be taken when lifting the valve/actuator assembly to ensure all accessories and tubing are not damaged in the process. Accessories and tubing may need to be removed prior to lifting to prevent damage and properly reinstalled before use. Protect valve flange faces, butt weld ends, and other connection surfaces from damage during lifting.

Lifting Valve/Actuator Assembly

To lift the valve assembly, ATI actuator and accessories, the assembly should not be lifted by the actuator alone. It is also necessary to place lifting slings around the inlet and outlet of the valve body for lifting. Use padding as needed to protect any painted surfaces. The valve/actuator assembly can be lifted using a hoist capable of leveling the lifting points.

Lifting Valve Only

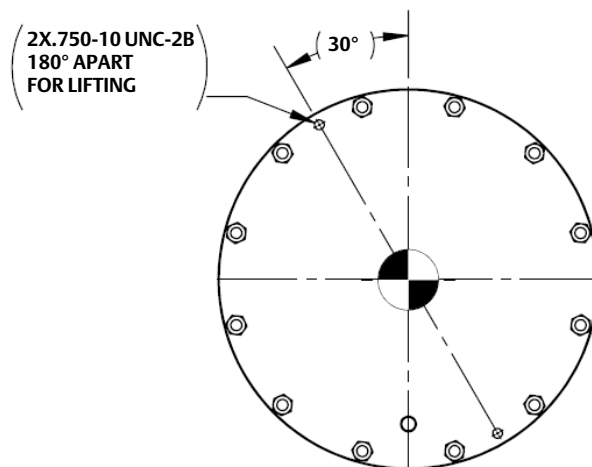
For guidance on lifting only the valve, please refer to the instruction manual for the applicable valve.

Lifting Actuator Only

The ATI L264.5SRE80 actuator with accessories may be lifted using the lifting ears located on the upper cartridge. The load rating for these lifting ears is 28.7 kN (6,400 lbf) and should not be exceeded. A single hoist lift point on the strap or chain will balance and lift the actuator, keeping it level. Use padding as needed to protect any painted surfaces.

The ATI L224.5SRR80 actuator with accessories may be lifted using appropriately rated hoist rings threaded into the two 3/4-10 UNC threaded holes provided in the upper head, see figure 2. The load rating for these threaded holes is 10,000 lbf (44.8 kN) combined and should not be exceeded. A single hoist lift point on the strap or chain will balance and lift the actuator, keeping it level. Use padding as needed to protect any painted surfaces.

Figure 2. Direct-Acting Piston Actuator (SSR) Top View



Installation

The actuator is normally shipped mounted on the valve body. Follow the applicable EWNS or HPNS valve instruction manual when installing the control valve in the pipeline. For information on mounting valve accessories, refer to the appropriate valve accessories instruction manual.

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

If the control valve and actuator are installed with the actuator in any position other than vertical, the actuator may not conform with safety-related qualifications. Certain nonvertical orientations can cause water to collect in the yoke and actuator spring areas, eventually causing degradation in product performance.

Note

The ATI actuator with Fisher NS2 yoke is intended to mount directly to the valve bonnet.

Mounting the Actuator on the Valve

NOTICE

The ATI SRE actuator spring load pushes the stem down out of the actuator yoke, and it can contact the valve stem during actuator mounting. It is possible to damage valve stem threads or bend the valve stem.

It may be necessary to apply a temporary loading pressure to the actuator to move the actuator stem away from the valve during installation. See the Disassembly section of this manual.

⚠ WARNING

When moving the actuator stem with loading pressure applied, exercise caution to keep hands and tools out of the actuator stem travel path. If the loading pressure is accidentally disconnected, personal injury and property damage may result if something is caught between the actuator stem and other control valve parts.

Adjustments

Bench Set

The ATI Assembly has a pre-loaded spring; therefore, there is no bench set adjustment.

Installing the Travel Limit Switch Bracket

Refer to figure 3 when installing the limit switch targets.

1. Apply Loctite® 242 (key 185) to hex cap screws (key 147).
2. Attach the proximity switch target mounting bracket (key 148) to the stem connector half (key 103B) using the hex cap screws (key 147) and washers (key 146).
3. Center the bracket vertically on the stem connector and tighten the hex cap screws, torque to 23 N • m (17 ft • lbf).
4. Adjust the travel scale vertically to align the closed mark on the scale with the pointer on the bracket and tighten the mounting screws.

⚠ WARNING

To avoid personal injury due to the sudden, uncontrolled movement of parts, do not loosen the cap screws (key 103C) when the stem connector has spring or loading pressure force applied to it.

Operation

In a SRE, an increasing loading pressure causes the actuator stem to move upward, compressing the spring. In the event of failure of the loading pressure to the piston of the actuator, the actuator stem moves to the extreme downward position, closing the valve.

In a SRR, an increasing loading pressure causes the actuator stem to move downward, compressing the spring. In the event of failure of the loading pressure to the piston of the actuator, the actuator stem moves to the extreme upward position, opening the valve.

The nameplate attached to the top of the piston provides information about the specific construction and operating range of the actuator.

When the control valve and actuator are installed, the actuator should be checked for correct travel, freedom from excessive friction, and correct action (air-to-open or air-to-close) to match the controlling instrument. For successful operation, the actuator stem and valve plug stem must move freely in response to the loading pressure change on the piston.

Maintenance

It is recommended that the ATI assembly be replaced every 10 years.

All maintenance operations can be performed with the valve in the line.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve, as much as possible, any actuator spring precompression.

- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Replacement of Elastomeric Parts

The ATI actuator assembly contains elastomeric parts; however, these parts cannot be repaired or replaced. Instead, the entire actuator assembly is replaced after the qualified life of 10 years.

Disassembly

ATI Piston Actuator with Fisher NS2 Size 80 Yoke

Key number references are shown in figures 3 and 4.

The ATI/Yoke Piston Actuator Assembly is manufactured as an assembly as shown in figure 3. This assembly should be replaced every 10 years.

Instructions are given below for removal of the ATI piston actuator assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin reassembly at the appropriate step.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve, and drain the process media from both sides of the valve. Shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

Note

The piston actuator spring compression is pre-set; therefore, there is not a way to act against the spring before disassembly of the stem connector assembly (key 103) without the use of controlled air.

2. Remove the limit switches and set aside.

NOTICE

It is advised to remove or protect the limit switches when working around them. Inadvertent contact can cause damage.

3. Remove the tubing or piping up from the solenoid to the piston actuator regulator. Construct a portable regulator assembly shown in figure 4 and connect it to the piston actuator input (3/4 inch NPT). This will be used during disassembly and lifting of the actuator assembly in the following steps.
4. Mark a line with a suitable marker just below the locknuts (key 115) on the valve stem. This will help in assembly of the stem-connector assembly (key 103). Loosen the locknuts (key 115) down away from the stem connector assembly (key 103).
5. Using the portable regulator assembly, reset the output pressure of the regulator to 0 psig, then open the three-way valve to the piston actuator and open the isolation ball valve to the plant air.

6. For the SRE actuator, dial up the regulator output pressure until the stem connector (key 103) just barely begins to move up. For the SRR actuator, increase the pressure until the plug is seated, then back off on the pressure until the stem connector (key 103) just barely begins to move up. At this pressure the valve plug is off the main seat and the compression is relieved from the stem connector assembly (key 103).
7. Prior to disassembly of the stem connector assembly (key 103), make a mark with a suitable marker just above the stem connector (key 103) on the piston actuator piston rod. This will aid in reassembly to ensure that proper travel and seat-load is achieved on the main seat.

⚠ WARNING

To avoid personal injury due to the sudden, uncontrolled movement of parts, do not loosen the cap screws when the stem connector (key 103) when spring force is applied without the aid of control air.

8. With controlled air to the casing, loosen the stem connector cap screws (key 103C). Remove the stem connector nut-half (key 103B) leaving the magnet target assembly (key 148) in place, if possible. Remove the stem connector bolt half (key 103A) and feedback arm. Carefully follow the positioner disassembly instructions for any feedback arm used on the stem connector. Set aside.
9. Loosen the yoke-to-bonnet bolting (keys 101 and 102). Remove nuts (key 102) and washers (key 143).

⚠ WARNING

Release of air from the actuator will cause movement of the actuator stem, to avoid personal injury and property damage, keep hands and tools out of the actuator stem travel path.

10. Lift actuator off the valve by following the recommendations in the Lifting Guidelines section. Shutoff control air and vent air from piston actuator. Reset portable regulator, secure and disconnect air hose.

Assembly

ATI Piston Actuator with Fisher NS2 Size 80 Yoke

The ATI/Yoke Piston Actuator Assembly is manufactured as an assembly as shown in figure 3. This assembly should be replaced every 10 years.

Instructions are given below for remounting of the ATI piston actuator assembly. Begin assembly at the appropriate step.

1. Ensure that the locknuts (key 115) are screwed down on the valve stem. If a mark was made from disassembly, use this as a guide at step 17 of this section.
2. Coat the threads of the actuator mounting studs (key 101) with Nuclear Grade anti-seize lubricant (key 27) up to the deformed thread. Thread the actuator mounting studs (key 101) into the valve bonnet until the deformed thread prevents further insertion.
3. Connect the portable regulator assembly to the piston actuator as shown in figure 4.
4. Using the portable regulator assembly, make sure the adjusting screw of the regulator is completely backed out to ensure that the regulator outlet pressure will be 0 psig when supply pressure is introduced, then open the three-way valve to the piston actuator. Open the isolation ball valve to supply plant air to the regulator.
5. For SRE actuators, increase the regulator output pressure until the stem connector (key 103) moves all the way up into the piston actuator (fully retracted) but do not exceed the Maximum Casing Pressure listed in table 1. SRR actuators will be fully retracted without air.

6. Lower the ATI Actuator assembly onto the mounting studs (key 101), make sure that the Fisher logo on the yoke is aligned to the Fisher logo on the valve body.

Note

The following two steps require a calibrated torque wrench up to 1356 N•m (1,000 ft•lbf) for SRE actuators and up to 407 N•m (300 ft•lbf) for SRR actuators. It is helpful to number the studs (key 101)/nuts (key 102) from 1 to 12 to accurately torque the studs.

7. Coat the remaining threads of the actuator mounting studs (key 101) and the contact faces of the nuts (key 102) with Nuclear Grade anti-seize lubricant (key 27). Place the washers (key 143) over the studs (key 101) and thread the nuts (key 102) onto the studs (key 101) and hand tighten. Torque the actuator mounting nuts (key 102) in a criss-cross pattern in increments of 25% up to the full actuator mounting bolt torque value listed in table 2.
8. Check the torque of nuts by performing one (1) circular pattern to applicable actuator mounting torque in table 2.

WARNING

Release of air in the actuator will cause sudden movement of the actuator piston. Do not place hands or any body parts between the valve stem and the piston rod, as this can cause severe injury.

9. To ensure that the valve plug is fully seated, place a flat metal block at least 1 inch thick or use a flat section of the bolt half (key 103A) on its side on the top of the valve stem between the stem and the piston rod.
10. Using the portable regulator and the air venting valve in figure 4, slowly release air of the piston actuator (SRE) or increase the regulator output pressure (SRR) to extend the piston and push down on the valve stem to ensure that the valve plug is seated. Immediately stop when the valve stem ceases movement.
11. Dial the air back up (SRE) or down (SRR) until the piston is fully retracted.
12. Remove the metal block or bolt half used in steps 9 and 10.
13. Using a measuring device next to the piston, slowly extend the piston from the actuator until the piston travels to 4.00-3.95 inches (Do not exceed 4.00 inches). Hold this pressure (piston position) of the actuator for the next steps. There should be a gap between the piston rod and the valve stem.

NOTICE

Piston travel greater than 4.00 inches will result in lower seating force on the valve plug from reduced spring force.

Piston travel less than 3.95 inches may result in an excessive gap between the piston rod and valve stem, which can result in less-than-full thread engagement on the valve stem and possible thread damage.

14. Connect the nut half (key 103B) and the bolt half (key 103A) with the cap screws (key 103C) of the stem-connector to the valve stem and the connector rod, ensuring to align the nut half in the guide notch of the yoke. If there are marked lines from disassembly on the stem and piston rod, use these as guides. If there are not marks, ensure that the stem connector (key 103) threads are fully engaged on the valve stem as a minimum. Some threads can be unused and visible on the piston rod.

NOTICE

Care should be used when engaging the threads, any cross-threading should be avoided, as this may require replacing the ATI assembly or the valve stem assembly. If cross-threading has occurred, contact your [Emerson sales office](#) for guidance.

Note

To avoid cross-threading, ensure that the bolt half (key 103A) threads are engaged by pressing against the threaded piston rod as the first step in tightening, then align the nut half (key 103B) to the other side. While holding these together start the cap screws (key 103C) and tighten evenly.

Manual clamps can be used to assist in holding the stem connector halves together.

The gap between the bolt half (key 103A) and the nut half (key 103B) should be the same on both sides of the threads as the cap screws (key 103C) are tightened. If there is misalignment visible, or it appears that the threads are not engaged, restart the previous step to avoid cross-threading.

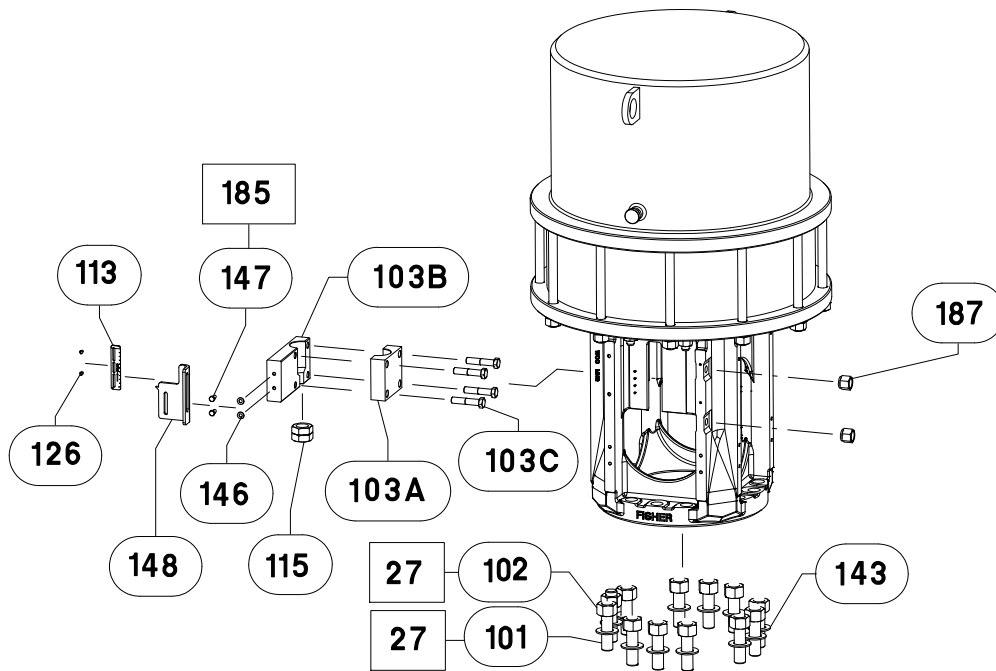
15. Tighten the cap screws (key 103C) evenly until just finger tight.
16. With the two bottom cap screws (key 103C) tight, remove the top cap screws and attach the feedback bracket to the stem connector bolt half (key 103A) with the cap screws (key 103C) and retighten. Torque the cap screws (key 103C) to 176 N•m (130 ft•lbf) in a criss-cross pattern. Carefully follow the positioner assembly instructions for any feedback arm used on the stem connector.
17. Screw the valve stem locknuts (key 115) up until the upper one contacts the bottom of the stem connector assembly (key 103). If a mark was made from disassembly, use this as a guide. Tighten until finger tight. Do not overtighten the locknuts.
18. Attach the travel scale (key 113) to the yoke using the pan head machine screws (key 126). Leave the screws finger-tight; they will be tightened after adjustment of the travel scale.
19. If not already attached, attached the target assembly per Installing the Travel Limit Switch Targets sections and align the travel scale.
20. Test the functionality of the limit switches and adjust as necessary. If significant changes to the position of the magnets appear necessary, then check the piston travel as it is likely that the travel measurement of the piston rod or thread engagement was not done properly.
21. Release pressure from the casing. Remove the portable regulator assembly.
22. Attach the air tubing provided to connect the solenoid valve to the piston actuator.

Troubleshooting

Table 3. ATI Actuator Troubleshooting

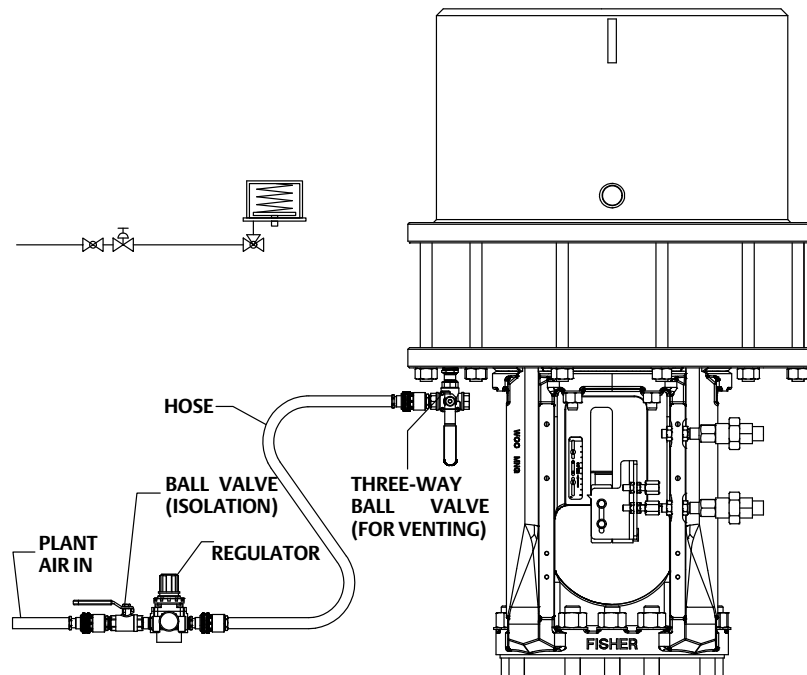
Problem	Possible Solution
Actuator Stroke is less than full rated travel	Ensure all parts are intact and assembled as specified.
	Check for debris or damaged parts that may be jamming actuator.
	Ensure stem connector is assembled as specified.
	Inspect valve, see EWNS instruction manual (D103551X012) or HPNS instruction manual (D103466X012).
Air leakage	Check for tightness of fittings.
	If leakage is from ATI seals, replace ATI assembly.
	Ensure stem connector is assembled as specified.
	Inspect valve, see EWNS instruction manual (D103551X012) or HPNS instruction manual (D103466X012).
Other	Inspect all air connections for leakage
	Contact Emerson sales office if more assistance is needed.

Figure 3. Fisher Size 80 Yoke/ATI Assembly



E1711

Figure 4. Fisher Size 80 Yoke/ATI Disassembly/Assembly Air Connection



E1712

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always refer to this serial number when corresponding with your [Emerson sales office](#) regarding replacement parts or technical information.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Key	Description	Part Number	Key	Description	Part Number
			103C	Hex Cap Screw, Stem Connector	see following table
			113	Travel Scale	see following table
			115	Hex Nut, Valve Stem	see following table
			126	Machine Screw, Travel Scale	see following table
			143	Washer, Mounting Stud	see following table
			146	Washer, Pointer	see following table
			147	Shoulder Screw, Pointer	see following table
			148	Travel Pointer, Bracket	see following table
			185	Loctite 242	see following table
			187	Adapter Switch	see following table
27	Nuclear Grade Anti-Seize Lubricant				
101	Stud, Mounting	see following table			
102	Nut, Mounting	see following table			
103A	Stem Connector Bolt Half	see following table			
103B	Stem Connector Nut Half	see following table			

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Table 4. ATI Assembly with Fisher NS2 Size 80A and 80C Yoke

ACTUATOR SIZE	VALVE SIZE, NPS	PART NUMBER
ATI with 80A NS2 Yoke	10x14	GH10437X022
ATI with 80C NS2 Yoke	20x16	GE86793X022
	22x16	GE86793X042

Table 5. Keys 101 and 143 Yoke Mounting Studs and Washers

ACTUATOR SIZE	VALVE SIZE, NPS	QUANTITY	STUD SIZE, INCH	KEY 101 MOUNTING STUD PART NUMBER	MATERIAL	KEY 143 WASHER PART NUMBER	
80A	10x14	12	3/4-10x4.50	1N6604X0242	SA 193 B7	1A375738982	
80C	20x16		1-1/8-8x5.25	10A7290X102		GA25577X032	
	22x16						

Table 6. Keys 102 Yoke Mounting Nuts

ACTUATOR SIZE	VALVE SIZE, NPS	QUANTITY	STUD SIZE, INCH	PART NUMBER	MATERIAL
80A	10x14	12	3/4-10	1A3520X1652	SA 192 2H
80C	20x16		1-1/8-8	1A4452X6132	
	22x16				

Table 7. Key 103 Stem Connector Assembly

ACTUATOR SIZE	VALVE SIZE, NPS	VALVE STEM SIZE, INCH	ASSEMBLY PART NUMBER
80A	10x14	1-1/4	GH10675X032
80C	20x16		GG08592X012
	22x16		

Table 8. Key 113 and 126 Travel Scale and Machine Screw

ACTUATOR SIZE	VALVE SIZE, NPS	VALVE TRAVEL	KEY 113 TRAVEL SCALE PART NUMBER	KEY 126 MACHINE SCREW PART NUMBER
		Inch		
80A	10x14	4	1U372738982	1A3431X0012
80C	20x16			1A3408K0012
	22x16			

Table 9. Key 115 Hex Nut, Valve Stem

ACTUATOR SIZE	VALVE SIZE, NPS	PART NUMBER
80A	10x14	0W0735X0022
80C	20x16	
	22x16	

Table 10. Keys 146, 147, 148, and 187 (Pointer Washer, Pointer Hex Cap Screw, Travel Pointer, Adaptor Switch)

ACTUATOR SIZE	VALVE SIZE, NPS	KEY 146 POINTER WASHER PART NUMBER	KEY 147 POINTER HEX CAP SCREW PART NUMBER	KEY 148/ KEY 208 TRAVEL POINTER PART NUMBER	KEY 187 ADAPTOR SWITCH PART NUMBER
80A	10x14	1B8659X0042	GE56486X012	GH10671X042	GE56473X012
80C	20x16			GG08595X032	
	22x16				

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Fisher™ Baumann™ 24000 Bronze Control Valve



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Section 1: Introduction

Fisher Baumann industrial control valves (Figure 1) are intended for general utility service in pressure, flow and temperature control applications.

Industrial grade control valves exhibit low hysteresis and deadband, good control characteristics, tight shutoff, rugged construction, high performance packing and easy maintainability. This translates into reduced maintenance costs, reduced process variability and increased process availability.

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for the Fisher Baumann 24000 bronze control valve.



WARNING



Do not install, operate or maintain Fisher Baumann 24000 control valves without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. Fisher Baumann 24000 Control Valve with Fisher Baumann 32 Actuator and Fisher FIELDVUE™ DVC2000 Digital Valve Controller



W9753-1

Table 1. Technical Specifications

VALVE TYPE	EN	ASME
NOMINAL SIZE	DN 15, 20, 25, 40 and 50	NPS 1/2, 3/4, 1, 1-1/2 and 2
END CONNECTIONS	Screwed NPT	
PRESSURE RATING	400 psi at 150°F / 250 psi at 400°F (ASME B16.15 CL250)	
SEAT PLUG SEALING	Metal-to-metal or PTFE soft seat	
CHARACTERISTIC	Equal Percentage or Linear	
TEMPERATURE LIMITS	-29 to +204°C	-20 to +400°F
ACTUATOR	See Fisher Baumann 16, 32, 54 and 70 Pneumatic Actuators Bulletin D104175X012	

1.2 Education Services

Emerson's Education Services
 Phone: 800-338-8158
 Email: education@emerson.com
emerson.com/en/final-control/services/valve-training

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Because some valve body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

NOTE

The acronym of CWP may appear on the nameplate. CWP (Cold Working Pressure) denotes the pressure rating at normal ambient temperature. A normal ambient temperature range being -4 to +100°F / -20 to +38°C.

**WARNING**

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

NOTICE

To avoid damaging valve seating surfaces, make sure the adjacent piping is free of pipe scale, welding slag and any other potentially damaging material.

1. Before installing the valve in the pipeline, inspect the valve body to be certain it is free of foreign material and thoroughly clean the line of all dirt, welding chips, scale, oil or grease and other foreign material.
2. Install the valve so the controlled fluid will flow through the valve body in the direction indicated by the arrow cast on the valve body.
3. A three-valve bypass must be used to permit removal of the control valve from the line without shutting down the system.
4. In case of a heat-insulated installation, insulate the valve body only, not the bonnet.

2.1 Air Piping

1. For an air-to-extend actuator (air-to-close action), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open action) connect the actuating air pressure line to the 1/4 NPT to the lower diaphragm case.
2. Use 6.4 mm / 1/4 in. O.D. tubing or equivalent for all air lines. If air line exceeds 8 m / 25 ft in length, 9.5 mm / 3/8 in. tubing is preferred. Air pressure not to exceed 2.41 barg / 35 psig.

2.2 Disassembly

NOTICE

When assembling or disassembling the valve, do not turn the valve stem while the plug is in contact with the valve seat. This can damage the seating surface very quickly.

When adjusting the valve stem do not grip the stem directly with pliers or a wrench. This will damage the surface of the stem and cause damage to the packing in the valve. Instead, counter-tighten the two locknuts (key 27) on the stem (key 5) together. This will allow you to turn the stem by turning the locknuts (key 27) with a wrench.

When placing the valve in a vise, clamp the flat end faces of the valve. Do not try to clamp the rounded sides of the valve. This will ruin the valve.

Actuator Removal

Access to the internal components of the valve body can be accomplished with the actuator removed. For actuator maintenance see the Fisher Baumann Pneumatic Actuator Instruction Manual (D103352X012).

Air-to-Close Actuators

1. Disconnect air supply to the actuator and remove air tubing.
2. Loosen drive nut (key 9) and then remove plug and stem (keys 4 and 5) assembly by holding actuator stem still while unthreading plug and stem assembly counterclockwise.
3. Remove stem locknuts (key 27), travel indicator (key 58) and yoke drive nut (key 9).
4. Remove actuator from valve.
5. Disconnect air supply to actuator and remove air tubing.

Air-to-Open Actuators

1. Using flexible tubing, apply sufficient air pressure to the actuator to lift the plug off the seat.
2. Loosen drive nut (key 9) and then remove plug and stem (keys 4 and 5) assembly by holding actuator stem still while unthreading plug and stem assembly counterclockwise.
3. Remove stem locknuts (key 27), travel indicator (key 58) and yoke drive nut (key 9).
4. Remove actuator from valve.
5. Disconnect air supply to actuator and remove air tubing.

Valve Body Disassembly

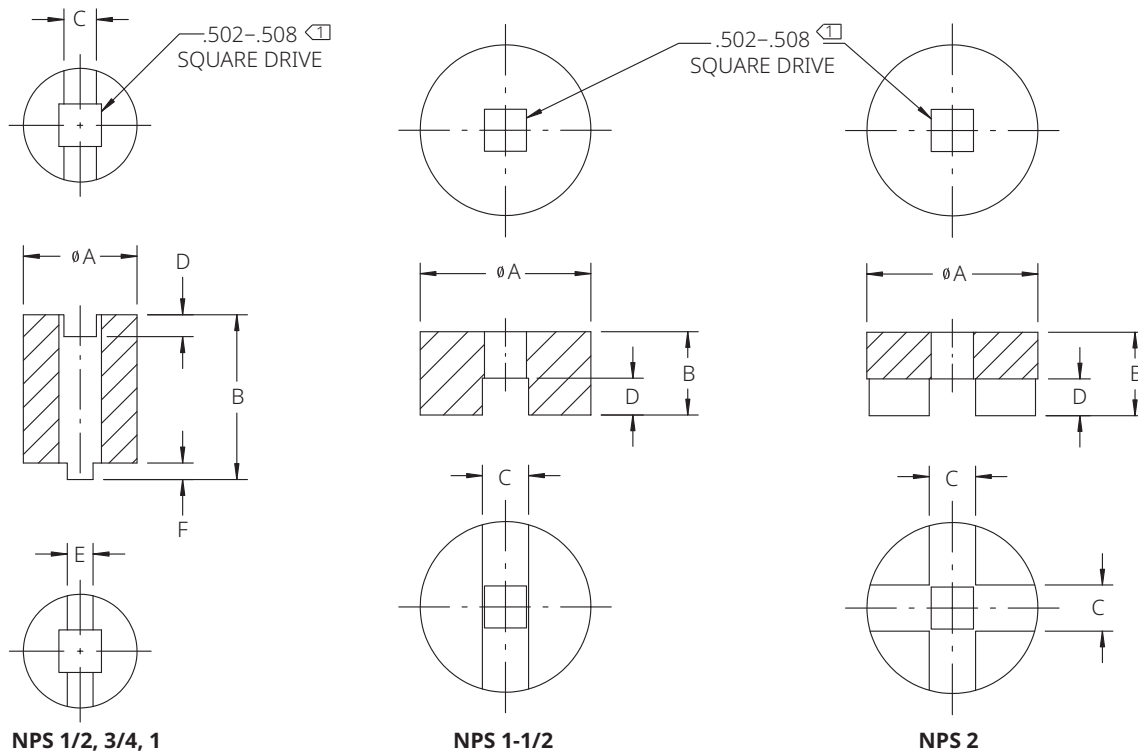
1. After removing the actuator, unscrew bonnet (key 8) and plug and stem (keys 4 and 5) from valve body (key 1). A new body gasket (key 49) should be installed each time the valve is disassembled.
2. Loosen packing spring load by removing the packing follower (key 10).
3. Remove the plug and stem assembly by pulling it out through the bottom of the bonnet (key 8) while rotating the stem (key 5). This will help prevent damage to the packing components.

NOTE

Handle the parts carefully to avoid damaging the seating and guiding surfaces. Wipe the parts with a clean soft cloth and examine for signs of wear or damage.

4. Use a seat ring tool made according to the dimensions in Figure 2 and Table 2 to remove the seat ring (key 2) as follows:
 - a. Insert the tool into the valve body. Be certain the tool lugs are engaged in the corresponding recesses in the seat ring.
 - b. Use a 1/2-in. drive breaker bar or impact wrench having sufficient torque capability to remove the seat ring. Seat ring installation torque is provided in Table 3 for reference. Connect the breaker bar or impact wrench and if needed, a impact-rated extension bar, to the square drive of the seat ring tool.
 - c. Remove the seat ring (key 2) from the valve body. Make sure the seat ring tool is held at a right angle to the seat ring during removal to prevent the tool from disengaging from the lugs of the seat ring.
 - d. Inspect parts for wear or damage that would prevent proper operation of the valve body.

Figure 2. Seat Ring Tool Dimensions



NOTE:
1. MAX ALLOWABLE CENTER DRILL $\varnothing$ 0.532

Table 2. Seat Ring Tool Dimensions (See Figure 2)

PART NUMBER	DN	NPS	A	B	C	D	E	F
			in.					
GE96219X012	15 20	1/2 3/4	1.32	2.0	0.38	0.26	0.29	0.19
GE96219X022	25	1	1.52	2.3	0.40	0.25	0.35	0.20
GE96219X032	40	1-1/2	2.06	0.9	0.55	0.30	---	---
GE96219X042	50	2	2.74	1.0	0.55	0.44	---	---

Table 3. Seat Ring Assembly and Torque Tool

FISHER BAUMANN 24000 BRONZE CONTROL VALVE		VALVE SIZE NPS (IN.) / DN				
		1/2 / 15	3/4 / 20	1 / 25	1-1/2 / 40	2 / 50
Port Diameter	0.25 ⁽¹⁾	GE96219X012	GE96219X012	GE96219X022	---	---
	0.375 ⁽¹⁾	GE96219X012	GE96219X012	GE96219X022	---	---
	0.8125 ⁽²⁾	GE96219X012	GE96219X012	GE96219X022	---	---
	1.0625 ⁽²⁾	---	---	GE96219X022	---	---
	1.25	---	---	---	GE96219X032	---
	1.5	---	---	---	GE96219X032	GE96219X042
	2	---	---	---	---	GE96219X042
Installation Torque (lb-ft)		60	60	70	90	120
1. Male end used for trim 151,177 and port diameters .25 and .375 2. Female end used for port diameters .8125 and 1.0625						

2.3 Lapping the Valve Seat

If valve seat leakage becomes excessive, it may be necessary to lap the valve seat.

Lapping is the process of mating the valve plug to the seat ring, with an abrasive to produce a close fit. When valve seat leakage becomes excessive, lapping becomes necessary. The plug and seat ring seating surfaces should be free of large scratches or dents and the contact surface of the seats should be as narrow as possible.

1. Use a good quality lapping compound with a mixture that contains 280 to 600 grit. Apply at several spots around the plug seating surface. Replace the plug (key 4) in the bonnet (key 8).
2. Screw the bonnet (key 8) loosely into the valve body (key 1) to serve as a guide during the lapping operation.
3. Lap the valve by applying a slight pressure on the stem and rotate the stem in short oscillating strokes approximately 8 to 10 times or until you see an even and complete lap line. The plug should be intermittently lifted and turned 90 degrees while lapping to keep the plug and seat ring concentric.
4. Clean the valve seat (key 2) and plug (key 4) thoroughly when the lapping is complete, removing all traces of lapping compound.

2.4 Replacing Packing

Refer to the standard and optional packing constructions (Figures 4 and 5) to determine the packing that has been preinstalled in your valve.

1. Disassemble the valve as directed earlier. Remove the locknuts (key 27) and indicator disk (key 58) and turn the plug stem (key 5) out through the packing box. Remove the packing box and packing. Push out the old packing by working from the underside of the bonnet (key 8).
2. For Standard Spring Loaded PTFE V-Ring Packing (Figure 4): Carefully insert each piece in exact order shown in Figure 4. Tighten the follower (key 10) until it shoulders on the bonnet (key 8). This will compress the packing spring (key 6) to enable constant stem sealing throughout packing life.
3. For Optional Molded Graphite Ribbon Packing (Figure 5): Carefully insert each piece in exact order shown in Figure 5. Hand tighten packing follower (key 10). Use a wrench to increase tightness by turning the nut an additional 60 degrees.

2.5 Actuator and Valve Body Reassembly

Before installing seat ring in valve body, thoroughly clean the threads in the valve body port. Apply suitable lubricate to the threads and tighten to torque specified in Table 3. Remove all excess lubricant after tightening.

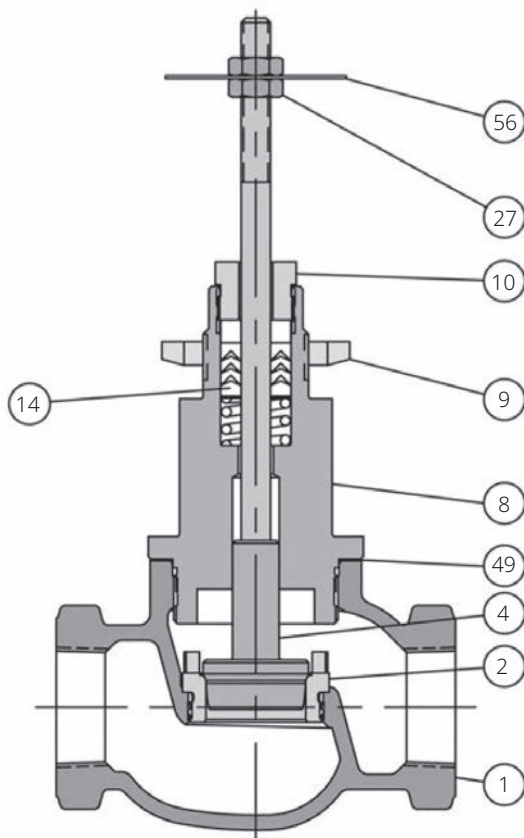
Insert a new valve body gasket (key 49) and install bonnet assembly (key 8). Place the actuator yoke over stem (key 5). While tilting actuator back, drop yoke drive nut (key 9) over stem (key 5). Run lock nuts (key 27) and travel indicator (key 58) down as far as possible and counter tighten locknuts (key 27) to lock.

Carefully position actuator over stem (key 5), lift plug stem and turn plug stem (key 5) into actuator stem as far as it will go before adjusting bench range. See the Fisher Baumann Pneumatic Actuator Instruction Manual (D103352X012).

NOTICE

When assembling or disassembling the valve, do not turn the valve stem while the plug is in contact with the valve seat. This can damage the seating surface very quickly.

Figure 3. Fisher Baumann 24000 Valve Body Assembly with Standard Bonnet and Standard PTFE Spring Loaded Packing



E1259

WARNING

To avoid personal injury or equipment damage due to possible sudden shifting or falling of the valve assembly, do not lift the valve by the handwheel.

Section 3: Maintenance



WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

NOTE

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

Section 4: Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name and desired material using the following parts tables.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

Table 4. Fisher Baumann 24000 Common Parts

Key No.	Qty	Description
1	1	Valve body
6*	1	V-ring packing set (Std)
8	1	Bonnet, Standard
9	1	Drive nut (Yoke)
10	1	Packing follower
27	2	Locknuts
49*	1	Valve body gasket
58	1	Travel indicator

*Recommended spare parts

Table 5. Plug and Seat Ring for NPS 1/2, 3/4 and 1 Valves

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _v	K _v
4*	Plug / Stem	Metal Seat, Micro Trim (Linear)	102	6.3 / 0.25	0.2 ⁽¹⁾	0.17 ⁽¹⁾
					1.0	0.86
		PTFE Seat (Equal %)	577	9.5 / 0.375	1.5	1.29
					2.5	2.15
					4	3.44
				20.6 / 0.8125	6	5.16
					7.5	6.45
					8.5	7.31
					13	11.18
		Metal Seat (Equal %)	548 (S41600)	6.3 / 0.25	0.2 ⁽¹⁾	0.17 ⁽¹⁾
					0.5 ⁽¹⁾	0.43 ⁽¹⁾
					1.0	0.86
				9.5 / 0.375	1.5	1.29
					2.5	2.15
					4	3.4
				20.6 / 0.8125	6	5.16
					8	6.88
					9	7.74
					13	11.18

- continued -

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

24000 Valve

Instruction Manual

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Table 5. Plug and Seat Ring for NPS 1/2, 3/4 and 1 Valves (continued)

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _V	K _V
4	Plug / Stem	Metal Seat (Equal %)	588	6.3 / 0.25	0.2 ⁽¹⁾	0.17 ⁽¹⁾
					0.5 ⁽¹⁾	0.43 ⁽¹⁾
					1.0	0.86
				9.5 / 0.375	1.5	1.29
					2.5	2.15
					4	3.4
				20.6 / 0.8125	6	5.16
					8	6.88
					9	7.74
					26.9 / 1.0625	13
		PTFE Seat (Linear)	677	9.5 / 0.375	0.1	0.086
					0.2	0.172
					0.5	0.43
					1.0	0.86
				2.5	2.15	
		20.6 / 0.8125	5	4.3		
		Metal Seat (Linear)	648 (S41600)	6.3 / 0.25	0.5	0.43
					1.0	0.86
				9.5 / 0.375	1.5	1.29
					2.5	2.15
					4	3.4
				6	5.16	
				8	6.88	
				9	7.74	
26.9 / 1.0625	13			11.18		
Metal Seat (Linear)	688			6.3 / 0.25	0.5	0.43
		1.0	0.86			
		9.5 / 0.375	1.5	1.29		
			2.5	2.15		
			4	3.4		
		6	5.16			
		8	6.88			
		9	7.74			
		26.9 / 1.0625	13	11.18		
2*	Seat Ring	6.3 mm / 0.25 in. Orifice Diameter, S31600				
		9.5 mm / 0.375 in. Orifice Diameter, S31600				
		20.6 mm / 0.8125 in. Orifice Diameter, S31600				
		26.9 mm / 1.0625 in. Orifice Diameter, S31600				
		6.3 mm / 0.25 in. Orifice Diameter, S41600				
		9.5 mm / 0.375 in. Orifice Diameter, S41600				
		20.6 mm / 0.8125 in. Orifice Diameter, S41600				
		26.9 mm / 1.0625 in. Orifice Diameter, S41600				
*Recommended spare parts 1. A matching seat ring (key 2) must be furnished with replacement plug orders for Micro Trim plug number 102 and plug number 548 and 588, C _V 's 0.2 and 0.5.						

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

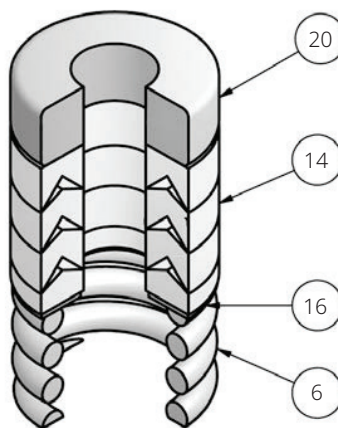
D103355X012

24000 Valve

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Table 6. Plug and Seat Ring for NPS 1-1/2 and 2 Valves

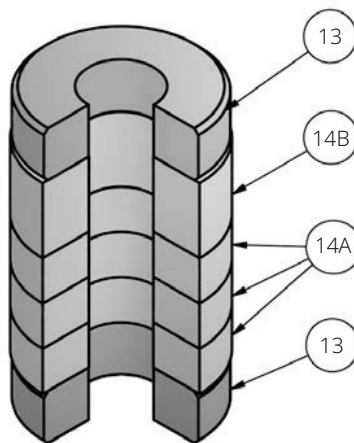
KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _v	K _v		
4*	Plug/Stem	PTFE Seat (Equal %)	577	31.8 / 1.25	20	17.2		
				38.1 / 1.50	10	8.6		
					17	14.62		
					28	24.08		
				50.8 / 2.0	30	25.8		
		PTFE Seat (Linear)	677	38.1 / 1.50	10	8.6		
					17	14.62		
				50.8 / 2.0	30	25.8		
					50	43		
		Metal Seat (Equal %)	548 (S41600)	31.8 / 1.25	10	8.6		
					20	17.2		
				38.1 / 1.50	10	8.6		
					17	14.62		
					28	24.08		
				50.8 / 2.0	30	25.8		
					50	43		
					Metal Seat (Equal %)	588	31.8 / 1.25	10
		20	17.2					
		38.1 / 1.50	10	8.6				
			17	14.62				
			28	24.08				
		50.8 / 2.0	30	25.8				
			50	43				
			Metal Seat (Linear)	648 (S41600)	31.8 / 1.25	20	17.2	
		10				8.6		
		38.1 / 1.50			17	14.62		
					28	24.08		
					50.8 / 2.0	30	25.8	
		50				43		
		Metal Seat (Linear)				688	31.8 / 1.25	20
					10			8.6
			38.1 / 1.50	17	14.62			
				28	24.08			
				50.8 / 2.0	30		25.8	
			50		43			
2*	Seat Ring		38.1 mm / 1.25 in. Orifice Diameter, S31600					
			38.1 mm / 1.50 in. Orifice Diameter, S31600					
		50.8 mm / 2.0 in. Orifice Diameter, S31600						
		38.1 mm / 1.25 in. Orifice Diameter, S41600						
		38.1 mm / 1.50 in. Orifice Diameter, S41600						
		50.8 mm / 2.0 in. Orifice Diameter, S41600						
*Recommended spare parts								

Figure 4. Spring Loaded PTFE V-Ring Packing Kit, P/N 24494T001

E1240

Table 7. Spring Loaded PTFE V-Ring Packing Kit, P/N 24494T001

Key No.	Description	Material
6	Spring	ASTM A313 S30200
14	Packing set	PTFE/Carbon-filled PTFE
16	Washer	ASTM A240 S31600
20	Spacer	J-2000 (filled (Polytetrafluoroethylene))

Figure 5. Molded Graphite (Flexible Graphite) Packing Kit, P/N 24492T001

E1241

Table 8. Molded Graphite (Flexible Graphite) Packing Kit, P/N 24492T001

Key No.	Description	Material
13	Bushing, qty 2	Carbon-Graphite
14A	Packing rings, qty 3	Graphite
14B	Packing ring	Graphite

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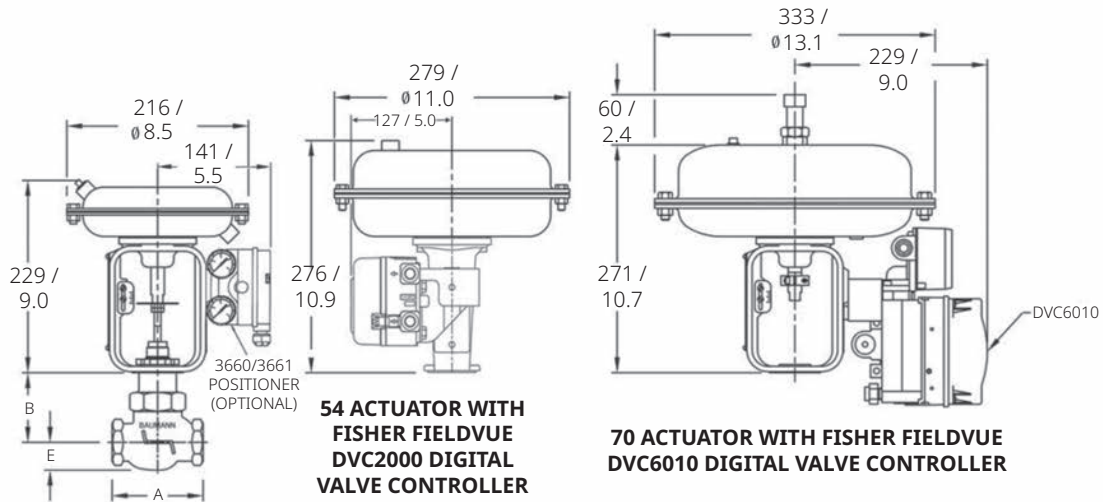
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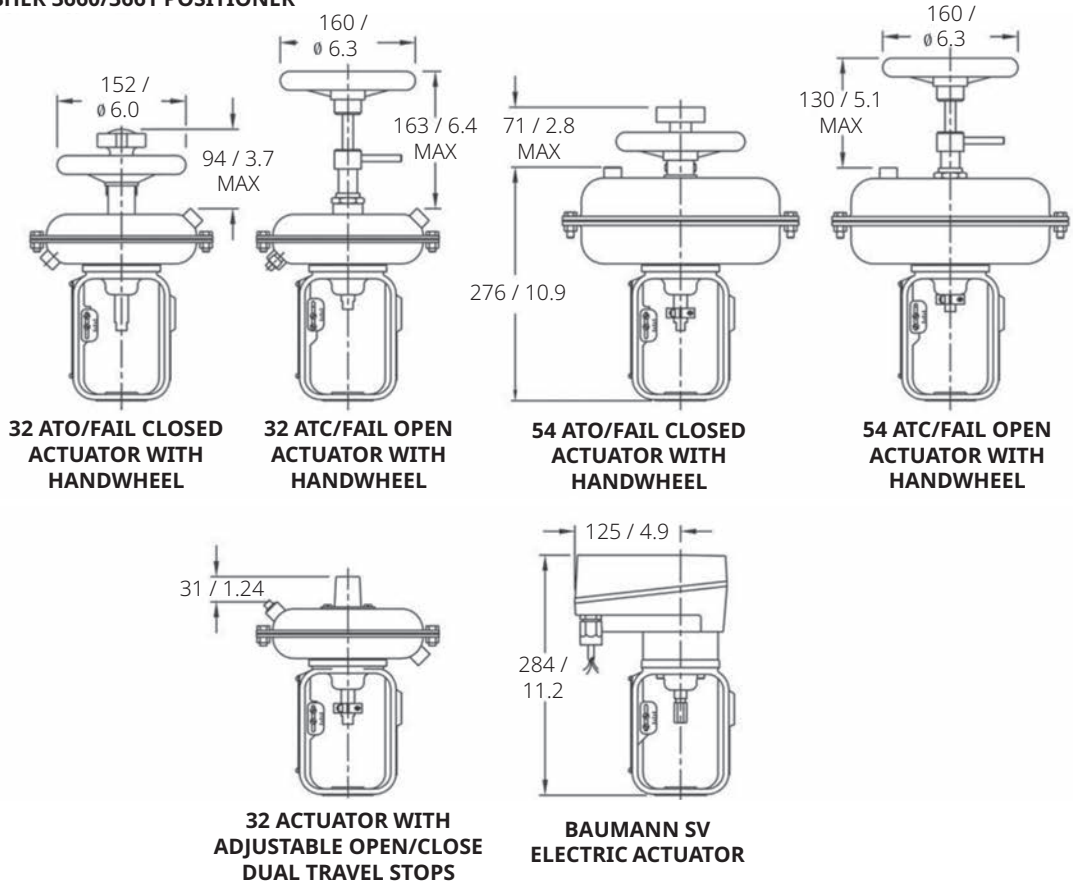
24000 Valve

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Figure 6. Dimensional Drawings



24000 WITH 32 ACTUATOR AND FISHER 3660/3661 POSITIONER



E1262

MM / IN.

NOTE:
ACTUATOR REMOVAL REQUIRES 115 MM / 4.5 IN. VERTICAL CLEARANCE.

Table 9. Fisher Baumann 24000 Valve Dimensions

VALVE SIZE		A VALVE BODY		B BONNET		E	
DN	NPS	mm	in.	mm	in.	mm	in.
15	1/2	89	3.5	78	3.1	27	1.06
20	3/4	89	3.5	78	3.1	27	1.06
25	1	109	4.3	83	3.3	33	1.3
40	1-1/2	137	5.4	99	3.9	46	1.8
50	2	168	6.6	104	4.1	58	2.3

Table 10. Fisher Baumann 24000 Valve Assembly Weights

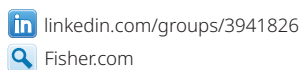
VALVE SIZE		WEIGHT	
DN	NPS	kg	lb
15	1/2	1.6	3.5
20	3/4	1.6	3.5
25	1	2.3	5.0
40	1-1/2	4.9	10.9
50	2	8.9	19.7

Table 11. Fisher Baumann Actuator Weights

ACTUATOR TYPE	WEIGHT	
	kg	lb
32	4.5	10
54	11.3	25
70	15.4	34
CML-250 ⁽¹⁾	8.3	18
CML-750 ⁽¹⁾	11.5	25
SVX-LIL (non spring return)	1.3	3
SVK-FO or SVK-FC ⁽¹⁾ (spring return)	1.6	4
1. Electric actuators, reference CML Electric Actuator for Fisher Baumann 24000 Series Bulletin 52.1:ECV (D103347X012) for additional information.		

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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FISHER™



Fisher™ Baumann™ 24000C Carbon Steel Control Valve



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Section 1: Introduction

Fisher Baumann 24000C carbon steel industrial control valves (Figure 1) are intended for general utility service in pressure, flow and temperature control applications.

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for the Fisher Baumann 24000C control valve.

WARNING



Do not install, operate or maintain Fisher Baumann 24000C control valves without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. 24000C Control Valve with Fisher Baumann 32 Actuator



w9743-1

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact your [Emerson sales office](#) for more complete specifications. Provide the product serial numbers (shown on the nameplate) and all other pertinent information.

NOTE

The acronym of CWP may appear on the nameplate. CWP (Cold Working Pressure) denotes the pressure rating at normal ambient temperature. A normal ambient temperature range being -4 to +100°F / -20 to +38°C.



WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

1.2 Education Services

Emerson's Education Services

Phone: 800-338-8158

Email: education@emerson.com

emerson.com/en/final-control/services/valve-training

Section 2: Maintenance

WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

NOTE

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

WARNING

Avoid personal injury or property damage by thoroughly cleaning the line of all dirt, welding chips, scale, oil or grease and other foreign material. Failure to do so could result in damage to the seating and sealing surfaces of the valve and result in damage to the valve and release of process materials.

Section 3: Installation

Refer to key numbers in Figure 3 unless otherwise specified.

1. Before installing the valve in the pipeline, thoroughly clean the line of all dirt, welding chips, scale, oil or grease and other foreign material.
2. Install the valve so the controlled fluid will flow through the valve body in the direction indicated by the arrow cast on the valve body.
3. A three-valve bypass would permit removal of the control valve from the line without shutting down the system.
4. In case of a heat-insulated installation, insulate the valve body only, not the bonnet.

WARNING

To avoid personal injury or property damage, do not attempt to do any work on a valve while the system is in operation. The valve must be isolated 100% from the active system and the isolated line voided of pressure and/or hazardous fluids.

3.1 Air Piping

1. For an air-to-extend actuator (air-to-close action), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open action) connect the actuating air pressure line to the 1/4 NPT opening in the lower diaphragm case.
2. Use 6.4 mm / 1/4 in. O.D. tubing or equivalent for all air lines. If air line exceeds 8 m / 25 ft in length, 9.5 mm / 3/8 in. tubing is preferred. Air pressure should not exceed 2.5 barg / 35 psig.

CAUTION

- **When assembling or disassembling the valve, do not turn the valve stem while the plug is touching the valve seat. This will damage the valve's seating surfaces.**
- **When adjusting the valve stem do not grip the stem directly with pliers or a wrench. This will damage the surface of the stem and cause damage to the packing in the valve. Instead, counter-tighten the two locknuts (key 27) on the stem (key 5). This will allow you to turn the stem by turning the locknuts (key 27) with a wrench.**
- **When placing valve in a vise, clamp the flat end faces of the valve. Do not clamp the rounded sides of the valve. This will distort the shape of the casting and will ruin the valve.**

3.2 Disassembly

1. Mount the valve in a vise by clamping flat end faces of the valve (Figure 3). Caution must be taken not to damage the serrated flange faces.
2. Remove the actuator, stem locknuts (key 27), travel indicator (key 58) and yoke drive nut (key 9).
3. Turn the bonnet (key 8) in a counter-clockwise direction from the valve body (key 1). Remove the O-ring (key 12) and remove and discard the valve body gasket (key 49). A new gasket should be installed each time the valve is disassembled.
4. Pull the plug and stem assembly (keys 4 and 5) out through the bottom of the bonnet. Rotate the assembly to prevent damage to the packing. Wipe the parts with a clean soft cloth and examine for signs of wear.



CAUTION

Handle the parts carefully to avoid damaging the seating and guiding surfaces.

5. Use a seat ring tool made according to the dimensions in Figure 2 and Table 1 to remove the seat ring (key 2) as follows:
 - a. Insert the tool into the valve body. Be certain the tool lugs are engaged in the corresponding recesses in the seat ring.
 - b. Use a 1/2 in. drive breaker bar or impact wrench having sufficient torque capability to remove the seat ring. Seat ring installation torque is provided in Table 2 for reference. Connect the breaker bar or impact wrench and if needed, an impact-rated extension bar, to the square drive of the seat ring tool.
 - c. Remove the seat ring (key 2) from the valve body. Make sure the seat ring tool is held at a right angle to the seat ring during removal to prevent the tool from disengaging from the lugs of the seat ring.
 - d. Inspect parts for wear or damage that would prevent proper operation of the valve body.

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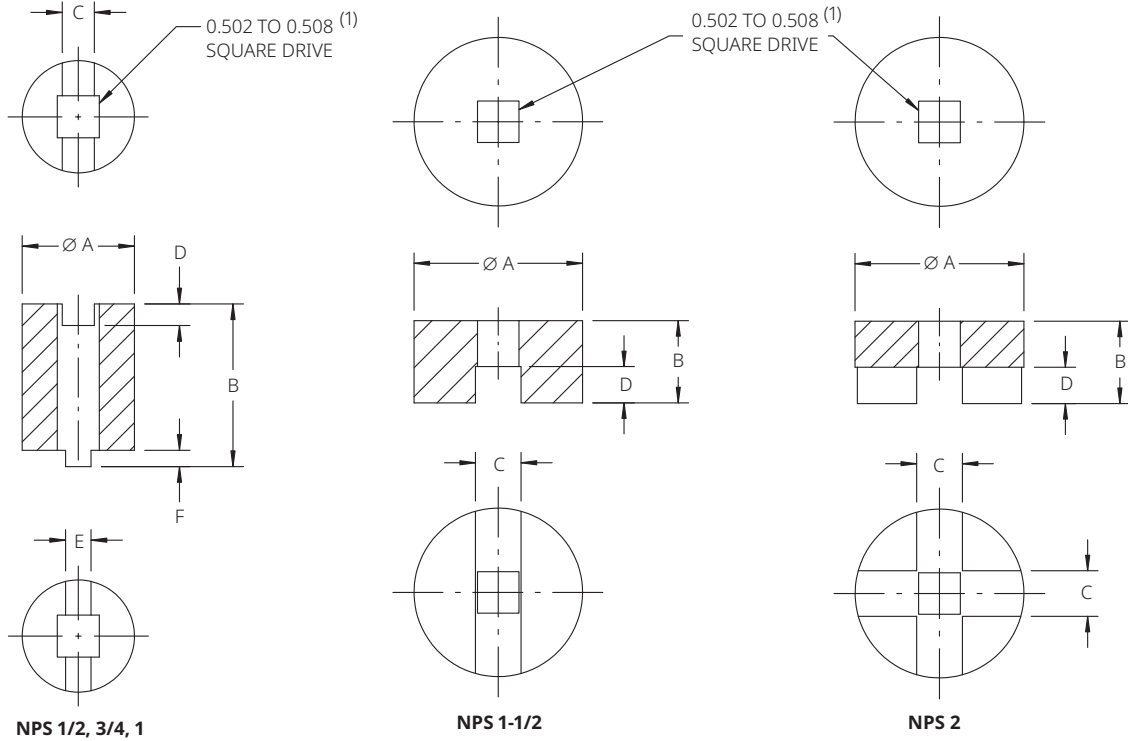
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Figure 2. Seat Ring Tool Dimensions



1. MAX ALLOWABLE CENTER DRILL Ø 0.532

Table 1. Seat Ring Tool Dimensions (see Figure 2)

PART NUMBER	DN	NPS	A	B	C	D	E	F
			in.					
GE96219X012	15	1/2	1.32	2.0	0.38	0.26	0.29	0.19
	20	3/4						
GE96219X022	25	1	1.52	2.3	0.40	0.25	0.35	0.20
GE96219X032	40	1-1/2	2.06	0.9	0.55	0.30	---	---
GE96219X042	50	2	2.74	1.0	0.55	0.44	---	---

Table 2. Seat Ring Assembly and Torque Tool

24000C		VALVE SIZE NPS, in. / DN				
		1/2 / 15	3/4 / 20	1 / 25	1-1/2 / 40	2 / 50
Port Diameter	0.25 ⁽¹⁾	GE96219X012	GE96219X012	GE96219X022	---	---
	0.375 ⁽¹⁾	GE96219X012	GE96219X012	GE96219X022	---	---
	0.8125 ⁽²⁾	GE96219X012	GE96219X012	GE96219X022	---	---
	1.0625 ⁽²⁾	---	---	GE96219X022	---	---
	1.25	---	---	---	GE96219X032	---
	1.5	---	---	---	GE96219X032	GE96219X042
	2	---	---	---	---	GE96219X042
Installation Torque, lb•ft		60	60	80	100	130

1. Male end used for trim 151.177 and port diameters 0.25 and 0.375.
2. Female end used for port diameters 0.8125 and 1.0625.

3.3 Lapping the Valve Seat

If valve seat leakage becomes excessive, it may be necessary to lap the valve seat.

Lapping is the process of mating the valve plug to the seat ring, with an abrasive to produce a close fit. When valve seat leakage becomes excessive, lapping becomes necessary. The plug and seat ring seating surfaces should be free of large scratches or dents and the contact surface of the seats should be as narrow as possible.

1. Use a good quality lapping compound with a mixture that contains 280 to 600 grit. Apply at several spots around the plug seating surface. Replace the plug (key 4) in the bonnet (key 8).
2. Place the bonnet (key 8) loosely into the valve body (key 1) to serve as a guide during the lapping operation.
3. Lap the valve by applying a slight pressure on the stem and rotate the stem in short oscillating strokes approximately 8 to 10 times or until you see an even and complete lap line. The plug should be intermittently lifted and turned 90 degrees while lapping to keep the plug and seat ring concentric.
4. Clean the valve seat and plug (key 4) thoroughly when the lapping is complete, removing all traces of lapping compound.

3.4 Replacing Packing

Refer to the standard packing construction and the optional packing shown in Figures 3, 4 and 5 to determine the packing that has been preinstalled in your valve.

1. Disassemble the valve as directed earlier. Remove the locknuts (key 27) and indicator disk (key 58) and turn the plug and stem (keys 4 and 5) out through the packing box. Remove the packing follower (key 10). Push out the old packing (key 14) by working from the underside of the bonnet (key 8).
2. Standard spring loaded PTFE V-ring packing (Figures 3 and 4): Insert each piece in exact order shown in Figures 3 and 4. Hand tighten the packing follower (key 10) until it shoulders on the bonnet (key 8). This will compress the packing spring (key 6), to enable constant stem sealing throughout the packing life.
3. Molded graphite (flexible graphite) packing (Figure 5): Insert each piece in exact order shown in the Figure 5. Hand tighten the packing follower (key 10). Use a wrench to increase tightness by turning the nut an additional 60 degrees.

3.5 Actuator and Valve Body Reassembly

1. Before installing seat ring in valve body, thoroughly clean the threads in the valve body port. Apply suitable lubricate to the threads and tighten to torque specified in Table 2. Remove all excess lubricant after tightening.
2. Insert a new valve body gasket (key 49) and install the bonnet assembly (key 8) with the plug and stem assembly in the valve. The O-ring (key 12) must be reinstalled by gently stretching over the bonnet and snapping into the gap between the top of the valve body (key 1) and the bonnet (key 8). This O-ring acts as a dust/moisture seat.
3. Place the actuator yoke over the stem (key 5). While tilting the actuator back, drop the yoke drive nut (key 9) over the stem (key 5). Run the locknuts (key 27) and travel indicator (key 58) down as far as possible and counter tighten the locknuts (key 27) to lock.

See the Fisher Baumann Pneumatic Actuator Instruction Manual ([D103352X012](#)) for reassembly and bench range adjustment.



CAUTION

When assembling or disassembling the valve, do not turn the valve stem while the plug is in contact with the valve seat. This can damage the seating surface very quickly.

Section 4: Parts

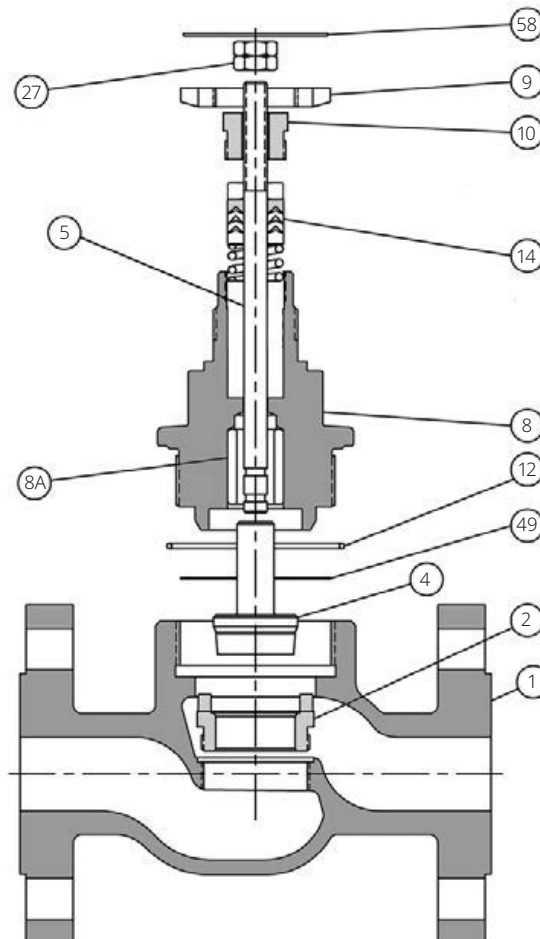
4.1 Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name and desired material using the following parts tables.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

Figure 3. Fisher Baumann 24000C Valve Body Assembly with Standard PTFE Spring-Loaded Packing



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Table 3. Fisher Baumann 24000C Common Parts⁽¹⁾

KEY NO.	DESCRIPTION
1	Valve Body, Carbon Steel, EN PN 10 to 40
	Valve Body, Carbon Steel, ASME CL150 RF
8	Bonnet
8A	Bonnet Bushing
9	Drive Nut (Yoke)
10	Packing Follower
12	O-ring
14*	Packing Kit, Spring Loaded PTFE V-Ring (standard)
	Packing Kit, Molded Graphite (optional)
27	Locknuts, qty 2
49*	Valve Body Gasket, Copper (standard)
	Valve Body Gasket, S31600 reinforced Graphite (optional)
58	Travel Indicator
*Recommended spare parts.	
1. For valves made before 2005, the common parts numbers above may not apply. Please notify your Emerson sales office if the valve is prior to 2005 so the appropriate parts can be ordered.	

Table 4. Plug for NPS 1/2, 3/4 and 1 Valves - Metal Seat

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _V	K _V
4*	Plug and Stem Assy	Metal Seat, Micro Trim (Linear)	102	6.3 / 0.25	0.2 ⁽¹⁾	0.17 ⁽¹⁾
		Metal Seat (Equal %)	548 (S41600)	6.3 / 0.25	0.2A	0.17A
					0.5 ⁽¹⁾	0.43 ⁽¹⁾
					1.0 ⁽¹⁾	0.86 ⁽¹⁾
				9.5 / 0.375	1.5 ⁽¹⁾	1.29 ⁽¹⁾
					2.5 ⁽¹⁾	2.15 ⁽¹⁾
				20.6 / 0.8125	4	3.4
					7.7	6.6
					10.1	8.7
				26.9 / 1.0625	13.6	11.7

*Recommended spare parts.

1. A matching seat ring (Table 5, key 2) must be furnished with replacement plug orders.

- continued -

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Table 4. Plug for NPS 1/2, 3/4 and 1 Valves - Metal Seat (continued)

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _v	K _v
4*	Plug and Stem Assy	Metal Seat (Equal %)	588 (S41600)	6.3 / 0.25	0.2	0.17
					0.5	0.43
					1.0	0.86
				9.5 / 0.375	1.5 ⁽¹⁾	1.29 ⁽¹⁾
					2.5 ⁽¹⁾	2.15 ⁽¹⁾
				20.6 / 0.8125	4	3.4
					7.7	6.6
					10.1	8.7
				26.9 / 1.0625	13.6	11.7
		Metal Seat (Linear)	648 (S41600)	6.3 / 0.25	0.5	0.43
					1.0	0.86
				9.5 / 0.375	1.5	1.29
					2.5	2.15
				20.6 / 0.8125	4	3.4
					6	5.16
					8	6.88
					9	7.74
				26.9 / 1.0625	13	11.18
		Metal Seat (Linear)	688	6.3 / 0.25	0.5	0.43
					1.0	0.86
				9.5 / 0.375	1.5	1.29
					2.5	2.15
				20.6 / 0.8125	4	3.4
					6	5.16
					8	6.88
					9	7.74
				26.9 / 1.0625	13	11.18

*Recommended spare parts.
1. A matching seat ring (Table 5, key 2) must be furnished with replacement plug orders.

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Table 5. Seat Ring for NPS 1/2, 3/4 and 1 Valves - Metal Seat

KEY NO.	DESCRIPTION	ORIFICE DIAMETER mm / in.
2*	Seat Ring S31600 ⁽¹⁾	6.3 / 0.25
		9.5 / 0.375
		20.6 / 0.8125
		26.9 / 1.0625
	Seat Ring S41600 ⁽¹⁾	6.3 / 0.25
		9.5 / 0.375
		20.6 / 0.8125
		26.9 / 1.0625
*Recommended spare parts 1. A matching seat ring (key 2) must be furnished with replacement plug orders. See Table 4.		

Table 6. Plug and Seat Ring for NPS 1/2, 3/4 and 1 Valves - Soft Seat

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _V	K _V
4*	Plug and Stem Assy	PTFE Seat (Equal %)	577	9.5 / 0.375	1.0	0.86
					1.5	1.29
					2.5	2.15
			20.6 / 0.8125	4	3.44	
				6	5.16	
				7.5	6.45	
				8.5	7.31	
				26.9 / 1.0625	13	11.2
		PTFE Seat (Linear)	677	9.5 / 0.375	0.1	0.086
					0.2	0.172
					0.5	0.43
					1.0	0.86
					2.5	2.15
				20.6 / 0.8125	5	4.3
2*	Seat Ring			6.3 mm / 0.25 in. Orifice Diameter		
		9.5 mm / 0.375 in. Orifice Diameter				
		20.6 mm / 0.8125 in. Orifice Diameter				
		26.9 mm / 1.0625 in. Orifice Diameter				
*Recommended spare parts						

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Table 7. Plug and Seat Ring for NPS 1-1/2 and 2 Valves

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _v	K _v
4*	Plug and Stem Assy	PTFE Seat (Equal %)	577	31.8 / 1.25	20	17.2
				38.1 / 1.50	10	8.6
					17	14.62
					28	24.08
				50.8 / 2.0	30	25.8
		PTFE Seat (Linear)	677	38.1 / 1.50	10	8.6
					17	14.62
				50.8 / 2.0	30	25.8
					50	43
		Metal Seat (Equal %)	548 (S41600)	31.8 / 1.25	10	8.6
					20	17.2
				38.1 / 1.50	10	8.6
					17	14.62
					32.9	28.3
				50.8 / 2.0	30	25.8
					52.9	45.5
		Metal Seat (Equal %)	588	31.8 / 1.25	10	8.6
					20	17.2
				38.1 / 1.50	10	8.6
					17	14.62
					32.9	28.3
				50.8 / 2.0	30	25.8
					52.9	45.5
		Metal Seat (Linear)	648 (S41600)	31.8 / 1.25	10	8.6
					20	17.2
				38.1 / 1.50	10	8.6
					17	14.62
					28	24.08
				50.8 / 2.0	30	25.8
					50	43
		Metal Seat (Linear)	688	31.8 / 1.25	10	8.6
					20	17.2
				38.1 / 1.50	10	8.6
					17	14.62
					28	24.08
				50.8 / 2.0	30	25.8
					50	43

*Recommended spare parts

- continued -

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Table 7. Plug and Seat Ring for NPS 1-1/2 and 2 Valves (continued)

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _v	K _v
2*	Seat Ring		38.1 mm / 1.25 in. Orifice Diameter, S31600			
			38.1 mm / 1.50 in. Orifice Diameter, S31600			
			50.8 mm / 2.0 in. Orifice Diameter, S31600			
			38.1 mm / 1.25 in. Orifice Diameter, S41600			
			38.1 mm / 1.50 in. Orifice Diameter, S41600			
			50.8 mm / 2.0 in. Orifice Diameter, S41600			
*Recommended spare parts						

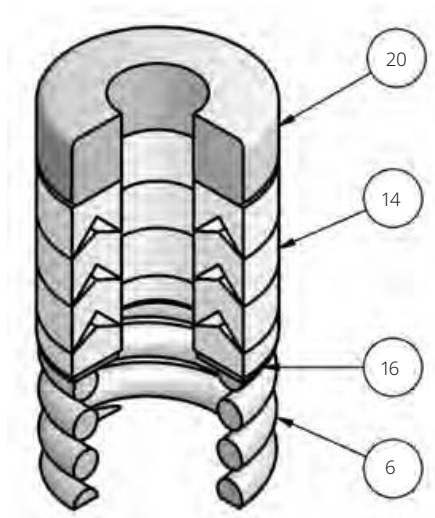
Table 8. Spring Loaded PTFE V-Ring Packing Kit P/N 24494T001

Key No.	Description	Material
6	Spring	ASTM A313 S30200
14	Packing Set	PTFE (Polytetrafluoroethylene)/ 25% carbon filled PTFE
16	Washer	ASTM A240 S31600
20	Spacer	J-2000 (filled Polytetrafluoroethylene)

Table 9. Molded Graphite (Flexible Graphite) Packing Kit P/N 24492T001 (Optional)

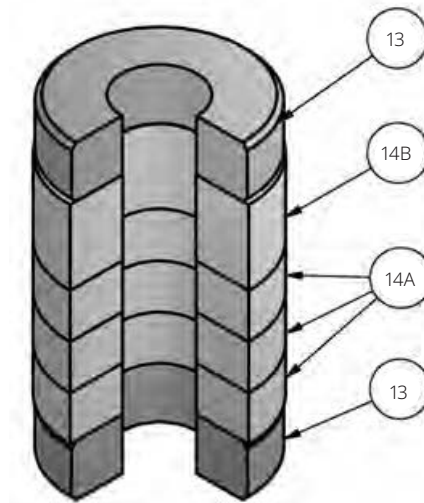
Key No.	Description	Material
13	Bushing, Qty 2	Carbon-Graphite
14A	Packing Ring, Qty 3	Graphite
14B	Packing Ring	Graphite

Figure 4. Spring Loaded PTFE V-Ring Packing Kit P/N 24494T001



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Figure 5. Molded Graphite (Flexible Graphite) Packing Kit P/N 24492T001 (Optional)



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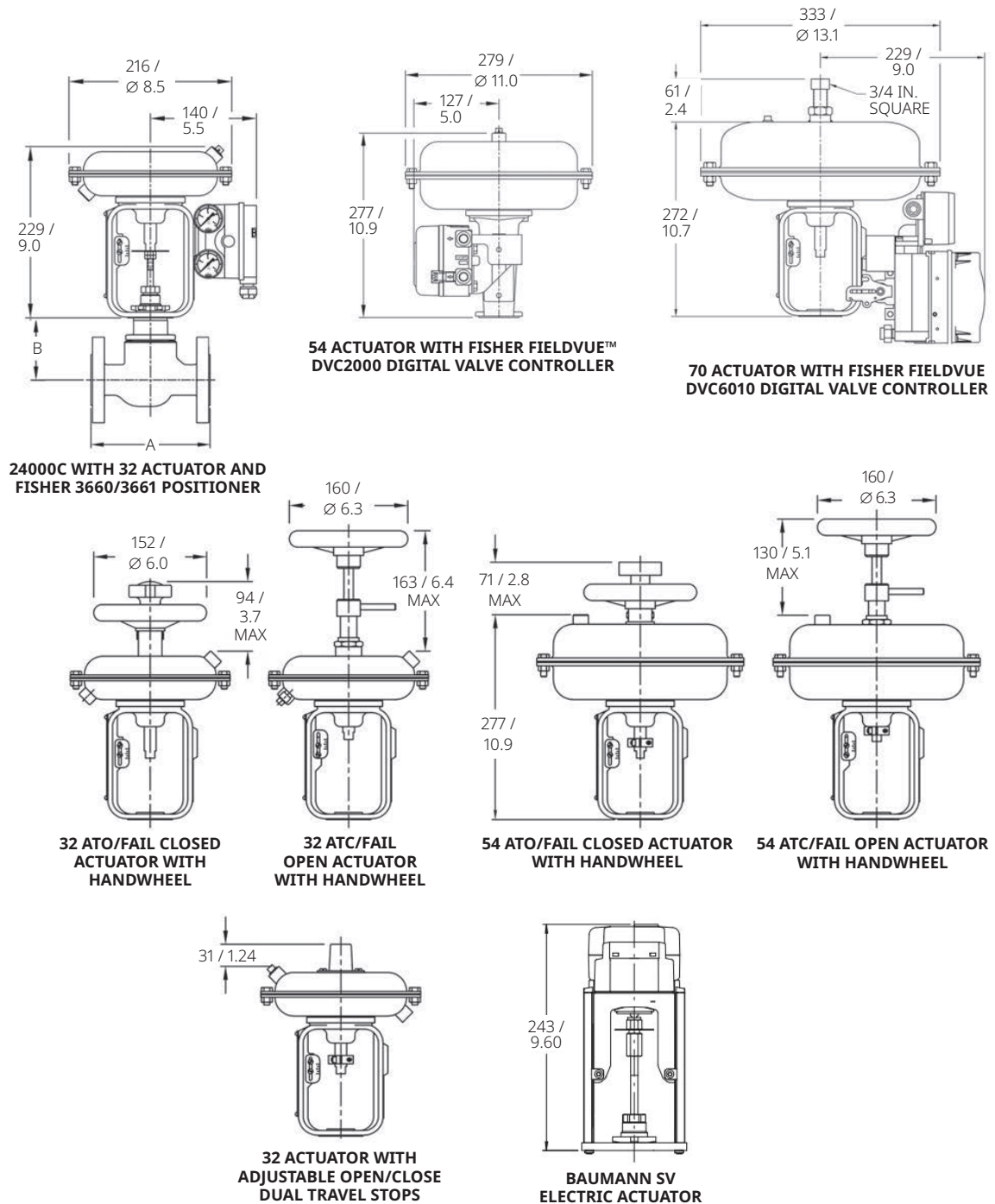
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Figure 6. Dimensional Drawings



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mm / in.

NOTE: ACTUATOR REMOVAL REQUIRES 115 mm / 4-1/2 in. VERTICAL CLEARANCE.

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Table 10. Valve Dimensions

VALVE SIZE		A FACE-TO-FACE				B BONNET	
EN	ASME	EN 10 to 40		CL 150			
DN	NPS	mm	in.	mm	in.	mm	in.
15	1/2	130	5.1	184	7.25	80	3.2
20	3/4	150	5.9	184	7.25	80	3.2
25	1	160	6.3	184	7.25	83	3.3
40	1-1/2	200	7.9	222	8.75	99	3.9
50	2	230	9.1	254	10.00	107	4.2

Table 11. Valve Assembly Weights

VALVE SIZE		WEIGHT	
EN	ASME		
DN	NPS	kg	lb
15	1/2	3.9	9
20	3/4	4.8	11
25	1	6.4	14
40	1-1/2	10	22
50	2	15	33

Table 12. Actuator Weights

ACTUATOR TYPE	WEIGHT	
	kg	lb
32	4.5	10
54	11.3	25
70	15.4	34
CML-250 ⁽¹⁾	8.3	18
CML-750 ⁽¹⁾	11.5	25
SVX-LIL (non-spring return)	1.3	3
SVK-FO or SVK-FC (spring return) ⁽¹⁾	1.6	4

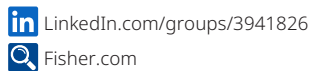
1. Electric actuators, reference CML Electric Actuator for Fisher Baumann 24000 Series Bulletin (D103347X012) for additional information.

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Baumann™ 24000CVF Carbon and 24000SVF Stainless Steel Flanged Control Valves

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Figure 1. Baumann Control Valve with FIELDVUE™ Digital Valve Controller



Introduction

The Baumann 24000CVF and 24000SVF line of pneumatic control valves (figure 1) may be used for the control of pressure, temperature, level, and flow. These valves are available with CL150 or 300 and EN PN10-40 flanged end connections.

The high performance 24000CVF and SVF designs feature low deadband and hysteresis, high flow capacity, superb control characteristics, tight shutoff, and advanced packing systems to meet demanding service conditions. The rugged, compact and light weight control valves are ideal for use in tight piping systems where space is a premium.

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Baumann 24000CVF carbon steel and SVF stainless flanged control valves.



Do not install, operate, or maintain Baumann 24000CVF or 24000SVF control valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

⚠ WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact your [Emerson sales office](#) for more complete specifications. Provide the product serial numbers (shown on the nameplate) and all other pertinent information.

⚠ WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

Educational Services

For information on available courses for Baumann 24000CVF/SVF valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Maintenance

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

Installation

1. Before installing the valve in the pipeline, thoroughly clean the line of all dirt, welding chips, scale, oil or grease, and other foreign material.
2. Install the valve so the controlled fluid will flow through the valve body in the direction indicated by the arrow cast on the valve body.
3. A three-valve bypass must be used to permit removal of the control valve from the line without shutting down the system.
4. In case of a heat-insulated installation, insulate the valve body only, not the bonnet.

⚠ WARNING

To avoid personal injury or property damage, do not attempt to do any work on a valve while the system is in operation. The valve must be isolated 100% from the active system and the isolated line voided of pressure and/or hazardous fluids.

Air Piping

1. For an air-to-extend actuator (air-to-close action), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open action) connect the actuating air pressure line to the 1/4 NPT in the lower diaphragm case.
2. Use 6.4 mm (1/4 inch) O.D. tubing or equivalent for all air lines. If air line exceeds 8 m (25 ft) in length, 9.5 mm (3/8 inch) tubing is preferred. Air lines must not leak. Air pressure not to exceed 2.5 barg (35 psig).

Disassembly

⚠ WARNING

If there is evidence of process fluid under pressure leaking from the joint, retighten the valve body/joint nuts. Return to the Warning at the beginning of the Maintenance section to ensure proper steps have been taken to isolate the valve and relieve process pressure.

CAUTION

- When assembling or disassembling the valve, do not turn the valve stem while the plug is touching the valve seat. This will damage the valve's seating surfaces.
- When adjusting the valve stem, do not grip the stem directly with pliers or a wrench. This will damage the surface of the stem, and cause damage to the packing in the valve. Instead, counter-tighten the two locknuts (key 27) on the stem (key 5). This will allow you to turn the stem by turning the locknuts (key 27) with a wrench.
- When placing the valve in a vise, do not clamp the rounded sides of the valve. This will distort the shape of the casting, and will ruin the valve. Caution must be taken not to damage the serrated flange faces.
- Mount the valve in a vise by clamping one flange below the serrated surface. Caution must be taken not to damage the serrated flange faces.

Actuator Removal

Access to the internal components of the valve body can be accomplished with the actuator removed. For actuator maintenance see the Baumann Pneumatic Actuators Instruction Manual ([D103352X012](#)).

Air-to-Close Actuators

1. Disconnect the air supply to the actuator and remove the air tubing.
2. Loosen the drive nut (key 9) and then remove the plug and stem (keys 4 and 5) assembly by holding the actuator stem still while unthreading the plug and stem assembly clockwise.
3. Remove the stem locknuts (key 27), travel indicator (key 58), and yoke drive nut (key 9).
4. Remove the actuator from the valve.

Air-to-Open Actuators

1. Using flexible tubing, apply sufficient air pressure to the actuator to lift the plug off the seat.
2. Loosen the drive nut (key 9) and then remove the plug and stem (keys 4 and 5) assembly by holding the actuator stem still while unthreading the plug and stem assembly clockwise.
3. Remove the stem locknuts (key 27), travel indicator (key 58), and yoke drive nut (key 9).
4. Remove the actuator from the valve.
5. Disconnect the air supply to the actuator and remove the air tubing.

Valve Body Disassembly

1. After removing the actuator, remove the hex nuts (key 12), lift bonnet (key 8), and plug and stem (keys 4 and 5) from the valve body (key 1). A new valve body gasket (key 49) should be installed each time the valve is disassembled.
2. Loosen the packing spring load by removing the packing follower (key 10).

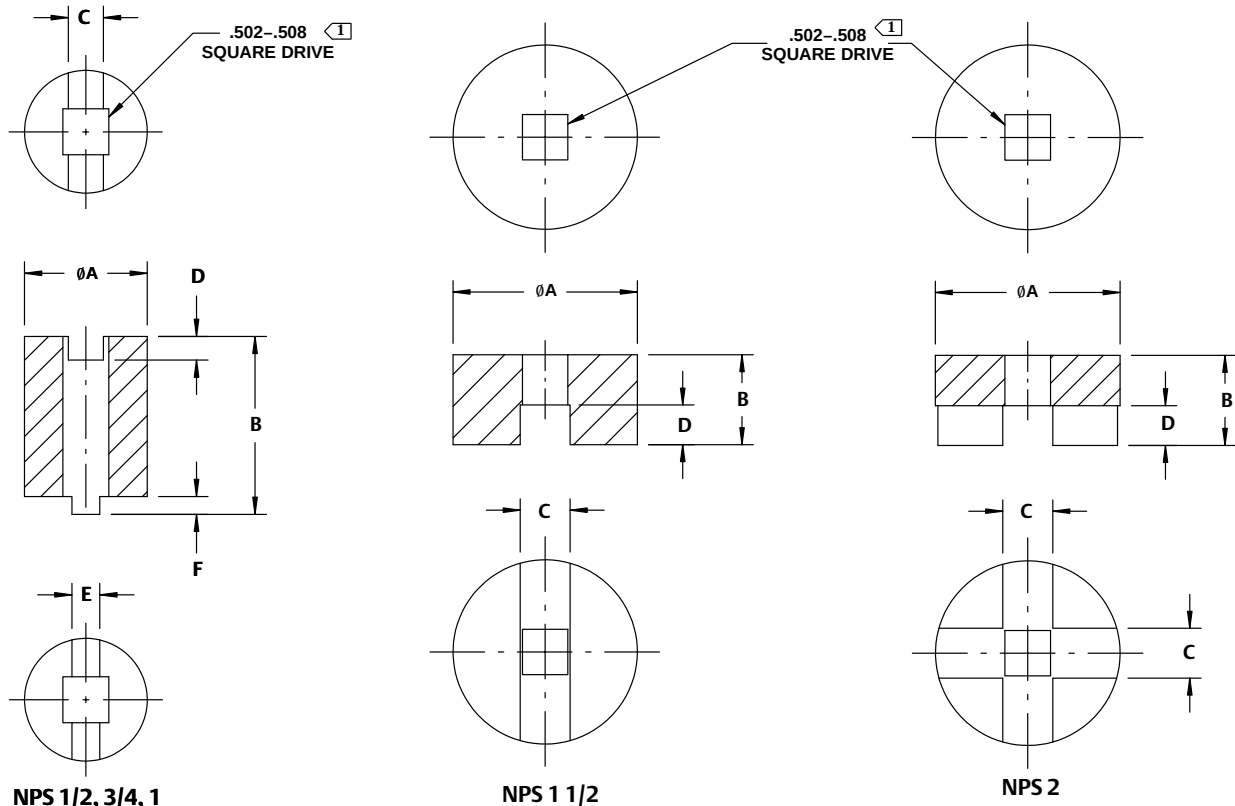
Remove the plug and stem assembly by pulling it out through the bottom of the bonnet (key 8) while rotating the stem (key 5). This will help prevent damage to the packing components.

Note

Handle the parts carefully to avoid damaging the seating and guiding surfaces. Wipe the parts with a clean soft cloth and examine for signs of wear or damage.

3. Use a seat ring tool made according to the dimensions in figure 2 and table 1 to remove the seat ring (key 2) as follows:
 - a. Insert the tool into the valve body. Be certain the tool lugs are engaged in the corresponding recesses in the seat ring.
 - b. Use a 1/2 inch drive breaker bar or impact wrench having sufficient torque capability to remove the seat ring. Seat ring installation torque is provided in table 2 for reference. Connect the breaker bar or impact wrench, and if needed, a impact-rated extension bar, to the square drive of the seat ring tool.
 - c. Remove the seat ring (key 2) from the valve body. Make sure the seat ring tool is held at a right angle to the seat ring during removal to prevent the tool from disengaging from the lugs of the seat ring.
 - d. Inspect parts for wear or damage that would prevent proper operation of the valve body.

Figure 2. Seat Ring Tool Dimensions



1 MAX ALLOWABLE CENTER DRILL Ø 0.532

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Table 1. Seat Ring Tool Dimensions (see figure 2)

Part Number	DN	NPS	A	B	C	D	E	F
			Inch					
GE96219X012	15 20	1/2 3/4	1.32	2.0	0.38	0.26	0.29	0.19
GE96219X022	25	1	1.52	2.3	0.40	0.25	0.35	0.20
GE96219X032	40	1-1/2	2.06	0.9	0.55	0.30	---	---
GE96219X042	50	2	2.74	1.0	0.55	0.44	---	---

Table 2. Seat Ring Assembly and Torque Tool

24000CVF/SVF		VALVE SIZE NPS (Inch) (DN)				
		1/2 (15)	3/4 (20)	1 (25)	1-1/2 (40)	2 (50)
Port Diameter	151 Low Flow ⁽¹⁾	GE96219X012	GE96219X012	GE96219X022	---	---
	177 Low Flow ⁽¹⁾	GE96219X012	GE96219X012	GE96219X022	---	---
	0.25 ⁽¹⁾	GE96219X012	GE96219X012	GE96219X022	---	---
	0.375 ⁽¹⁾	GE96219X012	GE96219X012	GE96219X022	---	---
	0.8125 ⁽²⁾	GE96219X012	GE96219X012	GE96219X022	---	---
	1.0625 ⁽²⁾	---	---	GE96219X022	---	---
	1.25	---	---	---	GE96219X032	---
	1.5	---	---	---	GE96219X032	GE96219X042
Installation Torque (lb•ft)		80	80	80	100	100

1. Male end used for trim 151, 177, and port diameters .25 and .375

2. Female end used for port diameters .8125 and 1.0625

4. Low Flow Trims:

- e. For Baumann 151 trim (figure 5) unscrew the seat subassembly (key 51) from the seat ring (key 2) with a 5/8 inch socket wrench. When reassembling, hand tighten the subassembly (key 51) and then rotate 1/8 of a turn with the 5/8 inch socket to lock in place.

Note

If changing to Baumann 151 trim, for correct flow characteristics, be sure the valve is reversed in the pipeline so that flow direction is flow down.

- f. For Baumann 177 trim (figure 6) unscrew the retainer nut (key 24) using a 3/4 inch socket wrench. Remove the gland (key 23) and insert (key 25). Replace the insert (key 25), making sure that the tapered portion faces up. If replacement of the housing (key 26) is required, use a 5/8 inch socket wrench.
5. NOLEEK Bellows Trim: Refer to figure 7 and table 9. Hold the bellows bonnet and push down on the stem to expose the plug retaining pin (key 21). Using a small punch, tap pin (key 21) out. To replace the new plug retaining pin (key 21), be sure the plug and stem are aligned to expose the hole (figure 7). With a needle nose pliers, slide the pin (key 21) into the hole.

⚠ WARNING

Be sure the plug retaining pin (key 21) is flush inside the hole and not exposed on either side of the plug or damage could happen to the bonnet interior.

Lapping the Valve Seat

If valve seat leakage becomes excessive, it may be necessary to lap the valve seat.

Lapping is the process of mating the valve plug to the seat ring, with an abrasive to produce a close fit. When valve seat leakage becomes excessive, lapping becomes necessary. The plug and seat ring seating surfaces should be free of large scratches or dents and the contact surface of the seats should be as narrow as possible.

1. Disassemble the valve body and remove the plug and stem assembly (keys 4 and 5) as directed in the previous Valve Body Disassembly section in this instruction manual.
2. Use a good quality lapping compound with a mixture that contains 280 to 600 grit. Apply at several spots around the plug seating surface. Replace the plug and stem carefully in the bonnet.
3. Install the bonnet (key 8) into the valve body, without gasket and hand tighten. The bonnet will serve as a guide during the lapping operation.
4. Lap the valve by applying a slight pressure on the stem and rotate the stem in short oscillating strokes approximately 8 to 10 times or until you see an even and complete lap line. The plug should be intermittently lifted and turned 90 degrees while lapping to keep the plug and seat ring concentric.
5. Clean the valve seat and plug (key 4) thoroughly when lapping is complete, removing all traces of lapping compound.
6. Reinsert the plug and stem assembly through the bottom of the bonnet (key 8) by slowly rotating through the packing. Be careful not to damage the packing rings.

Replacing Packing

Refer to figure 3 and the standard and optional packing constructions (figure 8) to determine the packing that has been preinstalled in your valve.

1. Disassemble the valve as directed earlier. Remove the locknuts (key 27) and travel indicator (key 58), and turn the plug stem (key 5) out through the packing box. Remove the packing follower (key 10). Push out the old packing (key 14) by working from the underside of the bonnet (key 8).
2. **Standard Spring Loaded PTFE V-Ring Packing (figures 3 and 8):** Carefully insert each piece in exact order shown in figure 8. Turn the packing follower (key 10) until it shoulders on the bonnet (key 8). This will compress the packing spring (key 6) to enable constant stem sealing throughout packing life.
3. **Molded Graphite Ribbon Packing (figure 8):** Carefully insert each piece in exact order shown in figure 8. Hand tighten the packing follower (key 10). Use a wrench to increase tightness by turning the follower an additional 60 degrees.
4. **ENVIRO-SEAL™ Packing (figure 8):** Carefully insert each piece in exact order as shown in figure 8. Tighten the packing follower (key 10) until the Belleville springs are compressed. This will be signaled by a significant increase in resistance. Back off the follower 1/8 to 1/4 turn. A gap of approximately 1.5 mm (1/16 inch) between the packing follower and the bonnet will ensure the packing is seated properly.
5. **For the optional NOLEEK bellows bonnet (not available with Baumann 24000CVF carbon steel valves):**

NOLEEK bellows seal packing (figure 7, table 9): Insert each piece in the exact order shown in the illustration. Hand tighten the packing follower (key 10).

Actuator and Valve Body Reassembly

1. Before installing seat ring in valve body, thoroughly clean the threads in the valve body port. Apply suitable anti-seize lubricant to the threads and tighten to torque specified in table 2. Remove all excess lubricant after tightening.
2. Insert a new valve body gasket (key 49) and install the bonnet assembly (key 8). For NPS 1/2 to 1 valves, tighten the nuts (key 12) to torque of 9.5-17.6 N•m (7-13 lbf•ft); NPS 1-1/2 to 2 valves, tighten nuts (key 12) to torque of 21.7-42.0 N•m (16-31 lbf•ft).

3. Place the actuator yoke over the stem (key 5). While tilting the actuator back, drop the yoke drive nut (key 9) over the stem (key 5). Run the locknuts (key 27), and the travel indicator (key 58), down as far as possible and counter tighten the locknuts (key 27) to lock.

See the Baumann Pneumatic Actuators Instruction Manual ([D103352X012](#)) for reassembly and bench range adjustment.

CAUTION

When assembling or disassembling the valve, do not turn the valve stem while the plug is in contact with the valve seat. This can damage the seating surface very quickly.

⚠ WARNING

To avoid personal injury or equipment damage due to possible sudden shifting or falling of the valve assembly, do not lift the valve assembly by the handwheel.

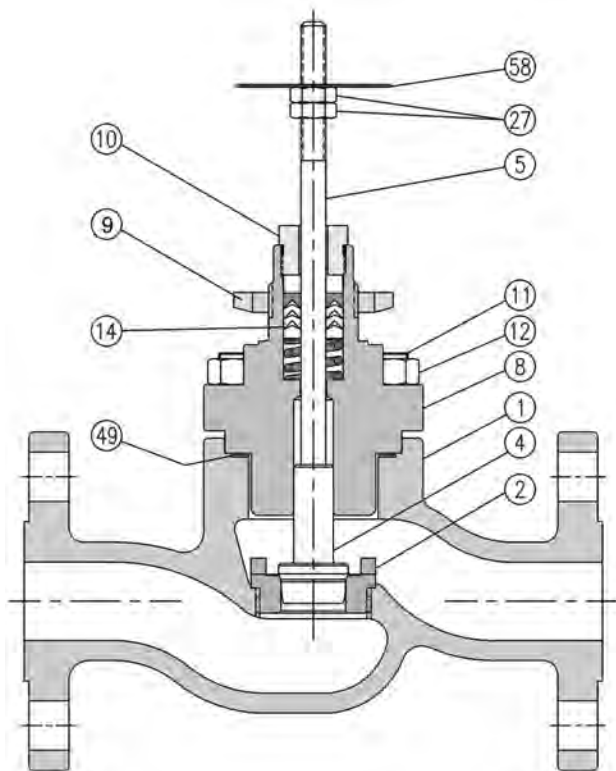
Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name, and desired material using the following parts tables.

⚠ WARNING

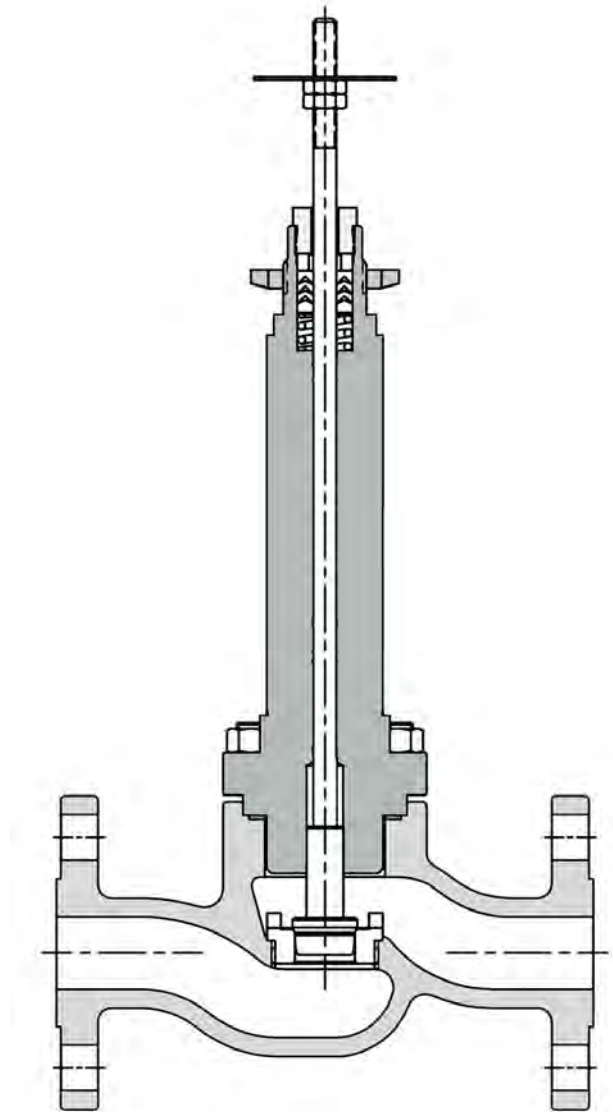
Use only genuine Fisher™ replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 3. Baumann 24000CVF Valve Body Assembly with Standard PTFE Spring-Loaded Packing



E1245

Figure 4. Baumann 24000SVF Valve Body Assembly with Standard PTFE Spring-Loaded Packing



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Table 3. Baumann 24000CVF/SVF Common Parts⁽¹⁾

KEY NO.	QTY	DESCRIPTION	VALVE SIZE				
			DN15 (NPS 1/2)	DN20 (NPS 3/4)	DN25 (NPS 1)	DN40 (NPS1-1/2)	DN50 (NPS 2)
1	1	Valve Body, Carbon Steel, CL150	24000-165	24000-265	24000-365	24000-565	24000-665
		Valve Body, Carbon Steel, CL300	24000-167	24000-267	24000-367	24000-567	24000-667
		Valve Body, Carbon Steel, PN 10-40	24000-169	24000-269	24000-369	24000-569	24000-669
		Valve Body, Stainless Steel, CL150	24000-115	24000-215	24000-315	24000-515	24000-615
		Valve Body, Stainless Steel, CL300	24000-117	24000-217	24000-317	24000-517	24000-617
		Valve Body, Stainless Steel, PN 10-40	24000-119	24000-219	24000-319	24000-519	24000-619
8	1	Bonnet, Standard for Carbon Steel	24000-163		24000-363	24000-563	24000-663
		Bonnet, Standard for Stainless Steel	24000-123		24000-323	24000-523	24000-623
		Bonnet, Single Ext ⁽³⁾	24000-123-1		24000-323-1	24000-523-1	24000-623-1
		Bonnet, Double Ext ⁽³⁾	24000-123-2		24000-323-2	24000-523-2	24000-623-2
		Bonnet, Triple Ext ⁽³⁾	24000-123-3		24000-323-3	24000-523-3	24000-623-3
		Bonnet, NOLEEK Bellows ⁽³⁾	24000-130		24000-330	24000-530	24000-630
8a	1	Guide Bushing ⁽²⁾	24000-124 (24000CVF ONLY)				
9	1	Drive Nut (Yoke)	011757-003-153				
10	1	Packing Follower	24490-1				
11	4	Stud	24000-127			24000-126	
12	4	Nut	25705			25717-1	
14*	1	V-Ring Packing Set (standard)	24494T001 (See page 13 for additional packing options)				
27	2	Locknuts	971514-002-250				
49*	1	Valve Body Gasket	24000-133	24000-133	24000-333	24000-533	24000-633
58	1	Travel Indicator	24299				
1. For valves made before 2005, the common parts numbers above may not apply. Please notify your Emerson sales office if the valve is prior to 2005 so the appropriate parts can be ordered. 2. Guide bushing is applicable to 24000CVF valve ONLY. 3. Extension bonnets and NOLEEK bellows bonnets are not available with 24000CVF carbon steel valves.							

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The guidelines below apply to tables 4, 5, 6, and 8.

For Extension Bonnet Construction

Substitute -104 for -101
-105 for -102

Double Extension Bonnet Construction

Substitute -107 for -101
-108 for -102

Triple Extension Bonnet Construction

Substitute -110 for -101
-111 for -102

Table 4. Plug and Seat Ring for NPS 1/2, 3/4, and 1 Valves

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm (Inch)	C _v (2)	VALVE SIZE			
						DN 15 (NPS 1/2)	DN 20 (NPS 3/4)	DN 25 (NPS 1)	
4*	Plug & Stem Assy	Low Flow	151	See table 6					
			177	See table 7					
		Metal Seat, Micro Trim (Linear)	102	6.3 (0.25)	0.02 ⁽¹⁾	GE46385X052		GE46385X092	
					0.05 ⁽¹⁾	GE46386X052		GE46386X092	
					0.1 ⁽¹⁾	GE46387X092		GE46387X052	
					0.2 ⁽¹⁾	GE46388X012		GE46388X092	
		PTFE Seat (Equal %)	577	9.5 (0.375)	1.0	24893-101-577		---	
					1.1	---	---	24893-101-577	
					1.6	24796-101-577			
					2.7	24609-101-577		---	
					3.2	---	---	24609-101-577	
				20.6 (0.8125)	3.9	24010-2-101-577		---	
					5	---	---	24010-2-101-577	
					6.1	24010-101-577	---	---	
					9.5	---	24010-101-577	---	
					11	---	---	24010-101-577	
					26.9 (1.0625)	13	---	---	24011-101-577
						Metal Seat (Equal %)	548 (S41600)	6.3 (0.25)	0.22 ⁽¹⁾
		0.61 ⁽¹⁾	GE46394X092		GE46394X052				
		1.0 ⁽¹⁾	GE46392X092		GE46392X052				
		9.5 (0.375)	1.6	24634-6-101-548				---	
			1.7	---	---			24634-6-101-548	
			2.9	24171-12-101-548				---	
			3.3	---	---			24171-12-101-548	
		20.6 (0.8125)	3.9	24185-6-101-548				---	
			4.4	---	---			24185-6-101-548	
			6.1	24061-5-101-548	---			---	
			9.8	---	24061-5-101-548			---	
			11	---	---			24061-5-101-548	
			26.9 (1.0625)	15.5	---	---	24062-1-101-548		
		Metal Seat (Equal %)	588	6.3 (0.25)	0.22 ⁽¹⁾	GE46390X052		GE46390X092	
					0.61 ⁽¹⁾	GE46391X052		GE46391X092	
					1.0 ⁽¹⁾	GE46389X052		GE46389X092	
				9.5 (0.375)	1.6	24634-101-588		---	
					1.7	---	---	24634-101-588	
					2.9	24171-101-588		---	
					3.3	---	---	24171-101-588	
					20.6 (0.8125)	3.9	24185-101-588		---
				4.4		---	---	24185-101-588	
				6.1		24061-101-588	---	---	
				9.8		---	24061-101-588	---	
				11		---	---	24061-101-588	
				26.9 (1.0625)		15.5	---	---	24062-101-588

-continued-

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Table 4. Plug and Seat Ring for NPS 1/2, 3/4, and 1 Valves (continued)

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm (Inch)	C _v (2)	VALVE SIZE		
						DN 15 (NPS 1/2)	DN 20 (NPS 3/4)	DN 25 (NPS 1)
4*	Plug & Stem Assy	PTFE Seat (Linear)	677	9.5 (0.375)	0.1	24660-101-677		
					0.2	24625-101-677		
					0.5	24617-101-677		
					1.0	24631-101-677		
					2.8	24656-101-677		---
				3.3	---	---	24656-101-677	
				20.6 (0.8125)	3.4	24010-1-101-677		---
		5.1	---		---	24010-1-101-677		
		Metal Seat (Linear)	648 (S41600)	6.3 (0.25)	0.5 ⁽¹⁾	GE46398X052		GE46398X092
					1.0 ⁽¹⁾	GE46397X052		---
					1.4 ⁽¹⁾	---	---	GE46397X092
					1.6	24669-1-101-648		---
				9.5 (0.375)	1.7	---	---	24669-1-101-648
					2.9	24671-2-101-648		---
					3.3	---	---	24671-2-101-648
				20.6 (0.8125)	3.7	24757-5-101-648		---
					4.6	---	---	24757-5-101-648
					6.1	24717-3-101-648	---	---
					9.8	---	24717-3-101-648	---
					11	---	---	24717-3-101-648
				26.9 (1.0625)	13	---	---	24791-1-101-648
				Metal Seat (Linear)	688	6.3 (0.25)	0.5 ⁽¹⁾	GE46396X052
		1.0 ⁽¹⁾	GE46395X062				---	
		1.4 ⁽¹⁾	---				---	GE46395X102
		9.5 (0.375)	1.6			24669-101-688		---
			1.7			---	---	24669-101-688
			2.9			24671-101-688		---
			3.3			---	---	24671-101-688
		20.6 (0.8125)	3.7			24757-101-688		---
			4.6			---	---	24757-101-688
			6.1			24717-101-688	---	---
			9.8			---	24717-101-688	---
			11			---	---	24717-101-688
		26.9 (1.0625)	13			---	---	24791-101-688
2*	Seat Ring	9.5 (0.375) Orifice Diameter, S31600				007635-002-163		24000-342
		20.6 (0.8125) Orifice Diameter, S31600				007635-005-163		24000-343
		26.9 (1.0625) Orifice Diameter, S31600				---	---	24000-344
		9.5 (0.375) Orifice Diameter, S41600				007635-002-416		24000-342-1
		20.6 (0.8125) Orifice Diameter, S41600				007635-005-416		24000-343-1
		26.9 (1.0625) Orifice Diameter, S41600				---	---	24000-344-1
1. Matching seat ring (key 2) is furnished with replacement plug orders. 2. K _v equals (0.86)*(C _v)								

1. Matching seat ring (key 2) is furnished with replacement plug orders.

2. K_v equals (0.86)*(C_v)

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Table 5. Plug and Seat Ring for NPS 1-1/2 and 2 Valves

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm (Inch)	C _v ⁽¹⁾	VALVE SIZE			
						DN 40 (NPS 1-1/2)	DN 50 (NPS 2)		
4*	Plug and Stem Assy	PTFE Seat (Equal %)	577	31.8 (1.25)	26	24411-102-577	---		
				38.1 (1.50)	13	24884-102-577			
					20	24774-102-577			
					33	24254-102-577	---		
					38	---	24254-102-577		
				50.8 (2.0)	33	---	24882-102-577		
		Metal Seat (Equal %)	548 (S41600)	31.8 (1.25)	10	24421-2-102-548	---		
				38.1 (1.50)	27	24401-2-102-548	---		
					11	24635-2-102-548			
					18	---	24710-2-102-548		
					19	24710-2-102-548	---		
					31	24038-2-102-548	---		
					35	---	24038-2-102-548		
				50.8 (2.0)	55	---	24039-1-102-548		
		Metal Seat (Equal %)	588	31.8 (1.25)	10	24421-102-588	---		
				38.1 (1.50)	27	24401-102-588	---		
					11	24635-102-588			
					18	---	24710-102-588		
					19	24710-102-588	---		
					31	24038-102-588	---		
					35	---	24038-102-588		
				50.8 (2.0)	55	---	24039-102-588		
		PTFE Seat (Linear)	677	31.8 (1.25)	26	24436-102-677	---		
				38.1 (1.50)	14	24799-102-677			
					23	24798-102-677			
				50.8 (2.0)	37	---	24891-102-677		
					56	---	24070-102-677		
				Metal Seat (Linear)	648 (S41600)	31.8 (1.25)	11	24425-1-102-648	---
		38.1 (1.50)	26			24424-1-102-648	---		
			12			24761-2-102-648			
			22			24899-2-102-648			
			31			24760-1-102-648	---		
			35			---	24760-1-102-648		
			50.8 (2.0)			33	---	24887-1-102-648	
		Metal Seat (Linear)	688			31.8 (1.25)	55	---	24762-1-102-648
							11	24425-102-688	---
						38.1 (1.50)	26	24424-102-688	---
				12	24761-102-688				
		22		24899-102-688					
		31		24760-102-688	---				
		35		---	24760-102-688				
		50.8 (2.0)		33	---		24887-102-688		
2*	Seat Ring	38.1 mm (1.25 inch) Orifice Diameter, S31600				24000-542	---		
		38.1 mm (1.50 inch) Orifice Diameter, S31600				24000-541	24000-642		
		50.8 mm (2.0 inch) Orifice Diameter, S31600				---	24000-641		
		38.1 mm (1.25 inch) Orifice Diameter, S41600				24000-542-1	---		
		38.1 mm (1.50 inch) Orifice Diameter, S41600				24000-541-1	24000-642-1		
		50.8 mm (2.0 inch) Orifice Diameter, S41600				---	24000-641-1		
1. K _v equals (0.86) * (C _v)									

1. K_v equals (0.86) * (C_v)

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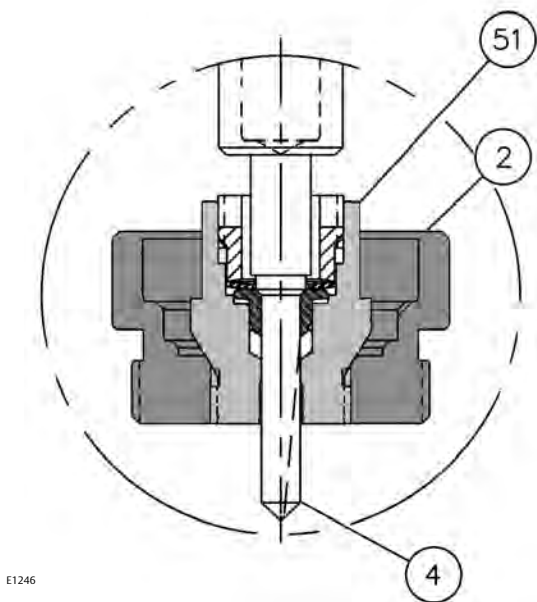
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Figure 5. Optional Baumann 151 Low Flow Trim Assembly



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Table 6. Plug and Seat Ring for Baumann 151 Trim

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG SERIES	ORIFICE DIAMETER mm (Inch)	C _v	K _v	VALVE SIZE		
							DN 15 (NPS 1/2)	DN 20 (NPS 3/4)	DN 25 (NPS 1)
2*	Seat Ring						24000-135		24000-345
51*	Seat Sub-Assembly						24151-20		
4*	Plug & Stem Assy	Modified Equal % Low Flow	151	3.96 (0.156)	0.00013	0.0001	24151-2-101-151		
					0.00025	0.0002	24151-3-101-151		
					0.0005	0.0004	24151-4-101-151		
					0.001	0.0009	24151-5-101-151		
					0.002	0.0017	24151-6-101-151		
					0.004	0.003	24151-7-101-151		
					0.008	0.007	24151-8-101-151		
					0.015	0.013	24151-9-101-151		
					0.03	0.026	24151-10-101-151		
					0.06	0.052	24151-11-101-151		
					0.1	0.86	24151-12-101-151		
					0.2	0.17	24151-24-101-151		
					0.45	0.39	24151-25-101-151		

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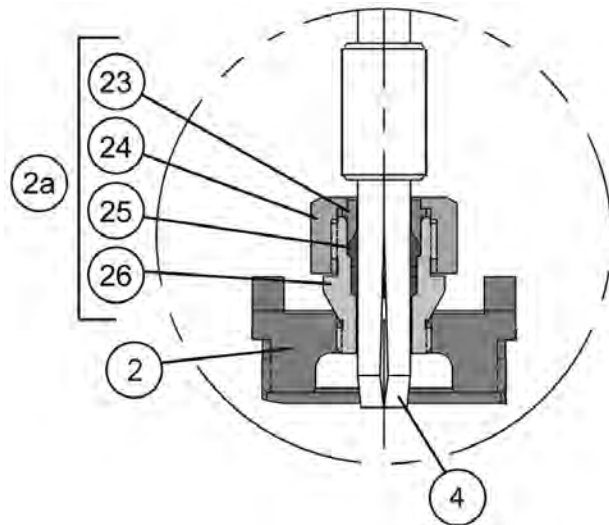
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Figure 6. Optional Baumann 177 Low Flow Trim Assembly



E1247

Table 7. Baumann 177 Low Flow Trim

Key No.		Description	
4*		Plug (see table 8)	
2a*	23	Gland	Seat Ring Subassembly, P/N 24241
	24	Retainer Nut	
	25	Insert	
	26	Housing	

Table 8. Plug and Seat Ring for Baumann 177 Trim

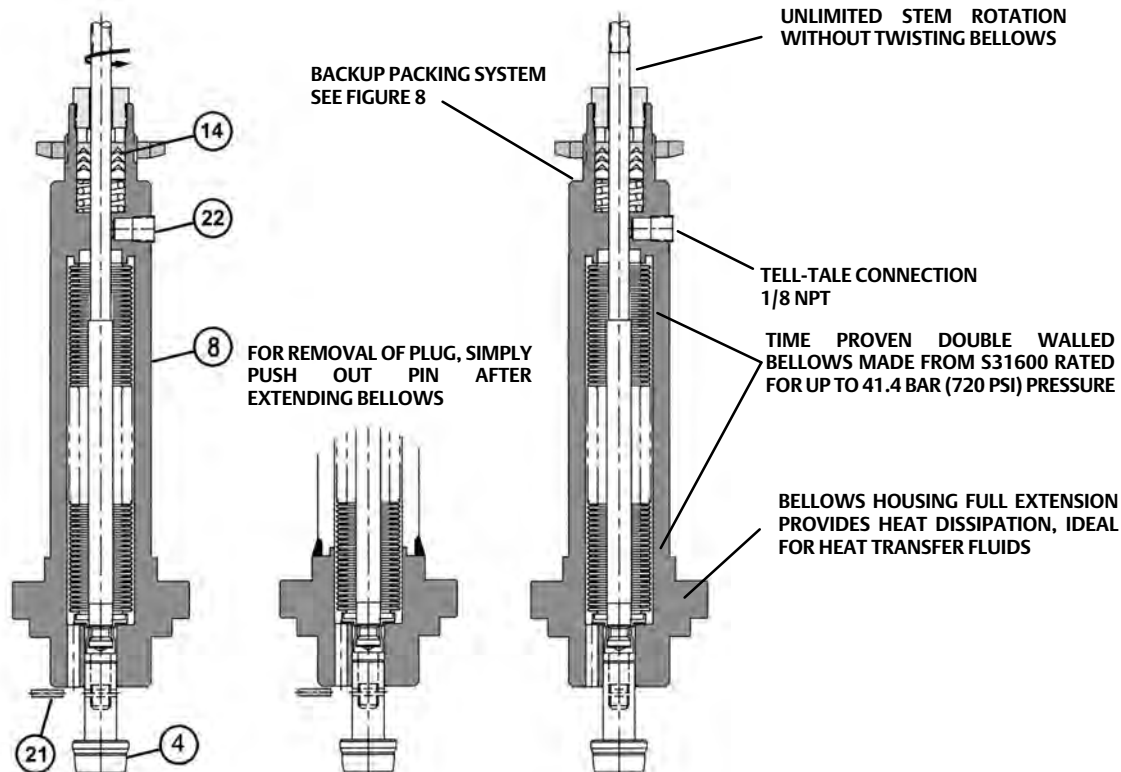
KEY NO.	DESCRIPTION	PLUG TYPE	PLUG SERIES	ORIFICE DIAMETER mm (Inch)	C _v	K _v	VALVE SIZE		
							DN 15 (NPS 1/2)	DN 20 (NPS 3/4)	DN 25 (NPS 1)
2*	Seat Ring						24000-135		24000-345
2a*	Seat Sub-Assembly (See table 7)						24241		
4*	Plug & Stem Assy	Low Flow	177	7.9 (0.3125)	0.0005	0.0004	24598-101-177		
					0.001	0.0009	24597-101-177		
					0.002	0.0017	24594-101-177		
					0.005	0.004	24595-101-177		
					0.01	0.009	24596-101-177		
					0.02	0.017	24621-10-101-177		
					0.05	0.04	24658-10-101-177		

* Recommended spare parts

⚠ WARNING

The Baumann NOLEEK valve bonnet assembly is not intended for use in lethal service applications.

Figure 7. Baumann NOLEEK Bellows Bonnet Assembly



E1293

Table 9. NOLEEK Bellows Bonnet Assembly with Standard Packing Kit⁽¹⁾

Key No.	Qty	Description	Part Number
4*	1	Plug	Contact Factory
8	1	Complete Bellows/ Bonnet Sub-Assembly, DN15 & 20 (NPS 1/2 & 3/4)	24000-130
		Complete Bellows/ Bonnet Sub-Assembly, DN25 (NPS 1)	24000-330
		Complete Bellows/ Bonnet Sub-Assembly, DN40 (NPS 1-1/2)	24000-530
		Complete Bellows/ Bonnet Sub-Assembly, DN50 (NPS 2)	24000-630
14*	1	V-Ring Packing Kit (standard)	24494T001
		ENVIRO-SEAL Packing Kit (optional)	24490T001
21*	1	Plug Retaining Pin	971342-005-163
22*	1	Hex Socket Pipe Plug, 1/8 NPT, Stainless Steel	Included with Key 8

1. Not available with Baumann 24000CVF carbon steel valves.

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Figure 8. Packing Kits

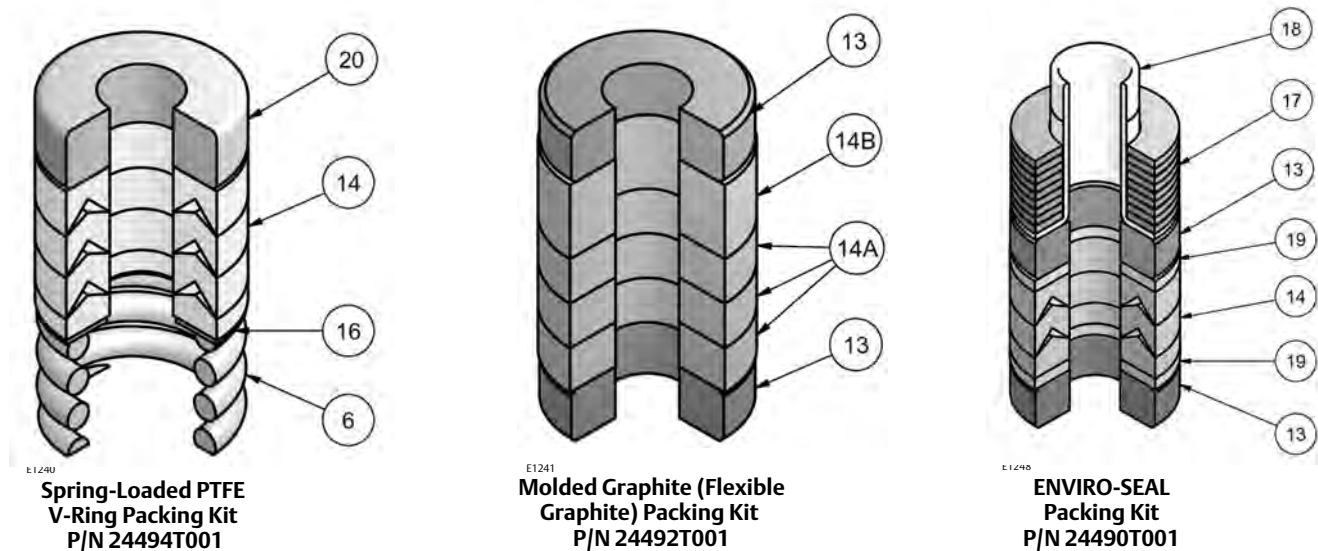


Table 10. Spring-Loaded PTFE V-Ring Packing Kit P/N 24494T001

Key No.	Description	Material
6	Spring	ASTM A313 S30200
14	Packing Set	PTFE / carbon-filled PTFE
16	Washer	ASTM A240 S31600
20	Spacer	J-2000 (filled PTFE)

Table 11. Molded Graphite (Flexible Graphite) Packing Kit P/N 24492T001

Key No.	Description	Material
13	Bushing, qty 2	Carbon - Graphite
14A	Packing Ring, qty 2	Graphite
14B	Packing Ring	Graphite

Table 12. ENVIRO-SEAL Packing Kit P/N 24490T001

Key No.	Description	Material
13	Bushing, qty 2	Carbon Graphite
14	Packing Set	PTFE / carbon-filled PTFE
17	Belleville Spring	ASTM B637 N07718
18	Bushing	PEEK
19	Washer, qty 2	Modified PTFE

Special ENVIRO-SEAL Packing Note

The ENVIRO-SEAL PTFE packing system is suitable for 100 ppm environmental applications on services up to 51.7 barg (750 psig) and process temperatures ranging from -46 to 232°C (-50 to 450°F).

For non-environmental applications, this packing system offers excellent performance at the same temperature range up to the maximum valve working pressure.

Temperature limits apply to packing arrangements only. Complete valve assembly temperature limits may differ. Refer to appropriate pressure/ temperature ratings.

Reference the Packing Selection Guidelines for Fisher Sliding Stem Valves Bulletin 59.1:062 ([D101986X012](#)).

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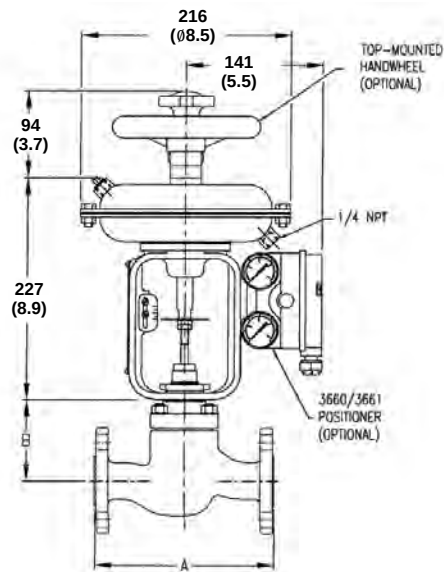
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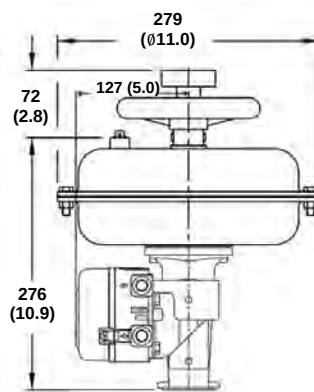
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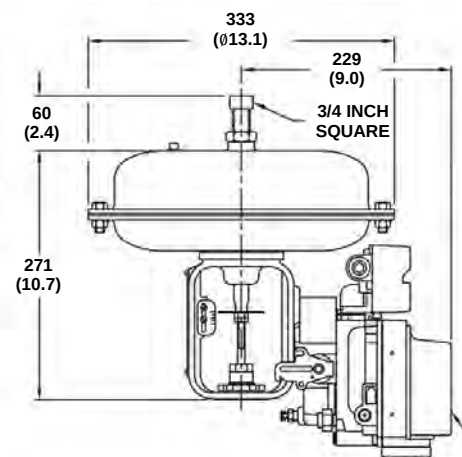
Figure 9. Dimensional Drawings



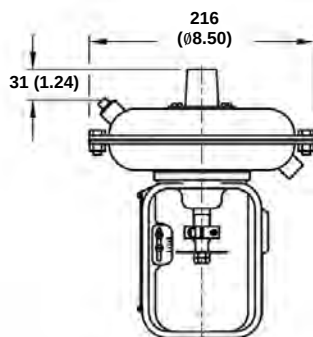
**24000CVF/SVF FLANGED
WITH BAUMANN 32 ATO
ACTUATOR WITH HANDWHEEL**



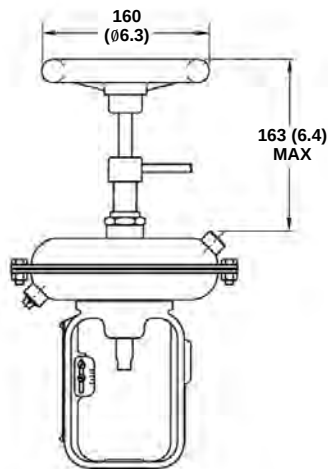
**BAUMANN 54 ATO ACTUATOR
WITH HANDWHEEL AND
DVC2000**



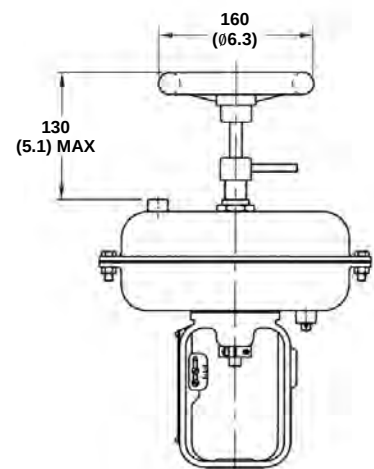
**BAUMANN 70 ATO ACTUATOR
WITH OPTIONAL FIELDVUE
DIGITAL VALVE CONTROLLER**



**BAUMANN 32 ACTUATOR WITH
ADJUSTABLE
OPEN / CLOSE DUAL TRAVEL STOPS**



**BAUMANN 32 ATC / FAIL OPEN
ACTUATOR WITH HANDWHEEL**



**BAUMANN 54 ATC / FAIL OPEN
ACTUATOR WITH HANDWHEEL**

E1257

NOTE: ACTUATOR REMOVAL REQUIRES 115 mm (4.5 INCHES) VERTICAL CLEARANCE.

mm
(inch)

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Table 13. Baumann Valve Dimensions

VALVE SIZE		A -- FACE-to-FACE						B -- BONNET					
		CL150		CL300		PN 10-40		Standard		Single Extension		Bellows	
DN	NPS	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
15	1/2	184	7.25	190	7.50	130	5.11	79	3.1	216	8.5	226	8.9
20	3/4	184	7.25	194	7.62	150	5.90	79	3.1	216	8.5	226	8.9
25	1	184	7.25	197	7.75	160	6.30	84	3.3	221	8.7	229	9.0
40	1-1/2	222	8.75	235	9.25	200	7.87	96	3.8	234	9.2	229	9.0
50	2	254	10.0	267	10.5	230	9.06	107	4.2	244	9.6	234	9.2

Table 14. Baumann Valve Assembly Weights

VALVE SIZE		WEIGHT					
		CL150		CL300		PN 10-40	
DN	NPS	kg	lb	kg	lb	kg	lb
15	1/2	3.0	6.6	3.5	7.7	3.3	7.3
20	3/4	3.1	6.9	4.2	9.3	3.4	7.6
25	1	5.1	11.3	5.9	13.1	5.7	12.6
40	1-1/2	7.9	17.5	10.7	23.5	8.8	19.5
50	2	13.4	29.5	15.0	33.1	14.4	31.9

Table 15. Baumann Actuator Weights

ACTUATOR	WEIGHT	
	kg	lbs
32	4.5	10
54	11.3	25
70	15.4	34
CML-250 ⁽¹⁾	8.3	18
CML-750 ⁽¹⁾	11.5	25
SVX-LIL (non spring return)	1.3	3
SVK-FO or SVK-FC ⁽¹⁾ (spring return)	1.6	4

1. Electric actuators, reference CML Electric Actuator for Baumann 24000 Series Bulletin 52.1:ECV ([D103347X012](#)) for additional information.

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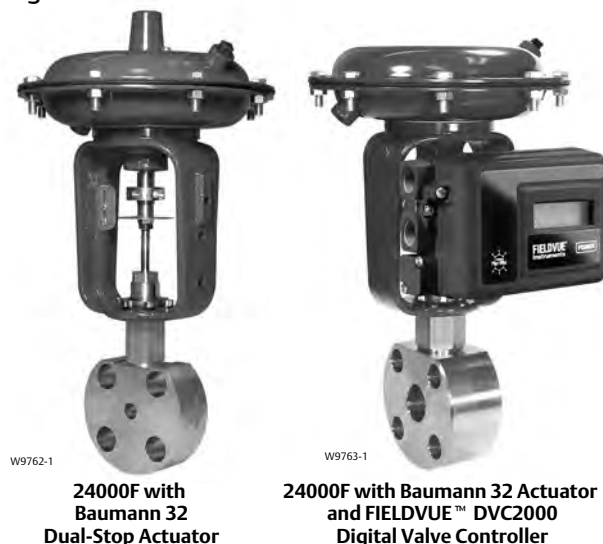


Baumann™ 24000F Wafer Control Valve

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Figure 1. 24000F Control Valve



Introduction

The Baumann 24000F Wafer Body Control Valve (figures 1) mates with ASME and EN line flange connections and is designed to control a wide range of process liquids, gases and vapors. This compact package provides the connection integrity of flanged body globe valves while being significantly lighter and easier to install.

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Baumann 24000F wafer body control valve.



Do not install, operate, or maintain Baumann 24000F control valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

⚠ WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact your [Emerson sales office](#) for more complete specifications. Provide the product serial numbers (shown on the nameplate) and all other pertinent information.

⚠ WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

Maintenance

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

WARNING

Avoid personal injury or property damage by thoroughly cleaning the line of all dirt, welding chips, scale, oil or grease, and other foreign material. Failure to do so could result in damage to the seating and sealing surfaces of the valve and result in damage to the valve and release of process materials.

Installation

1. Before installing the valve in the pipeline, thoroughly clean the line of all dirt, welding chips, scale, oil or grease, and other foreign material.
2. Install the valve so the controlled fluid will flow through the valve body in the direction indicated by the arrow cast on the valve body.
3. A three-valve bypass must be used to permit removal of the control valve from the line without shutting down the system.
4. In case of a heat-insulated installation, insulate the valve body only, not the bonnet.

WARNING

To avoid personal injury or property damage, do not attempt to do any work on a valve while the system is in operation. The valve must be isolated 100% from the active system and the isolated line voided of pressure and/or hazardous fluids.

Air Piping

1. For an air-to-extend actuator (air-to-close action), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open action) connect the actuating air pressure line to the 1/4 NPT in the lower diaphragm case.

2. Use 6.4 mm (1/4 inch) O.D. tubing or equivalent for all air lines. If air line exceeds 8 m (25 ft) in length, 9.5 mm (3/8 inch) tubing is preferred. Air lines must not leak. Air pressure not to exceed 2.5 bar (35 psig).

Disassembly

⚠ WARNING

If there is evidence of process fluid under pressure leaking from the joint, retighten the valve body/joint nuts. Return to the Warning at the beginning of the Maintenance section to ensure proper steps have been taken to isolate the valve and relieve process pressure.

CAUTION

- When assembling or disassembling the valve, do not turn the valve stem while the plug is touching the valve seat. This will damage the valve's seating surfaces.
- When adjusting the valve stem, do not grip the stem directly with pliers or a wrench. This will damage the surface of the stem, and cause damage to the packing in the valve. Instead, counter-tighten the two locknuts (key 27) on the stem (key 5). This will allow you to turn the stem by turning the locknuts (key 27) with a wrench.
- When placing the valve in a vise, do not clamp the rounded sides of the valve. This will distort the shape of the casting, and will ruin the valve.

Actuator Removal

Access to the internal components of the valve body can be accomplished with the actuator removed. For actuator maintenance see the following instruction manual ([D103352X012](#)).

Air-to-Close Actuators

1. Disconnect the air supply to the actuator and remove the air tubing.
2. Loosen the drive nut (key 9) and then remove the plug and stem (keys 4 and 5) assembly by holding the actuator stem still while unthreading the plug and stem assembly counterclockwise.
3. Remove the stem locknuts (key 27), travel indicator (key 58), and yoke drive nut (key 9).
4. Remove the actuator from the valve.

Air-to-Open Actuators

1. Using flexible tubing, apply sufficient air pressure to the actuator to lift the plug off the seat.
2. Loosen the drive nut (key 9) and then remove the plug and stem (keys 4 and 5) assembly by holding the actuator stem still while unthreading the plug and stem assembly counterclockwise.
3. Remove the stem locknuts (key 27), travel indicator (key 58), and yoke drive nut (key 9).
4. Remove the actuator from the valve.
5. Disconnect the air supply to the actuator and remove the air tubing.

Valve Body Disassembly

1. After removing the actuator, unscrew the bonnet (key 8), and plug and stem (keys 4 and 5) from valve body (key 1). A new body gasket (key 49) should be installed each time the valve is disassembled.

2. Loosen the packing spring load by removing the packing follower (key 10).

Remove the plug and stem assembly by pulling it out through the bottom of the bonnet (key 8) while rotating the stem (key 5). This will help prevent damage to the packing components.

Note

Handle the parts carefully to avoid damaging the seating and guiding surfaces. Wipe the parts with a clean soft cloth and examine for signs of wear or damage.

3. To remove the seat ring (key 2), use a 5/8 inch socket wrench. Clean the seat ring thoroughly and examine for signs of wear or damage.
4. Low Flow Trims:
 - a. For Baumann 151 trim (figure 5) unscrew the seat subassembly. When reassembling, hand tighten the subassembly (key 51) and then rotate 1/8 of a turn with the 5/8 inch socket to lock in place.

Note

If changing to Baumann 151 trim, for correct flow characteristics, be sure the valve is reversed in the pipeline so that flow direction is flow-to-close.

- b. For Baumann 177 trim (figure 6) unscrew the retainer nut (key 24) using a 3/4 inch socket wrench. Remove the gland (key 23) and insert (key 25). Replace the insert (key 25), making sure that the tapered portion faces up. If replacement of the housing (key 26) is required, use a 5/8 inch socket wrench.

Lapping the Valve Seat

If valve seat leakage becomes excessive, it may be necessary to lap the valve seat.

Lapping is the process of mating the valve plug to the seat ring, with an abrasive to produce a close fit. When valve seat leakage becomes excessive, lapping becomes necessary. The plug and seat ring seating surfaces should be free of large scratches or dents and the contact surface of the seats should be as narrow as possible.

1. Disassemble the valve body and remove the plug and stem assembly (keys 4 and 5) as directed in the previous Valve Body Disassembly section in this instruction manual.
2. Use a good quality lapping compound with a mixture that contains 280 to 600 grit. Apply at several spots around the plug seating surface. Replace the plug and stem carefully in the bonnet.
3. Install the bonnet (key 8) into the valve body, without gasket and hand tighten. The bonnet will serve as a guide during the lapping operation.
4. Lap the valve by applying a slight pressure on the stem and rotate the stem in short oscillating strokes approximately 8 to 10 times or until you see an even and complete lap line. The plug should be intermittently lifted and turned 90 degrees while lapping to keep the plug and seat ring concentric.
5. Clean the valve seat and plug (key 4) thoroughly when lapping is complete, removing all traces of lapping compound.
6. For the NPS 1 integral seat body, inspect internal seating surface for wear or damage and replace if necessary.

Replacing Packing

Refer to figure 2 and the standard and optional packing constructions (figures 7, 8, and 9) to determine the packing that has been preinstalled in your valve.

1. Disassemble the valve as directed earlier. Remove the locknuts (key 27) and indicator disk (key 58), and turn the plug stem (key 5) out through the packing box. Remove the packing follower (key 10). Push out the old packing (key 14) by working from the underside of the bonnet (key 8).
2. **Standard Spring Loaded PTFE V-Ring Packing (figures 2 and 7):** Carefully insert each piece in exact order shown in figure 7. Turn the packing follower (key 10) until it shoulders on the bonnet (key 8). This will compress the packing spring (key 6) to enable constant stem sealing throughout packing life.
3. **Molded Graphite Ribbon Packing (figure 8):** Carefully insert each piece in exact order shown in figure 8. Hand tighten the packing follower (key 10). Use a wrench to increase tightness by turning the follower an additional 60 degrees.
4. **ENVIRO-SEAL™ Packing (figure 9):** Carefully insert each piece in exact order as shown in figure 9. Tighten the packing follower (key 10) until the Belleville springs are compressed. This will be signaled by a significant increase in resistance. Back off the follower 1/8 to 1/4 turn. A gap of approximately 1.5 mm (1/16 inch) between the packing follower and the bonnet will ensure the packing is seated properly.

Actuator and Valve Body Reassembly

1. Insert a new valve body gasket (key 49) and install the bonnet assembly (key 8).
2. Place the actuator yoke over the stem (key 5). While tilting the actuator back, drop the yoke drive nut (key 9) over the stem (key 5). Run the locknuts (key 27), and the travel indicator (key 58), down as far as possible and counter tighten the locknuts (key 27) to lock.
3. Carefully position the actuator over the stem (key 5), lift the plug stem (key 5) and turn the plug stem (key 5) into the actuator stem as far as it will go before adjusting the bench range.

See the following instruction manual (Baumann Actuator Instructions, [D103352X012](#)) for reassembly and bench range adjustment.

CAUTION

When assembling or disassembling the valve, do not turn the valve stem while the plug is in contact with the valve seat. This can damage the seating surface very quickly.

⚠ WARNING

To avoid personal injury or equipment damage due to possible sudden shifting or falling of the valve assembly, do not lift the valve assembly by the handwheel.

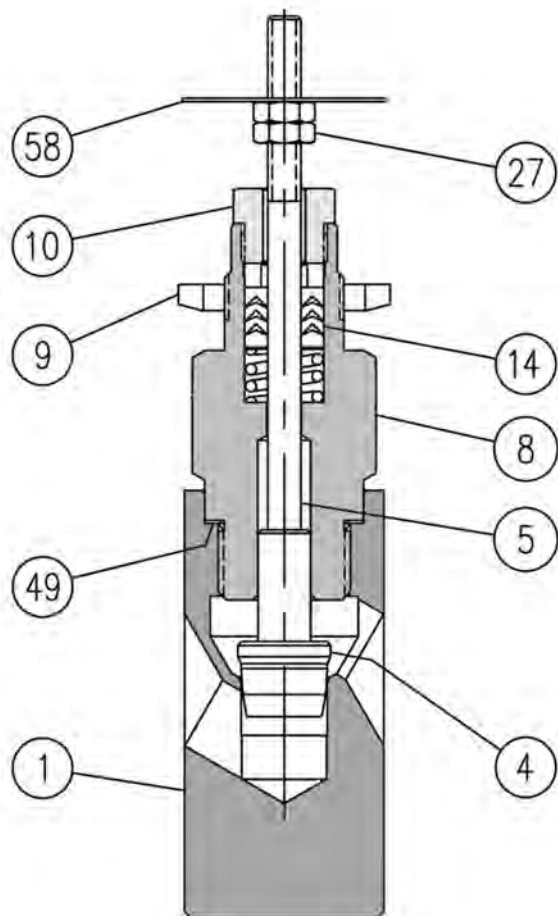
Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name, and desired material using the following parts tables.

⚠ WARNING

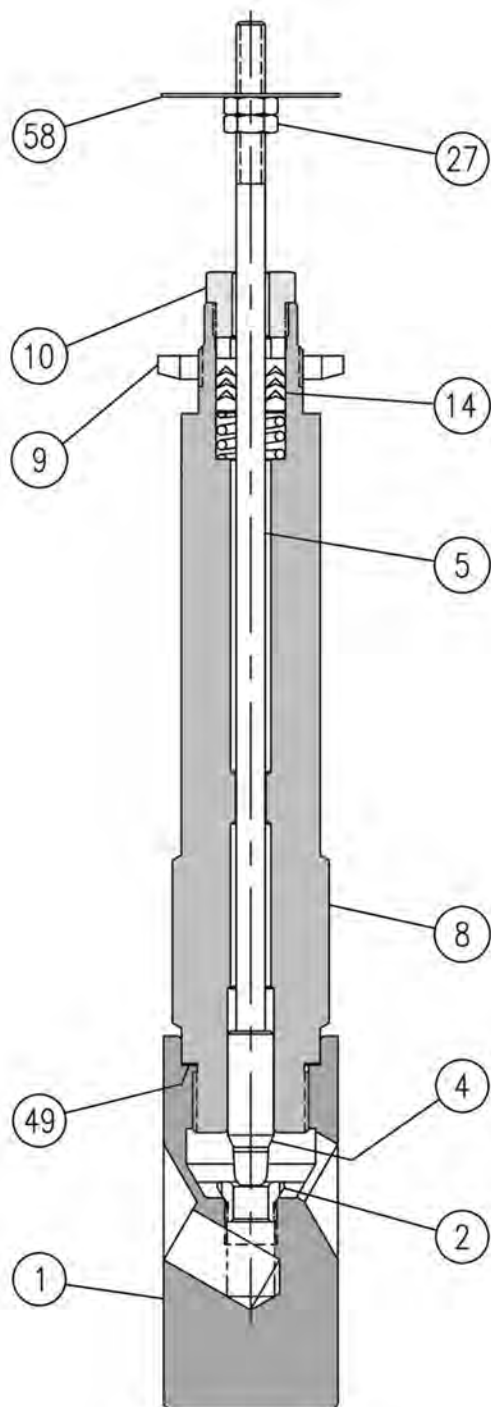
Use only genuine Fisher™ replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 2. Baumann 24000F Valve Body with Standard Bonnet and NPS 1 Integral Seat



E1278

Figure 3. Baumann 24000F Valve Body with Extension Bonnet and Screwed-In Seat Ring



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Table 1. Baumann 24000F Common Parts^(1,2)

KEY NO.	QTY	DESCRIPTION	REMARKS	VALVE SIZE		
				DN 15 (NPS 1/2)	DN 20 (NPS 3/4)	DN 25 (NPS 1)
				Part Number	Part Number	Part Number
1	1	Valve Body	Screwed Seat	24511	24518	24524
			Integral Seat	N/A	N/A	24521
4*	1	Plug (Metal Seat)		See table 2		
		Plug (Soft Seat)		See table 3		
8	1	Bonnet	Standard	24516-3	24516-3	24522-3
			Extension	24856	24856	24529
9	1	Yoke Drive Nut		011757-003-153	011757-003-153	011757-003-153
10	1	Packing Follower		24490-1	24490-1	24490-1
14	1	Packing Kit (standard)		24494T001		
		Packing Kit (optional)		See page 13		
27	2	Lock Nut		971514-002-250	971514-002-250	971514-002-250
49*	1	Body Gasket		24513	24513	24156
				24513-1	24513-1	24156-1
58	1	Travel Indicator		24299	24299	24299

1. Contact your [Emerson sales office](#) for part number, price, and delivery on optional valve and trim materials (N10276, N08020, and N04400).
2. For valves made before 2005, the common parts numbers above may not apply. Please notify your Emerson sales office if the valve is prior to 2005 so the appropriate parts can be ordered.

For Extension Bonnet Construction

Substitute -104 for -101
 -105 for -102

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Table 2. Plug and Seat Ring for Metal Seat

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm (Inch)	C _v	K _v	VALVE SIZE		
							DN 15 (NPS 1/2)	DN 20 (NPS 3/4)	DN 25 (NPS 1)
4*	Plug & Stem Assy	Metal Seat, Micro Trim (Linear)	102	6.3 (0.25)	0.02 ⁽¹⁾	0.017 ⁽¹⁾	GE46385X012		
					0.05 ⁽¹⁾	0.043 ⁽¹⁾	GE46386X012		
					0.1 ⁽¹⁾	0.086	GE46387X012		
					0.2 ⁽¹⁾	0.17 ⁽¹⁾	GE46388X052		
		Metal Seat (Equal %)	548 (416 SST)	6.3 (0.25)	0.2 ⁽¹⁾	0.17 ⁽¹⁾	GE46393X012		
					0.5 ⁽¹⁾	0.43 ⁽¹⁾	GE46394X012		
					1.0	0.86	GE46392X012		
				9.5 (0.375)	1.5	1.29	24634-6-101-548		
					2.0	1.72	24171-12-101-548		---
					2.5	2.15	---	---	24171-12-101-548
				20.6 (0.8125)	4	3.44	---	---	24185-6-101-548
					6.5	5.59	---	---	24061-5-101-548
		Metal Seat (Equal %)	588	6.3 (0.25)	0.2 ⁽¹⁾	0.17 ⁽¹⁾	GE46390X012		
					0.5 ⁽¹⁾	0.43 ⁽¹⁾	GE46391X012		
					1.0	0.86	GE46389X012		
				9.5 (0.375)	1.5	1.29	24634-101-588		
					2.0	1.72	24171-101-588		---
					2.5	2.15	---	---	24171-101-588
				20.6 (0.8125)	4	3.44	---	---	24185-101-588
					6.5	5.59	---	---	24061-101-588
		Metal Seat (Linear)	648 (416 SST)	6.3 (0.25)	0.5	0.43	GE46398X012		
					1.0	0.86	GE46397X012		
				9.5 (0.375)	1.5	1.29	24669-1-101-648		
					2.0	1.72	24671-2-101-648		---
					2.5	2.15	---	---	24671-2-101-648
				20.6 (0.8125)	4	3.44	---	---	24757-5-101-648
					6.5	5.59	---	---	24717-3-101-648
		Metal Seat (Linear)	688	6.3 (0.25)	0.5	0.43	GE46396X012		
					1.0	0.86	GE46395X012		
				9.5 (0.375)	1.5	1.29	24669-101-688		
					2.0	1.72	24671-101-688		---
					2.5	2.15	---	---	24671-101-688
				20.6 (0.8125)	4	3.44	---	---	24757-101-688
					6.5	5.59	---	---	24717-101-688
2*	Seat Ring	9.5 mm (0.375 in) Orifice Diameter, 316 SST					24167		
		9.5 mm (0.375 in) Orifice Diameter, 416 SST					24167-3		
1. Matching seat ring (key 2) must be furnished with replacement plug orders.									

1. Matching seat ring (key 2) must be furnished with replacement plug orders.

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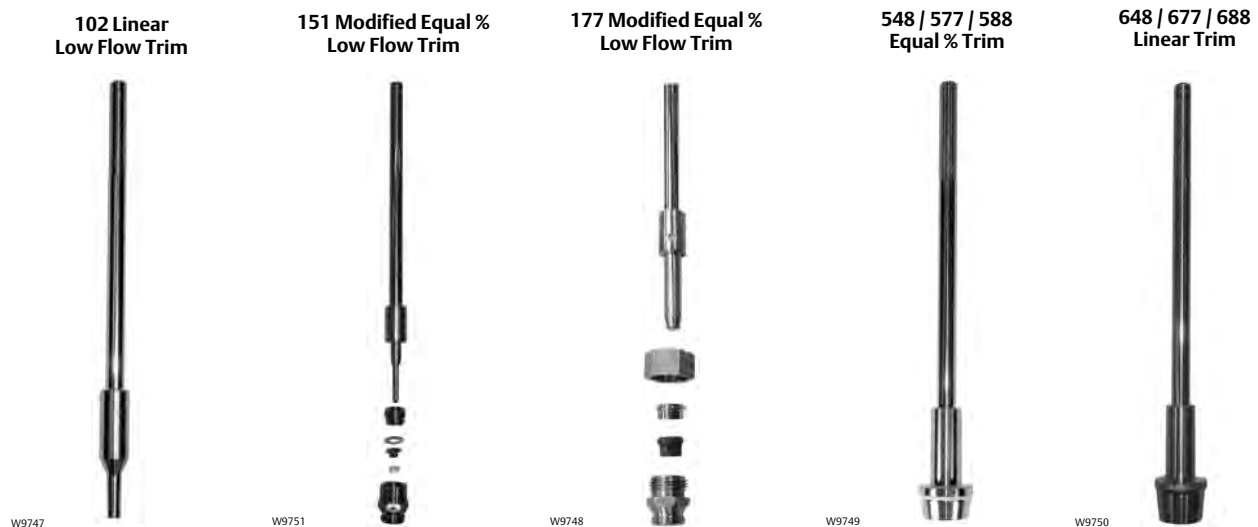
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Table 3. Plug and Seat Ring for Soft Seat

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm (Inch)	C _v	K _v	VALVE SIZE		
							DN 15 (NPS 1/2)	DN 20 (NPS 3/4)	DN 25 (NPS 1)
4*	Plug/Stem	PTFE Seat (Equal %)	577	9.5 (0.375)	1.0	0.86	24893-101-577		
					1.5	1.29	24796-101-577		
					2.0	1.72	24609-101-577		---
					2.5	2.15	---	---	24609-101-577
				20.6 (0.8125)	4	3.4	---	---	24010-2-101-577
					6.5	5.6	---	---	24010-101-577
		PTFE Seat (Linear)	677	9.5 (0.375)	0.1	0.086	24660-101-677		
					0.2	0.172	24625-101-677		
					0.5	0.43	24617-101-677		
					1.0	0.86	24631-101-677		
					2.0	1.72	24656-101-677		---
					2.5	2.15	---	---	24656-101-677
				20.6 (0.8125)	4	3.4	---	---	24010-1-101-677
							---	---	24010-1-101-677
2*	Seat Ring	6.3 mm (0.25 in) Orifice Diameter					24161		
		9.5 mm (0.375 in) Orifice Diameter					24167		

Figure 4. Baumann 24000F Trims



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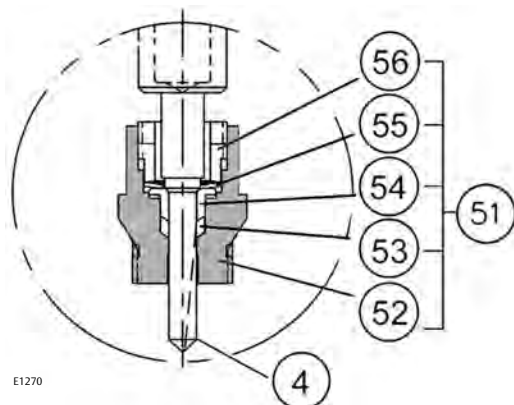
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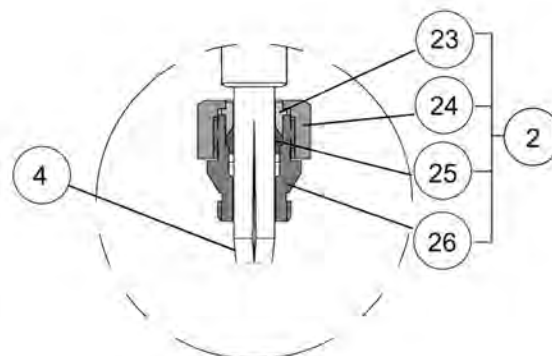
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Figure 5. Optional 151 Low Flow Trim Assembly



E1270

Figure 6. Optional 177 Low Flow Trim Assembly



E1271

Table 4. Plug and Seat for Baumann 151 Trim

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG SERIES	ORIFICE DIAMETER mm (Inch)	C _v	K _v	VALVE SIZE		
							DN 15 (NPS 1/2)	DN 20 (NPS 3/4)	DN 25 (NPS 1)
4*	Plug & Stem Assy	Modified Equal % Low Flow	151	3.96 (0.156)	0.00013	0.0001	24151-2-101-151		
					0.00025	0.0002	24151-3-101-151		
					0.0005	0.0004	24151-4-101-151		
					0.001	0.0009	24151-5-101-151		
					0.002	0.0017	24151-6-101-151		
					0.004	0.003	24151-7-101-151		
					0.008	0.007	24151-8-101-151		
					0.015	0.013	24151-9-101-151		
					0.03	0.026	24151-10-101-151		
					0.06	0.052	24151-11-101-151		
					0.1	0.86	24151-12-101-151		
					0.2	0.17	24151-24-101-151		
					0.45	0.39	24151-25-101-151		
51*	Seat Sub-Assembly					24151-20			

Table 5. Plug and Seat for Baumann 177 Trim

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG SERIES	ORIFICE DIAMETER mm (Inch)	C _v	K _v	VALVE SIZE		
							DN 15 (NPS 1/2)	DN 20 (NPS 3/4)	DN 25 (NPS 1)
2*	Seat Sub-Assembly (See table 6)						24241		
4*	Plug & Stem Assy	Low Flow	177	7.9 (0.3125)	0.0005	0.0004	24598-101-177		
					0.001	0.0009	24597-101-177		
					0.002	0.0017	24594-101-177		
					0.005	0.004	24595-101-177		
					0.01	0.009	24596-101-177		
					0.02	0.017	24621-10-101-177		
					0.05	0.04	24658-10-101-177		

Table 6. Baumann 177 Low Flow Trim

Key No.	Description		
4*	Plug (see table 5)		
2a*	23	Gland	Seat Ring Subassembly, P/N 24241
	24	Retainer Nut	
	25	Insert	
	26	Housing	

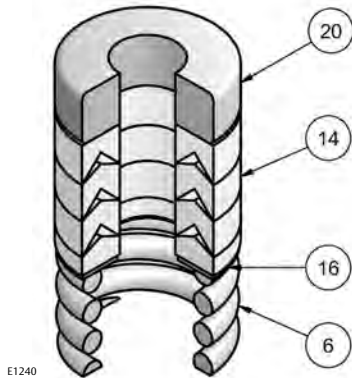
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Figure 7. Spring-Loaded PTFE V-Ring Packing Kit P/N 24494T001

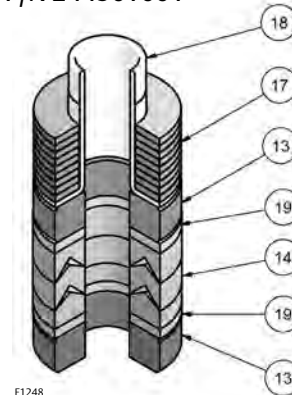


E1240

Table 7. Spring-Loaded PTFE V-Ring Packing Kit P/N 24494T001

Key No.	Description	Material
6*	Spring	ASTM A313 S30200
14	Packing Set	PTFE / carbon-filled PTFE
16	Washer	ASTM A240 S31600
20	Spacer	J-2000 (filled PTFE)

Figure 9. ENVIRO-SEAL Packing Kit P/N 24490T001

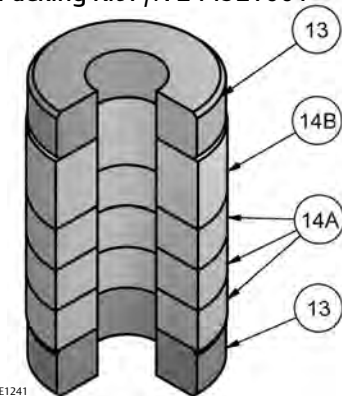


E1248

Table 9. ENVIRO-SEAL Packing Kit P/N 24490T001

Key No.	Description	Material
13	Bushing, qty 2	Carbon Graphite
14	Packing Set	PTFE / carbon-filled PTFE
17	Belleville Spring	ASTM B637 N07718
18	Bushing	PEEK
19	Washer, qty 2	Modified PTFE

Figure 8. Molded Graphite (Flexible Graphite) Packing Kit P/N 24492T001



E1241

Table 8. Molded Graphite (Flexible Graphite) Packing Kit P/N 24492T001

Key No.	Description	Material
13	Bushing, qty 2	Carbon - Graphite
14A	Packing Ring, qty 3	Graphite
14B	Packing Ring	Graphite

Special ENVIRO-SEAL Packing Note

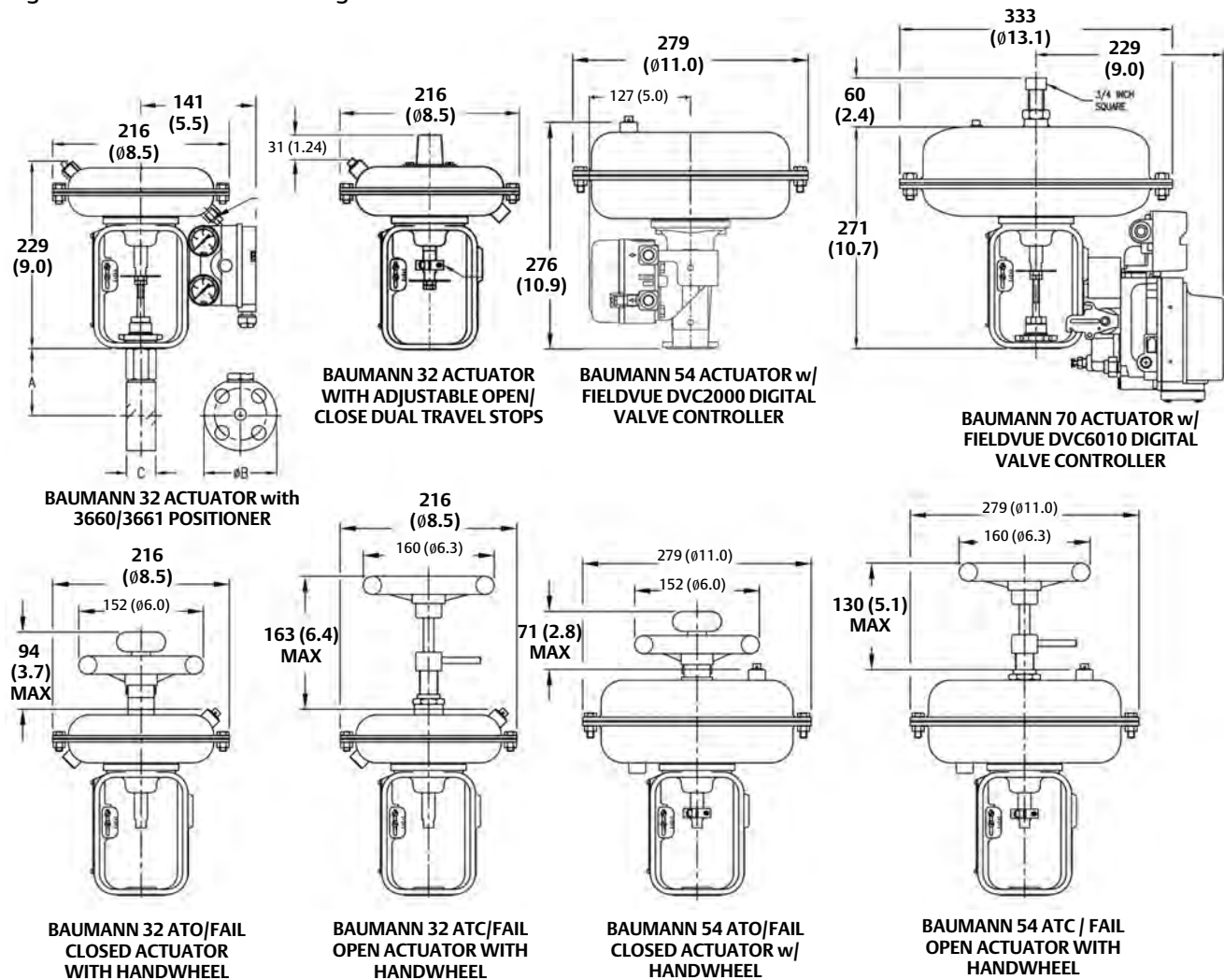
The ENVIRO-SEAL PTFE packing system is suitable for 100 ppm environmental applications on services up to 51.7 barg (750 psig) and process temperatures ranging from -46 to 232°C (-50 to 450°F).

For non-environmental applications, this packing system offers excellent performance at the same temperature range up to the maximum valve working pressure.

Temperature limits apply to packing arrangements only. Complete valve assembly temperature limits may differ. Refer to appropriate pressure/ temperature ratings.

Reference Fisher Packing Selection Guidelines for Sliding-Stem Valves, Bulletin 59.1:062, [D101986X012](#).

Figure 10. Dimensional Drawings



E1280

NOTE: ACTUATOR REMOVAL REQUIRES 115 mm (4.5 INCHES) VERTICAL CLEARANCE.

mm
(inch)

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Table 10. Baumann Valve Dimensions

VALVE SIZE		A -- BONNET				B -- DIAMETER		C	
		Standard		Extension					
DN	NPS	mm	Inch	mm	Inch	mm	Inch	mm	Inch
15	1/2	81.3	3.2	218.4	8.6	88.9	3.5	38.1	1.5
20	3/4	81.3	3.2	218.4	8.6	107.95	4.25	38.1	1.5
25	1	78.7	3.1	215.9	8.5	114.3	4.5	50.8	2.0

Table 11. Baumann Valve Assembly Weights

VALVE SIZE		WEIGHTS	
DN	NPS	kg	lb
15	1/2	1.7	3.8
20	3/4	2.4	5.3
25	1	3.3	7.3

Table 12. Baumann Actuator Weights

ACTUATOR	WEIGHTS	
	kg	lbs
32	4.5	10
54	11.3	25
70	15.4	34
MV1020 ⁽¹⁾	10	22
VA1020 ⁽¹⁾	14	30

1. Electric actuators, reference electric actuator bulletin for more details (52.1:ECV, [D103347X012](#)).

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Fisher™ Baumann™ 24000S Stainless Steel Control Valve



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Section 1: Introduction

The Fisher Baumann 24000S line of stainless steel pneumatic control valves (Figure 1) may be used for the control of pressure, temperature, level and flow. NPS 1/2 through 2 valves are available with NPT end connections. NPS 3 is available as wafer style only. The 316 stainless steel valve body will withstand mildly corrosive fluids, yet is economical enough to use in applications where carbon steel is normally specified.

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for the Fisher Baumann 24000S stainless steel control valve.

WARNING



Do not install, operate or maintain Fisher Baumann 24000S control valves without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. Fisher Baumann 24000S NPT Control Valve



W9759

1.2 Education Services

Emerson's Education Services
Phone: +1-800-338-8158
E-mail: education@emerson.com
emerson.com/en/final-control/services/valve-training

Table 1. Technical Specifications

NOMINAL PIPE SIZE	DN 15, 25, 40, 50 and 80	NPS 1/2, 1, 1-1/2, 2 and 3
END CONNECTIONS	Screwed NPT (except for NPS 3, wafer style only) Wafer / Buttweld	
PRESSURE RATING	CL300 (CL150 for NPS 3 per ASME B16.34)	
VALVE BODY MATERIAL	CF8M ASTM A351	
CHARACTERISTIC	Equal Percentage or Linear	

Figure 2. Valve Body Pressure / Temperature Ratings ASME CL150 Valves
(Source: ASME B16.34)

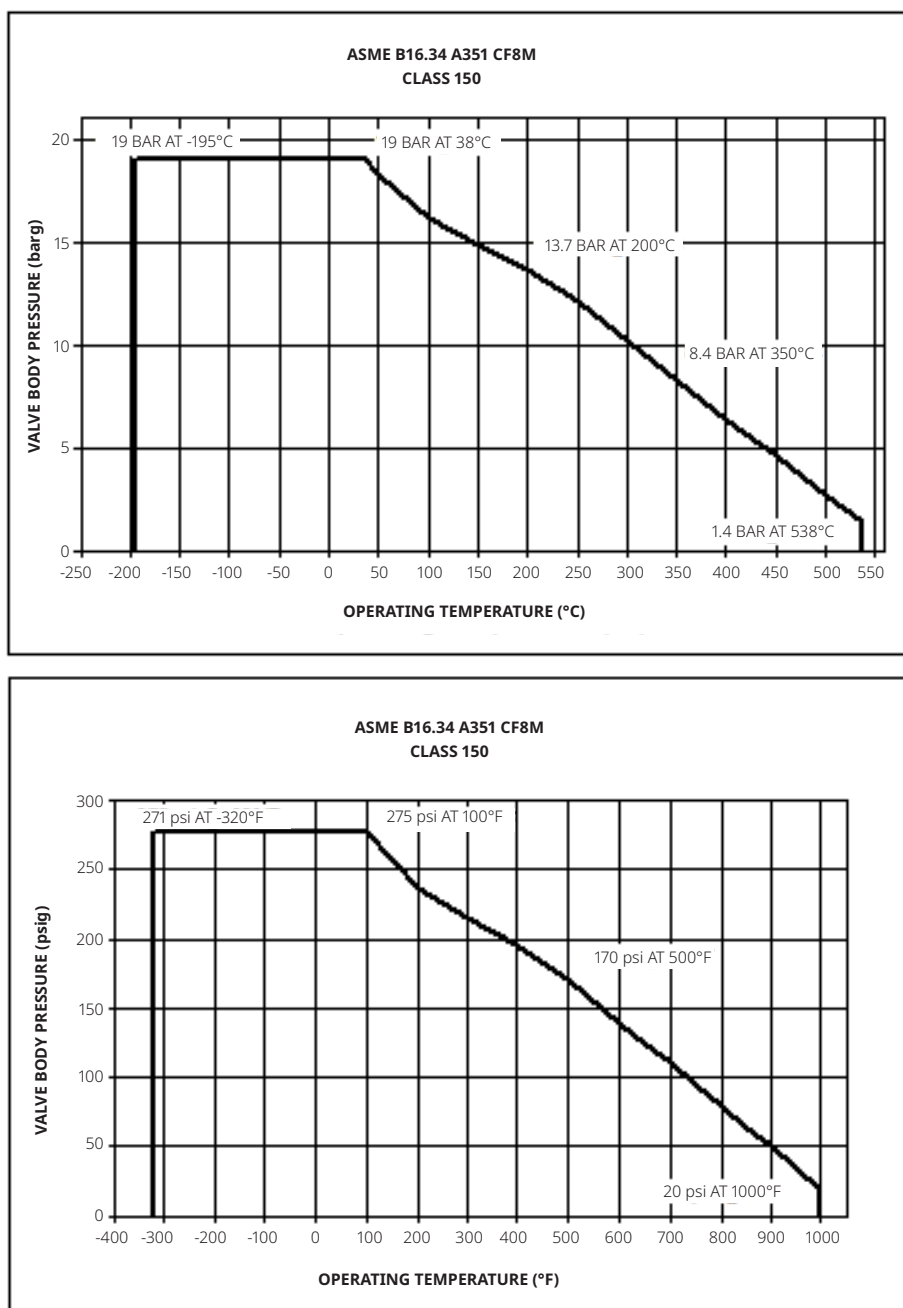
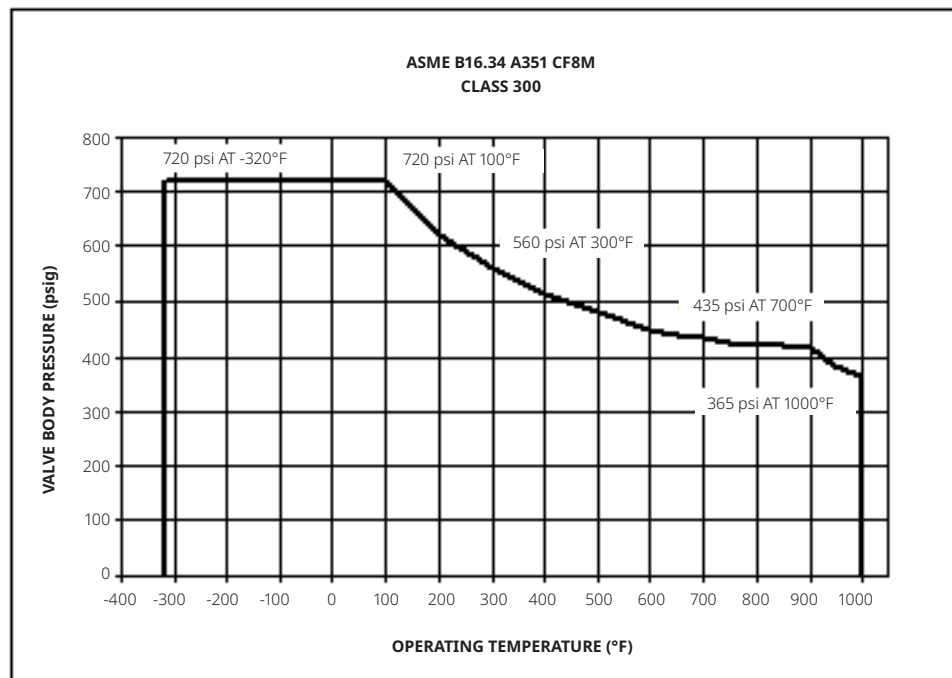
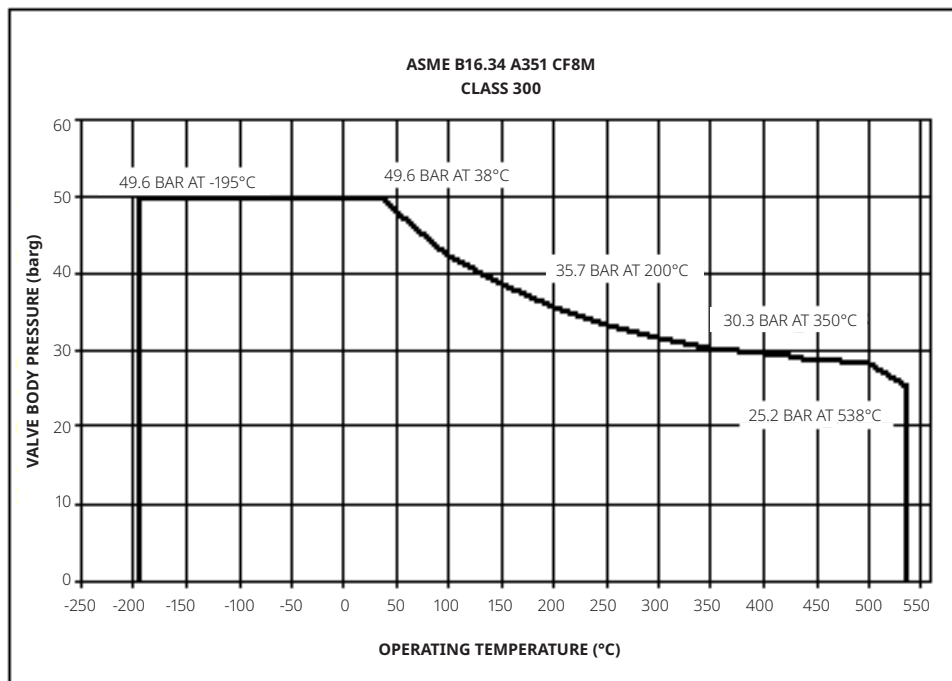


Figure 3. Valve Body Pressure / Temperature Ratings ASME CL300 Valves
(Source: ASME B16.34) (Does Not Apply to 24000S NPS 3 Valves)



Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end user. Because some valve body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

NOTE

The acronym of CWP may appear on the nameplate. CWP (Cold Working Pressure) denotes the pressure rating at normal ambient temperature. A normal ambient temperature range being -4 to +100°F / -20 to +38°C.

WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

NOTICE

To avoid damaging valve seating surfaces, make sure the adjacent piping is free of pipe scale, welding slag and any other potentially damaging material.

1. Before installing the valve in the pipeline, inspect the valve body to be certain it is free of foreign material and thoroughly clean the line of all dirt, welding chips, scale, oil or grease and other foreign material.
2. Install the valve so the controlled fluid will flow through the valve body in the direction indicated by the arrow cast on the valve body.
3. A three-valve bypass must be used to permit removal of the control valve from the line without shutting down the system.
4. In case of a heat-insulated installation, insulate the valve body only, not the bonnet.

2.1 Air Piping

1. For an air-to-extend actuator (air-to-close action), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open action) connect the actuating air pressure line to the 1/4 NPT in the lower diaphragm case.
2. Use 6.4 mm / 1/4 in. O.D. tubing or equivalent for all air lines. If air line exceeds 8 m / 25 ft in length, 9.5 mm / 3/8 in. tubing is preferred. Air lines must not leak. Air pressure not to exceed 2.5 bar / 35 psig.

Section 3: Maintenance

WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

NOTE

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

3.1 Disassembly

NOTICE

- When assembling or disassembling the valve, do not turn the valve stem while the plug is touching the valve seat. This will damage the valve's seating surfaces.
- When adjusting the valve stem, do not grip the stem directly with pliers or a wrench. This will damage the surface of the stem and cause damage to the packing in the valve. Instead, counter-tighten the two locknuts (key 27) on the stem (key 5). This will allow you to turn the stem by turning the locknuts (key 27) with a wrench.
- When placing the valve in a vise, do not clamp the rounded sides of the valve. This will distort the shape of the casting, and will ruin the valve.

Actuator Removal

Access to the internal components of the valve body can be accomplished with the actuator removed. For actuator maintenance, see the Fisher Baumann Actuator Instruction Manual (D103352X012).

Air-to-Close Actuators

1. Disconnect the air supply to the actuator and remove the air tubing.
2. Loosen the drive nut (key 9) and then remove the plug and stem (keys 4 and 5) assembly by holding the actuator stem still while unthreading the plug and stem assembly counterclockwise.
3. Remove the stem locknuts (key 27), travel indicator (key 58) and yoke drive nut (key 9).
4. Remove the actuator from the valve.

Air-to-Open Actuators

1. Using flexible tubing, apply sufficient air pressure to the actuator to lift the plug off the seat.
2. Loosen the drive nut (key 9) and then remove the plug and stem (keys 4 and 5) assembly by holding the actuator stem still while unthreading the plug and stem assembly counterclockwise.
3. Remove the stem locknuts (key 27), travel indicator (key 58) and yoke drive nut (key 9).
4. Remove the actuator from the valve.
5. Disconnect the air supply to the actuator and remove the air tubing.

Valve Body Disassembly

1. After removing the actuator, unscrew the bonnet (key 8) and plug and stem (keys 4 and 5) from valve body (key 1). A new body gasket (key 49) should be installed each time the valve is disassembled.
2. Loosen the packing spring load by removing the packing follower (key 10).

Remove the plug and stem assembly by pulling it out through the bottom of the bonnet (key 8) while rotating the stem (key 5). This will help prevent damage to the packing components.

NOTE

Handle the parts carefully to avoid damaging the seating and guiding surfaces. Wipe the parts with a clean soft cloth and examine for signs of wear or damage.

3. To remove the seat ring (key 2), use a 5/8 in. socket wrench. Clean the seat ring thoroughly and examine for signs of wear or damage.
4. Low Flow Trims:
 - a. For Fisher Baumann 151 trim (Figure 6), unscrew the seat sub-assembly (key 51) with a 5/8 in. socket wrench. When reassembling, hand tighten the sub-assembly (key 51) and then rotate 1/8 of a turn with the 5/8 in. socket to lock in place.

NOTE

If changing to Fisher Baumann 151 trim, for correct flow characteristics, be sure the valve is reversed in the pipeline so that flow direction is flow-to-close.

- b. For Fisher Baumann 177 trim (Figure 7), unscrew the retainer nut (key 24) using a 3/4 in. socket wrench. Remove the gland (key 23) and insert (key 25). Replace the insert (key 25), making sure that the tapered portion faces up. If replacement of the housing (key 26) is required, use a 5/8 inch socket wrench.
- c. For NOLEEK bellows trim (Figure 8), hold the bellows bonnet and push down on the stem to expose the plug retaining pin (key 21). Using a small punch, tap the pin (key 21) out. To replace the new plug retaining pin (key 21), be sure the plug and stem is aligned to expose the hole (refer to Figure 6) and with needle nose pliers slide the pin (key 21) into the hole.

NOTICE

Be sure the plug retaining pin (key 21) is flush inside the hole and not exposed on either side of the plug or damage could happen to the bonnet interior.

3.2 Lapping the Valve Seat

If valve seat leakage becomes excessive, it may be necessary to lap the valve seat.

Lapping is the process of mating the valve plug to the seat ring, with an abrasive to produce a close fit. When valve seat leakage becomes excessive, lapping becomes necessary. The plug and seat ring seating surfaces should be free of large scratches or dents and the contact surface of the seats should be as narrow as possible.

1. Use a good quality lapping compound with a mixture that contains 280 to 600 grit. Apply at several spots around the plug seating surface. Replace the plug and stem carefully in the bonnet.
2. Install the bonnet (key 8) into the valve body, without gasket and hand tighten. The bonnet will serve as a guide during the lapping operation.
3. Lap the valve by applying a slight pressure on the stem and rotate the stem in short oscillating strokes approximately 8 to 10 times or until you see an even and complete lap line. The plug should be intermittently lifted and turned 90 degrees while lapping to keep the plug and seat ring concentric.
4. Clean the valve seat and plug (key 4) thoroughly when lapping is complete, removing all traces of lapping compound.
5. For the NPS 1 through 3 integral seat valve body, inspect the internal seating surface for wear or damage and replace if necessary.

3.3 Replacing Packing

Refer to Figure 4 and the standard and optional packing constructions (Figure 9) to determine the packing that has been preinstalled in your valve.

1. Disassemble the valve as directed earlier. Remove the locknuts (key 27) and indicator disk (key 58) and turn the plug and stem (keys 4 and 5) out through the packing box. Remove the packing follower (key 10). Push out the old packing (key 14) by working from the underside of the bonnet (key 8).
2. Standard Spring Loaded PTFE V-Ring Packing (Figures 4 and 9): Carefully insert each piece in exact order shown in Figure 9. Tighten the packing follower (key 10) until it shoulders on the bonnet (key 8). This will compress the packing spring (key 7) to enable constant stem sealing throughout packing life.
3. Molded Graphite Ribbon Packing (Figure 9): Carefully insert each piece in exact order shown in Figure 9. Hand tighten the packing follower (key 10). Use a wrench to increase tightness by turning the follower an additional 60 degrees.
4. Fisher enhanced ENVIRO-SEAL Packing (Figure 9): Carefully insert each piece in exact order as shown in Figure 9. Tighten the packing follower (key 10) until the Belleville springs are compressed. This will be signaled by a significant increase in resistance. Back off the follower 1/8 to 1/4 turn. A gap of approximately 1.5 mm / 1/16 in. between the packing follower and the bonnet will ensure the packing is seated properly.
5. For Optional NOLEEK Bellows Seal Packing (Figure 8): Insert each piece in the exact order shown in the illustration. Tighten the packing follower (key 10) until it shoulders on the bonnet (key 8). This will compress the packing springs (key 7) to provide constant stem sealing throughout packing life.

3.4 Actuator and Valve Body Reassembly

1. Insert a new valve body gasket (key 49) and install the bonnet assembly (key 8). For NPS 1/2 to 1 valves, tighten the nuts (key 12) to a torque of 9.5 to 17.6 N•m / 7 to 13 lbf•ft; NPS 1-1/2 to 2 valves, tighten nuts (key 12) to a torque of 21.7 to 42.0 N•m / 16 to 31 lbf•ft.
2. Place the actuator yoke over the stem (key 5). While tilting the actuator back, drop the yoke drive nut (key 9) over the stem (key 5). Run the locknuts (key 27) and the travel indicator (key 58), down as far as possible and counter tighten the locknuts (key 27) to lock.

See the Fisher Baumann Actuator Instruction Manual ([D103352X012](#)) for reassembly and bench range adjustment.

NOTICE

When assembling or disassembling the valve, do not turn the valve stem while the plug is in contact with the valve seat. This can damage the seating surface very quickly.



WARNING

To avoid personal injury or equipment damage due to possible sudden shifting or falling of the valve assembly, do not lift the valve assembly by the handwheel.

Section 4: Parts

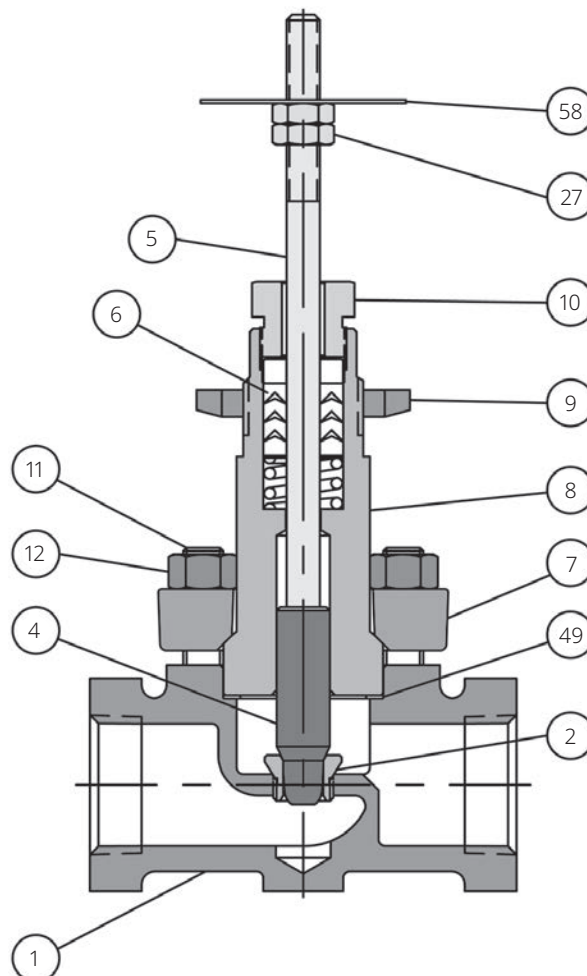
4.1 Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name and desired material using the following parts tables.

⚠ WARNING

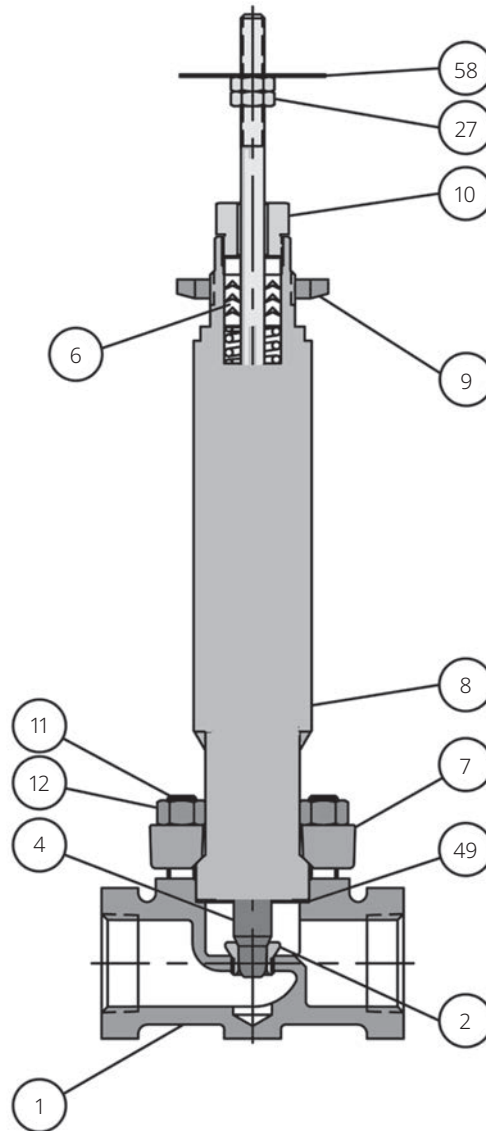
Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

Figure 4. Fisher Baumann Flangeless (NPT) Threaded Valve Body Assembly with Standard Bonnet



E1266

Figure 5. Fisher Baumann Flangeless (NPT) Threaded Valve Body Assembly with Single Extension Bonnet



E1366

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

24000S Valve

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Table 2. Fisher Baumann 24000S Common Parts⁽¹⁾

KEY NO.	QTY	DESCRIPTION	SEAT
1	1	Valve body, NPT	Threaded
4*	1		Integral
6*	1	Plug	
7	1	Packing kit	
8	1	Bonnet flange	
		Bonnet, standard	
		Bonnet, extension, single	
		Bonnet, extension, double	
		Bonnet, extension, triple	
		Bonnet, NOLEEK S/A	
9	1	Drive nut	
10	1	Packing follower	
11	4	Stud	
12	4	Hex nut	
13	4	Hex head cap screws	
27	2	Lock nut	
49*	1	Body gasket	
58	1	Travel indicator	
1. Please notify your Emerson sales office if the valve is prior to 2005 so the appropriate parts can be ordered.			

The guidelines below apply to Tables 3, 4, 6 and 8.

For Extension Bonnet Construction

Substitute -104 for -101
-105 for -102

Double Extension Bonnet Construction

Substitute -107 for -101
-108 for -102

Triple Extension Bonnet Construction

Substitute -110 for -101
-111 for -102

Table 3. Plug for NPS 1/2 and 1 Valves

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _v	K _v
4*	Plug and stem assy	Low Flow	151	(See Table 6)		
			177	(See Table 8)		
		Metal Seat, Micro Trim (Linear)	102	6.3 / 0.25	0.02 ⁽¹⁾	0.017 ⁽¹⁾
					0.05 ⁽¹⁾	0.04 ⁽¹⁾
					0.1 ⁽¹⁾	0.09 ⁽¹⁾
					0.2 ⁽¹⁾	0.17 ⁽¹⁾
		PTFE Seat (Equal %)	577	9.5 / 0.375	1.0	0.86
					1.5	1.29
					2.5	2.15
				20.6 / 0.8125	4	3.4
					8.5	7.3

- continued -

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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24000S Valve

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Table 3. Plug for NPS 1/2 and 1 Valves (continued)

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _V	K _V
4*	Plug and stem assy	Metal Seat (Equal %)	548 (416 SST)	6.3 / 0.25	0.22 ⁽¹⁾	0.19
					0.61 ⁽¹⁾	0.52 ⁽¹⁾
					1.0	0.86 ⁽¹⁾
				9.5 / 0.375	1.5	1.29
					2.5	2.15
					20.6 / 0.8125	4.7
				9.5		8.2
		Metal Seat (Equal %)	588	6.3 / 0.25	0.22 ⁽¹⁾	0.19 ⁽¹⁾
					0.61 ⁽¹⁾	0.52 ⁽¹⁾
					1.0	0.86
				9.5 / 0.375	1.5	1.29
					2.5	2.15
					20.6 / 0.8125	4.7
				9.5		8.2
		Metal Seat (Linear)	648 (416 SST)	6.3 / 0.25	0.5	0.43
					1.0	0.86
				9.5 / 0.375	1.5	1.29
					2.5	2.15
					20.6 / 0.8125	4
				9.5		8.2
				PTFE Seat (Linear)	677	9.5 / 0.375
		0.2	0.17			
		0.5	0.43			
		1.0	0.86			
		2.5	2.15			
		20.6 / 0.8125	4			3.4
		Metal Seat (Linear)	688			6.3 / 0.25
				1.0	0.86	
				9.5 / 0.375	1.5	1.29
					2.5	2.15
					20.6 / 0.8125	4
		9.5	8.2			
2*	Seat ring	3/8 in. threaded, 316 SST				
		3/8 in. threaded, 416 SST				
1. Matching seat ring (key 2) must be furnished with replacement plug orders. *Recommended spare parts						

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

24000S Valve

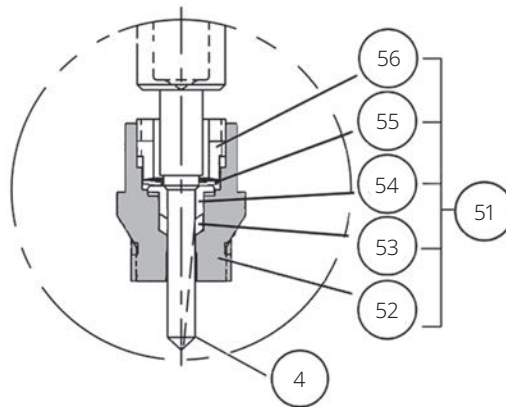
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Table 4. Plug for NPS 1-1/2, 2 and 3 Valves

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _v	K _v
4*	Plug and stem assy	PTFE Seat (Equal %)	577	31.8 / 1.25	17.5	15.1
				38.1 / 1.50	10	8.6
					18	15.5
					30.5	26.2
				50.8 / 2.0	35	30.1
		Metal Seat (Equal %)	548 (416 SST)	31.8 / 1.25	9.0	7.7
					17.5	15.1
				38.1 / 1.50	10	8.6
					17.5	15.1
					30.5	26.2
				50.8 / 2.0	35	30.1
					61	52.5
		Metal Seat (Equal %)	588	31.8 / 1.25	9.0	7.7
					17.5	15.1
				38.1 / 1.50	10	8.6
					17.5	15.1
					30.5	26.2
				50.8 / 2.0	35	30.1
					61	52.5
		Metal Seat (Linear)	648 (416 SST)	31.8 / 1.25	17.5	15.1
					10	8.6
				38.1 / 1.50	17.5	15.1
					30.5	26.2
				50.8 / 2.0	35	30.1
					61	52.5
		PTFE Seat (Linear)	677	31.8 / 1.25	17.5	15.1
				38.1 / 1.50	10	8.6
					17.5	15.1
				50.8 / 2.0	35	30.1
					61	52.5
		Metal Seat (Linear)	688	31.8 / 1.25	17.5	15.1
				38.1 / 1.50	10	8.6
					17.5	15.1
					30.5	26.2
				50.8 / 2.0	35	30.1
					61	52.5

Figure 6. Optional 151 Low Flow Trim Assembly

E1270

Table 5. Fisher Baumann 151 Low Flow Trim

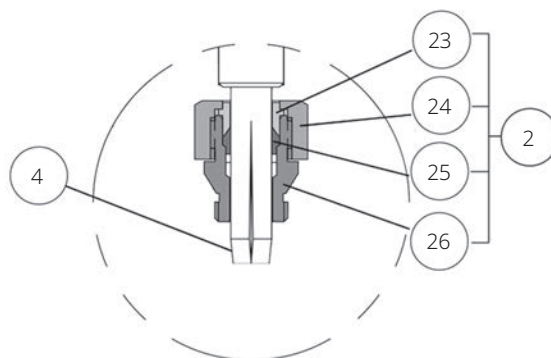
KEY NO.		DESCRIPTION	MATERIAL
4		Plug	ASTM A479 S21800
51	Seat sub-assembly		
	52	Cage	ASTM A276 S31600
	53	Seat	PTFE
	54	Collar	ASTM A276 S31600
	55	Washer	ASTM A276 S31600
	56	Insert	ASTM A276 S31600

Table 6. Plug and Seat for Fisher Baumann 151 Trim

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _V	K _V
4*	Plug and stem assy	Modified Equal % Low Flow	151	3.96 / 0.156	0.00013	0.0001
					0.00025	0.0002
					0.0005	0.0004
					0.001	0.0009
					0.002	0.0017
					0.004	0.003
					0.008	0.007
					0.015	0.013
					0.03	0.026
					0.06	0.052
					0.1	0.86
					0.2	0.17
					0.45	0.39
51*	Seat sub-assembly					
*Recommended spare parts						

*Recommended spare parts

Figure 7. Optional 177 Low Flow Trim Assembly



E1271

Table 7. Fisher Baumann 177 Low Flow Trim

KEY NO.		DESCRIPTION	
4*	- - -	Plug (see Table 8)	
2*	23	Gland	Seat ring sub-assembly, P/N 24241
	24	Retainer nut	
	25	Insert	
	26	Housing	

*Recommended spare parts

Table 8. Plug and Seat for Fisher Baumann 177 Trim

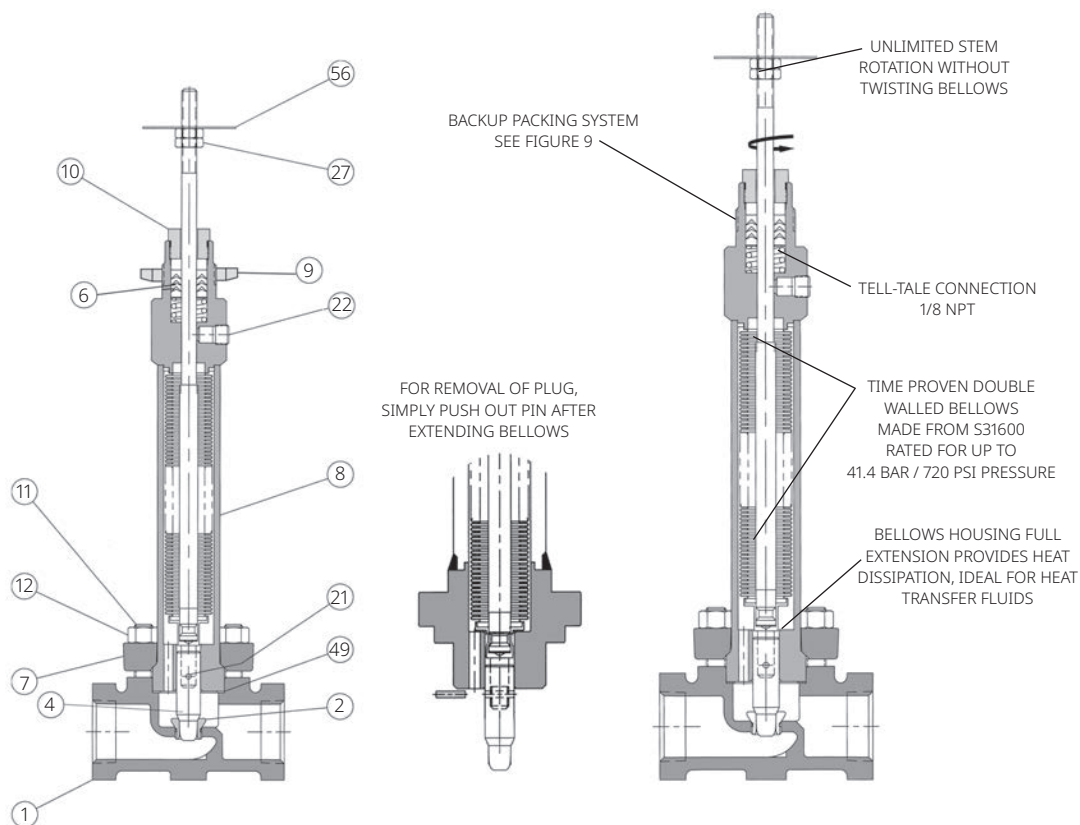
KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _v	K _v
2*	Seat sub-assembly (see Table 7)					
4*	Plug and stem assy	Low Flow	177	7.9 / 0.3125	0.0005	0.0004
					0.001	0.0009
					0.002	0.0017
					0.005	0.004
					0.01	0.009
					0.02	0.017
					0.05	0.04

*Recommended spare parts

⚠ WARNING

The Fisher Baumann NOLEEK valve bonnet assembly is not intended for use in lethal service applications.

Figure 8. Fisher Baumann NOLEEK Bellows Bonnet Assembly

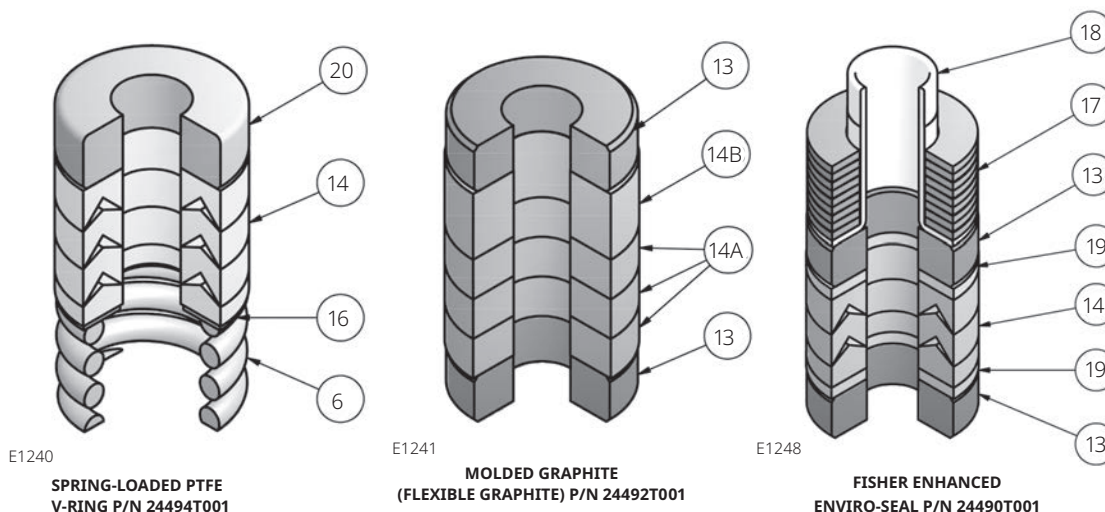


E1367

Table 9. Common Fisher Baumann NOLEEK Bellows Parts

KEY NO.	DESCRIPTION	VALVE SIZE	
		DN	NPS
4*	Plug	15 to 80	1/2 to 3
6*	V-ring packing kit (standard)	15 to 80	1/2 to 3
	Fisher enhanced ENVIRO-SEAL packing kit (optional)		
8	Complete bellows/Bonnet S/A	15 to 25	1/2 to 1
		40	1-1/2
		50	2
		80	3
21*	Plug retaining pin	15 to 80	1/2 to 3
22*	Hex socket pipe plug, 1/8 NPT, stainless steel		

*Recommended spare parts

Figure 9. Packing Kits**Table 10. Spring-Loaded PTFE V-Ring Packing Kit P/N 24494T001**

KEY NO.	DESCRIPTION	MATERIAL
6*	Spring	ASTM A313 S30200
14	Packing set	PTFE / Carbon-filled PTFE
16	Washer	ASTM A240 S31600
20	Spacer	J-2000 (filled PTFE)
*Recommended spare parts		

Table 11. Molded Graphite (Flexible Graphite) Packing Kit P/N 24492T001

KEY NO.	DESCRIPTION	MATERIAL
13	Bushing, qty 2	Carbon - Graphite
14A	Packing rings, qty 3	Graphite
14B	Packing ring	Graphite

Table 12. Fisher enhanced ENVIRO-SEAL Packing Kit P/N 24490T001

KEY NO.	DESCRIPTION	MATERIAL
13	Bushing, qty 2	Carbon graphite
14	Packing rings, qty 3	PTFE / Carbon-filled PTFE
17	Belleville spring	ASTM B637 N07718
18	Bushing	PEEK
19	Washer, qty 2	Modified PTFE

Special Fisher enhanced ENVIRO-SEAL Packing Note

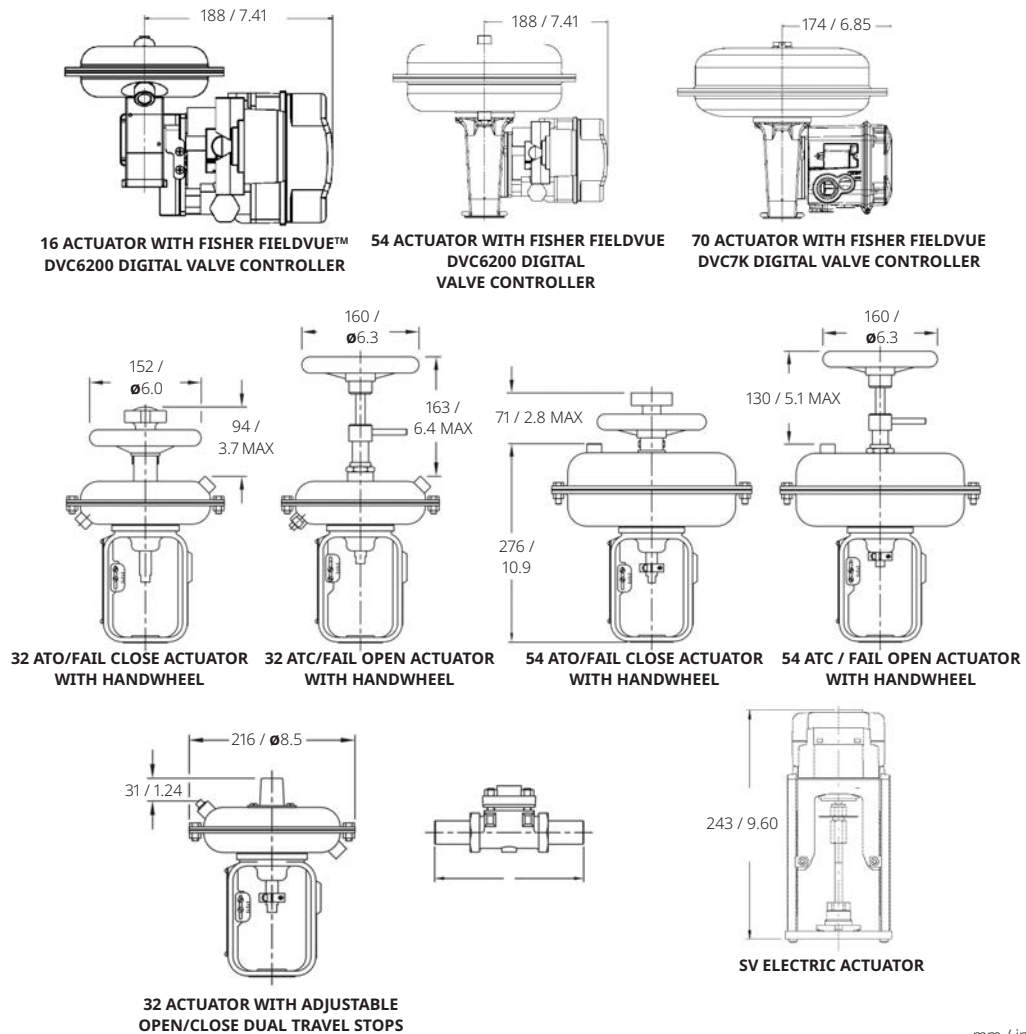
The Fisher enhanced ENVIRO-SEAL PTFE packing system is suitable for 100 ppm environmental applications on services up to 51.7 bar / 750 psig and process temperatures ranging from -46 to 232°C / -50 to 450°F.

For non-environmental applications, this packing system offers excellent performance at the same temperature range up to the maximum valve working pressure.

Temperature limits apply to packing arrangements only. Complete valve assembly temperature limits may differ. Refer to appropriate pressure/ temperature ratings.

Reference Packing Selection Guidelines for Fisher Sliding-Stem Valves Bulletin ([D101986X012](#)).

Figure 10. Dimensional Drawings



mm / in.

E1277

NOTES:

ACTUATOR REMOVAL REQUIRES 115 mm / 4.5 in. VERTICAL CLEARANCE.

ELECTRIC ACTUATORS ARE AVAILABLE. CONTACT YOUR [EMERSON SALES OFFICE](#) FOR DETAILS.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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24000S Valve

July 2026

Table 13. Valve Dimensions

VALVE SIZE		ASME CLASS	A				B									
			NPT		Wafer		Standard		Extension Bonnet						NOLEEK Bellows	
									Single		Double		Triple			
DN	NPS		mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
15	1/2	300	7.9	3.1	N/A	N/A	78.7	3.1	213.4	8.4	351	13.8	488	19.2	227.8	8.97
25	1	300	102	4.0	102	4.0	78.7	3.1	215.9	8.5	351	13.8	488	19.2	227.8	8.97
40	1-1/2	300	114	4.5	114	4.5	88.9	3.5	226	8.9	363	14.3	498	19.6	235.7	9.28
50	2	300	124	4.9	124	4.9	83.8	3.3	221	8.7	356	14	493	19.4	234.4	9.23
80	3	150	N/A	N/A	165	6.5	96.5	3.8	234	9.2	371	14.6	508	20	235.7	9.28

Table 14. Valve Assembly Weights

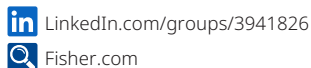
VALVE SIZE		WEIGHT	
DN	NPS	kg	lb
15	1/2	2.3	5
25	1	2.7	6
40	1-1/2	4.1	9
50	2	5.0	11
80	3	9.1	20

Table 15. Actuator Weights

ACTUATOR TYPE	WEIGHTS	
	kg	lb
32	4.5	10
54	11.3	25
70	15.4	34
MV1020 ⁽¹⁾	10	22
VA1020 ⁽¹⁾	14	30
NV24-MFT (non spring return) ⁽¹⁾	1.5	3.3
NVF24-MDT or NF24-MDT-E (spring return) ⁽¹⁾	1.8	4

1. Electric actuators, reference Fisher Baumann SV Bulletin ([D104169X012](#)).

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS



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FISHER™



Fisher™ Baumann™ 24000SB Barstock Control Valve



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Section 1: Introduction

The Fisher Baumann 24000SB Barstock Control Valve (Figures 1 and 2) is recommended for low flow, high pressure, industrial control applications.

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for the Fisher Baumann 24000SB barstock control valve.

WARNING



Do not install, operate or maintain Fisher Baumann 24000SB control valves without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. 24000SB Control Valve with 32 Actuator



x0567

Figure 2. Fisher Baumann 24000SB Control Valve with Flanges and Extension Bonnet**⚠ WARNING**

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact your [Emerson sales office](#) for more complete specifications. Provide the product serial numbers (shown on the nameplate) and all other pertinent information.

NOTE

The acronym of CWP may appear on the nameplate. CWP (Cold Working Pressure) denotes the pressure rating at normal ambient temperature. A normal ambient temperature range being -4 to +100°F / -20 to +38°C.

WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

WARNING

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

1.2 Education Services

Emerson's Education Services

Phone: 800-338-8158

Email: education@emerson.com

emerson.com/en/final-control/services/valve-training

Section 2: Maintenance

WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

NOTE

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

WARNING

Avoid personal injury or property damage by thoroughly cleaning the line of all dirt, welding chips, scale, oil or grease and other foreign material. Failure to do so could result in parts damage, malfunction of the control valve or loss of control of the process.

Section 3: Installation

1. Before installing the valve in the pipeline, thoroughly clean the line of all dirt, welding chips, scale, oil or grease and other foreign material.
2. Install the valve so the controlled fluid will flow through the valve body in the direction indicated by the arrow cast on the valve body.
3. A three-valve bypass must be used to permit removal of the control valve from the line without shutting down the system.
4. In case of a heat-insulated installation, insulate the valve body only, not the bonnet.



WARNING

To avoid personal injury or property damage, do not attempt to do any work on a valve while the system is in operation. The valve must be isolated 100% from the active system and the isolated line voided of pressure and/or hazardous fluids.

3.1 Air Piping

1. For an air-to-extend actuator (air-to-close action), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open action) connect the actuating air pressure line to the 1/4 NPT in the lower diaphragm case.
2. Use 6.4 mm / 1/4 in. O.D. tubing or equivalent for all air lines. If air line exceeds 8 m / 25 ft in length, 9.5 mm / 3/8 in. tubing is preferred. Air lines must not leak. Air pressure not to exceed 2.5 bar / 35 psig.

3.2 Disassembly



WARNING

If there is evidence of process fluid under pressure leaking from the joint, retighten the valve body/joint nuts. Return to the Warning at the beginning of the Maintenance section to ensure proper steps have been taken to isolate the valve and relieve process pressure.

 CAUTION

- **When assembling or disassembling the valve, do not turn the valve stem while the plug is touching the valve seat. This will damage the valve's seating surfaces.**
- **When adjusting the valve stem, do not grip the stem directly with pliers or a wrench. This will damage the surface of the stem and cause damage to the packing in the valve. Instead, counter-tighten the two locknuts (key 27) on the stem (key 5). This will allow you to turn the stem by turning the locknuts (key 27) with a wrench.**
- **When placing the valve in a vise, do not clamp the rounded sides of the valve. This will distort the shape of the casting and will ruin the valve.**

Actuator Removal

Access to the internal components of the valve body can be accomplished with the actuator removed. For actuator maintenance see the Fisher Baumann Pneumatic Actuator Instruction Manual (D103352X012).

Air-to-Close Actuators

1. Disconnect the air supply to the actuator and remove the air tubing.
2. Loosen the drive nut (key 9) and then remove the plug and stem (keys 4 and 5) assembly by holding the actuator stem still while unthreading the plug and stem assembly counterclockwise.
3. Remove the stem locknuts (key 27), travel indicator (key 58) and yoke drive nut (key 9).
4. Remove the actuator from the valve.

Air-to-Open Actuators

1. Using flexible tubing, apply sufficient air pressure to the actuator to lift the plug off the seat.
2. Loosen the drive nut (key 9) and then remove the plug and stem (keys 4 and 5) assembly by holding the actuator stem still while unthreading the plug and stem assembly counterclockwise.
3. Remove the stem locknuts (key 27), travel indicator (key 58) and yoke drive nut (key 9).
4. Remove the actuator from the valve.
5. Disconnect the air supply to the actuator and remove the air tubing.

Valve Body Disassembly

1. After removing the actuator, unscrew the bonnet (key 8) and plug and stem (keys 4 and 5) from valve body (key 1). A new body gasket (key 49) should be installed each time the valve is disassembled.
2. Loosen the packing spring load by removing the packing follower (key 10).
Remove the plug and stem assembly by pulling it out through the bottom of the bonnet (key 8) while rotating the stem (key 5). This will help prevent damage to the packing components.

NOTE

Handle the parts carefully to avoid damaging the seating and guiding surfaces. Wipe the parts with a clean soft cloth and examine for signs of wear or damage.

3. Use a seat ring tool made according to the dimensions in Figure 3 and Table 1 to remove the seat ring (key 2) as follows:
 - a. Insert the tool into the valve body. Be certain the tool lugs are engaged in the corresponding recesses in the seat ring.
 - b. Use a 1/2 in. drive breaker bar or impact wrench having sufficient torque capability to remove the seat ring. Seat ring installation torque is provided in Table 2 for reference. Connect the breaker bar or impact wrench and if needed, a impact-rated extension bar, to the square drive of the seat ring tool.
 - c. Remove the seat ring (key 2) from the valve body. Make sure the seat ring tool is held at a right angle to the seat ring during removal to prevent the tool from disengaging from the lugs of the seat ring.
 - d. Inspect parts for wear or damage that would prevent proper operation of the valve body.
 - e. For Fisher Baumann 151 trim (Figure 7) unscrew the seat subassembly (key 51) with a 5/8 in. socket wrench. When reassembling, hand tighten the subassembly (key 51) and then rotate 1/8 of a turn with the 5/8 in. socket to lock in place.

NOTE

If changing to Fisher Baumann 151 trim, for correct flow characteristics, be sure the valve is reversed in the pipeline so that flow direction is flow-to-close.

- f. For Fisher Baumann 177 trim (Figure 8) unscrew the retainer nut (key 24) using a 3/4 in. socket wrench. Remove the gland (key 23) and insert (key 25). Replace the insert (key 25), making sure that the tapered portion faces up. If replacement of the housing (key 26) is required, use a 5/8 in. socket wrench.

Figure 3. Seat Ring Tool Dimensions

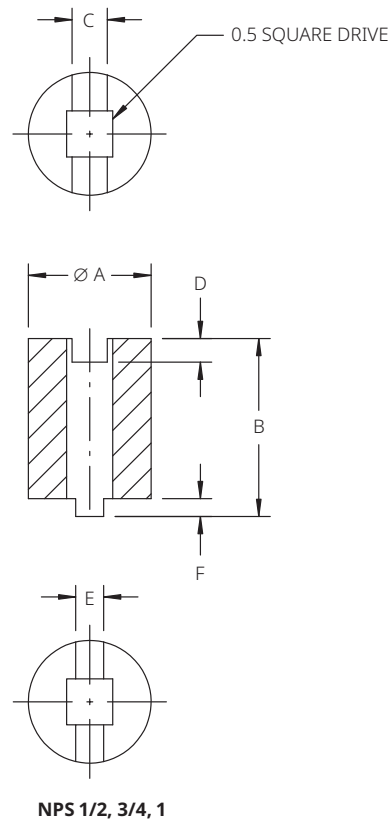


Table 1. Seat Ring Tool Dimensions (see Figure 3)

PART NUMBER	DN	NPS	A	B	C	D	E	F	Torque
			in.						lb•ft
GE96219X012	20	3/4	1.32	2.0	0.38	0.26	0.29	0.19	60
	25	1							

1. Use a 5/8 in. socket wrench to remove the seat ring in the 0.5 in. NPS body.

Table 2. Seat Ring Assembly and Torque Tool

24000SB		VALVE SIZE NPS, in. / DN		
		1/2 / 15	3/4 / 20	1 / 25
		in.		
Port Diameter	151 Low Flow ⁽¹⁾	---	GE96219X012	GE96219X012
	177 Low Flow ⁽¹⁾	---	GE96219X012	GE96219X012
	0.25 ⁽¹⁾	---	GE96219X012	GE96219X012
	0.375 ⁽¹⁾	---	GE96219X012	GE96219X012
	0.8125 ⁽²⁾	---	GE96219X012	GE96219X012
Installation Torque, lb•ft		17	60	60

1. Male end used for trim 151.177 and port diameters 0.25 and 0.375.
2. Female end used for port diameters 0.8125.

3.3 Lapping the Valve Seat

If valve seat leakage becomes excessive, it may be necessary to lap the valve seat.

Lapping is the process of mating the valve plug to the seat ring, with an abrasive to produce a close fit. When valve seat leakage becomes excessive, lapping becomes necessary. The plug and seat ring seating surfaces should be free of large scratches or dents and the contact surface of the seats should be as narrow as possible.

1. Use a good quality lapping compound with a mixture that contains 280 to 600 grit. Apply at several spots around the plug seating surface. Replace the plug and stem carefully in the bonnet.
2. Install the bonnet (key 8) into the valve body, without gasket and hand tighten. The bonnet will serve as a guide during the lapping operation.
3. Lap the valve by applying a slight pressure on the stem and rotate the stem in short oscillating strokes approximately 8 to 10 times or until you see an even and complete lap line. The plug should be intermittently lifted and turned 90 degrees while lapping to keep the plug and seat ring concentric.
4. Clean the valve seat and plug (key 4) thoroughly when lapping is complete, removing all traces of lapping compound.

3.4 Replacing Packing

Refer to Figure 4 and the standard and optional packing constructions (Figure 9) to determine the packing that has been preinstalled in your valve.

1. Disassemble the valve as directed earlier. Remove the locknuts (key 27) and indicator disk (key 58) and turn the plug stem (key 5) out through the packing box. Remove the packing follower (key 10). Push out the old packing (key 14) by working from the underside of the bonnet (key 8).
2. Standard Spring Loaded PTFE V-Ring Packing (Figure 4): Carefully insert each piece in exact order shown in Figure 9. Tighten the packing follower (key 10) until it shoulders on the bonnet (key 8). This will compress the packing spring (key 6) to enable constant stem sealing throughout packing life.
3. Molded Graphite Ribbon Packing (Figure 9): Carefully insert each piece in exact order shown in Figure 9. Hand tighten the packing follower (key 10). Use a wrench to increase tightness by turning the follower an additional 60 degrees.
4. Fisher enhanced ENVIRO-SEAL™ Packing (Figure 9): Carefully insert each piece in exact order as shown in Figure 9. Tighten the packing follower (key 10) until it shoulders on the bonnet, then back off 1/4 turn. This will compress the Belleville spring (key 17) to ensure constant stem sealing is seated properly throughout the packing life.

3.5 Actuator and Valve Body Reassembly

1. Insert a new valve body gasket (key 49) and install the bonnet assembly (key 8).
2. Place the actuator yoke over the stem (key 5). While tilting the actuator back, drop the yoke drive nut (key 9) over the stem (key 5). Run the locknuts (key 27) and the travel indicator (key 58), down as far as possible and counter tighten the locknuts (key 27) to lock.

Carefully position the actuator over the stem (key 5), lift the plug stem and turn the plug stem (key 5) into the actuator stem as far as it will go before adjusting the bench range. See the following instruction manual (Fisher Baumann Actuator Instructions, [D103352X012](#)) for reassembly and bench range adjustment.

CAUTION

When assembling or disassembling the valve, do not turn the valve stem while the plug is in contact with the valve seat. This can damage the seating surface very quickly.

WARNING

To avoid personal injury or equipment damage due to possible sudden shifting or falling of the valve assembly, do not lift the valve assembly by the handwheel.

Section 4: Parts

4.1 Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name and desired material using the following parts tables.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

Figure 4. Fisher Baumann Valve Body Assembly with Standard Spring-Loaded PTFE V-Ring Packing

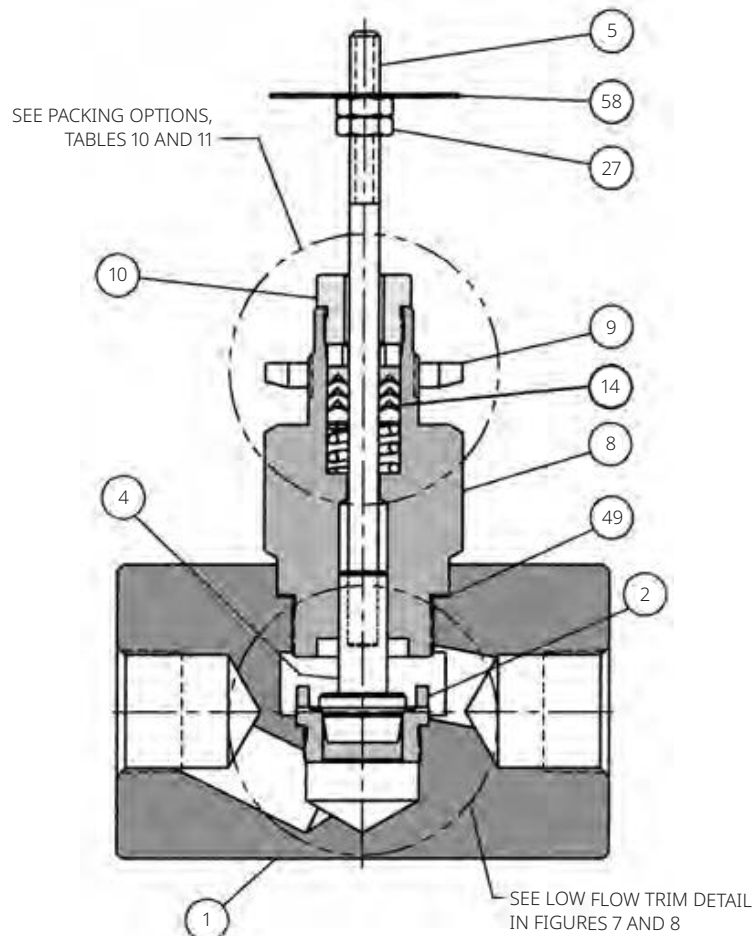
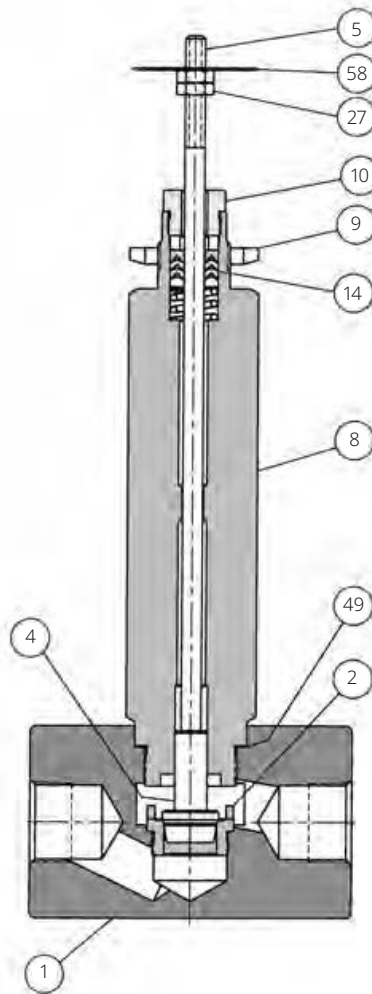


Figure 5. Fisher Baumann Valve Body with Extension Bonnet



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Table 3. Fisher Baumann 24000SB Common Parts^(1,2)

KEY NO.	QTY	DESCRIPTION	REMARKS
1	1	Valve Body ⁽¹⁾	3000 psi
			6000 psi
4*	1	Plug (Metal Seat) ⁽¹⁾	
		Plug (Soft Seat)	
8	1	Bonnet ⁽¹⁾	Standard
			Extension
14	1	Packing Kit (standard) ⁽¹⁾	
		Packing Kit (optional) ⁽¹⁾	
10	1	Packing Follower ⁽¹⁾	
9	1	Yoke Drive Nut	
27	2	Lock Nut	
49*	1	Body Gasket	
58	1	Travel Indicator	

*Recommended spare parts.

1. Consult your [Emerson sales office](#) for part number, price and delivery on optional valve and trim materials, N10276, N08020 and N04400.

2. For valves made before 2005, the common parts numbers above may not apply. Please notify your [Emerson sales office](#) if the valve is prior to 2005 so the appropriate parts can be ordered.

Table 4. Plug for NPS 1-1/2, 2 and 3 Valves

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _v	K _v
4*	Plug and Stem Assy	Metal Seat, Micro Trim (Linear)	102	6.3 / 0.25	0.02	0.017
					0.05	0.043
					0.1	0.086
					0.2	0.17
		Metal Seat (Equal %)	548 (416 SST)	6.3 / 0.25	0.2	0.17
					0.5	0.43
					1.0	0.86
			548 (416 SST)	9.5 / 0.375	1.5	1.29
					2.0	1.72
					2.5	2.15
			548 (416 SST)	20.6 / 0.8125	3.8	3.27
					4	3.44
					6.8	5.85

*Recommended spare parts

- continued -

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Table 4. Plug for NPS 1-1/2, 2 and 3 Valves (continued)

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _v	K _v
4*	Plug and Stem Assy	Metal Seat (Equal %)	588	6.3 / 0.25	0.2	0.17
					0.5	0.43
					1.0	0.86
				9.5 / 0.375	1.5	1.29
					2.0	1.72
					2.5	2.15
				20.6 / 0.8125	3.8	3.27
					4	3.44
					6.8	5.85
		Metal Seat (Linear)	648 (416 SST)	6.3 / 0.25	0.5	0.43
					1.0	0.86
					1.5	1.29
				9.5 / 0.375	2.0	1.72
					2.5	2.15
					20.6 / 0.8125	3.8
				4		3.44
				6.8		5.85
				Metal Seat (Linear)	688	6.3 / 0.25
		1.0	0.86			
		1.5	1.29			
		9.5 / 0.375	2.0			1.72
			2.5			2.15
			20.6 / 0.8125			3.8
		4				3.44
		6.8				5.85
2*	Seat Ring	9.5 mm / 0.375 in. Orifice Diameter, 316 SST				
		20.6 mm / 0.8125 in. Orifice Diameter, 316 SST				
		9.5 mm / 0.375 in. Orifice Diameter, 416 SST				
		20.6 mm / 0.8125 in. Orifice Diameter, 416 SST				
*Recommended spare parts						

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Table 5. Plug and Seat Ring for Soft Seat

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _v	K _v
4*	Plug and Stem Assy	PTFE Seat (Equal %)	577	9.5 / 0.375	1.0	0.86
					1.5	1.29
					2.0	1.72
					2.5	2.15
		PTFE Seat (Linear)	677	20.6 / 0.8125	3.8	3.3
					4	3.4
					6.8	5.9
				9.5 / 0.375	0.1	0.086
					0.2	0.172
					0.5	0.43
					1.0	0.86
					2.0	1.72
					2.5	2.15
20.6 / 0.8125	3.8			3.3		
	4			3.4		
2*	Seat Ring	6.3 mm / 0.25 in. Orifice Diameter				
		9.5 mm / 0.375 in. Orifice Diameter				
		20.6 mm / 0.8125 in. Orifice Diameter				
*Recommended spare parts						

Figure 6. Fisher Baumann 24000SB Trims

**102 LINEAR LOW
FLOW TRIM**



W9747

**151 MODIFIED EQUAL %
LOW FLOW TRIM**



W9751

**177 MODIFIED EQUAL %
LOW FLOW TRIM**



W9748

**548 / 577 / 588
EQUAL % TRIM**



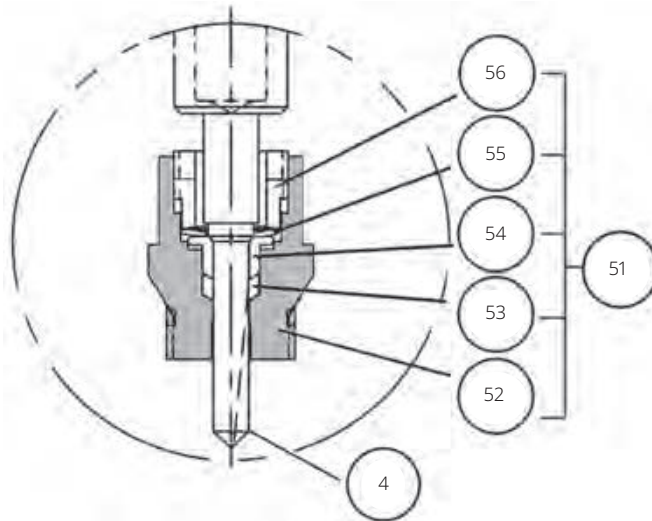
W9749

**648 / 677 / 688
LINEAR TRIM**



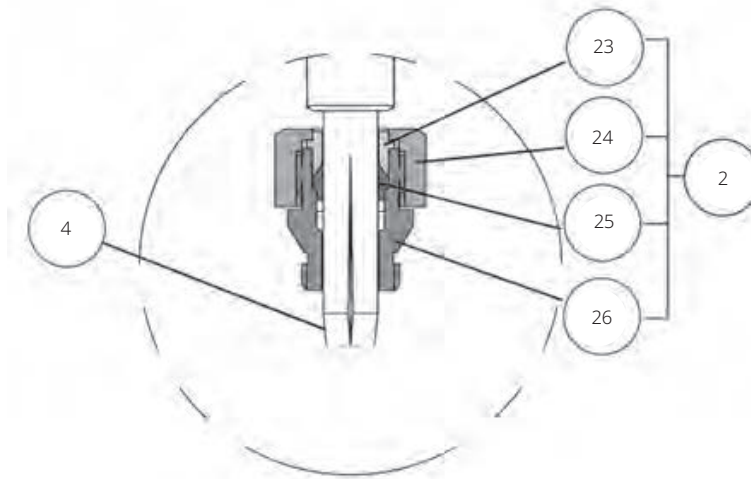
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Figure 7. Optional 151 Low Flow Trim Assembly



E1270

Figure 8. Optional 177 Low Flow Trim Assembly



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Table 6. Plug and Seat Ring for Fisher Baumann 151 Trim

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _v	K _v
2*	Seat Ring					
51*	Seat Sub-Assembly					
4*	Plug/Stem	Modified Equal % Low Flow	151	3.96 / 0.156	0.00013	0.0001
					0.00025	0.0002
					0.0005	0.0004
					0.001	0.0009
					0.002	0.0017
					0.004	0.003
					0.008	0.007
					0.015	0.013
					0.03	0.026
					0.06	0.052
					0.1	0.86
					0.2	0.17
					0.45	0.39
*Recommended spare parts						

Table 7. Plug and Seat Ring for Fisher Baumann 177 Trim

KEY NO.	DESCRIPTION	PLUG TYPE	PLUG NO.	ORIFICE DIAMETER mm / in.	C _v	K _v
2*	Seat Ring					
2a*	Seat Sub-Assembly (See Table 8)					
4*	Plug and Stem Assy	Low Flow	177	7.9 / 0.3125	0.0005	0.0004
					0.001	0.0009
					0.002	0.0017
					0.005	0.004
					0.01	0.009
					0.02	0.017
					0.05	0.04
*Recommended spare parts						

Table 8. Fisher Baumann 177 Low Flow Trim

Key No.	Description
4*	---
2a*	23
	24
	25
	26
*Recommended spare parts	

Table 9. Spring-Loaded PTFE V-Ring Packing Kit P/N 24494T001

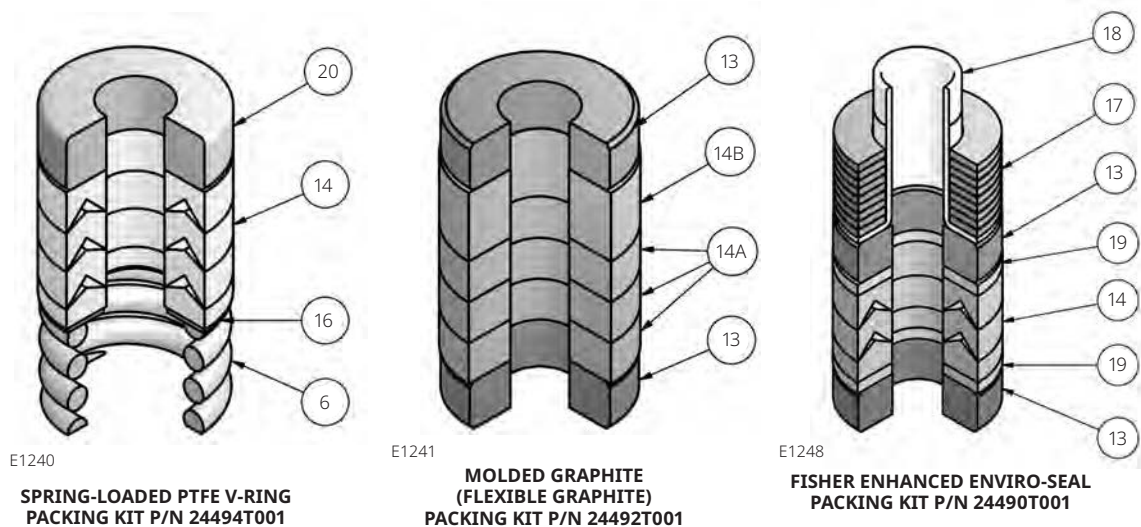
Key No.	Description	Material
6*	Spring	ASTM A313 S30200
14	Packing Set	PTFE / carbon-filled PTFE
16	Washer	ASTM A240 S31600
20	Spacer	J-2000 (filled PTFE)
*Recommended spare parts		

Table 10. Molded Graphite (Flexible Graphite) Packing Kit P/N 24492T001

Key No.	Description	Material
13	Bushing, qty 2	Carbon - Graphite
14A	Packing Rings, qty 3	Graphite
14B	Packing Ring	Graphite

Table 11. Fisher enhanced ENVIRO-SEAL Packing Kit P/N 24490T001

Key No.	Description	Material
13	Bushing, qty 2	Carbon Graphite
14	Packing Rings, qty 3	PTFE / carbon-filled PTFE
17	Belleville Spring	ASTM B637 N07718
18	Bushing	PEEK
19	Washer, qty 2	Modified PTFE

Figure 9. Packing Kits

Section 5: Special Fisher enhanced ENVIRO-SEAL Packing Note

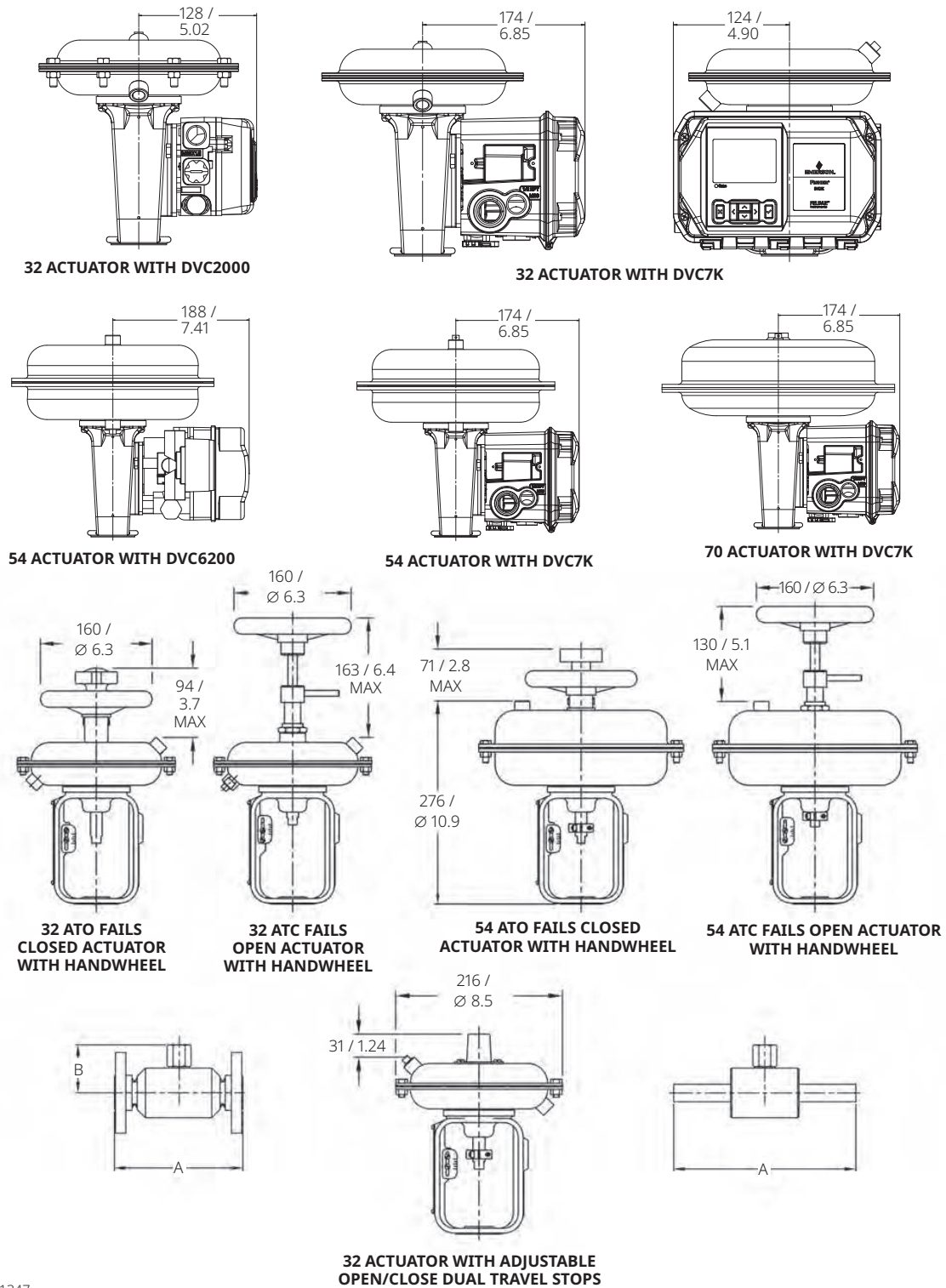
The Fisher enhanced ENVIRO-SEAL PTFE packing system is suitable for 100 ppm environmental applications on services up to 51.7 bar / 750 psig and process temperatures ranging from -46 to +232°C / -50 to +450°F.

For non-environmental applications, this packing system offers excellent performance at the same temperature range up to the maximum valve working pressure.

Temperature limits apply to packing arrangements only. Complete valve assembly temperature limits may differ. Refer to appropriate pressure/ temperature ratings.

Reference the Fisher Packing Selection Guidelines for Sliding-Stem Valves Bulletin ([D101986X012](#)).

Figure 10. Dimensional Drawings



E1347

mm / in.

NOTE: ACTUATOR REMOVAL REQUIRES 115 mm / 4.5 in. VERTICAL CLEARANCE.

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Table 12. Valve Dimensions

VALVE SIZE		A VALVE BODY														B BONNET				E DIAMETER	
		NPT		Flanged										Buttweld							
				CL150		CL300		CL600		CL900/ 1500		CL2500				Standard		Extension			
DN	NPS	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
15	1/2	102	4.00	184	7.25	191	7.50	203	8.00	273	10.25	264	10.38	387	15.25	71	2.8	208	8.2	64	2.50
20	3/4	105	4.13	184	7.25	194	7.62	206	8.12	273	10.75	273	10.75	387	15.25	74	2.9	211	8.3	76	3.00
25	1	127	5.00	184	7.25	197	7.75	210	8.25	273	10.75	308	12.12	406	16.00	74	2.9	211	8.3	76	3.00

Table 13. Valve Assembly Weights

VALVE SIZE		WEIGHT	
DN	NPS	kg	lb
15	1/2	3.0	6.6
20	3/4	3.1	6.9
25 ⁽¹⁾	1 ⁽¹⁾	5.1	11.3
25 ⁽²⁾	1 ⁽²⁾	---	---

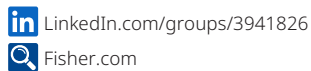
1. For 206 barg / 3000 psig valve body
2. For 413 barg / 6000 psig valve body

Table 14. Actuator Weights

ACTUATOR TYPE	WEIGHT	
	kg	lb
32	4.5	10
54	11.3	25
70	15.4	34
CML-250 ⁽¹⁾	8.3	18
CML-750 ⁽¹⁾	11.5	25

1. Electric actuators, reference CML Electric Actuator for Fisher Baumann 24000 Series Bulletin (D103347X012).

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Fisher™ Baumann™ 24003 3-Way Control Valve



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12

Section 1: Introduction

The Fisher Baumann 24003 3-way control valve (Figure 1) is ideally suited for control of flow and temperature where mixing or diverting service is required.

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for the Fisher Baumann 24003 3-way control valve.

WARNING



Do not install, operate or maintain Fisher Baumann 24003 3-way control valves without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. Fisher Baumann 24003 3-Way Valve



STAINLESS STEEL 3-WAY VALVE WITH 32 ACTUATOR

W7598

⚠ WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact your [Emerson sales office](#) for more complete specifications. Provide the product serial numbers (shown on the nameplate) and all other pertinent information.

NOTE

The acronym of CWP may appear on the nameplate. CWP (Cold Working Pressure) denotes the pressure rating at normal ambient temperature. A normal ambient temperature range being -4 to +100°F / -20°C to +38°C.

⚠ WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

1.2 Education Services

Emerson's Education Services

Phone: 800-338-8158

Email: education@emerson.com

emerson.com/en/final-control/services/valve-training

Section 2: Maintenance

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

NOTE

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

** WARNING**

Avoid personal injury or property damage by thoroughly cleaning the line of all dirt, welding chips, scale, oil or grease and other foreign material. Failure to do so could result in parts damage, malfunction of the control valve or loss of control of the process.

Section 3: Installation

1. Before installing the valve in the pipeline, thoroughly clean the line of all dirt, welding chips, scale, oil or grease and other foreign material.
2. Install the valve so the controlled fluid will flow through the valve body in the direction indicated for either mixing or diverting service (see Table 1).
3. A three-valve bypass must be used to permit removal of the control valve from the line without shutting down the system.
4. In case of a heat-insulated installation, insulate the valve body only, not the bonnet.

** WARNING**

To avoid personal injury or property damage, do not attempt to do any work on a valve while the system is in operation. The valve must be isolated 100% from the active system and the isolated line voided of pressure and/or hazardous fluids.

3.1 Air Piping

1. For an air-to-extend actuator (air-to-close Port L), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open Port L) connect the actuating air pressure line to the 1/4 NPT in the lower diaphragm case.
2. Use 6.4 mm / 1/4 in. O.D. tubing or equivalent for all air lines. If air line exceeds 8 m / 25 ft in length, 9.5 mm / 3/8 in. tubing is preferred. Air lines must not leak. Air pressure not to exceed 2.5 bar / 35 psig.

⚠ CAUTION

When assembling or disassembling the valve, do not turn the valve stem while the plug is touching the valve seat. This can damage the valve's seating surface very quickly.

When adjusting the valve stem, do not grip the stem directly with pliers or a wrench. This will damage the surface of the stem and cause damage to the packing in the valve. Instead, counter-tighten the two locknuts (key 27) on the stem (key 5). This will allow you to turn the stem by turning the locknuts (key 27) with a wrench.

3.2 Disassembly

⚠ WARNING

When placing the valve in a vise, clamp the flat end faces of the valve. Do not try to clamp the rounded sides of the valve. This will distort the shape of the casting and damage the valve internals.

1. Mount the valve in a vise.
2. Remove the actuator, stem locknuts (key 27), travel indicator (key 58) and yoke drive nut (key 8). See the Fisher Baumann Pneumatic Actuators Instruction Manual (D103352X012).
3. Unscrew the bonnet (key 3) by turning in a counterclockwise direction from the valve body (key 1). Lift the bonnet up and off the plug and stem assembly (key 4).
4. Unscrew the lower seat ring retainer (key 5) from the valve body (key 1) and remove the plug and stem assembly (key 4) (see Figure 2). Wipe the parts with a clean soft cloth and examine for signs of wear.

3.3 Lapping the Valve Seat

If valve seat leakage becomes excessive, it may be necessary to lap the valve seat.

Lapping is the process of mating the valve plug to the seat ring, with an abrasive to produce a close fit. When valve seat leakage becomes excessive, lapping becomes necessary. The plug and seat ring seating surfaces should be free of large scratches or dents and the contact surface of the seats should be as narrow as possible.

1. Use a good quality lapping compound with a mixture that contains 280 to 600 grit. Apply at several spots around the plug seating surface.

2. Replace the plug and stem assembly (key 4) through the bottom of the valve body (key 1) and screw in the lower seat ring retainer (key 5).
3. Place the bonnet (key 3) loosely into the valve body to serve as a guide during the lapping operation.
4. Rotate the plug and stem assembly (key 4), applying light pressure to the plug/seat mating surface.
5. Lap as little as possible. Excessive lapping will shoulder the seat ring and will not improve the seating. Repeat for the second seating surface.
6. Clean the valve seats and plug thoroughly when the lapping is complete.

3.4 Replacing Packing

Refer to Figure 2 and the standard and optional packing constructions (Figures 3, 4 and 5) to determine the packing that has been preinstalled in your valve.

1. Mount the valve in a vise.
2. Remove actuator, stem locknuts (key 27), travel indicator (key 58), packing follower (key 7) and yoke drive nut (key 8) per the Fisher Baumann Pneumatic Actuators Instruction Manual (D103352X012).
3. Unscrew the bonnet (key 3) by turning in a counterclockwise direction from the valve body (key 1). Lift the bonnet up and off the plug and stem assembly (key 4). Push the old packing out from the underside of the bonnet (key 3).
4. Standard Spring Loaded PTFE V-Ring Packing (Figures 2 and 3): Carefully insert each piece in exact order shown in Figure 3. Turn the packing follower (key 7) until it shoulders on the bonnet (key 3). This will compress the packing spring (key 9) to enable constant stem sealing throughout packing life.
5. Molded Graphite Ribbon Packing (Figure 4): Carefully insert each piece in exact order shown in Figure 4. Hand tighten the packing follower (key 7). Use a wrench to increase tightness by turning the nut an additional 60 degrees.
6. Fisher enhanced ENVIRO-SEAL Packing (Figure 5): Carefully insert each piece in exact order as shown in Figure 5. Tighten the packing follower (key 7) until the Belleville springs are compressed. This will be signaled by a significant increase in resistance. Back off the follower 1/8 to 1/4 turn. A gap of approximately 1/16 inch between the packing follower and the bonnet will ensure packing is seated properly.



CAUTION

Overtightening the packing may prevent stem movement and valve operation and result in equipment damage or loss of control of the process.

3.5 Reassembly

1. Place the plug and stem assembly (key 4) into the valve body (key 1) from the lower port and screw in the lower seat ring retainer (key 5).
2. Place the bonnet (key 3) over the stem and tighten in place.
3. Insert the packing kit by following steps 4, 5 or 6 of Replacing Packing shown previously.
4. Place the actuator yoke over the stem and bonnet. While tilting the actuator back to allow access to the top of the stem, place the yoke drive nut (key 8) over the stem.
5. Next, turn one locknut (key 27) onto the stem, turning it down as far as possible. Place the travel indicator (key 58) over the stem and then turn the second locknut (key 27) down against the travel indicator (key 58). Counter turn the locknuts to tighten securely.

See the Fisher Baumann Pneumatic Actuators Instruction Manual ([D103352X012](#)) for bench range adjustment.



CAUTION

When assembling or disassembling the valve, do not turn the valve stem while the plug is in contact with either seat. This can damage the seating surface very quickly.

Table 1. Application Port⁽¹⁾

Service	Inlet	Outlet
Diverting	C	U and L
Mixing	U and L	C

1. C = common port, U = upper port, L = lower port

Section 4: Parts

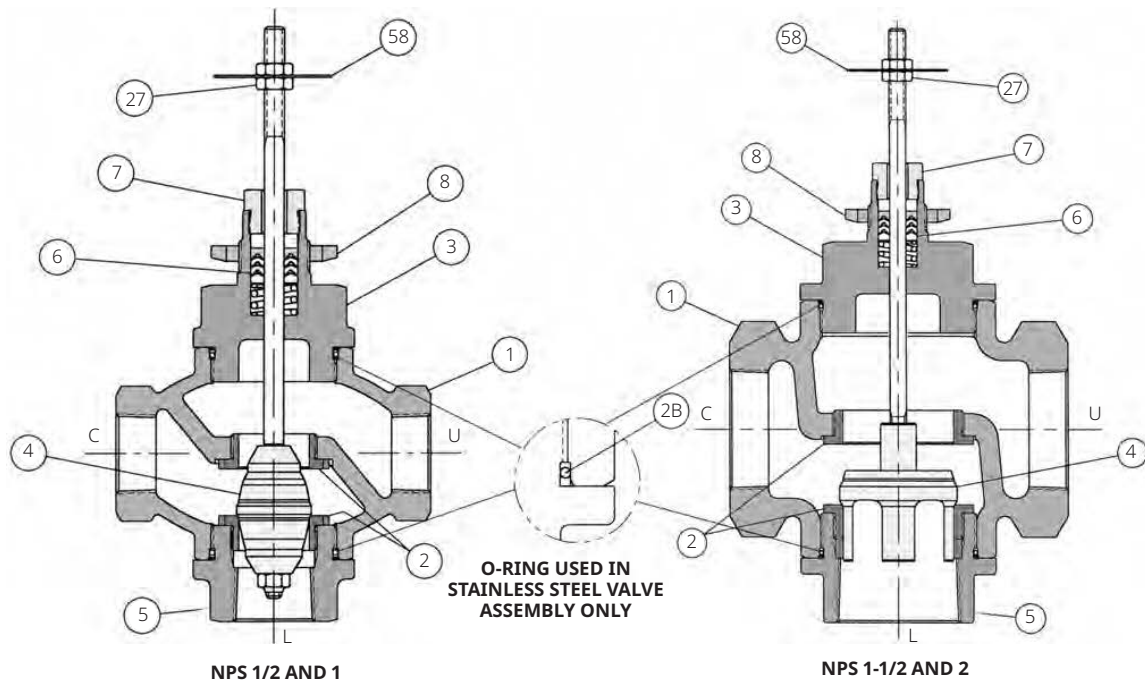
4.1 Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name and desired material using the following parts tables.

⚠ WARNING

Use only genuine Fisher™ replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

Figure 2. Fisher Baumann 24003 Valve Cross-Sectional Views



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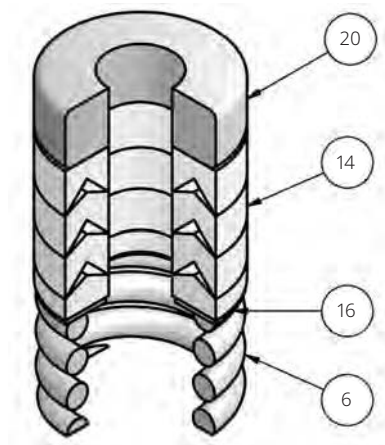
24003 Valve

July 2026

Table 2. Fisher Baumann 24003 Common Parts^(1,2)

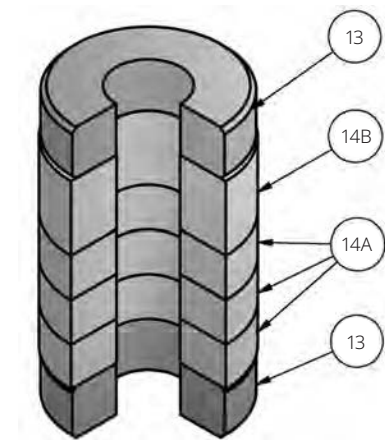
KEY NO.	QTY	DESCRIPTION	VALVE SIZE							
			DN 15 (NPS 1/2)		DN 15 (NPS 1)		DN 40 (NPS 1-1/2)		DN 50 (NPS 2)	
			Bronze	SST	Bronze	SST	Bronze	SST	Bronze	SST
1	1	Valve body	---							
2*	2	Seat ring, C _v = 1.0	B1790450-01		B1790450-01		---			
		Seat ring, C _v = 2.0	B1790450-01		B1790450-01					
		Seat ring, C _v = 4.0	C1790552-01		C1790552-01					
		Seat ring, C _v = 10	---		B1790630-01					
		Seat ring, C _v = 20	---		---		B1790830-01		---	
		Seat ring, C _v = 40	---		---		---		C1790930-01	
2B*	2	O-ring	---	04907134	---	04907134	---	04907144	---	04907150
3	1	Bonnet	---							
4*	1	Plug and stem assy, C _v = 1.0	K03004HDBC1		K03004HDBC1		---			
		Plug and stem assy, C _v = 2.0	K03004HDBC2		K03004HDBC2					
		Plug and stem assy, C _v = 4.0	K03005HDBC4		K03005HDBC4					
		Plug and stem assy, C _v = 10	---		K03006HDBC10					
		Plug and stem assy, C _v = 20	---		---		K03008HDBC20		---	
		Plug and stem assy, C _v = 40	---		---		---		K03009HDBC40	
5	1	Lower seat ring retainer	---							
6*	1	Packing kit	---							
7	1	Packing follower	---							
8	1	Drive nut, Actuator yoke	---							
27	2	Stem locknut	---							
58	1	Travel indicator	---							
*Recommended spare parts. 1. Serial number of valve is required. 2. For valves made before 2005, the common parts numbers above may not apply. Please notify your Emerson sales office if the valve is prior to 2005 so the appropriate parts can be ordered.										

Figure 3. Spring-Loaded PTFE V-Ring Packing Kit P/N 24494T001

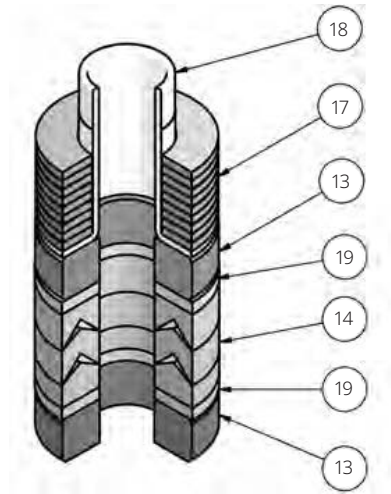


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Figure 4. Molded Graphite (Flexible Graphite) Packing Kit P/N 24492T001



E1241

Figure 5. Fisher enhanced ENVIRO-SEAL Packing Kit P/N 24490T001

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Table 3. Spring-Loaded PTFE V-Ring Packing Kit P/N 24494T001

Key No.	Description	Material
9*	Spring	ASTM A313 S30200
14	Packing set	PTFE / carbon-filled PTFE
16	Washer	ASTM A240 S31600
20	Spacer	J-2000 (filled PTFE)

*Recommended spare parts.

Table 4. Molded Graphite (Flexible Graphite) Packing Kit P/N 24492T001

Key No.	Description	Material
13	Bushing, qty 2	Carbon - Graphite
14	Packing rings, qty 4	Graphite

Table 5. Fisher enhanced ENVIRO-SEAL Packing Kit P/N 24490T001

Key No.	Description	Material
13	Bushing, qty 2	Carbon Graphite
14	Packing set	PTFE / carbon-filled PTFE
17	Belleville spring	ASTM B637 N07718
18	Bushing	PEEK
19	Washer, qty 2	Modified PTFE

Section 5: Special Fisher enhanced ENVIRO-SEAL Packing Note

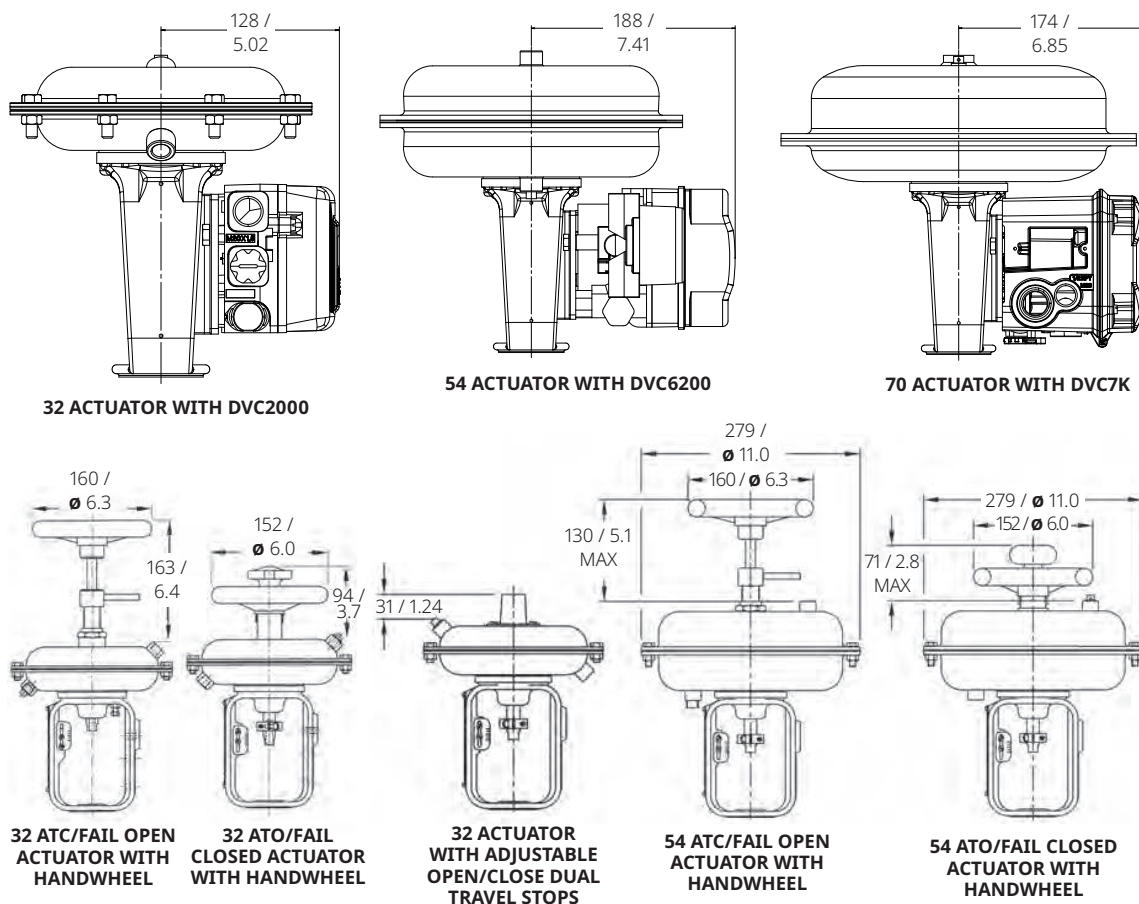
The Fisher enhanced ENVIRO-SEAL PTFE packing system is suitable for 100 ppm environmental applications on services up to 51.7 bar / 750 psig and process temperatures ranging from -46 to +232°C / -50 to +450°F.

For non-environmental applications, this packing system offers excellent performance at the same temperature range up to the maximum valve working pressure.

Temperature limits apply to packing arrangements only. Complete valve assembly temperature limits may differ. Refer to appropriate pressure/ temperature ratings.

Reference Fisher Packing Selection Guidelines for Sliding-Stem Valves Bulletin (D101986X012).

Figure 6. Dimensional Drawings



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mm / in.

NOTE: ACTUATOR REMOVAL REQUIRES 115 mm / 4.5 in. VERTICAL CLEARANCE

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Table 6. Valve Dimensions and Weights, NPT Valve Bodies Only

VALVE SIZE		VALVE BODY MATERIAL						TRAVEL	WEIGHT
		Bronze, NPT			Stainless Steel, NPT				
DN	NPS	A	B	C ₁	A	B	C ₁	in.	lbs
15	1/2	4.875	2.75	2.75	4.8125	2.75	2.75	0.56	8
25	1	4.875	2.75	2.75	5.0	2.75	2.75	0.56	8
40	1-1/2	5.75	3.8125	3.3125	6.125	3.375	3.125	0.75	15
50	2	6.50	4.0	3.625	6.50	3.75	3.625	0.75	20

Table 7. Actuator Weights

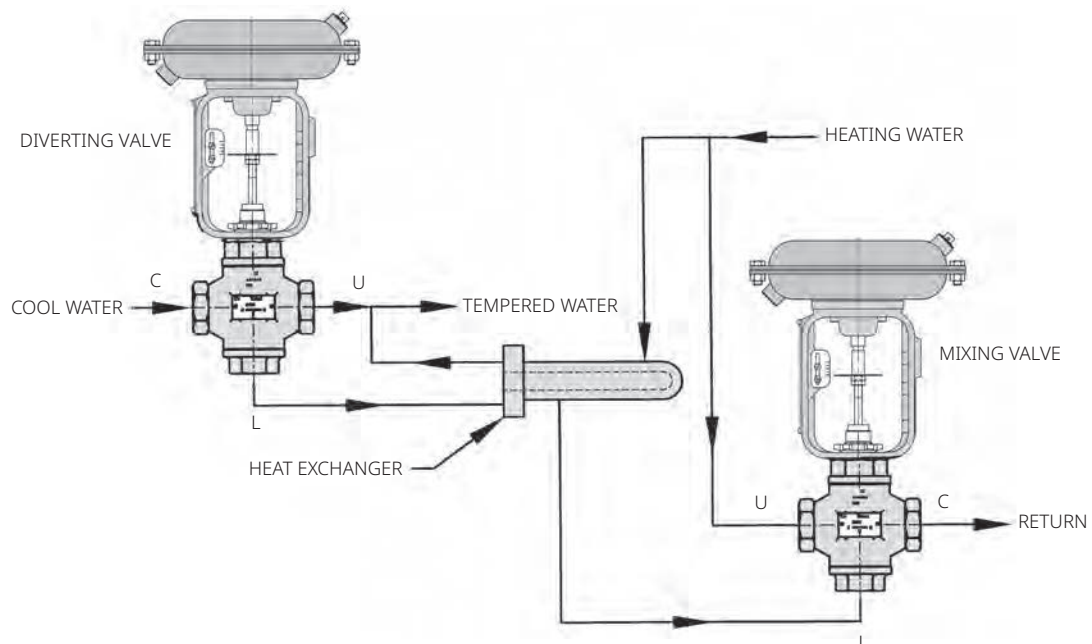
ACTUATOR TYPE	WEIGHTS	
	kg	lb
32	4.5	10
54	11.3	25
70	15.4	34

Table 8. Application Port⁽¹⁾

Service	Inlet	Outlet
Diverting	C	U and L
Mixing	U and L	C

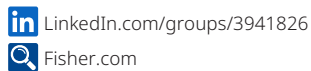
1. C = Common port, U = Upper port, L = Lower port

Figure 7. Mixing and Diverting Applications



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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS



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FISHER™



Fisher™ Baumann™ 26000 Corrosion Resistant Control Valve

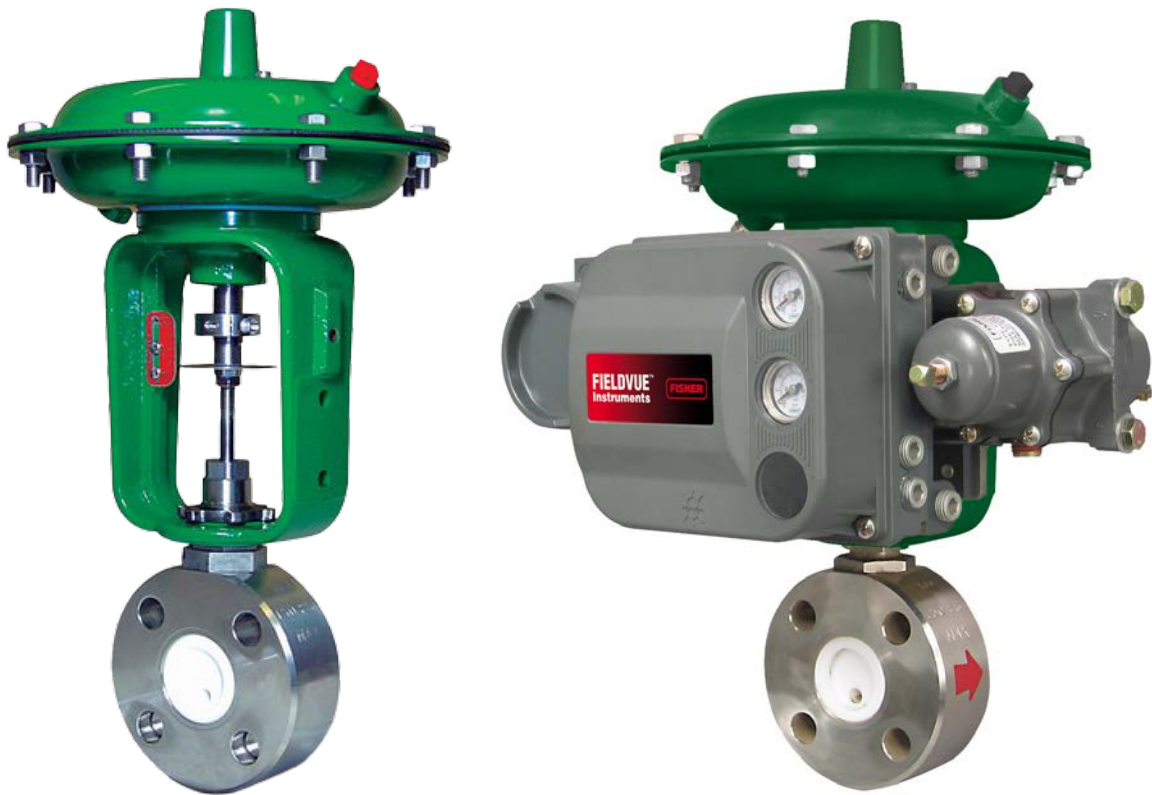


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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for the Fisher Baumann 26000 corrosion resistant control valve.

WARNING

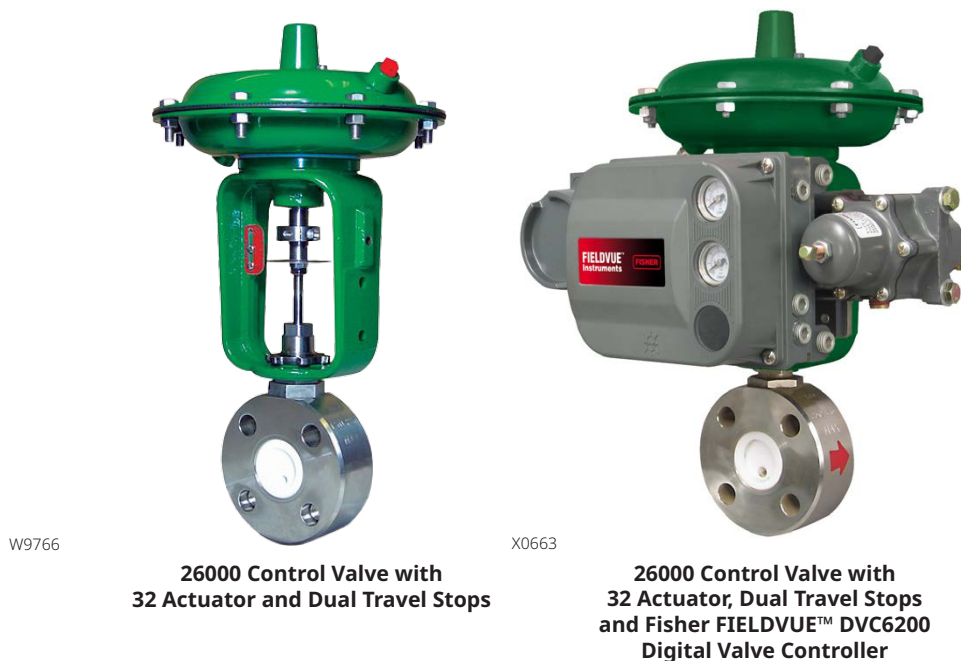


Do not install, operate or maintain Fisher Baumann 26000 control valves without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

1.2 Description

The Fisher Baumann 26000 Corrosion Resistant Control Valve (Figure 1) features a flangeless wafer valve body. The 316 stainless steel flangeless body and thru-hole wafer design allows for installation between plastic pipeline flanges without risk of gasket leakage. This same valve body, fully pressurized, retains an all wetted PTFE interior resulting in a solid mechanical structure.

Figure 1. Fisher Baumann 26000 Control Valve



1.3 Education Services

Emerson's Education Services
Phone: 800-338-8158
Email: education@emerson.com
emerson.com/en/final-control/services/valve-training

1.4 Safety Precautions

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are, you should contact your [Emerson sales office](#) for more complete specifications. Provide the product serial numbers (shown on the nameplate) and all other pertinent information.

NOTE

The acronym of CWP may appear on the nameplate. CWP (Cold Working Pressure) denotes the pressure rating at normal ambient temperature. A normal ambient temperature range being -4 to +100 °F / -20 to +38°C.

⚠ WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise, take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

Section 2: Maintenance

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

NOTE

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

⚠ WARNING

Avoid personal injury or property damage by thoroughly cleaning the line of all dirt, welding chips, scale, oil or grease and other foreign material. Failure to do so could result in parts damage, malfunction of the control valve or loss of control of the process.

To avoid personal injury or property damage, do not attempt to do any work on a valve while the system is in operation, the valve must be isolated 100% from the active system and the isolated line voided of pressure and/or hazardous fluids.

Section 3: Installation

1. Before installing the valve in the pipeline, thoroughly clean the line of all dirt, welding chips, scale, oil or grease and other foreign material.
2. Install the valve so the controlled fluid will flow through the valve body in the direction indicated by the arrow cast on the valve body.
3. A three-valve bypass must be used to permit removal of the control valve from the line without shutting down the system.
4. In case of a heat-insulated installation, insulate the valve body only, not the bonnet.

⚠ CAUTION

The PTFE valve body insert protrudes slightly beyond both sides of the valve body (key 1); it is highly recommended that the included PTFE encapsulated line flange adapter gaskets (key 21) be utilized. (Refer to Figures 2, 3 and 4).

3.1 Air Piping

1. For an air-to-extend actuator (air-to-close action), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open action) connect the actuating air pressure line to the 1/4 NPT in the lower diaphragm case.
2. Use 6.4 mm / 1/4 in. O.D. tubing or equivalent for all air lines. If air line exceeds 8 m / 25 ft in length, 9.5 mm / 3/8 in. tubing is preferred. Air lines must not leak. Air pressure not to exceed 2.5 bar / 35 psig.

3.2 Packing Adjustments

Refer to Figures 2, 3 and 4.

Should seat leakage or leakage by the bonnet (key 8) occur, try to retighten the internal packing (key 17) by disconnecting the air line to the actuator, loosen the hex clamp nut (key 12) and turn the bonnet (key 8) clockwise into the valve body (key 1). This rotation will compress the packing (key 17) around the plug and stem assembly (key 4) and against the valve body interior. Retighten the hex clamp nut (key 12) and recheck for leakage.

Should the valve stem packing (key 14) need to be adjusted, turn the packing follower (key 10) clockwise to tighten or counterclockwise to loosen.

3.3 Disassembly

Significant wear or contamination may require replacement of the plug or seals. Proceed as follows:

1. Loosen the yoke clamp nut (key 9) and disconnect the actuator (see appropriate actuator instructions).
2. Loosen the packing follower (key 10) and the hex clamp nut (key 12).
3. Unscrew and remove the bonnet (key 8) from the valve body (key 1).
4. Remove the packing (key 17) from the valve body (key 1) by flowing air into port A. This will drive the V-ring packing seals and plug out of the top opening of the valve body.



CAUTION

The PTFE valve body insert protrudes slightly beyond both sides of the valve body (key 1); it is highly recommended that the included PTFE encapsulated line flange adapter gaskets (key 21) be utilized.

3.4 Reassembly and Calibration

1. Lay out all parts and clean the valve body thoroughly.
2. Hold the valve body (key 1) upside down, see Figure 5.
3. Insert the lower (half round) packing ring.

NOTE

The flat side should rest in the bottom of the housing bore.

4. Insert the first packing V-ring with the V opening facing the lower ring. Tip the ring slightly to prevent the ring from hanging up at the corner of the outlet port, see Figure 5.
5. For $C_v < 1.0$, insert a spacer ring (key 3) with the V opening towards first packing ring. Note: The cross hole must line up with the hole B in a radial direction and within 1/16 in. in the vertical direction. The spacer ring (key 3) is not required in $C_v = 2.5$ or $C_v = 4.2$.

6. Insert the remainder of the packing V-rings (key 17) as shown, one at a time. Tip each ring slightly to ease installation.
7. Move the valve body (key 1) right-side up and clamp in a vise or test fixture, using the line flange adapter gaskets (key 21).
8. Screw the hex clamp nut (key 12) all the way onto the lower thread of the bonnet (key 8).
9. Screw the bonnet seal (key 50) all the way onto the lower thread of the bonnet (key 8) until it touches the nut (key 12).
10. Lubricate the lower bonnet thread with anti-seize lubricant and insert the valve plug and stem assembly (key 4) into the bonnet (key 8).
11. Screw the bonnet (key 8) with the plug and stem assembly (key 4) loosely into the valve body (key 1).
12. Push the stem all the way down until the plug is fully seated.
13. Install the valve body in the test fixture or between a pair of appropriate mating line flanges.
14. Apply 50 psi air pressure to the fixture or the flange connected to valve port A and connect port B to a flow meter or bubble indicator (tube in water).
15. For $C_v < 1.0$, slowly screw the bonnet (key 8) into the valve body with a 1-1/4 in. wrench until the air flow stops completely. Push the valve stem up and down several times and repeat the leakage test. For $C_v > 1.0$, screw the bonnet (key 8) down until it touches the packing and then turn an additional 180 degrees.

NOTE

The force to pull up or push down the stem should not exceed 25 lbs.

16. Close off air flow leaving port B and pull up the stem. This will pressurize all parts of the valve body.
17. Apply leak detection fluid or soap solution to the thread between the valve body and bonnet (key 8). There should be no leakage.
18. Hold the bonnet in place and tighten the nut (key 12) firmly (this will compress the bonnet seal (key 50)).
19. Install the secondary packing kit [packing spring (key 6), washer (key 16), stem packing rings (key 14), packing spacer (key 20) and packing follower (key 10)] into the bonnet as shown in Figure 6. Tighten by rotating the packing follower (key 10) nut clockwise.
20. Attach the actuator to the bonnet. Turn the actuator to thread the actuator stem onto the valve stem until the yoke touches the shoulder of the bonnet.
21. Lock the drive nut (key 9), see Figures 2, 3 and 4.
22. Apply 4 to 5 psi to the actuator for air-to-open or 13 to 14 psi for air-to-close.
23. With 50 psi air applied to port A, counter tighten the jam nuts (key 27) and slowly turn the valve plug and stem assembly (key 4) clockwise to thread it into the actuator stem. Stop and lock the stem with the jam nut (key 27) when port B shows some minimum flow.
24. Adjust the zero position of the travel indicator to the present position of the travel indicator disk (key 58).

25. Reduce air pressure to 3 psi for air-to-open or increase air pressure to 15 psi for air-to-close. For $C_v < 1.0$, there should be no seat leakage (Class VI). For $C_v > 1.0$, the allowed leakage is Class IV. If leakage is noted, loosen the jam nuts (key 27) and turn the plug and stem assembly (key 4) further into the valve bonnet (key 8).
26. At the lowest actuator travel position, the indicator disk (key 58) shall be at least 0.040 in. below the zero travel position. If not, move the stem (key 4) further into the bonnet (key 8) and recalibrate the travel indicator.
27. Check the valve travel for a full 1/2 in. from the zero point on the indicator scale.
28. Check the dead band of the actuator. The difference between the signal to move the stem up and the signal to move stem down shall not exceed 2 psi. If it does exceed 2 psi, the secondary packing (key 14) is too tight.
29. See appropriate actuator instructions to set the travel stops. (Refer to illustrations in the appropriate actuator instruction manual to determine what type of stops are being used).
30. Attach and calibrate the positioner.

NOTE

Travel should commence from the zero travel indicator mark at 3.2 psi / 4.3 mA air-to-open or at 14.8 psi / 19.7 mA air-to-close. The flow should enter only through the lower port A to help energize the V-ring packing set (key 17).

Section 4: Parts

4.1 Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name and desired material using the following parts tables.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

4.2 Parts List

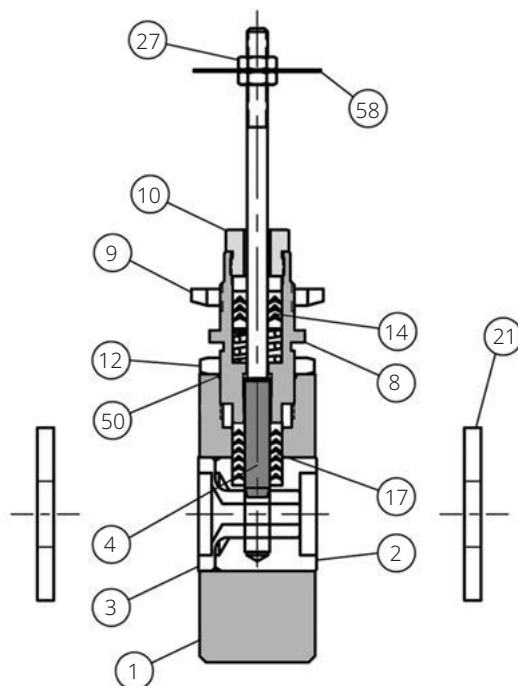
NOTE

Contact your [Emerson sales office](#) for Part Ordering information.

Table 1. Parts List

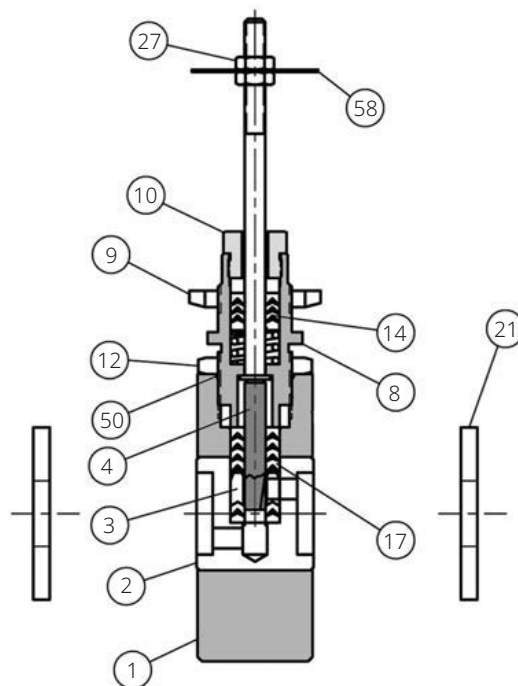
Key No.	Description
1	Valve Body with PTFE Insert, Cv= 0.001 - 1.0
	Valve Body with PTFE Insert, Cv= 2.5
	Valve Body with PTFE Insert, Cv= 4.2
3*	Spacer (Cv = .001 to 1.0 ONLY)
4*	Plug and Stem Subassembly, Cv=0.001
	Plug and Stem Subassembly, Cv=0.005
	Plug and Stem Subassembly, Cv=0.01
	Plug and Stem Subassembly, Cv=0.02
	Plug and Stem Subassembly, Cv=0.05
	Plug and Stem Subassembly, Cv=0.1
	Plug and Stem Subassembly, Cv=0.2
	Plug and Stem Subassembly, Cv=0.4
	Plug and Stem Subassembly, Cv=0.8
	Plug and Stem Subassembly, Cv=1.0
	Plug and Stem Subassembly, Cv=2.5
	Plug and Stem Subassembly, Cv=4.2
8	Bonnet
	Bonnet, Extension
9	Drive Nut (Yoke)
10	Packing Follower
12	Hex Clamp Nut
14*	Secondary Packing Kit, V-ring, Standard
17*	Primary Packing, Cv < 1.0 (6 rings)
	Primary Packing, Cv = 2.5 (6 rings)
	Primary Packing, Cv = 4.2 (9 rings)
21	Line Flange Adapter Gaskets, qty 2
27	Jam Nut, qty 2
50	Bonnet Seal
58	Travel Indicator
*Recommended spare parts	

Figure 2. Valve Body for Cv Rating of 2.5 (Class IV Seat Leakage)



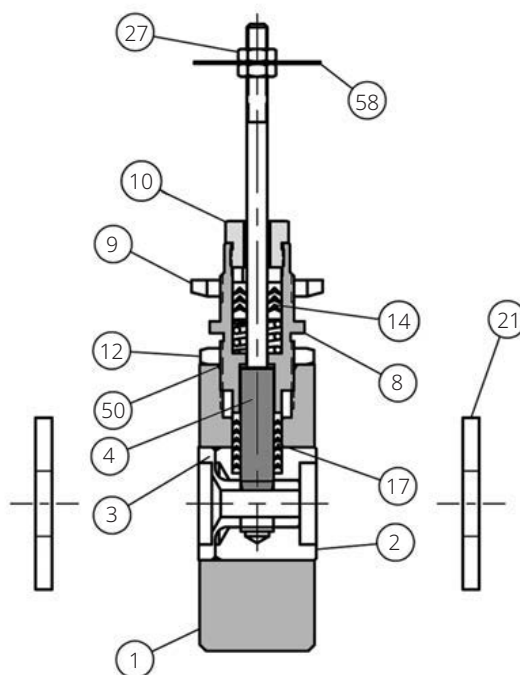
E1289

Figure 3. Valve Body for Cv Ratings of 0.001 to 1.0 (Class VI Seat Leakage)



E1287

Figure 4. Valve Body for Cv Rating of 4.2 (Class IV Seat Leakage)

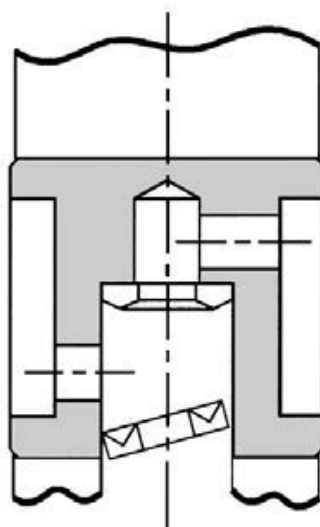


E1288

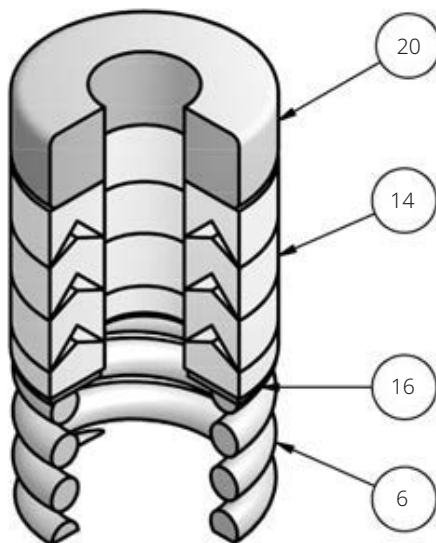
CAUTION

It is highly recommended that the included PTFE encapsulated line flange adapter gaskets (key 21) be utilized.

Figure 5. Fisher Baumann 26000 Valve Body Shown Upside Down for Assembly Procedure



E1368

Figure 6. Secondary Packing: Spring-Loaded PTFE V-ring Packing Kit

E1240

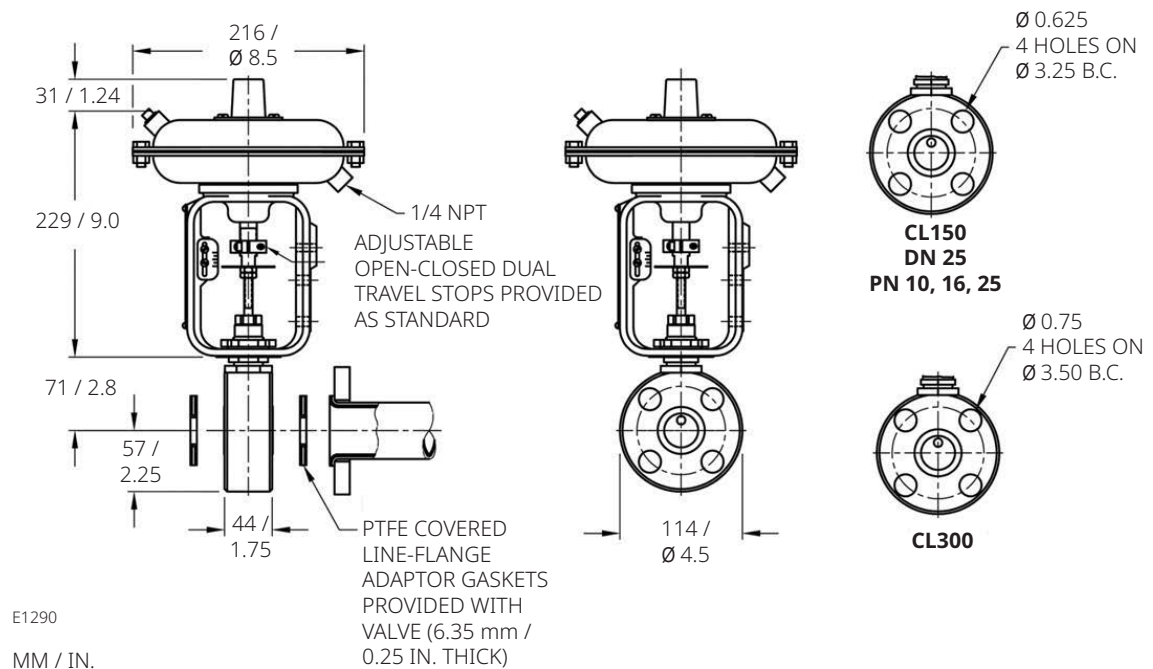
Table 2. Secondary Packing Spring-Loaded PTFE V-ring Packing Kit, Part Number 24494T001

Key Number	Description	Material
6	Spring	ASTM A313 S30200
14	Packing set	PTFE/Carbon-filled PTFE
16	Washer	ASTM A240 S31600
20	Spacer	J-2000 (filled-Polytetrafluoroethylene)

Table 3. Fisher Baumann 26000 Valve and Actuator Weights

VALVE WEIGHT		ACTUATOR WEIGHT	
kg	lbs	kg	lbs
3.3	7.3	4.5	10

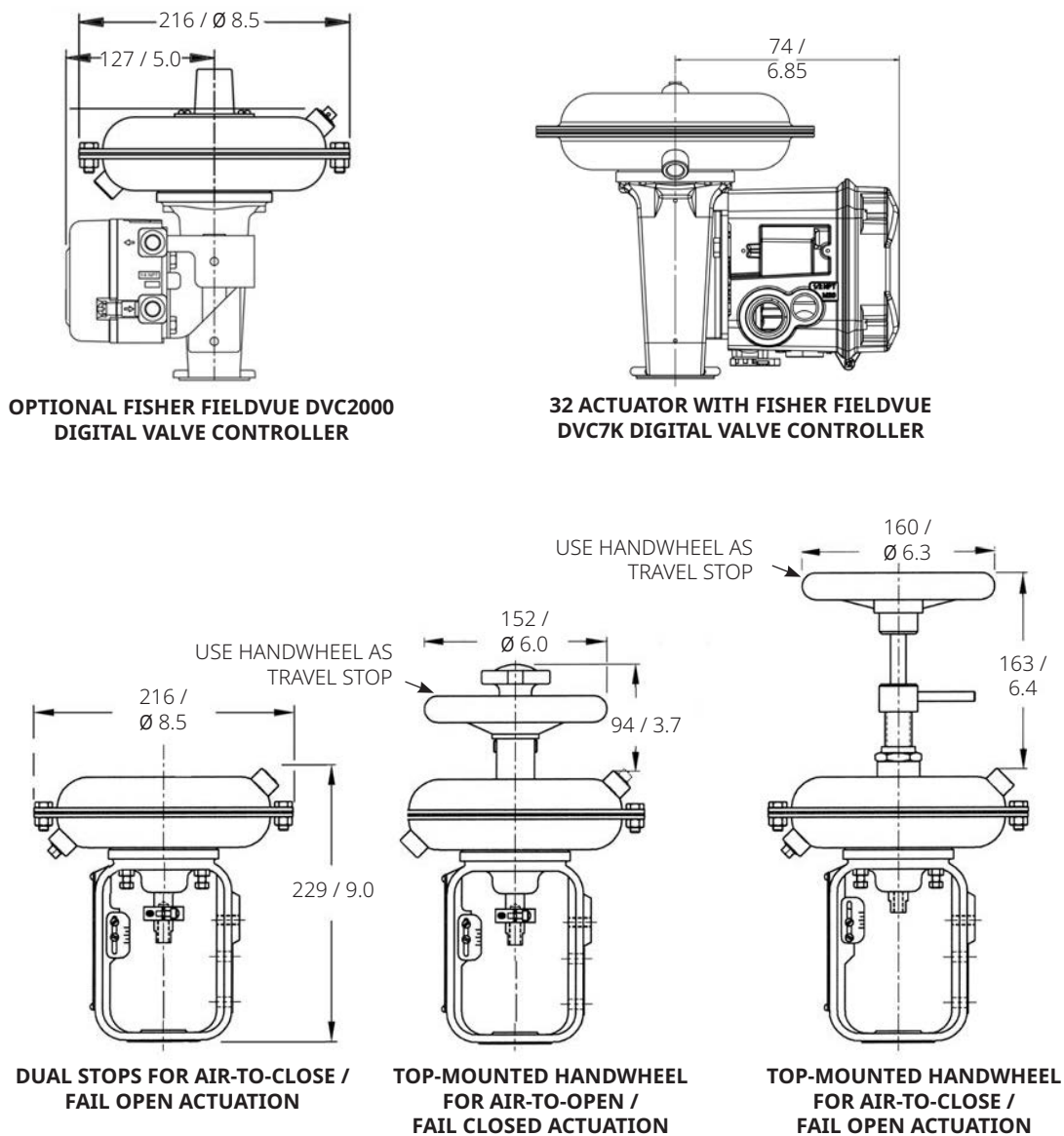
Figure 7. Dimensions NPS 1 26000 Valve with Fisher Baumann 32 Actuator and Dual Travel Stops



CAUTION

The PTFE valve body insert protrudes slightly beyond both sides of the valve body (key 1). It is highly recommended that the included PTFE encapsulated line flange adaptor gaskets (key 21) be utilized.

Figure 8. Dimensions for Fisher Baumann 32 Actuator with Options



E1291

MM / IN.

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Fisher™ Baumann™ 51000 Low Flow Control Valve



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Section 1: Introduction

The Fisher Baumann 51000 control valve (Figure 1) is optimally designed for demanding low flow control and is a perfect fit where space is at a premium. This compact package provides the connection integrity of flanged body globe valves, while being significantly lighter and easier to install.

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for the Fisher Baumann 51000 control valve and Fisher Baumann 16 actuator.

⚠ WARNING



Do not install, operate or maintain Fisher Baumann 51000 control valves without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. 51000 NPS 1/2 Control Valve with Fisher Baumann 16 Actuator and Fisher FIELDVUE™ DVC2000 Digital Valve Controller



W9066

1.2 Education Services

Emerson Education Services
 Phone: +1-800-338-8158
 E-mail: education@emerson.com
emerson.com/en/final-control/services/valve-training

Table 1. Valve Body S/A Pressure-Temperature Ratings

WORKING PRESSURE, barg			WORKING PRESSURE, psig		
Temperature, °C	Stainless Steel	N10276, 35 HRC Max	Temperature, °F	Stainless Steel	N10276, 35 HRC Max
-195 to +37.8	207	207	-320 to +100	3000	3000
93.3	178	207	200	2580	3000
149	161	200	300	2330	2910
176	154	196	350	2235	2850

Section 2: Installation



WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.



WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Because some valve body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

NOTE

The acronym of CWP may appear on the nameplate. CWP (Cold Working Pressure) denotes the pressure rating at normal ambient temperature. A normal ambient temperature range being -4 to +100°F / -20 to +38°C.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

NOTICE

To avoid damaging valve seating surfaces, make sure the adjacent piping is free of pipe scale, welding slag and any other potentially damaging material.

1. Before installing the valve in the pipeline, inspect the valve body to be certain it is free of foreign material and thoroughly clean the line of all dirt, welding chips, scale, oil or grease and other foreign material.
2. Install the valve so the controlled fluid will flow through the valve body in the direction indicated by the arrow.
3. A three-valve bypass permits removal of the control valve from the line without shutting down the system.
4. In case of a heat-insulated installation, insulate the valve body only, not the bonnet.

Section 3: Maintenance

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

NOTE

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

3.1 Actuator Removal

Refer to Figures 2, 3, 7 and 8.

1. For air-to-open actuators, lift actuator travel with air to lessen tension on the upper clamp nut (key 10).

NOTE

For air-to-close, this is NOT required.

2. Gently tap the upper clamp nut (key 10). With slight downward pressure on top of the actuator, unscrew the upper clamp nut (key 10) completely.
3. The Fisher Baumann 16 actuator assembly must be unscrewed from the stem adapter (key 26).

3.2 Plug and Packing Replacement

Refer to Figures 2 and 3.

NOTICE

When adjusting the valve stem, do not grip the stem directly with pliers or a wrench. This will damage the surface of the stem and cause damage to the packing in the valve.

1. For valves supplied with Fisher Baumann 16 actuators, remove the travel indicator disc (key 58). With the hex jam nuts (key 27) still tight, loosen the stem adapter (key 26) from the stem adapter nut (key 31) and unthread the stem adapter (key 26) from the plug stem (key 4).

For valves with rated C_v 's less than 1.0, unscrew the packing nut (key 11) and gently pull the plug (key 4) out through the top of the bonnet (key 6).

For valves with rated C_v 's greater than or equal to 1.0, follow the valve disassembly instructions to first remove the bonnet (key 6) before removing the plug (key 4).

2. Inspect or replace the packing (key 9) and the stem guide (key 8).
3. Inspect the valve plug (key 4) for wear or particle accumulation.

3.3 Valve Disassembly

Refer to Figures 2 and 3.

NOTE

The actuator must be removed from the valve body before valve body disassembly.

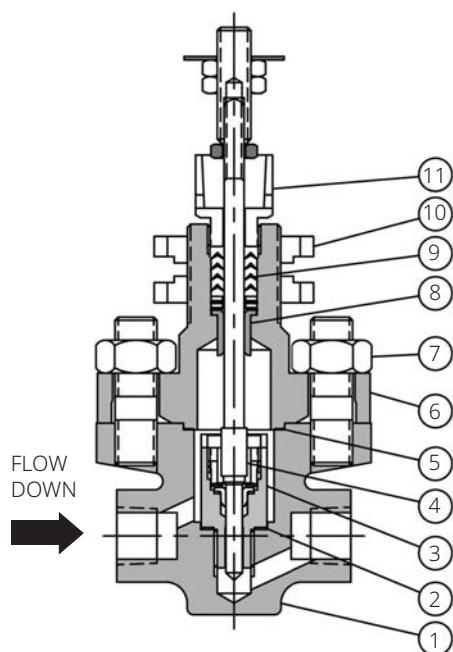
1. Remove the bonnet hex nuts (key 7) and lift the bonnet (key 6) off the valve body (key 1), which may include the packing (key 9) and plug assembly (key 4). [For alloy valve bodies, lift the bonnet flange (key 34) off from the bonnet (key 6) and then lift the bonnet (key 6) off the valve body (key 1)].
2. Remove the bonnet gasket (key 5) and replace.
3. The cage subassembly (key 3) can be removed by unscrewing with a flat screwdriver, using the outer screw slot and lifting out of the valve body (key 1). The cage subassembly should be inspected and cleaned with water or an approved solvent.

For valves with rated C_v 's greater than or equal to 1.0, remove and inspect the plug guide (key 33) for wear. Replace if necessary. Replacement of the entire assembly will be necessary if excessive leakage or wear has occurred in service.

NOTE

The seat cage gasket (key 2) must be replaced when the cage subassembly (key 3) has been removed. The seat cage will appear oblong. This is to prevent loosening of the soft seat.

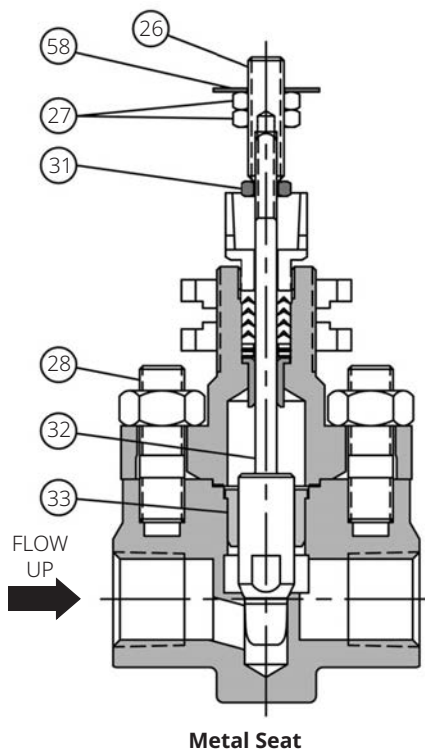
Figure 2. Fisher Baumann 51000 Valve Body Subassembly, NPS 1/4 Soft Seat



E1230

Soft Seat

Figure 3. Fisher Baumann 51000 Valve Body Subassembly, NPS 1/2 Alloy Valve Body Integral (Metal) Seat



E1232

3.4 Valve Reassembly

1. Place the cage gasket (key 2) and cage subassembly (key 3) in the valve body (key 1).
2. Tighten the cage (key 3) hand tight plus 1/8 of a turn. (For valves with rated C_v 's greater than or equal to 1.0, insert the plug guide (key 33)).
3. Place the seat plug (key 4) into the valve body (key 1).
4. Place the bonnet gasket (key 5) into the valve body (key 1). Look at the bonnet (key 6) and valve body (key 1) for correct bonnet orientation.
5. Place the bonnet (key 6) onto the valve body (key 1) and secure with the hex nuts (key 7). For alloy valve bodies, place the bonnet (key 6) onto the valve body (key 1), then place the bonnet flange (key 34) over the bonnet—confirm correct orientation—then secure with the hex nuts (key 7).

DO NOT TIGHTEN AT THIS POINT.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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51000 Valve

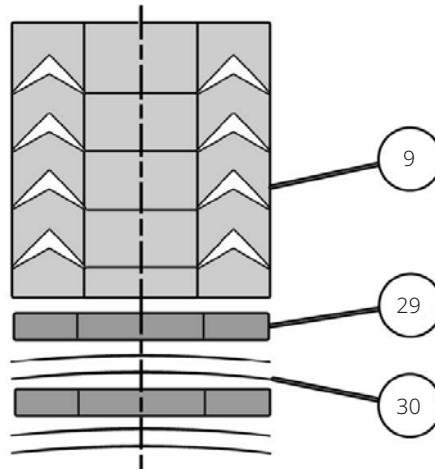
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6. Install the stem guide (key 8) and packing kit (key 9) on the plug stem (key 4) in the proper order (as shown in Figure 4).
7. Carefully press into the top of the bonnet (key 6) making sure each part is seated properly.
8. Install packing rings over the stem one at a time. Use the packing follower nut (key 11) to push each packing ring in individually to avoid jamming.
9. With all required packing (key 9) in place, tighten the packing follower nut (key 11) until it becomes stiff.

DO NOT OVERTIGHTEN THE PACKING FOLLOWER (key 11).

10. Now tighten the hex nuts (key 7)

Figure 4. V-ring Packing Kit



E1233

Table 2. Fisher Baumann 51000 V-ring Packing Kit 51607

KEY NO.	QTY	DESCRIPTION	PART NUMBER	
			S31600 Valve Body	N10276 Nickel Alloy Valve Body
9 ⁽¹⁾	1	Packing set	51604	
29	2	Flat washer	51606	---
30	4	Disc spring	51605	---

1. P/N 51604 used by itself for N10276 Nickel alloy packing.

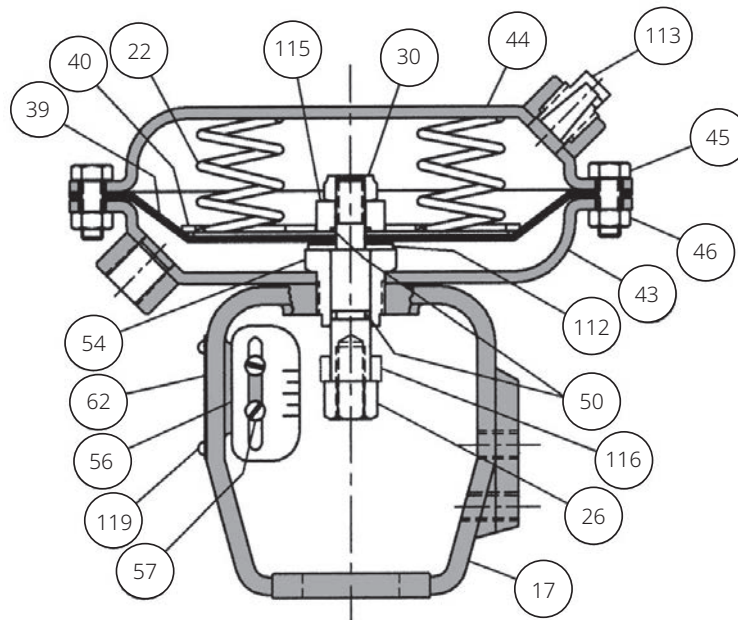
Section 4: Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name and desired material using the following parts tables.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

Figure 5. Fisher Baumann 16 Actuator



E1300

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51000 Valve

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Table 3. Fisher Baumann 16 Actuator

Key No.	Qty	Description
17	1	Yoke - Machined
22	5	Spring 1/2-in. Stroke 4 to 15 psi
	4	Spring 1/2-in. Stroke 3 to 12 psi
26	1	Actuator stem
30	1	Hex FLEXLOC Nut
39*	1	Diaphragm
40	1	Diaphragm plate
43	1	Lower actuator case
44	1	Upper actuator case
45	8	Hex head cap screw
46	8	Hex nut
50*	2	O-ring, FKM (Fluorocarbon)
54	1	Coupling
56	1	Travel scale
57	2	Pan head machine screw
62	1	Serial plate
112	1	Washer
113	1	Vent plug
115	1	Collar
116	1	Collar, Upper stop (Not shown)
119	2	Drive screw
* Recommended spare parts		

Table 4. Valve Body Assembly

KEY NO.	DESCRIPTION	QTY
1	Valve body	1
2*	Seat cage gasket	1
3*	Soft seat cage subassembly	1
4*	Plug	1
5*	Bonnet gasket	1
6	Bonnet	1
7	Hex nut	2
8	Stem guide	1
9*	V-ring	1
	V-ring packing kit	1
10	Clamp nut	2
11	Packing follower nut	1
28	Stud	2
32	Plug and stem S/A	1
33	Plug guide	1
34	Flange, Bonnet	1
26	Stem adapter	---
27	Hex jam nut	---
31	Stem adapter jam nut	---
58	Travel indicator disc	---

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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51000 Valve

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Table 5. Fisher Baumann 51000 Plug Selection

Key No.	Valve Size	Plug C _v	Marking Code
4	NPS 1/2 ONLY	2.5	T01
		1.5	T02
		1.0	T03
	NPS 1/4 and 1/2	0.45	T04
		0.2	T05
		0.1	T06
		0.06	T07
		0.03	T08
		0.015	T09
		0.008	T10
		0.004	T11
		0.002	T12
		0.001	T13
		0.0005	T14
		0.00025	T15
		0.00013	T16
Linear		0.5	T17

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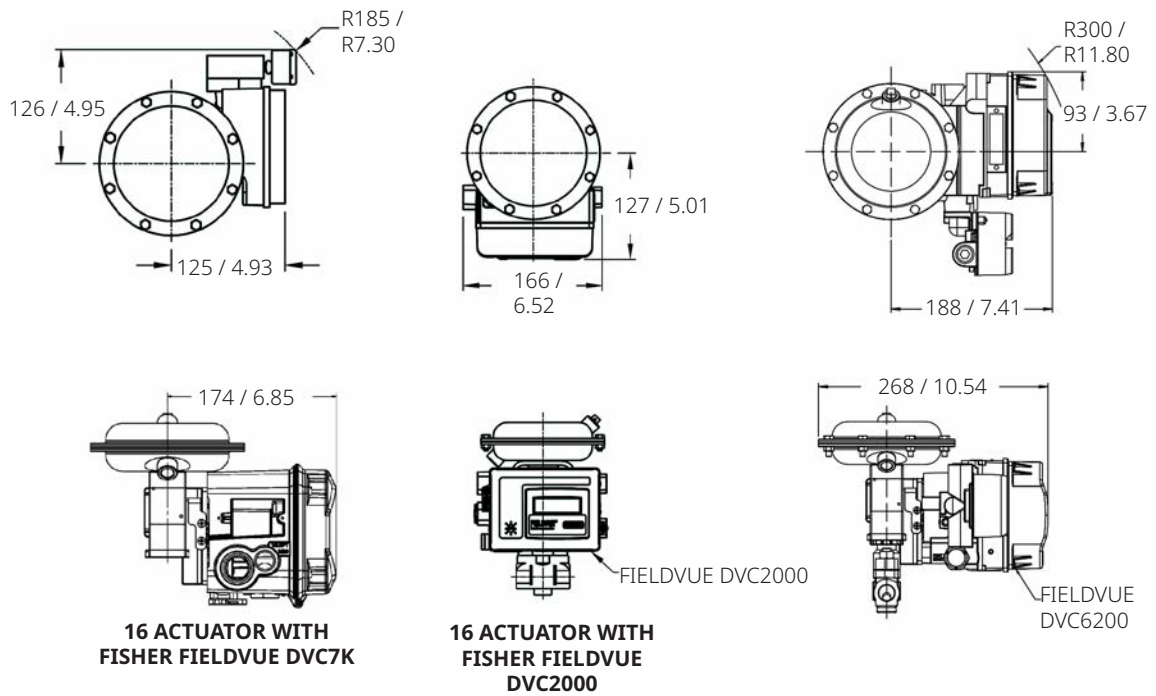
51000 Valve

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Figure 6. Dimensions



mm / in.

Table 6. Dimensions and Weights, Valve Body Subassembly

VALVE SIZE		A		MATERIAL	APPROXIMATE WEIGHTS	
mm	NPS	mm	in.		kg	lbs
6.35	1/4	55.9	2.20	Stainless steel	0.64	1.4
				N10276 Nickel alloy	1.0	2.2
12.7	1/2	68.6	2.70	Stainless steel	0.82	1.8
				N10276 Nickel alloy	1.18	2.6

Figure 7. Fisher Baumann 16 Actuator (Front View)

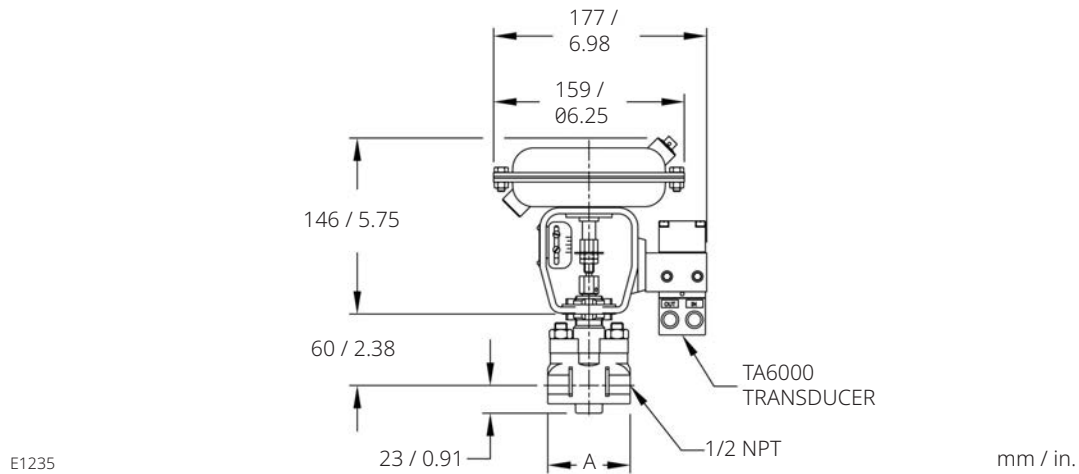


Figure 8. Fisher Baumann 16 Actuator with TA6000 (Top View)

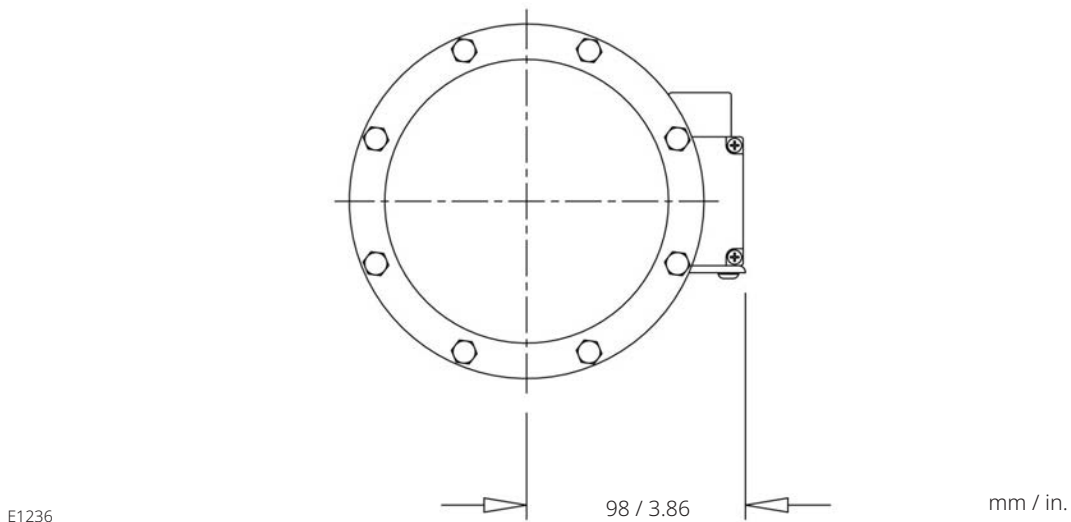


Table 7. Actuator/Instrument Weights

ACTUATOR	INSTRUMENT	APPROXIMATE WEIGHT	
		kg	lbs
16	Actuator without instrument	2.1	4.6
	Fisher 3660/3661 Positioner	3.6	8.0
	Fisher FIELDVUE DVC2000	3.8	8.3
	Fisher FIELDVUE DVC6200 and DVC6200f (Aluminum)	3.5	7.7
	Fisher FIELDVUE DVC6200 and DVC6200f (SST)	8.6	19
	Fisher FIELDVUE DVC7K	3.9	8.9
	TA6000 Electropneumatic Transducer	2.5	5.5

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Fisher™ Baumann™ 81000 Control Valve



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Section 1: Introduction

The Fisher Baumann 81000 control valve (Figure 1) is excellent for throttling of liquid or gaseous media. A low friction mechanical force-amplifying mechanism is used to reduce the travel of the pneumatic or electric actuators. This mechanism moves the closure diaphragm precisely against the valve orifice to throttle or stop the passing fluid.

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for the Fisher Baumann 81000 control valve.

WARNING



Do not install, operate or maintain Fisher Baumann 81000 control valves without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. Fisher Baumann 81000 Control Valve



**NPS 1/4 ANGLE VALVE WITH
16 ACTUATOR**

W9846



**NPS 1/2 INLINE VALVE WITH 16 ACTUATOR
AND FISHER FIELDVUE™ DVC2000
DIGITAL VALVE CONTROLLER**

W9847

⚠ WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact your [Emerson sales office](#) for more complete specifications. Provide the product serial numbers (shown on the nameplate) and all other pertinent information.

NOTE

The acronym of CWP may appear on the nameplate. CWP (Cold Working Pressure) denotes the pressure rating at normal ambient temperature. A normal ambient temperature range being -4 to +100°F / -20 to +38°C.

⚠ WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

1.2 Education Services

Emerson's Education Services

Phone: 800-338-8158

Email: education@emerson.com

emerson.com/en/final-control/services/valve-training

Section 2: Maintenance

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

NOTE

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

⚠ WARNING

Avoid personal injury or property damage by thoroughly cleaning the line of all dirt, welding chips, scale, oil or grease and other foreign material. Failure to do so could result in parts damage, malfunction of the control valve or loss of control of the process.

Section 3: Installation

1. Before installing the valve in the pipeline, thoroughly clean the line of all dirt, welding chips, scale, oil or grease and other foreign material. A micron size filter is recommended upstream of the valve.
2. Install the valve so that the controlled fluid will flow through the valve body in the direction selected from the guidelines shown below.
3. A three-valve bypass must be used to permit removal of the control valve from the line without shutting down the system.
4. A pressure gauge may be installed in the 1/8 inch port in the bolted bonnet (see Figure 4). This gauge tells when leakage or breakage of the diaphragm has occurred.

⚠ WARNING

To avoid personal injury or property damage, do not attempt to do any work on a valve while the system is in operation, the valve must be isolated 100% from the active system and the isolated line voided of pressure and/or hazardous fluids.

3.1 Air Piping

1. For an air-to-extend actuator (air-to-close action), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open action) connect the actuating air pressure line to the 1/4 NPT in the lower diaphragm case. See Figures 2 and 3.
2. Use 6.4 mm / 1/4 in. O.D. tubing or equivalent for all air lines. If the air line exceeds 8 m / 25 ft in length, 9.5 mm / 3/8 in. tubing is preferred. Air pressure should not to exceed 2.5 bar / 35 psig.

3.2 Flow Direction

There are two possible ways to pass fluid through the valve (see Figures 6 and 7). In the flow-to-open mode, fluid enters from Port A to Port B. In the flow-to-close mode, fluid enters from Port B to Port A.

Each flow direction has its advantages and disadvantages. The following guide will make a selection easier.

Use Flow From Port B to A

- In vacuum applications with spring P/N 81168Z, vacuum on down stream.
- With fluids that have a tendency to cavitate.
- In applications where inlet pressure is low and no seat spring can be tolerated.
- When self-cleaning operation is required for removal of solid particles in flow stream.

Use Flow From Port A to B

- When valve has to fail close in case of bursting or damage to the sealing diaphragm.

3.3 Disassembly

WARNING

If there is evidence of process fluid under pressure leaking from the joint, retighten the valve body/joint nuts and return to the Warning at the beginning of the Maintenance section to provide proper steps have been taken to isolate the valve and relieve process pressure.

1. Remove the actuator by unscrewing the yoke drive nut (key 9) and lifting off the complete actuator assembly. This keeps the actuator assembly intact and calibrated to the factory setting. Refer to actuator instructions.
2. Remove the bolts (key 13) and lift the bonnet yoke assembly (key 2) with the diaphragm (key 5) and O-ring (key 15) from the valve body (key 1). Lift out the spring (key 6).
3. Remove the O-ring (key 15) and diaphragm (key 5). Wipe with a clean soft cloth and examine for wear.
4. Inspect the valve body sealing surfaces. Refer to the Lapping the Valve Seat procedure in this instruction manual.

3.4 Lapping the Valve Seat

If valve seat leakage becomes excessive, it may be necessary to lap the valve seat.

1. Use a good quality lapping compound with a mixture that contains 280 to 600 grit. Apply at several spots around the plug seating surface (refer to Figure 5).
2. Thoroughly lap the valve body on a flat, preferably cast iron, surface plate.
3. Clean the seats thoroughly after lapping.
4. Inspect the diaphragm (key 5) and replace if necessary.

3.5 Bonnet Maintenance

1. Remove the actuator by unscrewing the yoke drive nut (key 9) and lifting off the complete actuator assembly. Hold the flattened portions of the bonnet yoke (key 2) in a vise and unscrew the valve bonnet (key 8) using a 2-1/4 in. wrench. Remove and inspect the bearing cartridge assembly (key 4) and O-ring (key 49).
2. Reinsert the parts, O-ring (key 49) and bearing cartridge assembly (key 4), ensuring the bearings extend below the side plate of the bearing cartridge assembly (key 4) and contact the piston subassembly (key 3). With the plunger (key 10) removed, screw the bonnet (key 8) onto the yoke (key 2). There should be no binding or galling. Tighten the bonnet with a wrench until there is metal-to-metal contact.
3. Insert the plunger (key 10) and push it in and out. The piston subassembly (key 3) should travel easily up and down.

3.6 Calibration

1. Reassemble the valve by inserting the spring (key 6), O-ring (key 15) and diaphragm (key 5) into the valve body.
2. Replace the bonnet yoke assembly (key 2) and install the bolts (key 13) and tighten. Add the jam nut (key 27) and travel indicator disk (key 58) to the plunger (key 10). Line up the plunger (key 10) in the bearing cartridge assembly (key 4). Screw the actuator onto the plunger (key 10) until the actuator yoke touches the bonnet (key 8). Lock the actuator with the drive nut (key 9).
3. To prevent damage to the plunger (key 10) or the bearing cartridge subassembly (key 4), be sure the hex jam nut (key 27) is not tightened against the travel indicator (key 58).



CAUTION

To prevent damage to the plunger (key 10) or bearing cartridge subassembly (key 4), be sure the hex jam nut (key 27) is not tightened against the travel indicator (key 58).

3.7 Do Not Attempt to Rotate the Plunger (key 10)

1. For an air-to-retract actuator (air-to-open). Apply 6.9 bar / 100 psi air pressure (or N2) to the normal valve inlet. Apply 0.2 bar / 3.2 psi air signal to the actuator. Use 0.07 bar / 1 psi signal to the actuator if the inlet pressure exceeds 6.9 bar / 100 psi. If the valve leaks, slowly turn the actuator stem counterclockwise. This will move the plunger (key 10) down until leakage is below 1 cc/min. Lock the plunger (key 10) in position with the jam nut (key 27). Calibrate the travel scale and check for 12.7 mm / 1/2 in. valve travel; apply a 1.04 bar / 15 psi signal. Reverse the signal; the plunger should move in the opposite direction with less than 0.014 bar / 0.2 psi signal change.
2. For an air-to-extend actuator (air-to-close), use the same procedure as in step one, except apply 0.88 bar / 12.8 psi to the actuator to calibrate the shut off position.

Section 4: Parts

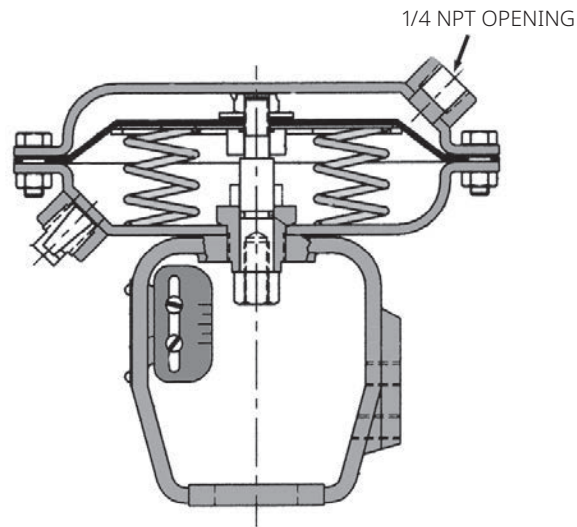
4.1 Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name and desired material using the following parts tables.

WARNING

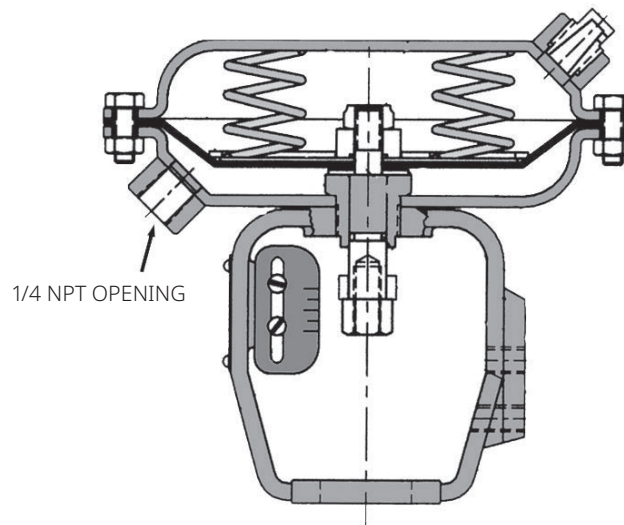
Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

Figure 2. Air-to-Extend (Air-to-Close Action)



E1369

Figure 3. Air-to-Retract (Air-to-Open Action)



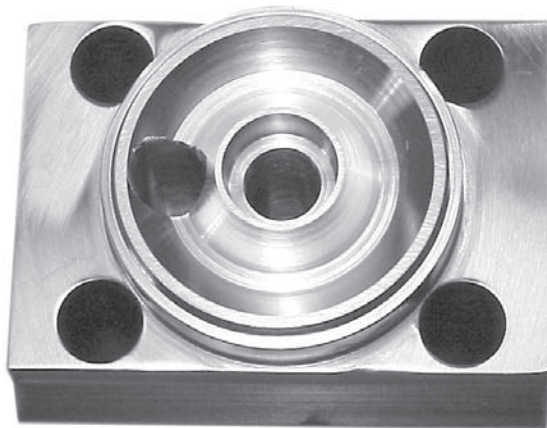
E1234

Figure 4. 1/8 Port



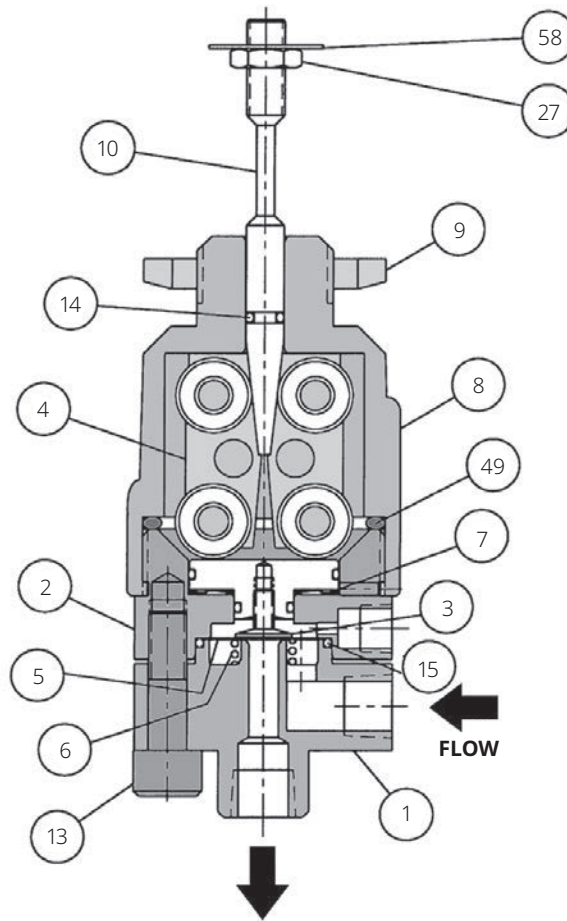
W9916

Figure 5. Seating Surfaces



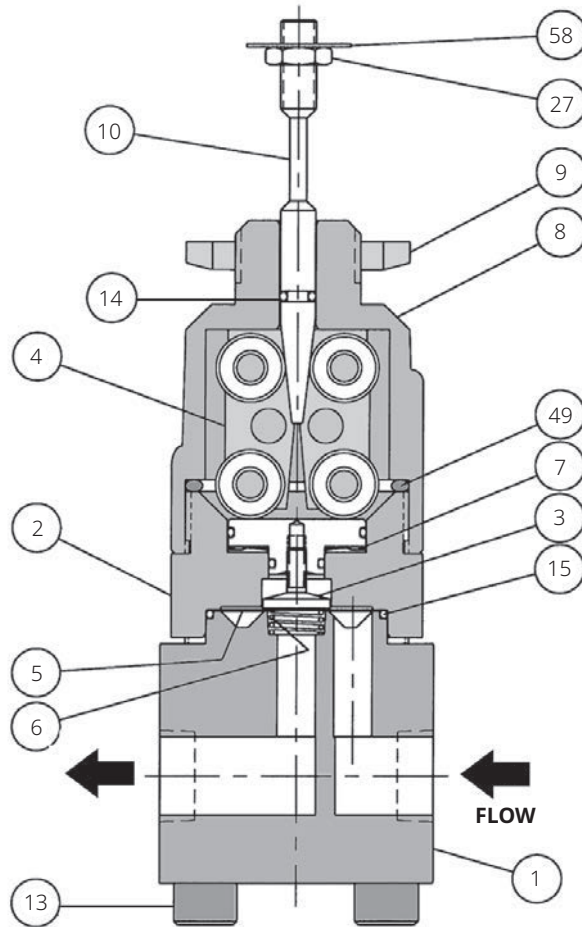
W9917

Figure 6. Fisher Baumann 81000 NPS 1/4 Angle Valve Body



E1324

Figure 7. Fisher Baumann 81000 NPS 1/2 Inline Valve Body



E1325

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

81000 Valve

July 2026

Instruction Manual

D103366X012

Table 1. Common Parts

Key Number	Quantity	Description
1	1	Valve body
2	1	Bonnet yoke, NPS 1/2
		Bonnet yoke, NPS 1/4
3	1	Piston subassembly, NPS 1/2
		Piston subassembly, NPS 1/4
4*	1	Bearing cartridge subassembly
5*	1	Closure diaphragm, NPS 1/2, 316 Stainless Steel
		Closure diaphragm, NPS 1/2, N10276 Nickel Alloy
		Closure diaphragm, NPS 1/4, 316 Stainless Steel
		Closure diaphragm, NPS 1/4, N10276 Nickel Alloy
6*	1	Seat spring
7*	1	Wave spring
8	1	Bonnet
9	1	Drive nut (Yoke)
10*	1	Plunger
13	4	NPS 1/2, Allen head bolt 3/8-16x2-5/8
		NPS 1/4, Allen head bolt M8x30
14*	1	O-ring, Plunger
15*	1	O-ring, NPS 1/2 body, (PTFE)
		O-ring, NPS 1/4 body, (PTFE)
27	1	Jam nut
49*	1	O-ring
58	1	Travel indicator disk
*Recommended spare parts.		

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D103366X012

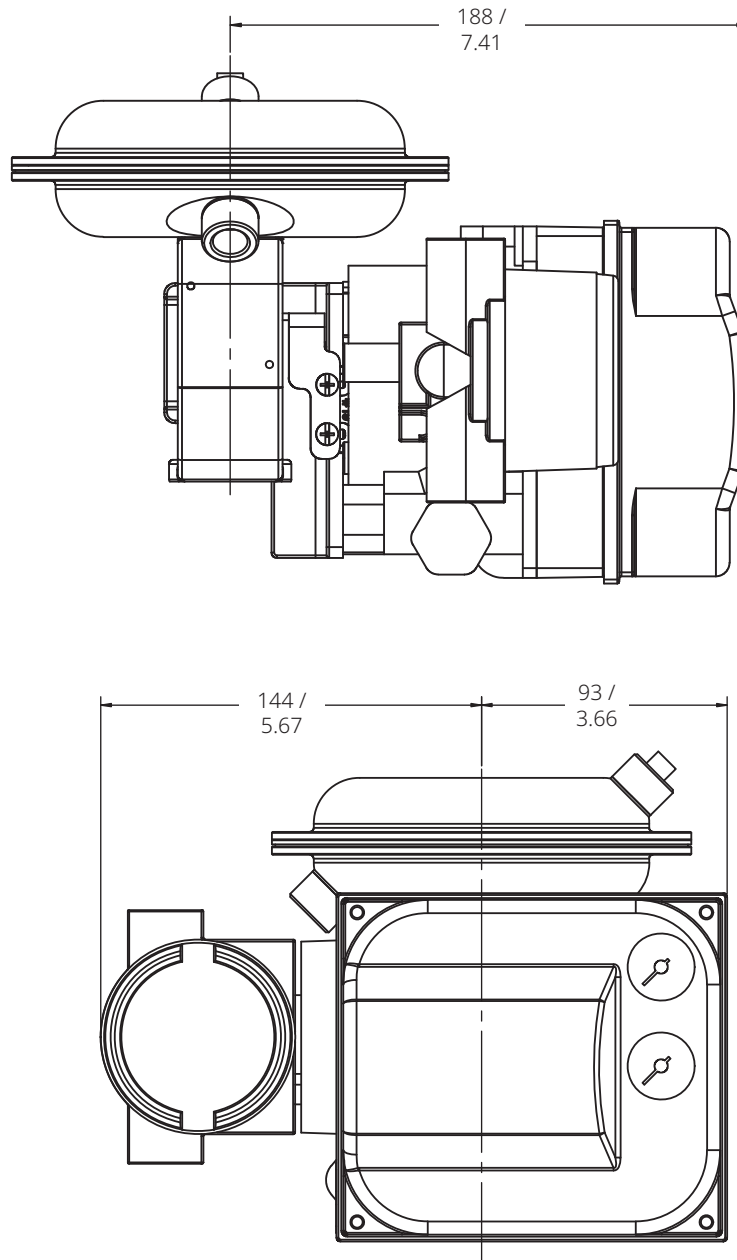
81000 Valve

July 2026

Table 2. Fisher Baumann 81000 Valve Body and Plunger

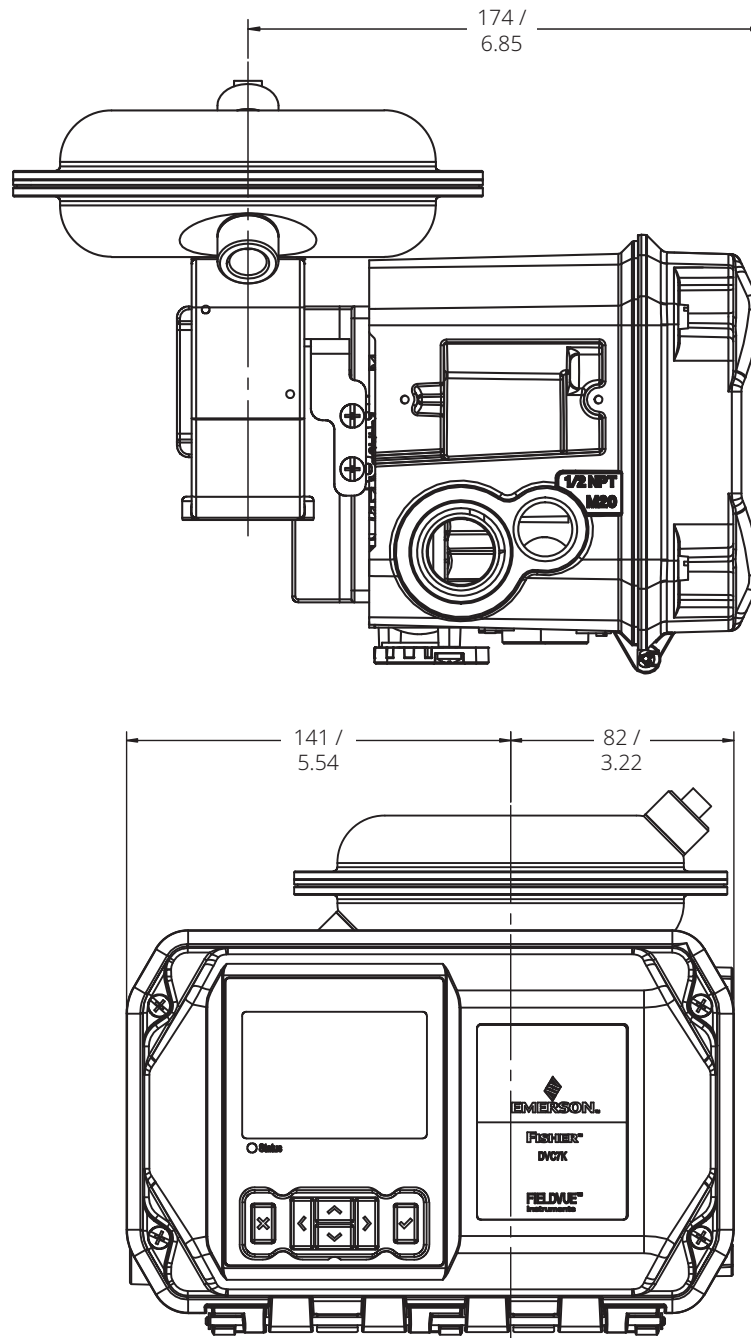
PLUG TRAVEL		ORIFICE DIAMETER		DIAPHRAGM TRAVEL	
C _v	K _v	mm	in.	mm	in.
0.01	0.009	0.635	0.025	0.1778	0.007
0.03	0.026	1.60	0.063	0.1778	0.007
0.10	0.09	7.92	0.312	0.1778	0.007
0.30	0.26	7.92	0.312	0.3810	0.015
0.50	0.43	13.2	0.520	0.0005	0.012
0.70	0.60	13.2	0.520	0.3810	0.015
1. Add the suffix of the letter "H" to the valve body part number when N10276 Nickel Alloy material is specified. 2. Refer to key 5 in Table 1 for the appropriate closure diaphragm.					

Figure 8. 81000 Angle Valve with 16 Actuator and Fisher FIELDVUE DVC6200 Digital Valve Controller

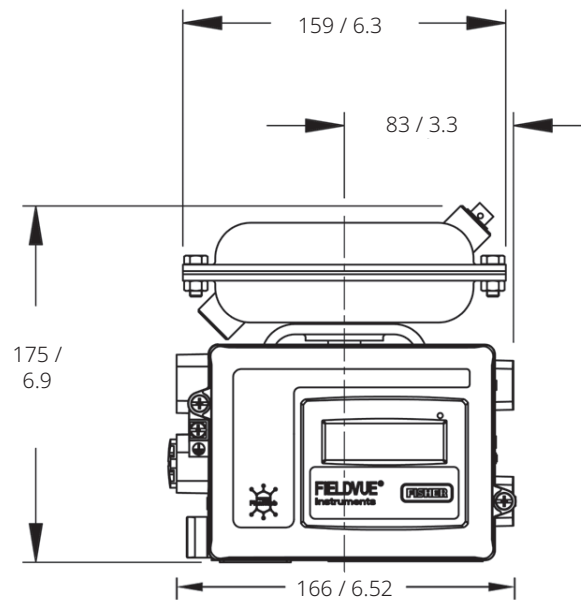


mm / in.

Figure 9. 81000 Inline Valve with 16 Actuator and Fisher FIELDVUE DVC7K Digital Valve Controller



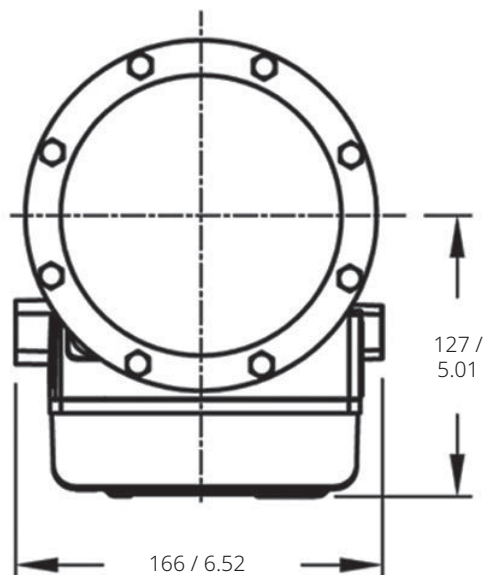
mm / in.

Figure 10. 16 Actuator with Fisher FIELDVUE DVC2000 Digital Valve Controller

NOTE: 16 ACTUATOR REQUIRES 77 mm / 3 in. VERTICAL CLEARANCE

mm / in.

E1330

Figure 11. 16 Actuator with Fisher FIELDVUE DVC2000 Digital Valve Controller, Top View

NOTE: 16 ACTUATOR REQUIRES 77 mm / 3 in. VERTICAL CLEARANCE

mm / in.

E1328

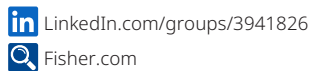
Table 3. Fisher Baumann 81000 Valve Weights

6.35 mm / NPS 1/4		12.7 mm / NPS 1/2	
kg	lbs	kg	lbs
1.35	3	1.82	4

Table 4. Fisher Baumann Actuator Weights

BAUMANN ACTUATOR	WEIGHT	
	kg	lbs
16	2.1	4.6

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS



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Baumann™ 83000 Sanitary Angle Control Valve

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Figure 1. Baumann 83000 Control Valve



83000 Sanitary Angle Valve
with Baumann 16 Actuator

83000 Sanitary Angle Valve
with FIELDVUE™ DVC2000
Digital Valve Controller

Introduction

The Baumann 83000 Sanitary angle control valve (figure 1) features a packless design and is intended for laboratory flow rates as low as 0.001 liters per minute (l/m) with a Cv range of 0.00001 to 1.2. This innovative design also allows for clean-in-place (CIP) and sanitize-in-place (SIP) procedures and is self-draining. Meets 3-A sanitary standards for design and fabrication.

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Baumann 83000 sanitary angle control valve.

Do not install, operate, or maintain Baumann 83000 control valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

⚠ WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact your [Emerson sales office](#) or Local Business Partner for more complete specifications. Provide the product serial numbers (shown on the nameplate) and all other pertinent information.

⚠ WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

Educational Services

For information on available courses for the Baumann 83000 sanitary angle control valve, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Maintenance

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

⚠ WARNING

Avoid personal injury or property damage by thoroughly cleaning the line of all dirt, welding chips, scale, oil or grease, and other foreign material. Failure to do so could result in parts damage, malfunction of the control valve or loss of control of the process.

Installation

1. Before installing the valve in the pipeline, thoroughly clean the line of all dirt, welding chips, scale, oil or grease, and other foreign material. A micron size filter is recommended upstream of the valve.
2. Install the valve so that the controlled fluid will flow through the valve body in the direction selected from the guidelines shown below.
3. A three-valve bypass must be used to permit removal of the control valve from the line without shutting down the system.
4. A pressure gauge or other telltale connection should be installed in the 1/8 inch port in the bolted yoke (see figure 7). This gauge tells when leakage or breakage of the diaphragm has occurred.

⚠ WARNING

To avoid personal injury or property damage, do not attempt to do any work on a valve while the system is in operation, the valve must be isolated 100% from the active system and the isolated line voided of pressure and/or hazardous fluids.

Air Piping

1. For an air-to-extend actuator (air-to-close action), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open action) connect the actuating air pressure line to the 1/4 NPT in the lower diaphragm case. See figures 4 and 5.
2. Use 6.4 mm (1/4 inch) O.D. tubing or equivalent for all air lines. If the air line exceeds 8 m (25 ft) in length, 9.5 mm (3/8 inch) tubing is preferred. Air lines must not leak. Air pressure should not exceed 2.5 bar (35 psig).

Flow Direction

There are two possible ways to pass fluid through the valve: in the Flow-to-Open mode, fluid enters through Port B and flows to Port A (see figure 2). In the Flow-to-Close mode, fluid enters through the port leading into the chamber or body bowl, Port A to port B. See figure 2 for port identification.

Each flow direction has its advantages and disadvantages. The following guide will make a selection easier.

Use Flow to Open: Port B to A

- When the valve has to fail close in case of bursting or damage to sealing diaphragm.
- When the valve must drain from inlet to outlet. (Valve mounted with actuator horizontal.)

Use Flow to Close: Port A to B

- In vacuum applications, vacuum on down stream.
- With fluids that have a tendency to cavitate.
- When a self-cleaning operation is required for removal of solid particles in the flow stream.

Disassembly

⚠ WARNING

If there is evidence of process fluid under pressure leaking from the joint, retighten the valve body/joint nuts and return to the Warning at the beginning of the Maintenance section to provide proper steps have been taken to isolate the valve and relieve process pressure.

1. Remove the actuator by unscrewing the yoke drive nut (key 9) and lifting off the complete actuator assembly. This keeps the actuator assembly intact and calibrated to the factory setting. Refer to actuator instructions.
2. Remove the bolts (key 13) and lift the bonnet yoke assembly (key 2) with the diaphragm (key 5) and O-ring (key 15) from the valve body (key 1).

3. Remove the O-ring (key 15) and diaphragm (key 5). Wipe with a clean soft cloth and examine for wear.
4. Inspect the valve body sealing surfaces. Refer to the Lapping the Valve Seat procedure in this instruction manual.

Lapping Sealing Surfaces

If valve leakage becomes excessive, it may be necessary to lap the sealing surfaces.

1. Use a good quality lapping compound with a mixture that contains 280 to 600 grit. Apply at several spots around the valve body sealing surfaces (refer to figure 6).
2. Thoroughly lap the valve body (key 1) on a flat, preferably cast iron, surface plate.
3. Clean the seats thoroughly after lapping.
4. Inspect the diaphragm (key 5) and replace if necessary.

Bonnet Maintenance

1. Remove the actuator by unscrewing the yoke drive nut (key 9) and lifting off the complete actuator assembly. Hold the flattened portions of the bonnet yoke (key 2) in a vise and unscrew the valve bonnet (key 8) using a 2-1/4 inch wrench. Remove and inspect the bearing cartridge assembly (key 4) and O-ring (key 49).
2. Reinsert the parts, O-ring (key 49) and bearing cartridge assembly (key 4), ensuring the bearings extend below the side plate of the bearing cartridge assembly (key 4) and contact the piston subassembly (key 3). With the plunger (key 10) removed, screw the bonnet (key 8) onto the yoke (key 2). There should be no binding or galling. Tighten the bonnet with a wrench until there is metal-to-metal contact.
3. Insert the plunger (key 10) and push it in and out. The piston subassembly (key 3) should travel easily up and down.

Valve Body to Bonnet Assembly

1. Place the diaphragm (key 5) in the bonnet yoke (key 2) cavity.
2. Place the O-ring (key 15) on the diaphragm (key 5) in the cavity. This should hold the diaphragm in place while assembling.
3. Place the bonnet assembly onto the valve body (key 1).
4. The locking screw (key 13) will thread through the bonnet yoke (key 2) and tighten into the valve body (key 1).

Calibration

1. Reassemble the valve by inserting the O-ring (key 15) and diaphragm (key 5) into the valve body.
2. Replace the bonnet yoke assembly (key 2) and install the bolts (key 13) and tighten. Add the jam nut (key 27) and travel indicator disk (key 58) to the plunger (key 10). Place the drive nut (key 9) over the plunger (key 10). Line up the plunger (key 10) in the bearing cartridge assembly (key 4). Screw the actuator onto the plunger (key 10) until the actuator yoke touches the bonnet (key 8). Lock the actuator with the drive nut (key 9).

Do Not Attempt to Rotate the Plunger (key 10)

CAUTION

To prevent damage to the plunger (key 10) or bearing cartridge subassembly (key 4), be sure the hex jam nut (key 27) is not tightened against the travel indicator (key 58).

1. For an air-to-retract actuator (air-to-open/fail closed). Apply 6.9 bar (100 psi) air pressure (or N2) to the normal valve inlet A. Apply 0.2 bar (3.2 psi) air signal to the actuator. Add 0.07 bar (1 psi) signal to the actuator if the inlet pressure exceeds 6.9 bar (100 psi). If the valve leaks, slowly turn the actuator stem counterclockwise. This will move the plunger (key 10) down until leakage is below 1 cc/min. Lock the plunger (key 10) in position with the jam nut (key 27). Calibrate the travel scale and check for 12.7 mm (1/2 inch) valve travel; apply a 1.04 bar (15 psi) signal. Reverse the signal; the plunger should move in the opposite direction with less than 0.014 bar (0.2 psi) signal change.
2. For an air-to-extend actuator (air-to-close/fail open), use the same procedure as in step one, except apply 0.88 bar (12.8 psi) to the actuator to calibrate the shut off position.

Note

For Baumann 16 actuator ONLY. For inlet pressures exceeding 10.6 bar (150 psi), 12.77 mm (NPS 1/2) or 20.7 bar (300 psi), 6.35 mm (NPS 1/4), use a positioner or I/P transducer with an output pressure of 0.07 - 1.2 bar (1-17 psi) (ASME-FCI Standard 87-2) to ensure the valve will close properly.

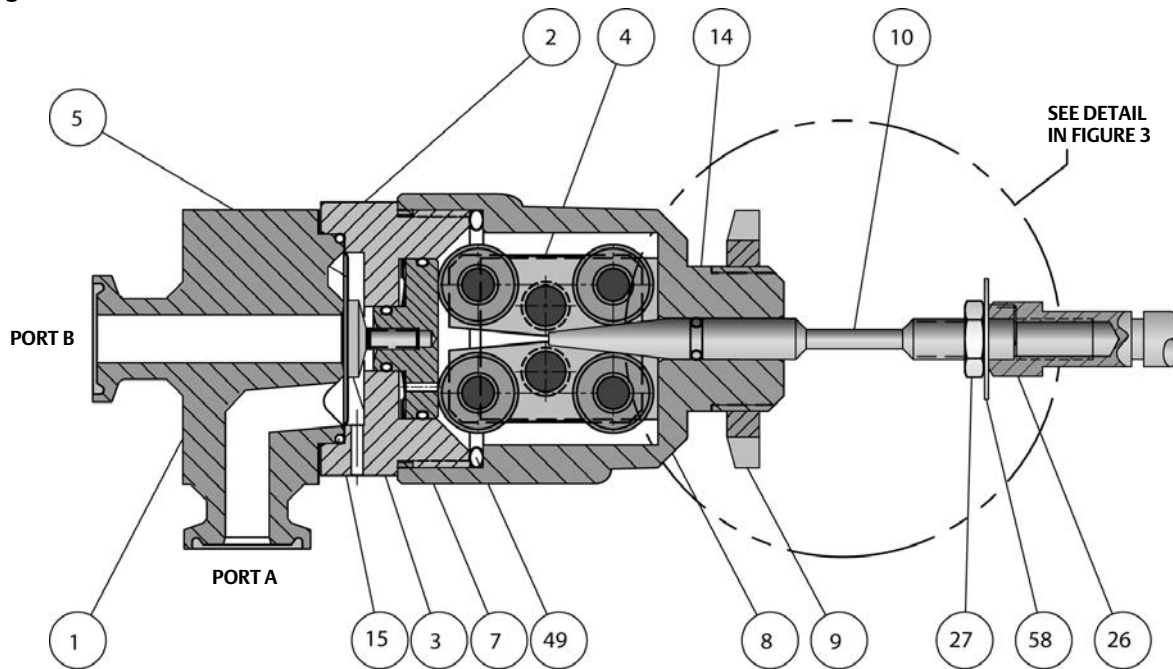
Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name, and desired material using the following parts tables.

WARNING

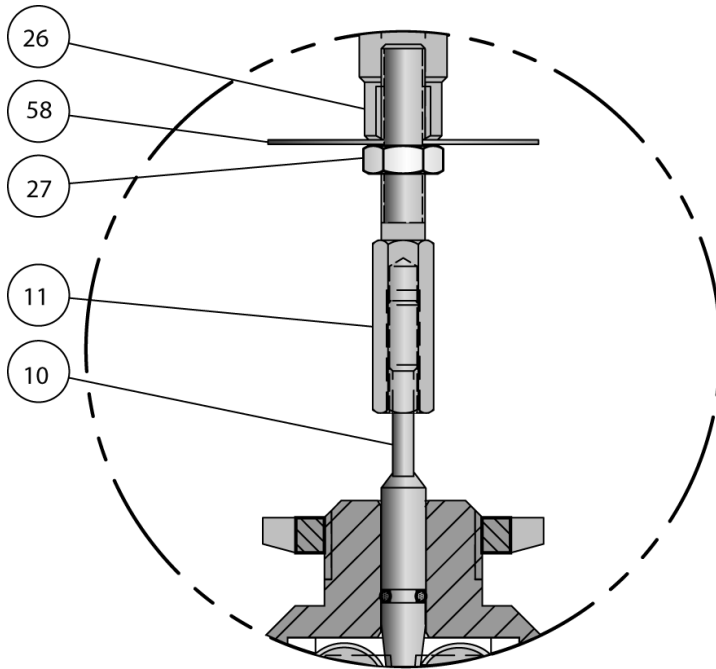
Use only genuine Fisher™ replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 2. 83000 for Baumann 16 Actuator



E1332

Figure 3. 83000 with Stem Adaptor for Baumann 32 Actuator



E1333

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Table 1. Common Parts

KEY NUMBER	QUANTITY	DESCRIPTION	PART NUMBER	
			Baumann 16 Actuator	Baumann 32 Actuator
1	1	Valve Body	Refer to table 2	
2	1	Bonnet Yoke	81305	
3	1	Piston Subassembly	81188	
4*	1	Bearing Cartridge Subassembly	81180-2	
5*	1	Closure Diaphragm, 316 Stainless Steel	81148	
		Closure Diaphragm, N10276 Nickel Alloy	81148-1	
7*	1	Wave Spring	81401	
8	1	Bonnet	81205	
9	1	Drive Nut, (Yoke)	011757-003-153	
10*	1	Plunger	Refer to table 2	
11	1	Actuator Stem Adapter for Baumann 32 Actuator	---	81932
13	2	Locking Bolt (refer to figure 8)	81173	
14*	1	O-Ring, Plunger	81147	
15*	1	O-Ring, Body (FKM)	81165-5	
		O-Ring, Body, (EPDM)	81165-6	
		O-Ring, Body, (PTFE)	81165-8	
27	1	Hex Jam Nut, Baumann 16 Actuator	81841	971514-002-250
49*	1	O-Ring, Bonnet	81206	
58	1	Travel Indicator Disk	011765-002-152	24299

Table 2. Baumann 83000 Valve Body and Plunger

PLUG TRAVEL		ORIFICE DIAMETER		DIAPHRAGM TRAVEL		83000 VALVE BODY (KEY 1)		PLUNGER (KEY 10)	
Cv	Kv	mm	Inch	mm	Inch	≤ 30 Ra Microinch	≤ 20 Ra Microinch	Baumann 16 Actuator	Baumann 32 Actuator
0.014	0.012	0.686	0.027	0.1778	0.007	81664	81664-1	81193 (5°) ⁽¹⁾	81933 (5°) ⁽¹⁾
0.053	0.046	1.60	0.063	0.1778	0.007	81663	81663-1	81193 (5°) ⁽¹⁾	81933 (5°) ⁽¹⁾
0.182	0.157	3.81	0.150	0.1778	0.007	81661	81661-1	81193 (5°) ⁽¹⁾	81933 (5°) ⁽¹⁾
0.427	0.367	3.81	0.150	0.3810	0.015	81661	81661-1	81192 (13°) ⁽¹⁾	81931 (13°) ⁽¹⁾
0.631	0.543	9.40	0.370	0.0005	0.012	81657	81657-3	81191 (8°) ⁽¹⁾	81934 (8°) ⁽¹⁾
1.02	0.877	9.40	0.370	0.3810	0.015	81657	81657-3	81192 (13°) ⁽¹⁾	81931 (13°) ⁽¹⁾

1. Degree of angle cut on the plunger.

Figure 4. Air-to-Extend (Air-to-Close Action)

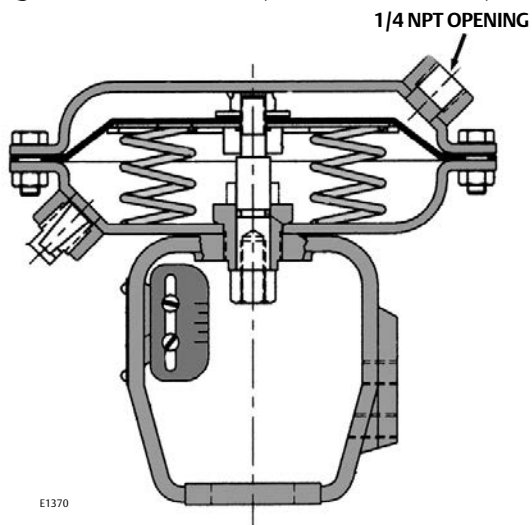


Figure 6. Seating (Sealing) Surfaces



Figure 5. Air-to-Retract (Air-to-Open Action)

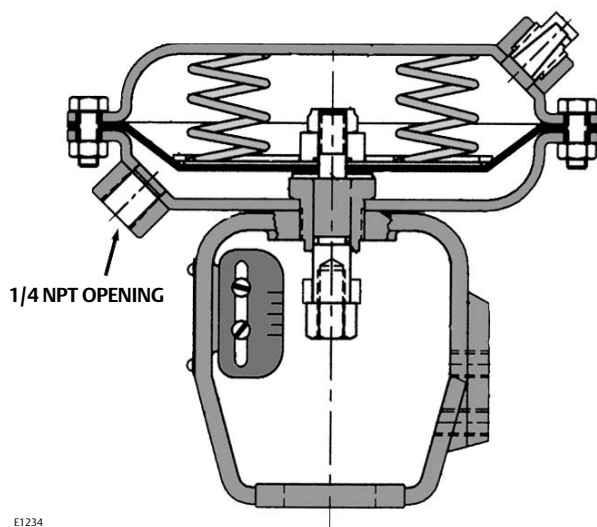


Figure 7. 1/8 Inch Port

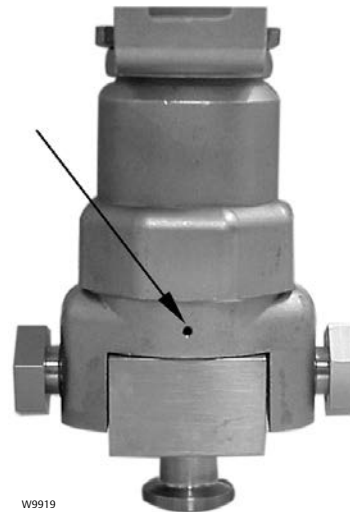


Figure 8. Baumann 83000 - Rotated View to Show Locking Bolts

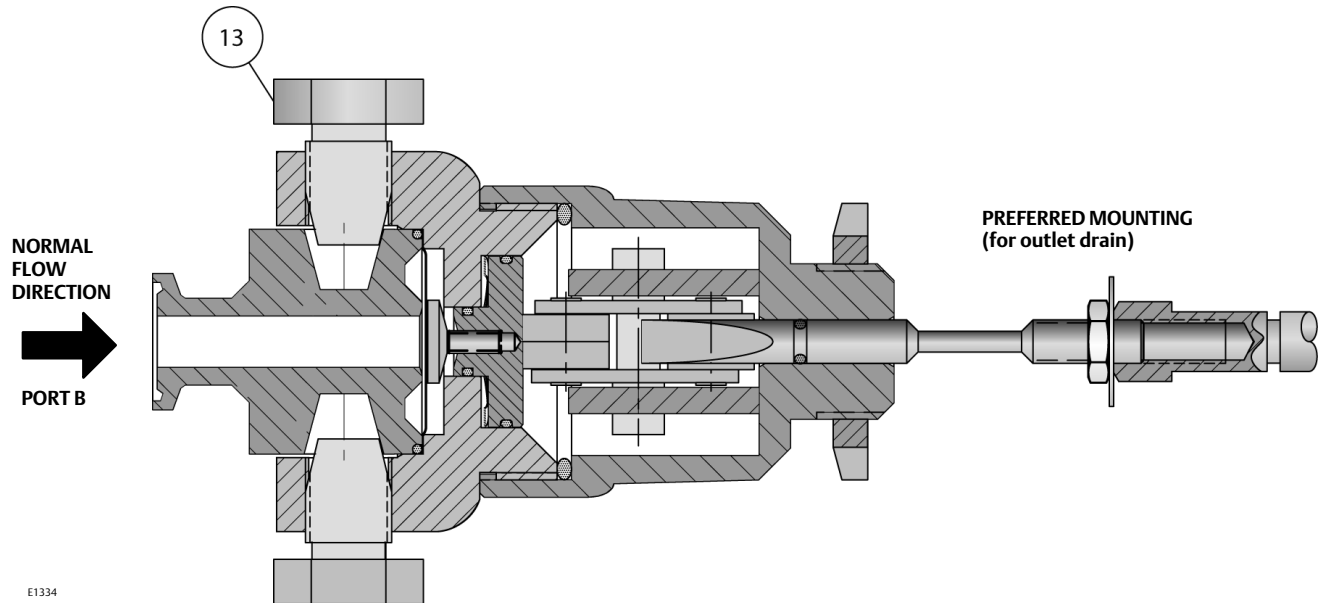


Figure 9. Valve Body Subassembly

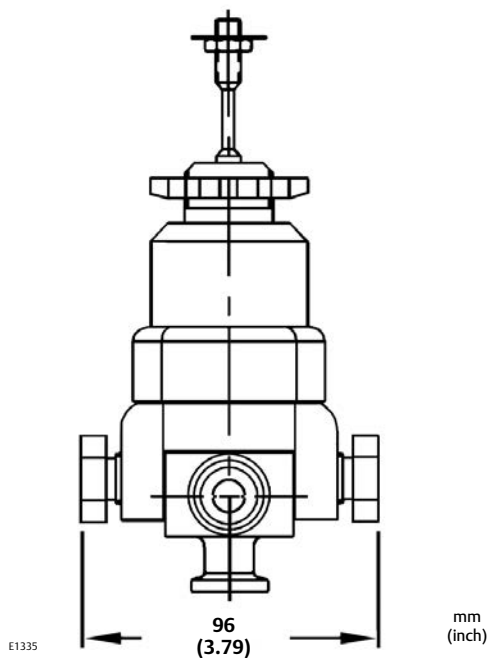


Figure 10. 83000 with Baumann 16 Actuator and FIELDVUE DVC6000 Digital Valve Controller

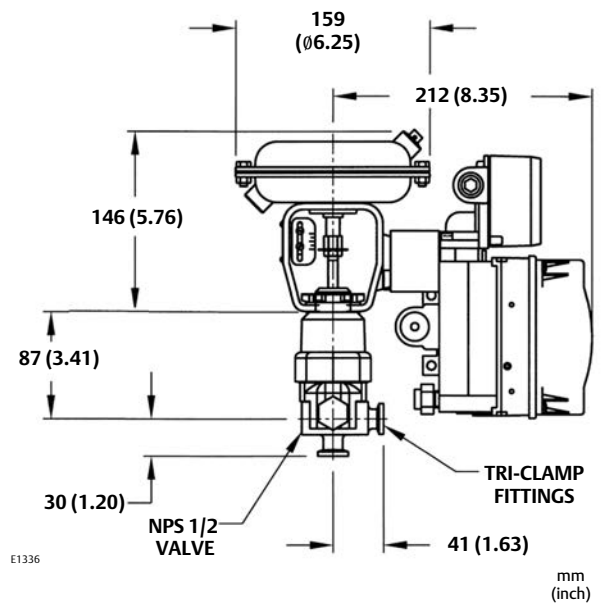


Figure 11. Baumann 16 Actuator with Fisher 3660/3661 Positioner and 67CFR Airset

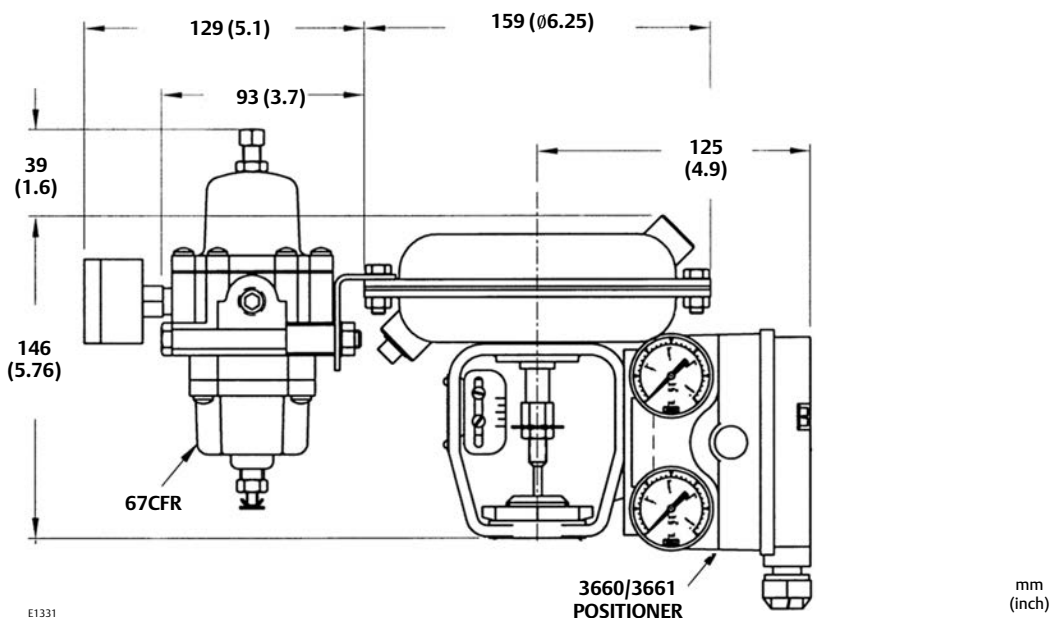


Figure 12. Baumann 16 Actuator with FIELDVUE DVC2000 Digital Valve Controller

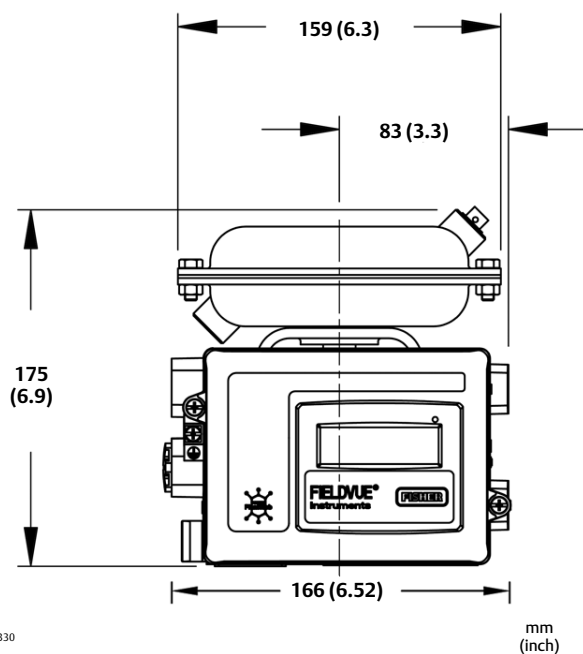
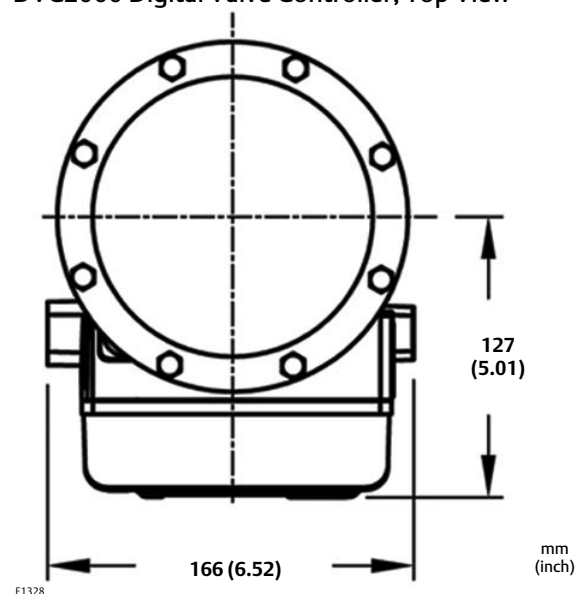


Figure 13. Baumann 16 Actuator with FIELDVUE DVC2000 Digital Valve Controller, Top View



Note

The actuator requires 115 mm (4-1/2 inches) of vertical clearance.

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Table 3. Baumann 83000 Valve Weight

VALVE SIZE: 12.7 mm (NPS 1/2)	
kg	lbs
1.82	4

Table 4. Baumann Actuator Weights

BAUMANN 16		BAUMANN 32	
kg	lbs	kg	lbs
2.1	4.6	4.5	10

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Baumann™ 84000 Sanitary Diaphragm Angle and Inline Control Valve



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Introduction

The Baumann 84000 sanitary control valve (figures 1, 2, and 3) is designed to satisfy the stringent demands of the pharmaceutical and biotechnology industries. These valves are in compliance with 3-A Sanitary Standards, Inc. requirements.

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Baumann 84000 sanitary control valve.

Do not install, operate, or maintain Baumann 84000 control valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Figure 1. 84000 Inline Sanitary Valve with Baumann 32 Actuator



W9838

Figure 2. 84000 Angle Sanitary Valve with Baumann 32 Actuator and FIELDVUE™ DVC2000 Digital Valve Controller



W9839

Figure 3. 84000 Angle Sanitary Valve with Baumann 54 Actuator and FIELDVUE DVC6000 Digital Valve Controller



W9840

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact your [Emerson sales office](#) or Local Business Partner for more complete specifications. Provide the product serial numbers (shown on the nameplate) and all other pertinent information.

WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

WARNING

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

Maintenance

WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

Flow Direction

The preferred flow direction for self-draining is shown in figures 8 and 9.

Installation

1. Before installing the valve in the pipeline, thoroughly clean the line of all dirt, welding chips, scale, oil or grease, and other foreign material. A micron size filter is recommended upstream of the valve.
2. Install valve so that the controlled fluid will flow through the valve body in the direction selected in figures 8 and 9. The leak detection port should be located at the lowest point in the installed position.
3. A three-valve bypass must be used to permit removal of the control valve from the line without shutting down the system.
4. To detect if leakage or breakage of the diaphragm has occurred, a pressure gauge may be installed in the 1/8 NPT port (key 14) in the bonnet, see figures 4, 5, and 6.

WARNING

To avoid personal injury or property damage, do not attempt to do any work on a valve while the system is in operation, the valve must be isolated 100% from the active system and the isolated line voided of pressure and/or hazardous fluids.

Air Piping

1. For an air-to-extend actuator (air-to-close action), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open action) connect the actuating air pressure line to the 1/4 NPT in the lower diaphragm case.

2. Use 6.4 mm (1/4 inch) O.D. tubing or equivalent for all air lines. If the air line exceeds 8 m (25 ft) in length, 9.5 mm (3/8 inch) tubing is preferred. Air lines must not leak. Air pressure should not exceed 2.5 bar (35 psig).

Valve Body Removal

Reference figures 4, 5, and 6.
(Not Required For Actuator Reversal)

For field replacement of the diaphragm (key 8), follow steps 1 through 4 below.

Note

Do not squeeze the valve body in a vise.

1. For fail-closed action (air-to-open), stroke the actuator up to take pressure off from the diaphragm pushing against seat. For fail-open action (air-to-close), there is no need to stroke actuator.
2. Remove the bonnet screws (key 18) for NPS 1 valves or the clamp (key 11) for NPS 1-1/2 or 2 valves.
3. Lift the bonnet assembly (key 2) with the actuator from the valve body (key 1).
4. Once disassembled; for fail-closed action ONLY, release pressure from the actuator to be able to unscrew the diaphragm, for fail-open action you must pressurize the actuator to unscrew the diaphragm. This is the only action required for inspection or cleaning.
5. Stroke the actuator down to exert some pressure and remove the diaphragm (key 8) by unscrewing the diaphragm (key 8) from the compressor (key 5). Remove the bonnet O-ring (key 15) (NPS 1-1/2 and 2 valves only). Wipe the diaphragm (key 8) with a clean soft cloth and examine for wear.
6. Inspect the valve body sealing surfaces. If valve leakage becomes excessive, replacement of the diaphragm (key 8) may be necessary.

Actuator Removal

To remove the actuator, unscrew the drive nut (key 9) and loosen the jam nuts (key 27). Unscrew the piston stem (key 3) from the actuator stem.

CAUTION

Avoid personal injury or property damage from sudden release of pressure or bursting of parts. Remove the actuator before attempting to disassemble the valve.

Bonnet Disassembly

Actuator Removed

Remove the diaphragm (key 8) and the bonnet O-ring (key 15) (NPS 1-1/2 and 2 valves only) per instructions under the previous Valve Body Removal section. Proceed as follows:

1. Turn over the bonnet assembly (key 2).

2. Pry out the retaining ring (key 7) using a small flat screwdriver.
3. Remove the wave springs (key 6), compressor (key 5) and drive mechanism (key 4).
4. Push out the piston-stem assembly (key 3). Clean and replace as required.

Note

For NPS 1-1/2 & 2 valves, measure the gap between the free ends of the clamp (key 11) and return to this position upon reassembly to minimize change in zero calibration.

Bonnet Reassembly

Actuator Removed

For correct orientation of the sub-assemblies to the bonnet refer to figure 7, exploded view.

1. Insert the piston stem assembly (key 3) into the bonnet (key 2).
2. Orient the drive mechanism as shown in figure 7.
3. Verify that the machined surfaces at the end of the rectangular plates are in full contact with the machined recess inside the bonnet (key 2).
4. **IMPORTANT:** Verify that the recessed roller bearings in the drive mechanism (key 4) rest against the flats of the piston stem assembly (key 3).
5. Install the compressor (key 5) per figures 4, 5, and 6 with the flat side resting against the extended roller bearings.
6. Drop the wave springs (key 6) into place, prongs down; the NPS 1 valve requires two wave springs. The NPS 1-1/2 and 2 valves require three wave springs. Oppose the spring opening 180 degrees when installing the wave springs.
7. Retain all parts by installing the retaining ring (key 7) into the bonnet groove.
8. The gap in the retaining ring (key 7) should align with the crest of the wave spring (key 6).
9. Push down on the bonnet assembly to drive the piston stem assembly (key 3) firmly into the drive mechanism (key 4) to provide some tension.
10. Insert the O-ring (key 15) (NPS 1-1/2 and 2 valves only), so that it rests on the retaining ring (key 7).
11. Lubricate the screw thread and the cone of the diaphragm (key 8) with sterile food grade lubricant.
12. Screw the diaphragm (key 8) onto the compressor (key 5) snugly. **DO NOT OVERTIGHTEN.**
13. Place the complete bonnet assembly onto the valve body (key 1).
 - a. The diaphragm (key 8) rim must fit into the body groove for proper centering.
 - b. The NPS 1 bolted flange configuration should be tightened for metal-to-metal contact between the flange and the valve body. Be sure to use 45 lbf•ft when tightening the valve body bolts on the NPS 1 valve.
 - c. For NPS 1-1/2 and 2 valves, apply the clamp (key 11) and tighten the nut gradually, checking for an even amount of PTFE over the valve body, between the bonnet and clamp, for proper centering.
 - d. The gap between the clamp ends should be approximately 1/2 inch or less for proper diaphragm compression. **DO NOT OVERTIGHTEN THE CLAMP.**
 - e. Examine through port B to ensure the diaphragm is centered on the seating area.

Valve Calibration

After the valve is assembled per the previous instructions, install the properly configured actuator (reference the Baumann Pneumatic Actuators instruction manual, [D103352X012](#)), making sure to engage the piston stem (key 3) as much as possible into the actuator stem. Tighten the drive nut (key 9). (Refer to figures 8 and 9 for the preferred flow direction.)

Calibration of Fail-Close (Air-to-Open) Actuator

1. Apply 50 psi air or nitrogen to port B. Apply 3 psi air signal to the actuator.
 - a. Slowly turn the piston stem assembly (key 3) out of the actuator stem until flow stops.

Note

When adjusting the valve stem, do not grip the stem directly with pliers or a wrench. This will damage the surface of the stem. Instead, counter-tighten the two locknuts on the stem together. This will allow you to turn the stem by turning the locknuts with a wrench.

- b. Check the valve for leaks with 50 psi air under the diaphragm (port B). Leakage should be less than 1 cc/min. The valve should start to leak or low flow at a minimum pressure signal to the actuator. If it takes more than minimum pressure to open, then screw the piston stem assembly (key 3) further into the actuator stem. If the valve is not tight at 3 psi signal, screw the piston stem assembly (key 3) out of the actuator stem further. Next, calibrate Zero on the travel indicator scale with a minimum pressure signal to the actuator. Check for full travel at the maximum pressure signal. If the leak persists, increase the force on the clamp (key 11) to compress the diaphragm (key 8) by tightening the clamp nut. For NPS 1 valves, tighten the bolts (key 18) on the bonnet flange (key 11) using 45 lbf•ft.

CAUTION

The stem should travel below zero by approximately 1/16 to 1/8 inch after the signal is decreased below 3 psi. IF THE VALVE DOES NOT CLOSE PROPERLY, INCREASE THE CLAMP COMPRESSION AROUND THE DIAPHRAGM (key 8) by tightening 1/2 turn. DO NOT tighten to the point that the diaphragm wrinkles.

Calibration of Fail-Open (Air-to-Close) Actuator

2. Apply 50 psi air pressure or nitrogen to port B. Apply 15 psi air signal to actuator.
 - a. Slowly turn the piston stem assembly (key 3) out of the actuator stem until flow stops.
 - b. Check the valve for leaks with 50 psi air under the diaphragm (port B). Leakage should be less than 1 cc/min. The valve should start to leak or low flow at a maximum pressure signal to the actuator. If it takes more than the maximum pressure to open, then screw the piston-stem (key 3) further into the actuator stem. If the valve is not tight at 15 psi signal, screw the piston-stem (key 3) out of the actuator stem further. Next, calibrate Zero on the travel indicator scale with maximum pressure signal to the actuator. Check for full travel at minimum pressure signal. If the leak persists, increase the force on the clamp (key 11) to compress the diaphragm (key 8) by tightening the clamp nut. For NPS 1 valves, tighten the bolts (key 18) on the bonnet flange (key 11) using 45 lbf•ft.

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CAUTION

The stem should travel below zero by approximately 1/16 to 1/8 inch after the signal is increased above 15 psi. IF THE VALVE DOES NOT CLOSE PROPERLY, INCREASE THE CLAMP COMPRESSION AROUND THE DIAPHRAGM (key 8) by tightening 1/2 turn. DO NOT tighten to the point that the diaphragm wrinkles.

Note

When using a Baumann 32 actuator with dual stops or a Baumann 54 actuator, the shaft collar (key 25) can also be set at intermediate positions to provide a minimum opening valve travel stop.

Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name, and desired material using the following parts tables.

⚠ WARNING

Use only genuine Fisher™ replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Table 1. Common Parts

KEY NO.	QTY	DESCRIPTION	VALVE SIZE			
			NPS 1 Angle	NPS 1 Inline	NPS 1-1/2 Angle	NPS 2 Angle
1	1	Valve Body, < 30 Ra Microinch	82128	82128-2	82124	82125
		Valve Body, < 20 Ra Microinch	82128-10	82128-2-1	82124-6	82125-4
2	1	Bonnet	82214	82215		
3*	1	Piston Stem Sub-Assembly Cv = 8	82610-001-999		---	---
		Piston Stem Sub-Assembly Cv = 4	82614-001-999		---	---
		Piston Stem Sub-Assembly Cv = 2	82621-001-999		---	---
		Piston Stem Sub-Assembly	---	---	82615-001-999	
4*	1	Drive Mechanism Sub-Assembly	82510-3		82515	
5*	1	Compressor	82413		82411	82412
6*	2	Wave Spring	82710		---	---
	3	Wave Spring	---		82712	
7*	1	Retaining Ring	82711		82713	
8*	1	Diaphragm, Closure Member	82310-6		82311-6	82312-6
9	1	Drive Nut, Actuator Yoke	011757-003-153		011757-003-153	
11	1	Bonnet Flange	82213		---	
		Clamp	---		82814	
13*	1	O-Ring, Stem	24080		24080	
14	1	Tell Tale Port	82212		82212	
15*	1	O-Ring, Bonnet	---		82714	
18	4	Hex Head Cap Screw	82813		---	
27	2	Jam Nut	971514-002-250		971514-002-250	
58	1	Travel Indicator	Baumann 32 Actuator		24299	
			Baumann 54 Actuator		24299	

* Recommended spare parts

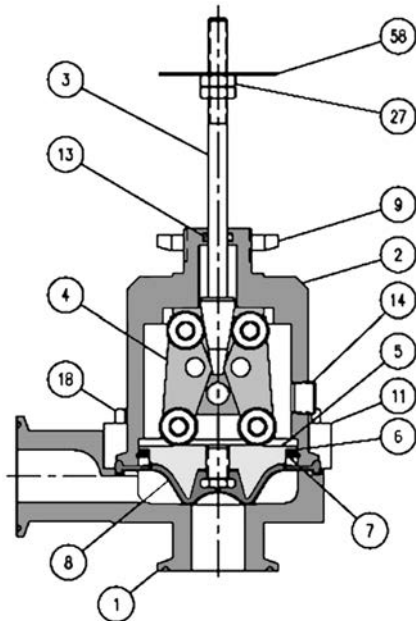
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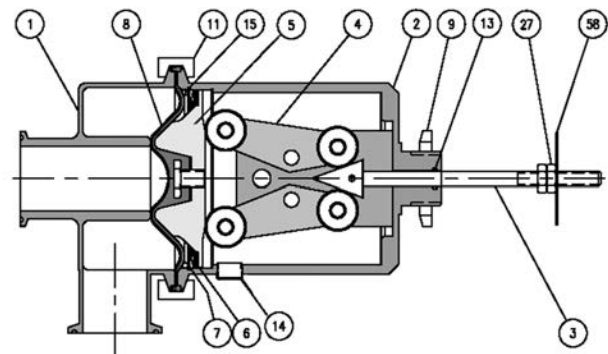
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Figure 4. Baumann 84000 NPS 1 Angle Valve Body Sub-Assembly



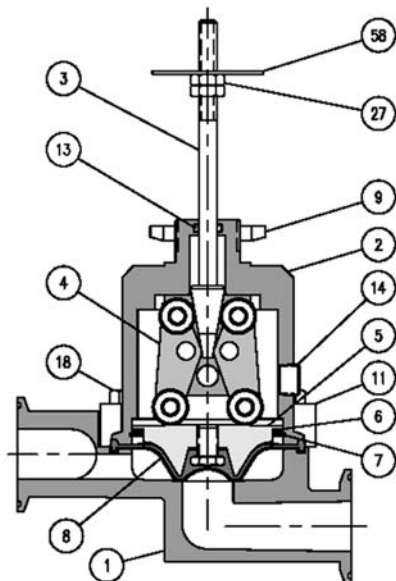
E1314

Figure 6. Baumann 84000 NPS 1-1/2 and 2 Angle Valve Body Sub-Assembly



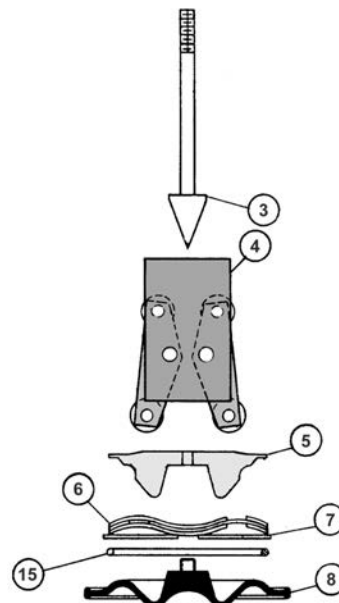
E1316

Figure 5. Baumann 84000 NPS 1 Inline Valve Body Sub-Assembly



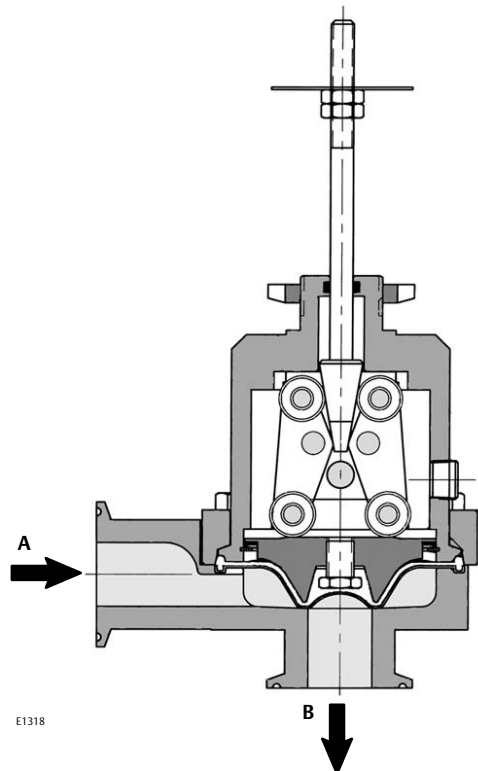
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Figure 7. Baumann 84000 Linkage Mechanism

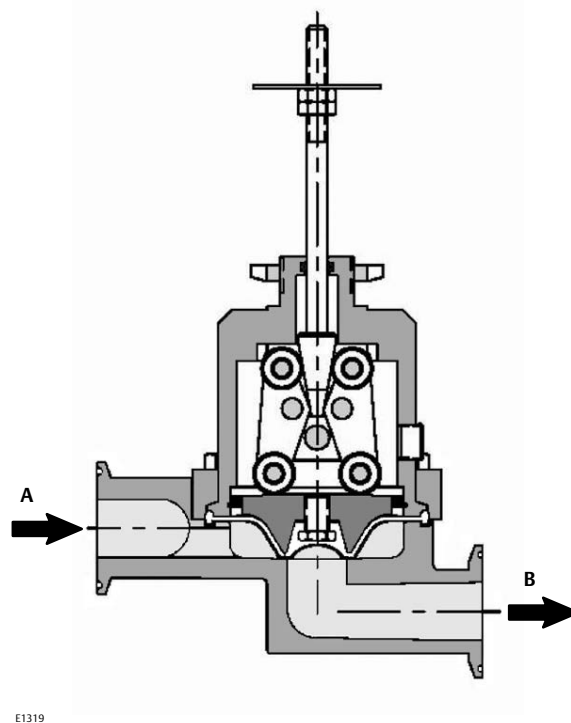


E1317

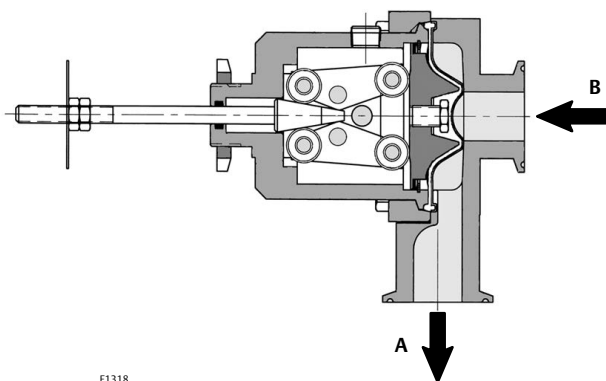
Figure 8. Preferred Flow Directions for Self-Draining



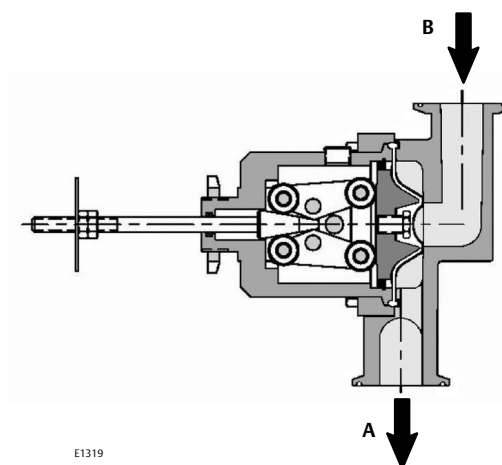
NPS 1 ANGLE VALVE BODY POSITIONED FOR FORWARD FLOW SELF DRAINING FROM PORT A TO B



NPS 1 INLINE VALVE BODY POSITIONED FOR FORWARD FLOW SELF DRAINING FROM PORT A TO B

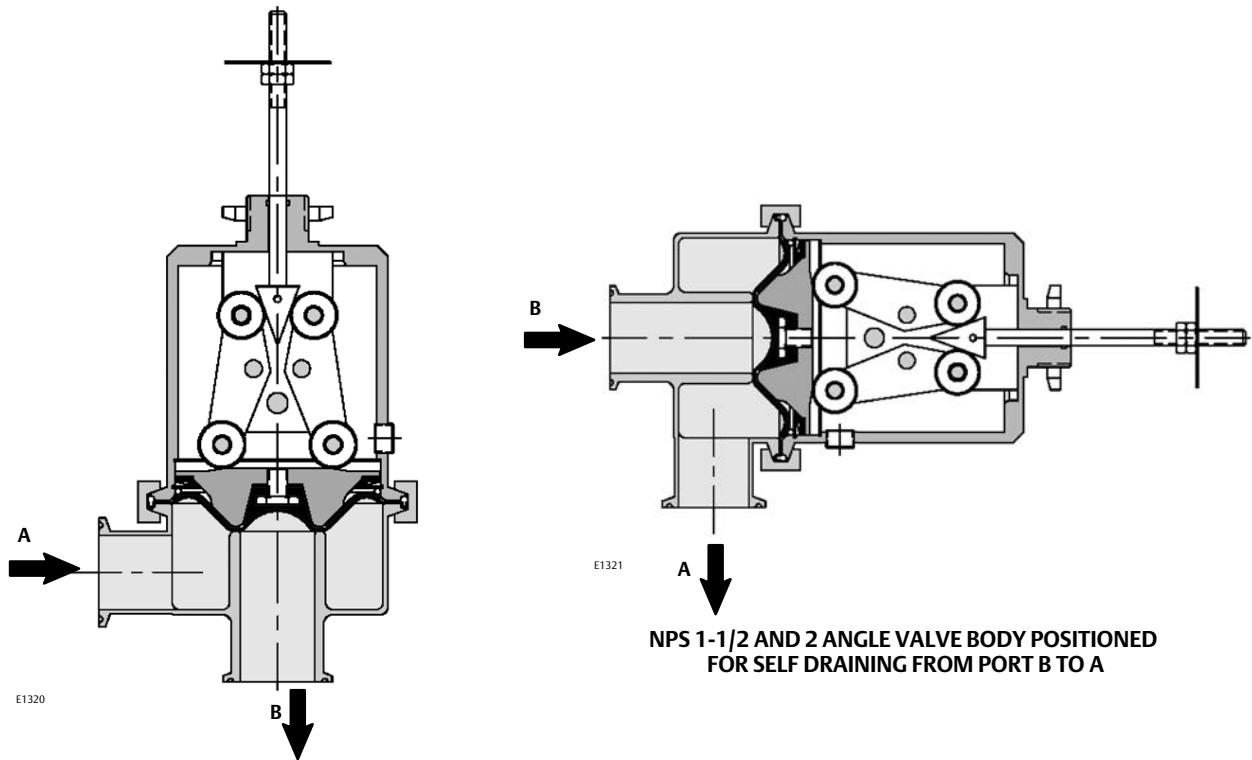


NPS 1 ANGLE VALVE BODY POSITIONED FOR FORWARD FLOW SELF DRAINING FROM PORT B TO A (BONNET ROTATED 90° TO SHOW TELL-TALE PORT)



NPS 1 INLINE VALVE BODY POSITIONED FOR FORWARD FLOW SELF DRAINING FROM PORT B TO A (BONNET ROTATED 90° TO SHOW TELL-TALE PORT)

Figure 9. NPS 1 Angle and Inline Valve Body Orientations



NPS 1-1/2 AND 2 ANGLE VALVE BODY POSITIONED
FOR SELF DRAINING FROM PORT B TO A

NPS 1-1/2 AND 2 ANGLE VALVE BODY (RECOMMENDED FOR PROCESSES
WHERE ATMOSPHERIC OR SLIGHT VACUUM IS PRESENT DOWNSTREAM
OF PORT B [PORTS A AND B MUST BE DRAINED SEPARATELY])

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

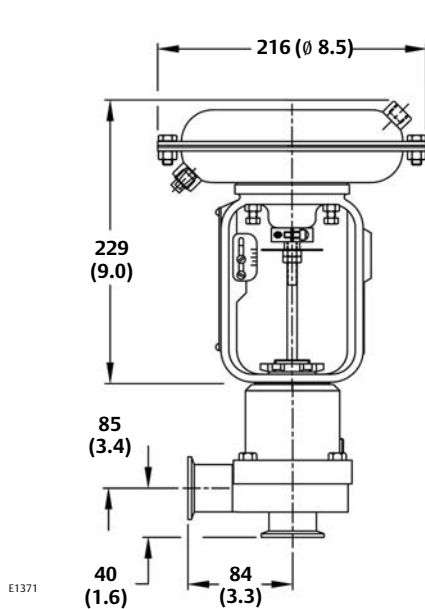
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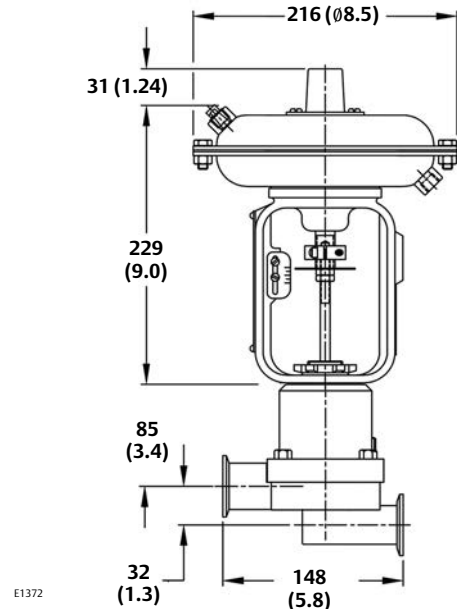
84000 Valve

June 2017

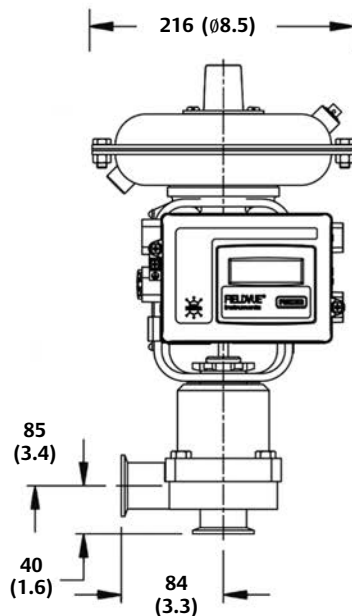
Figure 10. Dimensional Drawings for Baumann 84000 NPS 1 Angle and Inline Valves



84000 ANGLE VALVE BODY WITH BAUMANN 32 ACTUATOR ATO/FC ACTION

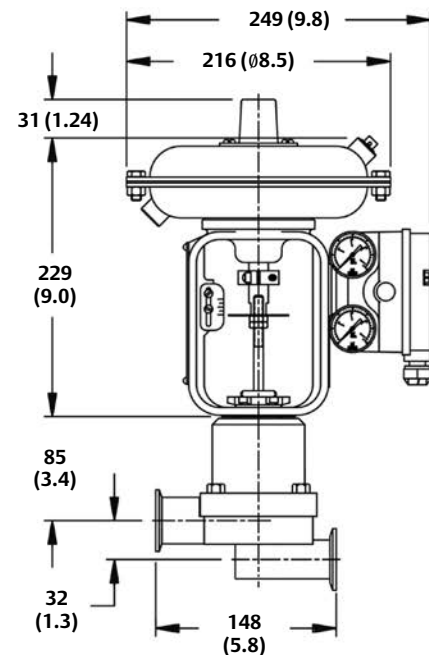
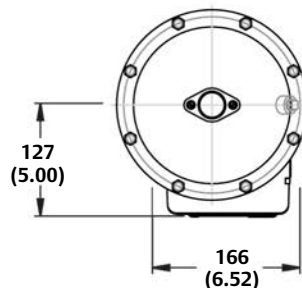


84000 INLINE VALVE BODY WITH BAUMANN 32 ACTUATOR ATC/FO ACTION, DUAL STOP



84000 ANGLE VALVE BODY WITH BAUMANN 32 ACTUATOR ATC/FO ACTION, DUAL STOP AND FIELDVUE DVC2000 DIGITAL VALVE CONTROLLER

BAUMANN 32 ACTUATOR WITH FIELDVUE DVC2000, TOP VIEW



84000 INLINE VALVE BODY WITH BAUMANN 32 ACTUATOR ATC/FO ACTION, DUAL STOP AND 3660/3661 POSITIONER

E1322

NOTE: ACTUATOR REMOVAL REQUIRES 115mm (4.5 INCHES) VERTICAL CLEARANCE. FOR PROPER ADJUSTMENTS TO DUAL TRAVEL STOPS, REFER TO ACTUATOR INSTRUCTIONS

mm
(inch)

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

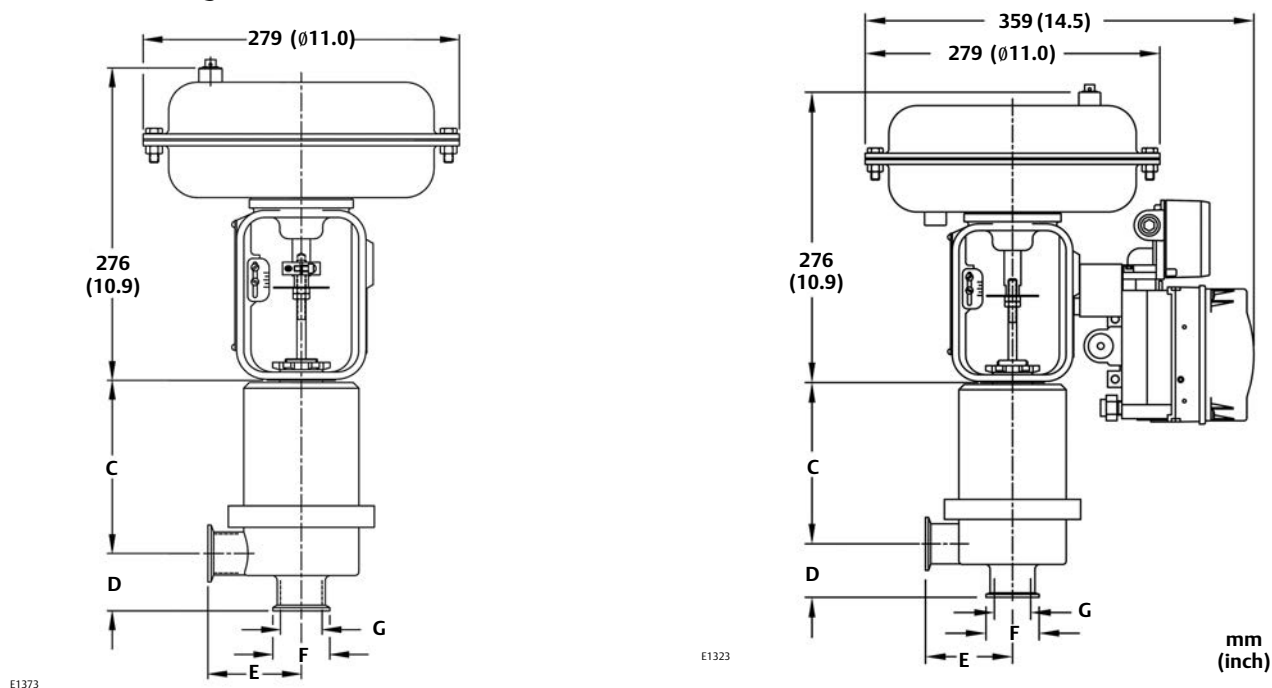
84000 Valve

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D103370X012

Figure 11. Dimensional Drawing for Baumann 84000 NPS 1-1/2 and 2 Angle Valve with FIELDVUE DVC6010 Digital Valve Controller



NOTE: ACTUATOR REMOVAL REQUIRES 115mm (4.5 INCHES) VERTICAL CLEARANCE. FOR PROPER ADJUSTMENTS TO DUAL TRAVEL STOPS, REFER TO ACTUATOR INSTRUCTIONS

Table 2. Dimensions for NPS 1-1/2 and 2 Angle Valve Body

VALVE SIZE	C		D		E		F		G	
NPS	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
1-1/2	152.4	6.0	50.8	2.00	82.55	3.25	50.39	1.984	34.44	1.356
2	160	6.3	50.8	2.00	88.9	3.50	63.9	2.516	47.63	1.875

Table 3. Weights, Valve Assemblies, and Actuators

VALVE SIZE	84000 ANGLE ASSY		84000 INLINE ASSY		ACTUATOR WEIGHTS		
NPS	lbs	kg	lbs	kg	TYPE	lbs	kg
1	9.0	4.08	9.5	4.31	32	10	4.5
1-1/2	11.5	5.22	N/A		54	25	11.3
2	11.5	5.22	N/A				

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Baumann™ 85000 Sanitary Pinch Valve

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Disassembly	4
Actuator and Valve Body Reassembly	5
Parts Ordering	6
Dimensions	7

Figure 1. Baumann 85000 Sanitary Pinch Valve



Introduction

Baumann 85000 sanitary pinch valves (figure 1) are intended for use with pharmaceutical grade tubing.

Note

The maximum temperature and process pressure is dependent upon the type/grade of process tubing selected by the user.

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the 85000 sanitary pinch valve.

Do not install, operate, or maintain 85000 pinch valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

⚠ WARNING

To avoid personal injury, keep fingers clear of tubing passage when flexible tubing is not installed in the valve body.

⚠ WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury. Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact your [Emerson sales office](#) or Local Business Partner for more complete specifications. Provide the product serial numbers (shown on the nameplate) and all other pertinent information.

⚠ WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

Maintenance

WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

WARNING

To avoid personal injury, keep fingers clear of tubing passage when flexible tubing is not installed in the valve body.

Assembly

1. Place four captive screws in the valve body.
2. Set two bushings in the bonnet, one after the other, so that the top bushing is flush with the top of the bonnet.
3. Place the stem in the bushing, as shown in figure 2, to ensure free movement.
4. Align the valve body and bonnet and tighten the screws to a maximum torque of 2.6 N•m (23 lbf•in).
5. Install the actuator assembly with the yoke clamp nut, two hex nuts, and the indicator washer. Ensure that the indicator washer is aligned.
6. Align the actuator with the valve body, tighten the yoke clamp nut and lock down nut.

WARNING

To avoid personal injury or property damage, do not attempt to perform any work on a valve while the system is in operation. The valve must be isolated 100% from the active system and the isolated line voided of pressure and/or hazardous fluids.

Air Piping

1. For an air-to-extend actuator (air-to-close action), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open action) connect the actuating air pressure line to the 1/4 NPT in the lower diaphragm case.
2. Use 6.4 mm (1/4 inch) O.D. tubing or equivalent for all air lines. If air line exceeds 8 m (25 ft) in length, 9.5 mm (3/8 inch) tubing is preferred. Air lines must not leak. Air pressure is not to exceed 2.5 bar (35 psig).

Installation

1. Loosen all four captive screws and remove the valve body.
2. Install flexible tubing; ensure the spherical closure member is retracted.
3. Align the valve body with the bonnet and retighten the four captive screws to a maximum torque of 2.6 N•m (23 lbf•in).

Disassembly

CAUTION

When assembling or disassembling the valve, do not turn the valve stem. Turning the valve stem will affect calibration.

CAUTION

When adjusting the valve stem, do not grip the stem directly with pliers or a wrench. This will damage the surface of the stem, and cause damage to the bushings in the valve. Instead, counter-tighten the two locknuts on the stem together. This will allow you to turn the stem by turning the locknuts with a wrench.

Actuator Removal

Access to the internal components of the valve body can be accomplished with the actuator removed. For actuator maintenance see the following instruction manual (Baumann Actuator Instructions, [D103352X012](#)).

Air-to-Close Actuators

1. Disconnect the air supply to the actuator and remove the air tubing.
2. Loosen the drive nut and then remove the plug and stem assembly by holding the actuator stem still while unthreading the plug and stem assembly counterclockwise.
3. Remove the stem locknuts, travel indicator, and yoke drive nut.
4. Remove the actuator from the valve.
5. Disconnect the air supply to the actuator and remove the air tubing.

Air-to-Open Actuators

1. Using flexible tubing, apply sufficient air pressure to the actuator to lift the plug off the seat.
2. Loosen the drive nut and then remove the plug and stem assembly by holding the actuator stem still while unthreading the plug and stem assembly counterclockwise.
3. Remove the stem locknuts, travel indicator, and yoke drive nut.
4. Remove the actuator from the valve.
5. Disconnect the air supply to the actuator and remove the air tubing.

Actuator and Valve Body Reassembly

1. Place the actuator yoke over the stem. While tilting the actuator back, drop the yoke drive nut over the stem. Run the locknuts, and the travel indicator down as far as possible and counter tighten the locknuts to lock.

Carefully position the actuator over the stem, lift the plug stem, and turn the plug stem into the actuator stem as far as it will go before adjusting the travel.

Travel Adjustment

With the actuator mounted on the valve, turn the stem until a 4 mm (0.16 inch) clearance is left between the spherical surface of the plunger and the bottom surface of the valve body against which the flexible tubing will be compressed.

This 4mm (0.16 inch) clearance is appropriate for most types/grades of tubing, but if leakage is experienced it may be necessary to reduce this gap.

Setting the clearance too small may result in reduced tubing life.

WARNING

To avoid personal injury or equipment damage due to possible sudden shifting or falling of the valve assembly, do not lift the valve assembly by the handwheel.

Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the part name using the following parts tables.

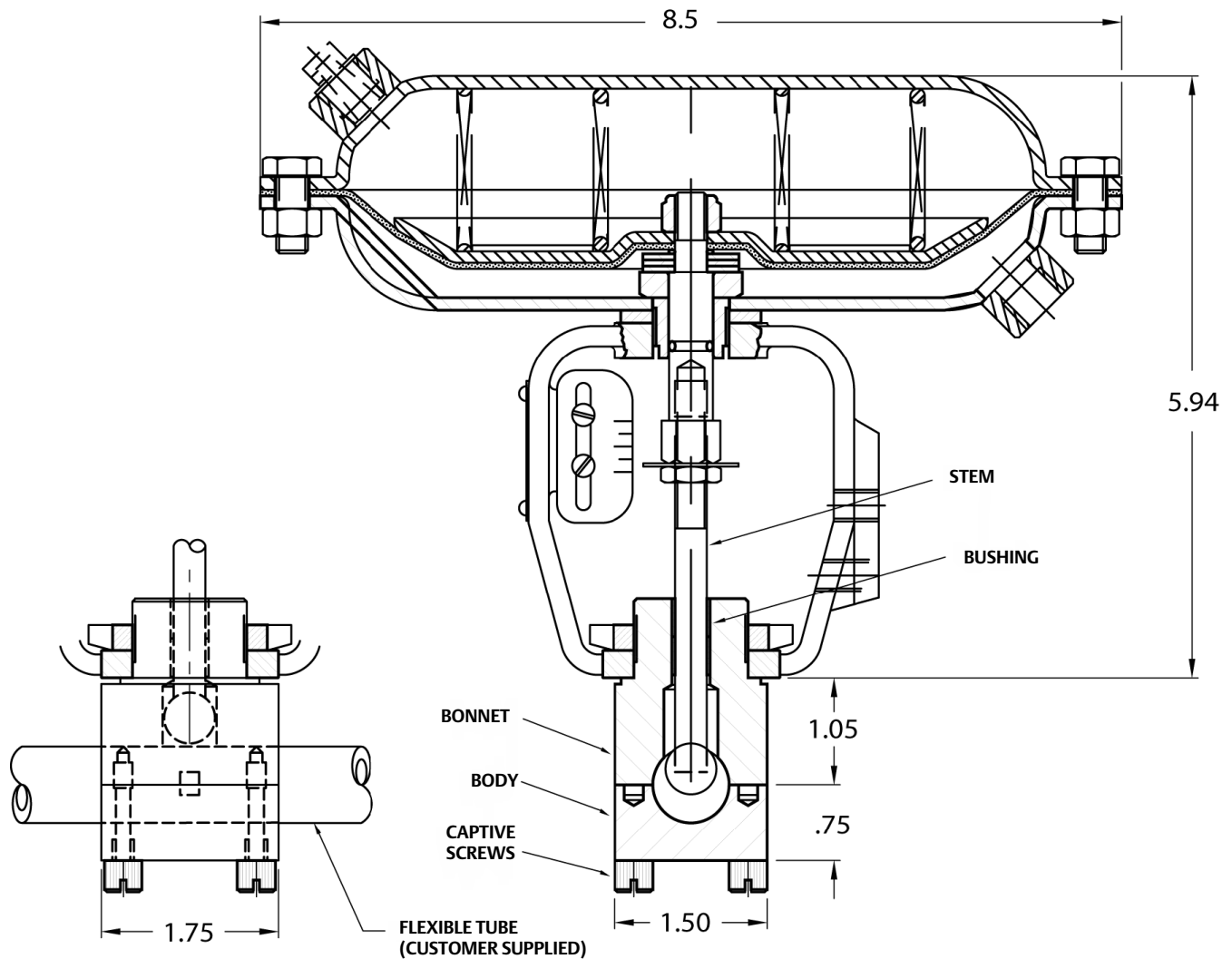
⚠ WARNING

Use only genuine Fisher™ replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Table 1. Parts List

Component	Part Number	Quantity
Bonnet	GE48200X012	1
Valve Body	GE48199X012	1
Stem	GE48280X012	1
Bushing	81186	2
Captive Screw	GE48222X012	4
Yoke Drive Nut	011757-003-153	1
Travel Indicator	011765-002-152	1
Stem Jam Nut	81841	1

Figure 2. Baumann 85000 Pinch Valve Dimensions



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

85000 Valve

June 2017

Instruction Manual

D103379X012

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Baumann™ 87000 Flexsleeve Sanitary Control Valve

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Reassembly of Valve	4
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Dimensions and Weights	8

Figure 1. Baumann 87000 Valve



W9823

**RECOMMENDED MOUNTING POSITION
FOR SELF-DRAINING**



W9824

**WITH FIELDVUE™ DVC2000
DIGITAL VALVE CONTROLLER**

Introduction

The Baumann 87000 Flexsleeve control valve (figure 1) with tri-clamp body connections and polished flow contours, is excellent for throttling high purity liquid or gaseous media. The valve is suitable for repeated steam sterilization cycles with 35 psi maximum steam pressures. Assembly of valve body sections uses only two bolts allowing for ease of cleaning and inspection. A lower telltale port is provided. The valve will drain either horizontally or vertically with the actuator in the horizontal position. The operation is not affected by vacuum.

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Baumann 87000 sanitary control valve.

Do not install, operate, or maintain Baumann 87000 control valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is

important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

⚠ WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact your Emerson sales office or Local Business Partner for more complete specifications. Provide the product serial numbers (shown on the nameplate) and all other pertinent information.

⚠ WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

Maintenance

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.

- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

WARNING

Avoid personal injury or property damage by thoroughly cleaning the line of all dirt, welding chips, scale, oil or grease, and other foreign material. Failure to do so could result in damage to the seating and sealing surfaces of the valve and result in release of process materials.

Installation and Maintenance

1. Before installing the valve in the pipeline, thoroughly clean the line of all dirt, welding chips, scale, oil or grease, and other foreign material. A micron size filter is recommended upstream of the valve.
2. Install the valve so the controlled fluid will flow through the valve body in the direction indicated by the arrow on the valve body.
3. A three-valve bypass must be used to permit removal of the control valve from the line without shutting down the system.

WARNING

To avoid personal injury or property damage, do not attempt to do any work on a valve while the system is in operation, the valve must be isolated 100% from the active system and the isolated line voided of pressure and/or hazardous fluids.

Air Piping

Refer to figure 2.

1. For an air-to-extend actuator (air-to-close action), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open action) connect the actuating air pressure line to the 1/4 NPT in the lower diaphragm case.

2. Use 6.4 mm (1/4 inch) O.D. tubing or equivalent for all air lines. If the air line exceeds 8 m (25 ft) in length, 9.5 mm (3/8 inch) tubing is preferred. For proper operation, air lines must not leak. Air pressure should not exceed 2.5 bar (35 psig).
3. Tri-clamp connections should line up properly to provide a tight seal.

CAUTION

Do not place the valve in a vise. This will damage the exterior of the valve body and possibly the end connections of the valve.

⚠ WARNING

If there is evidence of process fluid under pressure leaking from the joint, retighten the valve body/joint nuts. Return to the Warning at the beginning of the Installation and Maintenance section to ensure proper steps have been taken to isolate the valve and relieve process pressure.

Disassembly of Valve

Refer to figure 3.

1. Depressurize the pipeline and valve interior. Disconnect air lines from the positioner.
2. Loosen the tri-clamp connections and remove the valve from the line.
3. Remove the hex head cap screws (key 12) that secure the valve body to the lower bonnet (key 3) and the upper bonnet (key 2). Remove the upper bonnet, actuator and positioner from the valve. Be sure the ceramic ball (key 5) does not fall out of the assembly and get lost.
4. In order to remove the shaft (key 4), unscrew the alignment pin (key 15) and remove the retaining ring (key 11).

Reassembly of Valve

Refer to figures 3, 4, and 5.

1. Reassemble the valve in reverse order using the instructions above. The valve body is designed so it cannot be assembled improperly. Make sure the beveled edge of the anvil (key 8) points toward the ceramic ball (key 5). Make sure the tapered end of the sleeve bushing (key 6) also points towards the ceramic ball.
2. If the sleeve (key 7) seating surface is distorted, the sleeve should be replaced, or be rotated to use a new seating surface.
3. New O-rings (keys 9 and 50) should be installed after suitable lubrication (e.g. food grade) of the shaft O-ring (key 50).
4. Make sure the alignment pin (key 15) is tight and the shaft (key 4) moves easily.
5. Refer to separate instructions for the actuator (D103352X012) and positioner assembly and maintenance.
6. Place the actuator yoke over the shaft (key 4). While tilting the actuator back, drop the yoke drive nut (key 16) over the shaft (key 4). Run the locknut (key 27), and travel indicator (key 58) down as far as possible onto the shaft (key 4).
7. Carefully place the actuator yoke in a vertical position and thread the actuator stem onto the shaft, spin the actuator onto the shaft as far as it will go before adjusting the bench range. Refer to Baumann Pneumatic Actuators instruction manual, [D103352X012](#).

Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name, and desired material using the following parts tables.

⚠ WARNING

Use only genuine Fisher™ replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 2. Baumann 87000 Valve

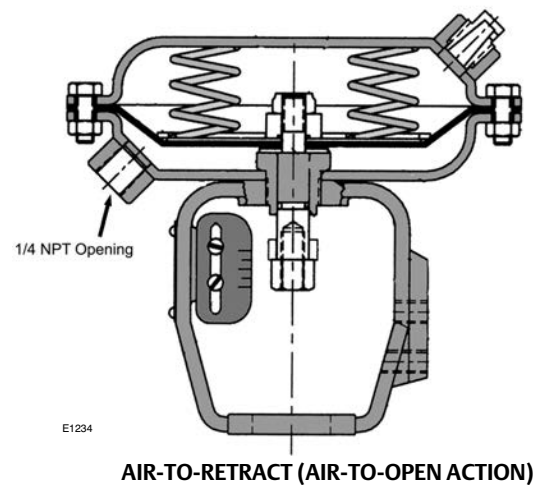
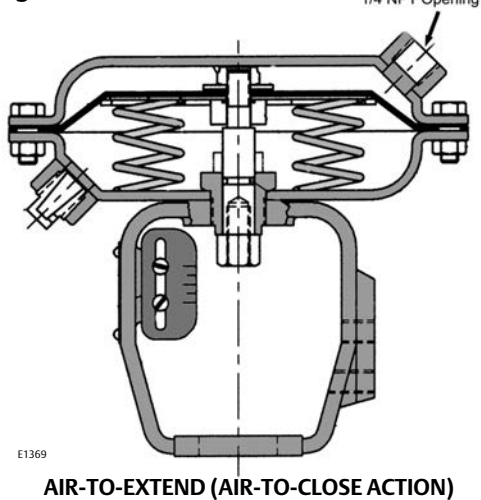
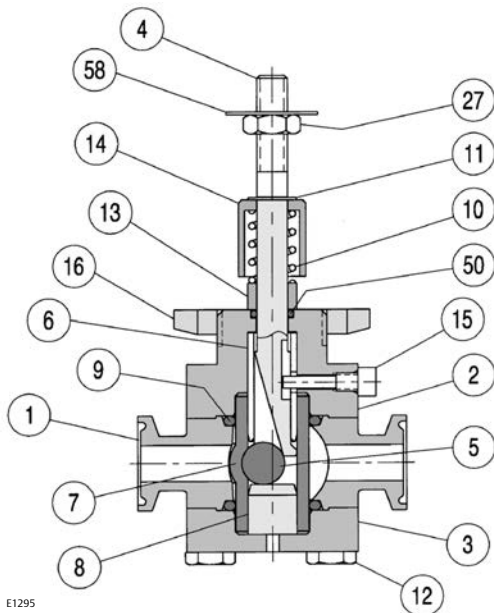


Figure 3. Baumann 87000 Flexsleeve Valve Assembly



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

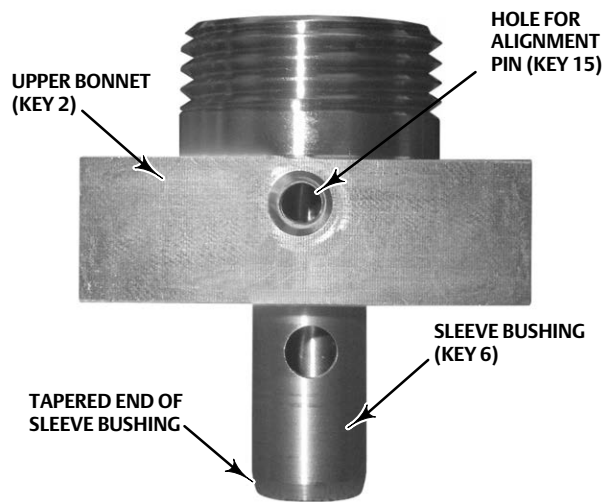
87000 Valve

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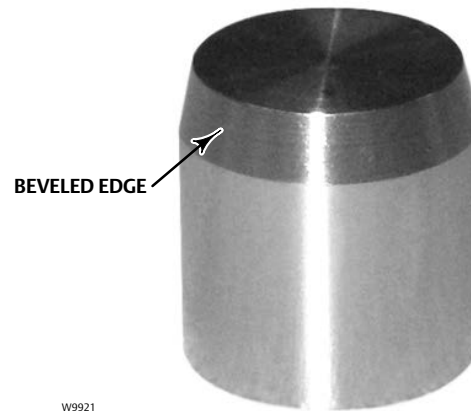
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Figure 4. Upper Bonnet and Sleeve Bushing



W9920

Figure 5. Upper Bonnet and Sleeve Bushing

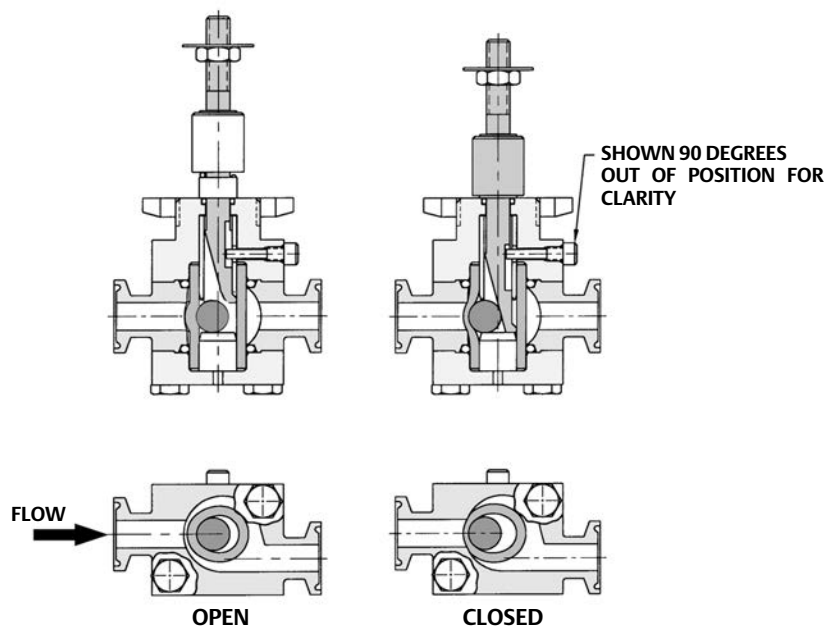


W9921

Table 1. Baumann 87000 Parts List

KEY NO.	QTY	DESCRIPTION	PART NUMBER	
			30 Ra	20 Ra
1	1	Valve Body, Cv= 0.25 (orifice diameter = 3.18 mm [0.125 inches])	87104	87104-1
		Valve Body, Cv = 1.25 (orifice diameter = 9.40 mm [0.370 inches])	87105	87105-1
2	1	Bonnet, Upper	87305	
3	1	Bonnet, Lower	87306	
4	1	Shaft	87505	
5	1	Ceramic Ball	87405	
6*	1	Sleeve Bushing	87605	
7*	1	Sleeve, VMQ (Silicone)	87705-688	
		Sleeve, EPDM	87705-709	
		Sleeve, FKM (Fluorocarbon)	87705-697	
		Sleeve, FFKM (Perfluoroelastomer)(Consult Factory)	87705-703	
8	1	Anvil	87406	
9*	2	O-Ring, VMQ (Silicone)	87706-688	
		O-Ring, EPDM	87706-709	
		O-Ring, FKM (Fluorocarbon)	87706-697	
		O-Ring, FFKM (Perfluoroelastomer)(Consult Factory)	87706-703	
10*	1	Spring, Stem	87803	
11	1	Retaining Ring	87806	
12	2	Hex Head Cap Screw	87807	
13	1	Spring, Seat	87802	
14	1	Protecting Cap	87801	
15	1	Alignment Pin	87805	
16	1	Drive Nut, Actuator Yoke	011757-003-153	
27	1	Jam Nut (locknut)	81841	
50*	1	O-Ring	24080	
58	1	Travel Indicator	011765-002-152	

Figure 6. Mode of Operation

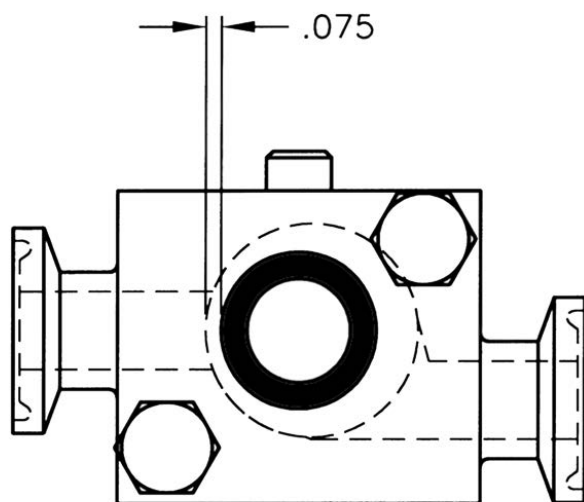


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Mode of Operation

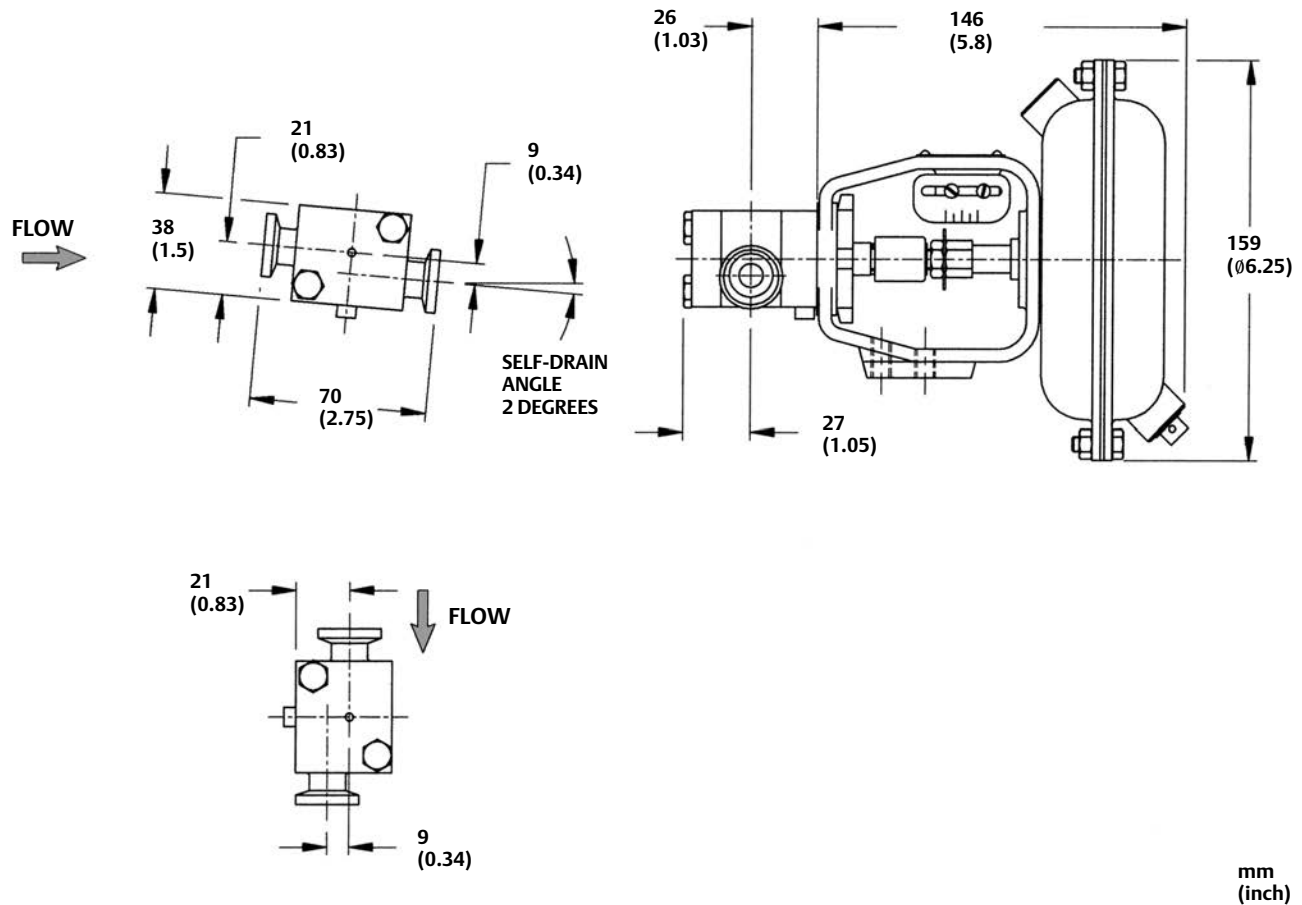
As shown in figure 6, a flexible sleeve is inserted through the length of the valve and sealed between the valve body and bonnet by O-rings. The actuator-motivated valve stem has a tapered groove that pushes a ceramic ball against the inside of the sleeve and, thereby, the sleeve against a valve seat.

Figure 7. Sleeve Clearance



E1374

Figure 8. Dimensions

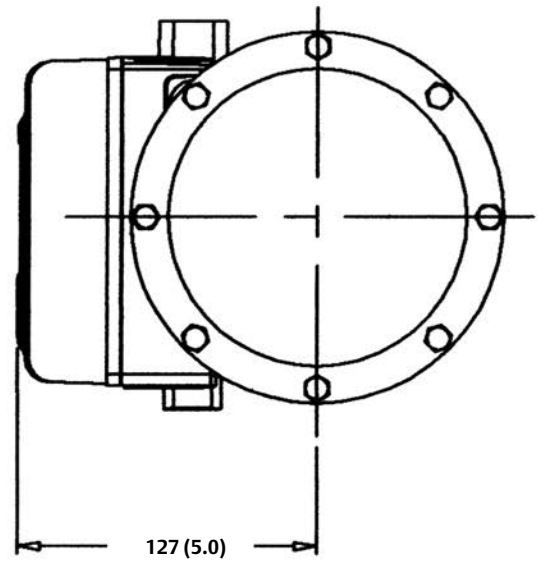
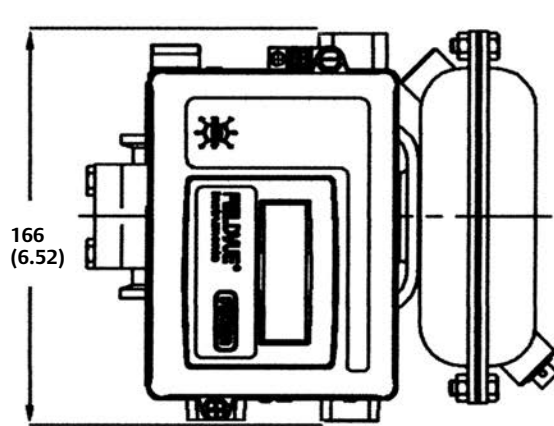


E1297

RECOMMENDED MOUNTING FOR SELF-DRAINING (ACTUATOR SHOULD BE MOUNTED HORIZONTALLY)

NOTE: ACTUATOR REQUIRES 115 mm (4.5 INCHES) VERTICAL CLEARANCE.

Figure 9. Dimensions



E1299

mm
(inch)

RECOMMENDED MOUNTING FOR SELF-DRAINING (ACTUATOR SHOULD BE MOUNTED HORIZONTALLY)

NOTE: ACTUATOR REQUIRES 115 mm (4.5 INCHES) VERTICAL CLEARANCE.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

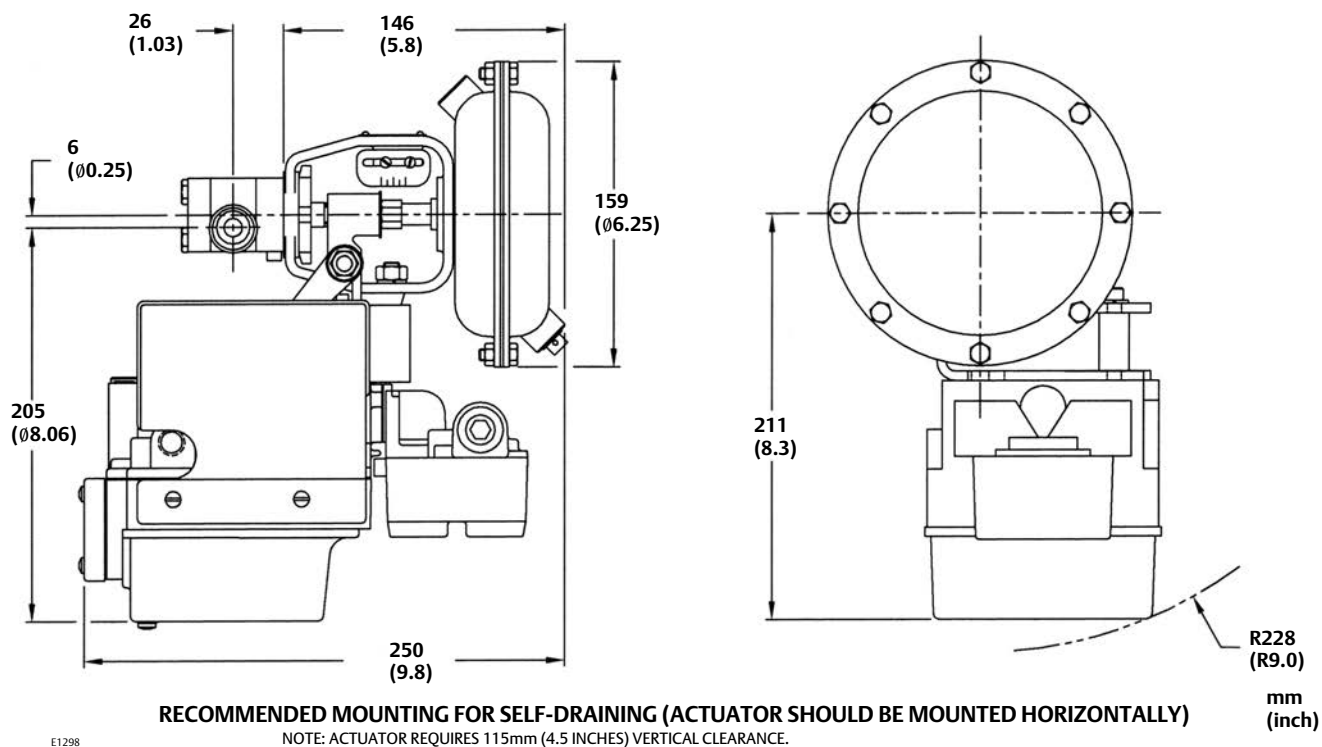
87000 Valve

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Figure 10. Dimensions



E1298

Table 2. Weights, Valve, Actuator, and Positioner

VALVE						ACTUATOR		POSITIONER ⁽¹⁾			
Size		Travel		Weight		Baumann 16		FIELDVUE DVC2000		FIELDVUE DVC6010	
DN	NPS	mm	Inch	kg	lb	kg	lb	kg	lb	kg	lb
15	1/2	7.9	0.3125	3.6	8	4.5	10	1.5	3.3	3.5	7.7

1. Not available with Fisher 3660/3661 positioner.

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Baumann™ 89000 Sanitary Control Valve

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Figure 1. Baumann 89000 NPS 1/2 Sanitary Control Valve Shown with FIELDVUE™ DVC2000 Digital Valve Controller



W9850

Introduction

The Baumann 89000 sanitary control valve (figures 1 and 2) provides control solutions for sanitary and aseptic process systems. These valves meet FDA and USP CLVI standards. They are designed to drain freely from inlet to outlet. In sanitary and aseptic valve applications, the surface finish of all wetted parts is of the utmost importance and needs to be free of pits and cracks. The Baumann 89000 series valves meet all of these requirements.

The 89000 control valve covers a wide range of applications in many industries including food and beverage, biotechnology, pharmaceutical, and others where cleanliness and sterility are required. The valves are designed for easy maintenance and all parts in contact with the media are made of corrosion resistant S31603 stainless steel.

Figure 2. Baumann 89000 NPS 3 Sanitary Control Valve Shown with FIELDVUE DVC6200 Digital Valve Controller



W9851-2

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Baumann 89000 series sanitary control valve.

Do not install, operate, or maintain Baumann 89000 control valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Educational Services

For information on available courses for Baumann 89000 valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Safety Precautions

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact your [Emerson sales office](#) or Local Business Partner for more complete specifications. Provide the product serial numbers (shown on the nameplate) and all other pertinent information.

WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

Maintenance

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to perform safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This provides a good gasket seal because the used gasket may not seal properly.

Installation

1. Before installing the valve in the pipeline, thoroughly clean the line of all dirt, welding chips, scale, oil or grease, and other foreign material.
2. Install the valve so the controlled fluid will flow through the valve body in the direction indicated. If you are not sure, reference Baumann bulletin 51.2:89SV, [D103346X012](#) or contact your [Emerson sales office](#) or Local Business Partner.
3. A three-valve bypass must be used to permit removal of the control valve from the line without shutting down the system.

⚠ WARNING

To avoid personal injury or property damage, do not attempt to do any work on a valve while the system is in operation, the valve must be isolated 100% from the active system and the isolated line voided of pressure and/or hazardous fluids.

Air Piping

1. For an air-to-extend actuator (air-to-close action), connect the actuating air pressure line to the 1/4 NPT opening in the upper diaphragm case. For an air-to-retract actuator (air-to-open action) connect the actuating air pressure line to the 1/4 NPT in the lower diaphragm case.
2. Use 6.4 mm (1/4 inch) O.D. tubing on type 20 and 9.6 mm (3/8 inch) on types 50, 50H, and 112 or equivalent for all air lines. If the air line exceeds 8 m (25 ft) in length, 9.5 mm (3/8 inch) tubing is preferred. Air lines must not leak. Air pressure not to exceed 6.9 bar (100 psig).

CAUTION

When assembling or disassembling the valve, do not turn the valve stem while the plug is touching the valve seat. This will damage the valve's seating surfaces.

When adjusting the valve stem, do not grip the stem directly with pliers or a wrench. This will damage the surface of the stem, and cause damage to the O-ring seals in the valve. Instead, use a spanner or Allen wrench through the recessed holes on the stem (key 12). This will allow you to turn the stem.

Do not place valve in a vise. This can distort the shape of the valve.

CAUTION

Prior to performing maintenance on the valve, isolate the valve, vent the process pressure, and shut off supply and signal air lines to the actuator.

Disassembly

Actuator Removal

Access to the internal components of the valve body can be accomplished with the actuator removed.

Air-to-Close Actuators

1. Disconnect the air supply to the actuator (key 2) and remove the air tubing.
2. Loosen the upper body clamp (key 5) and then remove the plug and stem (key 12) by holding the actuator stem still while unthreading the plug and stem (key 12) counterclockwise.
3. Remove the stem locknut (key 8) and the upper body clamp (key 5) by sliding the yoke (key 4) and actuator assembly off from the plug and stem (key 12).
4. Carefully remove the actuator from the valve.

Air-to-Open Actuators

1. Using flexible tubing, apply sufficient air pressure to the actuator (key 2) to lift the plug and stem (key 12) off the valve seat/lower pipe connection (key 13).
2. Loosen the upper body clamp (key 5) and then remove the plug and stem (key 12) by holding the actuator stem still while unthreading the plug and stem (key 12) counterclockwise.
3. Remove the stem locknut (key 8) and the upper body clamp (key 5).

4. Carefully remove the actuator from the valve.

Valve Body Disassembly

89000A, Angle Valve Body

1. After removal of the actuator (key 2), the bonnet (key 10) should be visible. Slide the bonnet (key 10) out of the valve body assembly and off of the plug and stem (key 12). Be sure not to tear the O-ring seals.
2. Remove the plug and stem (key 12) from the valve body (key 1a).
3. Unthread the lower body clamp bolts and remove the bolts from the lower body clamp (key 7). Take the lower body clamp off of the valve body (key 1a) and the valve seat/lower pipe connection (key 13) from the valve body.
4. Carefully slide the valve seat/lower pipe connection (key 13) from the valve body (key 1a), being sure not to tear the O-ring seal.
5. Inspect all O-rings and sealing surface for signs of wear and scratches. Replace O-rings if needed.

89000I, Inline Valve Body

1. After removal of the actuator (key 2), the bonnet (key 10) should be visible. Slide the bonnet (key 10) out of the upper valve body (key 1b) and off of the plug and stem (key 12).
2. Remove the plug and stem (key 12) from the upper valve body (key 1b).
3. Unthread the middle valve body clamp bolts and remove the bolts from the middle body clamp (key 6). Take the middle body clamp (key 6) off and slide the lower body (key 1c) away from the upper body (key 1b). Be sure not to tear the O-ring seal.
4. Once the lower body (key 1c) has been removed, the valve seat (key 16) should be visible. Carefully slide the valve seat (key 16) from the upper valve body (key 1b), being sure not to tear the O-ring seal.
5. Carefully slide the lower valve body wall from the lower valve body (key 1c), being sure not to tear the O-ring seal.
6. Inspect all O-rings and sealing surfaces for signs of wear and scratches. Replace the O-rings if needed.

Replacing O-Ring Seals

Remove the old O-rings by hand or with an appropriate tool. Be sure not to scratch the sealing surfaces of the valve components. Replace the O-rings with care, being sure not to overstretch, tear, or twist the O-rings.

Valve Body Reassembly

Reverse the previous Valve Body Disassembly procedure. Be sure to take care and not damage the O-rings when pressing the valve body components back into place.

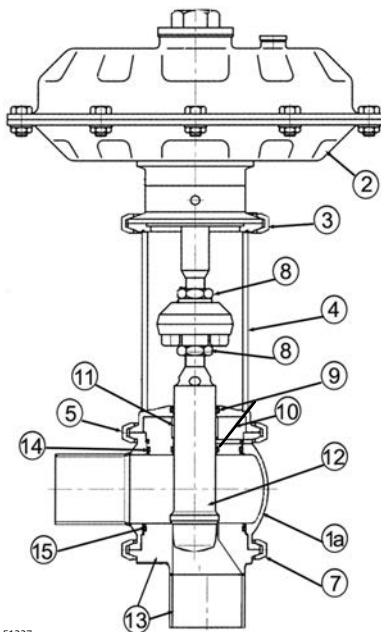
Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name, and desired material using the following parts tables.

⚠ WARNING

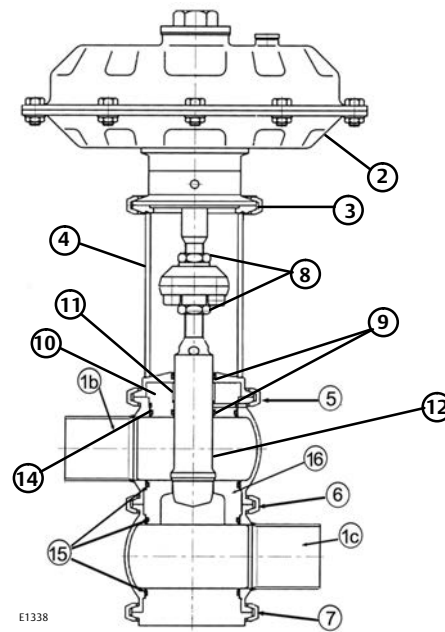
Use only genuine Fisher™ replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 3. Baumann 89000A Angle Valve Assembly



E1337

Figure 4. Baumann 89000I Inline Valve Assembly



E1338

Table 1. Baumann 89000 Common Parts

Key Number	Description	Key Number	Description
1a	Upper Angle Valve Body	8	Stem Locknut
1b	Upper Inline Valve Body	9	O-Ring
1c	Lower Inline Valve Body	10	Bonnet
2	Diaphragm Actuator	11	Bushing
3	Actuator Clamp	12	Valve Plug/Stem (1 piece)
4	Yoke	13	Angle Valve Seat/Lower Angle Valve Body (1 piece)
5	Upper Body Clamp	14	O-Ring
6	Middle Body Clamp (Inline Valve Body Only)	15	O-Ring
7	Lower Body Clamp	16	Inline Valve Seat

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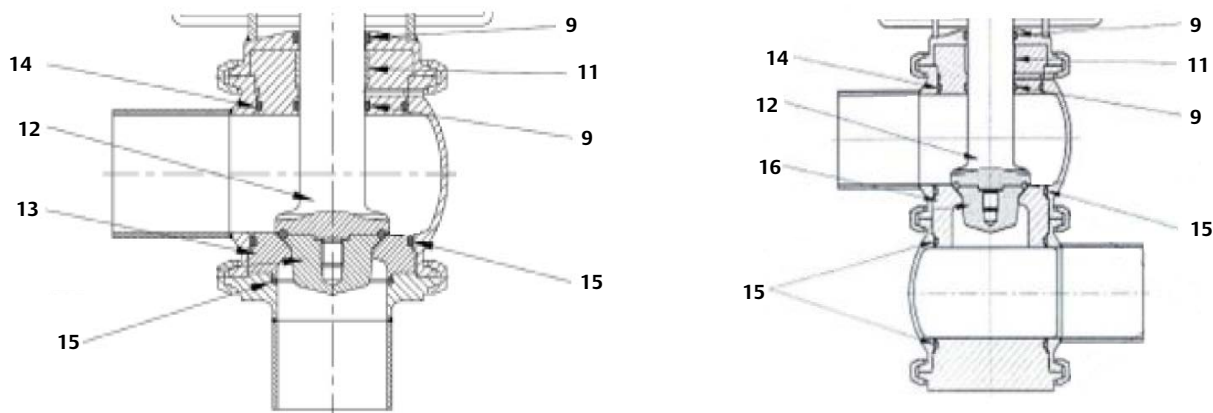
89000 Valve

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D103374X012

Figure 5. Baumann 89000 Valve Body Spare Parts



Parts Kits

Table 2. Baumann 89000 Valve Kits

DN	NPS	Valve Body Type	Capacity (Cv)	Valve Seat & Plug ⁽¹⁾	O-Ring Kit ⁽²⁾ EPDM	O-Ring Kit ⁽²⁾ FFKM (Perfluoroelastomer)
15	1/2	Angle	0.29	GE56512X012	89T001	89T001-X022
			1.2	GE56142X012		
		Inline	0.29	GE56513X012	89T007	89T007-X022
			1.2	GE56514X012		
20	3/4	Angle	1.9	GE56143X012	89T001	89T001-X022
			4.7	GE56515X012		
		Inline	1.9	GE56516X012	89T007	89T007-X022
			4.7	GE56517X012		
25	1	Angle	10	GE56144X012	89T001	89T001-X022
		Inline	10	GE56518X012	89T007	89T007-X022
40	1-1/2	Angle	21	GE53538X012	89T002	89T002-X022
		Inline	21	GE56519X012	89T008	89T008-X022
50	2	Angle	21	GE52287X022	89T003	89T003-X022
			33	GE52287X012		
		Inline	33	GE56520X012	89T009	89T009-X022
			79	GE52860X012		
---	3	Angle	79	GE52860X012	89T005	89T005-01
		Inline	79	GE56521X012	89T011	89T011-X022
80	---	Angle	99	GE56522X012	89T004	89T004-X022
		Inline	99	GE56523X012	89T010	89T010-X022
100	4	Angle	209	GE53537X012	89T006	89T006-X022
		Inline	209	GE56524X012	89T012	89T012-X022
150	6	Inline	442	GE56034X012	GE56033X012	GE56033X022

1. Includes key numbers 12 (plug/stem) and 13 (angle valve body only) or 16 (inline valve body only).

2. Includes key numbers 9, 11, 14, and 15.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

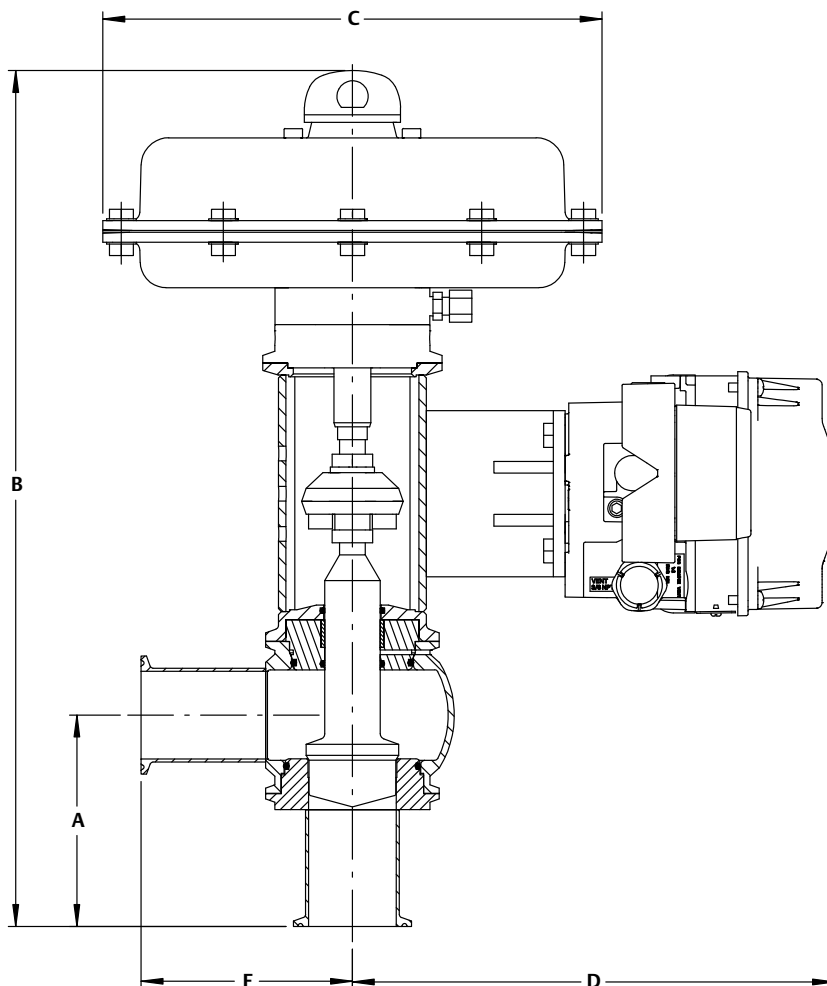
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89000 Valve

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Figure 6. Dimensions for Baumann 89000A Angle Valve with FIELDVUE DVC6200 Digital Valve Controller



GE59923-A

Table 3. Baumann 89000A Angle Valve Dimensions

VALVE SIZE			DIMENSIONS															
			Tri-Clamp A		Weld End A		Tri-Clamp B		Weld End B		C		D		Tr-Clamp E		Weld End E	
DN	NPS	Capacity	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
15	1/2	0.29	62.7	2.5	50	1.97	344	13.5	331	13	165	6.5	261	10.3	65.40	2.57	52.70	2.07
15	1/2	1.2	62.7	2.5	50	1.97	344	13.5	331	13	165	6.5	261	10.3	63.90	2.52	51.20	2.01
20	3/4	1.9	62.7	2.5	50	1.97	344	13.5	331	13	165	6.5	261	10.3	66.35	2.61	53.65	2.11
20	3/4	4.7	62.7	2.5	50	1.97	344	13.5	331	13	165	6.5	261	10.3	62.70	2.47	50.00	1.97
25	1	10	62.7	2.5	50	1.97	344	13.5	331	13	270	10.6	261	10.3	61.75	2.43	49.05	1.93
40	1-1/2	21	102.7	4	90	3.54	445	17.5	432	17	270	10.6	261	10.3	104.10	4.1	91.40	3.60
50	2	33	112.7	4.4	100	3.94	459	18.1	446	17.6	270	10.6	261	10.3	112.70	4.44	100.00	3.94
---	3	79	142.7	5.6	130	5.12	531	20.9	519	20.4	270	10.6	261	10.3	148.15	5.83	135.45	5.33
80	---	99	142.7	5.6	130	5.12	531	20.9	519	20.4	270	10.6	261	10.3	142.70	5.62	130.00	5.12
100	4	209	155.9	6.1	140	5.50	552	21.7	536	21.1	270	10.6	261	10.3	155.90	6.14	150.00	5.91
150	6	442	Contact your Emerson sales office or Local Business Partner for NPS 6 availability.															

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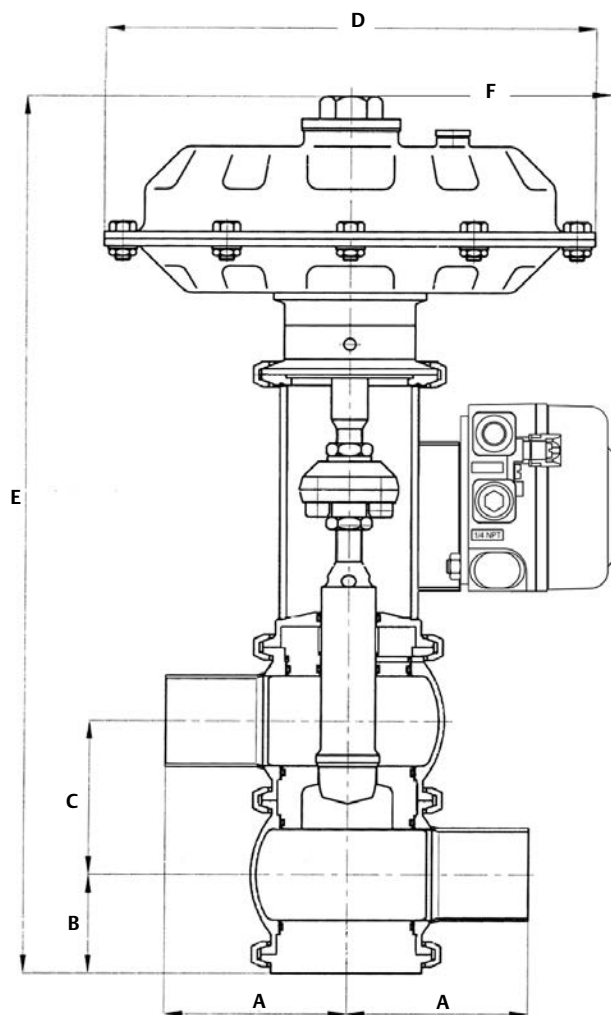
89000 Valve

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Figure 7. Dimensions for Baumann 89000I Inline Valve with FIELDVUE DVC2000 Digital Valve Controller



E1342

Table 4. Baumann 89000I Inline Valve Dimensions

VALVE SIZE		DIMENSIONS													
		Tri-Clamp A		Weld End A		B		C		D		E		F	
DN	NPS	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
15	1/2	62.7	2.5	50	1.97	34.5	1.36	50	1.97	165	6.5	366	14.4	127	5
20	3/4	62.7	2.5	50	1.97	34.5	1.36	50	1.97	165	6.5	366	14.4	127	5
25	1	102.7	4	90	3.54	48	1.89	74	2.91	165	6.5	464	18.3	153	6
40	1-1/2	102.7	4	90	3.54	48	1.89	74	2.91	270	10.6	464	18.3	153	6
50	2	112.7	4.4	100	3.94	56	2.20	85	3.35	270	10.6	488	19.2	153	6
80	3	147.7	5.6	130	5.12	78	3.07	116	4.57	270	10.6	581	22.9	153	6
100	4	1553.9	6.1	140	5.50	86	3.39	136	5.35	270	10.6	617	24.3	153	6
150	6	Contact your Emerson sales office or Local Business Partner for NPS 6 availability.													

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Baumann™ Pneumatic Actuators

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Introduction

The Baumann multiple-spring diaphragm actuators are powerful and compact devices designed to operate control valves, louvers, dampers or mechanical speed adjusting devices. The actuators can provide either direct air-to-extend action (ATE) or reverse air-to-retract action (ATR). When an ATE actuator is installed on a typical Baumann valve, it provides an air-to-close (ATC) or fail-open function. When an ATR actuator is installed, it provides an air-to-open (ATO) or fail-closed function. The design features exceptionally low hysteresis due to the absence of side loads imposed by misalignment of single coiled springs. The use of multiple springs also offers a substantially lower profile.

The units include zinc-plated, epoxy-coated steel diaphragm cases and an epoxy-coated ductile-iron yoke. Stainless steel diaphragm cases, actuator stems, and yokes are available for Baumann size 32 and 54 actuators. The Baumann size 16 actuator comes standard with a stainless steel yoke and epoxy-coated steel diaphragm case. All remaining metal parts are made of either stainless or zinc plated steel for optimum corrosion resistance.

All actuators are suitable for a standard ambient temperature range of -29 to 71 °C (-20 to 160 °F); for higher temperature service, an optional design is available, consult your [Emerson sales office](#).

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for Baumann pneumatic actuators.



Do not install, operate, or maintain Baumann actuators without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson sales office before proceeding.

Design Notes

The same basic actuator may be configured in several ways. Variations may produce either a 7.9 mm (5/16 inch), 12.7 mm (1/2 inch), or 19.1 mm (3/4 inch) stroke. The spring tables list the nominal bench spring ranges. Each line in the table lists the high and low limits for the signal air pressure, measured in bar and pounds per square inch (psi). These signal pressures produce the rated stroke lengths when the actuator is not loaded. The signal air connections use 1/4 NPT fittings, and are located in both the lower (key 43) and upper (key 44) diaphragm cases. Use the lower connection for an air-to-retract (ATR) actuator and the upper connection for an air-to-extend (ATE) actuator. The signal air pressure must not exceed 2.4 bar (35 psi). Higher pressures may cause the diaphragm to leak.

Installation

⚠ WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the bursting of pressure retaining parts, be certain the service conditions do not exceed either the valve body rating or the flange joint rating, or other limits given on the nameplate. Use pressure-relieving or pressure-limiting devices to prevent the service conditions from exceeding these limits.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section on page 6 in this manual.

NOTICE

Often, these types of actuators are attached to valves which include a stainless steel stem and valve seat. When assembling or adjusting the actuators, never turn the valve stem when the plug is touching the valve seat. If the two stainless steel parts rotate while they are touching, they can be damaged very easily.

When adjusting the valve stem (key 5), do not grip the stem directly with pliers or a wrench. This will damage the surface of the stem, and cause damage to the packing in the valve. Instead, counter-tighten the two locknuts (key 27) on the stem together. This will allow you to turn the stem by turning the locknuts with a wrench.

⚠ WARNING

Personal injury or equipment damage caused by sudden release of pressure or bursting of parts may result if the valve assembly is installed where service conditions could exceed the limits given in the product literature, the limits on the appropriate nameplates, or the mating pipe flange rating. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices. If you cannot determine the ratings and limits for this product, contact your [Emerson sales office](#) before proceeding.

Personal injury could result from packing leakage. The packing might require some readjustment to meet specific service conditions.

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

Attaching an Air-to-Retract (ATR) Actuator to a Valve - Part 1

Follow these instructions when assembling the actuator to a valve or other device which provides a positive stop in one direction.

1. Before starting, identify and locate these parts on the valve assembly, figure 1: stem locknuts (key 27), travel indicator (key 58), bonnet (key 8), yoke drive nut (key 9), and plug and stem assembly (keys 4 and 5). Refer to the assembly instructions for the appropriate Baumann control valve.
2. Place the valve body (key 1) in a vise. Clamp the flat end faces of the valve. **DO NOT CLAMP THE SIDES OF THE VALVE.** This may distort the shape of the casting, and ruin the valve.
3. Begin to attach the actuator to the valve body, figures 1 and 2 through figure 14, depending on actuator type. The yoke drive nut (key 9) and travel indicator (key 58) must be removed from the valve body assembly. The hole at the bottom of the actuator yoke (key 17) should fit over the top of the valve stem (key 5). Tilt the top of the actuator back at an angle so you can access the top of the valve stem (key 5).
4. Position the drive nut (key 9) over the valve stem (key 5) with the flat side facing up. (The rounded side should face down, toward the top surface of the yoke.)
5. Thread the two locknuts (key 27) onto the valve stem (key 5). Turn both nuts down as far as possible. Lock nuts together using two wrenches to counter-tighten them. By turning the locked nuts with a wrench, you can turn the valve stem without damaging the surface of the stem.
6. Place the travel indicator (key 58) over the valve stem (key 5).
7. If applicable, loosen shaft collar (key 25), figure 6, and turn clockwise until it reaches the bottom of the actuator stem (key 26).
8. Apply anti-seize compound to the first few threads of the valve stem (key 5). Turn the actuator counterclockwise to locate the first thread on the stem. Thread stem into the actuator a half turn.
9. Apply 1 bar (15 psi) to the signal air port in the lower diaphragm case (key 43). The bottom of the yoke will drop down and touch the top of the valve bonnet (key 8).
10. By hand, tighten the drive nut (key 9).
11. Using a wrench on the counter-tightened nuts (key 27), turn the stem (key 5) up until you feel a resistance.
12. Using a hammer and punch, tighten the drive nut (key 9).
13. Next, make the bench range adjustment. See the next section.

Bench Range Adjustment Air-to-Retract (ATR) Actuator

This adjustment sets the valve so that it opens and closes at the correct signal air pressures. On an air-to-retract actuator, when the pressure reaches the low end of the range, the valve should just begin to open. Once the bench range has been set correctly, the valve should be completely open when it receives full signal air pressure, and the valve travel should also be correct. The spring tables list the possible pressure ranges for different valve configurations. The signal pressure at the low end of the range is dependent on the springs used in the actuator. In order to make this adjustment, you will need an adjustable source of compressed air ranging from 0 to 1 bar (0 to 15 psi) for Baumann 16 and 32 actuators, 0 to 1.4 bar (0 to 20 psi) for Baumann 54 and 70 actuators with a 1/4 NPT external connector.

1. Connect the air source to the signal air port in the lower diaphragm case (key 43). Begin at 0 bar (0 psi) and gradually increase the pressure. Notice the pressure at the point when the valve stem (key 5) just begins to move.
 - a. If the pressure at this point is too low (lower than the recommended bench initials shown in the spring tables), the actuator and stem assembly should be longer. Turn the valve stem (key 5) out of the actuator stem (key 26) 1/2 turn.
 - b. If the pressure at this point is too high, the actuator and stem assembly should be shorter. Turn the valve stem (key 5) into the actuator stem (key 26) 1/2 turn.
2. Adjust the length of the valve stem (key 5) as described above. Always turn the valve stem (key 5) using a wrench on the two counter-tightened nuts (key 27). Never turn stems while the plug is on the seat.

3. You may have to repeat steps 1 and 2 several times to get the correct setting.

NOTICE

Remember that the valve stem (key 5) cannot be allowed to turn against the valve seat when the two parts are touching. Before you make any adjustment, apply 1 bar (15 psi) to the actuator. This will lift the valve stem away from the seat, and help prevent damage.

Attaching an Air-to-Retract (ATR) Actuator to a Valve - Part 2

1. Once the bench range has been adjusted correctly, you can complete the assembly. Apply 1 bar (15 psi) to the signal port on the actuator.
2. Using two wrenches, unlock the two counter-tightened nuts (key 27). There are flats on the actuator stem (key 26). Hold these flats with a wrench and, one at a time, turn each nut up as far as possible. Counter-tighten the two nuts together again.
3. Reduce the air pressure to 0 bar (0 psi). Loosen the screws (key 57) which hold the travel indicator scale (key 56) in place. Set the scale so the lowest line matches the level of the travel indicator washer.
4. Set the air pressure to the high end of the valve's operating pressure. The travel indicator should move through the full rated travel of 7.9, 12.7, or 19.1 mm (5/16, 1/2, or 3/4 inch).

Note

The shaft collar (key 25), if applicable, can be set at intermediate positions to provide a minimum opening valve travel stop following calibration.

Attaching an Air-to-Extend (ATE) Actuator to a Valve - Part 1

Follow these instructions when assembling the actuator to a valve or another device which provides a positive stop in one direction. (Baumann 70 actuator is ATR only.)

1. Before starting, identify and locate these parts on the valve assembly, figure 1: stem locknuts (key 27), travel indicator (key 58), bonnet (key 8), yoke drive nut (key 9), and plug and stem assembly (keys 4 and 5). Refer to the assembly instructions for the appropriate Baumann control valve.
2. Place the valve body (key 1) in a vise. Clamp the flat end faces of the valve. **DO NOT CLAMP THE SIDES OF THE VALVE.** This may distort the shape of the casting, and ruin the valve.
3. Begin to attach the actuator to the valve body. The yoke drive nut (key 9) and travel indicator (key 58) must be removed from the valve body assembly. The hole at the bottom of the actuator yoke (key 17) should fit over the top of the valve stem (key 5). Tilt the top of the actuator back at an angle so you can access the top of the valve stem (key 5).
4. Position the drive nut (key 9) over the valve stem (key 5) with the flat side facing up. (The rounded side should face down, toward the top surface of the yoke.)
5. Thread the two locknuts (key 27) onto the valve stem (key 5). Turn both nuts down as far as possible. Lock nuts together using two wrenches to counter-tighten them. By turning the locked nuts with a wrench, you can turn the valve stem without damaging the surface of the stem.
6. Place the travel indicator (key 58) over the valve stem (key 5).

7. If applicable, loosen shaft collar (key 25, figure 6) and turn clockwise until it reaches the bottom of the actuator stem (key 26).
8. Apply anti-seize compound to the first few threads of the valve stem (key 5). Place the actuator over the top of the valve bonnet (key 8). The yoke of the actuator will make contact with the top of the bonnet (key 8). Extend the valve stem (key 5) into the actuator stem (key 26). Turn the stem (key 5) until it comes to a stop, then back off 1/2 turn.
9. By hand, tighten the drive nut (key 9).
10. Using a wrench on the counter-tightened nuts (key 27), turn the stem (key 5) up until you feel a resistance.
11. Using a hammer and punch, tighten the drive nut (key 9).
12. Next, make the bench range adjustment. See the next section.

Bench Range Adjustment Air-to-Extend (ATE) Actuator

This adjustment sets the valve so that it opens and closes at the correct signal air pressures. On an air-to-extend actuator, when the pressure reaches the high end of the range, the valve should be completely closed. Once the bench range has been set correctly, the valve should be completely open when it receives the low reading for the signal air pressure, and the valve travel should also be correct. The spring tables list the possible pressure ranges for different valve configurations. The signal pressure at the high end of the range is dependent on the springs used in the actuator. In order to make this adjustment, you will need an adjustable source of compressed air ranging from 0 to 1 bar (0 to 15 psi) for Baumann 16 and 32 actuators, or 0 to 1.4 bar (0 to 20 psi) for Baumann 54 and 70 actuators with a 1/4 NPT external connector.

1. Connect the air source to the signal air port in the upper diaphragm case (key 44). Gradually increase the pressure toward the high rating listed in the appropriate spring table. Notice the pressure at the point when the valve is fully seated, and the valve stem (key 5) stops moving.
 - a. If the pressure at this point is too high, the actuator and stem assembly should be longer. Turn the valve stem (key 5) out of the actuator stem (key 26) 1/2 turn.
 - b. If the pressure at this point is too low, the actuator and stem assembly should be shorter. Turn the valve stem (key 5) into the actuator stem (key 26) 1/2 turn.
2. Adjust the length of the valve stem (key 5) as described in the last step. Always turn the valve stem (key 5) using a wrench on the two counter-tightened nuts (key 27).

NOTICE

Remember that the valve stem (key 5) cannot be allowed to turn against the valve seat when the two parts are touching. Before you make any adjustment, be certain that there is no air signal to the actuator.

3. You may have to repeat steps 1 and 2 several times to get the correct setting.

Attaching an Air-to-Extend (ATE) Actuator to a Valve - Part 2

1. Once the bench range has been adjusted correctly, you can complete the assembly. Apply 0 bar (0 psi) to the signal port on the actuator.
2. Using two wrenches, unlock the two counter-tightened nuts (key 27). There are flats on the actuator stem (key 26). Hold the flats with a wrench and, one at a time, turn each nut up until you feel a resistance. Counter-tighten the two nuts together again.
3. Apply 1 bar (15 psi) to the signal port. Loosen the screws (key 57) which hold the travel indicator scale (key 56) in place. Set the scale so the lowest line matches the level of the travel indicator (key 58).

4. Apply 0 bar (0 psi). The travel indicator (key 58) should move through the full rated travel of 7.9, 12.7, or 19.1 mm (5/16, 1/2, or 3/4 inches).

Spring Replacement, Changing Bench Range

The springs inside the actuator can be replaced or changed if necessary. This is necessary if you want to change the bench range - the range of pressures over which the actuator is designed to operate. The spring tables list the possible spring combinations. To use the tables, identify the stroke and the pressure range for the new valve configuration. This will tell you the part number and the quantity of the springs needed.

Figures 2 and 3 for Baumann 16 actuators, figures 4 and 5 for Baumann 32 actuators, figures 10 and 11 for Baumann 54 actuators, and figure 14 for Baumann 70 actuators show the correct assembly configurations for air-to-extend and air-to-retract valves. Notice that both types include the same parts, but they are arranged differently. The following sections detail the disassembly and assembly instructions.

Maintenance

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any spring precompression.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Field Conversion - ATE to ATR or ATR to ATE

Except for the Baumann 70, these actuators can be changed in the field from air-to-extend (ATE) operation to air-to-retract operation, or from ATR to ATE operation. If you are making this change without changing the bench range, you can reuse the same parts. The parts are simply assembled in a different way. This is described in more detail in the following sections. The following sections list the disassembly and reassembly instructions.

Note

Baumann 70 actuator is available in ATR only.

Field conversion cannot be done on dual-stop actuators.

WARNING

To avoid personal injury or property damage due to actuator springs being under compression, remove the long cap screws last.

The upper actuator casing may remain fixed to the diaphragm and lower casing during disassembly, even if the casing cap screws have been loosened. If this happens, the actuator springs are still under compression. The upper casing could suddenly come loose and jump, due to the compressed energy of the springs. If the upper casing is stuck to the diaphragm and lower casing when you begin loosening the casing cap screws, pry the casings apart with a prying tool. Always be sure that the springs are dispersing energy and the upper casing is moving against the long bolts during disassembly.

WARNING

To avoid personal injury or property damage by uncontrolled movement of the actuator yoke, loosen the body/yoke nuts or bonnet/yoke nuts by following the instructions in the next step. Do not remove a stuck actuator by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the actuator yoke.

Removing the Actuator from the Valve

1. For an air-to-retract (ATR) actuator: Apply 1 bar (15 psi) for Baumann 16 and 32 actuators, or 1.4 bar (20 psi) for Baumann 54 and 70 actuators, to the signal air inlet located in the lower diaphragm case (key 43). This will lift the plug and stem (4/5) away from the valve seat.

For an air-to-extend (ATE) actuator: Disconnect the signal air line connected to the upper diaphragm case (key 43). This will assure that the actuator is vented and that the valve plug and stem (4/5) are fully lifted away from the valve seat.
2. For both types: Place a wrench on the flats of the actuator stem. With an additional wrench, engage the upper locknut (key 27) on the stem and back out the stem about 6.4 mm (1/4 inch). (This procedure will prevent the actuator stem from turning and causing damage to the diaphragm.)
3. Loosen the yoke drive nut (key 9).
4. Using the wrench to work against one of the counter-tightened nuts, turn the valve stem (key 5) completely down until the end unthreads from the actuator stem (key 26).
5. Remove the travel indicator (key 58) from the valve stem (key 5). Loosen the locknuts (key 27) and remove them. Remove the yoke drive nut (key 9).
6. Lift the actuator assembly off of the valve bonnet (key 8).
7. Disconnect airline from ATR actuators.

Disassembling the Actuator

1. Remove the actuator from the valve as described earlier.
2. Remove the cap screws (key 45) and nuts (key 46). Loosen the nuts from the cap screws gradually and evenly. Some units may have a combination of longer and shorter screws. After removing the shorter screws, the remaining longer screws must be loosened evenly. The springs put a lot of force on the diaphragm cases (keys 43 and 44). It is important to release the spring tension gradually before you try to open them.
3. Remove the upper diaphragm case (key 44) and note the position of the parts inside. For the Baumann 70 actuator, the upper diaphragm plate (key 40) must also be removed.
4. Except for the Baumann 16 actuator, lift out the actuator stem (key 26) with the diaphragm plate (key 40) and the diaphragm (key 39). For the Baumann 16 actuator, loosen locknut (key 30) and remove the stem (key 26) through the bottom.
5. For Baumann 32, 54, and 70 actuators, the lower part of the actuator stem (key 26) has flats. Use these flats to clamp the lower end of the stem into a vise. Unscrew the nylon insert locknut (key 30). On an ATE unit, remove the washer (key 112, key 116 for the Baumann 54 actuator), diaphragm (key 39), diaphragm plate (key 40), and for the Baumann 32 actuator, stop cup (key 79). **NOTE: There is not a stop cup for the Baumann 16 actuator. (An ATR unit has the same parts, but they are attached in a different order.)**
6. Replace the diaphragm (key 39) and the O-ring(s) (key 50) if these parts are damaged.

Reassembling the ATE Actuator

1. Use the flats on the actuator stem (key 26) to grip the lower end of the stem in a vise.
2. For the Baumann 32 actuator, place the stop cup (key 79) in position on the upper end of the stem. On an ATE actuator, the stop cup faces down.
3. Place the diaphragm plate (key 40) on the upper end of the stem (key 26), also facing down.
4. Place the diaphragm (key 39) in position. The curved part of the diaphragm should open downward.
5. Place the washer (key 112, key 116 for the Baumann 54 actuator) over the opening in the diaphragm plate.
6. Thread the nylon insert locknut (key 30) onto the end of the stem (key 26) and tighten it.
7. Turn the assembly upside-down, and grip the nylon insert locknut (key 30) in the vise.
8. Place the springs (key 22) onto the diaphragm plate (key 40). Each spring should be centered on one of the raised bosses on the plate.
9. Slide the stop collar (key 115) over the free end of the actuator stem (key 26).
10. Check to see that the O-ring (key 50) is in position on the actuator stem (key 26).
11. Apply some light grease to the O-ring (key 50) and to the surface of the actuator stem (key 26).
12. Slide the lower diaphragm case (key 43), with the actuator yoke (key 17) attached, over the actuator stem (key 26). Make sure that the outer bolt holes of the lower diaphragm case (key 43) line up with the holes in the diaphragm (key 39). If there is interference with any of the springs, rotate the case into another position.
13. Remove the assembly from the vise. Press on the diaphragm assembly slightly to compress the springs. Flip over the assembly and reattach the upper diaphragm case (key 44). As you do this, be sure that all of the springs are upright, and none of them are sitting on the bolt heads. Insert the cap screws (key 45) and tighten the nuts (key 46). It may be necessary to compress the springs slightly to start the nuts. Tighten the nuts evenly, and cross from one side of the assembly to the other as you tighten. This will ensure that the spring tension is taken up evenly.
14. Apply air pressure to the actuator and check for friction or leakage. The actuator should travel smoothly through the entire travel range. Apply leak detection fluid to the area around the guide bushing (key 54). Also check for leaks around the outer edge of the diaphragm (key 39).
15. Make the adjustments described in the section on Bench Range Adjustment - Air-to-Extend (ATE) Valve.

Reassembling the ATR Actuator

1. Use the flats on the actuator stem (key 26) to grip this part in a vise.
2. Place the washer (key 112, key 116 for the Baumann 54 actuator) over the threaded part of the actuator stem (key 26).
3. Place the diaphragm (key 39) in position. The curved part of the diaphragm should open upward.
4. Place the diaphragm plate (key 40) onto the upper end of the stem (key 26), also facing up.
5. For the Baumann 32 actuator, place the stop cup (key 79) in position on the upper end of the stem (key 26). On an ATR actuator, the stop cup faces up.
6. Thread the nylon insert locknut (key 30) onto the end of the stem (key 26) and tighten it.
7. Slide the stop collar (key 115) over the free end of the actuator stem (key 26).
8. Check to see that the O-ring (key 50) is in position on the actuator stem (key 26).
9. Apply some light grease to the O-ring (key 50), and to the surface of the actuator stem (key 26).
10. Slide the actuator stem into the lower diaphragm case (key 43). Turn the assembly so the holes in the diaphragm (key 39) line up with the holes in the diaphragm case (key 43).
11. Place the springs (key 22) onto the diaphragm plate (key 40). Each spring should be centered on one of the raised bosses on the plate.
12. Reattach the upper diaphragm case (key 44). As you do this, be sure that each of the springs is upright. Insert the cap screws (key 45) and tighten the nuts (key 46). It may be necessary to press down on the upper diaphragm case (key 44) slightly to compress the springs slightly and start the nuts. Tighten the nuts evenly, and cross from one side of the assembly to the other as you tighten. This will ensure that the spring tension is taken up evenly.
13. Apply air pressure to the actuator and check for friction or leakage. The actuator should travel smoothly through the entire travel range. Apply leak detection fluid to the area around the guide bushing (key 54). Also check for leaks around the outer edge of the diaphragm.
14. Make the adjustments described in the section on Bench Range Adjustment-Air-to-Retract (ATR) Valve.

WARNING

To avoid personal injury or equipment damage due to possible sudden shifting or falling of the valve assembly, do not lift the valve assembly by the handwheel.

Actuator Maintenance

A routine maintenance schedule might call for regular replacement of the O-ring(s) (key 50) or the diaphragm (key 39). Follow the disassembly and reassembly instructions listed earlier.

Handwheel Operation

For air-to-retract actuators, turn handwheel clockwise to manually retract the stem and counterclockwise to extend the stem. The small locking knob on top of the handwheel assembly enables the user to lock the desired handwheel position.

For an air-to-extend actuator, turn the handwheel clockwise to manually extend the stem and counterclockwise to retract the stem. The lever on the handwheel stem enables the user to lock the desired handwheel position.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

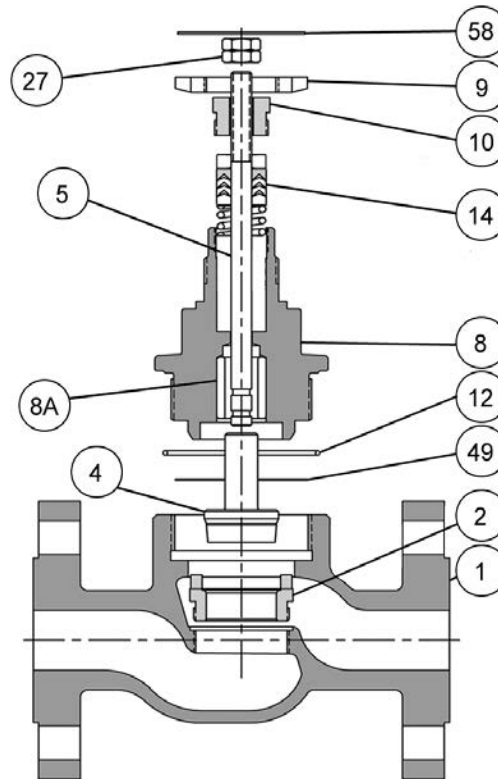
Baumann Pneumatic Actuators

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Figure 1. Typical Baumann Valve Components



E1239

Table 1. Common Valve Parts

Key Number	Description
1	Valve Body
2	Seat Ring
4	Plug
5	Stem
8	Bonnet
8A	Bonnet Bushing
9	Drive Nut
10	Packing Follower
12	O-Ring
14	Packing
27	Locknuts
49	Body Gasket
58	Travel Indicator

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

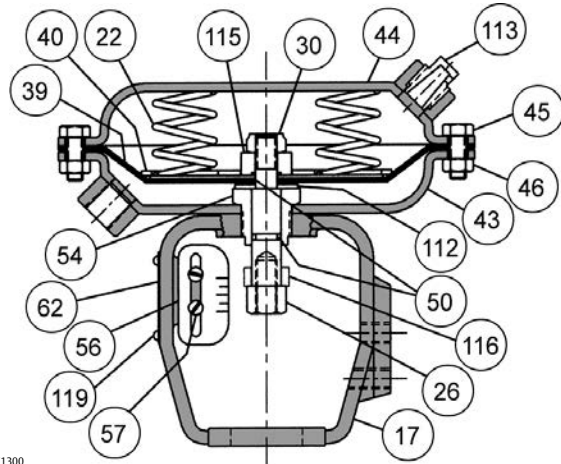
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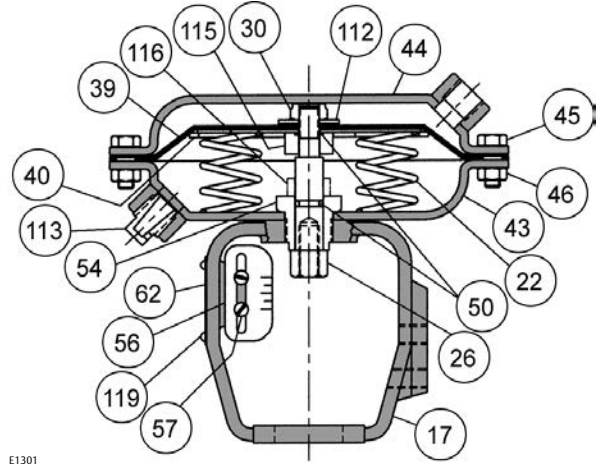
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Figure 2. Baumann 16 Actuator, Air-to-Retract (ATR)



E1300

Figure 3. Baumann 16 Actuator, Air-to-Extend (ATE)



E1301

Table 2. Baumann 16 Actuator Common Parts

Key Number	Description		Part Number	Quantity
17	Actuator yoke		81811	1
22*	Spring		See table 3	See table 3
26	Actuator Stem		81840	1
30	Nut, Self-Locking		81844	1
39*	Diaphragm		011759-001-686	1
40	Diaphragm Plate		81850-1	1
43	Diaphragm Case, Lower	Steel	81820	1
		S30400	GG15182X012	1
44	Diaphragm Case, Upper	Steel	81823	1
		S30400	GG15181X012	1
45	Hex Head Cap Screw		81824	8
46	Nut, Hex		81825	8
50*	O-Ring [FKM (Fluorocarbon)]		24080	2
54	Coupling		81830	1
56	Travel Scale, 0.5 inch		983674-001-250	1
	Travel Scale, 0.3125		87935	
57	Screw		81812	2
62	Nameplate		983753-21	1
112	Washer		25861-24	1
113	Vent Plug		24147	1
115	Collar		81870	1
116	Collar (0.3125 inch travel only)		81842	1
119	Drive Screw		24686	2

* Recommended spare part

Table 3. Baumann 16 Actuator Spring Ranges

ACTION	TRAVEL		NOMINAL BENCH SPRING RANGE		SPRING PART NO. (KEY 22)	QTY	COLLAR (KEY 116)	QTY
	mm	Inch	bar	psi				
ATE (ATC)	12.7	0.5	0.2-0.9	3-13	81860	4	---	---
	7.9	0.3125	0.3-0.9	4-13	81864	4	81842	1
ATR (ATO)	12.7	0.5	0.2-1.0	3-15	81860	5	---	---
	7.9	0.3125	0.3-1.0	4-15	81863	4	81842	1

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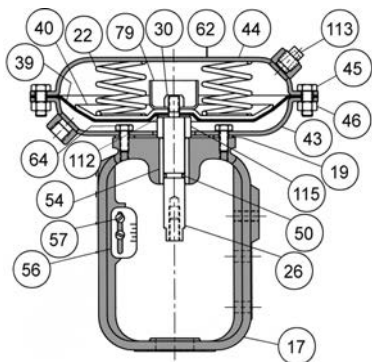
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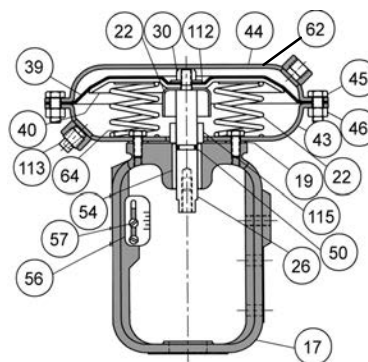
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Figure 4. Baumann 32 Actuator, Air-to-Retract (ATR)



E1302

Figure 5. Baumann 32 Actuator, Air-to-Extend (ATE)



E1303

Table 4. Baumann 32 Actuator Common Parts

KEY NO.	DESCRIPTION		12.7 mm (0.5 in) TRAVEL		19.1 mm (0.75 in) TRAVEL	
			Part No.	Qty	Part No.	Qty
17/54	Yoke w / guide bushing	Ductile Iron	24184-10	1	24184-10	1
		300 Series Stainless Steel	24184-10X022	1	24184-10X022	1
	Yoke (for Fisher™ valves) w/ guide bushing	Ductile Iron	24184-1-1	1	24184-1-1	1
		300 Series Stainless Steel	---	---	---	---
19	Gasket (standard)		See key 39A			
	Gasket (Hi-Temperature)					
22	Actuator Spring		See table 5	---	See table 5	---
26	Actuator Stem, 5/16 thread		24613	1	24613	1
	Actuator Stem (for Fisher valves), 3/8 thread	Steel	24613-2		24613-2	
		300 Series Stainless Steel	---	---	---	---
30 ⁽²⁾	Nylon insert locknut		See key 39A			
39 ⁽²⁾	Diaphragm		See key 39A			
39A ^(1,2)	Diaphragm Kit (standard)		24462-1	1	24462-1	1
	Diaphragm Kit (Hi-Temperature)		24464-1	1	24464-1	1
40	Diaphragm Plate		24811	1	24811	1
43	Diaphragm Case (Lower)	Steel	011767-004-999	1	011767-004-999	1
		300 Series Stainless Steel	011767-004-999ZX032	1	011767-004-999ZX032	1
44	Diaphragm Case (Upper)	Steel	011766-001-999	1	011766-001-999	1
		300 Series Stainless Steel	011766-001-999ZX032	1	011766-001-999ZX032	1
45	Cap Screw		25913-1	8	25913-1	8
46	Nut		971511-011-250	8	971511-011-250	8
50 ⁽²⁾	O-Ring FKM (Fluorocarbon)		See key 39A			
56	Travel Indicator Scale		983674-001-250	1	983674-003-250	1
57	Machine Screw		971302-003-250	2	971302-003-250	2
62	Nameplate		983753-21	1	983753-21	1
64	Cap Screw		See key 39A			
79	Stop Cup		See table 5	---	See table 5	---
112	Washer		25861-24	1	25861-24	1
113	Vent Plug		24147	1	24147	1
115	Stop Collar		24187	1	24187	1

1. Recommended spare parts.

2. Diaphragm kit (39A) includes Locknut (key 30), O-ring (key 50), gasket (key 19), cap screw (key 64), and Diaphragm (key 39). These parts are not sold separately.

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Table 5. Baumann 32 Mini Actuator Common Parts

KEY NO.	DESCRIPTION		12.7 mm (0.5 in) TRAVEL	
			Part No.	Qty
17	Yoke		81811	1
54	Yoke Coupling		81830	1
19	Gasket (standard)		009191-445-883	1
22	Actuator Spring		See table 5	---
26	Actuator Stem, 5/16 thread		81840	1
39 ⁽²⁾	Diaphragm		See key 39A	
39A ^(1,2)	Diaphragm Kit (standard)		24462-7X012	1
40	Diaphragm Plate		24811	1
43	Diaphragm Case (Lower)	Steel	011766-002-999	1
		300 Series Stainless Steel	011766-002-999X022	1
44	Diaphragm Case (Upper)	Steel	011766-001-999	1
		300 Series Stainless Steel	011766-001-999ZX032	1
45	Cap Screw		25913-1	8
46	Nut		971511-011-250	8
56	Travel Indicator Scale		983674-001-250	1
57	Machine Screw		81812	2
62	Nameplate		983753-21	1
112	Washer		25861-24	1
113	Vent Plug		24147	1
115	Stop Washer		25958-1	1

1. Recommended spare parts.
2. Diaphragm kit (39A) includes Locknut (key 30), O-ring (key 50), and Diaphragm (key 39). These parts are not sold separately.

Table 6. Baumann 32 Actuator Spring Ranges

ACTION	TRAVEL		NOMINAL BENCH SPRING RANGE		SPRING PART NO. (KEY 22)	QTY	STOP CUP (KEY 79)	QTY
	mm	in	bar	psi				
ATE (ATC)	12.7	0.5	0.2-0.6	3-9	24820	4	24116	1
			0.2-0.7	3-10	24821	6	24116	1
			0.2-0.9	3-13	24820	6	24116	1
	19.1	0.75	0.2-0.7	3-10	24821	4	24830	1
			0.2-0.9	3-13	24821	6	24830	1
ATR (ATO)	12.7	0.5	0.2-0.7	3-9	24820	4	24116	1
			0.3-1.0	5-15	24820	6	24116	1
			0.5-1.0	7-15	24821	6	24830	1
	19.1	0.75	0.2-0.7	3-9	24821	4	24830	1
			0.3-1.0	5-15	24827	6	24830	1

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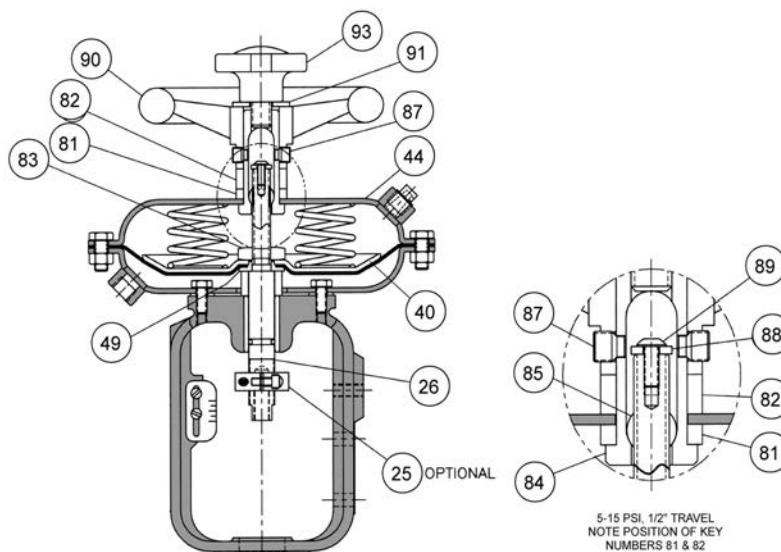
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Figure 6. Baumann 32 Actuator with Handwheel and Optional Up Stop, Air-to-Retract (ATR)



E1304

NOTICE

Do not continue to turn handwheel after the stem is fully extended (valve fully closed and plug seated) or fully retracted (valve fully open) to avoid damage to the handwheel assembly.

Table 7. Baumann 32 ATR with Handwheel and Up Stop (ATO)

Key No.	Description	Part No.	Qty
25	Shaft Collar (optional up stop)	24732-2	1
26	Actuator Stem, 5/16 thread	24613-4	1
	Actuator Stem (for Fisher valves), 3/8 thread	24613-3	1
	Actuator Stem (for optional up stop collar)	24613-16	1
39A ^(1,2)	Diaphragm Kit (standard)	24462-3	1
	Diaphragm Kit (Hi-Temperature)	24464-3	1
40	Diaphragm Plate	24811-1	1
44	Diaphragm Case (Upper)	011766-012-999	1
49	Spacer	24276	1
81	Spacer	24855-1	1
82	Spacer	24855	1
83	Stem Extension	24602-1	1
84	Clevis	24603-1	1
85	Nut, Round Bronze	24604	1
87	Screw, Set Socket	24606	2
88	Washer, Flat	24620	1
89	Screw, Socket Head	24619	1
90	Handwheel	24605	1
91	Washer, Flat	25958	1
93	Locking Knob	24607	1

1. Recommended spare parts

2. Diaphragm kit (39A) includes O-ring (key 50) and Diaphragm (key 39). These parts are not sold separately.

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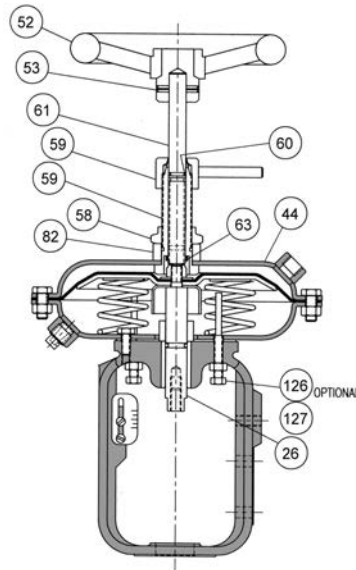
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Figure 7. Baumann 32 Actuator with Handwheel and Optional Dual Stop, Air-to-Extend (ATE)



E1305

NOTICE

Do not continue to turn handwheel after the stem is fully extended (valve fully closed and plug seated) or fully retracted (valve fully open) to avoid damage to the handwheel assembly.

Table 8. Baumann 32 ATE with Handwheel and Dual Stop

Key No.	Description	Part No.	Qty
26	Actuator Stem, 5/16 thread (Handwheel, No Dual Stop)	24613	1
	Actuator Stem (for Fisher valves), 3/8 thread (Handwheel, No Dual Stop)	24613-2	1
	Actuator Stem, 5/16 thread (Handwheel and Dual Stop)	24613-15	1
	Actuator Stem (for Fisher valves), 3/8 thread (Handwheel and Dual Stop)	24613-20	1
44	Diaphragm Case (Upper)	24807T001	1
52	Handwheel, P/N 24605Z		
53	Roll Pin, P/N 25897		
55	Stem, Handwheel, P/N 25976		
58	Nut, Self-Locking		
59	Adapter, Handwheel		
60	O-Ring		
61	Lock-Nut		
63	Spring Pin		
82	Bushing, Handwheel		
126	Hex Bolt (0.5 in travel) - Dual Stop Only	24756-6	2
	Hex Bolt (0.75 in travel) - Dual Stop Only	24756-7	
127	Hex Nut - Dual Stop Only	971511-010-250	2
112	Washer - Dual Stop Only	25861-24	1

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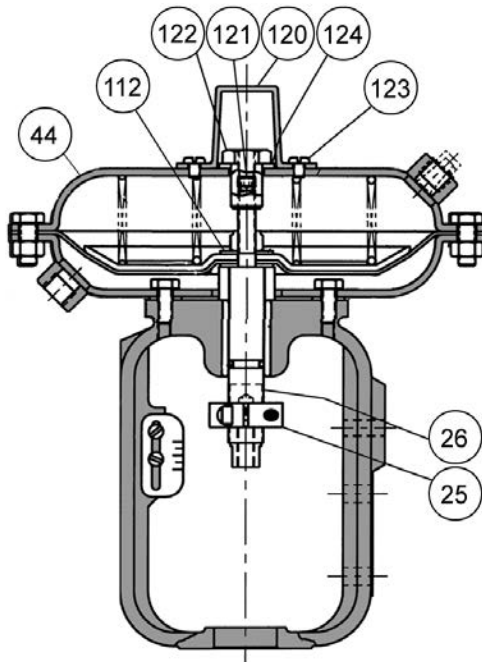
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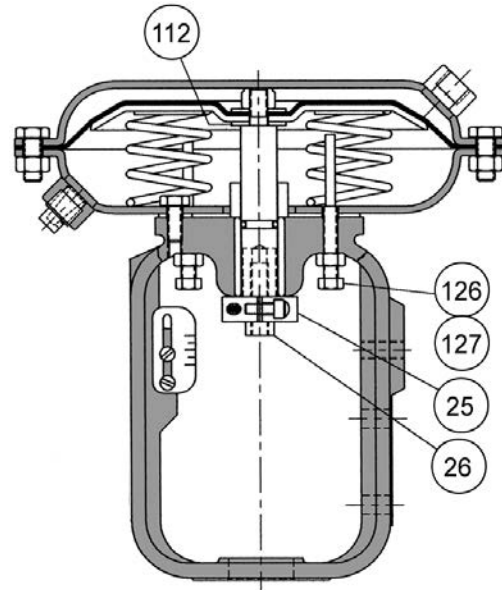
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Figure 8. Baumann 32 Actuator with Dual Stop Air-to-Retract (ATR)



E1306

Figure 9. Baumann 32 Actuator with Dual Stop Air-to-Extend (ATE)



E1307

Table 9. Baumann 32 Actuator with Dual Stop (ATR) Parts (ATO)

Key No.	Description		Part No.	Qty
25	Shaft Collar		24732-2	1
26	Actuator Stem, 5/16 thread		24732-1	1
	Actuator Stem (for Fisher valves), 3/8 thread	300 Series SST	24732-6	
44	Diaphragm Case (Upper)	Steel	24132	1
		300 Series SST	24132ZX022	1
112	Washer		25861-24	1
120	Travel Stop Cover	Steel	24128	1
		300 Series SST	24128S	1
121	Set Screw		24126	1
122	Travel Stop		24129	1
123	Screw		24128-1	2
124	Bottom Ring		25602	1

Table 10. Baumann 32 Actuator with Dual Stop (ATE) Parts (ATC)

Key No.	Description	Part No.	Qty
25	Shaft Collar	24732-2	1
26	Actuator Stem, 5/16 thread	24613-15	1
	Actuator Stem (for Fisher valves), 3/8 thread	24613-20	
112	Washer	25861-24	1
126	Hex Bolt, (0.5 in travel)	24756-6	2
	Hex Bolt, (0.75 in travel)	24756-7	
127	Hex Nut	971511-010-250	2

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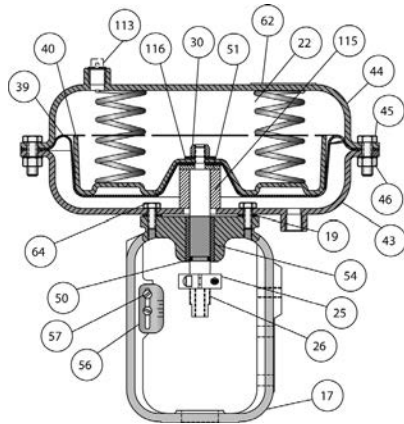
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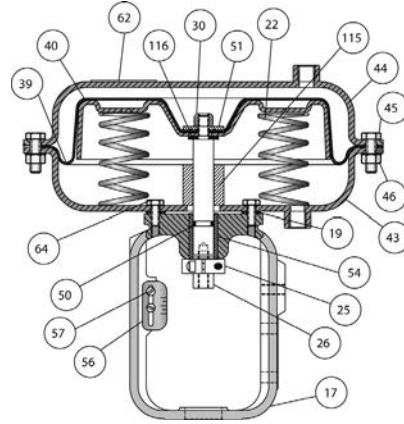
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Figure 10. Baumann 54 Actuator, Air-to-Retract (ATR)



E1308

Figure 11. Baumann 54 Actuator, Air-to-Extend (ATE)



E1309

Table 11. Baumann 54 Actuator Common Parts

Key No.	Description		12.7 mm (0.5 in Travel)		19.1 mm (0.75 in) Travel	
			Part No.	Qty	Part No.	Qty
17/54	Yoke w / guide bushing	Ductile Iron	24184-10	1	24184-10	1
		300 Series Stainless Steel	24184-10X022	1	24184-10X022	1
	Yoke (for Fisher valves) w / guide bushing	Ductile Iron	24184-1-1	1	24184-1-1	1
		300 Series Stainless Steel	---	---	---	---
19	Gasket (standard)		See Key 39A			
	Gasket (Hi-Temperature)	Steel				
		300 Series Stainless Steel				
22	Actuator Spring	Steel	See table 12	---	See table 12	---
		300 Series Stainless Steel	See table 13	---	See table 13	---
25	Shaft Collar		24732-2	1	24732-2	1
26	Actuator Stem, 5/16 thread		24295-2	1	24295-2	1
	Actuator Stem, 3/8 thread	Steel	24295-3		24295-3	
		300 Series Stainless Steel	---	---	---	---
30 ⁽²⁾	Nylon Insert Locknut		See Key 39A			
39 ⁽²⁾	Diaphragm		See Key 39A			
39A ^(1,2)	Diaphragm Kit (standard)		24463-1	1	24463-1	1
	Diaphragm Kit (Hi-Temperature)	Steel	24465-1	1	24465-1	1
		300 Series Stainless Steel	---	---	---	---
40	Diaphragm Plate		0.330-0420	1	0.330-0420	1
43	Diaphragm Case (Lower)	Steel	24294	1	24294	1
		300 Series Stainless Steel	24294ZX032	1	24294ZX032	1
44	Diaphragm Case (Upper)	Steel	25989	1	25989	1
		300 Series Stainless Steel	25989ZX032	1	25989ZX032	1
45	Cap Screw	Steel	See table 12	---	See table 12	---
		300 Series Stainless Steel	See table 13	---	See table 13	---
46 ⁽¹⁾	Nut		971511-011-250	8	971511-011-250	8
50 ⁽²⁾	O-Ring (FKM (Fluorocarbon))		See Key 39A			
51	Spacer		24724	1	24724	1
56	Travel Indicator Scale		983674-001-250	1	983674-003-250	1
57	Machine Screw		971302-003-250	2	971302-003-250	2
62	Nameplate		983753-21	1	983753-21	1
64	Hex Head Cap Screw		See Key 39A			
113	Vent Plug		24147	1	24147	1
115	Stop Collar ⁽³⁾		24297-1	1	24297-1	1
116	Washer		25861-24	1	25861-24	1

1. Recommended spare parts.

2. Diaphragm key (39A) includes locknut (key 30), O-ring (key 50), gasket (key 19), cap screw (key 64), and diaphragm (key 39). These parts are not sold separately.

3. See table 12 for stop collar for sanitary valve.

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Table 12. Baumann 54 Actuator Spring Ranges - Non-Sanitary

ACTION	TRAVEL		NOMINAL BENCH SPRING RANGE		SPRING PART NO. (KEY 22)	QTY	CAP SCREWS (KEY 45)	QTY	CAP SCREW COVERS	QTY
	in	mm	psi	bar						
ATE (ATC)	0.50	12.7	3-10	0.2-0.7	24906	4	24783	2	24900	2
							25913-1	6		
			3-13	0.2-0.9	24906	6	24783	2	24900	2
							25913-1	6		
	0.75	19.1	3-10	0.2-0.7	25915	4	24783	2	24900	2
							25913-1	6		
3-13			0.2-0.9	25915	6	24783	2	24900	2	
						25913-1	6			
ATR (ATO)	0.50	12.7	3-10	0.2-0.7	24906	4	24783	2	24900	2
							25913-1	6		
			5-15	0.3-1.0	24906	6	24783	2	24900	2
							25913-1	6		
			6-14	0.4-1.0	25915	6	24783	2	24900	2
							25913-1	6		
			7-13	0.5-0.9	25915	6	24783	2	24900	2
							25913-1	6		
			7-15	0.5-1.0	25915	6	24783	2	24900	2
							25913-1	6		
	8-15	0.6-1.0	25915	6	24783	2	24900	2		
					25913-1	6				
	9-15	0.6-1.0	21819	4	24783	2	24900	2		
					25913-1	6				
	10-16	0.7-1.1	25940	6	24783	2	24900	2		
					25913-1	6				
	11-15	0.8-1.0	24654	6	24783	2	24900	2		
					25913-1	6				
	12-16	0.8-1.1	24654	6	24783	2	24900	2		
					25913-1	6				
0.75	19.1	3-10	0.2-0.7	25915	4	24783	2	24900	2	
						25913-1	6			
		3-14	0.2-1.0	24906	4	24783	2	24900	2	
						25913-1	6			
		4-16	0.2-1.1	24906	4	24783	2	24900	2	
						25913-1	6			
		5-15	0.3-1.0	25915	6	24783	2	24900	2	
						25913-1	6			
		6-16	0.4-1.1	25915	6	24783	2	24900	2	
						25913-1	6			
7-13	0.5-0.9	25940	4	24783	2	24900	2			
				25913-1	6					
8-14	0.6-1.0	21819	3	24783 (ATO)	2	24900	2			
					6					
9-17	0.6-1.2	21819	4	24783	2	24900	2			
				25913-1	6					
10-14	0.7-1.0	41825	6	24783	2	24900	2			
				25913-1	6					
11-16	0.8-1.1	24654	6	24783	2	24900	2			
				25913-1	6					

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Table 13. Baumann 54 Actuator Spring Ranges - Sanitary

ACTION	TRAVEL		NOMINAL BENCH SPRING RANGE		SPRING PART NO. (KEY 22)	QTY	CAP SCREWS (KEY 45)	QTY	CAP SCREW COVERS	QTY	STOP COLLAR (KEY 115)	QTY
	in	mm	psi	bar								
ATE (ATC)	0.50	12.7	3-10	0.2-0.7	24906	4	24783	2	24900	2	24907	1
							25913-1	6				
	0.75	19.1	3-13	0.2-0.9	24906	6	24783	2	24900	2	24907	1
							25913-1	6				
			3-10	0.2-0.7	25915	4	24783	2	24900	2	24297	1
							25913-1	6			24333	1
ATR (ATO)	0.50	12.7	3-13	0.2-0.9	25915	6	24783	2	24900	2	24187	2
							25913-1	6				
	0.75	19.1	5-15	0.3-1.0	24906	6	24783	2	24900	2	24297	1
							25913-1	6				
			8-15	0.6-1.0	25915	6	24783	2	24900	2	24670 (machined to 1.54 inch length)	1
							25913-1	6				
			5-15	0.3-1.0	25915	6	24783	2	24900	2	24297	1
							25913-1	6				
			7-13	0.5-0.9	25940	4	24783	2	24900	2	24333	1
							25913-1	6			24187	2
	0.75	19.1	8-14	0.6-1.0	21819	3	24783	2	24900	2	24670-2 (machined to 1.50 inch length)	1
							25913-1	6				

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NOTICE

Do not continue to turn the handwheel after the stem is fully extended (valve fully closed and plug seated) or fully retracted (valve fully open) to avoid damage to the handwheel assembly.

Figure 12. Baumann 54 Actuator, Air-to-Retract (ATR) with Handwheel

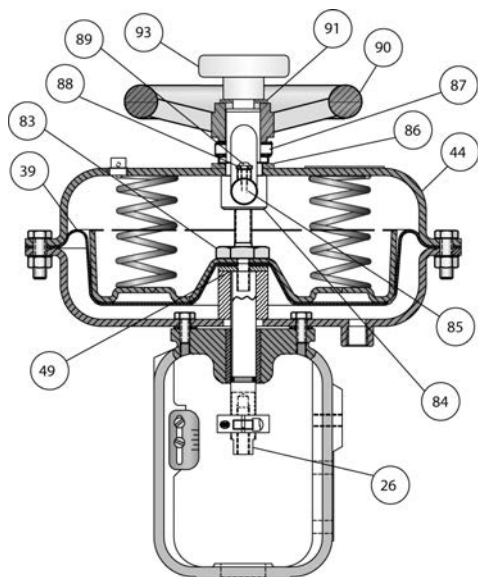


Figure 13. Baumann 54 Actuator, Air-to-Extend (ATE) with Handwheel

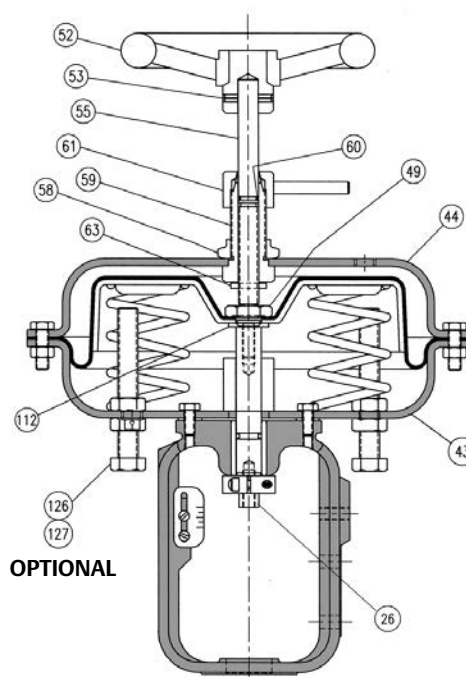


Table 14. Baumann 54 Actuator (ATR) with Handwheel Parts (ATO)⁽¹⁾

Key No.	Description	Part No.	Qty
26	Actuator Stem, 5/16 thread	24601	1
	Actuator Stem, 3/8 thread	GE50137X012	
44	Diaphragm Case (Upper)	24608	1
49	Spacer	24726	1
83	Nut	24603-1	1
84	Clevis	24603	1
85	Nut, Round Bronze	24604	1
86	Washer	25613	1
87	Screw, Set Socket	24606	2
88	Washer, Flat	24620	1
89	Screw, Socket Head	24619	1
90	Handwheel	24605	1
91	Washer, Flat	25958	2
93	Locking Knob	24607	1

1. Standard construction furnishes up and down travel stops.

Table 15. Baumann 54 Actuator (ATE) with Handwheel Parts (ATC)

Key No.	Description	Part No.	Qty
26	Actuator Stem, 5/16 thread	24295	1
	Actuator Stem, 3/8 thread	24295-1	1
43	Diaphragm Case (Lower)	24294	1
44	Diaphragm Case (Upper)	24608	1
49	Hex Bolt	25987	1
52	Handwheel	Kit No. 25985	1
53	Roll Pin		
55	Stem, Handwheel		
58	Nut, Self-Locking	25924	1
59	Adapter	25978	1
60	O-Ring	25926	1
61	Lock-nut	25979	1
63	Roll Pin	25931	1
112	Washer	25918	1
126	Hex Tap Bolt (for dual stop only)	24756-8	3
127	Hex Jam Nut (for dual stop only)	42789	3

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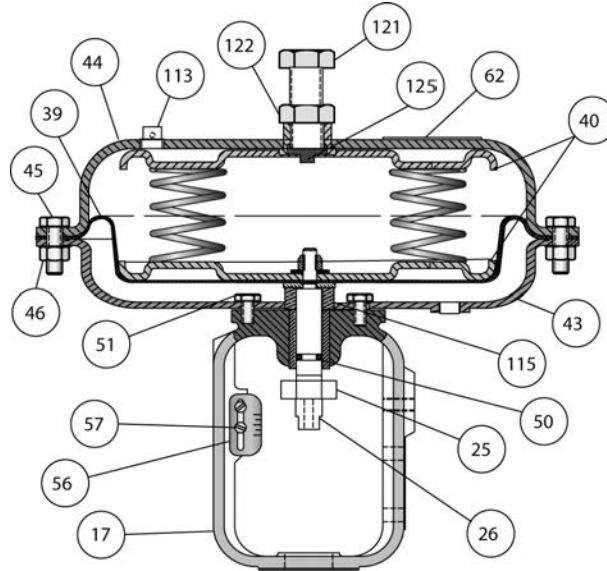
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Figure 14. Baumann 70 Actuator



E1312

Table 16. Baumann 70 Actuator Parts

Key No.	Description	Part No.	Qty
17/54	Yoke w / guide bushing	24184-10	1
	Yoke (for Fisher valves) w / guide bushing	24184-1-1	
19	See Key 39A		
22	Actuator Spring	See Table 16	---
25	Shaft Collar	24732-2	1
26	Actuator Stem, 5/16 thread	24330-2	1
	Actuator Stem, 3/8 thread	24330-3	
30 ⁽²⁾	Nylon Insert Locknut	See Key 39A	
39 ⁽²⁾	Diaphragm	See Key 39A	
39A ^(1,2)	Diaphragm Kit (standard)	24471-1	1
40	Diaphragm Plate	24350	2
43	Diaphragm Case (Lower)	24310	1
44	Diaphragm Case (Upper)	24317	1
45	Cap Screw (short)	See Table 16	---
46	Nut	24705M	16
50 ⁽²⁾	O-ring (FKM (Fluorocarbon))	See Key 39A	
51	Spacer	24724	1
56	Travel Indicator Scale (0.5 in travel)	983674-001-250	1
	Travel Indicator Scale (0.75 in travel)	983674-003-250	
57	Machine Screw	971302-003-250	2
62	Serial Plate	983753-21	1
64	See Key 39A		
112	Washer	25861-24	2
113	Vent Plug	24147	1
115	Stop Collar	24333	1
121	Set Screw	24332-1	1
122	Jam Nut	24334	1
125	Adjustment Screw Seat	24331	1
1. Recommended spare parts. 2. Diaphragm key (39A) includes locknut (key 30), O-ring (key 50), gasket (key 19), cap screw (key 64), and diaphragm (key 39). These parts are not sold separately.			

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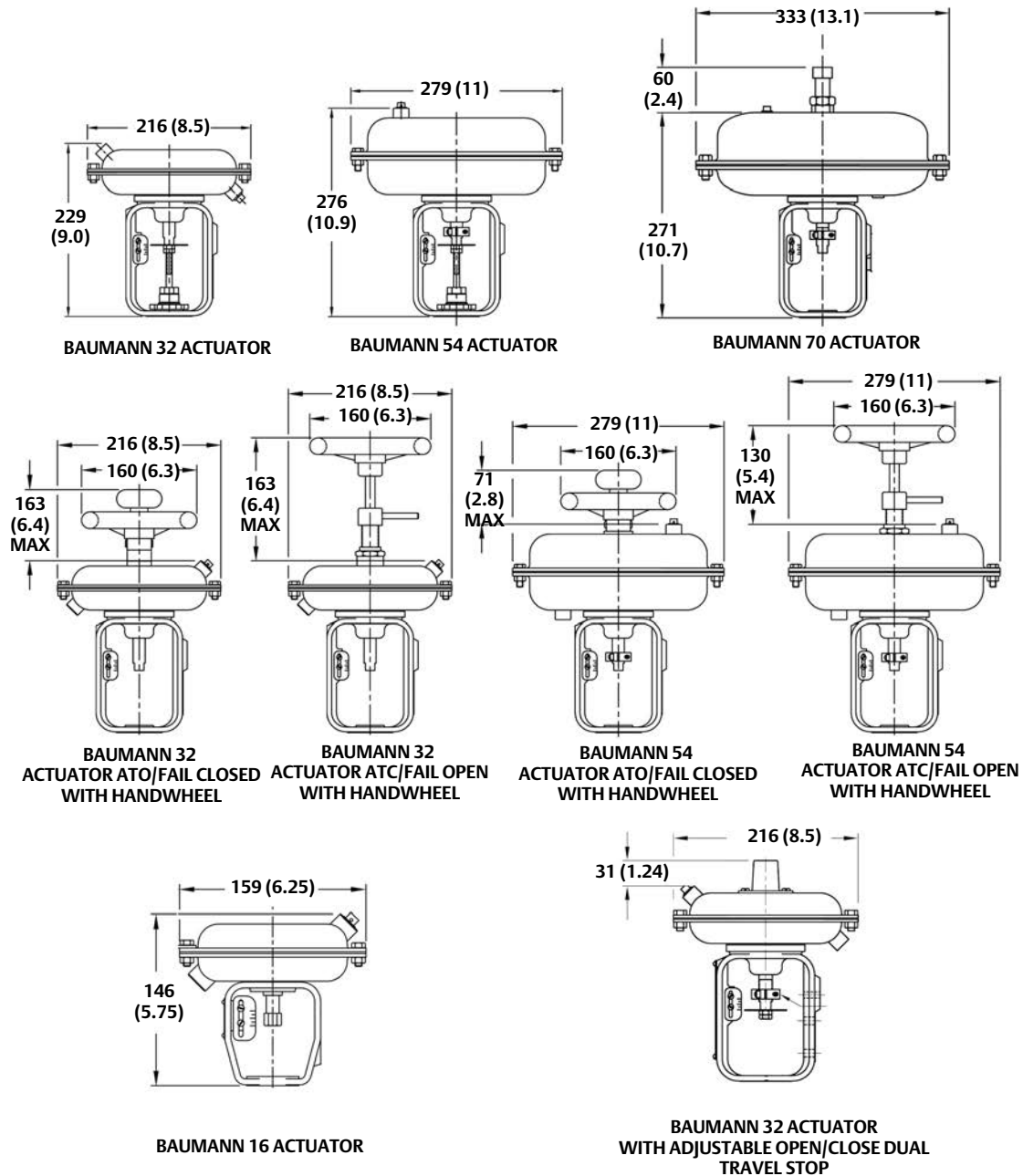
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Table 17. Baumann 70 Actuator Spring Ranges

ACTION	TRAVEL		NOMINAL BENCH SPRING RANGE		SPRING PART NO. (KEY 22)	QTY	CAP SCREWS (KEY 45)	QTY	CAP SCREW COVERS	QTY
	in	mm	psi	bar						
ATR (ATO)	0.5	12.7	2-13	0.1-0.9	24380	8	24335M	12	---	---
							24336M	4	24338	4
			3-9	0.2-0.6		4	24335M	12	---	---
							24336M	4	24338	4
			3-14	0.2-1.0	24906	8	24335M	12	---	---
							24336M	4	24338	4
			5-14	0.3-1.0		6	24335M	12	---	---
							24336M	4	24338	4
			7-14	0.5-1.0	25915	8	24335M	12	---	---
							24336M	4	24338	4
			8-15	0.6-1.0			24335M	12	---	---
							24336M	4	24338	4
	0.75	19.1	9-15	0.6-1.0	25940	6	24335M	12	---	---
							24336M	4	24338	4
			10-15	0.7-1.0			24335M	12	---	---
							24336M	4	24338	4
			11-15	0.8-1.0	24654	8	24335M	12	---	---
							24336M	4	24338	4
			12-16	0.8-1.1		8	24335M	12	---	---
							24336M	4	24338	4
			4-15	0.3-1.0	24380	6	24335M	12	---	---
							24336M	4	24338	4
			3-9	0.2-0.6	25915	4	24335M	12	---	---
							24336M	4	24338	4
			4-13	0.3-0.9			24335M	12	---	---
							24336M	4	24338	4
			5-14	0.3-1.0	24906		24335M	12	---	---
							24336M	4	24338	4
			6-14	0.4-1.0	25915	6	24335M	12	---	---
							24336M	4	24338	4
			7-15	0.5-1.0			24335M	12	---	---
							24336M	4	24338	4
			8-15	0.6-1.0	21819	4	24335M	12	---	---
							24336M	4	24338	4
			9-16	0.6-1.1	25940	6	24335M	12	---	---
							24336M	4	24338	4
			10-15	0.7-1.0	41825		24335M	12	---	---
							24336M	4	24338	4
			11-17	0.8-1.2	24654	8	24335M	12	---	---
							24336M	4	24338	4
			12-18	0.8-1.2			24335M	12	---	---
							24336M	4	24338	4

Figure 15. Dimensional Drawings



E1313

Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name, and desired material using the Parts List table.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and actuator, and could cause personal injury and property damage.

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Baumann™ SV Electric Actuator



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Section 1: Introduction

Baumann SV electric actuators (Figure 1) provide high accuracy for industrial temperature, HVAC and sanitary applications.

This system is specifically designed for Fisher Baumann sliding stem-control valves.

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for Baumann SV electric actuators.

WARNING



Do not install, operate or maintain Baumann SV electric actuators without fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. Fisher Baumann 24000CVF Valve with SV Electric Actuator



X1326

1.2 Actuator Specifications

Table 1. Actuator Specifications

ACTUATOR TYPE		SVX24-MFT	SVK24-MFT
POWER FAILURE		Lock in last position	Fail Open/Fail Closed
ACTION		Direct or Reverse	
POWER CONSUMPTION		4 W	8.5 W
TRANSFORMER SIZE		6 VA (class 2 power source)	21 VA (class 2 power source)
TRAVEL		12.7 and 19.1 mm / 0.50 and 0.75 in.	
MATERIAL	Housing	Aluminum die cast and plastic casing	
	Yoke Legs	Aluminum	
ENCLOSURE RATING		NEMA 2, / IP 54 UL Enclosure Type 2	
INPUT SIGNAL		2 to 10 V DC or 4 to 20 mA input signal	
POWER SUPPLY		24 V AC or 24 V DC	
ELECTRICAL CONNECTION		3 ft, 18GA appliance cable, 0.5 in. conduit fitting	
AMBIENT TEMPERATURE		-30 to +50°C / -22 to +122°F	
RELATIVE HUMIDITY RANGE		5 to 95% RH, non-condensing	
OUTPUT THRUST		1500 N / 337 lbf	
VALVE STEM POSITION FEEDBACK OUTPUT		2 to 10 V DC / 0.5 mA maximum	
SHUTOFF CLASS		Class IV or VI per ANSI/FCI 70-2 (Refer to Valve Technical Bulletin)	
TRAVEL TIME		35 seconds	
NOISE LEVEL		< 45 dB(A)	
MANUAL OVERRIDE		4 mm Hex Head	
POSITION INDICATION		Travel Indicator on Yoke	
SPLIT RANGE CAPABILITY		Yes	
AGENCY APPROVALS		CE (A), UL 60730-1A/-2 -14, CSA E60730-1:02 (CE approval for actuator only)	
WEIGHT		1.3 kg / 2.9 lbs	1.6 kg / 3.6 lbs

1.3 Education Services

Emerson's Education Services

Phone: 800-338-8158

Email: education@emerson.com

emerson.com/en/final-control/services/valve-training

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

When ordered, this actuator configuration was selected for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the actuator could result in parts damage, malfunction of the actuator or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended without first contacting your [Emerson sales office](#).

WARNING

Keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional and national codes for any given hazardous area approval. Failure to follow the local, regional and national codes could result in personal injury or property damage from fire or explosion.

2.1 Recommended Installation Location

It is permissible to install the SV actuator upright or horizontally. Allow 12 in. of clearance for removal of the actuator.

NOTICE

To avoid equipment damage, do not install the valve with the stem in a downward position. Equipment damage may occur from liquids leaking into the actuator cover.

NOTE

Assembly can be mounted horizontally or vertically. Do not install with the actuator below the pipe.

Figure 2. Actuator Parts

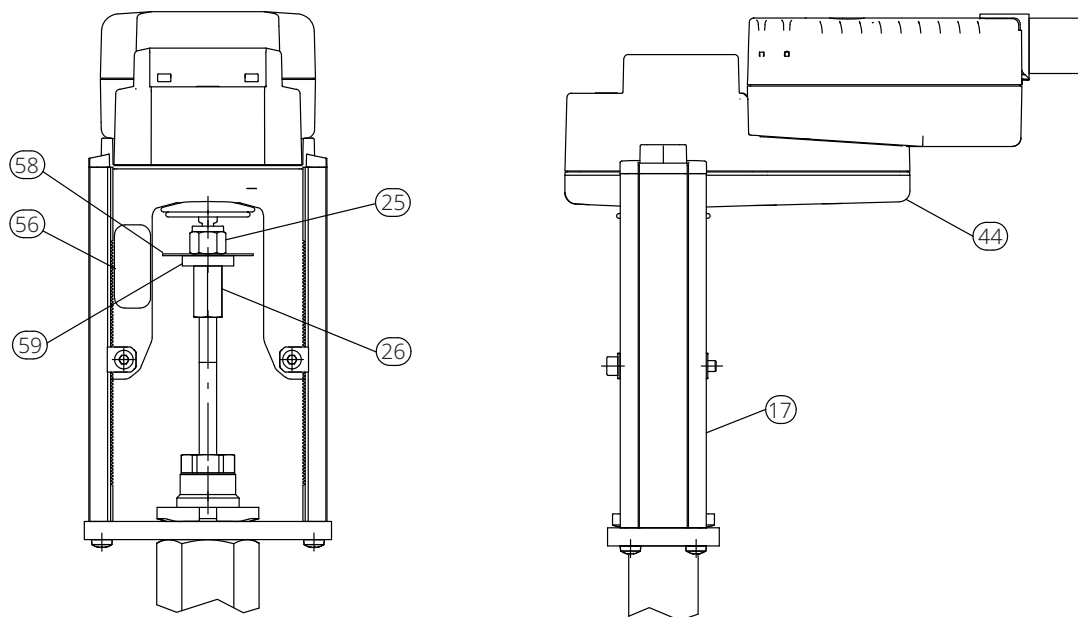


Table 2. Actuator Assembly Parts List

KEY NO.	DESCRIPTION	QTY
17	Actuator yoke	1
25	Stem connector	1
26	Stem adapter	1
44	SV actuator	1
56	Travel scale	1
58	Travel indicator	1
59	Spacer	1

Table 3. Common Valve Parts for Fisher Baumann 24000, 24000C, 24000S, 24000F, 24000SVF and 24000CVF

KEY NO.	DESCRIPTION
1	Valve body
2	Seat ring
4	Plug
5	Stem
8	Bonnet
9	Drive nut
10	Packing follower
27	Locknuts

See Table 2 for actuator parts/key numbers referenced in this Installation section.
See Table 3 and also refer to the appropriate Fisher Baumann valve instruction manual for valve parts referenced in this Installation section.

1. Before starting, ensure you have the correct actuator part number for the necessary stroke and locate the following parts: stem locknuts, travel indicator, bonnet, yoke drive nut, plug and stem assembly, packing follower. Refer to the assembly instructions for the appropriate Fisher Baumann control valve for parts identification.
2. Place the body of the valve in a vise. Clamp the flat end faces of the valve.
3. Connect the actuator wires in the proper setup. The black and red wires should be connected to power and the black and white wires should be connected to the input signal. Cycle the actuator to the upper travel point.
4. When mounting the actuator assembly to the valve body, the hole in the yoke plate should fit over the top of the valve stem. Tilt the top of the actuator back at an angle so you can access the top of the valve stem.
5. Position the yoke drive nut over the valve stem with the flat side facing up (the rounded side should face down, toward the top surface of the yoke plate).
6. Thread two locknuts onto the valve stem. Finger-tighten both nuts down as far as possible. Lock the nuts together using two wrenches to counter-tighten them. By turning the locked nuts with a wrench, you will be able to turn the valve stem in step 8 without damaging the surface of the valve stem.

NOTICE

When assembling or disassembling the valve, do not turn the valve stem while the plug is touching the valve seat. This will damage the valve's seating surfaces.

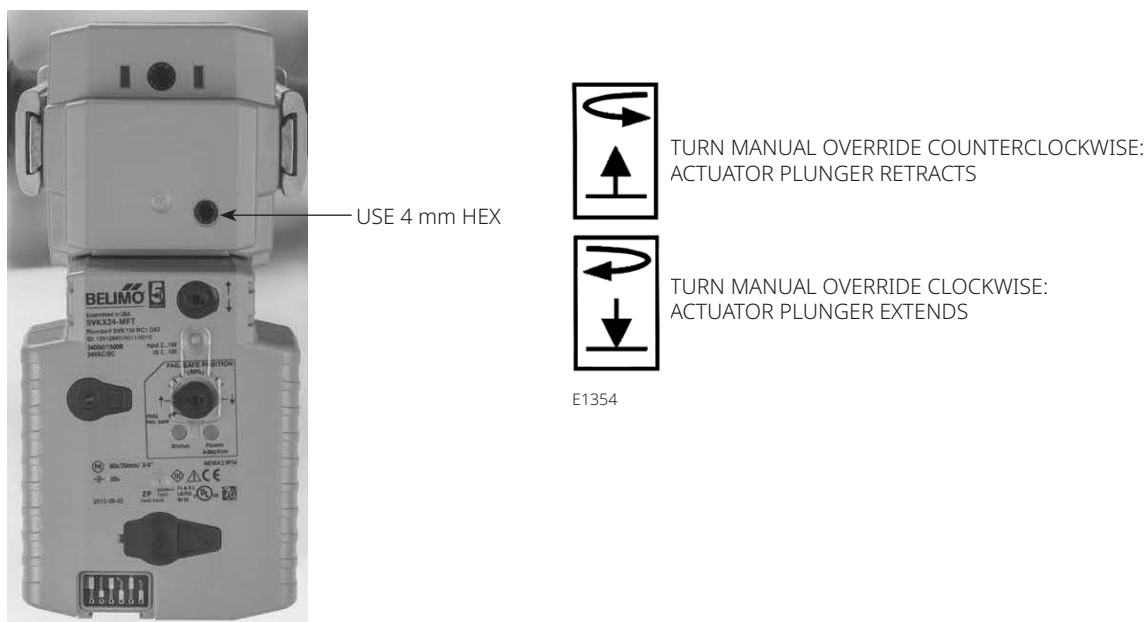
7. Apply anti-seize compound to the first few threads of the valve stem. Lift the valve stem up so that the plug is off the seat. Turn the valve stem so that the threads begin to catch in the lower end of the stem adapter (key 26). Using one wrench placed on the lower counter-tightened nut and one wrench on the stem adapter (key 26), turn the valve stem up until you feel resistance, then back off or unscrew the stem adapter one full turn. Be sure that the actuator yoke plate is firmly seated on the bonnet.
8. Using a hammer and punch, tighten the drive nut.
9. Place the spacer (key 59) on top of the stem adapter (key 26). Place the travel indicator disk on top of the spacer and tighten the stem connector (key 25) to the stem adapter (key 26) until rigid.
10. Check the seat leak and adjust the stem adapter down as required to achieve shutoff.
11. Using two wrenches, unlock the two counter-tightened locknuts. Holding the stem adapter (key 26) with a wrench, turn the locknuts, one at a time, up until they are locked together against the stem adapter (key 26).
12. With the valve in the closed position, add the travel indicator sticker (key 56). The closed line on the travel indicator sticker (key 56) should be aligned with the travel indicator (key 58) at this point.

2.2 Additional Calibration and Setup

For additional calibration and setup information, please visit [71821-0001.B](#), Quick Mount Visual Instruction Manual for UFVL Linkage with LV and SV Series Actuators. The calibration PC tool, as well as MFT documentation, is available.

2.3 SV Manual Override

Figure 3. SV Manual Override



Y2A7087

Section 3: Maintenance

WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- Do not tamper with actuator positioning bolts located on the adjustable yoke legs.

NOTE

It is recommended that you review Figure 2 before performing maintenance or installation of the SV electric actuator.

Section 4: Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number and part name shown in Table 2.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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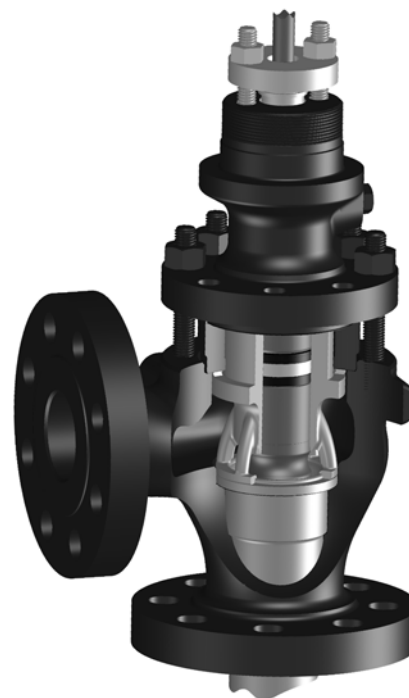


Fisher™ CCV-N Control Valves

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Figure 1. Fisher NPS 2 CCV-N



X1430

Introduction

Scope of Manual

This instruction manual includes installation, maintenance and parts information for NPS 2 through 4 CCV-N fuel gas control valves. These valves are used in gas turbines which meter the fuel gas to the combustion chamber of the turbine and provide linear flow with the ability to choke very quickly at a low pressure drop. Refer to separate manuals for instructions covering the actuator and accessories.

Do not install, operate, or maintain CCV-N valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

<

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

Description

CCV-N valves are single port, angle-style, and balanced or unbalanced valves with metal seat, seat ring retainer guide, and push-down-to-close valve plug action.

Educational Services

For information on available courses for Fisher CCV-N fuel gas control valves, as well as a variety of other products, contact:

Emerson Automation Solutions
 Educational Services - Registration
 Phone: 1-641-754-3771 or 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Since some valve body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

1. Before installing the valve, inspect the valve and associated equipment for any damage and any foreign material.
2. Make certain the valve body interior is clean, that pipelines are free of foreign material, and that the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.
3. It is recommended the valve should be installed in the vertical orientation with the actuator vertical above the valve. Other positions may result in uneven valve plug, seal set, seat ring, seat ring retainer, packing wear and improper operation. For more information, consult your Emerson sales office.
4. It is recommended the valve upstream pipe inside diameter should match or be close to valve body inlet inside diameter to reduce valve inlet turbulence.
5. It is recommended to have a length of 6 to 12 pipe diameters of straight pipe upstream of the valve body inlet and 4 to 8 pipe diameters length downstream of the valve seat ring outlet. The straight pipe upstream and downstream of the valve body should have a smooth inside surface with no weld slag or other inside surface irregularities. It is recommended that pipe reducers not be installed in the straight pipe upstream and downstream of the valve.
6. Use a suitable gasket between valve and pipeline flanges.
7. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
8. Refer to the actuator mounting procedure in the appropriate actuator instruction manual.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

Valves with ENVIRO-SEAL live-loaded packing or HIGH-SEAL live-loaded packing will not require this initial re-adjustment. See the Fisher instruction manuals, ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) or HIGH-SEAL Live-Loaded Packing System ([D101453X012](#)) (as appropriate), for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the Parts Kit sub-section near the end of this manual.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing maintenance and trim maintenance. All maintenance operations may be performed with the valve in the line.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Release the actuator loading pressure and relieve any actuator spring pre-compression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

CAUTION

Follow instructions carefully to avoid damaging the product surfaces, which could result in damage to the product. Protect all surfaces of the valve plug, valve seat ring, and seat ring retainer during maintenance to ensure control valve accuracy and choking performance is not affected.

Note

Whenever a gasket seal is disturbed by removing or shifting parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal, since the used gasket may not seal properly.

Packing Maintenance

Note

For valves with ENVIRO-SEAL packing, see the Fisher instruction manual, ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#), for packing instructions.

If there is undesirable packing leakage, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

If the packing is relatively new and tight on the stem, and if tightening the packing flange nuts does not stop the leakage, it is possible that the valve stem is worn or nicked so that a seal cannot be made. The surface finish of a new valve stem is critical for a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

Replace Packing

WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual

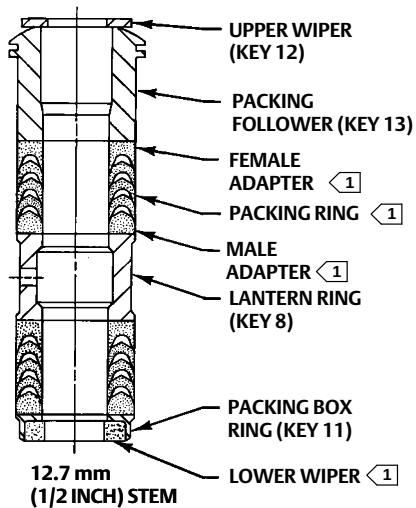
1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, and releases all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment. Observe the **Warnings** at the start of the Maintenance section.
2. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet. Disconnect the stem connector and remove the actuator from the valve.
3. Loosen the packing flange nuts (key 5, figures 3, 4, and key 212, figure 5) so that the packing is not tight on the valve stem (key 7, figures 6, 7, 8, 12, 13, and 14). Remove any travel indicator parts and stem locknuts from the valve stem threads.

WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet.

Figure 2. Packing Arrangements

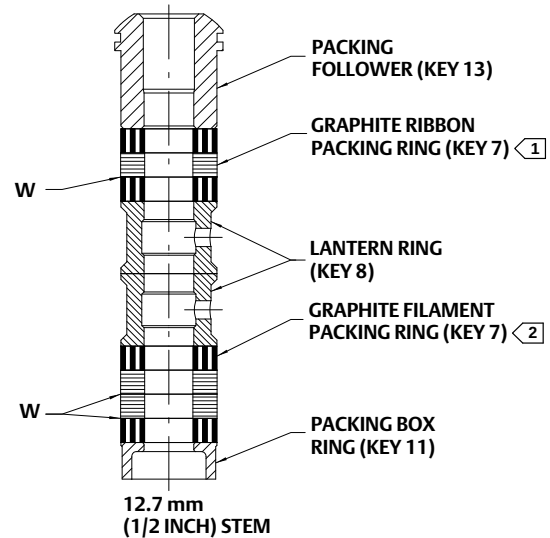
DOUBLE PTFE



NOTE:

1 PAKING SET (KEY 6) CONTAINS A FEMALE ADAPTER, V-RING PACKING RINGS, MALE ADAPTER, AND LOWER WIPER RINGS.

GRAPHITE LEAK-OFF



NOTE: INSTALL SACRIFICIAL WASHERS AT PLACES MARKED "W"

1 HAS THE APPEARANCE OF DIE FORMED GRAFOIL MATERIAL.
2 HAS THE APPEARANCE OF A WOVEN OR BRAIDED RING.

4. Hex nuts (key 16, figures 6, 7, 8, 12, 13, and 14) attach the bonnet (key 1, figures 3, 4, and 5) to the body (key 1, figures 6, 7, 8, 12, 13, and 14). Loosen these nuts approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, remove the nuts or cap screws completely and carefully lift the bonnet off the valve.

CAUTION

Avoid damaging the seating surface caused by the valve plug and stem assembly dropping from the bonnet (key 1, figure 3) after being lifted partway out. When lifting the bonnet, temporarily install a valve stem locknut on the valve stem. The locknut will prevent the valve plug and stem assembly from dropping out of the bonnet.

5. Remove the locknut and separate the valve plug and stem from the bonnet. Set the parts on a protective surface to prevent damage to gasket or seating surfaces.
6. Remove the bonnet gasket (key 10 and 12, figures 6, 7, 8, 12, 13, and 14) and cover the opening in the valve to protect the gasket surface and prevent foreign material from getting into the valve body cavity.

CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to prevent foreign material from getting into the valve body cavity.

7. Remove the packing flange nuts, packing flange, upper wiper, and packing follower when applicable (keys 3, 5, and 13, figure 4). For Enviro-Seal Graphite ULF packing, remove the packing flange nuts, packing flange, and spring pack

assembly (keys 201, 212, and 217, figure 5). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.

8. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts by following the appropriate steps in the Trim Maintenance procedure.
9. Remove the covering protecting the valve body cavity and install new bonnet gaskets (key 10 and 12, figures 6, 7, 8, 12, 13, and 14) making sure the gasket seating surfaces are clean and smooth. Then slide the bonnet over the stem and onto the stud bolts (key 15, figures 6, 7, 8, 12, 13, and 14.)

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) representative immediately if a discrepancy between actual parts and approved parts is suspected.

10. Lubricate the bonnet studs (key 15, figure 6, 7, or 8) and all surfaces the studs and nuts come into contact with. Make sure the nuts material matches the valve specification and set the nut surface with material specification stamp facing up, therefore it is visible. Tighten the nuts (key 16, figures 6, 7, 8, 12, 13, and 14) in a uniform, multistage cross pattern. Monitor the distance between the bonnet and body and keep it even to ensure that the bonnet is being torqued evenly. Use no more than 1/4 of the specified torque as indicated in table 2. Repeat the crisscross pattern, work up to the specified torque in 1/4 increments until the final torque is achieved. Wait a minimum of 2 minutes to allow for gasket/screw relaxation and recheck the torque, retightening as necessary. After final torquing, ensure there is an even gap and that the metal-to-metal contact between the valve body (or bonnet spacer) and bonnet is achieved around the entire circumference of the body-bonnet joint.

Table 2. Body-to-Bonnet Torque Guidelines

VALVE SIZE, NPS	BOLT TORQUES			
	SA193-B7 Studs		S20910 (Nitronic 50) Studs	
	N•m	Lbf-in	N•m	Lbf-in
2	91	67	60	44
3	122	90	85	63
4	163	120	118	87

11. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 2. For Enviro-Seal Graphite ULF packing only, see figure 5, parts list in this instruction manual and ENVIRO-SEAL Packing System for Sliding-Stem Valves Instruction Manual ([D101642X012](#)) for packing arrangement and installation, complete step 11, then move to step 14. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box.
For all other packing, except Enviro-Seal packing, move to step 12.
12. Slide the packing follower, upper wiper (not applicable for graphite leak-off packing), and packing flange (keys 3,13, 12, figure 3 or 4) into position. Lubricate the packing flange studs (key 4, figure 3 or 4) and the faces of the packing flange nuts (key 5, figure 3 or 4). Install the packing flange nuts.
13. For **graphite leak-off packing**, tighten the packing flange nuts to the maximum recommended torque shown in table 3. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 3.
For **other packing types**, tighten the packing flange of the nuts alternatively in small increments until one of the nuts reaches the minimum recommended torque shown in table 3. Then, tighten the remaining flange nut until the packing flange is level and at a 90-degree angle to the valve stem.

Table 3. Recommended Torque for Packing Flange Nuts

Packing	STEM SIZE		Rating	MINIMUM TORQUE		MAXIMUM TORQUE	
	mm	inch		N•m	Lbf-in	N•m	Lbf-in
PTFE Packing	12.7	1/2	CL300	3	30	5	42
Graphite Leak-off Packing	12.7	1/2	CL300	7	59	10	88
			CL600	9	81	14	122

14. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

Trim Maintenance

Non-Bore Seal Trim Constructions

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

CAUTION

Follow instructions carefully to avoid damaging the product surfaces, which could result in damage to the product. Protect all surfaces of the valve plug, valve seat ring, and seat ring retainer during maintenance to ensure control valve accuracy and choking performance is not affected.

Disassembly

1. Remove the actuator and the bonnet according to steps 1 through 6 of the Replacing Packing procedure in the Maintenance section.

⚠ WARNING

To avoid personal injury due to leaking fluid, avoid damaging gasket sealing surfaces. The surface finish of the valve stem (key 7, figure 6, 7, 8, 12, and 13) is critical for making a good packing seal. The inside surface of the seat ring retainer (key 3, figure 6, 7, 8, 12, and 13), is critical for smooth operation of the valve plug. The seating surfaces of the valve plug (key 2, figure 6, 7, 8, 12, and 13) and seat ring (key 9, figure 6, 7, 8, 12, and 13) are critical for proper shutoff. Unless inspection reveals otherwise, assume all these parts are in good condition and protect them accordingly.

2. Remove the packing flange nuts, packing flange, upper wiper (not applicable for graphite leak-off packing), and packing follower (keys 3, 5, 12, and 13, figure 3 or 4). For Enviro-Seal packing, remove the packing flange nuts, packing flange, and spring pack assembly (key 201, 212, and 217, figure 5.) Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
3. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
4. On a CCV-N design with bonnet spacer, remove the bonnet spacer (key 32, figure 6 and 12) and associated gaskets (key 10 and 12, figure 6 and 12) on top of the spacer without rotating the seat ring retainer (key 3, figure 6 and 12).

5. Mark the orientation between valve body (key 1, figures 6, 7, 8, 12, and 13) and seat ring retainer (key 3, figure figures 6, 7, 8, 12, and 13). Remove the seat ring retainer, valve plug and stem assembly, and associated gaskets (key 10, 12, figures 6, 7, 8, 12, and 13).
6. Separate the plug stem assembly and seat ring retainer (key 3, figures 6, 7, 8, 12, and 13) by sliding the plug stem assembly through the bottom of seat ring retainer.
7. Remove the seat ring (key 9, figure figures 6, 7, 8, 12, and 13) and seat ring gasket (key 13, figures 6, 7, 8, 12, and 13).
8. For all constructions, inspect parts for wear or damage which would prevent proper operation of the valve. Replace or repair trim parts according to the following procedure for plug maintenance procedure.

NPS 4 Balanced Bore-Seal Trim Maintenance

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

1. Remove the actuator and the bonnet according to steps 1 through 6 of the Replacing Packing procedure in the Maintenance section.

⚠ WARNING

To avoid personal injury due to leaking fluid, avoid damaging gasket sealing surfaces. The surface finish of the valve stem (key 7, figure 14) is critical for making a good packing seal. The inside surface of the seat ring retainer (key 3, figure 14) is critical for smooth operation of the valve plug. The seating surfaces of the valve plug (key 2, figure 14) and seat ring (key 9, figure 14) are critical for proper shutoff. Unless inspection reveals otherwise, assume all these parts are in good condition and protect them accordingly.

2. Remove the packing flange nuts, packing flange, and packing follower (keys 3, 5, and 13, figure 4). For Enviro-Seal packing, remove the packing flange nuts, packing flange and spring pack assembly (key 201, 212 and 217, figure 5). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
3. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
4. On a CCV-N design with bonnet spacer, remove the bonnet spacer (key 32, figure 14) and associated gaskets (key 10 and 12, figure 14) without rotating the seat ring retainer (key 3, figure 14).
5. Mark the orientation between valve body (key 1, figure 14), and seat ring retainer (key 3, figure 14).
6. Gently pull the valve stem (key 7, figure 14) up to lift the whole valve plug and stem assembly, seat ring retainer, Bore-seal and piston rings set (key 2, 4, 7, 8, 17, 18, figure 14) out of valve body (key 1 in figure 14). The plug stem assembly contains sensitive guiding and sealing surfaces on its outside diameter and care must be taken in its handling.
7. Locate the break between sections of the piston rings (key 18, figure 14), which should be out of seat ring retainer by holding the valve stem and seat ring retainer. Using an appropriate tool such as a flat-blade screwdriver, carefully pry out the piston rings from the grooves in the Bore Seal retainer.
8. By holding both valve stem and seat ring retainer, place the whole valve plug and stem assembly, seat ring retainer, Bore-seal trim set on a soft surface such as clean cloth, which will not damage the trim. The valve plug and stem assembly, seat ring retainer and Bore-seal will remain as a whole trim set. Do not rotate the valve plug and stem assembly within seat ring retainer. Do not apply any axial force into valve stem which might damage the Bore-seal.

9. Remove the seat ring (key 9, figure 14) and seat ring gasket (key 13, figure 14).
10. Inspect parts for wear or damage which would prevent proper operation of the valve. Replace or repair trim parts according to the following procedure for NPS 4 Bore-seal plug maintenance procedure.

Valve Plug Maintenance (Except NPS 4 Balanced Bore-seal Plug)

Except where indicated, NPS 2 key numbers are referenced in figure 6 or 12, NPS 3 key numbers are referenced in figure 7 or 13, and NPS 4 key numbers are referenced in figure 8.

Note

Due to the design requirement of this product, the valve and stem are precision-matched and the stem is not replaceable. If damaged, the valve plug and stem must be replaced as an assembly. Contact your [Emerson sales office](#) for parts replacement.

CAUTION

To avoid the valve plug seal ring (key 24) not sealing properly, be careful not to scratch the surfaces of the ring groove in the valve plug or any of the surfaces of the replacement ring.

Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem. Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and damage may result in service.

1. With the valve plug (key 2) removed according to the Disassembly portion of the Trim Maintenance procedure, proceed as appropriate:
2. **NPS 2 design for application up to and including 316°C (600°F) (figure 6):** Mark the orientation between valve plug (key 2) and seal retainer (key 4). Punch out the pin (key 8) that connects the valve plug (key 2), stem (key 7) and seal retainer (key 4). Remove the seal retainer (key 4) with a spanner wrench or strap wrench while counter-holding the valve plug (key 2) with a second strap wrench, or other suitable tool, to prevent rotation of the valve plug on the valve stem (key 7). Slide the upper anti-extrusion ring, seal ring, bi-directional back up ring, seal ring, and anti-extrusion ring (key 63, 24, and 33) off the plug.

Inspect all parts for defects and cleanliness and replace the damaged parts. The removed seal set soft parts should not be reused. To install the new seal parts, slide the lower anti-extrusion ring, seal ring, bi-directional back up ring, seal ring, and upper anti-extrusion ring (key 63, 24, and 33) into the plug, as shown in figure 6. Apply anti-seize lubricant (key 45) to the thread of the seal retainer and flat mating surfaces between the seal retainer and plug (key 2 and 4). Then, install the seal retainer (key 4) into the plug (key 2) and tighten it with a spanner wrench or strap wrench until the pin holes and previous mark are aligned. Once the holes are aligned, secure the seal retainer (key 4) to the plug stem assembly with a new pin (key 8). Make sure the pin is inserted completely into the assembly with 0.025" depth from the radial surface.

CAUTION

To avoid damaging the seal ring, slowly and gently stretch it for the following procedure. Avoid jerking sharply on the ring.

NPS 3 design for application up to and including 316°C (600°F) (figure 7): Remove the retainer ring (key 26) off the groove, and slide the back up ring, upper anti-extrusion ring, seal ring, bidirectional back up ring, seal ring, and anti-extrusion ring (key 63, 24, 25, and 33) off the plug.

Inspect all parts for defects and cleanliness and replace the damaged parts. The removed seal set soft parts should not be reused. To install the new seal parts, slide the lower anti-extrusion ring, seal ring, bi-directional back up ring,

seal ring, upper anti-extrusion ring, and back up ring (key 63, 24, 25, and 33) into the plug, as shown in figure 7, view B. Then install the retaining ring (key 26) by inserting one end in the groove and pressing the ring into the groove while turning the plug. Again, be careful not to scratch any surfaces of the ring or plug.

NPS 4 design for application up to and including 316°C (600°F) (figure 8): Using a punch, drive the pin (key 5) further into the pin hole, as shown in figure 9. To prevent damaging the outer diameter of the plug, use a face spanner wrench to unthread the seal retainer (key 4) from the plug (key 2) using the pin holes on the top surface of the seal retainer, as shown in figure 9. Once the seal retainer is unthreaded, slide the upper anti-extrusion ring, seal ring, bi-directional back up ring, seal ring, and anti-extrusion ring (key 63, 24, and 33) off the plug.

Inspect all parts for defects and cleanliness and replace the damaged parts. The removed seal set soft parts should not be reused. To install the new seal parts, slide the lower anti-extrusion ring, seal ring, bi-directional back up ring, seal ring, and upper anti-extrusion ring (key 63, 24, and 33) into the plug, as shown in figure 8, view B. Then, apply anti-seize lubricant (key 45) to the seal retainer threads and flat mating surfaces between the seal retainer and plug (key 2 and 4). Install the seal retainer into the plug (key 2 and 4) and tighten it with a spanner wrench until the pin holes are aligned. Retain the seal retainer (key 4) to the plug (key 2) by pinning a new pin (key 5) into one of the remaining pin holes with 0.025" depth from the surface. Do not insert the pin into a pin hole that was previously pinned, as shown in figure 9.

NPS 2 and 3 unbalanced design for application above 316°C (600°F) (figure 12 and 13): No seal is required for the unbalanced design. Inspect all parts for defects and cleanliness and replace the damaged parts.

NPS 4 Balanced Bore-seal Valve Plug Maintenance

Except where indicated, NPS 4 Balanced Bore-seal Valve Plug key numbers are referenced in figure 14. Contact your Emerson sales office for Bore Seal trim replacement.

Note

Due to the design requirement of this product, the valve and stem are precision-matched and the stem is not replaceable. If damaged, the valve plug and stem must be replaced as an assembly. The set of valve plug and stem assembly, seat ring retainer and Bore-seal is designed as a whole assembly trim set, which might need special tool and fixture to remove and install. Contact your [Emerson sales office](#) for parts replacement.

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance. Use caution when removing piston ring(s) and the Bore Seal plug seal to avoid scratching any sealing surface.

Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem. Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service.

Follow instructions carefully to avoid damaging the product surfaces, which could result in damage to the product. Protect all surfaces of the valve plug, valve seat ring, and seat ring retainer during maintenance to ensure control valve accuracy and choking performance is not affected.

1. With the whole valve plug and stem assembly, seat ring retainer and Bore-seal set (key 2, 4, 7, 8, 17) removed from valve body (key 1), pull the valve stem (key 7) to the top end of seat ring retainer (key 3) as shown in figure 15. Remove the two graphite piston rings (key 18, figure 14). To remove plug retainer for maintenance purpose, locate the staked thread on top of the valve plug (key 2) between the valve plug and plug retainer. The staked thread secures the retainer. Use a drill with a 1/8 inch bit to drill out the staked area of the thread. Drill approximately 1/8

inch into the metal to remove the staking. The seat ring retainer and valve plug should be protected during processing.

2. Loosen the plug retainer (key 4) with strap wrench or spanner wrench and remove plug retainer from the valve plug (key 2). Pull the plug retainer out of valve stem (key 7).
3. Remove the Bore-seal (key 17) without damaging the Bore-seal sealing surface and plug sealing surface.
4. Gently slide or push the plug and stem assembly (key 2, 7) into seat ring retainer (key 3) to move out from the seat ring retainer bottom end.
5. Inspect plug sealing surface. Replace valve plug and stem assembly, and seat ring retainer if wear or damage is found on the sealing, guiding and seat ring retainer window surfaces. Clean all parts if necessary to remove any buildup especially on the sealing, guiding and seat ring retainer window surfaces.
6. Gently slide the plug and stem assembly (key 7) back into seat ring retainer (key 3) from the seat ring retainer bottom end. Hold the seat ring retainer (key 3) and pull the valve stem (key 7) all the way up until there is metal to metal contact between valve plug and seat ring retainer. The two piston ring grooves on top of the plug retainer should stick out of the top of seat ring retainer. Coat new Bore-seal sealing surface and valve plug bore-seal groove sealing surface with high temperature grease. Place the new Bore-Seal plug seal over the top of the valve plug by hand. The Bore-seal opening should be oriented down into the valve plug as shown in view B on figure 14. Do not use uneven force to push the Bore-seal into the valve plug groove.
7. Coat thread of plug retainer (key 4) or valve plug (key 2) with anti-seize lubricant. Hand tighten the plug retainer into valve plug, which might push the Bore-seal into plug sealing groove. Use strap wrench to overcome extra thread friction to tighten plug retainer into valve plug until metal-to-metal contact between them. The Bore-seal will be pushed into the plug Bore-seal groove. To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance.
8. Pull the valve plug and stem assembly all the way to the top end of the seat ring retainer (key 3) and hold the valve plug and stem assembly so that the plug retainer (key 4) and bore seal are above the top of the seat ring retainer (as shown in Figure 15). Make sure the plug retainer is fully tightened onto the valve plug to ensure a metal-to-metal contact with the valve plug. Stake the thread between the valve plug and plug retainer in one place to deform the thread to secure the plug retainer to the valve plug.
9. The replacement piston rings will arrive in one piece. Use a vise with smooth or taped jaws to break this replacement piston rings into halves. Coat new piston ring surface and plug retainer grooves sealing surface with high temperature grease. Place piston rings into plug retainer therefore the openings of one piston ring would be 90° away from the other piston ring.
10. Gently slide the valve plug, plug retainer, stem, Bore-seal and piston rings assembly into seat ring retainer. Do not try to push the valve plug, plug retainer, stem, Bore-seal and piston rings assembly into seat ring retainer Bore-seal sealing surface, which might require extra actuator force. Do not rotate the valve stem end when the whole assembly is inside seat ring retainer. Set the whole trim set of valve plug, plug retainer, stem, seat ring retainer, Bore-seal and piston rings on a soft surface such as clean cloth, without any movement.

Assembly

Except where indicated, key numbers are referenced in figure 6, 7, 8, 12, 13, and 14.

1. Inspect all parts for damage and cleanliness; remove any burrs on metal valve components.
2. Place a gasket (key 13) into the valve body (key 1) where the seat ring flange seats. Then, insert the seat ring (key 9) into the valve body (key 1). The seat ring (key 9) end will protrude out from the valve body (key 1).
3. Assemble the plug stem assembly of each size into the valve body (key 1) as the following:
4. Inspect the sealing surface of the plug, stem, and seal assembly for nicks and scratches. Then, apply high temperature grease (key 46) sparingly around the spring-loaded seal ring (key 24) or piston rings. For unbalanced design, there is no seal in the valve plug (key 2). Apply high temperature grease (key 46) sparingly around the unbalanced plug guiding surface only.

No lubricant (key 46) should be applied on the balanced or unbalanced plug surfaces which would contact the flow fluid.

5. For NPS 2 and 3 balanced design, carefully insert the bottom end of plug stem seal assembly into the top of the seat ring retainer (key 3) through the inner bore as shown in figure 10. Make sure there is no damage done to the seals. Slide the plug stem seal assembly into the seat ring retainer (key 3) until the top of the plug stem seal assembly is even with the top of the seat ring retainer (key 3). At this point, the plug (key 2) should have a snug fit with the seal ring retainer (key 3).

For NPS 2 and 3 unbalanced design, carefully insert the bottom end of plug stem assembly into the top of the seat ring retainer (key 3) through the inner bore. Make sure there is no damage done to the seals. Slide the plug stem assembly into the seat ring retainer (key 3) until the top of the plug stem seal assembly is even with the top of the seat ring retainer (key 3).

For NPS 4 balanced design, except Bore-seal trim, carefully insert the top end of the plug stem seal assembly into the bottom of the seat ring retainer (key 3) through the inner bore. Ensure no damage is done to the seals, as shown in figure 11. Slide the plug stem seal assembly into the seat ring retainer (key 3) until the top of the plug stem seal assembly is even with the top of the seat ring retainer (key 3). At this point, the plug (key 2) should have a snug fit with the seat ring retainer (key 3).

For NPS 4 balanced design Bore-seal trim, the valve plug, stem, plug retainer, Bore-seal, piston rings assembly is in a whole trim set with seat ring retainer, which is ready for step 6. See the NPS 4 Balanced Bore-seal Valve Plug Maintenance section.

6. Hold on to the end of the stem (key 7) and seat ring retainer (key 3) and slowly insert them into the valve body (key 1), as shown in figures 6, 7, 8, 12, 13, and 14. Be cautious and do not swing the assemblies, as the seat ring retainer (key 3) may fall off. At the same time, ensure that the seat ring retainer (key 3) bottom diameter is guided properly to the seat ring (key 9) when installed into the valve body (key 1).
7. After the plug (key 2), stem (key 7, figure 3), and seat ring retainer (key 4) assembly is placed into valve body (key 1), ensure one of the seat ring retainer legs centerline aligns with the valve body inlet centerline and the previous orientation mark between valve body (key 1, figures 6, 7, 8, 12, 13, and 14) and seat ring retainer (key 3, figures 6, 7, 8, 12, 13, and 14) aligns with each other. Once the seat ring retainer is oriented, gently push the plug seating surface against the seat ring (key 9). Note the plug stem assembly is symmetrical, so no orientation is necessary.

For NPS 4 balanced design Bore-seal trim, do not try to push the valve plug, plug retainer, stem, Bore-seal and piston rings assembly very hard into seat ring retainer Bore-seal sealing surface might require extra actuator force. Wait until the valve stem is attached to actuator therefore the actuator could push the Bore-seal plug into Bore-seal sealing surface.

8. Identify the spiral wound gasket (key 12) quantity per figures 6, 7, 8, 12, 13, and 14. Slide quantity 1 spiral wound gasket (key 12) per figures 6, 7, and 8, or quantity 3 spiral wound gaskets (key 12, figures 12, 13, and 14) and quantity 1 flat sheet gasket (key 10) over the seat ring retainer (key 3). Make sure the bottom of the gasket is flush with the mating surface on the seat ring retainer shoulder.
9. Coat the bonnet studs (key 15) with anti-seize lubricant (key 45) up to the deformed thread. Thread the studs into the valve body (key 1) by hand until the deformed thread prevents further insertion.
10. If no bonnet spacer is required for the construction, skip this step and go to step 11. Slide the bonnet spacer (key 32) onto the flat sheet gasket (key 10) over the seat ring retainer (key 3). Then, slide another flat sheet gasket (key 10) onto the bonnet spacer (key 32) over the seat ring retainer (key 3).
11. Mount the bonnet on the valve body and complete the assembly according to steps 10 through 14 of the packing replacement procedure.
12. Attach valve to actuator by securing the actuator yoke to valve bonnet with yoke locknut (key 15, figure 3, 4, or 5), and connecting valve stem to actuator stem connector per actuator instruction manual. Make sure the actuator stem and the valve stem are aligned with each other before connecting.

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CAUTION

Do not force the actuator to stroke the valve stem if actuator stem and valve stem are misaligned with each other, which might damage the valve trim and packing. Contact your [Emerson sales office](#) for further troubleshooting assistance.

Parts Ordering

Each body-bonnet assembly is assigned a serial number which can be found on the valve body. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and to the eleven-character part number for each part required from the following parts kit or parts list information.

CAUTION

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Standard Packing Repair/Retrofit Kits

Table 4. Standard Packing Repair/Retrofit Kits

Stem Diameter mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (1/2) 71 (2-13/16)
Double PTFE (Contains keys 12, 6, 8, 11, and 218)	RPACKX00662
Graphite Leak-off Packing (Contains keys 7, 8, and 11)	RPACKX00722
Graphite Leak-off Packing (Contains keys 4, 5, 7, 8, 11, and 13)	RPACKXRTA22
ENVIRO-SEAL Graphite ULF (Contains keys 207, 208, 209, 210, 211, 214, and 217)	RPACKXRTA32
ENVIRO-SEAL Graphite ULF (Contains keys 200, 201, 207, 208, 209, 210, 211, 212, 214, and 217)	RPACKXRTA42

Gasket Kits

Table 5. Gasket Kits

Valve Size, NPS	Application	Key Numbers	Kits
2	<600°F	10, 12, 13	RGASKETXF82
	>600°F	10, 12, 13	RGASKETXG82
3	<600°F	10, 12, 13	RGASKETXF92
	>600°F	10, 12, 13	RGASKETXG92
4	<600°F	10, 12, 13	RGASKETXG12
	>600°F	10, 12, 13	RGASKETXH02

Table 6. Gasket Descriptions

Key Number	Description	Materials
10	Bonnet Gasket	Graphite/ S31600
12	Spiral-Wound Gasket	N06600/ Graphite
13	Seat Ring Gasket	Graphite/ S31600

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Seal Ring Kits

Table 7. Seal Ring Kits

Valve Size	Port Size	Design	Application	Key Numbers	Kits
NPS 2	1.50	Balanced	≤600°F	8, 63, 24, 33	RSEALX00262
	1.00	Unbalanced	>600°F	Not Applicable	Not Applicable
	1.60	Unbalanced	>600°F	Not Applicable	Not Applicable
NPS 3	2.25	Balanced	≤600°F	26, 25, 63, 24, 33	RSEALX00272
	2.25	Unbalanced	>600°F	Not Applicable	Not Applicable
NPS 4	3.10	Balanced, PTFE seal ring with anti-extrusion ring	≤600°F	5, 63, 24, 33	RSEALX00282
	3.10	Balanced, Bore-Seal	>600°F	17, 18	RSEALX00292

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Bonnet Assembly (figures 3, 4 and 5)

Key	Description	
1	Bonnet	
3	Packing Flange	
4	Packing Stud	
5	Packing Nut	
6	Packing Set	See Parts Kits
7	Packing Ring	See Parts Kits
8	Lantern Ring	See Parts Kits
11	Packing Box Ring	See Parts Kits
12	Upper Wiper	See Parts Kits
13	Packing Follower	
14	Pipe Plug	
15	Yoke Locknut	
34	Lubricant, anti-seize	
37	Warning tag	
200	Packing Studs	
201	Packing Flange	
207	Guide Bushing	
208	Guide Bushing	
209	Packing Ring (qty 2 req'd)	12B5799X012
210	Packing Ring (qty 2 req'd)	14B7498X012
211	Packing Box Ring	
214	Packing Washer	
217	Spring Pack Assembly	
218	Lower Wiper	See Parts Kits

Recommended Spare Trim Parts

All designs except NPS 4 Bore-Seal design: Seat Ring Retainer (key 3) and Seat Ring (key 9)

NPS 4 Bore-Seal design: Seat Ring (key 9)

Recommended Spare Trim Parts Assembly

Balanced Plug/Stem/Seal Assembly for Applications Up to and Including 316°C (600°F)

NPS 2: Includes key 2, 4, 7, 8, 24 (qty 2), 63 (qty 2), and 33

NPS 3: Includes key 2, 7, 8, 24 (qty 2), 63 (qty 2), 33, 25, and 26

NPS 4: Includes key 2, 4, 5, 7, 8, 24 (qty 2), 63 (qty 2), and 33

Valve Assembly (figures 6, 7, 8, 12, 13, and 14)

Key	Description	
1	Valve Body	
2	Plug	
3	Seat Ring Retainer	
4	Plug Retainer	
5	Groove Pin, Nameplate	
6	Flow Direction Arrow	
7	Valve Stem	
8	Groove pin	
9	Seat Ring	
10	Bonnet Gasket	See Parts Kits
11	Drive Screw	
12	Spiral-wound Gasket	See Parts Kits
13	Seat Ring Gasket	See Parts Kits
14	Lead Seal and Wire	
15	Bonnet Stud	
16	Bonnet Nut	
17	Bore-seal	
18	Piston Ring	
24	Spring Load Seal Ring	See Parts Kits
25	Backup Ring	See Parts Kits
26	Retaining Ring	See Parts Kits
32	Bonnet Spacer	
33	Bi-directional Ring	See Parts Kits
45	Lubricant, anti-seize	
46	High temperature grease	
63	PEEK Anti-extrusion Ring	See Parts Kits

Recommended Spare Packing, Gasket and Seal Ring Kits

See table 4, 5, and 7

Un-Balanced Plug/Stem Assembly for Applications Above 316°C (600°F)

NPS 2: Includes key 2, 7, and 8

NPS 3: Includes key 2, 7, and 8

Balanced NPS 4 Bore-Seal Plug/Plug Retainer/Stem Assembly, Seat Ring Retainer and Seal set for Applications Above 316°C (600°F)

NPS 4: Includes key 2, 3, 4, 7, 8, 17, and 18 (qty 2)

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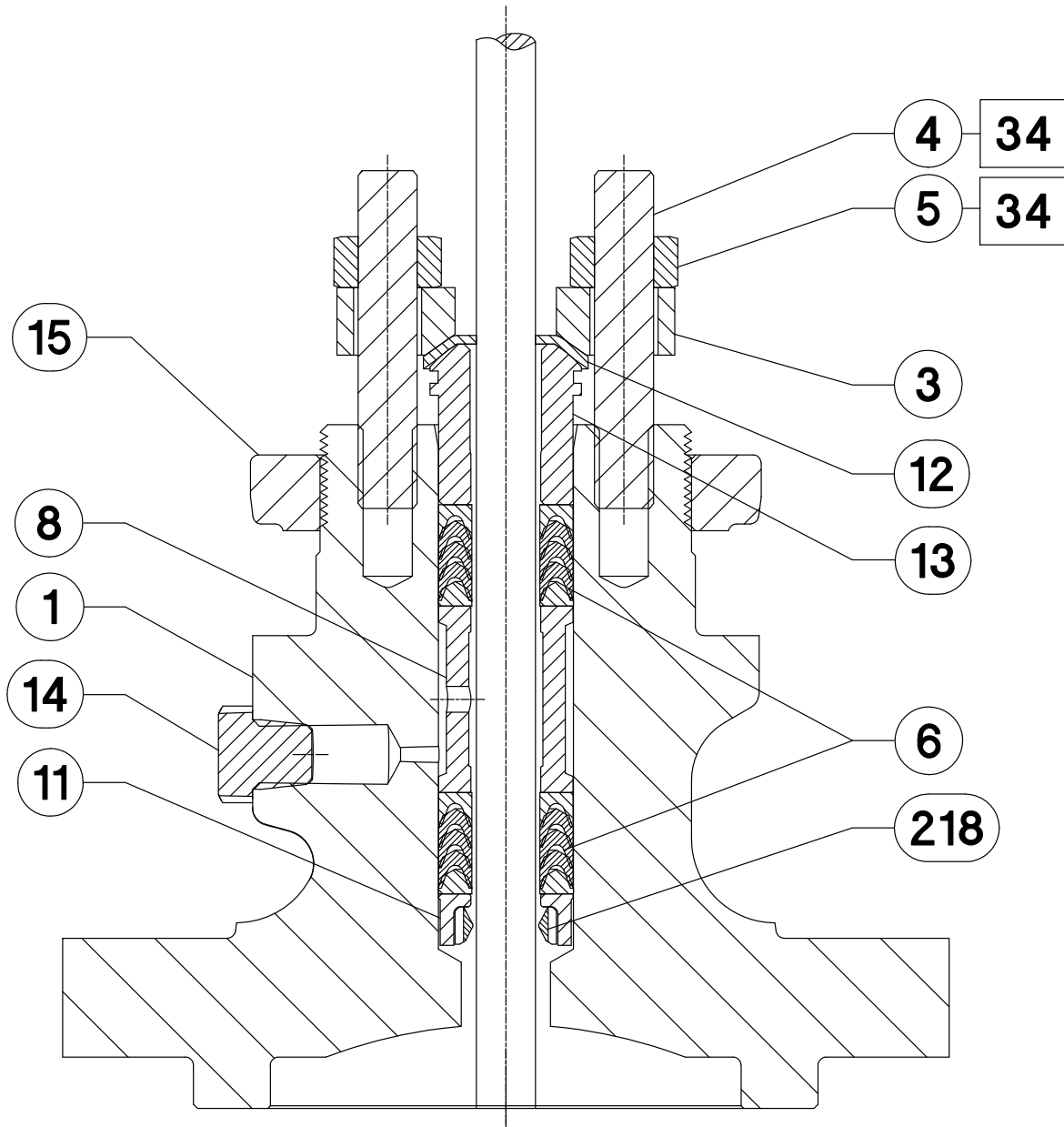
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Figure 3. Bonnet and Single PTFE Packing Arrangements with Key Numbers



☐ APPLY LUB/SEALANT

NOTE: KEY 14 PIPE PLUG IS NOT APPLICABLE FOR OPTIONAL NON-TAPPED BONNET.

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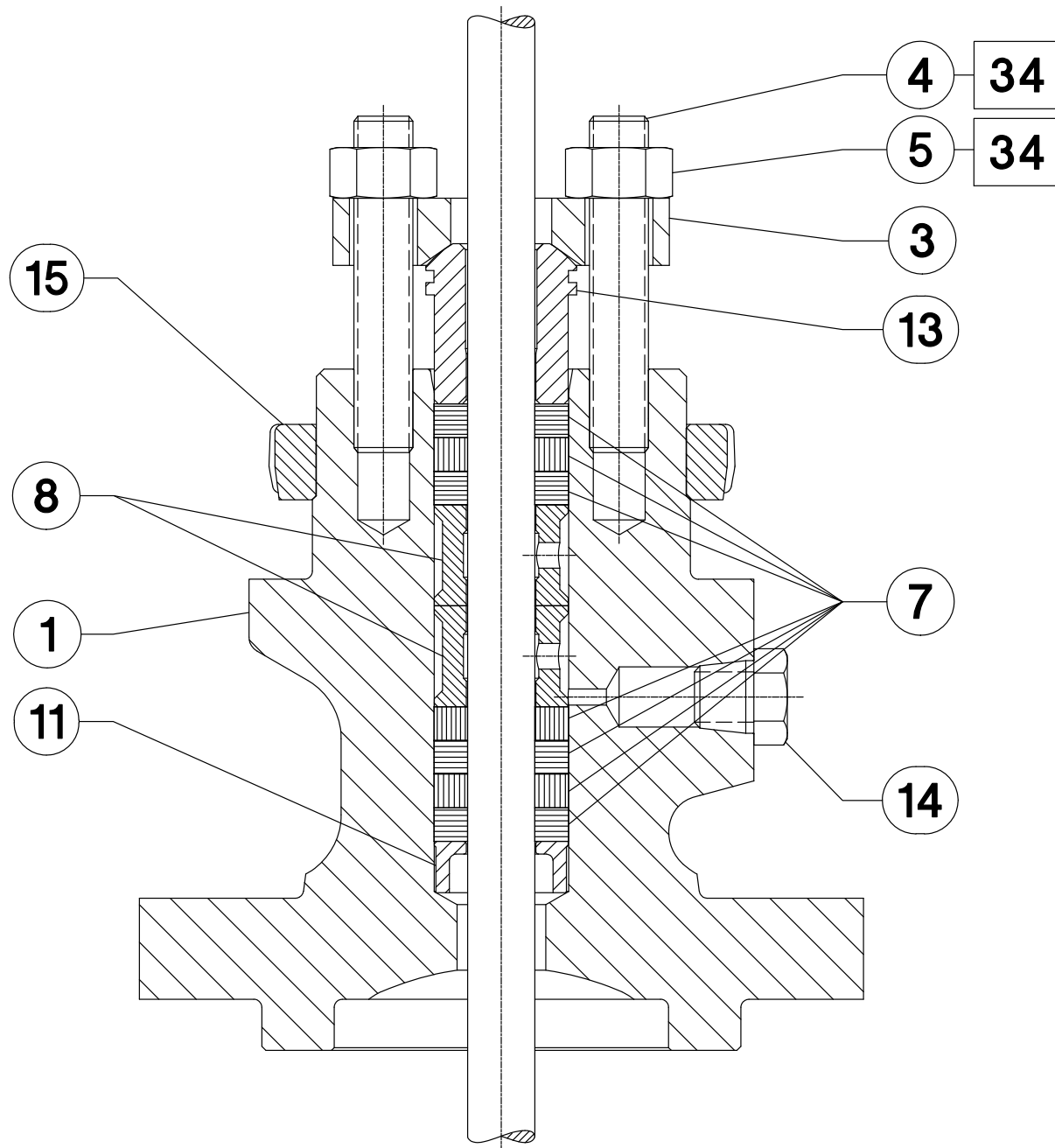
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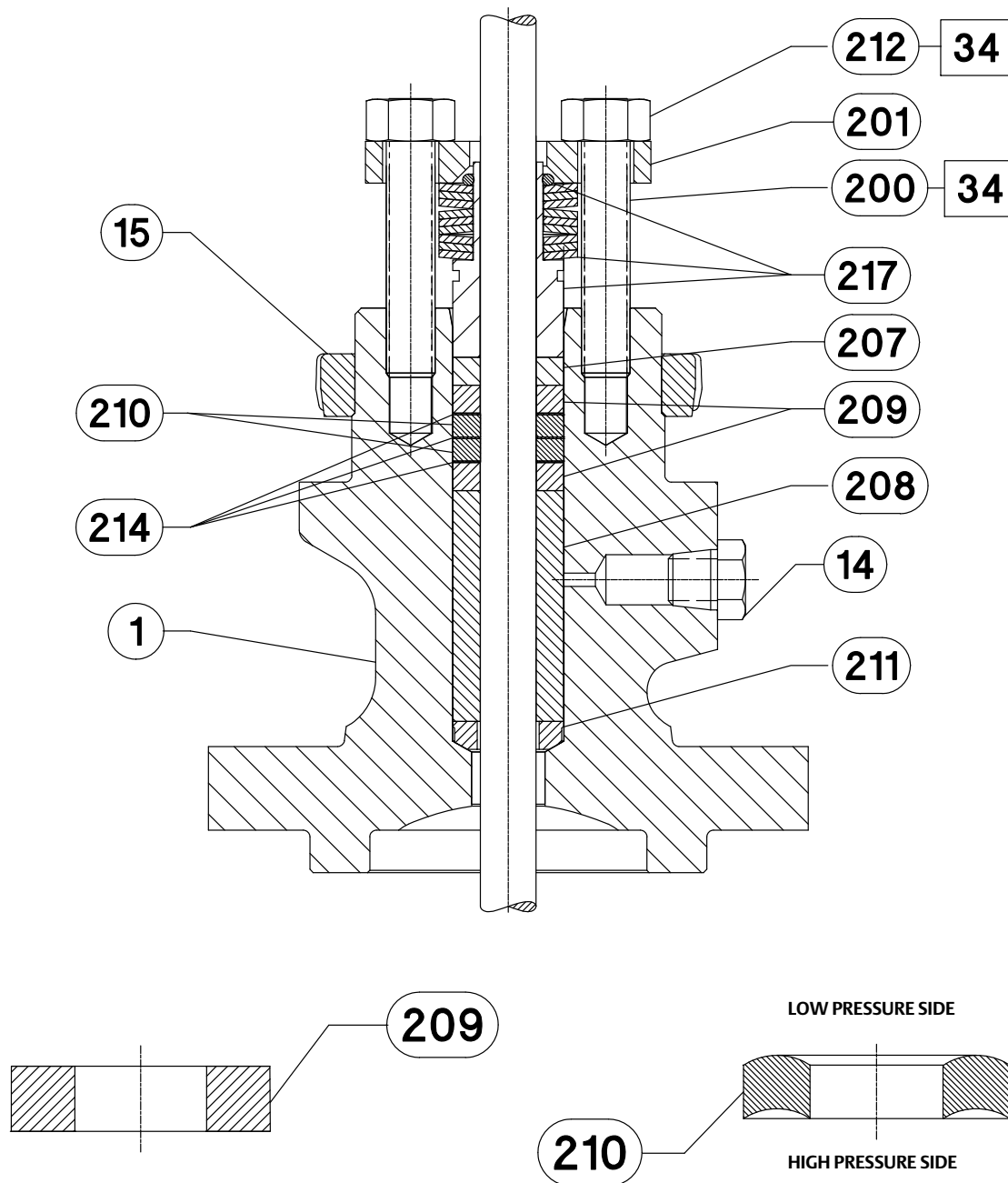
Figure 4. Bonnet and Graphite Leak-Off Packing Arrangements with Key Numbers



☐ APPLY LUB/SEALANT

NOTE: KEY 14 PIPE PLUG IS NOT APPLICABLE FOR OPTIONAL NON-TAPPED BONNET.

Figure 5. Bonnet and Enviro-Seal Graphite ULF Packing Arrangement with Key Numbers



☐ APPLY LUB/SEALANT

NOTE: PARTS SHOULD BE IDENTIFIED BY PART NUMBER OR SHAPE AS SHOWN BEFORE INSTALLATION. KEY 210 SHOULD BE INSTALLED WITH ITS CONCAVE SURFACE FACING TO THE HIGH PRESSURE SIDE AS SHOWN. KEY 14 PIPE PLUG IS NOT APPLICABLE FOR OPTIONAL NON-TAPPED BONNET.

Figure 6. NPS 2 Balanced CCV-N Valve Assembly with Key Numbers for Application
Up to and Including 316°C (600°F)

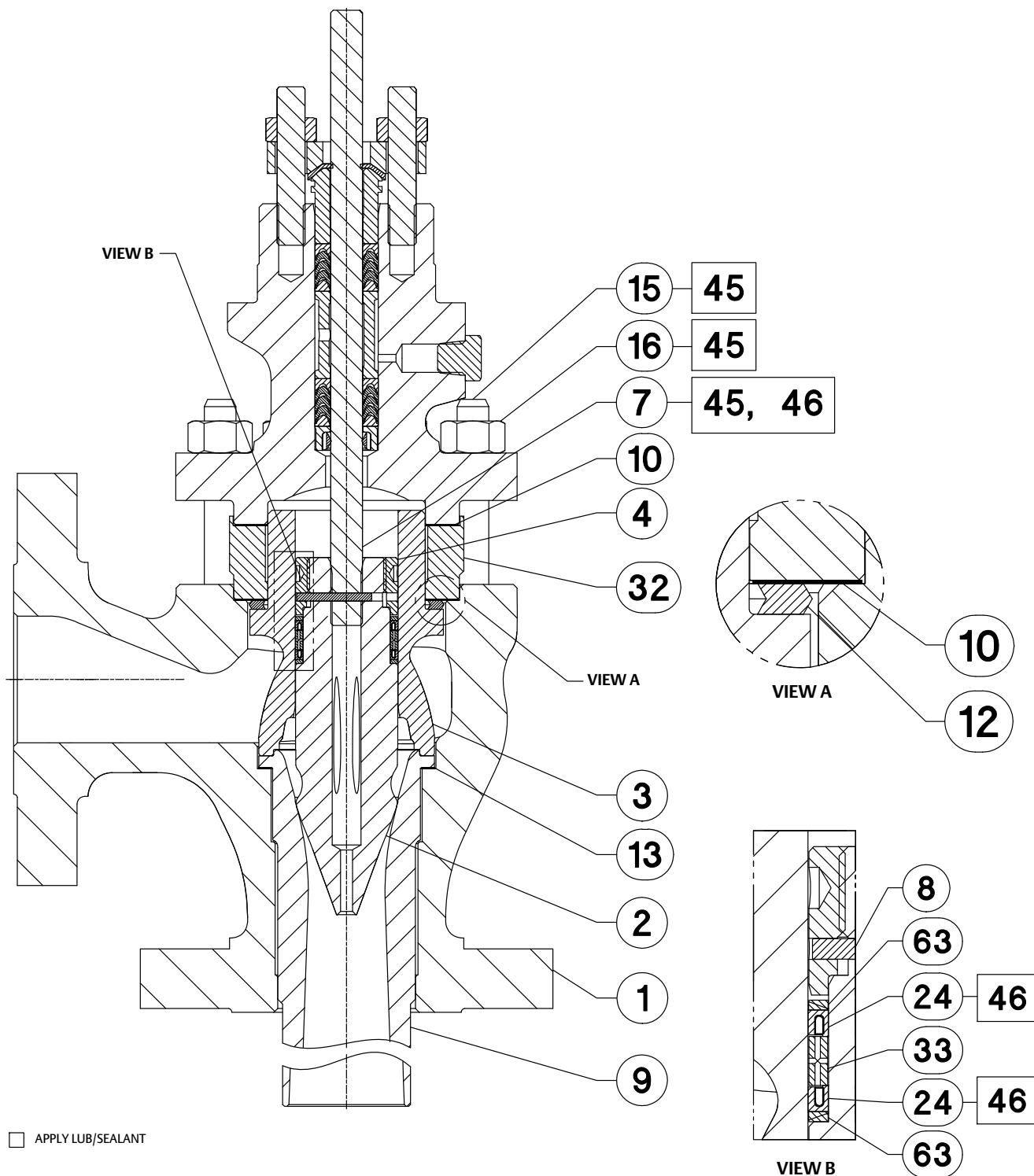


Figure 7. NPS 3 Balanced CCV-N Valve Assembly with Key Numbers for Applications
Up to and Including 316°C (600°F)

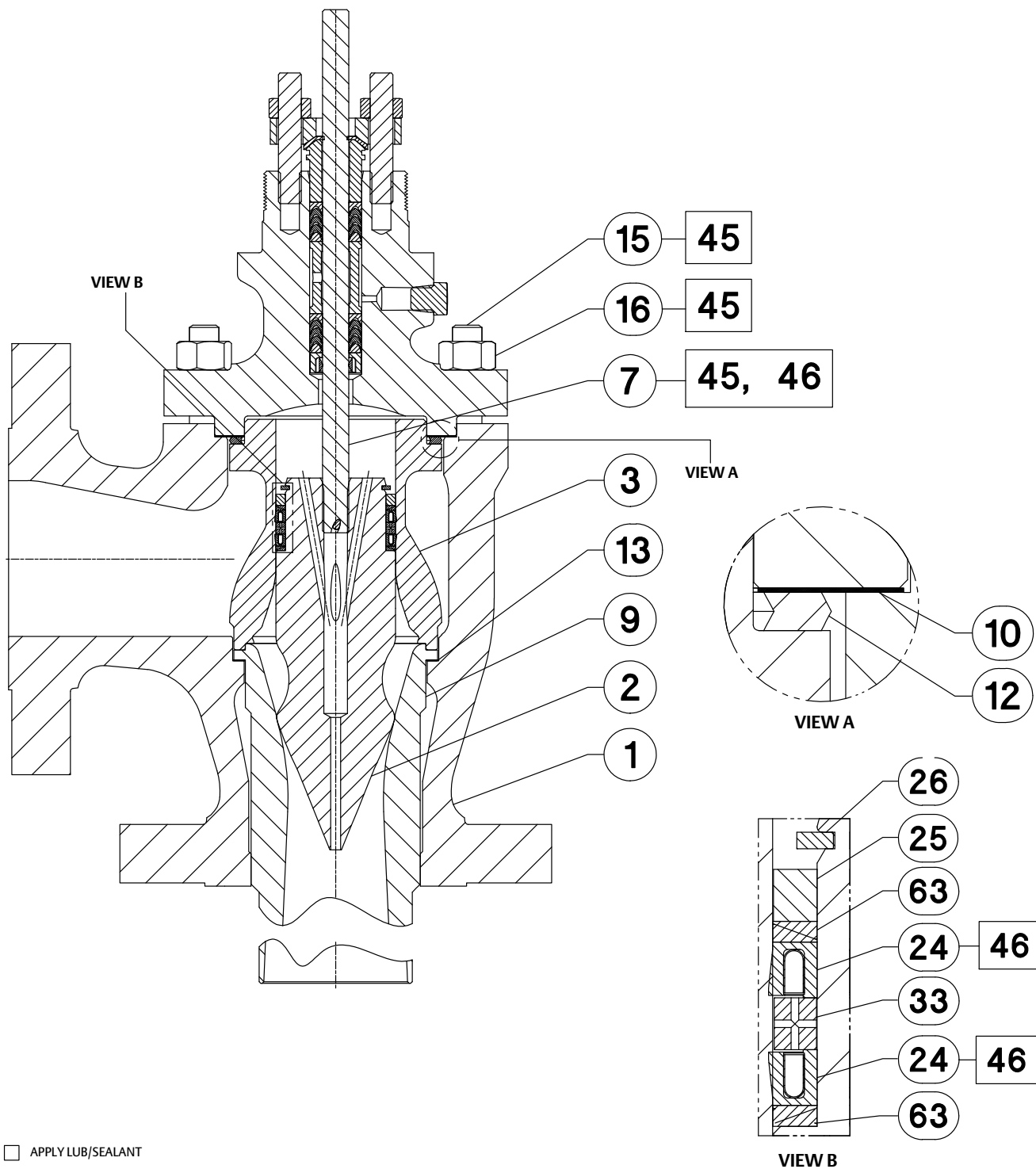


Figure 8. NPS 4 Balanced CCV-N Valve Assembly with Key Numbers for Applications Up to and Including 316°C (600°F)

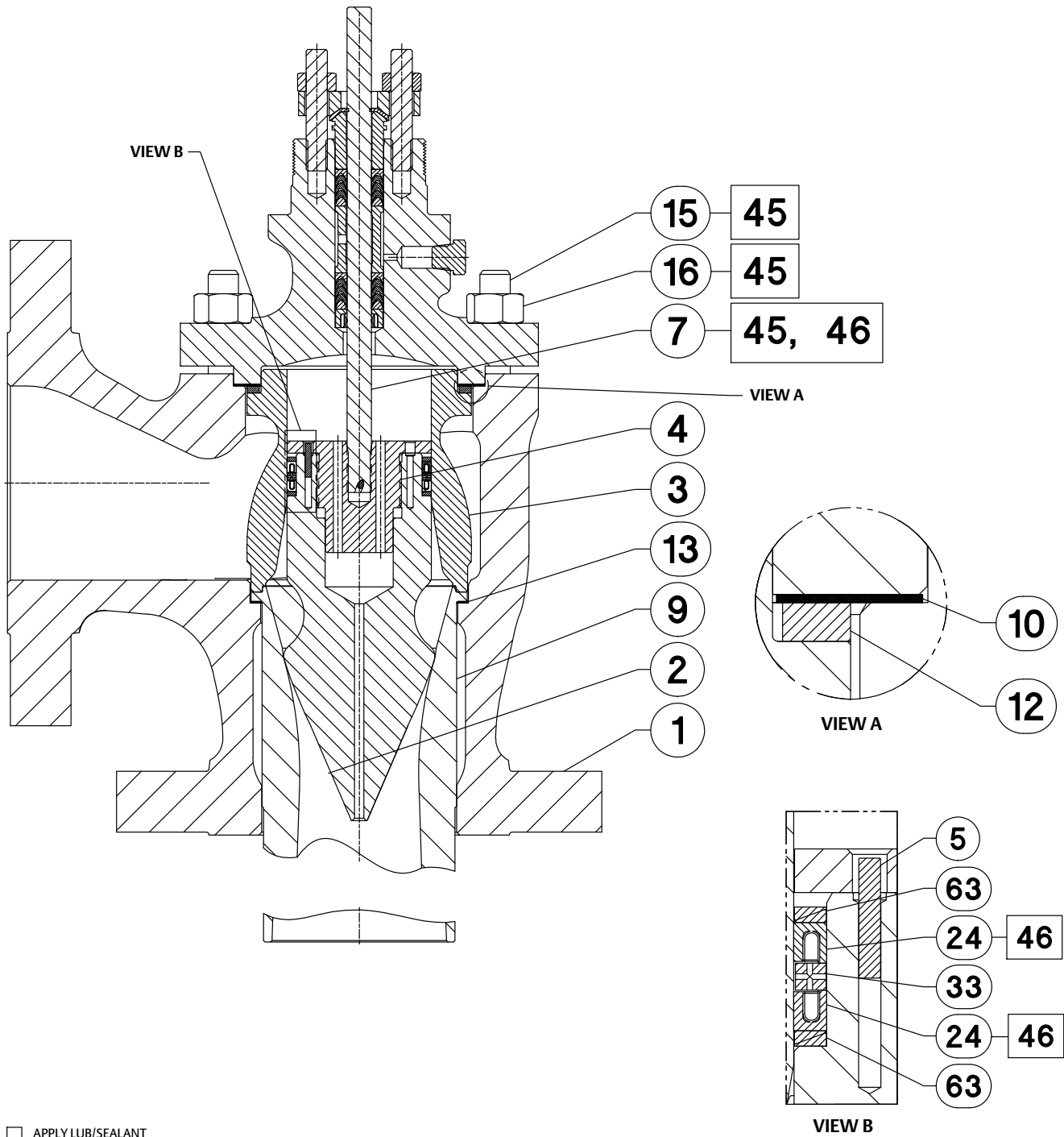


Figure 9. Non-Bore-Seal NPS 4 CCV-N Maintenance for Application Up to and Including 316°C (600°F)

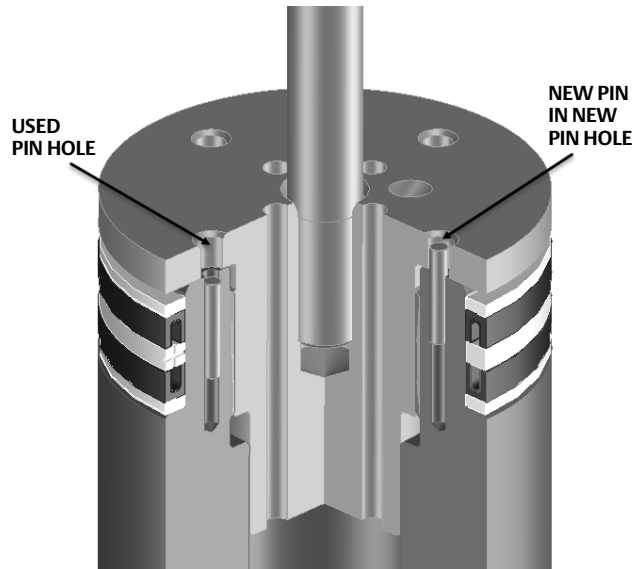


Figure 10. CCV-N NPS 2 and 3 Assembly —
Insert of Plug Stem Seal Assembly through the Top of the Seat Ring Retainer

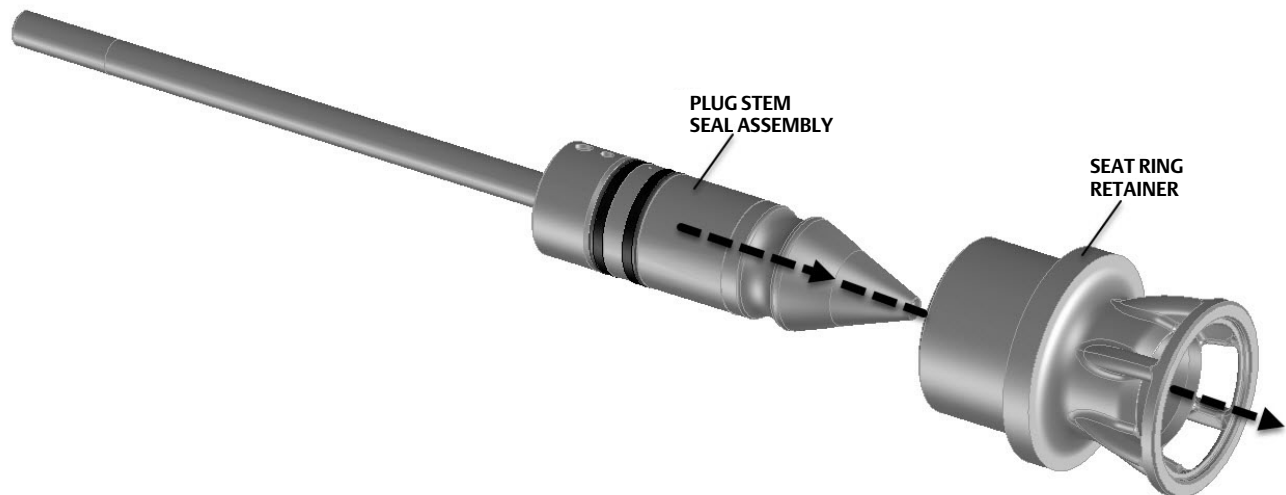


Figure 11. CCV-N NPS 4 Assembly for Application Up to and Including 316°C (600°F) (Except Bore-Seal Trim) — Insert of Plug Stem Seal Assembly through the Bottom of the Seat Ring Retainer



Figure 12. NPS 2 Unbalanced CCV-N Valve Assembly with Key Numbers for Applications Above 316°C (600°F)

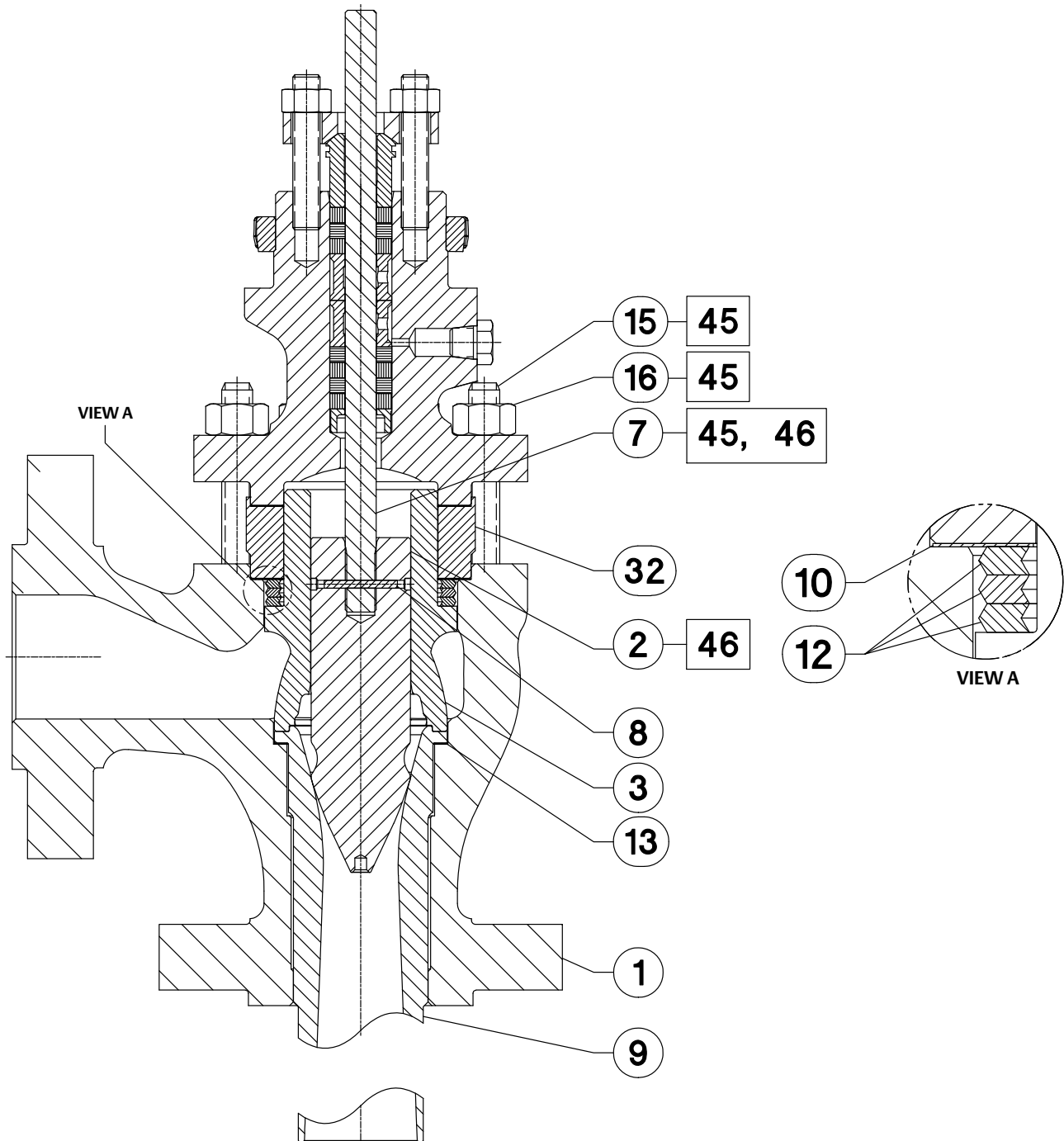


Figure 13. NPS 3 Unbalanced CCV-N Valve Assembly with Key Numbers for Applications Above 316°C (600°F)

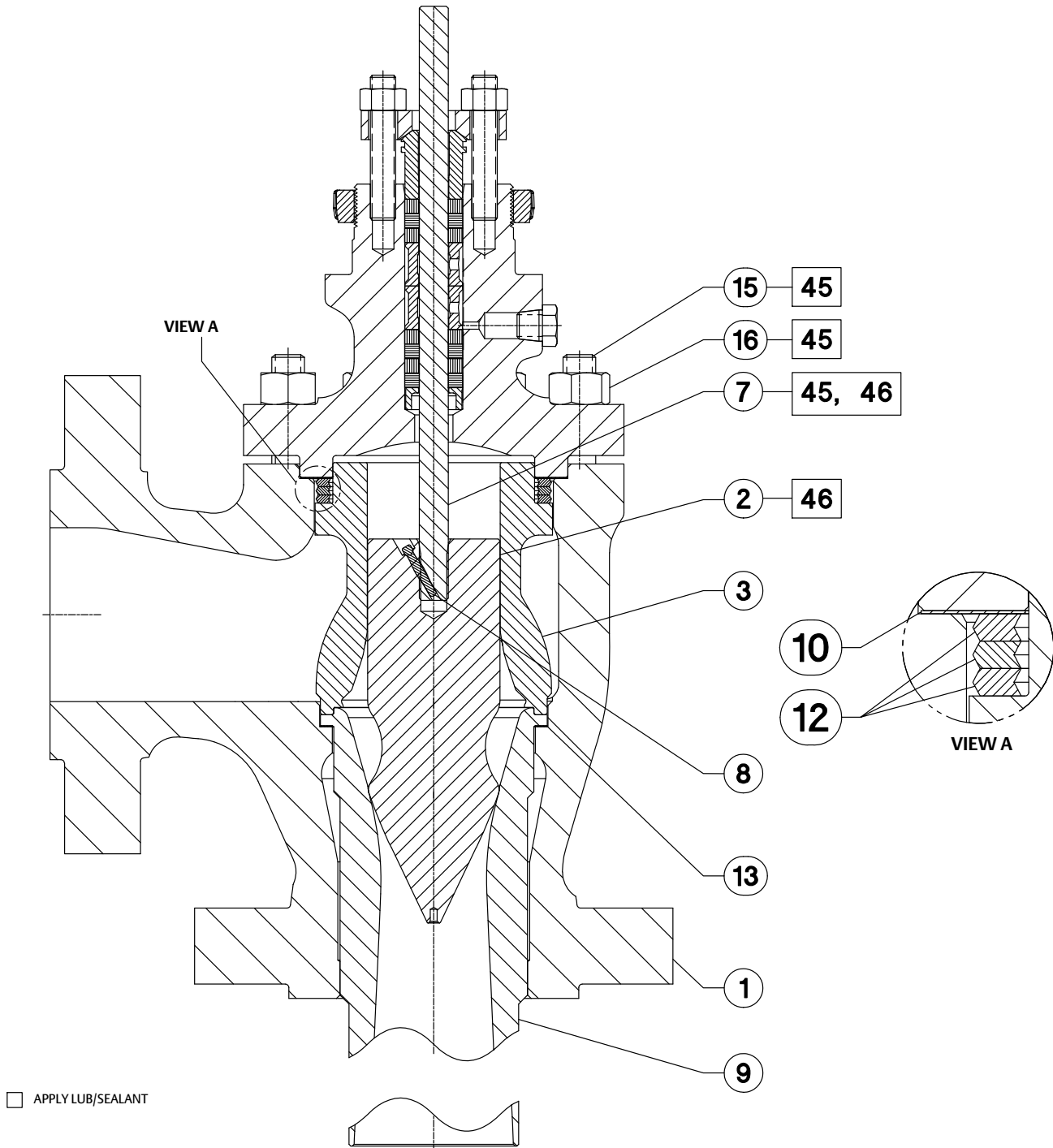


Figure 14. NPS 4 Balanced Bore-Seal Design CCV-N Valve Assembly with Key Numbers for Applications Above 316°C (600°F)

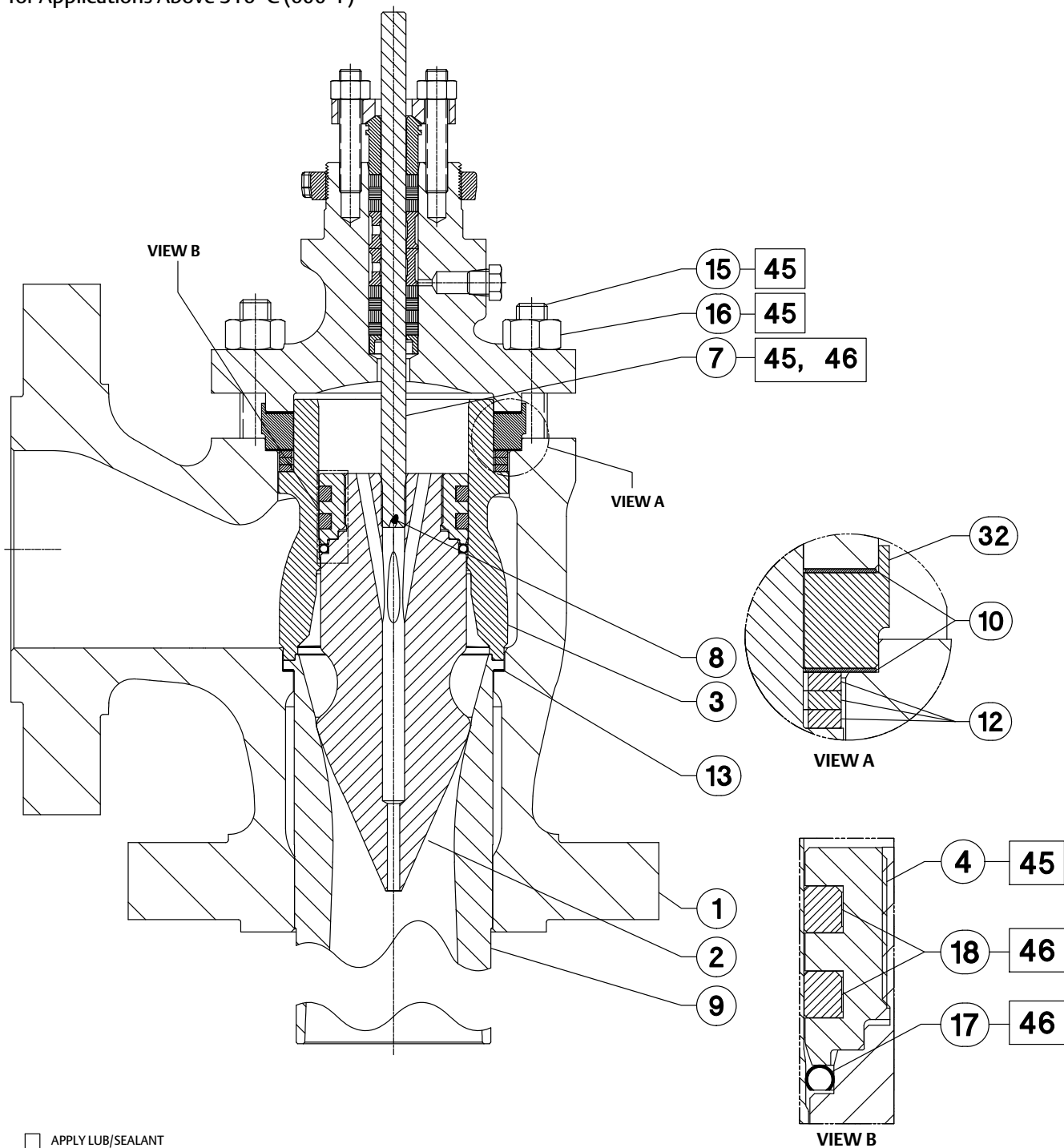
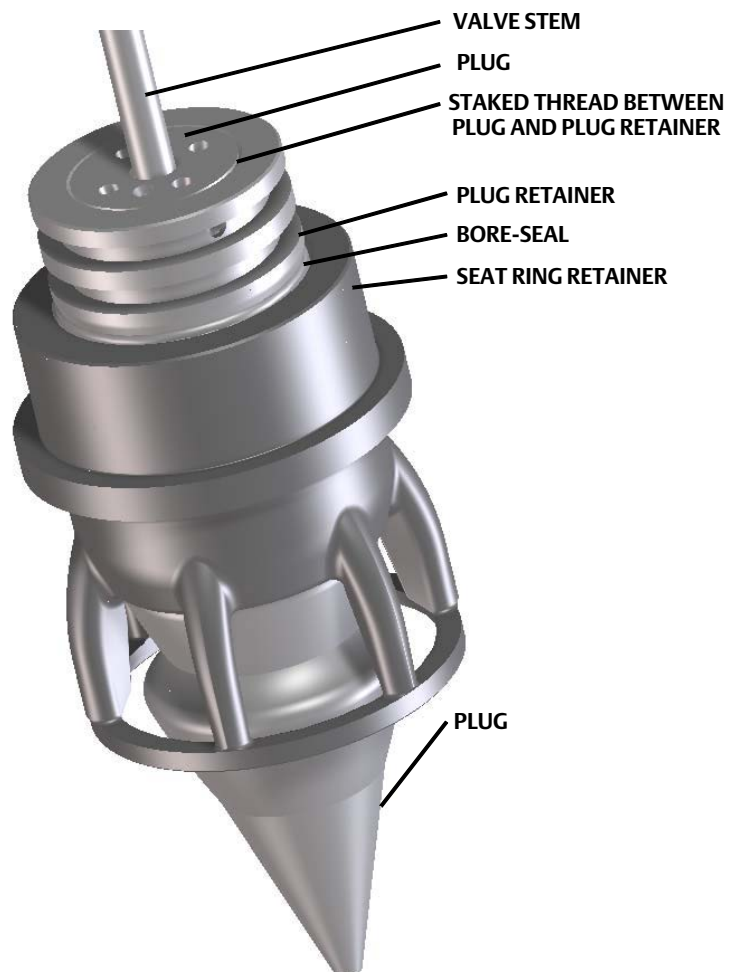


Figure 15. NPS 4 Balanced Bore-Seal CCV-N Trim Maintenance — Pull the Valve Plug and Stem Assembly to the Top of the Seat Ring Retainer



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

CCV-N Valve

October 2018

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CML Electronic Actuator for Baumann™ 24000 Series

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Figure 1. Baumann 24000CVF Valve with
CML-250 Electric Actuator



Introduction

CML electric actuators (figure 1) provide high accuracy for industrial temperature, HVAC, and sanitary applications with Baumann sliding-stem control valves.

Scope of Manual

This instruction manual includes installation information for CML electric actuators.

Do not install, operate, or maintain CML electric actuators without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Actuator Specifications

Table 1. CML Actuator Specifications

ACTUATOR	CML-250	CML-750
ACTUATOR HOUSING	Cast Aluminum	
ENVIRONMENTAL RATINGS	FM, CSA, ATEX, IEC	
OPTIONAL RATINGS	FM, CSA, ATEX, IEC	
STANDARD ENCLOSURE	FM NEMA 4 and 6 / IP67 Class 1 Div 1 Gr C, D Class II Div I E, F, G	
STANDARD TEMPERATURE RATING	-30°C to +70°C (-22°F to +158°F)	
HAZAROUS AREA TEMPERATURE RANGE	-20°C to +65°C (-4°F to +150°F)	
CONDUIT CONNECTION	3/4" - 14 NPT (M25 x 1.50p optional)	
MOTOR TYPE	Brushless DC	
OPTIONAL VOLTAGES	120VAC, 240VAC, 24VDC ⁽¹⁾	
STANDARD POWER	120VAC/240VAC	
THRUST RATING	250 lbs Mod/Run (1112.1 N) 375 lbs Seating (1668.1 N)	750 lbs Mod/Run (3336.2 N) 1125 lbs Seating (5004.2 N)
THRUST ADJUSTABILITY	60% - 150% Rated Thrust	
MAX SPEED	0.13 in/sec ⁽²⁾	
STANDARD CONTROL	Full range 4-20mA / Split Range 4/12 or 12-20mA **optional: 0-5Vdc and 0-10Vdc	
STANDARD FEEDBACK	4-20mA loop powered feedback ⁽³⁾	
STANDARD CONTROL OPTIONS (SPECIAL)	Discrete On/Off RIRO [24VDC or 120VAC control], HART, Foundation Fieldbus, DeviceNet, Profibus, Modbus, Pakscan	
HMI/GUI SETUP	LCD - text	
MODULATING DUTY CYCLE	Unrestricted and Continuous	
RESOLUTION	0.2% (adjustable deadband 0 - 10% of analogue signal)	
SENSITIVITY	0.2%	
RESPONSE TIME	20 milliseconds	
STANDARD FAILURE ACTION	Close valve / Open valve / Hold-in-Place / Fail to Position on loss of input signal (selectable). Holds in place on power failure (standard)	
CUSTOMER SETTINGS SAVED	Yes, Standard	
WEIGHT (ACTUATOR ONLY)	8.3 kg (18.4 lbs)	11.5 kg (25.4 lbs)
POWER BACK-UP OPTION	Available: Super Capacitors. Fail to Position on Loss of Power. Adjustable to Fail Closed, Fail Open, Fail to Position, Fail in Place	
LOWER CONTROL OPTION	Available: Separate option. Local controls come standard with Super Capacitor Power Back-up	

1. 24VAC not available.
2. Adjustable from 50 to 100%.
3. Includes 2 adjustable relay outputs.

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure or bursting of pressure retaining parts may result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

This actuator is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressures and temperatures to the actuator could result in parts damage, malfunction of the actuator or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact your [Emerson sales office](#) for more complete specifications. Provide the product serial numbers (shown on the nameplate) and all other pertinent information.

⚠ WARNING

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem.

Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve, take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequate sized hoists and chains or slings to handle the valve.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

Educational Services

For information on available courses for CML electric actuators, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Maintenance

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

It is recommended that you review figure 2 before performing maintenance or installation of the CML electric actuator.

Recommended Installation Location

It is permissible to install the CML actuator upright or horizontally. Allow 12 inches of clearance for removal of the actuator. Do not install with the actuator below the pipe.

CAUTION

To avoid equipment damage, do not install the valve with the stem in a downward position. Equipment damage may occur from liquids leaking into the actuator cover.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104302X012

CML Electric Actuator

January 2019

Figure 2. CML Actuator Components

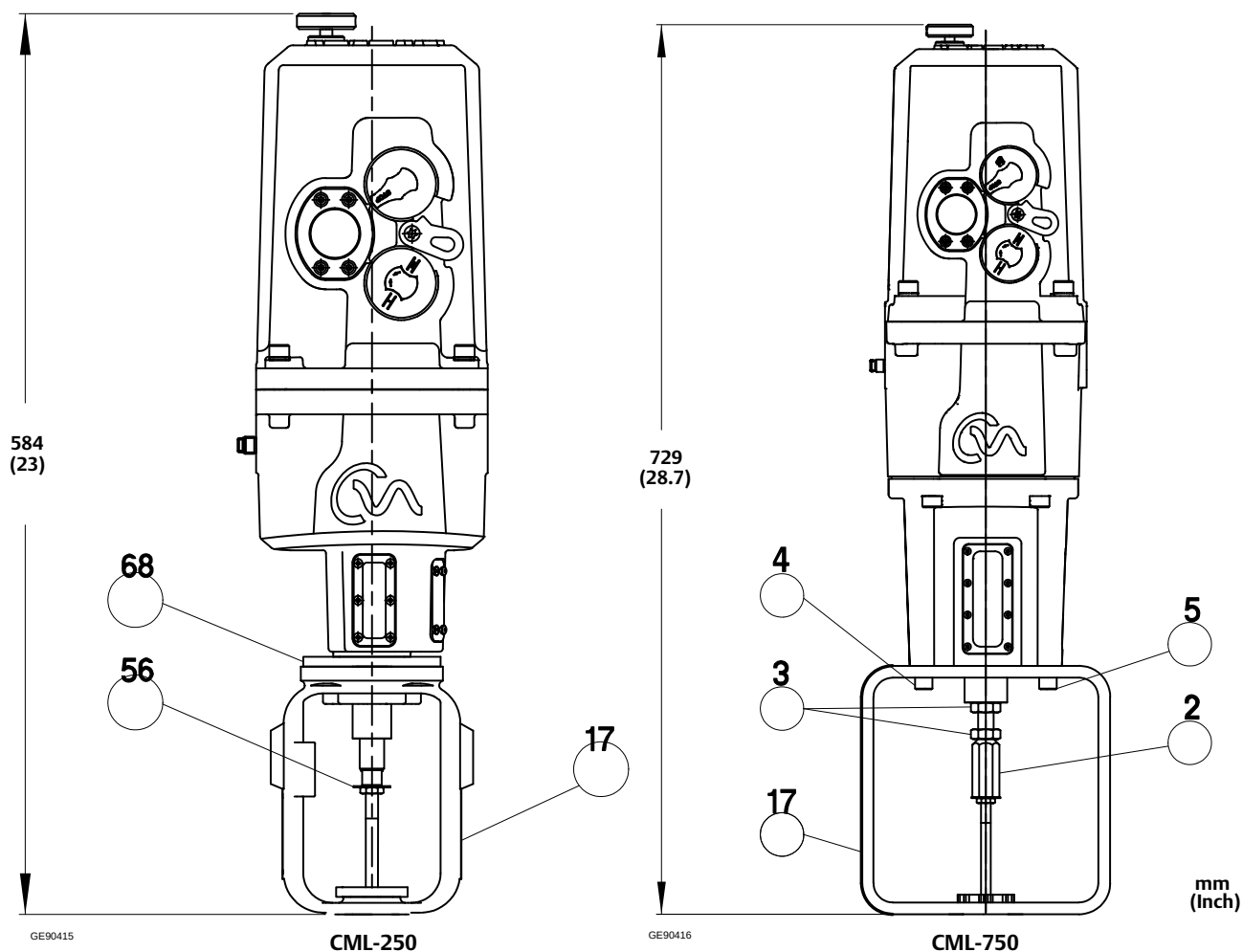


Table 2. CML Mounting Parts List

Key No.	Description	Qty	CML 250	CML 750
			Part Number	Part Number
--	Actuator	1	Consult your Emerson sales office	
2	Stem Adaptor	1	NA	GE87952X022
3	Nut	2	NA	24334-1
4	Lock Washer	4	NA	20075
5	Cap Screw	4	NA	82813
17	Actuator Yoke	1	24184-3B	GE87978X022
56	Travel Scale	1	983674-001-250	NA
68	Spacer	1	24186	GE79905X012

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

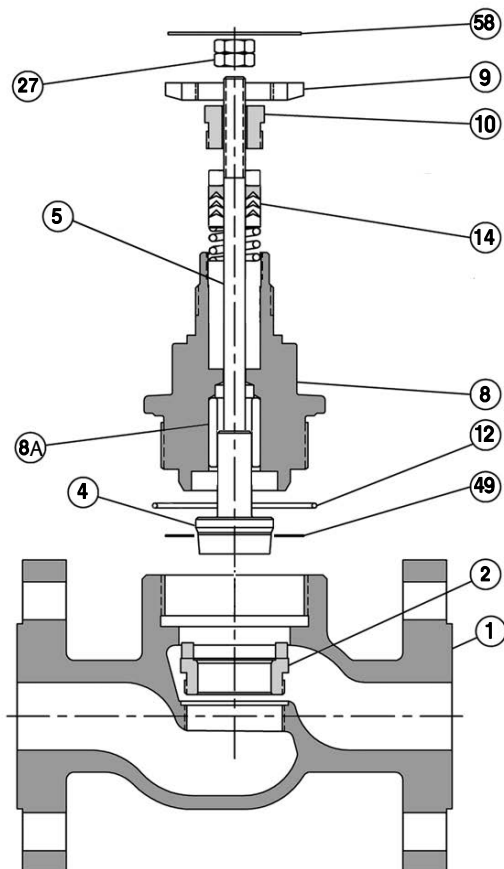
CML Electric Actuator

January 2019

Instruction Manual

D104302X012

Figure 3. Typical Baumann Valve Components



E1239

Table 3. Common Valve Parts

Key Number	Description
1	Valve Body
2	Seat Ring
4	Plug
5	Stem
8	Bonnet
8A	Bonnet Bushing
9	Drive Nut
10	Packing Follower
12	O-Ring
14	Packing
27	Lock Nuts
49	Body Gasket
58	Travel Indicator

Installation

See table 2 for actuator parts/key numbers referenced in this Installation section. See table 3 and also refer to the appropriate Baumann valve instruction manual for valve parts referenced.

1. Before starting, ensure you have the correct actuator part number and locate the parts listed in table 2. Refer to the assembly instructions for the appropriate Baumann control valve for parts identification.
2. Place the valve body (key 1) in a vise. Clamp the flat end faces of the valve. DO NOT CLAMP THE SIDES OF THE VALVE. This may distort the shape of the casting and ruin the valve.
3. Push the valve stem (key 5) to the closed position. Install the two lock nuts (key 27) onto the stem (key 25).
4. Slowly lower the actuator down on the valve body (key 1). As the yoke (key 17) passes over the end of the valve stem (key 5), place the yoke drive nut (key 9) over the valve stem (key 5).
5. Screw the yoke drive nut (key 9) on to the bonnet (key 8) and tighten.
6. Place travel indicator disc (key 58) onto the valve stem (key 5).
7. For CML 750: Skip to step 10.
8. For CML 250: Remove the drive nut (supplied with actuator) from the base of the actuator and set the upper drive nut over the valve stem (key 5).
9. Place the spacer (key 68) on top of the actuator yoke (key 17) over the opening.
10. Set the actuator on top of the actuator yoke (key 17) and prepare for mounting
11. Lift the valve stem (key 5) with the travel indicator (key 58) and hold it. Spin the actuator onto top of the yoke (key 17) to screw the actuator stem onto the valve stem (key 5) by 9 full turns. The actuator should be facing forward when engagement is complete.

For the CML750 align the four bolt holes in the yoke (key 17) with the bolt holes in the actuator with the actuator facing forward.

12. For the CML 250 tighten the upper lock nut (supplied with actuator) on the actuator thread.

For the CML750 install the 4 cap screws (key 5) and tighten to 20 ft•lbs.

13. Raise the top lock nut (key 27) and lock travel indicator (key 58) on top. Then raise the lower lock nut (key 27) and lock in place to secure travel indicator (key 58) tight against the actuator stem.

Additional Calibration and Setup

Additional calibration and setup information is available:

- CMA Installation and Maintenance Manual ([PUB094-009](#))
- CMA Range Quick Start Guide ([PUB094-007](#))

Parts Ordering

Contact your [Emerson sales office](#) about this equipment.

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Fisher™ 1B and 1BR Constant-Pressure Pump Governor Actuators

Figure 1. Fisher 1B Actuator on Direct-Acting easy-e™ Valve



W2232-1

Introduction

Scope of Manual

This instruction manual provides information on installation, adjustment, maintenance, and parts ordering for the Fisher 1B pump governor actuator. Refer to separate instruction manuals for information about the valve and other accessories used with these actuators.



Do not install, operate, or maintain a 1B pump governor actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The 1B pump governor actuator (figure 1) is used to maintain a constant discharge pressure on steam driven turbine or reciprocating pumps and for pressure reducing or pressure relief applications. Typical pump governor applications include fire pumps, boiler feedwater pumps, and industrial or refining pumps where the discharge medium is oil, steam, air, or other noncorrosive fluid.

The 1BR pump governor actuator is combined with a push-down-to-open valve for service as a relief governor. A relief governor is used to divert excess pump discharge to the suction side of the pump.

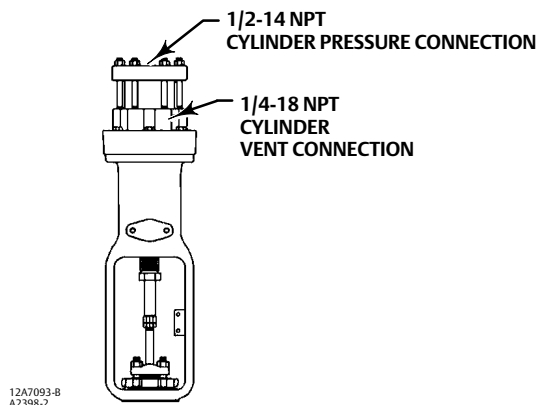
Specifications

Table 1 provides specifications for the 1B and 1BR pump governor actuators.

Educational Services

Emerson Educational Services
Phone: +1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Figure 2. Cylinder Connections



Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some valve body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson sales office.

The 1B pump governor can be installed either above or below the line but if possible it should be installed above it.

Note

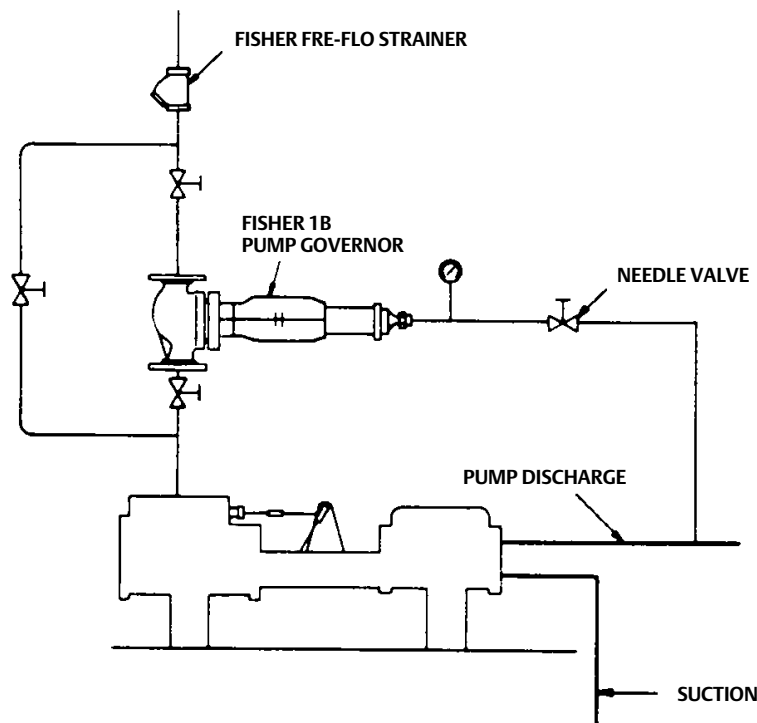
Thoroughly clean and blow out all pipe scale and other foreign matter. It is recommended that a Fisher strainer be installed in the line ahead of the main valve to protect the governor while in service.

If continuous operation is desired during inspection or maintenance, install a conventional three-valve bypass around the governor.

Refer to figure 3.

1. Using good piping procedure install the governor with flow in the direction of the arrow cast on the valve body.
2. Run a 1/4 inch control line from the top of the governor to the side or top of the pump discharge line, about 10 feet from the pump. Install a pressure gauge and a large port needle valve in this line. Throttling this needle valve places a restriction in the control line to smooth out operation.

Figure 3. Fisher 1B Installation



AC4650

Note

Before putting the governor into operation, be sure to remove the plastic shipping plug in the vent hole of the adaptor piece.

3. Open the gate valve on the downstream side and close the valve in the bypass line.
4. Slowly open the upstream gate valve.
5. Allow the governor sufficient time to assume normal operation before checking the controlled pressure. If the governor is not controlling at the set point needed, make the necessary changes as directed in the section entitled Adjustments.

Adjustments

The pump governor has been factory set for the operating conditions stated in the order. To change the pump discharge, use the adjusting screw (key 3). To increase the discharge pressure, turn the adjusting screw into the yoke.

Pressure pulsation in the discharge line can be minimized by slightly closing the needle valve in the control line. Never completely close the needle valve while the pump governor is in operation.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

When performing maintenance procedures, isolate the control valve from the process line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Use lock-out procedures to be sure that the above measures stay in effect while you are working on the actuator.

To Replace the Piston Cup:

1. Isolate the pump governor.
2. Remove the control line connection.
3. Unscrew the hex nuts (key 8).
4. Remove the cylinder cap (key 12).
5. Unscrew the cap screw (key 10) and remove the follower (key 6).
6. Remove the old piston cup (key 13) and install the new one.
7. Reassemble the pump governor in the following order: piston cup (key 13), follower (key 6), cap screw (key 10), cylinder cap (key 12), and hex nuts (key 8).

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always mention this number when corresponding with your [Emerson sales office](#) regarding technical information or replacement parts.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your Emerson sales office for Part Ordering information.

Key Description

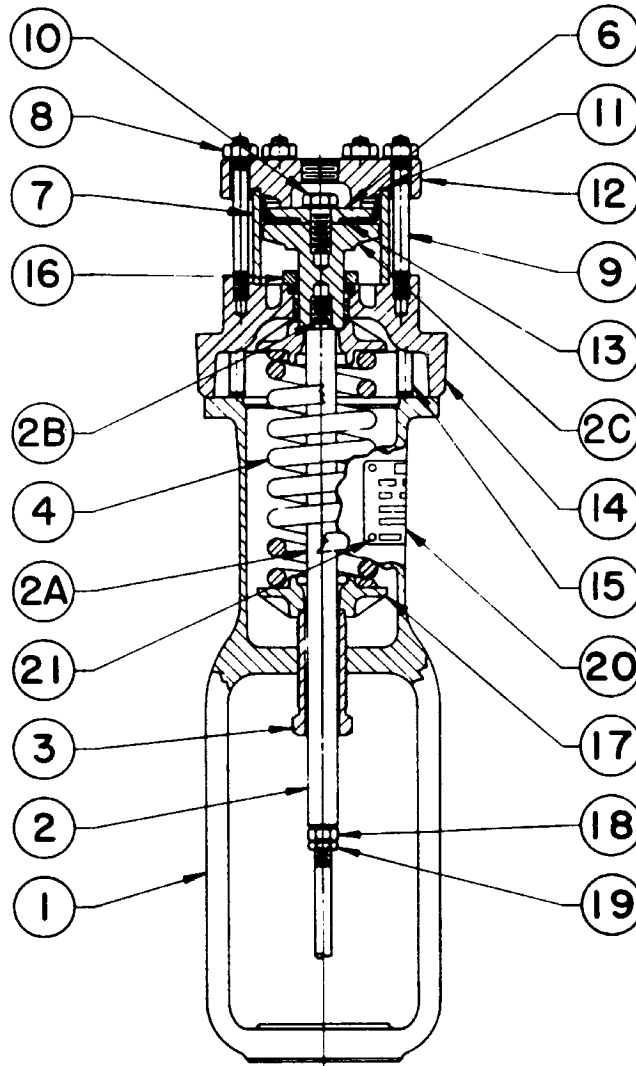
1	Yoke
2	Piston Rod Assembly
2A	Piston Rod
2B	Pin
2C	Piston
3	Adjusting Screw

Key Description

4	Spring
6	Follower
7	Cylinder
8	Finished Hex Nut (6 req'd)
9	Stud Bolt (6 req'd)
10	Cap Screw
11*	Gasket
12	Cylinder Cap
13*	Piston Cup
14	Adaptor Assembly
15	Hex Head Cap Screw (6 req'd)
16	Travel Stop (reverse-acting only)
17	Spring Seat (2 req'd)
18	Finished Hex Nut
19	Finished Hex Jam Nut
20	Name Plate
21	Drive Screw (4 req'd)

* Recommended spare parts

Figure 4. Fisher 1B Assembly



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Singapore 128461 Singapore

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Fisher™ 262K Filter

Introduction

Scope of Manual

This manual provides instructions for installation, maintenance and parts information for Fisher 262K filters.



Do not install, operate, or maintain a Fisher 262K filter without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Product Description

The 262K filter is designed to remove dirt, scale, and other solid substances from the air supply to actuators and instruments.

The 262K filter is available with a cast iron (Style B) or stainless steel body (Style SSB) with NPT screwed connections. See table 1 for temperature capabilities.

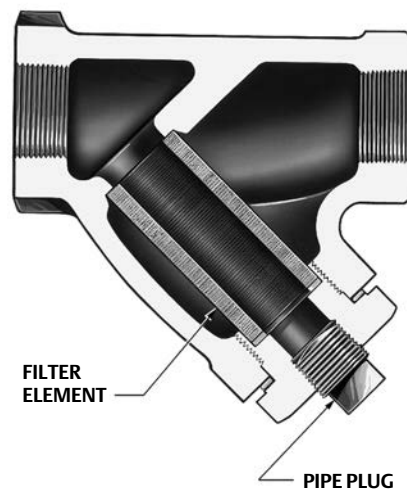
The filter has a resin-impregnated cellulose filter element capable of capturing particles as small as 40 microns.

Figure 1. Typical Fisher 262K Filter



W7910

Figure 2. Construction Details



W0225-1

Table 1. Specifications

Body Size NPS 3/4 End Connection Styles 3/4 NPT screwed Flow Coefficients C_v : 3.96 Maximum Inlet and Outlet Pressure Capabilities^(1,2) Cast Iron: 28 bar at 65°C (400 psig at 150°F) Stainless Steel: 41 bar at 65°C (600 psig at 150°F)	Temperature Capabilities⁽¹⁾ Cast Iron: -28 to 208°C (-20 to 406°F) Stainless Steel: -54 to 208°C (-65 to 406°F) Clean Out Connection Screwed Hazardous Area Classification Complies with the requirements of ATEX Group II Category 2 Gas and Dust   II 2 G D Ex h IIC Tx Gb Ex h IIIC Tx Db Maximum surface temperature depends on operating conditions Gas: T6...T2 Dust: T85...T208
---	---

1. The pressure/temperature limits in this instruction manual and any applicable standard or code should not be exceeded.

2. A pressure exceeding this value can cause failure of, or leakage from, pressure-containing components.

Specifications

Specifications for the 262K filter are in table 1.

WARNING

Installation, operation, and maintenance procedures performed by unqualified personnel may result in unsafe operation. This condition may result in personal injury or equipment damage. Use qualified personnel when installing, operating, and maintaining this filter.

If a leak develops in the system, the escaping gas may accumulate and become a fire or explosion hazard. Immediately call qualified service personnel in case of trouble.

Installation

WARNING

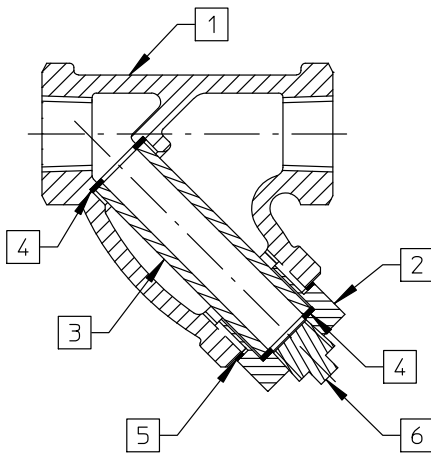
Personal injury, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if the filter is installed where its capabilities can be exceeded or where conditions exceed any ratings of the adjacent piping or piping connections. To avoid this, install a filter where:

- Service conditions are within unit capabilities.
- Service conditions are within applicable codes, regulations, or standards.
- Additionally, physical damage to the filter could result in breakage, causing personal injury and property damage due to escaping gas. To avoid such injury or damage, install the unit in a safe location.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

- If installing into an existing application, also refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

Using good piping practices, install the filter in the line with the flow in the direction of the arrow cast on the body. As shown in figure 2, when the 262K filter is mounted in a horizontal line, the filter element must be pointed down. When mounted in a vertical line, the filter element must also point down, with the flow passing from top to bottom.

Figure 3. Fisher 262K Filter



1980172-A

Maintenance

Filter parts are subject to normal wear and must be inspected periodically and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions and upon applicable codes and government regulations.

⚠ WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled gas or other process fluid. Before starting disassembly, carefully release all pressures. Use a gauge to monitor pressure while releasing it.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Parts Ordering

When corresponding with your [Emerson sales office](#) about this filter, always reference the filter style (Cast iron, Style B; Stainless steel, Style SSB).

When ordering the repair kit, specify the complete 11-character part number from the following parts list.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your Emerson sales office for Part Ordering information.

262K Filter (figure 3)

Key	Description	Part Number
1	Body	
2	Drain Plug	
3	Filter Element	
4	Cartridge Gasket	
5	Cap Gasket	
6	Pipe Plug	
*	Repair Kit	19B0173X012

*Recommended spare parts

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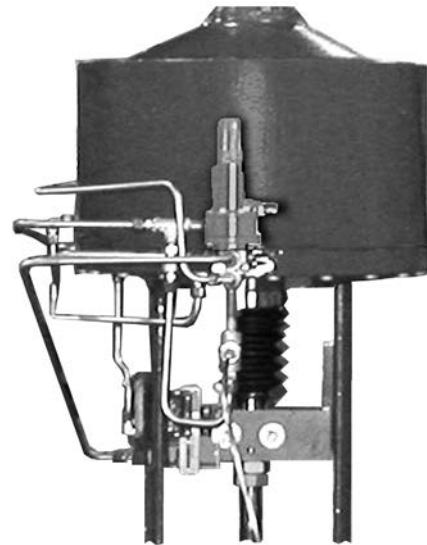


Fisher™ 377 Trip Valve

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Figure 1. Fisher 377 Trip Valve Mounted on Size 130 585C Actuator



W8435-1

Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for the Fisher 377 trip valve. Refer to separate instruction manuals for information regarding the control valve, actuator, and accessories.



Do not install, operate, or maintain a 377 trip valve without being fully trained and qualified in valve, actuator and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings. If you have any questions regarding these instructions contact your [Emerson sales office](#) before proceeding.

Description

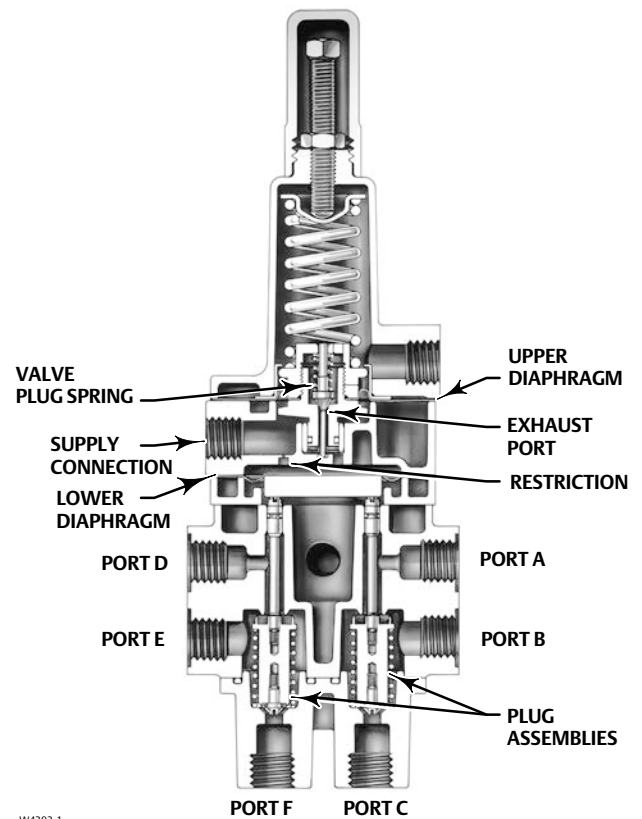
377 pressure-sensing trip valves, shown in figures 1, 2, and 3, are for control applications where a specific valve/actuator action is required when supply pressure falls below a specific point. When supply pressure falls below the trip point, the trip valve cause the actuator to fail up, lock in the last position, or fail down. When the supply pressure rises above the trip point, the 377 trip valve automatically resets, allowing the system to return to normal operation. The trip valve can be top-mounted on a manifold, yoke-mounted, or bracket-mounted to match the application requirements. 377 trip valves are used with all types of piston actuators.

Figure 2. Typical Fisher 377 Trip Valve



W4292-1

Figure 3. Simplified Sectional View of Trip Valve



W4303-1

Specifications

Specifications for 377 trip valves are given in table 1.

Educational Services

Emerson Automation Solutions
Educational Services - Registration
Phone: +1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Table 1. Specifications

Available Configurations

377 Trip Valve: Includes check valve, but no volume tank: user configured for locking position. For field use or replacement.

When supply pressure falls below the trip point,
377D Trip Valve: Fails actuator piston down. Includes check valve and volume tank.

377L Trip Valve: Locks actuator piston in the last position.

377U Trip Valve: Fails actuator piston up. Includes check valve and volume tank.

377CW Trip Valve: Fails fully clockwise to close valve. Requires check valve and volume tank. Trip valve moves piston to either up/down position and requires actuator configuration for actual clockwise movement.

377CCW Trip Valve: Fails fully counterclockwise to close valve. Requires check valve and volume tank. Trip valve moves piston to either up/down position and requires actuator configuration for actual counterclockwise movement.

All 377 Trip Valves can be converted to any of the above fail modes with minor hookup changes

Allowable Supply Pressure for Trip Valve⁽¹⁾

Maximum: 10.3 bar (150 psig)

Minimum: 3.8 bar (55 psig)

Outlet Pressure

Normal Operation: Pressure from control device

Fail-Up or Fail-Down Mode: Maximum volume tank pressure

Lock-In-Last-Position: Respective cylinder pressure

Trip Point⁽²⁾

Adjustable from a minimum of 2.8 bar (40 psig) to a maximum of 72 percent of supply pressure; see figure 4

Reset: 12.5 to 33 percent above adjusted trip point

Flow Coefficients (C_v)⁽³⁾

Depends on flow path (shown in figure 3) as follows:

Port A to Port B and Port D to Port E: 0.5

Port B to Port C and Port E to Port F: 0.6

Pressure Connections

1/4 NPT internal

Temperature Capabilities⁽¹⁾

Nitrile Diaphragms and O-Rings: -40 to 82°C (-40 to 180°F)

Fluorocarbon Diaphragms and O-Rings: -18 to 104°C (0 to 220°F)

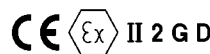
Volume Tank Maximum Internal Working Pressure (for 377D, 377U, 377CW and 377CCW trip valves)

Standard: 10.3 bar (150 psig) for non-ASME approved applications. See note on page 7.

ASME Approved Applications: Rated 10.3 bar (150 psig), maximum; 9.3 bar (135 psig), recommended. See note on page 7.

Hazardous Area Classification

Complies with the requirements of ATEX Group II Category 2 Gas and Dust

 II 2 G D Ex h IIC Tx Gb
Ex h IIIC Tx Db

Maximum surface temperature (Tx) depends on operating conditions

Gas: T4, T5, T6

Dust: T85...T104

Meets Customs Union technical regulation TP TC 012/2011 for Groups II/III Category 2 equipment

 II Gb c T*XX
III Db c T*XX 

377 SST

Safety Instrumented System Classification

SIL 3 capable - certified by exida Consulting LLC

Mounting

Top-Mounted: Manifold-mounted between a Fisher 3570 positioner and 480 actuator (manifolds cannot be supplied with Fisher 585C, 685, 1061, 1066, and 1069 piston actuators)

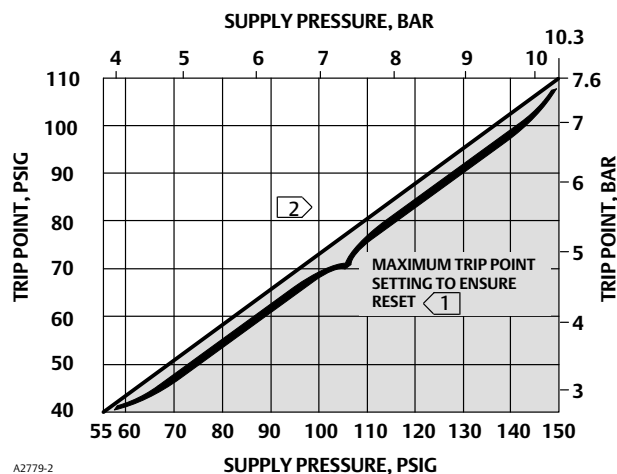
Side-Mounted: Yoke-mounted or bracket-mounted for use with a FIELDVUE™ DVC6200, DVC6200f, DVC6200p, DVC6000 or DVC6000f digital valve controller

-continued-

Table 1. Specifications (continued)

Approximate Weight	Declaration of SEP
Trip Valve Aluminum: 0.95 kg (2.1 pounds) SST: 2.31 kg (5.1 pounds) Mounting Manifold: 0.5 kg (1.2 pounds) Volume Tank: Varies between 5.4 and 363 kg (12 and 800 pounds) depending on size	Fisher Controls International LLC declares this product to be in compliance with Article 4 paragraph 3 of the PED Directive 2014/68/EU. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance. However, the product <i>may</i> bear the CE marking to indicate compliance with <i>other</i> applicable European Community Directives.
1. The pressure/temperature limits in this document and any applicable standard or code limitation should not be exceeded. 2. If the trip point is not specified, the trip point is factory set at 72 percent of supply pressure or 2.8 bar (40 psig), whichever is higher. 3. Values represent nominal C_v measures for each port pair using a trip valve/actuator combination.	

Figure 4. Maximum Trip Point Settings



NOTES:

- 1 > TRIP POINT MAY BE SET TO ANY VALUE BETWEEN 2.8 BAR (40 PSIG) AND THE MAXIMUM TRIP POINT LINE.
- 2 > RESET OCCURS AT 12.5 TO 33 PERCENT ABOVE ADJUSTED TRIP POINT.

Installation

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before mounting the controller:

- Always wear protective clothing, gloves, and eyewear when performing any installation operations to avoid personal injury.
- Overpressuring any system component could result in personal injury or property damage due to fire and explosion caused by venting or leakage of the supply medium. To avoid such injury or damage, provide suitable pressure-relief or pressure-limiting devices if the supply pressure is capable of exceeding the maximum allowable pressure of the system component.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

NOTICE

Do not use sealing tape on pneumatic connections. This instrument contains small passages that may become obstructed by detached sealing tape. Thread sealant paste should be used to seal and lubricate pneumatic threaded connections.

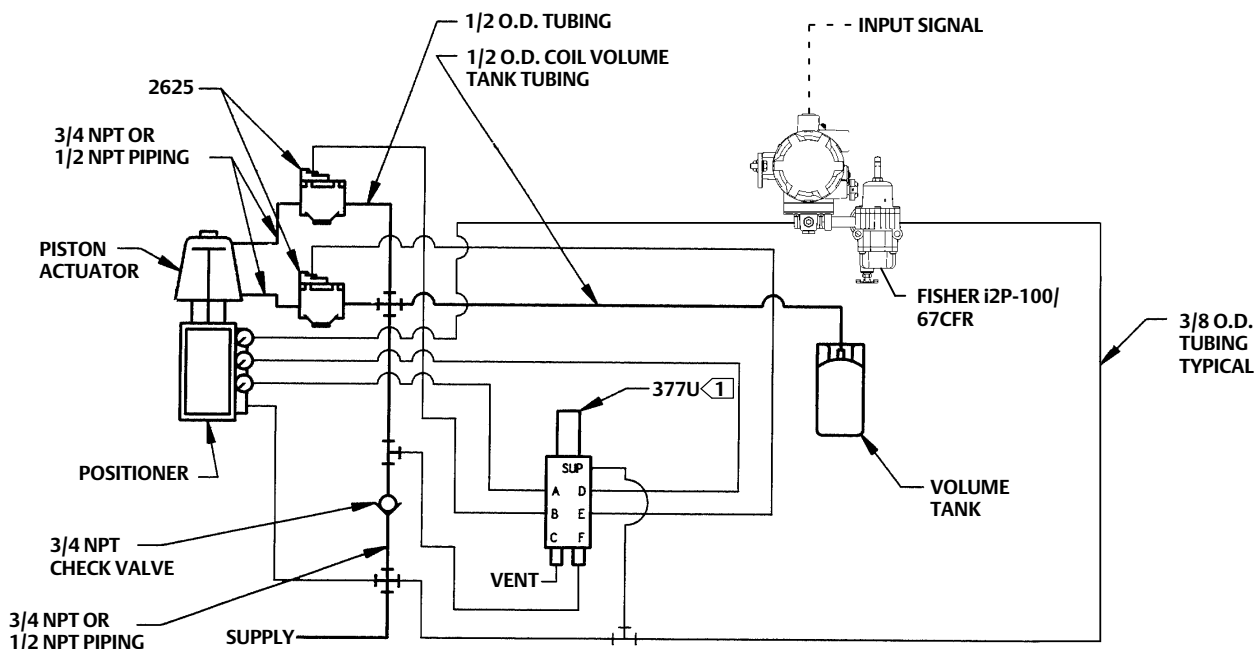
The 377 trip valve is normally ordered as part of a control valve assembly. Follow the procedure in the appropriate valve body and actuator instruction manual when installing the control valve in the piping.

If the 377 trip valve is shipped separately from the control valve assembly, the installation procedure depends upon the type of actuator and accessory equipment required for the individual control valve system. Install any accessory equipment in the control valve system so that the overall functioning of the specified trip valve pressure line connections is not disrupted. Figures 7, 8, and 9 are schematics showing the pressure line connections for each of the three possible fail-mode configurations of the trip valve.

Note

377 trip valves are leak tested to ensure that the intended actuator fail mode is maintained upon loss of supply pressure. Control system accessories, such as volume boosters with hard seats, compromise the integrity of the entire system due to leakage. Therefore, using control system accessories, such as volume boosters, between the trip valve and the actuator is not recommended. If this cannot be avoided and a volume booster is required, a volume booster designed for tight shutoff, such as the Fisher 2625, provides a higher probability of control system integrity. Refer to figures 5 and 6 for proper installation of 377 trip valves with 2625 volume boosters.

Figure 5. Fisher 2625 Volume Booster used with 377U or 377D Trip Valve



NOTES:

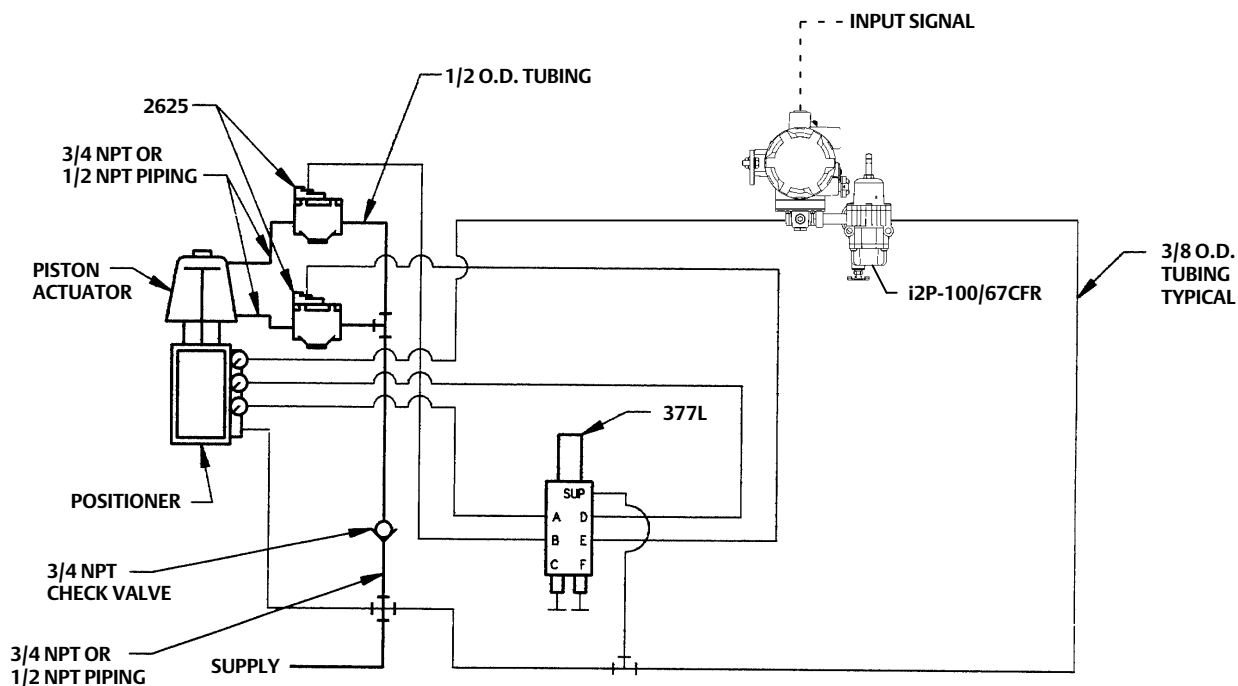
1. THE HOOK UP OF PORT C AND F ARE REVERSED FOR 377D.

2. 3/4 NPT CHECK VALVE, 1/2 OR 3/4 NPT PIPING, AND 1/2-INCH (OUTSIDE DIAMETER) COIL TUBING FOR THE VOLUME TANK ARE REQUIRED.

3. THE SUPPLY PRESSURE REGULATOR SPECIFIED MUST HAVE ADEQUATE CAPACITY FOR 2625 BOOSTERS. ALSO, IF THE 2625 BOOSTER IS TO BE NIPPLE MOUNTED, THE BOOSTER MUST BE MOUNTED TO A 1/2 NPT OR LARGER CYLINDER CONNECTION. SOME SMALLER CYLINDERS CANNOT BE TAPPED THIS LARGE; CONTACT YOUR [EMERSON SALES OFFICE](#) FOR AVAILABILITY ON SPECIFIC TYPES AND SIZES.

E1570

Figure 6. Fisher 2625 Volume Booster used with 377L Trip Valve



NOTES:

1. 3/4 NPT CHECK VALVE AND 1/2 OR 3/4 NPT PIPING ARE REQUIRED.
2. THE SUPPLY PRESSURE REGULATOR SPECIFIED MUST HAVE ADEQUATE CAPACITY FOR 2625 BOOSTERS. ALSO, IF THE 2625 BOOSTER IS TO BE NIPPLE MOUNTED, THE BOOSTER MUST BE MOUNTED TO A 1/2 NPT OR LARGER CYLINDER CONNECTION. SOME SMALLER CYLINDERS CANNOT BE TAPPED THIS LARGE; CONTACT YOUR [EMERSON SALES OFFICE](#) FOR AVAILABILITY ON SPECIFIC TYPES AND SIZES.

E1571

Supply Pressure Requirements

⚠ WARNING

Severe personal injury or property damage may occur if the instrument air supply is not clean, dry, and oil free. While use and regular maintenance of a filter that removes particles larger than 40 micrometers in diameter will suffice in most applications, check with an Emerson field office and instrument industry air quality standards for use with corrosive gas or if you are unsure about the proper amount or method of air filtration or filter maintenance.

NOTICE

Do not use sealing tape on pneumatic connections. This instrument contains small passages that may become obstructed by detached sealing tape. Thread sealant paste should be used to seal and lubricate pneumatic threaded connections.

A supply regulator, if used, must have a flow capacity greater than the required combined capacity of the trip valve and actuator. In order to ensure proper selection of a supply regulator, be sure the C_v value of the regulator is greater than the appropriate flow path C_v value listed in table 1 for the trip valve. A regulator with insufficient capacity may allow supply pressure to droop, which can cause the trip valve to trip again and begin a trip-reset cycle. An example of an appropriate supply regulator to use with a 377 trip valve is a 64 regulator; its capacity is usually great enough to meet the demands of most trip valve/actuator combinations. Determine the requirements of your trip valve/actuator combination for proper selection of a supply regulator.

Note

During normal operation, an adequately sized supply regulator maintains a greater supply pressure than the pressure demand of the trip valve and control devices. However, if the normal actuator piston position is not relatively close to the actuator piston fail position during startup, or during the restoration of supply pressure, the regulator supply pressure may droop and cause the trip valve to trip again and begin a trip-reset cycle. To prevent this, perform the following steps:

1. Adjust the instrument (control device) pressure to position the actuator piston as it is positioned in the fail mode.
 2. Restore the supply pressure to the normal operating range.
 3. Manually reset the instrument pressure for normal operation.
-

WARNING

If a flammable or hazardous gas is used as the supply pressure medium, personal injury or property damage could result from fire or explosion of accumulated gas or from contact with hazardous gas. The positioner/ actuator assembly does not form a gas-tight seal, and when the assembly is enclosed, a remote vent line, adequate ventilation, and necessary safety measures should be used. However, a remote vent pipe alone cannot be relied upon to remove all hazardous gas. Vent line piping should comply with local and regional codes and should be as short as possible with adequate inside diameter and few bends to reduce case pressure buildup.

Note

To ensure trip system integrity upon loss of supply pressure, a 377D or 377U trip system requires a volume tank and check valve as shown in figures 7 and 9.

State and local regulations may require the use of ASME approved volume tanks. Determine requirements and applicable regulations for proper volume tank selection.

For ASME approved applications, the volume tank is rated at 10.3 bar (150 psig) internal working pressure, and has a safety valve with a 10.3 bar (150 psig) set pressure mounted on the volume tank for pressure relief. Avoid supply pressure too near the safety valve set pressure. To ensure safety valve seat tightness and longevity, the recommended maximum supply pressure is 9.3 bar (135 psig).

Standard volume tanks supplied in Europe must conform to Directive 2009/105/EC for simple pressure vessels. The maximum pressure rating is stated on the tank.

For standard applications (not ASME approved), a DOT tank is used. This tank is rated at 14.5 bar (240 psig) in LP service. When used with air, the rating should be considered to be 10.3 bar (150 psig), consistent with the maximum pressure allowed for the 377 trip valve.

1. Before installing the trip valve, inspect it to be sure it is free of any foreign material.
2. Be sure all connecting tubing is free of foreign material.
3. Use acceptable piping practices when installing the trip valve. Coat all external threaded connections with a pipe compound.

NOTICE

To avoid damage and possible operational impairment to the trip valve, be careful not to get excessive pipe compound on the connections. Excess compound could result in improper pilot and cylinder valve operation.

Note

To ensure the integrity of control systems utilizing a 2625 volume booster in conjunction with a 377 trip valve, apply supply pressure to the volume booster and to the volume tank (volume tank not required on 377L trip valve) through a check valve. Failure to install the check valve properly will allow the cylinder pressure to bleed back through the open volume booster supply port upon loss of supply pressure. The actuator may not fail as intended.

⚠ WARNING

Personal injury or property damage could result from bursting of parts due to temperature fluctuations or extreme heat. If temperature fluctuations or extreme heat cannot be avoided, use a relief valve to protect the volume tank.

4. Read the following information before making pressure connections:

- a. Trip valve port A must receive the operating pressure that is intended for the top of the actuator cylinder. Depending on the actuator type and accessories being used, this operating pressure will be from a valve positioner or switching solenoid.
- b. Trip valve port B must provide operating pressure to the top of the actuator cylinder. Depending on the actuator type and accessories being used, connect this port to the manifold assembly, to the top of the cylinder, or to the cylinder connection on the hydraulic snubber (if one is used).
- c. Trip valve port C must provide a fail-mode outlet for the operating pressure to or from the top of the actuator cylinder. For the fail-down mode, connect this port to the volume tank. For the fail-up mode, vent this port to atmosphere. For the lock-in-last-position mode, plug this port.
- d. Trip valve port D must receive the operating pressure that is intended for the bottom of the actuator cylinder. Depending on the actuator type and accessories being used, this operating pressure will be from a valve positioner or switching solenoid.
- e. Trip valve port E must provide operating pressure to the bottom of the actuator cylinder. Always connect this port to the bottom of the actuator cylinder.
- f. Trip valve port F must provide a fail-mode outlet for the operating pressure to or from the bottom of the actuator cylinder. For the fail-down mode, vent this port to atmosphere. For the fail-up mode, connect this port to the volume tank. For the lock-in-last-position mode, plug this port.

Operating Information

Calibration

This calibration procedure assumes that the trip valve is mounted on the actuator (or other device) and that all piping and the appropriate volume tank (if necessary) are installed. All key numbers refer to figure 10. For the appropriate fail-mode schematic, see figure 7, 8, or 9.

⚠ WARNING

The following procedure requires taking the trip valve out of service. To avoid personal injury and property damage by an uncontrolled process medium, provide some temporary means of control of the process medium while the trip valve is out of service.

1. Remove the adjusting screw cap (key 1).
2. Loosen the hex nut (key 3), and turn the set screw (key 2) counterclockwise until all loading is removed from the spring (key 6).
3. Connect an adequately sized gauge for the supply pressure reading to the supply line. To make the fail action more visible, adjust the control device signal so that actuator stem movement is visible when the trip valve is actuated.
4. For the lock-in-last-position mode, remove the plugs from ports C and F.
5. Set the supply pressure at the required trip point pressure (refer to table 1 for the trip point limits).

Note

For proper calibration, completely back out the set screw (key 2) until there is no spring compression. Then, set the trip point by turning the set screw clockwise to compress the spring.

6. Slowly turn the set screw clockwise to compress the spring until the trip valve trips. When the trip valve trips in the fail-up or fail-down mode, the actuator stem moves to the appropriate position. In the lock-in-last-position mode, the actuator stem does not move, however, air will be heard escaping from ports C and F. This is because pressure is being released from both sides of the actuator cylinder.
7. Tighten the hex nut (key 3), and install the adjusting screw cap (key 1).
8. For the lock-in-last-position mode, reinstall the plugs in ports C and F.
9. Reset the control device for normal operation.

Principle of Operation

377D Trip Valve

Figure 7 illustrates trip valve operation in the fail-down mode.

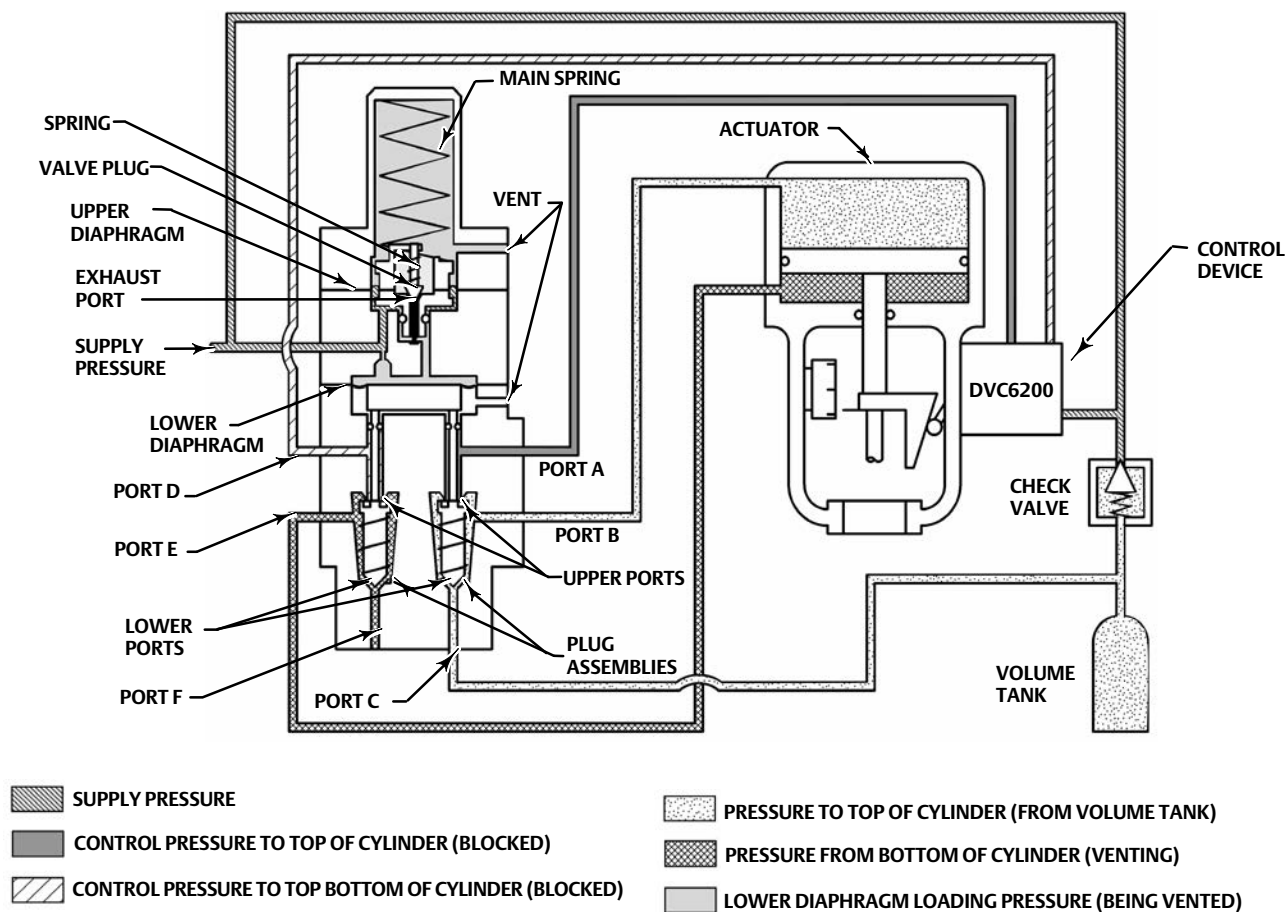
In normal operation, supply pressure loads the upper diaphragm of the trip valve. The valve plug spring keeps the exhaust port closed. Supply pressure also loads the lower diaphragm through the restriction, causing the plug assemblies to move down and isolate ports C and F while connecting port A to B and port D to E. Normal actuator control pressure from the control device is applied to the top of the cylinder through ports A and B and to the bottom of the cylinder through ports D and E. A volume tank is charged to the maximum supply pressure through a check valve. The check valve maintains maximum supply pressure in the volume tank if the supply pressure drops.

When the supply pressure falls below the trip point, the exhaust port opens venting the supply pressure that is loading the lower diaphragm. This causes the upper ports of the plug assemblies to close and disconnect normal pressure from the control device to the actuator.

Volume tank pressure is then applied through ports C and B to the top of the actuator cylinder, while pressure in the bottom of the actuator cylinder is vented through ports E and F. The pressure imbalance created forces the actuator piston down.

When supply pressure is restored, it again loads the upper and lower diaphragms causing the trip valve to reset. The exhaust port closes, the upper ports of the plug assemblies open, and the lower ports close. Normal actuator control pressure from the control device is restored through ports A and B and ports D and E. The check valve opens and recharges the volume tank to the maximum supply pressure.

Figure 7. Fisher 377D Trip Valve Shown in Tripped Condition



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A6905-1

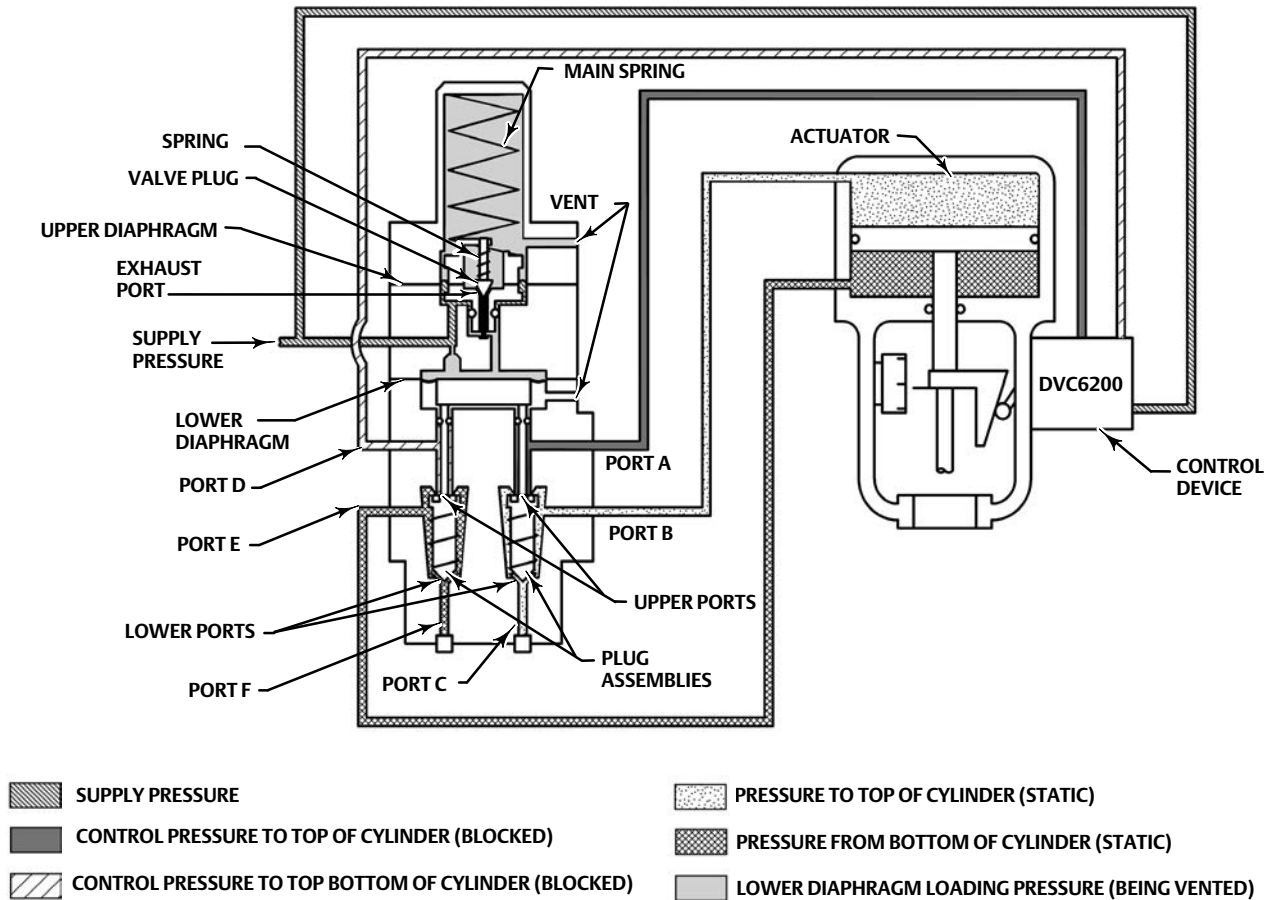
377L Trip Valve

Figure 8 illustrates trip valve operation in the lock-in-last-position mode.

When supply pressure falls below the trip point, the exhaust port opens venting supply pressure from the lower diaphragm. This causes the upper ports of the plug assemblies to close and the lower ports to open. Because ports C and F are plugged, no pressure change occurs on either side of the actuator piston and the piston is pressure-locked in position. No volume tank is necessary in this mode.

When supply pressure is restored, the plug assemblies move back into the normal operating position. Supply pressure from the control device is applied to the actuator through ports A and B and ports D and E.

Figure 8. Fisher 377L Trip Valve Shown in Tripped Condition

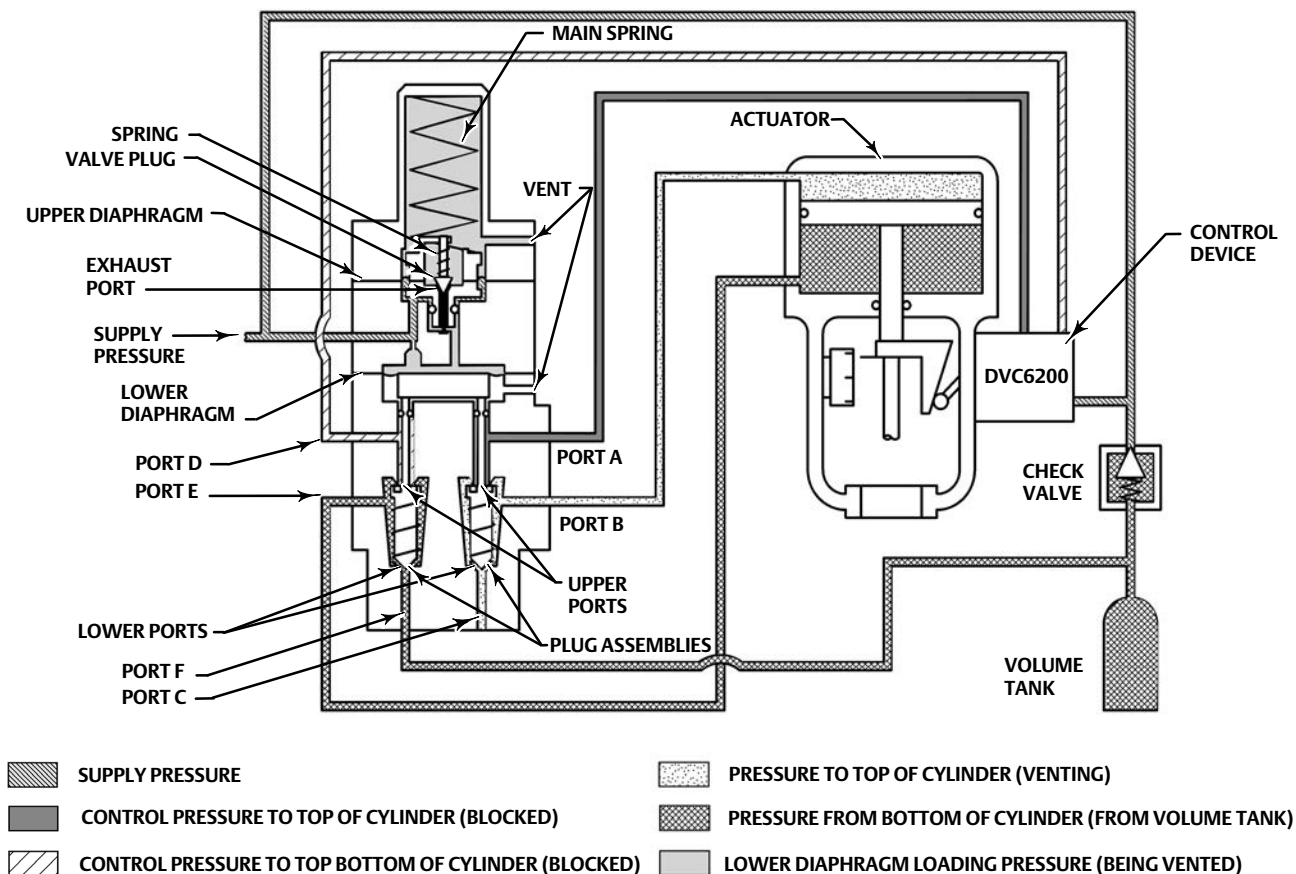


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A6906-1

377U Trip Valve

Figure 9 illustrates trip valve operation in the fail-up mode. The fail-up mode of operation is similar to the fail-down mode of operation except that the connections to port C and F are reversed. When supply pressure falls below the trip point, the top of the actuator cylinder vents, and volume tank pressure loads the bottom of the actuator cylinder. The pressure imbalance created forces the actuator piston up.

Figure 9. Fisher 377U Trip Valve Shown in Tripped Condition



GE08413-A
A2284-6

Maintenance

Trip valve parts are subject to normal wear so the trip valve must be actuated periodically to determine if it is working properly. If the trip valve does not work properly, use the following procedures to inspect and repair or replace parts as necessary. The frequency of inspection and repair or replacement depends upon the severity of service conditions. Be sure to note the location of all pressure connections to ensure proper trip valve installation upon reassembly, or use the installation procedures in this instruction manual. All key numbers refer to figure 10 unless otherwise indicated.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Always wear protective clothing, gloves, and eyewear when performing any maintenance operations to avoid personal injury.
- Do not remove the actuator from the valve while the valve is still pressurized.

- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Periodic Operational Check

⚠ WARNING

The following procedure requires taking the trip valve out of service. To avoid personal injury and property damage by uncontrolled process medium, provide some temporary means of control of the process medium while the trip valve is out of service.

1. Isolate the actuator/valve assembly from the process loop.
2. Provide a means of monitoring the supply pressure input to the trip valve.
3. Starting with normal supply pressure applied to the trip valve, slowly reduce the supply pressure until the trip valve trips. The trip valve should trip at the pressure set during the calibration procedures.
4. Increase the supply pressure until the trip valve resets. This should occur at a supply pressure 12.5 to 33 percent above the trip point.
5. If the trip valve fails to trip and reset at the calibrated settings, refer to the calibration procedures.
6. If the trip valve will not calibrate, continue with the following maintenance procedures.

Trip Valve Part Replacement Procedures

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance Section in this instruction manual.

Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

Replacing Diaphragms and Valve Plug Parts

NOTICE

Care must be taken during the following procedure to prevent damage to the upper diaphragm.

1. Remove the adjusting screw cap (key 1), and loosen the hex nut (key 3) that locks the set screw (key 2). Loosen the set screw to remove all spring compression.
2. Remove the cap screws (key 7, not shown) from the spring case, and lift off the body assembly (key 16) and attached parts from the trip valve body (key 21). Note the orientation of the vent and supply connections to the body (see figure 1).
3. Remove the cap screws (key 20, not shown) and separate the diaphragm (key 17), diaphragm spacer (key 19), and the pusher plate (key 18) from the rest of the body assembly. Lift off the spring case (key 4), travel stop (key 75, aluminum housing only), upper spring seat (key 5), and spring (key 6).
4. Take out the upper diaphragm assembly (keys 8, 9, 10, 11, 12, 13, 14, and 15).
5. Carefully unscrew the spring seat (key 9) from the upper diaphragm retainer (key 13). Be careful not to lose the valve plug (key 14), valve guide (key 8), and spring (key 10). Also be careful not to damage the upper diaphragm (key 12).
6. Inspect the upper diaphragm, valve plug, body assembly, and O-ring (key 15) for nicks, scratches, or cuts that could cause leakage. Replace parts as necessary. Make sure the O-ring (key 15) is properly lubricated (key 77) to avoid leakage past the O-ring.
7. With the spring (key 10), spring seat (key 9), valve plug (key 13), valve guide (key 8), diaphragm washer (key 11), and upper diaphragm (key 12) in place, screw the upper diaphragm retainer (key 13) and spring seat (key 9) together, being careful not to damage the diaphragm.
8. Inspect the lower diaphragm (key 17) and pusher plate (key 18), and replace them if damaged or excessively worn.
9. Place the upper diaphragm assembly (keys 8, 9, 10, 11, 12, 13, 14, and 15), travel stop (key 75, aluminum housing only), spring (key 6), upper spring seat (key 5), diaphragm spacer (key 19), pusher plate (key 18), and diaphragm (key 17) onto the body assembly (key 16). Secure the body assembly parts to the spring case (key 4) with the cap screws (key 20). Position the supply and vent connections as noted in step 2.
10. Note the orientation of the supply connection to the body (see figure 1). Attach the assembly, from step 9, to the body (key 21) with the cap screws (key 7, not shown). Tighten the screws.
11. Refer to the installation and calibration procedures.

Replacing Stem/Plug Assembly Parts

1. Remove the cap screws (key 76, not shown) from the body (key 21), and remove the manifold (key 73) and the stem/plug assemblies (keys 22, 23, 24, 26, and 27).
2. Inspect the upper and lower O-rings (keys 23 and 26) for nicks or wear. If the lower O-ring needs to be replaced, remove the O-ring retainer screw (key 27) before installing the new O-ring. The upper O-ring simply slips over the end of the stem (key 22). Lightly lubricate O-rings (key 77) prior to reassembly.
3. Inspect the stem/plug assemblies, inspect the valve seats in the body (key 21), and replace any parts if necessary.
4. When stem/plug assembly maintenance procedures are complete, carefully slide the stem/plug assemblies (keys 22, 23, 24, 26, and 27) and springs (key 25) into the body. Attach the manifold (key 73) to the bottom of the body (key 21), and tighten the screws (key 76).
5. Refer to the installation and calibration procedures.

Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always refer to the trip valve serial number which is located on the nameplate. Refer to table 2 for common parts. Contact your Emerson sales office if part numbers are needed.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher trip valve. Use of components not supplied by Emerson may void your warranty, might adversely affect the performance of the instrument, and could cause personal injury and property damage.

Parts Kits

Description	Part Number
Repair Kit	
Kit include valve plugs, stems, plug assemblies, and nitrile diaphragms, O-rings, and gasket (keys 12, 14, 15, 17, 22, 23, 24, 26, 29, 63, 74, and 89).	
Aluminum Construction	R377X000012
Stainless Construction	R377X000032

Parts List

Table 2. Common Parts

Key Number	Description
1	Adjusting screw cap
2	Set screw
3	Hex nut
4	Spring case
5	Upper spring seat
6	Spring
7	Cap screw (not shown), 4 req'd
8	Valve guide
9	Spring, seat
10	Spring
11	Diaphragm washer
12 ⁽¹⁾	Diaphragm
13	Diaphragm retainer
14 ⁽¹⁾	Valve plug
1. Included in Repair Kit	

-continued-

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Table 2. Common Parts (continued)

Key Number	Description
15 ⁽¹⁾	O-ring
16	Pilot body assembly
17 ⁽¹⁾	Diaphragm
18	Pusher plate
19	Diaphragm spacer
20	Cap screw (not shown), 4 req'd
21	Body
22 ⁽¹⁾	Stem, 2 req'd
23 ⁽¹⁾	O-ring, 2 req'd
24 ⁽¹⁾	Plug assembly, 2 req'd
25	Spring, 2 req'd
26 ⁽¹⁾	O-ring, 2 req'd
27	O-ring retainer screw, 2 req'd
29 ⁽¹⁾	O-ring (top-mounted only), 2 req'd
30	Cap screw top mounted, 2 req'd yoke mounted, 1 req'd bracket mounted, 1 req'd
31	Manifold assembly
32	Cap screw (use w/manifold assembly) (not shown), 2 req'd
33	Cap screw (not shown) yoke mounted bracket mounted
34	Pipe plug (for 377L only) (not shown)
35	Pipe plug (boss or bracket mounted w/o manifold assembly for 480-16 only) (not shown)
36	Check valve (for 377D, 377U 377CW and 377CCW only) (not shown) For use w/o 2625 For use with 2625
37	Vent assembly (not shown) Top mounted 377D, 377U 377CW, and 377CCW, 1 req'd Top or boss mounted 377D, 377U, 377CW and 377CCW with flow control valve, 1 req'd Boss mounted 377D, 377L, 377U, 377CW and 377CCW, 2 req'd
37	Flow control valve (optional on 377D, 377U 377CW and 377CCW trip valves)
39	Lithium grease (not furnished with trip valve)
1. Included in Repair Kit	

-continued-

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Table 2. Common Parts (continued)

Key Number	Description
44	Volume Tank⁽²⁾ (for 377D, 377U, 377CW, and 377CCW only) (not shown) Standard Alloy steel 11.8 L / 721 inch³ / 3.1 gal 21.6 L / 1315 inch³ / 5.7 gal 32.3 L / 1970 inch³ / 8.5 gal 42.9 L / 2615 inch³ / 11.3 gal 65.6 L / 4001 inch³ / 17.3 gal 131 L / 8002 inch³ / 34.6 gal [requires two 4001 inch³ volume tanks⁽²⁾] ASME Approved (use w/safety valve) Canadian Registered Alloy steel 8.5L / 518 inch³ / 2.2 gal 24.9 L / 1520 inch³ / 6.6 gal 30.0 L / 1831 inch³ / 7.9 gal 42.8 L / 2609 inch³ / 11.3 gal 68.8 L / 4199 inch³ / 18.1 gal 71.6L / 4371 inch³ / 18.9 gal 143.3 L / 8742 inch³ / 37.86 gal [requires two 4371 inch³ volume tanks⁽²⁾] Alloy steel or S31600 (316 SST) 114 L / 6930 inch³ / 30 gal 227 L / 13860 inch³ / 60 gal 303 L / 18480 inch³ / 80 gal 454 L / 27720 inch³ / 120 gal 908 L / 55440 inch³ / 240 gal
45	Pipe bushing, 1 req'd per volume tank For standard volume tanks w/o 2625 For standard volume tanks w/2625 or ASME approved volume tanks
46	Pipe tee For two standard volume tanks w/o 2625 For two standard volume tanks w/2625 or two ASME approved volume tanks For one ASME approved volume tank w/o 2625 For one ASME approved volume tank w/2625
47	Pipe nipple For two standard volume tanks w/o 2625 For two standard volume tanks w/2625 or two ASME approved volume tanks or one ASME approved volume tank w/o 2625 For one ASME approved volume tank w/2625
48	Safety valve, for ASME approved volume tanks
49	Connector, 2 req'd For two standard volume tanks w/o 2625 For two standard volume tanks w/2625 or two ASME approved volume tanks
51	Volume tank tubing 7.6 m (25 foot) coil 1/4 O.D. 1/2 O.D.
61	Pipe cross, for two ASME approved volume tanks only
63 ⁽¹⁾	O-ring (use w/manifold assembly)
64	Screen (not shown) For top mounted 377D, 377U, 377L, 377CW and 377CCW, 2 req'd For 377D, 377U, 377CW or 377CCW with speed control valve, 1 req'd
1. Included in Repair Kit 2. Volume tank capacity values are nominal values only. Actual volume may vary slightly due to tolerances within the volume tank and supplier variability.	

-continued-

Table 2. Common Parts (continued)

Key Number	Description
65	Screen (not shown) For boss mounted 377D, 377U, 377CW, or 377CCW
71	Spring retainer spacer (use w/ manifold assembly) (not shown)
73	Manifold
74 ⁽¹⁾	O-ring, 2 req'd
75	Travel stop, not required for stainless steel trip valve
76	Cap screw (not shown), 2 req'd
77	Silicone-based lubricant (not furnished with trip valve)
78	Cap Screw (not shown), Bracket mounted, 2 req'd
79	Lockwasher (not shown), Bracket mounted, 4 req'd
80	Hex nut (not shown), Bracket mounted, 2 req'd
88	Washer (not shown), Bracket mounted, 2 req'd
89	Gasket Standard ⁽¹⁾ High temperature
95	Mounting plate (not shown), Bracket mounted
1. Included in Repair Kit	

Fittings

Note

The following is a list of tubing fittings and pipe fittings used for trip valve installation. Key numbers and quantities are not shown due to the variations in piping arrangements possible. To order replacement fittings, determine the part name, size, and number of replacements required and contact your [Emerson sales office](#).

Description

Pipe Tee
1/4 NPT
3/4 NPT

Description

Pipe Nipple
1/4 NPT
3/4 NPT

Connector
1/4 NPT x 1/4 O.D.
1/4 NPT x 3/8 O.D.
1/2 NPT x 1/2 O.D.

Elbow
1/4 NPT x 3/8 O.D.

Pipe cross
1/4 NPT
3/4 NPT

Pipe Bushing
3/4 NPT x 1/4 NPT
3/4 NPT x 1/2 NPT

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

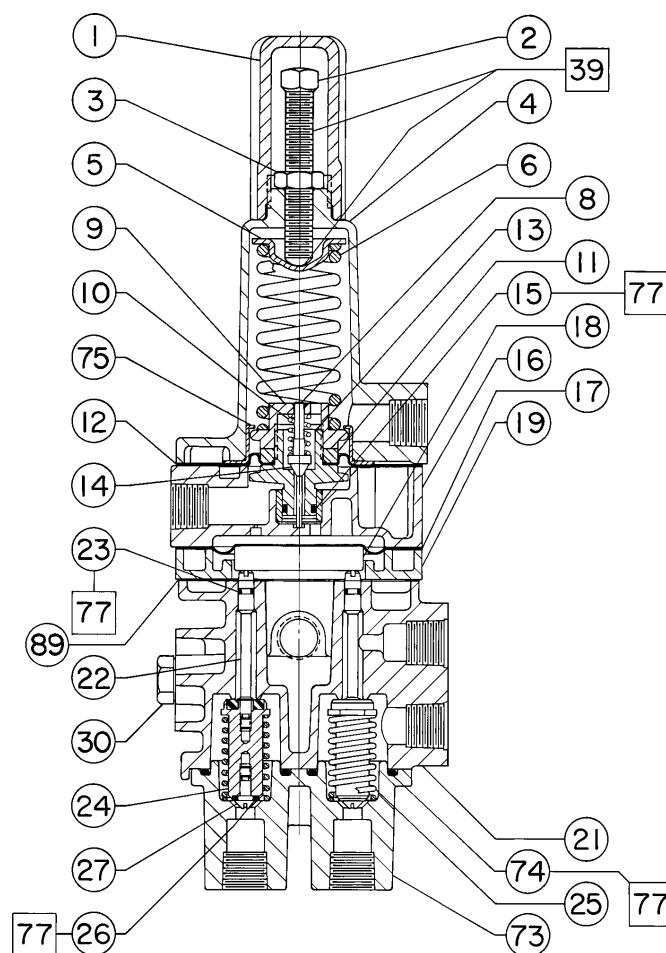
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Figure 10. Trip Valve Assembly

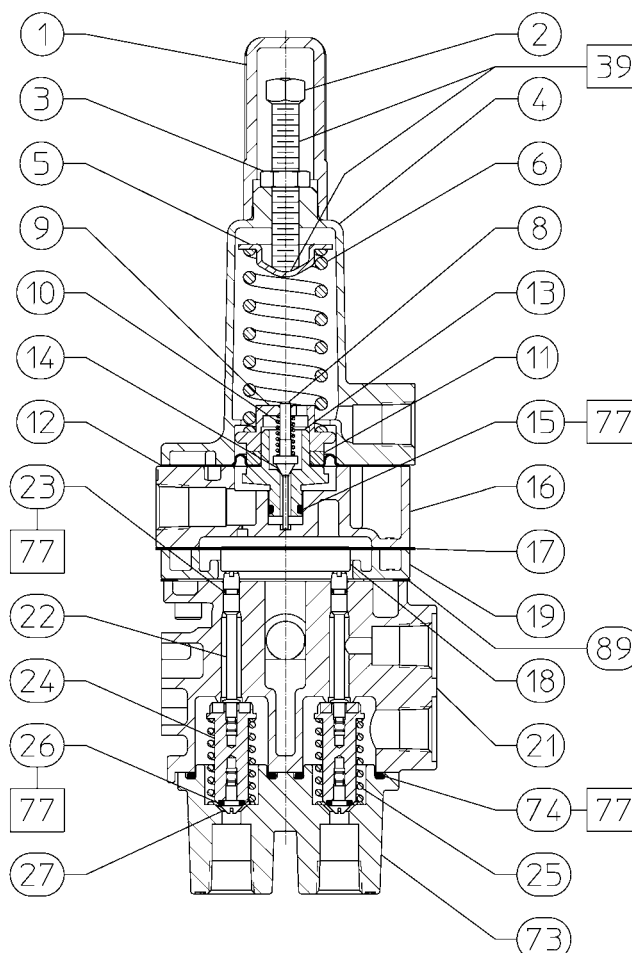


NOTE: KEY NUMBERS 7, 20, 64, 65, 76, 78, 79, 80, 88 NOT SHOWN

□ APPLY LUB

49A3195-C

ALUMINUM CONSTRUCTION



NOTE: KEY NUMBERS 7, 20, 30, 33, 36, 37, 64, 65, 76, 78, 79, 80, 88 NOT SHOWN

□ APPLY LUB

GE51600-A

STAINLESS STEEL CONSTRUCTION

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Fisher™ 461 Increased Outlet Angle Sweep-Flo Valve

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Figure 1. Fisher 461 Valve with 657 Actuator



W9553-2

Introduction

Scope of Manual



This instruction manual includes installation, maintenance, and parts information for the Fisher 461 anti-choke valve. Refer to separate manuals for instructions covering the actuator, positioner, and accessories.

Description

The 461 valve (figure 1) is a self-cleaning, increased-outlet, angle valve that is typically used in the chemical and hydrocarbon industries where control of residual oils or other liquids with choking properties is necessary. The 461 features a venturi-type throat, which is useful in power plants or slurry services where high pressure drops and flashing might exist.

Do not install, operate, or maintain a 461 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

Valve Sizes (inlet size x outlet size) NPS ■ 2x3, ■ 3x4, ■ 4x6, and ■ 6x8 Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4 Standard: Class IV Optional: Class V	Flow Characteristic Equal percentage Micro-Form flow characteristic in the 12.7 to 31.8 mm (0.5 to 1.25 inch) port size and a modified parabolic flow characteristic in the 38.1 to 114.3 mm (1.5 to 4.5 inch) port size Flow Direction Flow down Packing Arrangement PTFE and graphite ribbon/filament are available as standard packing
---	---

Specifications

Specifications for the 461 valve are shown in table 1. If the valve is shipped with the actuator, some of the valve specifications are on the valve nameplate, which is attached to the actuator. If the valve is shipped without the actuator, the valve nameplate is wired to the valve.

Educational Services

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Installation

WARNING

To avoid personal injury or equipment damage caused by sudden release of pressure, install the valve assembly only where service conditions will not exceed the limits given on the appropriate nameplate.

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

1. Before installing a 461 valve, inspect it for any foreign material that may have collected during crating or shipping.
2. Check that the pipelines are free of pipe scale, chips, welding slag, and other foreign material.
3. Use accepted piping practices when installing the valve.
4. Do not install the valve in a system where the service conditions exceed those specified when the valve was ordered.
5. If continuous operation is required during maintenance and inspection, install a three-valve bypass around the valve body so that it will be isolated.
6. Orient the valve body so that the flow will be in the direction indicated by the flow direction arrow located on the outside of the valve body to ensure proper self-cleaning action.
7. If the actuator and valve are shipped separately, refer to the actuator mounting procedure outlined in the appropriate actuator instruction manual.
8. If the valve body was shipped without packing installed in the packing box, install the packing before putting the valve body into service. Refer to instructions given in the Packing Maintenance procedure.

WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

Valves with ENVIRO-SEAL™ live-loaded packing or HIGH-SEAL Heavy-Duty live-loaded packing will not require this initial re-adjustment. See the instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#), or HIGH-SEAL Live-Loaded Packing System, [D101453X012](#), (as appropriate) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section near the end of this manual.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

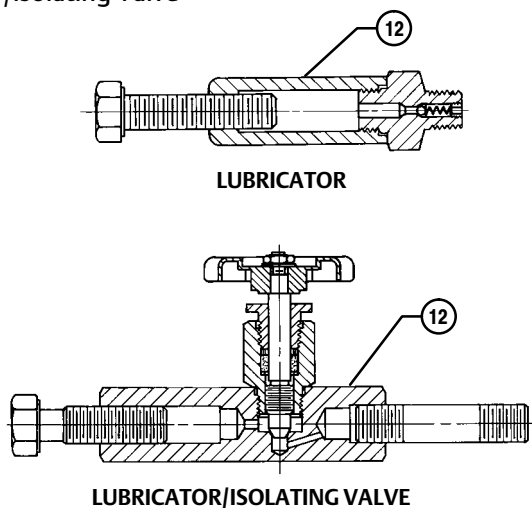
- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

If the valve has ENVIRO-SEAL live-loaded packing installed (figure 4), see the instruction manual entitled ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#), for packing instructions.

If the valve has HIGH-SEAL Heavy-Duty live-loaded packing installed (figure 4), see the instruction manual entitled HIGH-SEAL Live-Loaded Packing System, [D101453X012](#), for packing instructions.

Figure 2. Lubricator and Lubricator/Isolating Valve



10A9421-A
AJ5428-D
A0832-2

Packing Lubrication

Note

To avoid lubricants breaking down at elevated temperatures, do not lubricate packing used in processes with temperatures over 260°C (500°F).

⚠ WARNING

Do not lubricate parts when used in oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

If a lubricator or lubricator/isolating valve (figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the pipe plug (key 12, figure 6). Use a good quality silicon-base lubricant. Packing used in oxygen service or in processes with temperatures over 260°C (500°F) should not be lubricated. To operate the lubricator, turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except the isolating valve must first be opened and then closed after lubrication is completed.

Packing Maintenance

If there is undesirable packing leakage in the spring-loaded PTFE V-ring packing shown in figure 3, tighten the packing flange nuts (key 25, figure 6) until the shoulder on the packing follower (key 29, figure 6) contacts the bonnet (key 14, figure 6). If leakage continues, replace the packing by following the numbered steps presented in the replacing packing procedure.

If there is undesirable packing leakage with other than spring-loaded PTFE V-ring packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts (key 25, figure 6) to at least the minimum recommended torque in table 2 or 3. However, do not exceed the maximum recommended torque in table 2 or 3 or excessive friction may result. If leakage continues, replace the packing by following the numbered steps presented in the Replacing Packing procedure.

If the packing is relatively new and tight on the valve plug stem, and if tightening the packing flange nuts does not stop the leakage, it is possible that the stem is worn or nicked so that a seal cannot be made. The surface finish of a new stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. While replacing the packing according to the Replacing Packing procedure, inspect the valve plug stem and packing box wall for nicks or scratches.

Adding Packing Rings

Key numbers referred to in this procedure are shown in figure 6, unless otherwise indicated.

When using packing with a lantern ring, it may be possible to add packing rings above the lantern ring as a temporary measure without removing the actuator from the valve body.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the packing flange nuts (key 25) and lift the packing flange, upper wiper, and packing follower (keys 23, 16, and 29) away from the valve body.
3. It may be possible to dig out the old packing rings on top of the lantern ring, but use care to avoid scratching the valve plug stem or packing box wall. Clean all metal parts to remove particles that would prevent the packing from sealing.
4. Remove the stem connector and slip the packing rings over the end of the valve plug stem.
5. Reassemble the packing follower, upper wiper, packing flange, and packing flange nuts (keys 29, 16, 23, and 25).
6. Reconnect the body-actuator stem connection according to the appropriate actuator instruction manual.
7. Tighten the packing flange nuts only far enough to stop leakage under operating conditions. Check for leakage around the packing follower when the valve is being put into service. Retighten the packing flange nuts as required (see table 2 or 3).

Replacing Packing

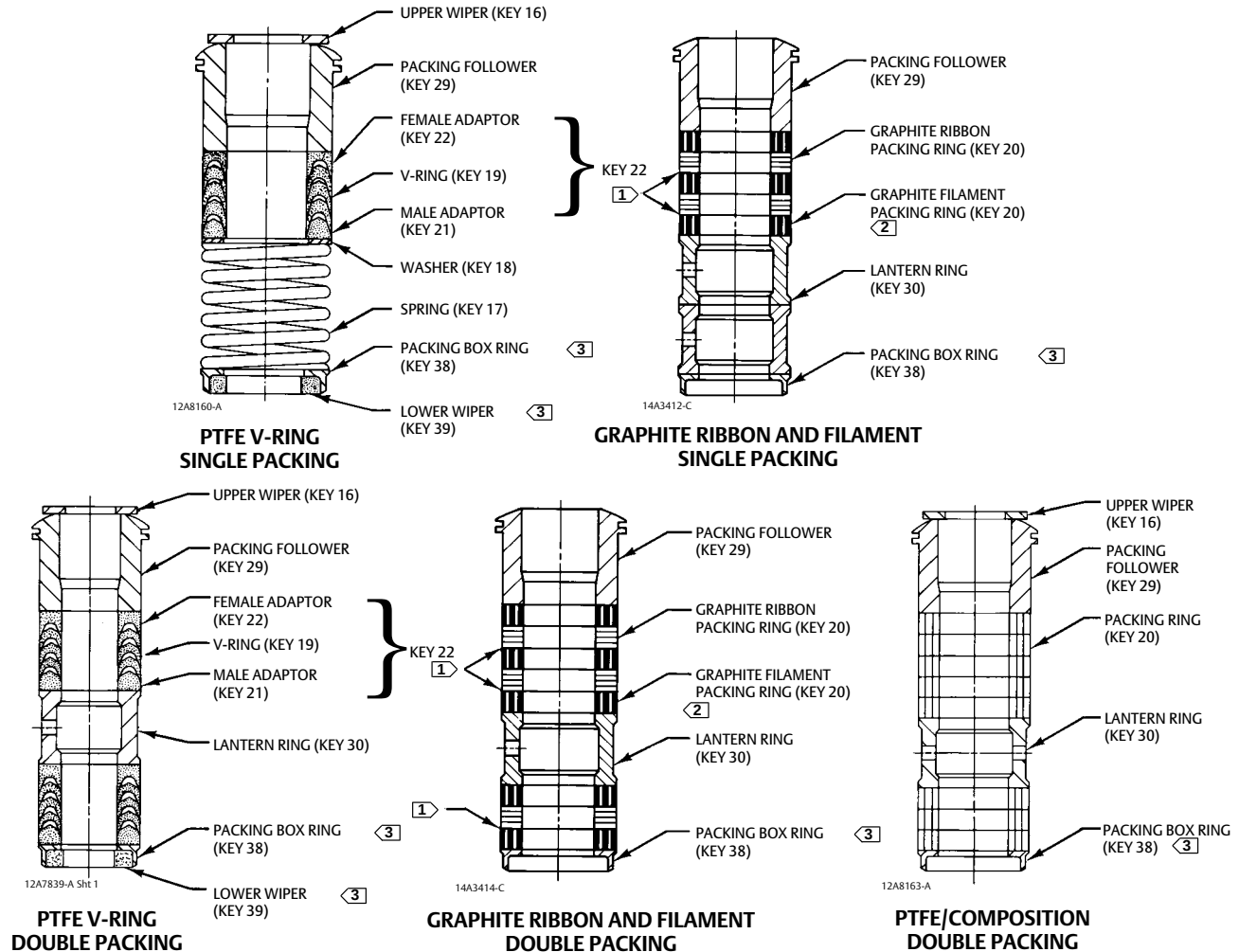
WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Key numbers referred to in this procedure are shown in figure 6, unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the cap screws in the stem connector, and separate the two halves of the stem connector. Then exhaust all actuator pressure, if any was applied, and disconnect the actuator supply and any leakoff piping.

Figure 3. Packing Arrangements

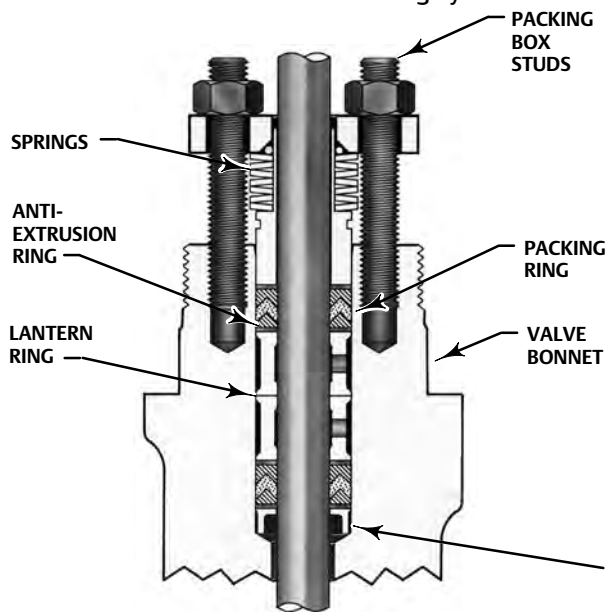


NOTES:

- 1 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS. USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.
- 2 HAS THE APPEARANCE OF A WOVEN OR BRAIDED RING.
- 3 FOR A FLAT BOTTOM PACKING BOX, THESE PARTS ARE NOT NEEDED.

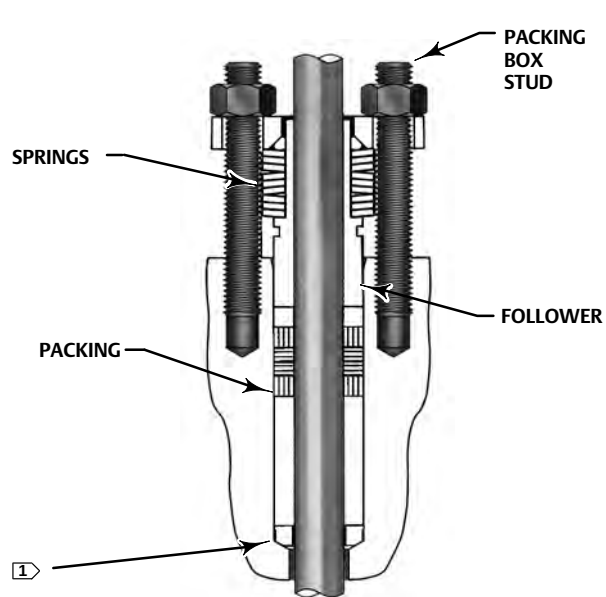
C0747-1

Figure 4. ENVIRO-SEAL and HIGH-SEAL Packing Systems



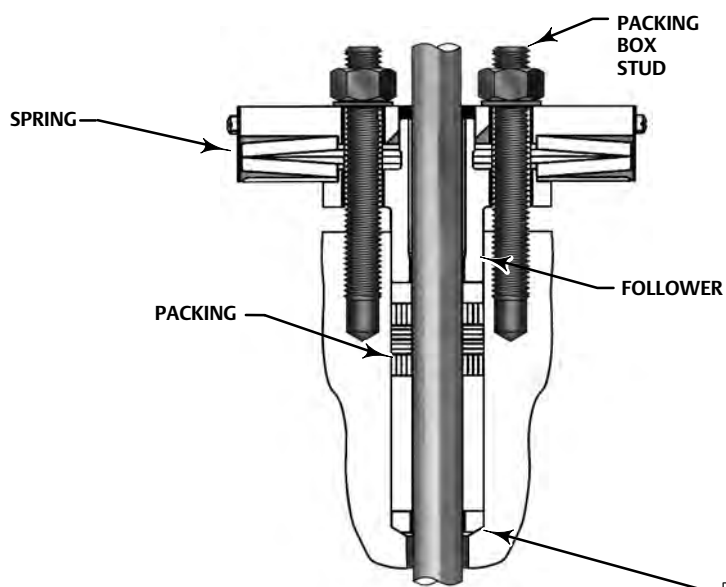
W5803-3

TYPICAL ENVIRO-SEAL PACKING SYSTEM WITH PTFE PACKING



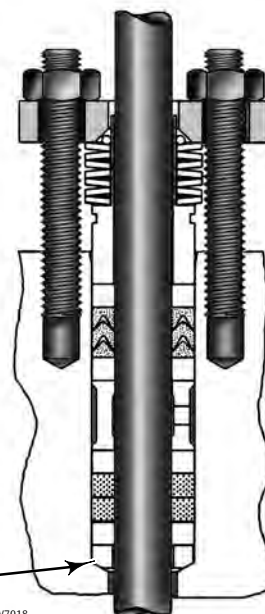
W8532-1

TYPICAL ENVIRO-SEAL PACKING SYSTEM WITH GRAPHITE ULF PACKING



W8533-1

TYPICAL HIGH-SEAL PACKING SYSTEM WITH GRAPHITE ULF PACKING



W7018

TYPICAL ENVIRO-SEAL PACKING SYSTEM WITH DUPLEX PACKING

1 FOR A FLAT BOTTOM PACKING BOX, THE PACKING BOX RING AND LOWER WIPER ARE NOT NEEDED.

3. Remove the yoke locknut (key 26), and remove the actuator from the bonnet (key 14).
4. Loosen the packing flange nuts (key 25) so that the packing is not tight on the valve plug stem (key 10). Remove any travel indicator disk and stem locknuts from the valve plug stem threads.

NOTICE

When lifting the bonnet (key 14), be sure that the valve plug and stem assembly (keys 3 and 10) remains on the seat ring (key 2). This avoids damage to the seating surfaces as a result of the assembly dropping from the bonnet after being lifted part way out. The parts are also easier to handle separately. Use care to avoid damaging gasket sealing surfaces.

⚠ WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. If the liner sticks to the bonnet, proceed carefully with bonnet removal and support the liner so that it will not fall unexpectedly from the bonnet.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

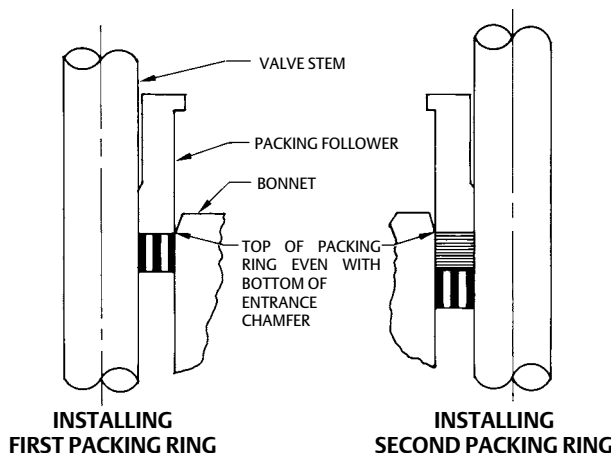
5. Hex nuts (key 8) attach the bonnet to the valve body. Loosen these nuts approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed to the next step.
6. Unscrew the hex nuts (key 8) and carefully lift the bonnet off the valve stem. If the valve plug and stem assembly starts to lift with the bonnet, use a brass or lead hammer on the end of the stem and tap it back down. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.
7. Remove the valve plug (key 3), bonnet gasket (key 6) and the liner (key 5).

⚠ WARNING

To avoid personal injury or property damage caused by process media leakage, inspect the liner, bonnet, and body gasket surfaces to ensure they are in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm (0.003 inches) in height (the thickness of a human hair) can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, because they will prevent the gaskets from sealing properly.

8. Clean all gasket surfaces with a good wire brush. Clean in the same direction as the surface serrations, not across them.
9. Cover the opening in the valve body to protect the gasket surface and to prevent foreign material from getting into the valve body cavity.
10. Remove the packing flange nuts (key 25), packing flange (key 23), upper wiper (key 16), and packing follower (key 29). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall.

Figure 5. Installing Graphite Ribbon/Filament Packing Rings One at a Time



A2207-2

11. Clean the packing box and the following metal packing parts: packing follower, packing box ring, spring or lantern ring, and, for single arrangements of PTFE V-ring packing only, special washer (key 18).
12. Inspect the valve stem threads for any sharp edges that might cut the packing. A whetstone or emery cloth may be used to smooth the threads if necessary.
13. Remove the protective covering from the valve body cavity, and install the liner. Install the plug and position the new bonnet gasket (key 6) on top of the valve body. Then slide the bonnet over the stem and onto the studs (key 7).

Note

The prelubricated hex nuts (key 8) referred to in step 14 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 14 include--but are not limited to--ensuring that the bonnet stud threads are clean, and that the hex nuts are evenly tightened to the specified torque values.

NOTICE

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 4 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended.

14. Lubricate the stud threads, nut threads, and the faces of the hex nuts (key 8) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Replace the hex nuts and tighten them finger-tight. Stroke the valve several times to center the trim. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 4.

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January 2023

Instruction Manual

D100714X012

When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

Note

When installing packing rings, prevent entrapping air between the rings. Add the rings one at a time without forcing them below the chamfer of the packing box entrance chamber. As each successive ring is added, the stack should not be pushed down more than the thickness of the added ring (figure 5).

15. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 3. If desired, packing parts may be pre-lubricated with a silicon base grease for easier installation. Slip a smooth-edged pipe over the valve stem, and gently tamp each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.
16. Slide the packing follower, wiper, and packing flange into position. Lubricate the packing flange studs (key 24) and the faces of the packing flange nuts (key 25). Replace the packing flange nuts.

For the spring-loaded PTFE V-ring packing shown in figure 3, tighten the packing flange nuts until the shoulder on the packing follower (key 29) contacts the bonnet.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 2. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 2.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 3. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

For ENVIRO-SEAL or HIGH-SEAL live-loaded packing, refer to the note at the beginning of the Maintenance section.

17. Mount the actuator on the valve body assembly, and reconnect the actuator and valve plug stems according to the procedures in the appropriate actuator instruction manual.

Table 2. Recommended Torque for Graphite Type Packing Flange Nuts (Non Live-Loaded)

VALVE STEM DIAMETER		PRESSURE RATING	TORQUE			
			N•m		lbf•ft	
mm	Inches		Min	Max	Min	Max
19.1	3/4	CL600	21	31	15	23
		CL900	27	41	20	30
		CL1500	34	50	25	37
		CL2500	41	61	30	45
25.4	1	CL600	35	53	26	39
		CL900	42	62	31	46
		CL1500	52	77	38	57
		CL2500	61	91	45	67
31.8	1-1/4	CL600	49	74	36	55
		CL900	56	83	41	61
		CL1500	68	102	50	75
		CL2500	81	122	60	90

Replacing Trim

Refer to figure 6.

Disassembly

1. Remove the actuator and the bonnet according to steps 1 through 6 of the Replacing Packing section.
2. Remove the valve plug and stem assembly (keys 3 and 10) from the valve. If the stem needs to be replaced, drive the pin (key 11) out, and unthread the stem from the plug.

NOTICE

Never use an old stem with a new valve plug. The use of an old stem requires drilling a new pin hole through the stem, which will weaken the stem.

3. If the valve plug needs replacing, replace the entire valve plug and stem assembly. Do not reuse the old stem on a new valve plug. If only a new stem is necessary, screw the plug onto the new stem. Drill a 4.8 mm (3/16 inch) hole through the stem using the plug pin hole as a guide. Drive the pin into the stem and plug.

Table 3. Recommended Torque for PTFE Type Packing Flange Nuts (non live-loaded)

VALVE STEM DIAMETER		PRESSURE RATING	TORQUE			
			N•m		lbf•ft	
mm	Inches		Min	Max	Min	Max
19.1	3/4	CL600	10	15	7	11
		CL900	27	41	20	30
		CL1500	34	50	25	37
		CL2500	41	61	30	45
25.4	1	CL600	17	25	13	18
		CL900	42	62	31	46
		CL1500	52	77	38	57
		CL2500	61	91	45	67
31.8	1-1/4	CL600	24	36	18	27
		CL900	56	83	41	61
		CL1500	68	102	50	75
		CL2500	81	122	60	90

4. With the stem and valve plug assembly removed, slide the liner (key 5) out of the valve body. Inspect the seat ring (key 2) for nicks and scratches. Make sure the valve plug and seat ring contact surfaces are free of nicks and scratches.
5. To remove the liner (key 5), break it loose by using cap screws in the tapped holes located in the liner's flange. (In some very hard materials, i.e., R30006, the holes have been omitted; therefore, a sleeve puller or similar device must be used).
6. To replace the seat ring (key 2), remove the valve from the line, or remove the pipe connected to the flange. Then, unthread the seat ring retainer (key 4), and remove the seat ring through the bottom of the valve body.

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Table 4. Recommended Torque for Valve Body to Bonnet Nuts⁽¹⁾

VALVE SIZE, NPS	PRESSURE RATING	STUD DIAMETER, INCHES	TORQUE			
			B7/2H, B7M/2HM, B8M2/8M, S20910, S32760, S66286/Gr. 7M		N06625	
			N•m	lbf•ft	N•m	lbf•ft
2x3	CL300	7/8	373	275	339	250
	CL600		373	275	339	250
	CL900		373	275	339	250
	CL1500		373	275	339	250
	CL2500	1-1/8	712	525	712	525
3x4	CL300	7/8	373	275	339	250
	CL600		373	275	339	250
	CL900	1	522	385	502	370
	CL1500		522	385	502	370
	CL2500	1-1/2	1654	1220	1654	1220
4x6	CL300	1	522	385	502	370
	CL600		522	385	502	370
	CL900	1-1/4	942	695	942	695
	CL1500		942	695	942	695
	CL2500	1-3/4	2670	1970	2670	1970
6x8	CL300	1	522	385	502	370
	CL600		522	385	502	370
	CL900	1-1/2	1654	1220	1654	1220
	CL1500		1654	1220	1654	1220

1. Contact your [Emerson sales office](#) for torque requirements when other bolt materials or lubricants other than anti-seize lubricants are used.

Table 5. Recommended Torque for Seat Ring Retainer

VALVE SIZE, NPS	PRESSURE RATING	TORQUE (lbf•ft)
2x3	CL600	1100
	CL1500	1200
	CL2500	
3x4	CL600	2100
	CL1500	
	CL2500	
4x6	CL600	4600
	CL1500	4800
	CL2500	
6x8	CL600	6100
	CL1500	

Assembly

1. When assembling, use a new bonnet gasket (key 6), and wipe all sealing surfaces (valve body, bonnet, and gaskets) with a clean cloth. If the seat ring (key 2) was removed, install it in the valve body (key 1), and then torque the seat ring retainer (key 4) into the valve body. Because there is no gasket between the seat ring and the valve body, make sure that the mating surfaces are clean and free of nicks and scratches.
2. Replace the liner (key 5). Then, slide the valve plug and stem assembly (keys 3 and 10) into the valve body (key 1).

3. Mount the bonnet (key 14) onto the valve body (key 1), being careful not to damage the gasket.

Note

If the seating surfaces of the valve plug and seat ring require lapping, refer to the Lapping Seating Surfaces section before continuing to assemble the valve.

NOTICE

Avoid product damage in the following step by taking care not to damage the packing while installing the bonnet.

4. If it is necessary to replace the packing, perform steps 10 through 16 of the Replacing Packing section. However, if it is not necessary to replace the packing, make sure to install the bonnet carefully on the valve body to avoid damaging the packing with the valve stem threads.
5. Lubricate the valve body studs and nuts (key 7) with anti-seize lubricant, and install the nuts (key 8) on the bolts. Tighten the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 4 to ensure a positive seal and even pressure on the bonnet.

When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

Note

It may be necessary to repeat the bolting pattern several times until the bonnet-to-body seal is made since the tightening of one nut might loosen an adjacent nut. It is recommended that the pattern be repeated until none of the nuts will turn at the recommended torque.

6. Mount the actuator on the bonnet, and make up the stem connection according to the procedure given in the appropriate actuator instruction manual.

Lapping Seating Surfaces

A certain amount of leakage should be expected with metal-to-metal seating in any valve body. If the leakage becomes excessive, however, the condition of the seating surfaces of the valve plug and seat ring can be improved by grinding. Large nicks should be machined out rather than ground out. Use a commercial lapping compound or a mixture of 600-grit Carborundum and solidified vegetable oil. Apply the compound to the bottom of the valve plug, and apply white lead to the seat ring to prevent excessive tearing or cutting during lapping. The white lead should not be mixed with the grinding compound, but rather applied separately.

The valve must be assembled to the extent that the valve plug and stem assembly (keys 3 and 10) and the seat ring (key 2) are in place and the bonnet (key 14) is bolted to the valve body (key 1). A simple handle can be made from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction to lap the seats. After lapping, remove the bonnet, and clean the seating surfaces. Completely assemble as described in the Assembly part of the Maintenance section, and test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

Parts Ordering

Each body-bonnet assembly is assigned a serial number, which is on the body nameplate. The serial number also appears on the actuator nameplate if you bought a valve and actuator assembly. Refer to this serial number when contacting your [Emerson sales office](#) for technical advice. When ordering replacement parts, mention this serial number. Also specify key number and part description following Parts List.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your Emerson sales office for Part Ordering information.

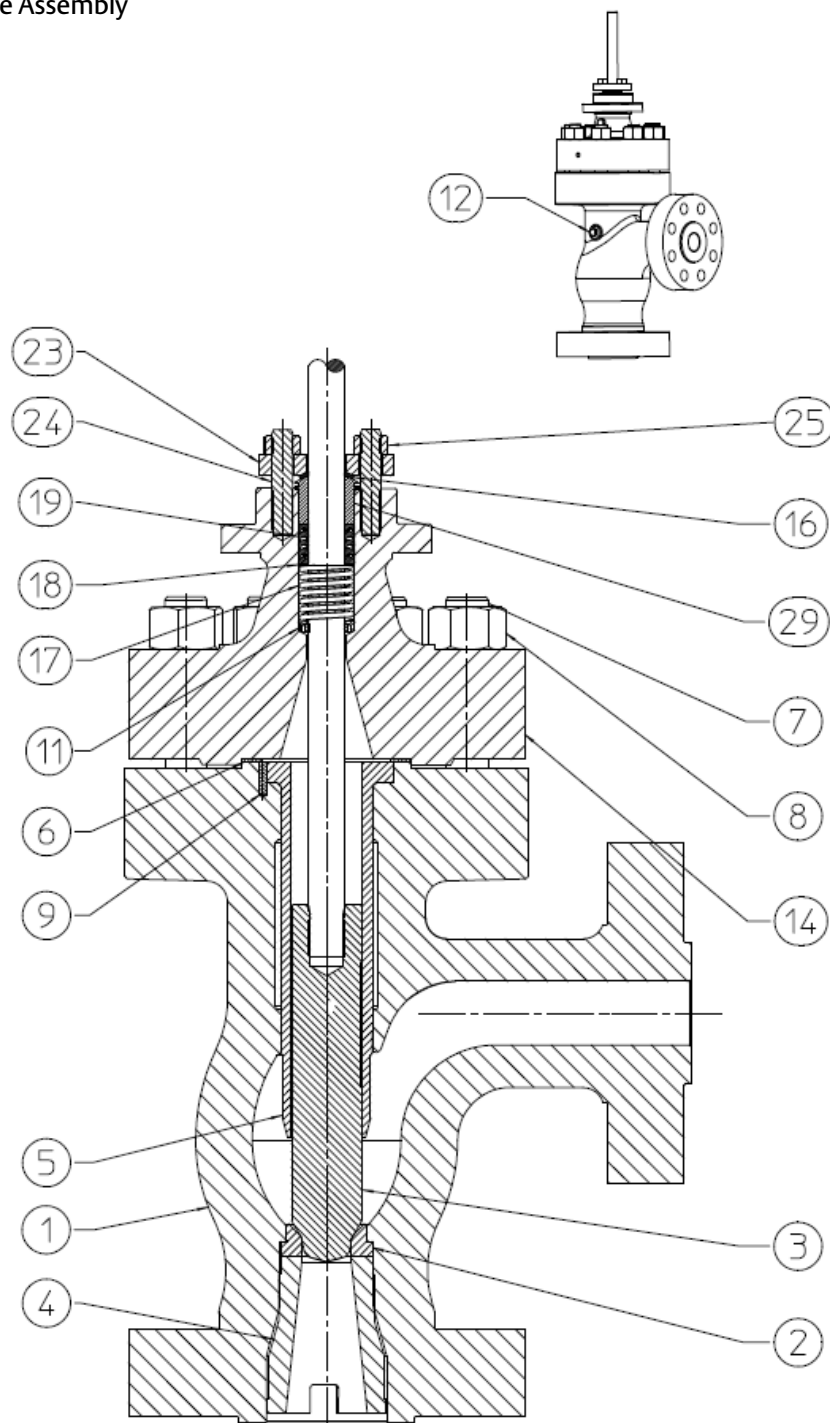
Key Description

1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number, and desired material.
2*	Seat Ring
3*	Plug/Stem Assembly
4*	Seat Ring Retainer
5*	Liner
6*	Gasket
7	Stud Bolt, (8 req'd for NPS 2x3 through NPS 4x6, 12 req'd for NPS 6x8)
8	Hex Nut, (12 req'd for NPS 6x8, 8 req'd for all other sizes)

Key Description

9	Line Position Pin
11	Packing Box Ring
12	Pipe Plug
14	Bonnet If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.
16*	Upper Wiper
17	Spring
18	Washer
19*	Packing Ring
21*	Male Adaptor
22*	Female Adaptor
23	Packing Flange
24	Packing Stud (2 req'd)
25	Packing Nut (2 req'd)
26	Yoke Locknut
29	Packing Follower
33	Companion Flange
34*	Gasket (2 req'd)
35	Stud Bolt (4 req'd)
36	Hex Nut (4 req'd)
37	Equalizing Connection
40	Nameplate
41	Wire
42	Drive Screw
43	Nameplate

Figure 6. Fisher 461 Valve Assembly



KEYS 26, 33, 34, 35, 36, 37, 40, 41, 42, AND 43 NOT SHOWN

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Actuator Groups (by Type Number)

Group 1 90 mm (3-9/16 Inch) Yoke Boss	Group 100 & 407 127 mm (5, 5H Inch) Yoke Boss
585C 657 and 667—76.2 mm (3 Inch) Travel 1008 685 785C	585C 657 1008 685 785C
	Group 101 & 404 127 mm (5, 5H Inch) Yoke Boss
	667

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Fisher™ 480 Series Yokeless Piston Actuators

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Figure 1. Fisher 480-15 Piston Actuator



W1867

Introduction

Scope of Manual

This instruction manual provides installation, maintenance, and parts information for Fisher 480 Series yokeless piston actuators.

Do not install, operate, or maintain 480 Series actuators without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

480 Series actuators (figure 1) are yokeless piston actuators that are used in either throttling or on/off applications with ball valves, butterfly valves, louvers, dampers, and rheostats. They require pneumatic pressure loading from double-acting positioners (Fisher 3570) or from on/off loading and unloading devices.

Specifications

Table 1 lists specifications for the 480 Series actuator and table 3 lists specifications for the 3570 actuator.

Table 1. Fisher 480 Series Actuator Specifications

Available Configurations See the Actuator Configurations section. Cylinder Pressure Maximum Allowable:⁽⁴⁾ 10.3 bar (150 psig) Required to Produce a Given Thrust: See figure 2 Minimum Recommended: Valves with low torque requirements -- (2.4 bar [35 psig]); all other valves -- (3.4 bar [50 psig]) Maximum Supply Source Consumption With Positioner and Constant Input Signal: 0.54 normal m³/hr⁽¹⁾ (20 scfh⁽¹⁾) of air at 6.9 bar (100 psig) Without Positioner: Depends on cylinder volume and supply pressure Travel Information Maximum Rated Travels, All 480 Series actuators with Linear Output: See table 2 Travel Stops Available for 480 Series actuators with 105 mm (4.125 inch) Maximum Rated Travels: See table 2 Thrust Information See figure 2 Torque Output 480, 480-15, and 480-16 (for butterfly valves): Contact your Emerson sales office or Local Business Partner	Stroking Speeds See table 2 Operative Ambient Temperature⁽²⁾ With Nitrile O-Rings: -46 to 80°C (-50 to 175°F) With Fluorocarbon O-Rings (Optional):⁽³⁾ -18 to 149°C (0 to 300°F) Actuator Size and Piston Size See table 2 Pressure Connections Standard is 1/4 NPT. For larger sizes, contact your Emerson sales office. Construction Materials Actuator: <table border="1"> <thead> <tr> <th>Part</th><th>Material</th></tr> </thead> <tbody> <tr> <td>Cylinder and Piston</td><td>Aluminum</td></tr> <tr> <td>Piston Rod Extension</td><td>SST, Chrome Plated</td></tr> <tr> <td>Cylinder Seal Bushings</td><td>Brass</td></tr> <tr> <td>O-Rings</td><td>Nitrile or Fluorocarbon</td></tr> </tbody> </table> Options ■ 376 Series trip valve system to fail actuator ■ up or ■ down or ■ lock in last position ■ TopWorx™ DXP M21GNEB electrical valve stem position switch ■ Micro-Switch limit switches	Part	Material	Cylinder and Piston	Aluminum	Piston Rod Extension	SST, Chrome Plated	Cylinder Seal Bushings	Brass	O-Rings	Nitrile or Fluorocarbon
Part	Material										
Cylinder and Piston	Aluminum										
Piston Rod Extension	SST, Chrome Plated										
Cylinder Seal Bushings	Brass										
O-Rings	Nitrile or Fluorocarbon										

1. Normal m³/hr. - normal cubic meters per hour (0°C and 1.01325 bar, absolute); Scfh - standard cubic feet per hour (60°F and 14.7 psia).

2. These terms are defined in ANSI/ISA Standard 551.1

3. Without snubber. If this actuator has a snubber, the temperature specification is the same for the nitrile version.

4. The pressure limits in this bulletin and any applicable standard or code limitation for actuator should not be exceeded.

Table 2. Size, Piston, Stroking Speed, and Travel Information

ACTUATOR SIZE	EFFECTIVE PISTON AREA		PISTON DIAMETER		STROKING SPEED ⁽¹⁾		SINGLE-FLANGE				TRAVEL STOPS AVAILABLE FOR ACTUATORS WITH 105 mm (4.125 INCHES) MAXIMUM RATED TRAVEL	
							-16 Versions		All Others Except Fisher 487, 487-1 ⁽²⁾			
	Cm ²	Inch ²	mm	Inch	mm/s	Inch/s	mm	Inch	mm	Inch	mm	Inch
30	107	16.5	121	4.75	102	4	---	---	105	4.125	89	3.5
40	182	28.25	156	6.125	52	2.05	206	8.125	105	4.125	89	3.5
60	258	55.5	216	8.5	33	1.30						
1. For actuators with positioners at 6.9 bar (100 psig) supply pressure and all prestroke conditions satisfied. Stroking speeds for actuators without positioners or with snubbers will depend on the particular construction involved. 2. See 480 series Actuators Specifications for these travels.												

Table 3. Fisher 3570 Actuator Specifications

Available Configurations

3570: Valve positioner with two relays and three pressure gauges for monitoring input signal and output pressures to the top and underside of the actuator piston

3570C: Similar to 3570 except that the positioner is equipped with automotive tire valves instead of pressure gauges. The valves can be used for clip-on test pressures gauges. The relay nozzles on these positioners are locked in place with locknuts to resist unwanted nozzle movement due to vibration

Input Signal

Standard Ranges: 0.2 to 1.0 bar (3 to 15 psig) or 0.4 to 2.0 bar (6 to 30 psig)

Split Ranges: Typically uses one half of standard range when two control valves are operated by one input signal from a single controller

Optional Ranges: As required within the limits of the bellows

Bellows Pressure Rating

Standard Bellows: 3.4 bar (50 psig)

Optional Bellows: 6.2 bar (90 psig)

Supply Pressure

Maximum: 10.3 bar (150 psig)

Minimum: 2.4 bar (35 psig)

Output Signal

Type: Pneumatic pressure as required by the actuator

Action: Field reversible between direct and reverse (see table 4)

Hysteresis^(1,2)

0.15% of total stroke or instrument pressure span

Resolution^(1,2)

0.2% of instrument pressure span

Repeatability^(1,2)

0.3% of instrument pressure span

Frequency Response^(1,2)

See figure 3

Pressure Connections

Vent: 3/8 NPT

All Others: 1/4 NPT

Pressure Indications

3570C: Tire valves accept standard pressure gauge chucks

3570: See table below

Type of Indication	Number Used	Standard Gauge Range bar (psig)
Positioner input signal gauge	1	0 to 2.1 (0 to 30) or 0 to 4.1 (0 to 60)
Cylinder supply pressure gauge	0	0 to 11.0 (0 to 160)

Static Air Consumption⁽³⁾

0.56 normal m³/hr (20 scfh) with 6.9 bar (100 psig) supply pressure

Operative Ambient Temperature^(1,2)

With Nitrile O-Rings: -34 to 79°C (-30 to 175°F)

With Fluorocarbon O-Rings (Optional):⁽³⁾

-18 to 149°C (0 to 300°F)

Construction Materials**Actuator:**

Part	Material
Base, Cover and Beam	Aluminum, die cast
Bellows	Brass
Bias and Range Spring	Steel, Plated
Relay Body	Zinc, Die Cast
Relay Nozzle(s)	SST
Diaphragm	Nitrile or Fluorocarbon
O-Rings	Nitrile or Fluorocarbon

Options

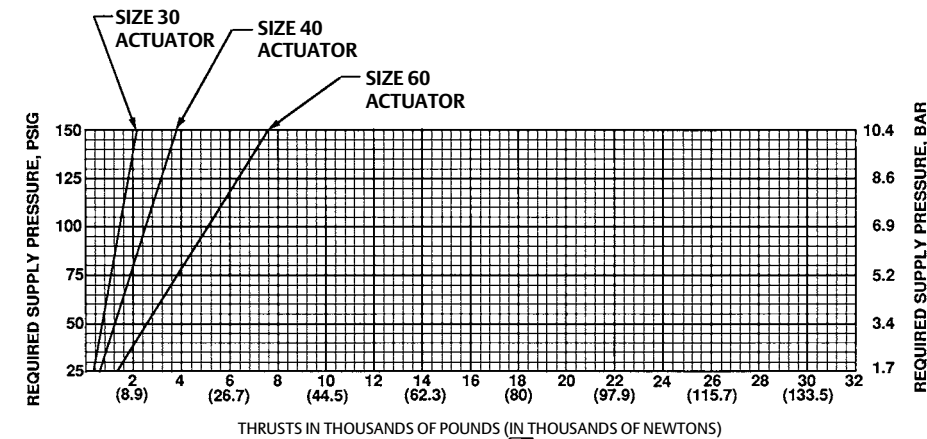
Fisher SS-52 clip-on chuck (with or without gauge) for 3570C positioners

1. These terms are defined in ANSI/ISA Standard S51.1

2. For actuator with positioner only. Does not apply to other constructions or actuator-valve combination.

3. Normal m³/hr.- normal cubic meters per hour (0°C and 1.01325 bar, absolute); Scfh - standard cubic feet per hour (60°F and 14.7 psia).

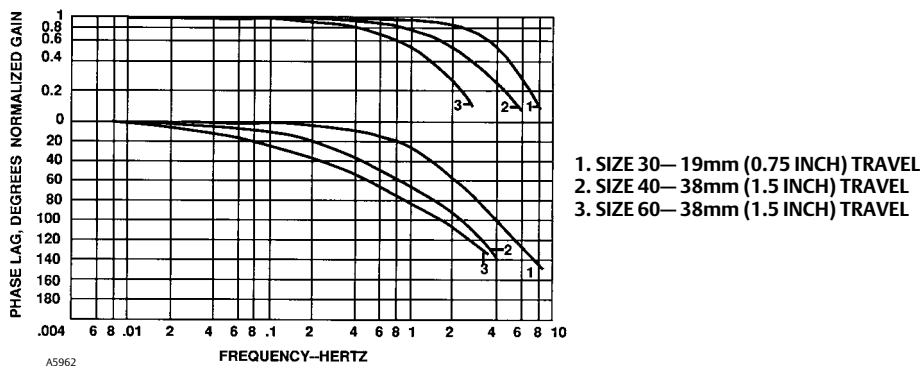
Figure 2. Supply Pressure and Thrusts



NOTE:

- 1 MAY BE INCREASED BY 10% FOR ACTUATORS WITHOUT POSITIONERS. EITHER THIS THRUST, OR THE MAXIMUM ALLOWABLE LOADING FOR THE CONTROL DEVICE IS THE LIMITING FACTOR FOR USABLE ACTUATOR FORCE.

Figure 3. Frequency Response



Educational Services

For information on available courses for Fisher 480 Series actuators, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Actuator Configurations

480: Yokeless piston actuator with positioner.

481: Yokeless piston actuator without positioner. Other actuators may be obtained without positioner by adding -1 to the type number.

The above actuators come with standard mounting flange, 105 mm (4.125 inch) maximum rated travel, and threaded piston rod connection with sizes 30 through 60 for mounting on ball valves, louvers, and dampers with brackets.

These actuators may be obtained with the following alternate universal mounting flange constructions:

-15 Added to Type Number: Allows butterfly valve mounting for a standard actuator with 105 mm (4.125 inch) maximum travel and threaded piston rod connection, and comes in sizes 30 through 60.

-16 Added to Type Number: Provides 206 mm (8.125 inch) maximum travel and threaded piston rod connection, and comes in sizes 40 through 60.

Table 4. Action Under Normal Operating Conditions

ACTUATOR DESCRIPTION		DESIRED PISTON MOTION	
		Down	Up
With Positioner	Direct-acting	Increasing input signal pressure to bellows ⁽¹⁾	Decreasing input signal pressure to bellows ⁽¹⁾
	Reverse-acting	Decreasing input signal pressure to bellows ⁽¹⁾	Increasing input signal pressure to bellows ⁽¹⁾
Without positioner		Supply pressure loaded on top of piston, exhausted from bottom	Supply pressure loaded on bottom of piston, exhausted from top

1. Supply pressure is routed through relays to piston.

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or 3 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for overpressure protection as required by accepted industry or local, state, and Federal codes and good engineering practices.

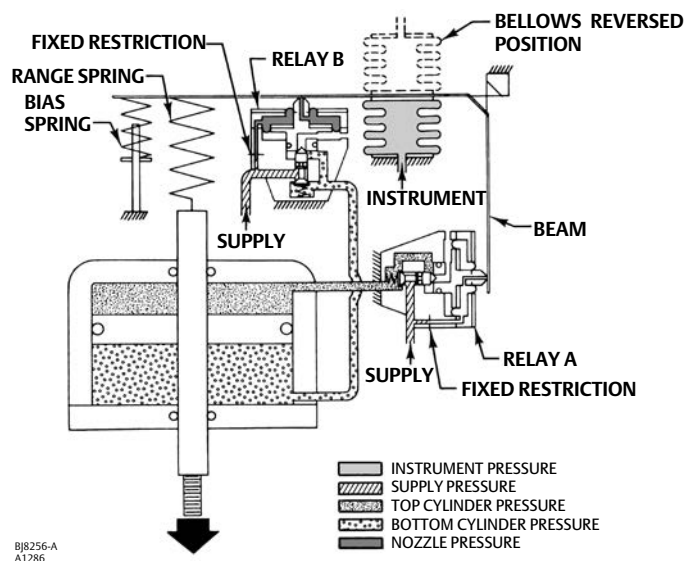
Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Inspect this equipment on arrival to note any damage which may have occurred in transit. If the actuator is attached to a valve body when received, install the valve in the pipeline with flow in the direction of the arrow on the valve body. (Some valve types, notably various butterfly valves, can be installed with flow in either direction and are unmarked as to proper flow direction.)

A three-valve bypass around the main valve is recommended to permit continuous operation during periodic maintenance or inspection of the main valve.

Figure 4. Operation of Actuator with Positioner



When 480 Series actuators are supplied to operate dampers, louvers, or similar equipment, a suitable mounting plate should be provided, and the piston rod of the actuator connected to the operating arm of the damper, etc., with appropriate linkage.

Figure 5. Cylinder Diameter and Bolt Center Location, All Actuators (refer to table 5)

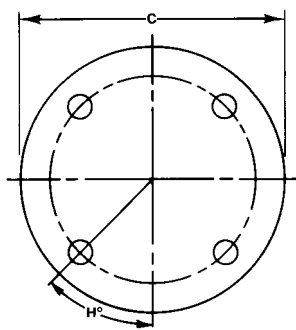
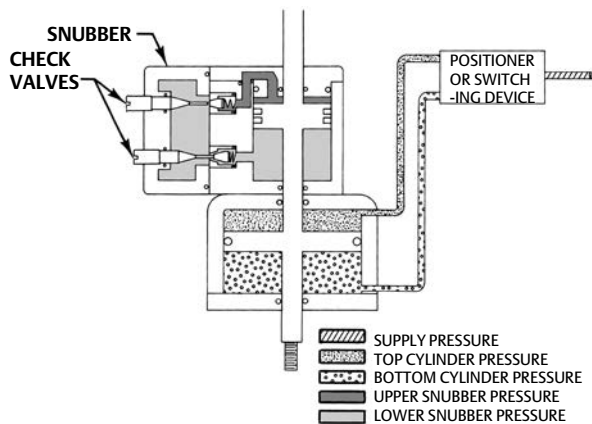


Table 5. Cylinder Diameter and Bolt Center Location, All Actuators

ACTUATOR SIZE	C		H, DEGREE OF ARC	
	mm	Inch	Standard Flange	Universal Mounting Flange
30	171	6.75	0	45
40	206	8.12	45	45
60	267	10.50	22.5	45

Figure 6. Operation of Actuator with Snubber



Principle of Operation

Actuator

These actuators react to a pressure unbalance that is created by loading supply pressure on one side of the piston and unloading the opposite side. Some type of switching device is required to shift the supply pressure from one side of the piston to the other. For most actuators in the 480 Series, this device is a 3570 positioner. However, a separate loading device must be provided for actuators without positioners.

For actuators with positioners (figure 4), the pneumatic output signal from a controller or instrument is piped to the positioner bellows. As long as the bellows receives a constant input signal pressure, the beam remains motionless and allows supply pressure to bleed through both relay nozzles so that a constant pressure is maintained between the nozzle and the fixed orifice. The relays are in equilibrium with their inlet and exhaust valves closed.

Assume that a downward piston motion is required and the bellows receives a corresponding change in input signal pressure. This causes the beam to pivot so that it covers the nozzle on relay A. (Beam movement is accomplished either by increasing the input signal pressure on a direct-acting positioner to expand the bellows, or by decreasing the input signal pressure on a reverse-acting positioner to contract the bellows.)

The nozzle pressure in relay A increases due to the restriction created by the beam over the nozzle. Through relay action, the air pressure to the top of the piston is increased. At the same time, relay B reacts to the change in beam position to decrease the pressure to the underside of the piston. Due to the resulting unbalanced forces acting on the piston, it moves down, changing the valve plug position.

Piston movement is fed back to the beam by means of a range spring which is connected to the beam and to the piston rod extension, applying a force to the beam opposite to that caused by the expanding or contracting bellows. This feedback arrangement prevents overcorrection and ensures a definite position of the piston and valve plug for a given instrument signal.

If upward piston motion is required, the beam pivots over the nozzle on relay B. The result is relay, piston, and feedback action opposite that for downward piston motion.

Reversal of positioner action is accomplished simply by removing four screws, inverting the bellows, and installing two bellows posts for support if the change is from direct to reverse action. Bellows posts are stored in the positioner case and are not used if the change is from reverse to direct.

Actuator with Snubber

As the actuator piston strokes, the snubber piston moves inside an oil-filled cylinder, forcing oil from one side of the piston to the other through two check valves (see figure 6). The resistance to flow created by the settings of the check valves and the shock absorbing quality of the oil combine to damp out any tendency of the valve plug to jump. The plug of each check valve is held off its seat by the positioning of the adjusting screws. Thus, with the adjusting screws backed off all the way, maximum damping will be obtained.

Pressure Connections

480

The 3570 positioner, an integral part of 480 actuator units, is factory-assembled to the actuator. Two connections, "Supply" and "Instrument", remain to be made after valve installation. Both are 1/4 NPT holes in the positioner and are labelled. Minimum supply pressure is 2.4 bar (35 psig), but for optimum performance, supply pressure should be held as near as possible to the 10.3 bar (150 psig) maximum. Supply pressure air or gas should be clean and dry, as well as non-corrosive. Use of a Fisher 252 filter is recommended.

The positioner case should always be vented to prevent pressure buildup. If the valve is installed with the actuator below the pipeline, provide a new vent location in the lowest part of the case by removing the cadmium-plated pipe plug from the case and screwing it into the standard vent location. This also serves as a drain hole to prevent accumulation of condensate.

481

The 481 actuator also requires 1/4 NPT external supply pressure piping. The 481 has only a pressure tap cover on top of the cylinder. Supply air pressure must be connected to it, and also to the lower cylinder connection located near the cylinder/cylinder flange joint. An external four-way valve or other switching device must be provided between the main supply pressure line and these two actuator pressure connections.

Adjustments

All three adjustments on the 480 actuator are on the 3570 positioner. For further information on the positioner, such as Adjustments, Maintenance, Reversing, and Relay Operation, refer to the Fisher 3570 instruction manual, [D200137X012](#).

The 481 actuator requires no adjustments.

Actuator Maintenance

WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

It is necessary for efficient and proper operation of the actuator that all parts be free from dirt, abrasives, and foreign material. Upon assembly at the factor, all synthetic rubber O-rings have been coated with water-resistant lithium grease. It is recommended that this lubricant be used on all O-rings, especially those on moving parts or in contact with moving parts, whenever the actuator is dismantled.

Disassembly

Refer to figures 7 and 8.

References to “positioner” can be ignored if a 481 actuator is involved.

1. Bypass the valve body or shut off the pressure in the pipeline.

CAUTION

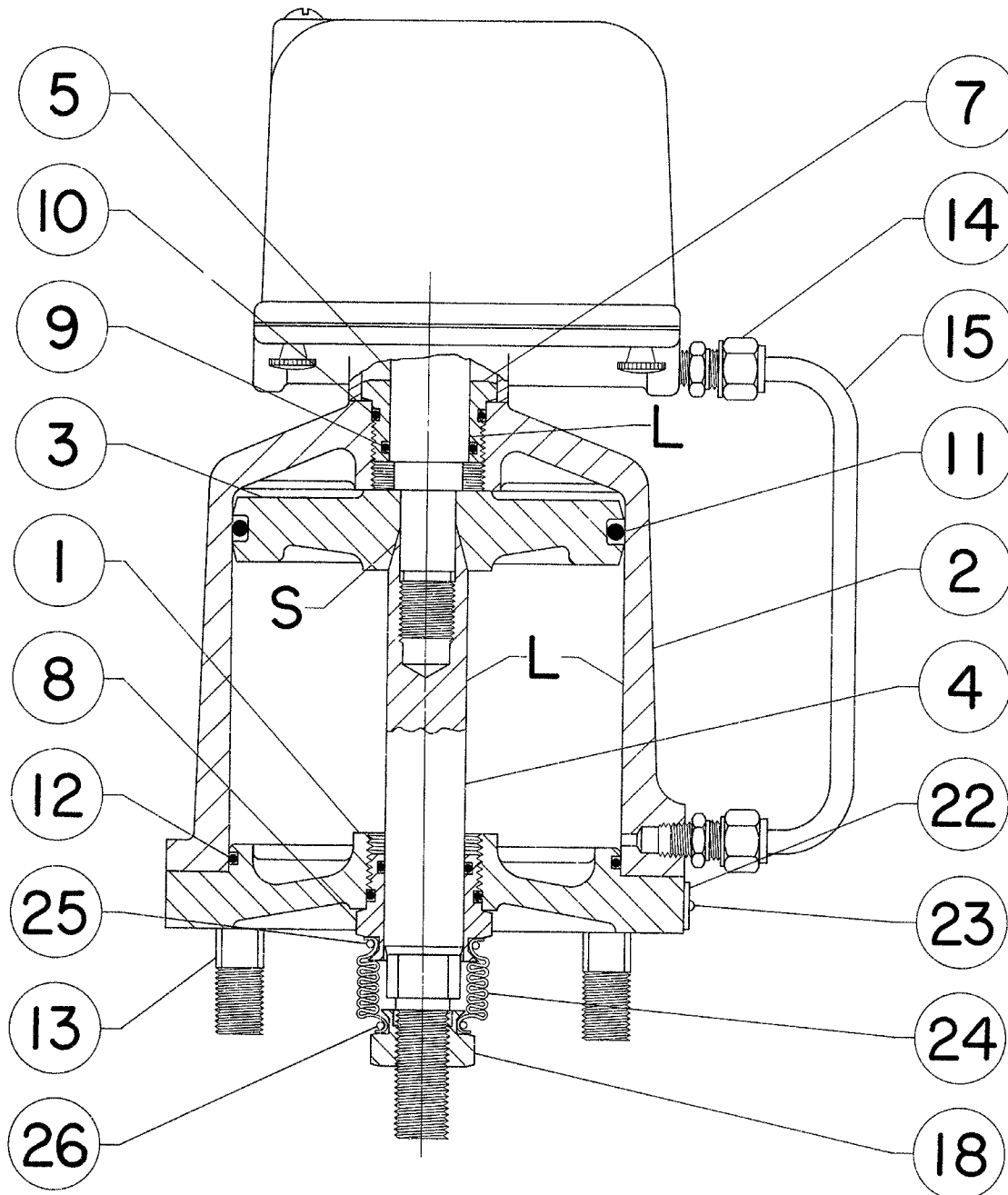
The adjustable linkage between the actuator and the main valve should not be disconnected when the valve is open with fluid flowing. (Dampers or louvers should be in safe, stable positions prior to disconnection.)

2. Shut off all pressure to the actuator. Remove all tubing lines (cylinder, instrument, and supply) from the actuator.
3. Remove the positioner cover after loosening the four cover screws on the underside of the positioner base.
4. Disengage the range spring by unscrewing the spring retainer from the piston rod extension.
5. Loosen the two cap screws that hold the positioner to the cylinder. When removing the positioner, do not lose the small O-ring that is used in the passage from the positioner to the top of the cylinder.
6. Next remove the clevis bolt from the adjustable linkage. Remove the bottom snap ring (key 26) and unscrew the clevis and the boot locknut from the actuator piston rod.
7. Remove the nuts that hold the cylinder to the mounting flange and lift off the cylinder.
8. Remove the stud bolts (key 123) that hold the cylinder to the cylinder flange. Two slots, 180 degrees apart, are located at the lower edge of the cylinder. Insert a screwdriver in these slots and pry the cylinder loose. The piston and piston rod will come out with the cylinder. the piston can then be removed by pulling it out the open end of the cylinder.
9. Unscrew both seal bushings (keys 7 and 8).
10. Inspect all parts for excessive wear and defects. Replace all worn O-rings. Lubricate as mentioned above.
11. To reassemble, reverse the above procedure.

Note

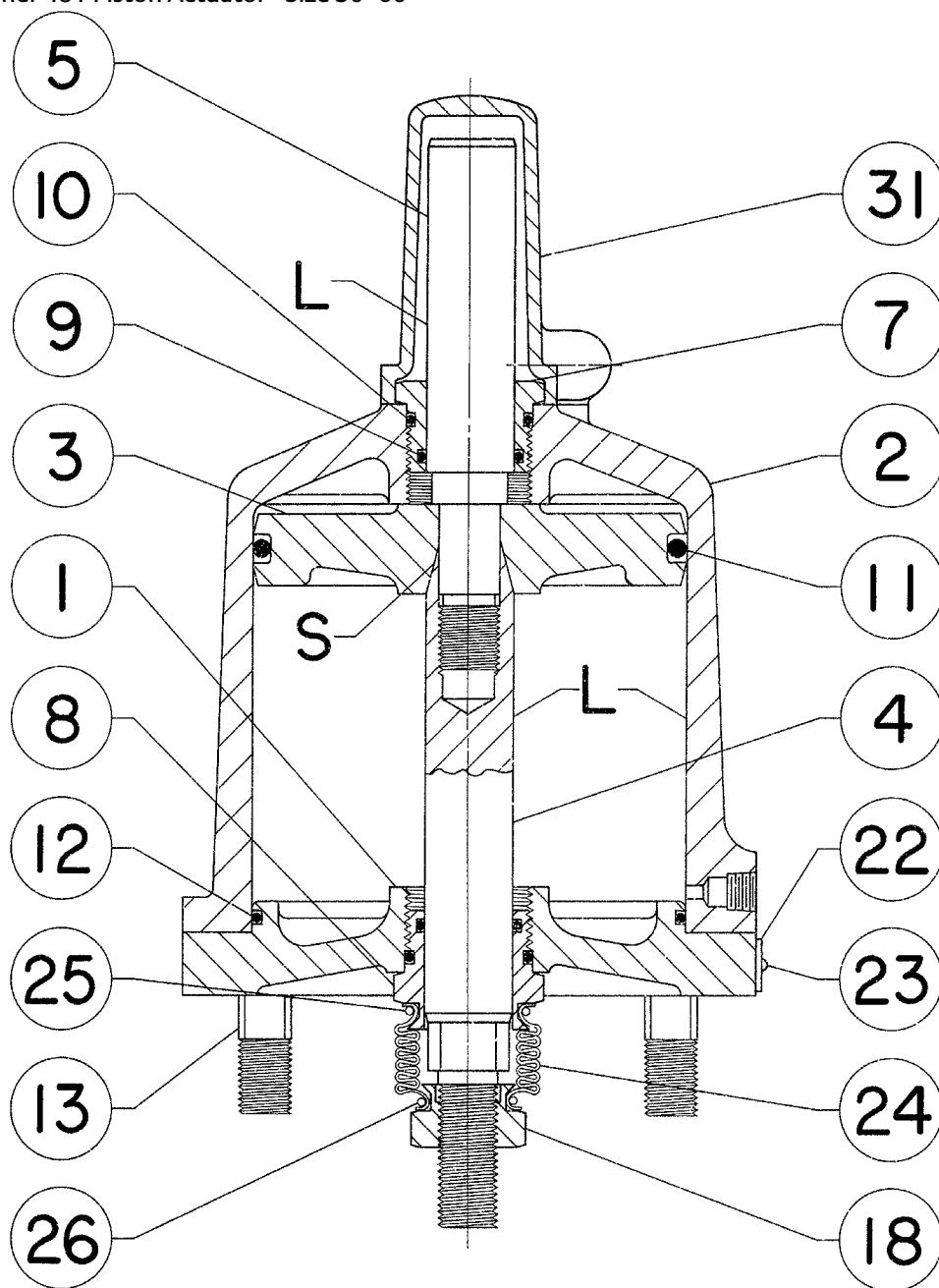
When reassembling the actuator after the piston rod extension (key 5) has been removed from the piston rod (key 4), clean the threads of the piston rod thoroughly and apply a thread locking adhesive (medium strength) to the threads. Tighten the piston rod extension securely to a torque of 203 N•m (150 lbf•ft). This torque is approximately equal to the torque that would be developed by placing a force of 150 pounds on the end of a one-foot wrench, 75 pounds on the end of a two-foot wrench, etc.

Figure 7. Fisher 480 Piston Actuator - Size 30- 60



PARTS NOT SHOWN: 27 AND 112

Figure 8. Fisher 481 Piston Actuator - Size 30- 60



PARTS NOT SHOWN: 27, 78, 79, AND 112

Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, refer to the serial number found on the actuator nameplate (key 22).

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Description	Part Number	Description	Part Number
* Repair Kit		480, Size 60, 2 inch travel	R480X000032
Includes key numbers 9, 10, 11, 12, 24, 25, 26, and 78		480, Size 60, 4 inch travel	R470X000052
480, Size 30	R480X000012	480-16, Size 40	R480-16X012
480, Size 40	R480X000022	480-16, Size 60	R470-16X012

Parts List

Note

Contact your Emerson sales office or Local Business Partner for Part Ordering information.

Key	Description	Key	Description
1	Cylinder Flange	12*	Cylinder Seal O-ring
2	Cylinder	13	Cylinder Stud
3	Piston	14	Compression Fitting
4	Piston Rod	15	Cylinder Tubing
5	Piston Rod Extension	18	Boot Locknut
7	Upper Seal Bushing	22	Nameplate
8	Lower Seal Bushing	23	Drive Screw
9*	Stem Seal O-ring	24*	Piston Rod Boot
	Sizes 30, 40, and 60 (2 req'd)		Sizes 30, 40, and 60
10*	Bushing Seal O-ring	25	Top Boot Snap Ring
	Sizes 30, 40, and 60 (2 req'd)	26	Bottom Boot Snap Ring
11*	Piston Seal O-ring	27	Travel stop
		30	Piston Nut
		31	Cylinder Cover
		45	Spring Retainer Spacer
		78*	Cover Seal
			481 only
		79	Cover Screw
		160	Pipe Plug

*Recommended spare parts

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Fisher™ 525 Manual Pneumatic Override

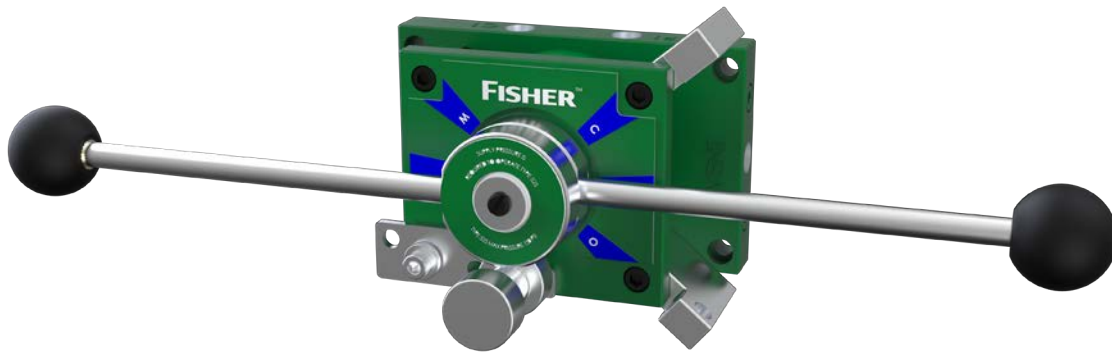


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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual provides installation, operation and maintenance information for the Fisher 525 Manual Pneumatic Override.

WARNING

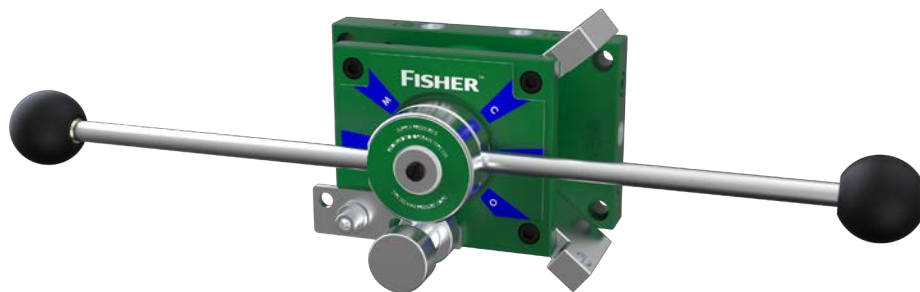


Do not install, operate or maintain a 525 Manual Pneumatic Override without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury and property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

1.2 Description

The Fisher 525 Manual Pneumatic Override is a manual switching valve. The 525 MPO is installed between a positioner/controller and a pneumatic actuator, allowing an operator to switch between instrument control and manual control of a pneumatically actuated valve. The 525 MPO includes Lockout/Tagout features to lock the 525 MPO and valve in a desired position and prevent accidental or unauthorized operation.

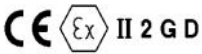
Figure 1. Fisher 525 Manual Pneumatic Override



1.3 Specifications

Specifications for the 525 MPO are listed in Table 1.

Table 1. Specifications

Available Configurations	Supply and Output Connections
Single or Double-Acting	1/4 NPT internal
Supply Pressure ⁽¹⁾	Ambient Operating Temperature Limits ⁽¹⁾
Maximum: 10.3 bar / 150 psig or maximum pressure rating of the actuator, whichever is lower	-40 to +71°C / -40 to +160°F
Supply Pressure Medium	Hazardous Area Classification
Air or Natural Gas Supply medium must be clean, dry and non-corrosive Per ISA Standard 7.0.01 A maximum 40 micrometer particle size in the air system is acceptable. Further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimized. Pressure Dew Point: At least 10°C less than the lowest ambient temperature expected Per ISO 8573-1 Maximum particle density size: Class 7 Oil content: Class 3 Pressure Dew Point: Class 3 or at least 10°C less than the lowest ambient temperature expected	Complies with the requirements of ATEX Group II Category 2 Gas and Dust  Ex h IIC Tx Gb Ex h IIIC Tx Db Maximum surface temperature (Tx) depends on operating condition Gas: T6 Dust: T71 Refer to Figure 15 for location of ATEX marking.
	Approximate Weight
	4.7 kg / 10.4 lbs
1. The pressure/temperature limits in this document and any applicable standard or code limitation should not be exceeded.	

1.4 Education Services

Emerson Education Services
 Phone: +1-800-338-8158
 E-mail: education@emerson.com
emerson.com/mytraining

Section 2: Installation

⚠ WARNING

To avoid personal injury or property damage resulting from the sudden release of pressure:

- Always wear protective clothing, gloves and eyewear when performing any installation operations.
- Personal injury or system damage may result when service conditions exceed controller or other equipment ratings. Exceeding the pressure specifications in Table 1 may cause leakage, parts damage or personal injury due to bursting of pressure-containing parts or explosion of accumulated gas.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

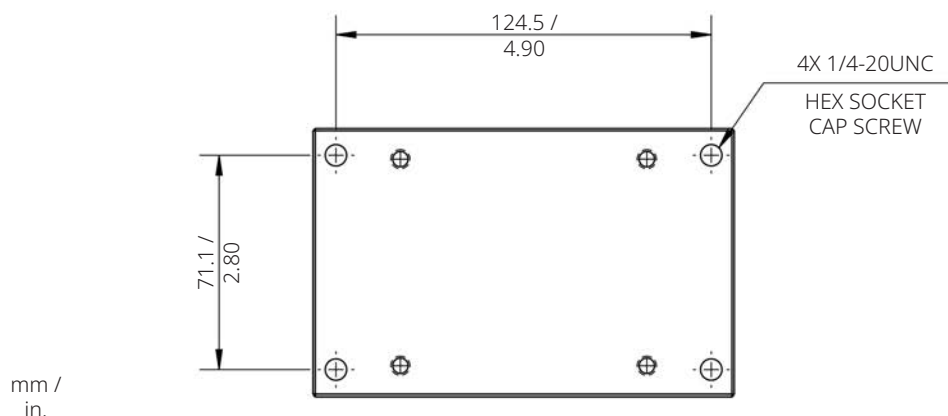
NOTICE

Do not use sealing tape on pneumatic connections. This instrument contains small passages that may become obstructed by detached sealing tape. Thread sealant paste should be used to seal and lubricate pneumatic threaded connections.

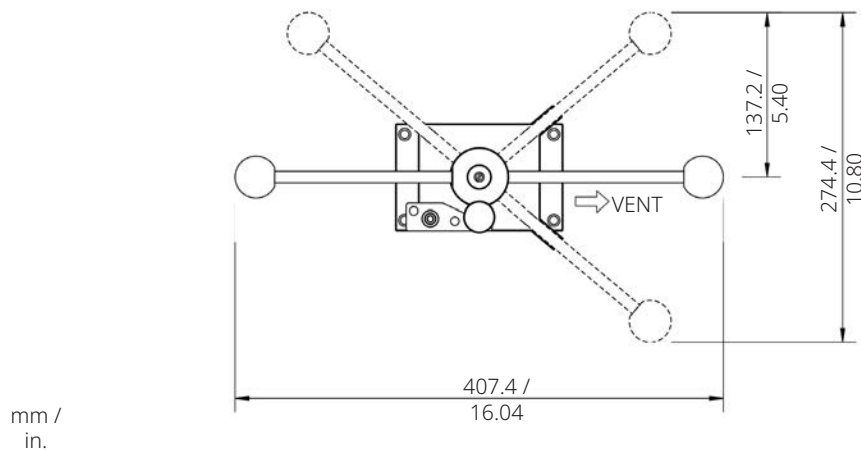
2.1 Field Mounting

525 MPO specified for mounting on a valve actuator is mounted at the factory. If the controller is ordered separately for field installation, mount the controller according to the following instructions.

Figure 2. 525 MPO Mounting Dimensions



For installation orientation, ensure that sufficient clearance is provided for proper operation and that the vent port remains unobstructed. Refer to Figure 3.

Figure 3. 525 MPO Mounting Space

To ensure proper operation, the mode indicator label/handles located on the top view of the 525 MPO must always remain unobstructed and clearly visible during operation. Operators are required to maintain a forward-facing orientation toward the label/handles throughout the entire operation process.

2.2 Pressure Connections

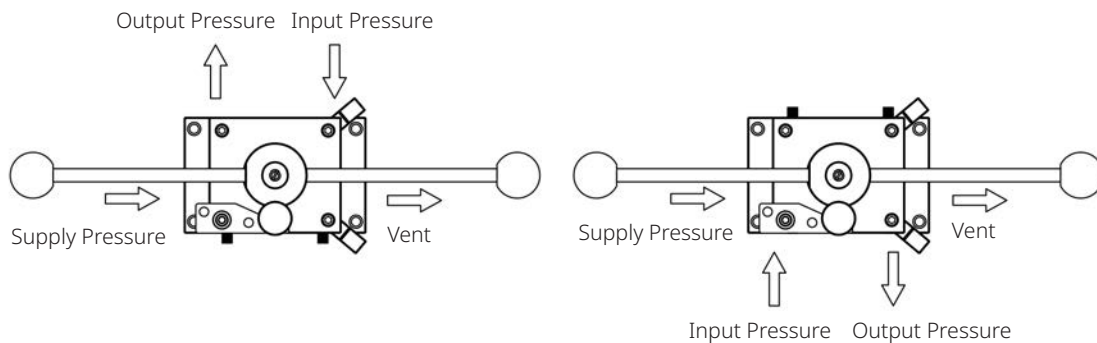
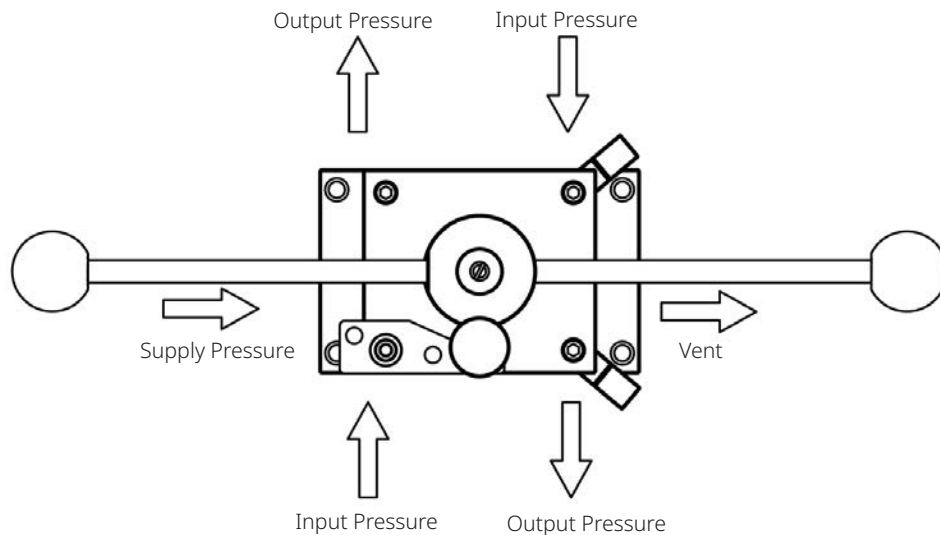
⚠ WARNING

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install any system component where service conditions could exceed the limits given in this manual. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

NOTICE

Do not use sealing tape on pneumatic connections. This instrument contains small passages that may become obstructed by detached sealing tape. Thread sealant paste should be used to seal and lubricate pneumatic threaded connections.

All pressure connections on the 525 MPO are 1/4 NPT internal. Use 10 mm / 3/8-in. pipe or tubing for supply, input and output piping. The pressure connection locations are shown in Figures 4 and 5.

Figure 4. Single-Acting Pressure Connection**Figure 5. Double-Acting Pressure Connection**

2.3 Supply Pressure

⚠ WARNING

Severe personal injury or property damage may occur from an uncontrolled process if the instrument supply medium is not clean, dry, oil-free and non-corrosive. A regularly maintained air filter removing particles larger than 40 micrometers in diameter will suffice in most applications. Further filtration down to 5 micrometer particle size is recommended. If you are unsure of your filtration needs or use a hazardous gas, check with an [Emerson sales office](#) or industry instrument supply medium quality standard.

Supply pressure must be filtered, clean, dry and non-corrosive gas. It must meet the requirements of ISA Standard 7.0.01 or ISO 8573-1. A maximum 40 micrometer particle size in the air system is acceptable. Further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the supply medium should be minimized.

Use a suitable supply pressure regulator to reduce the supply pressure source to the normal operating supply pressure shown in Table 1.

WARNING

To avoid personal injury or property damage resulting from the sudden release of process pressure, use a pressure regulator system when operating 525 MPO from a high-pressure source. Ensure that supply pressure does not exceed the maximum pressure rating of the 525 MPO, actuator or any instruments.

2.4 Vent Port

WARNING

Personal injury or property damage could result from fire or explosion of accumulated gas or from contact with hazardous gas. The controller will exhaust pressure when operating it. If a flammable or hazardous gas is used as the supply pressure medium, adequate ventilation and necessary safety measures should be used to prevent the accumulation of flammable or hazardous gas.

Vent to the atmosphere is through VENT port in the side of the unit. Keep the VENT port free of any obstructions or foreign materials that might clog them.

2.5 Typical Application

WARNING

Avoid personal injury and property damage caused by supply pressure exceeding pressure rating of 525 MPO or attached other instruments.

Refer to Figures 6, 7, 8 and 9.

This section provides typical applications with different types of pneumatic actuator.

Figure 6. Single-Acting Actuator with Push-Down-to-Close

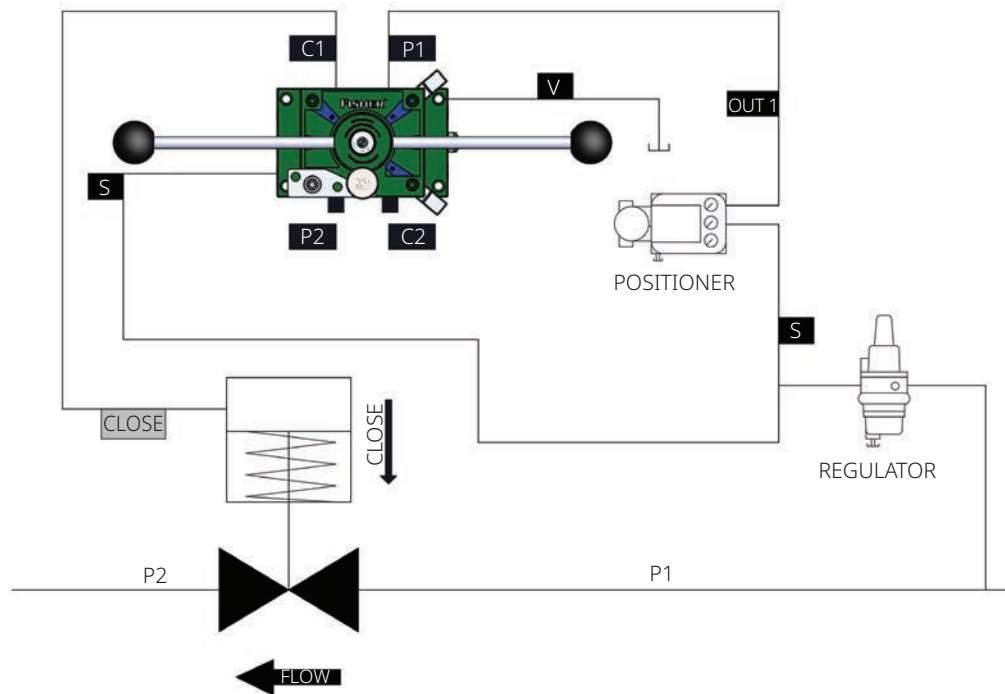


Figure 7. Single-Acting Actuator with Push-Down-to-Open

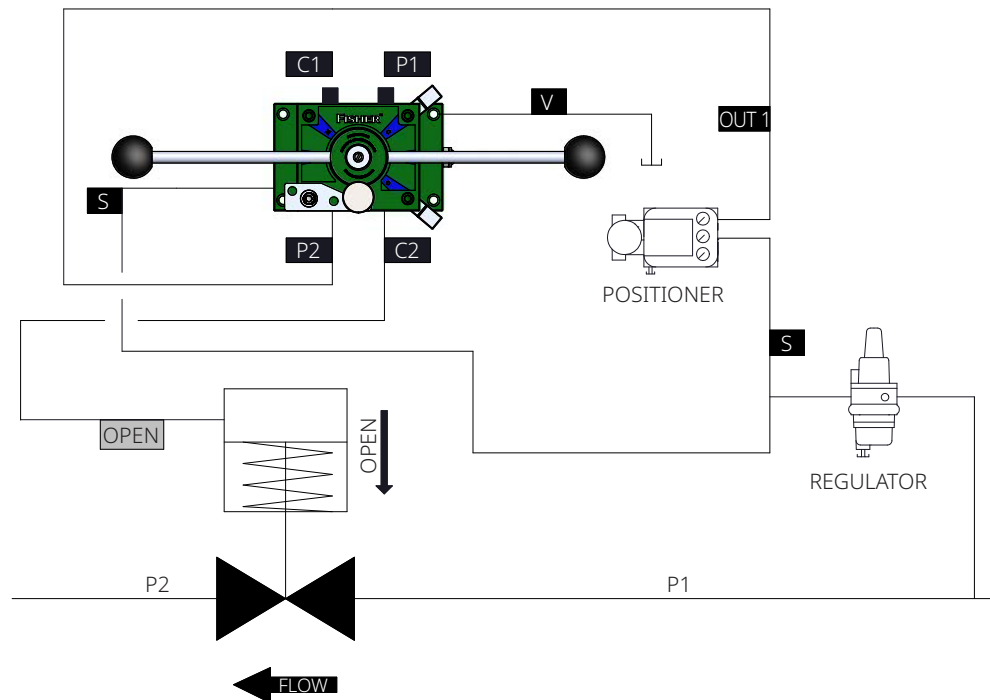


Figure 8. Double-Acting Actuator with Push-Down-to-Close

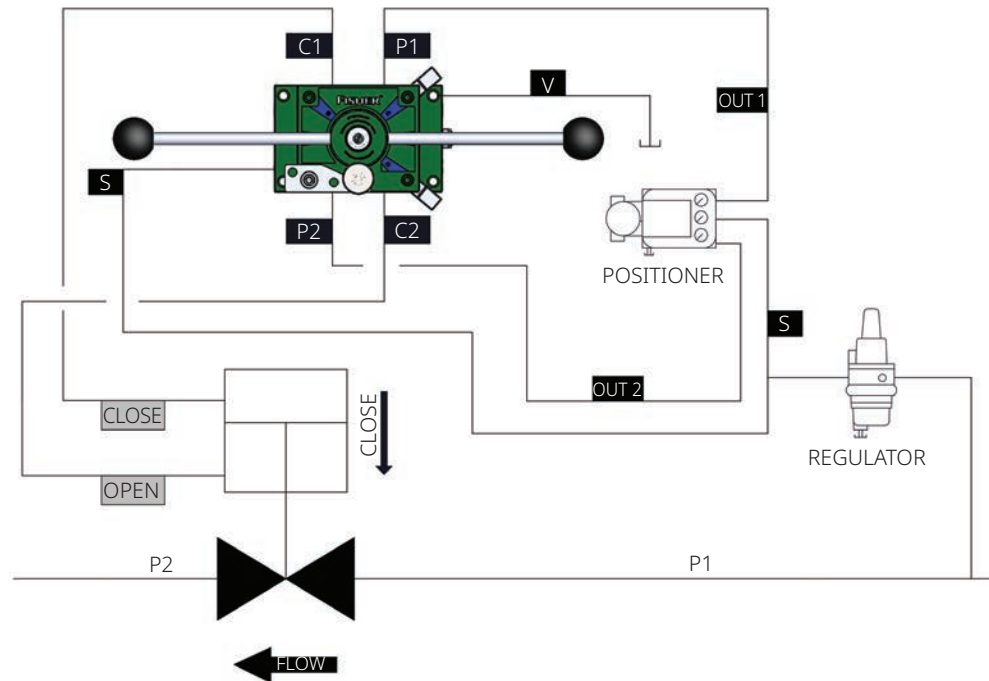


Figure 9. Double-Acting Actuator with Push-Down-to-Open

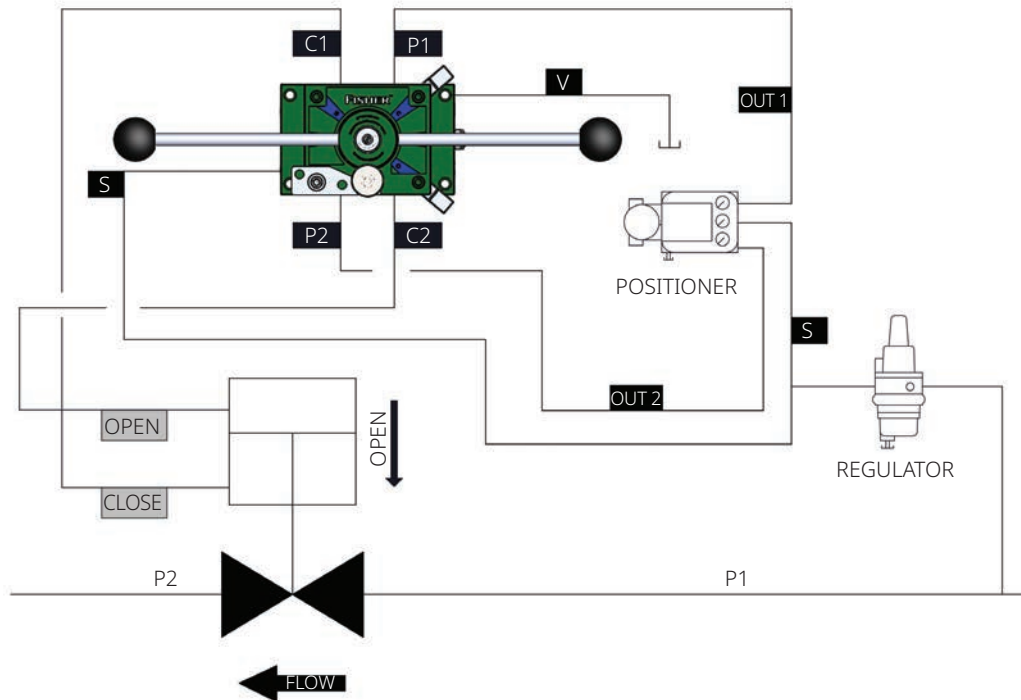


Table 2 illustrates the port cross-connections corresponding to each operational mode of the 525.

Table 2. Double-Acting Configuration⁽¹⁾

525 Modes	Connected Ports	Isolated Ports
Automatic	P1 ↔ C1, P2 ↔ C2	Supply, Vent
Manual-Lock	None	All ports isolated
Manual-Open	C1 ↔ Vent, C2 ↔ Supply	P1, P2
Manual-Close	C1 ↔ Supply, C2 ↔ Vent	P1, P2

1. Single-acting configuration will plug C1 and P1 or C2 and P2 ports, see Figures 6 and 7.

Section 3: Operation

⚠ WARNING

Avoid personal injury and property damage caused by supply pressure exceeding pressure rating of the 525 MPO or other attached instruments or equipment.

3.1 Principle of Operation

Figure 10. 525 MPO Modes

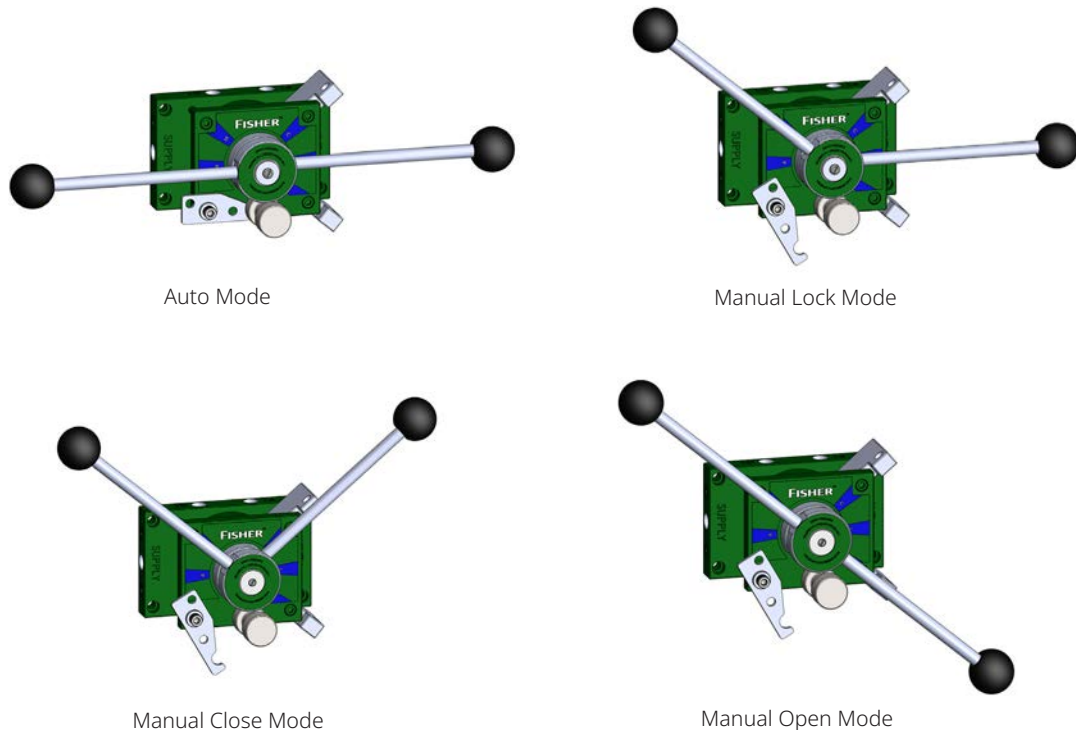
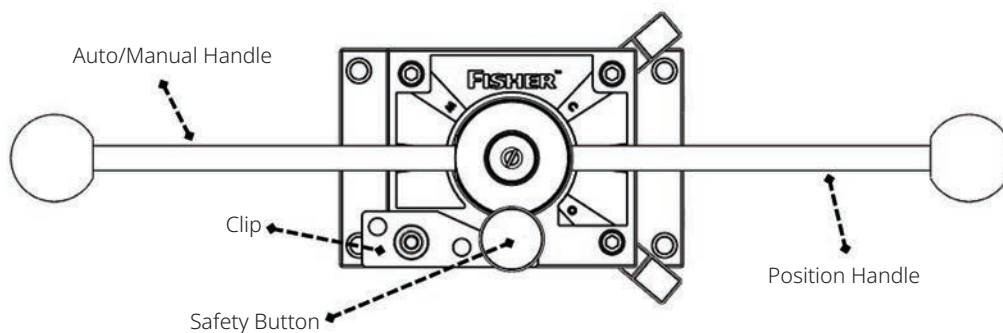


Figure 11. 525 MPO Construction

Auto Mode to Manual Modes Operation

1. AUTO mode is limited by a safety button to prevent accidental mode changes.
2. Rotate the clip clockwise to disengage the limit position, press the safety button, rotate the Auto/Manual handle to MANUAL (M) position, the 525 MPO will be operated to the MANUAL LOCK mode.

NOTE

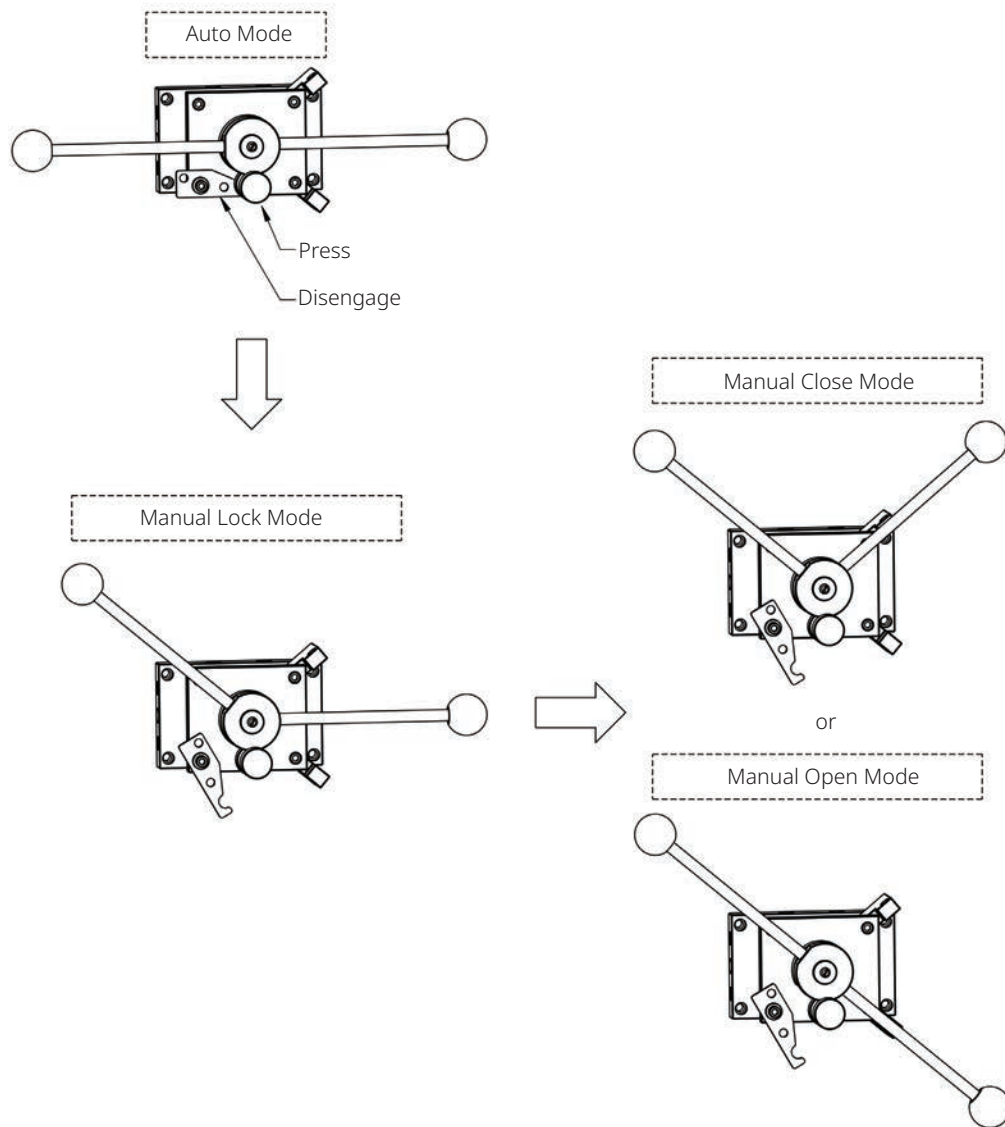
Pressure will exhaust from vent port when changing modes.

NOTE

Slow changes in valve travel may occur if the 525 MPO is left in manual-lock mode for extended periods of time.

3. Rotate the Position handle to MANUAL OPEN (O) or CLOSE (C) position, the 525 MPO will override any control instruments to position valve open or close.

Figure 12. Auto Mode to Manual Modes Operation



Manual Modes to Auto Mode Operation

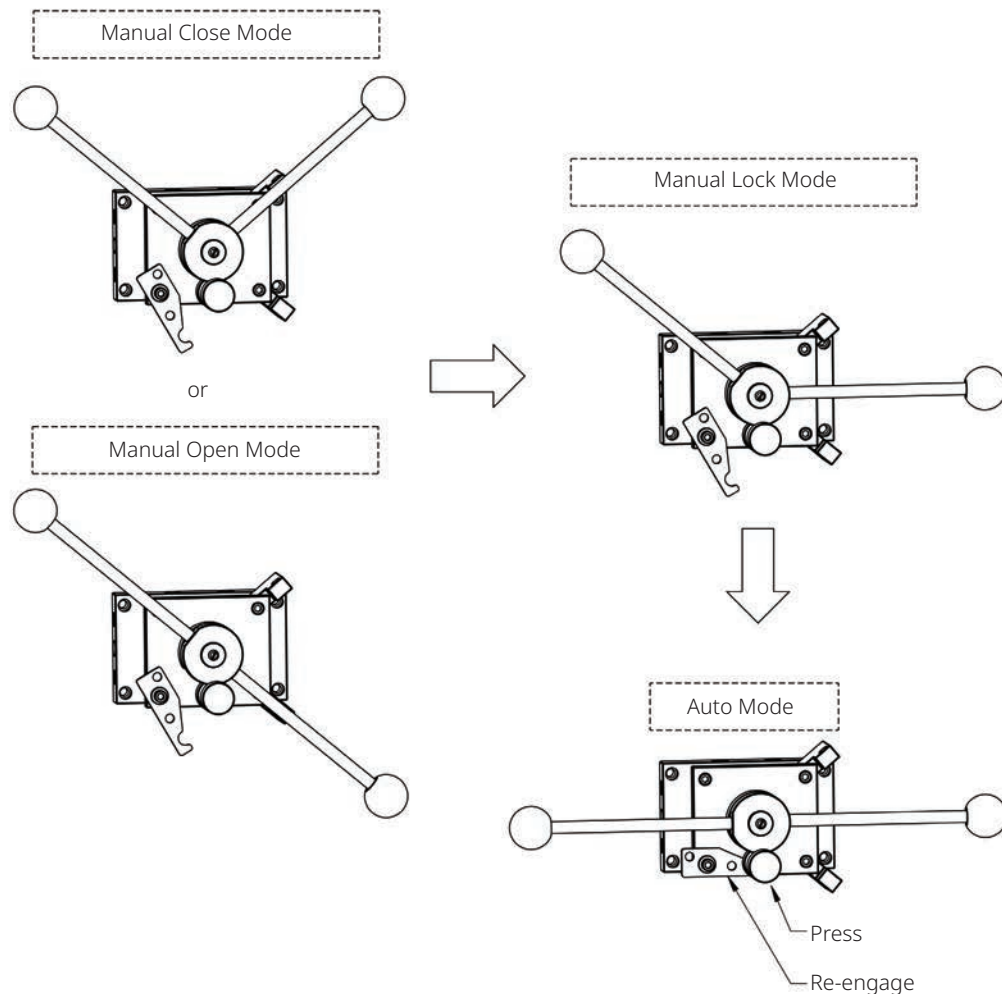
1. When the 525 MPO is in MANUAL CLOSE (C) or OPEN (O) mode, rotate the position handle, return to MANUAL LOCK (L) mode.

NOTE

Slow changes in valve travel may occur if the 525 MPO is left in manual-lock mode for extended periods of time.

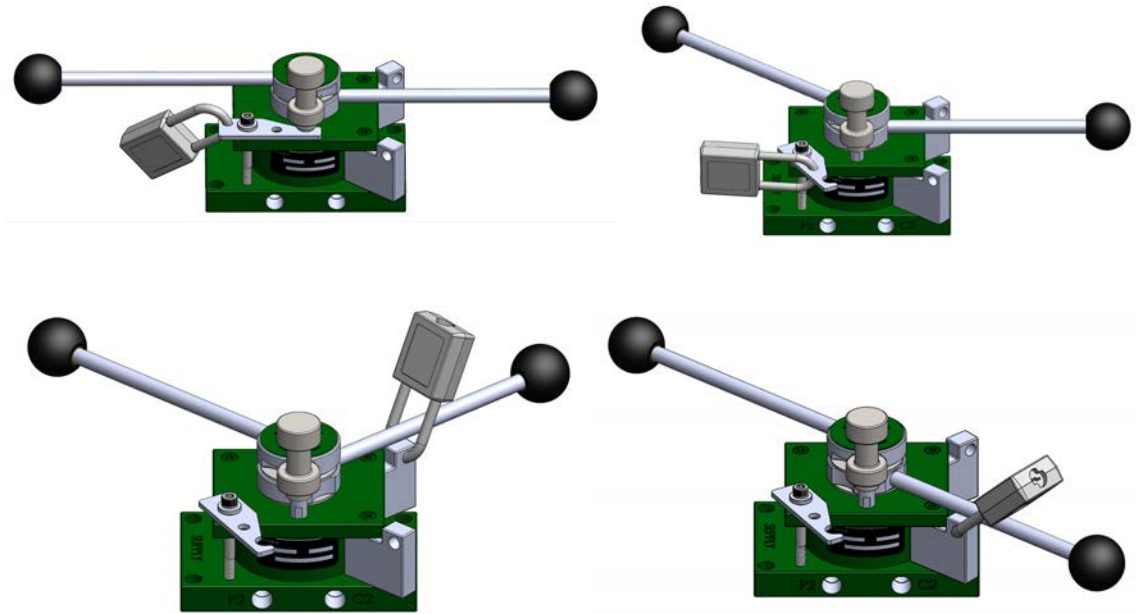
2. Press the safety button, rotate the Auto/Manual handle, return to AUTO mode, rotate the clip counterclockwise to re-engage it to the limit position.
-

Figure 13. Manual Modes to Auto Mode Operation



The 525 MPO includes features to lock the Manual Pneumatic Override in a desired position and prevent accidental or unauthorized operation. Proper selection of lockout padlock is essential to prevent accidental movement of the Type 525 MPO handles.

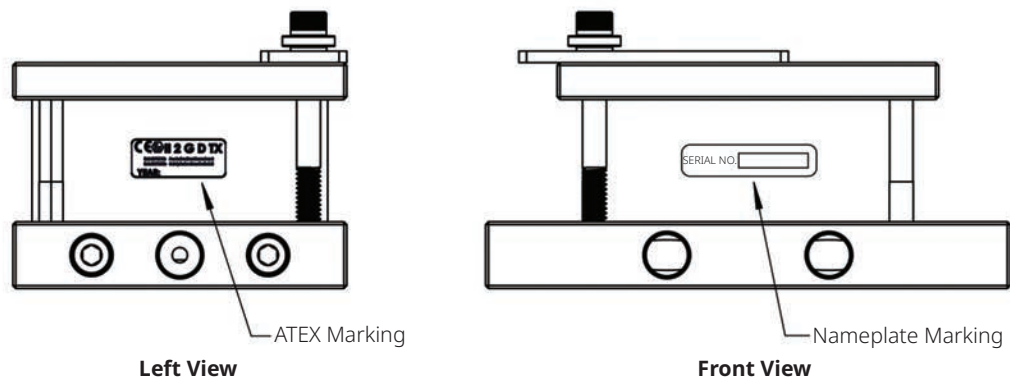
Figure 14. Lockout/Tagout Feature



Section 4: Maintenance

There are no repairable or replaceable parts on the 525 MPO. Contact your [Emerson sales office](#) if a replacement 525 MPO is needed, always mention the controller serial number. The serial number can be found on the nameplate.

Figure 15. 525 MPO Assembly Marking Locations



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Fisher™ 585C Series Piston Actuators

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Figure 1. Fisher 585C Series Piston Actuator



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Introduction

Scope of Manual

This instruction manual provides information on installation, maintenance, and parts ordering for the Fisher 585C piston actuators. Refer to separate instruction manuals for information about other equipment and accessories used with these actuators.

Information for the 585CLS long stroke actuator can be found in the Fisher 585CLS Instruction Manual ([D103793X012](#)).



Do not install, operate, or maintain a 585C Series actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

585C pneumatic piston actuators (figure 1) provide accurate throttling or on-off control of sliding-stem valves. The 585C actuator uses a double-acting cylinder, which requires air pressure for operation.

Size 25 and 50 actuators are available as a springless construction or with a bias spring. Depending on configuration, the bias spring will retract or extend the piston rod upon loss of cylinder air pressure. Size 60 through 130 actuators are available as springless constructions only.

585C actuators are typically supplied with a DVC6200 digital valve controller, or a 3600 P/P or I/P analog positioner. The 585C actuator is available with a top-mounted or side-mounted manual handwheel, depending on actuator size.

Specifications

Specifications for the 585C piston actuators are given in table 1. Some individual actuators come from the factory with specifications stamped on a nameplate attached to the yoke.

Educational Services

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Table 1. 585C Specifications (Sizes 25-130)

Operating Pressure⁽¹⁾

Sizes 25-50

Maximum Allowable: 10.3 bar (150 psig)

Minimum Recommended: 1.4 bar (20 psig)

Sizes 60-130

Maximum Allowable: See table 8

Minimum Recommended: 2.4 bar (35 psig)

Travel

See table 2

Thrust Capabilities

See tables 4 through 8

Stroking Speeds

Varies with actuator size, actuator spring, travel, and supply pressure. If stroking speed is critical, consult your [Emerson sales office](#)

Piston Area

See table 2

Cylinder Volumetric Displacement

See table 2

Operative Temperature Limits⁽¹⁾

For All Sizes

Standard Construction

(Nitrile O-Rings): -40 to 80°C (-40 to 175°F)

Optional Construction

(Fluorocarbon O-Rings): -18 to 149°C (0 to 300°F)

For Sizes 60-130

Low Ambient Temperature option:

Fluorosilicone O-Rings: -60 to 80°C (-76 to 175°F)

Yoke Boss and Valve Stem Diameters

See table 3

Pressure Connections

Size 25-60

■ 1/4 NPT internal (standard), or ■ 3/8 NPT internal (optional)

Sizes 68-130

■ 1/2 NPT internal (standard)

Instrument Mounting

Universal NAMUR mounting

Construction Materials

Part	Material
Yoke	Ductile Iron
Piston	Aluminum
Cylinder	Aluminum
Bolting and Fasteners	Steel NCF (std)
	Stainless Steel (std and low ambient)
Springs (sizes 25 and 50 only)	Alloy Steel
O-Rings	Nitrile (std), Fluorocarbon, Fluorosilicone
Actuator Stem	Chrome-plated Steel
Stem Connection	Stainless Steel
Travel Indicator Scale	Stainless Steel
Paint	Polyester Powder
Cylinder Seal Bushings (sizes 60-130 only)	Brass
Stem Connector (sizes 60-130)	Zinc-plated steel (std)
	Stainless Steel (std and low ambient)

Approximate Weights

(less positioner and handwheel)

Size 25

2-1/8 inch yoke boss, 7 kg (16 pounds)

2-13/16 inch yoke boss, 8 kg (17 pounds)

Size 50

2-13/16 inch yoke boss, 20 kg (45 pounds)

3-9/16 inch yoke boss, 22 kg (48 pounds)

Size 60: 31 kg (68 pounds)

Size 68: 54 kg (120 pounds)

Size 80: 102 kg (225 pounds)

Size 100: 113 kg (250 pounds)

Size 130: 188 kg (415 pounds)

Options

Sizes 25 and 50

■ Top-mounted handwheel, see figures 6, 8, and 9 and table 9

■ Cylinder bypass valve ■ Limit switches ■ Fisher 4200 position transmitter

Sizes 60-130

■ Integral side-mounted handwheel, (figure 10)

Sizes 25-130

■ FIELDVUE™ mounting options

■ Fisher 377 trip valve system to fail actuator

■ up or ■ down or ■ lock in last position

■ TopWorx™ DXP M21GNEB electrical valve stem position switch

■ Micro-Switch limit switches

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

585C Actuator

November 2022

Instruction Manual

D102087X012

Table 2. Fisher 585C Piston Cylinder Clearance Volumes

PISTON AT TOP OF CYLINDER (SPRINGS BELOW PISTON FOR SIZE 25 AND 50)								
Actuator Size	Piston Area		Maximum Actuator Travel		Upper Clearance Volume		Volume Below Piston	
	cm ²	Inches ²	cm	Inches	cm ³	Inches ³	cm ³	Inches ³
25	168	26	2.9	1.125	104	6.3	1750	107
50	303	47	5.1	2	330	20	5200	320
60	358	55.5	5.1	2	310	19	2700	163
			10	4	310	19	4400	270
			20	8	310	19	8200	500
68	571	88.5	5.1	2	1230	75	7500	460
			10.2	4	1230	75	7500	460
			20.3	8	1230	75	13300	810
80	571	88.5	10.2	4	1230	75	7500	460
			20.3	8	1230	75	13300	810
100	842	130.5	10.2	4	1700	104	10700	650
			20.3	8	1700	104	19200	1170
130	1430	221.5	10.2	4	4600	280	18500	1130
			20.3	8	4600	280	33000	2000
PISTON AT BOTTOM OF CYLINDER (SPRINGS ABOVE PISTON FOR SIZE 25 AND 50)								
Actuator Size	Piston Area		Maximum Actuator Travel		Lower Clearance Volume		Volume Above Piston	
	cm ²	Inches ²	cm	Inches	cm ³	Inches ³	cm ³	Inches ³
25	168	26	2.9	1.125	77	4.7	1790	109
50	303	47	5.1	2	350	22	5200	320

Table 3. Yoke Boss and Valve Stem Diameters

ACTUATOR SIZE	YOKE BOSS DIAMETER		VALVE STEM DIAMETER	
	mm	Inches	mm	Inches
25	54	2-1/8	9.5	3/8
	71	2-13/16	12.7	1/2
50	71	2-13/16	12.7	1/2
	90	3-9/16	19.1	3/4
60	90	3-9/16	19.1	3/4
68	90	3-9/16	19.1	3/4
80	127	5, 5H	25.4	1
			31.8	1-1/4
100	127	5, 5H	25.4	1
			31.8	1-1/4
130	127	5, 5H	25.4	1
			31.8	1-1/4

1. Heavy actuator to bonnet bolting.

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Actuator Thrust Capabilities

Table 4. Fisher 585C Size 25 and 50 Actuator Thrust Capabilities, U.S. Units (spring retracts actuator stem)

ACTU- ATOR SIZE	SPRING RATE, lb/in	ACTUATOR STEM TRAVEL, INCHES	SPRING THRUST W/ ACTUATOR STEM RETRACTED, POUNDS	SPRING THRUST W/ ACTUATOR STEM EXTENDED, POUNDS	NET THRUST FOR 585C WITH ACTUATOR STEM FULLY EXTENDED AT FULL TRAVEL										SPRINGS USED, BY COLOR
					Operating Pressure, psig										
					40	50	60	70	80	90	100	110	125	150	
					Force, Pounds										
25	0	All	0	0	1040	1300	1560	1820	2080	2340	2600	2860	3250	3900	Springs Not Used
	200	0.5625	200	313	730	990	1250	1510	1760	2020	2280	2540	2930	3580	Gold
		0.75	200	350	690	950	1210	1470	1730	1990	2250	2510	2900	3550	
		0.875	200	375	660	920	1180	1440	1700	1960	2220	2480	2870	3520	
		1.125	200	425	610	870	1130	1390	1650	1910	2170	2430	2820	3470	
	400	0.5625	400	625	410	670	930	1190	1450	1710	1970	2230	2620	3270	Light Green
		0.75	400	700	340	600	860	1120	1380	1640	1900	2160	2550	3200	
		0.875	400	750	290	550	810	1070	1330	1590	1850	2110	2500	3150	
		1.125	400	850	190	450	710	970	1230	1490	1750	2010	2400	3050	
	500	0.5625	500	781	260	520	780	1040	1300	1560	1820	2080	2460	3110	White
		0.75	500	875	160	420	680	940	1200	1460	1720	1980	2370	3020	
		0.875	500	938	100	360	620	880	1140	1400	1660	1920	2310	2960	
		1.125	500	1063	X	240	500	760	1010	1270	1530	1790	2180	2830	
	700	0.5625	700	1094	X	200	460	720	980	1240	1500	1760	2150	2800	Gold & White
		0.75	700	1225	X	70	330	590	850	1110	1370	1630	2020	2670	
		0.875	700	1313	X	X	250	510	760	1020	1280	1540	1930	2580	
		1.125	700	1488	X	X	70	330	590	850	1110	1370	1760	2410	
	900	0.5625	900	1406	X	X	150	410	670	930	1190	1450	1840	2490	Light Green & White
		0.75	900	1575	X	X	X	240	500	760	1020	1280	1670	2320	
		0.875	900	1688	X	X	X	130	390	650	910	1170	1560	2210	
		1.125	900	1913	X	X	X	X	160	420	680	940	1330	1980	
50	0	All	0	0	1840	2300	2760	3220	3680	4140	4600	5060	5750	6900	Springs Not Used
	330	0.75	330	578	1310	1780	2250	2720	3190	3660	4140	4610	5310	6490	Pink
		0.875	330	619	1270	1740	2210	2680	3150	3620	4090	4570	5270	6450	
		1.125	330	701	1180	1660	2130	2600	3070	3540	4010	4480	5190	6370	
		1.5	330	825	1060	1530	2000	2470	2950	3420	3890	4360	5070	6250	
		2	330	990	900	1370	1840	2310	2780	3250	3720	4190	4900	6080	
	600	0.75	600	1050	840	1310	1780	2250	2720	3190	3660	4130	4840	6020	Light Blue
		0.875	600	1125	760	1230	1700	2170	2650	3120	3590	4060	4770	5950	
		1.125	600	1275	610	1080	1550	2020	2500	2970	3440	3910	4620	5800	
		1.5	600	1500	390	860	1330	1800	2270	2740	3210	3680	4390	5570	
		2	600	1800	90	560	1030	1500	1970	2440	2910	3380	4090	5270	
	930	0.75	930	1628	260	730	1200	1670	2140	2610	3090	3560	4260	5440	Pink & Light Blue
		0.875	930	1744	140	610	1080	1560	2030	2500	2970	3440	4150	5330	
		1.125	930	1976	X	380	850	1320	1790	2270	2740	3210	3910	5090	
		1.5	930	2325	X	30	500	970	1450	1920	2390	2860	3570	4750	
		2	930	2790	X	X	40	510	980	1450	1920	2390	3100	4280	
	1550	0.75	1550	2710	X	X	110	580	1050	1520	1990	2460	3165	4345	Green
		0.875	1550	2906	X	X	X	385	855	1325	1795	2265	2970	4150	
		1.125	1550	3294	X	X	X	X	465	935	1405	1875	2580	3760	
		1.5	1550	3875	X	X	X	X	X	355	825	1295	2000	3180	
		2	1550	4650	X	X	X	X	X	X	50	520	1225	2405	
1880	0.75	1880	3290	X	X	X	X	470	940	1410	1880	2585	3765	Pink & Green	
	0.875	1880	3525	X	X	X	X	235	705	1175	1645	2350	3530		
	1.125	1880	3995	X	X	X	X	X	235	705	1175	1880	3060		
	1.5	1880	4700	X	X	X	X	X	X	X	470	1175	2355		
	2	1880	5640	X	X	X	X	X	X	X	X	235	1415		
X—Indicates where the listed supply pressure is not sufficient to overcome the opposing bias spring effect.															

X—Indicates where the listed supply pressure is not sufficient to overcome the opposing bias spring effect.

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Table 5. Fisher 585C Size 25 and 50 Actuator Thrust Capabilities, Metric Units (spring retracts actuator stem)

ACTUATOR SIZE	SPRING RATE, N/mm	ACTUATOR STEM TRAVEL, mm	SPRING THRUST W/ ACTUATOR STEM RETRACTED, N	SPRING THRUST W/ ACTUATOR STEM EXTENDED, N	NET THRUST FOR 585C WITH ACTUATOR STEM FULLY EXTENDED AT FULL TRAVEL										SPRINGS USED, BY COLOR
					Operating Pressure, bar										
					2.8	3.4	4.1	4.8	5.5	6.2	6.9	7.6	8.6	10.3	
					Force, N										
25	0	All	0	0	4626	5783	6939	8096	9252	10,409	11,565	12,722	14,457	17,348	Springs Not Used
	35.0	14.3	890	1393	3247	4404	5560	6717	7829	8985	10,142	11,298	13,033	15,925	Gold
		19.1	890	1558	3069	4226	5382	6539	7695	8852	10,008	11,165	12,900	15,791	
		22.2	890	1669	2936	4092	5249	6405	7562	8718	9875	11,032	12,766	15,658	
		28.6	890	1891	2713	3870	5026	6183	7340	8496	9653	10,809	12,544	15,435	
	70.1	14.3	1780	2781	1824	2980	4137	5293	6450	7606	8763	9919	11,654	14,546	Light Green
		19.1	1780	3115	1512	2669	3825	4982	6139	7295	8452	9608	11,343	14,234	
22.2		1780	3338	1290	2447	3603	4760	5916	7073	8229	9386	11,121	14,012		
28.6		1780	3783	845	2002	3158	4315	5471	6628	7784	8941	10,676	13,567		
87.6	14.3	2225	3475	1156	2313	3470	4626	5783	6939	8096	9252	10,943	13,834	White	
	19.1	2225	3894	712	1868	3025	4181	5338	6494	7651	8807	10,542	13,434		
	22.2	2225	4174	445	1601	2758	3914	5071	6227	7384	8541	10,275	13,167		
	28.6	2225	4730	X	1068	2224	3381	4493	5649	6806	7962	9697	12,588		
122.6	14.3	3115	4868	X	890	2046	3203	4359	5516	6672	7829	9564	12,455	Gold & White	
	19.1	3115	5451	X	311	1468	2624	3781	4938	6094	7251	8985	11,877		
	22.2	3115	5843	X	X	1112	2269	3381	4537	5694	6850	8585	11,476		
	28.6	3115	6622	X	X	311	1468	2624	3781	4938	6094	7829	10,720		
157.7	14.3	4005	6257	X	X	667	1824	2980	4137	5293	6450	8185	11,076	Light Green & White	
	19.1	4005	7009	X	X	X	1068	2224	3381	4537	5694	7428	10,320		
	22.2	4005	7512	X	X	X	578	1735	2891	4048	5204	6939	9831		
	28.6	4005	8513	X	X	X	X	712	1868	3025	4181	5916	8807		
50	0	All	0	0	8180	10,200	12,300	14,300	16,400	18,400	20,500	22,500	25,600	30,700	Springs Not Used
	57.8	19.1	1468	2571	5827	7918	10,008	12,099	14,190	16,280	18,416	20,506	23,620	28,869	Pink
		22.2	1468	2753	5649	7740	9831	11,921	14,012	16,102	18,193	20,328	23,442	28,691	
		28.6	1468	3118	5249	7384	9475	11,565	13,656	15,747	17,837	19,928	23,086	28,335	
		38.1	1468	3670	4715	6806	8896	10,987	13,122	15,213	17,303	19,394	22,552	27,801	
		50.8	1468	4404	4003	6094	8185	10,275	12,366	14,457	16,547	18,638	21,796	27,045	
	105.1	19.1	2669	4671	3736	5827	7918	10,008	12,099	14,190	16,280	18,371	21,529	26,778	Light Blue
		22.2	2669	5004	3381	5471	7562	9653	11,788	13,878	15,969	18,060	21,218	26,467	
		28.6	2669	5671	2713	4804	6895	8985	11,121	13,211	15,302	17,392	20,551	25,800	
		38.1	2669	6672	1735	3825	5916	8007	10,097	12,188	14,279	16,369	19,528	24,777	
		50.8	2669	8007	400	2491	4582	6672	8763	10,854	12,944	15,035	18,193	23,442	
162.9	19.1	4137	7242	1157	3247	5338	7428	9519	11,610	13,745	15,836	18,949	24,198	Pink & Light Blue	
	22.2	4137	7758	623	2713	4804	6939	9030	11,121	13,211	15,302	18,460	23,709		
	28.6	4137	8790	X	1690	3781	5872	7962	10,097	12,188	14,279	17,392	22,641		
	38.1	4137	10,342	X	133	2224	4315	6450	8541	10,631	12,722	15,880	21,129		
	50.8	4137	12,410	X	X	178	2269	4359	6450	8541	10,631	13,789	19,038		
271.4	19.1	6894	12054	X	X	489	2580	4670	6761	8852	10942	14078	19,328	Green	
	22.2	6894	12925	X	X	X	1712	3803	5894	7984	10075	13211	18,460		
	28.6	6894	14652	X	X	X	X	2068	4159	6249	8340	11476	16,725		
	38.1	6894	17236	X	X	X	X	X	1579	3670	5760	8896	14,145		
	50.8	6894	20683	X	X	X	X	X	X	222	2313	5449	10,698		
329.2	19.1	8362	14634	X	X	X	X	2091	4181	6272	8362	11498	16,748	Pink & Green	
	22.2	8362	15679	X	X	X	X	1045	3136	5226	7317	10453	15,702		
	28.6	8362	17770	X	X	X	X	X	1045	3136	5226	8362	13,612		
	38.1	8362	20906	X	X	X	X	X	X	X	2091	5226	10,476		
	50.8	8362	25087	X	X	X	X	X	X	X	X	1045	6294		
X—Indicates where the listed supply pressure is not sufficient to overcome the opposing bias spring effect.															

X—Indicates where the listed supply pressure is not sufficient to overcome the opposing bias spring effect.

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Table 6. Fisher 585CR Size 25 and 50 Actuator Thrust Capabilities, U.S. Units (spring extends actuator stem)

ACTUATOR SIZE	SPRING RATE, lb/in	SPRING THRUST W/ ACTUATOR STEM EXTENDED, POUNDS	TOTAL THRUST FOR 585CR WITH ACTUATOR STEM FULLY EXTENDED											SPRINGS USED, BY COLOR
			Operating Pressure, psig ⁽¹⁾											
			40	50	60	70	80	90	100	110	125	150		
			Force, Pounds											
25 ⁽²⁾	0	0	1040	1300	1560	1820	2080	2340	2600	2860	3250	3900	Springs Not Used	
	200	200	1240	1500	1760	2020	2280	2540	2800	3060	3450	X	Gold	
	400	400	1440	1700	1960	2220	2480	2740	3000	3260	3650	X	Light Green	
	500	500	1540	1800	2060	2320	2580	2840	3100	3360	3750	X	White	
	700	700	1740	2000	2260	2520	2780	3040	3300	3560	X	X	Gold & White	
	900	900	1940	2200	2460	2720	2980	3240	3500	3760	X	X	Light Green & White	
50 ⁽³⁾	0	0	1840	2300	2760	3220	3680	4140	4600	5060	5750	6900	Springs Not Used	
	330	330	2210	2680	3150	3620	4090	4560	5030	5500	6205	X	Pink	
	600	600	2480	2950	3420	3890	4360	4830	5300	5770	6475	X	Light Blue	
	930	930	2810	3280	3750	4220	4690	5160	5630	6100	6805	X	Pink & Light Blue	
	1550	1550	3430	3900	4370	4840	5310	5780	6250	6720	X	X	Green	
	1880	1880	3760	4230	4700	5170	5640	6110	6580	7050	X	X	Pink & Green	
X—Indicates where the listed supply pressure is not sufficient to overcome the opposing bias spring effect. 1. The maximum design pressure for size 25 and 50 actuator is 150 psig. 2. Maximum thrust is 3900 lbs. 3. Maximum thrust is 6900 lbs.														

Table 7. Fisher 585CR Size 25 and 50 Actuator Thrust Capabilities, Metric Units (spring extends actuator stem)

ACTUATOR SIZE	SPRING RATE, N/mm	SPRING THRUST W/ ACTUATOR STEM EXTENDED, N	TOTAL THRUST FOR 585CR WITH ACTUATOR STEM FULLY EXTENDED										SPRINGS USED, BY COLOR
			Operating Pressure, bar ⁽¹⁾										
			2.8	3.4	4.1	4.8	5.5	6.2	6.9	7.6	8.6	10.3	
			Force, N										
25 ⁽²⁾	0	0	4626	5782	6939	8095	9251	10408	11565	12721	14456	17347	Springs Not Used
	35.0	890	5516	6672	7828	8985	10141	11298	12454	13610	15346	X	Gold
	70.0	1780	6405	7562	8718	9874	11031	12188	13344	14500	16235	X	Light Green
	87.6	2225	6850	8006	9163	10319	11476	12632	13789	14945	16680	X	White
	122.6	3115	7740	8896	10052	11209	12365	13655	14678	15835	X	X	Gold & White
	157.6	4005	8629	9786	10942	12099	13255	14412	15568	16724	X	X	Light Green & White
50 ⁽³⁾	0	0	8180	10200	12300	14300	16400	18400	20500	22500	25600	30700	Springs Not Used
	57.8	1468	9830	11921	14011	16102	18192	20282	22373	24464	27600	X	Pink
	105.1	2670	11031	13122	15212	17303	19393	21484	23574	25665	28800	X	Light Blue
	162.8	4135	12499	14589	16680	18770	20861	22952	25042	27133	30269	X	Pink & Light Blue
	271.4	6894	15256	17347	19438	21528	23619	25709	27800	29891	X	X	Green
	329.2	8362	16724	18815	20906	22996	25087	27177	29268	31358	X	X	Pink & Green
X—Indicates where the listed supply pressure is not sufficient to overcome the opposing bias spring effect. 1. The maximum design pressure for size 25 and 50 actuator is 10.3 bar. 2. Maximum thrust is 17347 N. 3. Maximum thrust is 31358 N.													

Table 8. Fisher 585C Thrust (springless construction)

ACTUATOR SIZE	PISTON AREA	TOTAL THRUST FOR 585C ⁽¹⁾										MAXIMUM ALLOWABLE THRUST
		Operating Pressure, bar ⁽³⁾										
		2.8	3.4	4.1	4.8	5.5	6.2	6.9	7.6	8.6	10.3	
	cm ²	Force, Newtons ⁽²⁾										Newtons
25	168	4630	5780	6940	8100	9260	10400	11600	12700	14500	17300	17300
50	303	8180	10200	12300	14300	16400	18400	20500	22500	25600	30700	31400
60	358	9880	12300	14800	17300	19800	22200	24700	27200	30900	36900	36900
68	571	15700	19700	23600	27600	31500	35400	39400	43300	49200	55600	55600 ⁽⁴⁾
80	571	15700	19700	23600	27600	31500	35400	39400	43300	49200	58700	58700
100	842	23200	29000	34800	40600	46400	52200	58000	63900	72600	86700	86700
130	1430	39400	49300	59100	69000	78700	88500	98800	108100	X	X	111200
ACTUATOR SIZE	PISTON AREA	Operating Pressure, psig ⁽³⁾										MAXIMUM ALLOWABLE THRUST
		40	50	60	70	80	90	100	110	125	150	
	Inches ²	Force, Pounds ⁽²⁾										Pounds
25	26	1040	1300	1560	1820	2080	2340	2600	2860	3250	3900	3900
50	47	1840	2300	2760	3220	3680	4140	4600	5060	5750	6900	7050
60	55.5	2220	2780	3330	3890	4440	5000	5550	6110	6940	8300	8300
68	88.5	3540	4430	5310	6200	7080	7970	8850	9740	11100	12500	12500 ⁽⁴⁾
80	88.5	3540	4430	5310	6200	7080	7970	8850	9740	11100	13200	13200
100	130.5	5220	6530	7830	9140	10440	11700	13100	14400	16300	19500	19500
130	221.5	8860	11100	13300	15500	17700	19900	22200	24300	X	X	25000
X—Indicates where the listed supply pressure will exceed the maximum thrust allowable. 1. The maximum design pressure for size 25 through 100 actuators is 10.3 bar (150 psig). The size 68 and 130 actuators are limited to 9.7 and 7.8 bar (140 and 113 psig) respectively. 2. The size 25 and 50 data is for the construction without a bias spring. 3. Minimum operating pressure for sizes 60-130 actuators is 2.4 bar (35 psig). 4. The size 68 actuator with a handwheel is limited to 40000 Newtons (9000 lb) thrust.												

Principle of Operation

The 585C piston actuator (figures 2 and 3) uses a piston that moves inside the actuator cylinder. An O-ring (see figure 3) provides a seal between the piston and the cylinder.

From an equilibrium state, the actuator reacts to a force unbalance that is created by increasing supply pressure on one side of the piston, and decreasing it on the other. This moves the piston up or down, and results in a repositioning of the valve plug.

Actuator with Handwheel (figures 2 and 6)

The handwheel version can be used to open or close the valve manually (either during normal operation or in an emergency), to position the valve at any point in the stroke, or to act as a travel stop.

Size 25 and 50 actuators use an integral top-mounted handwheel. See figure 6.

Size 60 to 130 actuators use a side-mounted handwheel, and come with a spring-loaded ball detent which prevents vibration from changing the handwheel setting. Handwheels for most types are either 203 mm (8 inches) in diameter with beveled gears or 432 mm (17 inches) in diameter with worm gears.

Handwheel Specifications

Table 9. Fisher 585C Handwheel Specifications

ACTUATOR SIZE	HANDWHEEL MOUNTING	HANDWHEEL DIAMETER	TURNS PER mm TRAVEL	MAXIMUM RIM FORCE REQUIRED	HANDWHEEL OUTPUT FORCE	HANDWHEEL WEIGHT
		mm		Newtons	Newtons	kg
25	Top-Mounted	356	0.5	325	12,810	17
50		482	0.5	445	23,790	20
60 ⁽¹⁾	Integral Side-Mounted	203	0.6	276	40000	28
60 ⁽²⁾		356	0.6	160	40000	30
68 ⁽¹⁾		203	0.6	276	40000	30
68 ⁽²⁾		356	0.6	160	40000	33
80		432	0.4	423	50000	35
100		432	0.4	623	75600	94
130		432	0.4	623	75600	123
ACTUATOR SIZE	HANDWHEEL MOUNTING	HANDWHEEL DIAMETER	TURNS PER INCH TRAVEL	MAXIMUM RIM FORCE REQUIRED	HANDWHEEL OUTPUT FORCE	HANDWHEEL WEIGHT
		Inches		Pounds	Pounds	Pounds
25	Top-Mounted	14	12	73	2880	37
50		19	12	100	5350	45
60 ⁽¹⁾	Integral Side-Mounted	8	16	62	9000	61
60 ⁽²⁾		14	16	36	9000	66
68 ⁽¹⁾		8	16	62	9000	66
68 ⁽²⁾		14	16	36	9000	71
80		17	10	95	11250	77
100		17	10	140	17000	208
130		17	10	140	17000	272

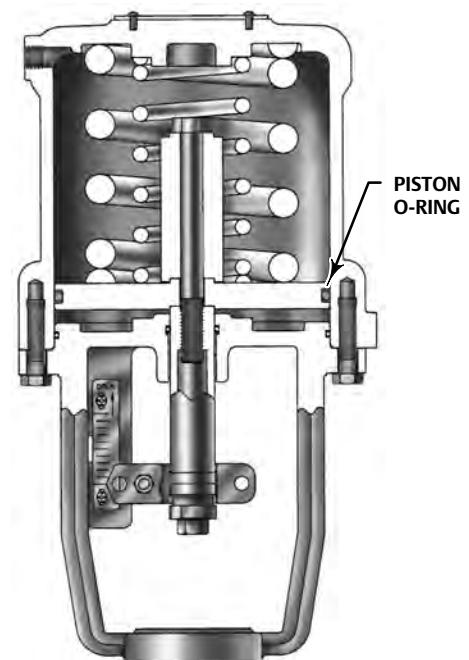
1. 2 and 4 inch maximum travel constructions.
2. 8 inch maximum travel construction.

Figure 2. Fisher 585C Piston Actuator with Handwheel



E0410

Figure 3. Fisher 585C Piston Actuator with Spring Return



W7447-1

Actuator with Spring Return (figure 3)

585C size 25 and 50 actuators are available with bias springs in two configurations. The 585C actuator, with the bias spring under the piston, fully retracts the actuator stem upon loss of cylinder pressure. The 585C actuator, with the bias spring on top of the piston, fully extends the actuator stem upon loss of cylinder pressure. No additional parts are required to convert from one actuator type to the other.

For more detailed information on the 3610 positioner and DVC6200 digital valve controllers, refer to the Principle of Operation section in the 3610J Instruction Manual ([D200149X012](#)) and [DVC6200](#) instruction manuals.

Installation

⚠ WARNING

To avoid personal injury or property damage caused by cylinder fracture as a result of piston impact, install the stem connector securely before supplying pressure to the positioner. Use only a regulator-controlled air supply to move the actuator piston so that you can install the stem connector. Do not use the positioner to move the actuator piston before installing the stem connector.

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts, be certain the cylinder pressure or other pressure ratings do not exceed the limits listed in table 1. Use pressure-limiting or pressure-relieving devices to prevent cylinder pressure or other pressure ratings from exceeding these limits.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance sections in this instruction manual.

When an actuator and valve are shipped together as a control valve assembly, the actuator is normally mounted on the valve. Follow the valve instructions when installing the control valve in the pipeline. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the Actuator Mounting procedures in this instruction manual corresponding to your actuator size. For information on mounting valve positioners, refer to the 3610J Instruction Manual (D200149X012) or DVC6200 instruction manuals for details.

If a 585C actuator is being installed without a positioner, the cylinder loading pressures should be supplied through a 4-way solenoid valve or a switching valve. The bottom side of the piston is pressured through the bottom side of the mounting flange on the actuator yoke (key 6, figures 5 and 7) for sizes 25 and 50 or the connection at the lower side of the cylinder (key 1, figure 10 to 15) for sizes 60 to 130. The top side of the piston is pressured through the connection in the cylinder cover (key 1 for figures 5, 7; and 10 to 15).

The supply pressure medium should be clean, dry filtered air. If the supply source is capable of exceeding the maximum actuator operating pressure or positioner supply pressure, appropriate steps must be taken during installation to protect the positioner and all connected equipment against overpressure.

⚠ WARNING

Dropping the actuator and any attached accessories and/or valve may cause personal injury and/or equipment damage. For all mounting procedures use an adequately sized chain, sling, hoist, or crane to handle the actuator and any attached accessories and/or valve. Use caution during lifting and handling to prevent slippage, swinging, faulty equipment connections, or sudden shock loads.

NOTICE

To avoid damage to actuator parts and difficult operation of actuator handwheels, open the bypass valve before using a handwheel.

If manual operation is required, the actuator should be equipped with a manual handwheel. To manually move the piston rod with the handwheel, first open the bypass needle valve (key 66 for sizes 25 and 50, figure 9; key 92 for sizes 60 to 130, figure 16), place the handwheel pointer in the neutral position, and insert the locking pin in the sleeve assembly (for size 60-130). Then turn the handwheel in the selected direction as indicated on the wheel.

The control valve should be located where it will be accessible for servicing. Room should be left above and below the control valve to permit removal of the actuator and valve plug.

Bypass Assembly

The bypass is furnished as shown in figures 6, 8, 9, and 16 only when a handwheel actuator is specified. The bypass allows the pressure to equalize on either side of the piston, so that the manual actuator can be used to position the valve.

Flow through the bypass tubing is controlled by an angle needle valve (key 66 for figures 6, 8, and 9; and key 92 for figure 16), which is operated manually. This valve should be closed when air pressure is being used to operate the valve.

Three-Way Valve Applications Note

⚠ WARNING

To avoid loss of control of process fluid and subsequent personal injury or property damage caused by bursting of pressure-retaining parts, be sure the cylinder pressure does not exceed 80 psig in high cycle-rate, fast stroking speed, three-way valve applications.

In three-way valve applications where the actuator fully strokes at a frequency of once per minute or faster, and the stroking speed is rapid (less than 0.5 seconds per stroke), there is a possibility that the stem can fracture at the plug if the actuator cylinder pressure is greater than 80 psig. This can cause loss of control of process fluid and further damage to the actuator. Consideration should be given to the use of high-strength, fatigue-resistant stem materials in these applications.

Actuator Mounting

Size 25 and 50 Actuator Mounting

The following procedure describes how to mount a 585C actuator size 25 and 50 on a push-down-to-close valve so that the piston stem to valve plug stem connection allows full travel and proper shutoff. Key numbers referenced in the following steps are shown in figures 5 through 9.

1. If not already removed, remove the stem connector (key 12) by loosening the cap screws (key 14).
2. Thread the stem connector nuts (keys 13 and 15) onto the valve stem, and run the nuts to the bottom of the valve stem threads.
3. Push the valve plug stem until the valve plug is closed for push-down-to-close valve plug action.
4. Place the actuator on the bonnet of the valve and secure the actuator tightly to the bonnet with the yoke locknut.

NOTICE

In the following procedure, do not rotate the valve plug while it is seated since this may cause damage to the seating surface and thereby allow excessive leakage. Also, during adjustment, use tools carefully to avoid damaging the valve plug stem. A damaged valve plug stem could cut the packing and allow leakage.

Note

When using an actuator with handwheel in the following step to stroke the valve plug, be sure the bypass valve (key 66, figure 6, 8, or 9) is open. Rotating the handwheel (key 47, figure 6, 8, or 9) clockwise extends the actuator stem (key 10); rotating the handwheel counterclockwise retracts the actuator stem.

5. Perform one of the following procedures (a or b as appropriate):
 - a. For a 585C actuator with spring retraction upon loss of cylinder pressure (figures 5 and 6) on a push-down-to-close valve, manually move the valve plug to the seated position. Rotate the handwheel or apply pressure to the pressure connection in the cylinder (key 1) until the piston (key 3) and actuator stem (key 10) move down the specified travel. Run the stem connector nut (key 13) up on the valve stem until it contacts the actuator stem. Be sure the flats on the actuator stem are perpendicular to the scale indicator web on the yoke (key 6). Adjust the stem connector nut as necessary, so that the flats on the nut and the actuator stem are parallel. Clamp the actuator stem and stem connector nut together with the stem connector (key 12) and the two cap screws and hex nuts (keys 14 and 23). Run the hex nut (key 15) up the valve stem and tighten against the stem connector nut (key 13).
 - b. For a 585C actuator with spring extension upon loss of cylinder pressure (figures 7 and 8) with push-down-to-close valve, manually move the valve plug to the seated position. Run the stem connector nut (key 13) up the valve stem until it contacts the actuator stem (key 10). Rotate the handwheel or apply pressure to the pressure connection in the yoke (key 6) to move the actuator stem (key 10) approximately 1/4 inch away from the stem connector nut. Rotate the stem connector nut so that it moves up the valve stem two full turns. Manually move the valve plug so that the stem connector nut again contacts the actuator stem. Be sure the flats on the actuator stem are perpendicular to the scale indicator web on the yoke (key 6). Adjust the stem connector nut, as necessary, so that the flats on the nut and the actuator stem are parallel. Clamp the actuator stem and stem connector nut together with the stem connector (key 12) and the two cap screws and hex nuts (keys 14 and 23). Run the hex nut (key 15) up the valve stem and tighten it against the stem connector nut (key 13).
6. Cycle the actuator several times to check for proper operation.

Note

In the following step, make sure the correct travel indicator scale (key 19) is used per the Parts List for the desired travel.

7. If necessary, remove the travel indicator scale screws (key 18) and reposition the travel indicator scale (key 19) so that the scale arrow points in the same direction as the valve plug moves when opening. Close the valve. Adjust the scale up or down so that the stem connector (key 12) indicator lines up with the closed mark on the scale. Secure the scale with the scale screws.

Size 60-130 Actuator Mounting

The following procedure describes how to mount a 585C size 60 to 130 actuator on a push-down-to-close valve so that the piston stem to valve plug stem connection allows full travel and proper shutoff. Key numbers referenced in the following steps are shown in figures 10 through 15.

If an actuator is purchased separately for field installation on a control valve, mount it on the valve and secure it in place with the yoke locknut for size 60 and 68 or with eight bolts on actuator sizes 80, 100, and 130 which use a 127 mm (5-inch) yoke boss.

The stem connector should then be set up to clamp the actuator stem and valve plug stem together to provide the proper valve travel. This procedure is outlined in the Stem Connector Assembly procedures of this instruction manual.

Stem Connector Assembly (Size 60-130)

NOTICE

To avoid damaging the seating surfaces, do not rotate the valve plug while it is seated. Also avoid damage to the valve plug stem by careful use of tools during travel adjustment.

⚠ WARNING

- To avoid personal injury or property damage caused by cylinder fracture as a result of piston impact, install the stem connector securely before supplying pressure to the positioner. Incomplete engagement of valve stem and/or actuator stem in the stem connector can result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than the diameter of that stem. Do not loosen the cap screws when the stem connector has spring or loading pressure force applied to it.
- Install the stem connector securely before a positioner is mounted to the actuator and pressurized, using only a regulator- controlled air supply, *not the positioner*, to move the actuator piston to position the actuator stem.
- To avoid personal injury or property damage, keep hands and tools out of the actuator stem travel path while pressuring the actuator to move the actuator stem in the following steps.

585C Size 60-130 Direct-Acting (Push-Down-to-Close) Valves

1. With the valve assembled and the actuator mounted, make sure the valve plug is in the closed position, and the actuator is at the top of its stroke. Then screw the two stem locknuts (key 15) all the way onto the stem thread and place the travel indicator disk (key 32) (if any) on the stem locknuts.
2. Keeping your hands away from any moving parts, use a regulator-controlled air supply to move the actuator stem (key 10) down from the top of its stroke to the specified valve travel.
3. Using one half of the stem connector (key 12), align the actuator stem and the valve stem with threads from *both* stems mated root-to-crest with the stem connector. Install the other half of the stem connector and tighten the cap screws. With the stem locknuts (key 15), raise the travel indicator disk (key 32) to the stem connector (key 12).
4. Cycle the actuator to check availability of desired total travel and that the valve plug seats before the actuator contacts the lower travel stop. Minor travel adjustments can be made by loosening the stem connector (key 12) slightly, tightening the locknuts (key 15) together, and screwing the valve stem either into or out of the stem connector (key 12) with a wrench on the locknuts (key 15). If the valve stem cannot be turned, as with a bellows seal bonnet, remake the stem connection to achieve the desired travel.
5. Once the total travel is adequate, tighten the stem connector (key 12) securely, lock the stem locknuts (key 15) against the connector, and adjust the indicator scale (key 19) on the yoke to show correct valve plug position.

6. Provide a gauge to measure the pressure to the actuator. Make a final adjustment of the actuator or its positioner to set the starting point of valve travel and to obtain full travel for the given instrument range.

585C Size 60-130 Reverse-Acting (Push-Down-to-Open) Valves

1. Keeping your hands away from moving parts, pressure the actuator, using a regulator-controlled air supply, to move the actuator stem (key 10) to the extreme upward position then reverse loading pressure to lower the actuator stem (key 10) approximately 3 mm (1/8 inch).
2. Pull the valve stem up to seat the valve plug.
3. Using one half of the stem connector (key 12), align the actuator stem and the valve stem with threads from *both* stems mated root-to-crest with the stem connector. Install the other half of the stem connector and tighten the cap screws.
4. If there is a travel indicator disk (key 32), raise it to the stem connector (key 12) and tighten in position with the stem locknuts (key 15). The indicator disk (key 32) should show the valve to be open with the piston (key 3) at the bottom of its stroke. If it does not, loosen two screws (key 18) and shift the travel indicator scale (key 19) to indicate OPEN.
5. Cycle the actuator to check availability of desired total travel and that the valve plug seats before the actuator contacts the upper travel stop. Minor travel adjustments can be made by loosening the stem connector (key 12) slightly, tightening the locknuts (key 15) together, and screwing the valve stem either into or out of the stem connector (key 12) with a wrench on the locknuts. If the valve stem cannot be turned, as with a bellows seal bonnet, remake the stem connection to achieve the desired travel.
6. Once the total travel is adequate, tighten the stem connector (key 12) securely, lock the stem locknuts (key 15) against the connector, and adjust the indicator scale (key 19) on the yoke to show correct valve plug position.
7. Provide a gauge to measure the pressure to the actuator. Make a final adjustment of the actuator or its positioner to set the starting point of valve travel and to obtain full travel for the given instrument range.

585C Handwheels

Handwheel Operation (Sizes 25 and 50)

Key numbers referenced in the following steps are shown in figures 6, 8, and 9 for the 585C actuator.

The handwheel assembly on a 585C actuator may be used as an adjustable travel stop to limit full upward or downward travel of the actuator stem (key 10), or as a manual actuator to fully stroke the valve. When the neutral indicator (key 42) is in the neutral position, travel is not restricted. With clockwise handwheel (key 47) rotation, the operating nut (key 46) is screwed downward, forcing the actuator stem (key 10) down. With counterclockwise rotation, the operating nut is screwed upward against the handwheel stem washer (key 45), pulling the actuator stem up.

Note

When using an actuator with handwheel to stroke the valve plug or position the travel stop, be sure the bypass valve (key 66) is open.

Handwheel Operation (Sizes 60-130)

The 585C handwheel assembly for sizes 60 through 130 actuators (figures 10 and 12) has three main functions:

- To open or close the valve manually or to position the valve at any point in the stroke, regardless of the cylinder pressure. The tapered pin is inserted during manual throttling operation.
- To act as a travel stop to limit full opening or closing of the valve but not both at the same time. As shown in table 11, the tapered pin is left out when the assembly is used as a travel stop.
- To open or close the valve manually in an emergency without the necessity of inserting the tapered pin, as shown in table 11.

Bevel gears are used in sizes 60 and 68 and worm gears in sizes 80 through 130. A spring-loaded ball detent is provided in the handwheel to prevent a change in setting due to vibration. The following table 10 lists pertinent information on these handwheel units.

Table 10. Fisher 585C Size 60 to 130 Handwheel Information

Actuator Size	60-68	80-130
Handwheel Diameter, Inches	8	17
Turns Required for One Inch of Travel	16	10

Table 11. Fisher 585C Size 60 to 130 Handwheel Information with Travel Stop Function and Emergency Operation without Tapered Pin Engaged

Actuator Size	Maximum Travel, Inch	Used as Upper Travel Stop	To Close the Valve without Tapered Pin Engaged	Used as Lower Travel Stop	To Open the Valve without Tapered Pin Engaged
60 and 68	2	Yes		Yes	
	4 and 8			No	
80, 100, and 130	4	Yes		Yes	
	8			Yes but with travel restriction	

Maintenance (Sizes 25 and 50)

Actuator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends on the severity of service conditions. This section provides two separate procedures, one on Replacing Handwheel Housing O-Ring or Thrust Bearings, and the other on Replacing Seals, Changing Action, or Changing Bias Spring(s).

Refer to figures 6 and 8.

For an actuator with handwheel, a grease fitting (key 50) is provided on the bearing cover (key 38) for periodic bearing lubrication with lithium grease (key 24).

WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.

- Vent the power actuator loading pressure and release all bias spring compression force by slowly unscrewing the cylinder cover bolting in a crisscross pattern.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Replacing Handwheel Housing O-Ring or Thrust Bearings (Sizes 25 and 50)

Perform this procedure if inspecting or replacing the handwheel housing O-ring, handwheel thrust bearings, or any other handwheel parts located above the cylinder (key 1). Inspection or replacement of the cylinder O-ring, handwheel stem, or handwheel stem jam nut (key 57, 56, or 52) are covered in the Replacing Seals, Changing Action, or Changing Bias Spring(s) procedure. Key numbers are referenced in figure 6 for a 585C actuator (spring retracts actuator rod) and in figure 8 for a 585C actuator (spring extends actuator rod).

Note

This procedure may be performed without removing the cylinder, or yoke (key 1 or 6) from the bonnet of the valve.

Disassembly

Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut-off all pressure lines and power to the actuator, and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

1. Shut off the bypass valve (key 66). Remove the cylinder pressure piping and bypass tubing from the bypass tees (key 68) on the cylinder (key 1).
2. Turn the handwheel (key 47) in the appropriate direction so the neutral indicator (key 42) is behind the NEUTRAL position of the neutral indicator plate (key 37).
3. Unscrew and remove the neutral indicator cover (key 35).
4. Remove the handwheel retaining ring, handwheel, and locking key (keys 48, 47, and 65).
5. Loosen the bearing cover set screws (key 51), and unscrew and carefully remove the bearing cover (key 38).
6. Remove the handwheel housing O-ring (key 58) and the top set of thrust bearings (key 39).
7. Since both the handwheel housing (key 36) and the operating nut (key 46) have left-hand threads, unscrew the handwheel housing by turning it clockwise off the operating nut. Carefully remove the detent ball and detent spring (keys 64 and 63), and remove the bottom set of thrust bearings (key 39).

8. Unscrew the handwheel stem cap screw (key 60) while using a 7/8 inch wrench to hold the handwheel stem (key 56). Remove the handwheel stem washer (key 45), and the operating nut (key 46) with attached neutral indicator (key 42).
9. Unscrew the neutral indicator (key 42) counterclockwise if necessary to separate it from the operating nut (key 46).

Reassembly

1. If the neutral indicator (key 42) was removed, coat its threads with thread locking adhesive (medium strength) (key 70) and screw it into the operating nut (key 46). Position the 90-degree elbow of the neutral indicator so that it will not interfere with the neutral indicator cover (key 35) when assembled.
2. If necessary, replace the anti-rotation key (key 40), by pushing the key outward from the cylinder (key 1) then install the replacement key (key 40) into the anti-rotation hole of the cylinder.
3. Lubricate the inside surface of the operating nut (key 46) with lithium grease (key 24). Install the operating nut with the attached neutral indicator, and the handwheel stem washer (key 45), onto the handwheel stem (key 56) and secure with the handwheel stem cap screw (key 60). Tighten the cap screw to 169 N•m (125 lbf•ft).
4. Place the bottom set of thrust bearings (key 39) on top of the cylinder (key 1). Insert the detent spring and ball (keys 63 and 64) into the cylinder.
5. Install the handwheel housing O-ring (key 58) on the handwheel housing (key 36). Since both the handwheel housing and the operating nut (key 46) have left-hand threads, thread the handwheel housing onto the operating nut by turning it counterclockwise over the operating nut until the handwheel housing is snug against the bottom set of thrust bearings (key 39).
6. Install the top set of thrust bearings (key 39) over the handwheel housing (key 36).
7. Carefully slide the bearing cover (key 38) over the handwheel housing (key 36) and thread the bearing cover hand tight onto the cylinder (key 1). Secure by tightening the set screws (key 51) to 18 N•m (13 lbf•ft).
8. Install the locking key, handwheel, and handwheel retaining ring (keys 65, 47, and 48).
9. Screw the neutral indicator cover (key 35) hand tight only onto the handwheel housing (key 36).
10. Install the bypass tubing with attached bypass valve (key 66) into the bypass tees (key 68) in the cylinder (key 1).

Replacing Seals, Changing Action, or Changing Bias Spring(s) (Sizes 25 and 50)

Key numbers are referenced in figures 5 and 6 for a 585C actuator (spring retracts actuator rod) and in figures 7 and 8 for a 585C actuator (spring extends actuator rod).

Disassembly

Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut-off all pressure lines and power to the actuator, release all pressure from the actuator, and release all bias spring compression force by slowly unscrewing the cylinder cover bolting in a crisscross pattern. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

For 585C actuators with push-only handwheel, figure 9, be sure the handjack stem is backed out of the cylinder as far as it will go to relieve any extra spring compression.

1. Remove the cylinder pressure piping. With a handwheel construction, perform steps 1. through 2. of the Replacing Handwheel Housing O-Ring or Thrust Bearings procedure.

Note

In the following step, loosen each cylinder-to-yoke cap screw a slight amount in turn in a crisscross pattern to keep the cylinder square with the yoke while relieving spring precompression.

2. While carefully allowing bias spring precompression to be slowly released, remove the cylinder-to-yoke cap screws and cylinder cover (keys 2 and 1).

NOTICE

When performing the following step, set the cylinder on a protective surface to prevent damage to the cylinder surfaces.

3. Remove the cylinder (key 1). Set the cylinder on a protective surface to prevent damage to the cylinder surfaces. With a handwheel construction, inspect the cylinder O-ring (key 57) and replace it if necessary, applying lithium grease (key 24) to the replacement O-ring.
4. Inspect the piston O-ring (key 8) and replace, if necessary. If the only further maintenance to be performed is replacement of the piston O-ring, skip to step 3 of this procedure.

Note

585C actuators may be used with or without the bias springs. In the following procedures, references are made to the bias springs. If the bias springs are not used, disregard references to them when performing the maintenance procedures.

5. Perform one of the following disassembly procedures (a, b, c, d, or e, as appropriate):
 - a. For 585C actuators without handwheel (*If the bias spring is present, it extends the piston rod.*) (figure 7), remove the piston cap screw (key 4), piston (key 3), bias spring(s) (key 16 and/or key 17), and travel stop spacer (key 5).
 - b. For 585C actuators with handwheel (*If the bias spring is present, it extends the piston rod.*) (figure 8), remove the handwheel stem (key 56) with attached piston stud (key 69), piston (key 3), bias spring(s) (key 16 and/or key 17), and travel stop spacer (key 5).
 - c. For 585C actuators without handwheel (*If the bias spring is present, it retracts the piston rod.*) (figure 5), remove the bias spring(s) (key 16 and/or key 17), piston cap screw (key 4), travel stop spacer (key 5) and piston (key 3).
 - d. For 585C actuators with handwheel (*If the bias spring is present, it retracts the piston rod.*) (figure 6), remove the bias spring(s) (key 16 and/or key 17), the handwheel stem (key 56) with attached piston stud (key 69), travel stop spacer (key 5), and piston (key 3).
 - e. For 585C actuators with push-only handwheel (figure 9), remove the cotter pin and slotted nut (keys 73 and 72) and lift off the handwheel. Remove the jam nut (key 52). Remove the cap screws (key 60) and lift off the handwheel housing (key 36). Back the handwheel stem (key 56) out of the housing. Inspect the O-rings (keys 57 and 58). Replace these parts as necessary.
6. If inspection or replacement of the actuator stem O-ring or bearing (key 9 or 11) is necessary, perform steps 1. through 7. Otherwise, skip to step 2, being sure to comply with the note preceding step 2.

7. Loosen the two cap screws in the stem connector (key 14) and remove it. If the actuator is mounted on a valve, separate the actuator stem (key 10) from the valve plug stem. Remove the actuator from the valve.
8. To inspect the actuator stem bearing (key 11), actuator stem O-ring (key 9), or backup ring (key 25, size 50 only) remove the actuator stem (key 10) from the yoke (key 6). Replace these parts if necessary. Apply lithium grease (key 24) to the replacement O-ring or bearing and install it into the yoke.

Assembly

1. Install the actuator stem through the yoke.

Note

Make certain the travel indicator scale (key 19) correctly matches the travel per the Parts List.

2. To achieve the desired construction (either a direct-acting or a reverse-acting 585C actuator), perform one of the following assembly procedures (a, b, or c, as appropriate):
 - a. For 585C actuators (bias spring retracts the piston rod) (figures 5 and 6), center the inner bias spring, if used, (key 17 per table 6 or 7) around the center boss in the yoke (key 6). If used per table 6 or 7, center the outer bias spring (key 16) around the inner bias spring. The outer bias spring should be within the outer boss in the yoke. Put the travel stop spacer and the piston (keys 5 and 3) on the actuator stem. Apply lithium grease (key 24) to the threads of the piston cap screw or piston stud (key 4 or 69). Insert the piston cap screw, or stud plus attached handwheel stem (key 56), through both the piston and travel stop spacer and into the actuator stem. Use a wrench on the flats of the actuator stem to prevent it from turning. Tighten the piston cap screw, or stud plus attached handwheel stem, to 102 N•m (75 lbf•ft) for size 25 actuators or 136 N•m (100 lbf•ft) for size 50 actuators.
 - b. For 585C actuators with push-only handwheel (figure 9), lubricate the O-rings and handjack stem threads with lithium grease. Install the O-ring (key 57) and handjack stem (key 56), turning the screw into the housing as far as possible. Place the O-ring (key 58) over the housing and insert into the cylinder (key 1). Replace the cap screws (key 60) and tighten to 41 N•m (30 lbf•ft) on size 25 actuators or 81 N•m (60 lbf•ft) on size 50 actuators. Replace the jam nut (key 52), handwheel (key 47), and slotted nut and cotter pin (keys 72 and 73).
 - c. For 585C actuators (bias spring extends the piston rod) (figures 7 and 8), put the piston (key 3) on the actuator stem and the travel stop spacer (key 5) on the piston. Apply lithium grease (key 24) to the threads of the piston cap screw or piston stud (key 4 or 69). Insert the piston cap screw, or stud plus attached handwheel stem (key 56), through both the travel stop spacer and piston and into the actuator stem. Use a wrench on the flats of the actuator stem to prevent it from turning. Tighten the piston cap screw, or stud plus attached handwheel stem, to 102 N•m (75 lbf•ft) for size 25 actuators or 136 N•m (100 lbf•ft) for size 50 actuators. Center the inner bias spring, if used, (key 17 per table 4 or 5) around the travel stop spacer. If used per table 4 or 5, center the outer bias spring (key 16) around the inner bias spring. The outer bias spring should be within the outer boss on the piston.
3. Install the piston O-ring (key 8) if it was removed from the piston, and the yoke O-ring (key 7, figure 5 or 7) if it was removed from the yoke (key 6). Apply lithium grease (key 24) to the wall of the cylinder (key 1) and carefully slide the cylinder over the piston O-ring. Be sure the cylinder pressure connection is aligned with the yoke pressure connection. Square the cylinder in place over the yoke O-ring.
4. Line up the cylinder holes with the yoke holes making sure for a handwheel construction that the anti-rotation groove in the handwheel stem (key 56) is aligned with the hole in the cylinder for the anti-rotation key (key 40).

Note

When placing the cylinder on the yoke and tightening the cylinder-to-yoke bolts, be sure to keep the cylinder square and aligned with the top of the yoke.

5. Lubricate the cylinder-to-yoke bolts (key 2) with lithium grease (key 24). In a criss cross pattern, alternately tighten each cylinder-to-yoke bolt a slight amount so that the cylinder stays square with the yoke. When all cylinder surfaces are in contact with the yoke, tighten each cylinder-to-yoke bolt to 70 N•m (55 lbf•ft) for a size 25 or 95 N•m (70 lbf•ft) for a size 50.
6. With a handwheel construction, perform steps 2 through 10 of the Replacing Handwheel Housing O-ring or Thrust Bearings procedure.
7. If the actuator will be mounted on a valve, perform the appropriate actuator mounting procedure. Otherwise, place the stem connector nut (key 13), stem connector (key 12), two cap screws (key 14), two hex nuts (key 23) and hex nut (key 15) in a parts bag and attach the bag to the actuator yoke.

Maintenance (Sizes 60-130)

WARNING

To avoid personal injury or property damage caused by cylinder fracture as a result of piston impact, install the stem connector securely before supplying pressure to the positioner. Use only a regulator-controlled air supply to move the actuator piston so that you can install the stem connector. Do not use the positioner to move the actuator piston before installing the stem connector.

WARNING

Avoid personal injury from sudden release of process pressure or uncontrolled process fluid. Before starting disassembly:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Key numbers indicated refer to figures 10 through 15.

Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut-off all pressure lines and power to the actuator, and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

1. If positioner is not used, go to step 5. If positioner is used, shut off all pressure lines to the positioner then remove all tubing lines (cylinder, instrument and supply) from the positioner.

NOTICE

Do not use wrenches or other tools directly on the valve stem. Damage to the stem surface could result in subsequent damage to the valve packing.

2. Remove the stem connector (key 12) and the piston rod boot (key 29) used to protect the lower end of the actuator stem.
3. Remove the socket head cap screws that hold the cylinder (key 1) to the yoke (key 6).

NOTICE

Exercise care in the following step to prevent damage to the cylinder wall during removal of the cylinder from the yoke.

4. Insert a screwdriver in the two slots on the lower edge of the cylinder casting and pry the cylinder loose from the yoke. Remove the cylinder, being careful not to mar the cylinder wall.
5. The piston (key 3) and actuator stem (key 10) will come out with the cylinder. The piston can then be removed by forcing it out the open end of the cylinder.
6. Unscrew the seal bushing (key 110 or 26), in the upper end of the yoke (key 6).
7. With the unit disassembled, inspect all parts for excessive wear. Replace all worn O-rings. Lubricate with lithium grease for standard service and Krytox[®] GPL 202 for low ambient temperature service (key 24) as indicated on the assembly drawings. Apply sealant (key 70) as indicated on the assembly drawings.
8. When reassembling the actuator after the piston nut (key 4) has been removed from the actuator stem (key 10), clean the threads of the piston nut thoroughly and apply thread sealant to the threads. Tighten the piston nut securely to a torque of 237 N•m (175 lbf•ft) for size 60 actuators, 1290 N•m (950 lbf•ft) for size 68, 80, and 100 actuators, or 2070 N•m (1530 lbf•ft) for size 130 actuators.

Side-Mounted Handwheel Maintenance (Sizes 60-130)

Refer to figure 10, 11, and 12.

1. The handwheel parts should be fully lubricated periodically per figure 10, 11, 12, and 13. Lack of lubrication might cause handwheel to malfunction or reduction of output thrust. A grease fitting (key 140) is provided on sizes 80, 100, and 130. On sizes 60 and 68, remove the handwheel (key 118) and the bevel pinion (key 116) and pack the gear case with lithium grease. Loosen the set screw (key 139) before attempting to remove the pinion and extension.
2. If it is necessary to change the valve plug action from push-down-to-close to push-down-to-open or vice versa, change the handwheel arrangement so that the arrow indicates the correct rotation required to open the valve.
 - a. For sizes 60 and 68, remove the handwheel, invert and replace it. On sizes 60 and 68 (figure 10), remove and replace the spring-loaded ball assembly (key 123) in the opposite side.
 - b. For sizes 80-100, remove the handwheel assembly and install in the opposite end of the gear case by unscrewing the back and front worm retainers (keys 135 and 136, not shown) and turn the handwheel to disengage the bevel pinion (key 116).

Disassembly of Handwheel Constructions (Sizes 60 and 68)

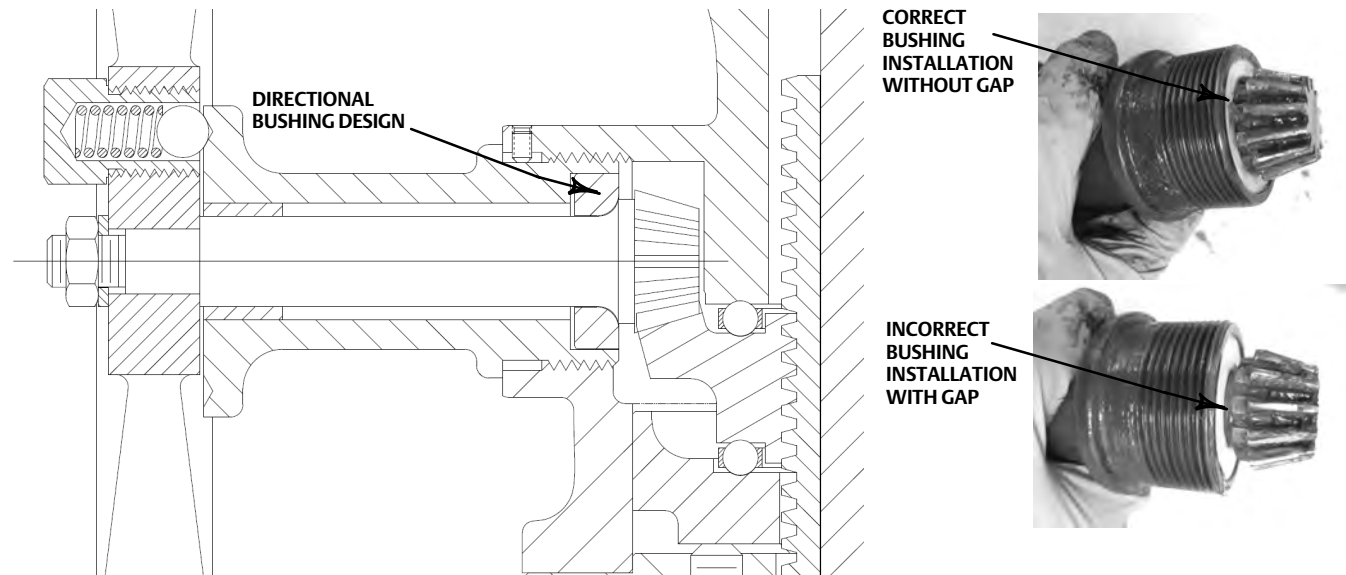
⚠ WARNING

Refer to the WARNING at the beginning of the Maintenance section (Sizes 60-130) in this instruction manual.

To disassemble 585C piston actuators sizes 60 and 68 (with handwheel) for maintenance, perform the following procedures (figure 10 and 12):

1. Be sure that all pressure is out of the cylinder and valve body.
2. Remove all tubing lines to the positioner.
3. Remove the cap screws (key 2) on the underside of either the cylinder flange (key 100) for size 60 or the adapter flange (key 76) for size 68. Remove the cylinder (key 1).
4. Remove the piston nut (key 4), then use a mallet to tap the piston (key 3) off the piston connector (key 107).
5. Remove the handwheel extension (key 117) by loosening the set screw (key 139) and unscrewing the extension. Loosen the hex nut (key 119) and the lockwasher (key 120) to remove the handwheel unit (key 118, 121, 122, and 123) from the bevel pinion (key 116). Slide the bevel pinion (key 116) out of the handwheel extension (key 117) and slide the bushing (key 124) out of the bevel pinion (key 116). Inspect the bushing (key 124) and the bevel pinion (key 116) for wearing or damage, and replace with new parts as needed. The bushing (key 124) is a directional design and its insider radius should be installed to the bevel pinion (key 116) gear side mating with the bevel pinion shoulder radius as shown in figure 4.

Figure 4. Fisher 585C Size 60 and 68 Handwheel Directional Bushing Design and Installation



6. Remove the cap screws (key 2) holding the cylinder flange (key 100) to the yoke (key 6).
7. Lift the cylinder flange (key 100) off the yoke (key 6).
8. Inspect the handwheel bearing retainer (key 113), bevel gear (key 114) and thrust bearing (key 115). Replace damaged parts as needed.
9. To remove the actuator stem (not shown), loosen the stem connection (key 12) and pull the actuator stem out the top of the sleeve assembly (key 104).
10. Remove the sleeve by screwing it out of the sleeve assembly (key 104).
11. Unscrew the seal bushing (key 110) to inspect the O-rings (keys 9 and 27).

Disassembly of Handwheel Constructions (Sizes 80-130)

⚠ WARNING

Refer to the WARNING at the beginning of the Maintenance section (Sizes 60-130) in this instruction manual.

To disassemble 585C piston actuators sizes 80-130 (with handwheel) for maintenance, perform the following procedures (figure 12):

1. Be sure that all pressure is out of the cylinder and valve body.
2. Remove all tubing lines to the positioner.
3. Remove the cap screws (key 2) on the underside of the cylinder adapter (key 101) and remove the cylinder (key 1).
4. Remove the piston nut (key 4), then use a mallet to remove the piston (key 3) from the piston connector (key 107).
5. Remove the cap screws (key 127) and cylinder adaptor (key 101).
6. Remove the cap screws (key 128) and remove the spacer (key 102), being careful not to lose the key (key 144).
7. Remove the locking pin (key 131), disconnect the stem connector (key 12) and pull out the actuator stem.
8. Remove the pointer (key 129) and turn the sleeve out of the sleeve assembly (key 104).
9. Remove the cap screws (key 128) holding the gear case (key 103) to the yoke (key 6).
10. Lift the gear case (key 103) to expose the handwheel assembly.

Reassembly (Sizes 60-130)

When reassembling the 585C piston actuator with side-mounted handwheel, adjust the setscrew (key 125) to eliminate play in gear bearings. When properly set, lock with key 126.

When reassembling the side mounted handwheel, all parts required lubrication as shown in per figure 10, 11, 12, and 13 should be fully lubricated.

When reassembling the actuator after the piston nut (key 4) has been removed from the piston connector (key 107), clean the threads of the piston nut thoroughly and apply thread sealant to the threads. Tighten the piston nut securely to a torque of 237 N•m (175 lbf•ft) for size 60 actuators, 1290 N•m (950 lbf•ft) for size 68, 80, and 100 actuators, or 2070 N•m (1530 lbf•ft) for size 130 actuators.

Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, refer to the serial number found on the actuator nameplate (key 21).

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

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585C Actuator

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Parts Kits

Table 12. Standard Construction

Actuator Size	Parts Kit Description	Parts Kit Number
25	O-ring (contains keys 7, 8, and 9)	R585CX00252
50	Backup ring (key 25) for size 50 actuators only	R585CX00502
60 (2-inch maximum travel)	O-ring (contains keys 7, 8, 9, and 27) Piston rod boot (key 29) and Snap ring (keys 30 and 31)	R585CX00012
60 (4-inch maximum travel)	O-ring (contains keys 7, 8, 9, and 27) Piston rod boot (key 29) and Snap ring (keys 30 and 31)	R585CX00022
60 (2-, 4-, and 8-inch maximum travel w/ handwheel) (8-inch maximum travel)	O-ring (contains keys 7, 8, 9, and 27)	R585CX00032
68 (2-, 4-, and 8-inch maximum travel w/ handwheel)	O-ring (contains keys 7, 8, 9, 27, and 112)	R585CX00102
68 (2-, 4-, and 8-inch maximum travel) 80 (8-inch maximum travel)	O-ring (contains keys 7, 8, 9, and 27)	R585CX00042
80 (2-, 4-, and 8-inch maximum travel w/ handwheel)		
80 (4-inch maximum travel)	O-ring (contains keys 7, 8, 9, and 27) Piston rod boot (key 29) and Snap ring (keys 30 and 31)	R585CX00052
100 (4-inch maximum travel)	O-ring (contains keys 7, 8, 9, and 27) Piston rod boot (key 29) and Snap ring (keys 30 and 31)	R585CX00062
100 (8-inch maximum travel) 4- and 8-inch maximum travel w/ handwheel)	O-ring (contains keys 7, 8, 9, and 27)	R585CX00072
130 (4-inch travel)	O-ring (contains keys 7, 8, 9, and 27) Piston rod boot (key 29) and Snap ring (keys 30 and 31)	R585CX00082
130 (8-inch travel) (4- and 8-inch travel with handwheel)	O-ring (contains keys 7, 8, 9, and 27)	R585CX00092

Table 13. Low Ambient Temperature Construction

Actuator Size	Parts Kit Description	Parts Kit Number
60 (2, 4 and 8-inch maximum travel) 60 (2, 4 and 8-inch maximum travel w/ handwheel)	O-ring (contains key 7, 8, 9 and 27) lubricant (key 24)	R585CF00012
68 (2, 4 and 8-inch maximum travel) 68 (2, 4 and 8-inch maximum travel w/ handwheel) 80 (2, 4 and 8-inch maximum travel) 80 (2, 4 and 8-inch maximum travel w/ handwheel)	O-ring (contains key 7, 8, 9 and 27) lubricant (key 24)	R585CF00022
100 (4 and 8-inch maximum travel)	O-ring (contains key 7, 8, 9 and 27)	R585CF00032
130 (4 and 8-inch maximum travel) 130 (4 and 8-inch maximum travel w/ handwheel)	O-ring (contains key 7, 8, 9 and 27) lubricant (key 24)	R585CF00042

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Sizes 25 and 50

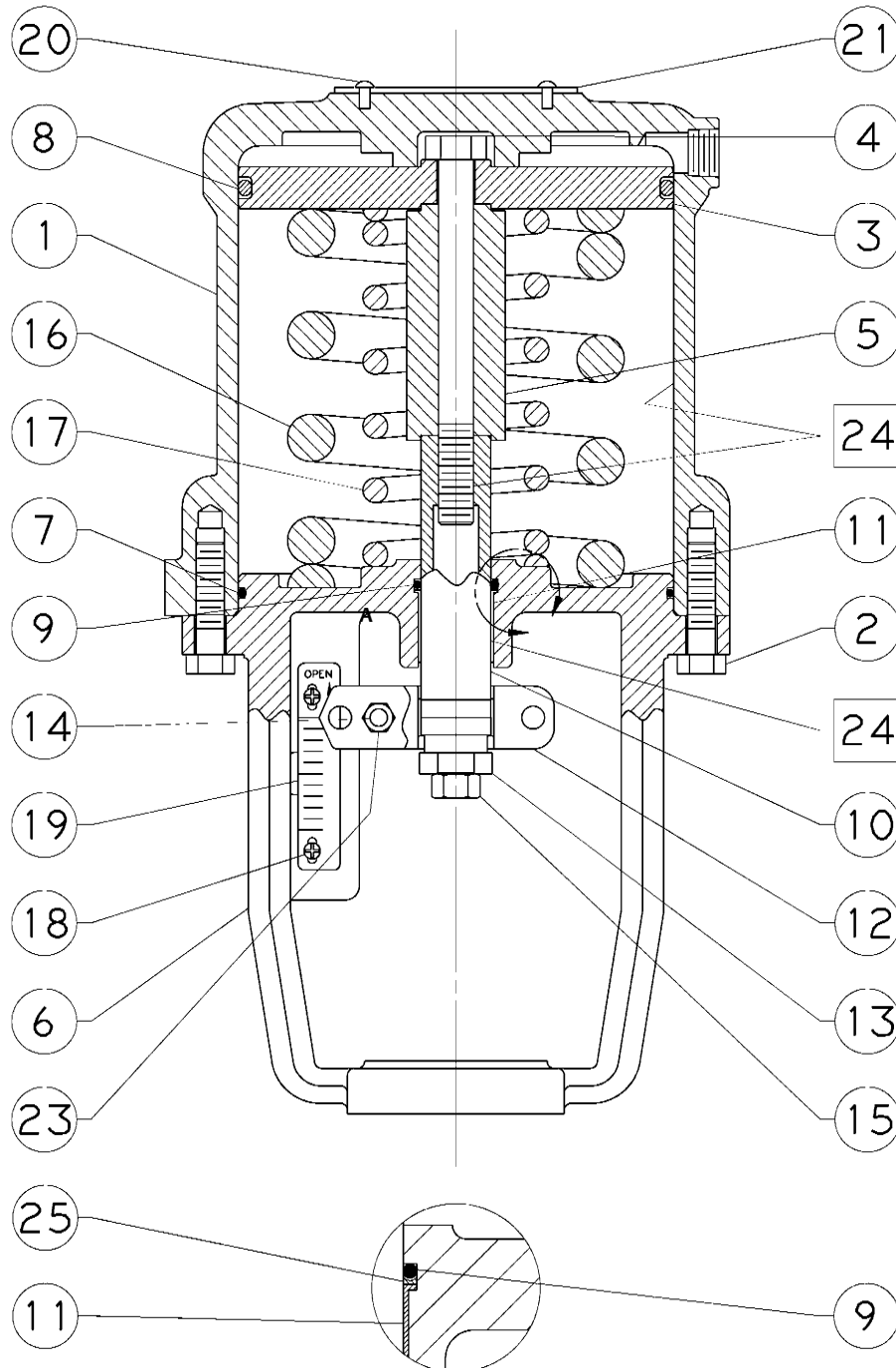
Common Actuator Parts (figure 5 or 7)

Key	Description
1	Cylinder
2	Cylinder-to-Yoke Bolts
3	Piston
4	Cap Screw, for actuators without handwheel
5	Travel Stop Spacer
6	Yoke
7*	Yoke O-ring
8*	Piston O-ring
9*	Actuator Stem O-ring
10	Actuator Stem
11*	Piston Stem Bearing
12	Stem Connector
13	Stem Connector Nut
14	Cap Screw (2 req'd)
15	Hex Nut
16	Bias Spring, outer (see table 4-7 for use)
17	Bias Spring, inner (see table 4-7 for use)
18	Self Tapping Screw (2 req'd)
19	Travel Indicator Scale
20	Drive Screw (7 req'd)
21	Nameplate
22	Warning Tag
23	Hex Nut (2 req'd)
24	Lithium grease (not furnished with actuator)
25*	Back-Up Ring, Size 50 only
71	Warning Nameplate
75	Spacer (2 req'd)

Additional Parts for Actuator with Handwheel (figure 6, 8, or 9)

Key	Description
1	Cylinder,
35	Neutral Indicator Cover
36	Handwheel Housing
37	Neutral Indicator Plate
38	Bearing Cover
39	Thrust Bearing
40	Anti-rotation Key
42	Neutral Indicator
43	Neutral Indicator Plate Screw (2 req'd)
45	Handwheel Stem Washer
46	Operating Nut
47	Handwheel
48	Handwheel Retaining Ring
50	Grease Fitting
51	Bearing Cover Set Screw (3 req'd)
52	Handwheel Jam Nut
53	Button Plug
56	Handwheel Stem
57*	Cylinder Cover O-Ring - For Push Only
58*	Handwheel Housing O-Ring - For Push Only
60	Handwheel Stem Cap Screw, (4 req'd for size 25), (3 req'd for size 50)
63	Detent Spring
64	Detent Ball
65	Locking Key
66	Bypass Valve
67	Bypass Tubing
68	Bypass Tee
69	Piston Stud
70	Thread locking adhesive (medium strength) (not furnished with actuator)
72	Hex Nut, Slotted
73	Cotter Pin
74	Elbow, Tube

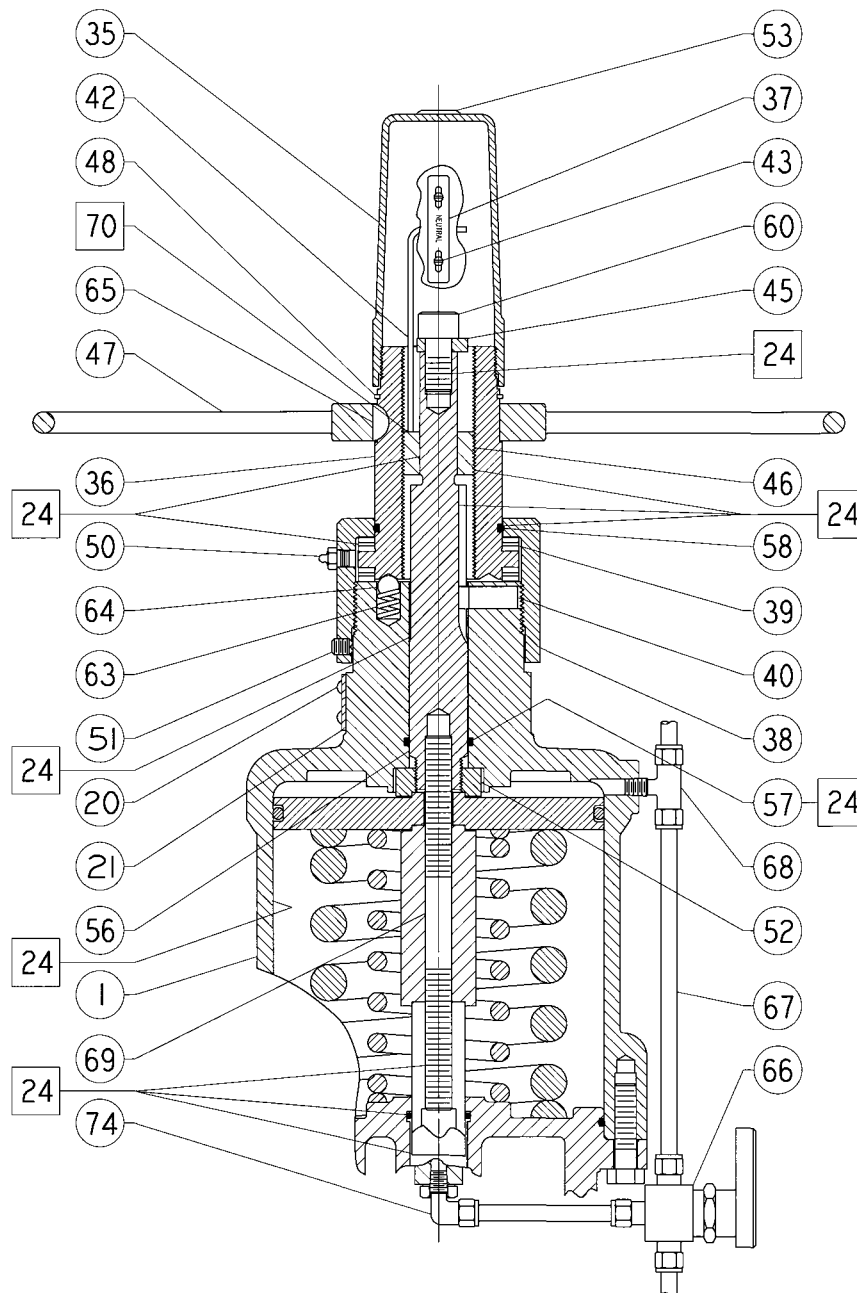
Figure 5. Fisher 585C Size 25 and 50 Actuators (spring retracts actuator rod)



□ APPLY LUB
NOTE:
KEY NUMBERS 22 AND 71 NOT SHOWN

4486335-C

Figure 6. Fisher 585C Size 25 and 50 Actuators Handwheel Assembly (spring retracts actuator rod)

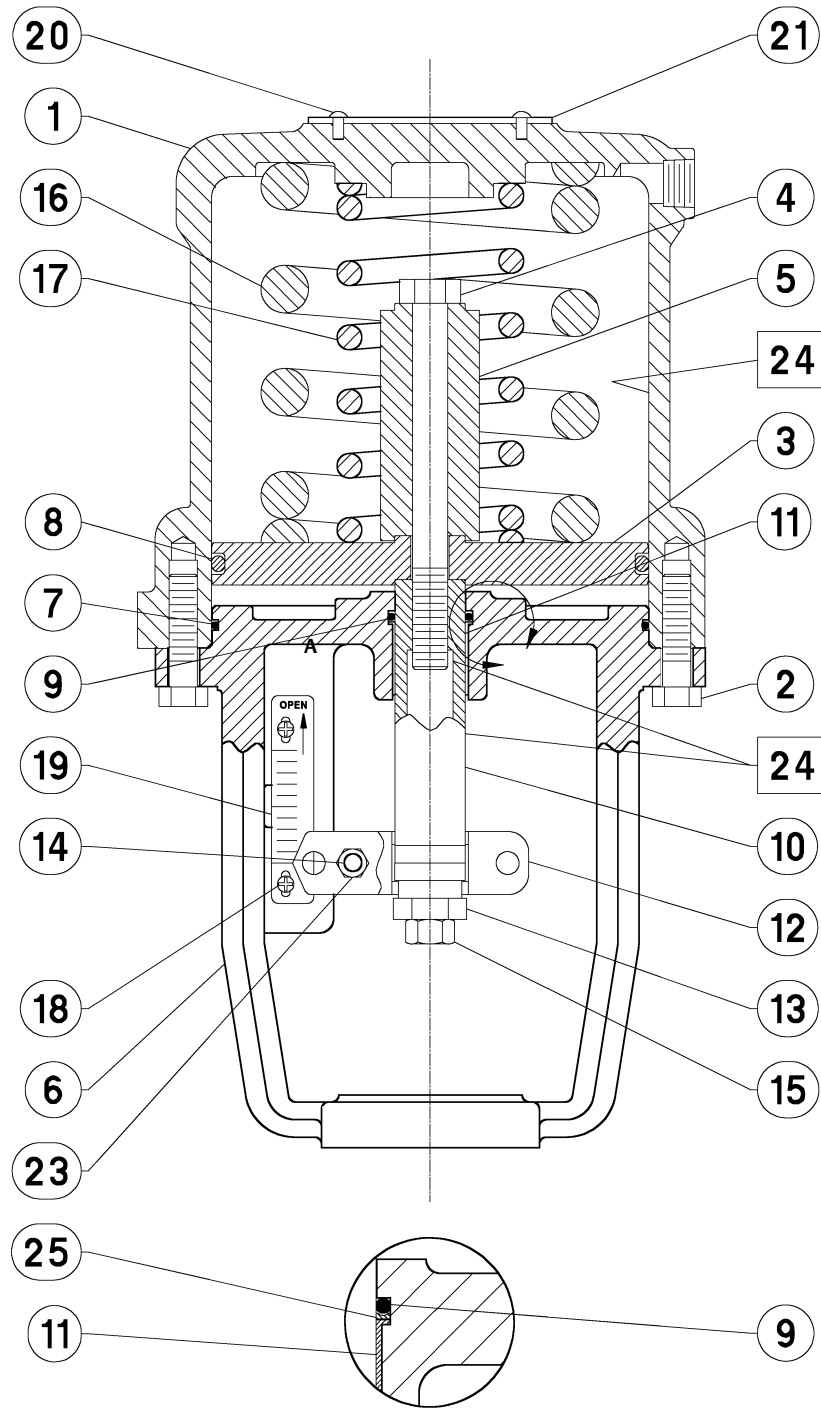


□ APPLY LUB

4486330-B

HANDWHEEL ASSEMBLY

Figure 7. Fisher 585CR Size 25 and 50 Actuators (spring extends actuator rod)

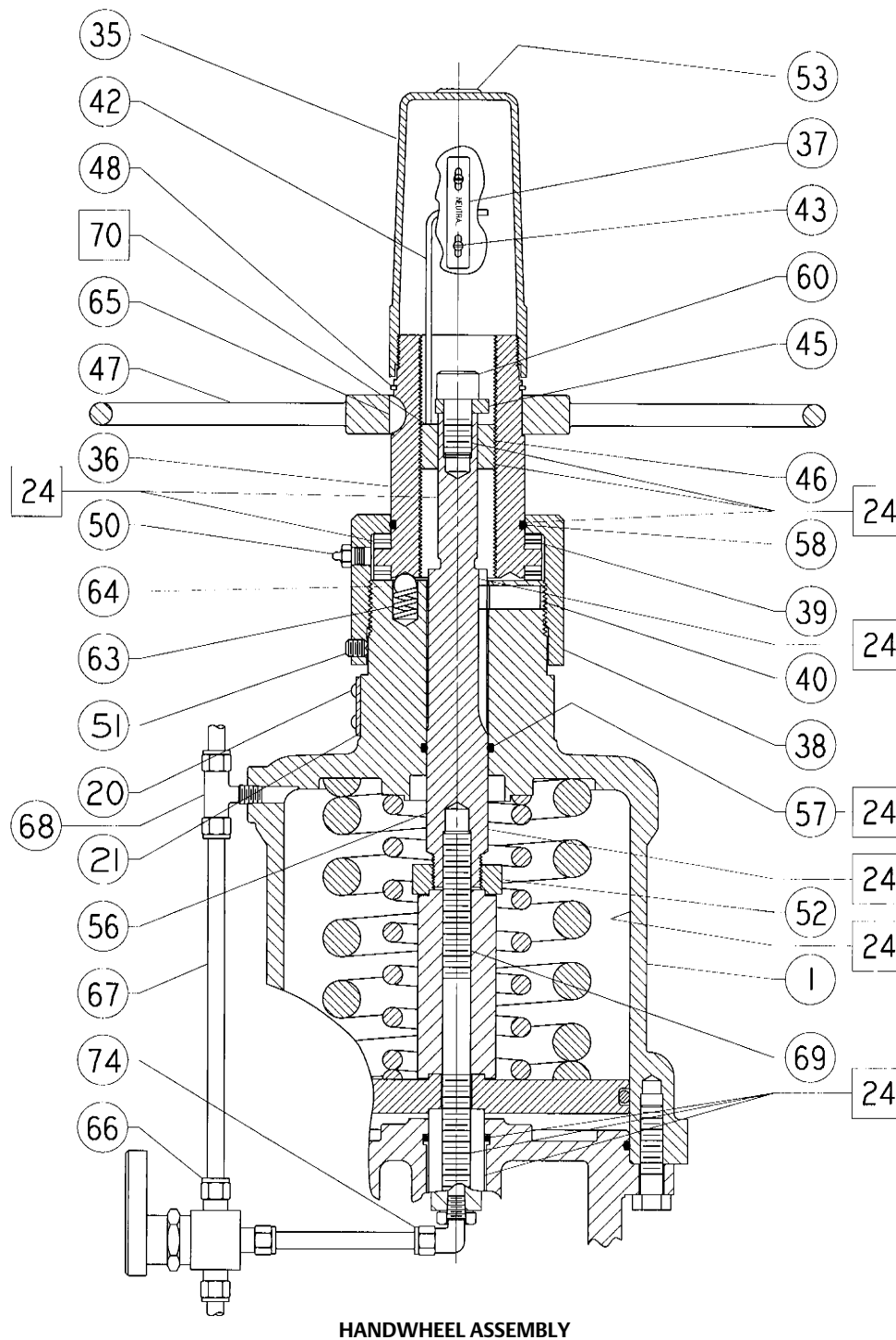


□ APPLY LUB

NOTE:
KEY NUMBERS 22 AND 71 NOT SHOWN

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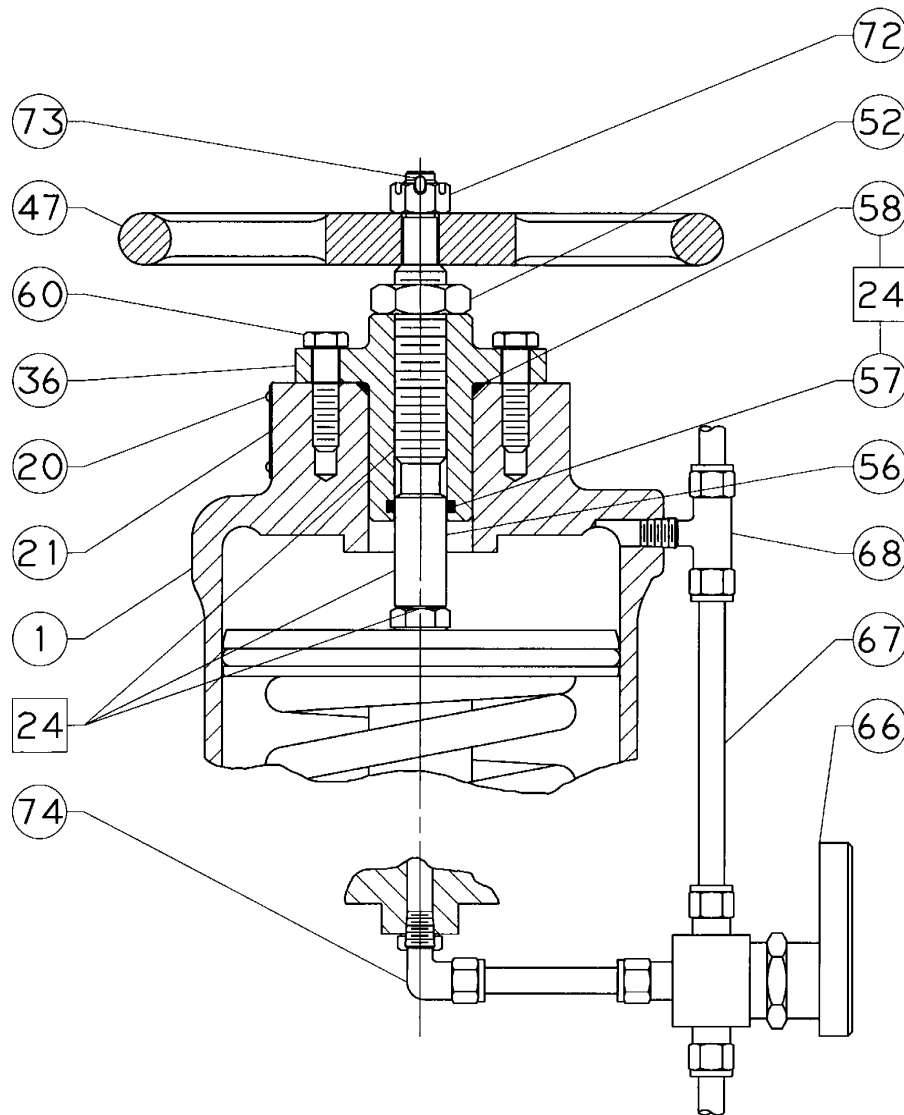
Figure 8. Fisher 585CR Size 25 and 50 Actuators Handwheel Assembly (spring extends actuator rod)



□ APPLY LUB, SEALANT

4486337-C

Figure 9. Fisher 585C Size 25 and 50 Actuators Handwheel Assembly—Direct Acting, Push Only
(spring retracts actuator rod)



HANDWHEEL ASSEMBLY

□ APPLY LUB

3488587-B

Sizes 60-130 (figures 10-16)

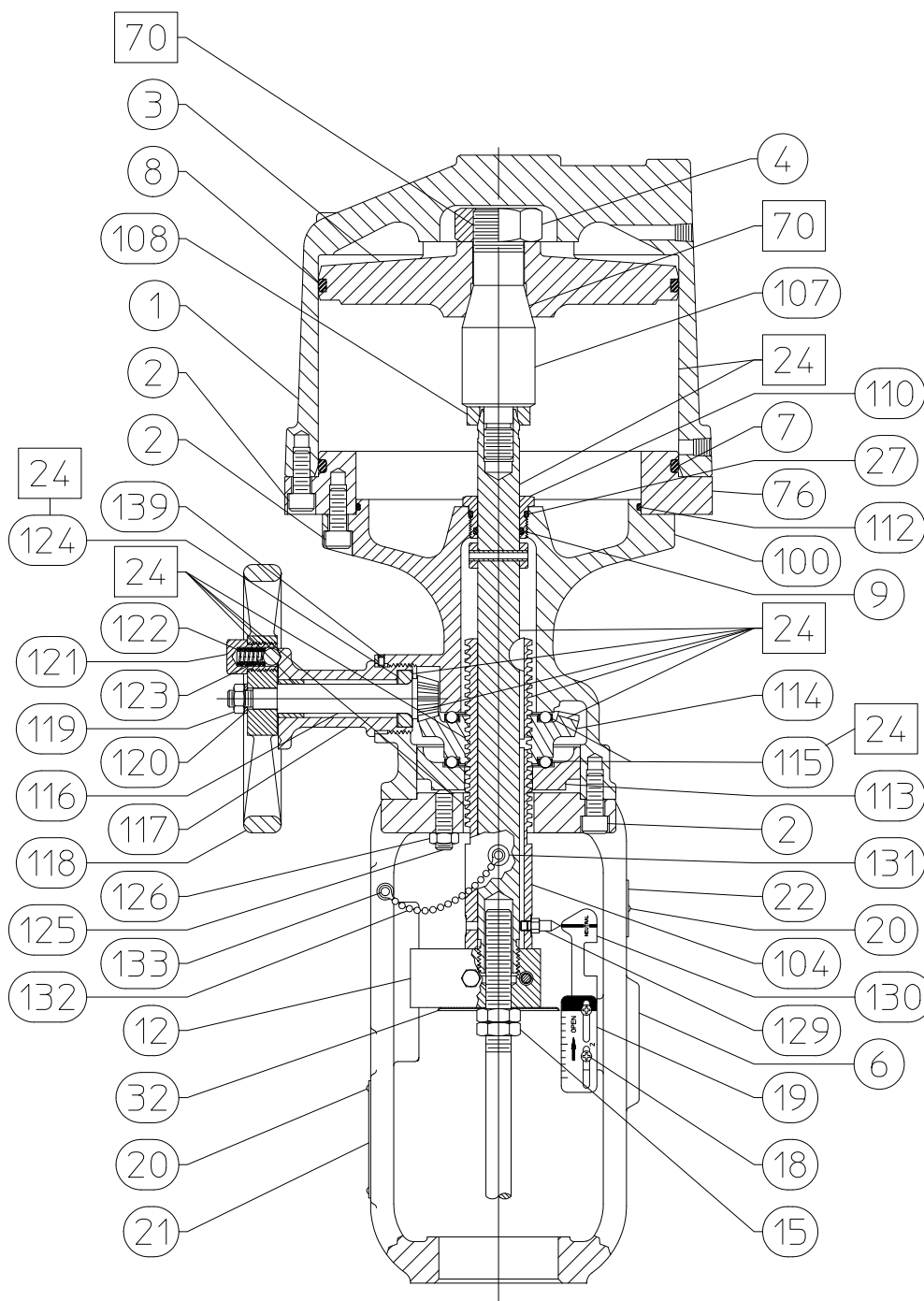
Key Description

1	Cylinder Assembly
2	Cap Screw
3	Piston
4	Piston Nut
6	Yoke
7*	O-Ring
8*	O-Ring
9*	O-Ring
10	Actuator Stem
12	Stem Connector Assembly
15	Hex Nut
18	Screw (2 req'd)
19	Travel Indicator Scale
20	Drive Screw
21	Nameplate
22	Warning Nameplate (not shown)
24	Lithium grease for standard service and for handwheel locations in all services (not furnished with actuator)
24	Krytox GPL 202 for cylinder and o-ring locations for low ambient temperature service (not furnished with actuator)
26*	Seal Bushing (without handwheel)
27*	O-Ring
28*	Wiper Scraper
29*	Piston Rod Boot
30*	Snap Ring
31*	Snap Ring
32	Travel Indicator Disk
33	Twin Speed Nut (not shown)
34	Machine Screw
70	Thread sealant (not furnished with actuator)
76	Adaptor Flange
76	Cylinder Flange
77	Cap Screws
90	Pipe Nipple (not shown)
91	Pipe Tee
92	Needle Valve
100	Cylinder Flange
101	Cylinder Adaptor
102	Spacer
103	Gear Case
104	Sleeve Assembly
105	Sleeve

Key Description

106	Actuator Stem
107	Piston Connector
108	Piston Ring Adaptor
109	Washer
110*	Seal Bushing (with handwheel)
111	Retaining Ring
112*	O-Ring
113	Bearing Retainer
114	Bevel Gear
114	Worm Gear
115	Thrust Bearing (2 req'd)
116	Bevel Pinion
116	Worm Shaft
117	Extension
118	Handwheel
119	Handwheel Cap
119	Hex Nut (1 req'd)
120	Lockwasher
121	Spring Cap
122	Spring
123	Ball
123	Cover Screw
124	Bushing
125	Set Screw
126	Hex Nut
127	Cap Screw
128	Cap Screw
129	Pointer
130	Handjack Indicator
131	Locking Pin
132	Chain
133	Drive Screw
134	Ball Bearing
135	Front Worm Retainer
136	Back Worm Retainer
137	Hand Grip
138	Hand Grip Bolt
139	Set Screw
140	Zerk Fitting
141	Ring
142	Machine Screw (2 req'd)
143	Key
144	Key
145	Caution Tag (not shown)
146	Cable Tie (2 req'd) (not shown)

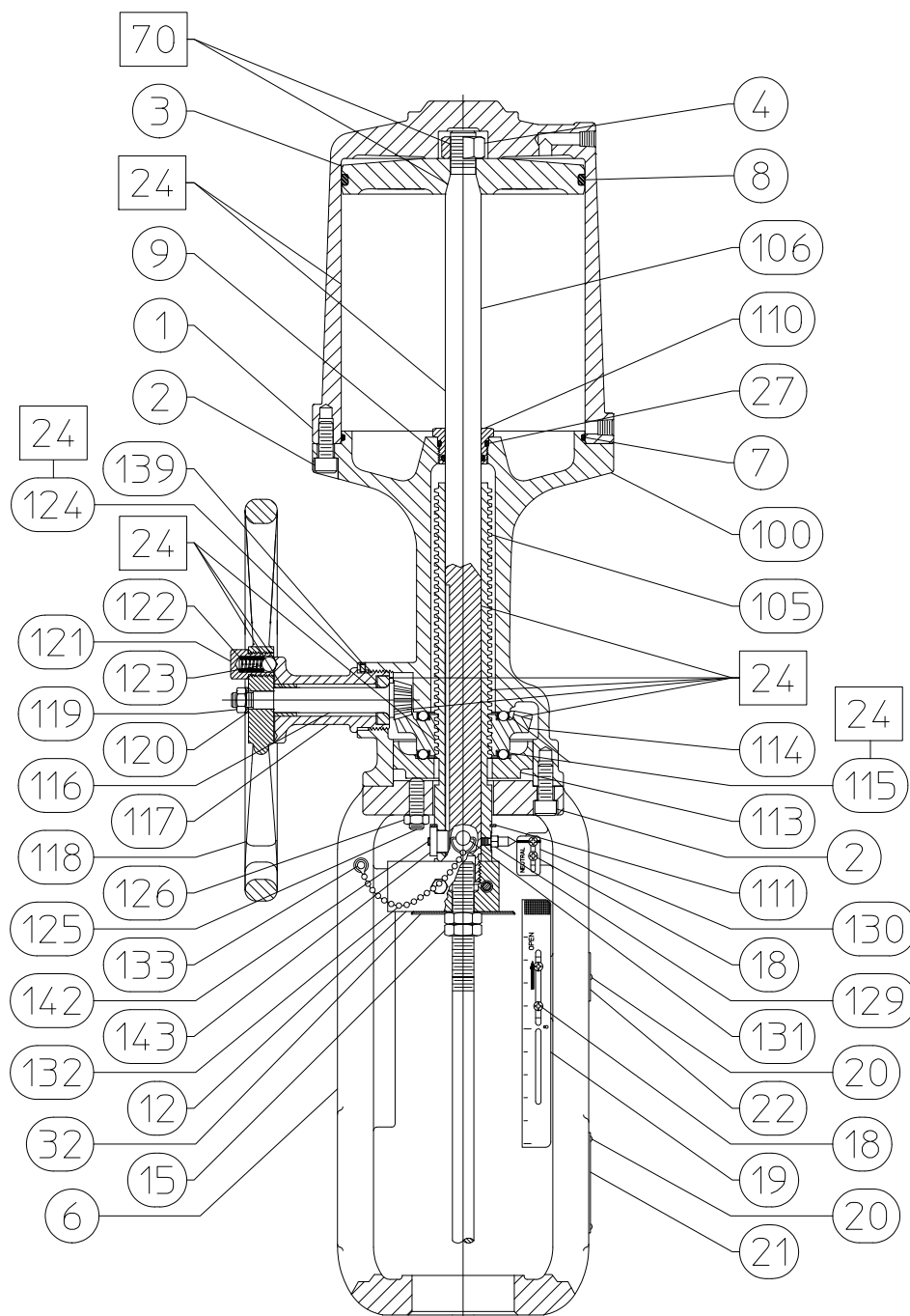
Figure 10. Fisher 585C Actuator with Integral Handjack Size 68 with 2- and 4-Inch Travel



□ APPLY LUB/SEALANT
 PARTS NOT SHOWN: 33, 145, 146
 FOR BYPASS ASSEMBLY, SEE FIGURE 16

GH17769_A

Figure 11. Fisher 585C Actuator with Integral Handjack Size 60 with 8-Inch Travel



□ APPLY LUB/SEALANT

PARTS NOT SHOWN: 33, 141, 145, and 146
FOR BYPASS ASSEMBLY, SEE FIGURE 16

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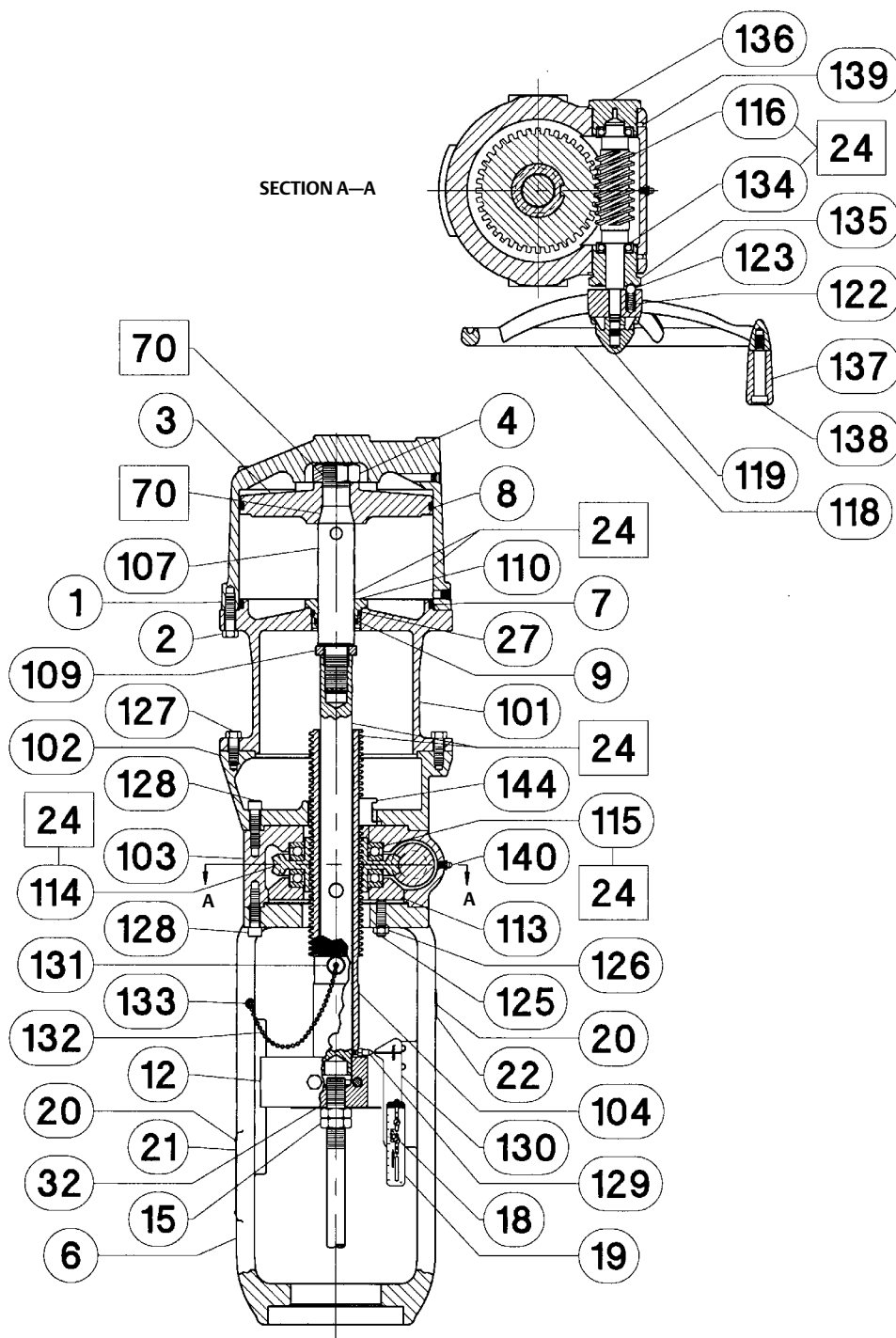
Instruction Manual

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585C Actuator

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Figure 12. Fisher 585C Actuator with Integral Handjack Size 80 and 100 with 4-Inch Travel

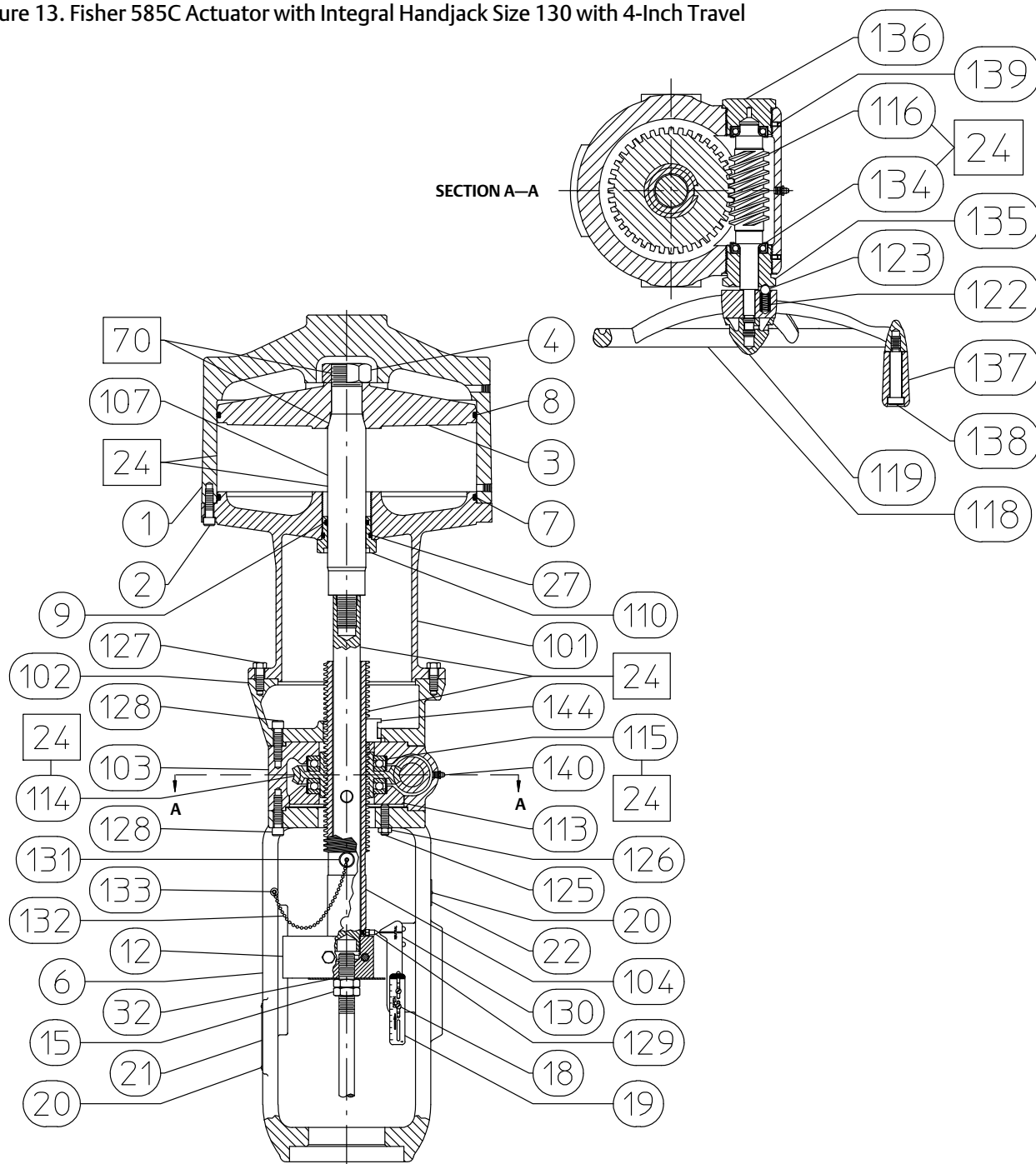


□ APPLY LUB/SEALANT

PARTS NOT SHOWN: 141, 145, 146
FOR BYPASS ASSEMBLY, SEE FIGURE 16

58B1373-A

Figure 13. Fisher 585C Actuator with Integral Handjack Size 130 with 4-Inch Travel

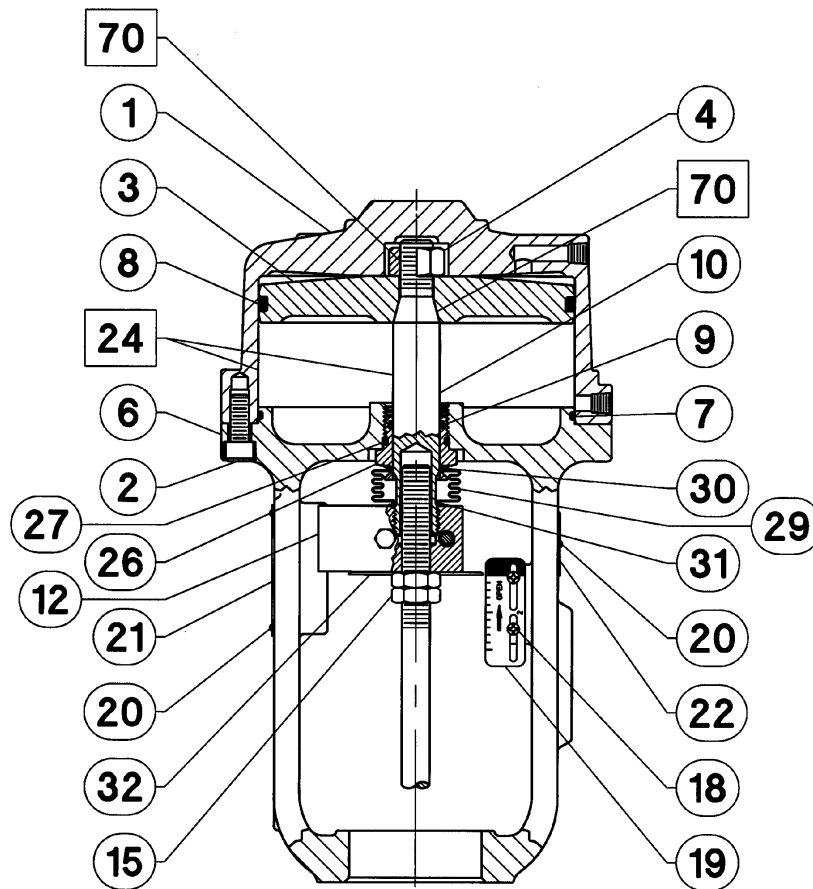


□ APPLY LUB/SEALANT

PARTS NOT SHOWN: 141, 145, 146
FOR BYPASS ASSEMBLY, SEE FIGURE 16

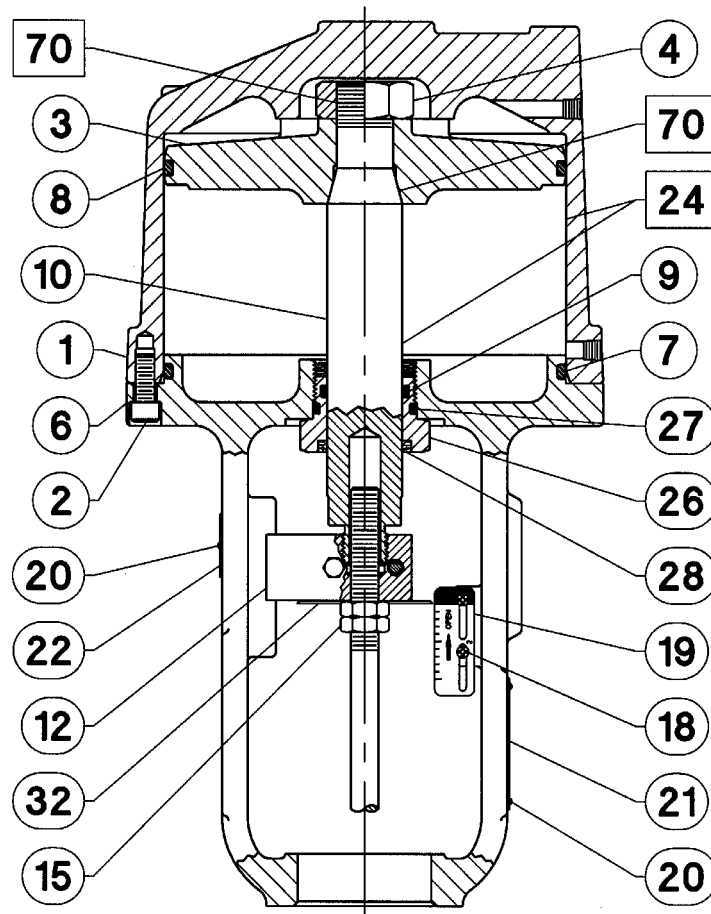
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58B1378-2

Figure 14. Fisher 585C Actuator Size 60 with 2- and 4-Inch Travel



□ APPLY LUB/SEALANT
PARTS NOT SHOWN: 33

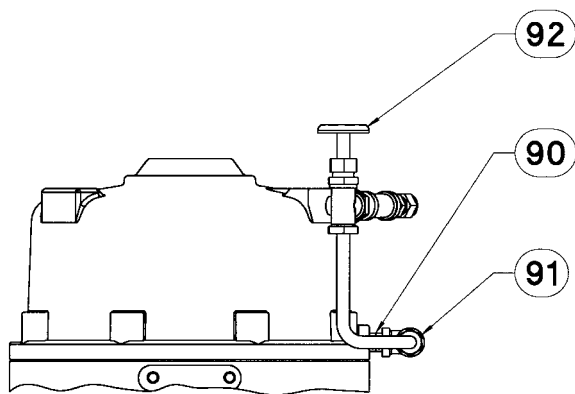
Figure 15. Fisher 585C Actuator Size 60 with 8-Inch Travel and Size 68 with 2-, 4-, and 8-Inch Travel



□ APPLY LUB/SEALANT
PARTS NOT SHOWN: 33

58B1366-A

Figure 16. Fisher 585C Size 60-130 Bypass Assembly



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Fisher™ 644 and 645 Differential Pressure Pump Governors

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Figure 1. Fisher 644 Actuator Mounted on a Typical easy-e™ Valve



Introduction

Scope of Manual

This instruction manual provides information on installation, adjustment, maintenance, and parts ordering for the Fisher 644 and 645 differential pressure pump governors. Refer to separate instruction manuals for information about the valve and other accessories used with these governors.

Do not install, operate, or maintain 644 or 645 governors without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

644 and 645 actuators are used in combination with any of several sliding-stem valves to automatically control steam-driven boiler feedwater pumps (reciprocating or turbine). The 644 or 645 actuator (see figures 1 and 2), when used in combination with one of several push-down-to-close sliding-stem valves, forms a pump governor.

644 and 645 actuators may also be combined with push-down-to-open valves to be used as relief governors. Relief governors are used to divert excess pump discharge back to the suction side of the pump.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

644 and 645 Pump Governors

June 2017

Instruction Manual

D100302X012

Table 1. Specifications

Actuator Sizes See table 2	Maximum ΔP Across Diaphragm 13.8 bar (200 psi)
Actuator Travel Chloroprene Diaphragm: 11 mm (0.4375 inch) maximum Stainless Steel Diaphragm: 3 mm (0.125 inch) maximum	Effective Diaphragm Area 644: Size 1: 146 cm ² (8.9 inch ²) Size 2: 243 cm ² (14.8 inch ²) Size 3: 364 cm ² (22.2 inch ²) 645: 338 cm ² (20.6 inch ²)
Operating Principle ■ Direct-acting with push-down-to-close valve ■ Reverse-acting with push-down-to-open valve	Material Temperature Capabilities 644: Chloroprene Diaphragm: -40 to 82°C (-40 to 180°F) Stainless Steel Diaphragm: Cast-iron casing: -40 to 232°C (-40 to 450°F); Steel casing: -40 to +399°C (-40 to 750°F) 645: -37 to 82°C (-35° to 180°F)
Differential Pressure Ranges See table 2	Casing Pressure Connections 1/4 NPT internal
Maximum Casing Pressure 644 Actuator: Cast-Iron Casing: 20.7 bar (300 psig) Steel Casing: 41.4 bar (600 psig) 645 Actuator: Cast-Iron Casing: 34.5 bar (500 psig) Steel Casing: 69.0 bar (1000 psig)	Spring Ranges and Sensitivity See table 2

Specifications

Specifications for the 644 and 645 pump governors are shown in table 1. Information for a specific pump governor is also found on the nameplate of that pump governor.

Table 2. Spring Information

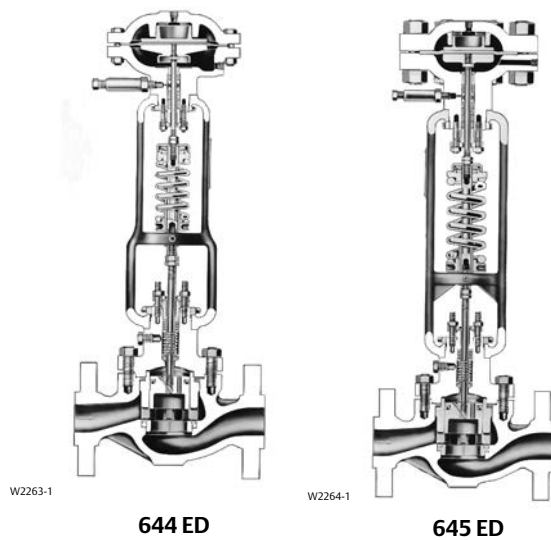
ACTUATOR		DIFFERENTIAL PRESSURE RANGE		SPRING RATE		SENSITIVITY		SPRING PART NUMBER
		Bar	Psi	N/mm	Lbf/in	mm/N	in/Psi	
644	Size 3 Casing	0.3-1.2	5-18	56	314	26.1	0.0707	1F945527032
		1.2-1.9	18-27	107	609	13.5	0.0365	1F945627032
	Size 2 Casing	1.9-2.8	27-40	107	609	9.0	0.0244	1F945627032
		2.8-3.8	40-55	165	940	6.2	0.0168	1F945727042
645	Size 1 Casing	3.8-4.7	55-68	107	609	5.4	0.0146	1F945627032
		4.7-6.9	68-100	165	940	3.7	0.0101	1F945727042
		1.0-1.7	14-24	43	246	21.0	0.057	1F714427112
		1.7-2.4	24-35	64	368	14.0	0.038	1F176727032
		2.4-3.2	35-47	86	490	10.5	0.0286	1F176827092
		3.2-4.1	47-59	107	612	11.0	0.0299	1F176927092
		4.1-4.3	59-62	129	735	7.1	0.0191	1E792327092
		4.3-5.9	62-85	145	830	6.2	0.0169	1F714327092
		5.9-6.8	85-99	221	1260	4.1	0.0111	1E795327082
		6.8-8.2	99-119	257	1470	3.5	0.0095	1E792427082
		8.2-9.7	119-140	310	1770	2.9	0.0079	1E795427082
		9.7-10.7	140-155	368	2100	2.5	0.0067	1E793327082

Educational Services

For information on available courses for Fisher 644 and 645 pump governors, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Figure 2. Typical Pump Governor Sectionals



⚠ WARNING

These governors must be installed, operated, and maintained in accordance with Fisher instructions and all applicable federal, state, and local codes, laws, rules and regulations.

If a leak develops in the system or if any of the equipment is damaged, service is required. Failure to investigate problems immediately may cause a hazardous condition.

Call a serviceman in case of trouble. Only a qualified person must install or service the actuator.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.

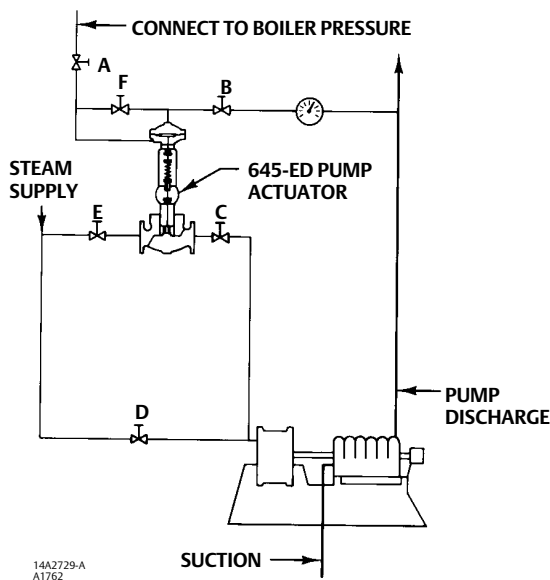
To avoid personal injury or property damage caused by bursting of pressure-retaining parts, be certain the service conditions do not exceed the casing pressure limit (maximum ΔP across the diaphragm) of 13.8 bar (200 psi). Use pressure-limiting or pressure-relieving devices to prevent service conditions from exceeding this limit.

Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Normal operating temperature range for the 644 actuator is from -40 to 82°C (-40 to 180°F). For the 645 actuator, the range is from -37 to 82°C (-35 to 180°F).

Figure 3. Typical Installation for a Direct-Acting Governor

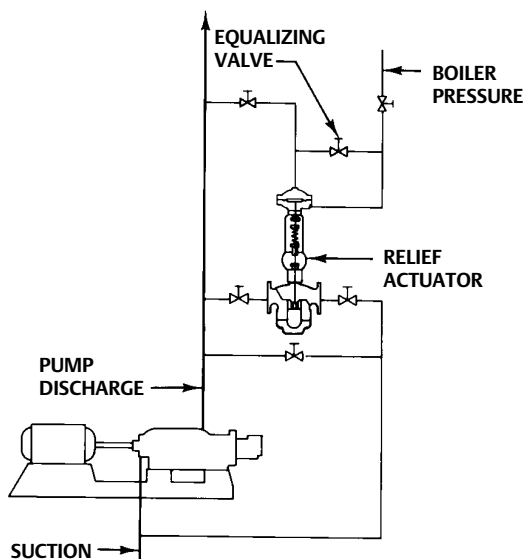


Direct-Acting Actuators

Proceed as follows to install 644 and 645 actuators that are used with push-down-to-close valves (644-ED, 645-ED). Refer to figure 3.

1. Place the governor in the steam line between a hand operated throttle valve (C) and the steam inlet to the pump. The governor may be installed in any position, as long as the flow is in the direction of the arrow cast on the valve body. However, when used for steam service, the unit should be installed so condensate will drain back into the diaphragm casing and maintain a water seal on the diaphragm. Failure to do so may impact performance.
2. Install a hand-operated throttle valve (E) between the governor and the steam supply line.
3. Run a 1/4-inch control line from the upper diaphragm casing to the side or top of the pump discharge line. Keep the control line away from any nipple, swage, or elbow.
4. Install a lock-shield needle valve (B) and a pressure gauge in this control line.
5. Run a second 1/4-inch control line from the lower diaphragm casing to the boiler steam pressure line. Install a needle valve (A) in this line. Slope the line toward the actuator in order to form a water seal on the diaphragm.
6. Connect the two control lines with an equalizing line in which a needle valve (F) has been installed.

Figure 4. Typical Installation for a Relief Governor



14A2789-A
A1763

CAUTION

The equalizing line helps prevent damage to the diaphragm when the system is started up.

Reverse-Acting Actuators

Proceed as follows to install 644 and 645 actuators that are used with push-down-to-open valves (644-EDR, 645-EDR).

Table 3. Maximum Static Casing Pressures

Diaphragm Casing Material		Cast Iron	Steel
Valve Body Ratings		CL125 and CL250	CL150, CL300 and CL600
Actuator	644	300 psig	600 psig
	645	500 psig	1000 psig

- Place the governor in the steam line. It may be installed in any position as long as the flow is in the direction of the arrow cast on the valve body. However, when used for steam service, the unit should be installed so condensate will drain back into the diaphragm casing and maintain a water seal on the diaphragm. Failure to do so may impact performance.
- Run a bypass line from the pump's discharge line to the suction line of the pump. In this line, install a hand-operated throttle valve (D).
- Run a 1/4-inch control line from the upper diaphragm casing to the pump discharge line. Install a needle valve (B) in this line.
- Extend a second 1/4-inch control line from the lower diaphragm casing to the boiler steam pressure line. Place a needle valve (A) in this line.
- Connect the two control lines with an equalizing line in which a needle valve (F) has been installed.

Overpressure

WARNING

Overpressuring any portion of this equipment may cause damage to the governor parts, leaks in the system, or personal injury due to bursting of pressure-containing parts.

To avoid overpressure, provide an appropriate overpressure protection device to ensure that none of the limits listed in table 3 will be exceeded.

Check the system for damage after any overpressure condition.

Startup

Proceed as follows to start up direct-acting actuators (644-ED, 645-ED). See figure 3.

1. Close all valves except the bypass valve (D).
2. Open the equalizing valve (F).
3. Open the needle valve (B) in the pump discharge line approximately 1/2 turn.
4. Open needle valve (A) in the pressure control line and close equalizing valve (F).
5. Open valve (C) that is downstream of the governor. Close bypass valve (D).
6. Slowly open valve (E) which is upstream of the governor.
7. To increase the discharge pressure, if it is too low, turn the lower spring seat (key 19, figures 6 and 7) clockwise into the yoke.
8. If the discharge pressure is too high, slightly open needle valve (B). If the pressure does not fall to the desired setting, turn the lower spring seat counterclockwise out of the yoke.
9. Open or close the lock-shield needle valve (B) to a point where a very slight movement of the valve stem (approximately 1/64-inch) is noticeable with each stroke of the pump. Greater stem movement will result in erratic operation and shorten the life of the diaphragm.

To start up reverse-acting actuators (644-EDR, 645-EDR) proceed as follows. See figure 4.

1. Close all valves except the bypass valve (D).
2. Open the equalizing valve (F).
3. Open valve (A) that is in the boiler pressure control line.
4. When the pump has built up the discharge pressure, open valve (B) that is in the discharge pressure control line. Close equalizing valve (F).
5. Valve (C), downstream of the governor, should now be opened. Close bypass valve (D).
6. Slowly open upstream valve (E).
7. To increase the discharge pressure if it is too low, turn the lower spring seat (key 19, figures 6 and 7) clockwise into the yoke.
8. If discharge pressure is too high, slightly open equalizing valve (F). If the pressure does not fall low enough, turn the lower spring seat counterclockwise out of the yoke.
9. Open or close valve (B) to a point where very slight movement (approximately 1/64-inch) of the stem is noticeable with each stroke of the pump. Greater stem movement will result in erratic operation and shorten the life of the diaphragm.

Adjustment

No adjustment is required other than that described in the procedure for putting the governor into operation. If it is necessary to change the setting, turn the lower spring seat clockwise into the yoke to increase the pressure setting. Turn the lower spring seat counterclockwise, out of the yoke, to decrease the pressure setting.

Principle Of Operation

Figure 3 shows a 645-ED being used to directly maintain a differential setting between the pump discharge pressure and the boiler steam pressure in a boiler feedwater system.

If pump discharge pressure increases, the change is registered on the top of the actuator diaphragm. The increased pressure forces the diaphragm and valve plug downward. With the steam supply thus restricted, less steam reaches the pump. This causes the discharge pressure to drop so that a difference between the discharge pressure and the boiler pressure will return to the desired differential setting.

In figure 4, a 644-EDR is being used as a relief governor maintaining a differential pressure between the boiler and pump discharge.

An increase in the pump discharge pressure is registered on the top of the actuator diaphragm. The increased pressure forces the diaphragm and valve plug downward. Since this governor is reverse-acting, this action opens the valve and allows the excess pump discharge to flow to the pump suction line. The pump discharge pressure drops and the difference between the boiler pressure and the pump discharge pressure returns to the desired level.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

⚠ WARNING

To avoid personal injury and equipment damage, isolate the pump governor from all pressure before beginning disassembly. The pump governor can be isolated by throttling valve (D) and closing the shut-off valves (A, B, C, and E).

Disassembly

Refer to figures 6 and 7.

1. Remove the control line from the upper casing.
2. Relieve spring compression by turning the lower spring seat (key 19) clockwise into the yoke.
3. Disconnect the stem (key 22) and the diaphragm rod (key 14) by unscrewing the locknuts (key 31).

CAUTION

To avoid damage to the valve plug and seating surface, do not turn the stem while the valve plug is seated.

4. Unscrew hex nuts (key 9) and remove the packing box flange (key 7) and the packing follower (key 6).
5. Remove cap screws (key 23) and hex nuts (key 24) and lift off the upper diaphragm casing (key 1).
6. Lift off the upper diaphragm head (key 29). Pull the diaphragm (key 3), lower diaphragm head (key 13), and the diaphragm rod (key 14) out of the lower diaphragm casing (key 2). (A travel stop or washer, key 17, figure 6, may also be present between the lower diaphragm head and locknut.) Do not change the position of the lower diaphragm head and locknut (key 15) on the diaphragm rod because they are set to give the proper clearance for valve travel.
7. With a wire hook, pull the packing (key 11, figure 6; key 12, figure 7) from the bottom of the lower diaphragm casing. Remove the spacer (key 5) and the upper piece of packing (key 12, figure 6; key 11, figure 7) in the same manner.

Reassembly

Note

Bearings and adjusting screw threads should be lubricated with anti-seize prior to the reassembly steps below.

644 (figure 6)

1. Install packing onto the diaphragm rod (key 14) from the bottom of the lower diaphragm casing (key 2) in the following order:

For PTFE packing:

- a. Bushing (key 10, if previously removed), packing spring (key 5), special washer (key 37), male adaptor (key 28), packing rings (key 12, 3 required), female adaptor (key 38), packing follower (key 6) and felt wiper ring (key 39.)

For graphite packing:

- a. Bushing (key 10, if previously removed), packing ring (key 11), packing ring (key 12, with zinc washer), packing ring (key 11), lantern ring (key 5), packing ring (key 11), packing ring (key 12, with zinc washers between, 2 each required), packing ring (key 11) and packing follower (key 6).

2. Replace the packing flange (key 7.)

3. Lubricate the packing flange studs (key 8) and the faces of the packing flange nuts (key 9) and install the packing flange nuts (torque: 26 lbf•in for PTFE, 53 lbf•in for graphite.)
4. Place a new diaphragm (key 3) on the lower diaphragm head (key 13).
5. Put the upper diaphragm head (key 29) onto the diaphragm. Set the upper diaphragm casing (key 1) onto the lower casing, lubricating and tightening the diaphragm casing cap screws (key 23) and hex nuts (key 24) finger-tight only.
6. Reconnect the connecting rod (key 22) and the diaphragm rod.
7. Turn the lower spring seat counterclockwise out of the yoke to remove slack from the diaphragm. Torque the diaphragm casing cap screws and nuts to the following:
 - a. Size 1: 29 lbf•ft.
 - b. Sizes 2 and 3: 67 lbf•ft.

Note

For 644 reverse-acting, travel stops (key 17) are required to be installed between the lower diaphragm head and the hex jam nut (key 15.) See the Parts List for the type and quantity of travel stops required for each actuator size.

645 (figure 7)

1. Install packing onto the diaphragm rod (key 14) from the bottom of the lower diaphragm casing (key 2) in the following order:

For PTFE packing:

- a. Packing box ring (key 10, if previously removed), packing spring (key 5), special washer (key 28), packing set (key 11), and packing follower (key 6).

For graphite packing:

- a. Packing box bushing (key 10, if previously removed packing ring (key 11), packing ring (key 12, with zinc washer), packing ring (key 11), lantern rings (key 5, 2 required), packing ring (key 11), packing rings (key 12, with zinc washers between, 2 each required), packing ring (key 11) and packing follower (key 6).
2. Replace the packing flange (key 7.)
3. Lubricate the packing flange studs (key 8) and the faces of the packing flange nuts (key 9) and install the packing flange nuts (torque: 58 lbf•in for PTFE, 122 lbf•in for graphite.)
4. Place a new diaphragm (key 3) on the lower diaphragm head (key 13).
5. Put the upper diaphragm head (key 29) onto the diaphragm. Set the upper diaphragm casing (key 1) onto the lower casing, lubricating and tightening the diaphragm casing studs (key 23) and hex nuts (key 24) finger-tight only.
6. Reconnect the connecting rod (key 22) and the diaphragm rod.
7. Turn the lower spring seat counterclockwise out of the yoke to remove slack from the diaphragm. Torque the diaphragm casing studs and hex nuts to 385 lbf•ft.

Note

For 645 reverse-acting, two washers (key 17) are required to be installed as shown in figure 7.

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always mention this number when corresponding with your [Emerson sales office](#) or Local Business Partner regarding technical information or replacement parts. Also, reference the complete 11-character part number of each needed part as found in the following Parts List.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your Emerson sales office or Local Business Partner for Part Ordering information.

Key	Description	Part Number	Key	Description	Part Number
			13	Lower Diaphragm Head	
			14	Diaphragm Rod	
			15	Hex Jam Nut	
			16	Yoke Lock Nut	
			17	Travel Stops	
				644 Reverse-Acting	
				Size 1, washer (2 req'd)	
				Size 2, washer (1 req'd)	
				Size 3, bearing retainer	
				645 Reverse-Acting	
				Washer (2 req'd)	
			18	Upper Spring Seat	
			19	Lower Spring Seat	
			20	Spring	
			21	Adjusting Screw	
			22	Connecting Rod	
			23	Cap Screw	
			24	Nut	
			25	Set Screw	
			26	Bearing Retainer	
			27	Pipe Plug	
				Lubricator	
				Lubricator/Isolating Valve	
			28*	Male Adaptor, PTFE	
				(with PTFE packing)	1F124801012
				Special Washer (645 with	
				PTFE packing)	1F125136042
			29	Upper Diaphragm Head	
			30	Bearing	
			31	Hex Nut	
			32	Hex Jam Nut	
			33	Name Plate	
			34	Drive Screw	
			35	Hex Nut	
			36	Needle Valve	
			37	Special Washer (644 with PTFE packing)	
			38*	Female Adaptor, PTFE (PTFE packing)	
				644 only	1F124401012
			39*	Wiper Ring, felt	
				644 only	1J872606332
			40	Nipple	
			41	Tee	
			42	Nipple	
			43	Union	
			44	Elbow	
			45	Nipple	
			47	Stem Disk	
1	Upper Diaphragm Casing				
2	Lower Diaphragm Casing				
3*	Diaphragm				
	Neoprene				
	644				
	Size 1	1F939502192			
	Size 2	1F939302192			
	Size 3	1F939602192			
	645	0F092802162			
	SST				
	644 only				
	Size 1	1J8430X0012			
	Size 2	1U5770X0012			
	Size 3	1H5791X0012			
4	Yoke				
5	Lantern Ring or Packing Spring				
6	Packing Follower				
7	Packing Box Flange				
8	Stud Bolt				
9	Hex Nut				
10*	Bushing, SST				
	644	1E943835012			
	Packing Box Ring, SST				
	645	1E839135012			
11*	Packing, 644 (4 req'd)				
	Graphite	1F3370X0322			
	Packing Ring, 645, (4 req'd)				
	Graphite	1E3190X0222			
	Packing Set, 645				
	PTFE	1R290201012			
12*	Packing, 644 (3 req'd)				
	Graphite	1V3160X0022			
	PTFE	1C752601012			
	Packing Ring, 645 (3 req'd)				
	Graphite	1V3802X0022			

Figure 5. Equalizing Piping Configuration

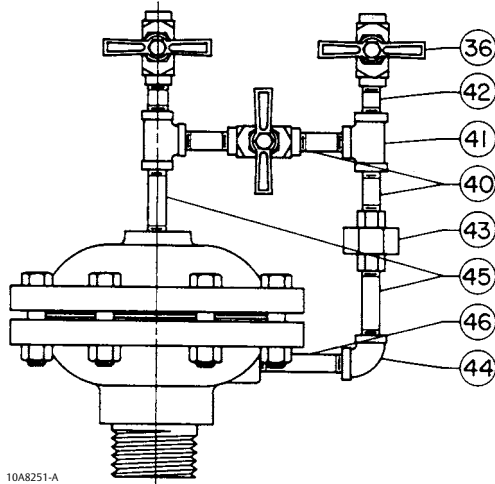
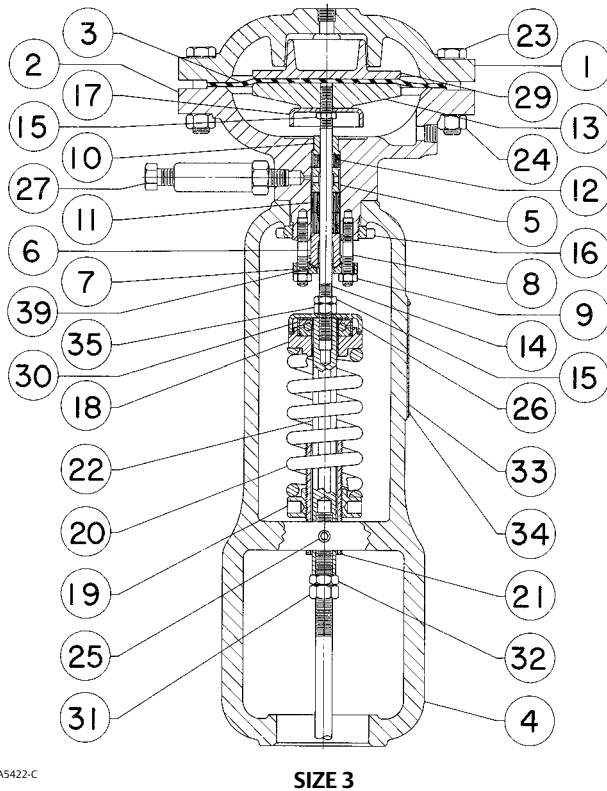
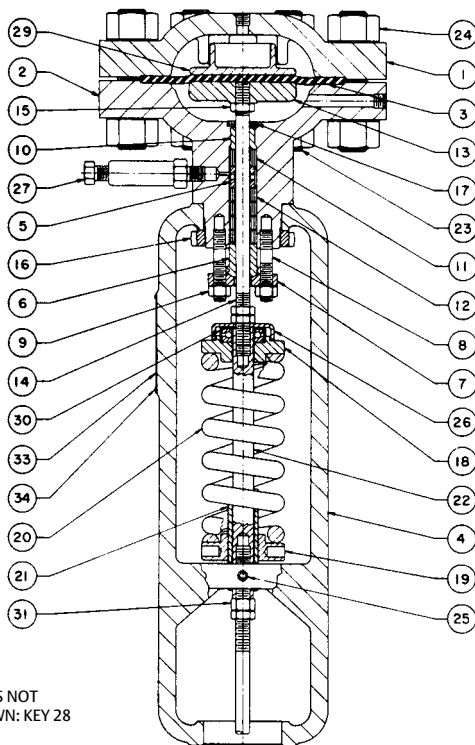


Figure 6. Fisher 644 Actuator Assembly



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Figure 7. Fisher 645 Actuator Assembly



DF9840-A

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Fisher™ 655 and 655R Actuators for Self-Operated Control

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Figure 1. Fisher 655-ED Pressure-Reducing Valve



W0466-1

Introduction

Scope of Manual

This instruction manual provides installation, adjustment, maintenance, and parts ordering for the Fisher 655 and 655R actuators and the top-mounted handwheel. Refer to separate instruction manuals for information about valves and accessories used with these actuators.

Do not install, operate, or maintain 655 or 655R actuators without being fully trained and qualified in valve, actuator, and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Table 1. Specifications

Actuator Sizes and Maximum Casing Pressures

ACTUATOR SIZE	MAXIMUM CASING PRESSURE	
	Bar	Psig
3A, 4A	17.2	250
3B, 4B	12.1	175
32, 42	6.9	100
33, 43	4.5	65
34, 44	3.1	45
35, 45	2.1	30
36, 46	1.0	15

Actuator Pressure Setting Ranges

See table 2

Actuator Yoke Boss and Valve Stem Connection Diameters

Sizes 3A through 36: 54 mm (2-1/8 inch) yoke boss with 9.5 mm (3/8 inch) stem connection

Sizes 4A through 46: 71 mm (2-13/16 inch) yoke boss with 12.7 mm (1/2 inch) stem connection

Maximum Travel

Sizes 3A and 4A: 11 mm (0.4375 inch) plus 3 mm (0.125 inch) for seating

All Other Sizes: 19 mm (0.75 inch) plus 3 mm (0.125 inch) for seating

Effective Diaphragm Area

See table 3

Spring Rate

See key 6 in the parts list section

Temperature Capabilities

-29 to 82°C (-20 to 180°F) with standard diaphragm material. For the fluid and temperature capabilities of nonstandard diaphragm materials, consult your [Emerson sales office](#) or Local Business Partner

Casing Pressure Connections

1/2 NPT internal

Approximate Weights

ACTUATOR SIZE	APPROXIMATE WEIGHT	
	Kg	Lb
3A, 3B, 32, 33	20	45
34, 35, 36	23	50
4A, 4B, 42, 43	29	65
44, 45, 46	34	75

Description

655 and 655R actuators (figure 1) are pressure-actuated, spring-and-diaphragm actuators used in conjunction with various valves to provide control for a wide variety of pressure regulation applications. 655 actuators are used for pressure-reducing service when mounted on push-down-to-close valves such as the Fisher ED and ET valves. 655R actuators are used for pressure-relief service when mounted on push-down-to-open valves such as the Fisher EDR and ETR valves. Both types are self-operated and direct-acting; that is, increasing pressure in the diaphragm casing forces the actuator stem downward, and decreasing the pressure allows the actuator spring to lift the actuator stem upward.

Specifications

Specifications for the 655 and 655R actuators are shown in table 1. Information for a specific actuator is also found on the nameplate of that actuator.

Installation

⚠ WARNING

To avoid personal injury or property damage caused by bursting of pressure-retaining parts, be certain the service conditions do not exceed the casing pressure limits listed in table 1. Use pressure-limiting or pressure-relieving devices to prevent service conditions from exceeding these limits.

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

655 and 655R actuators are normally shipped mounted on a valve. Refer to the appropriate valve instruction manual when installing the valve in the pipeline. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the procedures described in the Actuator Mounting portion of this section.

CAUTION

To avoid premature wear of the diaphragm due to debris in the pressure line to the diaphragm, install a strainer in the pipeline ahead of the regulator or relief valve.

Before installing the actuator, inspect it for any damage. Also, keep any adjacent piping clean and free of pipe scale or other debris that could possibly disrupt service. It is recommended that a strainer be installed in the pipeline ahead of the regulator or relief valve to protect it while in service. And a conventional three-valve bypass (see figure 2) should be placed around the regulator or relief valve to permit continuous operation when it is being installed or repaired.

Actuator Mounting

The actuator may be installed either above or below the pipeline.

CAUTION

In steam service applications, avoid premature wear of the diaphragm, due to high temperature steam, by installing the valve with the actuator positioned below the pipeline.

If the regulator or relief valve is to be used for steam service, the valve should be installed with the actuator positioned below the pipeline, and the control line should be sloped down toward the diaphragm casing. This is to ensure that any forming condensate will maintain a water seal to protect the diaphragm.

The following procedure describes how to mount the actuator on either a push-down-to-close or a push-down-to-open valve so that the actuator stem and valve stem thread engagement will allow full travel and proper shutoff. Refer to figure 3 for actuator mounting components. Key numbers refer to figure 4 unless otherwise stated.

1. Turn the adjusting screw (key 10) into the yoke (key 7) to force the diaphragm (key 2) and diaphragm plate (key 4) against the upper diaphragm casing (key 1).
2. Perform the following steps as appropriate for either push-down-to-close or push-down-to-open valve action.

CAUTION

In the following procedures, do not rotate the valve plug while it is seated since this may cause damage to the seating surfaces and thereby allow excessive leakage. Also, during travel adjustment, use tools carefully to avoid damaging the valve plug stem. A damaged stem could cut the packing and allow leakage.

For Push-Down-To-Close Valves:

- a. Place the actuator part way over the valve stem. Then, place the yoke locknut over the valve stem, and slide the travel indicator disk (key 11, if used) on top of the hex nuts (key 12).
- b. Set the actuator onto the valve body. The length of the valve stem will prevent the actuator yoke (key 7) from sitting on the bonnet properly. Measure the distance from the bottom of the actuator yoke to the mating shoulder on the bonnet, and then add the valve plug travel to this measurement.
- c. Raise the actuator so the valve plug can be lifted off the seat ring.

Note

Either turn the actuator, or tighten the hex nuts together, and use a wrench on the hex nuts to turn the valve plug and stem assembly.

Thread the valve stem into the actuator stem the distance measured in the previous step.

- d. Lower the actuator onto the valve body bonnet, and tighten the yoke locknut.
- e. Connect the pressure control lines as described in the Loading Connection portion of this section.
- f. Stroke the actuator, and measure the stem movement to check travel. If the movement is more than full travel, turn the valve stem out of the actuator stem the amount of over-travel. If movement is less than full travel, turn the valve stem into the actuator stem the amount of under-travel.

For Push-Down-To-Open Valves:

- a. Place the actuator, yoke locknut, and travel indicator disk (key 11, if used) over the valve stem. Support the actuator above the valve body so the actuator stem and valve stem do not contact when the valve plug is seated.
- b. Connect the pressure control lines as described in the Loading Connection portion of this section.
- c. Move the valve plug, by hand, from the seated to the open position, and make sure that valve stem movement corresponds to the desired travel.
- d. Stroke the actuator until the diaphragm plate (key 4) contacts the down travel stop (see figure 3).
- e. With the valve plug positioned as described in step c above, lower the actuator until the actuator stem contacts the valve stem, and measure the distance from the bottom of the actuator yoke to the mating shoulder on the bonnet.
- f. Thread the valve stem into the actuator stem until the thread engagement is equal to the distance measured in the previous step. Tighten the hex nuts (key 12) together, and use a wrench to turn the valve plug and stem assembly.
- g. Lower the actuator onto the valve body bonnet, and tighten the yoke locknut.
- h. Stroke the actuator, and measure the stem movement to check travel. If the movement is more than full travel, turn the valve stem into the actuator stem the amount of over-travel. If the movement is less than full travel, turn the valve stem out of the actuator stem the amount of under-travel.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D100305X012

655 and 655R Actuators

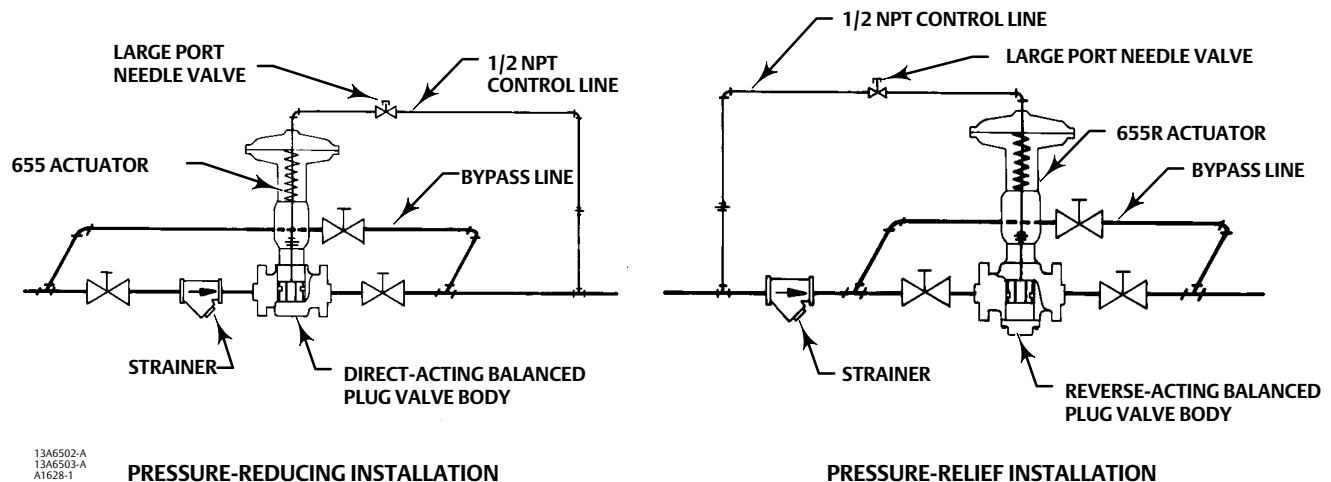
June 2017

Table 2. Actuator Pressure-Setting Ranges⁽¹⁾

ACTUA- TOR SIZE	SPRING PART NUMBER	PRESSURE REDUCTION				PRESSURE RELIEF				ACTUA- TOR SIZE	SPRING PART NUMBER	PRESSURE REDUCTION				PRESSURE RELIEF			
		Minimum		Maximum		Minimum		Maximum				Minimum		Maximum		Minimum		Maximum	
		Bar	Psig	Bar	Psig	Bar	Psig	Bar	Psig			Bar	Psig	Bar	Psig	Bar	Psig	Bar	Psig
3A, 4A	1E792427082	5.4	78	12.0	174	4.5	65	10.1	146	44	1E793327082	0.9	13	1.9	28	0.8	11	1.6	23
	1F714327092	3.0	44	9.3	135	3.0	43	8.2	119		1E795427082	0.8	11	1.6	23	0.6	9.0	1.3	19
	1F176927092	2.2	32	6.6	96	2.6	37	5.9	85		1E792427082	0.6	9.0	1.4	20	0.5	7.0	1.1	16
	1F176827092	1.8	26	5.4	78	2.3	34	5.2	75		1F714327092	0.3	5.0	1.1	16	0.3	5.0	0.9	13
	1F176727032	1.3	19	4.1	59	1.4	20	3.9	57		1F176927092	0.3	3.8	0.8	11	0.3	4.0	0.7	10
3B	1E793327082	3.4	50	7.4	107	3.0	43	4.4	64	35	1F176827092	0.2	2.8	0.6	8.5	0.1	2.0	0.6	8.5
	1E795427082	2.9	42	6.3	92	2.4	35	4.4	64		1E793327082	0.6	8.3	1.2	18	0.5	7.0	0.8	11
4B	1E793327082	3.4	50	7.4	107	3.0	43	6.1	89	45	1E795427082	0.5	7.0	1.0	15	0.4	5.5	0.8	11
	1E795427082	2.9	42	6.3	92	2.4	35	5.3	77		1E793327082	0.6	8.3	1.2	18	0.5	7.0	1.0	15
3B, 4B	1E792427082	2.4	35	5.4	78	2.0	29	4.4	64	35, 45	1E795427082	0.5	7.0	1.0	15	0.4	5.5	0.9	13
	1F714327092	1.4	20	4.1	60	1.3	19	3.7	53		1E792427082	0.4	5.8	0.9	13	0.3	5.0	0.8	11
	1F176927092	1.0	14	3.0	43	1.2	17	2.6	38		1F714327092	0.2	3.3	0.7	10	0.2	3.2	0.6	9.0
32	1E793327082	2.2	32	4.5	65	1.8	26	2.6	38		1F176927092	0.2	2.4	0.5	7.2	0.2	2.8	0.4	6.3
	1E795427082	1.8	26	3.8	55	1.5	22	2.6	38		1F176827092	0.1	2.0	0.4	5.9	0.2	2.5	0.4	5.5
42	1E793327082	2.2	32	4.5	65	1.8	26	3.7	53		1F176727032	0.1	1.5	0.3	4.4	0.1	1.5	0.3	4.2
	1E795427082	1.8	26	3.8	55	1.5	22	3.1	45		1F714427112	0.07	1.0	0.2	2.9	0.09	1.3	0.2	2.8
32, 42	1E792427082	1.5	22	3.2	47	1.2	18	2.6	38	36	1E793327082	0.4	5.8	0.9	13	0.3	5.0	0.5	7.7
	1F714327092	0.8	12	2.5	36	0.8	12	2.1	31		1E795427082	0.3	4.9	0.8	11	0.3	4.2	0.5	7.7
33	1E793327082	1.3	19	2.8	40	1.1	16	1.7	24	46	1E793327082	0.4	5.8	0.9	13	0.3	5.0	0.8	11
	1E795427082	1.1	16	2.3	34	0.9	13	1.7	24		1E795427082	0.3	4.9	0.8	11	0.3	4.2	0.6	9.0
43	1E793327082	1.3	19	2.8	40	1.1	16	2.3	33	36, 46	1E792427082	0.3	4.1	0.6	9.2	0.2	3.5	0.5	7.7
	1E795427082	1.1	16	2.3	34	0.9	13	1.9	28		1F714327092	0.2	2.3	0.5	7.1	0.2	2.3	0.4	6.3
33, 43	1E792427082	1.0	14	2.0	29	0.8	11	1.7	24		1F176927092	0.1	1.7	0.4	5.1	0.1	2.0	0.3	4.5
	1F714327092	0.5	7.0	1.5	22	0.5	7.0	1.4	20		1F176827092	0.09	1.3	0.3	4.2	0.1	1.8	0.3	4.0
	1F176927092	0.4	5.2	1.1	16	0.3	5.0	1.1	16		1F176727032	0.07	1.0	0.2	3.1	0.08	1.1	0.2	3.0
34	1E793327082	0.9	13	1.9	28	0.8	11	1.1	16		1F714427112	0.05	0.7	0.1	2.1	0.06	0.9	0.1	2.0
	1E795427082	0.8	11	1.6	23	0.6	9.0	1.1	16		1F713027112	0.02	0.34	0.08	1.1	0.05	0.7	0.07	1.0
1. Effects of packing box friction, unbalance, and weight of valve plug not considered in calculations.																			

1. Effects of packing box friction, unbalance, and weight of valve plug not considered in calculations.

Figure 2. Typical Installation Schematics



13A6502-A
13A6503-A
A1628-1

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

655 and 655R Actuators

June 2017

Instruction Manual

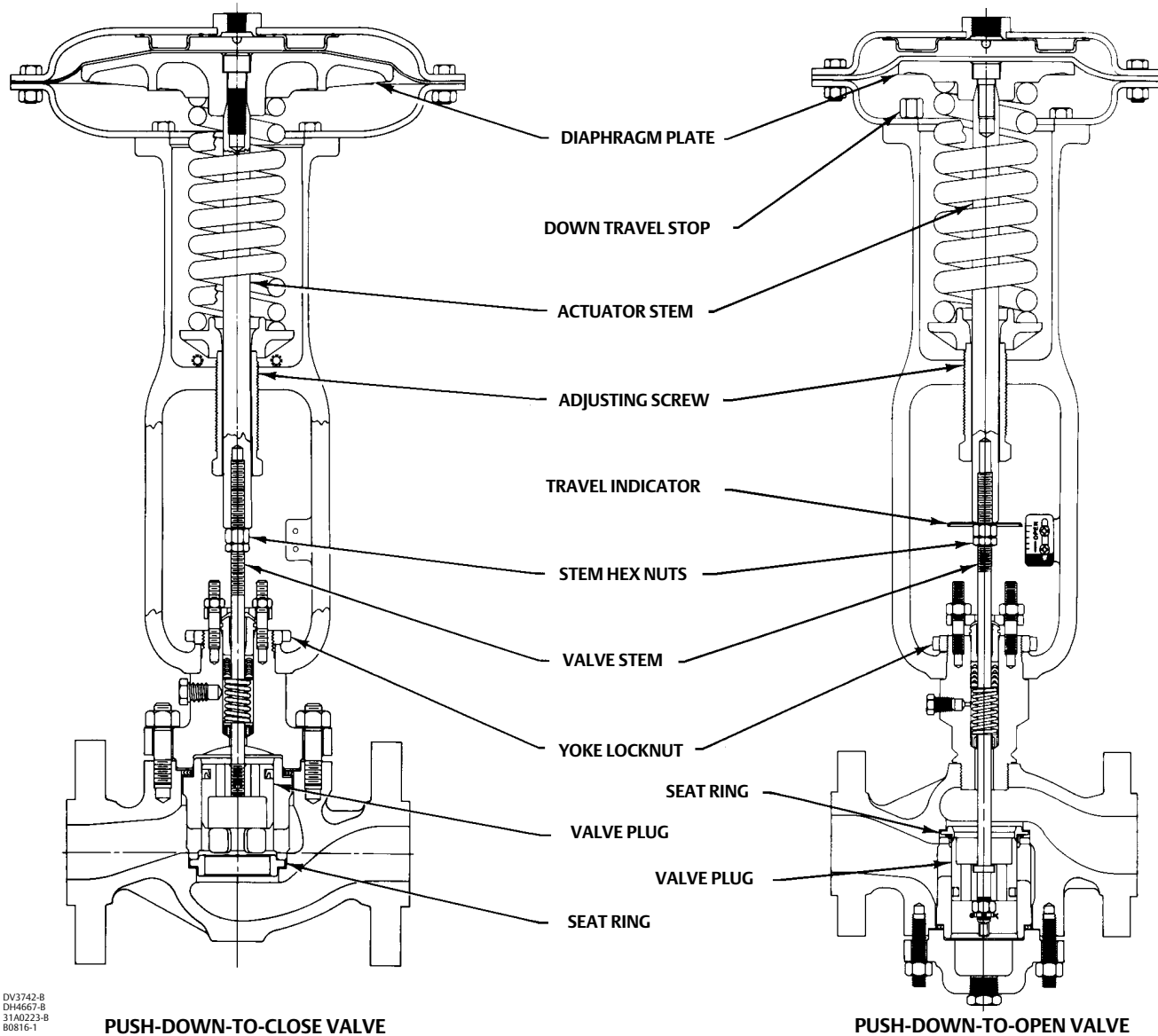
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Table 3. Effective Diaphragm Area⁽¹⁾

ACTUA- TOR SIZE	TRAVEL DOWN FROM UPPER CASING STOP, mm (IN.)																			
	0		3 (0.125)		5 (0.1875)		6 (0.25)		10 (0.375)		11 (0.4375)		13 (0.5)		14 (0.5625)		19 (0.75)		22 (0.875)	
	Cm ²	In. ²	Cm ²	In. ²	Cm ²	In. ²	Cm ²	In. ²	Cm ²	In. ²	Cm ²	In. ²	Cm ²	In. ²	Cm ²	In. ²	Cm ²	In. ²	Cm ²	In. ²
3A, 4A	66	10.2	62	9.6	61	9.5	61	9.4	59	9.2	59	9.1	57	8.9	56	8.7	---	---	---	---
3B, 4B	152	23.5	139	21.6	136	21.1	134	20.8	132	20.5	131	20.3	130	20.1	128	19.8	117	18.1	103	16.0
32, 42	258	40.0	235	36.4	227	35.2	221	34.2	210	32.6	205	31.8	200	31.0	195	30.3	182	28.2	170	26.4
33, 43	406	63.0	374	58.0	366	56.8	358	55.5	345	53.5	340	52.7	335	52.0	330	51.2	318	49.3	307	47.6
34, 44	600	93.0	547	84.8	534	82.8	523	81.0	508	78.8	502	77.8	497	77.0	490	76.0	474	73.5	465	72.0
35, 45	865	134.0	834	129.2	821	127.2	809	125.4	788	122.2	777	120.5	768	119.0	759	117.6	736	114.1	723	112.0
36, 46	1230	190.0	1170	181.5	1150	179.0	1140	177.0	1120	173.5	1110	172.3	1100	171.0	1100	169.8	1070	166.5	1050	163.5

1. For the spring rates of a particular spring, see key 6 in the Parts List section.

Figure 3. Actuator/Valve Components



DV3742-B
DH4667-B
31A0223-B
B0816-1

PUSH-DOWN-TO-CLOSE VALVE

PUSH-DOWN-TO-OPEN VALVE

3. After correct travel has been obtained, tighten the hex nuts (key 12) against the actuator stem (key 8), and tighten the yoke locknut with a hammer and punch.

Note

Changing the spring adjustment will not change the actuator pressure range for that particular spring (see table 2). Changing the spring adjustment merely shifts the position of the spring either up or down so that valve travel can coincide with the actuator pressure setting range.

4. While monitoring loading pressure with a pressure gauge, stroke the actuator, and then turn the adjusting screw until the valve begins to travel at the desired pressure. Turn the adjusting screw out of the yoke to decrease spring compression and thus allow the valve to begin travel at a lower loading pressure. Turn the adjusting screw into the yoke to increase spring compression and thus allow the valve to begin travel at a higher loading pressure.

Loading Connections

Install the control line following the steps listed below. Typical installations are shown in figure 2.

1. Connect the control line into either the upstream pipeline for pressure-relief service or into the downstream pipeline for pressure-reducing service as shown in figure 2. Make the pipeline tap at least four to eight pipe diameters away from the regulator or relief valve, or any elbow, swage, or nipple, to avoid abnormal velocities or turbulence.
2. Connect the other end of the control line to the 1/2 NPT connection in the center of the upper diaphragm casing (key 1) or to the connection in the handwheel body (key 28, figures 6 and 7; key 142, figure 5).
3. Fit the control line with a large-port needle valve. Partially closing or throttling this valve will tend to dampen any cycling or pulsating action of the regulator. Never completely close the needle valve while the regulator is in operation.

Startup

The procedures for placing into operation and adjusting the equipment for both pressure-reducing and pressure-relief applications are described below. Typical installation schematics are shown in figure 2.

Startup For Pressure-Reducing Service

1. Open the needle valve in the control line.
2. Open the downstream shutoff valve.
3. Close the valve in the bypass line.
4. Slowly open the upstream shutoff valve.

Startup For Pressure-Relief Service

1. Open the needle valve in the control line.
2. Open the downstream shutoff valve.
3. Slowly open the upstream shutoff valve.
4. Close the valve in the bypass line.

Adjustment For Pressure-Reducing or Pressure-Relief Service

The actuator is factory-set as specified on the order, and the pressure range is stamped on the nameplate. If a pressure setting other than the one specified is desired, change the pressure setting by following the procedures listed below. Be sure to change the nameplate to indicate the new pressure setting. The new pressure setting must not exceed the limits given in tables 1 and 2 or in any applicable codes.

CAUTION

To protect equipment in the process system from a sudden release of pressure, always use a pressure gauge to monitor pressure when making adjustments.

To adjust the downstream pressure setting for pressure-reducing service, or the upstream pressure setting for pressure-relief service, proceed as follows. To decrease the pressure setting, turn the adjusting screw (key 10, figure 4) counterclockwise; to increase the pressure setting, turn the adjusting screw clockwise. If the spring does not provide the required pressure setting, replace it through the following steps:

1. Disassemble the actuator by following steps 1, 3 and 4 of the Disassembly portion of the Maintenance section.
2. Remove the diaphragm (key 2). Then, unscrew the cap screw (key 3), and lift the diaphragm plate (key 4) out of the actuator body.
3. Replace the spring and reassemble the actuator by following steps 5 and 6 of the Assembly portion of the Maintenance section.

Shutdown

For both pressure-reducing and pressure-relief applications, refer to figure 2, and follow the procedures described below.

1. Close the upstream shutoff valve slightly.
2. Slowly open the bypass valve while monitoring downstream pressure.
3. Slowly close the downstream shutoff valve.
4. Close the upstream shutoff valve.
5. Close the needle valve in the control line.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

The maintenance instructions are divided into two sections: Actuator and Top-Mounted Handwheel.

Actuator

This procedure describes how the actuator can be completely disassembled and assembled. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job; then, start the assembly at the appropriate step.

Key numbers refer to figure 4.

Disassembly

CAUTION

In the following procedure, do not rotate the valve plug while it is seated since this may cause damage to the seating surfaces and thereby allow excessive leakage. Also, during travel adjustment, use tools carefully to avoid damaging the valve plug stem. A damaged stem could cut the packing and allow leakage.

1. Rotate the handwheel (if one is used) counterclockwise to be sure the handwheel is not compressing the spring (key 6).
2. For complete disassembly, the actuator must be removed from the valve, and the actuator stem (key 8) must be completely disengaged from the valve plug stem by rotating the actuator. Perform the appropriate procedure according to the respective valve action.

For Push-Down-To-Close Valves:

Note

To prevent the actuator stem (key 8) from rotating while performing the following procedure, make sure the adjusting screw (key 10) remains screwed into the yoke (key 7).

- a. Loosen the two hex nuts (key 12).
- b. Loosen the yoke locknut (figure 3) with a hammer and punch, and unscrew it from the valve bonnet.
- c. While lifting the actuator so that the valve plug is not forced against the seat, rotate the entire actuator until the actuator stem disengages completely from the valve plug stem.

For Push-Down-To-Open Valves:

- a. Turn the adjusting screw (key 10) counterclockwise to relieve all spring compression. Then, move the valve plug, by hand, off the seat.
 - b. Loosen the hex nuts (key 12), and unscrew the valve plug stem out of the actuator stem as far as it will go.
 - c. Turn the adjusting screw into the yoke (key 7) to force the diaphragm (key 2) and diaphragm plate (key 4) against the upper diaphragm casing (key 1).
 - d. Loosen the yoke locknut (figure 3) with a hammer and punch, and unscrew it from the valve bonnet.
 - e. Rotate the entire actuator until the actuator stem disengages from the valve plug stem.
3. Turn the adjusting screw (key 10) counterclockwise out of the yoke (key 7) to relieve all spring compression.
 4. To remove the upper diaphragm casing (key 1), unscrew the cap screws (key 19) for size 3A and 4A actuators or the cap screws and hex nuts (keys 19 and 20) for all other sizes.
 5. Remove the diaphragm (key 2); then, lift the diaphragm plate (key 4) and actuator stem assembly out of the actuator body. Also, remove the spring and the lower spring seat (key 9).
 6. For size 3A and 4A actuators, remove the lower diaphragm casing (key 5).
 7. Remove the cap screw (key 3), and separate the diaphragm plate from the actuator stem.
 8. For size 3B through 46 actuators, unscrew the cap screws (key 21), and remove the lower diaphragm casing (key 5). Some 655R actuators will have travel stops (key 13, not shown) in place of three of these six cap screws.
 9. If a top-mounted handwheel assembly is used, refer to steps 4 through 8 of the Disassembly portion of the Top-Mounted Handwheel section.

Assembly

This procedure assumes that the actuator is completely disassembled. If it is not, start the instructions at the appropriate step.

1. Before starting assembly, apply moly-grease lubricant to the threads and the bearing end of the adjusting screw (key 10) as indicated in figure 4 by the letter A.
2. For size 3A and 4A actuators, set the lower diaphragm casing (key 5) onto the yoke (key 7).
3. For size 3B through 46 actuators, install the lower diaphragm casing (key 5), and secure it with the cap screws (key 21). Some 655R actuators will have travel stops (key 13, not shown) in place of three of these six cap screws.
4. Install the lower spring seat (key 9) and the actuator spring (key 6).

Note

To take some of the slack out of the diaphragm (key 2) at the bolt circle, turn the adjusting screw into the yoke (key 7) to raise the diaphragm plate (key 4). This will also ensure that the diaphragm will have enough slack inside the casings for efficient travel.

5. Secure the diaphragm plate (key 4) to the actuator stem (key 8) with the cap screw (key 3), and install this assembly into the actuator. Install the diaphragm, making sure that the patterned side of the diaphragm is next to the diaphragm plate.

Note

When replacing the upper diaphragm casing (key 1), be sure there are no wrinkles in the diaphragm that might cause the diaphragm to tear or allow leakage.

6. Place the upper diaphragm casing onto the lower diaphragm casing. For size 3A and 4A actuators, secure the casings with the cap screws (key 19). For all other actuator sizes, secure the casing with the cap screws and hex nuts (keys 19 and 20).

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench.

CAUTION

Over-tightening the diaphragm cap screws (key 19) or cap screws and nuts (keys 19 and 20) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

7. Install the upper diaphragm casing (key 1), and install the cap screws (key 19) or cap screws and nuts (keys 19 and 20). Tighten in the following manner.
8. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
9. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
10. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
11. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
12. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
13. Once completed, no more tightening is recommended.
14. Mount the actuator onto the valve by following the procedures outlined in the Actuator Mounting portion of the installation section.
15. Connect the pressure control line by following the procedures outlined in the Loading Connections portion of the Installation section.
16. To start up and adjust the actuator, follow the procedures outlined in the Startup section of this instruction manual.

Top-Mounted Handwheel

Top-mounted handwheel assemblies (figures 6, 7 and 5) are normally used as adjustable travel stops to limit full upward travel of the actuator stem. Turning the handwheel clockwise forces the actuator stem downward, while turning the handwheel counterclockwise allows the spring to force the actuator stem upward. If the actuator is used with a push-down-to-close valve, full opening of the valve plug can be restricted through the appropriate positioning of the top-mounted handwheel. If the actuator is used with a push-down-to-open valve, closing of the valve plug can be restricted by using the handwheel. A locknut (key 27, figures 6 and 7; key 137, figure 5) is used to hold the handwheel in position.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Key numbers refer to figure 6 for size 3A and 4A, figure 7 for size 3B and 4B, and figure 5 for size 32 through 46 top-mounted handwheel assemblies.

Disassembly

1. Bypass the control valve. Relieve all loading pressure, and remove the tubing or pipe from the handwheel body.
2. Loosen the hex nut (key 27, figures 6 and 7; key 137, figure 5). Turn the adjusting screw (key 10, figure 4) and the handwheel (key 25, figures 6 and 7; key 51, figure 5) counterclockwise to relieve all compression.
3. For size 3A and 4A actuators, remove the cap screws (key 19, figure 4), and lift the handwheel body (key 28, figure 6) off the actuator.
4. For size 3B through 46 actuators, remove the cap screws and hex nuts (keys 19 and 20, figure 4), and then lift off the upper diaphragm casing (key 1, figure 4) and handwheel assembly. To replace the O-ring (key 139, figure 5) or for ease of handling, separate the handwheel assembly from the upper diaphragm casing. This can be accomplished by removing the cap screws that secure the handwheel assembly to the upper diaphragm casing (key 33, figure 7; key 141, figure 5).
5. Turn the handwheel clockwise two or three turns. Remove the hex nut (key 22, figures 6 and 7; key 54, figure 5) and washer (key 24, figures 6 and 7; key 134, figure 5), and lift off the handwheel.
6. Unscrew the locknut (key 27, figures 6 and 7; key 137, figure 5) from the handwheel stem (key 26, figures 6 and 7; key 133, figure 5), and then remove the handwheel stem through the bottom of the handwheel body (key 28, figures 6 and 7; key 142, figure 5). A screwdriver slot in the top of the handwheel stem is provided for this purpose.
7. Check the O-ring (key 29, figures 6 and 7; key 138, figure 5), and replace it if necessary.
8. To complete disassembly, drive out the groove pin (key 31, not shown; key 140, figure 5), and slide the pusher plate (key 32, figures 6 and 7; key 135, figure 5) off the handwheel stem. For 655, size 3B and 4B actuators, a travel stop (key 34, figure 7) should also be removed with these parts.

Assembly

This procedure assumes that the handwheel assembly is completely disassembled. If it is not, start the instructions at the appropriate step.

1. During assembly, apply lithium grease lubricant (key 241) to the handwheel stem and threads, the pusher, and to the O-rings as shown in figures 6, 7 and 5.
2. Slide the pusher plate (key 32, figures 6 and 7; key 135, figure 5) onto the handwheel stem, and, if necessary, insert the groove pin (key 31, not shown; key 140, figure 5). For 655, size 3B and 4B actuators, a travel stop (key 34, figure 7) should also be inserted on the handwheel stem with these parts.
3. Insert the handwheel stem into the handwheel body (key 28, figures 6 and 7; key 142, figure 5); then, screw the hex nut (key 27, figures 6 and 7; key 137, figure 5) onto the handwheel stem.

4. Install the handwheel (key 25, figures 6 and 7; key 51, figure 5) and washer (key 24, figures 6 and 7; key 134, figure 5) onto the handwheel stem, and secure it with the hex nut (key 22, figures 6 and 7; key 54, figure 5).
5. For size 3A and 4A actuators, set the handwheel body onto the actuator, and secure it with the cap screws (key 19, figure 4).

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench.

CAUTION

Over-tightening the diaphragm cap screws (key 19) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

6. Install the upper diaphragm casing (key 1), and install the cap screws (key 19). Tighten in the following manner.
7. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
8. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
9. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
10. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
11. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
12. Once completed, no more tightening is recommended. Proceed to step 21.
13. For size 3B through 46 actuators, set the upper diaphragm casing (key 1, figure 4) and handwheel assembly onto the actuator body, and secure it with the cap screws and hex nuts (keys 19 and 20, figure 4).

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 19 and 20) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

14. Install the upper diaphragm casing (key 1), and install the cap screws and nuts (keys 19 and 20). Tighten in the following manner.
15. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
16. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
17. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
18. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
19. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
20. Once completed, no more tightening is recommended.
21. Connect the pressure control line to the top-mounted handwheel assembly by following the procedures outlined in the Loading Connections portion of the Installation section.
22. To start up and adjust the actuator, follow the procedures outlined in the Startup section of this instruction manual.

Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, refer to the serial number found on the actuator nameplate (key 17, figure 4).

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your Emerson sales office or Local Business Partner for Part Ordering information.

Actuator

Key	Description
1	Upper Diaphragm Casing
2*	Diaphragm, chloroprene
	Sizes 3A & 4A
	Sizes 3B & 4B
	Sizes 32 & 42
	W/o top-mounted handwheel
	W/ top-mounted handwheel

Instruction Manual

D100305X012

655 and 655R Actuators

June 2017

Key Description

Sizes 33 & 43	
W/o top-mounted handwheel	
W/ top-mounted handwheel	
Sizes 34 & 44	
W/o top-mounted handwheel	
W/ top-mounted handwheel	
Sizes 35 & 45	
W/o top-mounted handwheel	
W/ top-mounted handwheel	
Sizes 36 & 46	
W/top-mounted handwheel	
3	Cap Screw
4	Diaphragm Plate
5	Lower Diaphragm Casing
6	Spring See following table
7	Yoke
8	Actuator Stem
9	Lower Spring Seat
10	Adjusting Screw
11	Travel Indicator Disk
12	Hex Nut
13	Travel Stop
14	Screw
15	Travel Indicator Scale
16	Twin Speed Nut
17	Nameplate
18	Drive Screw
19	Cap Screw
20	Hex Nut
21	Cap Screw

Top-Mounted Handwheel

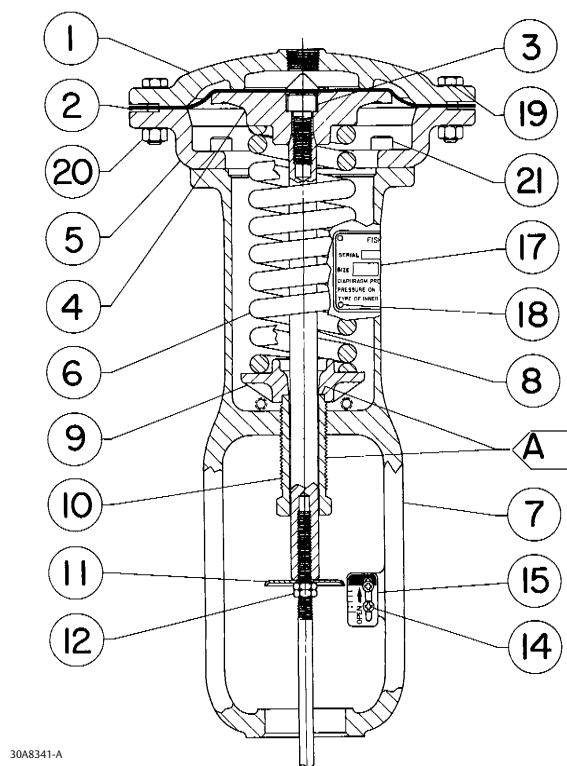
Sizes 3A, 4A, 3B & 4B

22	Hex Jam Nut
24	Washer
25	Handwheel
26	Handwheel Stem
27	Hex Jam Nut
28	Handwheel Body
29*	O-Ring, nitrile
30*	O-Ring, nitrile (not shown) Sizes 3B & 4B only
31	Groove Pin
32	Pusher Plate
33	Cap Screw
34	Travel Stop

Sizes 32 thru 46

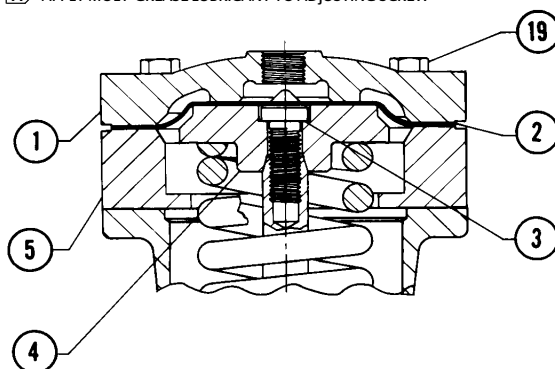
51	Handwheel
54	Hex Nut
133	Handwheel Stem
134	Washer
135	Pusher
137	Hex Nut
138*	O-Ring, nitrile
139*	O-Ring, nitrile
140	Groove Pin
141	Cap Screw
142	Handwheel Body
241	Lithium grease lubricant-1, 0.396 kg (14 oz.) can (not furnished with actuator)

Figure 4. Fisher 655 Actuator



30A8341-A

A APPLY MOLY-GREASE LUBRICANT TO ADJUSTING SCREW



30A8342-A

SIZE 3A AND 4A ACTUATOR DIAPHRAGM CASINGS

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

655 and 655R Actuators

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Instruction Manual

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Figure 5. Size 32 through 46 Top-Mounted Hand-wheel Assembly

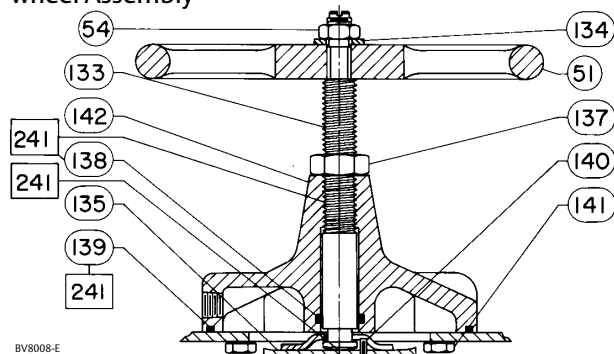


Figure 6. Size 3A and 4A Top-Mounted Handwheel Assembly

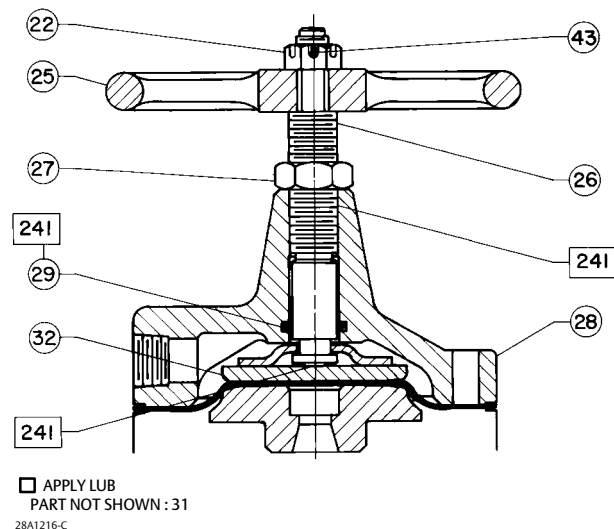
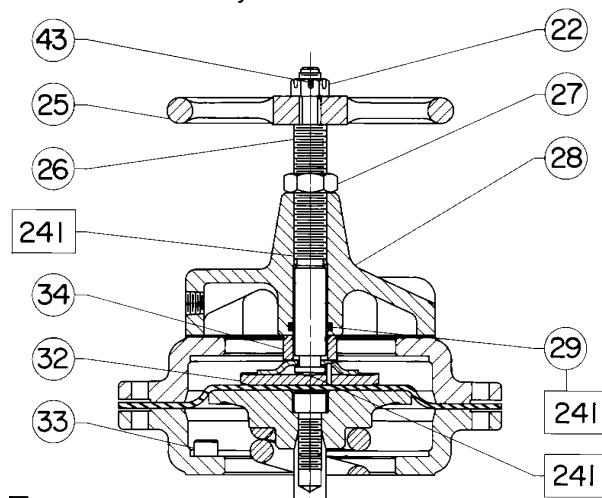


Figure 7. Size 3B and 4B Top-Mounted Handwheel Assembly



Key 6 Spring, steel

COLOR CODE	SPRING RATE		SAFE LOAD	
	N/mm	Lb/in.	N	Lb
Aluminum & red	22	123	1290	290
Aluminum & dark green	43	246	2420	545
Dark green	64	368	3750	843
Aluminum	86	490	4720	1060
Dark blue	107	612	5200	1187
Aluminum & dark blue	145	830	7250	1630
Light blue	220	1260	8184	1840
Light green	257	1470	9790	2200
Light grey	310	1770	11,600	2600
Yellow	368	2100	13,500	3045
Dark grey	129	735	5160	1160
Aluminum & brown	175	1000	7000	1575
White	441	2520	14,010	3150

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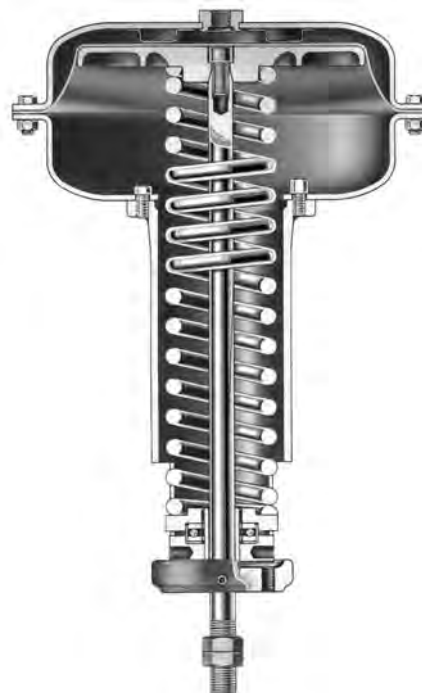


Fisher™ 656 Diaphragm Actuator

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Figure 1. Fisher 656 Actuator



W0454

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for Fisher 656 diaphragm actuators. Refer to separate manuals for instructions covering the valve, positioner, and accessories.

Description

Fisher 656 actuators are long stroke, spring opposed, direct-acting diaphragm actuators. They operate Vee-Ball™ control valves, butterfly valves, built-in turbine valves, louvers, dampers and similar equipment. They are suitable for either push-down-to-close (PDTC) or push-down-to-open (PDTO) applications and are available in sizes 30, 40 and 60 to provide 54 mm (2.125 inch), 89 mm (3.5 inch) and 105 mm (4.125 inch) travel, respectively.

Do not install, operate, or maintain a 656 actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

Maximum Recommended Casing Operating Pressure⁽¹⁾

2.4 bar (35 psig)

Maximum Allowable Casing Pressure⁽²⁾

Actuator Size	Maximum Casing Pressure for Actuator Sizing ⁽²⁾ , Bar (Psig)	Maximum Excess Diaphragm Pressure ⁽¹⁾ , Bar (Psig)	Maximum Diaphragm Casing Pressure ^(2,3) , Bar (Psig)
30	8.6 (125)	1.0 (15)	9.7 (140)
40	4.5 (65)	0.69 (10)	5.2 (75)
60	2.8 (40)	0.69 (10)	3.4 (50)

1. Additional pressure may be added when the actuator is at full travel. If the Maximum Excess Diaphragm Pressure is exceeded, damage to the diaphragm or diaphragm casing might result. See the Maximum Pressure Limitation section.
2. Maximum diaphragm casing pressure must not be exceeded and must not produce a force on the actuator stem greater than the maximum allowable actuator output thrust or the maximum allowable stem load. See the Maximum Pressure Limitation section.
3. This maximum casing pressure is not to be used for normal operating pressure. Its purpose is to allow for typical regulator supply settings and/or relief valve tolerances.

Operating Temperature Range⁽³⁾

- -40 to 82°C (-40 to 180°F) with Nitrile Elastomer
- -40 to 149°C (-40 to 300°F) with Silicone Diaphragm

1. Control and stability may be impaired if this pressure is exceeded.
2. Exceeding this pressure can cause damage to the diaphragm, diaphragm casing, or other parts.
3. The temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

Casing Pressure Connection

1/4 NPT internal

Maximum Travel

ACTUATOR SIZE	MAXIMUM RATED STEM TRAVEL, mm (INCHES)	
	Standard Travel Stop	Optional Travel Stop
30	54 (2.125)	Not available
40	89 (3.5)	76 (3)
60	105 (4.125)	97 (3.8125)

Actuator Weight

Actuator Size	Approximate Shipping Weight, kg (Pounds)
30	23 (50)
40	32 (70)
60	73 (160)

Options

- Top-mounted handwheel/adjustable travel stop
- Casing-mounted adjustable down travel stop

Principle of Operation

In a direct acting diaphragm actuator, increasing loading pressure moves the actuator stem downward, compressing the spring. When the diaphragm pressure is decreased, the spring moves the actuator stem upward. In the event of failure of the loading pressure, the actuator stem moves to the extreme upward position.

Specifications

Refer to table 1 for Specifications of the 656 actuator. See the actuator nameplate for specific information for your actuator.

WARNING

To avoid personal injury or damage to equipment that may result in the malfunction of the control valve or loss of control of the process caused by excessive pressure, do not exceed the Maximum Pressures listed in table 1. Refer to the following Maximum Pressure Limitations section.

Maximum Pressure Limitations

The casing and diaphragm of 656 actuators are pressure operated. This air pressure provides energy to compress the spring, to stroke the actuator, and to seat the valve. The following explanations describe the maximum pressure limits for an actuator. Refer to the nameplate or table 1 for maximum values for your actuator.

- **Maximum Casing Pressure for Actuator Sizing:** This is the maximum pressure that can be applied at less than full travel of the actuator. If this stroking pressure is exceeded before the upper diaphragm plate contacts the travel stop, damage to the stem or other parts might result.
- **Maximum Excess Diaphragm Pressure:** Additional pressure may be added when the actuator is at full travel. If the Maximum Excess Diaphragm Pressure is exceeded, damage to the diaphragm or diaphragm casing might result.

Because the actuator has traveled its specified travel, and the diaphragm head is physically stopped from movement, the energy from any additional air pressure is transmitted to the diaphragm and diaphragm casings. The amount of air pressure that can be added once the actuator has traveled to the stops is limited by the resultant adverse effects that may occur. Exceeding this limiting factor could result in leakage or casing fatigue due to the deformation of the upper diaphragm casing.

- **Maximum Diaphragm Casing Pressure:** If the Maximum Diaphragm Casing Pressure is exceeded, damage to the diaphragm, diaphragm casing, or actuator might result.

Installation

When an actuator and valve are shipped together, the actuator is normally mounted on the valve. Follow the valve instructions when installing the valve and actuator in a pipeline. If the actuator is shipped separately, or if it is necessary to mount the actuator on the valve, four holes have been tapped into the yoke boss to anchor it to a mounting bracket.

WARNING

Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure retaining parts, be certain the diaphragm casing pressure does not exceed the limits listed in the Specifications table. Use pressure relieving or pressure limiting devices to prevent the diaphragm casing pressure from exceeding these limits.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

To make the stem connection, follow the appropriate assembly step 10 in the Maintenance section. Standard actuator sizes 30 and 40 have mounting holes tapped 3/8 inch UNC, and the size 60 mounting holes are tapped 1/2 inch UNC.

A 1/4 NPT loading pressure connection is located in the top of the upper diaphragm case. Using either pipe or tubing, connect either the loading pressure connection or valve positioner input connection (if a valve positioner is furnished, the loading pressure connection to the actuator will be made at the factory) to the output pressure connection on the controller. Keep the length of the pipe or tubing as short as possible to avoid transmission lag in the control signal.

Adjustment

When the actuator is completely installed and connected to the controller, it should be checked for correct travel, freedom from friction and correct PDTC or PDTO action.

The actuator spring and diaphragm have been selected to meet the requirements of the application. It should be noted that the actuator spring has a constant rate of compression and that adjustment of the spring compression merely shifts the initial spring setpoint up or down to make the actuator travel within the initial spring setpoint and the maximum diaphragm pressure indicated on the nameplate.

In some instances, however, such as high friction butterfly and ball valves, the actuator will fully stroke with less diaphragm pressure than indicated on the nameplate. To increase the pressure required to initiate actuator stem movement, turn the lower bearing seat (key 14) up toward the spring case. To decrease the pressure at which movement begins, turn the lower bearing seat down, away from the spring case.

Maintenance

WARNING

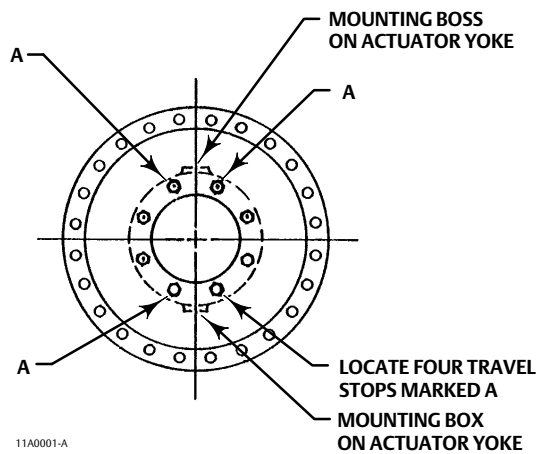
Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you are working on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Disassembly

1. If the actuator is installed on a control valve, isolate or bypass the control valve.
2. Shut off the diaphragm loading pressure and remove the pipe or tubing from the loading pressure connection in the top of the diaphragm case.
3. Turn the lower bearing seat (key 14) down, away from the spring case to relieve all spring compression.
4. If the entire actuator is to be removed from its mounting, disconnect the actuator stem (key 10) from the stem connector, clevis, etc., and remove the jam nuts (key 23). Loosen the cap screws that hold the yoke (key 9) to its mounting plate or bracket, and lift the entire actuator from its mounting.
5. Remove the diaphragm case cap screws and nuts (keys 19 and 20) and lift the upper diaphragm case (key 1) off the actuator. Remove the diaphragm (key 2).
6. Lift out the diaphragm plate (key 4) and stem (key 10). They may be separated by removing the cap screw (key 3).

Figure 2. Travel Stop Orientation for Size 60



7. Take out the actuator spring (key 6).
8. The lower diaphragm case (key 5) can be removed from the yoke, if required, by loosening the travel stops and cap screws (keys 7 and 8).
9. Remove the lower spring seat (key 11) and thrust bearing (key 13). Unscrew the lower bearing seat (key 14) from the adjusting screw (key 12).
10. Remove the set screw (key 22) and remove the adjusting screw to complete disassembly.

Assembly

1. Apply lithium grease lubricant, or equivalent, to the adjusting screw threads (key 12) and screw this into the yoke (key 9). Replace set screw (key 22). The set screw should engage the machined thread relief in the adjusting screw.
2. With the eared portion up, screw the lower bearing seat (key 14) all the way onto the adjusting screw.
3. Apply lithium grease lubricant, or equivalent, to the thrust bearing (key 13) and position it on the lower bearing seat (key 14). Lay the lower spring seat (key 11) on top of the thrust bearing assembly.
4. Mount the lower diaphragm case (key 5) to the top of the yoke (key 9) using the travel stops and cap screws (keys 7 and 8). Alternate screws and travel stops on the sizes 30 and 40. See figure 2 for the correct orientation of the size 60.
5. Position the actuator spring (key 6) on the lower spring seat.
6. Attach the diaphragm plate (key 4) to the actuator stem (key 10) with the cap screw (key 3). Apply lithium grease lubricant, or equivalent, to the stem. Place this assembly, actuator stem first, into the yoke with the actuator stem through the spring adjustor (key 12).
7. Position the diaphragm (key 2) on the diaphragm plate (key 4) and align the holes with the lower diaphragm casing (key 5). Attach the upper diaphragm case (key 1) to the lower diaphragm casing (key 5) using the cap screws and nuts (keys 19 and 20).

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

- a. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
 - b. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
 - c. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
 - d. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
 - e. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle. Once completed, no more tightening is recommended.
8. If the actuator has been removed from its mounting, position it on its mounting plate or bracket, and secure with cap screws.
 9. Attach the pressure pipe or tubing to the loading pressure connection on top of the upper diaphragm case.
 10. Attach the actuator stem to the stem connector or clevis and adjust the travel by using the appropriate procedure below.

For Push-Down-to-Open applications:

1. Set the controlled element (valve plug, louver, damper, etc.) in the closed position.
2. Turn the lower bearing seat (key 14) up toward the spring case far enough to ensure that the actuator stem is at the top of its stroke.
3. Make the actuator stem connection, making sure that there is full engagement of the actuator stem threads. Tighten slightly.
4. Apply loading pressure to the diaphragm case to move the controlled element toward its wide open position. Screw the controlled element linkage into the actuator stem connection far enough to move the controlled element toward its closed position 3.2 mm (1/8 inch), and tighten the stem connection securely. This adjustment ensures that the controlled element will close before the actuator stem travels to the top of its stroke. The travel stops (key 7) in the lower diaphragm case ensure correct travel of the controlled element in the open direction.
5. If travel starts at a lower or higher pressure than is required for proper operation, turn the lower bearing seat (key 14) up or down respectively, as described in the Adjustment section.

For Push-Down-to-Close applications:

1. Set the controlled element (valve plug, louver, damper, etc.) in the open position.
2. Turn the lower bearing seat (key 14) up toward the spring case far enough to ensure that the actuator stem is at the top of its stroke.
3. Tighten the actuator stem connection slightly, making sure that there is full engagement of the actuator stem threads.
4. Apply loading pressure to the diaphragm case and observe the travel of the controlled element to make sure that it closes completely. If the travel is not correct, it can be changed by screwing the controlled element linkage in or out of the stem connection. When the travel is set correctly, tighten the stem connection securely, and lock the jam nuts (key 23).
5. If travel starts at a lower or higher pressure than is required for proper operation, turn the lower bearing seat in or out respectively, as described in the Adjustment section.

Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, refer to the serial number found on the actuator nameplate.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your Emerson sales office for Part Ordering information.

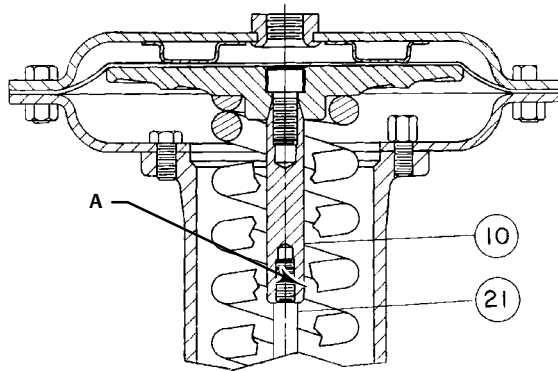
Key	Description
1	Diaphragm Case Standard
2*	Diaphragm
3	Cap Screw
4	Diaphragm Plate
5	Lower Diaphragm Case
6	Actuator Spring
7	Down Travel Stop, Sizes 30 & 40 (3 req'd), Size 60 (4 req'd)
8	Cap Screw, Sizes 30 & 40 (3 req'd), Size 60 (4 req'd)
9	Yoke
10	Actuator Stem
11	Lower Spring Seat
12	Adjusting Screw
13	Thrust Bearing
14	Lower Bearing Seat

Key	Description
17	Nameplate
18	Drive Screw (6 req'd)
19	Cap Screw, Size 30 (12 req'd), Size 40 (16 req'd), Size 60 (24 req'd)
20	Hex Nut, Size 30 (12 req'd), Size 40 (16 req'd), Size 60 (24 req'd)
21	Valve Stem (Size 30 only)
22	Set Screw
23	Hex Nut (2 req'd)
25	Warning Nameplate

Handwheel Assembly

51	Handwheel
54	Jam Nut
133	Stem
135	Pusher Plate Assembly
137	Jam Nut
138*	O-ring
139*	O-ring
140	Groove Pin
141	Cap Screw, Sizes 30 & 40 (6 req'd), Size 60 (8 req'd)
142	Handwheel body
164	Body Extension
171	Spacer (Size 60 only)

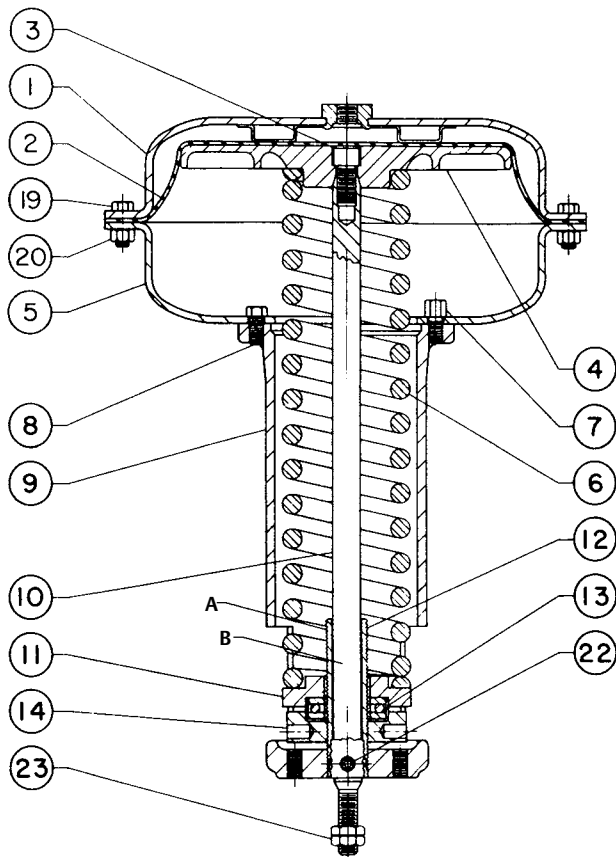
Figure 3. Fisher 656 Size 30 Actuator



APPLY THREAD LOCKING ADHESIVE (HIGH STRENGTH) TO SURFACE A

CK1580
A0345-1

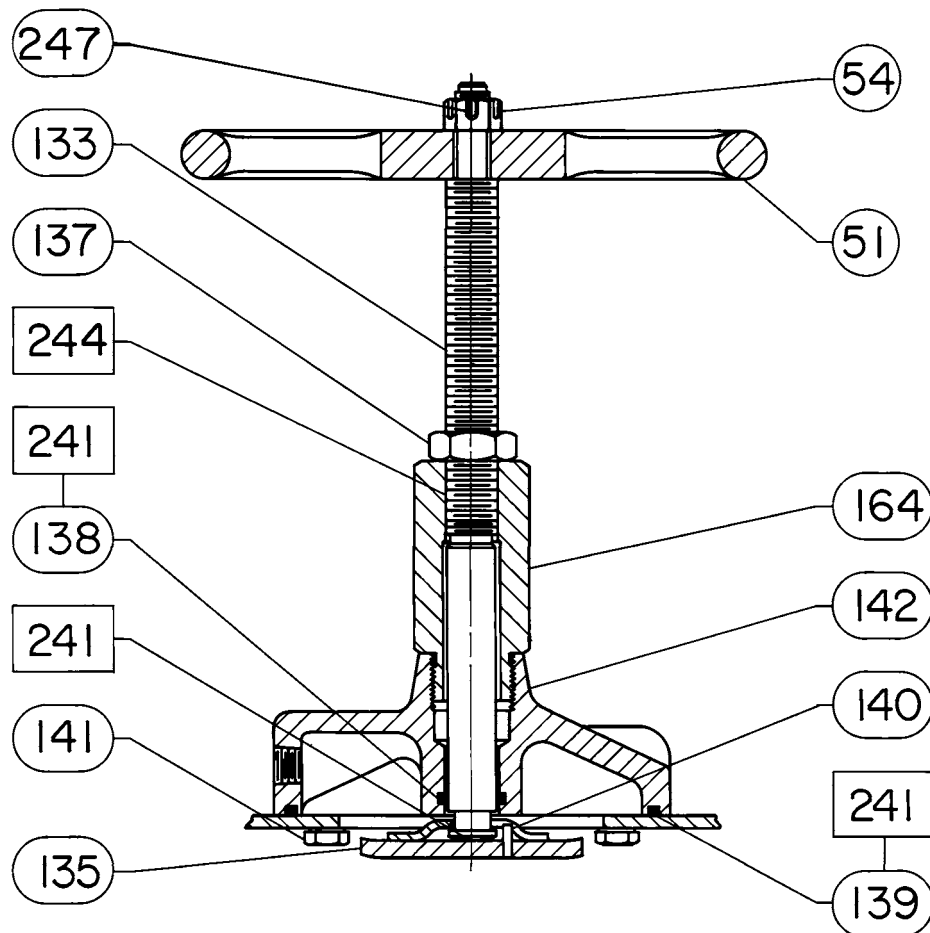
Figure 4. Fisher 656 Size 40 & 60 Actuators



APPLY LITHIUM GREASE LUBRICANT ON SURFACES A & B

40A7798A

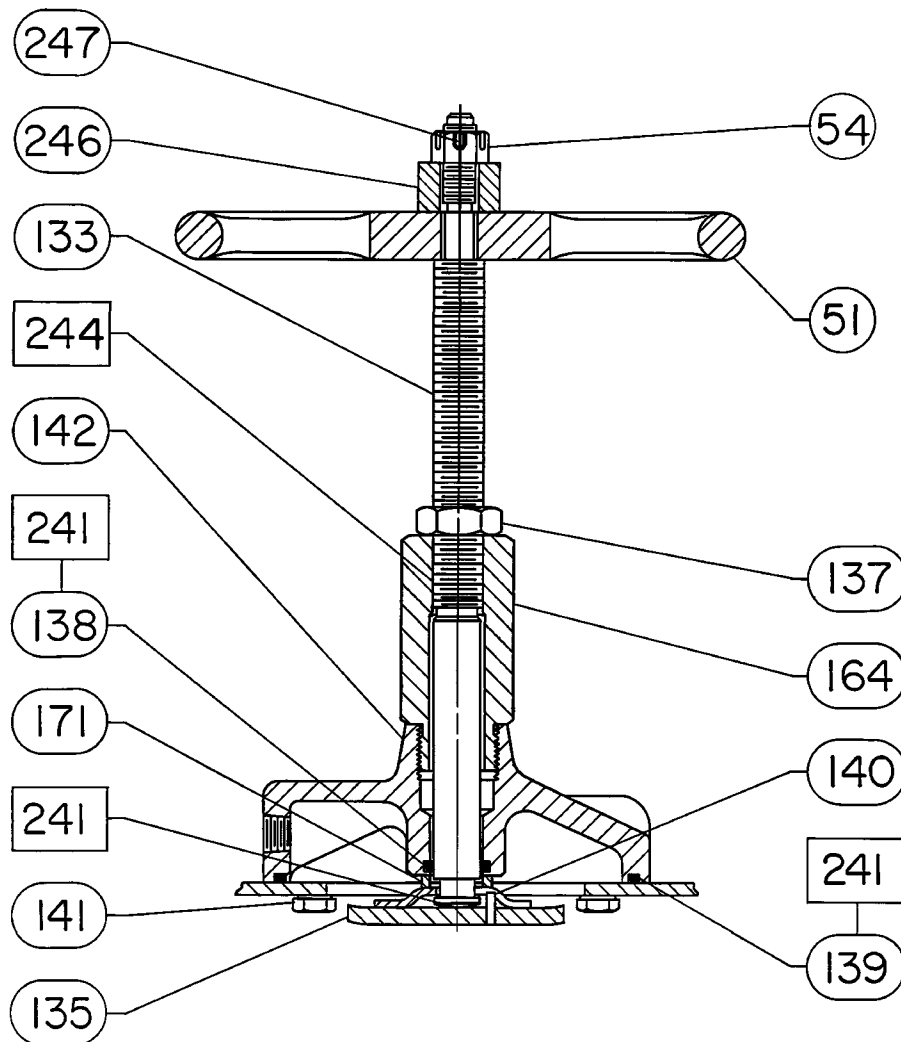
Figure 5. Typical Top-Mounted Handwheel Assembly for Diaphragm Actuator, Size 30 & 40



LUBRICATE END OF STEM AND PLATE WITH LITHIUM GREASE
LUBRICATE STEM THREADS WITH ANTI-SEIZE LUBRICANT

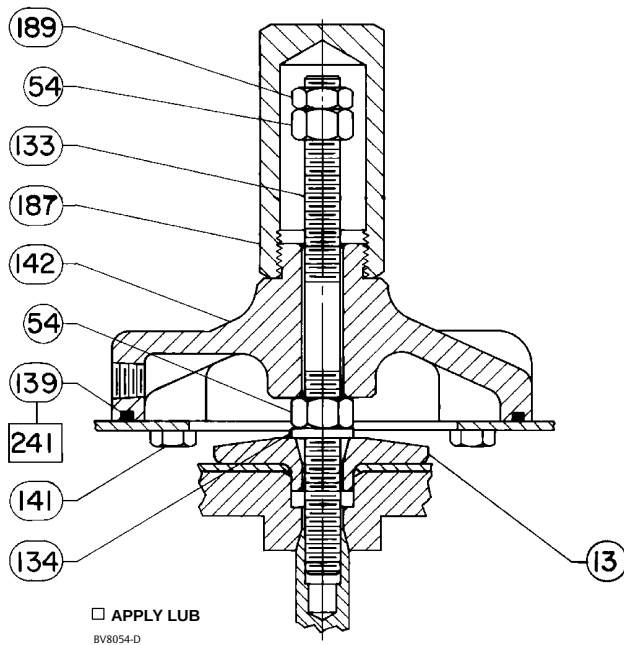
38A1209-D

Figure 6. Typical Top-Mounted Handwheel Assembly for Diaphragm Actuator, Size 60



LUBRICATE END OF STEM AND PLATE WITH LITHIUM GREASE
LUBRICATE STEM THREADS WITH ANTI-SEIZE LUBRICANT
3280262-B

Figure 7. Casing-Mounted Adjustable Down Travel Stop for Size 30 and 40 Actuators (Style 2)



Casing-Mounted Adjustable Down Travel Stop (figure 7)

Key Description

54	Stop Nut
133	Travel Stop Stem
134	Washer

Key Description

139*	O-Ring Sizes 30, 34, & 40 Sizes 45, 46, 50, & 60 Sizes 70 & 87
141	Cap Screw
142	Body
187	Travel Stop Cap
189	Jam Nut
241	Lubricant, Lithium Grease or equivalent (not furnished with travel stop)

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

656 Actuator

November 2020

Instruction Manual

D100304X012

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Fisher™ 657 Diaphragm Actuator Sizes 30/30i through 70/70i and 87

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Figure 1. Fisher 657 Actuator Mounted
on an easy-e™ Valve



X1175

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Introduction

Scope of Manual

This instruction manual provides information on installation, adjustment, maintenance, and parts ordering for the Fisher 657 actuator in sizes 30/30i through 70/70i and size 87. The 657-4 actuator in sizes 70/70i and 87 is also covered. Refer to separate instruction manuals for information about the valve positioner and other accessories used with these actuators.

Do not install, operate, or maintain a 657 actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

657 Actuator (30/30i-70/70i and 87)

June 2018

Instruction Manual

D100306X012

Table 1. Specifications

SPECIFICATION ⁽¹⁾		ACTUATOR SIZE								
		30/30i	34/34i	40/40i	45/45i	46/46i	50/50i	60/60i	70/70i ⁽¹⁾	87 ⁽¹⁾
Nominal Effective Area	cm ²	297	445	445	677	1006	677	1006	1419	1419
	Inch ²	46	69	69	105	156	105	156	220	220
Yoke Boss Diameters	mm	54	54	71	71	71	90	90	90	127
	Inches	2-1/8	2-1/8	2-13/16	2-13/16	2-13/16	3-9/16	3-9/16	3-9/16	5
Acceptable Valve Stem Diameters	mm	9.5	9.5	12.7	12.7	12.7	19.1	19.1	19.1	25.4
	Inches	3/8	3/8	1/2	1/2	1/2	3/4	3/4	3/4	1
Maximum Allowable Output Thrust ⁽⁴⁾	N	10230	10230	12010	25131	33582	25131	30246	39142	39142
	Lb	2300	2300	2700	5650	7550	5650	6800	8800	8800
Maximum Travel ⁽²⁾	mm	19	29	38	51	51	51	51	76 ⁽³⁾	76 ⁽³⁾
	Inches	0.75	1.125	1.5	2	2	2	2	3 ⁽³⁾	3 ⁽³⁾
Maximum Casing Pressure for Actuator Sizing ⁽⁴⁾	Bar	8.6	4.5	4.5	3.4	2.8	3.4	2.8	3.8	3.8
	Psig	125	65	65	50	40	50	40	55	55
Maximum Diaphragm Casing Pressure ⁽⁴⁾⁽⁵⁾	Bar	9.6	5.2	5.2	4.1	3.4	4.1	3.4	4.5	4.5
	Psig	140	75	75	60	50	60	50	65	65
Material Temperature Capabilities	°C	Nitrile Elastomers: -40 to 82°C, Silicone Elastomers: -54 to 149°C, Fluorocarbons: -18 to 149°C								
	°F	Nitrile Elastomers: -40 to 180°F, Silicone Elastomers: -65 to 300°F, Fluorocarbons: 0 to 300°F								
Pressure Connections (internal)	1/4 NPT	X	X	X	X	X	X	X	---	---
	1/2 NPT	---	---	---	---	---	---	---	X	X
Approximate Weights	kg	16/17	22/25	23/25	37/40	49/52	42/45	53/56	107/109	116
	Lb	36/38	48/54	51/56	82/84	107/114	92/99	116/125	235/240	255

1. These values also apply to the 657-4 actuator construction.
 2. Actuator travel may be less than the value listed after connecting the actuator to the valve.
 3. Maximum travel for 657-4 is 102 mm (4 inches).
 4. Normal operating diaphragm pressure must not exceed maximum diaphragm casing pressure and must not produce a force on the actuator stem greater than the maximum allowable output thrust or the maximum allowable valve stem load. Contact your [Emerson sales office](#) or Local Business Partner with questions concerning maximum allowable valve stem load.
 5. This maximum casing pressure is not to be used for normal operating pressure. Its purpose is to allow for typical regulator supply settings and/or relief valve tolerances.

Description

The 657 actuator (figure 1) and the 657-4 actuator are direct-acting, spring-opposed diaphragm actuators. They provide automatic operation of control valve body assemblies. The 657 actuator offers 76 mm (3 inches) maximum actuator travel. The 657-4 actuator provides 102 mm (4 inches) maximum actuator travel. Both actuators position the valve plug in response to varying pneumatic loading pressure on the actuator diaphragm. Figure 2 shows the operation of these actuators.

A 657 or 657-4 actuator can be equipped with either a top-mounted or a side-mounted handwheel assembly. A top-mounted handwheel assembly is used as an adjustable up travel stop to limit actuator travel in the up direction (see figure 2). A side-mounted handwheel assembly is usually used as an auxiliary manual actuator. Adjustable casing-mounted up or down travel stops are also available for this actuator.

Note

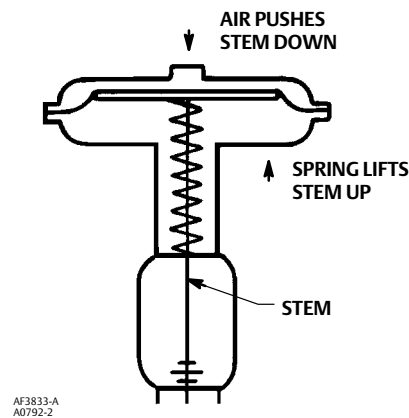
If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel.

The side-mounted handwheel is designed for more frequent use as a manual operator.

Specifications

Refer to table 1 for Specifications of the 657 and 657-4 actuators. See the actuator nameplate for specific information about your actuator.

Figure 2. Schematic of Fisher 657 and 657-4 Actuators



Educational Services

For information on available courses for Fisher 657 diaphragm actuators, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Instructional Videos

[Click here](#) or access the following QR code for a video on mounting a DVC6200 Digital Valve Controller on a 657 actuator.



[Click here](#) or access the following QR code for a video on installing a side-mounted handwheel on a 657 actuator.



Installation

Key number locations are shown in figures 6, 7, 8, 9, and 10, unless otherwise indicated. Also, refer to figure 3 for location of parts.

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

To avoid parts damage, do not use an operating pressure that exceeds the Maximum Diaphragm Casing Pressure (table 1) or produces a force on the actuator stem greater than the Maximum Allowable Output Thrust (table 1) or the maximum allowable valve stem load. (Contact your [Emerson sales office](#) or Local Business Partner with questions concerning maximum allowable valve stem load.)

- **Valve/Actuator Assembly:** If the actuator and valve are shipped together as a control valve assembly, it has been adjusted at the factory, and may be installed in the pipeline. After installing the valve in the pipeline, refer to the Loading Connection procedures.
- **Actuator Mounting:** If the actuator is shipped separately or the actuator has been removed from the valve, the actuator should be mounted to the valve before placing the valve in the pipeline when practical. In the case of needing to place a weld-end body in-line, the trim will be removed from the body during the welding process. When completed and reassembled, the actuator should then be mounted to the welded in valve assembly. Refer to the actuator mounting procedures before placing the valve in service. You may perform the Bench Set Spring Adjustment procedures in this section to confirm the adjustment has not changed since it was shipped from the factory.
- **Positioner:** If a positioner is installed, or is to be installed on the actuator, refer to the positioner instruction manual for installation. During the adjustment procedures, it will be necessary to provide a temporary loading pressure to the actuator diaphragm.

Mounting the Actuator on the Valve

The 657 actuator spring loading pushes the actuator stem up towards the actuator diaphragm (see figure 2). This spring action moves the stem away from the valve while installing the actuator.

CAUTION

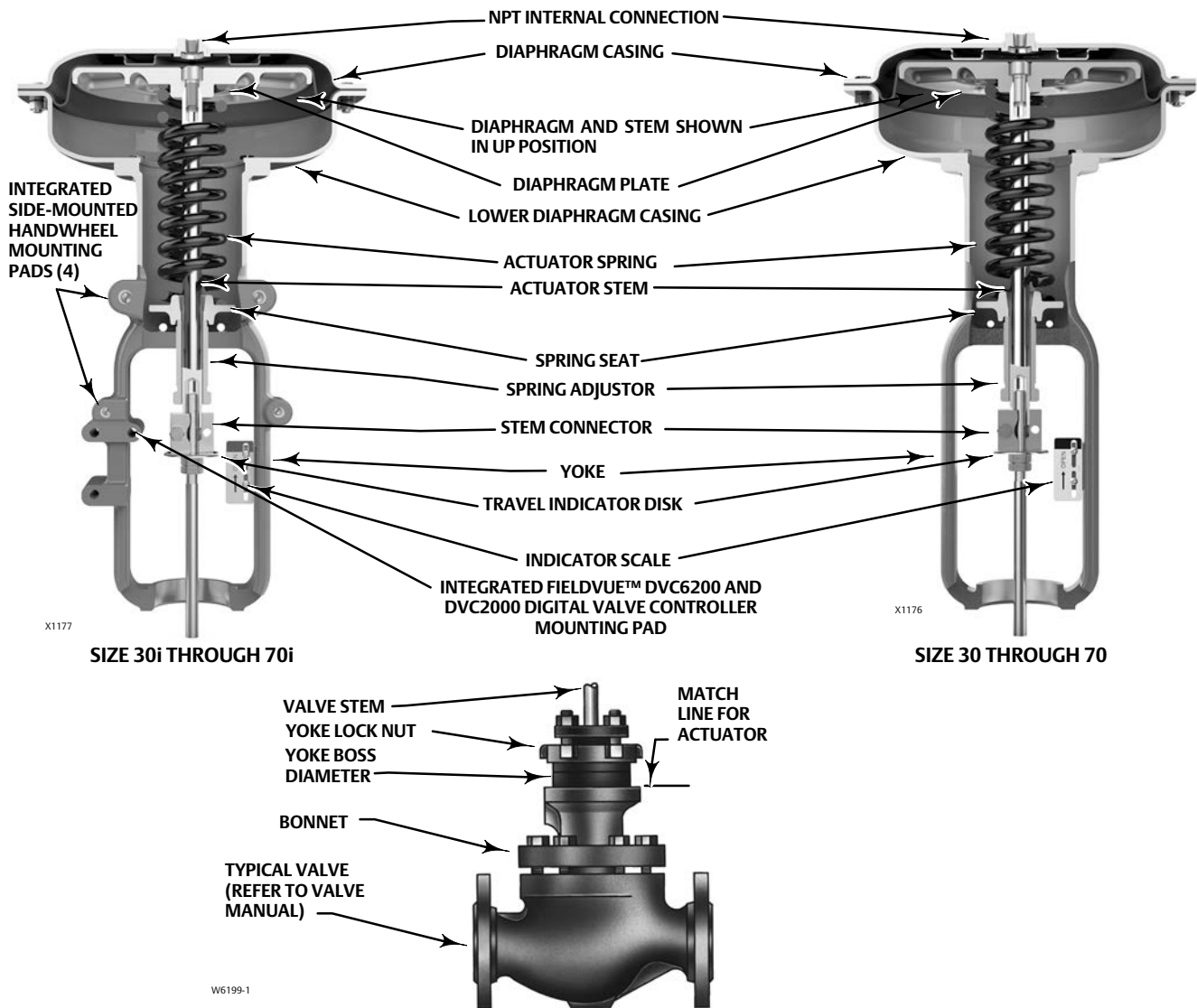
If the valve stem is allowed to remain in the up position (towards the actuator) during mounting, it can interfere with the actuator mounting, possibly damage valve stem threads or bend the valve stem. Be sure the valve stem is pushed down (into the valve body), away from the actuator while mounting.

Provide a temporary method of applying diaphragm loading pressure to the diaphragm to extend the actuator stem during bench set spring adjustments.

1. Provide a vise or some other method of supporting the valve and the weight of the actuator during assembly. For direct or reverse acting valves, push the valve stem down away from the actuator while mounting the actuator.
2. Screw the stem locknuts all the way onto the valve stem. With the concave side of the travel indicator disk (key 14) facing the valve, install the travel indicator disk on the valve stem. (Note: The travel indicator disk is not used with size 87 actuators.)
3. Lift or hoist the actuator onto the valve bonnet:
 - a. For size 87 actuators, insert the cap screws and tighten the hex nuts, securing the actuator to the bonnet.
 - b. For all other size actuators, screw the yoke locknut onto the valve bonnet and tighten the locknut. (Note: On small size actuators, it may be necessary to remove the indicator disk and re-install it while lowering the actuator on to the valve because the disk will not go through the actuator yoke opening.)

- Do not connect the actuator stem to the valve stem at this time. Whenever the actuator is installed on the valve, it is recommended to perform the Bench Set Spring Adjustment procedure to verify that the actuator is still adjusted correctly.

Figure 3. Actuator Mounting Components for Size 30/30i through 70/70i Actuators



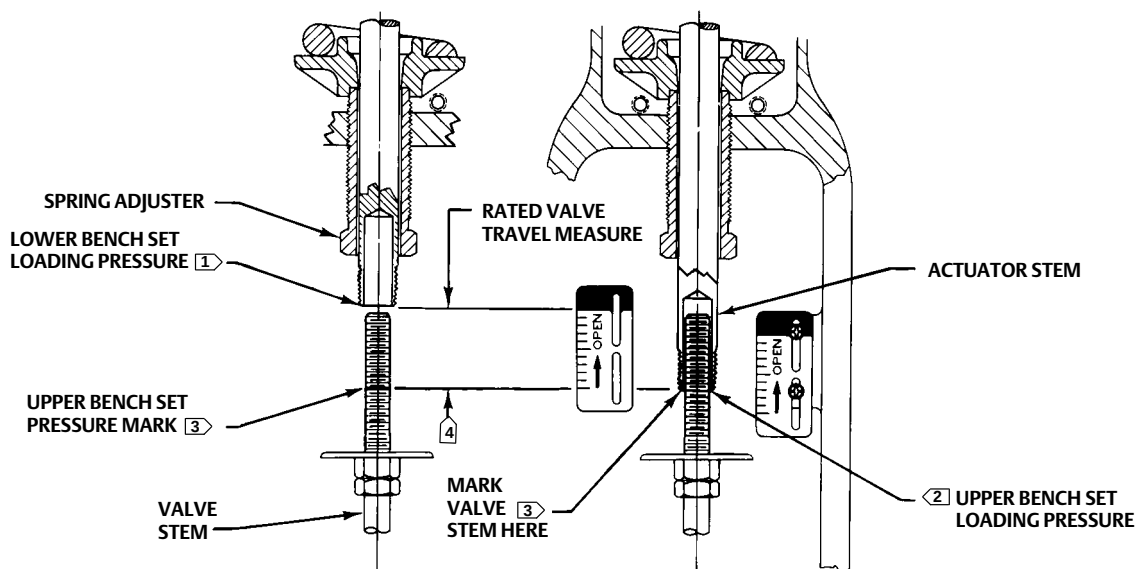
Discussion of Bench Set

The bench set pressure values are used to adjust the initial compression of the actuator spring with the valve-actuator assembly “on the bench.” The correct initial compression is important for the proper functioning of the valve-actuator assembly when it is put into service and the proper actuator diaphragm operating pressure is applied.

The bench set values are established with the assumption that there is no packing friction. When attempting to adjust the spring in the field, it is very difficult to ensure that there is no friction being applied by “loose” packing.

Accurate adjustment to the bench set range can be made during the actuator mounting process by making the adjustment before the actuator is connected to the valve (see the Spring Verification procedure).

Figure 4. Bench Set Adjustment



NOTES:

- 1 THE LOWER PSIG LOADING PRESSURE (MARKED ON NAMEPLATE) WHERE THE FIRST MOVEMENT OF ACTUATOR STEM IS DETECTED.
- 2 THE UPPER PSIG LOADING PRESSURE EXTENDS ACTUATOR STEM.
- 3 MARK THIS POINT WITH TAPE OR A MARKER.
- 4 MEASURE DISTANCE OF TRAVEL. IT SHOULD EQUAL THE TRAVEL SPAN SHOWN ON THE NAMEPLATE.

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Spring Verification

Ensure that the actuator stem is at the top of its travel as shown in figure 4 and not connected to the valve. (Note: Some spring compression is required to move the diaphragm to the top of its travel.) The steps provided are the same for push-down-to-close (direct acting) or push-down-to-open (reverse acting) valves.

⚠ WARNING

When moving the actuator stem with diaphragm loading pressure, use caution to keep hands and tools out of the actuator stem travel path. Personal injury and/or property damage is possible if something is caught between the actuator stem and other control valve assembly parts.

Also, provide a certified pressure gauge suitable to accurately read the diaphragm pressure from 0 through 0.3 bar (5 psig) above the upper operating range pressure marked on the nameplate. Apply loading pressure to the diaphragm.

CAUTION

Stroke the actuator a few times to ensure that the pressure gauge is working correctly, and that the actuator is functioning properly. To prevent actuator damage, it is important to ensure that the actuator stem is stroking smoothly and not exhibiting binding or excessive friction. Binding or excessive friction could be an indicator of incorrect assembly or damaged parts.

1. If not already accomplished, provide a temporary means of applying an adjustable loading pressure to the actuator during bench set adjustments.
2. Set the diaphragm loading pressure at 0 bar (0 psig). Then, slowly raise the pressure towards the lower bench set pressure, as indicated on the nameplate, while checking for the first linear movement of the actuator stem. The actuator stem should show movement at the lower bench set pressure. If movement occurs before or after the lower pressure is reached, adjust the spring adjuster (see figure 4) into or out of the yoke until the actuator stem's movement is first detected at the lower bench set pressure.

Note

Before turning the spring adjuster on size 70/70i or 87 actuators, assemble the stem connector around the actuator stem and the anti-rotating lug on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.

3. Be sure the spring adjuster is adjusted to meet the requirements of step 2 above.
4. Apply the upper bench set pressure, as indicated on the nameplate. This pressure extends the actuator stem down towards the valve. At the end of the actuator stem, use a marker or a piece of tape to mark the valve stem (see figure 4).

Note

The actuator stem may slide over the valve stem as shown in figure 4. If the actuator stem does not pass over the valve stem, provide a method to mark this point of stem travel.

5. Slowly decrease the diaphragm loading pressure to the lower bench set pressure, as indicated on the nameplate.
6. Measure the distance between the marker or tape on the valve stem to the end of the actuator stem. The distance should match the rated travel indicated on the nameplate.
7. If the measured travel matches the nameplate travel, bench set is complete. Proceed to the Installing the Stem Connector Assembly subsection.
8. If the measured travel is not exact, consider the spring free-length and spring rate tolerances may produce a slightly different bench set than specified. Contact your [Emerson sales office](#) or Local Business Partner for assistance.

Installing the Stem Connector Assembly

When installing the stem connector assembly (key 26), the actuator and valve stem threads should engage the threads of the stem connector by the distance equal to the diameter of the stem.

⚠ WARNING

Install the stem connector securely before a positioner is mounted to the actuator and pressurized, using only a regulator-controlled air supply, not the positioner, to move the actuator stem.

To avoid personal injury or property damage, keep hands and tools out of the actuator stem travel path while applying loading pressure to move the actuator stem in the following steps.

CAUTION

To avoid damaging the seating surfaces, do not rotate the valve plug while it is seated. Exercise care while installing the stem connector assembly to avoid damage to the valve plug stem and valve stem threads.

Note

Replacement stem connectors are an assembly of two stem connector halves, cap screws, and a spacer between the connector halves. Remove the spacer and discard, if present, before clamping the actuator and valve stems together. Use only a mated pair of stem connector halves.

1. If necessary, push the valve stem down so that it is touching the seat ring on direct acting valves. For reverse acting valves, push the stem down to the open position.

If necessary, screw the valve stem locknuts down, away from the connector location. For all actuators except size 87, ensure that the travel indicator disk (key 14) is located on top of the locknuts.

2. Slowly increase the diaphragm pressure to the upper bench set pressure. This should be the same pressure used in the Spring Verification steps, and it is marked on the nameplate.
3. Place the stem connector half with the threaded holes, approximately half way between the actuator and valve stems, and align with the stem connector. A slight change to loading pressure may be necessary to align the threads. Refer to figures 6, 7, 8, 9, and 10 to help locate the connector position.

CAUTION

Incomplete engagement of either the valve stem or actuator stem in the stem connector can result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than one diameter of that stem. Damage to threads on either stem or in the stem connector can cause the parts to be replaced prematurely. Do not loosen the cap screws when the stem connector has spring or loading pressure force applied.

4. Install the other half of the stem connector and insert the cap screws and tighten them while ensuring even spacing between the stem connector halves on all sides. If installing a positioner, also attach the feedback bracket at the same time.

CAUTION

Over-tightening the valve stem locknuts can make disassembly difficult.

5. Screw the valve stem locknuts up against the stem connector for the size 87 actuator. For all other actuator sizes, screw the valve stem locknuts up until the indicator disk contacts the bottom of the stem connector. Do not overtighten the locknuts.
6. Slowly stroke the valve from fully open to fully closed and verify full rated travel is achieved.

Be sure that the valve is in the closed position. Loosen the screws on the travel indicator scale (key 18), and align it with the travel indicator disk (key 14) or stem connector for the size 87 actuator. Stroke the valve full travel to ensure that the travel matches the rated travel on the nameplate. If valve travel is not correct, repeat the stem connector procedure.

Friction Discussion

If you are attempting to adjust the bench set after the actuator is connected to the valve and the packing tightened, you must take friction into account. Make the spring adjustment so full actuator travel occurs at the bench set values (a) plus the friction force divided by the effective diaphragm area with increasing diaphragm pressure or (b) minus the friction force divided by the effective diaphragm area with decreasing diaphragm pressure.

If the stem connector assembly has been installed, the valve friction may be determined by the following procedure:

1. Install a pressure gauge in the actuator loading pressure line that connects to the actuator diaphragm casing.

Note

Steps 2 and 4 require that you read and record the pressure shown on the pressure gauge.

2. Increase the actuator diaphragm pressure and read the diaphragm pressure as the actuator reaches a travel position in the rated travel of the valve that does not contact a travel stop. Make a reference mark on the travel indicator scale using tape or some other method at this point.
3. Increase the actuator diaphragm pressure until the actuator is at a travel position greater than the position referenced in step 2 using the reference point to identify first movement.
4. Decrease the actuator diaphragm pressure and read the diaphragm pressure as the actuator returns to the position referenced in step 2.

The difference between the two diaphragm pressure readings is the change in the diaphragm pressure required to overcome the friction forces in the two directions of travel.

5. Calculate the actual friction force:

$$\text{Friction Force, = pounds} = 0.5 \left(\begin{array}{c} \text{Difference} \\ \text{in pressure} \\ \text{readings, psig} \end{array} \right) \times \left(\begin{array}{c} \text{Effective} \\ \text{diaphragm area,} \\ \text{inches}^2 \end{array} \right)$$

Refer to table 1 for the effective diaphragm area.

It is difficult to rotate the spring adjustor (key 74, figures 6, 7, 8, 9, and 10) when the full actuator loading pressure is applied to the actuator. Release the actuator loading pressure before adjusting. Then re-apply loading pressure to check the adjustment.

Note

For push-down-to-close valves, the valve plug seat is the limit for downward travel and the actuator up-stop is the limit for upward (away from the valve) movement. For push-down-to-open valves, the actuator down stop is the limit for downward movement, and the valve seat is the limit for upward (away from the valve) movement.

Deadband Measurement

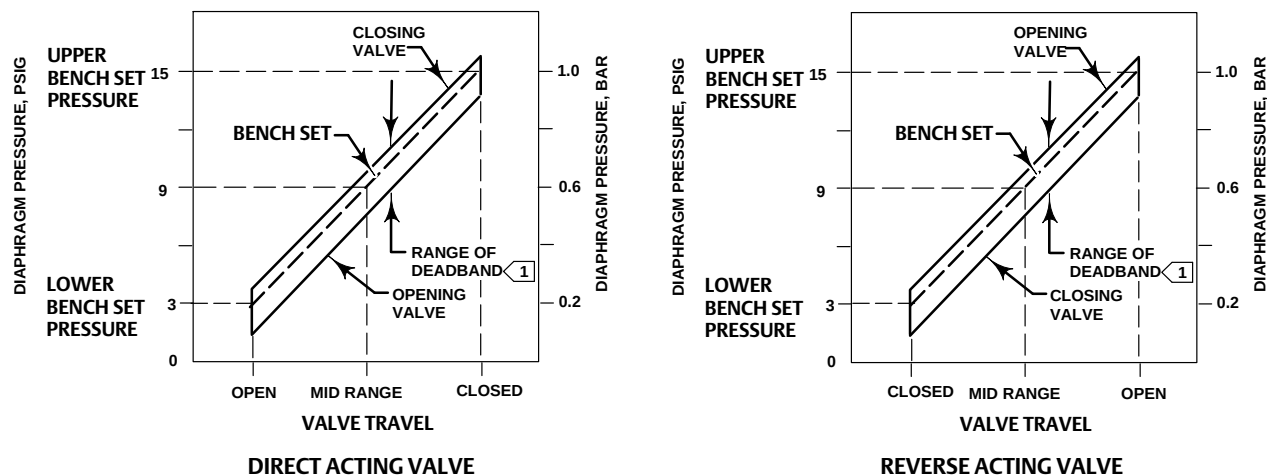
Deadband is caused by packing friction, unbalanced forces, and other factors in the control valve assembly. Deadband is the range a measured signal can vary without initiating a response from the actuator (see figure 5). Each actuator spring has a fixed spring rate (force divided by compression). You have verified that the right spring was installed in the actuator by completing the Spring Verification steps.

Deadband is one factor that affects the control valve assembly operation during automatic loop control. The control loop tolerance for deadband varies widely depending on the loop response. Some common symptoms of the deadband being too wide are no movement, a “jump” movement, or oscillating movements of the actuator during automatic loop control. The following steps are provided to determine the span of deadband. The percent of deadband is helpful in troubleshooting problems with the process control loop.

1. Start at a pressure near the lower bench set pressure, slowly increase pressure until the valve is approximately at mid-travel. Note this pressure reading.
2. Slowly decrease pressure until movement of the valve stem is detected, and note this pressure.
3. The difference between these two pressures is deadband, in psi.
4. Calculate the percent of deadband by:

$$\text{Deadband} = \frac{\text{Deadband, psi}}{\text{Bench Set Span, psi}} = \text{nn\%}$$

Figure 5. Typical Valve Response to Deadband



NOTE:
 1 DEADBAND IS CAUSED BY FRICTION.
 A6763-2

Loading Connection

The loading pressure connections are made at the factory if the valve, actuator, and positioner come as a unit. Keep the length of tubing or piping as short as possible to avoid transmission lag in the control signal. If a volume booster, valve positioner or other accessory is used, be sure that it is properly connected to the actuator. Refer to the positioner instruction manual or other manuals as necessary.

For actuators shipped separately or whenever the actuator pressure connections are installed, use the following steps:

1. Connect the loading pressure piping to the NPT internal connection in the top of the diaphragm casing.
2. For sizes 70/70i and 87 actuators, if necessary, remove the 1/4 NPT bushing if a 1/2 NPT internal connection is needed to increase connection size. The connection can be made with either piping or tubing.
3. Cycle the actuator several times to be sure that the valve stem travel is correct when the correct pressure ranges are applied to the diaphragm.

⚠ WARNING

If valve stem travel appears to be incorrect, refer to the Bench Set Spring Adjustment procedures at the beginning of this section. To avoid personal injury or product damage, do not place the valve into service if it is not reacting correctly to diaphragm loading pressure changes.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Actuator Maintenance

This procedure describes how the actuator can be completely disassembled and assembled. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job; then, start the assembly at the appropriate step.

Key numbers refer to figures 6, 7, 8, 9, or 10 unless otherwise indicated. Figure 6 shows the size 30 through 60 actuators, figure 7 shows the size 30i through 60i actuators, figure 8 illustrates the size 70 actuator, figure 9 illustrates the size 70i actuator, and figure 10 shows the size 87 actuator.

Actuator Disassembly

1. Bypass the control valve. Reduce the loading pressure to atmospheric, and remove the tubing or piping from the upper diaphragm casing (key 1).

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⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1) away from the actuator, relieve spring compression (step 2, below), and carefully remove casing cap screws (key 22) (step 4, below).

2. Thread the spring adjuster (key 12) out of the yoke (key 9) until all spring compression is relieved.
3. If required, remove the actuator from the valve body by separating the stem connector (key 26) and removing the yoke locknut or, for the size 87 actuator, the stud bolt nuts. Separate the stem connector by loosening the stem nuts (keys 15 and 16) and unscrewing the two cap screws.
4. Remove the diaphragm casing cap screws and nuts (keys 22 and 23), then lift off the upper diaphragm casing (key 1).
5. Remove the actuator diaphragm (key 2).
6. Remove the diaphragm plate, actuator stem, and cap screw (keys 4, 10 and 3) as an assembly. This assembly can be broken down further, if required, by removing the cap screw (key 3).
7. Remove the actuator spring (key 6) and the spring seat (key 11).
8. If required, remove the lower diaphragm casing (key 5) from the yoke (key 9) by loosening the cap screws (key 8) that hold it in place.
9. If required, remove the spring adjuster (key 12) by unscrewing it from the yoke (key 9).

Table 2. Actuator Assembly Recommended Torque Values

DESCRIPTION, KEY NUMBER	ACTUATOR SIZE	THREAD SIZE, INCH	TORQUE	
			N • m	Lbf • ft
Diaphragm plate to stem, key 3	30/30i	3/8-24	41	30
	34/34i and 40/40i	1/2-20	54	40
	45/45i to 70/70i and 87	3/4-16	149	110
MO U-bolt, key 170	34 and 40	1/2-13	81	60
	45 to 60	5/8-11	163	120
MO U-bolt, key 147	34 and 40	3/8-16	41	30
MO U-bolt, key 144	45 to 60	3/8-16	41	30
Diaphragm casing, key 23 ⁽¹⁾	30/30i to 70/70i and 87	3/8-24	27	20
Hex cap screw, key 256	34i to 40i	1/2-13	92	68
	45i to 60i	5/8-11	163	120
Hex cap screw, key 257	34i to 60i	3/8-16	39	29
Casing to yoke, key 8	30/30i to 60/60i	3/8-16	39	29
	70/70i and 87	1/2-13	92	68
Top-mounted handwheel and travel stop mounting, key 141	30/30i to 60/60i	3/8-16	39	29
Stem connector, key 26 ⁽²⁾	30/30i through 40/40i	5/16-18	23	17
	45/45i through 70/70i	3/8-16	39	29
	87	1/2-13	91	67

1. Observe tightening pattern and procedure described in the appropriate Actuator Assembly section.

2. Torque values when lithium grease is used on the threads.

Actuator Assembly

Refer to table 2 as appropriate.

1. Coat the threads and the spring seat bearing surface of the spring adjuster (key 12) with lithium grease (key 241), and thread the spring adjuster into the yoke (key 9). Place the spring seat (key 11) in the yoke on the spring adjuster and turn the spring adjuster to ensure that threads are properly engaged.

2. Position the lower diaphragm casing (key 5) on the yoke (key 9), and fasten the parts together by installing and evenly tightening the cap screws (key 8).
3. Set the actuator spring (key 6) squarely onto the spring seat (key 11).
4. If the diaphragm plate and actuator stem (keys 4 and 10) are separate, fasten them together using the cap screw and washer (keys 3 and 25). Coat the cap screw threads with lithium grease (key 241). Tighten the cap screw (key 3) to 41 N•m (30 lbf•ft) torque for size 30/30i actuators, 54 N•m (40 lbf•ft) torque for size 34/34i and 40/40i actuators, or 149 N•m (110 lbf•ft) torque for size 45/45i to 87 actuators. Slide the actuator stem and diaphragm plate (keys 10 and 4) into the yoke (key 9) so that the actuator spring (key 6) fits squarely between the diaphragm plate and the spring seat (key 11). Then slide the diaphragm rod through the spring adjuster (key 12).

Note

Key 25 is not part of size 40 and 40i constructions.

5. Place the diaphragm (key 2) pattern-side up on the diaphragm plate (key 4). Align the holes in the diaphragm and the lower diaphragm casing (key 5).
6. Position the upper diaphragm casing (key 1) on the diaphragm (key 2) and align the holes.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-70/70i and 87 actuators.

CAUTION

Over-tightening the diaphragm casing cap screws and nuts (keys 22 and 23) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

7. Insert the cap screws (key 22), and tighten the hex nuts (key 23) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to 13 N•m (10 lbf•ft).
8. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
9. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
10. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
11. After the last hex nut is tightened to 27 N•m (20 lbf•ft), all of the hex nuts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
12. Once completed, no more tightening is recommended.
13. Mount the actuator on the valve by following the procedures in the Installation section.

Top-Mounted Handwheel Assembly

A top-mounted handwheel assembly (figures 11 and 12) is usually used as an adjustable casing-mounted up travel stop to limit full retraction of the actuator stem. Turning the handwheel clockwise moves the the handwheel stem (key 133, figures 11 and 12) down, compressing the spring.

Instructions are given below for complete disassembly and assembly of the top-mounted handwheel assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Key numbers refer to figure 11 (sizes 30/30i through 60/60i) and figure 12 (sizes 70/70i and 87), unless otherwise indicated.

Disassembly for Top-Mounted Handwheel

1. Turn the handwheel (key 51) counter-clockwise so that the handwheel assembly is not causing any spring compression.
2. Bypass the control valve, reduce loading pressure to atmospheric, and remove the tubing or piping from the upper handjack body (key 142, figures 11 or 12).

⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1) away from the actuator, thread the spring adjuster (key 12) out of the yoke until all spring compression is relieved, then carefully remove casing cap screws (key 22).

3. Remove the diaphragm casing cap screws and nuts (keys 22 and 23, figures 6, 7, 8, 9, or 10), and lift off the upper diaphragm casing and handwheel assembly.
4. If necessary, the handwheel assembly can be separated from the diaphragm casing by removing the cap screws (key 141). This may be necessary to replace the O-ring (key 139), or for ease of handling.
5. Loosen the travel stop locknut (key 137), and turn the handwheel (key 51) counter-clockwise. Remove the cotter pin and stop nut (keys 247 and 54), then lift off the handwheel.
6. Unscrew the travel stop locknut (key 137) from the handwheel stem (key 133), and turn the stem out of the bottom of the body (key 142). A screwdriver slot is provided on the top of the stem for this purpose.
7. Replace the O-ring (key 138) in the body (key 142).
8. For a handwheel assembly used on sizes 30/30i through 60/60i actuators, complete the disassembly by driving out the groove pin (key 140, figure 11) and sliding the pusher plate (key 135, figure 11) off the stem.

For a handwheel assembly used on a sizes 70/70i or 87 actuator, complete the disassembly by unscrewing the retaining screw (key 174, figure 12) and removing the thrust bearing and pusher plate (keys 175 and 135, figure 12). Because the retaining screw (key 174) has left-hand threads, turn clockwise to loosen.

Assembly for Top-Mounted Handwheel

1. For a handwheel assembly used on sizes 30/30i through 60/60i actuators, coat the end of the handwheel stem (key 133, figure 11) with anti-seize lubricant (key 244). Slide the pusher plate (key 135, figure 11), onto the stem, and drive in the groove pin (key 140, figure 11) to lock the pieces together.

For a handwheel assembly used on a sizes 70/70i or 87 actuator, pack the thrust bearing (key 175, figure 12) with anti-seize lubricant (key 244). Place the thrust bearing in the pusher plate (key 135, figure 12), slide the two parts onto the handwheel stem (key 133). Coat the retaining screw threads with thread locking sealant (key 242). Insert and tighten the retaining screw (key 174, figure 12).

2. Coat the O-ring (key 138) with lithium grease (key 241), and insert the O-ring in the body (key 142).
3. Coat the threads of the handwheel stem (key 133) with anti-seize lubricant (key 244). Screw the stem into the body (key 142).
4. Thread the travel stop locknut (key 137) onto the handwheel stem (key 133).

5. Place the handwheel (key 51), and the stop nut (key 54) on the handwheel stem (key 133). Tighten the hex nut to fasten the parts together. Secure the nut with the cotter pin (key 247).
6. If the body (key 142) was separated from the upper diaphragm casing (key 1, figures 6, 7, 8, 9, or 10), lubricate the O-ring (key 139) with lithium grease (key 241), and place the O-ring in the body. Align the holes in the diaphragm casing and the body, insert the cap screws (key 141), and tighten them evenly following a crisscross pattern to ensure a proper seal.
7. Position the upper diaphragm casing (key 1) on the diaphragm (key 2) and align the holes.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-70/70i and 87 actuators.

CAUTION

Over-tightening the diaphragm casing cap screws and nuts (keys 22 and 23) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

8. Insert the cap screws (key 22), and tighten the hex nuts (key 23) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to 13 N•m (10 lbf•ft).
9. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
10. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
11. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
12. After the last hex nut is tightened to 27 N•m (20 lbf•ft), all of the hex nuts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
13. Once completed, no more tightening is recommended.
14. Mount the actuator on the valve following the procedures in the Installation section.

Side-Mounted Handwheel for Sizes 34 through 60 and 34i through 60i Actuators

A side-mounted handwheel assembly is normally used as a manual actuator for sizes 34 through 60 (figures 13 and 15) and 34i through 60i actuators (figures 14 and 16). Turning the handwheel counter-clockwise past the neutral position opens the valve. Two levers (key 146, figures 13, 14, 15, and 16) on a handwheel assembly operate the valve by moving the valve stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then begin the assembly at the appropriate step.

Disassembly for Side-Mounted Handwheel (Sizes 34-60 and 34i-60i)

1. Use step a. for size 34 through size 60 actuators, and use step b. for sizes 34i through 60i.
 - a. **For Size 34 through 60:** If desired, the handwheel assembly can be removed from the actuator yoke. To do this, remove the hex nuts (keys 147 and 170) from the U-bolts (key 166 and 143) that hold the assembly to the yoke for the size 30 and size 40. Remove the hex nuts (key 144 and 170) from the U-bolts (key 166 and 143) that hold the assembly to the yoke for the size 45 through size 60.
 - b. **For Size 34i through 60i:** If desired, the handwheel assembly can be removed from the actuator yoke. To do this, remove the cap screws (key 256 and 257) and spacers (key 258) that hold the assembly to the yoke for the size 30i through size 60i.
2. Remove the retaining ring (key 154) and drive out the lever pivot pin (key 153).
3. Two screws (key 156) hold the right- and left-hand levers (key 146) together. Remove the screw from the top of the levers so that the levers will drop down out of the assembly. Disassemble further, if necessary, by removing the other screw.
4. Remove the screw (key 161) and pointer mounting bolt (key 159, not shown) located behind the pointer (key 160).
5. Remove the stop nut (key 54), lockwasher (key 150), and washer (key 149). Then remove the handwheel (key 51), being careful not to lose the small ball (key 55) and spring (key 56).
6. Loosen the locking set screw (key 168, figure 16). Then, using a suitable tool, unscrew the bearing retainer (key 136).
7. Pull the handwheel screw assembly (key 145) out of the handwheel body. The operating nut (key 132) will come out with the screw. Also remove the bushing (key 151, figure 13 or 14) on size 34 and 40.
8. If required, remove the two ball bearings (key 152), one from the bearing retainer and the other from the handwheel body.

Assembly for Side-Mounted Handwheel (Sizes 34-60 and 34i-60i)



[Click here](#) or access the following QR code for a video on installing a side-mounted handwheel on a 657 actuator.

1. Pack the ball bearings (key 152) with anti-seize lubricant (key 244). Insert one bearing and the bushing (key 151, figure 13 or 14) into the handwheel body (key 142). The bushing is not used in a handwheel assembly for sizes 45/45i through 60/60i actuators.
2. Coat the handwheel screw assembly (key 145) threads with anti-seize lubricant (key 244), and thread the operating nut (key 132) onto the screw. Slide the second ball bearing (key 152) onto the screw, and insert the end of the screw into either the bushing (key 151, figure 13 or 14) for sizes 34/34i and 40/40i, or into the bearing for sizes 45/45i through 60/60i.
3. Thread the bearing retainer (key 136) into the body (key 142). Completely tighten the bearing retainer, and then loosen it one-quarter turn. Tighten the set screw (key 168, figure 13 or 14) to hold the bearing retainer in place.
4. Coat the groove in the handwheel body (key 142) with lithium grease (key 241). Insert the spring (key 56) and ball (key 55) into the handwheel (key 51). Holding the ball and spring in the handwheel, put the handwheel, the washer (key 149), the lockwasher (key 150), and the stop nut (key 54) onto the end of the end of the handwheel screw (key 145). Tighten the stop nut.
5. Position the pointer mounting bolt (key 159, not shown) and pointer (key 160). Insert and tighten the screw (key 161).
6. Assemble the two levers (key 146) with the cap screws (key 156) for handwheel assemblies for sizes 45/45i, 50/50i, and 60/60i actuators, or with the machine screws (key 156) for handwheel assemblies on sizes 34/34i and 40/40i actuators.

7. Use step a. for size 34 through size 60 actuators, and use step b. for sizes 34i through 60i.
 - a. **For Size 34 through 60:** If the handwheel assembly was removed from the yoke (key 9, figures 6, 8, or 10), remount the handjack assembly to the yoke using the dowel pins for alignment. For the size 34 and size 40, position the U-bolts and J-bolts (keys 166 and 143) on the yoke, and hand-tighten the hex nuts (keys 170 and 147) to hold the handwheel assembly in position. For the size 45 through size 60, position the U-bolts (keys 166 and 143) on the yoke, and hand-tighten the hex nuts (keys 170 and 144) to hold the handwheel assembly in position. Cap screws (key 163) should be tight against the yoke legs to provide stability. Tighten the nuts (key 144 for size 30 and size 40, key 158 for the size 45 through size 60). For the size 34 and size 40 finish tightening the U-bolt nuts to 81 N•m [60lbf•ft] (key 170) and 41 N•m [30 lbf•ft] (key 147). For the sizes 45 through 60 finish tightening the U-bolt nuts to 163 N•m [120lbf•ft] (key 170) and 41 N•m [30 lbf•ft] (key 144). Be sure the handwheel assembly remains flat against the mounting pad and perpendicular to the yoke.
 - b. **For Size 34i through 60i:** If the handwheel assembly was removed from the yoke (key 9, figures 7, 9, or 10), remount the handjack assembly to the yoke using the dowel pins for alignment. Position the upper cap screws (key 256) on the assembly and hand-tighten to hold the handwheel assembly in position. Place the spacers (key 258) between the yoke and handjack assembly, position cap screws (key 257), and hand-tighten. For the size 34i and size 40i, finish tightening the cap screws (key 256) to 81 N•m [60 lbf•ft] and (key 257) to 41 N•m [30 lbf•ft]. For the sizes 45i through 60i, finish tightening the cap screws (key 256) to 163 N•m [120 lbf•ft] and (key 257) to 41 N•m [30 lbf•ft].
8. Position the levers (key 146) as shown in figures 11 or 12. Insert the lever pivot pin (key 153), and snap the retaining ring (key 154) onto the lever pivot pin.

Side-Mounted Handwheel for Sizes 70 and 87 Actuators

A side-mounted handwheel assembly (figure 17) is normally used as a manual actuator for sizes 70 and 87 actuators. Turning the handwheel counter-clockwise past the neutral position opens the valve body. A pair of sleeves (keys 34 and 46, figure 17) operates the valve by moving the valve stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; and then begin the assembly at the appropriate step.

Key numbers refer to figures 8 or 10, and 13.

Disassembly for Side-Mounted Handwheel (Size 70 and 87)

1. Bypass the control valve, reduce loading pressure to atmospheric, and remove the tubing or piping from the upper diaphragm casing (key 1).
2. Remove cover band (key 60), and relieve spring compression by turning the spring adjuster (key 12) counter-clockwise.
3. Remove the cap screws and casing screws and nuts (keys 22 and 23), lift off the upper diaphragm casing (key 1), and remove the diaphragm (key 2).
4. Remove the cap screw (key 3) and the washer (key 25), then take off the diaphragm plate (key 4).
5. Remove the actuator spring (key 6), the upper sleeve (key 34), and the spring seat (key 11) from the yoke cylinder. This exposes the needle bearing and races (keys 37 and 38).
6. Separate the halves of the stem connector assembly (key 26) by removing the two cap screws. Remove the actuator stem (key 10).
7. Remove the travel indicator (key 14).

CAUTION

To avoid possible product damage, do not move the neutral indicator scale after completing the following step.

8. Turn the handwheel to raise the lower sleeve (key 46) until it is free of the worm gear (key 44). Lift out the lower sleeve and the key (key 47). Do not move the neutral indicator scale (key 59).
9. Loosen two set screws (key 40), then unscrew the bearing retainer flange (key 39) and the attached spring adjuster (key 12), using a suitable tool in the open neck of the flange. Take out the gear and two needle bearings (key 42), one on each side of the gear.
10. Remove the spring adjuster (key 12) from the bearing retainer flange (key 39). If desired, the worm shaft (key 45) and associated parts can be disassembled to replace or lubricate them. To do so, first remove the stop nut (key 54) and the handwheel (key 51). Do not lose the small ball (key 55) and spring (key 56).
11. Loosen the two set screws (key 41), and unscrew the front and back retainers (keys 48 and 49). The ball bearings (key 50) will come out with the retainers. Remove the worm shaft (key 45).

Assembly for Side-Mounted Handwheel (Size 70 and 87)

1. The front and back retainers (keys 48 and 49) each have a slot in their threads for a set screw (key 41). Pack the ball bearings (key 50) with anti-seize lubricant (key 244), and insert one ball bearing into the back retainer (key 49) as shown in figure 17.
2. Thread the back retainer and ball bearing (keys 49 and 50) into the yoke (key 9). Align the slot in the bearing retainer with the set screw hole in the yoke, insert the set screw (key 41), and tighten it.
3. Coat the worm shaft (key 45) threads with anti-seize lubricant (key 244), and slide the shaft into the yoke so that the end of the shaft fits snugly into the back retainer (key 49).
4. Insert the bearing into the front retainer (key 48), and thread the retainer and ball bearing into the yoke (key 9). Align the slot in the retainer with the hole in the yoke, insert the set screw (key 41), and tighten it.
5. Put the spring and ball (keys 56 and 55) into the handwheel (key 51). Slide the handwheel onto the worm shaft (key 45). Thread the stop nut (key 54) onto the shaft.
6. Pack the two needle bearings (key 42) and coat the worm gear (key 44) threads with anti-seize lubricant (key 244). Insert the key (key 47), the bearings, and the gear into the yoke (key 9) as shown in figure 17.
7. Slots are cut into the threads of the bearing retainer flange (key 39). Thread the flange into the yoke (key 9) so that the slots and the holes for the set screws (key 40) align. Insert the screws, and tighten them.
8. The lower sleeve (key 46) has milled slots in one end. Coat the sleeve threads with lithium grease (key 241), then slide the end of the lower sleeve with the milled slots into the bearing retainer flange (key 39).
9. Turn the handwheel (key 51), and feed the sleeve through the gear so that the slot in the lower sleeve (key 46) engages the key (key 47) in the yoke (key 9). Continue turning the handwheel until the lower sleeve protrudes 93.7 mm (3.69 inches) below the surface of the yoke. The pin in the side of the lower sleeve should line up with the extension on the neutral indicator.
10. Slide the square end of the actuator stem (key 10) through the lower sleeve (key 46) so the stem contacts the valve stem. Clamp both stems in the two halves of the stem connector (key 26). The stem connector should not be closer than 3.2 mm (1/8 inches) to the lower sleeve when the actuator stem is in the retracted position. This adjustment will provide approximately 3.2 mm (1/8 inches) of free travel of the lower sleeve in either direction for manual operation. Fasten the stem connector halves together with the cap screws.
11. Pack the needle bearing and race (keys 37 and 38) with lithium grease (key 241), and slide the bearing onto the spring adjuster (key 12).
12. Put the spring seat and actuator spring (keys 11 and 6) into the yoke (key 9). Slide the upper sleeve (key 34) onto the actuator stem (key 10).
13. Put the diaphragm plate and washer (keys 4 and 25) onto the actuator stem (key 10). Insert and tighten the cap screw (key 3) to fasten the parts together.
14. Place the diaphragm (key 2) pattern-side up onto the diaphragm plate (key 4). Align the holes in the diaphragm and the lower diaphragm casing (key 5).

15. Position the upper diaphragm casing (key 1) onto the diaphragm (key 2) and align the holes.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30-70, 30i-70i, and 87 actuators.

CAUTION

Over-tightening the diaphragm casing cap screws and nuts (keys 22 and 23) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

16. Insert the cap screws (key 22), and tighten the hex nuts (key 23) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to 13 N•m (10 lbf•ft).
17. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
18. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
19. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
20. After the last hex nut is tightened to 27 N•m (20 lbf•ft), all of the hex nuts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
21. Once completed, no more tightening is recommended.
22. Mount the actuator onto the valve, following the procedures in the Installation section.
23. Return the actuator to service after completing the Loading Connection procedure in the Installation section and the procedures in the Adjustments section.

Casing-Mounted Adjustable Travel Stops

Note

If repeated or daily manual operation is expected, the actuator should be equipped with a manual top-mounted or side-mounted handwheel. Refer to the Top-Mounted Handwheel and Side-Mounted Handwheel sections of this instruction manual.

The casing-mounted adjustable up travel stop (figures 18 or 19) limits the actuator stroke in the upward direction. To adjust, first relieve actuator loading pressure before removing the travel stop cap (key 187, figure 18 or 19). Loosen the travel stop nut (key 137). Then turn the travel stop stem (key 133) clockwise into the diaphragm case to move the actuator stem downward (or counter-clockwise to move the stem upward). Finally, tighten the travel stop nut and replace the travel stop cap.

The adjustable down travel stop (figure 20) limits the actuator stroke in the downward direction. To adjust, first relieve actuator loading pressure before removing the travel stop cap (key 187). Then loosen the jam nut and adjust the stop nut (keys 189 and 54) either down on the stem to limit travel, or up on the stem to allow more travel. Lock the jam nut against the stop nut, then replace the closing cap.

Instructions are given below for disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Key numbers are shown in figures 18, 19, and 20.

Disassembly for Casing-Mounted Travel Stop

Bypass the control valve. Reduce the loading pressure to atmospheric, and remove the tubing or piping from the connection in the body (key 142).

Casing-Mounted Adjustable Up Travel Stops

⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1) away from the actuator, relieve spring compression (steps 1 and 2, below), and carefully remove casing cap screws (key 22) (step 3, below).

1. Thread the spring adjuster (key 12) out of the yoke (key 9) until all spring compression is relieved.
2. Remove the travel stop cap (key 187) and loosen the travel stop nut (key 137). Rotate the travel stop stem (key 133) counter-clockwise until the travel stop assembly is no longer compressing the spring.
3. Remove the upper diaphragm casing (key 1, figures 6, 7, 8, 9, or 10) as outlined in the Maintenance section.
4. Remove the cap screws (keys 141) and separate the travel stop assembly from the upper casing.
5. Remove and inspect the O-rings (keys 138 and 139); replace if necessary.
6. Proceed with the following procedure, based on actuator size:
 - For sizes 30/30i through 60/60i, drive out the groove pin (key 140), and slide the pusher plate (key 135) off the travel stop stem (key 133).
 - For sizes 70/70i and 87, remove the retaining screw (key 174) to inspect the thrust bearing (key 175).

Casing-Mounted Adjustable Down Travel Stops

⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1) away from the actuator, relieve spring compression (steps 1 and 2, below), and carefully remove casing cap screws (key 22) (step 3, below).

1. Thread the spring adjuster (key 12) out of the yoke (key 9) until all spring compression is relieved.
2. Remove the travel stop cap (key 187). Unscrew the jam nut and stop nut (keys 189 and 54) until the travel stop assembly is no longer compressing the spring. Remove the jam nut and stop nut.
3. Remove the upper diaphragm casing (key 1, figures 6, 7, 8, 9, or 10) as outlined in the Maintenance section.
4. Remove the cap screws (keys 141) and separate the travel stop assembly from the upper casing.

5. Remove and inspect the O-ring (keys 139); replace if necessary.
6. For all actuator sizes: Loosen the stop nut (key 54), then unscrew the travel stop stem (key 133) out of the actuator stem. The lower diaphragm plate can now be removed.

Assembly for Casing-Mounted Travel Stop

1. Reassemble the up or down travel stop in the reverse order of the disassembly steps, being sure to apply lubricant as shown by the lubrication boxes (key 241) in figures 6, 7, 8, 9, 10, 18, 19, or 20, as appropriate.
2. Readjust the travel stop to obtain the appropriate restriction by following the adjustment procedures presented in the introductory portion of the Casing-Mounted Adjustable Travel Stops section. Return the unit to operation.

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always mention this number when corresponding with your [Emerson sales office](#) or Local Business Partner regarding technical information or replacement parts. Also, reference the complete 11-character part number of each needed part as found in the following Parts List.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Kits for Side-Mounted Handwheels

Retrofit kit includes parts to add a side-mounted handwheel.

Description	Part Number
Size 34 push down to close	30A8778X0A2
Size 34 push down to open	30A8778X0B2
Size 40 push down to close	30A8778X0C2
Size 40 push down to open	30A8778X0D2
Size 45 & 46 push down to close	40A8779X0A2
Size 45 & 46 push down to open	40A8779X0B2
Size 50 & 60 push down to close	40A8779X0C2
Size 50 & 60 push down to open	40A8779X0D2
Size 34i push down to close	GE71635X0A2
Size 34i push down to open	GE71635X0B2
Size 40i push down to close	GE71635X0C2
Size 40i push down to open	GE71635X0D2
Size 45i & 46i push down to close	GE71636X0A2
Size 40i & 60i push down to open	GE71636X0B2
Size 50i & 60i push down to close	GE71636X0C2
Size 50i & 60i push down to open	GE71636X0D2

Transition Kits for Side-Mounted Handwheels

Transition kits include fasteners necessary to remount an existing side-mounted handwheel to an actuator where the yoke has been changed to a size i yoke.

Contains key numbers 256, 257, and 258.

Description	Part Number
Size 34i/40i push-down-to-close or push-down-to-open	GE71635X0J2
Size 45i - 60i push-down-to-close or push-down-to-open	GE71636X0E2

Kits for Top-Mounted Handwheels

Retrofit kit includes parts to add a top-mounted handwheel. Kit 1 includes the handwheel assembly only. Kit 2 includes kit 1 and a new diaphragm case that is required to mount the handwheel assembly.

Description	Part Number
KIT 1	
Size 30/30i	28A1205X012
Sizes 34/34i & 40/40i	28A1205X022
Sizes 45/45i, 50/50i, & 60/60i	28A1205X032
Sizes 70/70i & 87	CV8010X0032
KIT 2	
Size 30/30i	28A1205X042
Sizes 34/34i & 40/40i	28A1205X052
Sizes 45/45i & 50/50i	28A1205X062
Sizes 46/46i & 60/60i	28A1205X072
Sizes 70/70i & 87	CV8010X0042

Parts List

Note

Contact your [Emerson sales office](#) or Local Business Partner for part numbers.

Actuator Assembly (figures 6, 7, 8, 9, or 10)

Key Description

1	Upper Diaphragm Casing
2*	Diaphragm
3	Cap Screw
4	Diaphragm Plate
5	Lower Diaphragm Casing
6	Actuator Spring
7	Travel Stop Cap Screw
8	Cap Screw
9	Yoke
10	Actuator Stem
11	Spring Seat
12	Spring Adjuster
13	Lower Diaphragm Plate
14	Travel Indicator Disk
15	Stem Nut
16	Stem Jam Nut
17	Self-Tapping Screw
18	Travel Indicator Scale
19	Nameplate
20	Drive Screw
22	Cap Screw
23	Hex Nut

Key Description

24	Twin Speed Nut
25 ⁽¹⁾	Washer
26	Stem Connector Assy
28	Screw
29	Yoke Extension
30	Indicator Adaptor
31	Machine Screw
32	Washer
33	Pipe Bushing
61	Nameplate
73	Cap Screw
238	Warning label
241	Lubricant, Lithium Grease (not furnished with the actuator)
249	Caution nameplate

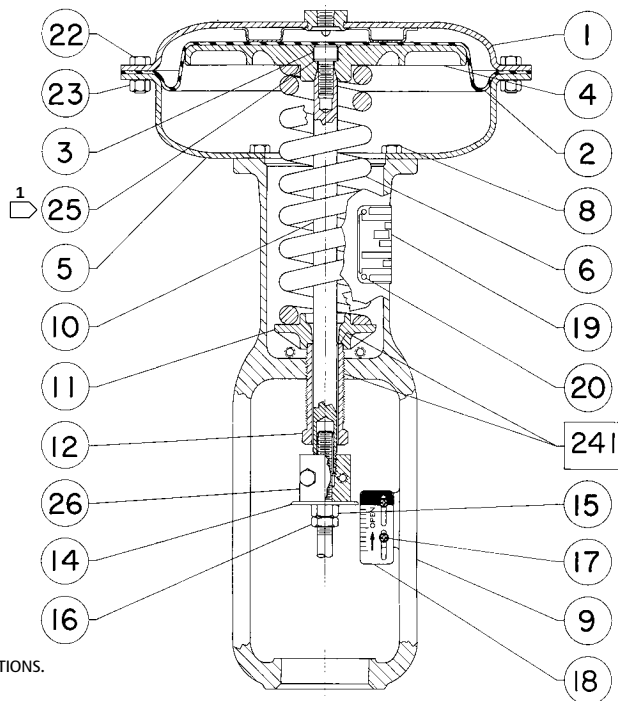
Top Mounted Handwheel (figure 11 or 12)

51	Handwheel
54	Stop Nut
133	Handwheel Stem
134	Washer
135	Pusher Plate
137	Casing-Mounted Travel Stop Locknut
138*	O-Ring
139*	O-Ring
140	Groove Pin
141	Cap Screw
142	Body
169	Grease Fitting
174	Retaining Screw
175	Thrust Bearing
176	Thrust Race
241	Lubricant, Lithium Grease (not furnished with actuator)
242	Sealant, Thread-Locking (not furnished with handwheel)
244	Lubricant, Anti-Seize (not furnished with handwheel)
246	Spacer
247	Cotter Pin

*Recommended spare parts

1. Key 25 not part of size 40 and 40i constructions.

Figure 6. Fisher 657 Actuator Sizes 30 through 60



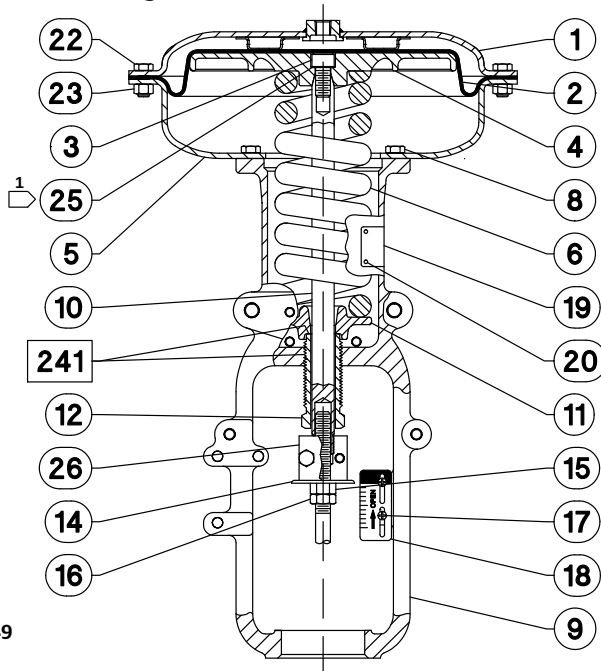
□ APPLY LUB

NOTE:

1 KEY 25 IS NOT PART OF SIZE 40 CONSTRUCTIONS.

40A8765-C

Figure 7. Fisher 657 Actuator Sizes 30i through 60i



□ APPLY LUB

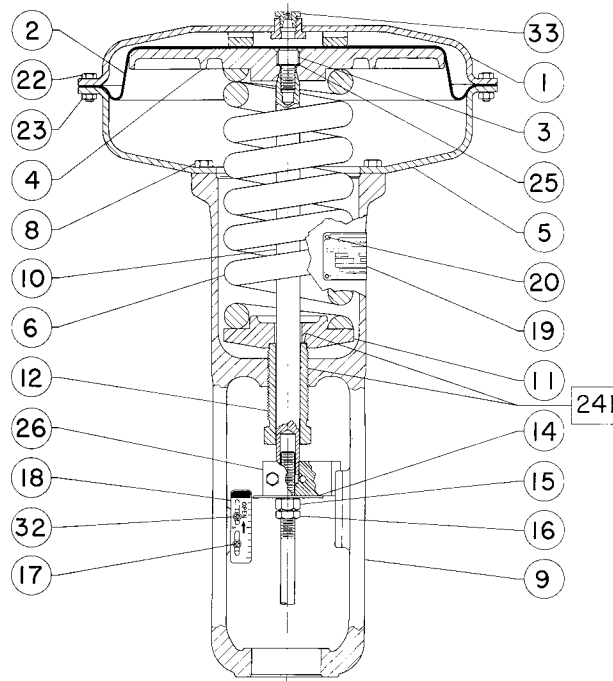
PARTS NOT SHOWN: KEY 7, 24, AND 249

NOTE:

1 KEY 25 IS NOT PART OF SIZE 40 CONSTRUCTIONS.

GE71419-A

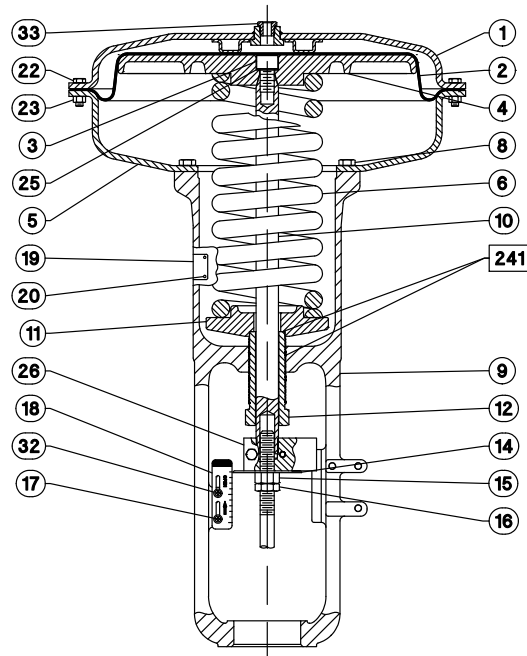
Figure 8. Fisher 657 Size 70 Actuator



□ APPLY LUB

50A8768-C

Figure 9. Fisher 657 Size 70i Actuator

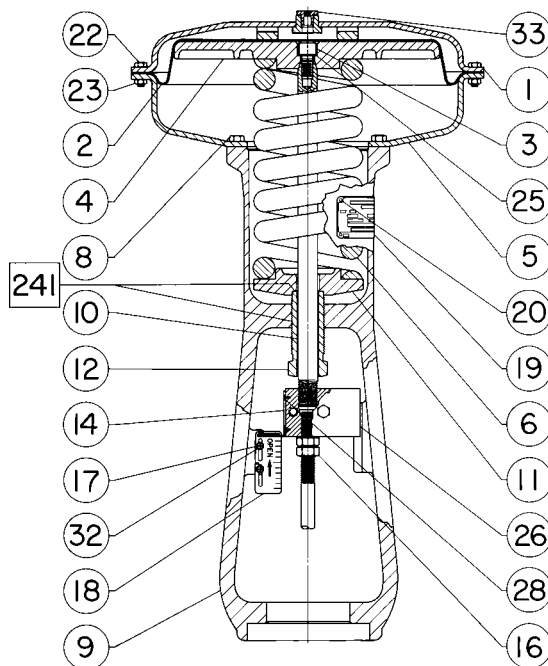


□ APPLY LUB

PARTS NOT SHOWN: KEY 7, 24, AND 249

GE71634-A

Figure 10. Fisher 657 Size 87 Actuator



□ APPLY LUB

50A8767-C

Side-Mounted Handwheel (figures 13 through 17)

Key Description

34	Upper Sleeve
37	Needle Bearing
38	Needle Bearing Race
39	Bearing Retainer Flange
40	Set Screw
41	Set Screw
42	Needle Bearing
43	Needle Bearing Race
44	Worm Gear
45	Worm Shaft
46	Lower Sleeve
47	Key
48	Front Retainer
49	Back Retainer
50	Ball Bearing
51	Handwheel
52	Handgrip
53	Handgrip Bolt
54	Stop Nut
55	Ball
56	Spring
59	Handwheel Indicator
60	Cover Band Ass'y
61	Grease Fitting
132	Operating Nut
136	Bearing Retainer
142	Handwheel Body

Key Description

143	U-Bolt
144	Hex Nut
145	Handwheel Screw
146	Lever & Pin Ass'y
147	Hex Jam Nut
148	Dowel Pin
149	Washer
150	Lockwasher
151	Bushing
152	Ball Bearing
153	Lever Pivot Pin
154	Retaining Ring
155	Lever Spacer
156	Screw
157	Lockwasher
158	Hex Nut
159	Pointer Mounting Bolt
160	Pointer
161	Screw
162	Indicator Plate
163	Cap Screw
166	U-Bolt
167	Guide Bolt
168	Set Screw
169	Grease Fitting
170	Hex Nut
177	Spring Cap
178	Machine Screw
241	Lubricant, Lithium Grease (not furnished with handwheel)
244	Lubricant, Anti-Seize (not furnished with handwheel)
256	Capscrew
257	Capscrew
258	Spacer

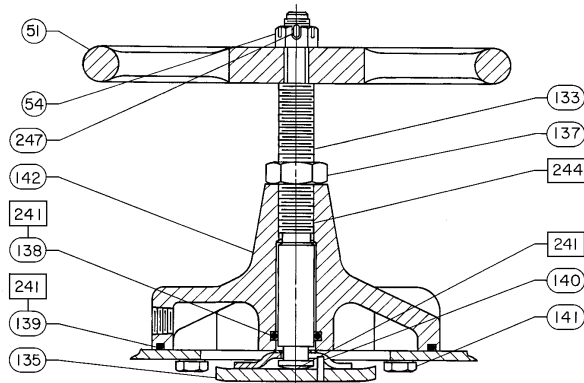
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657 Actuator (30/30i-70/70i and 87)

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Figure 11. Top-Mounted Handwheel Assembly for Size 30/30i through 60/60i Actuators

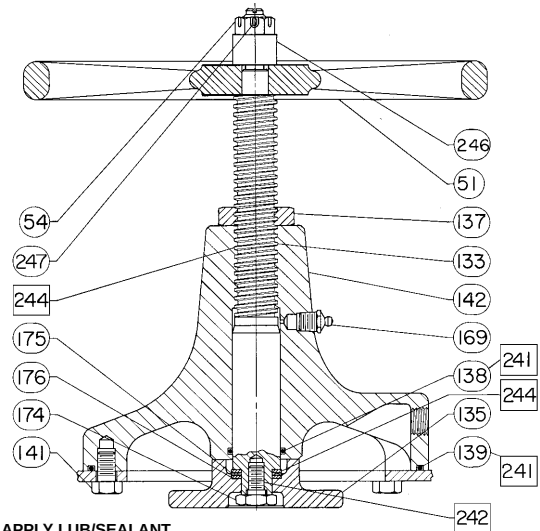


□ APPLY LUB/SEALANT

NOTES:
THE TOP MOUNTED HANDWHEEL IS NOT DESIGNED FOR USE UNDER HEAVY LOAD OR FOR FREQUENT USE.

28A1205-D

Figure 12. Top-Mounted Handwheel Assembly for Sizes 70/70i through 87 Actuators



□ APPLY LUB/SEALANT

NOTES:
THE TOP MOUNTED HANDWHEEL IS NOT DESIGNED FOR USE UNDER HEAVY LOAD OR FOR FREQUENT USE.

CV8010-G

Figure 13. Side-Mounted Handwheel Assembly for Size 34 and 40 Actuators

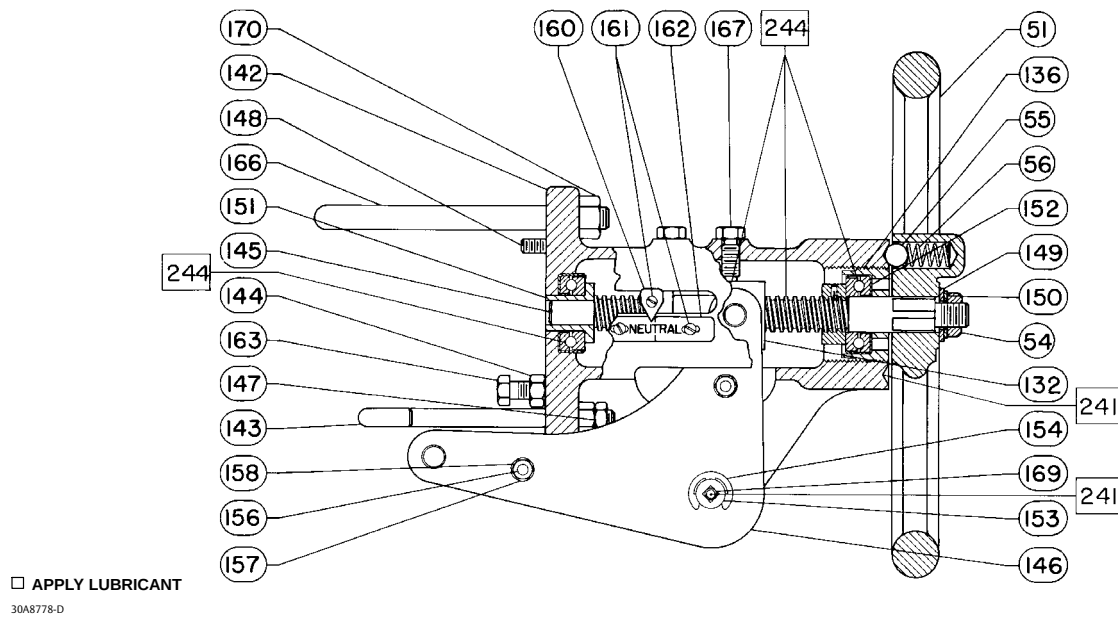


Figure 14. Side-Mounted Handwheel Assembly for Size 34i and 40i Actuators

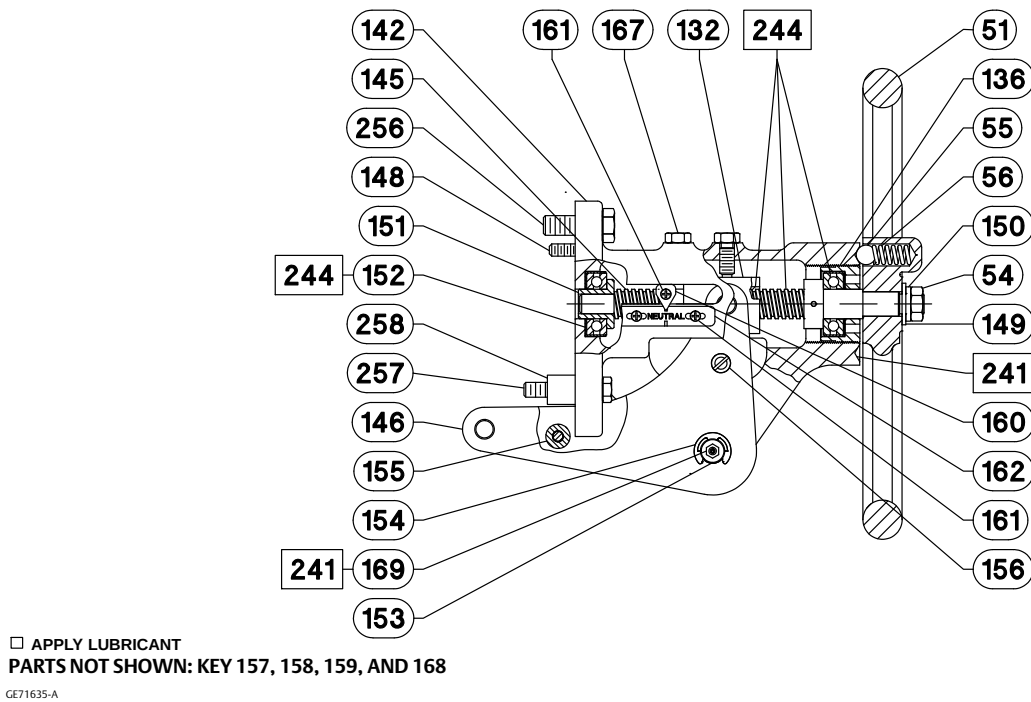


Figure 15. Side-Mounted Handwheel Assembly for Size 45, 46, 50, and 60 Actuators

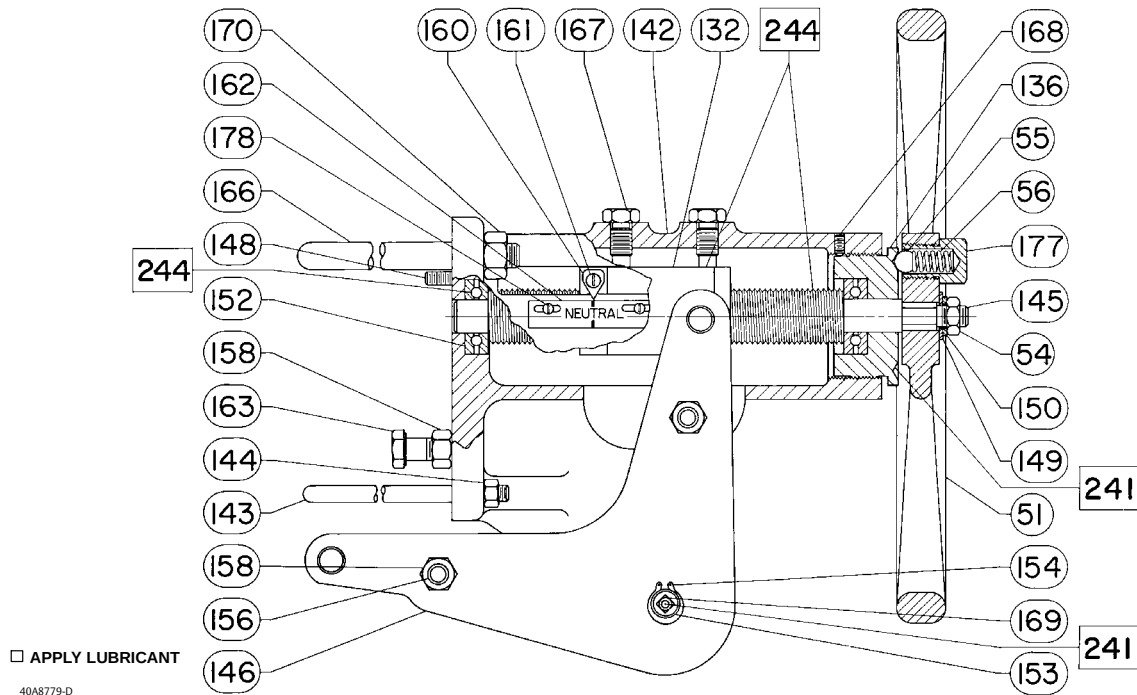


Figure 16. Side-Mounted Handwheel Assembly for Size 45i, 46i, 50i, and 60i Actuators

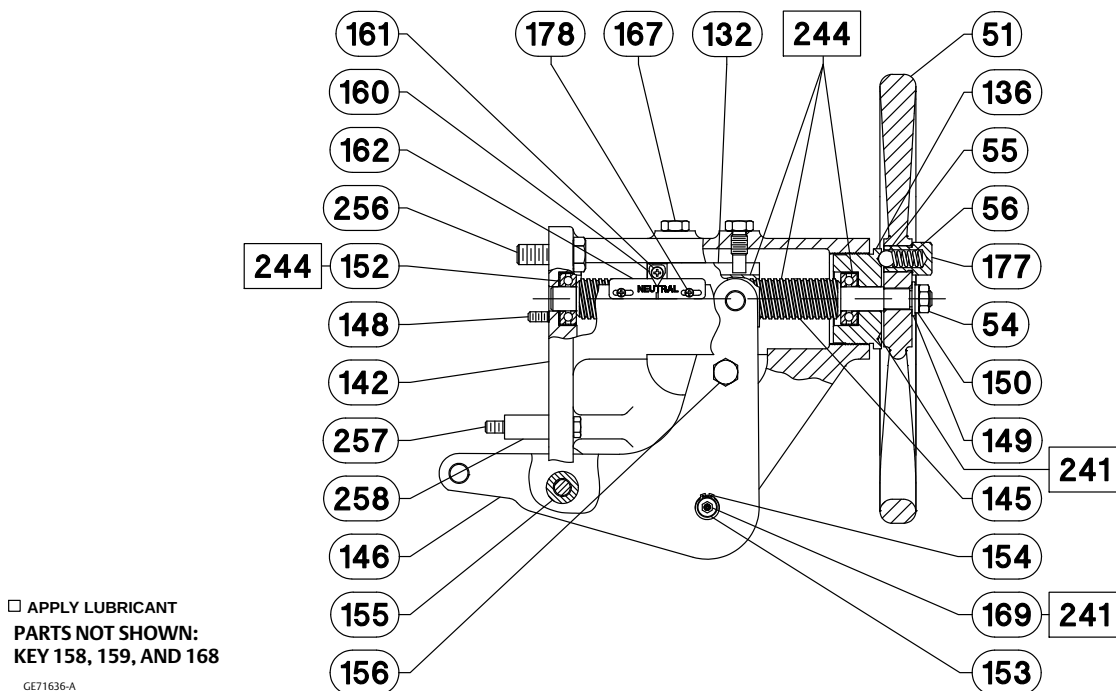
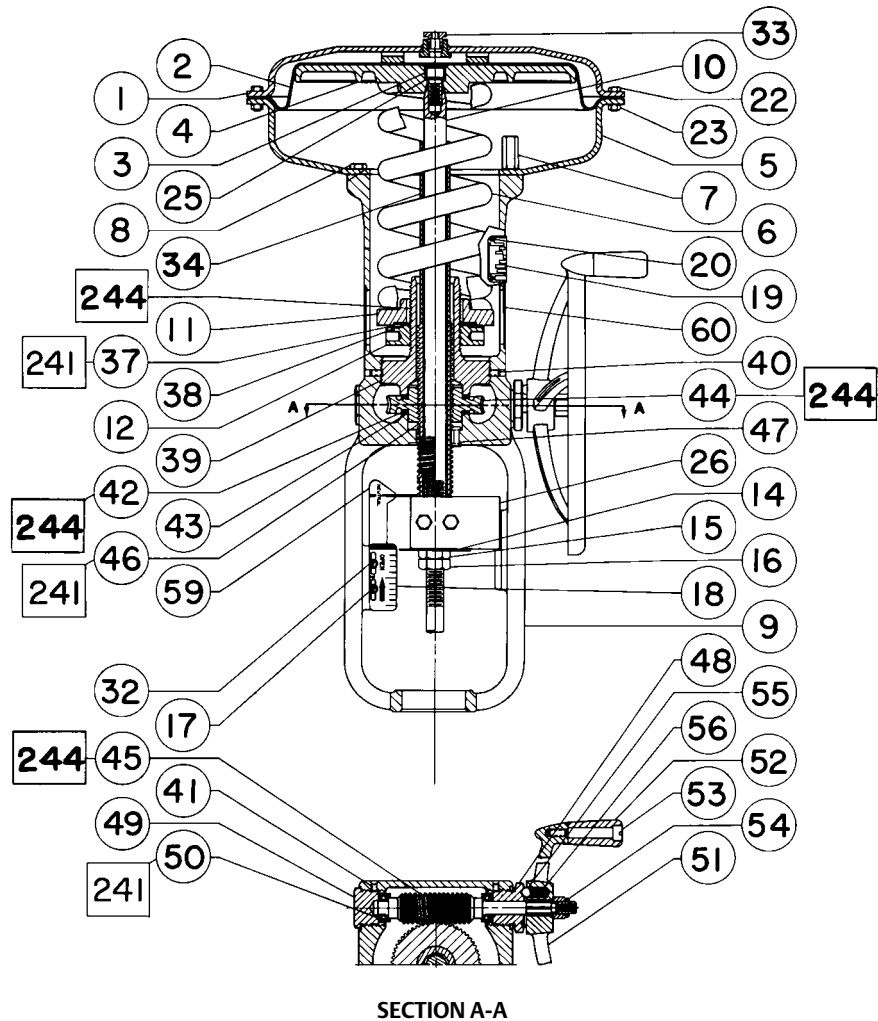


Figure 17. Fisher 657 Size 70 and 87 Actuators with Side-Mounted Handwheel



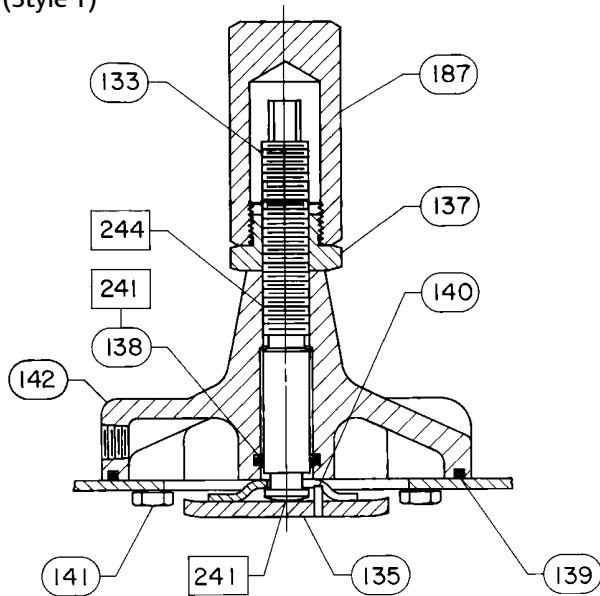
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657 Actuator (30/30i-70/70i and 87)

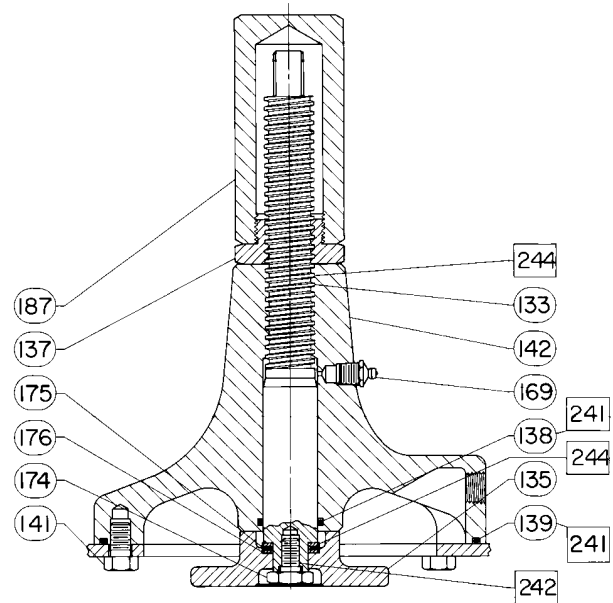
June 2018

Figure 18. Casing-Mounted Adjustable Up Travel Stop for Sizes 30/30i through 60/60i Actuators (Style 1)



□ APPLY LUBRICANT
28A1206-C

Figure 19. Casing-Mounted Adjustable Up Travel Stop for Sizes 70/70i and 87 Actuators (Style 1)



□ APPLY LUB/SEALANT
CV8057-E

Casing-Mounted Adjustable Up Travel Stops (figures 18 or 19)

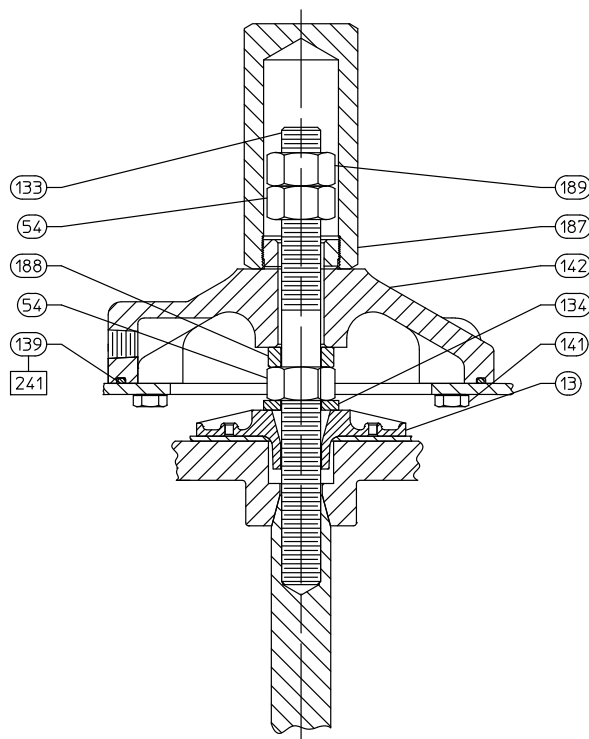
Key Description

133	Travel Stop Stem
135	Pusher Plate
137	Travel Stop Nut
138*	O-Ring
139*	O-Ring

Key Description

140	Groove Pin
141	Cap Screw
142	Body
169	Grease Fitting
174	Retaining Screw
175	Thrust Bearing
176	Thrust Bearing Race
187	Travel Stop Cap
241	Lubricant, Lithium Grease (not furnished with travel stop)
244	Lubricant, Anti-Seize (not furnished with handwheel)

Figure 20. Casing-Mounted Adjustable Down Travel Stop for Size 30/30i and 40/40i Actuators (Style 2)



□ APPLY LUB

BV8054-E

Casing-Mounted Adjustable Down Travel Stop (figure 20)

Key Description

54	Stop Nut
133	Travel Stop Stem
134	Washer
139*	O-Ring
141	Cap Screw
142	Body
187	Travel Stop Cap
189	Jam Nut
241	Lubricant, Lithium Grease (not furnished with travel stop)

*Recommended spare parts

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Fisher™ 657 Diaphragm Actuators Size 80 and 100

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Figure 1. Sectional view of Fisher 657
Size 100 Actuator



W0366-1

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Introduction

Scope of Manual

This instruction manual provides information on installation, adjustment, maintenance, and parts ordering for the Fisher 657 actuator in sizes 80 and 100. Refer to separate instruction manuals for information about other equipment and accessories used with these actuators.

Do not install, operate, or maintain 657 actuators without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

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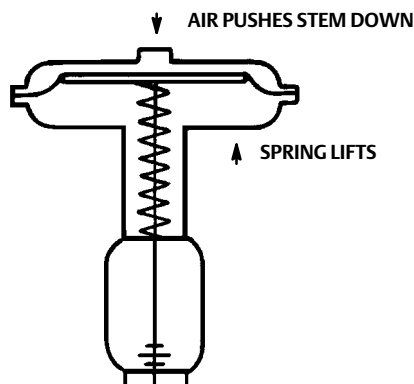
Table 1. Specifications

SPECIFICATIONS		ACTUATOR SIZE		
		80	100	
Nominal Effective Diaphragm Area	cm ²	1761	2902	
	inch ²	273	450	
Yoke Boss Diameters	mm	127	127	178
	inch	5	5H ⁽¹⁾	7
Acceptable Valve Stem Diameters	mm	25.4 or 31.8	31.8	50.8
	inch	1 or 1-1/4	1-1/4	2
Maximum Allowable Output Thrust		Standard Cast Iron Construction	All Steel Construction	
	N	62942	88075	200170
	lb	14150	19800	45000
Maximum Travel	mm	76	102	
	inch	3	4	
Maximum Casing Pressure for Actuator Sizing		Standard Cast Iron Construction	All Steel Construction	
	bar	3.4	4.9	6.9
	psig	50	70	100
Maximum Diaphragm Casing Pressure ⁽²⁾	bar	4.1	5.5	7.9
	psig	60	80	115
Material Temperature Capabilities	°C	-40 to 82		
	°F	-40 to 180		
Pressure Connections		1/4 NPT internal		
Approximate Weights Without Handwheel	kg	234	346	
	lb	515	762	

1. Heavy actuator-to-bonnet bolting.

2. This maximum casing pressure is not to be used for normal operating pressure.

Figure 2. Schematic Representation of Fisher 657 Actuator



AF3833-A
A0792-2

Description

The 657 actuator (figure 1) is a direct-acting, spring-opposed diaphragm actuator used for automatic operation of control valves. The actuator positions the valve plug in response to varying pneumatic loading pressure on the diaphragm. Figure 2 shows the operation of these actuators.

A 657 actuator can be furnished with either a top-mounted or side-mounted (size 80 only) handwheel assembly. A top-mounted handwheel assembly is normally used as an adjustable-up travel stop. The size 100 top-mounted

handwheel may be used as an auxiliary manual actuator. A side-mounted handwheel assembly is normally used as an auxiliary manual actuator.

Specifications

Refer to table 1 for specifications of the 657 actuator. See the actuator nameplate for information about a specific actuator.

Maximum Pressure Limitations

The casing and diaphragm of 657 actuators are pressure operated. The air pressure provides force to compress the spring and stroke the actuator. The following explanations describe the maximum pressure limitation for 657 actuators. Refer to the nameplate, warning tag, and table 1 for maximum values.

- **Maximum Casing Pressure for Actuator Sizing:** This is defined as the maximum pressure that can be applied to stroke the actuator, overcome unbalance forces, and provide seat load.
- **Maximum Diaphragm Casing Pressure:** If the maximum diaphragm casing pressure is exceeded, damage to the diaphragm, casing, or actuator may result. This pressure is not to be used for normal operating pressure.

WARNING

To avoid personal injury or parts damage, do not exceed the Maximum Diaphragm Casing Pressure listed in table 1. The Maximum Diaphragm Casing Pressure must not produce a force on the actuator stem greater than the maximum allowable actuator output thrust or the maximum allowable stem load.

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

When an actuator and valve body are shipped together, the actuator is normally mounted on the valve. Follow the valve body instructions when installing the control valve in the pipeline. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the Actuator Mounting procedures as described below.

For information on mounting valve positioners, refer to the appropriate valve positioner instruction manual.

Actuator Mounting

1. To permit adjustment of the actuator spring, the size 100 actuator must be installed in a vertical position above the valve body. Mount the actuator on the valve bonnet. Insert the cap screws, and tighten the hex nuts, securing the actuator to the bonnet.

2. Screw valve stem locknuts (key 16, figure 4) all the way onto valve stem thread.
3. Connect an air supply to the diaphragm casing.
4. For push-down-to-close valves, be sure the valve plug is on its seat. Apply pressure to ensure that the actuator stem is fully extended. Reduce actuator loading pressure to retract the stem approximately 3.2 mm (1/8-inch).
5. For push-down-to-open valves, move valve plug to closed position. On large body sizes, this may require the use of a pry bar inserted through the body line opening. If the body is installed in a pipeline, the bottom flange (if one is used) can be removed and the valve plug pushed to the seat from the bottom opening. Pressure the actuator to move the stem out 3.2 mm (1/8-inch).

⚠ WARNING

To avoid personal injury due to the sudden uncontrolled movement of parts, do not loosen the stem connector cap screws when the stem connector has spring or loading pressure force applied to it.

CAUTION

Incomplete engagement of both valve stem and actuator stem in the stem connector can result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than the diameter of that stem.

6. Clamp the actuator and valve plug stems between the two stem connector halves (key 26, figure 4). Insert and tighten the stem connector cap screws.
7. Thread the stem locknuts against the stem connector.
8. Align the travel indicator scale (key 18, figures 4 and 5) to show valve position.

Loading Connection

1. Connect the loading pressure piping to the connection in the top of the diaphragm casing.
2. Remove the 1/4-inch bushing (key 33, figure 4 and key 120, figure 5) to increase connection size, if necessary. The connection can be made with either piping or tubing.
3. Keep the length of tubing or piping as short as possible to avoid transmission lag in the control signal. If an accessory (such as a volume booster or valve positioner) is used, be sure that the accessory is properly connected to the actuator. Refer to the positioner instruction manual as necessary.
4. Cycle the actuator several times to check that the valve stem travel is correct and that the travel occurs when the correct pressure range is applied to the diaphragm.
5. If valve stem travel is incorrect, refer to the Travel procedure in the Adjustments section.
6. If the pressure range is incorrect, refer to the Spring procedure in the Adjustments section.

Adjustments

Travel

Make travel adjustments when the motion observed during actuator travel is different from the travel stamped on the actuator nameplate. If the Actuator Mounting procedure was followed correctly, this adjustment should not be necessary.

When adjusting travel of a reverse-acting (push-down-to-open) valve, apply a slight pressure on the actuator diaphragm. This moves the valve plug off the seat, reducing the chance of damaging the valve plug or seat during adjustments.

1. Back the stem locknuts away from the stem connector, and slightly loosen the stem connector cap screws.

CAUTION

Do not use wrenches or other tools directly on the valve stem. Damage to the stem surface and subsequent damage to the valve packing may result.

2. Tighten the locknuts together, using a wrench, then screw the valve stem either into the stem connector to lengthen travel or out of the stem connector to shorten travel.
3. Cycle the actuator to check the travel. If actual travel is not equal to the specified travel, adjust and check travel until correct. Tighten the stem connector cap screws when correct travel is obtained.
4. Raise the travel indicator disk by threading the stem locknuts against the stem connector.

Spring

Make spring adjustments when the loading pressure range applied to achieve specified travel is not equal to the pressure range stamped on the actuator nameplate. Refer to the Bench Set pressure range on the nameplate when the valve contains no pressure and the packing is loosely inserted in the bonnet. Refer to the Max. Allow. Supply on the nameplate when the valve is controlling the specified pressure drop and the packing is tightened to stop leaks around the stem.

Monitor loading pressure carefully when making adjustments. Do not exceed the pressure specifications of either the loading regulator or the actuator casings.

Each actuator spring has a fixed pressure span. Changing the spring compression shifts the span up or down to make valve travel coincide with the loading pressure range.

Size 80

Remove cover band (key 60, figure 4), insert a rod of approximately 12.7 mm (1/2-inch) diameter into a hole in the adjusting screw (key 12, figure 4), and rotate the adjusting screw with the rod. Rotating the screw from left to right will increase the loading pressure required to start actuator stem travel; opposite rotation will decrease the pressure required to start travel.

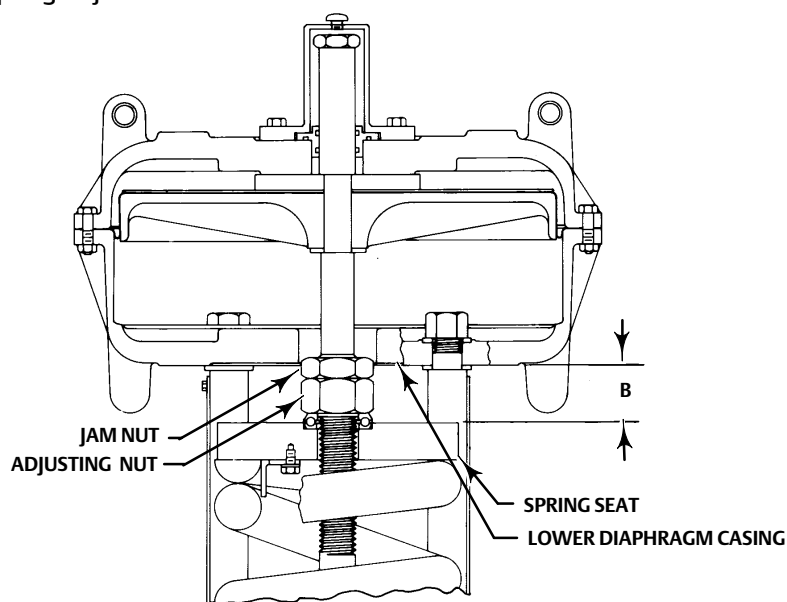
Size 100

CAUTION

The actuator must be in the vertical position when adjusting spring to avoid damage to thrust bearing (key 35, figure 5) and to properly position spacers required for adjustment.

Remove the shroud plate (key 107, figure 5), and loosen the jam nut (key 115, figure 5).

Figure 3. Dimension B for Spring Adjustment



For small spring forces, adjustments can be made by rotating the adjusting nut (key 114, figure 5). Clockwise rotation (when viewed from diaphragm casings) of the adjusting nut will increase the loading pressure required to start actuator stem travel, and counterclockwise rotation will decrease the pressure required to start travel. Tighten the jam nut when adjustment is complete.

For high spring forces, it is necessary to use spacers between the lower diaphragm casing and the spring seat to isolate spring force from the adjusting nut.

⚠ WARNING

To avoid personal injury from the compressed actuator spring snapping back to its original length, make and use the spacers by following the instructions in the steps below.

To avoid personal injury, keep hands and tools away from the spring and spring seat as instructed in the following procedure.

1. It is recommended that three spacers be made of 3-inch schedule 80 pipe cut to the appropriate length specified in step 2. If other than the recommended material is to be used, be certain that the spacers are capable of withstanding the spring force involved. The spacers must be of equal length with ends cut squarely.
2. Measure dimension B as shown in figure 3. Cut length of spacers as follows:
 - a. If it is desired to decrease spring compression, make the spacers approximately 4.8 mm (3/16-inch) longer than dimension B.
 - b. If it is desired to increase spring compression, make the spacers approximately 4.8 mm (3/16-inch) shorter than either dimension B plus the amount of adjustment required or dimension B plus valve travel, whichever is less.
3. Whenever the total amount of adjustment required is greater than valve travel, the adjustment must be made in two or more steps, and the amount of adjustment taken in each step must be less than valve travel.
4. Pressure the actuator to attain full travel. Cautiously insert the spacers at equal intervals around the spring seat (key 11, figure 5). The spacers must be seated squarely when in use or they may slip out of position. Keeping hands and

tools away from the spring and spring seat, slowly decrease loading pressure until the spring force holds the spacers firmly between the spring seat and lower diaphragm casing (key 5, figure 5).

5. Loosen the jam nut. The adjusting nut can now be rotated clockwise (when viewed from the diaphragm casings) to increase the loading pressure required to start actuator stem travel or counterclockwise to decrease the pressure required to start travel.
6. Pressure the actuator to move the spring seat away from the spacers, and carefully remove the spacers.
7. If the total adjustment required was greater than valve travel, repeat the procedure. It will be necessary to make new spacers using the new dimension B and the remaining adjustment required or valve travel, whichever is less. Tighten the jam nut when adjustment is complete.

Maintenance

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

The maintenance instructions are divided into four sections: actuator (sizes 80 and 100); side-mounted handwheel assembly (manual operator); hydraulic snubber; and top-mounted handwheel assembly (adjustable-up travel stop).

Actuator

This procedure describes how the actuator can be completely disassembled and assembled. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job; then, start the assembly at the appropriate step.

Key numbers refer to figure 4 for size 80 actuators and figure 5 for size 100 actuators.

Size 80 Disassembly

1. Bypass the control valve. Reduce the loading pressure to atmospheric, and remove the tubing or piping from the top of the diaphragm casing (key 1).

⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1) away from the actuator, relieve spring compression (step 2, below), and carefully remove casing cap screws (key 22) (step 4, below).

2. Remove cover band (key 60). Insert a rod of approximately 12.7 mm (1/2-inch) diameter into a hole in the adjusting screw (key 12), and rotate the adjusting screw from right to left until spring compression is relieved. If the actuator has a handwheel, rotate it counterclockwise, relieving all spring compression.
3. If necessary, the entire actuator may be removed from the valve body by unscrewing two cap screws from stem connector (key 26) and removing actuator-to-bonnet bolting.
4. Unscrew diaphragm casing cap screws and nuts (keys 22 and 23), and lift off upper diaphragm casing (key 1).
5. Remove the molded diaphragm (key 2).
6. For actuators without snubber, remove diaphragm plate and stem (keys 4 and 10) as an assembly. This assembly can be broken down further, if necessary, by removing the cap screw (key 3).
7. For actuators with snubber (see figure 7), unscrew cap screw (key 3), and remove diaphragm plate (key 4). Remove stem connector (key 26). Unscrew cap screws (key 85), and remove cylinder assembly (key 74) and attached stem and upper seat (keys 10 and 90) from actuator.

To disassemble snubber:

- a. Unscrew stem from piston/piston rod assembly (key 27).
- b. Remove retaining rings, cylinder heads, and piston/piston rod assembly (keys 76, 75, and 27). Replace packing and O-rings (keys 103, 104, 77 and 105) as required.
8. Remove actuator spring, upper sleeve, and spring seat (keys 6, 34 and 11).
9. Unscrew cap screws and nuts (keys 62 and 63), and remove spring case (key 29). Cap screws (key 62) on units with side-mounted handwheel do not use hex nuts (key 63).
10. For actuators without side-mounted handwheel, remove adjusting flange (key 36) and attached thrust bearing and adjusting screw (keys 35 and 12).
11. For actuators with side-mounted handwheel (see figure 7), unscrew cap screws (key 64), and remove adjusting flange (key 36) and attached thrust bearing and adjusting screw (keys 35 and 12). Do not lose the key (key 47).

Size 80 Assembly

1. Coat the threads of the adjusting flange (key 36) with anti-seize lubricant (key 244). Replace the adjusting flange, adjusting screw, and thrust bearing (keys 36, 12, and 35). Pack bearing with lithium grease lubricant (key 241).

For actuators with side-mounted handwheel, install the key (key 47) on the adjusting flange (key 36). Coat the adjusting flange threads with anti-seize lubricant. Install the adjusting flange so that the key engages the slot in the lower sleeve. Secure adjusting flange with cap screws (key 64). Adjust set screws (key 40, figure 7) to eliminate free play in handwheel bearings.

Note

Over-tightening the set screws will make handwheel operation difficult.

2. Mount the spring case (key 29) to the yoke (key 9) using cap screws and hex nuts (keys 62 and 63).

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3. Position the lower spring seat (key 11), and slide the actuator spring (key 6) squarely onto the spring seat.
4. If the diaphragm plate and actuator stem (keys 4 and 10) were separated, fasten them together using the cap screw (key 3) and tighten to a torque of 544 N•m (400 lbf•ft).

For actuators without a hydraulic snubber, slide upper sleeve (key 34) onto the actuator stem, and then slide upper sleeve, actuator stem and diaphragm plate into the spring case (key 29) so that the spring (key 6) fits squarely between the diaphragm plate and the spring seat (key 11).

For actuators with a snubber, thread the actuator stem and upper spring seat (keys 10 and 90) into the piston/piston rod assembly (key 27). Install the snubber assembly and attached actuator stem into the upper sleeve, spring case adaptor, and spring case (keys 34, 72, and 29). Secure with cap screws (key 85).

5. Place the diaphragm (key 2) with pattern side facing away from the diaphragm plate (key 4). Align the holes in the diaphragm and the lower diaphragm casing (key 5).
6. Position the upper diaphragm casing (key 1) on the diaphragm (key 2), and align the holes.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 80 and 100 actuators.

CAUTION

Over-tightening the diaphragm casing cap screws and nuts can damage the diaphragm. Do not exceed the following maximum torque values for the appropriate diaphragm material:

EPDM/Meta-Aramid: 95 N•m (70 lbf•ft) Nitrile, Silicone, FKM (fluorocarbon)/Meta-Aramid: 68 N•m (50 lbf•ft)

Table 2. Maximum Torque Values

DIAPHRAGM MATERIAL	INITIAL TORQUE N•m (lbf•ft)	FINAL TORQUE N•m (lbf•ft)
EPDM/Meta-Aramid	41 (30)	82, +/-13 (60, +/-10)
Nitrile, Silicone, FKM/Meta-Aramid	34 (25)	68 (50)

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

7. Insert the cap screws (key 22) into the diaphragm casing, and tighten the hex nuts (key 23) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to the initial torque value found in table 2 for the diaphragm material being used.
8. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to the initial torque value found in table 2 for the diaphragm material being used.
9. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to the final torque value that is specified in table 2 for the diaphragm material being used.

10. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to the final torque value that is specified in table 2 for the diaphragm material being used.
11. After the last hex nut is tightened complete another tightening sequence, this time in a circular pattern around the bolt circle to the final torque value that is specified in table 2 for the diaphragm material being used.
12. Once completed, no more tightening is recommended.
13. Mount the actuator on the valve in accordance with the procedures in the Installation section.

Size 100 Disassembly

Key numbers used in the following procedure are shown in figure 5 except when indicated.

Note

Two construction variations of the size 100 are based on spring length. Group 1 springs have a free length of 845 mm (33-1/4 inches), and group 2 springs have a free length of 419 mm (16-1/2 inches).

WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1) away from the actuator, relieve spring compression (step 1, below), and carefully remove casing cap screws (key 22) (step 7, below).

1. Remove shroud plate (key 107), loosen jam nut (key 115), and rotate adjusting nut (key 114) until spring compression is relieved.

Note

To relieve spring compression when high spring forces exist, refer to the Adjusting Actuator Spring section, and follow the instructions given for size 100 actuators with high spring forces.

2. Remove the pressure tubing or piping from the top of the diaphragm casing.
3. For actuators with top-mounted handwheel, rotate handwheel (key 51, figure 8) counterclockwise as far as it will go, unscrew cap screws (key 109, figure 5), and remove handwheel and gear case assembly (key 65, figure 8).
4. For actuators without top-mounted handwheel, unscrew cap screws (key 109), and remove diaphragm casing cover (key 123).
5. If necessary, remove the actuator from the valve body by separating the stem connector (key 26) and removing the actuator-to-bonnet bolting. Separate the stem connector by loosening the stem locknuts (key 16) and unscrewing the four cap screws.
6. Unscrew and remove actuator stem extension (key 116).
7. Unscrew cap screws (key 22), and remove upper diaphragm casing (key 1).
8. Remove backup plate, diaphragm retainer, diaphragm, diaphragm plate, and washer (keys 13, 110, 2, 4, and 117).
9. Unscrew the nuts that attach lower diaphragm casing (key 5) to actuator tie rods (key 21).
10. Remove lower diaphragm casing from tie rods and remove hex jam nut, adjusting nut thrust bearing (used with group 1 springs only), and spring seat (keys 115, 114, 35, and 11).

11. Remove seal bushing (key 111) and diaphragm casing cover O-rings (keys 112 and 113) from upper diaphragm casing (key 123). Replace with new parts if necessary. Apply lithium grease lubricant to the O-rings.
12. Remove actuator spring (key 6).

Size 100 Assembly

Note

Units using a group 2 spring require one spring seat (key 11) on each end of the spring (key 6); units using a group 1 spring require only one spring seat on the diaphragm end of the spring as shown in figure 5.

1. Place the spring and spring seats (keys 6 and 11) inside the spring case.
2. For actuators using a group 1 spring, pack the thrust bearing (key 35) with lithium grease lubricant (key 241). Place bearing on the spring seat.
3. Screw the hex jam nut and adjusting nut (keys 115 and 114) onto the actuator stem.
4. Install the lower diaphragm casing (key 5) on the actuator tie rods (key 21). Secure with hex nuts.

Note

Before installing diaphragm plate (key 4), rotate adjusting nut (key 114) until the top of the actuator stem is 264 mm (10-3/8 inches) above the inside surface of the lower casing (key 5).

When installing diaphragm (key 2), be certain that the rubber side of the diaphragm faces away from the spring.

CAUTION

To avoid product damage, smooth the edge of the diaphragm to avoid wrinkling, and be careful that the diaphragm fold does not get pinched when the upper casing (key 1) is installed.

5. Install washer, diaphragm plate, diaphragm, diaphragm retainer, and backup plate (keys 117, 4, 2, 110 and 13).
6. Apply lithium grease lubricant (key 241) to the thread on the diaphragm end of the actuator stem (key 10).
7. Position the upper diaphragm casing (key 1) on the diaphragm (key 2), and align the holes.

Note

If backup plate (key 13) interferes with installation of upper casing, rotate adjusting nut (key 114) to move the plate.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 80 and 100 actuators.

CAUTION

Over-tightening the diaphragm casing cap screws and nuts can damage the diaphragm. Do not exceed 68 N•m (50 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

8. Insert the cap screws (key 22), and tighten the hex nuts (key 23) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to 34 N•m (25 lbf•ft).
9. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 34 N•m (25 lbf•ft).
10. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to a torque of 68 N•m (50 lbf•ft).
11. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 68 N•m (50 lbf•ft).
12. After the last hex nut is tightened to 68 N•m (50 lbf•ft), all of the hex nuts should be tightened again to 68 N•m (50 lbf•ft) in a circular pattern around the bolt circle.
13. Once completed, no more tightening is recommended.
14. Install the actuator stem extension (key 116), diaphragm casing cover O-rings (keys 112 and 113), and seal bushing (key 111). Install the gear case cover (key 123) or the handwheel assembly (see figure 8).
15. Mount the actuator on the valve, and secure with the actuator-to-bonnet bolting. Refer to the Installation section to connect actuator stem to valve plug stem.

Size 80 Side-Mounted Handwheel

The side-mounted handwheel assembly (figure 7) is normally used as a manual operator. The handwheel can be mounted in either of two positions so that, regardless of valve plug action, counterclockwise rotation always opens the valve. The assembly is a continuously connected type with an indicator to show neutral position. By rotating handwheel away from neutral, the handwheel can be used to limit travel in either direction but not both directions at the same time.

A grease fitting is provided on the gear box for periodic gear lubrication with a general-purpose grease.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Key numbers refer to figure 7.

Disassembly

1. Complete steps 1 through 9 of the disassembly portion of the size 80 actuator section.
2. Unscrew cap screws (key 64), and remove adjusting flange (key 36). Do not lose the key (key 47).
3. Unscrew the two screws (key 28), and remove travel stop indicator (key 58) from lower sleeve (key 46).
4. Turn handwheel (key 51) to raise lower sleeve. Continue turning handwheel until lower sleeve is free of worm gear (key 44). Lift out lower sleeve, bearing and gear retainer, thrust bearings, and worm gear (keys 46, 66, 67, and 44).
5. The worm shaft (key 45) and associated parts can be removed in order to replace or lubricate them. First, remove the handwheel cap (key 54) and the handwheel (key 51). Do not lose the small ball or spring (keys 55 and 56).

6. Loosen the two set screws (key 41), and unscrew the two worm retainers (keys 48 and 49). The ball bearings (key 50) will come out with the retainers. Remove the worm shaft (key 45).

Assembly

1. Pack the ball bearings (key 50) with lithium grease lubricant, and insert one ball bearing in the back worm retainer (key 49) as shown in figure 7 (section C-C).
2. Thread the back worm retainer and ball bearing (keys 49 and 50) into the gear case. Align the slot in the worm retainer with the set screw hole in the gear case, insert the set screw (key 41), and tighten it.
3. Coat the worm shaft (key 45) threads with anti-seize lubricant (key 244), and slide the shaft into the gear case so that the end of the shaft fits snugly in the back worm retainer.
4. Insert the bearing in the front worm retainer (key 48), and thread the retainer and ball bearing into the gear case. Align the slot in the retainer with the set screw hole in the gear case, insert the set screw (key 41), and tighten it.
5. Put the spring and ball (keys 56 and 55) in the handwheel (key 51). Slide the handwheel onto the worm shaft (key 45). Thread the handwheel cap (key 54) onto the worm shaft.
6. Pack the two thrust bearings (key 67) with lithium grease lubricant. Install one thrust bearing; then, install the worm gear (key 44) followed by the second thrust bearing and the bearing and gear retainer (key 66).
7. The lower sleeve (key 46) has two screw holes in one end. Coat the sleeve threads with lithium grease lubricant, slide the end of the lower sleeve with the holes into the thrust bearing (key 67), turn the handwheel, and feed the sleeve through the worm gear. Continue turning the handwheel until the lower sleeve protrudes from the gear case. Fasten the travel stop indicator (key 58) to the sleeve with the two machine screws (key 28).
8. Install the key (key 47) on the adjusting flange (key 36). Coat the adjusting flange threads with anti-seize lubricant (key 244). Install the adjusting flange so that the key engages the slot in the lower sleeve. Secure adjusting flange with cap screws (key 64).
9. Adjust set screws (key 40) to eliminate free play in the bearings.

Note

Over-tightening the set screws will make handwheel operation difficult.

10. Install the adjusting screw and thrust bearings (keys 12 and 35). Pack bearings with lithium grease lubricant (key 241), and install as shown in figure 7.
11. Slide the spring case (key 29) into position, and secure with cap screws (key 62).
12. Complete steps 3 through 8 of the size 80 actuator assembly section.

Size 80 Hydraulic Snubber

The size 80 657 is available with a hydraulic snubber, as shown in figure 7, to dampen vertical instability of actuator stem movement. The snubber is adjusted by rotating the adjusting screws (key 83, figure 7) counterclockwise out of the reservoir (key 79, figure 7) to increase damping action and clockwise to decrease damping action. The adjusting screw on the right (the lower of the two adjusting screws in section B-B of figure 7) regulates downward damping action, and the screw on the left regulates upward damping action.

Size 80 Top-Mounted Handwheel (Adjustable Up Travel Stop)

CAUTION

If repeated or daily manual operation is expected, and the actuator is equipped with a casing-mounted travel stop or top-mounted handwheel, the diaphragm could be subject to excessive wear.

The actuator should be equipped with a side-mounted handwheel, which is designed for more frequent use as a manual operator.

A top-mounted handwheel assembly is normally used as an adjustable-up travel stop to limit full retraction of the actuator stem. Turning the handwheel clockwise turns the handwheel stem (key 133, figure 6) into the diaphragm casing and forces the pressure block assembly (key 179, figure 6) against the diaphragm and diaphragm plate. Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Key numbers refer to figure 4 for actuator parts and figure 6 for handwheel parts.

Disassembly

1. Bypass the control valve. Reduce the loading pressure to atmospheric, and remove the tubing or piping from the diaphragm casing (key 1).

⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1) away from the actuator, relieve spring compression (step 2, below), and carefully remove casing cap screws (key 141) (step 3, below).

2. Remove cover band (key 60). Insert a rod of approximately 12.7 mm (1/2-inch) diameter into a hole in the adjusting screw (key 12), and rotate the adjusting screw from right to left until spring compression is relieved. Rotate handwheel to be sure it is not compressing actuator spring.
3. Unscrew cap screws (key 141), and remove handwheel assembly.
4. Remove hex nut (key 54), and lift off the handwheel.
5. Unscrew support screws (key 182), and remove pressure block, stem, stem collar, and thrust bearing (keys 179, 133, 183, and 175).
6. Unscrew body nut (key 186), and remove gland (key 180). If necessary, remove and replace packing rings (key 181).

Assembly

1. Install new packing rings and gland (keys 181 and 180), and thread the body nut (key 186) onto the body.
2. Lubricate the thrust bearing and stem (keys 175 and 133), with lithium grease lubricant (key 241). Slide stem, stem collar, thrust bearing, and pressure block (keys 133, 183, 175, and 179) into the body as shown in figure 6 and install support screws (key 182).
3. Install handwheel and hex nut (keys 51 and 54).
4. Install a new handwheel gasket (key 185).
5. Mount the handwheel assembly on the diaphragm casing, and secure with cap screws (key 141).
6. Reconnect pressure tubing or piping to actuator casing.

Size 100 Top-Mounted Handwheel (Adjustable Up Travel Stop)

A top-mounted handwheel assembly is normally used as an adjustable-up travel stop to limit full retraction of the actuator stem. Clockwise rotation of the handwheel (key 51) moves the actuator stem (key 10) downward, compressing the spring (key 6). Spring action returns the stem as the handwheel is turned counterclockwise. Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Key numbers refer to figure 5 for actuator parts and figure 8 for handwheel parts.

Disassembly

1. Bypass the control valve. Reduce the loading pressure to atmospheric (refer to the Maintenance section), and remove the tubing or piping from the diaphragm casing.

⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1) away from the actuator, relieve spring compression (step 2, below), and carefully remove casing cap screws (key 124) (step 3, below).

2. Rotate handwheel counterclockwise, relieving all spring compression.
3. Unscrew cap screws (key 124), and remove gear case cover (key 123).
4. Loosen the set screws (key 41) in the front and back worm retainers (keys 48 and 49) and handwheel (key 51).
5. Remove retaining ring (key 118), and remove handwheel.
6. Remove front and back worm retainers (keys 48 and 49).
7. Remove worm shaft (key 45).
8. Pull the power screw assembly (key 122). The bearing and gear retainer, thrust bearing, and worm gear (keys 66, 67 and 44) will come out with the power screw.

Assembly

1. Pack the ball bearings (key 50) with lithium grease lubricant (key 241), and insert one ball bearing into the back worm retainer (key 49).
2. Thread the back worm retainer and ball bearing into the gear case. Align the slot in the worm retainer with the set screw hole in the gear case, insert set screw (key 41), and tighten.
3. Coat the worm shaft (key 45) threads with lithium grease lubricant, and slide the shaft into the gear case so that the end of the shaft fits snugly in the back worm retainer.
4. Insert the bearing into the front worm retainer (key 48), and thread the retainer and ball bearing into the gear case. Align the slot in the retainer with the hole in the gear case, insert the set screw (key 41), and tighten.
5. Slide the handwheel onto the worm shaft (key 45), and install retaining ring (key 118).
6. Pack the two thrust bearings (key 67) with lithium grease lubricant. Install one thrust bearing, then the worm gear (key 44), followed by the second thrust bearing and the bearing and gear retainer (key 66).
7. Coat the power screw threads (key 122) with lithium grease lubricant. Slide the power screw into the thrust bearing (key 67), turn the handwheel, and feed the sleeve through the worm gear.
8. Adjust set screws (key 40) to eliminate free play in the bearings.

Note

Over-tightening the set screws will make handwheel operation difficult.

9. Install gear case cover (key 123), and tighten cap screws (key 124).

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always refer to this number when corresponding with your [Emerson sales office](#) or Local Business Partner regarding replacement parts or technical information.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

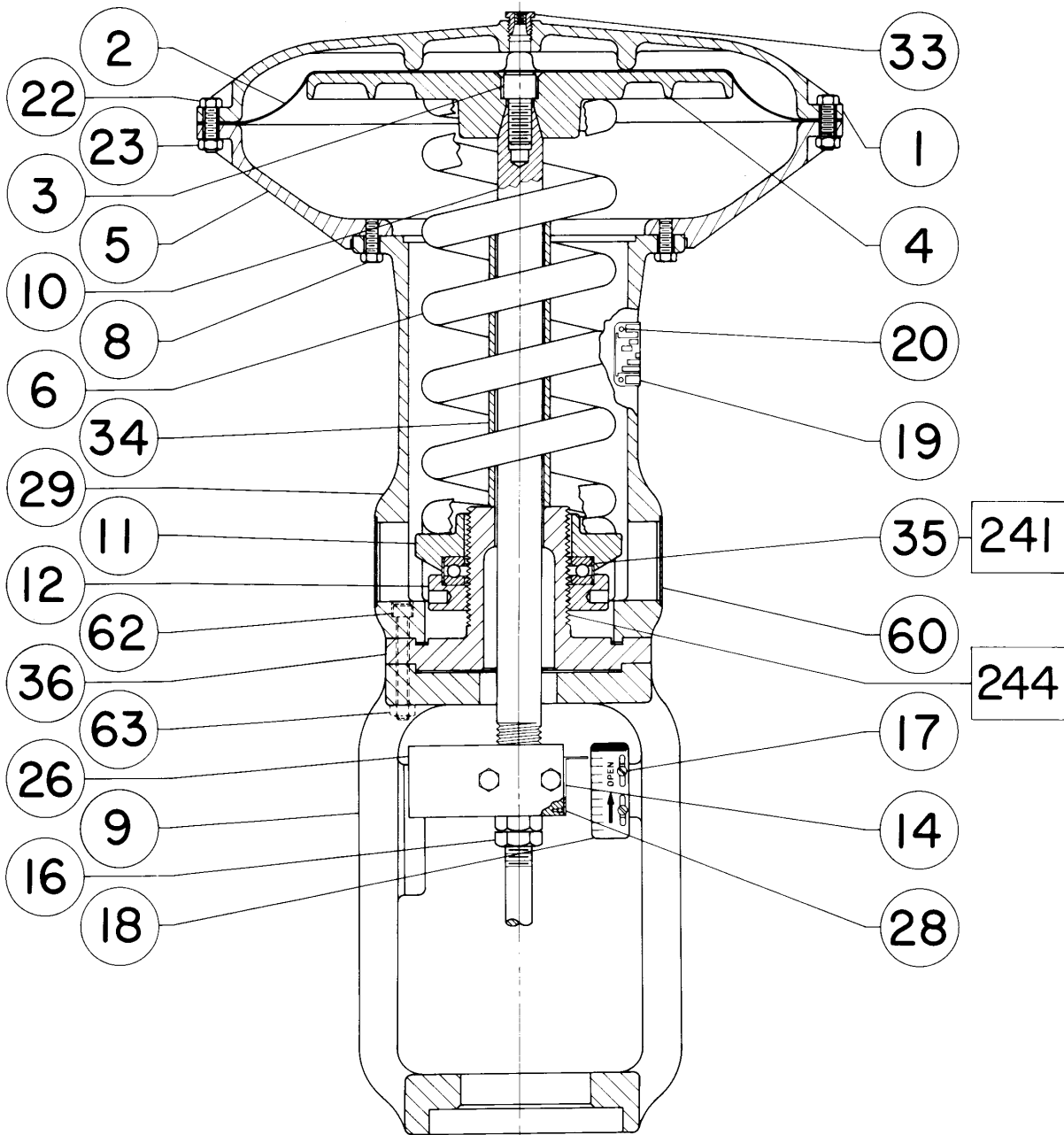
Note

Contact your [Emerson sales office](#) or Local Business Partner for Part Ordering information.

657 Sizes 80 & 100

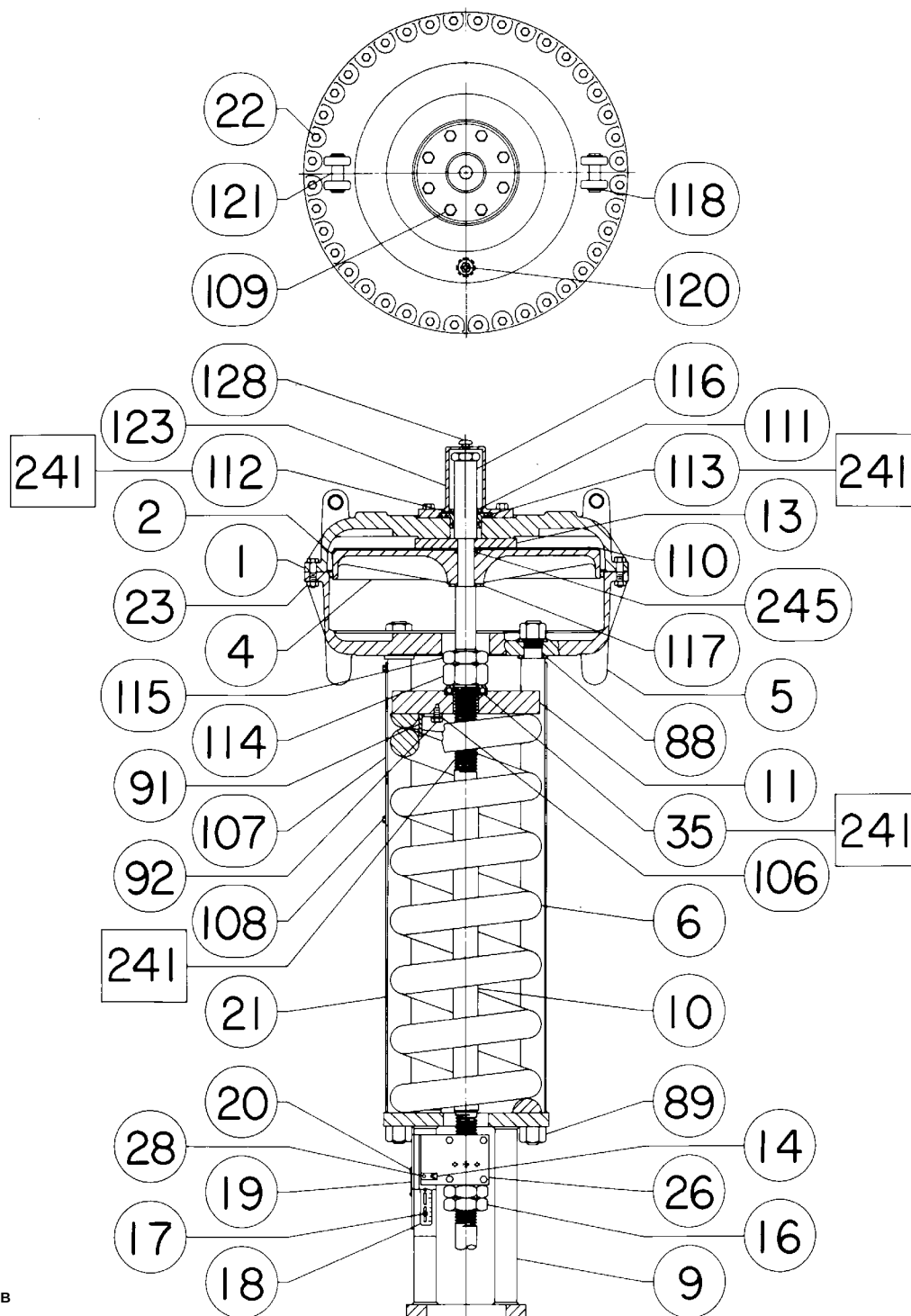
Key	Description	Key	Description
1	Upper Diaphragm Casing	20	Drive Screw
2*	Diaphragm	21	Actuator Tie Rod
	Size 80	22	Cap Screw
	Nitrile	23	Hex Nut
	Silicone	26	Stem Connector Ass'y
	Size 100, nitrile & TPES (thermoplastic polyester)	28	Cap Screw
3	Cap Screw	29	Spring Case
4	Diaphragm Plate	33	Pipe Bushing
5	Lower Diaphragm Casing	34	Upper Sleeve
5	Lower Diaphragm Casing, Yoke, &	35	Thrust Bearing
	Tie Rod Ass'y	36	Adjusting Flange
6	Spring	60	Cover Band Ass'y
8	Cap Screw	62	Cap Screw
9	Yoke	63	Hex Nut
10	Actuator Stem	88	Tie Rod Washer
11	Spring Seat	89	Hex Nut
12	Adjusting Screw	91	Spring Guide
13	Backup Plate	92	Cap Screw
14	Travel Indicator	106	Washer
16	Hex Jam Nut	107	Shroud Plate
17	Machine Screw	108	Self-tapping screw
18	Travel Indicator Scale	109	Cap Screw
19	Nameplate	110	Diaphragm Retainer
		111*	Seal Bushing, brass
			Size 100
		112*	O-Ring, nitrile (2 req'd) Size 100
		113*	O-Ring, nitrile Size 100
		114	Hex Nut
		115	Hex Jam Nut
		116	Actuator Stem Extension
		117	Washer
		118	Retaining Ring
		120	Hex Bushing
		121	Lifting Pin
		123	Diaphragm Casing Cover
		128	Vent Ass'y
		241	Lithium grease (not furnished with actuator)
		244	Anti-seize lubricant (not furnished with actuator)
		245*	O-Ring, nitrile Size 100 only

Figure 4. Size 80 Fisher 657 Actuator



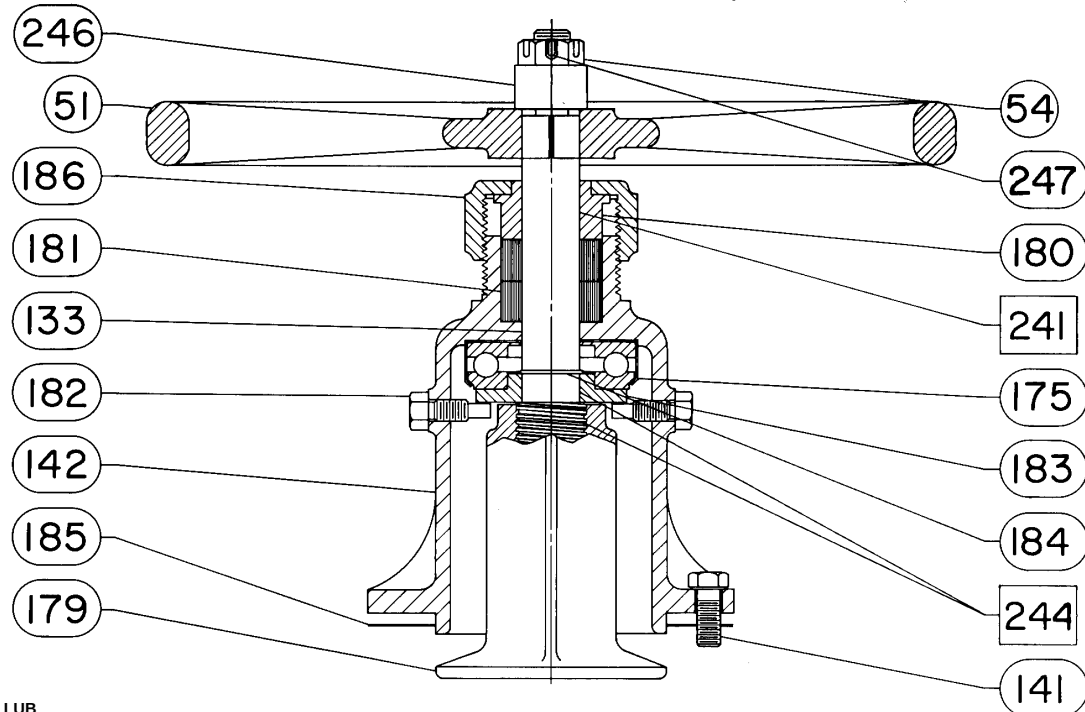
□ APPLY LUB
40A8771-B

Figure 5. Size 100 Fisher 657 Actuator



□ APPLY LUB
50A2621-F

Figure 6. Top-Mounted Handwheel for Size 80 Actuator



□ APPLY LUB
CV8009-E

Size 80 Side-Mtd Handwheel

Key	Description
7	Travel Stop
17	Machine Screw
28	Machine Screw
40	Set Screw
41	Set Screw
44	Worm Gear
45	Worm Shaft
46	Lower Sleeve
47	Key
48	Front Worm Retainer
49	Back Worm Retainer
50	Ball Bearing
51	Handwheel
52	Handgrip
53	Handgrip Bolt
54	Handwheel Cap
55	Ball
56	Spring
58	Travel Indicator
61	Grease Fitting
64	Cap Screw
65	Gear Case
66	Bearing & Gear Retainer
67	Thrust Bearing
68	Cap Screw
69	Indicator Scale
70	Stop Indicator Bracket
71	Machine Screw
243	Pliable sealant (not furnished with actuator)

Size 80 Top-Mtd Handwheel (Adjustable Up Travel Stop)

51	Handwheel
54	Nut
133	Stem
141	Cap Screw
142	Handwheel Body
175	Thrust Bearing
179	Pressure Block
180	Gland
181*	Packing Ring, TFE-graphite (2 req'd)
182	Support Screw
183	Stem Collar
184	Retaining Ring
185*	Gasket, composition
186	Body Nut
241	Lithium grease (not furnished with actuator)
246	Spacer
247	Cotter Pin

Size 100 Top-Mtd Handwheel (Adjustable Up Travel Stop)

Key	Description
17	Machine Screw
40	Set Screw
41	Set Screw
44	Worm Gear
45	Worm Shaft
48	Front Worm Retainer
49	Back Worm Retainer
50	Ball Bearing
51	Handwheel
61	Grease Fitting
65	Gear Case
66	Bearing & Gear Retainer
67	Thrust Bearing
118	Retaining Ring
122	Power Screw Ass'y
123	Gear Case Cover
124	Cap Screw
125	Hex Jam Nut
126	Woodruff Key
127	Slot Cover

Size 80 Hydraulic Snubber

27	Piston/Piston Rod Ass'y
63	Hex Nut
72	Spring Case Adaptor
73	Cap Screw
74	Cylinder
75	Cylinder Head
76	Retaining Ring
77*	O-Ring, nitrile (2 req'd)
78*	Piston Ring, iron (2 req'd)
79	Reservoir
80*	O-Ring, nitrile
81	Cap Screw
82*	O-Ring, nitrile (2 req'd)
83	Valve Adj Screw
84	Jam Nut
85	Cap Screw
86	Pipe Plug
87	Pipe Plug
90	Upper Spring Seat
93	Hydraulic Fluid
94*	O-Ring, nitrile (2 req'd)
95	Orifice
96	Bypass & Check Valve Plug
97	Spring
98	E-Ring
99	Bushing
100	Flange
101	Packing Sleeve
102	Machine Screw
103*	Packing, nitrile (8 req'd)
104*	Packing, CR (chloroprene) & cotton (4 req'd)
105*	Packing Sleeve O-Ring, nitrile (2 req'd)

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657 Size 80 and 100 Actuators

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Figure 7. Size 80 Fisher 657 Actuator with Side-Mounted Handwheel and Hydraulic Snubber

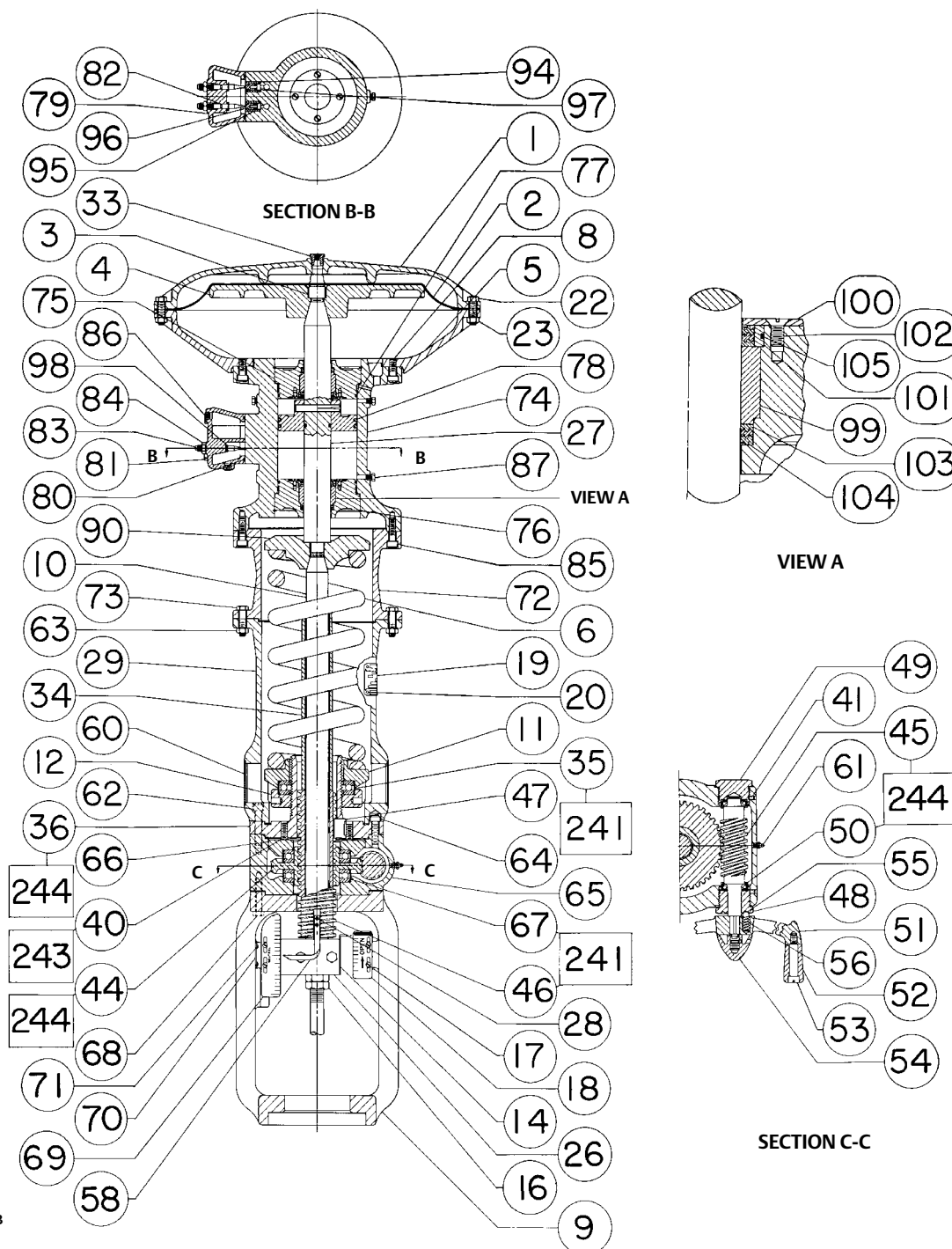
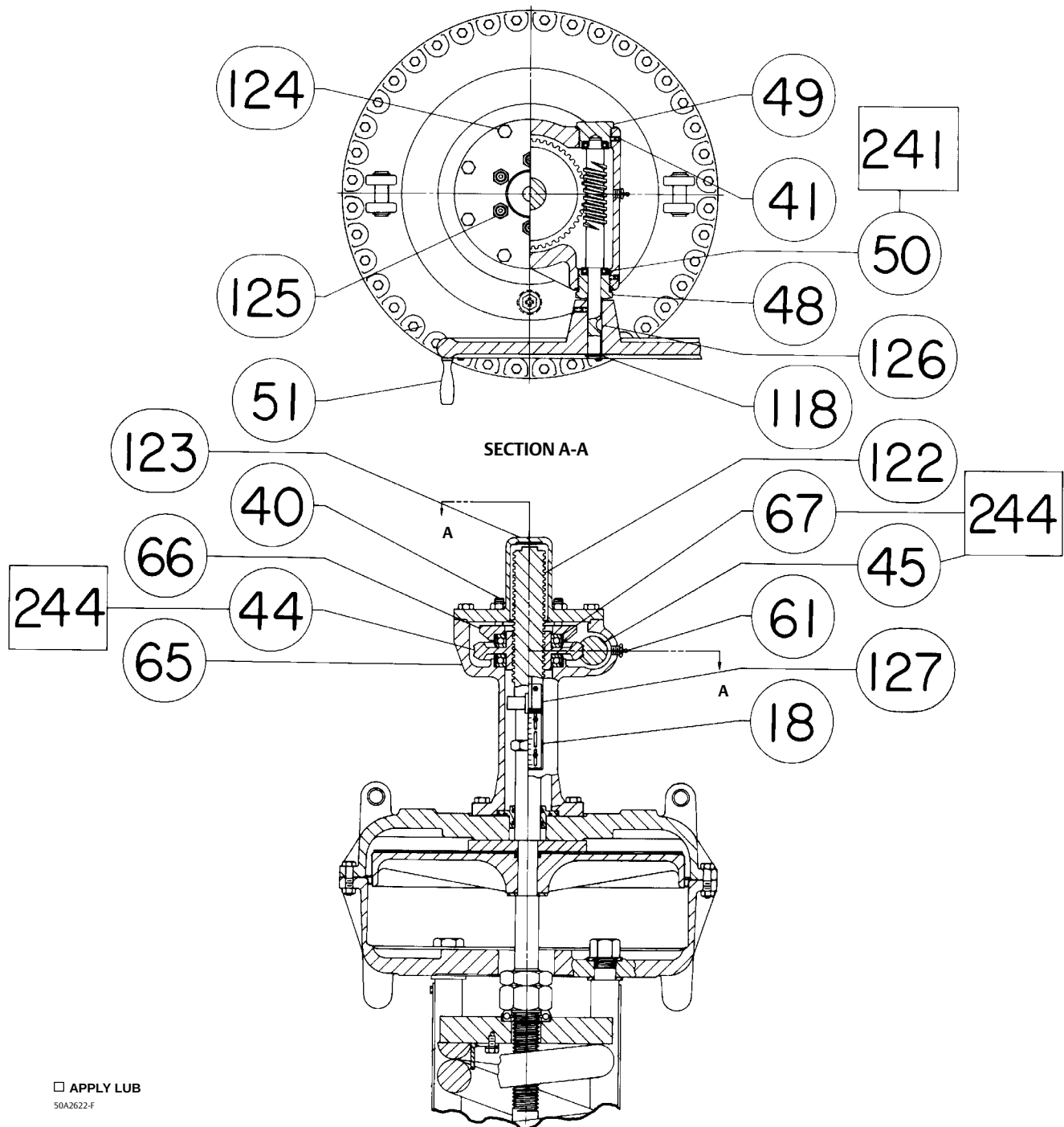


Figure 8. Top-Mounted Handwheel for Size 100 Actuator



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Fisher™ 657NS Diaphragm Actuators Size 40, 45, 70, and 80

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Introduction

Scope of Manual

This manual provides installation, maintenance, and parts list information for the Fisher 657NS actuator. Refer to separate instruction manuals for information regarding the control valve and accessories.



Do not install, operate, or maintain 657NS actuators without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The 657NS actuator is a direct-acting, spring-opposed diaphragm actuator used for operation of automatic control valves. The 657NS actuator yoke construction and special yoke-to-bonnet bolting provides a high structural resonant frequency that exceeds most nuclear service seismic requirements.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

657NS Actuator

June 2023

Instruction Manual

D102602X012

Table 1. Fisher 657NS Specifications

SPECIFICATION	ACTUATOR SIZE				
		40	45	70	80
Nominal Effective Area	cm ²	445	677	1419	see table 3
	Inch ²	69	105	220	see table 3
Yoke Boss Diameters	mm	71	71	90	5H
	Inch	2-13/16	2-13/16	3-9/16	5H
Acceptable Valve Stem Diameters	mm	12.7	12.7	19.1	25.4 & 31.8
	Inch	1/2	1/2	3/4	1 & 1-1/4
Maximum Allowable Output Thrust ⁽¹⁾	N	12,015	23,352	42,720	88,110
	Lb	2700	5250	9600	19,800
Maximum Travel	mm	38	51	76	76
	Inch	1.5	2	3	3
Maximum Casing Pressure for Actuator Sizing ⁽³⁾	Bar	4.5	3.4	3.8	4.9
	Psig	65	50	55	70
Maximum Diaphragm Casing Pressure ^(2, 3)	Bar	5.2	4.1	4.5	5.5
	Psig	75	60	65	80
Material Temperature Capabilities ⁽³⁾	-40 to 82°C (-40 to 180°F) with nitrile diaphragm				

1. Do not exceed maximum allowable valve stem load when applying maximum allowable thrust.
2. Maximum allowable diaphragm casing pressure may be used only when maximum allowable stem forces are not exceeded.
3. The pressure and temperature limitations in this manual, and any applicable code limitation, should not be exceeded.

Table 2. Diaphragm Casing Volumes, cm³ (Inch³)

ACTUATOR SIZE	CLEARANCE VOLUME, cm ³ (INCH ³)	TRAVEL, mm (INCH)						
		11 (0.4375)	16 (0.625)	19 (0.75)	29 (1.125)	38 (1.5)	51 (2)	76 (3)
40	934 (57)	1475 (90)	1704 (104)	1852 (113)	2327 (142)	2786 (170)	---	---
45	1556 (95)	---	2786 (170)	2999 (183)	3720 (227)	4424 (270)	5408 (330)	---
70	3490 (213)	5244 (320)	5948 (363)	6424 (392)	7833 (478)	9242 (564)	11,110 (678)	14,879 (908)
80	4818 (294)	---	---	---	10,488 (640)	12,454 (760)	14,863 (907)	19,337 (1180)

Table 3. Size 80 Diaphragm Area

TRAVEL	TRAVEL	AREA	
mm	Inch	cm ²	Inch ²
0	0	2039	316
19	0.75	1903	295
29	1.125	1865	289
38	1.5	1845	286
51	2	1832	284
64	2.5	1800	279
76	3	1761	273

Table 4. Actuator Stem Assembly Bolt Torque Values

ACTUATOR SIZE	TORQUE	
	N•m	Lbf•Ft
40	108	80
45	271	200
70	271	200
80	542	400

Table 5. Bonnet-to-Actuator Bolt Torque Values

ACTUATOR SIZE	BONNET-ACTUATOR STUD BOLT TORQUE	
	N•m	Lbf•Ft
40	102	75
45	102	75
70	176	130
80	292	215

Specifications

Tables 1, 2, and 3 provide specifications for the various sizes of 657NS actuators discussed in this instruction manual. Specific actuator information is found on the actuator yoke nameplate.

⚠ WARNING

To avoid personal injury or property damage, do not exceed pressure and temperature limits specified in table 1.

Educational Services

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Installation

The diaphragm actuator is normally shipped mounted on a valve body. Follow the valve body instructions when installing the control valve in the pipeline.

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

If the control valve and actuator are installed with the actuator in any position other than vertical, the actuator may not conform with safety-related qualifications. Nonvertical orientation should be part of existing qualification analysis on file at the plant site to ensure conformance with safety-related qualifications.

The control valve assembly normally may be installed in any orientation; however, the assembly must not be installed so that water can collect in the actuator yoke and lower diaphragm casing areas.

Note

The 657NS actuator will not mount on a standard valve bonnet; it requires a style NS bonnet having eight bonnet-to-yoke stud bolts.

If the actuator and control valve body are separate, mount the 657NS actuator on the valve body by following the procedures in the Actuator Mounting section of this manual.

Actuator Mounting

Direct-Acting (Push-Down-to-Close) Valves

See figure 1.

1. Screw the stem locknuts all the way onto the valve stem. Put the travel indicator disk, not used with the size 80 actuator, on the stem locknuts. The concave side of the disk should face the valve.
2. Push the valve stem down to close the valve.
3. Lift or hoist the actuator onto the valve bonnet.
4. Insert the cap screws and tighten the hex nuts (not shown), securing the actuator to the bonnet. Tighten the cap screws to the torque shown in table 5.
5. Thread the spring adjuster (see figure 1 for sizes 40 through 70 and key 12, figure 4 for size 80) until the actuator is at the full up position.
6. With the travel indicator scale attached to the actuator yoke, make a temporary mark on the actuator stem at a point parallel with the top mark on the travel indicator scale. This is the fully open position.
7. Refer to the actuator nameplate to determine the bench set pressure range of the actuator. Apply the lower bench set pressure to the actuator, and turn the spring adjuster until the actuator stem mark is even with the top mark on the travel indicator scale.
8. Apply the higher bench set pressure to the actuator. Verify that the mark on the actuator stem is even with the bottom mark on the travel indicator scale. This is the fully closed position. The distance from the top mark on the scale to the bottom mark is equal to the travel of the valve.

If the marks are in line, the actuator is properly bench set.

If the marks are not in line, the spring is not correct for the specified bench set. It is necessary to use a different spring or a different bench set.

⚠ WARNING

To avoid personal injury due to the sudden uncontrolled movement of parts, do not loosen the cap screws when the stem connector has spring or loading pressure force applied to it.

NOTICE

Incomplete engagement of the valve stem and/or actuator stem in the stem connector can result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than the diameter of that stem.

Note

Replacement stem connectors are an assembly of two stem connector halves, cap screws, and a spacer between the connector halves. Remove the spacer, if present, before clamping the stems together.

9. Push the valve stem firmly against its seat, and be sure that it remains firmly against the seat. Clamp the actuator stem and valve stem between the two stem connector halves. If necessary, increase loading pressure slightly to allow the valve stem, actuator stem, and stem connector threads to match.

Insert and tighten the stem connector cap screws.

10. Raise the travel indicator disk to the stem connector (for sizes 40 through 70). For all sizes, thread the stem locknuts against the stem connector.
11. Remove all loading pressure. Move the travel indicator scale so that the indicator disk (or pointer) is in line with the top mark of the travel indicator scale.
12. Check the valve travel to be sure that the valve travels fully with no overtravel.

Reverse-Acting (Push-Down-to-Open) Valves

See figure 1.

1. Screw the stem locknuts all the way onto the valve stem. Put the travel indicator disk (not used with the size 80 actuator) on the stem locknuts. The concave side of the disk should face the valve.
2. Push the valve stem down to open the valve.
3. Lift or hoist the actuator onto the valve bonnet.
4. Insert the cap screws and tighten the hex nuts (not shown), securing the actuator to the bonnet. Tighten the cap screws to the torque shown in table 5.
5. Apply actuator loading pressure until the actuator is at the full down position.
6. With the travel indicator scale attached to the actuator yoke, make a temporary mark on the actuator stem at a point parallel with the bottom mark on the travel indicator scale. This is the fully open position.
7. Refer to the actuator nameplate to determine the bench set pressure range of the actuator. Apply the lower bench set pressure to the actuator. Turn the spring adjuster until the actuator stem mark is even with the top mark on the travel indicator scale.
8. Apply the higher bench set pressure to the actuator and verify that the mark on the actuator stem is even with the bottom mark on the travel indicator scale. This is the fully-open position. The distance from the top mark on the scale to the bottom mark is equal to the travel of the valve.

If the marks are in line, the actuator is properly bench set.

If the marks are not in line, the spring is not correct for the specified bench set. It is necessary to use a different spring or a different bench set.

⚠ WARNING

To avoid personal injury due to the sudden uncontrolled movement of parts, do not loosen the cap screws when the stem connector has spring or loading pressure force applied to it.

NOTICE

Incomplete engagement of the valve stem and/or actuator stem in the stem connector can result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than the diameter of that stem.

Note

Replacement stem connectors are an assembly of two stem connector halves, cap screws, and a spacer between the connector halves. Remove the spacer, if present, before clamping the stems together.

9. Reduce loading pressure until the temporary mark on the actuator stem is parallel with the top mark on the indicator scale.
10. Pull the valve stem firmly against its seat, and be sure that it remains firmly against the seat. Clamp the actuator stem and valve stem between the two stem connector halves. If necessary, increase loading pressure slightly to allow the valve stem, actuator stem, and stem connector threads to match.

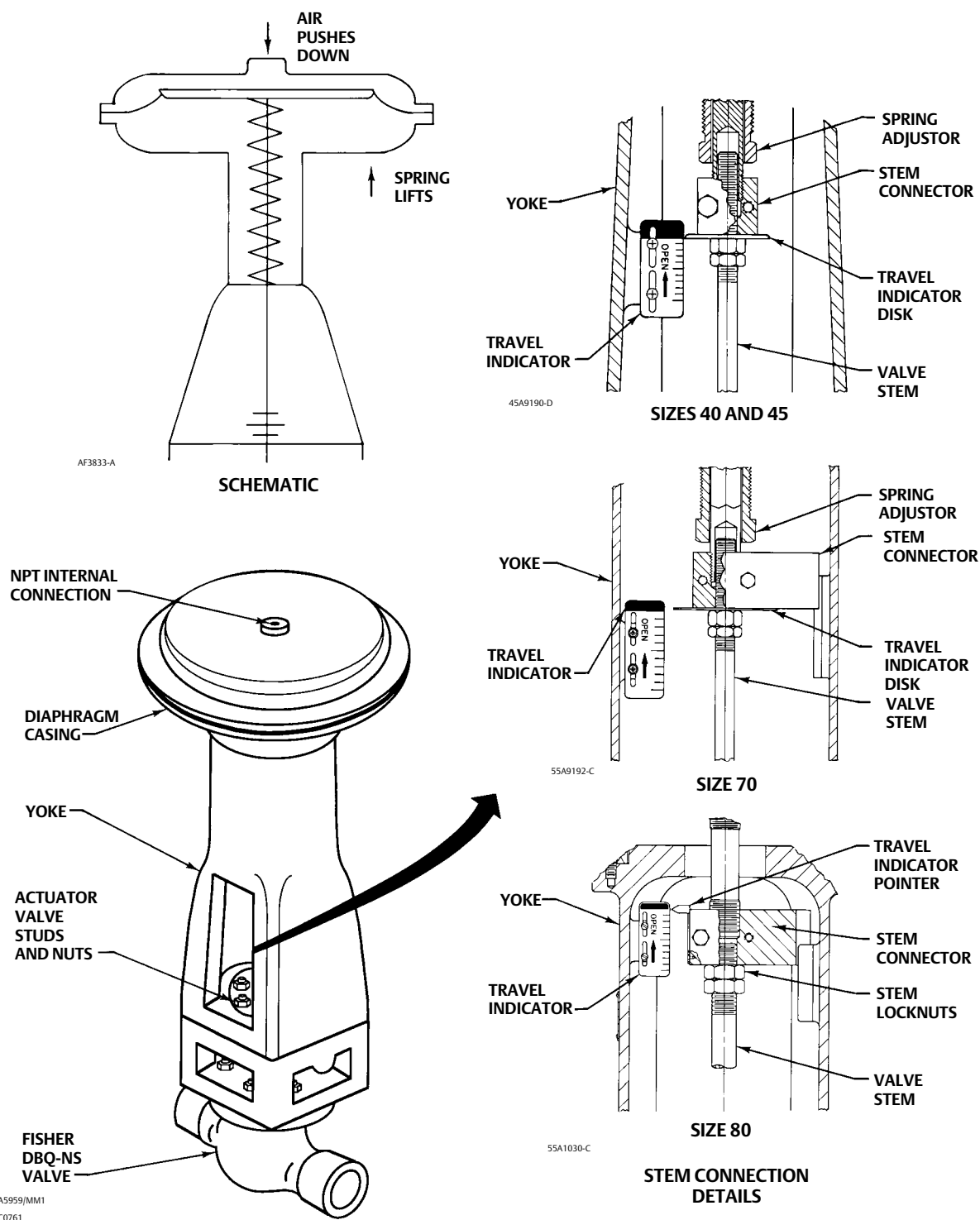
Insert and tighten the stem connector cap screws.

11. Raise the travel indicator disk to the stem connector (sizes 40 through 70 only). For all sizes, thread the stem locknuts against the stem connector.
12. Remove all loading pressure. Move the travel indicator scale so that the indicator disk (or pointer) is in line with the top mark of the travel indicator scale.
13. Check the valve travel to be sure that the valve travels fully with no overtravel.

Loading Connection

1. Connect the loading pressure piping to the NPT internal connection in the top of the actuator yoke.
2. For size 70 actuators, remove the 1/4-inch bushing in the 1/2 NPT internal connection to increase connection size, if necessary. The connection can be made with either piping or tubing.
3. Keep the length of tubing or piping as short as possible to avoid transmission lag in the control signal. If a volume booster, valve positioner or other accessory is used, be sure that it is properly connected to the actuator. Refer to the positioner instruction manual as necessary.
4. Cycle the actuator several times to check that the valve stem travel is correct and that the travel occurs when the correct pressure range is applied to the diaphragm.
5. If valve stem travel is incorrect, refer to the Travel procedure in the Adjustments section.
6. If the pressure range is incorrect, refer to the Spring procedure in the Adjustments section.

Figure 1. Schematic and Stem Connection Details for Fisher 657NS



Adjustments

Travel

⚠ WARNING

When moving the actuator stem with diaphragm loading pressure, use caution to keep hands and tools out of the actuator stem travel path. Personal injury and/or property damage is possible if something is caught between the actuator stem and other control valve assembly parts.

Make travel adjustments when the motion observed during actuator travel is different from the travel stamped on the actuator nameplate. If the Actuator Mounting procedure was followed correctly, this adjustment should not be necessary.

When adjusting travel of a reverse-acting (push-down-to-open) valve, apply sufficient loading pressure to move the valve plug off of the seat. This procedure reduces the chance of damaging the valve plug or seat during adjustments.

1. Back the stem locknuts and travel indicator disk away from the stem connector, and slightly loosen the stem connector cap screws.

NOTICE

Do not use wrenches or other tools directly on the valve stem. Damage to the stem surface and subsequent damage to the valve packing might result.

2. Tighten the locknuts together using a wrench, then screw the valve stem either into the stem connector to lengthen travel or out of the stem connector to shorten travel.
3. Cycle the actuator to check the travel. If actual travel is not equal to the specified travel, adjust and check travel until correct. Tighten the stem connector cap screws when correct travel is obtained.
4. Raise the travel indicator disk by threading the stem locknuts against the stem connector.

Spring

Bench Set

The bench set pressure range is used to adjust the initial compression of the actuator spring with the actuator assembly “on the bench”. The correct initial compression ensures that the valve-actuator assembly will function properly when it is put in service and the proper actuator diaphragm operating pressure is applied.

The bench set range is established with the assumption that there is no packing friction. When attempting to adjust the spring in the field, it is very difficult to ensure that there is no friction being applied by “loose” packing.

Accurate adjustment to the bench set range can be made during the actuator mounting process (see the Actuator Mounting procedure) by making the adjustment before the actuator is connected to the valve.

If you are adjusting to the bench set range after the actuator is connected to the valve and the packing tightened, you must take friction into account. Make the spring adjustment such that full actuator travel occurs at the bench set range (a) plus the friction force divided by the effective diaphragm area with increasing diaphragm pressure or (b) minus the friction force divided by the effective diaphragm area with decreasing diaphragm pressure.

For an assembled valve-actuator assembly, determine valve friction as described below:

1. Install a pressure gauge in the supply pressure line that connects to the actuator diaphragm casing.
2. Increase the actuator diaphragm pressure. Record the diaphragm pressure as the actuator reaches its mid-travel position.
3. Increase the actuator diaphragm pressure until the actuator is at a travel position greater than its mid-travel position.
4. Decrease the actuator diaphragm pressure. Record the diaphragm pressure as the actuator reaches its mid-travel position.

The difference between the two diaphragm pressure readings is the change in the diaphragm pressure required to overcome the friction forces in the two directions of travel.

5. Calculate the actual friction force:

$$\text{Friction Force, pounds} = 1/2 \left(\begin{array}{c} \text{Difference} \\ \text{in pressure} \\ \text{readings, psig} \end{array} \right) \times \left(\begin{array}{c} \text{Effective} \\ \text{diaphragm area,} \\ \text{inches}^2 \end{array} \right)$$

Refer to table 1 and 3 for the effective diaphragm area.

When determining valve friction, you can make diaphragm pressure readings at a travel position other than mid-travel if you desire. If you take readings at the zero or at the full travel position, ensure that the readings are taken when the travel just begins or just stops at the position selected.

The spring adjustor is difficult to rotate. Release the loading pressure before adjusting, then re-apply loading pressure to check the adjustment.

Bench Set Adjustments

1. Monitor loading pressure carefully when making adjustments. Do not exceed the maximum pressure specifications of either the loading regulator or the actuator casings (refer to table 1 for Maximum Diaphragm Casing Pressure).
2. Each actuator spring has a fixed pressure span. Changing the spring compression shifts the span up or down to make valve travel coincide with the loading pressure range.
3. For sizes 40 through 70, turn the spring adjustor (key 12, figure 2 or 3) into the yoke to shift the span up or turn the spring adjustor out of the yoke to shift the span down. For size 80, remove the spring case assembly (key 35, figure 4) by removing the cap screws (key 6, figure 4). Then rotate the spring adjustor (key 12, figure 4) to shift the span. Replace the spring case assembly and screws.

If the actuator has a side-mounted handwheel assembly, turn the handwheel clockwise to close the valve.

For successful operation, the actuator stem and valve plug stem must move freely in response to the loading pressure change on the diaphragm.

Operation

In a direct-acting diaphragm actuator, an increasing loading pressure causes the actuator stem to move downward, compressing the spring. When the diaphragm pressure is decreased, the spring moves the actuator stem upward. This

is shown graphically in figure 1. In the event of failure of the loading pressure to the diaphragm of the actuator, the actuator stem moves to the extreme upward position. Thus, by the proper selection of the valve plug action, either push-down-to-close or push-down-to-open, the control valve will either close or open on failure of the loading pressure.

The nameplate attached to the yoke of the actuator provides information about the specific construction and operating range. The spring and diaphragm have been selected to meet the requirements of the application, and in service, the actuator should create full travel of the valve plug when the diaphragm pressure (operate) range indicated on the nameplate is applied. This diaphragm pressure range is generally 0.2 to 1.0 bar or 0.4 to 2.0 bar (3 to 15 psi or 6 to 30 psi).

Pressure in the valve body creates a force on the valve plug that has a direct effect on the actual operating diaphragm pressure range. In some instances, the valve may not stroke completely over the indicated range because the pressure conditions in the body are different from those for which the control valve has been set at the factory. A simple spring adjustment, however, may be all that is required to obtain correct travel for the diaphragm pressure range utilized. Note that the actuator spring has a fixed pressure span and that adjustment of the spring compression merely shifts this span up or down to make valve travel coincide with the diaphragm pressure range.

The nameplate specifies a bench set pressure range in addition to a diaphragm pressure (operate) range. The bench set range is that pressure range required to stroke the valve fully without any pressure in the body, as would be the case if the valve were set on the work bench. However, in service, with the specified pressure drop applied across the valve, it should stroke over the diaphragm pressure (operate) range indicated on the nameplate.

When the control valve and actuator are installed, the actuator should be checked for correct travel, freedom from excessive friction, and correct action (air-to-open or air-to-close) to match the controlling instrument. For successful operation, the actuator stem and the valve plug stem must move freely in response to the loading pressure change on the diaphragm.

Maintenance

Normally, only the elastomeric parts and the spring of the 657NS actuator require inspection or replacement. The maintenance instructions are divided into three subsections: Replacement of the Elastomeric Parts, Disassembly, and Assembly. Perform only those steps applicable to the actuator size and required maintenance.

All maintenance operations can be performed with the valve in the line.

It is recommended that the diaphragm and all of the other elastomeric parts of the 657NS actuator be inspected every two years. The absolute maximum replacement period for any of the elastomeric parts is four years.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.

- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Replacement of the Elastomeric Parts

Size 40, 45, and 70 Actuators

Perform the following if it is desired to replace only the elastomeric parts of the 657NS actuator, and no other maintenance is necessary. The diaphragm is the only elastomeric part in the size 40, 45, and 70 actuators. Key number references are shown in figure 2 for size 40 and 45 actuators and in figure 3 for size 70 actuators.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Reduce the actuator loading pressure to atmospheric pressure, and remove the tubing or piping from the top of the upper diaphragm casing (key 1).
2. Remove the diaphragm casing cap screws and nuts (keys 22 and 23), and lift off the upper diaphragm casing.
3. Take out the diaphragm (key 2), and install a new one.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing cap screws are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 40, 45, and 70 actuators.

NOTICE

Overtightening the diaphragm casing cap screws and nuts (keys 22 and 23) can damage the diaphragm. Do not exceed a torque of 27 N•m (20 lbf•ft) when performing this tightening procedure.

Note

Do not use lubricant on these cap screws and nuts. Fasteners must be clean and dry.

4. Place the upper diaphragm casing (key 1) into position, and replace the diaphragm casing cap screws and nuts (keys 22 and 23). Tighten the hex nuts (key 23) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to 13 N•m (10 lbf•ft).
5. Tighten the remaining hex nuts in a clockwise, crisscross pattern to 13 N•m (10 lbf•ft).
6. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
7. Tighten the remaining hex nuts in a clockwise, crisscross pattern to 27 N•m (20 lbf•ft).

8. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
9. Once completed, no more tightening is recommended.
10. Replace the tubing or piping to the top of the upper diaphragm casing.

Size 80 Actuators

The elastomeric parts in a size 80 actuator include the diaphragm and O-rings. Since replacement of these parts necessitates complete disassembly, perform the steps outlined in Size 80 Actuators, disassembly and assembly procedures.

Disassembly

Size 40, 45, and 70 Actuators

Key number references are shown in figure 2 for size 40 and 45 actuators and in figure 3 for size 70 actuators.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Reduce the actuator loading pressure to atmospheric pressure, and remove the tubing or piping from the top of the upper diaphragm casing (key 1).
2. To aid in assembly, record the position of the spring adjusting screw (key 12) relative to the actuator yoke (key 9). Loosen the spring adjusting screw locking set screw (key 67), and thread the adjusting screw out of the yoke until all spring compression is relieved.
3. If necessary, remove the actuator from the valve body by separating the stem connector (key 26) and removing the eight bonnet stud bolt nuts. Separate the stem connector by loosening the stem hex nuts (keys 15 and 16) and unscrewing the two cap screws.
4. Remove the diaphragm casing cap screws and nuts (keys 22 and 23), and lift off the upper diaphragm casing (key 1).
5. Take out the molded diaphragm (key 2).
6. The diaphragm plate and actuator stem (keys 4 and 10) can be taken out of the yoke as an assembly. This assembly can be further disassembled, if desired, by removing the cap screw (key 3).
7. Take out the actuator spring (key 6) and the lower spring seat (key 11).
8. The lower diaphragm casing (key 5) can be removed from the yoke, if required, by removing the cap screws (key 8) that hold the lower diaphragm casing in place.
9. Unscrew the adjusting screw (key 12) from the yoke to complete the disassembly. Be careful not to lose the straight pin (key 89) since it could drop out of the yoke through the threaded adjusting screw hole.

Size 80 Actuators

Key number references are shown in figure 4.

1. Bypass the control valve. Reduce the actuator loading pressure to atmospheric pressure, and remove the piping or tubing from the upper diaphragm casing connection.
2. Loosen the hex nut (key 50), and back the adjustable travel stop (key 34) away from the diaphragm casings (keys 1 and 5).
3. Unbolt the cap screws (key 8), and remove the spring case assembly (key 35).
4. Measure and record how much of the actuator stem (key 10) extends past the spring adjusting screw (key 12). Using a hammer and a punch, loosen the spring adjusting screw locknut (key 91). Slip a 12.7 mm (1/2-inch)

diameter rod into a hole in the spring adjusting screw (key 12). Using the rod, turn the spring adjusting screw away from the diaphragm (key 2) to relieve all compression in the spring (key 6).

5. Loosen the hex nuts (key 16), and remove the stem connector cap screws and stem connector halves (key 26). If necessary, the actuator may be removed from the valve body by removing the valve bonnet stud bolt hex nuts.
6. Remove the spring adjusting screw (key 12), the spring seat guide (key 36), the lower spring seat (key 11), and the spring seat bearing and race (keys 41 and 42).
7. Remove the actuator spring (key 6) and the spring adjusting screw locknut (key 91).
8. Unbolt the diaphragm casing cap screws and hex nuts (keys 22 and 23), and lift the upper diaphragm casing (key 1) and attached casing flange (key 51) with seal bushing (key 46) straight up until clear of the actuator stem (key 10).
9. Remove the snap ring (key 47) and slide the seal bushing (key 46) out of the casing flange (key 51). Inspect the seal bushing for wear, and replace if necessary. Remove the seal bushing O-rings (keys 44 and 45). Separate the casing flange (key 51) from the upper diaphragm casing (key 1) by removing the cap screws (key 8). Remove the gasket (key 52) from the upper diaphragm casing (key 1).
10. Slide or lift the actuator stem (key 10) with the attached diaphragm plates and diaphragm (key 48, 4, and 1) out of the actuator.
11. To aid in unscrewing the hex nuts (key 49), attach the stem connector assembly (key 26) onto the actuator stem and grip the stem connector in a vise. This procedure will help secure the actuator stem and help prevent damage.
12. Unscrew the hex nuts (key 49), and slide them, the diaphragm plate (key 4), diaphragm (key 2), and upper diaphragm plate (key 48) off the actuator stem.
13. Remove the cap screws (key 8) that secure the lower diaphragm casing (key 5) to the actuator yoke (key 9), and remove the lower casing.

Assembly

Size 40, 45, and 70 Actuators

Key number references are shown in figure 2 for size 40 and 45 actuators and in figure 3 for size 70 actuators.

1. Apply lithium grease to the threads and spring seat bearing surface of the adjusting screw. Thread the adjusting screw (key 12) into the yoke (key 9).
2. Use the cap screws (key 8) to attach the lower diaphragm casing (key 5) to the yoke. Tighten the cap screws to 41 N•m (30 lbf•ft) for sizes 40 and 45 and 102 N•m (75 lbf•ft) for the size 70.
3. Insert the lower spring seat (key 11) and spring (key 6) into the yoke. Be sure the spring seat fits squarely on the adjusting screw and that the spring is properly seated in the spring seat.
4. Assemble the actuator stem (key 10) and the diaphragm plate (key 4) with the cap screw and washer (key 3 and 25). Tighten the cap screw in accordance with table 4. The size 40 actuator does not use a washer.
5. Insert the stem and diaphragm plate as an assembly, making sure that the stem fits inside the adjusting screw and that the spring fits squarely on the diaphragm plate.
6. Install a new diaphragm (key 2) if one is required. Otherwise, replace the molded diaphragm (key 2) onto the diaphragm plate so that the molded edge points outward toward the spring (see figures 2 and 3) and the word Fisher printed on the diaphragm is visible. Line up the holes in the diaphragm's edge with the diaphragm casing cap screw holes.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing cap screws are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 40, 45, and 70 actuators.

NOTICE

Overtightening the diaphragm casing cap screws and nuts (keys 22 and 23) can damage the diaphragm. Do not exceed a torque of 27 N•m (20 lbf•ft) when performing this tightening procedure.

Note

Do not use lubricant on these cap screws and nuts. Fasteners must be clean and dry.

7. Place the upper diaphragm casing (key 1) into position, and replace the diaphragm casing cap screws and nuts (keys 22 and 23). Tighten the hex nuts (key 23) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to 13 N•m (10 lbf•ft).
8. Tighten the remaining hex nuts in a clockwise, crisscross pattern to 13 N•m (10 lbf•ft).
9. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
10. Tighten the remaining hex nuts in a clockwise, crisscross pattern to 27 N•m (20 lbf•ft).
11. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
12. Once completed, no more tightening is recommended.
13. Thread the spring adjusting screw (key 12) into the yoke so that it is in the same position recorded during disassembly. Securely tighten the locking set screw (key 67).
14. Replace the tubing or piping to the top of the upper diaphragm casing. Mount the actuator, and make the stem connection by following the procedures in the Actuator Mounting section.

Size 80 Actuators

Key number references are shown in figure 4.

1. Place the lower diaphragm casing (key 5) on the actuator yoke (key 9), and secure them together with the cap screws (key 8). Torque the screws evenly to 102 N•m (75 lbf•ft) using a crisscross pattern.
2. Carefully slide the upper diaphragm plate (key 48), the diaphragm (key 2), and the diaphragm plate (key 4) onto the actuator stem (key 10). Thread the two hex nuts (key 49) lightly against the diaphragm plate. To aid in tightening the hex nuts (key 49), attach the stem connector assembly (key 26) onto the actuator stem, and grip the stem connector in a vise. Tighten the first hex nut (key 49) to approximately 542 N•m (400 lbf•ft) torque. Tighten the second hex nut securely against the first. Remove the actuator stem subassembly from the vise, and remove the stem connector assembly (key 26) from this subassembly.
3. Place the actuator stem and attached parts into the lower diaphragm casing (key 5). Prop the stem up so that the diaphragm plates are positioned as shown in figure 4.
4. Lubricate the O-rings (keys 44 and 45) and the inside diameter of the seal bushing (key 46) with either a high-temperature, radiation-resistant, polyphenyl ether grease or lithium grease, as appropriate for the installation. Place the seal bushing and O-rings in the casing flange (key 51), and secure the bushing with the snap ring (key 47). Place a new gasket (key 52) and then the casing flange (key 51) onto the upper diaphragm casing (key 1). Insert and tighten the cap screws (key 8) to 102 N•m (75 lbf•ft) torque to secure the parts.
5. Align the diaphragm cap screw holes with the lower diaphragm casing cap screw holes. Slide the upper diaphragm casing and casing flange (keys 1 and 51) over the actuator stem (key 10) and onto the lower diaphragm casing (key 5) so that all cap screw holes are aligned.

Table 6. Size 80 Casing Cap Screw Torque Values

DIAPHRAGM MATERIAL	INITIAL TORQUE	FINAL TORQUE
	N•m (lbf•ft)	N•m (lbf•ft)
EPDM / Meta-Aramid	41 (30)	82 ± 13 (60 ± 10)
Nitrile, Silicone, FKM/Meta-Aramid	34 (25)	68 (50)

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing cap screws are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 80 actuators.

NOTICE

Overtightening the diaphragm casing cap screws and nuts can damage the diaphragm. Do not exceed the following maximum torque values for the appropriate diaphragm material: EPDM/Meta-Aramid: 95 N•m (70 lbf•ft); Nitrile, Silicone, FKM (fluorocarbon) / Meta-Aramid: 68 N•m (50 lbf•ft).

Note

Do not use lubricant on these cap screws and nuts. Fasteners must be clean and dry.

- Fasten the two diaphragm casings together with the cap screws (key 22) and tighten the hex nuts (key 23) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to the initial torque value found in table 6 for the diaphragm material being used.
- Tighten the remaining hex nuts in a clockwise, crisscross pattern to the initial torque value found in table 6 for the diaphragm material being used.
- Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to the final torque value that is specified in table 6 for the diaphragm material being used.
- Tighten the remaining hex nuts in a clockwise, crisscross pattern to the final torque value that is specified in table 6 for the diaphragm material being used.
- After the last hex nut is tightened, complete another tightening sequence. Tighten in a circular pattern around the bolt circle to the final torque value that is specified in table 6 for the diaphragm material being used.
- Once completed, no more tightening is recommended.
- Thread the spring adjusting screw locknut (key 91) onto the actuator stem (key 10). Place the spring (key 6) on the casing flange (key 51).
- Assemble the spring seat and spring seat guide (keys 11 and 36). Place them on the actuator spring (key 6).
- Lubricate the spring seat race and bearings (keys 39 and 40) with lithium grease (key 53). Place them on the spring seat.
- Attach the stem connector (key 26) to the actuator stem so that the connector engages the antirotation guide on the actuator yoke. Thread the adjusting screw (key 12) onto the actuator stem until the actuator stem (key 10) extends above the adjusting screw the distance recorded in step 4 of the disassembly procedures for size 80 actuators. Securely tighten the spring adjusting screw locknut (key 91) against the spring adjusting screw (key 12).
- Connect piping or tubing to the pressure connection in the upper diaphragm casing (key 1). Pressure the actuator, and if necessary, readjust the spring compression with the adjusting screw (key 12) until the actuator fully strokes over the bench set pressure range stamped on the actuator nameplate. Remove the stem connector.

17. Lubricate the spring seat guide (key 36) and the appropriate area inside the spring case assembly (key 35) with either a high-temperature, radiation-resistant, polyphenyl ether grease or lithium grease (key 54), as appropriate for the installation.
18. Place the spring case assembly (key 35) on the upper diaphragm casing. Insert and tighten the cap screws (key 8) to 102 N•m (75 lbf•ft).
19. Thread the adjustable travel stop (key 34) into the spring case (key 35) so that the travel stop is approximately 3.2 mm (1/8-inch) from the actuator stem (key 10) when the stem is in the extreme upward position. Thread the hex locknut (key 50) against the spring case, and lock it securely against the spring case.
20. Mount the actuator, and make the stem connection by following the procedure in the Actuator Mounting section.

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always refer to this serial number when corresponding with your [Emerson sales office](#) regarding replacement parts or technical information.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Key	Description	Key	Description
1	Upper Diaphragm Casing, steel Std Size 40, 45, 70, and 80 W/top-mounted handwheel Size 40, 45, and 70	23	Hex Nut, pl steel Size 40 (16 req'd) Size 45 (20 req'd) Size 70 (28 req'd) Size 80 (36 req'd)
2*	Diaphragm, nitrile Std Size 40, 45, 70, and 80 W/adj travel stop Size 40, 45, and 70	24	Twin Speed Nut, stainless steel Size 70 only
3	Cap Screw, steel Size 40, 45, and 70	25	Washer, steel Size 45 and 70
4	Diaphragm Plate, steel Size 40, 45, 70, and 80	26	Stem Connector Assembly, stainless steel
5	Lower Diaphragm Casing, zn pl steel Size 40, 45, 70, and 80	28	Machine Screw, pl carbon steel (2 req'd) Size 80 only
6	Spring, steel	32	Washer, steel (2 req'd) Size 70 only
8	Cap Screw, steel Size 40 (6 req'd) Size 45 (8 req'd) Size 70 (12 req'd) Size 80 (36 req'd)	33	Pipe Bushing, pl steel Size 70 only
9	Yoke, steel Size 40, 45, 70, and 80		
10	Actuator Stem, pl steel Size 40, 45, and 70 Size 80	Note	
11	Lower Spring Seat, steel Size 40, 45, 70, and 80	Key numbers 34 through 52 are for size 80 only.	
12	Adjusting Screw, pl steel Size 40, 45, 70, and 80	34	Adjustable Travel Stop, steel
13	Lower Diaphragm Plate, steel Size 40, 45, and 70	35	Spring Case Assembly, steel
14	Indicator Disc, stainless steel Size 40, 45, 70, and 80	36	Spring Seat Guide, brass
15	Hex Nut, pl steel Size 40 and 70	37	Bearing Retainer, steel
16	Hex Nut, pl steel Size 40 Size 45 (2 req'd) Size 70 Size 80 (2 req'd)	38	Shoulder Screw, pl steel
17	Machine Screw, stainless steel (2 req'd) Size 40, 45, 70, and 80	39	Travel Stop Bearing, steel
18	Indicator Scale, stainless steel	40	Travel Stop Race, steel (2 req'd)
19	Nameplate, stainless steel	41	Spring Seat Bearing, steel
20	Drive Screw, stainless steel (4 req'd)	42	Spring Seat Race, steel (2 req'd)
22	Cap Screw, pl steel Size 40 (16 req'd) Size 45 (20 req'd) Size 70 (28 req'd) Size 80 (36 req'd)	43	Vent Assembly
		44*	O-Ring, fluoroelastomer (2 req'd)
		45*	O-Ring, fluoroelastomer
		46	Seal Bushing, brass
		47	Snap Ring, stainless steel
		48	Upper Diaphragm Plate, steel
		49	Hex Nut, steel (2 req'd)
		50	Hex Nut, steel
		51	Casing Flange, steel
		52*	Gasket, composition
		53	Lithium grease (not furnished with actuator)
		54	Lubricant (Size 80 only) (not furnished with actuator)
			Radiation Service
			High-temperature, radiation-resistant, polyphenyl ether grease
			Other Service
			Lithium grease
		67	Set Screw, carbon steel
		89	Straight Pin, brass Size 40, 45, and 70
		91	Locknut, pl steel (Size 80 only)
		242	Warning Nameplate

Figure 2. Size 40 or 45 Fisher 657NS Actuator

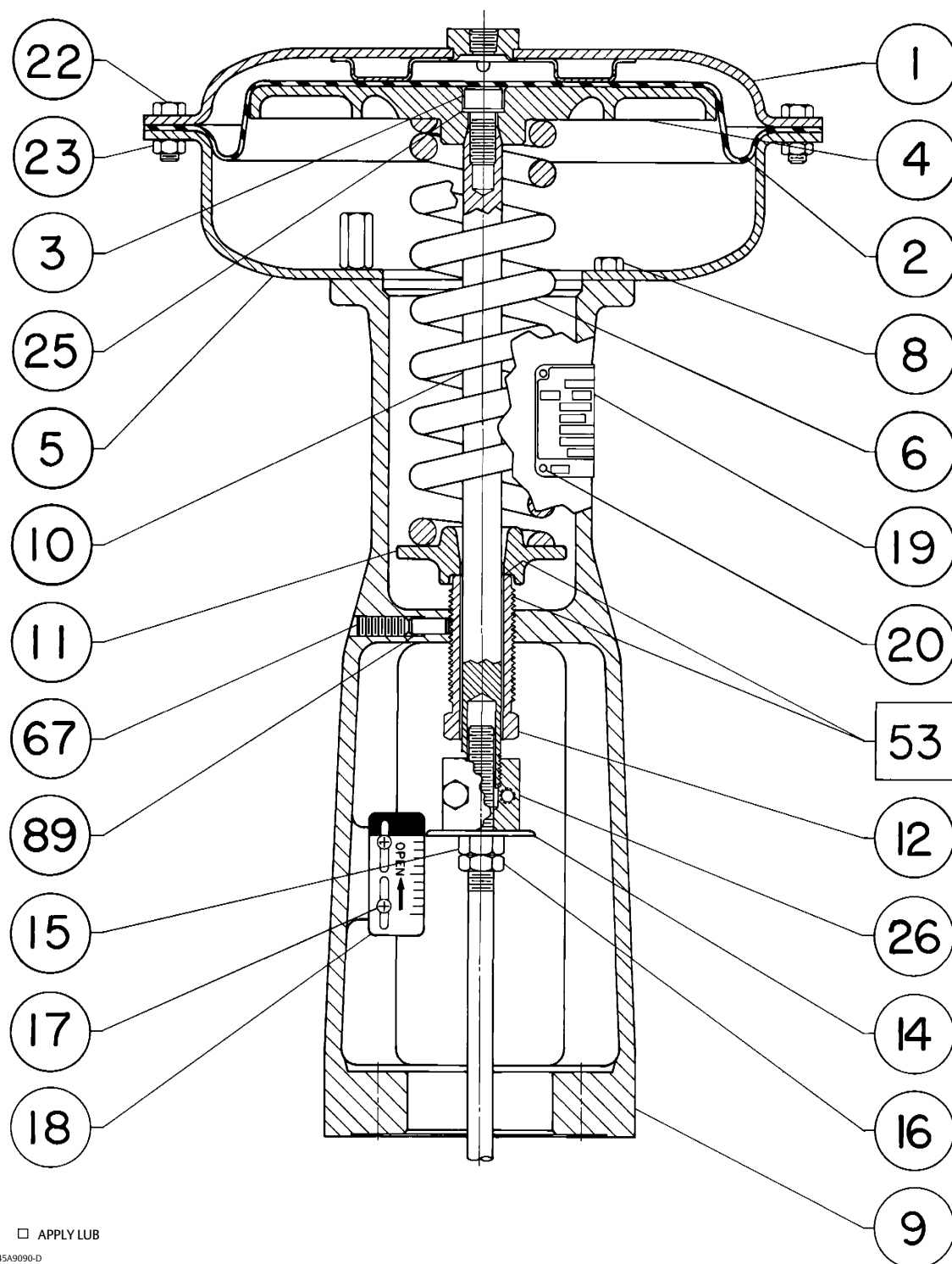
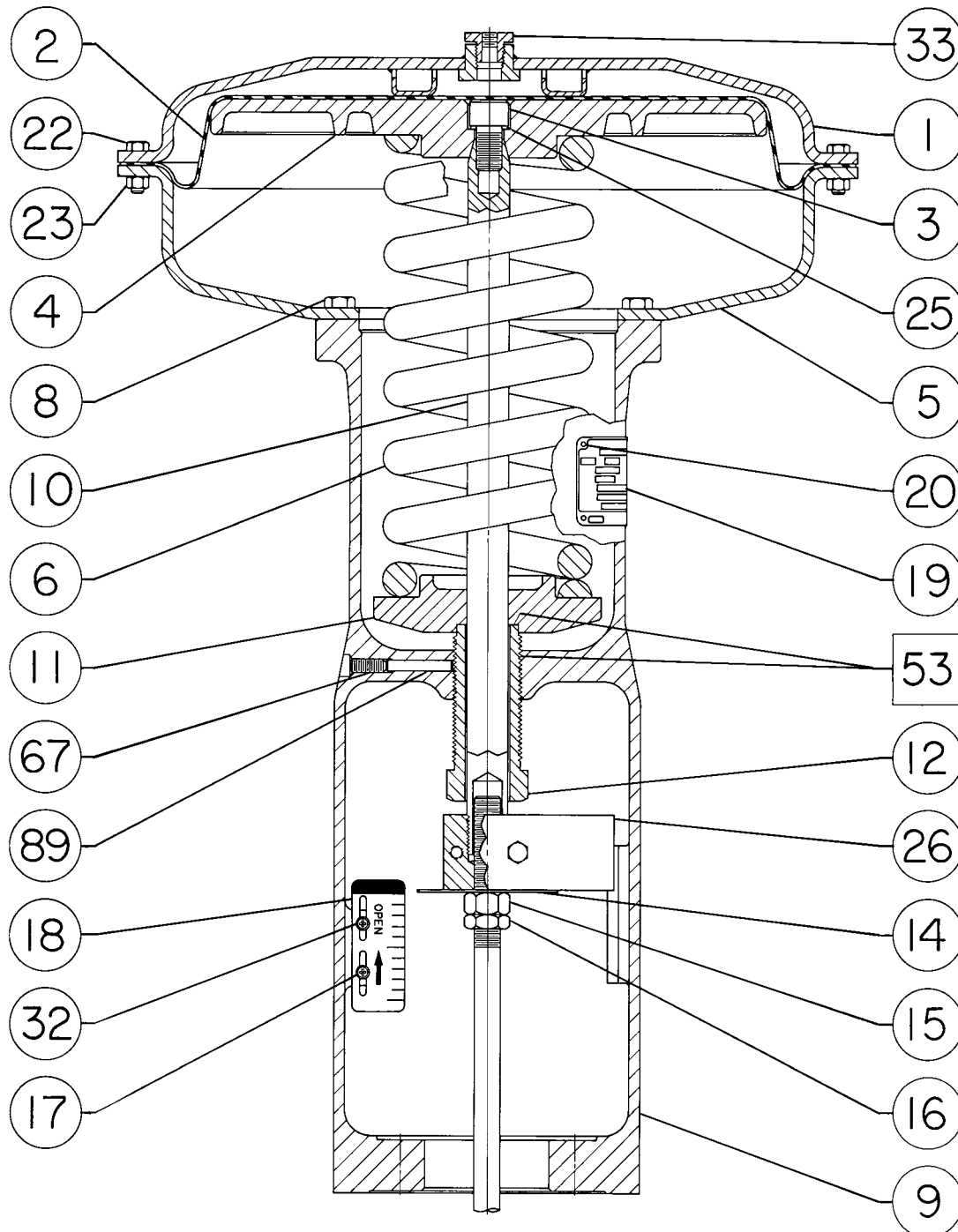
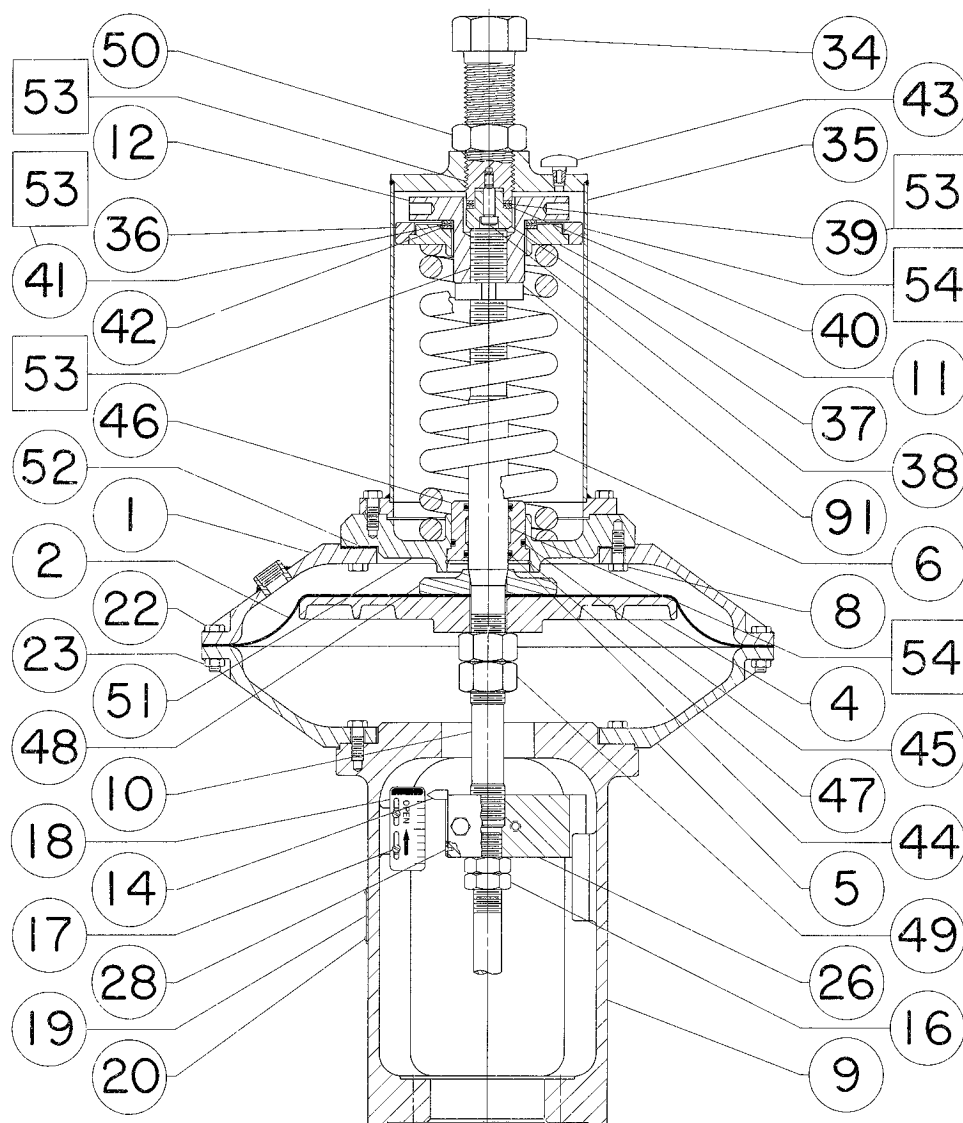


Figure 3. Size 70 Fisher 657NS Actuator



□ APPLY LUB
55A9192-C

Figure 4. Size 80 Fisher 657NS Actuator



□ APPLY LUB

56A1030-C

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EMERSON™

Fisher™ 667 Diaphragm Actuator Sizes 30/30i-76/76i and 87

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Figure 1. Fisher 667 Actuator Mounted on
easy-e™ Valve



X1182

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Introduction

Scope of Manual

This instruction manual provides information on installation, adjustment, maintenance, and parts ordering for the Fisher 667 actuator in sizes 30/30i through 76/76i and size 87. The 667-4 actuator in sizes 70/70i and 87 is also covered. Refer to separate instruction manuals for information about the valve positioner and other accessories used with these actuators.

Do not install, operate, or maintain a 667 actuator (see figure 1) without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

667 Actuator (Size 30/30i - 76/76i and 87)

May 2018

Instruction Manual

D100310X012

Table 1. Specifications

SPECIFICATION ⁽¹⁾		ACTUATOR SIZE									
		30/30i	34/34i	40/40i	45/45i	46/46i	50/50i	60/60i	70/70i ⁽¹⁾	76/76i	87 ⁽¹⁾
Nominal Effective Area	Sq cm	297	445	445	667	1006	677	1006	1419	1006	1419
	Sq Inch	46	69	69	105	156	105	156	220	156	220
Yoke Boss Diameter	mm	54	54	71	71	71	90	90	90	90	125
	Inch	2-1/8	2-1/8	2-13/16	2-13/16	2-13/16	3-9/16	3-9/16	3-9/16	3-9/16	5
Acceptable Valve Stem Diameter	mm	9.5	9.5	12.7	12.7	12.7	19.1	19.1	19.1	19.1	25.4
	Inch	3/8	3/8	1/2	1/2	1/2	3/4	3/4	3/4	3/4	1
Maximum Allowable Output Thrust ⁽⁴⁾	N	10230	10230	12010	25131	33582	25131	30246	39142	30246	39142
	LB	2300	2300	2700	5650	7550	5650	6800	8800	6800	8800
Maximum Travel ⁽²⁾	mm	19	29	38	51	51	51	51	76 ⁽³⁾	51	76 ⁽³⁾
	Inch	0.75	1.125	1.5	2	2	2	2	3 ⁽³⁾	2	3 ⁽³⁾
Maximum Casing Pressure for Actuator Sizing ^(4,6)	Bar	3.8	4.8	4.8	4.5	3.8	4.5	3.8	3.4	3.4	3.4
	Psig	55	70	70	65	55	65	55	50	50	50
Maximum Excess Diaphragm Pressure ^(4,5)	Bar	3.8	1.4	1.4	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Psig	55	20	20	10	10	10	10	10	10	10
Maximum Diaphragm Casing Pressure ^(4,6,7)	Bar	7.6	6.2	6.2	5.2	4.5	5.2	4.5	4.1	4.1	4.1
	Psig	110	90	90	75	65	75	65	60	60	60
Approximate Weight	Kg	15/17	22/26	23/26	41/44	55/59	43/48	55/60	115/118	86/89	118
	Pounds	34/37	48/58	50/56	90/98	121/129	94/105	122/133	254/260	190/196	260
Material Temperature Capabilities	Nitrile Elastomers	-40 to 82°C (-40 to 180°F)									
	Silicone Elastomers	-54 to 149°C (-65 to 300°F)									

1. These values also apply to the 667-4 actuator construction.
 2. Actuator travel may be less than the value listed after connected to the valve.
 3. Maximum actuator travel for 667-4 is 102 mm (4 inches).
 4. See also the Specifications portion of the introduction section.
 5. Additional pressure may be added when the actuator is at full travel. If the Maximum Excess Diaphragm Pressure is exceeded, damage to the diaphragm or diaphragm casing might result. See the Maximum Pressure Limitation section.
 6. Maximum diaphragm casing pressure must not be exceeded and must not produce a force on the actuator stem greater than the maximum allowable actuator output thrust or the maximum allowable stem load. See the Maximum Pressure Limitation section.
 7. This maximum casing pressure is not to be used for normal operating pressure. Its purpose is to allow for typical regulator supply settings and/or relief valve tolerances.

Description

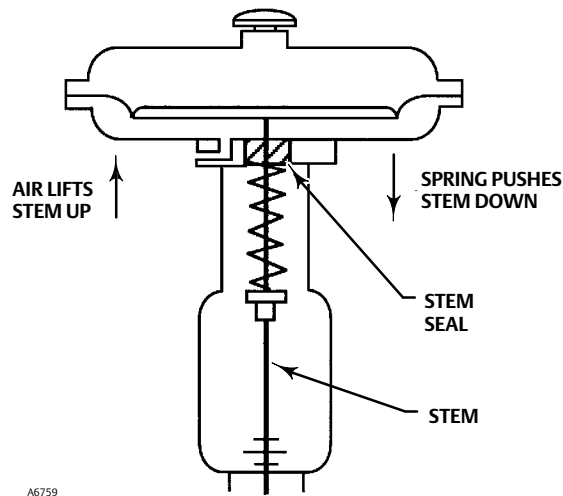
The 667 actuator (figure 1) and the 667-4 actuator are reverse-acting, spring-opposed diaphragm actuators. They provide automatic operation of control valves. The 667 actuator provides 76 mm (3 inches) maximum actuator travel. The 667-4 actuator provides 102 mm (4 inches) maximum actuator travel. Both actuators position the valve plug in response to varying pneumatic loading pressure on the diaphragm. Figure 2 shows the operation of these actuators.

A 667 or 667-4 actuator can be furnished with either a top-mounted or a side-mounted handwheel assembly. A top-mounted handwheel assembly is normally used as an adjustable down travel stop. (A down travel stop limits actuator travel in the down direction [when the stem is traveling out of the actuator]. Travel in the up direction is when the stem is traveling into the actuator.) A side-mounted handwheel assembly is normally used as an auxiliary manual actuator. The side-mounted handwheel can also be used as an adjustable up or down travel stop. Casing-Mounted adjustable up or down travel stops are also available on this actuator.

Note

If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel. The side-mounted handwheel is designed for more frequent use as a manual operator.

Figure 2. Schematic of Fisher 667 and 667-4 Actuators



Specifications

Refer to table 1 for Specifications of the 667 and 667-4 actuators. See the actuator nameplate for specific information for your actuator.

Educational Services

For information on available courses for Fisher 667 diaphragm actuators, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Instructional Videos

[Click here](#) or access the following QR code for a video on mounting a DVC6200 Digital Valve Controller on a 667 actuator.



[Click here](#) or access the following QR code for a video on installing a side-mounted handwheel on a 667 actuator.



⚠ WARNING

To avoid personal injury or damage to equipment that may result in the malfunction of the control valve or loss of control of the process caused by excessive pressure, do not exceed the Maximum Pressures listed in table 1. Refer to the Maximum Pressure Limitations section.

Maximum Pressure Limitations

The casing and diaphragm of 667 actuators are pressure operated. This air pressure provides energy to compress the spring, to stroke the actuator, and to seat the valve. The following explanations describe the maximum pressure limits for an actuator. Refer to the nameplate or table 1 for maximum values for your actuator.

- **Maximum Casing Pressure for Actuator Sizing:** This is the maximum pressure that can be applied at less than full travel of the actuator. If this stroking pressure is exceeded before the upper diaphragm plate contacts the travel stop, damage to the stem or other parts might result.
- **Maximum Excess Diaphragm Pressure:** Additional pressure may be added when the actuator is at full travel. If the Maximum Excess Diaphragm Pressure is exceeded, damage to the diaphragm or diaphragm casing might result.

Because the actuator has traveled its specified travel, and the diaphragm head is physically stopped from movement, the energy from any additional air pressure is transmitted to the diaphragm and diaphragm casings. The amount of air pressure that can be added once the actuator has traveled to the stops is limited by the resultant adverse effects that may occur. Exceeding this limiting factor could result in leakage or casing fatigue due to the deformation of the upper diaphragm casing.

- **Maximum Diaphragm Casing Pressure:** If the Maximum Diaphragm Casing Pressure is exceeded, damage to the diaphragm, diaphragm casing, or actuator might result.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations.

Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Key number locations are shown in figures 6, 7, 8, 9, and 10, unless otherwise noted. Also, refer to figure 3 for location of parts.

CAUTION

To avoid parts damage, do not use an operating pressure that exceeds the Maximum Diaphragm Casing Pressure (table 1) or produces a force on the actuator stem greater than the Maximum Allowable Output Thrust (table 1) or the Maximum Allowable Valve Stem Load.

- **Valve/Actuator Assembly:** If the actuator and valve are shipped together as a control valve assembly, it has been adjusted at the factory, and may be installed in the pipeline. After installing the valve in the pipeline, refer to the Loading Connection procedures.
- **Actuator Mounting:** If the actuator is shipped separately or the actuator has been removed from the valve, it is necessary to mount the actuator on the valve before placing the valve in the pipeline. Refer to the following actuator mounting procedures before placing the valve in service. It is recommended that you perform the Bench Set Spring Adjustment procedures in this section to confirm that the actuator is adjusted correctly for the valve travel.
- **Positioner:** If a positioner is installed, or is to be installed on the actuator, refer to the positioner instruction manual for installation. During the adjustment procedures, it will be necessary to provide a temporary loading pressure to the actuator diaphragm.
- **Handwheel Cap:** If the handwheel cap (key 247, figures 11, 13, or 21) is not in place, install the cap by pushing it on by hand until it snaps into place.

Mounting the Actuator on the Valve

CAUTION

The 667 actuator spring load pushes the stem down out of the actuator yoke (see figure 2), and it can come in contact with the valve stem during actuator mounting.

If the valve stem is allowed to remain in the up position (towards the actuator) during actuator mounting, it can interfere with the actuator stem during mounting. It is possible to damage valve stem threads or bend the valve stem. Be sure the valve stem is pushed down (into the valve body), away from the actuator while mounting.

It may be necessary to apply a temporary loading pressure to the actuator to move the actuator stem away from the valve during installation.

If it is not possible to provide a temporary loading pressure, be very careful when lowering the actuator over the valve stem to prevent damage to valve stem and threads.

⚠ WARNING

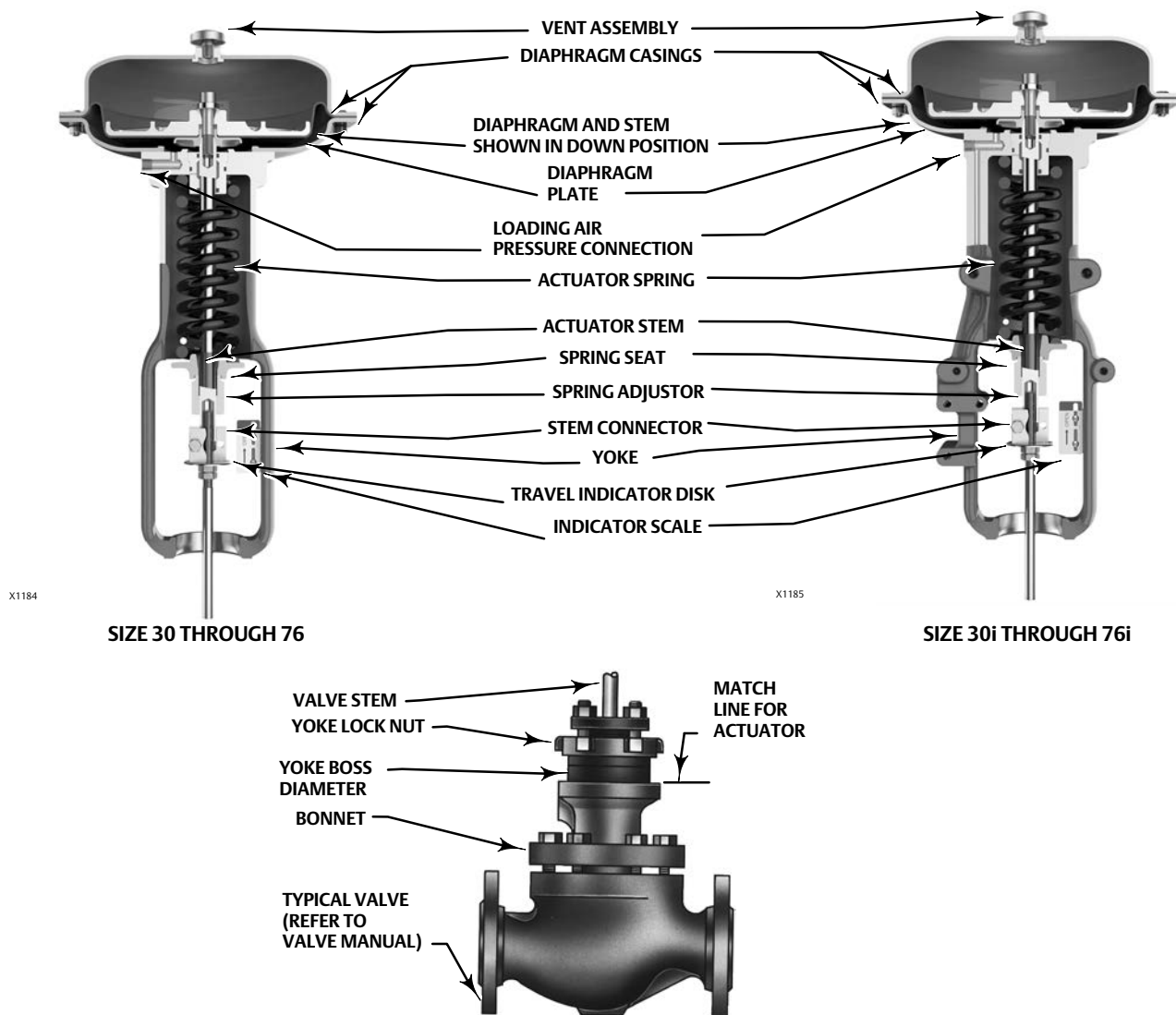
When moving the actuator stem with loading pressure applied, exercise caution to keep hands and tools out of the actuator stem travel path. If the loading pressure is accidentally disconnected, personal injury and property damage may result if something is caught between the actuator stem and other control valve parts.

1. Provide a vise or some other method of supporting the valve and the weight of the actuator during assembly. For direct or reverse acting valves, push the valve stem down away from the actuator while mounting the actuator.
2. Screw the stem locknuts all the way onto the valve stem. With the concave side of the travel indicator disk (key 34) facing the valve, install the travel indicator disk on the valve stem. (Note: The travel indicator disk is not used with size 87 actuators.)
3. Lift or hoist the actuator onto the valve bonnet:
 - a. For size 87 actuators: Slowly lower the actuator down onto the valve while guiding the valve stem into the opening in the end of the actuator stem (see figure 4). Once the actuator is in place, insert the cap screws and tighten the hex nuts, securing the actuator to the bonnet.

b. For all other size actuators:

- Slowly lower the actuator down onto the valve. As the yoke passes over the end of the valve stem, place the yoke locknut over the valve stem. (Note: On small size actuators, it may be necessary to remove the indicator disk and re-install it while lowering the actuator onto the valve because the disk will not go through the actuator yoke opening).
 - Continue to lower the actuator while guiding the valve stem into the opening in the end of the actuator stem until the actuator is in place (see figure 4).
 - Screw the yoke locknut onto the valve bonnet and tighten the locknut.
4. Do not connect the actuator stem to the valve stem at this time. Whenever the actuator is installed on the valve, it is recommended that you perform the Bench Set Spring Adjustment procedures below, to verify that the actuator is still adjusted correctly.

Figure 3. Actuator-Mounting Components for Size 30/30i through 70/70i Actuators



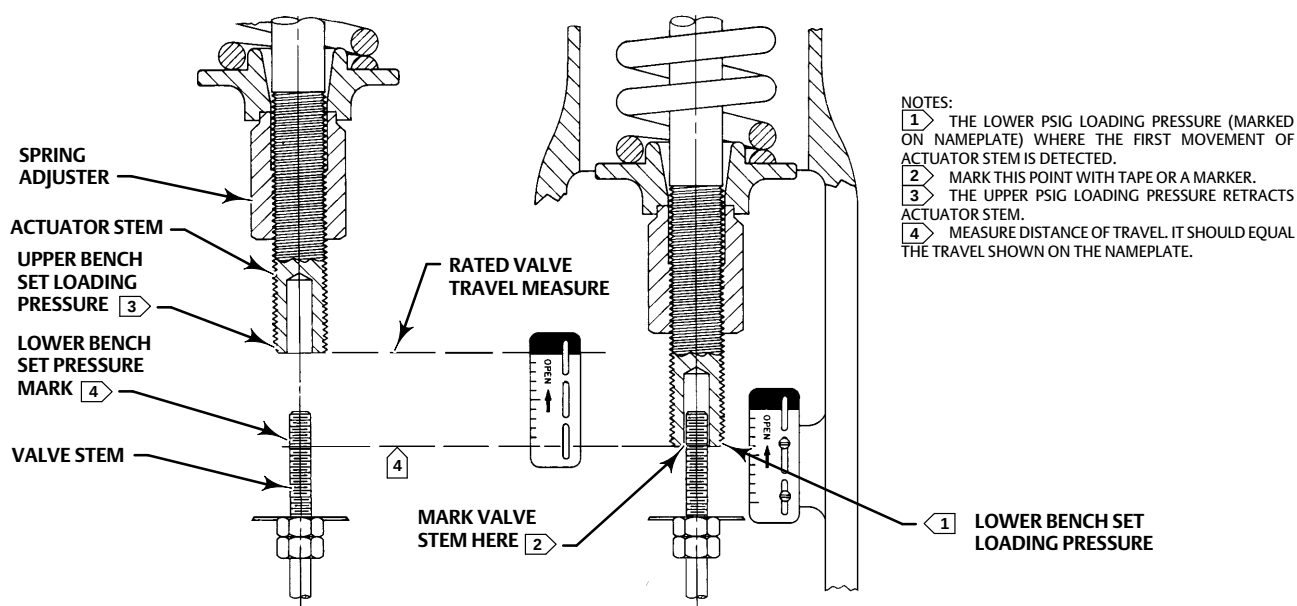
Discussion of Bench Set

The bench set pressure values are used to adjust the initial compression of the actuator spring with the valve-actuator assembly “on the bench.” The correct initial compression ensures that the valve-actuator assembly will function properly when it is put into service and the proper actuator diaphragm operating pressure is applied.

The bench set values are established with the assumption that there is no packing friction. When attempting to adjust the spring in the field, it is very difficult to ensure that there is no friction being applied by “loose” packing.

Accurate adjustment to the bench set range can be made during the actuator mounting process by making the adjustment before the actuator is connected to the valve (see the Spring Verification Procedure).

Figure 4. Bench Set Adjustment



Spring Verification

Ensure that the actuator diaphragm is at the bottom of its travel as shown in figure 4 and not connected to the valve. (Note: Some spring compression is required to move the diaphragm to the **bottom** of its travel.)

Also, provide a certified pressure gauge that will accurately read the diaphragm pressure from 0 through 0.3 bar (5 psig) above the upper operating range pressure marked on the nameplate. Apply loading pressure to the diaphragm.

Stroke the actuator a few times to ensure that the pressure gauge is working correctly, and that the actuator is functioning properly.

CAUTION

To prevent actuator damage, it is important to ensure that the actuator stem is stroking smoothly and not exhibiting binding or excessive friction between the actuator stem and the bushing (key 7). Binding or excessive friction could be an indicator of incorrect assembly or damaged parts.

Key numbers are shown in figures 6, 7, 8, 9, and 10.

Note

For 667 actuators installed on push-down-to-close (direct acting) valves with fail-close action, the valve plug seat is the limit for downward travel and the actuator is the limit for upward (away from the valve) movement.

For 667 actuators installed on push-down-to-open (reverse acting) valves with fail-open action, the actuator down stop is the limit for downward movement, and the valve seat is the limit for upward (away from the valve) movement.

Ensure the correct Spring Verification procedure is followed for the type of valve on which the 667 actuator is installed.

For Push Down to Close (Direct Acting) Valves

1. If not already accomplished, push the valve stem down away from the actuator to the closed position.
2. Set the diaphragm loading pressure to 0.3 bar (5 psig) over the upper operating range pressure. The travel stop cap screw (key 12) should be contacting the upper diaphragm casing.
3. Slowly decrease the pressure towards the upper bench set pressure, as indicated on the nameplate, while checking for the **first** linear movement of the actuator stem.

Note

Before turning the spring adjuster on size 70/70i, 76/76i, or 87 actuators, assemble the stem connector around the actuator stem and the anti-rotating lug on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.

4. If movement occurs before or after the upper bench set pressure is reached, adjust the spring adjuster (see figure 4). Thread the adjuster up or down on the actuator stem until the actuator stem movement is **first** detected at the upper bench set pressure. (Note: You may need to lower the loading pressure to reduce spring compression, allowing the spring adjuster to turn.)
5. Be sure the spring adjuster is adjusted to meet the requirements of step 4 above.
6. Slowly decrease diaphragm loading pressure to the lower bench set pressure, as indicated on the nameplate. This will extend the actuator stem toward the valve. Mark the end of the actuator stem on a nearby surface using tape or some other method.
7. Slowly increase the diaphragm loading pressure until the upper bench set pressure is reached. Again, the travel stop cap screw (key 12) should be against the upper diaphragm casing.
8. Measure the distance between the mark or tape to the end of the actuator stem. This distance should match the rated travel indicated on the nameplate.
9. If the measured travel matches the nameplate travel, bench set is complete. Proceed to the Installing the Stem Connector Assembly subsection.
10. If the measured travel is not exact, consider the spring free-length and spring rate tolerances may produce a slightly different bench set than specified. Contact your Emerson Automation Solutions sales office for assistance.

For Push Down to Open (Reverse Acting) Valves

1. If not already accomplished, push the valve stem down away from the actuator to the open position. Later, when installing the connector, pull up the valve stem to the closed position.

2. Set the diaphragm loading pressure to a value less than the lower bench set pressure, as indicated on the nameplate, or near zero. The down travel stops (key 77) should be contacting the yoke.
3. Slowly increase the pressure towards the lower bench set pressure while checking for the **first** linear movement of the actuator stem.

Note

Before turning the spring adjuster on size 70/70i, 76/76i, or 87 actuators, assemble the stem connector around the actuator stem and the anti-rotating lug on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.

4. If movement occurs before or after the lower pressure is reached, adjust the spring adjuster (see figure 4). Thread the adjuster up or down on the actuator stem until the actuator stem movement is **first** detected at the lower bench set pressure.
5. Apply the upper bench set pressure indicated on the nameplate to the diaphragm. This will retract the actuator stem away from the valve. Mark the end of the actuator stem on a nearby surface using tape or some other method.
6. Slowly decrease the diaphragm pressure until the lower bench set pressure is applied. Again, the down travel stops (key 77) should be against the yoke.
7. Measure the distance between the mark or tape to the end of the actuator stem. This distance should match the rated travel indicated on the nameplate.
8. If the measured travel matches the nameplate travel, bench set is complete. Proceed to the Installing the Stem Connector Assembly subsection.
9. If the measured travel is not exact, consider the spring free-length and spring rate tolerances may produce a slightly different bench set than specified. Contact your Emerson Automation Solutions sales office for assistance.

Installing the Stem Connector Assembly

When installing the stem connector assembly (key 31), the actuator and valve stem threads should engage the threads of the stem connector by a distance equal to the diameter of the stem.

WARNING

Install the stem connector securely before a positioner is mounted to the actuator and pressurized, using only a regulator-controlled air supply, not the positioner, to move the actuator stem.

To avoid personal injury or property damage, keep hands and tools out of the actuator stem travel path while applying loading pressure to move the actuator stem in the following steps.

CAUTION

To avoid damaging the seating surfaces, do not rotate the valve plug while it is seated. Exercise care while installing the stem connector assembly to avoid damage to the valve plug stem and valve stem threads.

Note

Replacement stem connectors are an assembly of two stem connector halves, cap screws, and a spacer between the connector halves. Remove the spacer and discard it, if present, before clamping the actuator and valve stems together. Use only a mated pair of stem connectors.

1. If necessary, push the valve stem down so that the valve plug is touching the seat ring on direct-acting valves. For reverse-acting valves, pull the stem up to the closed position. Always start with the valve plug on the seat.
2. If necessary, screw the valve stem locknuts down, away from the connector location. For all actuators except size 87, ensure that the travel indicator disk (key 34) is on top of the locknuts.
3. Adjust the diaphragm pressure to the lower bench set pressure (or, the upper bench set pressure for reverse-acting valves.) This should be the same pressure used in the Spring Verification steps, and it is marked on the nameplate.
4. Place the stem connector half with the threaded holes approximately half way between the actuator and valve stems, and align the actuator stem and valve stem with threads from both stems mated root-to-crest with the stem connector. If the threads from one of the stems do not fully align with the stem connector, a slight change to loading pressure may be necessary to align the threads. Refer to figures 6, 7, 8, 9, and 10 to help locate the connector position.

CAUTION

Incomplete engagement of either the valve stem or actuator stem in the stem connector can result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than one diameter of that stem. Damage to threads on either stem or in the stem connector can cause the parts to be replaced prematurely. Do not loosen the cap screws when the stem connector has spring or loading pressure force applied.

5. Install the other half of the stem connector and insert the cap screws and tighten them while ensuring even spacing between the stem connector halves on all sides. If installing a positioner, also attach the feedback bracket at the same time.

CAUTION

Over-tightening the valve stem locknuts can make disassembly difficult.

6. Screw the valve stem locknuts up against the stem connector for the size 87 actuator. For all other actuator sizes, screw the valve stem locknuts up until the indicator disk contacts the bottom of the stem connector. Do not overtighten the locknuts.
7. Slowly stroke the valve from fully open to fully closed and verify full rated travel is achieved.

Be sure that the valve is in the closed position. Loosen the screws on the travel indicator scale (key 32), and align it with the travel indicator disk (key 34). Stroke the valve full travel to ensure that the travel matches the rated valve travel on the nameplate. If valve travel is not correct, repeat the stem connector procedure.

Friction Discussion

If you are attempting to adjust the bench set after the actuator is connected to the valve and the packing tightened, you must take friction into account. Make the spring adjustment so full actuator travel occurs at the bench set values (a) plus the friction force divided by the effective diaphragm area with increasing diaphragm pressure or (b) minus the friction force divided by the effective diaphragm area with decreasing diaphragm pressure.

If the stem connector assembly has been installed, the valve friction may be determined by the following procedure:

1. Install a pressure gauge in the actuator loading pressure line that connects to the actuator diaphragm casing.

Note

Steps 2 and 4 require that you read and record the pressure shown on the pressure gauge.

2. Increase the actuator diaphragm pressure and read the diaphragm pressure as the actuator reaches a travel position in the rated travel of the valve that does not contact a travel stop. Make a reference mark on the travel indicator scale using tape or some other method at this point.
3. Increase the actuator diaphragm pressure until the actuator is at a travel position greater than the position referenced in step 2 using the reference point to identify first movement.
4. Decrease the actuator diaphragm pressure and read the diaphragm pressure as the actuator returns to the position referenced in step 2.

The difference between the two diaphragm pressure readings is the change in the diaphragm pressure required to overcome the friction forces in the two directions of travel.

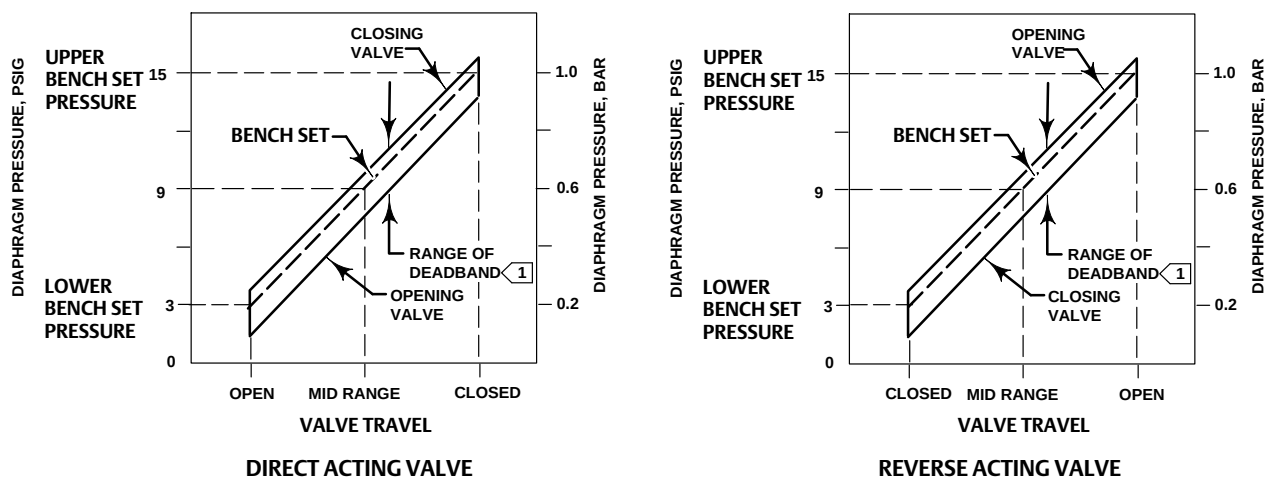
5. Calculate the actual friction force:

$$\text{Friction Force, = pounds} = 0.5 \left(\begin{array}{c} \text{Difference} \\ \text{in pressure} \\ \text{readings, psig} \end{array} \right) \times \left(\begin{array}{c} \text{Effective} \\ \text{diaphragm area,} \\ \text{inches}^2 \end{array} \right)$$

Refer to table 1 for the effective diaphragm area.

It is difficult to rotate the spring adjustor (key 74, figures 6, 7, 8, 9, and 10) when the full actuator loading pressure is applied to the actuator. Release the actuator loading pressure before adjusting. Then re-apply loading pressure to check the adjustment.

Figure 5. Typical Valve Response to Deadband



NOTE:

1

DEADBAND IS CAUSED BY FRICTION.

A6763-2

Deadband Measurement

Deadband is caused by packing friction, unbalanced forces, and other factors in the control valve assembly. Deadband is the range a measured signal can vary without initiating a response from the actuator (see figure 5). Each actuator spring has a fixed spring rate (force divided by compression). You have verified that the right spring was installed in the actuator by completing the Spring Verification steps.

Deadband is one factor that affects the control valve assembly operation during automatic loop control. The control loop tolerance for deadband varies widely depending on the loop response. Some common symptoms of the

deadband being too wide are no movement, a “jump” movement, or oscillating movements of the actuator during automatic loop control. The following steps are provided to determine the span of deadband. The percent of deadband is helpful in troubleshooting problems with the process control loop.

1. Start at a pressure near the lower bench set pressure, slowly increase pressure until the valve is approximately at mid-travel. Note this pressure reading.
2. Slowly decrease pressure until movement of the valve stem is detected, and note this pressure.
3. The difference between these two pressures is deadband, in psi.
4. Calculate the percent of deadband by:

Deadband, psi

$$\text{Deadband} = \frac{\text{Deadband, psi}}{\text{Bench Set Span, psi}} = \text{nn \%}$$

Loading Connection

Key number locations are shown in figures 6, 7, 8, 9, and 10, unless otherwise noted.

The loading pressure connections are made at the factory if the valve, actuator, and positioner come as a unit. Keep the length of tubing or piping as short as possible to avoid transmission lag in the control signal. If a volume booster, valve positioner, or other accessory is used, be sure that it is properly connected to the actuator. Refer to the positioner instruction manual or other manuals as necessary. For actuators shipped separately or whenever the actuator pressure connections are installed, use the following steps:

1. Connect the loading pressure piping to the NPT internal connection in the side of the yoke (key 73).
2. For size 70/70i and 87 actuators, if necessary, remove the 1/4 NPT bushing if a 1/2 NPT internal connection is needed to increase connection size. The connection can be made with either piping or tubing.
3. Cycle the actuator several times to be sure that the valve stem travel is correct when the correct pressure ranges are applied to the diaphragm.
4. If valve stem travel appears to be incorrect, refer to the Bench Set Spring Adjustment procedures at the beginning of this section. Do not place the valve in service if it is not reacting correctly to diaphragm loading pressure changes.

Maintenance

Actuator parts are subject to normal wear and must be inspected regularly and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.

- Vent the power actuator loading pressure and relieve any actuator spring pre-compression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

The maintenance instructions are divided into several sections: Actuator, Top-Mounted Handwheel Assembly (Adjustable Down Travel Stop), Side-Mounted Handwheel Assembly for Size 34/34i through 60/60i Actuators (Manual Actuator), Side-Mounted Handwheel Assembly for Size 70, 76 and 87 Actuators (Manual Actuator), and Casing-Mounted Travel Stops.

Actuator

This procedure describes how the actuator can be completely disassembled and assembled. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job; then, start the assembly at the appropriate step.

Key numbers are shown in figures 6, 7, 8, 9, or 10, unless otherwise noted. Figure 6 shows the size 30 through 60 actuators, figure 7 shows the size 30i through 60i actuators, figure 8 shows the size 70 actuator, figure 9 shows the size 70i actuator, and figure 10 shows the size 87 actuator.

Actuator Disassembly

Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

1. If equipped, remove the tubing or piping from the connection in the top of the yoke (key 73).
2. Turn the spring adjuster (key 74) counterclockwise (**toward the valve body**) until all spring compression is relieved.

WARNING

To avoid personal injury due to the sudden uncontrolled movement of parts, do not loosen the stem connector cap screws when the stem connector has spring force applied to it.

3. If necessary, remove the actuator from the valve body by separating the stem connector (key 31). Loosen the stem locknuts for the size 87 actuator, and remove the stem connector nuts. For all other sizes, separate the stem connector by loosening the stem locknuts (keys 69 and 75) and unscrewing the two stem connector cap screws.
4. Unscrew the spring adjuster (key 74) from the actuator stem (key 144). Also lift the spring seat and spring (key 19 and 18) out of the yoke.
5. Remove the diaphragm casing cap screws and nuts (keys 13 and 14), and lift off the upper diaphragm casing (key 1).

CAUTION

Be careful during disassembly to avoid damaging the O-rings (key 8).

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Instruction Manual

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6. Remove the following connected parts: the diaphragm (key 3), upper diaphragm plate (key 4), spacer (key 2), cap screw (key 12), lower diaphragm plate (key 71), and actuator stem (key 144). Be careful when pulling the threads of the actuator stem through the seal bushing (key 7) to avoid damaging the O-rings (key 8).
7. Remove the cap screw (key 12) to separate the parts of this assembly.
8. To remove the seal bushing, remove the snap ring (key 72), and lift out the bushing. Inspect, and if necessary, replace O-rings (keys 8 and 9).
9. Remove cap screws (key 30), and take off the lower diaphragm casing (key 64) and the gasket (key 70, size 30/30i through 60/60i and 76/76i) or O-ring (key 70, size 70/70i or 87). If necessary, the down travel stops (key 77) can be removed.

Table 2. Actuator Assembly Recommended Torque Values

DESCRIPTION, KEY NUMBER	ACTUATOR SIZE	THREAD SIZE, INCH	TORQUE	
			N • m	Lbf • ft
Casing to yoke, key 30 ⁽¹⁾	30/30i to 60/60i and 76/76i	3/8-16	41	30
	70/70i and 87	1/2-13	95	70
Travel stop, key 12	30/30i	3/8-24	41	30
	34/34i and 40/40i	1/2-20	68	50
	45/45i to 76/76i and 87	3/4-16	183	135
MO U-bolt nut, key 170	34 and 40	1/2-13	81	60
	45 to 60	5/8-11	163	120
MO U-bolt nut, key 147	34 and 40	3/8-16	41	30
MO U-bolt nut, key 144	45 to 60	3/8-16	41	30
Diaphragm casing, key 14 ⁽¹⁾	30/30i to 76/76i and 87	3/8-24	27	20
Hex cap screw, key 256	34i to 40i	1/2-13	92	68
	45i to 60i	5/8-11	163	120
Hex cap screw, key 257	34i to 60i	3/8-16	39	29
Stem connector, key 26 ⁽²⁾	30/30i through 40/40i	5/16-18	23	17
	45/45i through 70/70i	3/8-16	39	29
	87	1/2-13	91	67

1. Observe tightening pattern and procedure described in the appropriate Actuator Assembly section.
2. Torque values when lithium grease is used on the threads.

Actuator Assembly

Refer to table 2 as appropriate.

1. Coat the O-rings (key 70/70i, sizes 70 and 87) with lithium grease (key 237), or, coat the gasket with lithium grease (key 237). Place a new gasket or O-ring (key 70) on the yoke (key 73). Position the lower diaphragm casing (key 64) on the yoke and align the holes. Insert the cap screws (key 30) and tighten evenly in a crisscross pattern to 41 N•m (30 lbf•ft) for size 30/30i-60/60i and 76/76i actuators or 95 N•m (70 lbf•ft) for size 70/70i and 87 actuators. If down travel stops (key 77) were removed, insert and tighten them.
2. Coat the O-rings (keys 8 and 9) with lithium grease (key 237) and place the O-rings in the seal bushing (key 7).
3. Fill the seal bushing with lithium grease (key 237), slide the bushing into the yoke (key 73), and install the snap ring (key 72).

CAUTION

Be careful during assembly to avoid damaging the O-rings (key 8).

4. Assemble the actuator stem (key 144), lower diaphragm plate (key 71), diaphragm (key 3), upper diaphragm plate (key 4), and the travel stop cap screw and spacer (keys 12 and 2). Coat the cap screw threads with lithium grease

(key 237). Tighten the cap screw (key 12) to the appropriate torque as shown in table 2. Place this assembly in the actuator. Take care when pushing the actuator stem through the seal bushing so that the threads do not damage the O-rings.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-76/76i and 87 actuators.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

5. Install the upper diaphragm casing (key 1), and install the cap screws and nuts (keys 13 and 14). Tighten the diaphragm cap screws and nuts in the following manner.
6. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
7. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
8. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
9. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
10. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
11. Once completed, no more tightening is recommended.
12. Install the actuator spring (key 18) and spring seat (key 19). Apply anti-seize lubricant (key 239) to the threads of the actuator stem and to the surface of the spring adjuster (key 74) that contacts the spring seat. Thread the spring adjuster onto the actuator stem.
13. Mount the actuator onto the valve in accordance with the procedures in the Installation section.

Top-Mounted Handwheel Assembly (Adjustable Down Travel Stop)

Actuator key numbers are shown in figures 6, 7, 8, 9, and 10. And, top-mounted handwheels are shown in figures 11, 12, 13, 14, and 15.

Note

If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel. The side-mounted handwheel is designed for more frequent use as a manual operator.

A top-mounted handwheel assembly (figures 11, 12, 13, 14, and 15) is usually used as an adjustable down travel stop to limit full extension of the actuator stem. Turning the handwheel counterclockwise pulls the extension rod (key 150, figures 11, 13, and 14) up, retracting the actuator stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Note

For size 70/70i and 87 actuators with handjack bars (figure 15) it is recommended that the handjack bar (key 58) be removed when not in use and the handwheel cap (key 247) be installed for weather protection of the internal components.

Disassembly for Top-Mounted Handwheel

1. Bypass the control valve, reduce loading pressure to atmospheric, and if equipped, remove the tubing or piping from the connection in the top of the yoke (key 73, figures 6, 8, 9, and 10).
2. Turn the handwheel (key 58) clockwise so that the handwheel assembly is not causing any spring compression.
3. Turn the actuator spring adjuster (key 74) to relieve all the compression from the spring (key 18).
4. If servicing just the thrust bearing, races, and handwheel screw (keys 180, 181, and 160), use the following steps:
 - Remove the cap and take out the cotter pin. Remove the castle nut, bearing retainer, thrust bearing, and races (keys 247, 167, 166, 180, and 181).
 - Use the handwheel to remove the handwheel screw (key 160) from the handwheel body (key 148).
 - If necessary, remove the extension rod (key 150) at this time. Most maintenance procedures do not require the rod to be removed.
 - Clean and inspect all parts or replace parts as necessary. Upon re-assembly, lubricate handwheel threads, bearings, and races with anti-seize lubricant (key 239).
 - Lubricate and re-install the handwheel screw into handwheel body (key 148). Lubricate and replace the races, bearing, and retainer (keys 181, 180, and 182). Replace the castle nut (key 166), tighten it, and insert the cotter pin (key 167). Replace the handwheel cap (key 247).
5. For size 30/30i through 60/60i and 76/76i actuator handwheels (figures 11 and 13):
 - Remove the cap screws (key 161). Make sure that the guide plate can turn between the handwheel body and the mounting plate (keys 157, 148 and 158).
 - Remove the cap (key 247) and cotter pin (key 167). Remove the castle nut (key 166) and, if necessary, unscrew the extension rod (key 150). Remove the rod, the handwheel body (key 148), and the attached parts.
 - Remove the hex nuts and cap screws (keys 14 and 13, figures 6, 7, 8, 9, and 10) from the diaphragm casings. Lift off the upper diaphragm casing (key 1) and the mounting plate (key 158).
 - Turn the handwheel (key 58) to remove the handwheel screw (key 160) from the handwheel body (key 148). Remove the retaining ring (key 60) if the handwheel (key 58) must be separated from the handwheel screw.
 - If necessary, perform other actuator maintenance before returning to the following assembly steps.

6. For size 70/70i and 87 actuator handwheels (figures 14 and 15):

- Remove the cap (key 247). Take out the cotter pin (key 167) and remove the castle nut, the bearing retainer, and thrust bearing (keys 166, 182, 181, and 180). It is not necessary to remove the extension rod (key 150) at this time.
- Remove the hex nuts and cap screws (keys 14 and 13, figures 6, 7, 8, 9, and 10) from the diaphragm casings. Lift off the upper diaphragm casing (key 1), handwheel body (key 148) and attached parts.
- If travel stops (key 152) are used, note and record their position relative to the cap screws (key 154) for use in assembly. Remove the travel stops and cap screws, and remove either the mounting plate (key 158, figure 14) or the handwheel body (key 148, figure 14) and attached parts.
- Turn the handwheel (key 58) to remove the handwheel screw (key 160) from the handwheel body (key 148). Remove the retaining ring (key 60) if the handwheel (key 58) must be separated from the handwheel screw.
- If necessary, perform other actuator maintenance before returning to the following assembly steps.

Assembly for Top-Mounted Handwheel

For size 30/30i through 60/60i and 76/76i actuator handwheels:

Refer to figures 11, 12, and 13 for top-mounted handwheel assemblies.

1. If it was removed, slide the handwheel (key 58) onto the end of the handwheel screw (key 160), and snap the retaining ring (key 60) into place. Also, install the guide post (key 150) if it was removed.
2. Generously coat the threads of the handwheel screw (key 160) with anti-seize lubricant (key 239). Turn the screw into the handwheel body (key 148).
3. Install the mounting plate (key 158) to the diaphragm casing (key 1, figures 6, 8, 9, and 10) with the cap screws (key 154). Finger tighten the screws.
4. If travel stops were used, install the travel stops to their original positions as recorded in the proceeding Disassembly steps. Tighten the screws and travel stops.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-76/76i and 87 actuators.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

5. Position the diaphragm casing (key 1, figures 6, 7, 8, 9, and 10), mounting plate (key 158), travel stops (key 152), if used, and cap screws (key 154) on the diaphragm. Install the cap screws and hex nuts (keys 13 and 14, figures 6, 7, 8, 9, and 10) and tighten in the following manner.

6. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
7. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
8. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
9. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
10. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
11. Once completed, no more tightening is recommended.
12. If necessary, screw the extension rod (key 150) into the connector (key 27). Slide the guide plate (key 157) onto the extension rod (key 150). For size 45/45i through 76/76i, place the spacer (key 253) on top of the guide plate (key 157). If necessary, replace the extension rod (key 150). Slide the handwheel body (key 148) over the extension rod, position the handwheel body on the spacer (key 253), align the holes, and insert and tighten the cap screws (key 161).
13. Lubricate and install the thrust bearings (keys 181 and 180), install the bearing retainer (key 182), install the castle nut (key 166) on the extension rod. Do not overtighten the castle nut on the bearing. Install the cotter pin (key 167). Replace the cap (key 247).
14. Refer to the Assembly portion of the Actuator maintenance section.

For size 70/70i and 87 actuators handwheels (figures 14 and 15):

Refer to figure 14 for top-mounted handwheel assemblies and figure 15 for handjack bar assemblies.

1. If removed, slide the handwheel (key 58) onto the end of the handwheel screw (key 160), and snap the retaining ring (key 60) into place.
2. Generously coat the threads of the handwheel screw (key 160) with anti-seize lubricant (key 239). Turn the screw into the handwheel body (key 148).
3. If necessary, install the extension rod (key 150) into the connector (key 27) and tighten it. Position the handwheel body (key 148) on the diaphragm casing (key 1, figures 6, 7, 8, 9, and 10), and align the holes. Insert the cap screws (key 154). Finger tighten the screws.
4. If travel stops were used, return the travel stops to their original positions as recorded in the proceeding Disassembly steps. Tighten the screws and travel stops.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-76/76i and 87 actuators.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

5. Slide the extension rod (key 150) into the handwheel screw (key 160), and position the diaphragm casing (key 1, figures 6, 7, 8, 9, and 10) with the attached parts on the diaphragm. Install the cap screws and hex nuts (keys 13 and 14, figures 6, 7, 8, 9, and 10) and tighten in the following manner.
6. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
7. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
8. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
9. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
10. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
11. Once completed, no more tightening is recommended.
12. Lubricate and install the thrust bearings (keys 180 and 181), install the bearing retainer (key 182), install the castle nut (keys 166) on the extension rod. Do not overtighten the castle nut on the bearing. Install the cotter pin (key 167). Replace the cap (key 247).
13. Refer to the Assembly portion of the Actuator maintenance section.

Side-Mounted Handwheel for Sizes 34 through 60 and 34i through 60i Actuators

A side-mounted handwheel assembly is normally used as a manual actuator for sizes 34 through 60 (figures 16 and 18) and 34i through 60i actuators (figures 17 and 19). Turning the handwheel counter-clockwise past the neutral position opens the valve. Two levers (key 146, figures 16, 17, 18, and 19) on a handwheel assembly operate the valve by moving the valve stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then begin the assembly at the appropriate step.

Disassembly for Side-Mounted Handwheel (Sizes 34-60 and 34i-60i)

1. Use step a. for size 34 through size 60 actuators, and use step b. for sizes 34i through 60i.
 - a. **For Size 34 through 60:** If desired, the handwheel assembly can be removed from the actuator yoke. To do this, remove the hex nuts (keys 147 and 170) from the U-bolts (key 166 and 143) that hold the assembly to the yoke for the size 30 and size 40. Remove the hex nuts (key 144 and 170) from the U-bolts (key 166 and 143) that hold the assembly to the yoke for the size 45 through size 60.
 - b. **For Size 34i through 60i:** If desired, the handwheel assembly can be removed from the actuator yoke. To do this, remove the cap screws (key 256 and 257) and spacers (key 258) that hold the assembly to the yoke for the size 30i through size 60i.
2. Remove the retaining ring (key 154) and drive out the lever pivot pin (key 153).
3. Two screws (key 156) hold the right- and left-hand levers (key 146) together. Remove the screw from the top of the levers so that the levers will drop down out of the assembly. Disassemble further, if necessary, by removing the other screw.
4. Remove the screw (key 161) and pointer mounting bolt (key 159, not shown) located behind the pointer (key 160).
5. Remove the stop nut (key 54), lockwasher (key 150), and washer (key 149). Then remove the handwheel (key 51), being careful not to lose the small ball (key 55) and spring (key 56).
6. Loosen the locking set screw (key 168, figure 19). Then, using a suitable tool, unscrew the bearing retainer (key 136).

7. Pull the handwheel screw assembly (key 145) out of the handwheel body. The operating nut (key 132) will come out with the screw. Also remove the bushing (key 151, figure 16 or 17) on size 34 and 40.
8. If required, remove the two ball bearings (key 152), one from the bearing retainer and the other from the handwheel body.

Assembly for Side-Mounted Handwheel (Sizes 34-60 and 34i-60i)



[Click here](#) or access the following QR code for a video on installing a side-mounted handwheel on a 667 actuator.

1. Pack the ball bearings (key 152) with anti-seize lubricant (key 244). Insert one bearing and the bushing (key 151, figure 16 or 17) into the handwheel body (key 142). The bushing is not used in a handwheel assembly for sizes 45/45i through 60/60i actuators.
2. Coat the handwheel screw assembly (key 145) threads with anti-seize lubricant (key 244), and thread the operating nut (key 132) onto the screw. Slide the second ball bearing (key 152) onto the screw, and insert the end of the screw into either the bushing (key 151, figure 16 or 17) for sizes 34/34i and 40/40i, or into the bearing for sizes 45/45i through 60/60i.
3. Thread the bearing retainer (key 136) into the body (key 142). Completely tighten the bearing retainer, and then loosen it one-quarter turn. Tighten the set screw (key 168, figure 16 or 17) to hold the bearing retainer in place.
4. Coat the groove in the handwheel body (key 142) with lithium grease (key 241). Insert the spring (key 56) and ball (key 55) into the handwheel (key 51). Holding the ball and spring in the handwheel, put the handwheel, the washer (key 149), the lockwasher (key 150), and the stop nut (key 54) onto the end of the end of the handwheel screw (key 145). Tighten the stop nut.
5. Position the pointer mounting bolt (key 159, not shown) and pointer (key 160). Insert and tighten the screw (key 161).
6. Assemble the two levers (key 146) with the cap screws (key 156) for handwheel assemblies for sizes 45/45i, 50/50i, and 60/60i actuators, or with the machine screws (key 156) for handwheel assemblies on sizes 34/34i and 40/40i actuators.
7. Use **step a.** for size 34 through size 60 actuators, and use **step b.** for sizes 34i through 60i.
 - a. **For Size 34 through 60:** If the handwheel assembly was removed from the yoke (key 9, figures 6, 8, or 10), remount the handjack assembly to the yoke using the dowel pins for alignment. For the size 34 and size 40, position the U-bolts and J-bolts (keys 166 and 143) on the yoke, and hand-tighten the hex nuts (keys 170 and 147) to hold the handwheel assembly in position. For the size 45 through size 60, position the U-bolts (keys 166 and 143) on the yoke, and hand-tighten the hex nuts (keys 170 and 144) to hold the handwheel assembly in position. Cap screws (key 163) should be tight against the yoke legs to provide stability. Tighten the nuts (key 144 for size 30 and size 40, key 158 for the size 45 through size 60). For the size 34 and size 40 finish tightening the U-bolt nuts to 81 N • m [60 lbf • ft] (key 170) and 41 N • m [30 lbf • ft] (key 147). For the sizes 45 through 60 finish tightening the U-bolt nuts to 163 N • m [120 lbf • ft] (key 170) and 41 N • m [30 lbf • ft] (key 144). Be sure the handwheel assembly remains flat against the mounting pad and perpendicular to the yoke.
 - b. **For Size 34i through 60i:** If the handwheel assembly was removed from the yoke (key 9, figures 7, 9, or 10), remount the handjack assembly to the yoke using the dowel pins for alignment. Position the upper cap screws (key 256) on the assembly and hand-tighten to hold the handwheel assembly in position. Place the spacers (key 258) between the yoke and handjack assembly, position cap screws (key 257), and hand-tighten. For the size 34i and size 40i finish tightening the cap screws (key 256) to 92 N • m [68 lbf • ft] and (key 257) to 39 N • m [29 lbf • ft]. For the sizes 45i through 60i finish tightening the cap screws (key 256) to 163 N • m [120 lbf • ft] and (key 257) to 39 N • m [29 lbf • ft].
8. Position the levers (key 146) as shown in figures 11 or 12. Insert the lever pivot pin (key 153), and snap the retaining ring (key 154) onto the lever pivot pin.

Side-Mounted Handwheel Assembly for Size 70, 76, and 87 Actuators

A side-mounted handwheel assembly (figure 20) is usually used as a manual actuator. Turning the handwheel clockwise past the neutral position always closes the valve body. A sleeve (key 123, figure 20) on a handwheel assembly for a size 70, 76 or 87 actuator opens the valve body by moving the valve stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; and then begin the assembly at the appropriate step.

Disassembly for Side-Mounted Handwheel (Sizes 70, 76, and 87)

1. Bypass the control valve. Reduce the loading pressure to atmospheric. Disconnect the loading pressure tubing or piping at the yoke.
2. Remove the cover band (key 87), and relieve spring compression by turning the spring adjuster (key 74) counterclockwise.
3. Remove the cap screws and nuts (keys 13 and 14) and lift off the upper diaphragm casing (key 1).
4. Remove the travel stop screw (key 12) and spacer (key 2), and take off the diaphragm plate (key 4), the diaphragm (key 3), and the lower diaphragm plate (key 71).
5. Unscrew the cap screws (key 90) and remove the following connected parts: the lower diaphragm casing (key 64), the O-ring (key 70), spring case adaptor (key 89), the seal bushing, O-rings, and snap ring (keys 7, 8, 9, and 72).
6. Remove the snap ring (key 72), and slide the seal bushing and O-rings (keys 7, 8, and 9) out of the spring case adaptor (key 89).
7. Take out the actuator spring (key 18).
8. Remove the stem connector (key 31) and stem connector cap screws.
9. Pull the actuator stem (key 144) up and out of the yoke. The spring seat (key 19), spring adjuster (key 74), thrust bearing (key 128), and the pinned adjusting screw (key 131) will come out with the actuator stem.
10. Turn the handwheel so that the lower sleeve (key 123) extends out of the bottom of the yoke. DO NOT move the neutral indicator scale (key 125).
11. Loosen two set screws (key 121), and unscrew the bearing retainer flange (key 45). Take out the worm gear and two thrust bearings (key 132), one on each side of the gear.
12. The worm shaft (key 51) and associated parts can be disassembled, if desired, by first removing the handwheel nut (key 127) and the handwheel (key 58). Do not lose the small ball (key 141) and spring (key 142).
13. Loosen the set screw (key 52) for each worm shaft retainer (keys 48 and 49). Unscrew the two worm retainers (keys 48 and 49). The ball bearings (key 50) will come out with the retainers.

Assembly for Side-Mounted Handwheel (Sizes 70, 76, and 87)

1. The front and back worm retainers (keys 48 and 49) each have a slot in their threads for a set screw (key 52). Pack the ball bearings (key 50) with anti-seize lubricant (key 239), and insert one ball bearing in the back worm retainer (key 49) as shown in figure 20.
2. Thread the back bearing retainer and ball bearing (keys 49 and 50) into the yoke. Align the slot in the bearing retainer with the set screw hole in the yoke, insert the set screw (key 52), and tighten it.
3. Coat the worm shaft (key 51) threads with anti-seize lubricant (key 239), and slide the shaft into the yoke so that the end of the shaft fits snugly into the back bearing retainer.
4. Insert the bearing in the front bearing retainer (key 49), and thread the retainer and ball bearing into the yoke. Align the slot in the retainer with the hole in the yoke, insert the set screw (key 52), and tighten it.
5. Put the spring and ball (keys 141 and 142) in the handwheel (key 58). Slide the handwheel onto the worm shaft (key 51). Thread the hex nut (key 127) onto the worm shaft.

6. Pack the two needle bearings (key 132) and coat the worm gear (key 44) threads with anti-seize lubricant (key 239). Insert the key (key 122), the bearings, and the worm gear in the yoke (key 73) as shown in figure 20.
7. Slots are cut in the threads of the bearing retainer flange (key 45). Thread the flange into the yoke so that the slots and the holes for the set screws (key 121) align. Insert the screws, and tighten them.
8. The lower sleeve (key 123) has a milled groove in one end. Coat the sleeve threads with anti-seize lubricant (key 239), slide the end of the lower sleeve with the groove into the bearing retainer flange, turn the handwheel, and feed the sleeve through the worm gear so that the slot in the lower sleeve engages the key (key 122) in the yoke. Continue turning the handwheel until the lower sleeve protrudes 81 mm (3.19 inches) below the surface of the yoke. The bottom of the lower sleeve should be even with the bottom of the extension on the neutral indicator.
9. Pack the thrust bearing (key 128) with anti-seize lubricant (key 239). Slide the actuator stem (key 144) and the attached adjusting screw (key 131), pin (key 130), thrust bearing (key 128), spring seat (key 19), and spring adjuster (key 74) into the yoke. The lower end of the stem slides through the lower sleeve (key 123) and the lower sleeve slides into the adjusting screw (key 131), as shown in figure 20.
10. Position the actuator stem (key 144) against the valve stem. Clamp both stems between the two halves of the stem connector (key 31), and be sure the threads are engaged properly on both stems. The stem connector should not be closer than 3.2 mm (1/8 inches) to the lower sleeve when the actuator stem is in the retracted position. This adjustment will provide approximately 3.2 mm (1/8 inches) of free travel of the lower sleeve in either direction for manual operation. Fasten the halves together with the cap screws.
11. Put the actuator spring (key 18) in the yoke on the spring seat (key 19).
12. Coat the O-rings (keys 8 and 9) with lithium grease (key 237), and insert them in the seal bushing (key 7). Slide the seal bushing and O-rings into the spring case adaptor (key 89).
13. Install the snap ring (key 72).
14. Slide the seal bushing and O-rings (keys 7, 8, and 9) over the actuator stem (key 144), and position the spring case adaptor (key 89), lower diaphragm casing (key 64), and O-ring (key 70) on the yoke.
15. Insert and tighten the cap screws (key 90).
16. Slide the lower diaphragm plate (key 71), the diaphragm (key 3) with the patterned side up, the diaphragm plate (key 4), the spacer (key 2), and the cap screw (key 12) on the actuator stem (key 144). Tighten the cap screw.
17. Put the diaphragm casing (key 1) on the diaphragm. Align the holes in the diaphragm (key 3) and the diaphragm casings (keys 1 and 64).

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-76/76i and 87 actuators.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

18. Install the cap screws and hex nuts (keys 13 and 14) and tighten in the following manner.

19. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
20. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
21. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
22. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
23. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
24. Once completed, no more tightening is recommended.
25. Return the actuator to service after completing the Loading Connection procedure in the Installation section and the procedures in the Adjustments section.

Casing-Mounted Travel Stops

Note

If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel. The side-mounted handwheel is designed for more frequent use as manual operator.

Casing-mounted adjustable travel stops (shown in figures 21 through 25) are available to limit travel in the down direction (extending the actuator stem) or in the up direction (retracting the actuator stem). The travel stop in figure 21 is a down travel stop, the travel stop in figure 22 is an up and down travel stop, and the travel stops in figures 23, 24, and 25 are up travel stops.

Use the locknuts (key 151, figures 21 and 22), stem (key 150, figure 23), handwheel (key 58, figure 24) or cap screw (key 177, figure 25) to set the point at which the travel stop limits travel. Be sure to tighten the locknuts and replace the cap (key 149, figures 21 and 23; key 247, figure 22) after setting the travel stop.

Instructions are given below for disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Key numbers are shown in figures 21 through 25.

1. Remove the cap (key 149 or 247) if the travel stop uses one. For down travel stops, loosen the locknuts (key 151, figures 21 and 22) so that the stop is not causing any spring compression.
2. Bypass the control valve, reduce loading pressure to atmospheric, and remove the tubing or piping from the connection on top of the yoke (key 73, figures 6, 8, and 10).
3. For down travel stops, turn the spring adjuster (key 74, figures 6, 8, and 10) out of the yoke toward the stem connector (key 31) to relieve all the compression in the spring (key 18).
4. For style 11 travel stops (figure 22), unscrew the cap screws (key 161), and make sure that the guide plate (key 157) can turn between the handwheel body (key 148) and the mounting plate (key 158).
5. Use a wrench on the nuts (key 151) to unscrew the extension rod (key 150). Remove the rod, the handwheel body (key 148), and the attached parts.
6. Unscrew the hex nuts and cap screws (keys 14 and 13, figures 6, 8, and 10) from the diaphragm casings. Lift off the upper diaphragm casing (key 1, figures 6, 8, and 10) and, for the style 11 travel stop, the mounting plate (key 158). For styles 10, 12 and 13, the travel stop assembly will be removed with the casing.
7. Note and record the position of travel stops (key 152) relative to the cap screws (key 154) for use in assembly. Unscrew the travel stops and cap screws, and remove either the mounting plate (key 158) or the handwheel body (key 148) and attached parts.

8. Separate the stem (key 150) and screw (key 160, figure 22) from the handwheel body.
9. Before reassembling, lubricate parts indicated by key 239 in figures 21 through 25. Use anti-seize lubricant (key 239).
10. Reassemble parts in the reverse order of removal.
11. When replacing the cap screws (key 154) and, if used, the travel stops (key 152), be sure to return them to their original position as recorded in step 7.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14), figures 6, 7, 8, 9, and 10 can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

12. Install the cap screws and nuts (keys 13 and 14, figures 6, 7, 8, 9, and 10) and finger tighten. Tighten the diaphragm cap screws and nuts to 27 N•m (20 lbf•ft) torque in a crisscross pattern.
13. Return the spring adjuster (key 74, figure 6, 7, 8, 9, and 10) to its original position. Re-adjust the travel stop.

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always mention this number when corresponding with your [Emerson sales office](#) or Local Business Partner regarding technical information or replacement parts. Also, reference the complete 11-character part number of each needed part as found in the following Parts Kits and Parts List sections.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Actuator Repair — Soft Parts Kits

Parts kit includes keys 8, 9, and 70. O-ring material is nitrile, and gasket material is composition.

Description	Part Number
Size 30/30i	R667X000302
Sizes 34/34i & 40/40i	R667X000402
Sizes 45/45i through 60/60i	R667X000502
Sizes 70/70i & 87	R667X000702
Size 76/76i	R667X000762

Actuator Repair — Hardware Kits

Hardware kit includes casing bolts (key 13), casing nuts (key 14), actuator stem (key 144), and seal bushing (key 7) in standard materials.

Description	Part Number
Size 30/30i	R667X000312
Size 34/34i	R667X000412
Size 40/40i	R667X000422
Size 45/45i	R667X000512
Size 46/46i	R667X000522
Size 50/50i	R667X000532
Size 60/60i	R667X000542
Size 70/70i	R667X000722
Size 76/76i	R667X000772
Size 87	R667X000732

Side-Mounted Handwheels Retrofit Kits

Retrofit Kit includes parts to add a Side-Mounted Handwheel.

Description	Part Number
Size 34 Push-Down-To-Close	30A8778X0E2
Size 34 Push-Down-To-Open	30A8778X0F2
Size 40 Push-Down-To-Close	30A8778X0G2
Size 40 Push-Down-To-Open	30A8778X0H2
Size 45 & 46 Push-Down-To-Close	40A8779X0A2
Size 45 & 46 Push-Down-To-Open	40A8779X0B2
Size 50 & 60 Push-Down-To-Close	40A8779X0C2
Size 50 & 60 Push-Down-To-Open	40A8779X0D2
Size 34i push down to close	GE71635X0E2
Size 34i push down to open	GE71635X0F2
Size 40i push down to close	GE71635X0G2
Size 40i push down to open	GE71635X0H2
Size 45i & 46i push down to close	GE71636X0A2
Size 40i & 60i push down to open	GE71636X0B2
Size 50i & 60i push down to close	GE71636X0C2
Size 50i & 60i push down to open	GE71636X0D2

Top-Mounted Handwheels Retrofit Kits

Retrofit Kit includes parts to add a Top-Mounted Handwheel.

Kit number 1 includes the handwheel assembly only.

Kit number 2 includes Kit number 1 and a new diaphragm case that is required to mount the handwheel assembly.

Description	Part Number
Kit 1	
Size 30/30i	30B3940X102
Sizes 34/34i	30B3940X022
Size 40/40i	30B3940X042
Sizes 45/45i & 50/50i	33B9224X012
Sizes 46/46i, 60/60i, & 76/76i	33B9224X012
Sizes 70/70i & 87	CV8060X0012
Kit 2	
Size 30/30i	30B3940X052
Size 34/34i	30B3940X062
Size 40/40i	30B3940X092
Sizes 45/45i & 50/50i	33B9224X022
Sizes 46/46i, 60/60i, & 76/76i	33B9224X032
Sizes 70/70i & 87	CV8060X0022

Transition Kits for Side-Mounted Handwheels

Transition kits include fasteners necessary to remount an existing side-mounted handwheel to an actuator where the yoke has been changed to a size i yoke.

Contains key numbers 256, 257, and 258.

Description	Part Number
Size 34i/40i push-down-to-close or push-down-to-open	GE71635X0J2
Size 45i - 60i push-down-to-close or push-down-to-open	GE71636X0E2

Parts List

Note

Contact your [Emerson sales office](#) or Local Business Partner for Part Ordering information.

Actuator Assembly

Key	Description
1	Upper Diaphragm Casing
2	Travel Stop Spacer

Key	Description
3*	Diaphragm Molded Nitrile/Nylon Molded Silicone/Polyester
4	Upper Diaphragm Plate
7*	Bushing, Seal Brass PTFE w/25% Glass (sizes 70 and 87)
8*	O-Ring Nitrile Fluorocarbon
9*	O-Ring Nitrile Fluorocarbon
12	Screw, Cap, hex hd
13	Hex hd Cap Screw
14	Hex Nut
17	Vent Assembly
18	Spring
19	Seat, Lower Spring
27	Extension Rod Conn
30	Hex hd Cap Screw
31	Stem Connector Assembly
32	Travel Indicator Scale
33	Screw, Self Tapping
33	Screw, Mach, Fill hd
34	Disk, Travel Indicator
39	Nameplate
40	Screw, Drive
64	Lower Diaphragm Casing
69	Nut, Hex, Jam
70*	Gasket Composition [up to 232°C (450°F)]
70*	O-Ring Nitrile
71	Lower Diaphragm Plate
72	Ring, Snap
73	Yoke
74	Spring Adjuster
75	Nut, Hex
76	Nut, Speed, Twin
77	Stop, Travel
78	Bushing, Pipe, Hex
79	Screw, Mach, Flat Hd
81	Screw, Mach, Rd Hd
82	Indicator, Travel, Adaptor
83	Washer, Plain
89	Spring Case Adaptor
90	Screw, Cap
102	Plug, Pipe, Hex Hd
144	Actuator Stem
227	Washer, Plain
228	Stem Disk Spacer
237	Lubricant, lithium grease not furnished with actuator
239	Lubricant, anti-seize not furnished with actuator
254	Caution Nameplate

Top-Mounted Handwheel (figures 11, 12, 13, 14, and 15)

Key	Description
58	Handwheel / Handjack Bar
60	Retainer Ring
148	Handwheel Body
150	Extension Rod
152	Up Travel Stop
154	Cap Screw
156	Vent Assembly
157	Guide Plate
158	Mounting Plate
159	Lock Nut
160	Handwheel Screw
161	Cap Screw
166	Castle Nut
167	Cotter Pin
178	Machine Screw
179	Lockwasher
180	Thrust Bearing
181	Thrust Race
182	Bearing Retainer
183	Pipe Nipple
239	Lubricant, anti-seize not furnished with handwheel
247	Handwheel Cap
253	Spacer, Handjack

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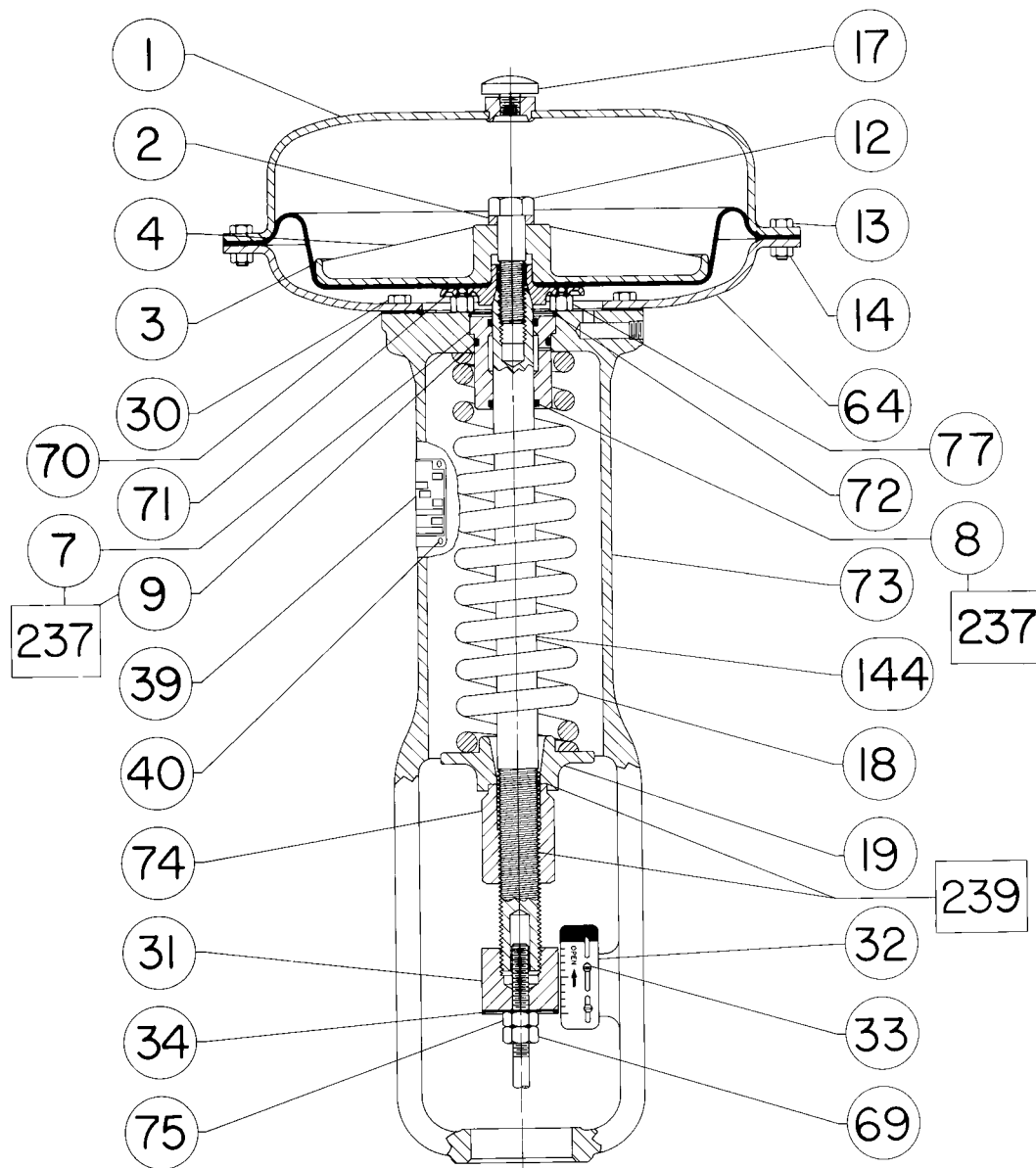
Instruction Manual

D100310X012

667 Actuator (Size 30/30i - 76/76i and 87)

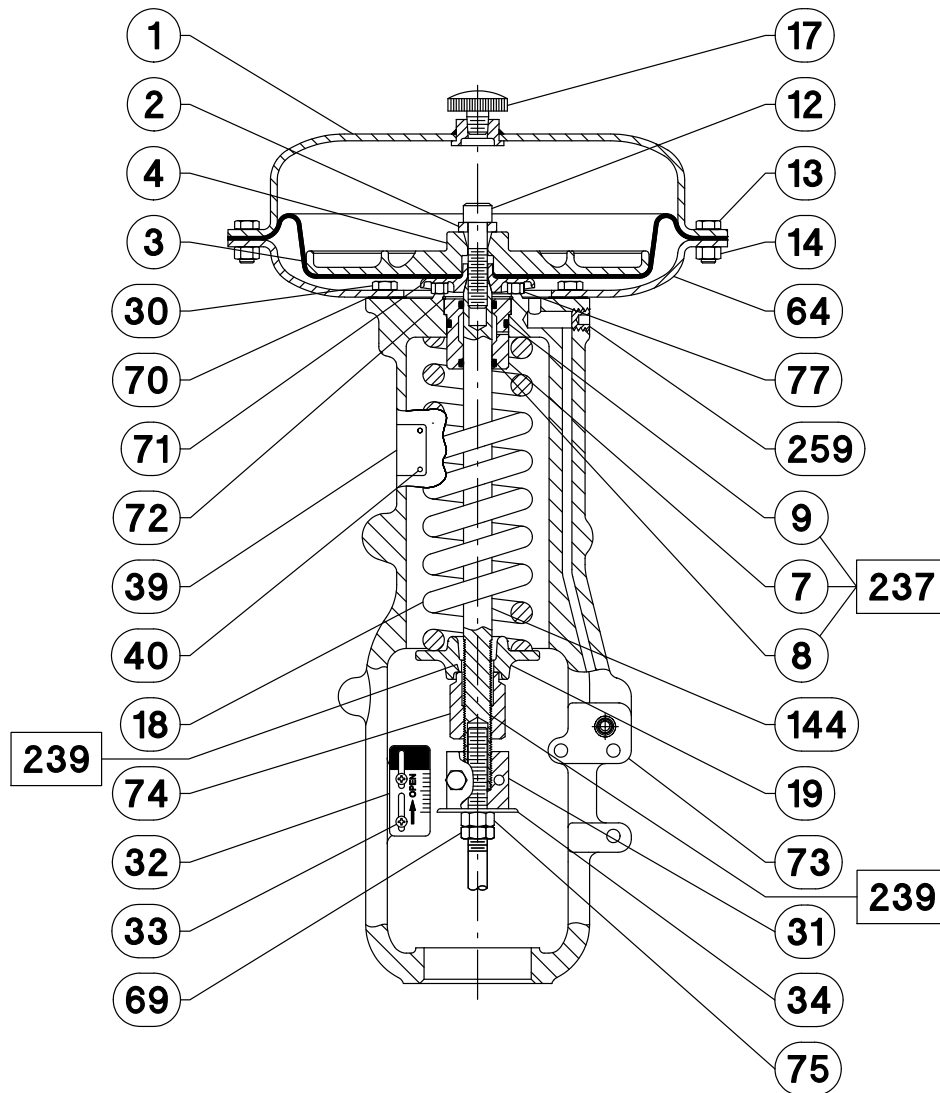
May 2018

Figure 6. Fisher 667 Actuator Sizes 30 through 60



50A8379-C

Figure 7. Fisher 667 Actuator Sizes 30i through 60i



□ APPLY LUB

PARTS NOT SHOWN: KEY 76 AND 254

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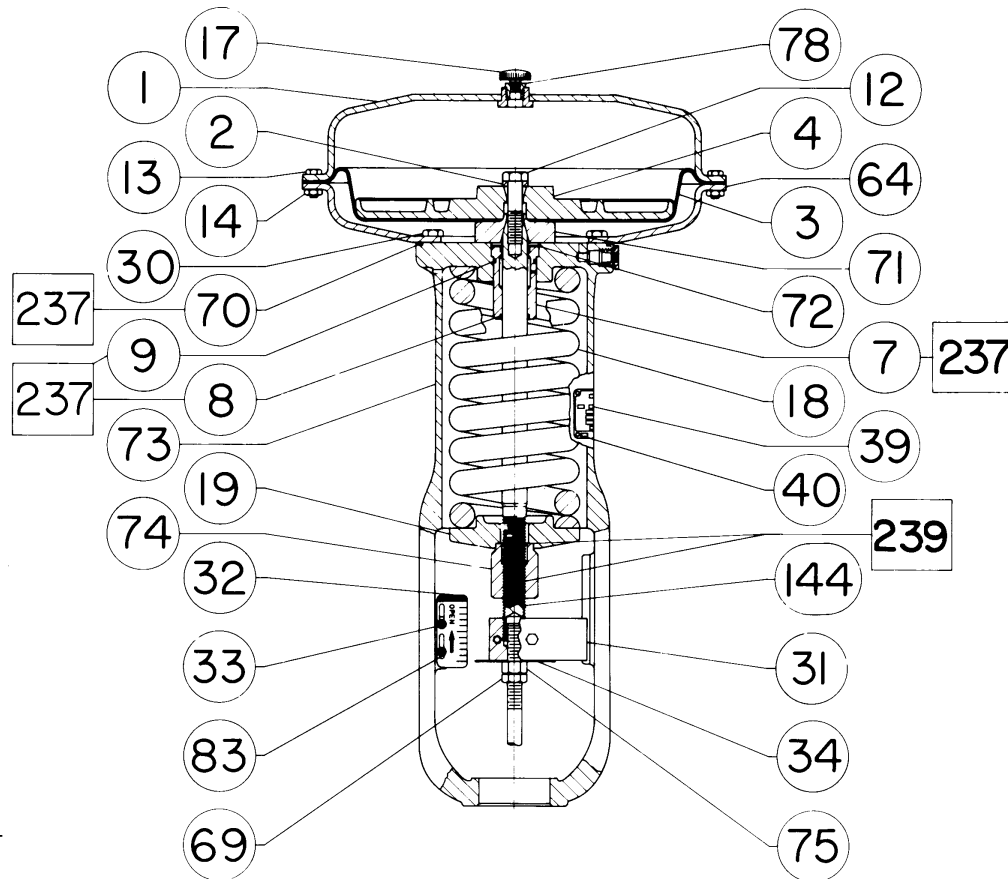
Instruction Manual

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667 Actuator (Size 30/30i - 76/76i and 87)

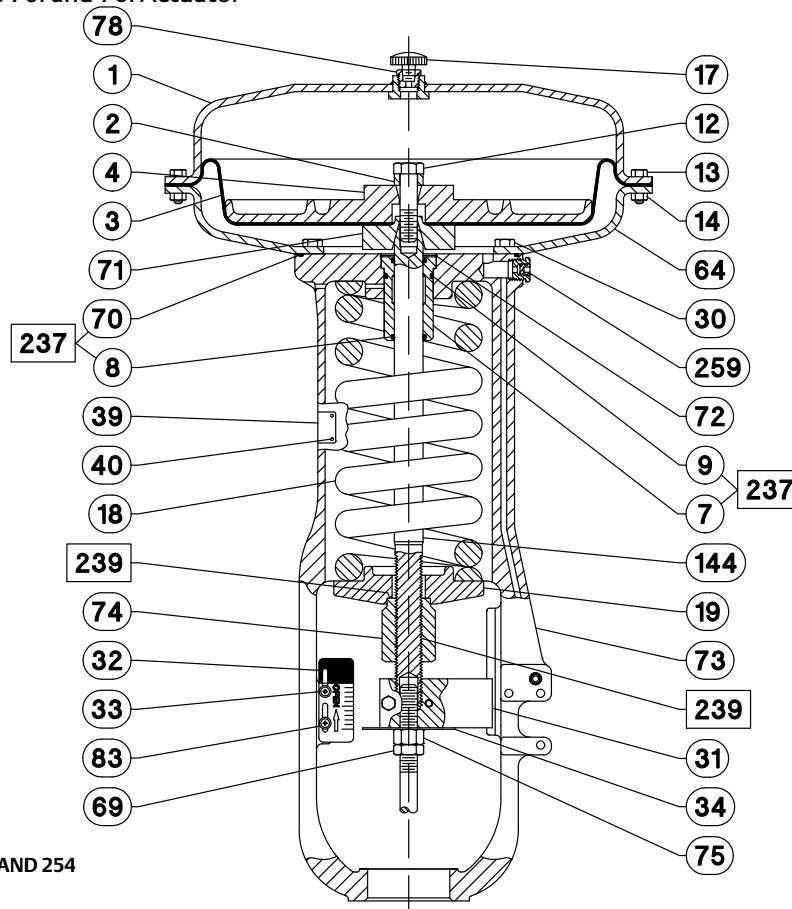
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Figure 8. Fisher 667 Size 70 and 76 Actuator



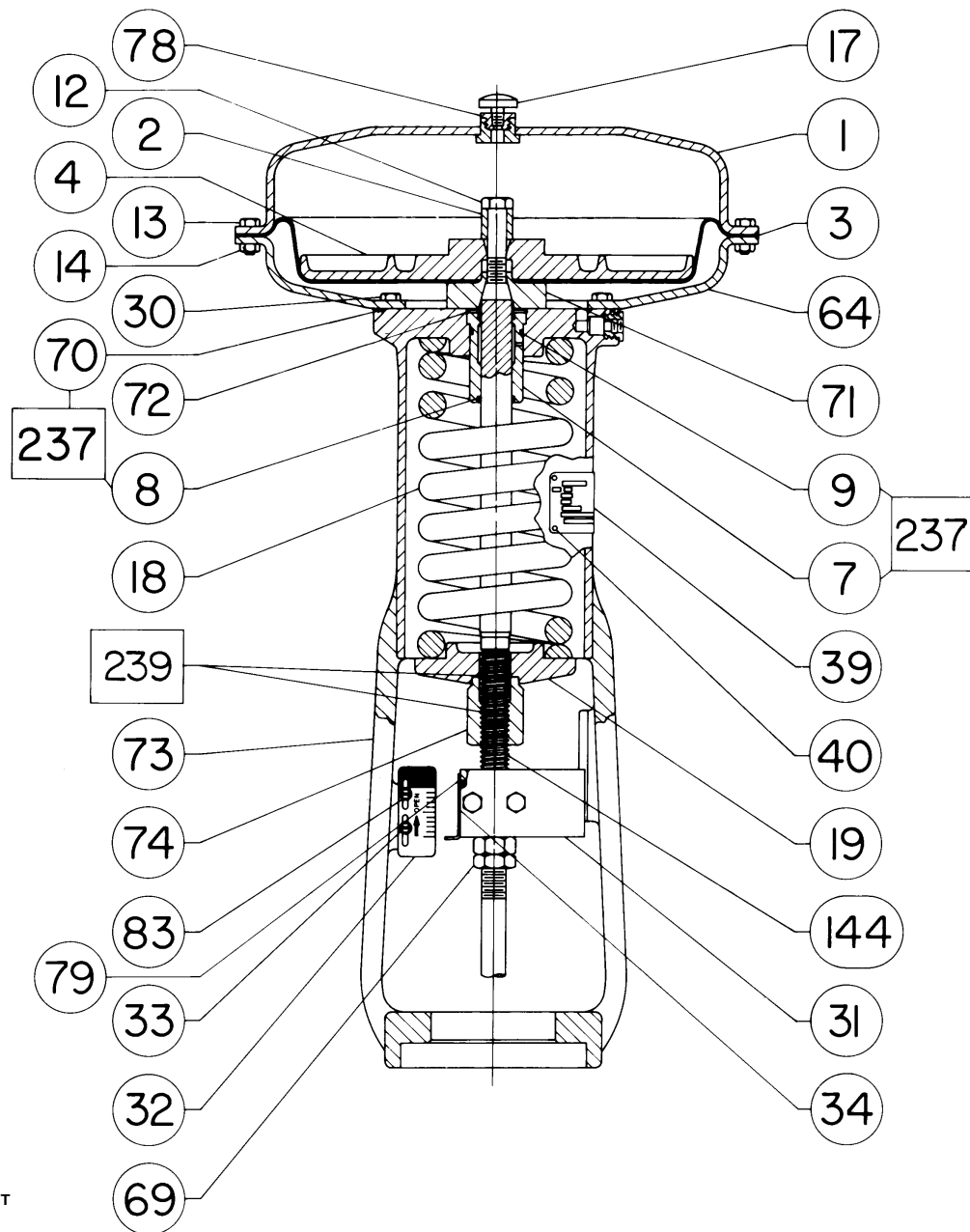
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Figure 9. Fisher 667 Size 70i and 76i Actuator



GE71630-A

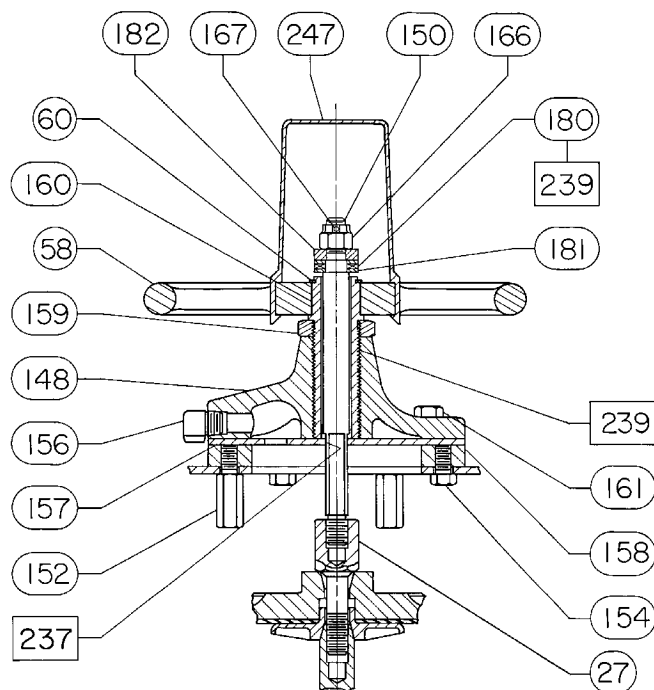
Figure 10. Fisher 667 Size 87 Actuator



□ APPLY LUBRICANT

50A8600-E

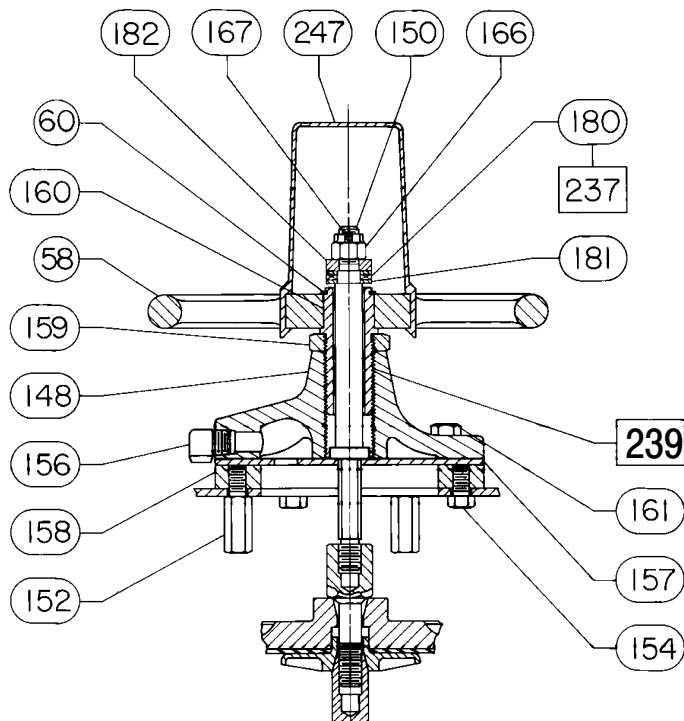
Figure 11. Top-Mounted Handwheel Assembly for Size 30/30i through 40/40i Actuators



□ APPLY LUBRICANT

NOTE:
THE TOP MOUNTED HANDWHEEL IS NOT DESIGNED FOR USE UNDER HEAVY LOAD OR FREQUENT USE.

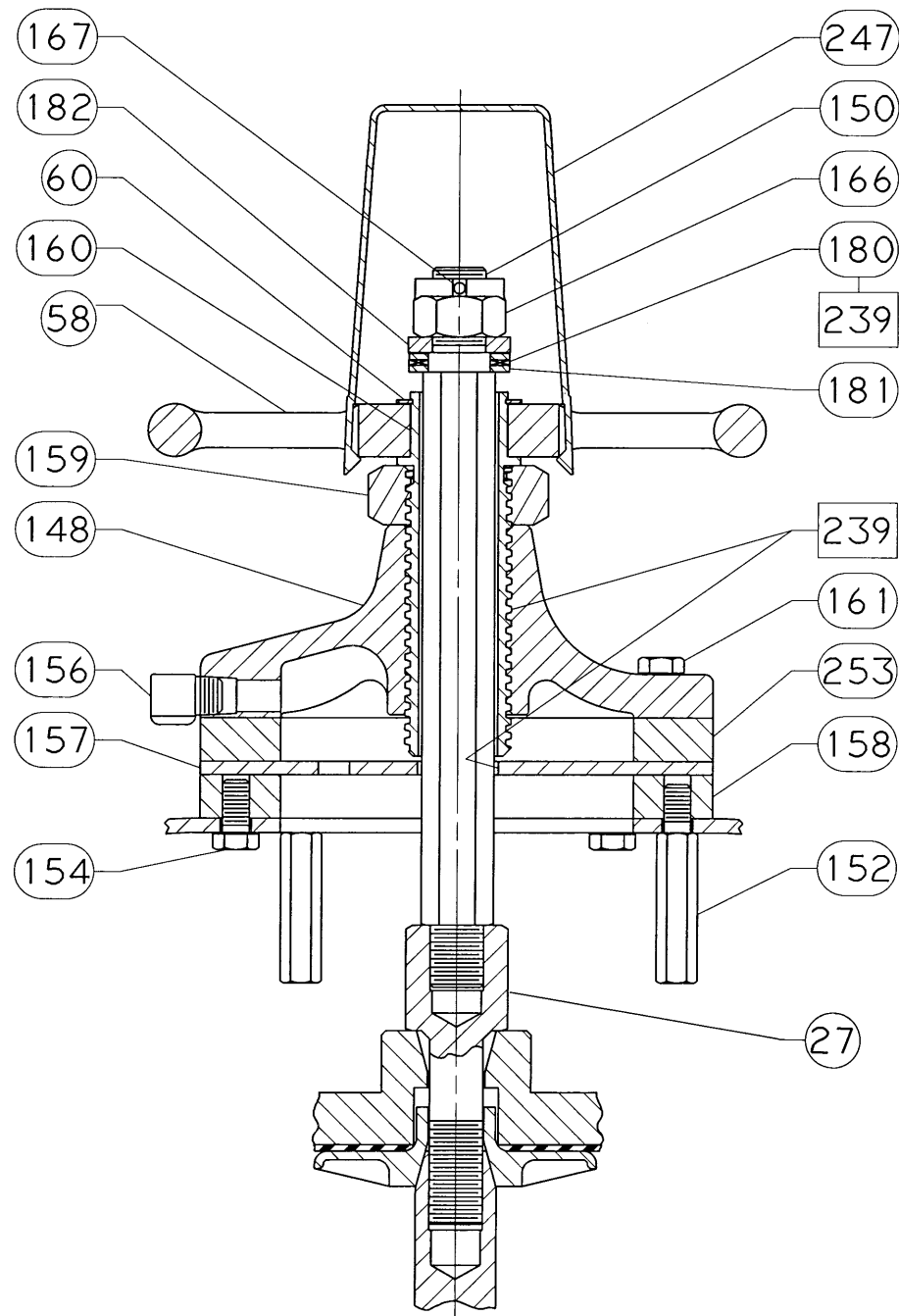
Figure 12. Top-Mounted Handwheel Assembly, Style P2 for Size 45/45i, 50/50i, 60/60i, and 76/76i Actuators



□ APPLY LUBRICANT

30B3942-A

Figure 13. Top-Mounted Handwheel Assembly for Size 45/45i-76/76i Actuators



□ APPLY LUBRICANT

33B9224-B

Figure 14. Top-Mounted Handwheel Assembly for Size 70/70i and 87 Actuators

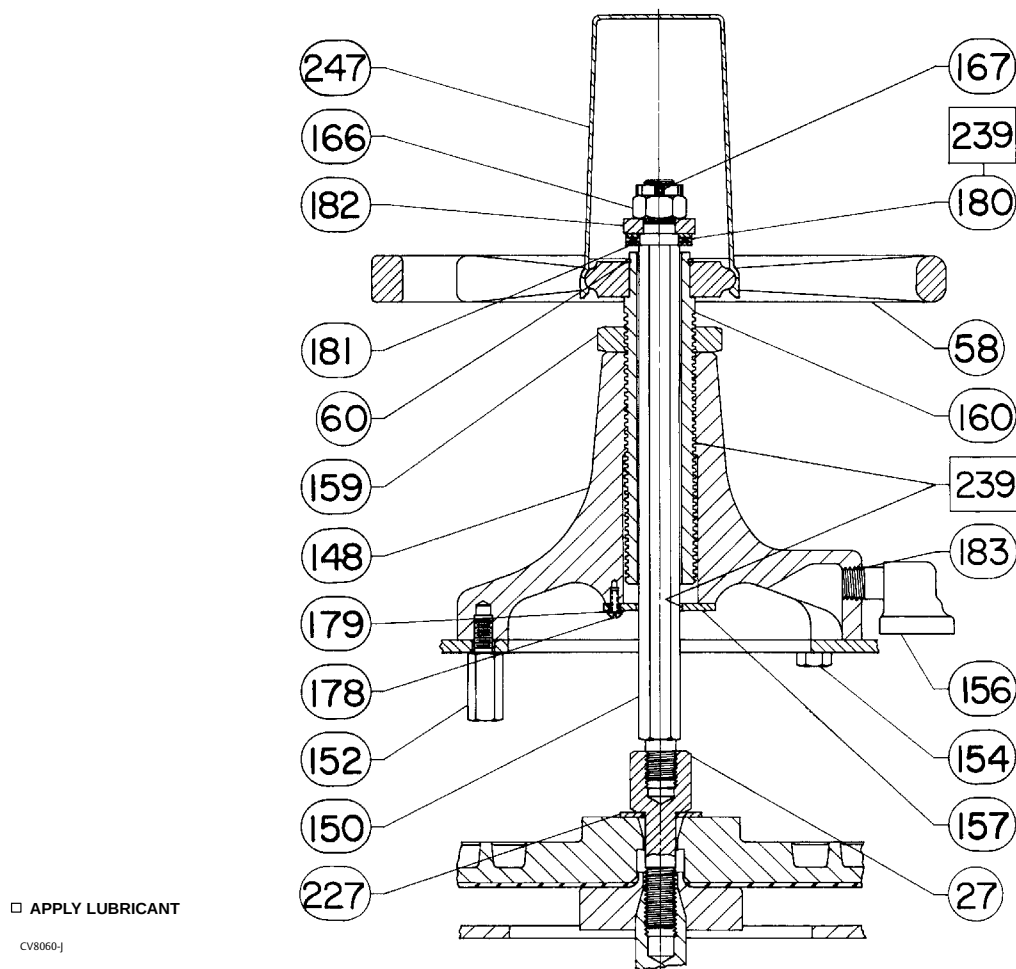
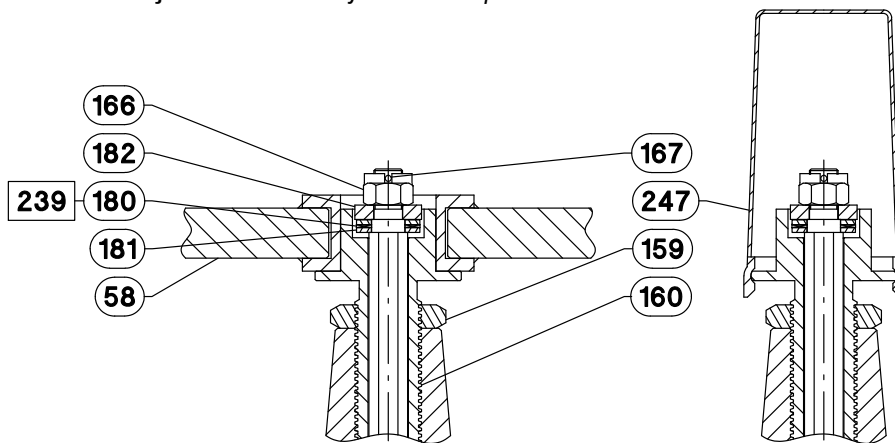


Figure 15. Top-Mounted Handjack Bar Assembly for Size 70/70i and 87 Actuators



NOTE:
THE TOP MOUNTED HANDJACK BAR SHOULD BE REMOVED WHEN NOT IN USE AND THE HANDWHEEL CAP INSTALLED FOR WEATHER PROTECTION OF INTERNAL COMPONENTS.

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667 Actuator (Size 30/30i - 76/76i and 87)

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Figure 16. Side Mounted Handwheel Assembly for Size 34 and 40 Actuators

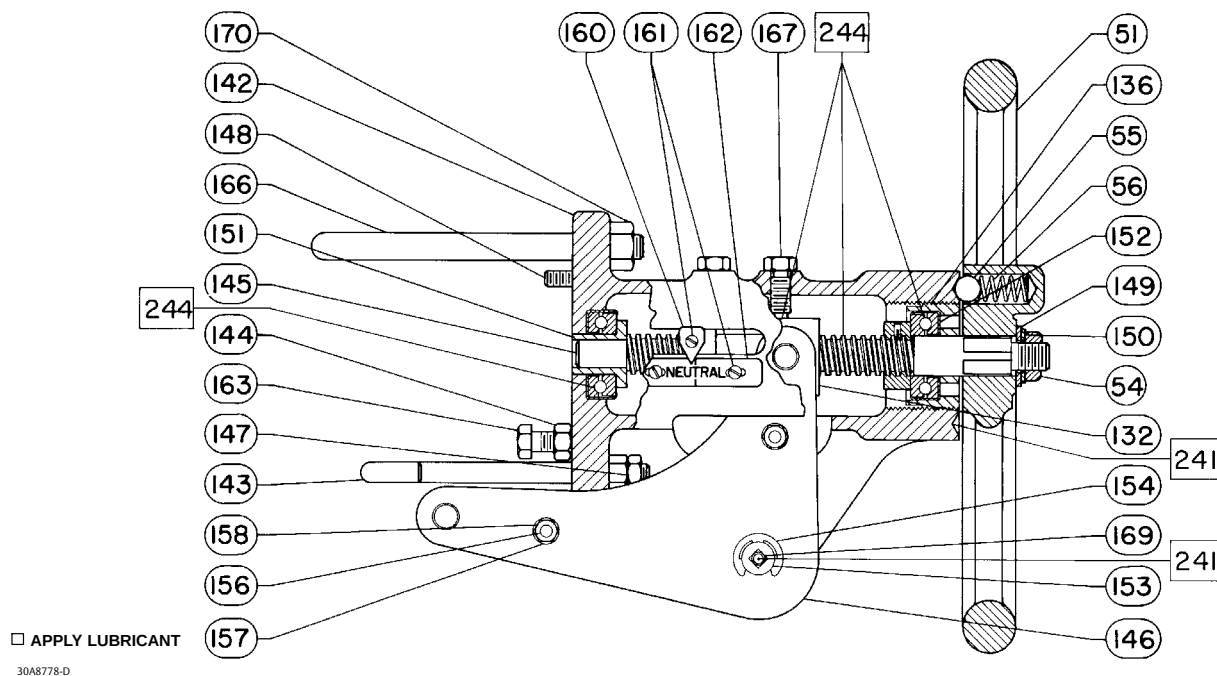
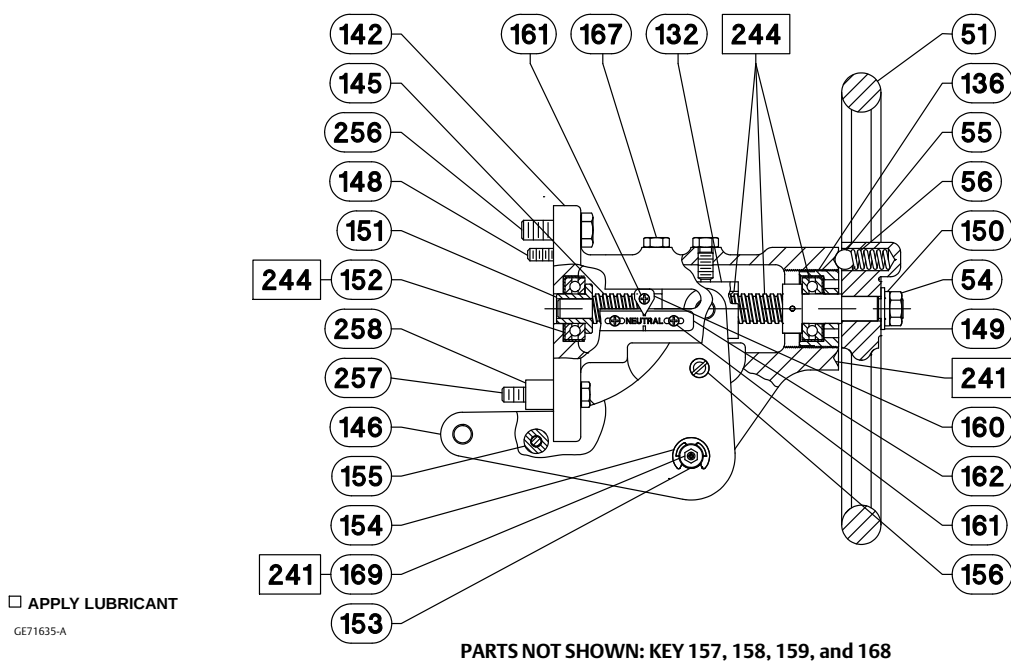


Figure 17. Side Mounted Handwheel Assembly for Size 34i and 40i Actuators



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667 Actuator (Size 30/30i - 76/76i and 87)

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Figure 18. Side-Mounted Handwheel Assembly for Size 45 through 60 Actuators

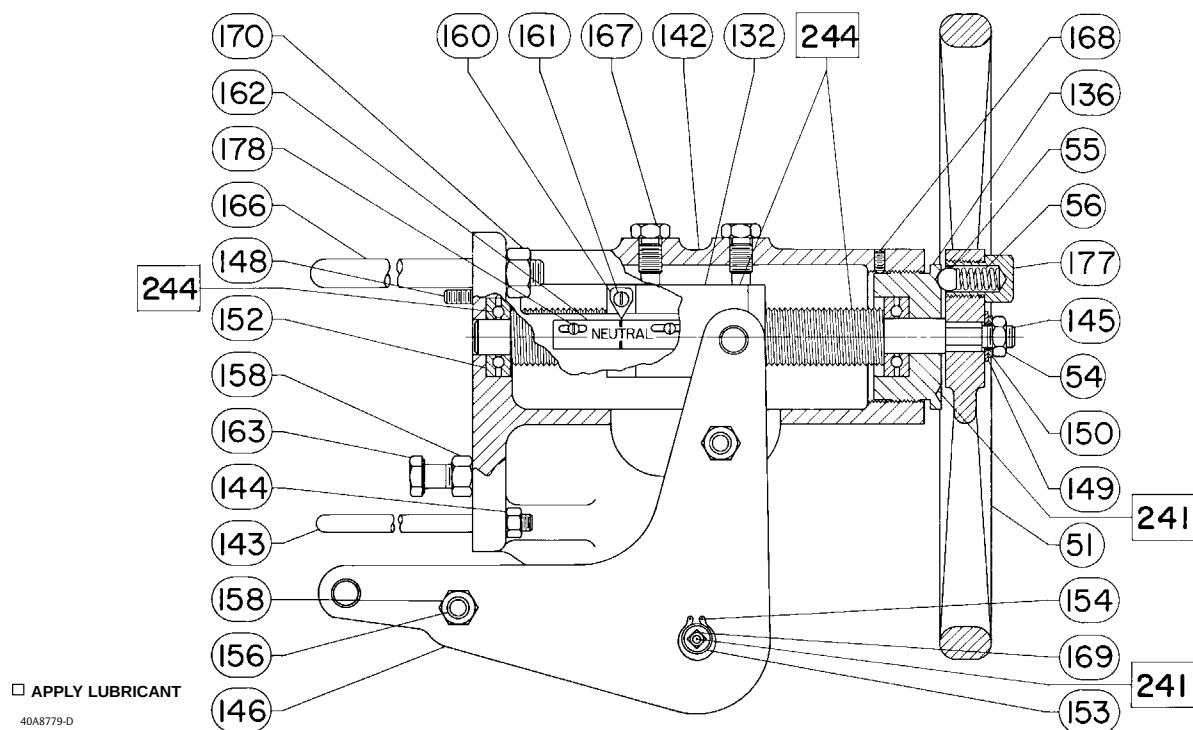
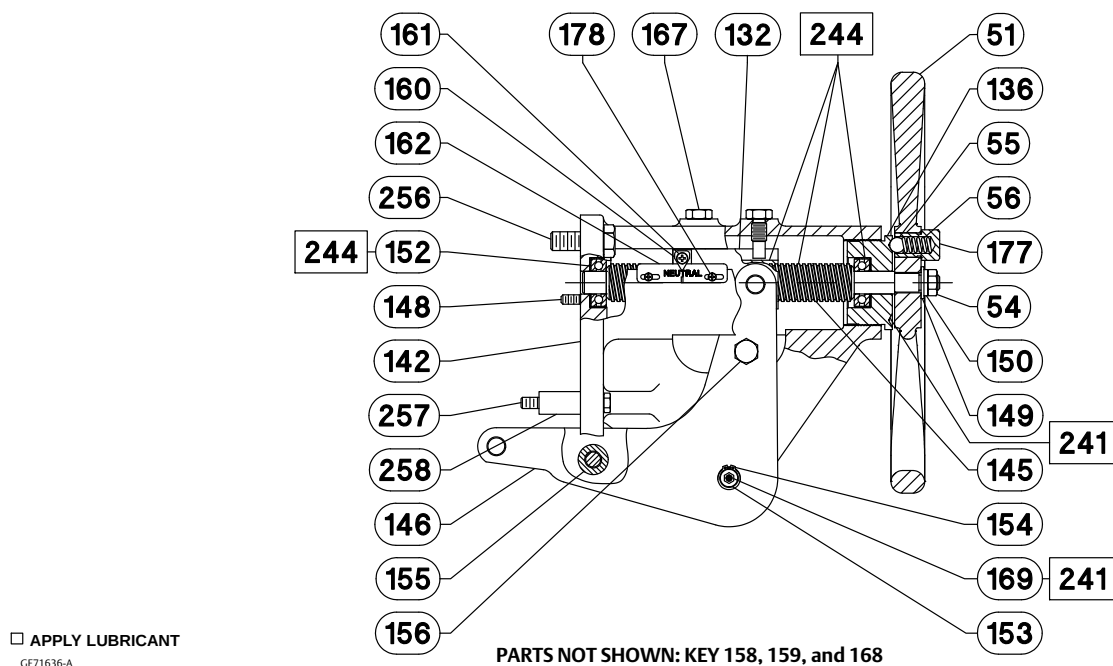


Figure 19. Side Mounted Handwheel Assembly for Size 45i through 60i Actuators



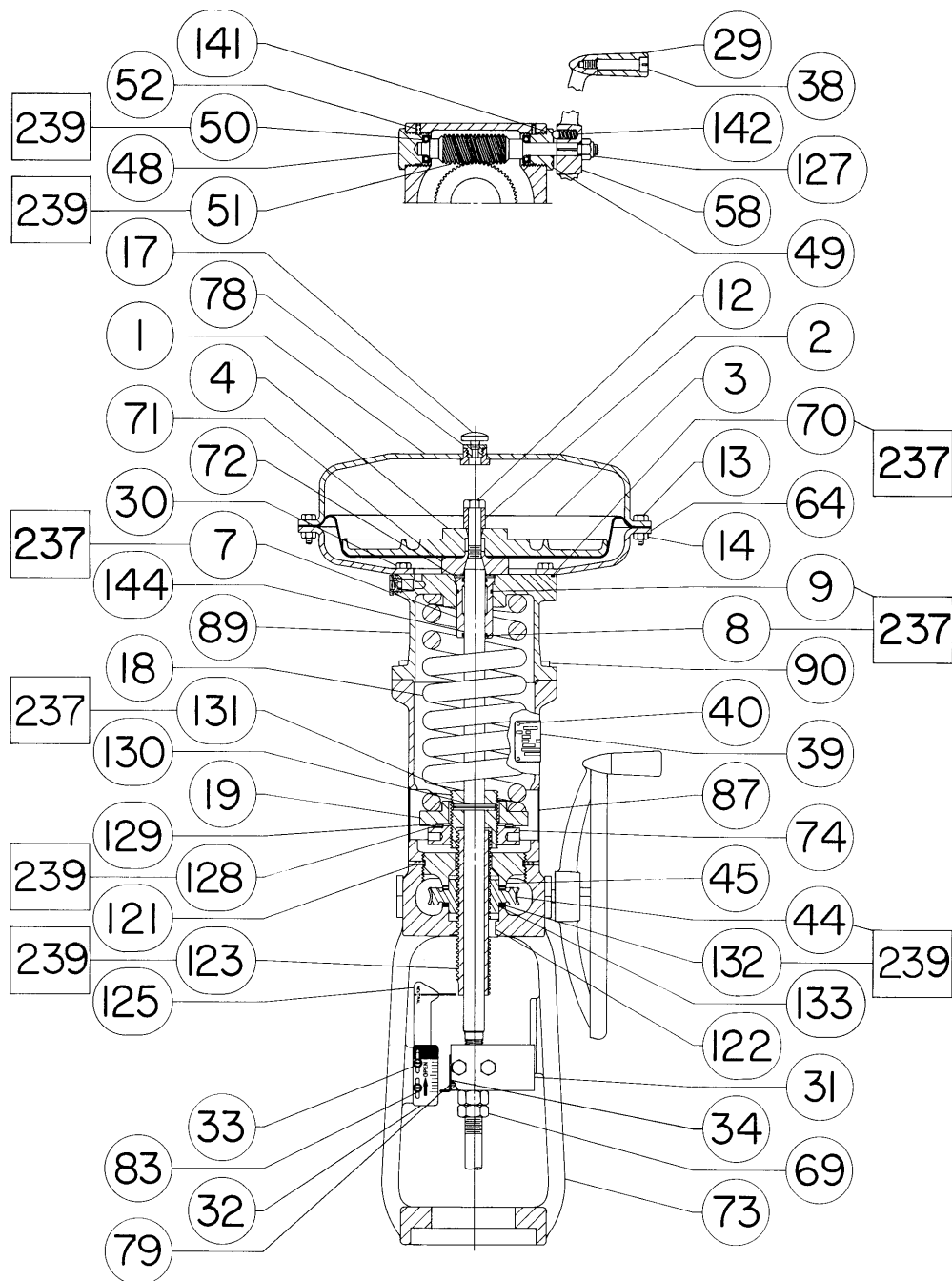
Side-Mounted Handwheel, Size 34-60 and 34i-60i (figures 16 and 18)

Key	Description
51	Handwheel
54	Hex Jam Nut
55	Ball
56	Spring
132	Operating Nut
136	Bearing Retainer
142	Handwheel Body
143	Mounting Bolts
144	Hex Nut
145	Handwheel Screw
146	Lever & Pin Assembly
147	Hex Jam Nut
148	Dowel Pin
149	Washer
150	Lockwasher
151	Bushing
152	Ball Bearing
153	Lever Pivot Pin
154	Retaining Ring
155	Spacer
156	Screw
157	Lockwasher
158	Hex Nut
159	Pointer Mounting Bolt
160	Pointer
161	Machine Screw
162	Indicator Plate (Aluminum)
163	Cap Screw
166	U-Bolt
167	Guide Bolt
168	Set Screw
169	Grease Fitting
170	Hex Nut
177	Spring Cap
178	Machine Screw
241	Lubricant, lithium grease Not furnished with handwheel
244	Lubricant, anti-seize Not furnished with handwheel
256	Cap Screw
257	Cap Screw
258	Spacer

Side-Mounted Handwheel, Size 70, 76 and 87 (figure 20)

Key	Description
29	Handgrip
38	Handgrip Bolt
44	Worm Gear
45	Bearing Retainer Flange
48	Back Worm Retainer
49	Front Worm Retainer
50	Ball Bearing
51	Worm Shaft
52	Set Screw
57	Grease Fitting
58	Handwheel
87	Cover Band Ass'y
89	Spring Case Adaptor
90	Cap Screw
121	Set Screw
122	Key
123	Lower Sleeve
125	Handwheel Indicator
127	Handwheel Cap
128	Needle Bearing
129	Needle Bearing Race
130	Roll Pin
131	Spring Adjusting Screw
132	Needle Bearing
133	Needle Bearing Race
141	Ball
142	Spring
237	Lubricant, lithium grease Not furnished with Handwheel
239	Lubricant, anti-seize Not furnished with Handwheel
245	Yoke Extension

Figure 20. Size 70, 76, and 87 Actuator with Side Mounted Handwheel Assembly



□ APPLY LUBRICANT
PART NOT SHOWN: 57
E0871

Figure 23. Style 12 Up Travel Stop (Casing Mounted)

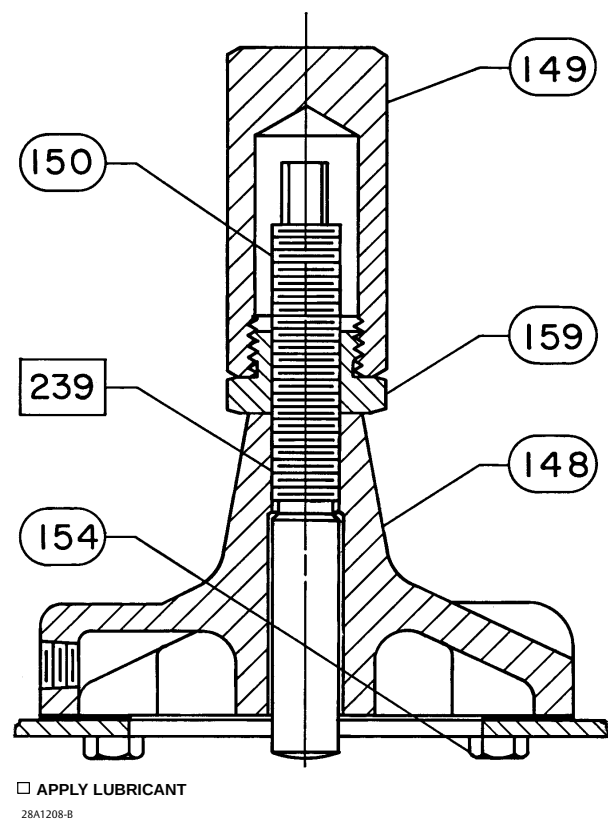


Figure 24. Style 13 Up Travel Stop - For Sizes 30/30i to 60/60i and 76/76i, Size 30/30i Shown (Casing Mounted)

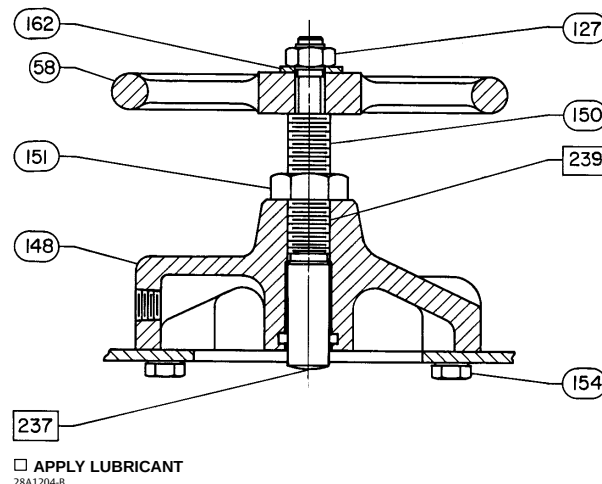
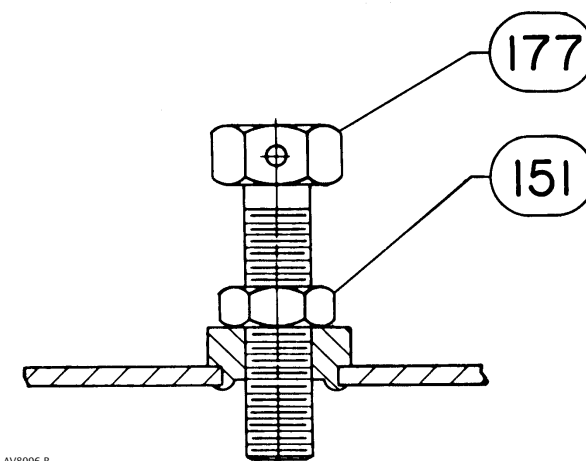


Figure 25. Style 14 Up Travel Stop (Casing Mounted)



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Fisher™ 667 Diaphragm Actuators Size 80 and 100

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Figure 1. Size 80 Fisher 667 Actuator



W1950

Introduction

Scope of Manual

This instruction manual provides information on installation, adjustment, maintenance, and parts ordering for the Fisher 667 actuator in sizes 80 and 100 (figure 1). Refer to separate instruction manuals for information about other equipment and accessories used with these actuators.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

667 Size 80 and 100 Actuators

July 2023

Instruction Manual

D100311X012



Do not install, operate, or maintain 667 actuators without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

SPECIFICATION		ACTUATOR SIZE			
		80		100	
Nominal Effective Diaphragm Area	cm ²	1761		2902	
	inch ²	273		450	
Yoke Boss Diameters	mm	127		127	178
	inch	5		5H ⁽¹⁾	7
Acceptable Valve Stem Diameters	mm	25.4 or 31.8		31.8	50.8
	inch	1 or 1-1/4		1-1/4	2
Maximum Allowable Output Thrust		Standard Cast Iron Construction	All Steel Construction		
	N	62942	88075	200170	
	lb	14150	19800	45000	
Maximum Pressure Limitations		Refer to table 2			
Maximum Travel	mm	76		102	
	inch	3		4	
Material Temperature Capabilities	°C	-40 to 82			
	°F	-40 to 180			
Pressure Connections		1/4 NPT internal			
Approximate Weights Without Handwheel	kg	284		544	
	lb	626		1200	
1. Heavy actuator-to-bonnet bolting.					

1. Heavy actuator-to-bonnet bolting.

Description

The 667 actuator is a reverse-acting actuator. Reverse-acting actuators use air action to lift the diaphragm (away from the valve), and spring action opposes the diaphragm action (see figure 2). The actuator position changes in response to varying controlled air pressure to the diaphragm. If air pressure is reduced or lost from the actuator diaphragm, spring action will extend the actuator stem. The actuator is often used with control valves using a pneumatic positioner for air pressure control, and where fail action will fully open or close the control valve as the actuator stem extends.

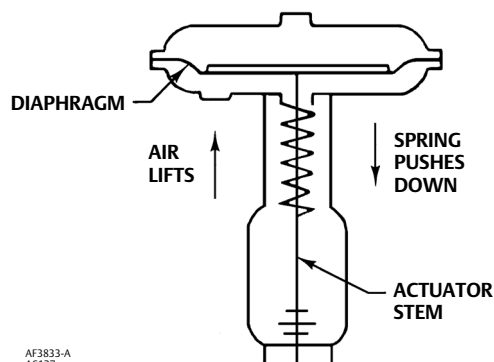
Also, the actuator can be furnished with either a side-mounted (size 80 only) handwheel assembly or a top-mounted handwheel (adjustable up travel stop) (size 100 only). The size 80 side-mounted handwheel is normally used as an auxiliary manual actuator. The size 100 top-mounted handwheel is used as either a travel stop or an auxiliary manual actuator.

The actuator can be furnished with a top-loading capability. A top-loaded actuator allows air pressure to be applied to the top of the diaphragm, aiding the spring to extend the actuator stem. This air pressure increases valve seat load on valve applications where additional seat-loading is necessary.

Specifications

Refer to table 1 for Specifications of the 667 actuator. See the actuator nameplate for information about a specific actuator.

Figure 2. Schematic Representation of Fisher 667 Actuator



667 REVERSE-ACTING DIAPHRAGM ACTUATOR

Table 2. Maximum Pressure Limitations

PRESSURE LIMITATIONS		ACTUATOR SIZE		
		80		100
		Standard Cast Iron Construction	All Steel Construction	
Maximum Casing Pressure for Actuator Sizing	bar	3.4	4.9	6.9
	psig	50	70	100
Maximum Excess Diaphragm Pressure	bar	1.4	1.4	1.7
	psig	20	20	25
Maximum Diaphragm Casing Pressure		Upper bench set plus Maximum Excess Diaphragm Pressure or 4.1 bar (60 psig), whichever is less.	Upper bench set plus Maximum Excess Diaphragm Pressure or 5.5 bar (80 psig), whichever is less.	Upper bench set plus Maximum Excess Diaphragm Pressure or 7.9 bar (115 psig), whichever is less.

Maximum Pressure Limitations

⚠ WARNING

To avoid personal injury or parts damage, do not apply pressure that exceeds the Maximum Pressures listed in table 2. Exceeding any of the maximum pressures can result in uncontrolled movement of parts, damage to actuator parts and the control valve, and loss of control of the process. Use pressure-limiting or pressure-relieving devices to prevent casing pressure from exceeding these limits.

Do not apply a pressure that produces a force on the actuator stem greater than the maximum allowable actuator output thrust or the maximum allowable stem load.

The casing and diaphragm of 667 actuators are pressure operated. This air pressure provides force to compress the spring and stroke the actuator. The following explanations describe the maximum pressure limits for 667 actuators. Refer to the nameplate, warning tag, and table 2 for maximum values.

- **Maximum Casing Pressure for Actuator Sizing:** This is the maximum pressure that can be applied to provide full travel of the actuator. If this stroking pressure is exceeded before the upper diaphragm plate contacts the travel stop, damage to the stem or other parts might result. The Maximum Diaphragm Casing Pressure for a specific actuator construction may be less than the Maximum Casing Pressure for Actuator Sizing. See table 2.
- **Maximum Excess Diaphragm Pressure:** This is the additional pressure that may be added when the actuator is at full travel. If the Maximum Excess Diaphragm Pressure is exceeded once the actuator has reached full travel, damage to the diaphragm or diaphragm casing might result.

Because the actuator has traveled its specified travel, and the diaphragm head is physically stopped from movement, the force from any additional air pressure is transmitted to the diaphragm and diaphragm casings. The amount of air pressure that can be added once the actuator has traveled to the stops is limited by the resultant adverse effects that may occur. Exceeding this limiting factor could result in leakage or casing fatigue due to the deformation of the upper diaphragm casing.

- **Maximum Diaphragm Casing Pressure:** If the Maximum Diaphragm Casing Pressure is exceeded, damage to the diaphragm, diaphragm casing, or actuator might result. For some actuator constructions, the maximum Diaphragm Casing Pressure is the sum of the upper bench set, noted on the nameplate, added to the Maximum Excess Diaphragm Pressure. For other actuator sizes, the value is lower, see table 2.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

When an actuator and valve are shipped together, the actuator is normally mounted on the valve. Follow the valve instructions when installing the control valve in the pipeline. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the following Actuator Mounting procedures.

For information on mounting valve positioners, refer to the appropriate valve positioner instruction manual.

Actuator Mounting

1. Mount the actuator on the valve bonnet. Insert the cap screws and tighten the hex nuts, securing the actuator to the bonnet.
2. Screw the valve stem jam nuts (key 69, figures 6 and 7) all the way onto the valve stem threads.
3. Connect an air supply to the lower diaphragm casing connection.
4. For push-down-to-close valves, be sure the valve plug is on its seat. Reduce loading pressure to ensure that the actuator stem is fully extended. Apply slight loading pressure to retract the stem approximately 3.2 mm (1/8-inch).

5. For push-down-to-open valves, apply pressure to ensure that the actuator stem is fully retracted. Be sure the valve plug is on its seat. On large valve sizes, this may require the use of a pry bar inserted through the valve body line opening. If the valve is installed in a pipeline, the bottom flange (if one is used) can be removed and the valve plug pushed to the seat from the bottom opening. Reduce actuator loading pressure to extend the stem approximately 3.2 mm (1/8-inch).

NOTICE

Incomplete engagement of either the valve stem or actuator stem in the stem connector can result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than the diameter of that stem.

6. Clamp the actuator and valve plug stems between the two stem connector halves (key 31, figures 6 and 7). Insert and tighten the stem connector cap screws.
7. Thread the stem locknuts against the stem connector.
8. Align the travel indicator scale (key 32, figures 6 and 7) to show valve position.

⚠ WARNING

To avoid personal injury due to the sudden, uncontrolled movement of parts, do not loosen the cap screws when the stem connector has spring or loading pressure force applied to it.

Loading Connection

Key number locations are shown in figures 6 and 7, unless otherwise directed.

1. Connect the loading pressure piping to the connection in the size 80 spring case adaptor (key 89) or in the size 100 lower diaphragm casing (key 67).

For top-loaded actuators

1. For size 80, remove the the pipe bushing (key 78), and connect the loading pressure piping in its place. For size 100, remove the hex bushing (key 62) from the upper casing (key 1), and connect the top loading pressure piping in its place.
2. Remove the 1/4-inch bushing (key 92, figure 6; key 62, figure 7) to increase connection size, if necessary. The connection can be made with either piping or tubing.
3. Keep the length of tubing or piping as short as possible to avoid transmission lag in the control signal. If an accessory (such as a volume booster or valve positioner) is used, be sure that the accessory is properly connected to the actuator. Refer to the positioner instruction manual as necessary.
4. Cycle the actuator several times to check that the valve stem travel is correct and that the travel occurs when the correct pressure range is applied to the diaphragm.
5. If valve stem travel is incorrect, refer to the Travel procedure in the Adjustments section.
6. If the spring pressure range is incorrect, refer to the Spring procedure in the Adjustments section.

Adjustments

Travel

Make travel adjustments when the motion observed during actuator travel is different from the travel stamped on the actuator nameplate. If the Actuator Mounting procedure was followed correctly, this adjustment should not be necessary.

When adjusting travel of a direct-acting valve, put a slight pressure on the actuator diaphragm. This moves the valve plug off the seat, reducing the chance of damaging the valve plug or seat during adjustments.

1. Back the stem jam nuts (key 69, figures 6 and 7) away from the stem connector (key 31, figures 6 and 7), and slightly loosen the stem connector cap screws.

NOTICE

Do not use wrenches or other tools directly on the valve stem. Damage to the stem surface and subsequent damage to the valve packing may result.

2. Tighten the locknuts together, using a wrench, then screw the valve stem either into the stem connector to lengthen travel or out of the stem connector to shorten travel.
3. Cycle the actuator to check for the specified travel. If actual travel is not equal to the specified travel, adjust and check travel until correct. Tighten the stem connector cap screws when correct travel is obtained.
4. Raise the travel indicator disk by threading the stem locknuts against the stem connector.

Spring

Make spring adjustments when the loading pressure range applied to achieve specified travel is not equal to the pressure range stamped on the actuator nameplate. Refer to the Bench Set pressure range on the nameplate when the valve contains no pressure and the packing is loosely inserted in the bonnet. Refer to the Maximum Allowable Supply pressure on the nameplate when the valve is controlling the specified pressure drop, and the packing is tightened to stop leaks around the stem.

Monitor loading pressure carefully when making adjustments. Do not exceed the pressure specifications of either the loading regulator or the actuator casings.

Each actuator spring has a fixed pressure span. Changing the spring compression shifts the span up or down to make valve travel coincide with the loading pressure range.

Size 80 Actuator Spring

Note

Before turning the spring adjuster on size 80 actuators, assemble the stem connector around the actuator stem and the anti-rotating lug on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.

Remove the cover band (key 87, figure 6), insert a rod of approximately 12.7 mm (1/2 inch) diameter into a hole in the spring adjuster (key 74, figure 6), and rotate the spring adjuster with the rod. Rotating the adjuster from left to right will increase the loading pressure required to start actuator stem travel; opposite rotation will decrease the pressure required to start travel.

Size 100 Actuator Spring

NOTICE

The actuator must be in the vertical position when adjusting the spring to avoid damage to the thrust bearing (key 86, figure 7) and to properly position the spacers required for adjustment.

Remove the shroud plate (key 65, figure 7), and loosen the jam nut (key 26, figure 7).

For small spring forces, adjustments can be made by rotating the adjusting nut (key 25, figure 7). Counterclockwise rotation (when viewed from the diaphragm casings) of the adjusting nut will increase the loading pressure required to start actuator stem travel, and clockwise rotation will decrease the pressure required to start travel. Tighten the jam nut when adjustment is complete.

For high spring forces, it is necessary to use spacers between the bottom of the yoke and the spring seat to isolate spring force from the adjusting nut.

⚠ WARNING

To avoid personal injury from the compressed actuator spring snapping back to its original length, make and use the spacers by following the instructions in the steps below.

1. It is recommended that three spacers be made of three-inch schedule 80 pipe cut to the appropriate length specified in step 2. If other than the recommended material is to be used, be certain that the spacers are capable of withstanding the spring force involved. The spacers must also be of equal length with ends cut squarely.
2. Measure dimension B as shown in figure 3. Cut the length of the spacers as follows:
 - a. If it is desired to decrease spring compression, make the spacers approximately 4.8 mm (3/16-inch) longer than dimension B.
 - b. If it is desired to increase spring compression, make the spacers approximately 4.8 mm (3/16-inch) shorter than either dimension B plus the amount of adjustment required or dimension B plus valve travel, whichever is less.
3. Whenever the total amount of adjustment required is greater than valve travel, the adjustment must be made in two or more steps, and the amount of adjustment taken in each step must be less than valve travel.
4. Pressure the actuator to attain full travel. Cautiously insert the spacers at equal intervals around the spring seat (key 19, figure 7). Spacers must be seated squarely, or they may slip out of position. Keeping hands and tools away from the spring and spring seat, slowly decrease loading pressure until the spring force holds the spacers firmly between the spring seat and the bottom of the yoke.
5. Loosen the jam nut. The adjusting nut can now be rotated counterclockwise (when viewed from the diaphragm casings) to increase the loading pressure required to start actuator stem travel or clockwise to decrease the pressure required to start travel.
6. Pressure the actuator to move the spring seat away from the spacers, and carefully remove the spacers.
7. Slowly reduce the air pressure to the actuator. Make sure that the thrust bearing (key 86) is correctly seated in the spring seat before contact with the adjustment nut (key 25) is made.
8. If the total adjustment required was greater than valve travel, repeat the procedure. It will be necessary to make new spacers using the new dimension B and the remaining adjustment required or valve travel, whichever is less. Tighten the jam nut when adjustment is complete.

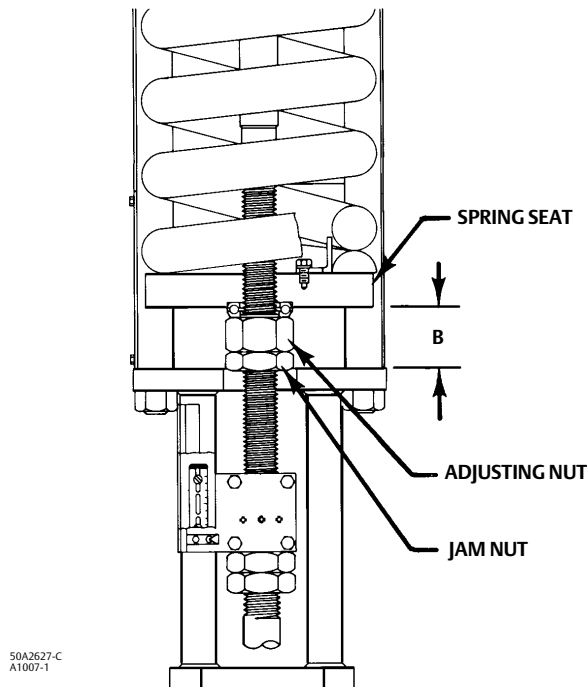
Maintenance

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Figure 3. Dimension B for Spring Adjustment



Size 80 Actuator Maintenance

For size 80 actuators, refer to figure 4 for part names and locations. Key number locations for size 80 actuators are shown in figure 6.

Disassembly

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve, and drain the process media from both sides of the valve. Shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

2. Remove the tubing or piping from the connection in the top of the spring case adaptor (key 89).
3. If the actuator has a handwheel, rotate the handwheel to relieve all spring compression.
4. Remove the cover band (key 87). Insert a steel rod of approximately 12.7 mm (1/2-inch) diameter into a hole in the spring adjustor (key 74), and rotate the spring adjustor from right to left until spring compression is relieved.

⚠ WARNING

To avoid personal injury due to the sudden, uncontrolled movement of parts, do not loosen the cap screws on the stem connector (key 31) when spring force is applied.

5. If necessary, the entire actuator assembly may be removed from the valve by unscrewing the cap screws from the stem connector (key 31) and removing actuator-to-bonnet bolting.
6. Unscrew the diaphragm casing cap screws and nuts (keys 13 and 14), and lift off the upper diaphragm casing (key 1).
7. Unscrew the diaphragm cap screw (key 12), remove the spacer, upper diaphragm plate, diaphragm, and lower diaphragm plate (keys 2, 4, 3, and 71).

Note

Standard and top-loaded constructions use the same key numbers for parts. The parts look different, but they use the same assembly and disassembly sequence. See figure 4, Size 80 Actuator Construction for location of parts.

8. Unscrew the cap screws (key 30), and remove the lower diaphragm casing (key 64).
9. For actuators without a snubber:
 - a. Unscrew the spring case adaptor cap screws and nuts (keys 90 and 91), and remove the adaptor (key 89) from the actuator.
 - b. Remove the snap ring and seal bushings (keys 72 and 7). Inspect, and if necessary, obtain a replacement seal bushing (key 7). Replace the seal bushing O-rings (keys 8 and 9) as required. Lubricate with lithium grease (key 237) lubricant.
 - c. Remove the actuator spring (key 18). Unscrew the cap screws from the stem connector (key 31), and remove the stem connector. Remove the stem (key 144) and attached spring adjustor, thrust bearing, and spring seat (keys 74, 86, and 19).
10. For actuators with a snubber (see figure 8):

⚠ WARNING

To avoid personal injury due to the sudden, uncontrolled movement of parts, ensure the actuator spring is not under compression before removing the travel stop.

- a. Remove the travel stop (key 84). Be certain there is not compression in the actuator spring (key 18). If the actuator was removed from the valve, secure the stem connector (key 31) to the actuator stem (key 144) to prevent the stem from turning while unscrewing the stem and piston assembly (key 23).
- b. Using a wrench on the wrench flats near the top of the stem and piston assembly, unscrew the stem and piston assembly from the actuator stem.

- c. Unscrew the cap screws (key 106), and remove the cylinder (key 93) and attached parts.

11. To disassemble snubber:

- a. Remove the retaining rings, cylinder heads, and stem and piston assembly (keys 95, 94, and 23).
- b. Replace packing and O-rings (keys 118, 119, 96, 107, and 120).
- c. Unscrew the spring case adaptor cap screws and nuts (keys 90 and 91), and remove the adaptor (key 89) from the actuator.

12. Remove the actuator spring and spring seat (keys 18 and 19).

13. Unscrew the cap screws and nuts (keys 88 and 91), and remove the spring case (key 85).

Note

In figure 8, the cap screws (key 88) on units with side-mounted handwheels do not use hex nuts (key 91).

14. Remove the spring adjustor (key 74) and the attached thrust bearing (key 86).

15. Remove the cap screws (key 252), yoke bushing retainer (key 251), 2 halves of the split yoke bushing (key 249), and yoke bushing holder (key 250).

16. Refer to the size 80 actuator assembly procedures. Carefully clean and inspect all parts, and obtain any replacement parts required for reassembly.

Assembly

See figure 4, Size 80 Actuator Construction for location of parts.

- 1. Coat the threads of the stem (key 144) with lithium grease lubricant (key 237). Install the spring adjustor (key 74) and thrust bearing. Pack the bearing (key 86) with lithium grease lubricant.
- 2. Mount the spring case (key 85) to the yoke (key 73) using cap screws and hex nuts (keys 88 and 91).

Note

Units with a side-mounted handwheel do not use hex nuts (key 91).

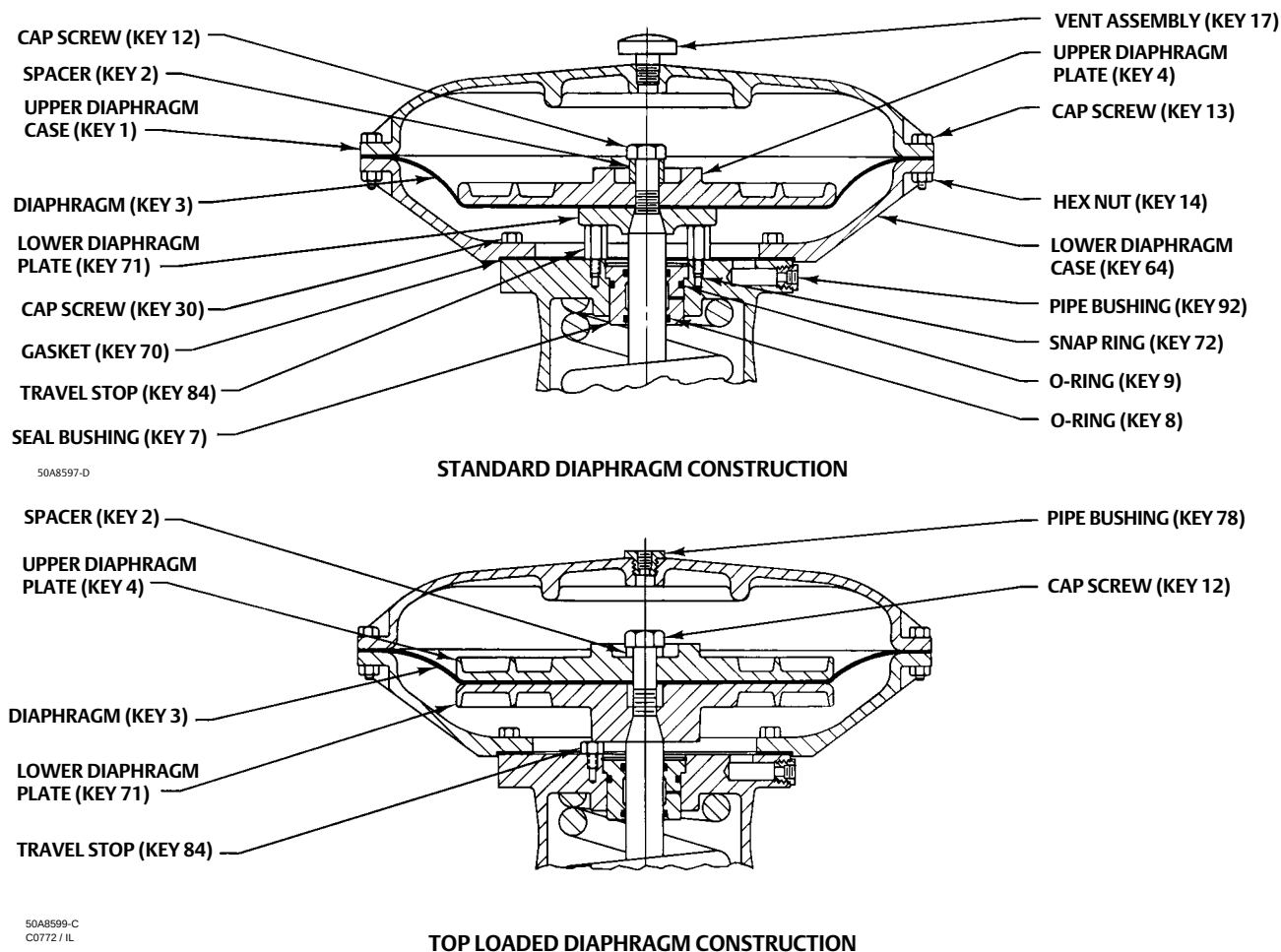
3. Install the spring adjustor, thrust bearing, and spring seat (keys 74, 86 and 19) onto the actuator stem (key 144). Slide the stem into the spring case (key 85).

4. Align the spring seat (key 19) on the spring adjustor (key 74), and slide the actuator spring (key 18) squarely onto the spring seat.

5. Mount the spring case adaptor (key 89) to the spring case (key 85) using cap screws and hex nuts (keys 90 and 91).

6. For actuators with a snubber (see figure 8), install the cylinder (key 93) and attached parts with cap screws (key 106). Slide the stem and piston assembly (key 23) into the cylinder and thread onto the actuator stem (key 144). Attach the travel stop (key 84), if one is used, to the stem and piston assembly.

Figure 4. Size 80 Actuator Construction



- For actuators without a snubber, install the seal bushing (key 7) into the spring case adaptor (key 89) followed by the snap ring (key 72). Replace the seal bushing O-rings (keys 8 and 9) as required.
- Coat the gasket (key 70) with lithium grease lubricant (key 237). Position the lower diaphragm casing (key 64) on the spring case adaptor, and secure with cap screws (key 30).
- Mount the lower diaphragm plate, diaphragm, upper diaphragm plate, and, if used, spacer (keys 71, 3, 4, and 2) on the actuator stem (key 144), and secure using the cap screw (key 12). Coat the cap screw threads with lithium grease (key 237). Tighten the cap screw (key 12) to 544 N•m (400 lbf•ft).

Note

Standard and top-loaded constructions use the same key numbers for parts. The parts look different, but they use the same assembly and disassembly sequence. See figure 4, Size 80 Actuator Construction.

10. Position the upper diaphragm casing (key 1) on the diaphragm (key 3), and align the holes.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing cap screws are tightened to the proper load to prevent leakage, but do not crush the material. Perform the following tightening sequence with a manual torque wrench for size 80 and 100 actuators.

NOTICE

Do not use lubricant on these cap screws and nuts. Fasteners must be clean and dry.

Overtightening the diaphragm casing cap screws and nuts can damage the diaphragm. Do not exceed the following maximum torque values for the appropriate diaphragm material: EPDM/Meta-Aramid: 95 N•m (70 lbf•ft); Nitrile, Silicone, FKM (fluorocarbon) / Meta-Aramid: 68 N•m (50 lbf•ft).

11. Insert the cap screws (key 13) into the diaphragm casing, and tighten the hex nuts (key 23) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to the initial torque value found in table 3 for the diaphragm material being used.
12. Tighten the remaining hex nuts in a clockwise, crisscross pattern to the initial torque value found in table 3 for the diaphragm material being used.
13. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to the final torque value that is specified in table 3 for the diaphragm material being used.
14. Tighten the remaining hex nuts in a clockwise, crisscross pattern to the final torque value that is specified in table 3 for the diaphragm material being used.
15. After the last hex nut is tightened, complete another tightening sequence. Tighten in a circular pattern around the bolt circle to the final torque value that is specified in table 3 for the diaphragm material being used.
16. Once completed, no more tightening is recommended.
17. For size 80 actuators without a manual operator, slide the following parts over the bottom of the stem; yoke bushing holder (key 250), two split yoke bushings (key 249), and yoke bushing retainer (key 251). Secure into place with 4 cap screws (key 252). Before inserting the bushing halves, lightly coat with lithium grease (key 237) lubricant.
18. Mount the actuator on the valve in accordance with the procedures in the Installation section.

Size 100 Actuator Maintenance

For size 100 actuators, refer to figure 5 for part names and locations. Key number locations for Size 100 actuators are shown in figure 7.

Table 3. Size 80 Casing Cap Screw Torque Values

DIAPHRAGM MATERIAL	INITIAL TORQUE	FINAL TORQUE
	N•m (lbf•ft)	N•m (lbf•ft)
EPDM / Meta-Aramid	41 (30)	82 ± 13 (60 ± 10)
Nitrile, Silicone, FKM/Meta-Aramid	34 (25)	68 (50)

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all air pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the shroud plate (key 65) by removing the cap head screws (key 66).
 - a. For small spring force, loosen the jam nut (key 26), and rotate the adjusting nut (key 25) until spring compression is relieved.
 - b. For high spring force:

Note

To relieve spring compression when high spring forces exist, refer to the Spring section, and follow the instructions given for size 100 actuators with high spring force. These instructions outline the procedure required to decrease high spring compression.

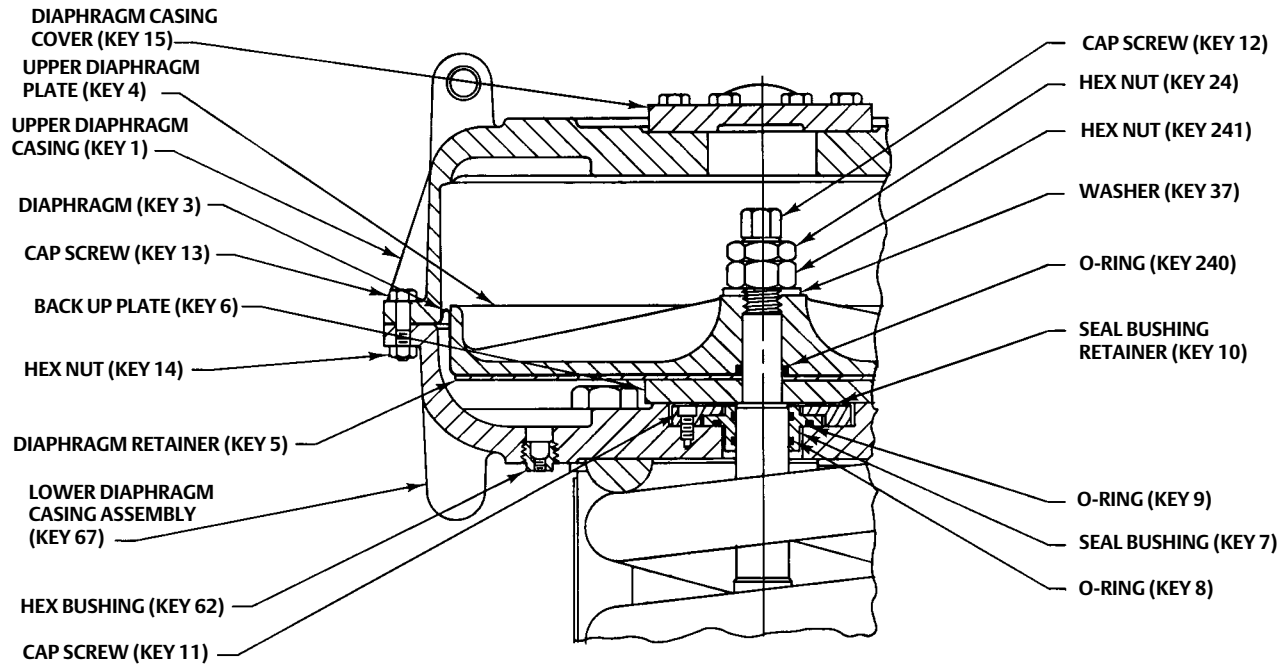
Loosen the jam nut (key 26), and rotate the adjusting nut (key 25) until spring compression is relieved.

3. Remove the pressure tubing or piping from the top of the diaphragm casing.
4. For actuators with a top-mounted handwheel (see figure 9), rotate the handwheel (key 58) clockwise as far as it will go, unscrew the cap screws (key 54), and remove the gear case cover (key 53). Remove the travel stop cap screw, if one is used, from the actuator stem extension (key 36), and unscrew the hex nuts (key 47). Unscrew the cap screws that attach the gear case assembly (key 41) to the actuator, and remove the gear case assembly.
5. If necessary, remove the actuator from the valve by separating the stem connector (key 31) and removing the actuator-to-bonnet bolting. Separate the stem connector by loosening the stem locknuts (key 69) and unscrewing the four cap screws.

Note

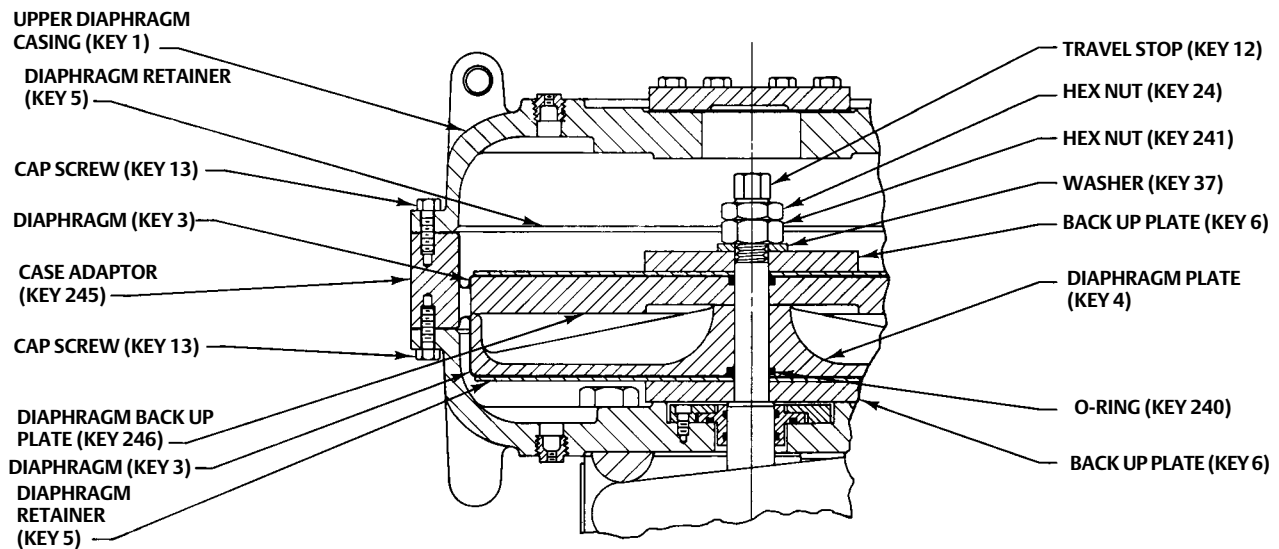
If the actuator has been removed from the valve, ensure that it is in the vertical position. Then, block the actuator stem (key 144) to support the weight of the actuator stem, spring seat and spring (keys 144, 19, and 18). This will facilitate removal of the nut (key 24) or actuator stem connector (key 31, figure 8).

Figure 5. Size 100 Actuator Construction



50A2623-F

STANDARD DIAPHRAGM CONSTRUCTION



56A9820-B
C0773-1

TOP LOADED DIAPHRAGM CONSTRUCTION

For Actuators Without the Top-Loaded Option

Disassembly

Part names and locations are shown in figure 5. Size 100 actuator key number locations are shown in figure 7.

1. Unscrew the diaphragm casing cap screws and nuts (keys 13 and 14) and remove the upper diaphragm casing.
2. For actuators without a top-mounted handwheel, unscrew and remove the travel stop cap screw (key 12), if one is used, and the hex nut (key 24).
3. For actuators with a top-mounted handwheel (see figure 9), remove the hex nut, actuator stem extension, and actuator stem connector (keys 28, 36, and 42).
4. Remove the washer, upper diaphragm plate, diaphragm, diaphragm retainer, and backup plate (keys 37, 4, 3, 5 and 6).
5. Unscrew the six cap screws (key 11), and remove the seal bushing retainer (key 10). Remove the seal bushing (key 7).

⚠ WARNING

To avoid personal injury and property damage from the sudden release of spring load, be sure that all spring load is removed from the actuator lower diaphragm casing.

6. Unscrew the four hex nuts that secure the lower diaphragm casing to the yoke assembly (key 67), and remove the lower diaphragm casing. Replace the yoke assembly O-rings (key 70) as necessary.
7. The actuator spring (key 18) and stem (key 144) can now be removed if necessary. Be sure to disconnect the stem connector (key 31) before removing the stem.
8. Refer to the following Assembly procedures. Carefully clean and inspect all parts, or obtain replacement parts required for reassembly.

Assembly

1. If the actuator stem (key 144, figure 7) was removed, lubricate the threads on the stem with lithium grease lubricant (key 237).
2. On the actuator stem, assemble the hex nuts, thrust bearing, and spring seat (keys 26, 25, 86, and 19) to the stem. Be certain that the thrust bearing race with the larger inside diameter faces the spring seat. Rotate the adjusting nut (key 25) to position the spring seat 305 mm (12 inches) from the end of the stem.
3. Install the actuator stem assembly into the yoke assembly (key 67). Place a support under the stem to position the lower end of the stem 254 mm (10 inches) above the bottom surface of the actuator (actuator-to-bonnet joint).

Note

When installing lower diaphragm casing, install the O-rings (key 70) into the grooves found in the lower diaphragm casing before placing the casing on the yoke assembly. If the spring interferes with installation of the lower diaphragm casing, reposition the spring by rotating the adjusting nut (key 25).

4. Install the lower diaphragm casing, and secure it by tightening the four hex nuts.
5. Lubricate the seal bushing O-rings (keys 8 and 9) and the seal bushing (key 7) with lithium grease lubricant. Install the seal bushing O-rings, seal bushing, and seal bushing retainer (keys 8, 9, 7 and 10) and secure with the cap screws (key 11).

6. Install the diaphragm backup plate, diaphragm retainer, diaphragm, upper diaphragm plate, and washer (keys 6, 5, 3, 4, and 37) on the actuator stem (key 144).

NOTICE

Install the diaphragm with the fabric side facing away from the spring. Smooth the edge of the diaphragm to avoid wrinkling and be careful that the diaphragm fold does not get pinched when the upper diaphragm casing (key 1) is installed.

NOTICE

If the diaphragm (key 3) is installed so air pressure is applied to the fabric side, it will immediately delaminate the sealing surface (smooth surface) from the fabric. The delamination can cause immediate failure of the diaphragm's ability to retain pressure.

7. For actuators with a top-mounted handwheel, screw the actuator stem extension (key 36, figure 9) as far as it will go into the actuator stem connector (key 42, figure 9) before tightening the hex nut (key 28, figure 9).
8. For actuators without a top-mounted handwheel, install the hex nut (key 241) and tighten, install the jam nut (key 24) and tighten so that it locks the hex nut key 24 in place. Install the travel stop (key 12).
9. Position the upper diaphragm casing (key 1) on the diaphragm (key 3) and align the holes.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing cap screws are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 80 and 100 actuators.

NOTICE

Do not use lubricant on these cap screws and nuts. Fasteners must be clean and dry.

Overtightening the diaphragm casing cap screws and nuts can damage the diaphragm. Do not exceed 68 N•m (50 lbf•ft) torque.

10. Insert the cap screws (key 13) into the upper diaphragm casing, and tighten the hex nuts (key 14) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to 34 N•m (25 lbf•ft).
11. Tighten the remaining hex nuts in a clockwise, crisscross pattern to 34 N•m (25 lbf•ft).
12. Repeat this procedure by tightening the four hex nuts, diametrically opposed and 90 degrees apart, to a torque of 68 N•m (50 lbf•ft).
13. Tighten the remaining hex nuts in a clockwise, crisscross pattern to 68 N•m (50 lbf•ft).
14. After the last hex nut is tightened to 68 N•m (50 lbf•ft), all of the hex nuts should be tightened again to 68 N•m (50 lbf•ft) in a circular pattern around the bolt circle.

15. Once completed, no more tightening is recommended.
16. For actuators with a top-mounted handwheel (see figure 9), mount the gear case assembly (key 41) on the actuator using the cap screws (key 16). Install the hex nuts (key 47) and travel stop cap screw (if used) on the actuator stem extension (key 36). Install the gear case cover (key 53) with the cap screws (key 54).
17. Mount the actuator on the valve, and secure with the actuator-to-bonnet bolting. Refer to the Installation section to connect the actuator stem to the valve plug stem.

For Actuators With the Top-Loaded Option

Disassembly

For key number locations refer to figure 7, and refer to the Top-Loaded Actuator Detail shown in figure 7. Also, refer to figure 5 for diaphragm construction details.

1. Remove the 40 cap screws (key 13) from the upper diaphragm casing (key 1) and remove the casing.
2. Remove the travel stop cap screw (key 12), hex nuts (key 24 and 241), washer (key 37), backup plate (key 6), diaphragm retainer (key 5), diaphragm (key 3), and diaphragm backup plate (key 246) with O-ring (key 240).
3. Remove the 40 cap screws (key 13) from the lower side of the casing adaptor (key 245) and remove the adapter.
4. Remove the diaphragm plate (key 4) with O-ring (key 240), diaphragm (key 3), diaphragm retainer (key 5), and backup plate (key 6).
5. Unscrew the six cap screws (key 11) and remove the seal bushing retainer (key 10). Remove the seal bushing (key 7). Remove and replace the seal bushing O-rings (keys 8 and 9) as necessary.

⚠ WARNING

To avoid personal injury due to the sudden, uncontrolled movement of parts, do not loosen the four hex nuts on the lower diaphragm casing when spring pressure is applied. Ensure that all spring precompression has been released.

6. Unscrew the four hex nuts that secure the lower diaphragm casing to the yoke assembly (key 67) and remove the lower diaphragm casing. Replace the yoke assembly O-rings (key 70) as necessary.
7. The actuator spring (key 18) and stem (key 144) can now be removed if necessary. Be sure to disconnect the stem connector (key 31) before removing the stem.
8. Unscrew the six cap screws (key 11) and remove the seal bushing retainer (key 10). Remove the seal bushing (key 7). Remove and replace the seal bushing O-rings (keys 8 and 9) as necessary.
9. Unscrew the four hex nuts that secure the lower diaphragm casing to the yoke assembly (key 67) and remove the lower diaphragm casing. Replace the yoke assembly O-rings (key 70) as necessary.
10. The actuator spring (key 18) and stem (key 144) can now be removed if necessary. Be sure to disconnect the stem connector (key 31) before removing the stem.
11. Refer to the size 100 actuator assembly procedures. Carefully clean and inspect all parts, and obtain any replacement parts required for reassembly.

Assembly

1. If the actuator stem (key 144) was removed, lubricate the threads on the stem with lithium grease lubricant (key 237).
2. Assemble the hex nuts, thrust bearing, and spring seat (keys 26, 25, 86, and 19) to the stem. Be certain that the thrust bearing race with the larger inside diameter faces the spring seat. Rotate the adjusting nut (key 25) to position the spring seat 305 mm (12 inches) from the end of the stem.

3. Install the actuator stem assembly into the yoke assembly (key 67). Place a support under the stem to position the lower end of the stem 254 mm (10 inches) above the bottom surface of the actuator (actuator-to-bonnet joint).

Note

When installing the lower diaphragm casing, install O-rings (key 70) into grooves found in the lower diaphragm casing before placing the casing on the yoke assembly. If the spring interferes with installation of the lower diaphragm casing, reposition the spring by rotating the adjusting nut.

4. Install the lower diaphragm casing (key 67), and secure it by tightening the four hex nuts.
5. Lubricate the seal bushing O-rings (keys 8 and 9) and the seal bushing (key 7) with lithium grease lubricant. Install the seal bushing O-rings, seal bushing (keys 8 and 9), and seal bushing retainer (key 7) and secure with four hex nuts.

NOTICE

Install the diaphragm with the fabric side facing away from the spring. Smooth the edge of the diaphragm to avoid wrinkling and be careful that the diaphragm fold does not get pinched when the diaphragm adaptor (key 245, figure 5) is installed.

NOTICE

If the diaphragm (key 3) is installed so air pressure is applied to the fabric side, it will immediately delaminate the sealing surface (smooth surface) from the fabric. The delamination can cause immediate failure of the diaphragm's ability to retain pressure.

6. Install the diaphragm backup plate, diaphragm retainer, diaphragm, O-ring, and diaphragm plate (keys 6, 5, 3, 240, and 4) on the actuator stem (key 144).
7. Carefully fold the diaphragm between the diaphragm backup plate (key 246) and the case adapter (key 245) while lowering the adapter onto the lower diaphragm casing assembly (key 67). Install all 40 cap screws (key 13) and finger tighten.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing cap screws are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 80 and 100 actuators.

NOTICE

Do not use lubricant on these cap screws and nuts. Fasteners must be clean and dry.

Overtightening the cap screws (key 13) can damage the diaphragm. Do not exceed 68 N•m (50 lbf•ft) torque.

8. Tighten the cap screws (key 13) in the following manner. The first four cap screws tightened should be diametrically opposed and 90 degrees apart. Tighten these four cap screws to 34 N•m (25 lbf•ft).
9. Tighten the remaining cap screws in a clockwise, crisscross pattern to 34 N•m (25 lbf•ft).
10. Repeat this procedure by tightening the four cap screws, diametrically opposed and 90 degrees apart, to a torque of 68 N•m (50 lbf•ft).
11. Tighten the remaining cap screws in a clockwise, crisscross pattern to 68 N•m (50 lbf•ft).
12. After the last cap screw is tightened to 68 N•m (50 lbf•ft), all of the cap screws should be tightened again to 68 N•m (50 lbf•ft) in a circular pattern around the bolt circle.
13. Once completed, no more tightening is recommended.

NOTICE

Install the diaphragm with the fabric side facing toward the spring. Smooth the edge of the diaphragm to avoid wrinkling and be careful that the diaphragm fold does not get pinched when the upper diaphragm casing (key 1) is installed.

14. Install the diaphragm backup plate, diaphragm, diaphragm retainer, backup plate, washer (keys 246, 3, 5, 6, 37, 241 and 24), hex nut (key 241), and hex nut (key 24).
15. For actuators with a top-mounted handwheel (see figure 9), screw the actuator stem extension (key 36) as far as it will go into the actuator stem connector (key 42) before tightening the hex nut (key 28).
16. For actuators without the handwheel, Install the travel stop cap screw (key 12), and tighten the screw.
17. Position the upper diaphragm casing (key 1) on the diaphragm (key 3) and align the holes.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing cap screws are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 80 and 100 actuators.

NOTICE

Do not use lubricant on these cap screws and nuts. Fasteners must be clean and dry.

Overtightening the cap screws (key 13) can damage the diaphragm. Do not exceed 68 N•m (50 lbf•ft) torque.

18. Insert the cap screws (key 13) into the upper diaphragm casing (key 1), and finger tighten the screws.
19. Tighten the cap screws (key 13) in the following manner. The first four cap screws tightened should be diametrically opposed and 90 degrees apart. Tighten these four cap screws to 34 N•m (25 lbf•ft).
20. Tighten the remaining cap screws in a clockwise, crisscross pattern to 34 N•m (25 lbf•ft).
21. Repeat this procedure by tightening the four cap screws, diametrically opposed and 90 degrees apart, to a torque of 68 N•m (50 lbf•ft).
22. Tighten the remaining cap screws in a clockwise, crisscross pattern to 68 N•m (50 lbf•ft).
23. After the last cap screw is tightened to 68 N•m (50 lbf•ft), all of the cap screws should be tightened again to 68 N•m (50 lbf•ft) in a circular pattern around the bolt circle.

24. Once completed, no more tightening is recommended.
25. For actuators with a top-mounted handwheel (see figure 9), mount the gear case assembly (key 41) on the actuator using cap screws (key 16). Install the hex nuts (key 47) and travel stop cap screw (if used) on the actuator stem extension (key 36). Install the gear case cover (key 53) with cap screws (key 54).
26. Mount the actuator on the valve, and secure with the actuator-to-bonnet bolting. Refer to the Installation section to connect the actuator stem to the valve plug stem.

Size 80 Side-Mounted Handwheel

The side-mounted handwheel assembly (figure 8) is normally used as a manual operator. The handwheel can be mounted in either of two position orientations so that, regardless of valve plug action, counterclockwise rotation always opens the valve. The assembly is a continuously connected type with an indicator to show neutral position. By rotating the handwheel away from neutral, the handwheel can be used to limit travel in either direction, but not both directions at the same time.

A grease fitting is provided on the gear box for periodic gear lubrication with a general purpose grease.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Key number location are shown in figure 8.

Disassembly

1. Complete steps 1 through 16 of the Disassembly portion of the Size 80 Actuator Maintenance section.
2. Unscrew the cap screws (key 88), and remove the spring case (key 85). Unscrew the cap screws (key 136), and remove the retaining flange (key 134). Do not lose the key (key 122).
3. Unscrew two screws (key 79), and remove the travel stop indicator (key 126).
4. Turn the handwheel (key 58) to raise the lower sleeve. Continue turning the handwheel until the lower sleeve is free of the worm gear (key 44). Lift out the lower sleeve, bearing and gear retainer, thrust bearing, and worm gear (keys 123, 45, 43, and 44).
5. The worm shaft (key 51) and associated parts can be removed in order to replace or lubricate them. First, remove the handwheel cap (key 127) and the handwheel (key 58). Do not lose the small ball or spring (keys 141 and 142).
6. Loosen the two set screws and unscrew the two worm retainers (keys 48 and 49). The ball bearings (key 50) will come out with the retainers. Remove the worm shaft (key 51).

Assembly

1. Pack the ball bearings (key 50) with lithium grease lubricant (key 237), and insert one ball bearing in the back worm retainer (key 48).
2. Thread the back worm retainer and ball bearing (keys 48 and 50) into the gear case. Align the set screw slot in the worm retainer with the set screw hole in the gear case, insert the set screw, and tighten.
3. Coat the worm shaft (key 51) threads with lithium grease lubricant, and slide the shaft into the gear case (key 41) so that the end of the shaft fits snugly in the back worm retainer.
4. Insert the bearing in the front worm retainer (key 49), and thread the retainer and ball bearing into the gear case. Align the set screw slot in the retainer with the set screw hole in the gear case, insert the set screw, and tighten.
5. Put the spring and ball (keys 142 and 141) in the handwheel (key 58). Slide the handwheel onto the worm shaft (key 51). Thread the handwheel cap (key 127) onto the worm shaft.
6. Pack the two thrust bearings (key 43) with lithium grease lubricant. Install one thrust bearing; then install the worm gear (key 44), followed by the second thrust bearing and the bearing and gear retainer (key 45).

7. The lower sleeve (key 123) has two screw holes in one end. Coat the sleeve threads with lithium grease lubricant, slide the end of the lower sleeve with the holes into the thrust bearing (key 43), turn the handwheel, and feed the sleeve through the worm gear. Continue turning the handwheel until the lower sleeve protrudes from the gear case. Fasten the travel stop indicator (key 126) to the sleeve with two machine screws (key 79).
8. Install the key (key 122) on the retaining flange (key 134).
9. Install the retaining flange (key 134) so that the key engages the slot in the lower sleeve. Secure the retaining flange with the cap screws (key 136).
10. Adjust the set screws (key 121) to eliminate free play in the bearings.

Note

Overtightening the set screws will make handwheel operation difficult.

11. Coat the spring adjustor (key 74) threads with lithium grease lubricant and install it over the lower sleeve.
12. Pack the thrust bearing (key 86) with lithium grease lubricant, and install it on the spring adjustor (key 74) as shown in figure 8.
13. Slide the spring case (key 85) into position, and secure with cap screws (key 88).
14. Complete steps 3 through 16 of the Assembly procedure in the Size 80 Actuator Maintenance section.

Size 80 Hydraulic Snubber

The size 80 667 actuator is available with a hydraulic snubber, as shown in figure 8, to aid vertical stability of the actuator stem movement. The snubber is adjusted by rotating the adjusting screws (key 104, figure 8) counterclockwise out of the reservoir (key 99, figure 8) to increase damping action and clockwise to decrease damping action. The adjusting screw on the right (the top one of the two adjusting screws in section B-B of figure 8) regulates downward damping action, and the screw on the left regulates upward damping action.

Size 100 Top-Mounted Handwheel (Adjustable Down Travel Stop)

Key numbers are shown in figure 9.

A top-mounted handwheel assembly is normally used as an adjustable-down travel stop to limit full extension of the actuator stem. Counterclockwise rotation will compress the spring and move the actuator stem upward. Clockwise rotation of the handwheel (key 58) allows spring action to return the actuator stem (key 144) downward.

Instructions are given below for complete disassembly and assembly. Disassemble only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Disassembly

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Bypass the control valve. Reduce the loading pressure to atmospheric (refer to the Maintenance section), and remove the tubing or piping from the diaphragm casing.
3. Unscrew the cap screws (key 54), and remove the gear case cover (key 53).
4. Loosen the set screws (key 52) in the front and back worm retainers (keys 48 and 49) and the handwheel (key 58).

5. Remove the retaining ring (key 60), and remove the handwheel.
6. Remove front and back worm retainers (keys 48 and 49) and the bearings (key 50).
7. Remove the worm shaft (key 51).
8. Remove the power screw assembly (key 46) by placing a wrench on the double hex nuts (key 47) and unscrew the assembly from the actuator stem extension (key 36). The bearing and gear retainer, thrust bearing, and worm gear (keys 45, 43, and 44) will come out with the power screw.

Assembly

1. The front and back worm retainers (keys 48 and 49) each have a slot in their threads for a set screw (key 52). Pack the ball bearings (key 50) with lithium grease, and insert one ball bearing into the back worm retainer (key 48).
2. Thread the back worm retainer and ball bearing into the gear case. Align the slot in the worm retainer with the set screw hole in the gear case, insert the set screw (key 52), and tighten.
3. Coat the worm shaft (key 51) threads with lithium grease lubricant, and slide the shaft into the gear case so that the end of the shaft fits snugly in the back worm retainer.
4. Insert the bearing into the front worm retainer (key 49), and thread the retainer and ball bearing into the gear case. Align the slot in the retainer with the hole in the gear case, insert the set screw (key 52), and tighten.
5. Slide the handwheel onto the worm shaft (key 51), and install the retaining ring (key 60).
6. Pack the two thrust bearings (key 43) with lithium grease lubricant. Install one thrust bearing, then the worm gear (key 44), followed by the second thrust bearing and the bearing and gear retainer (key 45).
7. Coat the power screw threads (key 46) with lithium grease lubricant. Slide the power screw into the thrust bearing (key 43), turn the handwheel, and feed the sleeve through the worm gear.
8. Install the gear case cover (key 53), and tighten the cap screws (key 54).
9. Adjust the set screws (key 55) to eliminate free play in the bearings.

Note

Overtightening the set screws (key 55) will make handwheel operation difficult.

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always refer to this number when corresponding with your [Emerson sales office](#) regarding replacement parts or technical information.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Actuator Repair Kit

Parts kit includes keys 8, 9, and 70.

Key	Description	Part Number
	Size 80	R667X000802

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Actuator

Key	Description	Key	Description
1	Upper Diaphragm Casing	19	Spring Seat
2	Spacer	19	Spring Plate
3*	Diaphragm	20	Spring Guide
	Size 80	21	Cap Screw
	Size 100 std	22	Washer
	Size 100 top loaded (2 required)	24	Hex Nut
4	Diaphragm Plate, upper	25	Hex Nut
5	Diaphragm Retainer	26	Hex Nut
6	Backup Plate	30	Cap Screw
7*	Seal Bushing	31	Stem Connector Assembly
	Size 80	32	Travel Scale
	Size 100	33	Machine Screw
8*	O-Ring (2 required)	34	Travel Indicator
	Size 80	35	Cap Screw
	Size 100	37	Washer
9*	O-Ring	39	Nameplate
	Size 80	40	Drive Screw
	Size 100	60	Retaining Ring
10	Seal Bushing Retainer	62	Hex Bushing
11	Cap Screw	63	Lifting Pin
12	Cap Screw	64	Lower Diaphragm Casing
13	Cap Screw	65	Shroud Plate
14	Hex Nut	66	Cap Screw
15	Diaphragm casing Cover	67	Lower Diaphragm Casing, yoke & tie rod assembly
16	Cap Screw	69	Hex Jam Nut
17	Y602 Vent Assembly	70*	Gasket
18	Spring		Size 80 only
		70*	O-Ring (4 required)
			Size 100 only
		71	Diaphragm Plate, lower
		72	Snap Ring
		73	Yoke
		74	Spring Adjustment screw
		78	Pipe Bushing
		79	Machine Screw
		84	Travel Stop
		85	Spring Case
		86	Thrust Bearing
		87	Cover Band Assembly
		88	Cap Screw
		89	Spring Case Adaptor
		90	Cap Screw
		91	Hex Nut
		92	Pipe Bushing
		144	Actuator Stem
		235	Bushing
		236	Tag/Wire Assembly
		237	Lithium Grease, 14 oz. (0.396 kg) can
		238	Gasket Sealant (hard set), 11 oz. (0.311 kg) tube
		240*	O-Ring, Size 100 only
			Std (1 required) and w/top loaded (2 required)
		241	Hex Nut
		242	Y602-12 Vent Assembly
		243	Warning Plate
		244*	Gasket, Size 100
			Top Loaded only (part not shown)
		245	Case Adaptor
		246	Backup Plate
		249	Bushing, split yoke
		250	Yoke Bushing Holder
		251	Yoke Bushing Retainer
		252	Cap Screw

Side-Mounted Handwheel Size 80

Key	Description
29	Hand Grip
38	Hand Grip Bolt
41	Gear Case
43	Thrust Bearing
44	Worm Gear
45	Bearing & Gear Retainer
48	Back Worm Retainer
49	Front Worm Retainer
50	Ball Bearing
51	Worm Shaft
57	Grease Fitting
58	Handwheel
121	Set Screw
122	Key
123	Lower Sleeve
124	Machine Screw
126	Travel Stop Indicator
127	Handwheel Cap
134	Retaining Flange
135	Travel Stop Nut
136	Cap Screw
137	Set Screw
138	Cap Screw
139	Travel Stop Scale
140	Travel Stop Indicator Bracket
141	Ball
142	Spring
143	Machine Screw
237	Lithium Grease, 14 oz. (0.396 kg) can
238	Gasket Sealant (pliable film), 11 oz. (0.311 kg) tube

Top-Mounted Handwheel Size 100

Key	Description
28	Hex Nut
36	Actuator Stem Extension
41	Gear Case
42	Actuator Stem Connector
43	Thrust Bearing
44	Worm Gear
45	Bearing & Gear Retainer
46	Power Screw Assembly
47	Hex Nut
48	Back Worm Retainer
49	Front Worm Retainer
50	Ball Bearing
51	Worm Shaft
52	Set Screw
53	Gear Case Cover
54	Cap Screw
55	Set Screw
56	Hex Nut
57	Grease Fitting
58	Handwheel
59	Woodruff Key
61	Slot Cover

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

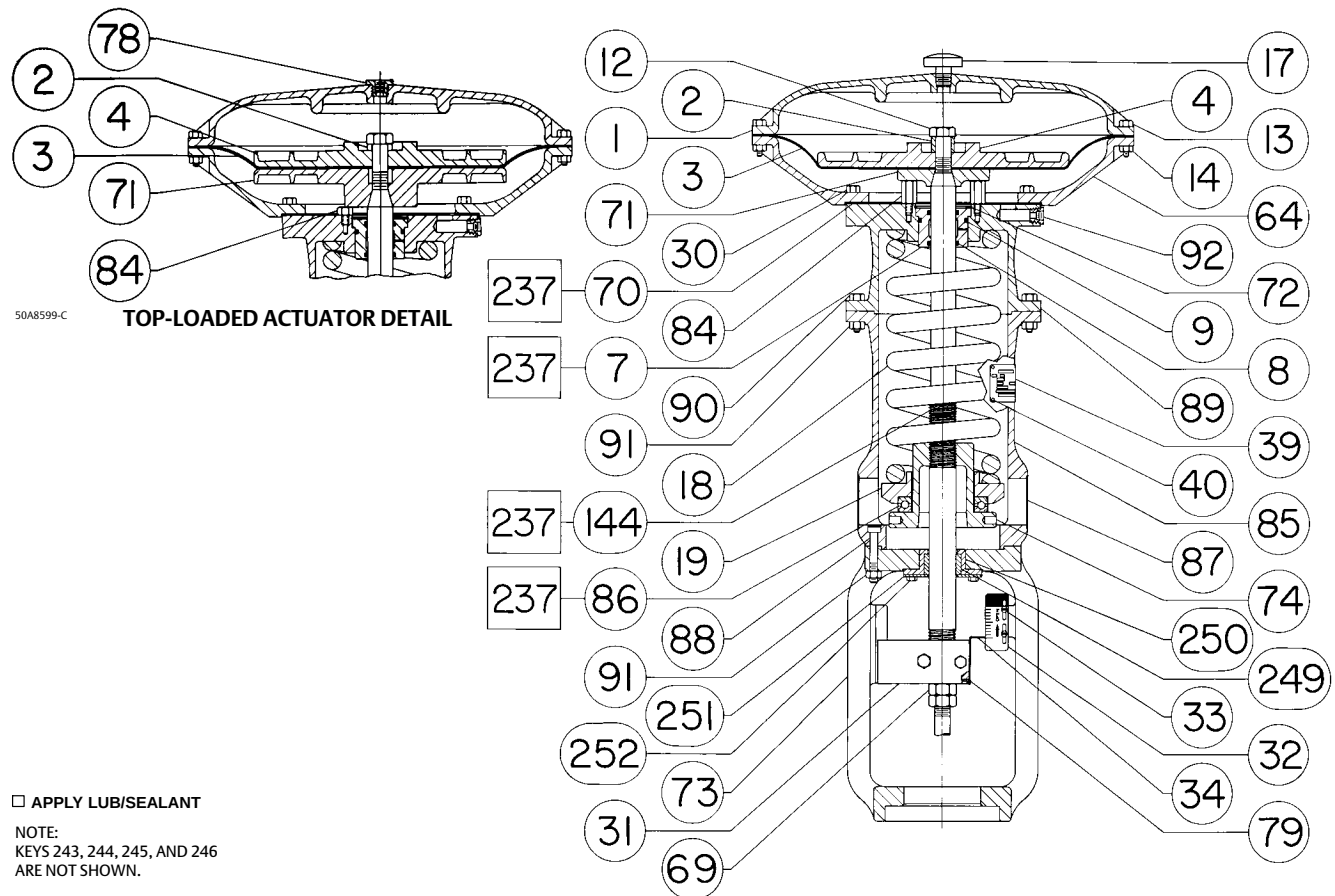
Instruction Manual

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667 Size 80 and 100 Actuators

July 2023

Figure 6. Size 80 Fisher 667 Actuator



Hydraulic Snubber Size 80

Key Description

23	Stem & Piston Assembly
93	Cylinder
94	Cylinder Head
95	Retaining Ring
96*	O-Ring (2 required)
97*	Piston Ring (2 required)
98	Pipe Plug
99	Reservoir
100*	O-Ring
101	Cap Screw
102	Pipe Plug
103*	O-Ring (2 required)

Key Description

104	Adjusting Screw
105	Hex Nut
106	Cap Screw
107*	O-Ring
108	Hydraulic fluid, 2 gal (7.6L)
109*	O-Ring (2 required)
110	Orifice
111	Bypass & Check Valve Plug
112	Spring
113	E-Ring
114	Bushing
115	Flange
116	Packing Sleeve
117	Machine Screw
118*	Packing (8 required)
119*	Packing (4 required)
120*	O-Ring (2 required)

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

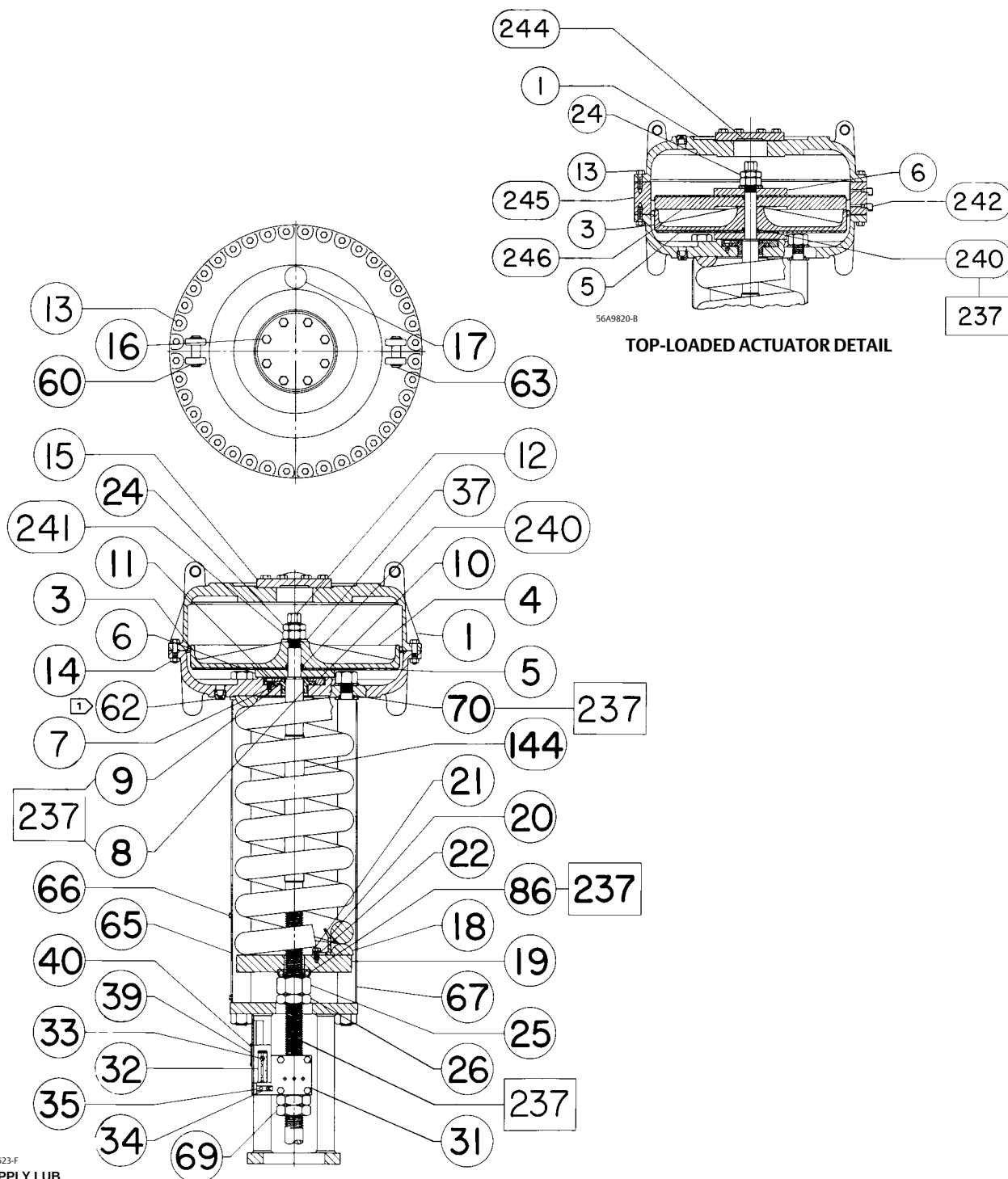
667 Size 80 and 100 Actuators

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Instruction Manual

D100311X012

Figure 7. Size 100 Fisher 667 Actuator



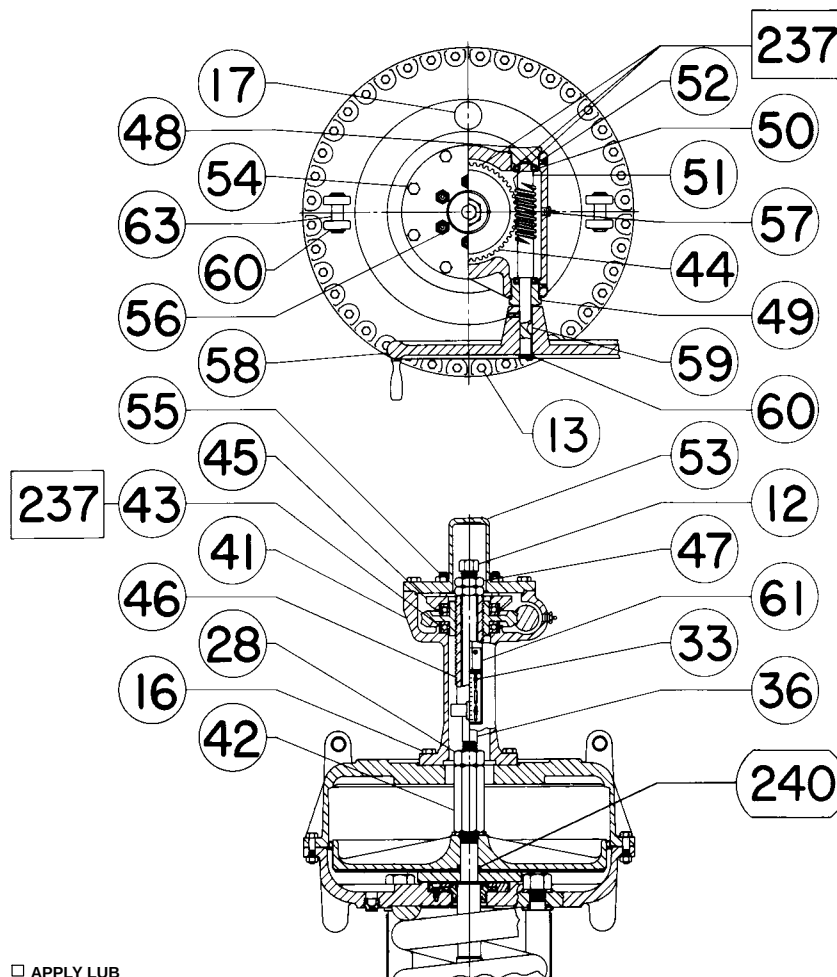
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□ APPLY LUB

NOTES:

1. THIS PART IS LOCATED 90° TO FRONT OF POSITION SHOWN
2. KEYS 243 AND 244 ARE NOT SHOWN

Figure 9. Size 100 Top-Mounted Handwheel



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Fisher™ 667NS Diaphragm Actuators Size 40, 45, 70, and 80

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Introduction

Scope of Manual

This manual provides installation, maintenance, and parts list information for the Fisher 667NS actuator. Refer to separate instruction manuals for information regarding the control valve and accessories.



Do not install, operate, or maintain 667NS actuators without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The 667NS actuator is a reverse-acting, spring-opposed diaphragm actuator that is used for operation of automatic control valves. The 667NS actuator yoke construction and special bonnet-to-yoke bolting provides a high structural resonant frequency that exceeds most nuclear service seismic requirements.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

667NS Actuator

June 2023

Instruction Manual

D102603X012

Table 1. Fisher 667NS Specifications

SPECIFICATION	ACTUATOR SIZE				
		40	45	70	80
Nominal Effective Diaphragm Area	cm ²	445	677	1419	see table 5
	Inch ²	69	105	220	see table 5
Yoke Boss Diameters	mm	71	71	90	5H
	Inch	2-13/16	2-13/16	3-9/16	5H
Acceptable Valve Stem Diameters	mm	12.7	12.7	19.1	25.4 & 31.8
	Inch	1/2	1/2	3/4	1 & 1-1/4
Maximum Allowable Output Thrust ⁽¹⁾	N	12,015	30,371	42,720	88,110
	Lb	2700	6825	9600	19,800
Maximum Travel	mm	38	51	76	76
	Inch	1.5	2	3	3
Maximum Diaphragm Pressure to Stroke Actuator ^(2,3)	Bar	4.5	4.5	3.5	4.8
	Psig	65	65	50	70
Maximum Excess Diaphragm Pressure ^(2,3)	Bar	1.4	0.7	0.7	1.4
	Psig	20	10	10	20
Maximum Casing Pressure for Actuator Sizing ⁽³⁾	Bar	4.8	4.5	3.4	4.9
	Psig	70	65	50	70
Maximum Diaphragm Casing Pressure ^(2,3)	Bar	6.2	5.2	4.1	5.5
	Psig	90	75	60	80
Material Temperature Capabilities ⁽³⁾	-40 to 82°C (-40 to 180°F) with nitrile diaphragm				

1. See also the Specifications portion of the Introduction section. Do not exceed maximum allowable valve stem load when applying maximum allowable thrust.
2. Maximum diaphragm casing pressure must not be exceeded and must not produce a force on the actuator stem greater than the maximum allowable actuator output thrust or the maximum allowable stem load.
3. The pressure and temperature limitations in this manual, and any applicable code limitation, should not be exceeded.

Table 2. Diaphragm Casing Volumes, cm³ (Inch³)

ACTUATOR SIZE	CLEARANCE VOLUME, cm ³ (INCH ³)	TRAVEL, mm (INCH)						
		11 (0.4375)	16 (0.625)	19 (0.75)	29 (1.125)	38 (1.5)	51 (2)	76 (3)
40	934 (57)	1475 (90)	1704 (104)	1852 (113)	2327 (142)	2786 (170)	---	---
45	1556 (95)	---	2786 (170)	2999 (183)	3720 (227)	4424 (270)	5408 (330)	---
70	3490 (213)	5244 (320)	5948 (363)	6424 (392)	7833 (478)	9242 (564)	11,110 (678)	14,879 (908)
80	4818 (294)	---	---	---	10,488 (640)	12,454 (760)	14,863 (907)	19,337 (1180)

Table 3. Actuator Stem Assembly Bolt Torque Values

ACTUATOR SIZE	TORQUE	
	N•m	Lbf•Ft
40	68	50
45	183	135
70	183	135
80	542	400

Table 4. Bonnet-to-Actuator Bolt Torque Values

ACTUATOR SIZE	BONNET-ACTUATOR STUD BOLT TORQUE	
	N•m	Lbf•Ft
40	102	75
45	102	75
70	176	130
80	292	215

Table 5. Size 80 Diaphragm Area

TRAVEL		AREA	
mm	Inch	cm ²	Inch ²
0	0	2039	316
19	0.75	1903	295
29	1.125	1865	289
38	1.5	1845	286
51	2	1832	284
64	2.5	1800	279
76	3	1761	273

Specifications

Tables 1 and 2 provide specifications for the various sizes of 667NS actuators discussed in this instruction manual.

⚠ WARNING

To avoid personal injury or property damage, do not exceed pressure and temperature limits specified in table 1.

Educational Services

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Maximum Pressure Limitations

The casing and diaphragm of 667 actuators are pressure operated. This air pressure provides energy to compress the spring, to stroke the actuator, and lift the diaphragm away from the valve. The following explanations describe the maximum pressure limits for an actuator. Refer to table 1 for maximum values.

⚠ WARNING

To avoid personal injury or property damage, do not exceed pressure and temperature limits specified in table 1.

- **Maximum Diaphragm Pressure to Stroke the Actuator:** This is the maximum pressure that can be applied at less than full travel of the actuator. If this stroking pressure is exceeded before the upper diaphragm plate contacts the travel stop, damage to the stem or other parts might result.

- **Maximum Excess Diaphragm Pressure:** Additional pressure may be added when the actuator is at full travel. If the Maximum Excess Diaphragm Pressure is exceeded, damage to the diaphragm or diaphragm casing might result.

Because the actuator has traveled its specified travel, and the diaphragm head is physically stopped from movement, the energy from any additional air pressure is transmitted to the diaphragm and diaphragm casings. The amount of air pressure that can be added once the actuator has traveled to the stops is limited by the resultant adverse effects that may occur. Exceeding this limiting factor could result in leakage or casing fatigue due to the deformation of the upper diaphragm casing.

- **Maximum Diaphragm Casing Pressure:** If the Maximum Diaphragm Casing Pressure is exceeded, damage to the diaphragm, diaphragm casing, or actuator might result. For some actuator sizes, the maximum casing pressure is the sum of the maximum stroking pressure added to the maximum excess pressure. For other actuator sizes, the value is lower than the sum of the two pressures.

Installation

The diaphragm actuator is normally shipped mounted on a valve body. Follow the valve body instructions when installing the control valve in the pipeline.

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

If the cover (key 84, figure 4) is not in place on the actuator, install it as shown in figure 4.

⚠ WARNING

If the control valve and actuator are installed with the actuator in any position other than vertical, the actuator may not conform with safety-related qualifications. Nonvertical orientation should be part of existing qualification analysis on file at the plant site to ensure conformance with safety-related qualifications.

The control valve assembly may be installed with any orientation; however, the actuator should not be installed in ways that allow water to collect in the yoke and actuator spring areas.

Note

The 667NS actuator will not mount on a standard valve bonnet; it requires a style NS bonnet having eight bonnet-to-yoke stud bolts.

If the actuator and control valve body are separate, mount the 667NS actuator on the valve body by following the procedures in the Actuator Mounting section of this manual.

Actuator Mounting

Direct-Acting (Push-Down-to-Close) Valves

Refer to figure 1.

1. Screw the stem locknuts all the way onto the valve stem. Put the travel indicator disk, not used with the size 80 actuator, on the locknuts. The concave side of the disk should face the valve.
2. Place the actuator on the valve bonnet.
3. Insert the cap screws and tighten the hex nuts (not shown), securing the actuator to the bonnet. Tighten the cap screws to the torque shown in table 4.
4. Apply loading pressure to the actuator to retract the actuator stem fully (against the travel stop).
5. With the travel indicator scale attached to the actuator yoke, make a temporary mark on the actuator stem in line with the top mark on the scale (the mark on the end of the scale that is marked "OPEN"). (The distance from the top mark on the scale to the bottom mark is equal to the travel of the valve.)

Note

Before turning the spring adjuster on size 70 or 80 actuators, assemble the stem connector around the actuator stem and the anti-rotating lug on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.

6. Refer to the actuator nameplate to determine the bench set pressure range of the actuator. Reduce actuator loading pressure to the lower end of the bench set range. (For size 80, remove the cap screw (key 91, figure 4) and remove the adjusting screw cover (key 84, figure 4). Rotate the spring adjuster (key 74, figure 2 for sizes 40 and 45; key 74, figure 3 for size 70; and key 74, figure 4 for size 80) until the mark you made on the actuator stem is in line with the bottom mark on the travel indicator scale. (Replace the size 80 adjusting screw cover and cap screw when you have completed the adjustments.)
7. Increase actuator loading pressure to the upper end of the bench range and check to be sure that the mark on the actuator stem is in line with the top mark on the travel indicator scale.

If the marks are in line, the actuator is properly bench set.

If the marks are not in line, the spring is not correct for the specified bench set. It is necessary to use a different spring or a different bench set.

8. Reduce actuator loading pressure until the mark on the actuator stem is in line with the bottom mark on the travel indicator scale.

NOTICE

Do not clamp just the tip of either the valve stem or the actuator stem in the stem connector. Incomplete engagement of the valve stem and/or actuator stem in the stem connector might result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than the diameter of that stem.

9. Push the valve stem firmly against its seat, and be sure that it remains firmly against the seat. Clamp the actuator stem and valve stem between the two stem connector halves.

If necessary, increase actuator loading pressure slightly to allow the valve stem, actuator stem, and stem connector threads to match.

Insert and tighten the stem connector cap screws.

⚠ WARNING

To avoid personal injury due to the sudden, uncontrolled movement of parts, do not loosen the cap screws when the stem connector has spring or loading pressure force applied to it.

10. Raise the travel indicator disk (sizes 40 through 70 only) to the stem connector. For all sizes, thread the stem locknuts against the stem connector.
11. Remove all actuator loading pressure. Move the travel indicator scale so that the indicator disk (or pointer) is in line with the bottom mark of the travel indicator scale.
12. Check the valve travel to be sure that the valve travels fully with no overtravel.

Reverse-Acting (Push-Down-to-Open) Valves

Refer to figure 1.

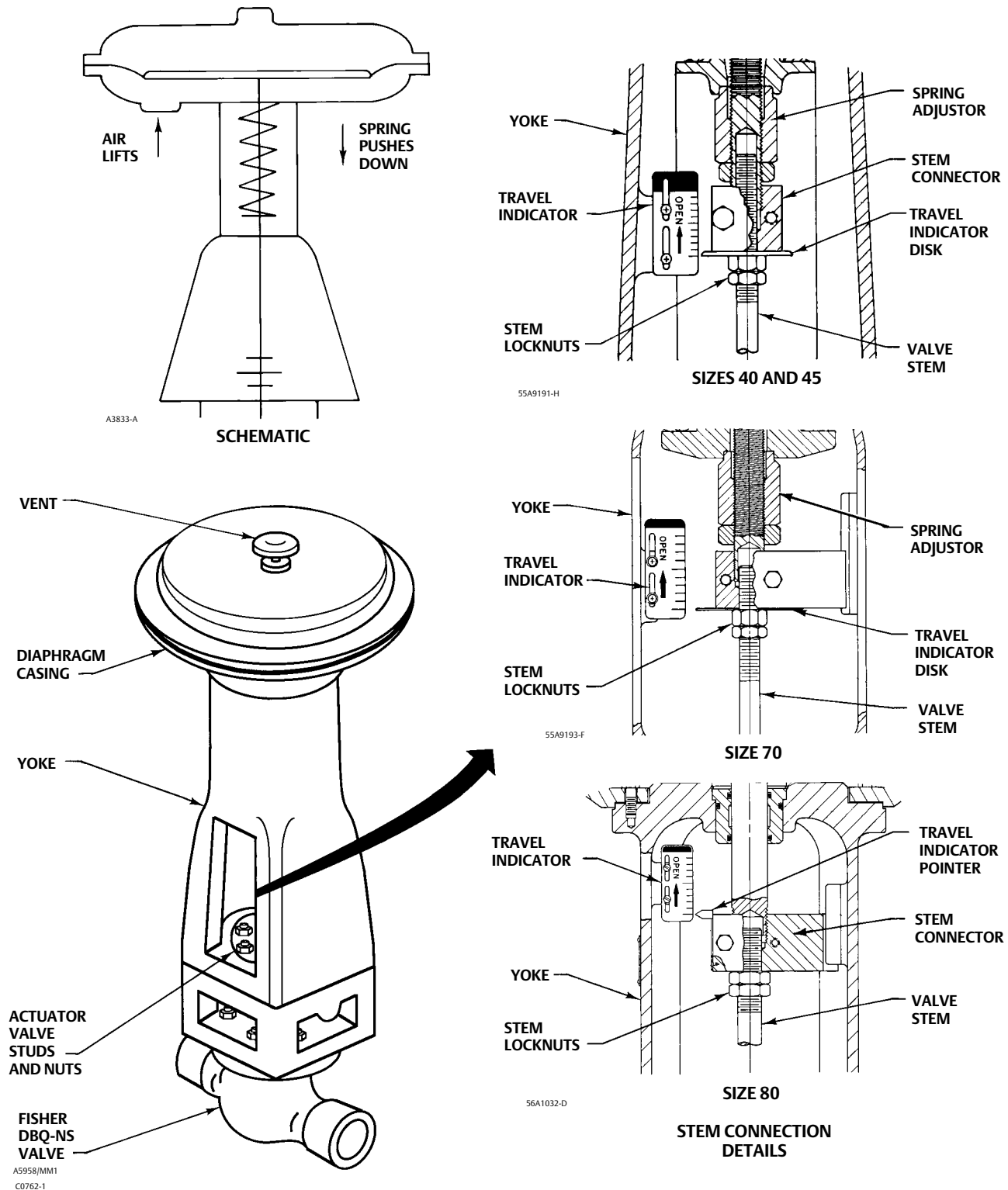
1. Screw the stem locknuts all the way onto the valve stem. Put the travel indicator disk, not used with the size 80 actuator, on the locknuts. The concave side of the disk should face the valve.
2. Place the actuator on the valve bonnet.
3. Insert the cap screws and tighten the hex nuts (not shown), securing the actuator to the bonnet. Tighten the cap screws to the torque in table 4.

Note

Before turning the spring adjuster on size 70 or 80 actuators, assemble the stem connector around the actuator stem and the anti-rotating lug on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.

4. (For size 80, remove the cap screw (key 91, figure 4) and remove the adjusting screw cover (key 84, figure 4). Rotate the spring adjuster (key 74, figure 2 for sizes 40 and 45; key 74, figure 4 for size 70; and key 74, figure 4 for size 80) to position the actuator stem at its fully extended position.
5. With the travel indicator scale attached to the actuator yoke, make a temporary mark on the actuator stem in line with the bottom mark on the scale (the mark on the end of the scale that is marked "OPEN"). (The distance from the bottom mark on the scale to the top mark is equal to the travel of the valve.)
6. Refer to the actuator nameplate to determine the bench set pressure range of the actuator. Apply an actuator loading pressure to the actuator equal to the lower end of the bench set range and rotate the spring adjuster until the mark you made on the actuator stem is in line with the bottom mark on the travel indicator scale. (Replace the size 80 adjusting screw cover and cap screw when you have completed the adjustments.)

Figure 1. Schematic and Stem Connection Details for Fisher 667NS



7. Increase actuator loading pressure to the upper end of the bench range and check to be sure that the mark on the actuator stem is in line with the top mark on the travel indicator scale.

If the marks are in line, the actuator is properly bench set.

If the marks are not in line, the spring is not correct for the specified bench set. It is necessary to use a different spring or a different bench set.

NOTICE

Do not clamp just the tip of either the valve stem or the actuator stem in the stem connector. Incomplete engagement of the valve stem and/or actuator stem in the stem connector might result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than the diameter of that stem.

8. Pull the valve stem firmly against its seat, and be sure that it remains firmly against the seat. Clamp the actuator stem and valve stem between the two stem connector halves.

If necessary, decrease actuator loading pressure slightly to allow the valve stem, actuator stem, and stem connector threads to match.

Insert and tighten the stem connector cap screws.

⚠ WARNING

To avoid personal injury due to the sudden uncontrolled movement of parts, do not loosen the cap screws when the stem connector has spring or loading pressure force applied to it.

9. Raise the travel indicator disk to the stem connector (sizes 40 through 70 only). For all sizes, thread the stem locknuts against the stem connector.
10. Remove all actuator loading pressure. Move the travel indicator scale so that the indicator disk (or pointer) is in line with the bottom mark of the travel indicator scale.
11. Check the valve travel to be sure that the valve travels fully with no overtravel.

Loading Connection

1. Connect the loading pressure piping to the NPT internal connection in the top of the actuator yoke.
2. For size 70 actuators, remove the 1/4-inch bushing in the 1/2 NPT internal connection to increase connection size, if necessary. Use either piping or tubing.
3. Keep the length of tubing or piping as short as possible to avoid transmission lag in the control signal. If an accessory (such as a volume booster or valve positioner) is used, be sure that the accessory is properly connected to the actuator. Refer to the positioner instruction manual if necessary.
4. Cycle the actuator several times to check that the valve stem travel is correct and that the travel occurs when the correct pressure range is applied to the diaphragm.
5. If valve stem travel is incorrect, refer to the Travel procedure in the Adjustments section.
6. If the pressure range is incorrect, refer to the Spring procedure in the Adjustments section.

Adjustments

Travel

⚠ WARNING

When moving the actuator stem with diaphragm loading pressure, use caution to keep hands and tools out of the actuator stem travel path. Personal injury and/or property damage is possible if something is caught between the actuator stem and other control valve assembly parts.

Make travel adjustments when the motion observed during actuator travel is different from the travel stamped on the actuator nameplate. If the Actuator Mounting procedure was followed correctly, this adjustment should not be necessary.

When adjusting travel of a direct-acting (push-down-to-close) valve, apply a low supply pressure to the actuator diaphragm casing. This moves the valve plug off of the seat, reducing the chance of damaging the valve plug or seat during adjustments.

1. Back the stem locknuts and indicator disk away from the stem connector, and slightly loosen the stem connector cap screws.

NOTICE

Do not use wrenches or other tools directly on the valve stem. Damage to the stem surface and subsequent damage to the valve packing might result.

2. Tighten the locknuts together, use a wrench on these locknuts, and screw the valve stem either into the stem connector to lengthen travel or out of the stem connector to shorten travel.
3. Cycle the actuator to check the travel. If travel is not equal to the specified travel, adjust and check travel until correct. Tighten the stem connector cap screws when correct travel is obtained.
4. Raise the travel indicator disk by threading the stem locknuts against the stem connector.

Spring

Discussion of Bench Set

The bench set pressure range is used to adjust the initial compression of the actuator spring with the actuator assembly “on the bench”. The correct initial compression ensures that the valve-actuator assembly will function properly when it is put in service and the proper actuator diaphragm operating pressure is applied.

The bench set range is established with the assumption that there is no packing friction. When attempting to adjust the spring in the field, it is very difficult to ensure that there is no friction being applied by “loose” packing.

Accurate adjustment to the bench set range can be made during the actuator mounting process (see the Actuator Mounting Procedure) by making the adjustment before the actuator is connected to the valve.

If you are attempting to adjust the bench set range after the actuator is connected to the valve and the packing tightened, you must take friction into account. Make the spring adjustment such that full actuator travel occurs at the

bench set range (a) plus the friction force divided by the effective diaphragm area with increasing diaphragm pressure or (b) minus the friction force divided by the effective diaphragm area with decreasing diaphragm pressure.

For an assembled valve-actuator assembly, determine valve friction as described below:

1. Install a pressure gauge in the actuator loading pressure line that connects to the actuator diaphragm casing.

Note

Steps 2 and 4 require that you read and record the pressure shown on the pressure gauge.

2. Increase the actuator diaphragm pressure and read the diaphragm pressure as the actuator reaches its mid-travel position.
3. Increase the actuator diaphragm pressure until the actuator is at a travel position greater than its mid-travel position.
4. Decrease the actuator diaphragm pressure and read the diaphragm pressure as the actuator reaches its mid-travel position.

The difference between the two diaphragm pressure readings is the change in the diaphragm pressure required to overcome the friction forces in the two directions of travel.

5. Calculate the actual friction force:

$$\text{Friction Force, pounds} = 1/2 \left(\begin{matrix} \text{Difference} \\ \text{in pressure} \\ \text{readings, psig} \end{matrix} \right) \times \left(\begin{matrix} \text{Effective} \\ \text{diaphragm area,} \\ \text{inches}^2 \end{matrix} \right)$$

Refer to table 1 and 5 for the effective diaphragm area.

When determining valve friction, you can make diaphragm pressure readings at a travel position other than mid-travel if you desire. If you take readings at the zero or at the full travel position, take extra care to ensure that the readings are taken when the travel just begins or just stops at the position selected.

It is difficult to rotate the spring adjuster (key 74, figure 2, 3, or 4) when the full actuator loading pressure is applied to the actuator. Release the actuator loading pressure before adjusting. Then re-apply loading pressure to check the adjustment.

Adjustment Steps

1. Monitor actuator loading pressure carefully when making adjustments. Do not exceed the maximum pressure specifications of either the loading regulator or the actuator casings (refer to table 1 for maximum diaphragm casing pressure).
2. Each actuator spring has a fixed pressure span. Changing the spring compression shifts the span up or down to make valve travel coincide with the pressure range.

Note

Before turning the spring adjuster on size 70 or 80 actuators, assemble the stem connector around the actuator stem and the anti-rotating lug on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.

3. For sizes 40 through 70, turn the spring adjustor (key 74, figure 2 or 3) into the yoke to shift the span up or turn the spring adjustor out of the yoke to shift the span down. For size 80, remove the cap screw (key 91, figure 4) and remove the adjusting screw cover (key 84); then rotate the spring adjustor (key 74) to shift the span. Replace the cover and cap screw when adjustment is complete.

If the actuator has a side-mounted handwheel assembly (manual actuator), clockwise handwheel rotation closes the valve.

For successful operation, the actuator stem and valve plug stem must move freely in response to the loading pressure change on the diaphragm.

Operation

In a reverse-acting diaphragm actuator, an increasing loading pressure causes the actuator stem to move upward, compressing the spring. When the diaphragm pressure is decreased, the spring moves the actuator stem downward. This is shown graphically in figure 1. In the event of failure of the loading pressure to the diaphragm of the actuator, the actuator stem moves to the extreme downward position. Thus, by the proper selection of the valve plug action, either push-down-to-close or push-down-to-open, the control valve will either close or open on failure of the diaphragm loading pressure.

The nameplate attached to the yoke of the actuator provides information about the specific construction and operating range. The spring and diaphragm have been selected to meet the requirements of the application, and in service, the actuator should create full travel of the valve plug when the diaphragm pressure (operate) range indicated on the nameplate is applied. This diaphragm pressure range is generally 0.2 to 1.0 bar or 0.4 to 2.0 bar (3 to 15 psi or 6 to 30 psi).

Pressure in the valve body creates a force on the valve plug that has a direct effect on the actual operating diaphragm pressure range. In some instances, the valve may not stroke completely over the indicated range because the pressure conditions in the body are different from those for which the control valve has been set at the factory. A simple spring adjustment, however, may be all that is required to obtain correct travel for the diaphragm pressure range utilized. Note that the actuator spring has a fixed pressure span and that adjustment of the spring compression merely shifts this span up or down to make valve travel coincide with the diaphragm pressure range.

The nameplate specifies a bench set pressure range in addition to a diaphragm pressure (operate) range. The bench set range is that pressure range required to stroke the valve fully without any pressure in the body, as would be the case if the valve were set on the work bench. However, in service with the specified pressure drop applied across the valve, it should stroke over that diaphragm pressure (operate) range indicated on the nameplate.

When the control valve and actuator are installed, the actuator should be checked for correct travel, freedom from excessive friction, and correct action (air-to-open or air-to-close) to match the controlling instrument. For successful operation, the actuator stem and valve plug stem must move freely in response to the loading pressure change on the diaphragm.

Maintenance

Normally, only the elastomeric parts and the spring of the 667NS actuator require inspection or replacement. The maintenance instructions are divided into three subsections: Replacement of Elastomeric Parts, Disassembly, and Assembly. Perform only those steps applicable to the actuator size and required maintenance.

It is recommended that the diaphragm and all of the other elastomeric parts of the 667NS actuator be inspected every two years. The absolute maximum replacement period for any of the elastomeric parts is four years.

All maintenance operations can be performed with the valve in the line.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Replacement of Elastomeric Parts

Size 40, 45, and 70 Actuators

Perform the following if you are replacing only the elastomeric parts of the 667NS actuator, and no other maintenance is necessary. The diaphragm, the gasket, and the seal bushing O-rings are the only elastomeric parts in the size 40, 45, and 70 actuators. Key number references are shown in figure 2 for size 40 and 45 actuators and in figure 3 for size 70 actuators.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Reduce the actuator loading pressure to atmospheric pressure.
2. Remove the diaphragm casing cap screws and nuts (keys 13 and 14), and lift off the upper diaphragm casing (key 1).

NOTICE

Do not allow the valve stem to rotate during this operation since it could cause damage to the valve seats.

3. Remove the diaphragm plate cap screw and spacer (key 12 and 2). For actuator sizes 40 and 45, place a wrench on the actuator-valve stem connector assembly (key 31) to prevent the actuator stem (key 144) from rotating during the loosening of the diaphragm plate cap screw (key 12).
4. Take out the diaphragm (key 3), the upper diaphragm plate (key 4), and the lower diaphragm plate (key 71).
5. Remove the snap ring (key 72), and pull out the seal bushing (key 7). The seal bushing has two 1/4-20 UNC tapped holes provided in its top surface to be used as an aid in removing it.

6. Install three new O-rings (keys 8 and 9) on the seal bushing.
7. Lubricate the O-rings, and fill the seal bushing with lithium grease (key 99) or high-temperature, radiation-resistant, polyphenyl ether grease (key 100), as appropriate to the installation and install the bushing in the top of the actuator yoke assembly (key 73). Secure with the snap ring.
8. Coat a new gasket (key 70) with lithium grease (key 99) or high-temperature, radiation-resistant, polyphenyl ether grease (key 100), as appropriate to the installation, and place the gasket on the yoke (key 73). Assemble the lower diaphragm plate, the new diaphragm, and the upper diaphragm plate onto the actuator stem.

NOTICE

Do not allow the valve stem to rotate during this operation because it could cause damage to the valve seats.

9. Install the diaphragm plate cap screw and spacer. Tighten the cap screw to the torque value indicated in table 3. For actuator sizes 40 and 45, place a wrench on the actuator valve stem connector assembly to prevent the actuator stem from rotating during the tightening of the diaphragm plate cap screw.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 40, 45, and 70 actuators.

NOTICE

Overtightening the diaphragm casing cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed a torque of 27 N•m (20 lbf•ft) when performing the following tightening procedure.

Note

Do not use lubricant on these cap screws and nuts. Fasteners must be clean and dry.

10. Place the upper diaphragm casing into position, and replace the diaphragm casing cap screws and nuts. Tighten in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to 13 N•m (10 lbf•ft).
11. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
12. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
13. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
14. After the last hex nut is tightened to 27 N•m (20 lbf•ft), all of the hex nuts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
15. Once completed, no more tightening is recommended.

Size 80 Actuators

The elastomeric parts in a size 80 actuator include the diaphragm and O-rings. Since replacement of these parts necessitates complete disassembly, perform the steps outlined in the procedures for disassembly and assembly of size 80 actuators.

Disassembly

Size 40, 45, and 70 Actuators

Key number references are shown in figure 2 for size 40 and 45 actuators and in figure 3 for size 70 actuators.

1. Bypass the control valve. Reduce the actuator loading pressure to atmospheric pressure, and remove the tubing or piping from the connection in the yoke cap (key 239).
2. To aid in assembly, record the position of the spring adjustor (key 74) on the actuator stem (key 144). Loosen the spring adjustor jam nut (key 102), and thread the spring adjustor jam nut and the spring adjustor off the actuator stem until all spring compression is relieved.
3. Remove the entire actuator from the valve body by removing the two cap screws from the stem connector assembly (key 31), separating the two halves of the stem connector and removing the eight bonnet stud bolt nuts.
4. Thread the spring adjustor jam nut and the spring adjustor off the actuator stem. Remove the spring seat (key 19).
5. Remove the diaphragm casing cap screws and nuts (key 13 and 14), and lift off the upper diaphragm casing (key 1).
6. Take out the diaphragm (key 3), the upper diaphragm plate (key 4), the lower diaphragm plate (key 71), and the actuator stem as an assembly. Use care when pulling the threads of the actuator stem through the seal bushing (key 7) to avoid damaging the O-rings (key 8).
7. Remove the diaphragm plate cap screw and spacer (keys 12 and 2) to separate the parts of this assembly.
8. Remove the snap ring (key 72), and lift out the seal bushing (key 7). Remove and check the O-rings (keys 8 and 9) for excessive wear or damage.
9. Remove the cap screws (key 30), and take off the lower diaphragm casing (key 64), the gasket (key 70), and the yoke cap. Lift out the spring (key 18).

Size 80 Actuators

Key number references are shown in figure 4.

1. Remove the cap screws (key 91) and the adjusting screw cover (key 84).
2. Unscrew the hex nuts (keys 85 and 86) from the actuator stem (key 93). Record the position of the spring adjustor (key 74) relative to the spring case (key 92). Loosen the spring adjustor locknut (key 90), and unscrew the spring adjustor, relieving all compression from the spring (key 18).
3. Remove the two cap screws from the stem connector assembly (key 31), and separate the stem connector halves.
4. If removal of the actuator is necessary, unbolt the eight bonnet stud bolt nuts, and remove the actuator from the valve body. Otherwise, leave the actuator mounted on the valve body.
5. Unscrew the cap screws and nuts (keys 13 and 14), and lift the upper diaphragm casing and spring case assembly (keys 1 and 92) over the spring.
6. Remove the spring seat (key 19), the bearing race and bearing (keys 88 and 89), and the guide bushing (key 97).
7. Lift off the spring.
8. Remove the actuator stem with the attached hex nuts (key 94), the diaphragm plate (key 4), the diaphragm (key 3), and the lower diaphragm plate (key 71) by carefully sliding the lower end of the actuator stem out of the seal bushing O-rings (key 8) and lifting the actuator stem with attached parts clear of the diaphragm case.
9. To aid in unfastening the actuator stem hex nuts (key 94) and to help prevent actuator stem damage, attach the stem connector assembly onto the actuator stem and grip the stem connector in a vise while unfastening the actuator stem hex nuts (key 94). Remove the hex nuts (key 94), and inspect the actuator stem and associated parts.
10. Remove the snap ring (key 72), and lift the seal bushing (key 7) and O-rings (keys 8 and 9) out of the actuator yoke (key 73).
11. Remove the O-rings.

12. Unbolt the lower diaphragm casing cap screws (key 30), and lift the lower diaphragm casing (key 64) and gasket (key 96) off the actuator yoke.

Assembly

Size 40, 45, and 70 Actuators

Key number references are shown in figure 2 for size 40 and 45 actuators and in figure 3 for size 70 actuators.

1. Place the spring (key 18) into the yoke (key 73). Coat the gasket (key 70) with lithium grease (key 99) or high-temperature, radiation-resistant, polyphenyl ether grease (key 100), as appropriate to the installation, and place the gasket on top of the yoke. Replace the yoke cap (key 239), and then place another lubricated gasket (key 70) on top of the yoke cap.
2. Attach the lower diaphragm casing (key 64) to the yoke cap with the cap screws (key 30). Tighten the cap screws to 41 N•m (30 lbf•ft) of torque for the size 40 and 45 actuators, and 102 N•m (75 lbf•ft) of torque for the size 70 actuators. Insert and evenly tighten the cap screws using a crisscross pattern.
3. Place the O-rings (keys 8 and 9) in the seal bushing (key 7).
4. Lubricate the O-rings, and fill the seal bushing with lithium grease (key 99) or high-temperature, radiation-resistant, polyphenyl ether grease (key 100) as appropriate to the installation, and reinstall the bushing in the top of the yoke. Secure with the snap ring (key 72).
5. Assemble the actuator stem (key 144), the lower diaphragm plate (key 71), the diaphragm (key 3), the upper diaphragm plate (key 4), and the diaphragm plate cap screw and spacer (keys 12 and 2). Tighten the cap screw to the torque value indicated in table 3; then place this assembly in the actuator. Take care when pushing the actuator stem through the seal bushing so that the threads do not damage the O-rings.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 40, 45, and 70 actuators.

NOTICE

Overtightening the diaphragm casing cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed a torque of 27 N•m (20 lbf•ft) when performing the following tightening procedure.

Note

Do not use lubricant on these cap screws and nuts. Fasteners must be clean and dry.

6. Install the upper diaphragm casing (key 1), and secure with the cap screws and nuts (keys 13 and 14) in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to 13 N•m (10 lbf•ft).
7. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
8. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).

9. Tighten the remaining hex nuts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
10. After the last hex nut is tightened to 27 N•m (20 lbf•ft), all of the hex nuts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
11. Once completed, no more tightening is recommended.

Table 6. Size 80 Casing Cap Screw Torque Values

DIAPHRAGM MATERIAL	INITIAL TORQUE	FINAL TORQUE
	N•m (lbf•ft)	N•m (lbf•ft)
EPDM / Meta-Aramid	41 (30)	82 ± 13 (60 ± 10)
Nitrile, Silicone, FKM/Meta-Aramid	34 (25)	68 (50)

12. Lift the spring (key 18) and spring seat (key 19) into position. Apply lithium grease to the threads of the actuator stem and to the surface of the spring adjustor (key 74) that contacts the spring seat. These locations are indicated on the assembly drawing in figures 2 and 3. Thread the spring adjustor on the actuator stem so that it matches the position recorded during disassembly. Thread the spring adjustor jam nut (key 102) up against the spring adjustor, and tighten securely.
13. Thread the stem hex nuts (keys 69 and 75) on the valve plug stem, and place the travel indicator (key 34) on these nuts with the cupped portion pointing towards the valve body.
14. Mount the actuator on the valve body, and make up the stem connection by following the procedures in the Actuator Mounting section.

Size 80 Actuators

Key number references are shown in figure 4.

1. Coat a new gasket (key 96) with lithium grease (key 99) or high-temperature, radiation-resistant, polyphenyl ether grease (key 100), as appropriate to the installation, and place the gasket on the yoke (key 73). Position the lower diaphragm casing (key 64) on the yoke. Insert and tighten the cap screws (key 30) to 102 N•m (75 lbf•ft) torque.
2. Insert new O-rings (keys 8 and 9) into the seal bushing (key 7). Lubricate the O-rings, and fill the seal bushing with lithium grease (key 99) or high-temperature, radiation-resistant, polyphenyl ether grease (key 100) or equivalent, as appropriate to the installation. Place the seal bushing and O-rings into the yoke, and install the snap ring (key 72).
3. To aid in assembling the actuator stem (key 93) and associated parts (keys 94, 4, 3, and 71), attach the stem connector assembly (key 31) onto the actuator stem, and grip the stem connector in a vise.
4. Slide the lower diaphragm plate (key 71), the diaphragm (key 3), and the upper diaphragm plate (key 4) onto the actuator stem. Slide the first hex nut (key 94) onto the stem, tighten the hex nut to 542 N•m (400 lbf•ft), slide the second hex nut onto the stem, and tighten it securely against the first hex nut. Remove the subassembly from the vise, and remove the stem connector assembly (key 31) from this subassembly.
5. Slide the shorter end of the actuator stem through the seal bushing and the O-rings (key 8), and align the diaphragm cap screw holes with the lower diaphragm case cap screw holes.
6. Lubricate the guide bushing (key 97) with lithium grease or high-temperature, radiation-resistant, polyphenyl ether grease, as appropriate to the installation. Lubricate the bearing race and bearing (keys 88 and 89) with lithium grease.
7. Position the spring (key 18), the spring seat (key 19), the lubricated guide bushing (key 97), and the lubricated bearing race and bearing on top of the diaphragm plate as shown in figure 4.
8. If the spring case assembly (key 92) has been removed from the upper diaphragm casing, replace it, making sure the vent holes in the diaphragm casing and in the spring case are aligned, and tighten the cap screws (key 30) to 102 N•m (75 lbf•ft) torque. Lower the diaphragm casing and spring case assembly onto the diaphragm.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 80 actuators.

NOTICE

Overtightening the diaphragm casing cap screws and nuts can damage the diaphragm. Do not exceed the following maximum torque values for the appropriate diaphragm material: EPDM/Meta-Aramid: 95 N•m (70 lbf•ft); Nitrile, Silicone, FKM (fluorocarbon) / Meta-Aramid: 68 N•m (50 lbf•ft).

Note

Do not use lubricant on these cap screws and nuts. Fasteners must be clean and dry.

9. Insert the diaphragm casing cap screws and nuts (keys 13 and 14) and tighten in the following manner. The first four hex nuts tightened should be diametrically opposed and 90 degrees apart. Tighten these four hex nuts to the initial torque value found in table 6 for the diaphragm material being used.
10. Tighten the remaining hex nuts in a clockwise, crisscross pattern to the initial torque value found in table 6 for the diaphragm material being used.
11. Repeat this procedure by tightening four hex nuts, diametrically opposed and 90 degrees apart, to the final torque value that is specified in table 6 for the diaphragm material being used.
12. Tighten the remaining hex nuts in a clockwise, crisscross pattern to the final torque value that is specified in table 6 for the diaphragm material being used.
13. After the last hex nut is tightened, complete another tightening sequence. Tighten in a circular pattern around the bolt circle to the final torque value that is specified in table 6 for the diaphragm material being used.
14. Once completed, no more tightening is recommended.
15. Lubricate the spring adjustor (key 74) threads and the bearing race and bearing with lithium grease. Thread the spring adjustor (key 74) into the spring case assembly so that the spring adjustor matches the position recorded in step 2 of the disassembly procedures for size 80 actuators. Also, make sure that the spring adjustor properly engages the spring seat.
16. Turn the spring adjustor hex nut (key 90) tightly against the spring case.
17. Lubricate the bearing race and bearing with lithium grease, and slide them over the actuator stem into the spring adjustor. Insert the bearing retainer snap ring (key 87) into the spring adjustor. Thread the two hex nuts (keys 85 and 86) onto the actuator stem. If the hex nuts (keys 85 and 86) are not used as a travel stop, thread them onto the actuator stem until they touch the spring adjustor. Back them off approximately 3.2 mm (1/8-inch), and lock them together. If these hex nuts (keys 85 and 86) are used as a travel stop, thread them onto the actuator stem so that they do not restrict actuator travel during travel adjustment. Adjust the hex nuts as outlined in the Actuator Mounting section.
18. Screw the two hex nuts (key 69) onto the valve plug stem. Mount the actuator on the valve body, and make the stem connection by following the procedures in the Actuator Mounting section.

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always refer to this serial number when corresponding with your [Emerson sales office](#) regarding replacement parts or technical information.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Key	Description	Key	Description
1	Upper Diaphragm Casing, zn pl steel Size 40 Std W/casing mounted handwheel W/adj travel stop Size 45 Std W/casing mounted handwheel W/adj travel stop Size 70 Std W/casing mounted handwheel Size 80	30	Cap Screw, pl steel Size 40 (6 req'd) Size 45 (8 req'd) Size 70 (12 req'd) Size 80 (24 req'd)
2	Spacer	31	Stem Connector Assy, stainless steel Size 40, 45, 70, and 80
3*	Diaphragm, nitrile Size 40, 45, 70, and 80	32	Travel Indicator Scale
4	Upper diaphragm Plate, steel Size 40, 45, 70, and 80	33	Machine Screw, stainless steel (2 req'd) Sizes 40, 45, 70, and 80
7	Seal Bushing, brass Size 40, 45, 70, and 80	34	Travel Indicator, stainless steel Size 40, 45, 70, and 80
8*	O-Ring, fluoroelastomer (2 req'd) Size 40, 45, 70, and 80	39	Nameplate, stainless steel
9*	O-Ring, fluoroelastomer Size 40, 45, 70, and 80	40	Drive Screw, stainless steel (4 req'd)
12	Cap Screw	64	Lower Diaphragm Casing, zn pl steel Size 40 std w/1/2-14 NPT connection
13	Cap Screw, pl steel Size 40 (16 req'd) Size 45 (20 req'd) Size 70 (28 req'd) Size 80 (36 req'd)	64	Lower Diaphragm Casing, zn pl steel (continued) Size 45 std w/1/2-14 NPT connection Size 70 and 80
14	Hex Nut, pl steel Size 40 (16 req'd) Size 45 (20 req'd) Size 70 (28 req'd) Size 80 (36 req'd)	69	Hex Nut, pl steel Sizes 40, 45, and 70 Size 80 (2 req'd)
17	Vent Assembly Size 40, 45, 70, and 80	70*	Gasket, composition-nitrile (2 req'd) Size 40, 45, and 70
18	Spring	71	Lower Diaphragm Plate, steel Size 40, 45, 70, and 80
19	Spring Seat, zn pl steel Size 40, 45, 70, and 80	72	Snap Ring, stainless steel Size 40, 45, 70, and 80
27	Connector, steel (for casing mounted handwheel) Size 40, 45, and 70	73	Yoke, steel Size 40, 45, 70, and 80
		74	Spring Adjustor, pl steel Size 40, 45, 70, and 80
		75	Hex Nut, pl steel Size 40 and 70
		76	Nut, Twin Speed (Size 70 only)
		78	Pipe Bushing, pl steel Size 70 only std (2 req'd) w/Casing mounted handwheel

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667NS Actuator

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Key	Description
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83	Washer, steel (2 req'd), size 70 only
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Note

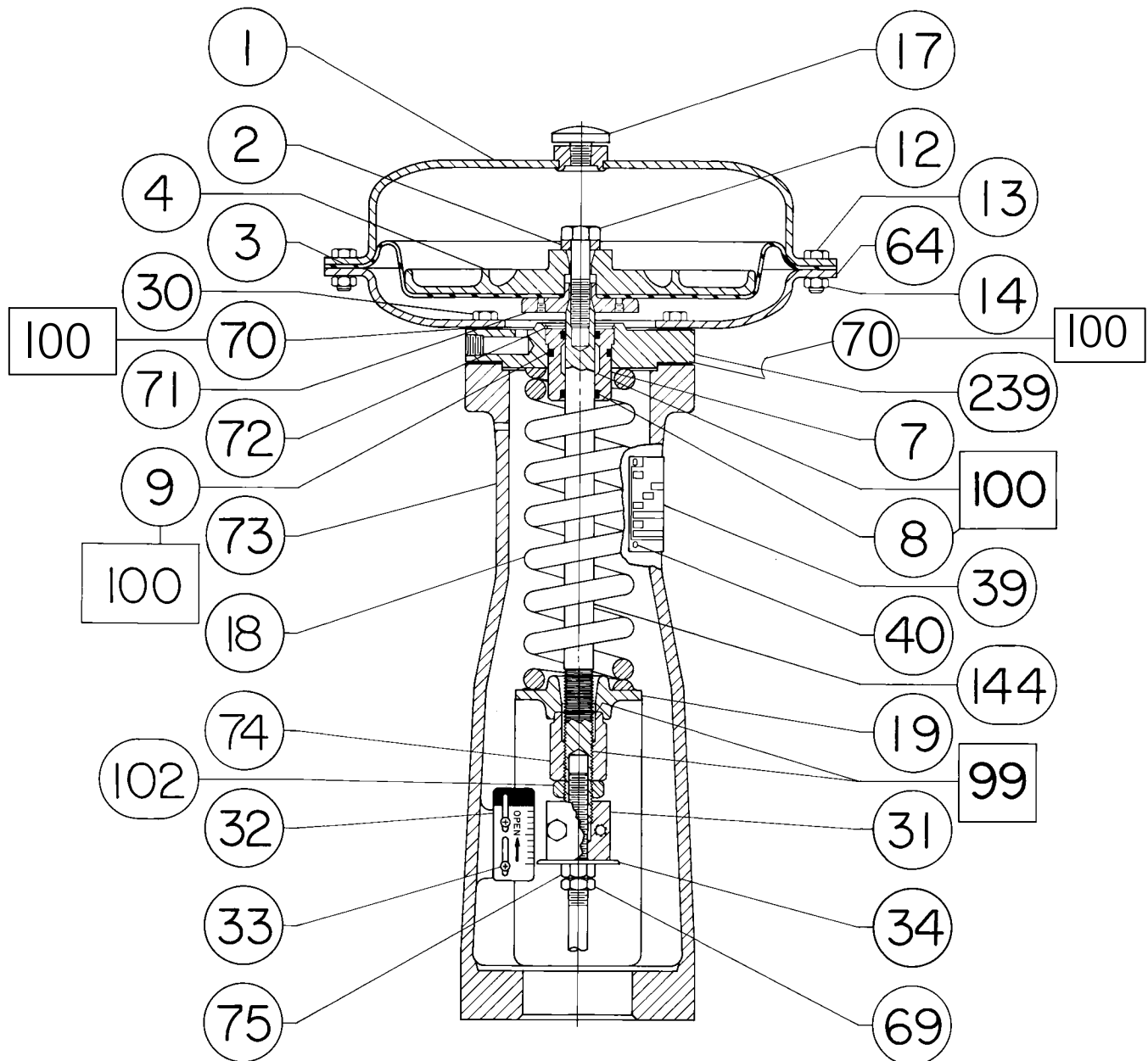
Key numbers 84 through 98 are for size 80 only.

84	Adjusting Screw Cover, steel
85	Hex Nut, pl steel
86	Hex Nut, steel
87	Snap Ring, stainless steel
88	Bearing Race, alloy steel (4 req'd)
89	Bearing, alloy steel (2 req'd)
90	Hex Nut, steel
91	Cap Screw, pl steel (2 req'd)
92	Spring Case Assembly, steel
93	Actuator Stem, pl steel
94	Hex Nut, steel (2 req'd)
95	Travel Stop, steel (3 req'd)

Key	Description
-----	-------------

96*	Gasket, composition/nitrile
97	Guide Bushing, brass
98	Machine Screw, pl steel (2 req'd)
99	Lithium grease (not furnished with actuator)
100	High-temperature, radiation-resistant, polyphenyl ether grease (not furnished with actuator)
101	Pipe Plug, steel for yoke cap connection only, sizes 40 & 45
102	Jam Nut, pl steel, size 40, 45, and 70
144	Actuator Stem Size 40 Pl steel 316 stainless steel Size 45 Pl steel 316 stainless steel Size 70 Pl steel
227	Washer, steel. size 70 only, casing mounted handwheel
239	Yoke Cap, steel Size 40, 45, and 70
240	Warning Nameplate

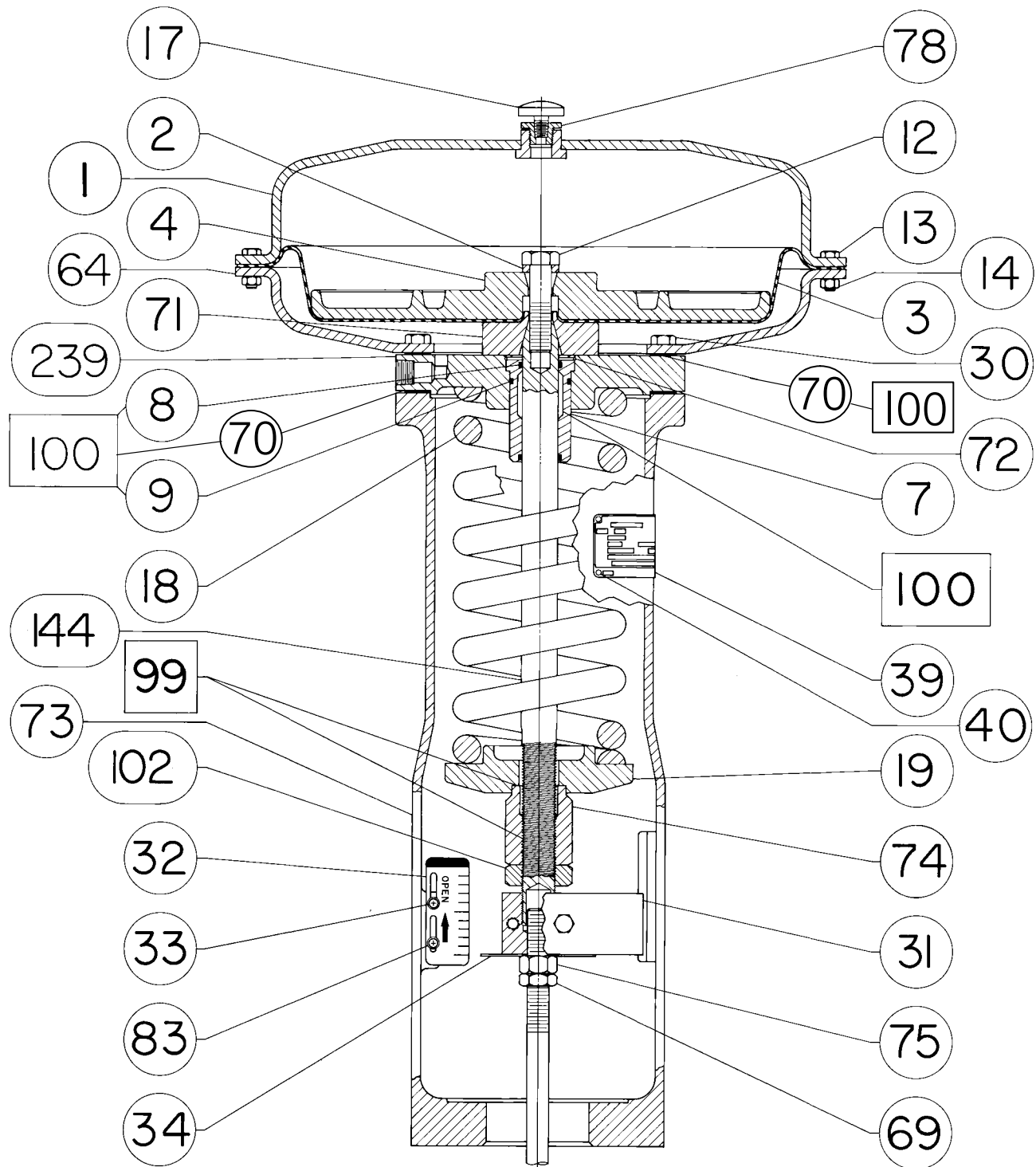
Figure 2. Size 40 or 45 Fisher 667NS Actuator



□ APPLY LUB

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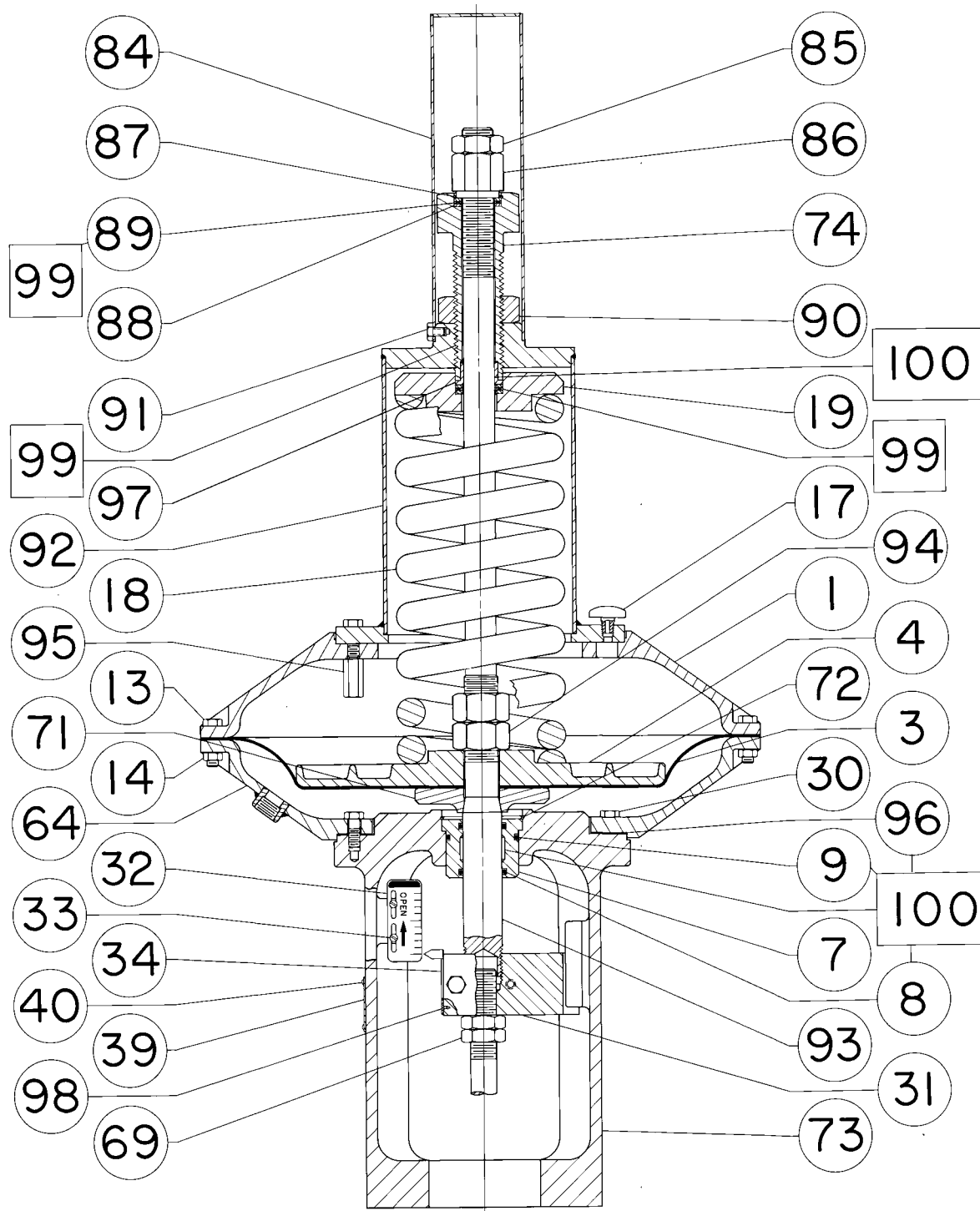
Figure 3. Size 70 Fisher 667NS Actuator



□ APPLY LUB

55A9193-F

Figure 4. Size 80 Fisher 667NS Actuator



□ APPLY LUB
56A1032-D

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Fisher™ 685 Piston Actuator

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Figure 1. Fisher 685 Piston Actuator



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Introduction

Scope of Manual

This instruction manual provides information on the installation, maintenance, and parts ordering for Fisher 685 piston actuators. Refer to separate instruction manuals for information regarding other equipment and accessories used with these actuators.



Do not install, operate, or maintain a Fisher 685 actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The Fisher 685 is a double acting piston actuator that provides accurate, high thrust output for short to long travel applications. This actuator is designed for use with a variety of medium to large Fisher sliding-stem control valves including the easy-e™, FB, TBX, HP, EH, and 461.

Table 1. Specifications

Operating Pressure⁽¹⁾

Minimum: 2.7 bar (40psig)

Maximum Allowable: 10.3 bar (150 psig)

Consult your [Emerson sales office](#) for supply pressures under 2.7 bar (40 psi)

Travel⁽²⁾

25 mm (1 inch) through 610 mm (24 inch)

See table 2

Thrust Capabilities

See table 3

Piston Diameter and Area⁽²⁾

Available in 51 mm (2 inch) increments between 305 mm (12 inch) and 660 mm (26 inch)

See table 2

Operative Temperature Limits

Standard: -40 to 93°C (-40 to 200°F)

Low Temperature: -54 to 93°C (-65 to 200°F)⁽³⁾

High Temperature: -29 to 204°C (-20 to 400°F)⁽³⁾

Yoke Boss and Valve Stem Diameter

■ 127 mm (5H inch) yoke boss with 32 mm (1-1/4 inch) stem ■ 178 mm (7 inch) yoke boss with 51 mm (2 inch) stem

Pressure Connections

Standard: 3/4 NPT

Optional: 1 and 1-1/4 NPT

Instrument Mounting

Mounting kits are available for use with the FIELDVUE DVC6200 Series positioner

Construction Materials

PART	MATERIAL
Yoke	ASTM A36 (steel)
Piston	ASTM A36 (steel)
Cylinder	305 to 559 mm (12 to 22 inch) Cylinder: 1026 DOM (steel) with chrome-plated bore 610 to 660 mm (24 to 26 inch) Cylinder: ASTM A516 Grade 70 (steel) with fluoropolymer coated bore
Upper/Lower Heads	ASTM A36 (steel)
Tie Bolt	ASTM A311 1045, Class B (steel)
Piston Rod	S31603 (316L stainless steel)
Stem Connector	ASTM A36 (steel)

Weights

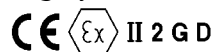
See tables 4 and 5

Lifting Point Load Ratings

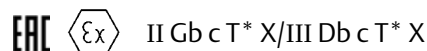
See table 6

Optional Certifications⁽⁴⁾

- Pressure Equipment Directive (PED) 2014/68/EU
- Complies with the requirements of ATEX Group II Category 2 Gas and Dust



- Customs Union Technical Regulations (CU TR) 010/2011 and 012/2011



Fisher 685 actuators have been evaluated for ignition hazard and certified for CUTR 012/2011 under “protection by constructional safety”. To ensure conformity with CUTR, only Fisher parts and materials can be used.

1. The pressure/temperature limits in this bulletin and any other applicable standard or code should not be exceeded.
2. Consult factory for larger travels or cylinder diameters. The Fisher 585C family of actuators are available for smaller travels or cylinder diameters.
3. Consult factory for applications requiring low or high temperature requirements.
4. Refer to the product nameplates to determine which certifications each actuator construction possesses.

Specifications

Specifications for 685 piston actuators are given in table 1. Refer to the nameplate affixed to the actuator yoke for specifications specific to individual constructions.

Educational Services

Emerson Educational Services
Phone: +1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Principle of Operation

685 piston actuators utilize a pneumatically controlled piston that moves inside of a cylinder to generate thrust. A seal contained on the circumference of the piston provides a seal between the piston and the cylinder, preventing supply pressure leakage.

From an equilibrium state, the actuator operates by reacting to a force unbalance that is created by increasing supply pressure on one side of the piston, and decreasing it on the other. This moves the piston up or down, and results in a repositioning of the attached control valve. Travel can be adjusted using travel limits within a valve positioner, which limit the travel range of the actuator. The optional handwheel manual override does not have the ability to act as a hard travel stop.

An optional handwheel manual override is capable of extending or retracting the actuator manually and can be engaged at any position from full open to full close. This override utilizes a worm gear assembly that is attached to the stem connector and not attached to the cylinder or piston rod. This enables the manual override to reposition the control valve even if the actuator cylinder or piston is removed for maintenance.

Table 2. Standard Constructions⁽¹⁾

ACTUATOR SIZE	PISTON DIAMETER	PISTON ROD AREA	PISTON AREA	VALVE STEM CONNECTOR SIZE	YOKE BOSS DIAMETER	VALVE TRAVEL	
						Minimum	Maximum
mm (cm ² for Area)							
12	305	16	730	32 or 51	127 or 178	>203	610
14	356	32	993	32 or 51	127 or 178	>203	610
16	406	32	1297	32 or 51	127 or 178	>203	610
18	457	32	1642	32 or 51	127 or 178	>203	610
20	508	46	2027	32 or 51	127 or 178	25	610
22	559	46	2452	32 or 51	127 or 178	25	610
24	610	62	2919	32 or 51	127 or 178	25	610
26	660	62	3425	32 or 51	127 or 178	25	610
Inches (inch ² for Area)							
12	12	2.41	113	1-1/4 or 2	5H or 7	>8	24
14	14	4.91	154	1-1/4 or 2	5H or 7	>8	24
16	16	4.91	201	1-1/4 or 2	5H or 7	>8	24
18	18	4.91	254	1-1/4 or 2	5H or 7	>8	24
20	20	7.07	314	1-1/4 or 2	5H or 7	1	24
22	22	7.07	380	1-1/4 or 2	5H or 7	1	24
24	24	9.62	452	1-1/4 or 2	5H or 7	1	24
26	26	9.62	531	1-1/4 or 2	5H or 7	1	24
1. Consult your Emerson sales office for additional sizes.							

1. Consult your Emerson sales office for additional sizes.

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Table 3. Thrust

ACTUATOR SIZE	STROKE	THRUST AT SUPPLY PRESSURE, N (LBF) ⁽¹⁾			
		4.1 barg (60 psig)	5.5 barg (80 psig)	6.9 barg (100 psig)	10.3 barg (150 psig) ⁽²⁾
12	Push	30183 (6786)	40245 (9048)	50306 (11310)	75459 (16965)
14		41083 (9236)	54777 (12315)	68472 (15394)	102707 (23091)
16		53659 (12064)	71546 (16085)	89432 (20106)	134149 (30159)
18		67913 (15268)	90550 (20358)	113188 (25447)	169782 (38170)
20		83843 (18850)	111790 (25133)	139738 (31416)	209607 (47124)
22		101450 (22808)	135266 (30411)	169083 (38013)	253625 (57020)
24		120734 (27143)	160978 (36191)	201223 (45239)	301834 (67858)
26		141694 (31856)	188926 (42474)	236157 (53093)	354236 (79639)
12	Pull	29540 (6641)	39387 (8855)	49234 (11069)	73851 (16603)
14		39773 (8942)	53030 (11922)	66288 (14903)	99432 (22354)
16		52349 (11769)	69799 (15692)	87248 (19615)	130873 (29423)
18		66602 (14974)	88803 (19965)	111004 (24956)	166506 (37434)
20		81956 (18425)	109275 (24567)	136593 (30709)	204890 (46063)
22		99563 (22384)	132751 (29845)	165938 (37306)	248907 (55959)
24		118166 (26566)	157555 (35422)	196944 (44277)	295416 (66415)
26		139127 (31279)	185503 (41705)	231878 (52131)	347817 (78196)

1. Consult your Emerson sales office for supply pressures below 40 psig.
2. Maximum available thrust.

Table 4. Approximate Weights for Constructions without Handwheels

MAXIMUM VALVE TRAVEL mm (inches)	APPROXIMATE WEIGHT FOR ACTUATOR SIZE, kg (lbs)							
	12	14	16	18	20	22	24	26
102 (4.00)					402 (886)	475 (1048)	662 (1459)	761 (1677)
203 (8.00)					430 (947)	505 (1114)	702 (1548)	804 (1771)
305 (12.00)	157 (346)	245 (541)	292 (643)	337 (742)	457 (1008)	535 (1180)	743 (1637)	847 (1866)
406 (16.00)	168 (370)	262 (577)	311 (686)	358 (789)	485 (1069)	565 (1246)	783 (1726)	889 (1961)
508 (20.00)	179 (395)	278 (614)	331 (729)	379 (836)	512 (1129)	595 (1311)	823 (1815)	932 (2056)
610 (24.00)	190 (420)	295 (650)	350 (773)	401 (883)	540 (1190)	625 (1377)	864 (1904)	975 (2150)

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Table 5. Approximate Weights for Constructions with Handwheels

MAXIMUM VALVE TRAVEL	APPROXIMATE WEIGHT FOR ACTUATOR SIZE, kg (lbs)							
mm (inches)	12	14	16	18	20	22	24	26
102 (4.00)					591 (1304)	664 (1463)	834 (1838)	925 (2038)
203 (8.00)					622 (1372)	696 (1535)	873 (1924)	965 (2128)
305 (12.00)	226 (499)	363 (800)	292 (643)	454 (1000)	653 (1440)	729 (1607)	912 (2010)	1006 (2218)
406 (16.00)	239 (527)	380 (838)	311 (686)	474 (1046)	684 (1508)	762 (1679)	951 (2096)	1047 (2308)
508 (20.00)	252 (555)	397 (876)	331 (729)	495 (1092)	715 (1576)	794 (1751)	990 (2182)	1088 (2398)
610 (24.00)	264 (583)	415 (914)	350 (773)	516 (1138)	746 (1644)	827 (1823)	1029 (2268)	1129 (2488)

Table 6. Lifting Point Load Ratings

ACTUATOR SIZE	LIFTING ORIENTATION	NUMBER OF LIFTING POINTS USED	MAXIMUM LOAD	
			kg	lbs
12 to 24	Actuator Centerline Horizontal	2	1540	3400
26		2	2860	6300
12 to 24	Actuator Centerline Vertical	2	3760	8300
26		2	6350	14000

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts, be certain the actuator cylinder pressure does not exceed the limits listed in table 1. Use pressure-limiting or pressure-relieving devices to prevent cylinder pressure from exceeding these limits.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Dropping the actuator and any attached accessories and/or valve may cause personal injury and/or equipment damage. For all mounting procedures use an adequately sized chain, sling, hoist, or crane to handle the actuator and any attached accessories and/or valve. Use caution during lifting and handling to prevent slippage, swinging, faulty equipment connections, or sudden shock loads.

NOTICE

Special care must be taken when installing an actuator in a horizontal service orientation. To avoid cantilever loads on the valve stem and yoke, it is the customer's responsibility to ensure proper support for a horizontal actuator.

When an actuator and control valve are shipped together as a control valve assembly, the actuator is normally mounted on the valve. Follow the valve instructions when installing the valve in the pipeline. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the actuator mounting procedures in this instruction manual. Refer to the individual product instruction manuals for the installation or mounting of a FIELDVUE DVC6200 digital valve controller or 3610 positioner.

If the actuator is being installed without a positioner, the cylinder loading pressures should be supplied through a 4-way solenoid valve or a switching valve. The top and bottom sides of the piston are pressurized through the upper and lower heads (i.e. top and bottom of the cylinder).

The supply pressure medium should be clean, dry filtered air. If the supply source is capable of exceeding the maximum actuator operating pressure or positioner supply pressure, appropriate steps must be taken during installation to protect the positioner and all connected equipment against over pressurization.

The control valve should be located where it will be accessible for servicing. Room should be left above and below the control valve to permit removal of the actuator and valve plug.

Three-Way Valve Applications Note

In three-way valve applications where the actuator fully strokes at a frequency of once per minute or faster, and the stroking speed is rapid (less than 0.5 seconds per stroke), there is a possibility that the stem can fracture at the plug if the actuator cylinder pressure is greater than 5.5 bar (80 psig). This can cause loss of control of process fluid and further damage to the actuator. Consideration should be given to the use of high-strength, fatigue-resistant stem materials in these applications.

⚠ WARNING

To avoid loss of control of process fluid and subsequent personal injury or property damage caused by bursting of pressure-retaining parts, be sure the cylinder pressure does not exceed 5.5 bar (80 psig) in high cycle-rate, fast stroking speed, three-way valve applications.

Actuator Mounting

The following procedure describes how to mount a 685 actuator on a push-down-to-close valve so that the piston rod to valve plug stem connection allows full travel and proper shutoff. Key numbers referenced in the following steps are shown in figures 3 and 4.

If you purchase a 685 actuator for field installation on a control valve, mount the actuator on the valve and secure it to the bonnet with the eight bonnet-to-actuator bolts. The stem connection should then be made up to clamp the actuator stem and valve plug stem together to provide proper valve travel.

NOTICE

If the valve stem is allowed to remain in the up position (towards the actuator) during mounting, it can interfere with the actuator mounting, possibly damage valve stem threads, or bend the valve stem. Be sure the valve stem is pushed down (into the valve body), away from the actuator while mounting.

To avoid damaging the seating surfaces, do not rotate the valve plug while it is seated. Also avoid damage to the valve plug stem by careful use of tools during travel adjustment.

1. Thread two lifting eyes into the free ports on the upper head (key 1) 180 degrees apart. Reference tables 4 and 5 for approximate weights of the actuator to select an appropriate lifting eye. Attach appropriate rigging gear to the lifting eyes.
2. Slowly lower the actuator down onto the valve. Once the actuator is in place, insert the bonnet-to-actuator bolts and tighten the hex nuts.

3. Turn the two stem locknuts (if present) all the way onto the valve stem thread.
4. Starting with the cylinder fully retracted, manually, or with air pressure, extend the piston rod to the specified valve travel.
5. Attach the stem connector (key 18), clamping the piston rod (key 17) to the valve stem. Be sure you also attach the feedback arm and travel indicator.
6. Cycle the actuator to check availability of desired total travel and that the valve plug seats before the cylinder reaches the end of its stroke. You can make minor travel adjustments, if necessary, by loosening the stem connector slightly, tightening the locknuts together, and (with the valve plug off the seat) screwing the stem either into or out of the stem connector by means of a wrench on the locknuts.
7. If the total travel is adequate, tighten the stem connector (key 18) securely, lock the stem locknuts (if present) against the connector, and adjust the indicator scale (key 22) on the yoke (key 21) to show valve plug position.
8. Provide a gauge, if necessary, to measure the pressure to the actuator. Make a final adjustment on the positioner to set the starting point of valve travel and to obtain full travel for the given instrument range.

Handwheel Operation

If manual operation is required, the actuator should be equipped with a manual handwheel.

NOTICE

To avoid damage to actuator parts and difficult operation of actuator handwheels, open the bypass valve (key 66) before using a handwheel.

The bypass assembly is furnished only when a handwheel actuator is specified. The bypass allows the pressure to equalize on either side of the piston, so that the manual actuator can be used to position the control valve. Flow through the bypass tubing is controlled by an angle needle valve, which is operated manually. This valve should be closed when air pressure is being used to operate the actuator.

Key numbers referenced in the following steps are shown in figures 2 and 3. Refer to table 7 for handwheel specifications.

1. Open the bypass valve.
2. Rotate the handwheel (key 45) to position the override engage pin (key 38) with the hole in the stem connector (key 18). Use the engage pin control knob (key 33) to insert the override engage pin into the stem connector until it stops. Refer to figure 2 for engage pin control knob operation.

Note

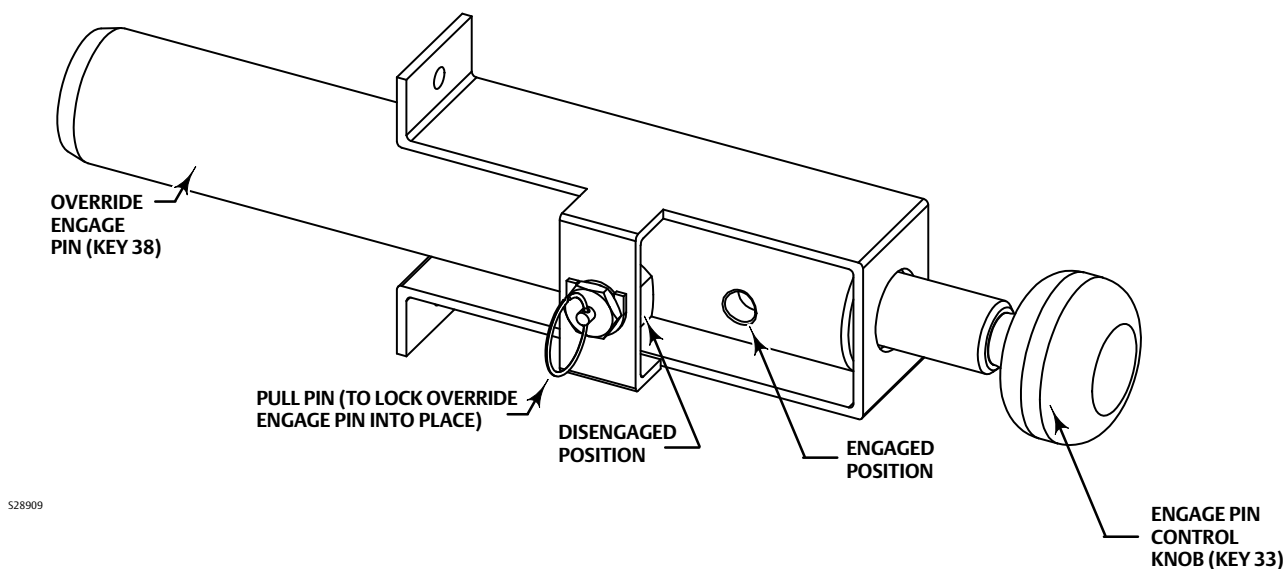
Depending on construction, the handwheel may have operation information stamped into the part. Always refer to steps 3 and 4 for operation information specific to push-down-to-close and push-down-to-open valves.

3. For a push-down-to-close valve: Rotate the handwheel (key 45) clockwise to close the valve and counterclockwise to open the valve.
4. For a push-down-to-open valve: Rotate the handwheel (key 45) counterclockwise to close the valve and clockwise to open the valve.
5. To disengage the manual handwheel, rotate the handwheel (key 45) to relieve any load placed on the override engage pin (key 38), and use the engage pin control knob (key 33) to remove the override engage pin from the stem connector (key 18). Refer to figure 2 for engage pin control knob operation.

Table 7. Handwheel Specifications

ACTUATOR SIZE	OUTPUT THRUST		HANDWHEEL DIAMETER		TURNS PER mm OF TRAVEL	TURNS PER INCH OF TRAVEL	MAXIMUM RIM FORCE REQUIRED	
	N	lbs	mm	Inch			N	lbs
12	44482	10000	305	12	3.8	96	290	65
14 to 18	88964	20000	406	16	3.0	80	380	85
20 to 26	133447	30000	610	24	2.8	72	450	100

Figure 2. Engage Pin Control Knob Operation



Maintenance

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Instructions are given below for complete disassembly of the actuator, seal replacement, and O-ring replacement. When inspection or repair is necessary, disassemble the actuator only as far as is required to accomplish the job. Key numbers referenced in the following steps are shown in figures 3 and 4.

Actuator Removal

The following procedure is for the removal of the actuator from a valve.

1. Disconnect the actuator tubing from the pressure connections on the upper and lower heads (keys 1 and 9) and positioner.

Note

Refer to the appropriate instruction manual for any maintenance or adjustments that need to be made on the positioner.

2. Break the stem connection by removing hex nuts (key 57), studs (key 58), and lock washers (key 10) from the stem connector (key 18).
3. Remove the bonnet-to-actuator bolting securing the actuator to the valve bonnet.
4. Thread two lifting eyes into the free ports on the upper head (key 1) 180 degrees apart. Reference tables 4 and 5 for approximate weights of the actuator to select an appropriate lifting eye. Attach appropriate rigging gear to both lifting eyes and lift the actuator away from the valve bonnet and stem.
5. Place the actuator upside-down with the upper head (key 1) flat against the ground. Cloth or wood should be used to prevent against paint damage.
6. Refer to the Actuator Mounting section of this manual for instructions on mounting and installing the actuator onto a valve

Seal and O-ring Replacement

The following procedure is for the replacement of the internal piston seals, bearing seals, and O-rings.

1. Complete Actuator Removal procedures above.
2. Loosen tie bolt hex nuts (key 11) in a crisscross pattern. Remove tie rod hex nuts and lock washers (key 10).
3. Remove the yoke (key 21) and the lower head (key 9) assembly from the cylinder (key 4) and place onto a flat surface with the O-ring side facing up. Using straps, secure this assembly to a solid structure to prevent it from falling over.
4. Extract bearing assembly (keys 12, 13, 14, and 15) from lower head (key 9) by removing the bearing retaining ring (key 16).
5. Remove the piston wiper seal (key 15), O-ring (key 13), and quad seal (key 12) from the bearing (key 14).
6. Clean bearing (key 14) with a light degreaser, if needed.
7. Lightly grease the new O-ring (key 13) and quad seal (key 12), then install onto bearing (key 14). Without grease, install a new piston wiper seal (key 15) onto the bearing.
8. Reinstall bearing assembly (keys 12, 13, 14, and 15) into lower head (key 9) and secure in place with the bearing retaining ring (key 16).
9. Remove the O-ring (key 2) from the lower head (key 9) and clean the groove with a light degreaser.
10. Lightly grease the new O-ring (key 2) and install on lower head (key 9).
11. Remove tie bolts (key 3) from upper head (key 1).
12. Lift piston assembly (keys 5, 6, 7, 17, and 19) out from cylinder (key 4) and place on a flat surface.

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13. Remove the wear ring (key 6) and quad seal (key 7) from the piston (key 5).
14. Thread locking compound is applied to the threads of the piston rod (key 17) by the manufacturer during initial assembly. As a result, disassembly will require heating to loosen the thread locking compound. To remove the piston rod O-ring (key 19), heat the piston assembly using a torch and unthread the piston rod (key 17) from the piston (key 5).
15. After the piston rod (key 17) has completely cooled, remove the piston rod O-ring (key 19). Clean the piston rod O-ring groove with a light degreaser. Lightly grease a new piston rod O-ring and install onto the piston rod.
16. Reinstall piston rod (key 17) onto piston (key 5) using thread locking compound.
17. Clean piston seal grooves. Install new lightly greased quad seal (key 7) onto piston (key 5).
18. Without grease, trim to length and then install a new wear ring (key 6).
19. Lift cylinder (key 4) vertically and place on a flat surface. Take extra precaution to avoid scratching or gouging the inner diameter of the cylinder.
20. Remove O-ring (key 2) from the upper head (key 1) and clean the seal groove. Install lightly greased new O-ring into upper head seal groove.
21. Install cylinder (key 4) onto upper head (key 1) making sure the O-ring (key 2) does not move out of its groove.
22. Carefully install the piston assembly (keys 5, 6, 7, 17, and 19) into cylinder (key 4) making sure all seals and O-rings stay in place on the outside diameter of the piston (key 5).
23. Install tie bolts (key 3) into upper head (key 1).
24. Carefully install the yoke (key 21) and the lower head (key 9) assembly onto cylinder (key 4) taking care not to damage threads on the tie bolts (key 3). Be sure the O-ring (key 2) is in place during this step.
25. Install lock washers (key 10) and tie rod hex nuts (key 11) onto tie bolts (key 4). Torque in a crisscross pattern according to table 8.
26. Refer to the Actuator Mounting section of this manual for instructions on mounting and installing the actuator onto a valve.

Table 8. Tie Bolt Torque

BOLT DIAMETER	TORQUE	
	N • m	lbf • ft
1/4-20	8	6
5/16-18	15	11
3/8-16	26	19
7/16-14	39	29
1/2-13	60	44
9/16-12	84	62
5/8-11	115	85
3/4-10	198	146
7/8-9	313	231
1-8	445	328
1-1/8-7	662	488

Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, refer to the serial numbers (there are two serial numbers located on the actuator) found on the actuator nameplate (key 22).

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Includes all soft seals and O-rings required for seal and O-ring replacement in standard operating temperature constructions. Refer to figures 3 and 4.

KIT CONTENTS	ACTUATOR SIZE	PART NUMBER		
		Standard Temperature	Low Temperature	High Temperature
Piston Rod Wiper Seal, Key 15 Bearing O-ring, Key 13 Bearing Quad Seal, Key 12 Piston Rod O-ring, Key 19 Piston Wear Ring, Key 6 Piston Quad Seal, Key 7 Upper/Lower Head O-ring, Key 2 Upper/Lower Head O-ring, Key 2 685 Actuator Grease, Key 100	12	R685X000012	R685X000092	R685X000172
	14	R685X000022	R685X000102	R685X000182
	16	R685X000032	R685X000112	R685X000192
	18	R685X000042	R685X000122	R685X000202
	20	R685X000052	R685X000132	R685X000212
	22	R685X000062	R685X000142	R685X000222
	24	R685X000072	R685X000152	R685X000232
	26	R685X000082	R685X000162	R685X000242

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Common Parts (figures 3 and 4)

Key	Description	
1	Upper Head	
2*	Upper/Lower Head O-ring	see parts kit
3	Tie Bolt	
4	Cylinder	
5	Piston	
6*	Piston Wear Ring	see parts kit
7*	Piston Quad Seal	see parts kit
9	Lower Head	
10	Lock Washer	
11	Tie Bolt Hex Nut	
12*	Bearing Quad Seal	see parts kit
13*	Bearing O-ring	see parts kit
14	Bearing	
15*	Piston Rod Wiper Seal	see parts kit
16	Bearing Retaining Ring	
17	Piston Rod	
18	Stem Connector	
19*	Piston Rod O-ring	see parts kit
20	Hex Head Cap Screw	
21	Yoke	
22	Travel Scale	
57	Stem Connector Hex Nut	
58	Stem Connector Stud	
100*	685 Actuator Grease (10 ounce tube)	see parts kit (19B0808X222)

Manual Handwheel Parts (figure 3)

Key	Description
24	ACME Thrust Shaft
25	Override Guide Shaft
26	Worm Gear
27	Thrust Shaft Upper Bushing
28	Thrust Shaft Bushing
29	Thrust Bearing
30	Thrust Guide Block
31	Engage Pin Guide
33	Engage Pin Control Knob
35	Socket Head Cap Screw
37	Key
38	Override Engage Pin
39	Position Indicator
40	All Thread Stud
42	Yoke Adaption Bracket
45	Handwheel
46	Helix Housing Cap O-ring
47	Helix Gear Shaft Bushing
48	Helix Gear Bushing
49	Helix Worm Gear Housing
50	Helix Worm Gear
52	Helix Shaft Wiper Seal
53	Helix Worm Gear Shaft
54	Helix Gear Housing Cap
55	Lock Washer
56	Pointer
64	Yoke Adaption Bracket Hex Nut
65	Yoke Adaption Bracket Stud

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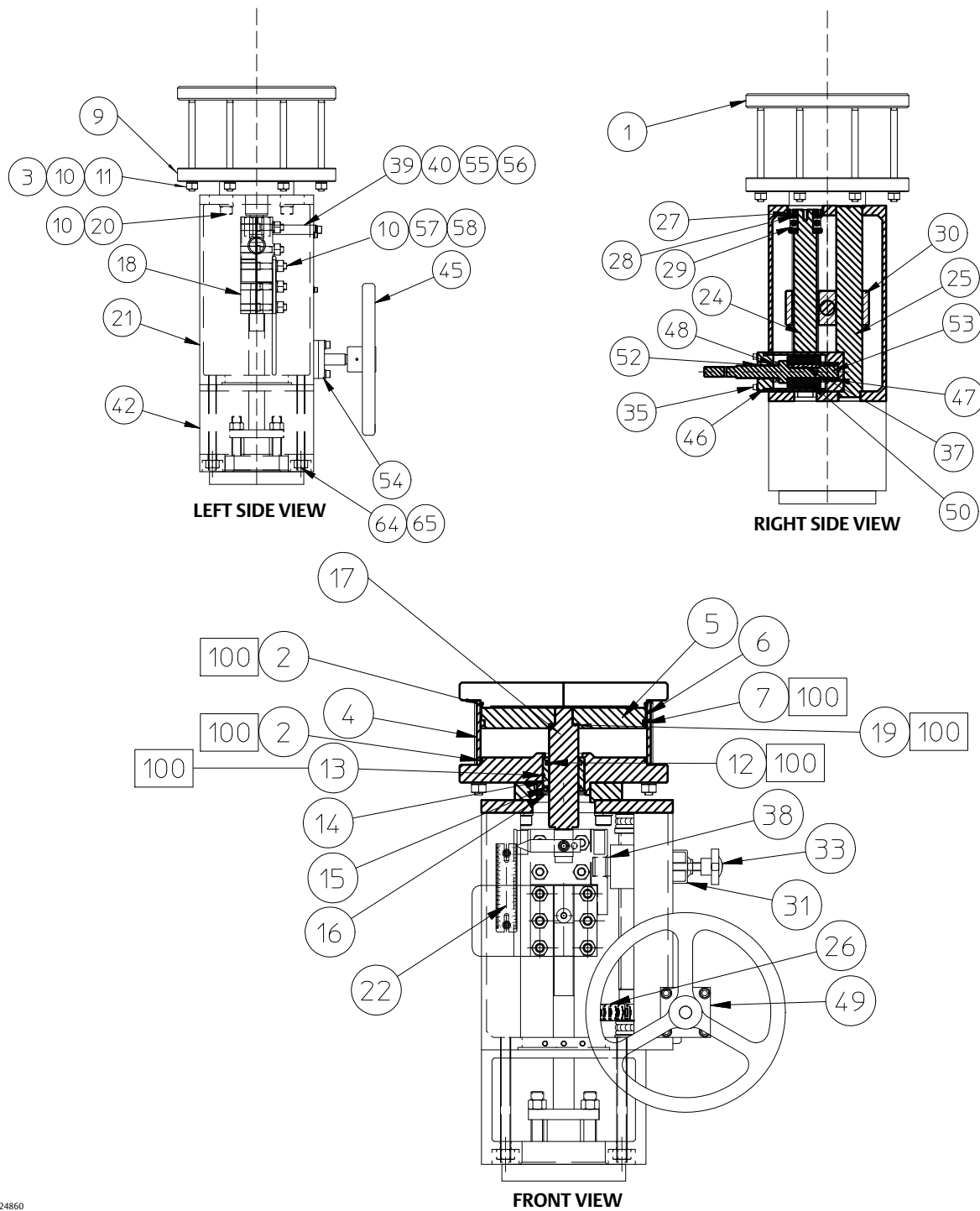
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Figure 3. Fisher 685 with Manual Handwheel



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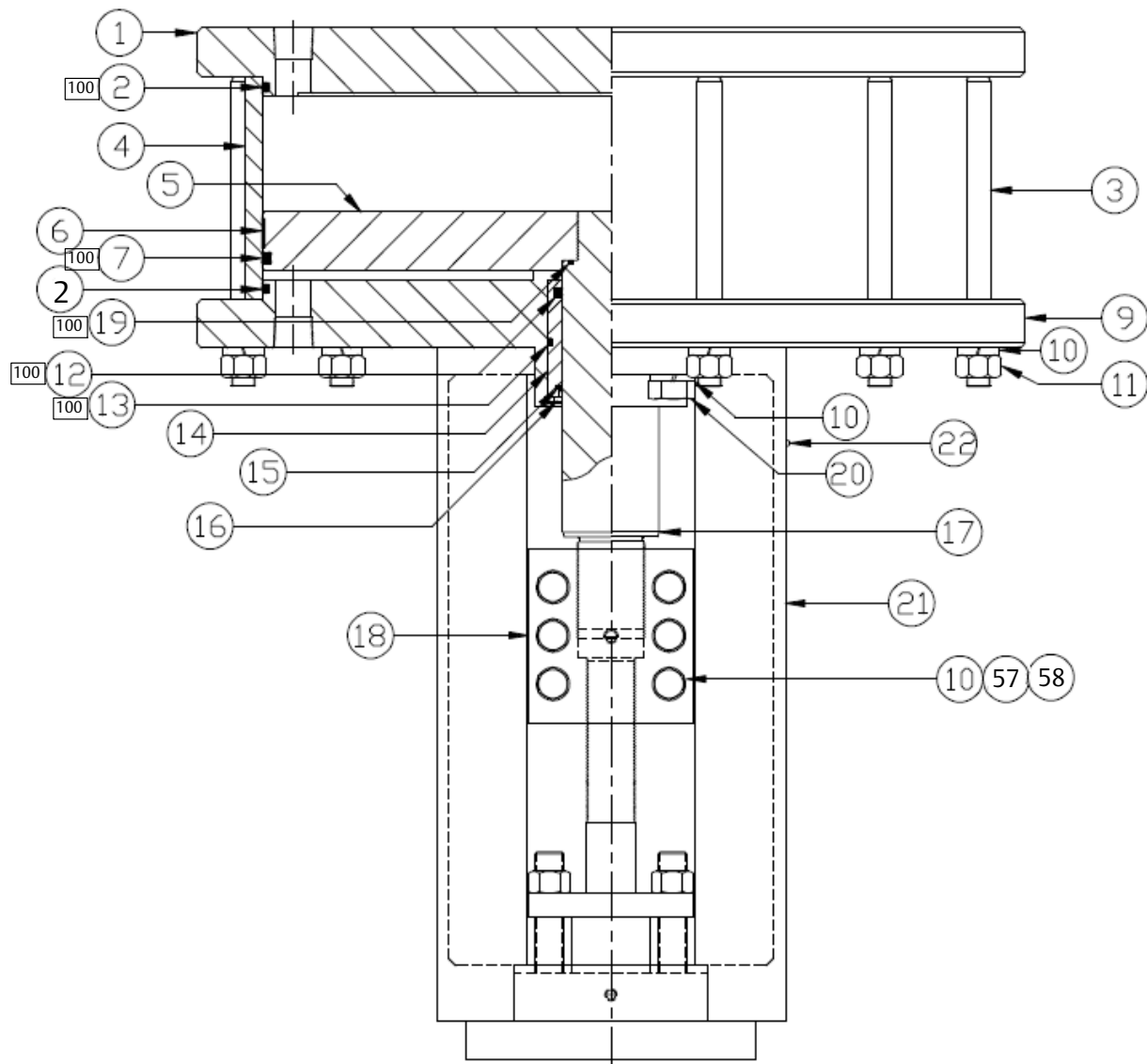
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Figure 4. Fisher 685 without Manual Handwheel



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Fisher™ 685SE and 685SR Piston Actuator

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Figure 1. Fisher 685SE Piston Actuator



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Introduction

Scope of Manual

This instruction manual provides information on the installation, maintenance, and parts ordering for Fisher 685SE and 685SR piston actuators. Refer to separate instruction manuals for information regarding other equipment and accessories used with these actuators.



Do not install, operate, or maintain 685SE or 685SR actuators without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The 685SE and 685SR are medium to large spring-return double-acting piston actuators that provide accurate, high thrust output for short to long travel applications. These actuators are designed for use with a variety of medium to large Fisher sliding-stem control valves including the easy-e™, FB, TBX, CVX, HP, EH, and 461.

These actuators feature an internal bias spring that forces the actuator piston rod to extend (685SE) or retract (685SR) upon a loss of supply pressure, thereby ensuring a fail-closed or fail-open mode of operation. This effectively eliminates the need for a trip valve and volume tank in most constructions.

Table 1. Specifications

Operating Pressure⁽¹⁾

Minimum: 2.7 bar (40psig)

Maximum Allowable: 10.3 bar (150 psig)

Consult your [Emerson sales office](#) for supply pressures under 2.7 bar (40 psi)

Travel⁽²⁾

25 mm (1 inch) through 610 mm (24 inch).

See table 2

Thrust Capabilities

Designed to meet the application requirements

Piston Diameter and Area⁽²⁾

Available in 51 mm (2 inch) increments between 254 mm (10 inch) and 711 mm (28 inch). See table 2

Operative Temperature Limits

Standard: -40 to 93°C (-40 to 200°F)

Low Temperature: -54 to 93°C (-65 to 200°F)⁽³⁾

High Temperature: -32 to 204°C (-25 to 400°F)⁽³⁾

Pressure Connections

See table 3

Yoke Boss and Valve Stem Diameter

■ 90.5 mm (3-9/16 inch) yoke boss with 19.1 mm (3/4 inch) stem ■ 127 mm (5 inch) yoke boss with 25.4 mm (1 inch) stem ■ 127 mm (5 inch) yoke boss with 31.8 mm (1-1/4 inch) stem ■ 127 mm (5H inch) yoke boss with 32 mm (1-1/4 inch) stem ■ 178 mm (7 inch) yoke boss with 51 mm (2 inch) stem

Instrument Mounting

Mounting kits are available for use with FIELDVUE™ DVC6200 Series digital valve controllers

Manual Override (optional)

Size 10 to 26: Handwheel

Size 28: Hydraulic Hand-pump⁽⁴⁾

Construction Materials

PART	MATERIAL
Yoke	ASTM A36 (steel)
Piston	ASTM A36 (steel)
Cylinder	254 to 559 mm (10 to 22 inch) cylinder: 1026 DOM (steel) with chrome-plated bore 610 to 711 mm (24 to 28 inch) cylinder: ASTM A516 Grade 70 (steel) with fluoropolymer coated bore
Upper/Lower Heads	ASTM A36 (steel)
Outer Spring Cartridge	ASTM A36 (steel)
Tie Bolt	ASTM A311 1045, Class B (steel)
Piston Rod	S31603 (316L Stainless Steel)
Stem Connector	ASTM A36 (steel)

Weights

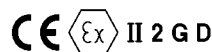
See tables 4 and 5

Lifting Point Load Ratings

See table 6

Optional Certifications⁽⁵⁾

- Pressure Equipment Directive (PED) 2014/68/EU
- Complies with the requirements of ATEX Group II Category 2 Gas and Dust



- Customs Union Technical Regulations (CU TR) 010/2011 and 012/2011



Fisher 685SE and 685SR actuators have been evaluated for ignition hazard and certified for CUTR 012/2011 under “protection by constructional safety”. To ensure conformity with CUTR, only Fisher parts and materials can be used.

1. The pressure/temperature limits in this instruction manual and any other applicable standard or code should not be exceeded.

2. Contact your Emerson sales office for larger travels or cylinder diameters. The Fisher 657, 667, and 585C family of actuators can be used for smaller travels or cylinder diameters.

3. Contact your Emerson sales office for applications requiring low or high temperature requirements.

4. Contact your Emerson sales office for applications requiring a manual override on a size 28 actuator.

5. Refer to the product nameplates to determine which certifications each actuator construction possesses.

Specifications

Specifications for the 685SE and 685SR piston actuators are shown in table 1. Refer to the nameplate affixed to the actuator yoke for specifications specific to individual constructions.

Principle of Operation

685SE and 685SR piston actuators utilize a piston that moves inside of a cylinder to generate thrust. A seal contained on the circumference of the piston provides a seal between the piston and the cylinder, preventing supply pressure leakage. A bias spring that is either below or above the piston, depending on construction, will retract or extend the piston rod upon a loss of supply pressure. This fail action will result in forcing an attached control valve to either fail-open or fail-closed.

From an equilibrium state, the actuator operates by reacting to a force unbalance that is created by increasing supply pressure on one side of the piston, and decreasing it on the other. This moves the piston up or down, and results in a repositioning of the attached control valve. Travel can be adjusted using travel limits within a valve positioner, which limit the travel range of the actuator. The optional handwheel manual override does not have the ability to act as a hard travel stop.

An optional handwheel or hydraulic hand-pump manual override is capable of extending or retracting the actuator manually and can be engaged at any position from full open to full close. This handwheel override utilizes a worm gear assembly that is attached to the stem connector and not attached to the cylinder or piston rod. This enables the handwheel manual override function to reposition the control valve even if the actuator cylinder or piston is removed for maintenance. The hydraulic hand-pump override utilizes a hydraulic cylinder that is connected to the piston rod, which is controlled by a manual hand-pump.

Table 2. Standard Constructions⁽¹⁾

ACTUATOR SIZE	PISTON DIAMETER		PISTON ROD		PISTON AREA		VALVE STEM CONNECTOR SIZE		YOKE BOSS DIAMETER		VALVE TRAVEL			
	mm	Inch	mm	Inch	cm ²	Inch ²	mm	Inch	mm	Inch	Minimum		Maximum	
											mm	Inch	mm	Inch
10	254	10	16	2.41	507	79	19	3/4	90	3-9/16	25	1	203	8
							25	1	127	5	25	1	203	8
							32 or 51	1-1/4 or 2	127 or 178	5H or 7	25	1	610	24
12	305	12	16	2.41	730	113	19	3/4	90	3-9/16	25	1	154	6
							25	1	127	5	25	1	203	8
							32 or 51	1-1/4 or 2	127 or 178	5H or 7	25	1	610	24
14	356	14	32	4.91	993	154	25	1	127	5	25	1	203	8
							32 or 51	1-1/4 or 2	127 or 178	5H or 7	25	1	610	24
16	406	16	32	4.91	1297	201	25	1	127	5	25	1	203	8
							32 or 51	1-1/4 or 2	127 or 178	5H or 7	25	1	610	24
18	457	18	32	4.91	1642	254	25	1	127	5	25	1	203	8
							32 or 51	1-1/4 or 2	127 or 178	5H or 7	25	1	610	24
20	508	20	46	7.07	2027	314	25	1	127	5	25	1	203	8
							32 or 51	1-1/4 or 2	127 or 178	5H or 7	25	1	610	24
22	559	22	46	7.07	2452	380	25	1	127	5	25	1	203	8
							32 or 51	1-1/4 or 2	127 or 178	5H or 7	25	1	610	24
24	610	24	62	9.62	2919	452	25	1	127	5	25	1	203	8
							32 or 51	1-1/4 or 2	127 or 178	5H or 7	25	1	610	24
26	660	26	62	9.62	3425	531	25	1	127	5	25	1	203	8
							32 or 51	1-1/4 or 2	127 or 178	5H or 7	25	1	610	24
28	711	28	62	9.62	3973	616	25	1	127	5	25	1	203	8
							32 or 51	1-1/4 or 2	127 or 178	5H or 7	25	1	610	24

1. Consult your [Emerson sales office](#) for additional sizes.

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Table 3. Pressure Connections

ACTUATOR SIZE	SUPPLY CONNECTION	
	Size, NPT	Quantity (Top/Bottom)
10	3/8	1/1
		2/2 (standard)
12	3/4	1/1
		2/2 (standard)
14 to 28	3/4 (standard), 1, or 1-1/4	1/1
		2/2 (standard)
	3/4 (standard), 1, or 1-1/4	1/1
		2/2 (standard for 3/4 NPT only)

Table 4. Approximate Weights for Constructions without Manual Override

ACTUATOR TYPE	MAX VALVE TRAVEL	APPROXIMATE WEIGHT FOR ACTUATOR SIZE, kg (lbs)									
	mm (inches)	10	12	14	16	18	20	22	24	26	28
685SE	25 (1.00)	109 (241)	147 (324)	221 (487)	270 (596)	315 (694)	462 (1018)	489 (1079)	680 (1500)	776 (1710)	931 (2053)
	51 (2.00)	114 (251)	156 (344)	231 (510)	284 (625)	329 (725)	479 (1056)	510 (1124)	704 (1551)	802 (1768)	957 (2110)
	102 (4.00)	122 (270)	174 (383)	252 (556)	310 (683)	358 (789)	514 (1132)	551 (1215)	750 (1654)	855 (1884)	1009 (2225)
	152 (6.00)	131 (289)	192 (423)	273 (601)	336 (740)	387 (852)	548 (1209)	592 (1305)	797 (1757)	907 (2000)	1061 (2339)
	203 (8.00)	140 (308)	210 (462)	293 (647)	362 (798)	415 (916)	583 (1285)	633 (1396)	843 (1859)	960 (2116)	1113 (2454)
	254 (10.00)	148 (327)	227 (501)	314 (693)	388 (855)	444 (979)	617 (1361)	674 (1486)	890 (1962)	1012 (2232)	1165 (2569)
	305 (12.00)	157 (346)	245 (541)	335 (738)	414 (913)	473 (1042)	652 (1437)	715 (1577)	937 (2065)	1065 (2348)	1217 (2683)
	356 (14.00)	165 (365)	263 (580)	356 (784)	440 (971)	502 (1106)	686 (1513)	756 (1667)	983 (2168)	1118 (2464)	1269 (2798)
	406 (16.00)	174 (384)	281 (619)	376 (829)	466 (1028)	530 (1169)	721 (1589)	797 (1758)	1030 (2270)	1170 (2580)	1321 (2912)
	457 (18.00)	183 (403)	299 (659)	397 (875)	493 (1086)	559 (1233)	756 (1667)	838 (1848)	1076 (2373)	1223 (2696)	1373 (3027)
	508 (20.00)	191 (422)	317 (698)	418 (921)	519 (1143)	588 (1296)	790 (1742)	879 (1939)	1123 (2476)	1275 (2812)	1425 (3142)
	559 (22.00)	200 (441)	334 (737)	438 (966)	545 (1201)	617 (1359)	825 (1818)	921 (2029)	1170 (2578)	1328 (2928)	1477 (3256)
	610 (24.00)	209 (460)	352 (776)	459 (1012)	571 (1259)	645 (1423)	859 (1894)	962 (2120)	1216 (2681)	1381 (3044)	1529 (3371)
685SR	25 (1.00)	127 (281)	165 (363)	242 (533)	311 (685)	353 (778)	479 (1056)	557 (1228)	760 (1676)	869 (1915)	1101 (2427)
	51 (2.00)	132 (291)	174 (384)	253 (557)	325 (716)	368 (812)	497 (1096)	578 (1273)	784 (1727)	895 (1973)	1127 (2485)
	102 (4.00)	142 (312)	193 (426)	275 (605)	352 (776)	398 (878)	534 (1176)	619 (1364)	830 (1830)	948 (2089)	1179 (2599)
	152 (6.00)	151 (333)	212 (468)	297 (654)	380 (837)	429 (945)	570 (1257)	660 (1454)	877 (1933)	1000 (2206)	1231 (2714)
	203 (8.00)	161 (354)	232 (511)	318 (702)	407 (898)	459 (1012)	606 (1337)	701 (1545)	923 (2035)	1053 (2322)	1283 (2829)
	254 (10.00)	170 (375)	251 (553)	340 (750)	435 (958)	489 (1079)	643 (1417)	742 (1635)	970 (2138)	1106 (2438)	1335 (2944)
	305 (12.00)	180 (396)	270 (595)	362 (798)	462 (1019)	520 (1146)	679 (1497)	783 (1726)	1016 (2241)	1159 (2554)	1387 (3059)
	356 (14.00)	189 (417)	289 (638)	384 (847)	490 (1079)	550 (1212)	716 (1577)	824 (1816)	1063 (2344)	1211 (2670)	1439 (3173)
	406 (16.00)	199 (438)	308 (680)	406 (895)	517 (1140)	580 (1279)	752 (1657)	865 (1907)	1110 (2446)	1264 (2786)	1491 (3288)
	457 (18.00)	208 (459)	328 (722)	428 (943)	545 (1201)	611 (1346)	788 (1738)	906 (1997)	1156 (2549)	1317 (2903)	1544 (3403)
	508 (20.00)	218 (480)	347 (765)	450 (991)	572 (1261)	641 (1413)	825 (1818)	947 (2088)	1203 (2652)	1369 (3019)	1596 (3518)
	559 (22.00)	227 (501)	366 (807)	472 (1039)	600 (1322)	671 (1480)	861 (1898)	988 (2178)	1249 (2754)	1422 (3135)	1648 (3633)
	610 (24.00)	237 (522)	385 (849)	493 (1088)	627 (1382)	702 (1547)	897 (1978)	1029 (2269)	1296 (2857)	1475 (3251)	1700 (3747)

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Table 5. Approximate Weights for Constructions with Handwheels

ACTUATOR TYPE	MAX VALVE TRAVEL	APPROXIMATE WEIGHT FOR ACTUATOR SIZE, kg (lbs)								
	mm (inches)	10	12	14	16	18	20	22	24	26
685SE	25 (1.00)	167 (369)	212 (468)	336 (742)	381 (839)	432 (953)	603 (1330)	675 (1489)	853 (1881)	941 (2075)
	51 (2.00)	173 (383)	221 (488)	347 (765)	394 (869)	447 (985)	621 (1370)	697 (1536)	876 (1932)	967 (2132)
	102 (4.00)	186 (410)	240 (529)	368 (811)	421 (928)	475 (1048)	658 (1450)	739 (1630)	922 (2033)	1019 (2246)
	152 (6.00)	199 (438)	259 (570)	389 (858)	448 (987)	504 (1111)	694 (1529)	782 (1723)	968 (2134)	1070 (2359)
	203 (8.00)	211 (465)	277 (611)	410 (904)	474 (1046)	532 (1174)	730 (1609)	824 (1817)	1014 (2235)	1122 (2473)
	254 (10.00)	224 (493)	296 (652)	431 (951)	501 (1105)	561 (1237)	766 (1689)	867 (1910)	1060 (2336)	1173 (2586)
	305 (12.00)	236 (521)	314 (693)	452 (997)	528 (1164)	590 (1300)	802 (1769)	909 (2004)	1106 (2438)	1225 (2700)
	356 (14.00)	249 (548)	333 (734)	473 (1043)	555 (1223)	618 (1363)	838 (1849)	951 (2098)	1152 (2539)	1276 (2814)
	406 (16.00)	261 (576)	352 (775)	494 (1090)	581 (1282)	647 (1426)	875 (1928)	994 (2191)	1197 (2640)	1328 (2927)
	457 (18.00)	274 (603)	370 (816)	515 (1136)	608 (1341)	675 (1489)	911 (2008)	1036 (2285)	1243 (2741)	1379 (3041)
	508 (20.00)	286 (631)	389 (857)	536 (1183)	635 (1400)	704 (1552)	947 (2088)	1079 (2378)	1289 (2842)	1431 (3154)
685SR	559 (22.00)	299 (659)	407 (898)	557 (1229)	662 (1459)	732 (1615)	983 (2168)	1121 (2472)	1335 (2944)	1482 (3268)
	610 (24.00)	311 (686)	426 (939)	579 (1275)	688 (1518)	761 (1678)	1019 (2248)	1164 (2566)	1381 (3045)	1534 (3382)
	25 (1.00)	185 (407)	230 (506)	357 (788)	421 (929)	471 (1038)	666 (1468)	743 (1638)	933 (2057)	1034 (2280)
	51 (2.00)	191 (422)	239 (528)	368 (812)	435 (960)	486 (1071)	685 (1510)	764 (1685)	956 (2108)	1060 (2337)
	102 (4.00)	204 (451)	259 (572)	391 (861)	463 (1022)	516 (1137)	723 (1594)	807 (1779)	1002 (2209)	1112 (2451)
	152 (6.00)	218 (480)	279 (616)	413 (910)	491 (1084)	546 (1204)	761 (1677)	849 (1872)	1048 (2310)	1163 (2565)
	203 (8.00)	231 (509)	299 (660)	435 (959)	520 (1146)	576 (1270)	799 (1761)	892 (1966)	1094 (2411)	1215 (2679)
	254 (10.00)	244 (538)	319 (704)	457 (1008)	548 (1208)	606 (1337)	837 (1845)	934 (2059)	1140 (2512)	1267 (2792)
	305 (12.00)	257 (568)	339 (748)	480 (1057)	576 (1270)	636 (1403)	875 (1929)	977 (2153)	1185 (2614)	1318 (2906)
	356 (14.00)	271 (597)	359 (792)	502 (1106)	604 (1332)	667 (1469)	913 (2013)	1019 (2247)	1231 (2715)	1370 (3020)
	406 (16.00)	284 (626)	379 (836)	524 (1155)	632 (1394)	697 (1536)	951 (2096)	1061 (2340)	1277 (2816)	1421 (3134)
	457 (18.00)	297 (655)	399 (880)	546 (1204)	660 (1456)	727 (1602)	989 (2180)	1104 (2434)	1323 (2917)	1473 (3248)
685SR	508 (20.00)	310 (684)	419 (924)	568 (1253)	688 (1518)	757 (1669)	1027 (2264)	1146 (2527)	1369 (3018)	1525 (3361)
	559 (22.00)	324 (714)	439 (968)	591 (1302)	716 (1580)	787 (1735)	1065 (2348)	1189 (2621)	1415 (3120)	1576 (3475)
	610 (24.00)	337 (743)	459 (1012)	613 (1351)	745 (1642)	817 (1801)	1103 (2432)	1231 (2715)	1461 (3221)	1628 (3589)

Table 6. Lifting Point Load Ratings

ACTUATOR SIZE	LIFTING ORIENTATION	NUMBER OF LIFTING POINTS USED	MAXIMUM LOAD	
			kg	lbs
10	Actuator Centerline Horizontal	2	810	1800
12 to 24		2	1540	3400
26 to 28		2	2860	6300
10	Actuator Centerline Vertical	2	2080	4600
12 to 24		2	3760	8300
26 to 28		2	6350	14000

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts, be certain the actuator cylinder pressure does not exceed the limits listed in table 1. Use pressure-limiting or pressure-relieving devices to prevent cylinder pressure from exceeding these limits.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Dropping the actuator and any attached accessories and/or valve may cause personal injury and/or equipment damage. For all mounting procedures use an adequately sized chain, sling, hoist, or crane to handle the actuator and any attached accessories and/or valve. Use caution during lifting and handling to prevent slippage, swinging, faulty equipment connections, or sudden shock loads.

NOTICE

Special care must be taken when installing an actuator in a horizontal service orientation. To avoid cantilever loads on the valve stem and yoke, it is the customer's responsibility to ensure proper support for a horizontal actuator.

When an actuator and control valve are shipped together as a control valve assembly, the actuator is normally mounted on the valve. Follow the valve instructions when installing the valve in the pipeline. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the actuator mounting procedures in this instruction manual. Refer to the individual product instruction manuals for the installation or mounting of a FIELDVUE DVC6200 digital valve controller or 3610 positioner.

If the actuator is being installed without a positioner, the cylinder loading pressures should be supplied through a 4-way solenoid valve or a switching valve. Pressure connection locations are indicated below:

- 685SE Actuators: Side of the outer spring cartridge and bottom of the lower head.
- 685SR Actuators: Top of the upper head and side of the outer spring cartridge.

The supply pressure medium should be clean, dry filtered air. If the supply source is capable of exceeding the maximum actuator operating pressure or positioner supply pressure, appropriate steps must be taken during installation to protect the positioner and all connected equipment against over pressurization.

The control valve should be located where it will be accessible for servicing. Room should be left above and below the control valve to permit removal of the actuator and valve plug.

Three-Way Valve Applications Note

In three-way valve applications where the actuator fully strokes at a frequency of once per minute or faster, and the stroking speed is rapid (less than 0.5 seconds per stroke), there is a possibility that the stem can fracture at the plug if the actuator cylinder pressure is greater than 5.5 bar (80 psig). This can cause loss of control of process fluid and further damage to the actuator. Consideration should be given to the use of high-strength, fatigue-resistant stem materials in these applications.

⚠ WARNING

To avoid loss of control of process fluid and subsequent personal injury or property damage caused by bursting of pressure-retaining parts, be sure the cylinder pressure does not exceed 5.5 bar (80 psig) in high cycle-rate, fast stroking speed, three-way valve applications.

Actuator Mounting

The following procedure describes how to mount a 685SE or 685SR actuator on a push-down-to-close valve so that the piston rod to valve plug stem connection allows full travel and proper shutoff. Key numbers referenced in the following steps are shown in figures 3, 4, 5, and 6.

NOTICE

The 685SE actuator spring load will force the piston rod to extend out of the cylinder, and it can come into contact with the valve stem during actuator mounting.

If the valve stem is allowed to remain in the up position (towards the actuator) during mounting, it can interfere with the actuator mounting, possibly damage valve stem threads or bend the valve stem. Be sure the valve stem is pushed down (into the valve body), away from the actuator while mounting.

To avoid damaging the valve plug seating surfaces, do not rotate the valve plug while it is seated. Also avoid damage to the valve plug stem by careful use of tools during travel adjustment.

For 685SE actuators only: It may be necessary to apply a temporary loading pressure to the bottom cylinder pressure connection to move the piston rod away from the valve stem during installation. If it is not possible to provide a temporary loading pressure, exercise caution when lowering the actuator over the valve stem to prevent damage to the valve stem or piston rod.

⚠ WARNING

When moving the piston rod with loading pressure applied, exercise caution to keep hands and tools out of the piston rod travel path. If the loading pressure is accidentally disconnected, personal injury and property damage is possible if something is caught between the piston rod and other control valve parts.

1. For 685SE Actuators: Using the lifting points along the outside perimeter of the outer spring cartridge (key 23) attach appropriate rigging gear to both lifting points.
For 685SR Actuators: Thread two lifting eyes into the free ports on the upper head (key 1) 180 degrees apart. Reference tables 4 and 5 for approximate weights of the actuator to select an appropriate lifting eye. Attach appropriate rigging gear to the lifting eyes.
2. Lower the actuator onto the valve bonnet.
 - a. For the 90.5 mm (3-9/16 inch) yoke boss: Slowly lower the actuator down onto the valve. As the yoke passes over the end of the valve stem, place the yoke locknut over the valve stem. Once the actuator is in place, screw the yoke locknut onto the valve bonnet and tighten.
 - b. For all other yoke bosses: Slowly lower the actuator down onto the valve. Once the actuator is in place, insert the bonnet-to-actuator bolts and tighten the hex nuts.
3. Turn the two stem locknuts (if present) all the way onto the valve stem thread.

4. Starting with the piston rod fully retracted, manually, or with air pressure, extend the piston rod to the specified valve travel.
5. Attach the stem connector (key 18), clamping the piston rod (key 17) to the valve stem. Be sure to also attach the feedback arm and travel indicator.
6. Cycle the actuator to check availability of desired total travel and that the valve plug seats before the cylinder reaches the end of its stroke. You can make minor travel adjustments, if necessary, by loosening the stem connector slightly, tightening the locknuts together, and (with the valve plug off the seat) screwing the stem connector either into or out of the stem connector by means of a wrench on the locknuts.
7. If the total travel is adequate, tighten the stem connector (key 18) securely, lock the stem locknuts (if present) against the connector, and adjust the indicator scale (key 22) on the yoke (key 21) to show valve plug position.
8. Provide a gauge, if necessary, to measure the pressure to the actuator. Make a final adjustment on the positioner to set the starting point of valve travel and to obtain full travel for the given instrument range.

Handwheel Operation

If manual operation is required, the actuator should be equipped with a manual handwheel for sizes 10 to 26.

NOTICE

To avoid damage to actuator parts and difficult operation of actuator handwheels, open the bypass valve (key 66) before using a handwheel.

The bypass assembly is furnished only when a handwheel actuator is specified. The bypass allows the pressure to equalize on either side of the piston, so that the manual actuator can be used to position the control valve. Flow through the bypass tubing is controlled by an angle needle valve, which is operated manually. This valve should be closed when air pressure is being used to operate the actuator.

Key numbers referenced in the following steps are shown in figures 2, 5, and 6. Refer to table 7 for handwheel specifications.

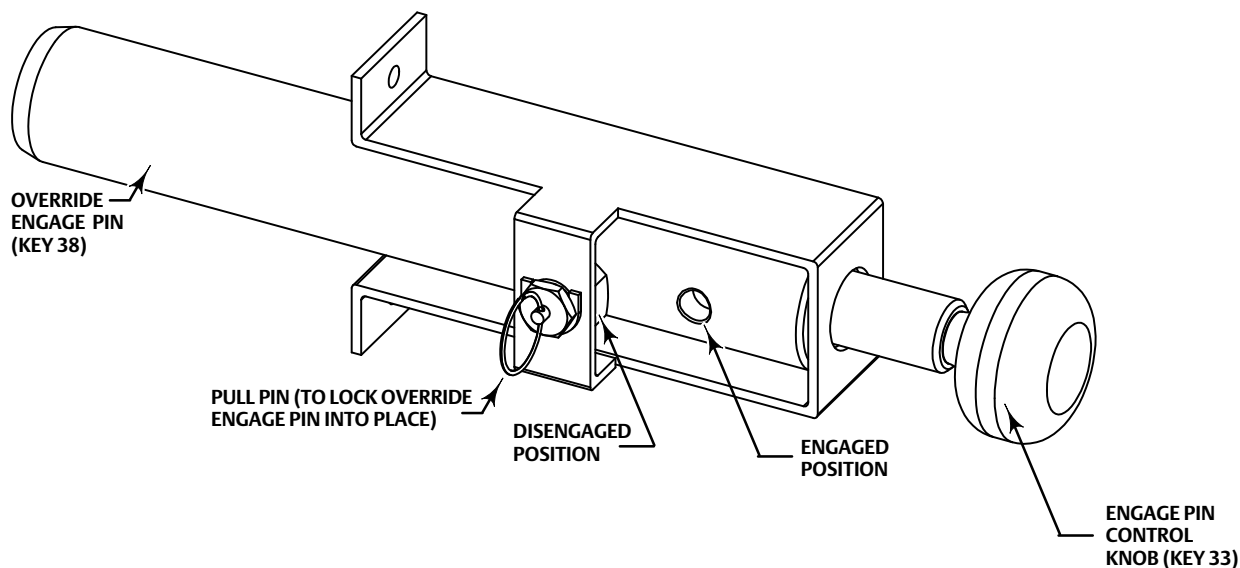
1. Open the bypass valve.
2. Rotate the handwheel (key 45) to position the override engage pin (key 38) with the hole in the stem connector (key 18). Use the engage pin control knob (key 33) to insert the override engage pin into the stem connector until it stops. Refer to figure 2 for engage pin control knob operation.

Note

Depending on construction, the handwheel may have operation information stamped into the part. Always refer to steps 3 and 4 for operation information specific to push-down-to-close and push-down-to-open valves.

3. **For a push-down-to-close valve:** Rotate the handwheel (key 45) clockwise to close the valve and counterclockwise to open the valve.
4. **For a push-down-to-open valve:** Rotate the handwheel (key 45) counterclockwise to close the valve and clockwise to open the valve.
5. To disengage the manual handwheel, rotate the handwheel (key 45) to relieve any load placed on the override engage pin (key 38), and use the engage pin control knob (key 33) to remove the override engage pin from the stem connector (key 18). Refer to figure 2 for engage pin control knob operation.

Figure 2. Engage Pin Control Knob Operation



528909

Table 7. Handwheel Specifications

ACTUATOR SIZE	OUTPUT THRUST		HANDWHEEL DIAMETER		TURNS PER mm OF TRAVEL	TURNS PER INCH OF TRAVEL	MAXIMUM RIM FORCE REQUIRED	
	N	lbs	mm	Inch			N	lbs
10 to 12	44482	10000	305	12	3.8	96	290	65
14 to 18	88964	20000	406	16	3.0	80	380	85
20 to 26	133447	30000	610	24	2.8	72	450	100

Maintenance

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

⚠ WARNING

The outer and inner spring cartridge (keys 23 and 57) contains a spring under compression. Do NOT attempt to dismantle any part of the spring cartridge without first consulting your local [Emerson sales office](#) to avoid personal injury.

Instructions are given below for complete disassembly of the actuator, seal replacement, and O-ring replacement. When inspection or repair is necessary, disassemble the actuator only as far as is required to accomplish the job. Key numbers referenced in the following steps are shown in figures 3, 4, 5, and 6.

Actuator Removal

The following procedure is for the removal of the actuator from a valve.

For 685SE actuators only: It may be necessary to apply a temporary loading pressure to the bottom cylinder pressure connection to move the piston rod away from the valve stem during removal. If it is not possible to provide a temporary loading pressure, exercise caution when removing the actuator to prevent damage to the valve stem or piston rod.

1. Disconnect the actuator tubing from the pressure connections on the upper/lower head and outer spring cartridge (keys 1/9 and 23) and positioner.

Note

Refer to the appropriate instruction manual for any maintenance or adjustments that need to be made on the positioner.

⚠ WARNING

To avoid personal injury due to the sudden uncontrolled movement of parts, do not loosen the stem connector hex nuts when the stem connector has spring force applied to it.

2. Break the stem connection by removing hex nuts (key 62), studs (key 63) and lock washers (key 10) from the stem connector (key 18).
3. Depending on the yoke boss size, there is either a yoke locknut or bonnet-to-actuator bolting securing the actuator to the valve bonnet. Remove whichever is present.
4. **For 685SE Actuators:** Using the lifting points along the outside perimeter of the outer spring cartridge (key 23), attach appropriate rigging gear to both lifting points and lift the actuator away from the valve bonnet and stem.
For 685SR Actuators: Thread two lifting eyes into the free ports on the upper head (key 1) 180 degrees apart. Reference tables 4 and 5 for approximate weights of the actuator to select an appropriate lifting eye. Attach appropriate rigging gear to both lifting eyes and lift the actuator away from the valve bonnet and stem.
5. Refer to the Actuator Mounting section of this manual for instructions on mounting and installing the actuator onto a valve.

685SE Seal and O-ring Replacement

The following procedure is for the replacement of the internal piston seals, bearing seals, and O-rings.

1. Remove the lower head (key 9) from the yoke (key 21) by removing hex head cap screws (key 20) and lock washers (key 10).

2. Loosen tie bolt hex nuts (key 11) in a crisscross pattern. Remove tie rod hex nuts and lock washers (key 10).
3. Remove lower head (key 9) from cylinder (key 4) and place the O-ring side down onto wooden blocks or other material that will not scratch or gouge the lower head.
4. Extract bearing assembly (keys 12, 13, 14, and 15) from lower head (key 9) by removing the bearing retaining ring (key 16).
5. Remove the piston wiper seal (key 15), O-ring (key 13), and quad seal (key 12) from the bearing (key 14).
6. Clean bearing (key 14) with a light degreaser, if needed.
7. Lightly grease the new O-ring (key 13) and quad seal (key 12), then install onto bearing (key 14). Without grease, install a new piston wiper seal (key 15) onto the bearing.
8. Reinstall bearing assembly (keys 12, 13, 14, and 15) into lower head (key 9) and secure in place with the bearing retaining ring (key 16).
9. Remove the O-ring (key 2) from the lower head (key 9) and clean the groove with a light degreaser.
10. Lightly grease the new O-ring (key 2) and install on lower head (key 9).
11. Remove tie bolts (key 3) from upper head (key 1).
12. Lift piston assembly (keys 5, 6, 7, 17, and 19) out from cylinder (key 4) and place on a flat surface.
13. Remove the wear ring (key 6) and quad seal (key 7) from the piston (key 5).
14. Thread locking compound is applied to the threads by the manufacturer during initial assembly. As a result, disassembly will require heating to loosen the thread locking compound. To remove the piston rod O-ring (key 19), heat the piston assembly using a torch and unthread the piston rod (key 17) from the piston (key 5).
15. After the piston rod (key 17) has completely cooled, remove the piston rod O-ring (key 19). Clean the piston rod O-ring groove with a light degreaser. Lightly grease a new piston rod O-ring and install onto the piston rod.
16. Reinstall piston rod (key 17) onto piston (key 5) using thread locking compound.
17. Clean piston seal grooves. Install new lightly greased quad seal (key 7) onto piston (key 5).
18. Without grease, trim to length and then install a new wear ring (key 6).
19. Lift cylinder (key 4) vertically and place on a flat surface. Take extra precaution to avoid scratching or gouging the inner diameter of the cylinder.
20. Remove O-ring (key 2) from the upper head (key 1) and clean the seal groove. Install lightly greased new O-ring into upper head seal groove.
21. Install cylinder (key 4) onto upper head (key 1), making sure the O-ring (key 2) does not move out of its groove.
22. Carefully install the piston assembly (keys 5, 6, 7, 17, and 19) into cylinder (key 4), making sure all seals and O-rings stay in place on the outside diameter of the piston (key 5).
23. Install tie bolts (key 3) into upper head (key 1).
24. Carefully install lower head (key 9) onto cylinder (key 4), taking care not to damage threads on the tie bolts (key 3). Be sure the O-ring (key 2) is in place during this step.
25. Install lock washers (key 10) and tie bolt hex nuts (key 11) onto tie bolts (key 4). Torque in a crisscross pattern according to table 8.
26. Refer to the Actuator Mounting section of this manual for instructions on mounting and installing the actuator onto a valve.

Table 8. Tie Bolt Torque

BOLT DIAMETER	TORQUE	
	N • m	lbf • ft
1/4-20	8	6
5/16-18	15	11
3/8-16	26	19
7/16-14	39	29
1/2-13	60	44
9/16-12	84	62
5/8-11	115	85
3/4-10	198	146
7/8-9	313	231
1-8	445	328
1-1/8-7	662	488

685SR Seal and O-ring Replacement

The following procedure is for the replacement of the internal piston seals, bearing seals, and O-rings.

1. Complete Actuator Removal procedures above. Using the same rigging and lifting points as in the Actuator Removal section, place the actuator upright with the yoke (key 21) flat against the ground. Place either a flat piece of plywood or cloth under the yoke to protect against damage. Using straps, secure the actuator to a solid structure to prevent it from falling over.
2. Loosen tie bolt hex nuts (key 11) in a crisscross pattern. Remove tie rod hex nuts and lock washers (key 10).
3. Using the same lifting eyes as in the Actuator Removal procedure, lift or hoist the upper head (key 1) off of the cylinder (key 4). Place the upper head onto wooden blocks or other material that will not cause damage with the O-ring side facing up.
4. Remove O-ring (key 2) from the upper head (key 1) and clean the seal groove. Install lightly greased new O-ring into upper head seal groove.
5. Remove tie bolts (key 3) from lower head (key 9).
6. Thread a suitable lifting eye into the free port on the top of the piston rod (key 17).
7. Lift or hoist the piston assembly (keys 5, 6, 7, 17, and 19) out from cylinder (key 4) and place on a flat surface upside down.
8. Remove the wear ring (key 6) and quad seal (key 7) from the piston (key 5).
9. Thread locking compound is applied to the threads by the manufacturer during initial assembly. As a result, disassembly will require heating to loosen the thread locking compound. To remove the piston rod O-ring (key 19), heat the piston assembly using a torch and unthread the piston rod (key 17) from the piston (key 5).
10. After the piston rod (key 17) has completely cooled, remove the piston rod O-ring (key 19). Clean the piston rod O-ring groove with a light degreaser. Lightly grease a new piston rod O-ring and install onto the piston rod.
11. Reinstall piston rod (key 17) onto piston (key 5) using thread locking compound.
12. Clean piston seal grooves. Install new lightly greased quad seal (key 7) onto piston (key 5).
13. Without grease, trim to length and then install a new wear ring (key 6).
14. Lift cylinder (key 4) vertically and place on a flat surface. Take extra precaution to avoid scratching or gouging the inner diameter of the cylinder.
15. Remove the O-ring (key 2) from the lower head (key 9) and clean the groove with a light degreaser.
16. Lightly grease the new O-ring (key 2) and install on lower head (key 9).
17. Extract bearing assembly (keys 12, 13, 14, and 15) from outer spring cartridge (key 23) by removing the bearing retaining ring (key 16).

18. Remove the piston wiper seal (key 15), O-ring (key 13), and quad seal (key 12) from the bearing (key 14).
19. Clean bearing (key 14) with a light degreaser, if needed.
20. Lightly grease the new O-ring (key 13) and quad seal (key 12), then install onto bearing (key 14). Without grease, install a new piston wiper seal (key 15) onto the bearing.
21. Reinstall bearing assembly (keys 12, 13, 14, and 15) into outer spring cartridge (key 23) and secure in place with the bearing retaining ring (key 16).
22. Install cylinder onto lower head (key 9), making sure the O-ring (key 2) does not move out of its groove.
23. Carefully install piston assembly (keys 5, 6, 7, 17, and 19) into the cylinder (key 4) using the lifting eye previously used for removal. Ensure all seals and O-rings stay in place on the outside diameter of the piston (key 5) during installation.
24. Install tie bolts (key 3) into lower head (key 9).
25. Carefully install upper head (key 1) onto cylinder (key 4) using the lifting eyes previously used for removal. Take care not to damage tie bolt (key 3) threads and ensure that the O-ring (key 2) is in place during this step.
26. Install lock washers (key 10) and tie bolt hex nuts (key 11) onto tie bolts (key 4). Torque in a crisscross pattern according to table 8.
27. Refer to the Actuator Mounting section of this manual for instructions on mounting and installing the actuator onto a valve.

Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, refer to the serial number found on the actuator nameplate.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Includes all soft seals and O-rings required for seal and O-ring replacement in standard operating temperature constructions. Refer to figures 3 and 4.

KIT CONTENTS	ACTUATOR SIZE	PART NUMBER		
		Standard Temperature	Low Temperature	High Temperature
Piston Rod Wiper Seal, Key 15 Bearing O-ring, Key 13 Bearing Quad Seal, Key 12 Piston Rod O-ring, Key 19 Piston Wear Ring, Key 6 Piston Quad Seal, Key 7 Upper/Lower Head O-ring, Key 2 Upper/Lower Head O-ring, Key 2 685SE/685SR Actuator Grease, Key 100	10	R685X000252	R685X000272	R685X000292
	12	R685X000012	R685X000092	R685X000172
	14	R685X000022	R685X000102	R685X000182
	16	R685X000032	R685X000112	R685X000192
	18	R685X000042	R685X000122	R685X000202
	20	R685X000052	R685X000132	R685X000212
	22	R685X000062	R685X000142	R685X000222
	24	R685X000072	R685X000152	R685X000232
	26	R685X000082	R685X000162	R685X000242
	28	R685X000262	R685X000282	R685X000302

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Common Parts (figures 3, 4, 5, and 6)

Key	Description	
1	Upper Head	
2*	Upper/Lower Head O-ring	see parts kit
3	Tie Bolt	
4	Cylinder	
5	Piston	
6*	Piston Wear Ring	see parts kit
7*	Piston Quad Seal	see parts kit
9	Lower Head	
10	Lock Washer	
11	Tie Bolt Hex Nut	
12*	Bearing Quad Seal	see parts kit
13*	Bearing O-ring	see parts kit
14	Bearing	
15*	Piston Rod Wiper Seal	see parts kit
16	Bearing Retaining Ring	
17	Piston Rod	
18	Stem Connector	
19*	Piston Rod O-ring	see parts kit
20	Hex Head Cap Screw	
21	Yoke	
22	Travel Scale	
23	Outer Spring Cartridge	
57	Inner Spring Cartridge	
58	Spring Cartridge Wear Ring	
61	Spring	
62	Stem Connector Hex Nut	
63	Stem Connector Stud	
100*	685SE/SR Actuator Grease (10 ounce tube)	see parts kit (19B0808X222)

Manual Handwheel Parts (figures 5 and 6)

Key	Description
24	ACME Thrust Shaft
25	Override Guide Shaft
26	Worm Gear
27	Thrust Shaft Upper Bushing
28	Thrust Shaft Bushing
29	Thrust Bearing
30	Thrust Guide Block
31	Engage Pin Guide
33	Engage Pin Control Knob
35	Socket Head Cap Screw
37	Key
38	Override Engage Pin
39	Position Indicator
40	All Thread Stud
42	Yoke Adaption Bracket
45	Handwheel
46	Helix Housing Cap O-ring
47	Helix Gear Shaft Bushing
48	Helix Gear Bearing
49	Helix Worm Gear Housing
50	Helix Worm Gear
52	Helix Shaft Wiper Seal
53	Helix Worm Gear Shaft
54	Helix Gear Housing Cap
55	Lock Washer
56	Pointer
64	Yoke Adaption Bracket Hex Nut
65	Yoke Adaption Bracket Stud

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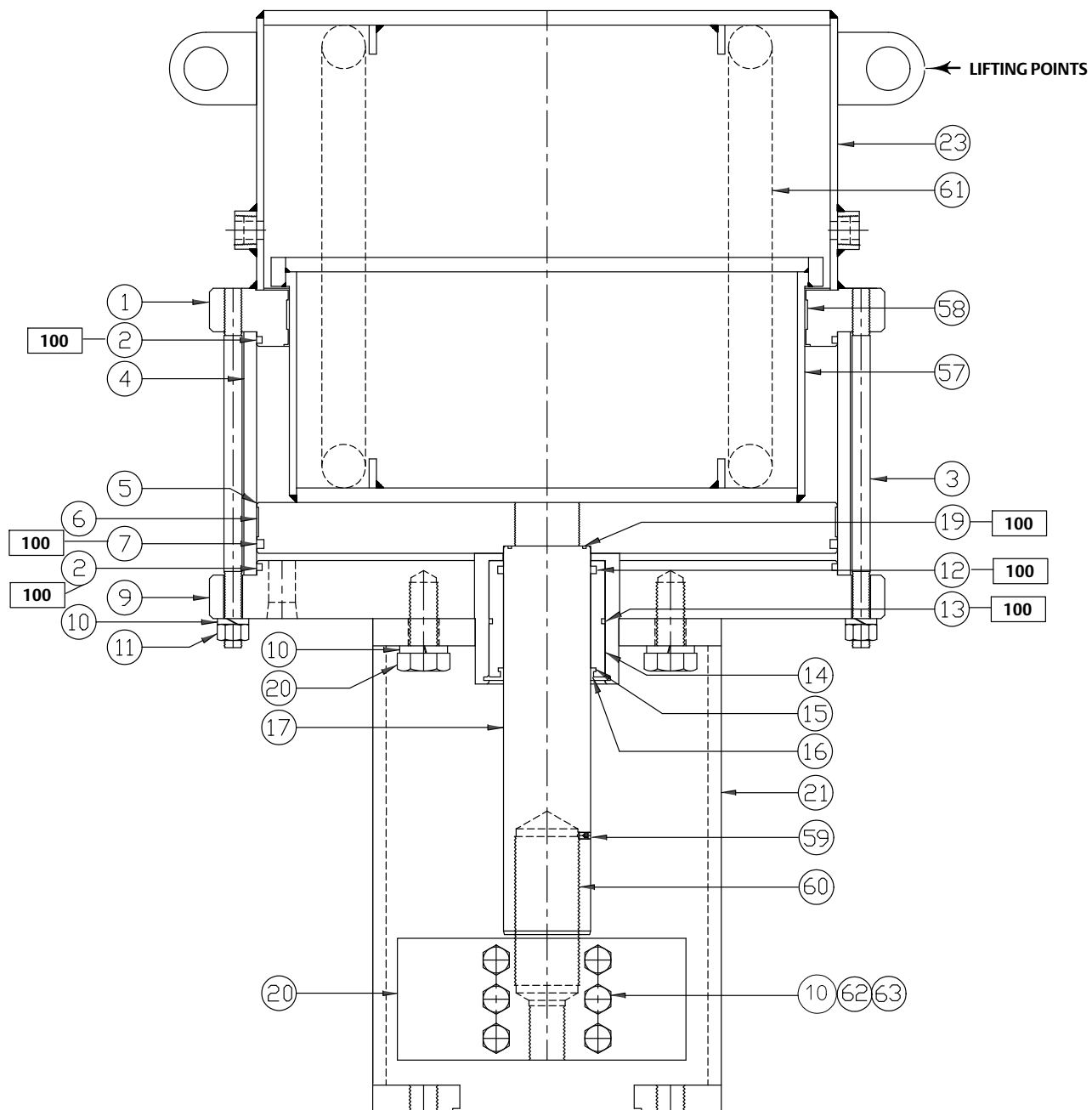
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685SE/685SR Piston Actuator

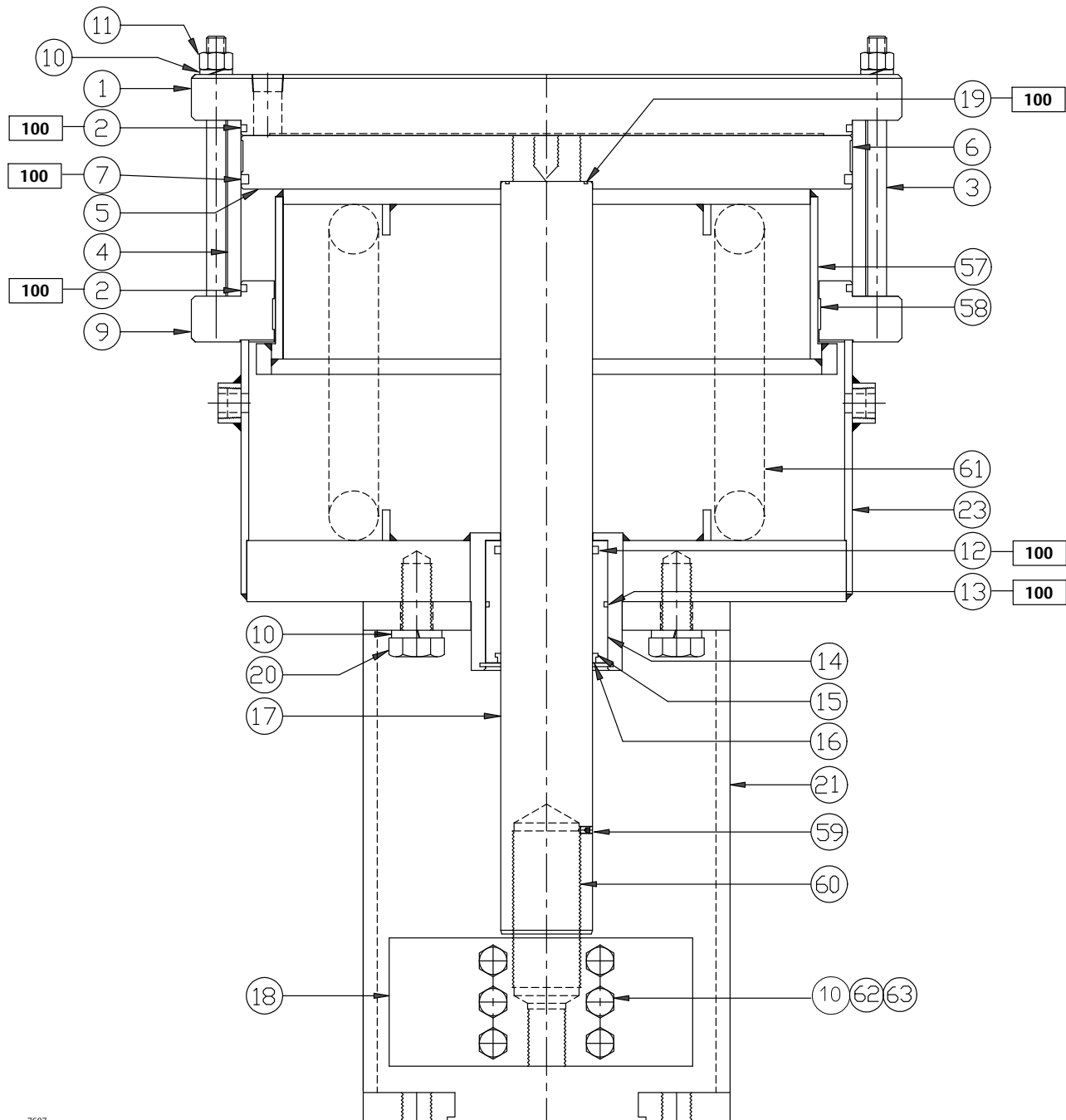
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Figure 3. Fisher 685SE Piston Actuator



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Figure 4. Fisher 685SR Piston Actuator



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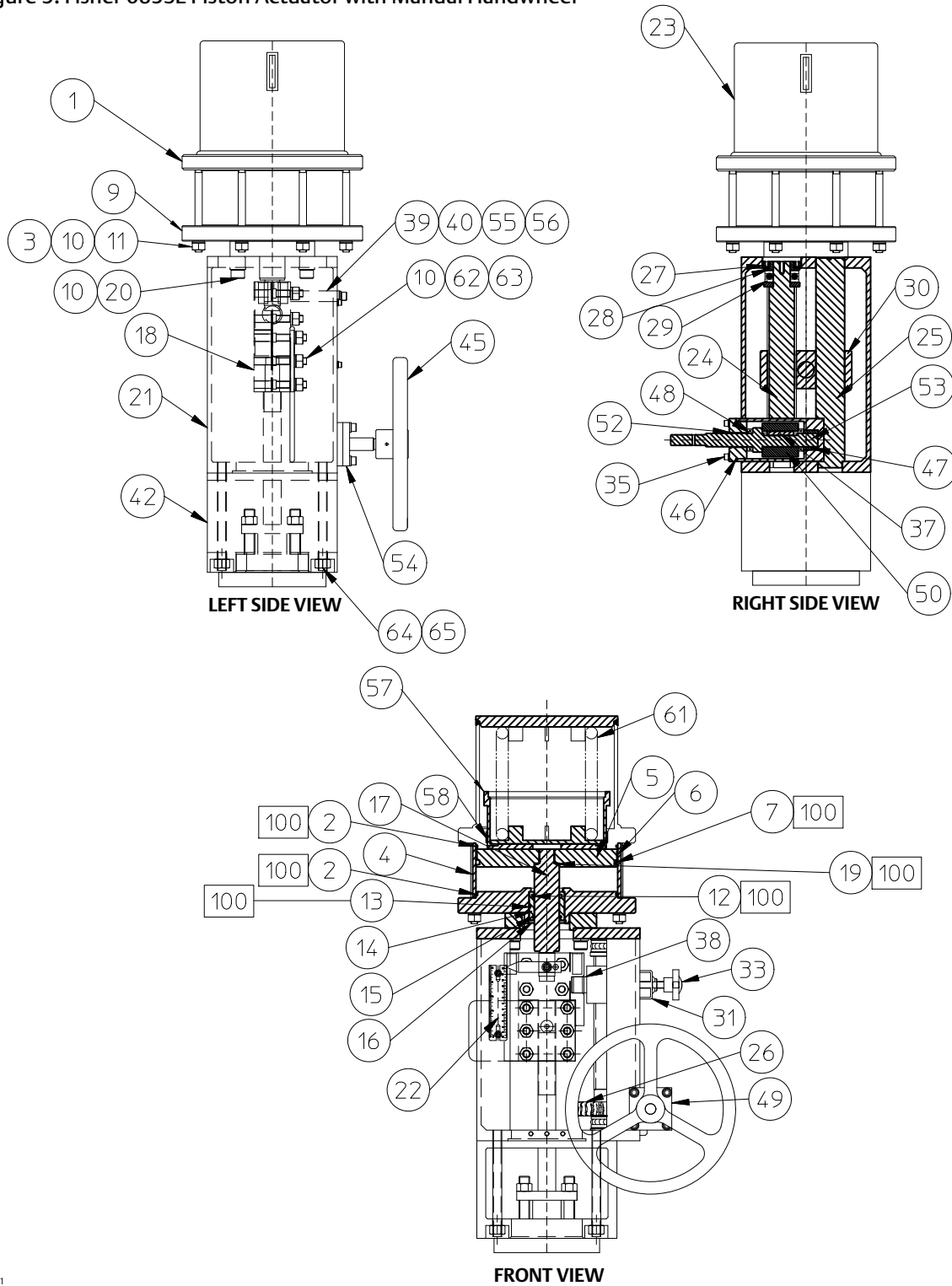
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685SE/685SR Piston Actuator

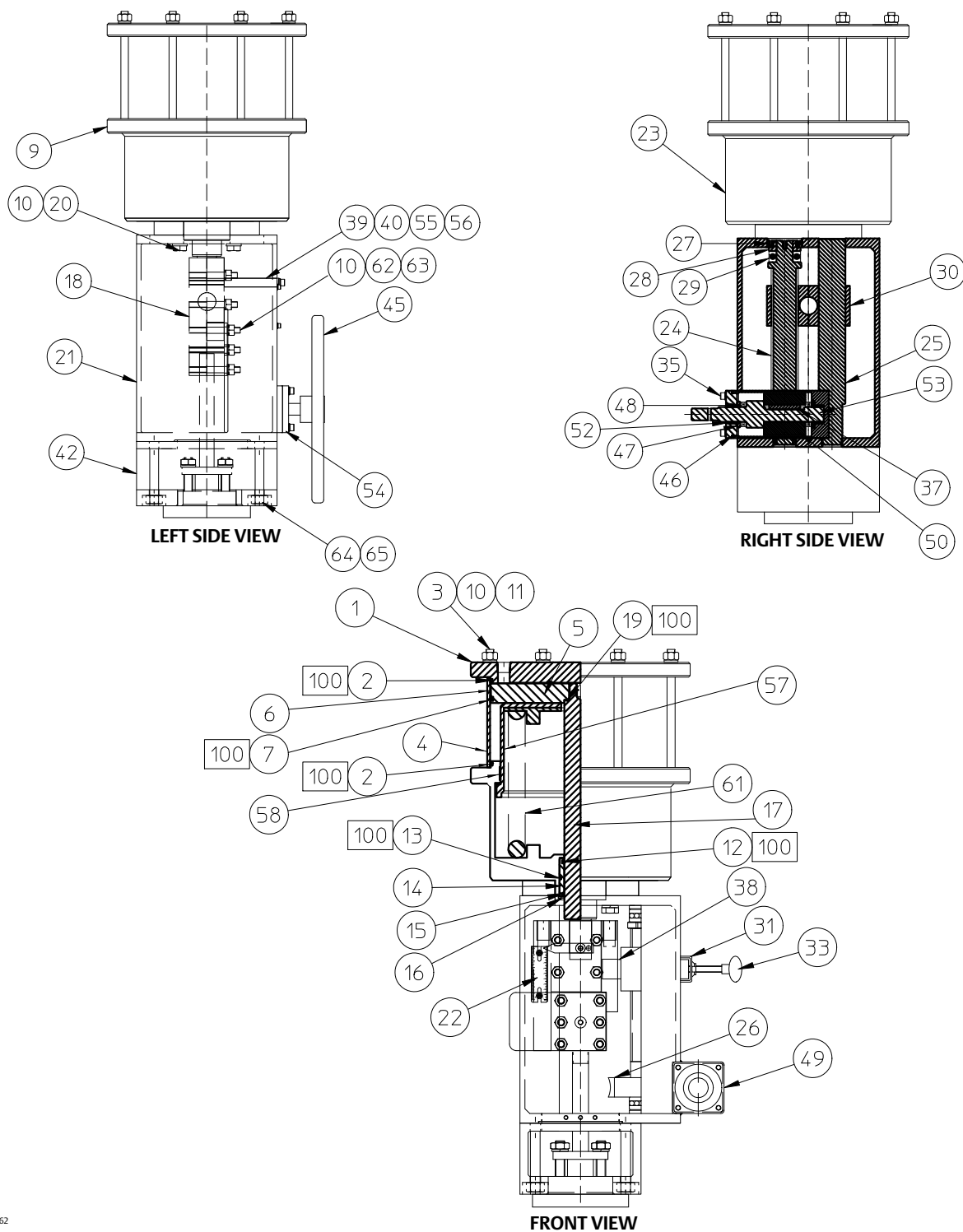
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Figure 5. Fisher 685SE Piston Actuator with Manual Handwheel



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Figure 6. Fisher 685SR Piston Actuator with Manual Handwheel



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Fisher™ 785C Piston Actuators

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Figure 1. Fisher 785C Single-Acting Spring Return with Handpump



X1851

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher 785C piston actuator. Refer to separate instruction manuals for information regarding other equipment and accessories used with these actuators.



Do not install, operate, or maintain 785C actuators without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

Operating Pressure⁽¹⁾

Minimum: 2.7 barg (40 psig)

Maximum Allowable: 10.3 barg (150 psig)

Consult your [Emerson sales office](#) for supply pressures under 2.7 barg (40 psig)

Travel⁽²⁾

16 mm (0.625 inch) through 610 mm (24 inch)
See table 2 and 4

Thrust Capabilities

See table 3, 6, and 7

Stroking Speeds

Varies with actuator size, spring, travel, and supply pressure. If stroking speed is critical, consult your Emerson sales office.

Piston Diameter and Area⁽²⁾

Available diameters range from 280 to 685 mm (11 to 27 inches).

See table 2, 4, and 5

For additional sizes, contact your Emerson sales office.

Operative Temperature Limits⁽³⁾

Standard: -20 to 100°C (-4 to 212°F)

Low Temperature Options:

-40 to 100°C (-40 to 212°F) or

-60 to 100°C (-76 to 212°F)

High Temperature Option:

-20 to 200°C (-4 to 392°F)

Yoke Boss and Valve Stem Diameter

Standard: ■ 90 mm (3-9/16 inch) yoke boss with 19 mm (3/4 inch) stem ■ 127 mm (5 inch) yoke boss with 25.4 mm (1 inch) stem ■ 127 mm (5H) yoke

boss with 32 mm (1-1/4 inch) stem ■ 178 mm (7 inch) yoke boss with 51 mm (2 inch) stem

High Performance: ■ 127 mm (5H) yoke boss with 32 mm (1-1/4 inch) stem ■ 178 mm (7 inch) yoke boss with 51 mm (2 inch) stem

Pressure Connections

Standard: 3/4 NPT

Optional: 1 and 1-1/4 NPT

Instrument Mounting

Standard mounting kits are available for use with FIELDVUE DVC6200 Series digital valve controllers up to 610 mm (24 inch) travel. High performance mounting kits are available for travel above 203 mm (8 inch).

Construction Materials⁽⁴⁾

Part	Material
Cylinder	Carbon Steel
Nameplate and Travel Scale	Stainless Steel
Piston	Carbon Steel
Piston Rod	Stainless Steel
Stem Connector	Carbon Steel or Stainless Steel
Tie Rod	Carbon Steel or Stainless Steel
Upper/Lower Heads	Carbon Steel
Yoke	Carbon Steel

Lifting Point Load Ratings

See table 8 and figure 2

Options

- Top mounted handwheel
- Side mounted handpump
- Pneumatic fail mode via Fisher 377 trip valve
- Volume boosters

Optional Certifications⁽⁵⁾

- Pressure Equipment Directive (PED) 2014/68/EU and Machinery Directive 2006/42/EC
- ATEX Group II Category 2 Gas and Dust
- Customs Union Technical Regulations (CUTR) 010/2011 and 012/2011
- Safety Instrumented System, SIL 3 Capable
- Inspection Documents EN 10204 3.1 Certificate

1. The pressure/temperature limits in this bulletin and any other applicable standard or code should not be exceeded.

2. Consult your Emerson sales office for longer travels or larger cylinder diameters. The Fisher 585C family of actuators can be used for smaller travels or cylinder diameters.

3. Standard temperature -20 to 100°C (-4 to 212°F) and -40 to 100°C (-40 to 212°F) are PED 2014/68/EU and 2006/42/EC compliant. The low ambient temperature option, -60 to 100°C (-76 to 212°F) is not PED compliant. The high temperature option, if used in conjunction with ATEX, is limited to 135°C (275°F).

4. Full stainless steel constructions are available upon request.

5. Refer to the product nameplates to determine which certifications each actuator construction possesses

Description

The 785C product lines encompass medium to large spring-return single-acting and double-acting piston actuators that provide accurate, high thrust output for short to long travel applications. These actuators are designed for use with a variety of medium to large Fisher sliding-stem control valves.

The single-acting actuators feature an internal bias spring that forces the actuator piston rod to extend or retract upon a loss of supply pressure, thereby ensuring a fail-closed or fail-open mode of operation. This effectively eliminates the need for a trip valve and volume tank in most constructions.

Specifications

Specifications for the 785C line of piston actuators are shown in tables 1 to 8. Refer to the nameplate affixed to the actuator yoke for specifications specific to individual constructions.

Educational Services

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Principle of Operation

785C piston actuators utilize a pneumatically controlled piston that moves inside of a cylinder to generate thrust. A seal contained on the circumference of the piston provides a seal between the top and bottom of the cylinder, preventing supply pressure leakage.

785C single-acting or double-acting spring-return piston actuators utilize a spring below the piston (outside the pressurized chamber) that will drive the piston rod upon a loss of supply pressure. This fail action will result in forcing an attached control valve to either fail-open or fail-closed. The fail action of 785C double-acting springless piston actuators relies on pneumatic system such as system with Fisher 377 trip valve.

From an equilibrium state, the actuator operates by reacting to a force unbalance that is created by change of supply pressure on one side of the piston for single-acting, or a change of differential pressure between each side of the piston for double-acting. This moves the piston up or down, and results in a repositioning of the attached control valve. Travel can be adjusted using travel limits within a valve positioner, which limit the travel range of the actuator. The option of a hard travel stopper is also available, consult your [Emerson sales office](#) for details. The optional manual override does not have the ability to act as a hard travel stop.

An optional manual override (top mounted handwheel or side mounted handpump) is capable of extending or retracting the actuator manually and can be engaged at any position from full open to full close. The top-mounted handwheel utilizes an engagement lever that couples the handwheel and piston rod. The handpump has a hydraulic cylinder attached to the piston rod. This enables the handpump to operate the actuator manually, unless the handpump is set to bypass position.

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Table 2. 785C Double-Acting Springless Standard Constructions⁽¹⁾

ACTUATOR SIZE	PISTON AREA				VALVE STEM CONNECTOR SIZE		YOKE BOSS DIAMETER		MAX TRAVEL	
	Without Manual Override		With Manual Override(2)							
	cm ²	Inch ²	cm ²	Inch ²	mm	Inch	mm	Inch	mm	Inch
280	616	95	616	95	19	3/4	90	3 9/16	203	8
					25	1	127	5		
					32	1 1/4	127	5H	610	24
335	881	137	881	137	19	3/4	90	3 9/16	203	8
					25	1	127	5		
					32	1 1/4	127	5H	610	24
385	1164	180	1164	180	19	3/4	90	3 9/16	203	8
					25	1	127	5		
					32	1 1/4	127	5H	610	24
					51	2	178	7		
435	1486	230	1474	228	25	1	127	5	203	8
					32	1 1/4	127	5H	610	24
					51	2	178	7		
485	1847	286	1828	283	25	1	127	5	203	8
					32	1 1/4	127	5H	610	24
					51	2	178	7		
535	2248	348	2228	345	25	1	127	5	203	8
					32	1 1/4	127	5H	610	24
					51	2	178	7		
585	2688	417	2660	412	32	1 1/4	127	5H	610	24
					51	2	178	7		
635	3167	491	3139	487	32	1 1/4	127	5H	610	24
					51	2	178	7		
685	3685	571	3657	567	32	1 1/4	127	5H	610	24
					51	2	178	7		

1. Consult your [Emerson sales office](#) for additional sizes.

2. Actuator size 280-385 are available with a top mounted handwheel. Size 435-685 are available with a side mounted manual handpump.

3. High Performance Yoke required for ODV packages with travel greater than 8 inches. Optional for use in high vibration or fast stroke package. When ordering a high performance yoke boss you will need to order a high performance mounting kit as well.

Table 3. 785C Double-Acting Springless Available Thrust

ACTUATOR SIZE	MAXIMUM ALLOWABLE CYLINDER PRESSURE		MAXIMUM ALLOWABLE THRUST			
			Without Manual Override		With Manual Override ⁽¹⁾	
	barg	psig	N	lb	N	lb
280	10.3	150	63682	14316	32635	7337
335			91157	20493	46715	10502
385			120399	27067	61700	13871
435			153702	34554	78726	17698
485			191066	42953	132291	29740
535			232492	52266	132291	29740
585			277979	62492	172788	38844
635			327527	73631	172788	38844
685			381137	85683	238555	53629

1. Actuator size 280-385 are available with a top mounted handwheel. Size 435-685 are available with a manual handpump.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104483X012

785C Actuator

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Table 4. 785C Single-Acting Spring Return Standard Constructions⁽¹⁾

ACTUATOR SIZE	PISTON AREA								VALVE STEM CONNECTOR SIZE		YOKE BOSS DIAMETER		MAX TRAVEL	
	Without Manual Override				With Manual Override ⁽²⁾									
	Rod Extends		Rod Retracts		Rod Extends		Rod Retracts							
	cm ²	Inch ²	cm ²	Inch ²	cm ²	Inch ²	cm ²	Inch ²						
335	881.4	136.6	868.9	134.7	881.4	136.6	868.9	134.7	19	3/4	90	3 9/16	203	8
									25	1	127	5		
									32	1 1/4	127	5H		
385	1164	180.4	1152	178.5	1164	180.4	1152	178.5	19	3/4	90	3 9/16	203	8
									25	1	127	5		
									32	1 1/4	127	5H	318	12
									51	2	178	7		
435	1486	230.4	1474	228.4	1474	228.4	1474	228.4	25	1	127	5	203	8
									32	1 1/4	127	5H	420	16
									51	2	178	7		
485	1847	286.4	1835	284.4	1828	283.3	1835	284.4	25	1	127	5	203	8
									32	1 1/4	127	5H	420	16
									51	2	178	7		
535	2248	348.4	2235	346.5	2228	345.4	2235	346.5	25	1	127	5	203	8
									32	1 1/4	127	5H	420	16
									51	2	178	7		
585	2688	416.6	2660	412.2	2660	412.2	2660	412.2	32	1 1/4	127	5H	420	16
									51	2	178	7		
635	3167	490.9	3139	486.5	3139	486.5	3139	486.5	32	1 1/4	127	5H	420	16
									51	2	178	7		
685	3685	571.2	3657	566.8	3657	566.8	3657	566.8	32	1 1/4	127	5H	420	16
									51	2	178	7		
1. Consult your Emerson sales office for additional sizes. 2. Actuator size 335-385 are available with a top mounted handwheel. Size 435-685 are available with a side mounted manual handpump.														

1. Consult your [Emerson sales office](#) for additional sizes.

2. Actuator size 335-385 are available with a top mounted handwheel. Size 435-685 are available with a side mounted manual handpump.

Table 5. 785C Double-Acting Spring Return Standard Constructions⁽¹⁾

ACTUATOR SIZE	PISTON AREA								VALVE STEM CONNECTOR SIZE		YOKE BOSS DIAMETER		MAX TRAVEL	
	Without Manual Override				With Manual Override ⁽²⁾									
	Rod Extends		Rod Retracts		Rod Extends		Rod Retracts							
	cm ²	Inch ²	cm ²	Inch ²	cm ²	Inch ²	cm ²	Inch ²						
280	615.8	95.4	603.2	93.5	615.8	95.4	603.2	93.5	19	3/4	90	3 9/16	203	8
									25	1	127	5		
									32	1 1/4	127	5H		
335	881.4	136.6	868.9	134.7	881.4	136.6	868.9	134.7	19	3/4	90	3 9/16	203	8
									25	1	127	5		
									32	1 1/4	127	5H		
385	1164	180.4	1152	178.5	1164	180.4	1152	178.5	19	3/4	90	3 9/16	203	8
									25	1	127	5		
									32	1 1/4	127	5H	318	12
									51	2	178	7		
435	1486	230.4	1474	228.4	1474	228	1473	228.4	25	1	127	5	203	8
									32	1 1/4	127	5H	420	16
									51	2	178	7		
485	1847	286.4	1835	284.4	1828	283	1835	284.4	25	1	127	5	203	8
									32	1 1/4	127	5H	420	16
									51	2	178	7		
535	2248	348.4	2235	346.5	2228	345	2235	346.5	25	1	127	5	203	8
									32	1 1/4	127	5H	420	16
									51	2	178	7		
585	2688	416.6	2660	412.2	2660	412	2660	412.2	32	1 1/4	127	5H	420	16
									51	2	178	7		
635	3167	490.9	3139	486.5	3139	486.5	3139	486.5	32	1 1/4	127	5H	420	16
									51	2	178	7		

- continued -

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

785C Actuator

May 2022

Instruction Manual

D104483X012

Table 5. 785C Double-Acting Spring Return Standard Constructions⁽¹⁾ (continued)

ACTUATOR SIZE	PISTON AREA								VALVE STEM CONNECTOR SIZE		YOKE BOSS DIAMETER		MAX TRAVEL	
	Without Manual Override				With Manual Override ⁽²⁾									
	Rod Extends		Rod Retracts		Rod Extends		Rod Retracts							
	cm ²	Inch ²	cm ²	Inch ²	cm ²	Inch ²	cm ²	Inch ²	mm	Inch	mm	Inch	mm	Inch
685	3685	571.2	3657	566.8	3657	566.8	3657	566.8	32	1 1/4	127	5H	420	16
									51	2	178	7		
1. Consult your Emerson sales office for additional sizes. 2. Actuator size 280-385 are available with a top mounted handwheel. Size 435-685 are available with a manual handpump.														

1. Consult your [Emerson sales office](#) for additional sizes.

2. Actuator size 280-385 are available with a top mounted handwheel. Size 435-685 are available with a manual handpump.

Table 6. Handwheel Specification

ACTUATOR SIZE	OUTPUT THRUST		HANDWHEEL DIAMETER		TURNS PER mm OF TRAVEL	TURNS PER INCH OF TRAVEL	MAXIMUM RIM FORCE REQUIRED	
	N	lbs	mm	Inch			N	lbs
280	32635	7337	850	33	0.2	4.2	437	98
335	46715	10502	1200	47	0.2	4.2	435	98
385	61700	13871	1400	55	0.2	4.2	489	110

Table 7. Handpump Specification

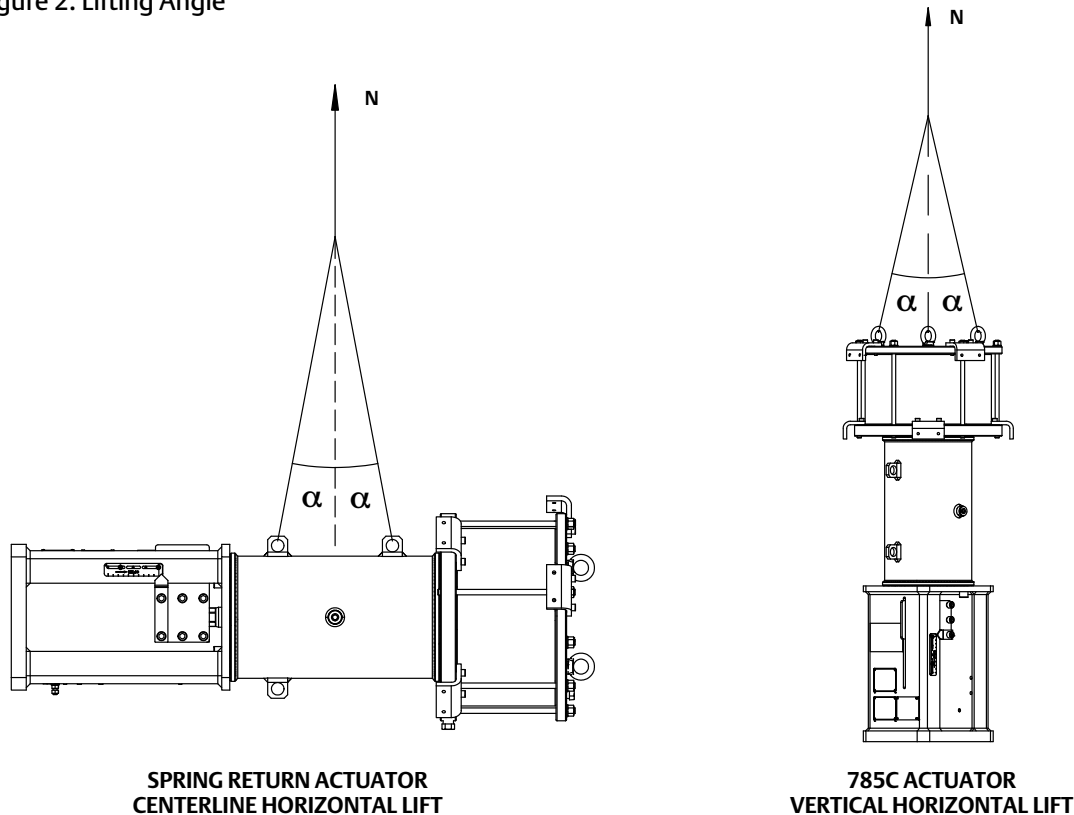
ACTUATOR SIZE	HYDRAULIC CYLINDER		OUTPUT THRUST	
	mm	Inch	N	lbf
435	135	5.3	78726	17698
485	175	6.9	132291	29740
535	175	6.9	132291	29740
585	200	7.9	172788	38844
635	200	7.9	172788	38844
685	235	9.3	238555	53629

Table 8. Lifting Point Load Ratings

ACTUATOR SIZE	LIFTING ORIENTATION	NUMBER OF LIFTING POINTS USED	MAXIMUM WELDED EYELET LOAD AT LIFTING ANGLE $\alpha \leq 20^\circ$ (SEE FIGURE 2)	
			Kg	lbs
280	Actuator Centerline Horizontal ⁽¹⁾	2	1572	3466
335		2	1572	3466
385		2	1572	3466
435		2	1572	3466
485		2	5697	12560
535		2	5697	12560
585		2	5697	12560
635		2	5697	12560
685		2	5697	12560
ACTUATOR SIZE	LIFTING ORIENTATION	NUMBER OF LIFTING POINTS USED	MAXIMUM LOAD AT EYEBOLT LIFTING ANGLE $\alpha \leq 45^\circ$ (SEE FIGURE 2)	
			Kg	lbs
280	Actuator Centerline Vertical ⁽²⁾	4	864	1905
335		4	864	1905
385		4	864	1905
435		4	864	1905
485		4	3096	6826
535		4	3096	6826
585		4	3096	6826
635		4	3096	6826
685		4	3096	6826

1. Welded eyelets for horizontal lifting are only available for the 785C Spring Return.
2. Vertical lifting loads are applicable to both the 785C Springless and Spring Return.

Figure 2. Lifting Angle



Installation

Key numbers in this procedure are shown in figures 9 to 28, unless otherwise indicated.

⚠ WARNING

To avoid personal injury or property damage caused by cylinder fracture as a result of piston impact, install the stem connector securely before supplying pressure to the positioner. Use only a regulator-controlled air supply to move the actuator piston so that you can install the stem connector. Do not use the positioner to move the actuator piston before installing the stem connector.

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

If installing into an existing application, also refer to the warning at the beginning of the Maintenance section in this manual.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts, be certain the cylinder pressure or other pressure ratings do not exceed the limits listed in table 1. Use pressure-limiting or pressure-relieving devices to prevent cylinder pressure or other pressures from exceeding these limits.

To avoid personal injury or equipment damage, use proper lifting and rigging practices while lifting the actuator or valve/actuator assembly. For all mounting procedures use an adequately sized chain, sling, hoist, or crane to handle the

actuator and any attached accessories and/or valve. Use caution during lifting and handling to prevent slippage, swinging, faulty equipment connections, or sudden shock loads.

NOTICE

Special care must be taken when installing an actuator in a horizontal service orientation. To avoid cantilever loads on the valve stem and yoke, it is the customer's responsibility to ensure proper support for a horizontal actuator.

The actuator may be installed in any orientation, but normal installation is with the actuator vertical above the valve.

If using a manual override in double acting application, a bypass valve should be furnished, allowing balance the pressure within both sides of the piston before operating the manual override.

If using a manual handpump, the handpump must be installed vertical above the valve (see figure 7).

If the supply source is capable of exceeding the maximum actuator operating pressure or instrument supply pressure, appropriate steps must be taken during installation to protect the instrument and all connected equipment against overpressure.

When an actuator and control valve are shipped together as a control valve assembly, the actuator is normally mounted on the valve. Follow the valve instructions when installing the valve in the pipeline. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the actuator mounting procedures in this instruction manual. Refer to the individual product instruction manuals for the installation or mounting of a FIELDVUE DVC6200 digital valve controller.

If the actuator is being installed without a positioner, the cylinder loading pressures should be supplied through a 4-way solenoid valve or a switching valve.

Pressure connections are located on top of the pneumatic cylinder end flange (key 2210) and on the side of the pneumatic cylinder head flange (key 2201).

- The supply pressure medium should be clean, dry filtered air. If the supply source is capable of exceeding the maximum actuator operating pressure or positioner supply pressure, appropriate steps must be taken during installation to protect the positioner and all connected equipment against over pressurization.
- The control valve should be located where it will be accessible for servicing. Space should be left above and below the control valve to permit removal of the actuator and valve plug.

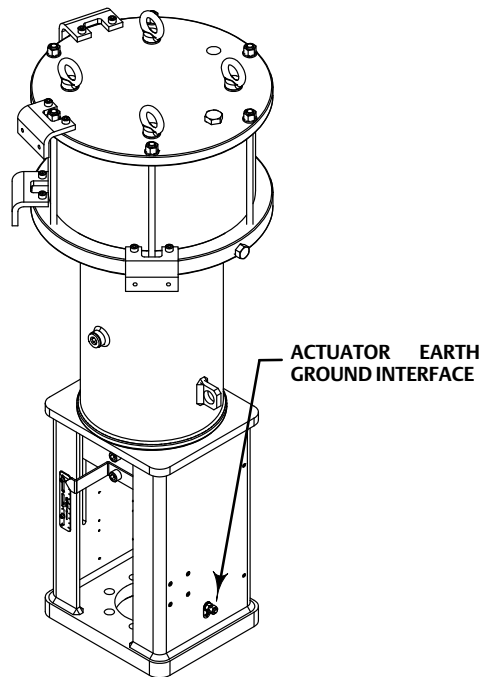
Actuator Earth Grounding

All Fisher 785C series actuators are provided with a threaded actuator earth grounding interface on the yoke (spool) for the earth connection as shown in the figure 3.

Note

Proper connection to the earth grounding interface is required for compliance with ATEX regulations.

Figure 3. Actuator Earth Grounding Interface



Three-Way Valve Applications Note

In three-way valve applications where the actuator fully strokes at a frequency of once per minute or faster, and the stroking speed is rapid (less than 0.5 seconds per stroke), there is a possibility that the stem can fracture at the plug if the actuator cylinder pressure is greater than 5.5 bar (80 psig). This can cause loss of control of process fluid and further damage to the actuator. Considerations should be given to the use of high-strength, fatigue-resistant stem materials in these applications.

⚠ WARNING

To avoid loss of control of process fluid and subsequent personal injury or property damage caused by bursting of pressure-retaining parts, be sure the cylinder pressure does not exceed 5.5 bar (80 psig) in high cycle-rate, fast stroking speed, three-way valve applications.

Manual Override

The actuator can be equipped with a manual override. The manual override can be executed with a Manual Handwheel or a Manual Hydraulic Pump which can operate the actuator.

Manual Handwheel Operation

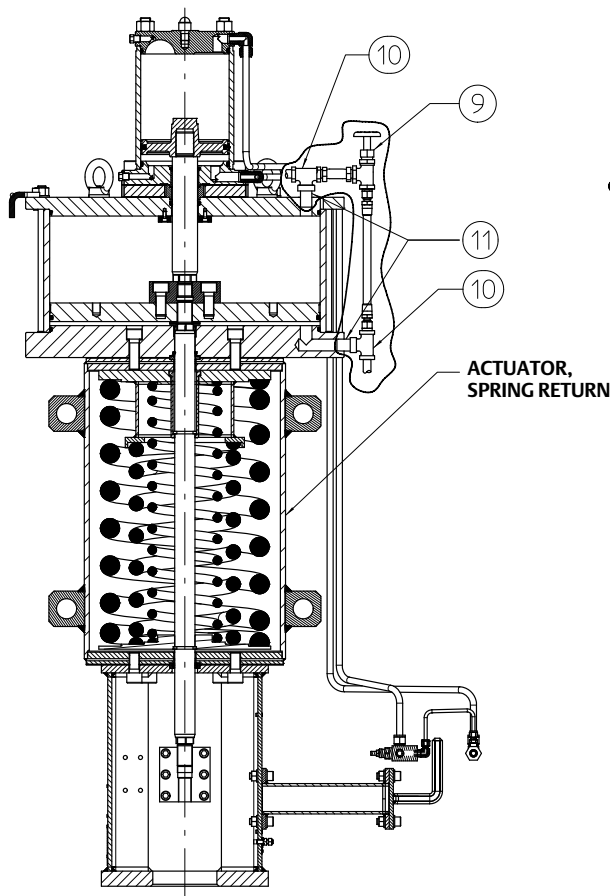
If manual operation is required for actuator sizes 280, 335, and 385 a manual handwheel should be equipped as standard construction.

NOTICE

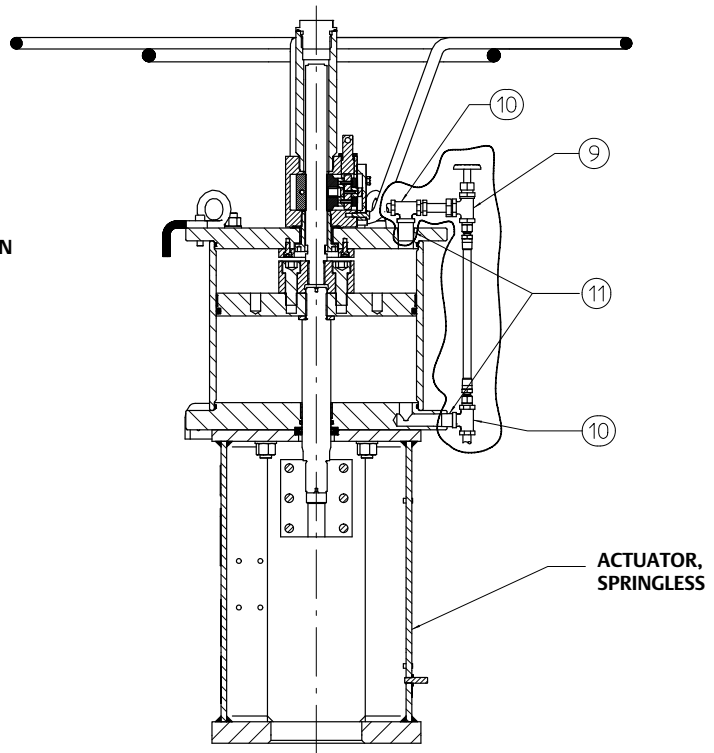
To avoid damage to actuator parts and difficult operation of actuator handwheels, open the bypass valve before using a handwheel. Do not disengage the handwheel if the spring thrust is not balanced by pneumatic load for spring return actuator.

A bypass assembly is furnished only when an actuator with manual override is specified, see figure 4. The bypass assembly allows the pressure to equalize on either side of the actuator piston, so that the manual override can be used to position the control valve. Flow through the bypass tubing is controlled by an angle needle valve, which is operated manually. This valve should be closed when air pressure is being used to operate the actuator.

Figure 4. Bypass Valve Examples for Double-Acting 785C Actuator with Manual Override



GH14579, sheet 1



GH14579, sheet 3

The following steps reference figure 5 and 6. Refer to table 6 for handwheel specifications.

Figure 5. Top Mounted Manual Handwheel

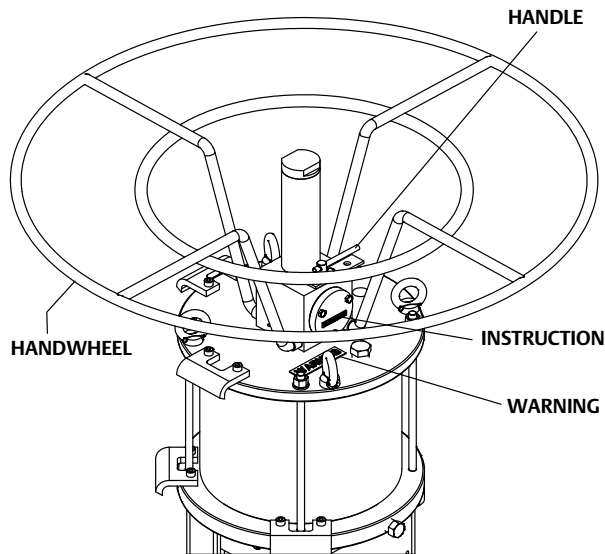
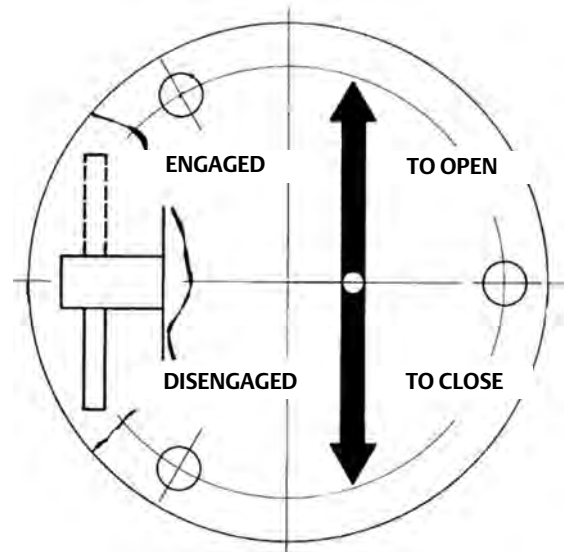


Figure 6. Top Mounted Manual Handwheel Engagement/Disengagement Instruction Label



1. Engage the manual override by rotating its handle, reference figure 5. Note that there is only one position (at 360° rotation of the handwheel) where the handle will correctly engage the manual operation. To reach that position during the rotation of the handle, slowly rotate the handwheel until the correct position, as indicated on the warning plate shown in figure 5.
2. Turn the handwheel of the manual override clockwise to close, or counterclockwise to open, as indicated on the instruction label shown in figure 6.
3. Check the correct operation of the actuator by monitoring the movement of the travel indicator.
4. Once manual operation is completed, the bypass valve should be close and remain shut off during pneumatic supply air operation.
5. Ensure the unbalanced thrust, such as spring return actuator spring thrust, is balanced by applying a pneumatic load and disengage the manual handwheel by rotating the handle as shown on the instruction plate. This allows the actuator to be operated by the pneumatic supply.

If it is necessary to keep the valve in its position and if the pneumatic supply is not restored yet, do not disengage the handwheel.

For spring return actuator, if it is not necessary to keep the valve in its position and if the pneumatic supply is not restored yet, in order to disengage the handwheel, turn the handwheel to the end which spring would fully release without applying any thrust to the handwheel, to get an easy disengagement of the handwheel.

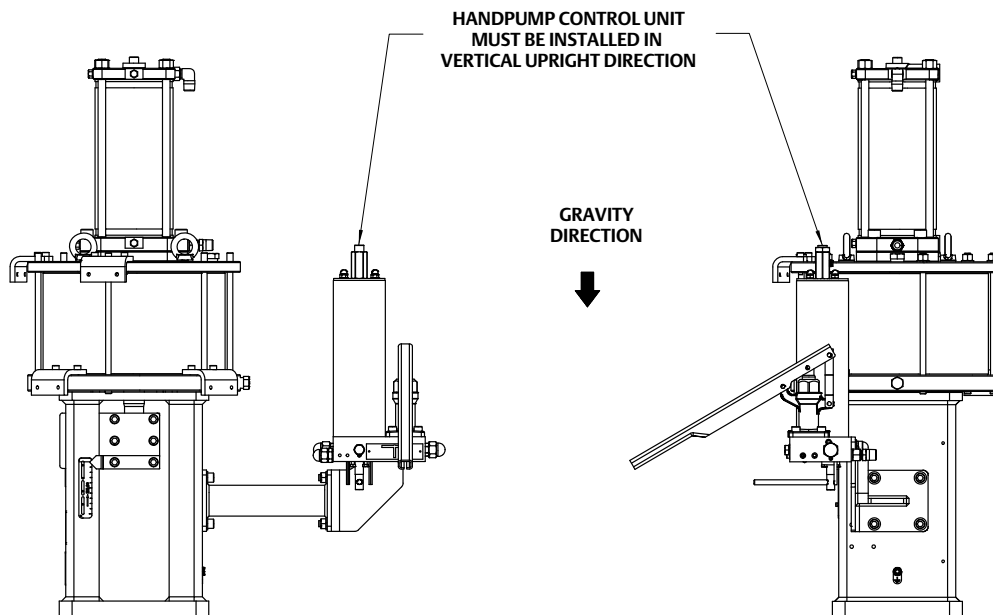
Manual Hydraulic Handpump Operation

If manual operation is required, actuator sizes 435, 485, 535, 585, 635, and 685 should be equipped with a manual handpump as standard construction.

Note

The manual handpump control unit must be installed in vertical up direction per figure 7. For application requiring actuator horizontal installation, a special design handpump support and hydraulic tubing must be used to install handpump in vertical up direction per figure 7. Contact your Emerson sales office for further information of manual handpump for actuator horizontal installation.

Figure 7. Handpump Orientation



GH15114 sheet 1

A bypass assembly is furnished only when an actuator with manual override is specified. The bypass assembly allows the pressure to equalize on either side of the actuator piston, so that the manual override can be used to position the control valve. Flow through the bypass tubing is controlled by an angle needle valve, which is operated manually. This valve should be closed when supply pressure is being used to operate the actuator.

The following steps are referenced in figures 8, 9, and 10. Refer to table 7 for handpump specifications and figures 11 through 17 for handpump schematics and more detail instructions.

1. Select “Manual Opening” or “Manual Closing” by rotating the Engagement/Disengagement handle as indicated on the instruction plate from pneumatic operation “REMOTE” mode.
2. Actuate the handpump according to figure 11 through 17 handpump schematic detail instructions until the desired position of the actuator is reached.
3. Check the correct operation of the actuator through the visual travel indicator.

- Once manual operation is completed, rotate the handle to the "REMOTE" position, as indicated on the instruction plate in figure 8, to disengage the manual operator. Follow figure 11 through 17 handpump schematic detail instructions to allow the "REMOTE" operation with the pneumatic supply. Once manual operation is completed, the bypass valve should be close and remain shutoff during pneumatic supply air operation.

Figure 8. Manual Hydraulic Handpump Engagement/Disengagement Instructions Plate

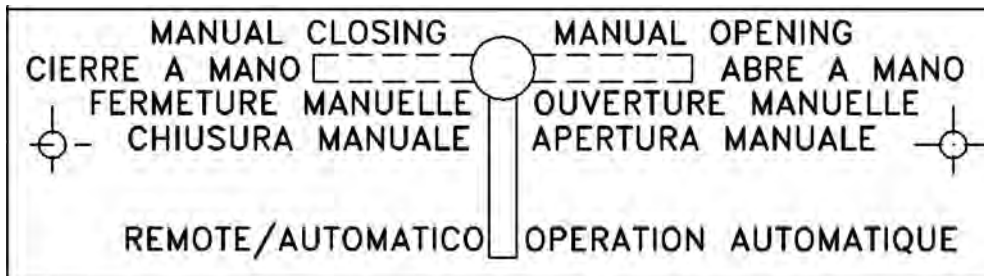
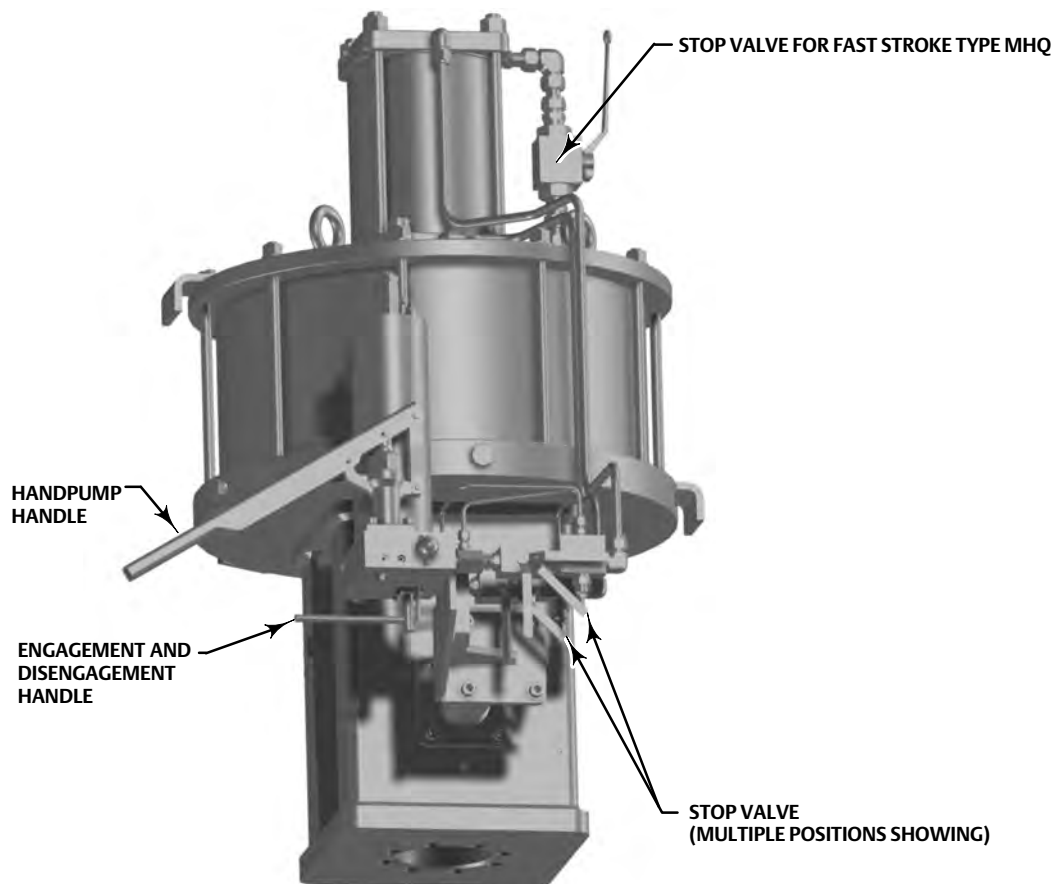


Figure 9. Manual Hydraulic Handpump Typical Constructions
(Design Varies for Different Actuator Type and Handpump Type)



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Figure 10. Manual Hydraulic Handpump Typical Constructions
(Design Varies for Different Actuator Type and Handpump Type)

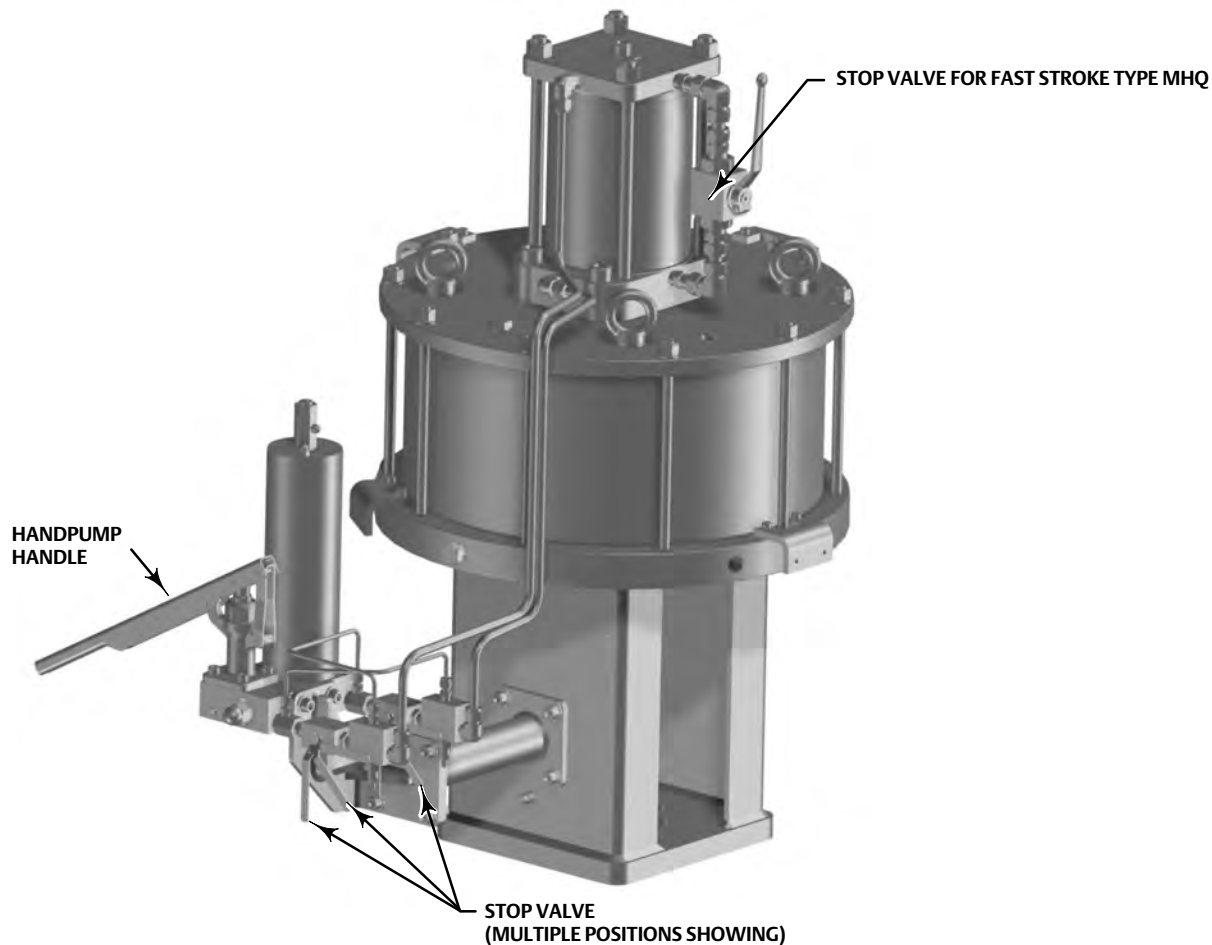
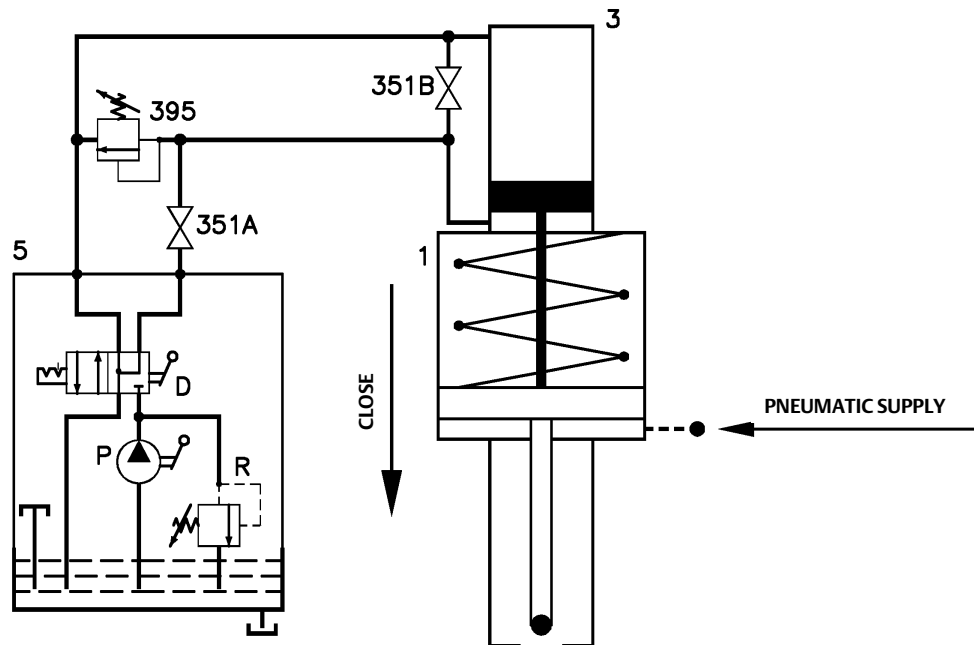


Table 9. Handpump Schematics⁽¹⁾

Actuator Type	Handpump Type	Schematics Figure
785C Spring Return Rod Extend (Fail Down) Single- or Double-Acting	Fast Stroke MHQ	11
	Standard Stroke MHP	12
785C Spring Return Rod Extend (Fail Up) Single- or Double-Acting	Fast Stroke MHQ	13
	Standard Stroke MHP	14
785C Springless, Double-Acting	Standard Stroke MHP	15
	Fast Stroke MHQ	16 or 17

1. Notice the 785C Spring Return schematics drawn as single-acting would also work for double-acting.

Figure 11. Handpump Schematic: Fast Stroke MHQ Handpump for 785C Spring Return Rod Extend (Fail Down), Single- or Double-Acting



PNEUMATIC REMOTE CONTROL TO OPEN
PRESSURIZED PERMANENTLY THE PNEUMATIC SUPPLY LINE.

PNEUMATIC REMOTE CONTROL TO CLOSE
DE-PRESSURIZED THE PNEUMATIC SUPPLY LINE.

EMERGENCY MANUAL OPERATION

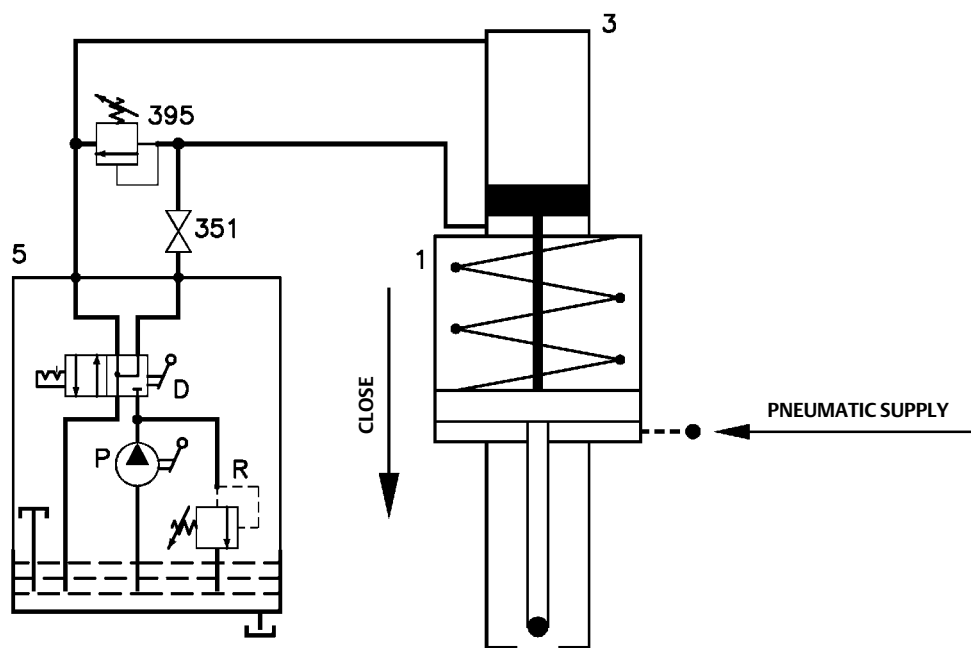
IN CASE OF PNEUMATIC SUPPLY FAILURE, CLOSE THE STOP VALVE 351B, SELECT BY THE VALVE "5-D" THE OPENING OPERATION AND ACTUATE THE HAND PUMP "5-P".

AT THE END OF THE OPENING OPERATION CLOSE THE VALVE 351A.

NOTE: THE VALVE "5-D" MUST BE IN "REMOTE CONTROL" POSITION AND THE STOP VALVES 351A AND 351B MUST BE OPEN TO ALLOW THE OPERATION WITH PNEUMATIC SUPPLY.

- | | |
|-----|---|
| 1 | SINGLE-ACTING SPRING RETURN PNEUMATIC LINEAR ACTUATOR |
| 3 | HYDRAULIC CYLINDER |
| 5 | MANUAL OVERRIDE |
| | R — RELIEF VALVE |
| | P — HAND PUMP |
| | D — HAND OPERATED DIRECTIONAL CONTROL VALVE |
| 351 | STOP VALVE |
| 395 | RELIEF VALVE |

Figure 12. Handpump Schematic: Standard Stroke MHP Handpump for 785C Spring Return Rod Extend (Fail Down), Single- or Double-Acting



PNEUMATIC REMOTE CONTROL TO OPEN
PRESSURIZED PERMANENTLY THE PNEUMATIC SUPPLY LINE.

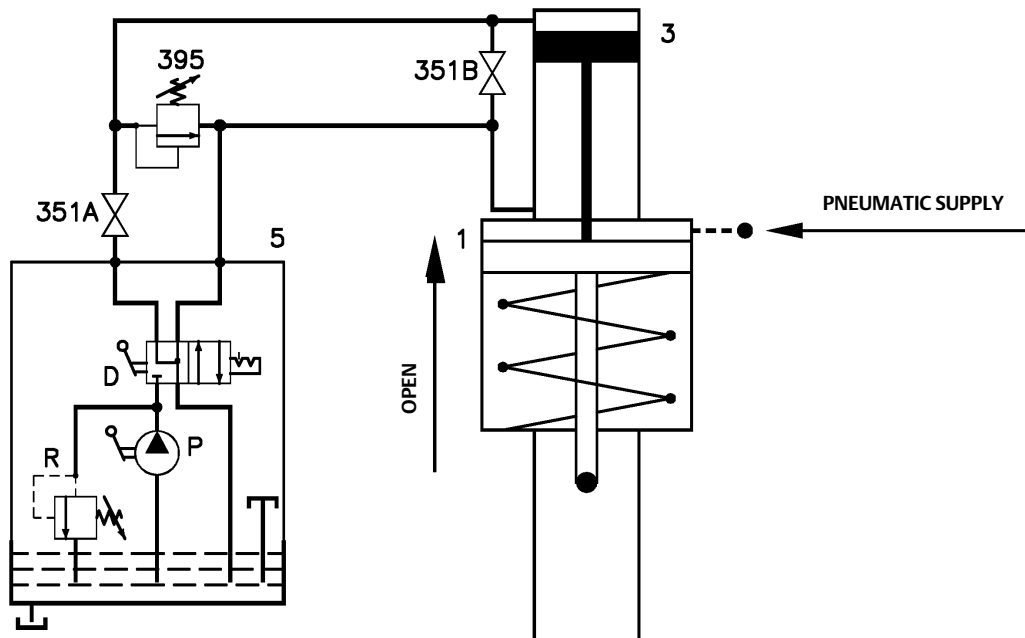
PNEUMATIC REMOTE CONTROL TO CLOSE
DE-PRESSURIZED THE PNEUMATIC SUPPLY LINE.

EMERGENCY MANUAL OPERATION

IN CASE OF PNEUMATIC SUPPLY FAILURE, SELECT BY THE VALVE "5-D" THE OPENING OPERATION AND ACTUATE THE HAND PUMP "5-P". AT THE END OF THE OPENING OPERATION CLOSE THE VALVE 351. NOTE: THE VALVE "5-D" MUST BE IN "REMOTE CONTROL" POSITION AND THE STOP VALVES 351 AND MUST BE OPEN TO ALLOW THE OPERATION WITH PNEUMATIC SUPPLY.

- | | |
|-----|---|
| 1 | SINGLE-ACTING SPRING RETURN PNEUMATIC LINEAR ACTUATOR |
| 3 | HYDRAULIC CYLINDER |
| 5 | MANUAL OVERRIDE |
| | R — RELIEF VALVE |
| | P — HAND PUMP |
| | D — HAND OPERATED DIRECTIONAL CONTROL VALVE |
| 351 | STOP VALVE |
| 395 | RELIEF VALVE |

Figure 13. Handpump Schematic: Fast Stroke MHQ Handpump for 785C Spring Return Rod Retract (Fail Up), Single- or Double-Acting



PNEUMATIC REMOTE CONTROL TO CLOSE
PRESSURIZED PERMANENTLY THE PNEUMATIC SUPPLY LINE.

PNEUMATIC REMOTE CONTROL TO OPEN
DE-PRESSURIZED THE PNEUMATIC SUPPLY LINE.

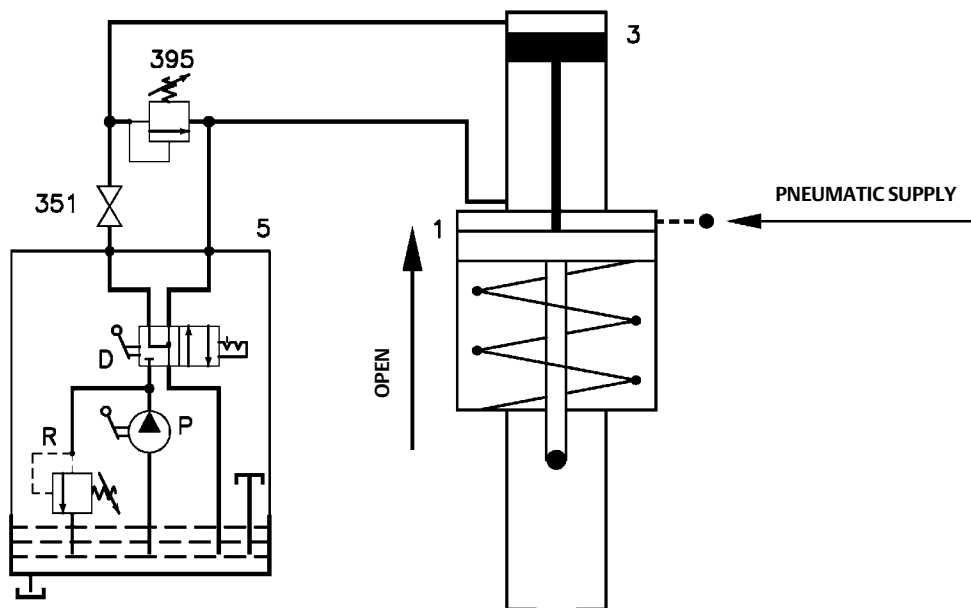
EMERGENCY MANUAL OPERATION

IN CASE OF PNEUMATIC SUPPLY FAILURE, CLOSE THE STOP VALVE 351B, SELECT BY THE VALVE "5-D" THE CLOSING OPERATION AND ACTUATE THE HAND PUMP "5-P".

AT THE END OF THE CLOSING OPERATION CLOSE THE VALVE 351A.
NOTE: THE VALVE "5-D" MUST BE IN "REMOTE CONTROL" POSITION AND THE STOP VALVES 351A AND 351B MUST BE OPEN TO ALLOW THE OPERATION WITH PNEUMATIC SUPPLY.

- | | |
|-----|---|
| 1 | SINGLE-ACTING SPRING RETURN PNEUMATIC LINEAR ACTUATOR |
| 3 | HYDRAULIC CYLINDER |
| 5 | MANUAL OVERRIDE |
| R | RELIEF VALVE |
| P | HAND PUMP |
| D | HAND OPERATED DIRECTIONAL CONTROL VALVE |
| 351 | STOP VALVE |
| 395 | RELIEF VALVE |

Figure 14. Handpump Schematic: Standard Stroke MHP Handpump for 785C Spring Return Rod Retract (Fail Up), Single-or Double-Acting



PNEUMATIC REMOTE CONTROL TO CLOSE
PRESSURIZED PERMANENTLY THE PNEUMATIC SUPPLY LINE.

PNEUMATIC REMOTE CONTROL TO OPEN
DE-PRESSURIZED THE PNEUMATIC SUPPLY LINE.

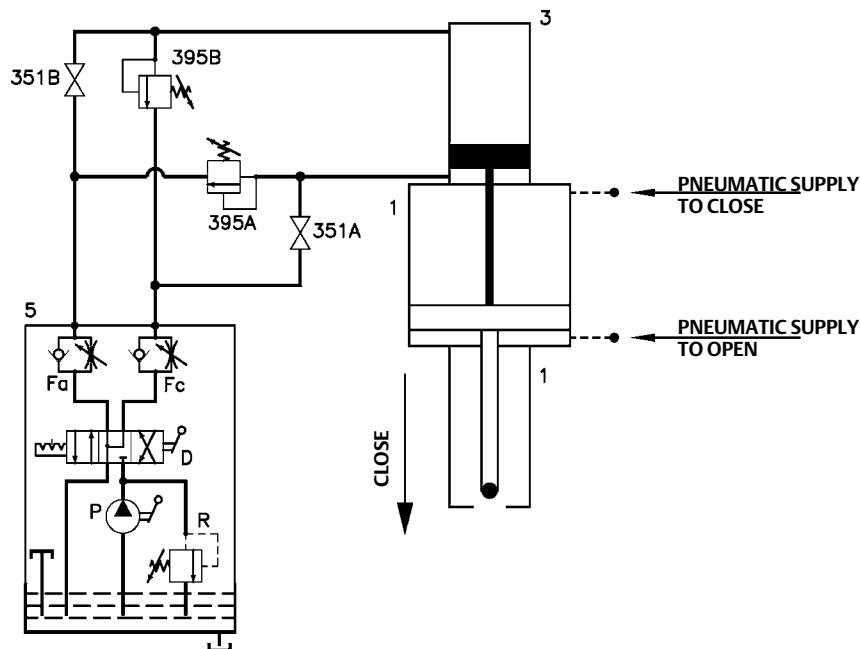
EMERGENCY MANUAL OPERATION

IN CASE OF PNEUMATIC SUPPLY FAILURE, SELECT BY THE VALVE "5-D" THE CLOSING OPERATION AND ACTUATE THE HAND PUMP "5-P". AT THE END OF THE CLOSING OPERATION CLOSE THE VALVE 351.

NOTE: THE VALVE "5-D" MUST BE IN "REMOTE CONTROL" POSITION AND THE STOP VALVES 351 MUST BE OPEN TO ALLOW THE OPERATION WITH PNEUMATIC SUPPLY.

- | | |
|-----|---|
| 1 | SINGLE-ACTING SPRING RETURN PNEUMATIC LINEAR ACTUATOR |
| 3 | HYDRAULIC CYLINDER |
| 5 | MANUAL OVERRIDE |
| | R — RELIEF VALVE |
| | P — HAND PUMP |
| | D — HAND OPERATED DIRECTIONAL CONTROL VALVE |
| 351 | STOP VALVE |
| 395 | RELIEF VALVE |

Figure 15. Handpump Schematic: Standard Stroke MHP Handpump for 785C Springless Double-Acting



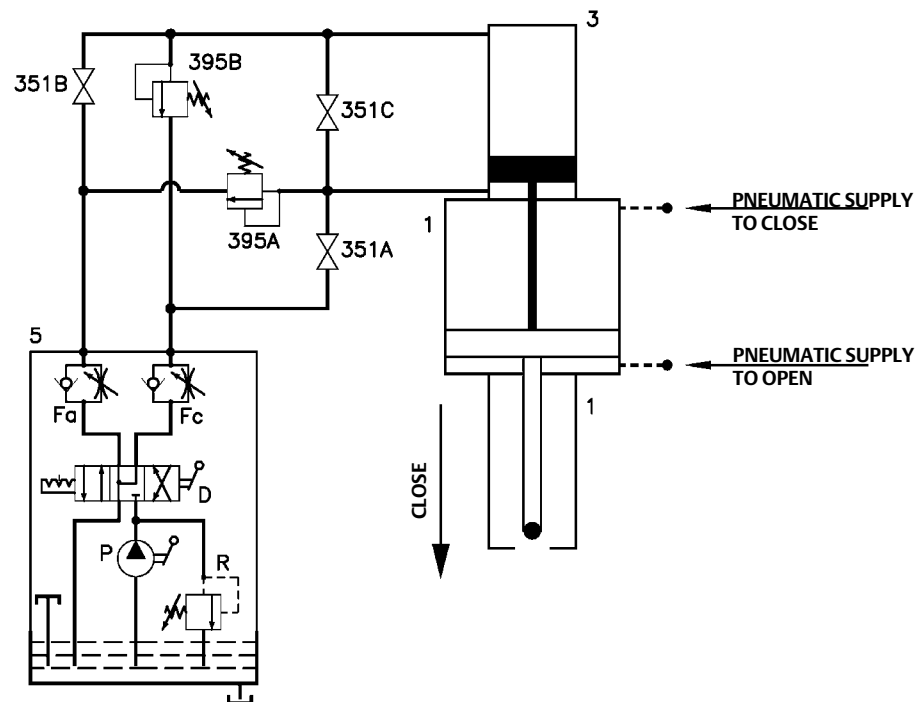
PNEUMATIC REMOTE CONTROL TO OPEN
PRESSURIZE THE OPENING PNEUMATIC SUPPLY LINE.
THE OPENING TIME IS ADJUSTABLE BY THE FLOW REGULATOR 5-Fa.

PNEUMATIC REMOTE CONTROL TO CLOSE
PRESSURIZE THE OPENING PNEUMATIC SUPPLY LINE.
THE CLOSING TIME IS ADJUSTABLE BY THE FLOW REGULATOR 5-Fc.

EMERGENCY MANUAL OPERATION
DE-PRESSURIZE BOTH PNEUMATIC SUPPLY LINE AND OPEN
BOTH STOP VALVES 351A/B.
SELECT BY THE VALVE "D" THE OPENING OR CLOSING OPERATION
AND ACTUATE THE HAND PUMP "P".
CLOSE THE STOP VALVE 351A TO KEEP THE ACTUATOR IN OPEN
POSITION OR CLOSE THE STOP VALVE 351B TO KEEP THE
ACTUATOR IN CLOSED POSITION.
NOTE: THE VALVE "D" MUST BE IN "REMOTE CONTROL" POSITION
AND THE STOP VALVES 351A AND 351B MUST BE OPEN TO ALLOW
THE OPERATION WITH GAS SUPPLY.

- | | |
|-----|---|
| 1 | DOUBLE-ACTING PNEUMATIC LINEAR ACTUATOR |
| 3 | HYDRAULIC CYLINDER |
| 5 | MANUAL OVERRIDE |
| R | RELIEF VALVE |
| P | HAND PUMP |
| D | HAND OPERATED DIRECTIONAL CONTROL VALVE |
| Fa | UNIDIRECTIONAL FLOW REGULATOR (OPENING OPERATION) |
| Fc | UNIDIRECTIONAL FLOW REGULATOR (CLOSING OPERATION) |
| 351 | STOP VALVE |
| 395 | RELIEF VALVE |

Figure 16. Handpump Schematic: Fast Stroke MHQ Handpump Type 1 for 785C Springless Double-Acting



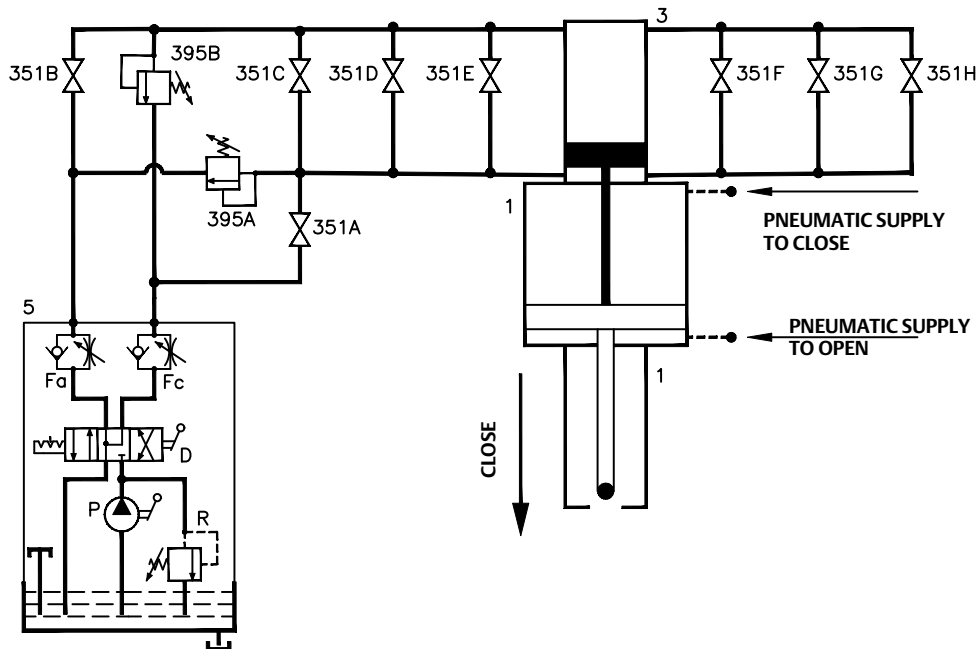
PNEUMATIC REMOTE CONTROL TO OPEN
PRESSURIZE THE OPENING PNEUMATIC SUPPLY LINE.
THE OPENING TIME IS ADJUSTABLE BY THE FLOW REGULATOR 5-Fa.

PNEUMATIC REMOTE CONTROL TO CLOSE
PRESSURIZE THE OPENING PNEUMATIC SUPPLY LINE.
THE CLOSING TIME IS ADJUSTABLE BY THE FLOW REGULATOR 5-Fc.

EMERGENCY MANUAL OPERATION
DE-PRESSURIZE BOTH PNEUMATIC SUPPLY LINE AND OPEN BOTH
STOP VALVES 351C AND OPEN BOTH STOP VALVES 351A/B.
SELECT BY THE VALVE "D" THE OPENING OR CLOSING OPERATION
AND ACTUATE THE HAND PUMP "P".
CLOSE THE STOP VALVE 351A TO KEEP THE ACTUATOR IN OPEN
POSITION OR CLOSE THE STOP VALVE 351B TO KEEP THE
ACTUATOR IN CLOSED POSITION.
NOTE: THE VALVE "D" MUST BE IN "REMOTE CONTROL" POSITION
AND THE STOP VALVES 351 MUST BE OPEN TO ALLOW THE
OPERATION WITH GAS SUPPLY.

- | | |
|-----|--|
| 1 | DOUBLE-ACTING PNEUMATIC LINEAR ACTUATOR |
| 3 | HYDRAULIC CYLINDER |
| 5 | MANUAL OVERRIDE |
| | R — RELIEF VALVE |
| | P — HAND PUMP |
| | D — HAND OPERATED DIRECTIONAL CONTROL VALVE |
| | Fa — UNIDIRECTIONAL FLOW REGULATOR (OPENING OPERATION) |
| | Fc — UNIDIRECTIONAL FLOW REGULATOR (CLOSING OPERATION) |
| 351 | STOP VALVE |
| 395 | RELIEF VALVE |

Figure 17. Handpump Schematic: Fast Stroke MHQ Handpump Type 2 for 785C Springless Double-Acting



PNEUMATIC REMOTE CONTROL TO OPEN
PRESSURIZE THE OPENING PNEUMATIC SUPPLY LINE.
THE OPENING TIME IS ADJUSTABLE BY THE FLOW REGULATOR 5-Fa.

PNEUMATIC REMOTE CONTROL TO CLOSE
PRESSURIZE THE CLOSING PNEUMATIC SUPPLY LINE.
THE CLOSING TIME IS ADJUSTABLE BY THE FLOW REGULATOR 5-Fc.

EMERGENCY MANUAL OPERATION

DE-PRESSURIZE BOTH PNEUMATIC SUPPLY LINE, OPEN BOTH STOP VALVES 351A/B AND CLOSE THE STOP VALVES 351C/D/E/F/G/H. SELECT BY THE VALVE "D" THE OPENING OR CLOSING OPERATION AND ACTUATE THE HAND PUMP "P". CLOSE THE STOP VALVE 351A TO KEEP THE ACTUATOR IN OPEN POSITION OR CLOSE THE STOP VALVE 351B TO KEEP THE ACTUATOR IN CLOSED POSITION.
NOTE: THE VALVE "D" MUST BE IN "REMOTE CONTROL" POSITION AND THE STOP VALVES 351 MUST BE OPEN TO ALLOW THE OPERATION WITH GAS SUPPLY.

- | | |
|-----|--|
| 1 | DOUBLE-ACTING PNEUMATIC LINEAR ACTUATOR |
| 3 | HYDRAULIC CYLINDER |
| 5 | MANUAL OVERRIDE |
| | R — RELIEF VALVE |
| | P — HAND PUMP |
| | D — HAND OPERATED DIRECTIONAL CONTROL VALVE |
| | Fa — UNIDIRECTIONAL FLOW REGULATOR (OPENING OPERATION) |
| | Fc — UNIDIRECTIONAL FLOW REGULATOR (CLOSING OPERATION) |
| 351 | STOP VALVE |
| 395 | RELIEF VALVE |

Actuator Mounting

The following procedure describes how to mount a 785C actuator on a push down to close valve so that the piston rod to valve plug stem connection allows full travel and proper shutoff. Key numbers referenced in the following steps are shown in figures 24 through 38 and 48. If you purchase a 785C actuator for field installation on a control valve, mount the actuator on the valve and secure it to the bonnet with the bonnet-to-actuator bolts. The stem connection should then be made up to clamp the actuator stem and valve plug stem together to provide proper valve travel.

⚠ WARNING

When moving the piston rod with loading pressure applied, exercise caution to keep hands and tools out of the piston rod travel path. If the loading pressure is accidentally disconnected, personal injury and property damage is possible if something is caught between the piston rod and other control valve parts.

NOTICE

The 785C spring extend actuator spring load will force the piston rod to extend out of the cylinder, and it can come into contact with the valve stem during actuator mounting.

If the valve stem is allowed to remain in the up position (towards the actuator) during mounting, it can interfere with the actuator mounting, possibly damage valve stem threads or bend the valve stem. Be sure the valve stem is pushed down (into the valve body), away from the actuator while mounting.

To avoid damaging the valve plug seating surfaces, do not rotate the valve plug while it is seated. Also avoid damage to the valve plug stem by careful use of tools during travel adjustment.

1. Using the given lifting eye bolts (key 2215), hoist the actuator vertically oriented. Slowly lower it over the valve taking care not to contact the stem in manner that could cause damage.
2. Once the actuator is seated on the bonnet yoke, install the studs through the yoke mounting plate. Install the nuts and tighten to the appropriate torque as specified in the applicable valve instruction manual.

⚠ CAUTION

Before pressurizing the cylinder, ensure the plastic plugs are removed from the pneumatic cylinder and replaced with appropriate metal plugs or other pressure-retaining devices.

3. Starting with the piston (key 2206) at the top of the pneumatic cylinder, manually, or with air pressure, extend the piston rod (key 2350 or 2402) to the specified valve travel.
4. With the valve plug on the seat, attach the valve stem connector (key 4301) by inserting the socket head cap screws (key 4302), clamping the piston rod (key 2350) to the valve stem. Make sure to attach the travel indicator (key 5000) and anti-rotator plate (key 4850) if supplied. Confirm proper operation and check travel, travel indicator adjustment, etc. before placing the actuator into operation.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any spring pre-compression.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Instructions are given below for complete disassembly of the actuator, seal replacement, and O-ring replacement. When inspection or repair is necessary, disassemble the actuator only as far as is required to accomplish the job. Key numbers referenced in the following steps are shown in figures 18 through 53.

Actuator Removal

The following procedure is for the removal of the actuator from the valve.

⚠ WARNING

To avoid personal injury or equipment damage, use proper lifting and rigging practices while lifting the actuator assembly.

To avoid personal injury due to the sudden uncontrolled movement of parts, do not loosen the stem connector hex nuts when the stem connector has spring force applied to it.

1. Ensure the valve and actuator are de-energized (mechanical, pneumatic, and electric) and appropriately isolated. Disconnect the actuator tubing from the pressure connections on the pneumatic cylinder head flange and end flange (key 2201 and 2210) and positioner. Provisions may need to be made to the actuator and spring if the design is spring extended.

For 785C Spring Extend actuator: It may be necessary to apply a temporary loading pressure to the bottom cylinder pressure connection to move the piston rod away from the valve stem during removal. If it is not possible to provide a temporary loading pressure, exercise caution when removing the actuator to prevent damage or personal injury.

2. Disconnect the stem connection by removing socket head cap screws (key 4302) from the valve stem connector (key 4301).

3. Remove the bonnet-to-actuator bolting securing the actuator to the bonnet. Make sure the actuator is supported and secured by other means prior to loosening nuts.
4. Using the lifting points provided (key 2215), hoist the actuator vertically taking care not to contact the stem in a manner that would cause damage.

Disassembling the Pneumatic Cylinder

The following procedure is for the replacement of the internal piston seals, bearing seals, and O-rings (see figure 19):

1. Complete Actuator Removal procedures per the applicable section of this instruction manual. Ensure the actuator is de-energized and isolated from the process.
2. Loosen the tie-rod hex nuts (key 2212) in a crisscross pattern to remove the pneumatic cylinder tie rod bolts (key 2213).
3. Remove the top cylinder end flange (key 2210) using the lifting lugs.
4. Remove the tie rods (key 2213). Remove the cylinder (key 2209) from the head flange (key 2201).

For a **partial replacement** of the pneumatic cylinder seals (namely, to replace all the seals with the exception of the head flange seal, (key 2102, 2107 and 2202), proceed to the Replacing Pneumatic Cylinder Seals section .

For complete **total replacement** of the pneumatic cylinder seals (namely, to replace all the seals), the pneumatic cylinder disassembly procedure proceed to step 5.

5. Unscrew the piston (key 2206) from the actuator stem using the two threaded holes (for actuator sizes 280 - 435 thread size is M10; for sizes 485 - 685 thread size is M16) by rotating counter-clockwise. Then lift and remove the piston from the actuator stem. Retain the washer (key 2205) located beneath the piston on to the stem. This operation is facilitated by the presence of threaded holes (figure 18).
6. Loosen and remove the fasteners holding the head flange (key 2201, figure 18 and 21).
7. Lift and remove the head flange (key 2201) from the spring can of 785C Spring Return Actuator or yoke of 785C Springless Actuator.

Figure 18. 785C Pneumatic Cylinder Components

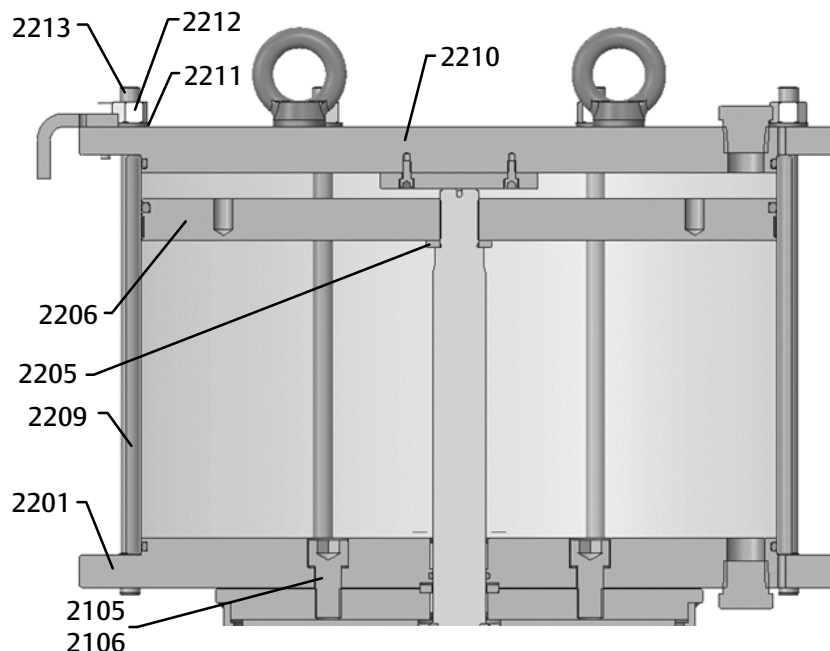
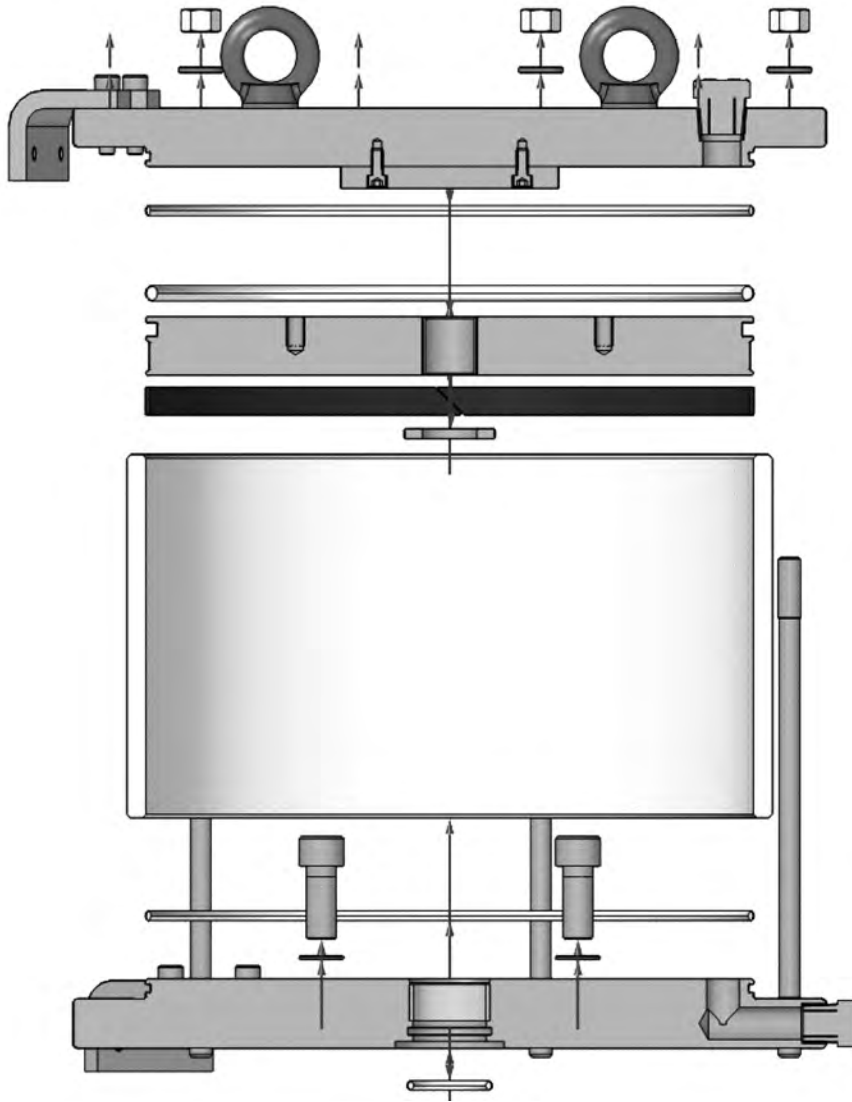


Figure 19. 785C Actuator Pneumatic Cylinder Components Disassembly Sequence

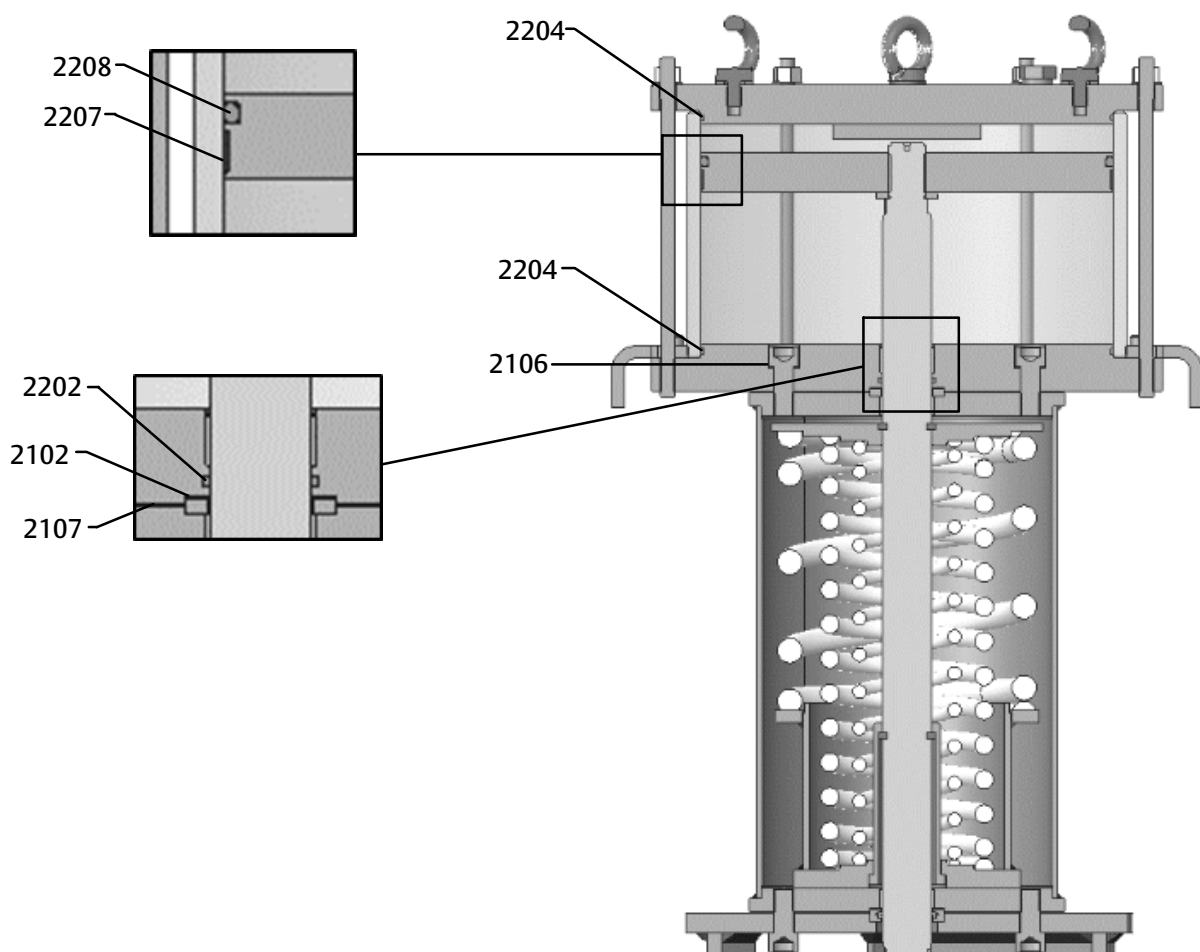


Replacing the Pneumatic Cylinder Seals

When the pneumatic cylinder is totally disassembled, all the seals can be replaced referencing figures 18, 34, 35, and 36. Pneumatic cylinder seals might include piston rod seal (key 2202), end flange seal (key 2204), piston sliding ring (key 2207), piston outside seal (key 2208), scraper ring (key 2102), washer (key 2106), gasket (key 2107), O-ring (key 2222) (only for with manual handpump).

1. Thoroughly clean the slots and housings of seals and sliding ring; lubricate with protective oil or with a thin film of grease. Inspect all parts, including the piston rod (key 2350) and cylinder tube (key 2209), for damage and wear.
2. Put the seals and sliding ring accurately in place on the relevant component, being careful that the material does not get pinched or damaged.
3. Grease and lubricate the seals in their housings and the sliding ring. See table 11 for recommended lubricants.

Figure 20. Typical Sectional View of 785C Spring Return Actuator Pneumatic Cylinder Seals



NOTE: KEY 2222 PART NOT SHOWN (ACTUATOR WITH HANDPUMP ONLY)

Figure 21. Threaded Holes in Pneumatic Cylinder



Assembling the Pneumatic Cylinder

The cylinder is reassembled by following in reverse order the sequence described in section Disassembling the Pneumatic Cylinder. The screws must be tightened properly. Refer to table 10.

If only a partial replacement of the pneumatic cylinder seals has been performed, the pneumatic cylinder assembly procedure starts from step 3.

1. Ensure the seals (key 2102, 2107 and 2202) of the head flange (key 2201) have been replaced, lubricated, and are properly seated.
2. Install the head flange (key 2201) on to the spring cylinder (in case of 785C spring return actuator) or on to the yoke (in case of 785C springless actuator).
3. Place the washers (key 2106).
4. Lubricate bolts (key 2105) and torque to values given in table 10.
5. Ensure the seal (key 2204) of the head flange (key 2201) is replaced, lubricated, and properly seated.
6. Place the washer (key 2205) on the stem. Thread the piston (key 2206) on to the stem. Rotate clockwise until it seats on the piston then turn another 1/4 turn.
7. Ensure the seal and gasket (key 2207 and 2208) of the piston (key 2206) are replaced and properly seated. Make sure the seal is well lubricated.
8. Lift the cylinder (key 2209) and put it back in place by performing the operations below:
 - a. Thoroughly clean the cylinder (key 2209) inner surface and ensure the surface nor the chamfers are damaged.
 - b. Lubricate the entire inner surface and chamfers.
 - c. Slide the cylinder (key 2209) onto the piston taking care not to damage the cylinder inner surface, piston seal (key 2208), gasket (key 2207) and the head flange seal (key 2204).
 - d. The full mating surface of the cylinder (key 2209) should rest against the head flange (key 2201). The cylinder (key 2209) is not provided with screw interfaces for handling purposes. Use padded clamps or jaws to prevent damaging.
9. Ensure the seal (key 2204) of the top end flange (key 2210) is replaced and properly seated.
10. Assemble the end flange (key 2210) by centering it with the inside diameter of the cylinder (key 2209), taking care not to damage the seal (key 2204). The full surface of the end flange should rest against the mating cylinder (key 2209) face. Align the top and bottom end flange (key 2210) tie rod holes.
11. Screw each tie rod (key 2213) back in its housing on the head flange.
12. Install the washers (key 2211) and tighten the nuts (key 2212) on the tie rods (key 2213) in a crisscross pattern to the appropriate torque per table 10.
13. Refer to the Actuator Mounting section of this manual for instructions on mounting and reinstalling the actuator onto the valve. As best practice, check for leakage after installation for all sealing surfaces.

Table 10. Tie Bolt Torque⁽¹⁾

BOLT DIAMETER	TIE ROD MATERIAL	NUT MATERIAL	TORQUE	
			N•m	lbf•ft
M10 x 1.5	ASTM A320-L7	ASTM A194 GR 7 S3	40	30
M12 x 1.75			70	52
M16 x 2			160	118
M20 x 2.5			320	236
M24 x 3			550	406
M27 x 3			800	590
M10 x 1.5	ASTM A320 B8M CL-2	EN ISO3506-2 A4-80	30	23
M12 x 1.75			58	43
M16 x 2			130	96
M20 x 2.5			250	185
M24 x 3			440	325
M27 x 3			535	395

1. For other bolting materials or lubricants contact your [Emerson sales office](#) for torque information.

Lubrication

The type of grease used and recommended for lubrication purposes at normal operating temperature, is described in table 11.

Table 11. Recommended Lubricant

MANUFACTURER	AGIP
TYPE	GR MU/EP2
NLGI GRADE	2
WORKED PENETRATION (DMM)	280
DROPPING POINT ASTM (°C)	185
ISO GRADE	X2
EQUIVALENT GREASE	ESSO BEACON EP2 BP GREASE LTX2 SHELL ALVANIA GREASE R2 ARAL ARALUB HL2 CHEVRON DURALITH GREASE EP2 CHEVRON SPHEEROL AP2 TEXACO MULTIFAK EP2 MOBILPLEX 47 PETROMIN GREASE EP2

Check and Restore Manual Handpump Hydraulic Oil Level

During the actuator operation, the oil tank has to be closed (not in connection with the atmosphere). To avoid cavitation, it is necessary to proceed as follows to check the oil tank oil level.

Refer to figure 45 and 46 unless otherwise indicated:

1. Remove the oil tank dipstick (key 2751-1.7).
2. Move the actuator into the open position.
3. Check that the oil level in the oil tank (key 2751-4) corresponds to the maximum level mark of the dipstick (figure 22).
4. With the dipstick still removed, move the actuator to the closed position using the handpump.

5. Reinstall and tighten the dipstick.

To replace or add oil, proceeding as follow:

1. Remove the dipstick (key 2751-1.7) from the tank cover (key 2751-22).
2. To drain oil, unscrew the plug (key 2751-27) and remove the washer (key 2751-9).

Note

If dirt and/or sludge is found in the oil drained from the tank, before filling with new oil in the tank, disassemble the oil tank tube by unscrewing the two cap nuts (key 2751-2) and clean the internal surfaces of the tank. If necessary replace the tank O-ring (key 2751-21).

3. Reinstall the washer (key 2751-9) and tighten the plug (key 2751-27) onto the plate (key 2751-11). Pour the new oil into the tank through the dipstick hole on the cover (key 2751-22).
4. Reinstall and tighten the dipstick (key 2751-1.7).
5. If the oil in the tank is below the minimum level mark (figure 22) add additional oil per table 12.

Figure 22. Hydraulic Manual Handpump Dipstick Oil Level Mark

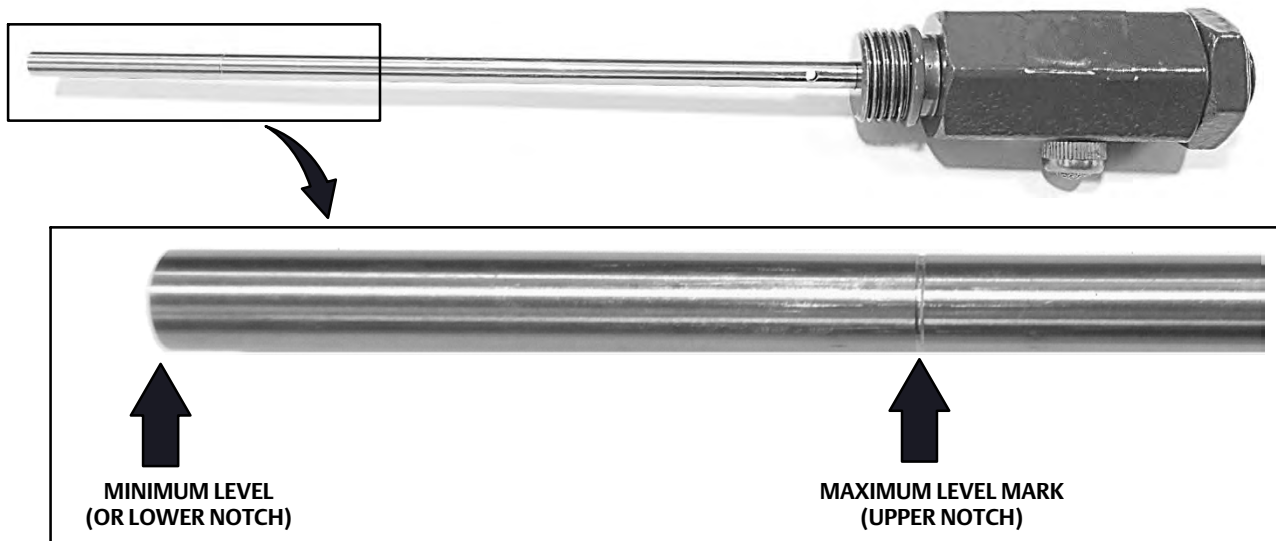


Table 12. Handpump Hydraulic Oil

Lower Temperature	Hydraulic Oil
Standard: -20 to 100 °C (-4 to 212 °F)	AGIP ARNICA 22 or equivalent oils (SHELL TELLUS PLUS 22, CHEVRON HYDRAULIC OIL AW ISO 22, MOBIL DTE22, EXXON UNIVIS N22, EQUIVIS ZS22, BP ENERGOL HLP-HM22, CASTROL DYSPIN AWS22)
Low Temperature Options: -40 to 100°C (-40 to 212°F) or -60 to 100°C (-76 to 212°F)	Aeroshell Fluid 41

Disassembling the Handpump Hydraulic Cylinder

WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

If there are leaks in the 785C Actuator manual handpump hydraulic cylinder, a malfunction in the mechanical components, or in case of scheduled preventive maintenance, the actuator must be disassembled, and the seals must be replaced with reference to the sectional drawings and following procedures:

1. Deenergize the actuator and valve assembly.
2. Drain the hydraulic fluid from the piston via the drain ports.
3. Remove the nuts (key 2714) from the tie rods (key 2713) at the end flange (key 2712) side.
4. Slide off the end flange and the hydraulic cylinder (key 2711).
5. Slide off the piston rod (key 2706) from the head flange (key 2701).

Handpump Hydraulic Cylinder Seals Replacement

1. Prior to reassembly check that the actuator components are in good condition.
2. Lubricate all mating surfaces with recommended lubricant (see table 11).
3. If the O-ring must be replaced, remove the existing one from its groove, clean the groove carefully and lubricate it with protective oil film. Assemble the new O-ring into its groove and lubricate.
4. Replace the O-rings (key 2708) of the head flange (key 2701).
5. Replace the O-ring (key 2708) of the end flange (key 2712).

For replacement of piston rod seal ring (key 2705) and of the O-ring (key 2704) proceed as follows:

1. Remove the existing PTFE seal ring (key 2705) and the O-ring (key 2704) from their groove.
2. Clean the groove carefully and lubricate.
3. Assemble the new O-ring (key 2704) into its groove and lubricate.
4. Assemble the new PTFE seal ring (key 2705) into the flange groove, on the rubber O-ring (key 2704), by bending it. Take care bend the seal the least amount required.
5. Enlarge the seal ring with your fingers to restore its round shape. Pay attention not to utilize any tools, which can damage the seal ring.

For replacement of piston rod seal ring (key 2710) and of the O-ring (key 2709) proceed as follows:

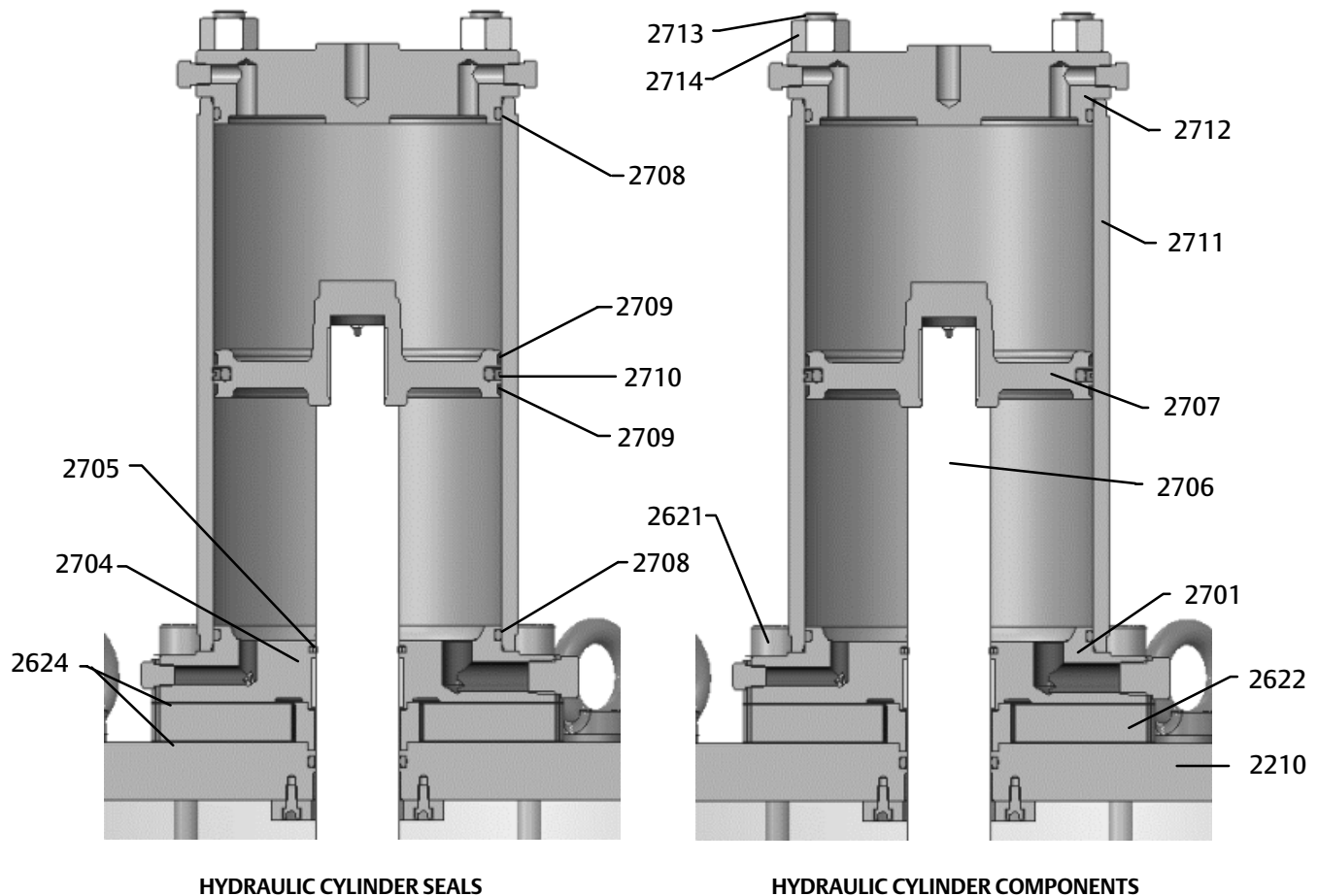
1. Remove the existing PTFE seal ring (key 2710) and the O-ring (key 2709) from their groove.
2. Clean the groove carefully and lubricate.
3. Assemble the new O-ring (key 2709) into its groove and lubricate.
4. Assemble the new PTFE seal ring (key 2710) on its rubber O-ring by introducing one side into the groove and then enlarge it with your fingers so as to seat it into the groove. Take care to enlarge it uniformly without any tools which could possibly damage it. The elastic memory of the of the PTFE the seal ring will allow the ring to shrink back to its previous dimension.

Handpump Hydraulic Cylinder Reassembling

1. Assemble the new gasket (key 2624) after cleaning the surfaces of pneumatic cylinder head flange (key 2210), spacer (key 2622) and head flange hydraulic (key 2701) which are in contact.

2. Assemble the head flange and tighten the screws (key 2621) to the recommended torque (see table 10).
3. Clean and lubricate the piston rod (key 2706) surface, particularly that of the bevel, and insert it into the head flange hole, taking care not to damage the PTFE seal ring (key 2705). The piston rod bevel has to enlarge the seal ring.
4. Carefully clean the inside of the tube (key 2711) and check that the entire surface, particularly that of the bevels, is not damaged. Lubricate the tube inside surface and the bevels at the ends.
5. Slide the tube onto the piston taking care not to damage the PTFE seal ring (key 2710). The tube bevel has to smoothly compress the seal ring. Take care to not damage the head flange O-ring (key 2708).
6. Assemble the end flange (key 2708) by centering it on the inside diameter of the tube, taking care not to damage the O-ring (key 2708).
7. Assemble the nuts (key 2714) onto the tie rods (key 2713). Tighten the nuts to the recommended torque per table 10, alternating between opposite corners.

Figure 23. 785C MHP/MHQ Hydraulic Cylinder



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Other Maintenance Specifications

Table 13. Fisher 785C Series Actuator Pneumatic Cylinder Seal Replacement Information⁽¹⁾

CYLINDER, DN	TRAVEL (mm)	MANUAL OVERRIDE	CYLINDER			NUT / TIE ROD TYPE	END FLANGE	HEAD FLANGE	PISTON	
			DN (mm)	Height (mm)	Weight (kg)	Thread	Weight (kg)	Weight (kg)	Weight (kg)	Lug Thread
280	102	0	280	195	12.7	M12x1.75	19.9	29.7	14.7	2x M10x1.5
335			335	195	20.3	M12x1.75	29.4	39.7	21.3	2x M10x1.5
385			385	195	20.3	M12x1.75	37.4	50.5	28.3	2x M10x1.5
435			435	195	23.7	M12x1.75	46.5	62.8	36.2	2x M10x1.5
485			485	205	28.8	M16x2	62.8	118.2	49.6	2x M16x2
535			535	205	32.8	M16x2	79.8	140	55.1	2x M16x2
585			585	218	39.4	M16x2	108	163.6	76.3	2x M16x2
635			635	218	52.3	M16x2	126.4	192.1	92.5	3x M16x2
685			685	230.5	57.6	M16x2	139.7	251.8	117.7	2x M16x2
280		MHW	280	232	15.1	M12x1.75	19.9	29.7	14.7	2x M10x1.5
335			335	232	20.3	M12x1.75	29.4	39.7	21.3	2x M10x1.5
385			385	232	24.1	M12x1.75	37.4	50.5	28.3	2x M10x1.5
435		MHP/MHQ	435	229	27.9	M12x1.75	46.5	62.8	36.2	2x M10x1.5
485			485	242	34	M16x2	62.8	118.2	49.6	2x M16x2
535			535	244	39	M16x2	79.8	140	55.1	2x M16x2
585			585	252	45.5	M16x2	108	163.6	76.3	2x M16x2
635			635	253	60.7	M16x2	126.4	192.1	92.5	3x M16x2
685			685	269.5	67.3	M16x2	139.7	251.8	117.7	2x M16x2
1. The cylinder DN, the travel and the available manual override can be read from the model string, e.g. PLAS-100K-335-13K-115-CL-SE-F2-0000.										
280	203	0	280	296	19.3	M12x1.75	19.9	29.7	14.7	2x M10x1.5
335			335	296	30.8	M12x1.75	29.4	39.7	21.3	2x M10x1.5
385			385	296	30.8	M12x1.75	37.4	50.5	28.3	2x M10x1.5
435			435	296	36	M12x1.75	46.5	62.8	36.2	2x M10x1.5
485			485	306	43	M16x2	62.8	118.2	49.6	2x M16x2
535			535	306	49	M16x2	79.8	140	55.1	2x M16x2
585			585	319	57.7	M16x2	108	163.6	76.3	2x M16x2
635			635	319	76.5	M16x2	126.4	192.1	92.5	3x M16x2
685			685	331.5	82.8	M16x2	139.7	251.8	117.7	2x M16x2
280		MHW	280	333	21.7	M12x1.75	19.9	29.7	14.7	2x M10x1.5
335			335	333	29.1	M12x1.75	29.4	39.7	21.3	2x M10x1.5
385			385	333	34.6	M12x1.75	37.4	50.5	28.3	2x M10x1.5
435		MHP/MHQ	435	330	40.2	M12x1.75	46.5	62.8	36.2	2x M10x1.5
485			485	343	48.2	M16x2	62.8	118.2	49.6	2x M16x2
535			535	345	55.1	M16x2	79.8	140	55.1	2x M16x2
585			585	353	63.7	M16x2	108	163.6	76.3	2x M16x2
635			635	354	84.9	M16x2	126.4	192.1	92.5	3x M16x2
685			685	370.5	92.5	M16x2	139.7	251.8	117.7	2x M16x2
1. The cylinder DN, the travel and the available manual override can be read from the model string, e.g. PLAS-100K-335-13K-216-CL-SF-F2-0000										

-continued-

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Table 13. Fisher 785C Series Actuator Pneumatic Cylinder Seal Replacement Information⁽¹⁾ (continued)

CYLINDER, DN	TRAVEL (mm)	MANUAL OVERRIDE	CYLINDER			NUT / TIE ROD TYPE	END FLANGE	HEAD FLANGE	PISTON	
			DN (mm)	Height (mm)	Weight (kg)	Thread	Weight (kg)	Weight (kg)	Weight (kg)	Lug Thread
280	305	0	280	398	25.5	M12x1.75	19.9	29.7	14.7	2x M10x1.5
335			335	398	34.8	M12x1.75	29.4	39.7	21.3	2x M10x1.5
385			385	398	41.4	M12x1.75	37.4	50.5	28.3	2x M10x1.5
435			435	398	49.8	M12x1.75	46.5	62.8	36.2	2x M10x1.5
485			485	408	57.3	M16x2	62.8	118.2	49.6	2x M16x2
535			535	408	66	M16x2	79.8	140	55.1	2x M16x2
585			585	421	76.1	M16x2	108	163.6	76.3	2x M16x2
635			635	421	101.1	M16x2	126.4	192.1	92.5	3x M16x2
685			685	433.5	108.3	M16x2	139.7	251.8	117.7	2x M16x2
280		MHW	280	435	27.9	M12x1.75	19.9	29.7	14.7	2x M10x1.5
335			335	435	38.1	M12x1.75	29.4	39.7	21.3	2x M10x1.5
385			385	435	45.3	M12x1.75	37.4	50.5	28.3	2x M10x1.5
435		MHP/MHQ	435	432	54	M12x1.75	46.5	62.8	36.2	2x M10x1.5
485			485	445	62.5	M16x2	62.8	118.2	49.6	2x M16x2
535			535	447	72.3	M16x2	79.8	140	55.1	2x M16x2
585			585	473	85.6	M16x2	108	163.6	76.3	2x M16x2
635			635	474	113.8	M16x2	126.4	192.1	92.5	3x M16x2
685			685	490.5	122.5	M16x2	139.7	251.8	117.7	2x M16x2
1. The cylinder DN, the travel and the available manual override can be read from the model string, e.g. PLAS-100K-335-13K-318-CL-SE-F2-0000										
280	406	0	280	500	32.1	M12x1.75	19.9	29.7	14.7	2x M10x1.5
335			335	500	43.8	M12x1.75	29.4	39.7	21.3	2x M10x1.5
385			385	500	52	M12x1.75	37.4	50.5	28.3	2x M10x1.5
435			435	500	62.5	M12x1.75	46.5	62.8	36.2	2x M10x1.5
485			485	510	71.7	M16x2	62.8	118.2	49.6	2x M16x2
535			535	510	82.5	M16x2	79.8	140	55.1	2x M16x2
585			585	523	94.6	M16x2	108	163.6	76.3	2x M16x2
635			635	523	125.6	M16x2	126.4	192.1	92.5	3x M16x2
685			685	535.5	133.8	M16x2	139.7	251.8	117.7	2x M16x2
280		MHW	280	537	34.5	M12x1.75	19.9	29.7	14.7	2x M10x1.5
335			335	537	47	M12x1.75	29.4	39.7	21.3	2x M10x1.5
385			385	537	55.9	M12x1.75	37.4	50.5	28.3	2x M10x1.5
435		MHP/MHQ	435	534	66.8	M12x1.75	46.5	62.8	36.2	2x M10x1.5
485			485	547	76.9	M16x2	62.8	118.2	49.6	2x M16x2
535			535	549	88.8	M16x2	79.8	140	55.1	2x M16x2
585			585	575	104	M16x2	108	163.6	76.3	2x M16x2
635			635	576	138.3	M16x2	126.4	192.1	92.5	3x M16x2
685			685	592.5	148	M16x2	139.7	251.8	117.7	2x M16x2
1. The cylinder DN, the travel and the available manual override can be read from the model string, e.g. PLAS-100K-335-13K-420-CL-SE-F2-0000										

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Table 13. Fisher 785C Series Actuator Pneumatic Cylinder Seal Replacement Information⁽¹⁾ (continued)

CYLINDER, DN	TRAVEL (mm)	MANUAL OVERRIDE	CYLINDER			NUT / TIE ROD TYPE	END FLANGE	HEAD FLANGE	PISTON	
			DN (mm)	Height (mm)	Weight (kg)	Thread	Weight (kg)	Weight (kg)	Weight (kg)	Lug Thread
280	508	0	280	601	38.6	M12x1.75	19.9	29.7	14.7	2x M10x1.5
335			335	601	52.6	M12x1.75	29.4	39.7	21.3	2x M10x1.5
385			385	601	62.5	M12x1.75	37.4	50.5	28.3	2x M10x1.5
435			435	601	75.1	M12x1.75	46.5	62.8	36.2	2x M10x1.5
485			485	611	85.9	M16x2	62.8	118.2	49.6	2x M16x2
535			535	611	98.8	M16x2	79.8	140	55.1	2x M16x2
585			585	624	112.9	M16x2	108	163.6	76.3	2x M16x2
635			635	624	149.8	M16x2	126.4	192.1	92.5	3x M16x2
685			685	636.5	159	M16x2	139.7	251.8	117.7	2x M16x2
280		MHW	280	638	41	M12x1.75	19.9	29.7	14.7	2x M10x1.5
335			335	638	55.8	M12x1.75	29.4	39.7	21.3	2x M10x1.5
385			385	638	66.4	M12x1.75	37.4	50.5	28.3	2x M10x1.5
435		MHP/MHQ	435	635	79.4	M12x1.75	46.5	62.8	36.2	2x M10x1.5
485			485	648	91.1	M16x2	62.8	118.2	49.6	2x M16x2
535			535	650	105.1	M16x2	79.8	140	55.1	2x M16x2
585			585	676	122.3	M16x2	108	163.6	76.3	2x M16x2
635			635	677	162.6	M16x2	126.4	192.1	92.5	3x M16x2
685			685	693.5	173.2	M16x2	139.7	251.8	117.7	2x M16x2
1. The cylinder DN, the travel and the available manual override can be read from the model string, e.g. PLAS-100K-335-13K-521-CL-SE-F2-0000										
280	610	0	280	703	45.1	M12x1.75	19.9	29.7	14.7	2x M10x1.5
335			335	703	61.5	M12x1.75	29.4	39.7	21.3	2x M10x1.5
385			385	703	73.2	M12x1.75	37.4	50.5	28.3	2x M10x1.5
435			435	703	87.9	M12x1.75	46.5	62.8	36.2	2x M10x1.5
485			485	713	100.2	M16x2	62.8	118.2	49.6	2x M16x2
535			535	713	115.3	M16x2	79.8	140	55.1	2x M16x2
585			585	726	131.3	M16x2	108	163.6	76.3	2x M16x2
635			635	726	174.3	M16x2	126.4	192.1	92.5	3x M16x2
685			685	738.5	184.5	M16x2	139.7	251.8	117.7	2x M16x2
280		MHW	280	740	47.5	M12x1.75	19.9	29.7	14.7	2x M10x1.5
335			335	740	64.8	M12x1.75	29.4	39.7	21.3	2x M10x1.5
385			385	740	77	M12x1.75	37.4	50.5	28.3	2x M10x1.5
435		MHP/MHQ	435	737	92.1	M12x1.75	46.5	62.8	36.2	2x M10x1.5
485			485	750	105.4	M16x2	62.8	118.2	49.6	2x M16x2
535			535	752	121.6	M16x2	79.8	140	55.1	2x M16x2
585			585	778	140.7	M16x2	108	163.6	76.3	2x M16x2
635			635	779	187.1	M16x2	126.4	192.1	92.5	3x M16x2
685			685	795.5	198.7	M16x2	139.7	251.8	117.7	2x M16x2
1. The cylinder DN, the travel and the available manual override can be read from the model string, e.g. PLAS-100K-335-13K-623-CL-SE-F2-0000										

Troubleshooting

Table 14. 785C Troubleshooting

Symptom	Common Possible Cause	Solution
Inadequate operation of actuator using handpump	Handpump control unit (key 2751) not in required vertical up orientation per figure 7	Contact your Emerson sales office to modify the handpump control unit into correct installation orientation per figure 7
	Handpump hydraulic oil level too low	Check and restore correct handpump hydraulic oil level
	Too much air within hydraulic cylinder	Contact your Emerson sales office to bleed the handpump hydraulic cylinder air
Pneumatic stroking speed too slow for actuator with handpump	Standard Stroke MHP handpump Engagement/Disengagement handle at “Manual Opening” or “Manual Closing” position	Set Standard Stroke MHP handpump Engagement/Disengagement handle to “REMOTE” position per figure 8 and the correct schematic figure 12, 14, or 15
	Fast Stroke MHQ handpump hydraulic cylinder bypass stop valve at close position	Open Fast Stroke MHQ handpump hydraulic cylinder bypass stop valve per the correct schematic in figure 11, 13, 16, or 17
	Flow restriction in hand pump or hydraulic system affecting actuator stroking speed	Contact your Emerson sales office to upgrade to 785C Fast Stroke MHQ handpump type 1 or type 2
	Flow restriction in pneumatic system affecting actuator stroking speed	Contact your Emerson sales office to investigate the stroking speed sizing problem
Single acting spring return actuator will not achieve full travel	Actuator venting port blocked	Clean venting side vent assemblies, e.g. Y602 vent
	Supply air pressure too low to fully extend/retract actuator	Increase supply air pressure back to actuator sizing required pressure
Actuator movement not smooth	Erratic, or jerky, actuator movement may indicate excessive actuator or valve friction	Contact your Emerson sales office to complete ValveLink scan of actuator and valve movement to identify if valve or actuator repair is required
Valve positioner out of calibration during fast stroking or high vibration	Severe application conditions affecting positioner or mounting kit	Contact your Emerson sales office to investigate the issue, and determine if upgrading to the high performance mounting kit is recommended

Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, refer to the serial number. When ordering replacement parts, also specify the key number, part name, using the Parts List.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Table 15. 785C Single-Acting Spring Return (Spring Restricts) Spare Part Kits

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	SPRING	MATERIAL	
			NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
			Parts Kit Number	
335	4	F1	R785X335C12	R785X335C32
385		F1	R785X385C12	R785X385C32
		F2		
435		F1	R785X435C22	R785X435C52
		F2	R785X435C12	R785X435C42
485		F1	R785X485C12	R785X485C32
		F2		
535		F1	R785X535C72	R785X535C92
		F2	R785X535C12	R785X535C32
585		F1	R785X585C72	R785X585C82
		F2		
635		F1	R785X635C22	R785X635C42
		F2		
685	F1	R785X685C12	R785X685C32	
	F2	R785X685C22	R785X685C42	
335	8	F1	R785X335C72	R785X335C82
385		F1	R785X385C22	R785X385C42
435		F1	R785X435C32	R785X435C62
485		F1	R785X485C22	R785X485C42
535		F1	R785X535C22	R785X535C42
585		F1	R785X585C22	R785X585C42
635		F1	R785X635C22	R785X635C42
685		F1	R785X685C22	R785X685C42

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Table 16. 785C Single-Acting Spring Return (Spring Extend, Fail Down) Spare Parts Kits

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	SPRING	MATERIAL	
			NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
			Parts Kit Number	
335	4	F1	R785X335C22	R785X335C42
		F2		
385		F1	R785X385C22	R785X385C42
		F2		
435		F1	R785X435C22	R785X435C52
		F2		
485		F1	R785X485C12	R785X485C32
		F2		
535		F1	R785X535C12	R785X535C32
		F2	R785X535C22	R785X535C42
585		F1	R785X585C12	R785X585C32
		F2	R785X585C22	R785X585C42
635		F1	R785X635C22	R785X635C42
		F2		
685		F1	R785X685C22	R785X685C42
	F2			
	F3			
335	8	F1	R785X335C22	R785X335C42
385		F1	R785X385C22	R785X385C42
		F2		
		F3	R785X385C12	R785X385C32
435		F1	R785X435C32	R785X435C62
		F2		
		F3		
485		F1	R785X485C22	R785X485C42
		F2		
		F3		
535		F1	R785X535C12	R785X535C32
		F2	R785X535C22	R785X535C42
		F3		
585		F1	R785X585C22	R785X585C42
		F2		
		F3		
635		F1	R785X635C22	R785X635C42
		F2		
	F3			
685	F1	R785X685C22	R785X685C42	
	F2			
	F3			

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Table 17. 785C Double-Acting Spring Return (Spring Retract, Fail Up) Spare Part Kits

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	SPRING PRELOAD CODE	SPRING	MATERIAL	
				NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
				Parts Kit Number	
280	4	7K	F1	R785X280C32	R785X280C62
		12K	F1		
		16K	F1	R785X280C42	R785X280C72
335	4	7K	F2	R785X335C12	R785X335C32
		12K	F1		
		16K	F1	R785X335C22	R785X335C42
		16K	F2		
		14K	F2		
		21K	F1		
385	4	16K	F1	R785X385C12	R785X385C32
		16K	F2	R785X385C22	R785X385C42
		20K	F1		
		21K	F2	R785X385C12	R785X385C32
		25K	F1		
435	4	16K	F1	R785X435C12	R785X435C42
		21K	F1		
		25K	F1		
		27K	F1	R785X435C22	R785X435C52
		22K	F2		
485	4	25K	F1	R785X485C72	R785X485C82
		33K	F1	R785X485C12	R785X485C32
		30K	F2		
535	4	34K	F1	R785X535C22	R785X535C42
585	4	34K	F1	R785X585C12	R785X585C32
685	4	38K	F1	R785X685C12	R785X685C32
		74k	F1	R785X685C22	R785X685C42
		83K	F2		
		75K	F3		
280	8	7K	F1	R785X280C32	R785X280C62
		12K	F1		
		16K	F1	R785X280C52	R785X280C82
335	8	7K	F1	R785X335C12	R785X335C32
		8K	F2	R785X335C22	R785X335C42
		12K	F1		
		16K	F2		
		21K	F1		
		16K	F1		
385	8	8K	F1	R785X385C12	R785X385C32
		12K	F1	R785X385C22	R785X385C42
		12K	F2		
		21K	F3	R785X385C12	R785X385C32
		13K	F1		
		16K	F1		
		17K	F1		
		21K	F1		
		22K	F1		
		29K	F1		
				R785X385C22	R785X385C42

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Table 17. 785C Double-Acting Spring Return (Spring Retract, Fail Up) Spare Part Kits (continued)

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	SPRING PRELOAD CODE	SPRING	MATERIAL	
				NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
				Parts Kit Number	
435	8	16K	F1	R785X435C32	R785X435C62
		21K	F1		
		25K	F1		
		27K	F1		
		17K	F2		
		16K	F3		
485	8	25K	F1	R785X485C12	R785X485C32
		34K	F1	R785X485C22	R785X485C42
		21K	F2		
		20K	F3		
535	8	34K	F1	R785X535C22	R785X535C42
		30K	F2		
		29K	F3		
585	8	34K	F1	R785X585C12	R785X585C32
		32K	F3	R785X585C22	R785X585C42
685	8	38K	F1	R785X685C22	R785X685C42
		51K	F1		
		49K	F2		
		64K	F3		
385	12	19K	F1	R785X385C22	R785X385C42
435	12	12K	F1	R785X435C12	R785X435C42
		23K	F1	R785X435C22	R785X435C52
485	12	23K	F1	R785X485C12	R785X485C32
535	12	32K	F1	R785X535C82	R785X535CA2
585	12	31K	F1	R785X585C22	R785X585C42
685	12	35K	F1	R785X685C82	R785X685CA2
435	16	18K	F1	R785X435C22	R785X435C52
485	16	18K	F1	R785X485C12	R785X485C32
535	16	29K	F1	R785X535C82	R785X535CA2
585	16	26K	F1	R785X585C22	R785X585C42
635	16	33K	F1	R785X635C72	R785X635C92
685	16	33K	F1	R785X685C72	R785X685C92

Table 18. 785C Double-Acting Spring Return (Spring Extend, Fail Down) Spare Part Kits

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	SPRING PRELOAD CODE	SPRING	MATERIAL	
				NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
				Parts Kit Number	
535	2	12K	F1	R785X535C12	R785X535C32
335	2	14K	F1	R785X335C22	R785X335C42
385	2	15K	F1	R785X385C22	R785X385C42
435	2	12K	F1	R785X435C22	R785X435C52
485	2	33K	F1	R785X485C72	R785X485C82
535	2	38K	F1	R785X535C12	R785X535C32
585	2	24K	F1	R785X585C12	R785X585C32
635	2	33K	F1	R785X635C12	R785X635C32

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Table 18. 785C Double-Acting Spring Return (Spring Extend, Fail Down) Spare Part Kits (continued)

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	SPRING PRELOAD CODE	SPRING	MATERIAL	
				NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
				Parts Kit Number	
280	4	7K	F1	R785X280C32	R785X280C62
		12K	F1		
		14K	F1		
		8K	F1	R785X280C42	R785X280C72
		11K	F1		
		16K	F1		
		16K	F2		
335	4	7K	F1	R785X335C12	R785X335C32
		12K	F1	R785X335C22	R785X335C42
		16K	F2		
		21K	F1		
385	4	16K	F1	R785X385C12	R785X385C32
		21K	F2		
		24K	F1		
		25K	F1		
435	4	16K	F1	R785X435C12	R785X435C42
		21K	F1		
		25K	F1		
		21K	F2	R785X435C32	R785X435C62
		36K	F1	R785X435C22	R785X435C52
485	4	25K	F1	R785X485C72	R785X485C82
		37K	F1	R785X485C22	R785X485C42
535	4	34K	F1	R785X535C22	R785X535C42
		58K	F1	R785X535C82	R785X535CA2
		67K	F1	R785X535C72	R785X535C92
585	4	34K	F1	R785X585C12	R785X585C32
		65K	F1		
		36K	F1	R785X585C72	R785X585C82
635	4	38K	F1	R785X635C12	R785X635C32
685	4	38K	F1	R785X685C12	R785X685C32
280	8	7K	F1	R785X280C32	R785X280C62
		12K	F1		
		14K	F1	R785X280C42	R785X280C72
		16K	F1	R785X280C52	R785X280C82
335	8	7K	F1	R785X335C12	R785X335C32
		8K	F1	R785X335C22	R785X335C42
		9K	F1		
		12K	F1		
		16K	F2		
		19K	F1		
		21K	F1		

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Table 18. 785C Double-Acting Spring Return (Spring Extend, Fail Down) Spare Part Kits (continued)

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	SPRING PRELOAD CODE	SPRING	MATERIAL	
				NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
				Parts Kit Number	
385	8	13K	F1	R785X385C12	R785X385C32
		16K	F1		
		17K	F1		
		21K	F1		
		22K	F1		
		29K	F1	R785X385C22	R785X385C42
		28K	F1		
435	8	12K	F1	R785X435C32	R785X435C62
		16K	F1		
		21K	F1		
		25K	F1		
		35K	F1	R785X435C22	R785X435C52
485	8	25K	F1	R785X485C12	R785X485C32
		32K	F1	R785X485C22	R785X485C42
535	8	19K	F1	R785X535C72	R785X535C92
		25K	F1	R785X535C22	R785X535C42
		34K	F1		
585	8	34K	F1	R785X585C12	R785X585C32
635	8	19K	F1	R785X635C22	R785X635C42
		38K	F1		
		55K	F1		
		67K	F1		
685	8	36K	F1	R785X685C22	R785X685C42
	8	38K	F1		
	8	73K	F1		
	8	81K	F1		
385	12	19K	F1	R785X385C22	R785X385C42
435	12	20K	F1	R785X435C22	R785X435C52
		23K	F1		
485	12	23K	F1	R785X485C12	R785X485C32
535	12	32K	F1	R785X535C82	R785X535CA2
585	12	31K	F1	R785X585C22	R785X585C42
635	12	35K	F1	R785X635C82	R785X635CA2
	12	45K	F1	R785X635C22	R785X635C42
685	12	35K	F1	R785X685C82	R785X685CA2
	12	49K	F1	R785X685C22	R785X685C42
435	16	18K	F1	R785X435C22	R785X435C52
485	16	18K	F1	R785X485C12	R785X485C32
535	16	29K	F1	R785X535C82	R785X535CA2
585	16	26K	F1	R785X585C22	R785X585C42
635	16	33K	F1	R785X635C72	R785X635C92
685	16	33K	F1	R785X685C72	R785X685C92

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Table 19. 785C Double-Acting Springless Spare Part Kits

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	MATERIAL	
		NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
		Parts Kit Number	
280	4, 8, 12, 16, 20, 24	R785X280C12	R785X280C22
335		R785X335C52	R785X335C62
385		R785X385C52	R785X385C62
435		R785X435C72	R785X435C82
485		R785X485C52	R785X485C62
535		R785X535C52	R785X535C62
585		R785X585C52	R785X585C62
635		R785X635C52	R785X635C62
685		R785X685C52	R785X685C62

Table 20. 785C Double-Acting Springless with Manual Override Spare Part Kits

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	MATERIAL	
		NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
		Parts Kit Number	
280	4, 8, 12, 16, 20, 24	R785X280M82	R785X280M72
335		R785X335M82	R785X335M72
385		R785X385M62	R785X385M52
435		R785X435M82	R785X435M72
485		R785X485M82	R785X485M72
535		R785X535M92	R785X535M82
585		R785X585M92	R785X585M82
635		R785X635MA2	R785X635M92
685		R785X685MA2	R785X685M92

Table 21. 785C Spring Return Actuators with Manual Override Spare Parts Kit

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	MAXIMUM PRELOAD	SPRING	MANUAL OVERRIDE	MATERIAL	
					NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
					Parts Kit Number	
280	4	7K	F1	Hand Wheel	R785X280M42	R785X280M12
		12K				
		14K ⁽¹⁾				
	8	7K				
		12K				
	4	8K ⁽¹⁾	F1	Hand Wheel	R785X280M52	R785X280M22
		11K ⁽¹⁾				
		16K				
		16K ⁽¹⁾	F2			
	8	14K ⁽¹⁾	F1			
		16K	F1	Hand Wheel	R785X280M62	R785X280M32

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Table 21. 785C Spring Return Actuators with Manual Override Spare Parts Kit (continued)

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	MAXIMUM PRELOAD	SPRING	MANUAL OVERRIDE	MATERIAL	
					NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
					Parts Kit Number	
335	4	7K	F1	Hand Wheel	R785X335M42	R785X335M12
		7K ⁽²⁾	F2			
		12K	F1			
	8	7K	F1	Hand Wheel	R785X335M52	R785X335M22
	2	14K	F1			
	4	14K ⁽²⁾	F2			
		16K	F1			
		16K	F2			
		13K	F2			
		21K	F1			
	8	8K	F1			
		8K ⁽²⁾	F2			
		9K ⁽¹⁾	F1			
		12K	F1			
		16K	F1			
		16K	F2			
		19K	F1			
		21K ⁽¹⁾	F1			
335	8	8K ⁽²⁾	F1	Hand Wheel	R785X335M62	R785X335M32
385	4	9K ⁽²⁾	F1	Hand Wheel	R785X385M32	R785X385M12
		9K ⁽²⁾	F2			
		16K	F1			
		21K	F2			
		24K ⁽¹⁾	F1			
		25K	F1			
	8	8K	F1			
		16K	F1			
		21K	F1			
		21K	F3			
		13K	F1			
		17K	F1			
		22K	F1			
385	2	15K	F1	Hand Wheel	R785X385M42	R785X385M22
	4	21K ⁽¹⁾	F1			
		16K	F2			
		20K ⁽²⁾	F1			
	8	9K ⁽²⁾	F1			
		12K	F1			
		12K	F2			
		28K ⁽¹⁾	F1			
		29K	F1			
	12	19K	F1			

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Table 21. 785C Spring Return Actuators with Manual Override Spare Parts Kit (continued)

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	MAXIMUM PRELOAD	SPRING	MANUAL OVERRIDE	MATERIAL	
					NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
					Parts Kit Number	
435	4	12K ⁽²⁾	F2	Hand Pump	R785X435M42	R785X435M12
		16K	F1			
		21K	F1			
		25K	F1			
	12	12K ⁽²⁾	F1			
435	2	12K ⁽¹⁾	F1	Hand Pump	R785X435M52	R785X435M22
	4	12K ⁽²⁾	F1			
		27K	F1			
		22K	F2			
		36K ⁽¹⁾	F1			
	8	35K ⁽¹⁾	F1			
	12	20K ⁽¹⁾	F1			
		23K	F1			
435	16	18K	F1	Hand Pump	R785X435M62	R785X435M32
	4	21K ⁽¹⁾	F2			
	8	11K ⁽²⁾	F1			
		12K	F1			
		27K	F1			
		17K	F2			
		16K	F1			
		16K	F3			
485	2	33K ⁽¹⁾	F1	Hand Pump	R785X485M42	R785X485M12
	4	25K	F1			
485	4	13K ⁽²⁾	F1	Hand Pump	R785X485M52	R785X485M22
		13K ⁽²⁾	F2			
		33K	F1			
		30K	F2			
	8	25K	F1			
	12	23K	F1			
	16	18K	F1			
485	4	37K ⁽¹⁾	F1	Hand Pump	R785X485M62	R785X485M32
	8	11K ⁽²⁾	F1			
		34K	F1			
		21K	F2			
		20K	F3			
		32K ⁽¹⁾	F1			
535	2	12K ⁽¹⁾	F1	Hand Pump	R785X535M42	R785X535M12
	2	38K ⁽¹⁾	F1			
	4	14K ⁽²⁾	F2			
		43K ⁽¹⁾	F1			
	8	40K ⁽¹⁾	F1			

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Table 21. 785C Spring Return Actuators with Manual Override Spare Parts Kit (continued)

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	MAXIMUM PRELOAD	SPRING	MANUAL OVERRIDE	MATERIAL	
					NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
					Parts Kit Number	
535	4	38K ⁽¹⁾	F2	Hand Pump	R785X535M52	R785X535M22
		34K	F1			
	8	13K ⁽²⁾	F1			
		30K	F2			
		29K	F3			
		34K	F1			
		25K ⁽¹⁾	F1			
535	4	14K ⁽²⁾	F1	Hand Pump	R785X535M62	R785X535M32
		67K ⁽¹⁾	F1			
	8	19K	F1			
535	4	58K ⁽¹⁾	F1	Hand Pump	R785X535M72	R785X535MA2
	12	32K	F1			
	16	29K	F1			
585	2	24K ⁽¹⁾	F1	Hand Pump	R785X585M52	R785X585M12
	4	34K	F1			
		51K ⁽¹⁾	F1			
		65K ⁽¹⁾	F1			
	8	34K	F1			
585	4	45K ⁽¹⁾	F2	Hand Pump	R785X585M62	R785X585M22
	8	16K ⁽²⁾	F1			
		49K ⁽¹⁾	F1			
		33K ⁽¹⁾	F2			
		32K	F3			
	12	31K	F1			
	16	26K	F1			
585	4	16K ⁽²⁾	F1	Hand Pump	R785X585M72	R785X585M42
		16K ⁽²⁾	F2			
		36K ⁽¹⁾	F1			
635	2	33K ⁽¹⁾	F1	Hand Pump	R785X635M52	R785X635M12
	4	38K ⁽¹⁾	F1			
635	12	35K ⁽¹⁾	F1	Hand Pump	R785X635M62	R785X635M22
635	4	19K ⁽²⁾	F1	Hand Pump	R785X635M72	R785X635M32
		19K ⁽²⁾	F2			
		62K ⁽¹⁾	F1			
		52K ⁽¹⁾	F2			
	8	17K ⁽²⁾	F1			
		19K ⁽¹⁾	F1			
		60K ⁽¹⁾	F1			
		40K ⁽¹⁾	F2			
		38K ⁽¹⁾	F3			
		38K ⁽¹⁾	F1			
		55K ⁽¹⁾	F1			
		67K ⁽¹⁾	F1			
		45K ⁽¹⁾	F1			
	12	45K ⁽¹⁾	F1			

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Table 21. 785C Spring Return Actuators with Manual Override Spare Parts Kit (continued)

CYLINDER SIZE	MAXIMUM TRAVEL, INCHES	MAXIMUM PRELOAD	SPRING	MANUAL OVERRIDE	MATERIAL	
					NBR (Standard Temperature)	Fluorosilicone (Low Temperature)
					Parts Kit Number	
635	16	33K	F1	Hand Pump	R785X635M82	R785X635M42
685	4	21K ⁽²⁾	F1	Hand Pump	R785X685M52	R785X685M12
		38K	F1			
685	12	35K	F1	Hand Pump	R785X685M62	R785X685M22
685	4	21K ⁽²⁾	F2	Hand Pump	R785X685M72	R785X685M32
		74K	F1			
		85K ⁽¹⁾	F2			
		75K	F3			
		83K ⁽²⁾	F2			
	8	21K ⁽²⁾	F1			
		38K	F1			
		51K	F1			
		49K	F2			
		64K	F3			
		36K ⁽¹⁾	F1			
		73K ⁽¹⁾	F1			
		81K ⁽¹⁾	F1			
	12	49K ⁽¹⁾	F1			
685	16	33K	F1	Hand Pump	R785X685M82	R785X685M42
Note: 1. Only available for spring extend (fail down) model. 2. Only available for spring retract (fail up) model.						

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description
1	785C Nameplate
2	Drive Screw
3	Travel Scale
4	Bushing
5	Vent Assembly
6	Nipple
7	Max Cylinder Pressure Warning Tag
8	Stem Connector Nuts
9	Bypass valve (see figure 4)
10	Tee (see figure 4)
11	Nipple (see figure 4)

1000 Nameplate Kits (figure 50)

Key	Description
1001	Linear Actuator Label
1002	Rivet
1003	Lifting Point Label
1004	Actuator Lifting Label

2000 Yoke (Spool) Assembly (figure 37)

Key	Description
2001	Yoke (Spool)
2002	Screw
2003	Screw
2004	Washer
2005	Screw
2006	Screw

2100 Repair Kit 785C Spring Return Assembly (figure 51 and 52)

Key	Description
2101	Scraper Ring Flange
2102*	Scraper Ring
2105	Screw
2106*	Washer
2107*	Gasket
2108	Washer
2109	Nut
2110	Screw

2200 Pneumatic Cylinder Assembly (figure 34, 35, and 36)

Key	Description
2201	Head Flange
2202*	O-Ring
2203	Bushing
2204*	O-Ring
2205	Washer
2206	Piston
2207*	Guide Sliding Ring, Piston
2208*	O-Ring
2209	Cylinder Tube
2210	End Flange
2211	Washer
2212	Nut
2213	Tie Rod
2214	Washer
2215	Eyebolt
2216	Plug
2217	End Stroke
2218	Screw
2219	Hub
2220	Screw
2221	Plug
2222*	O-Ring
2350	Piston Rod, Pneumatic Cylinder

2400 Spring Can (Spring Cartridge) Assembly (figure 38)

Key	Description
2401	Flange
2402	Rod
2403	Bushing
2404	Retainer Ring
2405	Piston Rod Guide Tube
2406	Flange
2407	Spring
2408	Spring
2409	Spring
2410	Calendered Sheet
2411	End Flange
2412	Lifting Eyelet
2413	Tube
2414	Plug

2600 Manual Handwheel Assembly (figure 39 and 40)

Key	Description
2601	Manual Handwheel
2601-1	Cover
2601-2*	Cover Gasket
2601-3	Engagement Level Pin
2601-4	Flange
2601-5	Fork
2501-6	Body
2501-7	Bush
2601-8*	Thrust Shoulder Washer
2601-9	Screw Nut

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Key	Description
2601-10	Plug
2601-11	Thrust Block Ring Nut
2601-12	Jack Screw
2601-13	Protection Pipe
2601-14	Spring
2501-15	Kit Cams & Pin
2601-16	Screw
2601-17	Screw
2601-18	Screw
2601-19*	O-Ring
2601-20*	O-Ring
2601-21*	O-Ring
2601-22	Pin
2601-23	Pin
2601-24	Ball
2601-25	Ball

2609* Seal Kit

2620 Hydraulic Cylinder Kit Assembly (figure 53)

Key	Description
2621	Screw
2622	Spacer
2623	Flange
2624*	Gasket

2700 Manual Handwheel Assembly (figure 23)

Key	Description
2701	Head Flange
2702	Plug
2703	Bushing
2704*	O-Ring
2705*	Piston Rod Sealing Ring
2706	Piston Rod
2707	Piston
2708*	O-Ring
2709*	Guide Sliding Ring, Piston
2710*	Piston Seal Ring
2711	Cylinder Tube
2712	End Flange
2713	Tie Rod
2714	Tie Rod
2715	Screw

2750 Hydraulic Control Unit & Handpump Assembly (figure 45, 46, and 47)

Key	Description
2751	Hydraulic Control Unit
2751-1.1	Check Valve
2751-1.2	Flow Regulator
2751-1.3	Relief Valve for Automatic Operation
2751-1.4	Relief Valve for Manual Operation

Key	Description
2751-1.5	Relief Valve Low
2751-1.6	Relief Valve High
2751-1.7	Oil Tank Dipstick
2751-2	Cap Nut
2751-3	Washer
2751-4	Hydraulic Tank
2751-6*	O-Ring
2751-7	Ball
2751-8	Spring
2751-9	Washer
2751-10	Screw
2751-11	Plate
2751-12	Flange
2751-13	Screw
2751-14	Lever
2751-15	Distributor
2751-16*	O-Ring
2751-17*	O-Ring
2751-18	Nozzle
2751-19	Screw
2751-20*	O-Ring
2751-21*	O-Ring
2751-22	Tank Cover
2751-23	Tie Rod
2751-24	Screw
2751-25	Flange
2751-26	Check Valve Body
2751-27	Plug
2751-28	Flow Control Valve Setting Screw
2751-29	Spring Pin
2751-30	Nut
2751-31	Flange
2751-32*	O-Ring
2751-33	Spring
2751-34	Plug
2751-35	Retainer Ring
2751-36	Spring Pin
2751-37	Screw
2751-38	Operation Instruction Plate
2751-39	Screw
2751-40	Spring
2751-41	Ball
2751-42	Ball
2751-43	Spring
2751-44	Relief Valve Setting Screw
2751-45	Spring Pin
2751-46	Screw
2751-47	Spring
2751-48	Nut
2751-49	Washer
2751-50	Washer
2751-51	Dipstick
2751-52*	Plug and O-Ring
2751-53	Spring
2751-54	Screw
2751-55	Nut
2751-56	Silencer
2751-57*	O-Ring
2751-58	Retainer Ring
2751-59	Dipstick Body
2751-60	Nut
2751-61	Relief Valve Body

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Key	Description
2752	Handpump
2752-1	Ball
2752-2	Delivery Valve Bush
2752-3	Suction Valve Bush
2752-4	Spring
2752-5	Suction Valve Seat
2752-6	Spring Retainer Ring
2752-7	Fork
2752-8	Pin
2752-9	Retainer Ring
2752-10	Rod
2752-11	Body
2752-12	Lever
2752-13	Split Pin with Rope
2752-14	Scarper Ring
2752-15	Threaded Bush
2752-16	Rod Seal Ring
2752-17	O-Ring
2752-18	O-Ring
2752-19	Piston Rod Bushing

2759* Seal Kit

2760 Hydraulic Control Unit & Handpump Support Assembly (figure 42)

Key	Description
2761	Support
2762	Washer
2763	Screw
2764	Support
2765	Screw
2766	Nut

2780 Hydraulic Fittings Kits (figure 43)

Key	Description
27H1	Nipple
27H2	Relief Valve
27H3	Tee Pipe Fitting
27H4	Stop Valve
27H5	Straight Fitting Male Connector
27H6	90° Elbows Fitting Unions Connector

Key	Description
27H7	90° Elbows Fitting Unions Connector
27H8	90° Elbows Fitting Unions Connector
27H9	Adapter Pipe Fitting

2786U	Power Up Tube
2786D	Power Down Tube
2787U	Pilot Up Tube
2787D	Pilot Down Tube

2790 MHQ Hydraulic Fitting and Tubing Kit (figure 44)

Key	Description
2791	Male Tube Adapter
2792	Straight Fitting Male Connector
2793	90° Elbows Fitting Unions Connector
2794	Tube
2795	Stop Valve

4300 Valve Stem Connector Assembly (figure 48)

Key	Description
4301	Split Coupling Block
4302	Screw
4850	Anti-Rotator Plate
5000	Travel Indicator

6520 Mounting Bracket & Screw Assembly (figure 49)

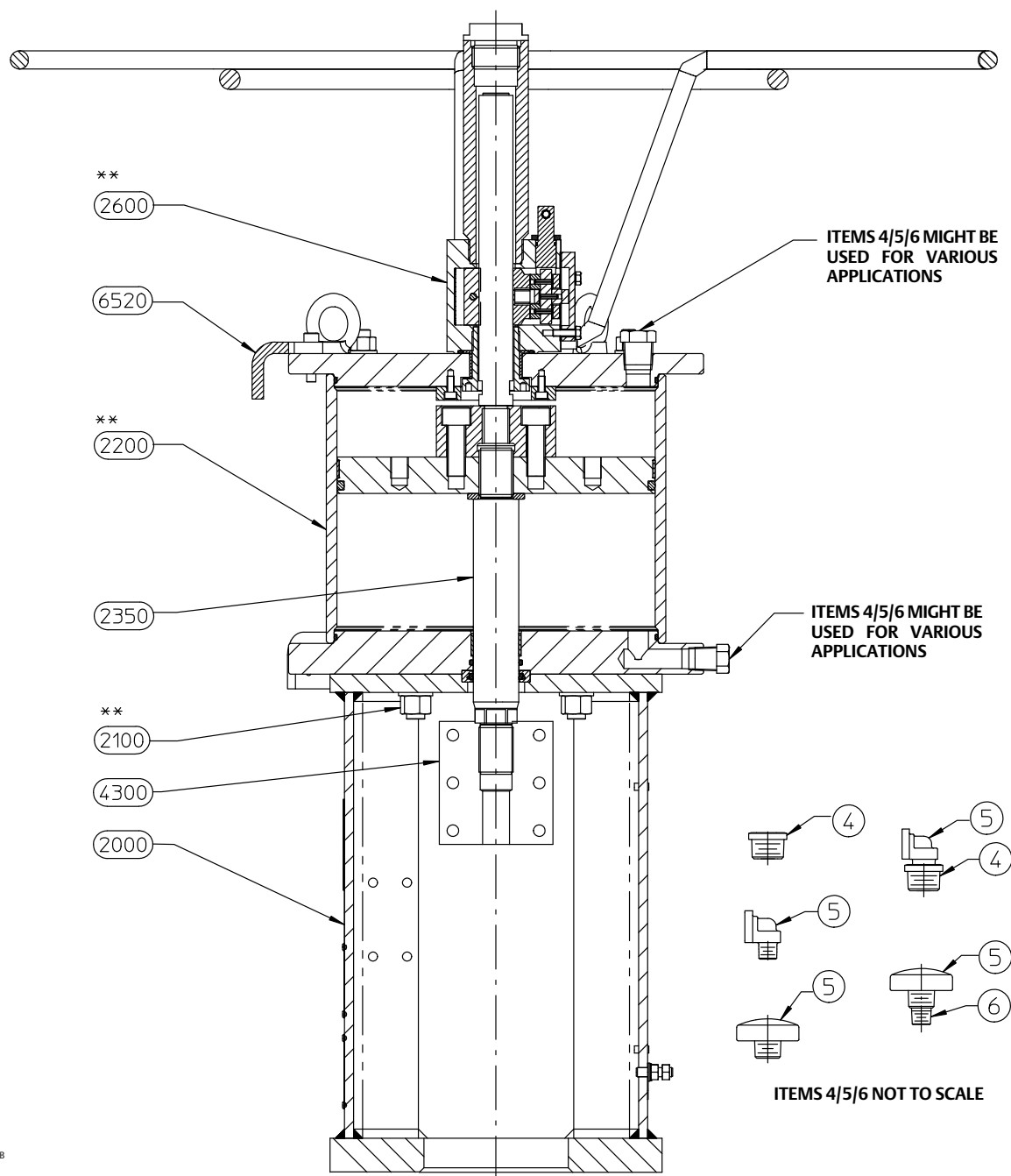
Key	Description
6521	Mounting Boss
6522	Screw
6523	Screw

Items Not Shown

Key	Description
400	Painting
500	Actuator Grease
600	MHP/MHQ Handpump Oil

Assembly Drawings

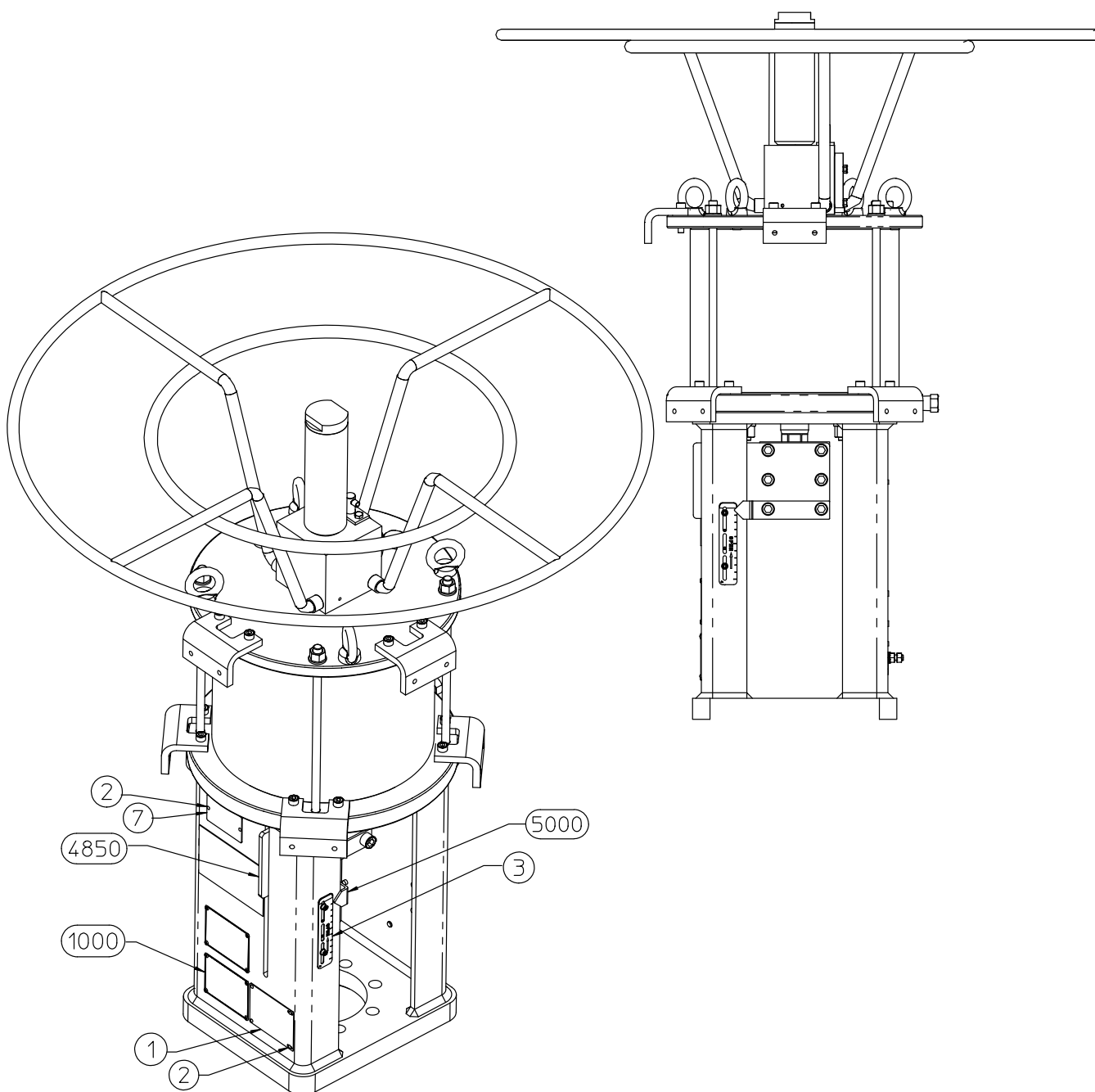
Figure 24. Fisher 785C Double-Acting Springless Actuator with Top Mounted Handwheel



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**** COMPONENT INCLUDES RECOMMENDED SPARE PART
PARTS NOT SHOWN: KEY 400 AND 500**

Figure 25. Fisher 785C Double-Acting Springless Actuator with Top Mounted Handwheel



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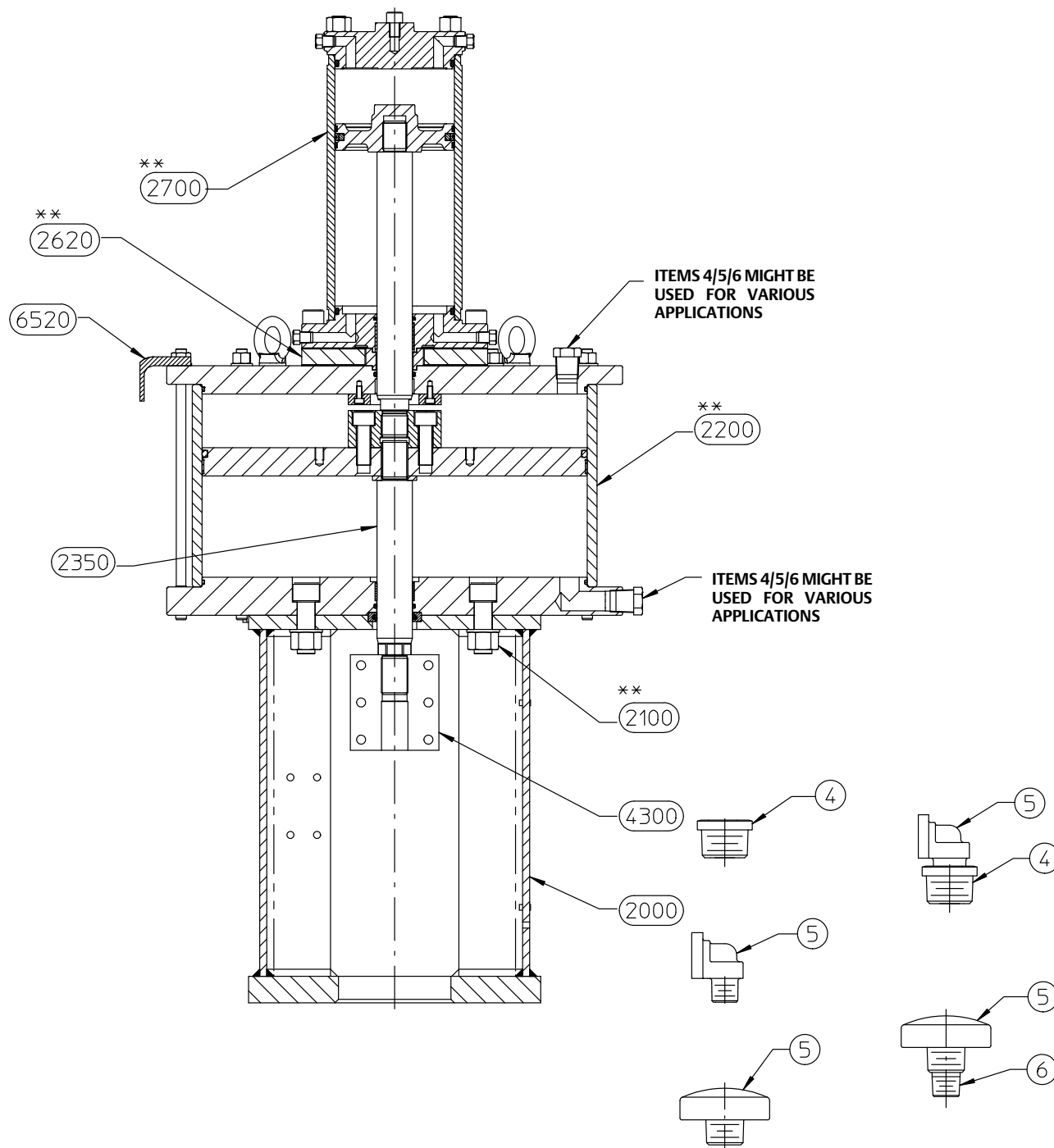
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Figure 26. Fisher 785C Double-Acting Springless Actuator with Side Mounted Handpump



** COMPONENT INCLUDES RECOMMENDED SPARE PART
PARTS NOT SHOWN: KEY 400, 500, AND 600

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Figure 27. Fisher 785C Double-Acting Springless Actuator with Side Mounted Handpump

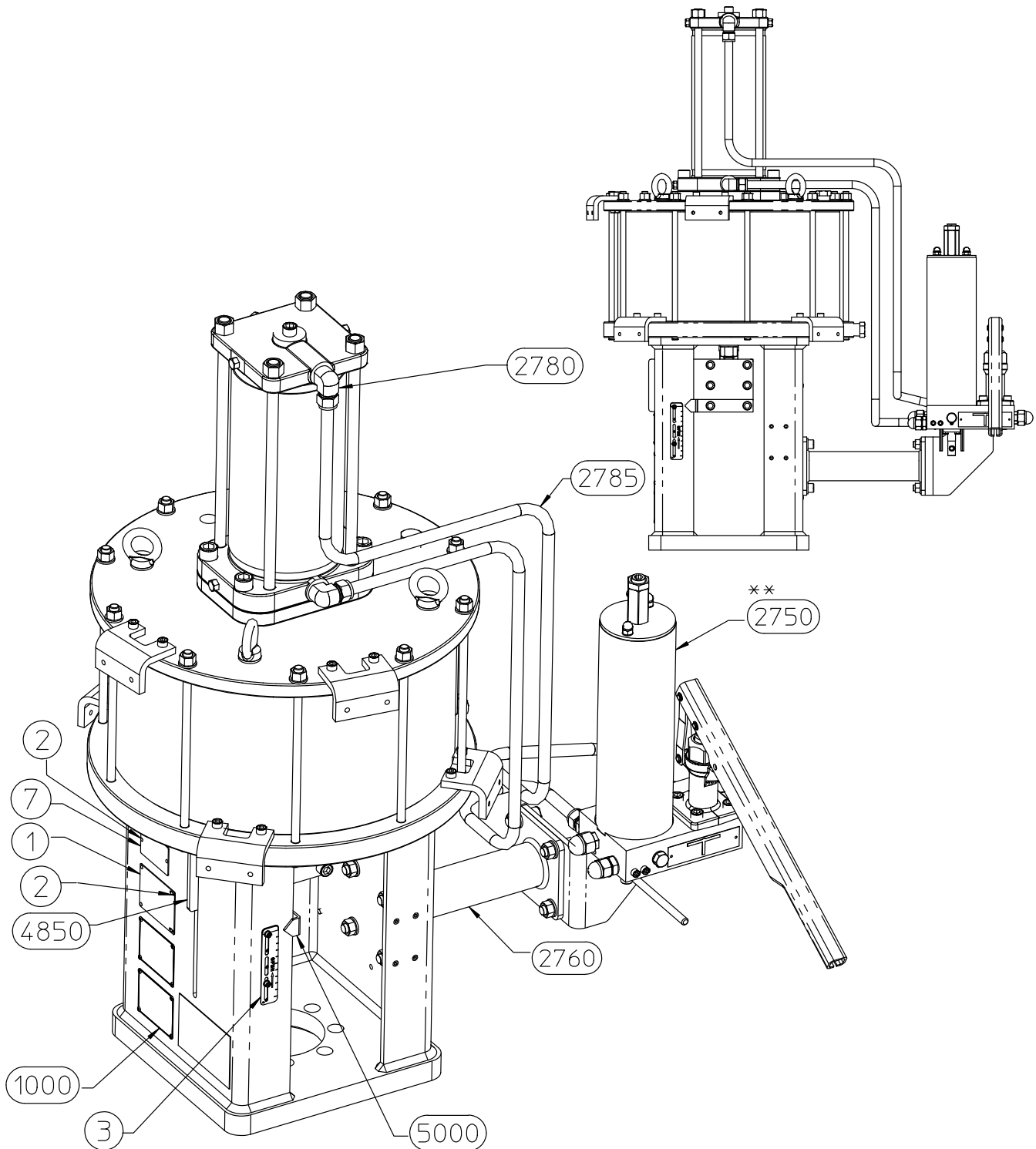


Figure 28. Fisher 785C Single-Acting Spring Return Actuator without Manual Override

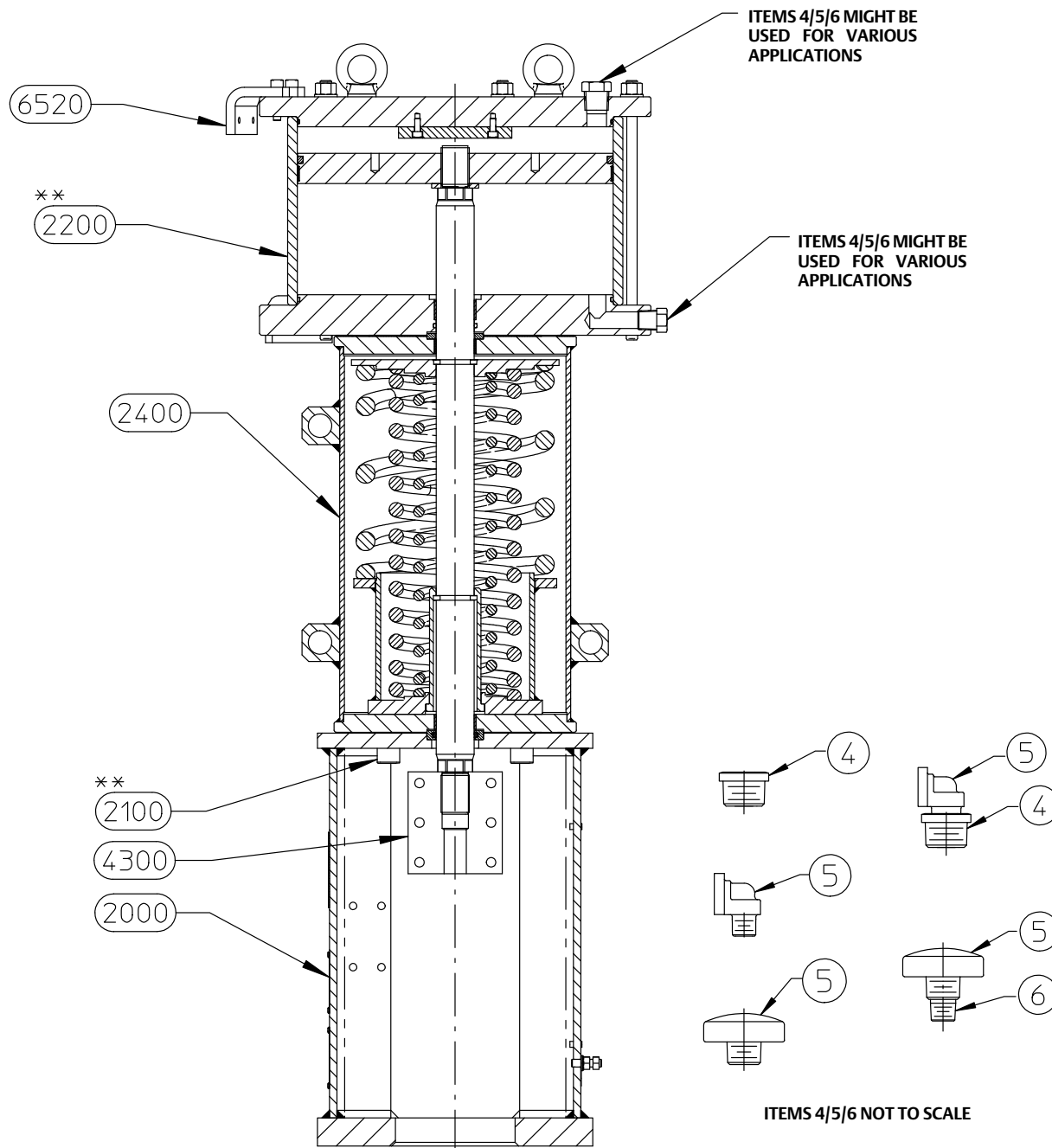
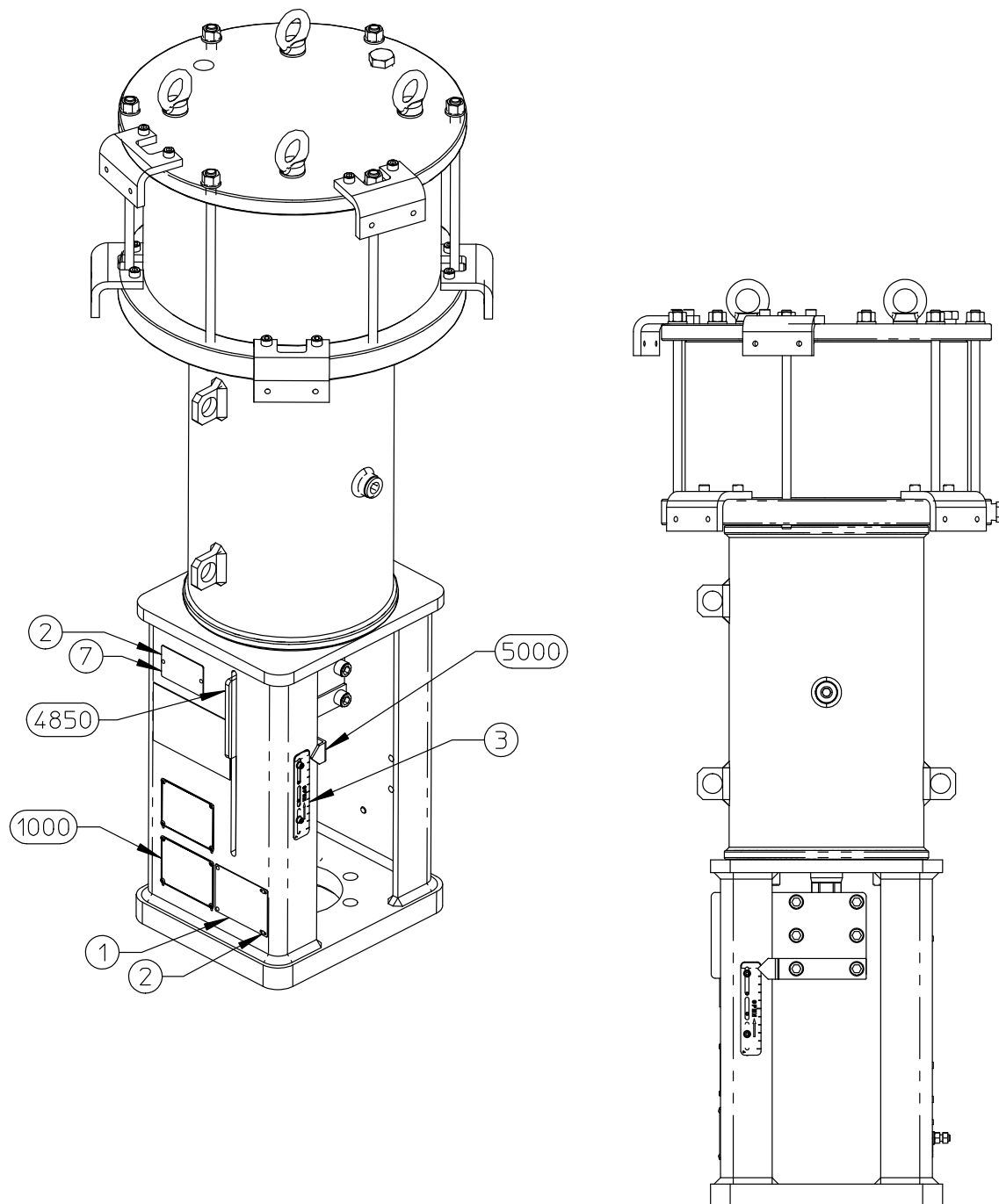


Figure 29. Fisher 785C Single-Acting Spring Return Actuator without Manual Override



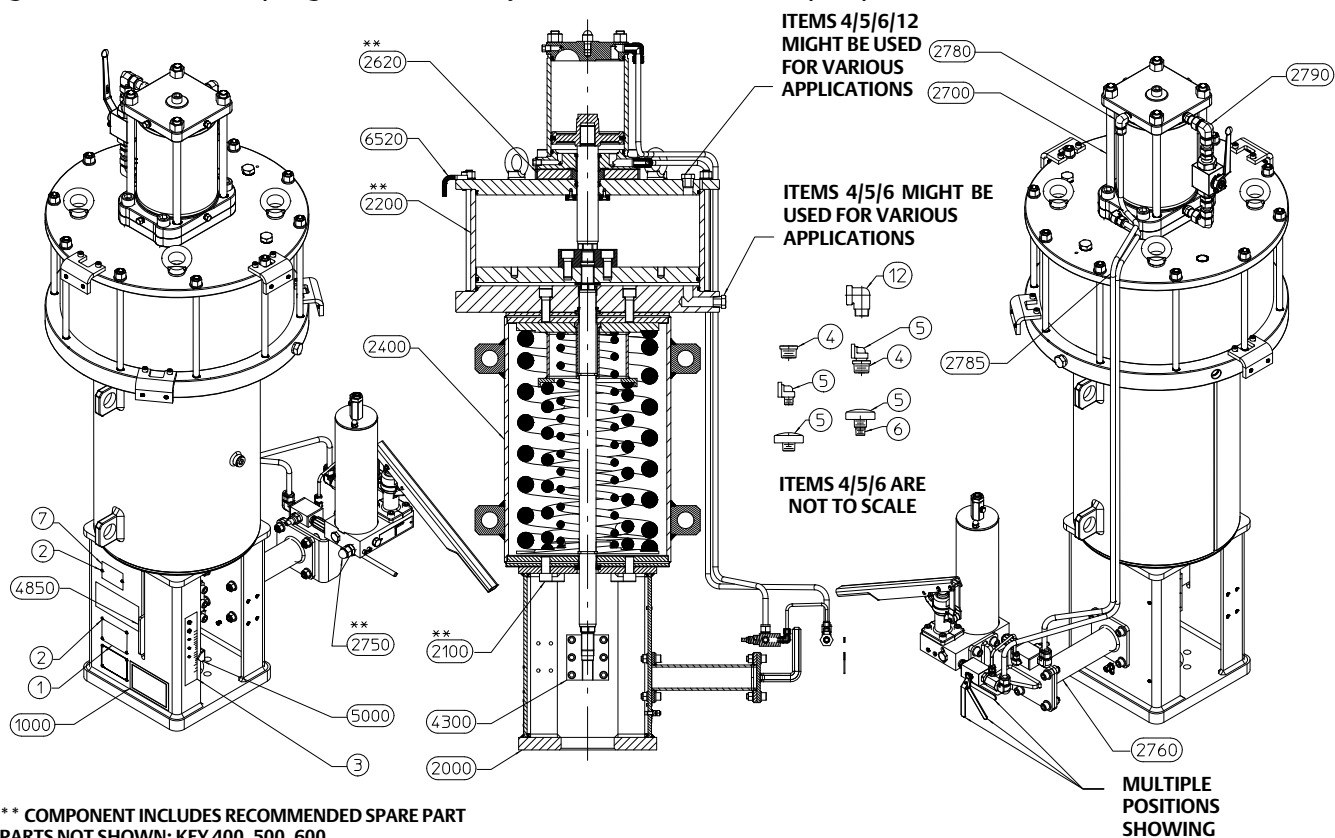
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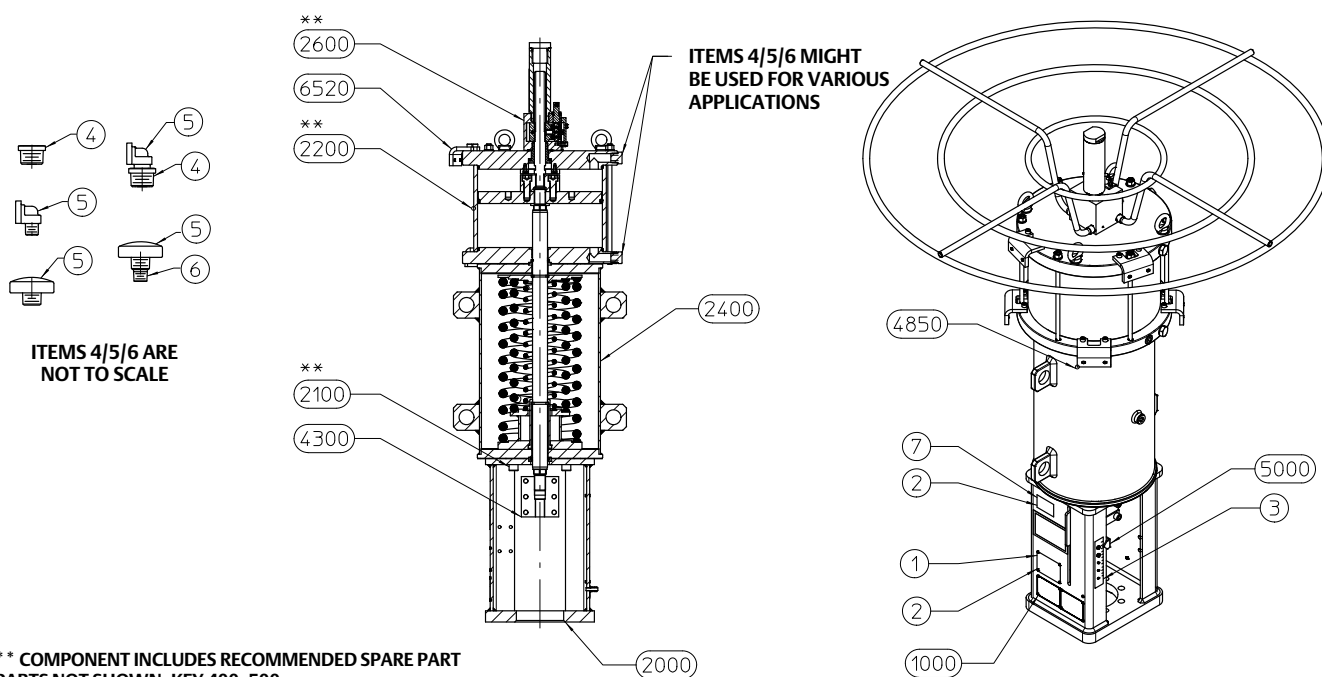
Figure 30. Fisher 785C Spring Return Assembly with Side Mounted Handpump, Rod Extend



** COMPONENT INCLUDES RECOMMENDED SPARE PART
PARTS NOT SHOWN: KEY 400, 500, 600

GH14039

Figure 31. Fisher 785C Spring Return Assembly with Top Mounted Handpump, Rod Retract



** COMPONENT INCLUDES RECOMMENDED SPARE PART
PARTS NOT SHOWN: KEY 400, 500

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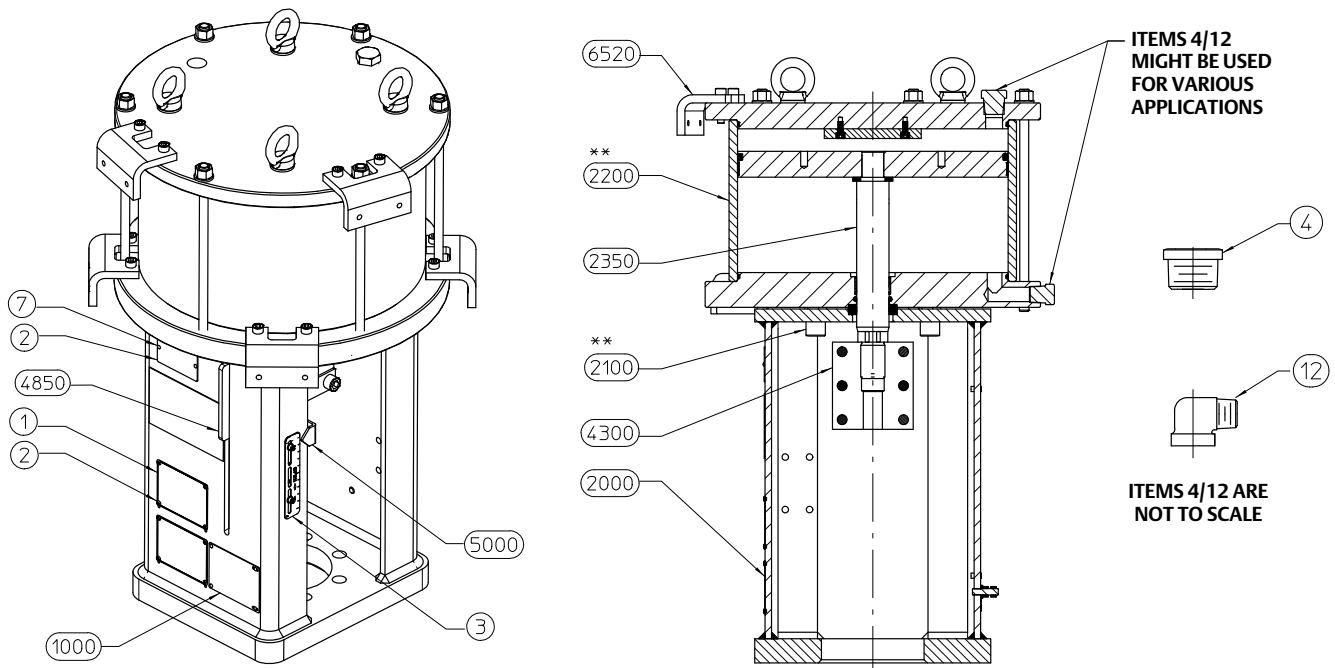
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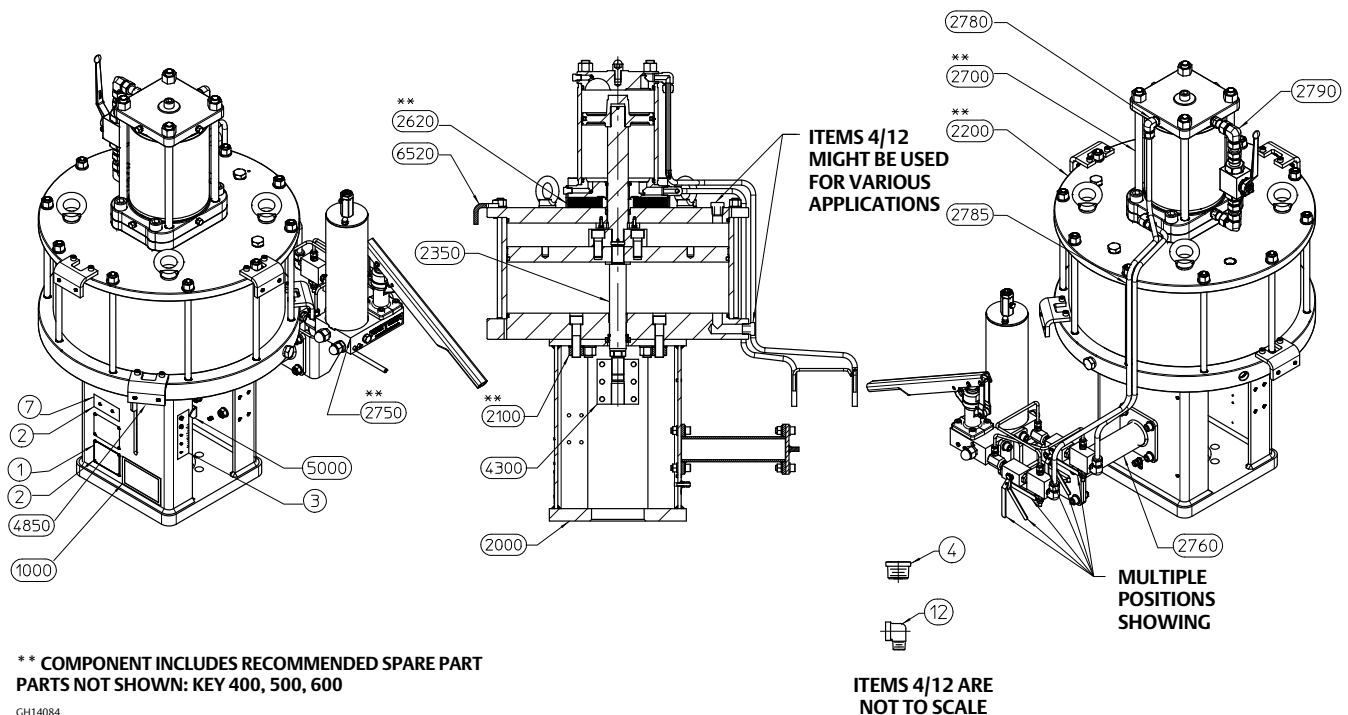
Figure 32. Fisher 785C Springless Assembly without Manual Override



** COMPONENT INCLUDES RECOMMENDED SPARE PART
PARTS NOT SHOWN: KEY 400, 500

GH14253

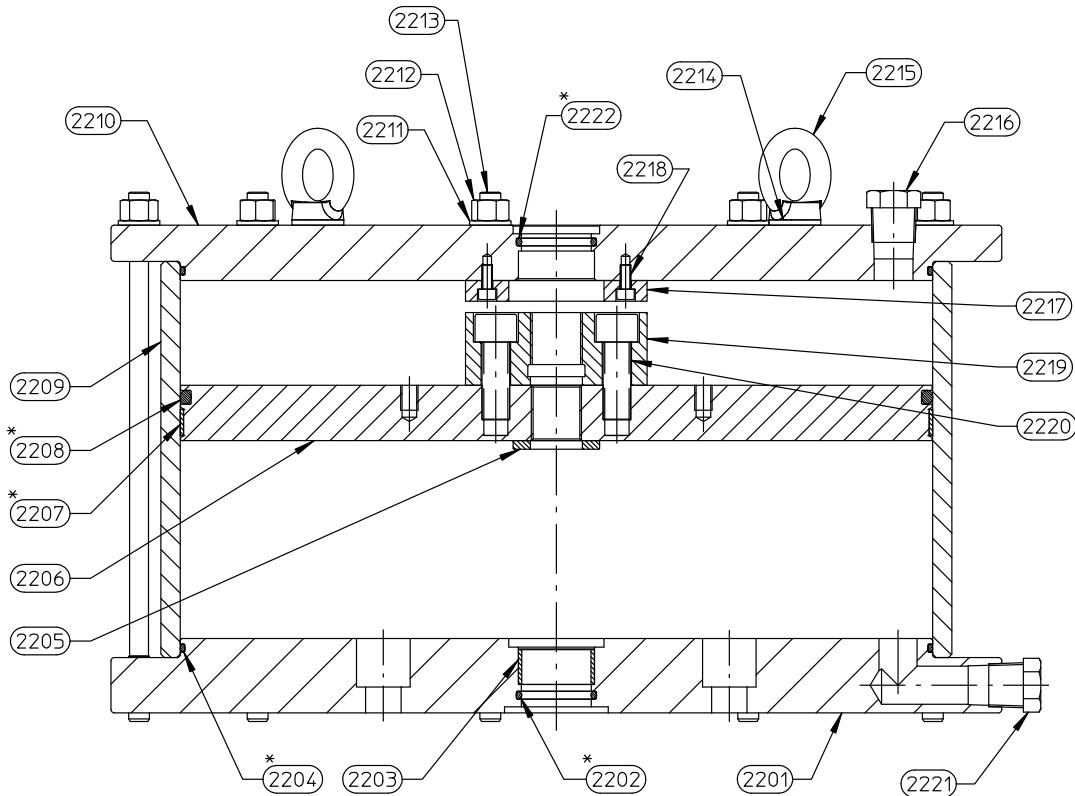
Figure 33. Fisher 785C Springless Assembly with Fast Stroke Side Mounted Handpump MHQ



** COMPONENT INCLUDES RECOMMENDED SPARE PART
PARTS NOT SHOWN: KEY 400, 500, 600

GH14084

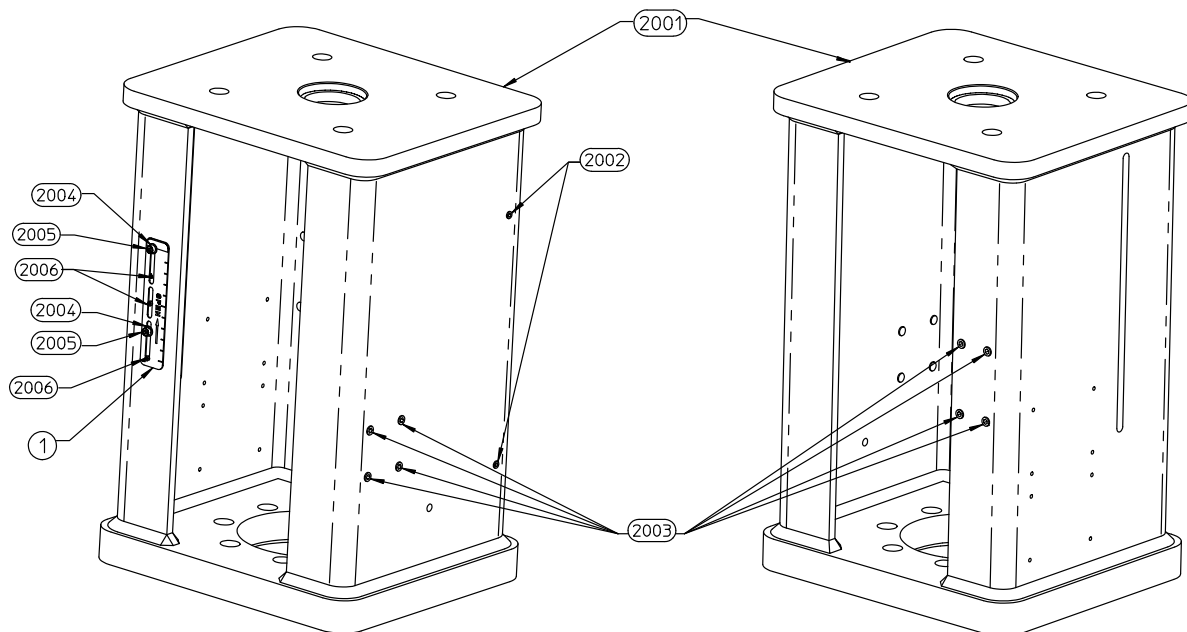
Figure 36. Pneumatic Cylinder Assembly of Fisher 785C Actuator with Side Mounted Handpump, Springless or Spring Return, Single- or Double-Acting



* COMPONENT INCLUDES RECOMMENDED SPARE PART

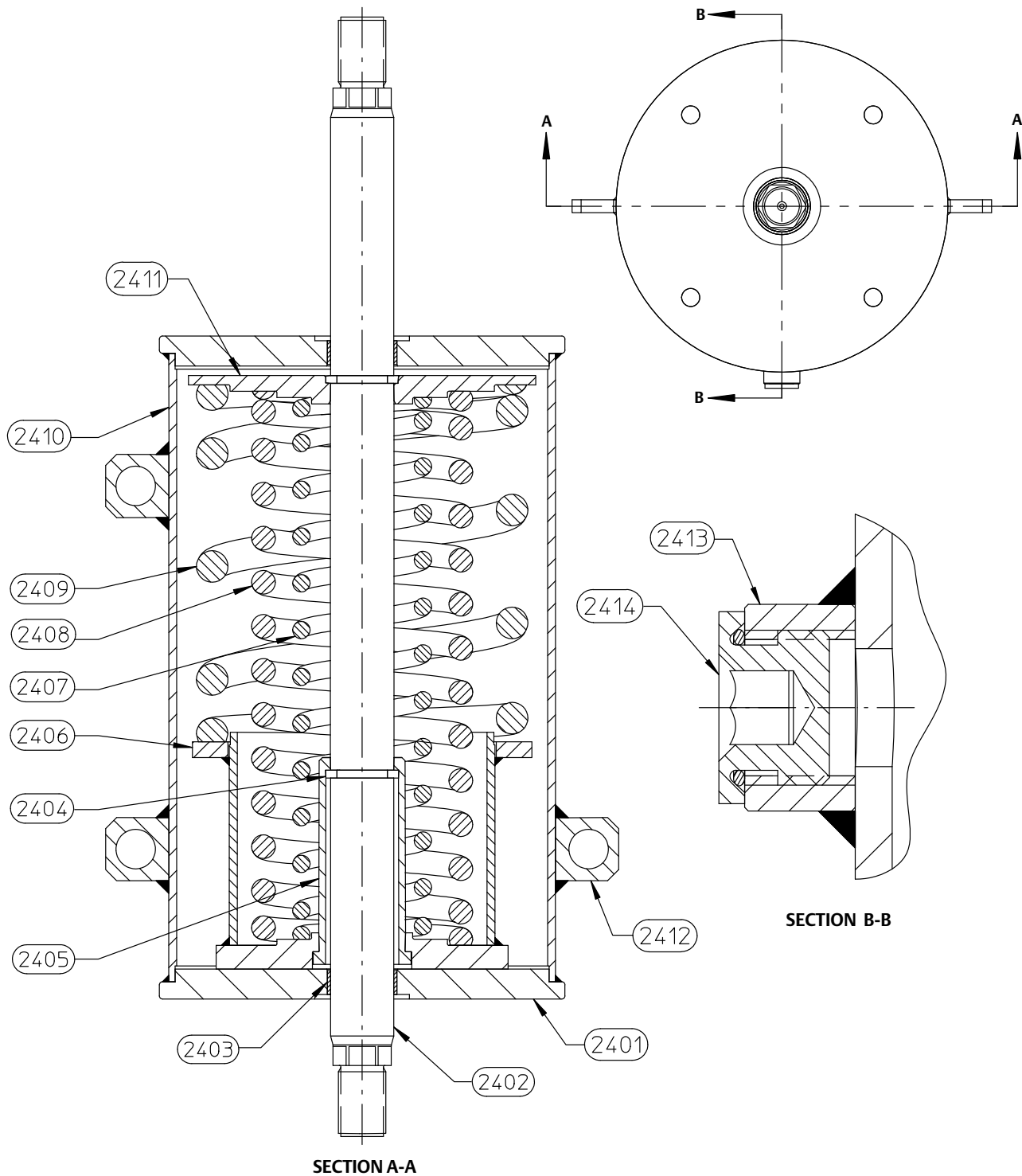
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Figure 37. Yoke (Spool) Assembly of Fisher 785C Actuator Springless or Spring Return, Single- or Double-Acting



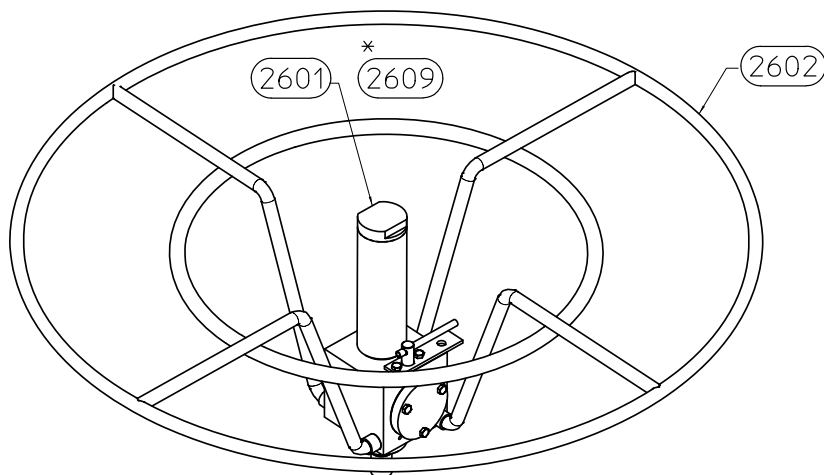
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Figure 38. Spring Can (Spring Cartridge) Fisher 785C Single-Acting Spring Return Actuator Single- or Double-Acting



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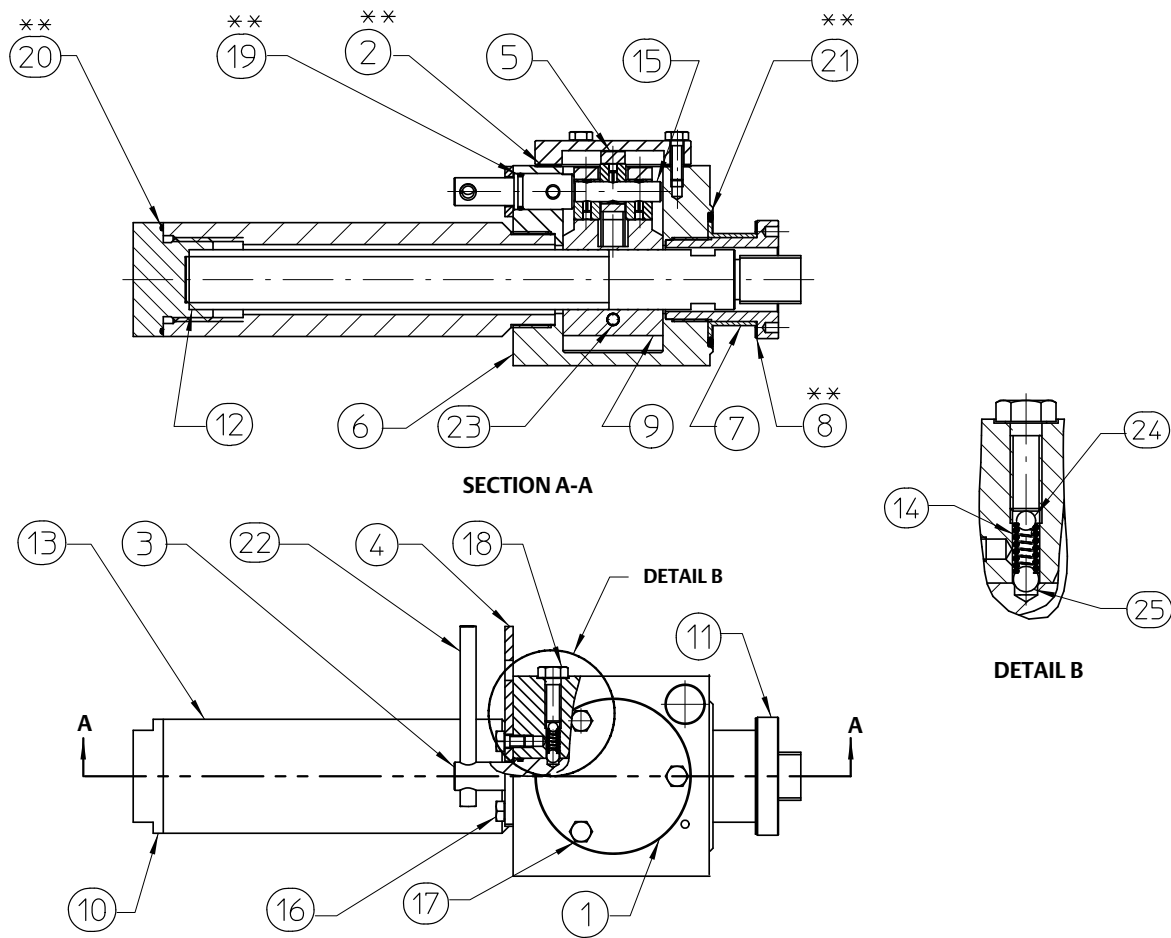
Figure 39. Top Mounted Handwheel of Fisher 785C Actuator, Springless or Spring Return, Single- or Double-Acting



* COMPONENT INCLUDES RECOMMENDED SPARE PART
PARTS NOT SHOWN: 2609

GH01762_B

Figure 40. Handwheel MHW Unit (Key 2601)



** RECOMMENDED SPARE PART

GH114287

Figure 41. Side Mounted Handpump Hydraulic Cylinder Assembly of Fisher 785C Actuator
Springless or Spring Return, Single- or Double-Acting

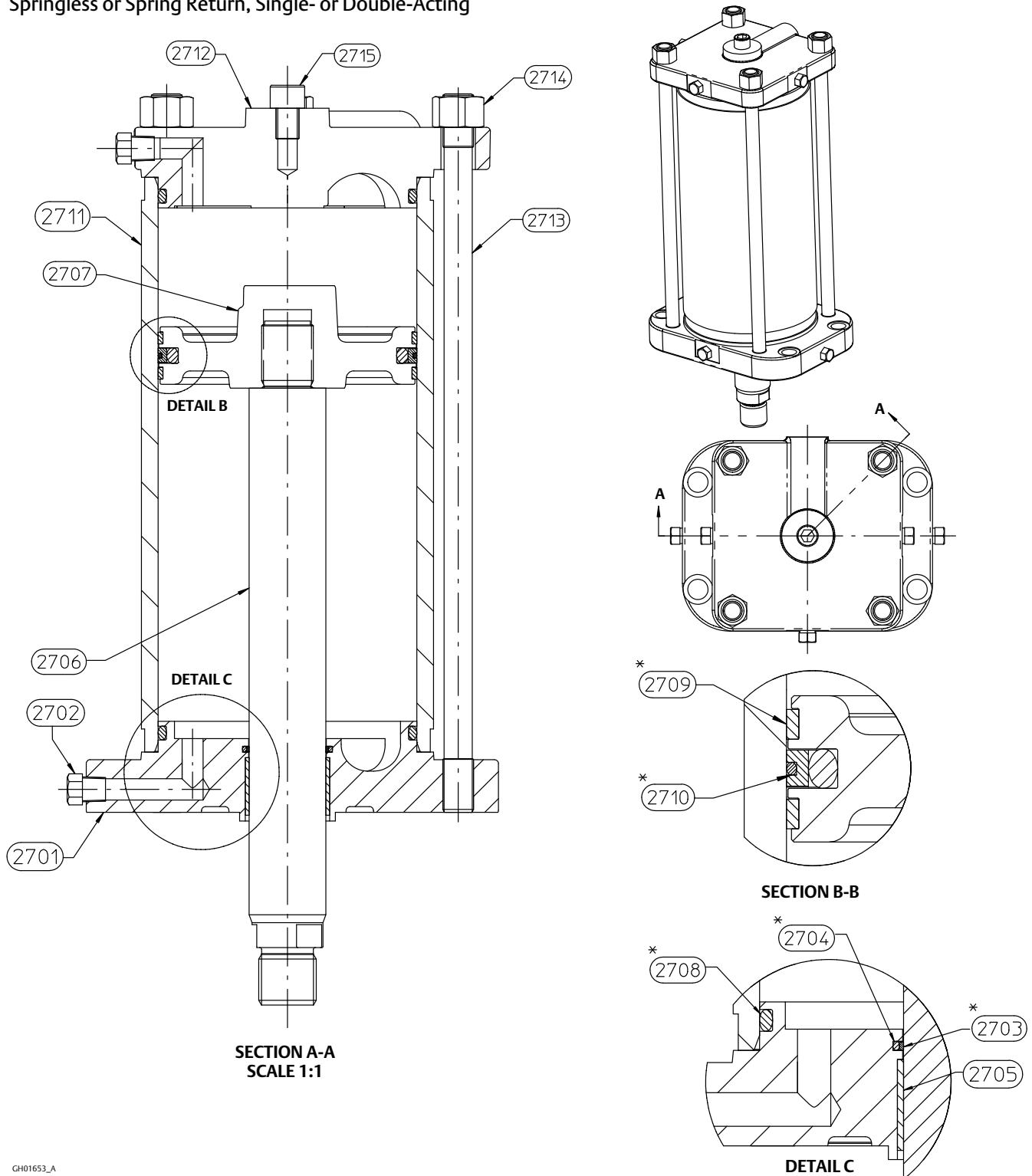
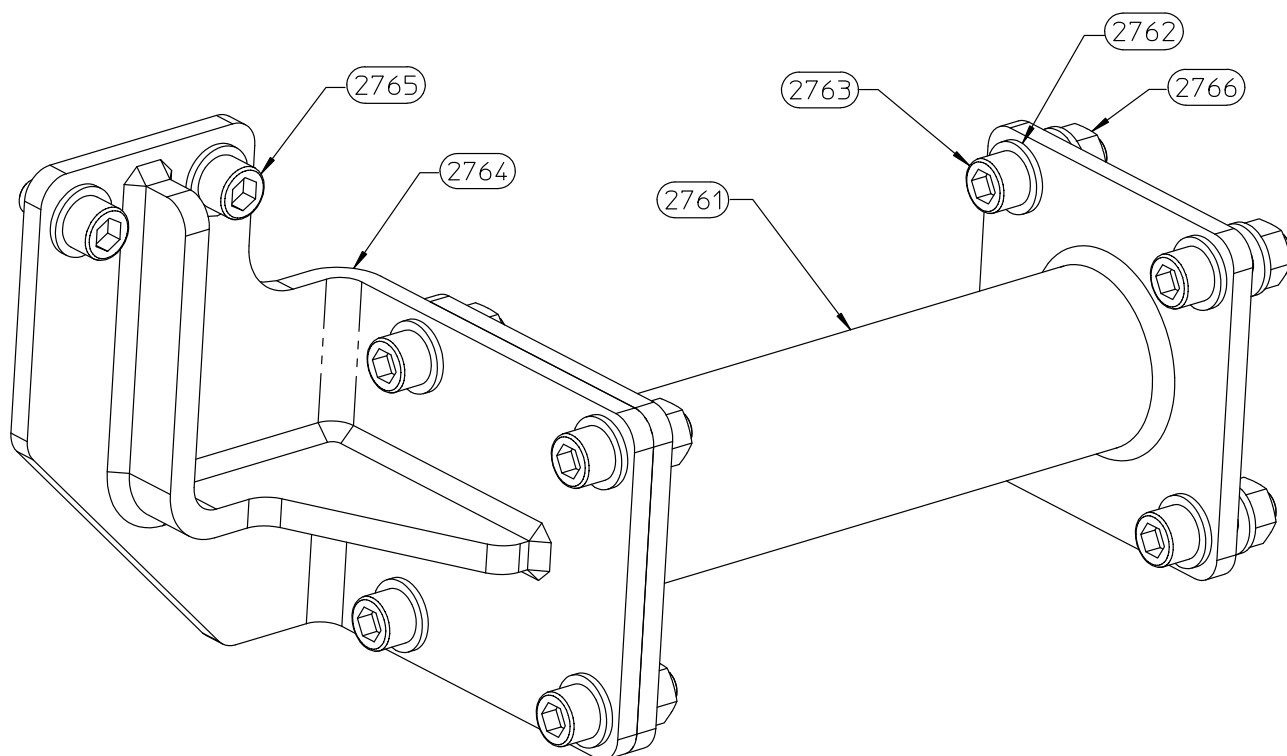
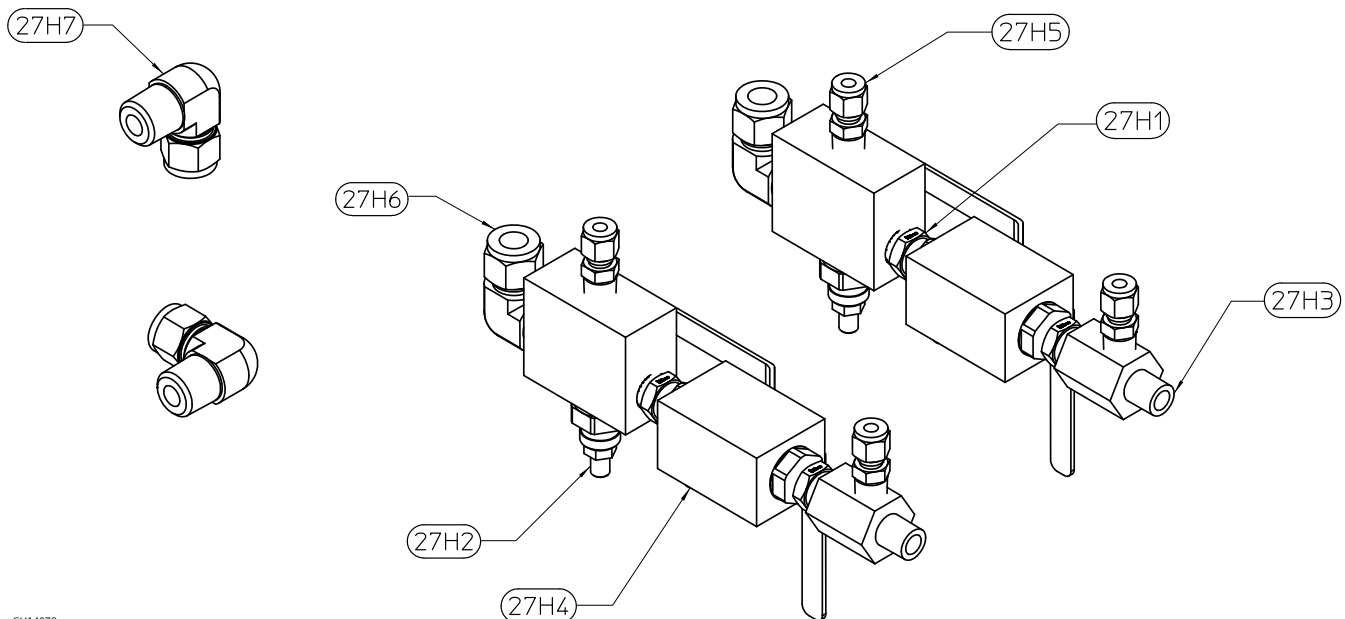


Figure 42. Side Mounted Handpump Support of Fisher 785C Actuator
Springless or Spring Return, Single- or Double-Acting

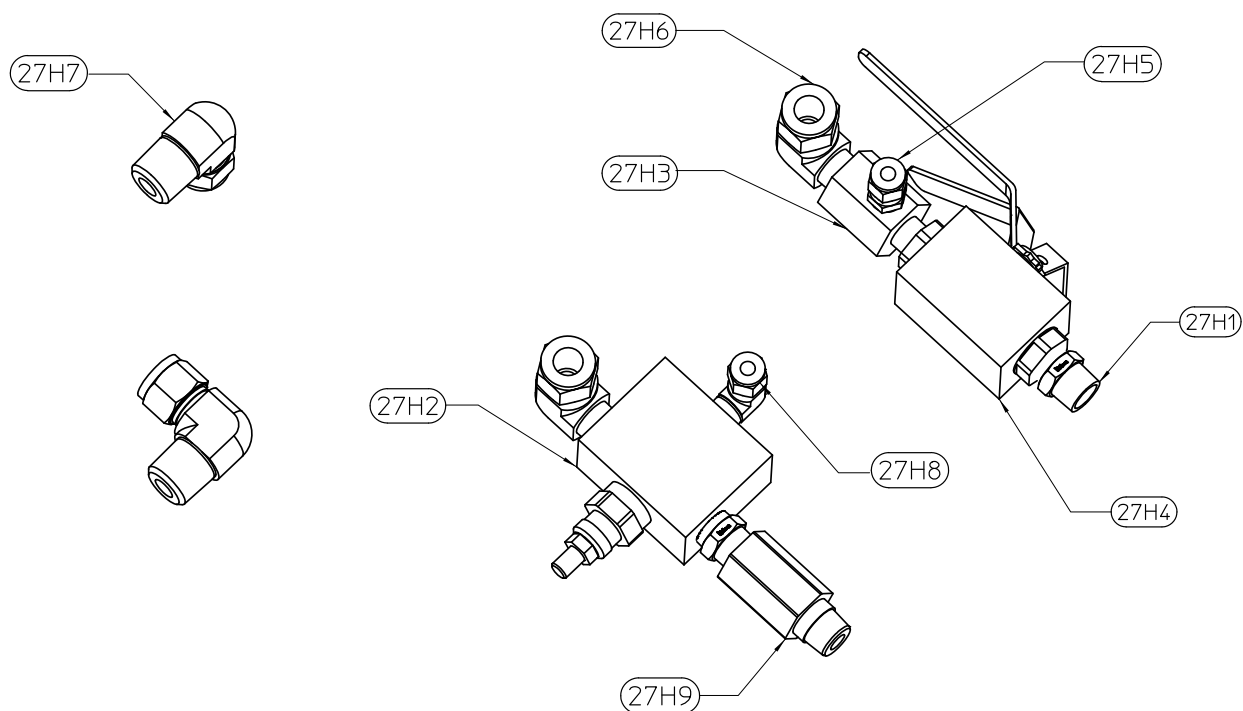


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Figure 43. MHP Hydraulic Fittings

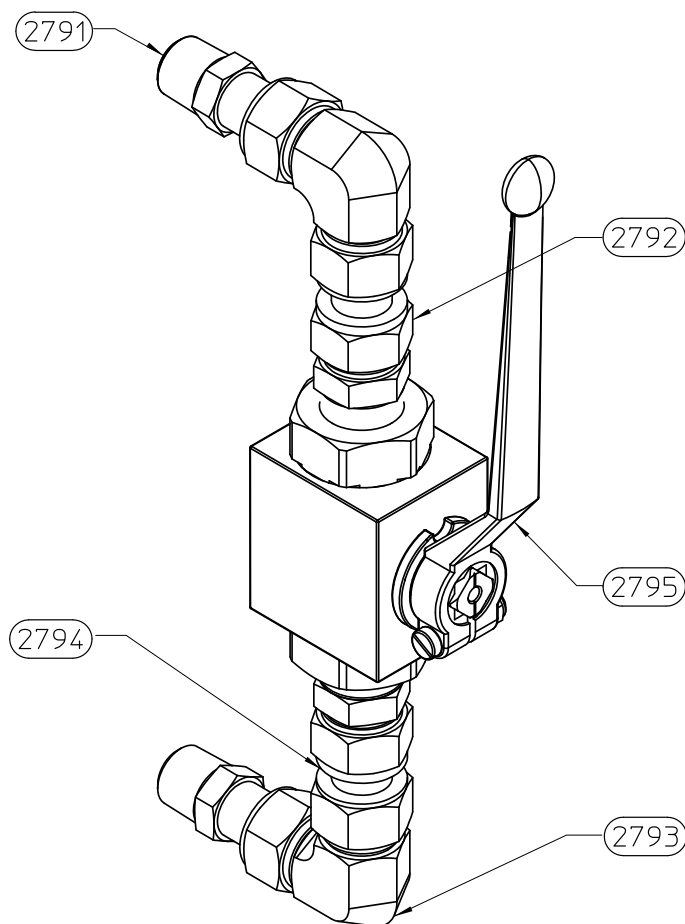


GH14070



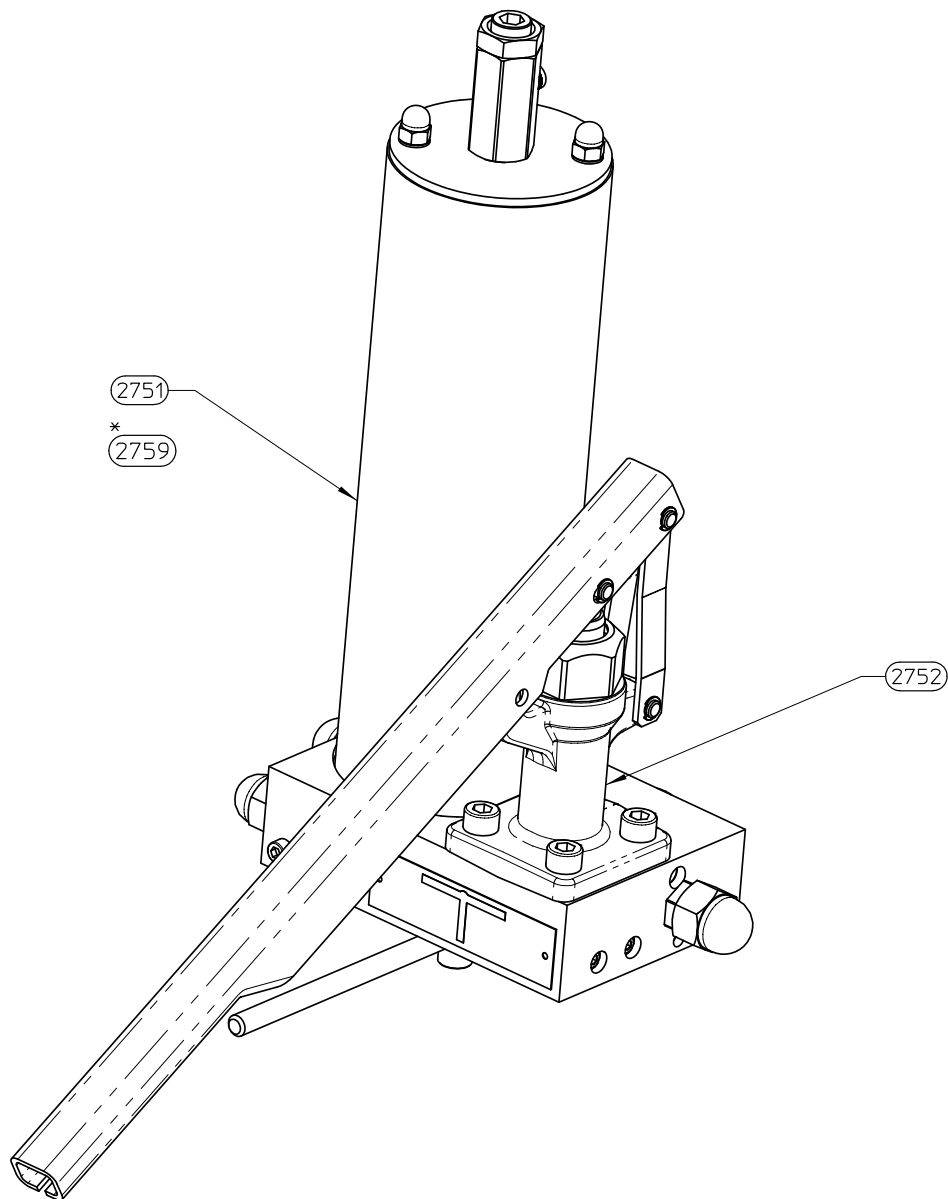
GH14490

Figure 44. MHQ Hydraulic Fitting, Tubes and Stop Valve



GH14073

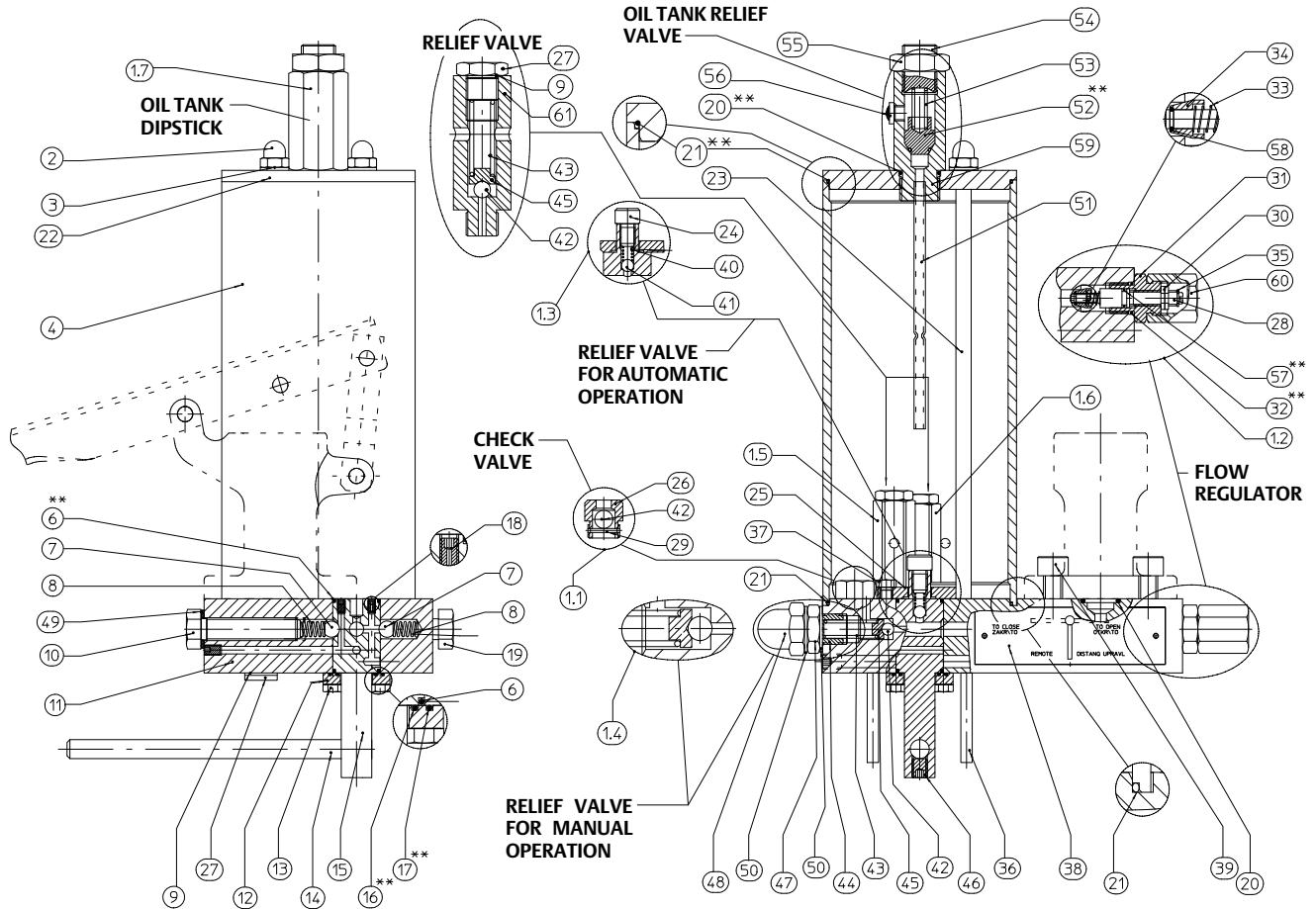
Figure 45. Side Mounted Handpump Hydraulic Control Unit of Fisher 785C Actuator
Springless or Spring Return, Single- or Double-Acting



* COMPONENT INCLUDES RECOMMENDED SPARE PART
PARTS NOT SHOWN: 2759

GH0172_9

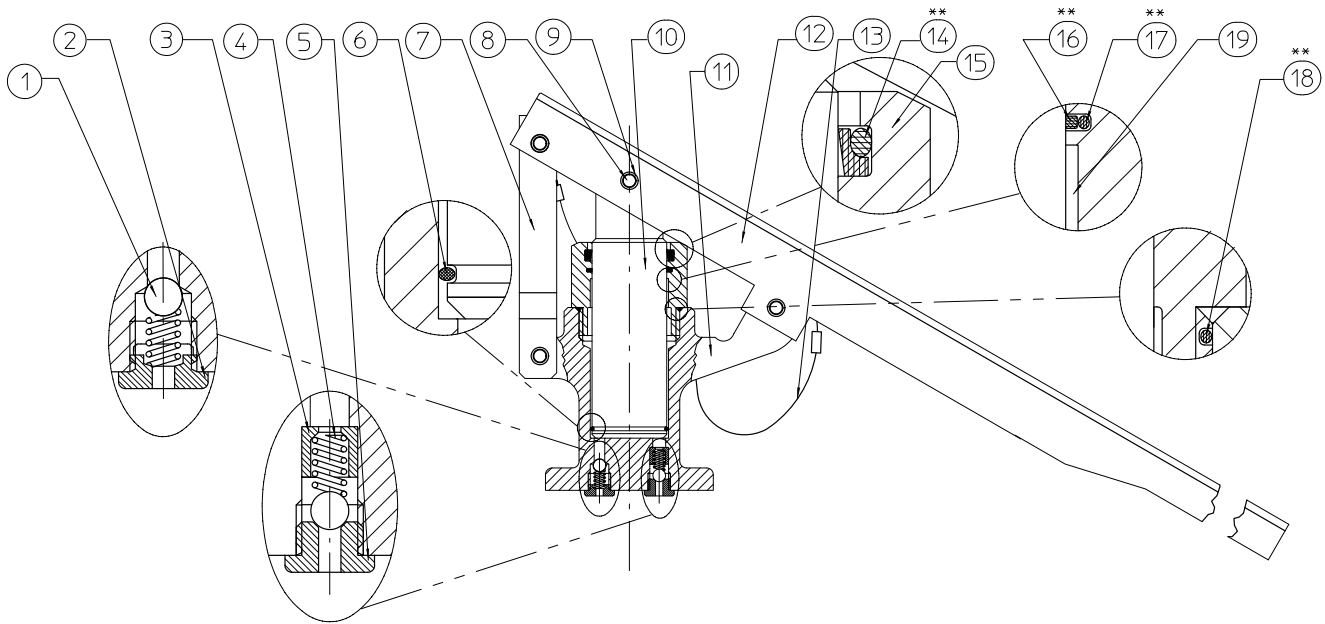
Figure 46. Handpump MHP/MHQ Hydraulic Control Unit (Key 2751)



****RECOMMENDED SPARE PART**

GH14297

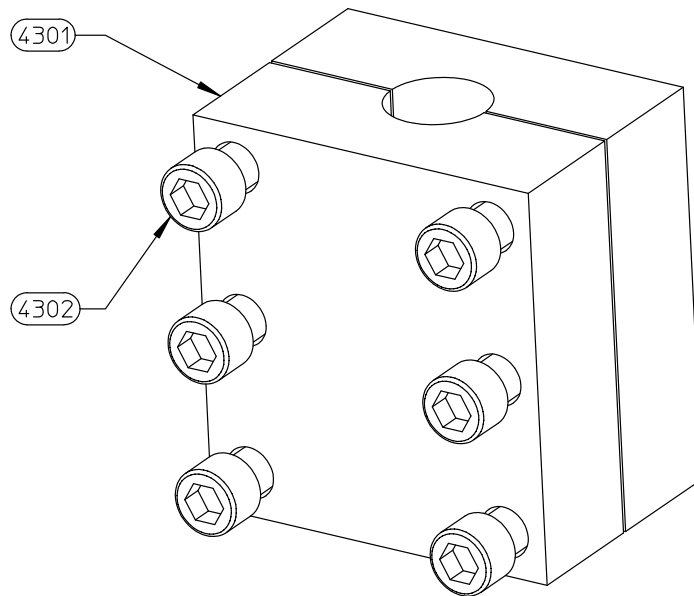
Figure 47. MHP/MHQ Handpump (Key 2752)



****RECOMMENDED SPARE PART**

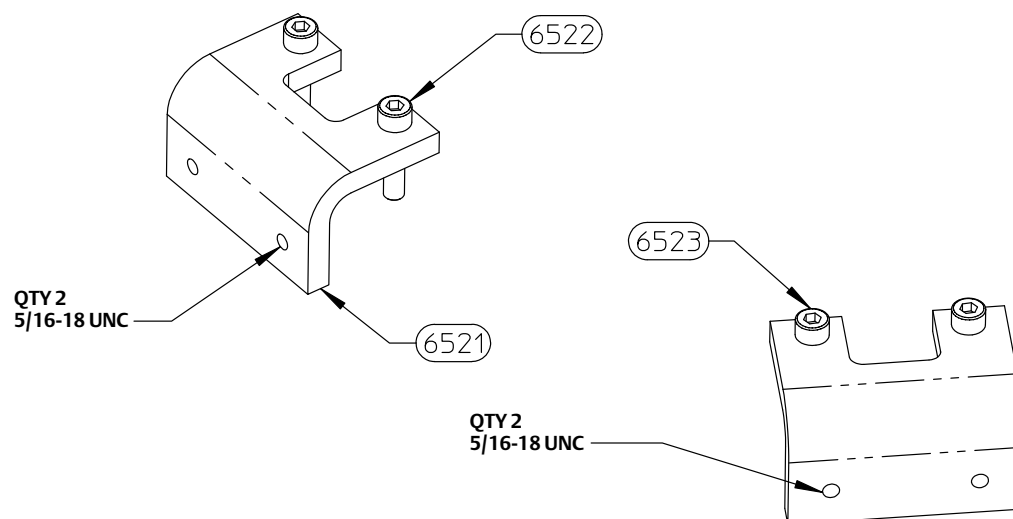
GH14482

**Figure 48. Valve Stem Connector Assembly of Fisher 785C Actuator
Springless or Spring Return, Single- or Double-Acting**



GH01638_A

**Figure 49. Mounting Bracket Assembly of Fisher 785C Actuator
Springless or Spring Return, Single- or Double-Acting**



GH01643_A

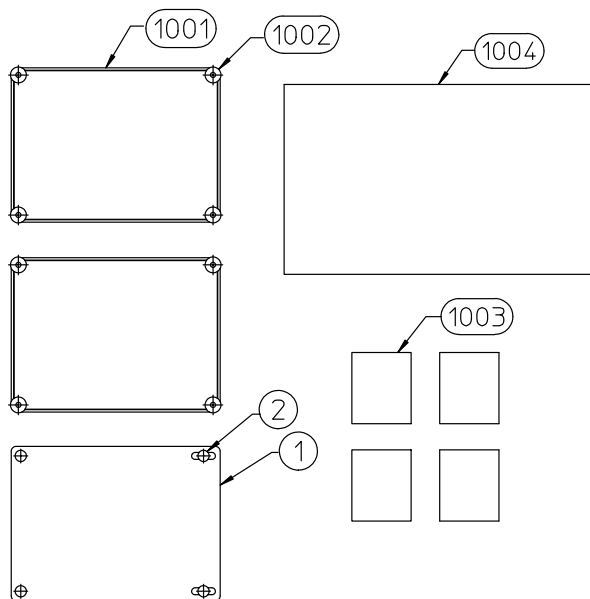
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785C Actuator

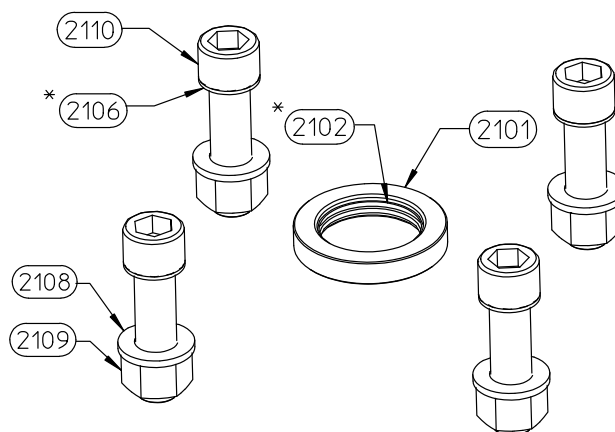
May 2022

Figure 50. Nameplate Assembly Kit of Fisher 785C Actuator Springless or Spring Return, Single- or Double-Acting



GH01593_A

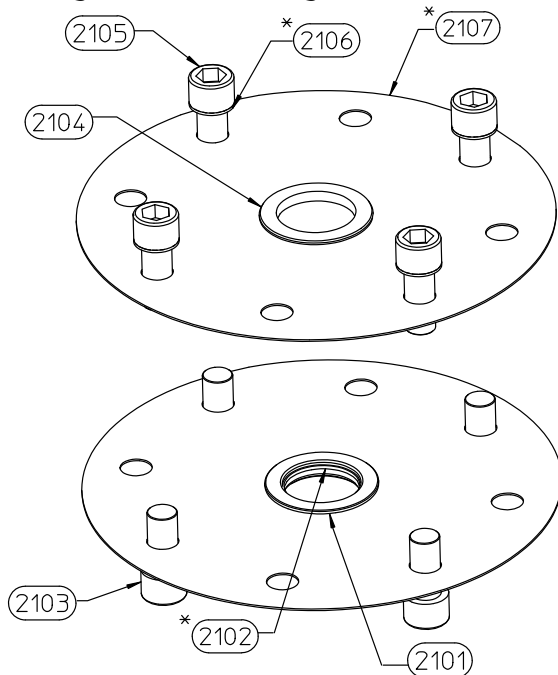
Figure 52. Fisher 785C Springless Actuator Repair Kit, Double-Acting



* COMPONENT INCLUDES RECOMMENDED SPARE PART

GH01657_A

Figure 51. Fisher 785C Spring Return Actuator Repair Kit, Single- or Double-Acting

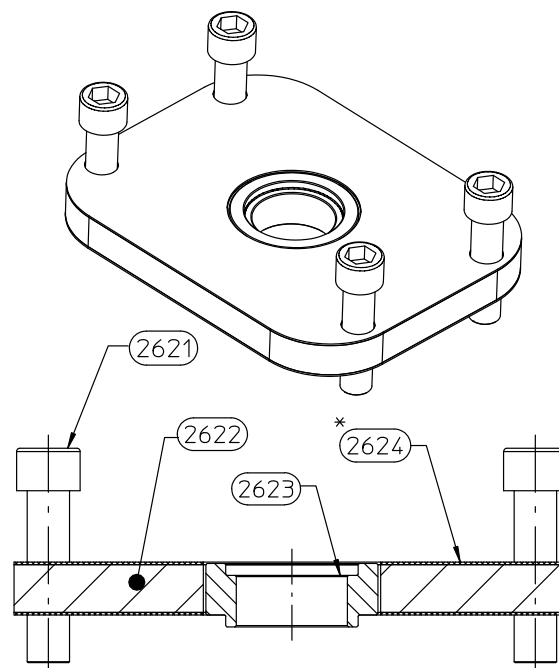


* COMPONENT INCLUDES RECOMMENDED SPARE PART

NOTE: UPPER PORTION LOCATES BETWEEN CYLINDER AND SPRING CAN.
LOWER PORTION LOCATES BETWEEN SPRING CAN AND YOKE.

GH01658_A

Figure 53. Side Mounted Handpump Hydraulic Cylinder Kit of Fisher 785C Actuator Springless or Spring Return, Single- or Double-Acting



* COMPONENT INCLUDES RECOMMENDED SPARE PART

GH01650_A

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Fisher™ 1008 Handwheel Actuator

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Figure 1. Fisher 1008 Handwheel Actuator



W0590-1

Introduction

Scope of Manual

This instruction manual presents principle of operation, installation, maintenance, and parts list for the Fisher 1008 handwheel actuator (figure 1). Refer to separate instruction manuals for information about other equipment and accessories used with these actuators.



Do not install, operate, or maintain a 1008 handwheel actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

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Table 1. Specifications

SIZE	YOKE BOSS DIAMETER		STEM DIAMETER		MAXIMUM STEM LOAD		MAXIMUM TRAVEL		APPROXIMATE WEIGHT	
	mm	Inch	mm	Inch	N	lbs	mm	Inch	kg	lbs
30	54	2-1/8	10	3/8	7340	1650 ⁽¹⁾	19	0.75	6.8	15
40	71	2-13/16	13	1/2	13122	2950 ⁽¹⁾	51	2	15.9	35
50	90	3-9/16	19	3/4	29581	6650 ⁽¹⁾	102	4	20.4	45
80	127	5	25	1	50042	11250 ⁽¹⁾	76 ⁽³⁾	3 ⁽³⁾	45.4	100
			32	1-1/4	75620	17000 ^(1,2)				
100	127	5	32	1-1/4	75620	17000 ^(1,2)	102	4	68.0	150
	178	7	51	2	251004	56000 ^(1,2)				

1. For S31600 (316 stainless steel) stems at 38°C (100°F).
2. Actuator limit.
3. Alternate 102 mm (4 inch) travel construction is available.

Description

The 1008 is a handwheel actuator for processes requiring a throttling valve that can be manually operated and set. The 1008 handwheel actuator is available in sizes 30, 40, 50, 80, and 100, and can be mounted on easy-e™ valves.

The 1008 handwheel actuator converts rotary motion of the handwheel to linear motion of the valve plug stem. Because the stem does not revolve, the valve plug contacts the same seating surface with each stroke. Sizes 40, 50, 80, and 100 include two thrust bearings to make rotation easier.

Turn the handwheel counterclockwise to open the valve regardless of valve plug action. All sizes of the 1008 handwheel actuator except size 100 are reversible following the Reversing Handwheel procedures in this instruction manual.

Specifications

Refer to table 1 for 1008 handwheel actuator specifications. Refer to the actuator nameplate for information about a specific actuator.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

The 1008 handwheel actuator can be installed horizontally, vertically, or at any orientation in between. However, if supplied with a Tejax position indicator (see figure 6), the actuator must be installed in a horizontal position.

When an actuator and valve body are shipped together as a control valve assembly, the actuator is normally mounted on the valve. Follow the valve body instructions when installing the control valve in the pipeline. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the Actuator Mounting procedures.

Actuator Mounting

Key numbers refer to figure 2 for size 30, figure 3 for sizes 40 and 50, figure 4 for size 80 or figure 5 for size 100.

1. Place the actuator on the body bonnet and tighten the yoke locknut or the actuator mounting hex nuts.
2. Ensure the valve plug is on its seat.
3. Adjust the travel indicator scale (key 27) so that the two screws (key 19) are centered in the slots.
4. Screw the hex nuts (key 29) onto the valve plug stem and place the travel indicator disk (key 20) onto the stem above the hex nuts. Adjust the nuts until the travel indicator disk (key 20) points to the closed position on the scale.
5. Temporarily connect the valve plug stem to the stem connector assembly (key 24) and tighten the cap screws into the stem connector.
6. Use the handwheel (key 28) to move the valve plug into the fully open position, as indicated by the travel indicator disk (key 20) on the travel indicator scale (key 27).
7. Remove the stem connector assembly (key 24).
8. **Size 30:** Turn the handwheel (key 28) counterclockwise until the stem connector assembly (key 24) almost touches the top of the yoke;

Sizes 40, 50, and 80: Turn the handwheel (key 28) counterclockwise as far as it will go;

Size 100: Turn the handwheel (key 28) counterclockwise (for push-down-to-close valves) or clockwise (for push-down-to-open valves) as far as it will go.

NOTICE

Incomplete engagement of both valve stem and stem screw assembly (key 38) or size 100 power screw (key 5) in the stem connector can result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than the diameter of that stem.

9. Connect the valve plug stem to the stem connector assembly (key 24). Ensure that the bottom of the stem connector is touching or nearly touching the travel indicator disk (key 20). Tighten the stem connector (key 24) cap screws and lock the hex nuts (key 29) against the travel indicator disk (key 20) and stem connector.
10. Rotate the handwheel until the valve plug seats. Adjust the travel indicator scale (key 27) with two screws (key 19) so that the travel indicator disk (key 20) points to the closed position on the scale. Tighten the two screws.

Position Indicator Mounting

The Tejax position indicator is available on 1008 handwheel actuators, sizes 30, 40, and 50. It must be mounted in a horizontal position to function correctly. To set the position indicator:

1. Seat the valve plug.
2. Loosen the four screws holding the dial indicating unit in place.
3. Turn the dial until both hands are at the “Shut” (Zero) position.
4. Tighten the four screws.

The long pointer indicates fractions of a turn; the small pointer counts the number of full turns. The position indicator requires no lubrication.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Key numbers refer to figure 2 for size 30, figure 3 for sizes 40 and 50, figure 4 for size 80 or figure 5 for size 100.

Lubrication

The interior parts of a 1008 handwheel actuator should be lubricated on a regular schedule with a quality gear lubricant. The interior parts should also be lubricated whenever handwheel rotation becomes difficult.

Disassembly

Parts are subject to normal wear and must be inspected periodically. The following procedure describes actuator disassembly for general inspection and replacement.

For Size 30:

1. Remove the stem connector assembly (key 24).
2. Unscrew the set screw (key 13) from the yoke (key 26) and remove the steel balls (key 33) through the threaded hole.

Note

Be careful not to lose the ball (key 33) and spring (key 34) as the handwheel is removed.

3. Remove the handwheel (key 28) and stem screw assembly (key 38) from the yoke (key 26).

4. Unscrew the handwheel (key 28) from the stem screw assembly (key 38).

For Sizes 40 & 50:

1. Remove the stem connector assembly (key 24).
2. Unscrew the hex nut (key 14) and remove the washer (key 41) and lockwasher (key 42).

Note

Be careful not to lose the ball (key 33) and spring (key 34) as the handwheel is removed.

3. Remove the handwheel (key 28) from the stem screw assembly (key 38).
4. Loosen the set screw (key 13) and unscrew the bearing retainer (key 44).
5. Remove the stem screw assembly (key 38), thrust bearings (key 2), and nut (key 43) from the yoke (key 26).
6. Remove the nut from the stem screw assembly (key 38) to reach the remainder of the parts.

For Size 80:

1. Remove the stem connector assembly (key 24).
2. Unscrew the cap screws (key 12) and remove the gear case cover (key 11).
3. Unscrew the two socket head cap screws (key 37) and remove the retaining flange (key 35).
4. Remove the bearing and gear retainer (key 4) and the stem screw assembly (key 38).
5. Remove the thrust bearings (key 2) and worm gear (key 3) from the stem screw assembly (key 38).

Note

Be careful not to lose the ball (key 33) and spring (key 34) as the handwheel is removed.

6. To remove the worm shaft (key 9):
 - a. Remove the set screw from the handwheel cap (key 32).
 - b. Unscrew the handwheel cap and remove the handwheel (key 28).
 - c. Loosen the front (nearest to the threaded end of the worm shaft) set screw (key 10) and unscrew the front worm retainer (key 7).
 - d. Remove the ball bearing (key 8) and the worm shaft.

For Size 100:

1. Remove the stem connector assembly (key 24).
2. Unscrew the cap screws (key 12) and remove the gear case cover (key 11).
3. Remove the bearing and gear retainer (key 4) and the stem screw assembly (key 38).
4. Remove the thrust bearings (key 2) and worm gear (key 3) from the stem screw assembly (key 38).

5. To remove the worm shaft (key 9):
 - a. Remove the retaining ring (key 17).
 - b. Loosen the set screw (key 10) found on the handwheel (key 28) hub.
 - c. Remove the handwheel (key 28).
 - d. Loosen the set screw (key 10) and remove the front (nearest to the threaded end of the worm shaft) worm retainer (key 7), worm shaft (key 9), and front ball bearing (key 8).

Assembly

For Size 30:

1. Replace the spring (key 34) and ball (key 33) in the yoke (key 26).
2. Screw the handwheel (key 28) on the stem screw assembly (key 38).
3. Position the grooves in the handwheel (key 28) and yoke (key 26) to mate, then replace the steel balls (key 33) in the yoke through the threaded hole.
4. Replace the set screw (key 13).
5. Refer to the Installation procedures for instructions on connecting the valve plug stem to the actuator stem screw assembly (key 38).

For Sizes 40 & 50:

1. Replace the thrust bearings (key 2) and bearing seat (key 45) on the stem screw assembly (key 38). Screw the nut (key 43) on the stem screw assembly.

Note

Verify that the key (key 16) fits into the slot milled in the yoke (key 26) before reassembly.

2. Place the stem screw assembly (key 38) in the yoke (key 26).
3. Replace the bearing retainer (key 44), tightening so that the thrust bearings (key 2) move freely, then tighten the set screw (key 13).
4. Place the ball (key 33) in one of the indentations on the yoke, then place the handwheel (key 28) with the spring (key 34) over the ball.
5. Replace the lock washer (key 42) and washer (key 41) on the stem screw assembly (key 38) and tighten the hex nut (key 14).
6. Refer to the Installation procedures for instructions on connecting the valve plug stem to the actuator stem screw assembly (key 38).

For Size 80:

1. If the worm shaft (key 9) was removed during disassembly:
 - a. Replace the worm shaft with the ball bearing (key 8) and the front worm retainer (key 7).
 - b. Adjust the worm retainer to eliminate end play (movement of the worm shaft along its axis) while allowing adequate movement.

- c. Tighten the set screw (key 10) on the front retainer.
2. Replace the ball (key 33), handwheel (key 28), and handwheel cap (key 32), then tighten the set screw in the handwheel cap.
3. Replace one of the thrust bearings (key 2) in the gear case (key 1) making sure that the bearing race with the smaller inside diameter is adjacent to the worm gear web.
4. Screw the worm gear (key 3) on the stem screw assembly (key 38) and place them in the gear case (key 1).
5. Install the other thrust bearing (key 2) on the worm gear (key 3), making sure that the bearing race with the smaller inside diameter is adjacent to the worm gear web.
6. Replace the bearing and gear retainer (key 4).
7. Install the retaining flange (key 35) making sure that the key (key 36) fits in the slot on the retaining flange.
8. Coat the threads on the six set screws (key 13) with a hard-setting sealant. Adjust the six set screws to eliminate end play (movement along the axis of the stem screw assembly) in the thrust bearings, while allowing adequate movement.
9. Replace the gear case cover (key 11) and cap screws (key 12).
10. Replace the stem connector assembly (key 24).
11. Refer to the Installation procedures for instructions on connecting the valve plug stem to the actuator stem screw assembly (key 38).

For Size 100:

1. If the worm shaft (key 9) was removed during disassembly:
 - a. Replace the worm shaft with the ball bearing (key 8) and the front worm retainer (key 7).
 - b. Adjust the worm retainer to eliminate end play (movement of the worm shaft along its axis) while allowing adequate movement.
 - c. Tighten the set screw (key 10) on the front retainer.
2. Replace the key (key 16), handwheel (key 28), and retaining ring (key 17), then tighten the set screw in the hub of the handwheel.
3. Replace one of the thrust bearings (key 2) in the gear case (key 1) making sure that the bearing race with the smaller inside diameter is adjacent to the worm gear web.
4. Screw the worm gear (key 3) on the stem screw assembly (key 38) and place them in the gear case (key 1).
5. Install the other thrust bearing (key 2) on the worm gear (key 3), making sure that the bearing race with the smaller inside diameter is adjacent to the worm gear web.
6. Replace the bearing and gear retainer (key 4).
7. Replace the gear case cover (key 11) and fasten with the cap screws (key 12).
8. Adjust the six set screws (key 13) to eliminate end play (movement along the axis of the stem screw assembly) in the thrust bearings, while allowing adequate movement.
9. Replace the stem connector assembly (key 24).
10. Refer to the Installation procedures for instructions on connecting the valve plug stem to the actuator stem screw assembly (key 38).

Reversing Handwheels

Refer to the previous Disassembly and Assembly sections in this manual for additional instructions, as needed.

To reverse 1008 handwheel actuators sizes 30, 40, or 50, substitute left- or right-hand screw assemblies (key 38). The standard size 100 is not reversible. To reverse size 80, refer to figure 4 while performing the following procedures:

1. Loosen the three set screws (key 10) in the gear case (key 1) and handwheel cap (key 32).

Note

Be careful not to lose the ball (key 33) and spring (key 34) as the handwheel is removed.

2. Unscrew the handwheel cap (key 32) and remove the handwheel (key 28).
3. Remove the front worm retainer (key 7), ball bearing (key 8), and worm shaft (key 9).
4. Remove the back worm retainer (key 6) and ball bearing (key 8).
5. Screw the back worm retainer (key 6) and ball bearing (key 8) into the opening in the gear case (key 1) where the front worm retainer is located.
6. Replace the front worm retainer (key 7) and ball bearing (key 8).
7. Replace the spring (key 34) and ball (key 33), handwheel (key 28), and handwheel cap (key 32).
8. Tighten the three set screws (key 10) in the gear case (key 1) and handwheel cap (key 32).

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always mention this number when corresponding with your [Emerson sales office](#) regarding technical information or replacement parts.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

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Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

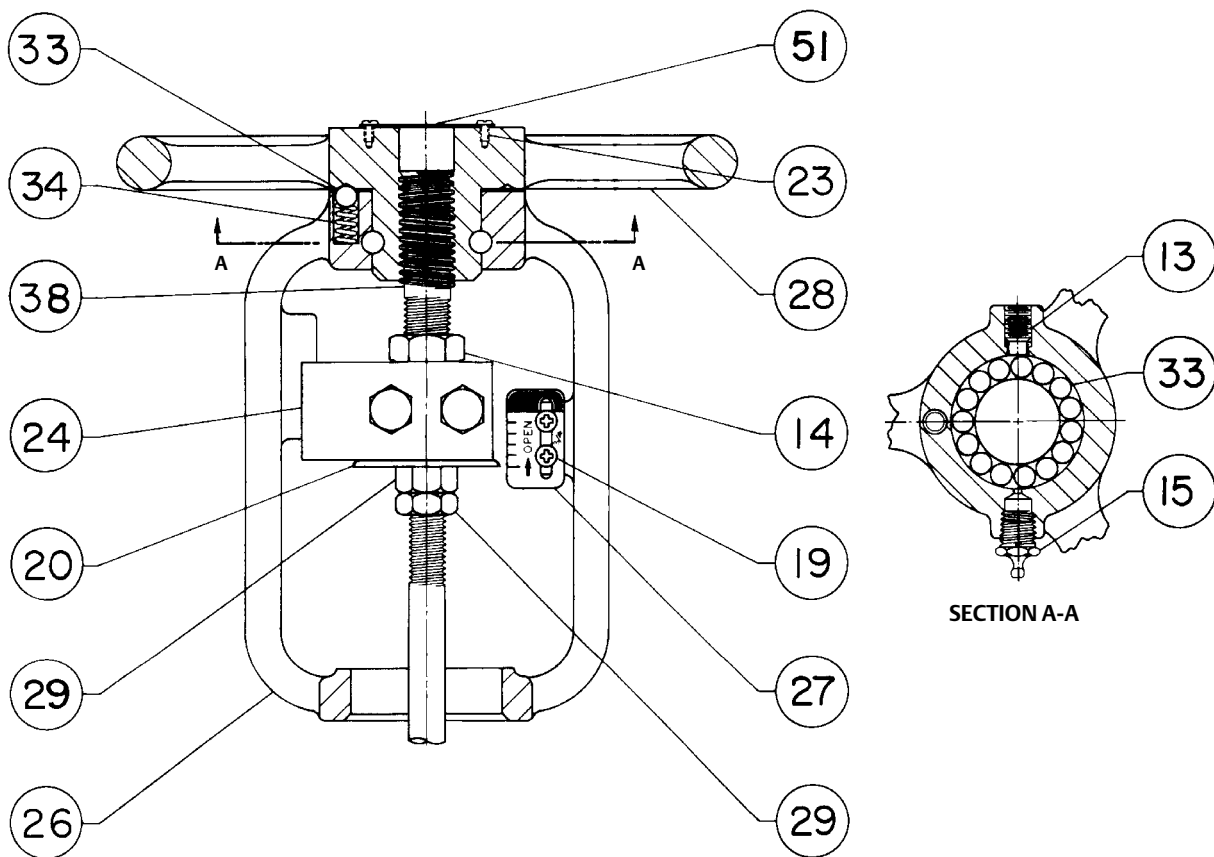
Key	Description
-----	-------------

1	Gear Case
2	Bearing (2 req'd)
3	Worm Gear
4	Bearing & Gear Retainer
5	Power Screw (size 100)
6	Back Worm Retainer (sizes 80 & 100)
7	Front Worm Retainer (sizes 80 & 100)
8	Ball Bearing (2req'd)
9	Worm Shaft
10	Set Screw (3 req'd) (sizes 80 & 100)
11	Gear Case Cover
12	Cap Screw (8 req'd) (size 100)
13	Set Screw
	Size 30
	Sizes 40 & 50
	Size 80 (6 req'd)
	Size 100 (6 req'd)
14	Hex Nut
	Size 30
	Sizes 40 & 50
	Size 100 (6 req'd)
15	Grease Fitting (all sizes)
16	Key
	Sizes 40 & 50
	Size 100
17	Retaining Ring (size 100)
18	Cap Screw (8 req'd) (size 100)
18	Socket-Head Cap Screw (6 req'd) (size 80)
19	Screw (2req'd)
20	Travel Indicator Disk

Key	Description
-----	-------------

21	Cap Screw (2req'd) (size 100)
22	Nameplate
23	Nameplate Screw (2 req'd)
23	Drive Screw (4 req'd)
24	Stem Connector Assembly
25	Cap Screw
	Size 80 (2req'd)
	Size 100 (4 req'd)
26	Yoke
27	Travel Indicator Scale
28	Handwheel
29	Hex Nut (2 req'd)
	Size 30 (1 each, full and jam)
	Size 40
	Size 50 (1 each, full and jam)
	Size 80
	Size 100
30	Hand Grip (size 80)
31	Hand Grip Bolt (size 80)
32	Handwheel Cap (size 80)
33	Ball
	Size 30 (16 req'd)
	Sizes 40 & 50 (1 req'd)
	Size 80 (1 req'd)
34	Spring
35	Retaining Flange (size 80)
36	Key (size 80)
37	Cap Screw (size 80) (2 req'd)
38	Stem Screw Assembly
39	Travel Stop (size 80)
40	Machine Screw (2 req'd) (size 80)
41	Washer (sizes 40 & 50)
42	Lock Washer (sizes 40 & 50)
43	Nut
44	Bearing Retainer (sizes 40 & 50)
45	Bearing Seat (sizes 40 & 50)
46	Twin Speed Nut
47	Tejax Indicator
48	Set Screw w/Set Screw Handwheel Lock, (not shown)
	(sizes 40 & 50)
51	Cover (size 30)

Figure 2. Fisher 1008 Handwheel Actuator Size 30



PARTS NOT SHOWN 46, 50, AND 22
30A6973-D

Figure 3. Fisher 1008 Handwheel Actuator Sizes 40 and 50

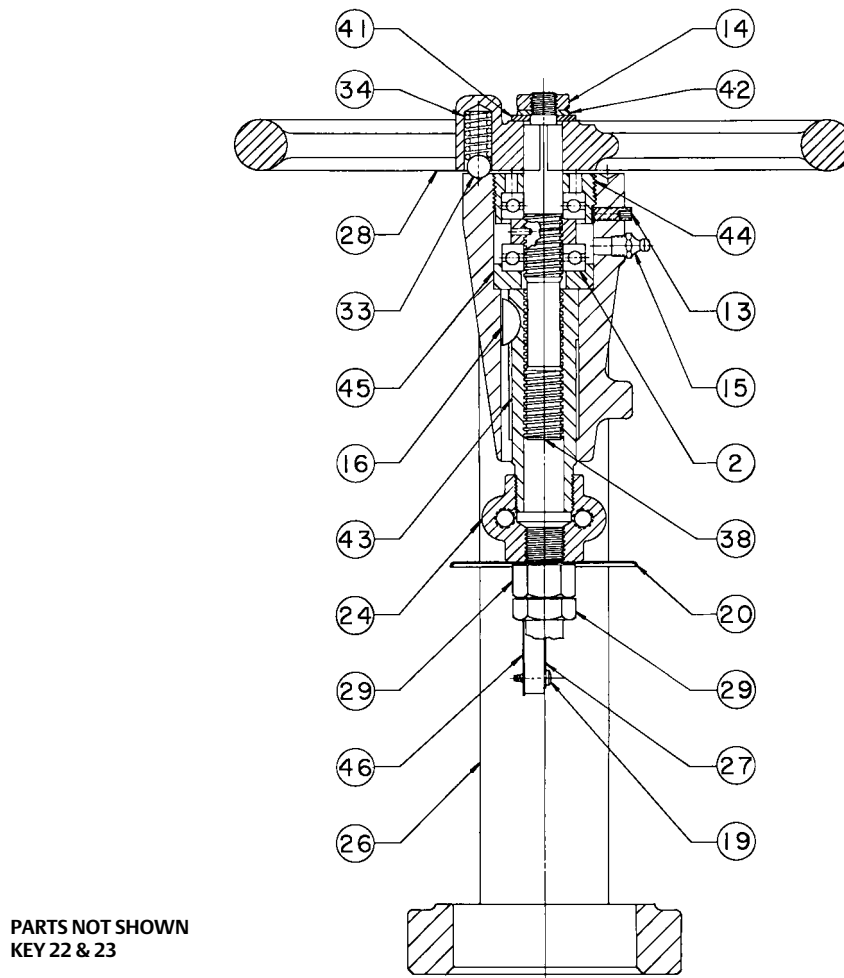


Figure 4. Fisher 1008 Handwheel Actuator Size 80

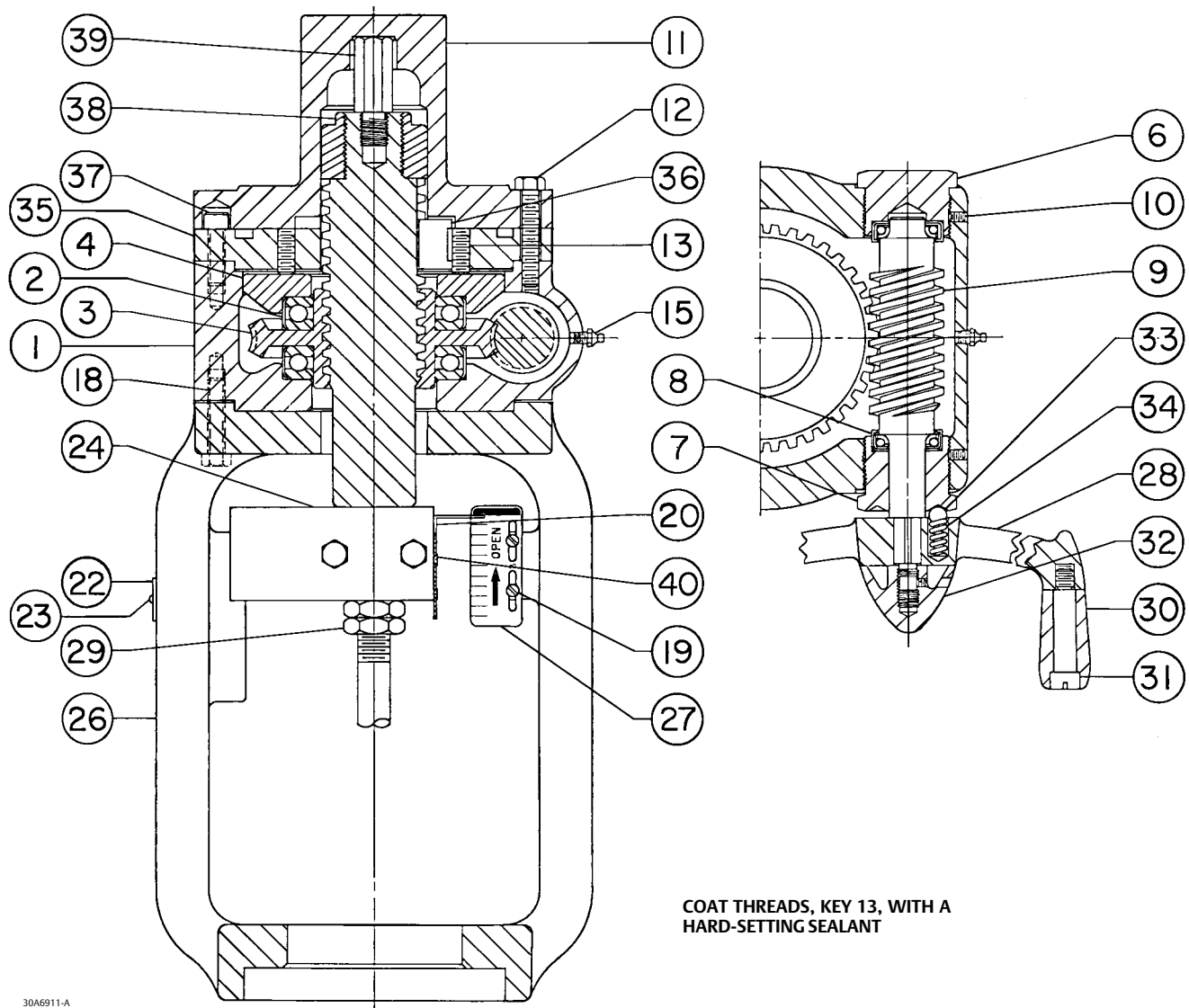
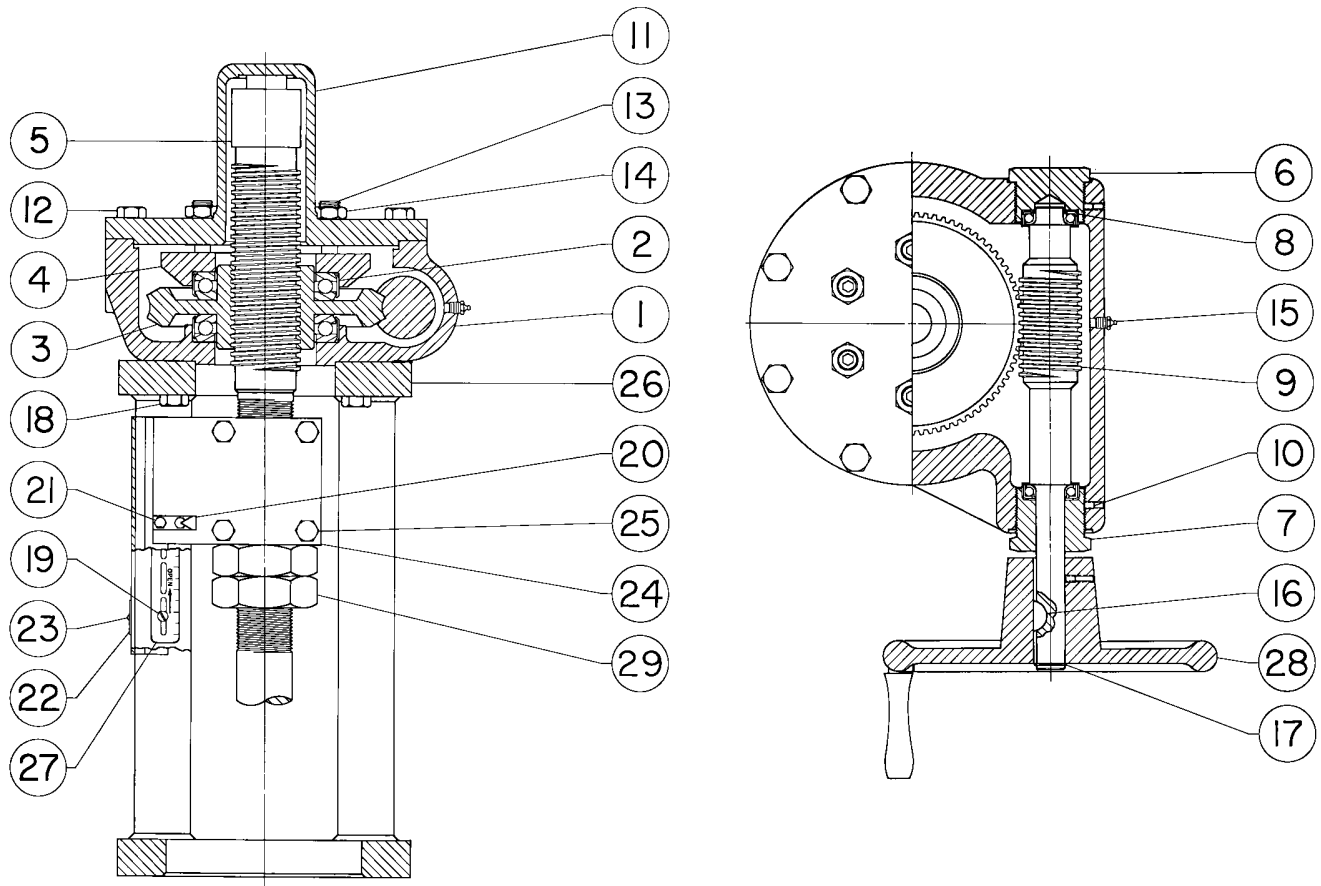
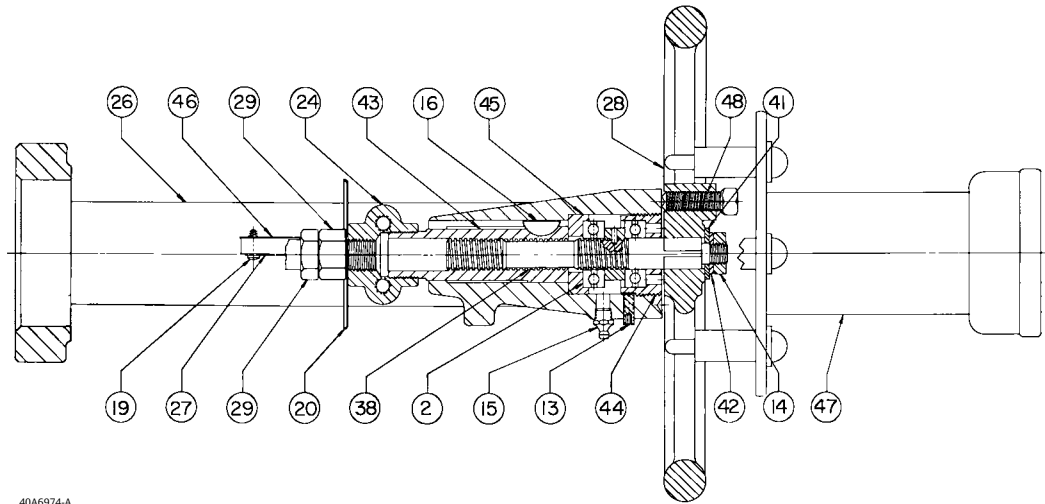


Figure 5. Fisher 1008 Handwheel Actuator Size 100



50A2650-B

Figure 6. Fisher 1008 Handwheel Actuator Sizes 40 and 50 with Tejax Position Indicator



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Fisher™ 1051 and 1052 Size 33 Diaphragm Rotary Actuators

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Figure 1. Fisher 1052 Actuator with CV500 Valve and FIELDVUE™ DVC6200 Digital Valve Controller



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Introduction

Scope of Manual

This instruction manual includes installation, adjustment, operation, maintenance, and parts information for the Fisher 1051 and 1052 Size 33 diaphragm rotary actuators (figure 1). Mounting adaptations F, G, H, and J are included in this manual. Instructions for the control valve, positioner, manual actuator, and other accessories are included in separate manuals.

Table 1. Specifications

Available Configuration

1051: For on-off service without a positioner or for throttling service with a positioner

1052: For on-off service without a positioner or for throttling service with or without a positioner

Standard Diaphragm Pressure Ranges

■ 0 to 1.2 bar (0 to 18 psig), ■ 0 to 2.3 bar (0 to 33 psig), ■ 0 to 2.8 bar (0 to 40 psig), and ■ 0 to 3.8 bar (0 to 55 psig)

Maximum Diaphragm Sizing Pressure^(1, 2)

3.8 bar (55 psig)

Maximum Diaphragm Casing Pressure^(1, 7)

4.5 bar (65 psig)

Maximum Valve Shaft Rotation

■ 90 degrees (adjustable through 60 degrees with integral travel stops)

Acceptable Valve Shaft Diameters, mm (Inches)

F and G mounting: ■ 12.7 (1/2), ■ 15.9 (5/8), or ■ 19.1 (3/4)

H mounting: varies—uses 22.2 mm (7/8 inch) output shaft with two flats

J mounting: ■ 9.5 (3/8), ■ 12.7 (1/2), or 15.9 (5/8)

Stroking Time

Dependent of actuator size, rotation, spring rate, initial spring compression, supply pressure, and size

of supply piping. If stroking time is critical, consult your Emerson sales office.

Diaphragm Casing Displacement

Clearance Volume⁽³⁾: 623 cm³ (38 cubic inches)

Casing Volume⁽⁴⁾

90 Degree Rotation: 2390 cm³ (146 cubic inches)

60 Degree Rotation: 1890 cm³ (115 cubic inches)

Material Temperature Capabilities⁽¹⁾

NBR (nitrile) Diaphragm or O-rings⁽⁵⁾:

-40 to 82°C (-40 to 180°F)

VMQ (silicone) Diaphragm:

-40 to 149°C (-40 to 300°F)

POM (polyoxymethylene) Push Rods and Guides (used with lever-operated switches):

-40 to 82°C⁽⁶⁾ (-40 to 180°F)

Travel Indication

Graduated disk and pointer

Pressure Connections

Standard: 1/4 NPT internal

Optional: ■ 1/2 or ■ 3/4 NPT internal

Mounting Positions

See figure 2

Approximate Weights

1051: 20 kg (45 pounds)

1052: 21 kg (46 pounds)

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

2. Use this value to determine the maximum torque output allowed.

3. Volume when the diaphragm is in the up position.

4. Includes clearance volume.

5. NBR (nitrile) O-rings are used in the optional top-mounted handwheel and in the optional up travel stop assembly.

6. For higher temperature ratings, contact your Emerson sales office.

7. This maximum casing pressure is not to be used for normal operating pressure. Its purpose is to allow for typical regulator supply settings and/or relief valve tolerances.



Do not install, operate, or maintain a 1051 or 1052 actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

1051 and 1052 Size 33 spring-and-diaphragm actuators are used on rotary-shaft valve bodies for throttling or on-off applications. The 1051 may be used for on-off service without a positioner or for throttling service with a positioner. The 1052 uses an adjustable spring seat to control spring compression. It may be used for on-off service without a positioner, or it may be used for throttling service with or without a positioner, depending on service conditions.

A top-mounted handwheel may be mounted for infrequent service as a manual override. A manual actuator is recommended for routine and repeated manual operation. Externally adjustable travel stops are used to limit the degree of rotation at both ends of the actuator stroke. Provisions are included for integral mounting of optional magnetic proximity switches. Lever-operated, mechanical switches are also available.

The lever for the 1051 and 1052 size 33 actuator is supported by bushings. The lever may be changed to accommodate valve bodies with different size valve shafts and different mounting adaptations. Levers and accessories are available for mounting valve bodies and equipment with the following mounting adaptations:

F and G mounting adaptations (figures 9 and 10) are for use with Fisher splined-shaft rotary valve bodies with 12.7, 15.9, and 19.1 mm (1/2, 5/8, and 3/4 inch) valve shaft diameters. A stub shaft is available for installation on the end of the lever opposite the valve body for use as a wrench-operated extension (for emergency override) or as a means of connecting a manual actuator (see figure 14).

H mounting (figure 11) is for use with non-Fisher products and user-provided mounting brackets and shaft couplings. It includes a mounting surface with threaded holes for attaching the user-provided mounting bracket. A 22.2 mm (7/8 inch) stub shaft with flats is pinned to the lever and is used to couple the actuator to the operated equipment. A second stub shaft may be installed on the opposite end of the lever for use as a wrench-operated extension (for emergency override) or as a means for connecting a manual actuator (see figure 14). Stub shafts are available in standard and reverse constructions (see figure 12) to provide proper operation with the mounting position and actuator action desired (see figure 2).

J mounting (figure 13) permits use of the actuator with Fisher keyed-shaft valve bodies and other keyed-shaft equipment with 9.5, 12.7, and 15.9 mm (3/8, 1/2, and 5/8 inch) shaft diameters. A stub shaft is pinned to the lever and a valve shaft coupling is pinned to the stub shaft. The coupling has multiple keyways (see figure 4) to accommodate mounting in the desired position. A second stub shaft may be installed on the opposite end of the lever for use as a wrench-operated extension (for emergency override) or as a means for connecting a manual actuator (see figure 14).

Table 2. Bolting Torque Requirements⁽¹⁾

DESCRIPTION KEY NUMBER	BOLT SIZE	TORQUE	
		N•m	Lbf•ft
Diaphragm Casing 5	3/8-24	27	20
Travel Stop 8	7/16-14	27	20
Diaphragm to rod 9	3/8-24	54	40
Rod end to lever 18	3/8-16	54	40
Housing to yoke 23	5/16-18	41	30
Housing to cover 34	5/16-18	41	30
Yoke to valve 71	3/8-16	(See appropriate valve instruction manual)	
Clamped lever 28	3/8-16	54	40
Switch Nut 78	3/8-16	27	20

1. Exceeding any torque requirements could damage the actuator and impair safe operation.

Specifications

Specifications are shown in table 1 for 1051 and 1052 size 33 actuators. Some specifications for a given actuator as it originally comes from the factory are stamped on a metal nameplate attached to the actuator.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

1051 and 1052 Size 33 Actuators

June 2023

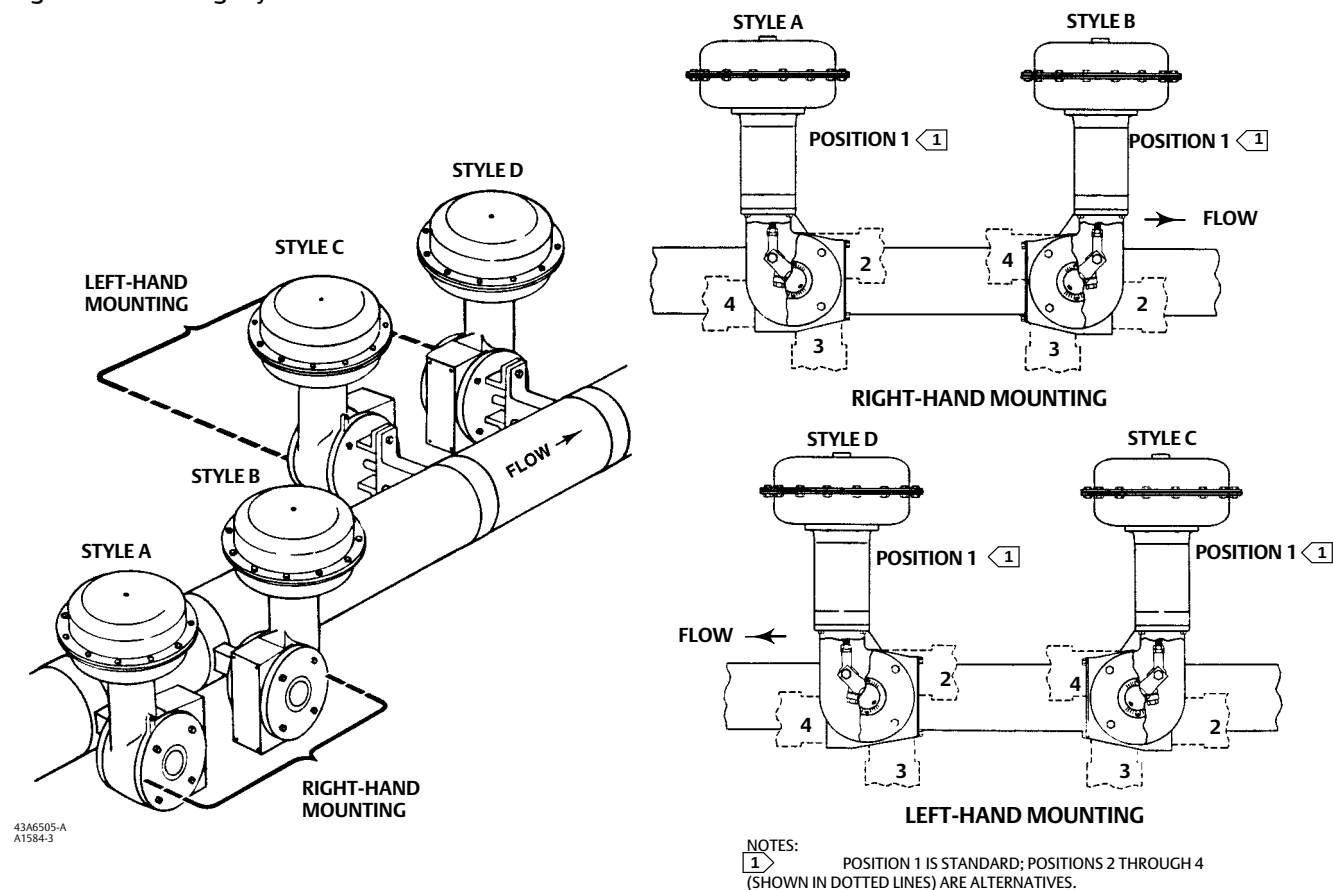
Instruction Manual

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MOUNTING	ACTION(1)	VALVE SERIES OR DESIGN				VALVE SERIES OR DESIGN		
		BALL/PLUG ROTATION TO CLOSE	V250	V150, V200 & V300	CV500 V500	DISK/BALL ROTATION TO CLOSE	V250	8510B, 8532, 8560 & 9500
Right-Hand	PDTC	CCW	A	A	A	CW	NA	B
	PDTO	CCW	B	B	B	CW	NA	A
Left-Hand	PDTC	CCW	NA	D	D	CW	C	C
	PDTO	CCW	NA	C	C	CW	D	D
Left-Hand (Optional)(2)	PDTC	CW	NA	C	NA	NA	NA	NA
	PDTO	CW	NA	D	NA	NA	NA	NA

1. PDTC—Push-down-to-close, and PDTO—Push-down-to-open.
2. A left hand ball will be required for the NPS 3 through 12 Series B and the NPS 14 to 20, with or without attenuator.

Figure 2. Mounting Styles and Positions for Fisher 1051 and 1052 Actuators



Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations.

To avoid personal injury or property damage caused by bursting of pressure retaining parts, do not apply pressure exceeding the Maximum Diaphragm Casing Pressure limit given in table 1 or on the nameplate. Use pressure limiting or pressure relieving devices to prevent the casing pressure from exceeding the maximum diaphragm casing pressure.

Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

NOTICE

To avoid parts damage, do not apply pressure that exceeds the Maximum Diaphragm Sizing Pressure (table 1) or produces a torque greater than the Maximum Allowable Valve Shaft Torque (see Catalog 14). Use pressure-limiting or pressure-relieving devices to prevent the diaphragm casing pressure from exceeding these limits.

The actuator, as it comes from the factory, is normally mounted on a valve body. Follow the procedures given in the valve instruction manual when installing the control valve in the pipeline.

If a positioner is ordered with the actuator, the pressure connection to the actuator is normally made at the factory. If it is necessary to make this connection, run either 1/4 inch pipe or 3/8 inch tubing (for standard diaphragm case fittings) between the pressure connection and the instrument. Keep the length of tubing or pipe as short as possible to avoid transmission lag in the control signal.

When the control valve is completely installed and connected to the controlling instrument, check to make sure that the action is correct (air-to-open or air-to-close) and that the controlling instrument is properly configured for the desired action. For successful operation, the diaphragm rod, lever, and valve shaft must move freely in response to changes in the loading pressure on the diaphragm.

Actuator Mounting and Changing Actuator Mounting

Use the following steps to mount the actuator or to change actuator mounting style or position.

F and G Mounting Adaptations

Unless otherwise specified, key numbers referenced in the following procedures are shown in figure 9 for the 1051 actuator and in figure 10 for the 1052 actuator.

1. Proceed as appropriate:

If the Actuator is mounted on a valve body and it is necessary to change mounting style or position, the actuator must first be separated from the valve body. Proceed to the Disassembly portion of the Changing or Replacing Actuator Lever procedure, observe all warnings, perform steps 1 through 6, and return to step 2 which follows.

If the Actuator is not mounted on a valve body, proceed to the Disassembly portion of the Changing or Replacing Actuator Lever procedure, perform steps 2 through 5, and return to step 2 which follows.

2. Refer to figure 2 for available mounting styles and positions. When mounting on a Vee-Ball™ V150, V200 or V300 valve, check the valve manual to determine if it is Series B. The actuator is normally positioned vertically with the valve in a horizontal pipeline.
3. Determine whether the actuator mounting yoke (key 22) will be mounted on the housing cover assembly (key 33) side or on the actuator housing boss side of the actuator. If the desired mounting position and style require moving the mounting yoke and travel indicator (key 35) to opposite sides of the actuator, remove the machine screws (key 38), the travel indicator pointer (key 37), the machine screws, and the travel indicator scale (key 35). Remove the cap screws (key 23) and the mounting yoke. Install the mounting yoke in the desired position (on the housing cover assembly or on the actuator housing boss). See table 2 for recommended torque for the mounting cap screws. Install the travel indicator components on the opposite side of the actuator. See figure 14 for travel indicator components used with wrench-operated extensions and manual actuators.

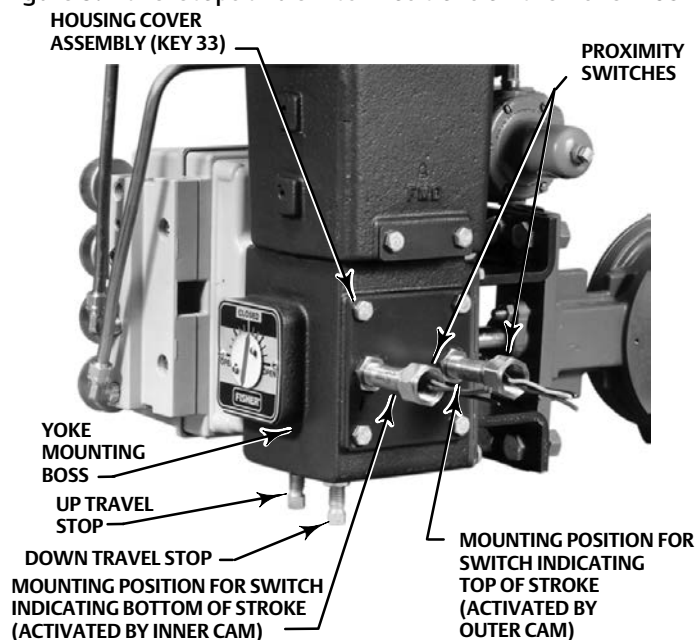
4. Before sliding the valve shaft into the lever, position the valve ball or disk as follows:

For push-down-to-close action, the valve ball or disk should be in the fully open position.

For push-down-to-open action, the valve ball or disk should be in the fully closed position (see the valve body instruction manual).

5. Make sure that the index markings on the valve shaft are properly aligned with the markings on the lever and slide the valve shaft into the lever. Install the valve mounting cap screws, washers, and nuts and tighten to the torque value given in the appropriate valve body instruction manual.
6. Ensure all end play in the valve shaft is removed by pulling the valve shaft toward the actuator as much as possible. Make sure the actuator rod is perpendicular to the valve shaft. Refer to the valve instruction manual for specific end play considerations.

Figure 3. Travel Stops and Switch Positions on the Fisher 1051 and 1052 Size 33 Actuator



W4738

7. Tighten the socket head cap screw which compresses the splined lever connection to the valve shaft (see table 2).

NOTICE

When adjusting the travel stop for the closed position of the valve ball or disk, refer to the appropriate valve instruction manual for detailed procedures. Undertravel or overtravel at the closed position may result in poor valve performance and/or damage to the equipment.

8. Adjust the up travel stop (see figure 3) so that the valve ball or disk is in the desired position.

⚠ WARNING

To avoid personal injury and equipment damage from moving parts, keep fingers and tools clear while stroking the actuator with the cover removed.

9. Stroke the actuator and adjust the down travel stop so that the valve ball or disk is in the desired position.
10. Make sure that the travel indicator pointer matches the ball or disk position. Remove and install in the proper position if necessary.
11. Install the cover plate or switch mounting plate (key 59) with cap screws (key 60).
12. Refer to the table of contents for accessory installation procedures.

H Mounting Adaptation

Unless otherwise specified, key numbers referenced in the following procedures are shown in figure 9 for the 1051 actuator and in figure 10 for the 1052 actuator. Unique parts used for the H mounting adaptation are shown in figure 11 for single stub shaft construction and in figure 14 for dual stub shaft construction.

1. To change mounting style or position, the actuator must be separated from the valve body (or other operated equipment). Remove the cap screws used to attach the actuator to the valve body (or other operated equipment) and remove the actuator.
2. Determine the desired mounting position. Note that stub shafts are available in standard and reverse constructions so that proper alignment with the operated equipment can be achieved (see figure 12). Refer to figure 2 for available mounting styles and positions.
3. If it is necessary to install or change stub shaft(s), the actuator lever (key 27) must be removed. Perform all applicable operations in the Disassembly portion of the Changing or Replacing Actuator Lever procedure. Install the stub shafts for the construction desired (refer to figures 11 and 14) and reassemble the actuator.
4. Determine whether the operated equipment will be mounted on the housing cover assembly (key 33) side or on the actuator housing boss side of the actuator. Depending on the desired mounting style and position, it may be necessary to move the operated equipment and travel indicator components to opposite sides of the actuator. If so, remove the travel indicator components, the operated equipment, and the mounting bracket if used. Install the operated equipment or mounting bracket in the desired position (on the housing cover assembly or on the actuator housing boss). See table 2 for recommended torque for the mounting cap screws. Install the travel indicator components on the side of the actuator opposite the operated equipment. Refer to figure 14 for travel indicator components used with wrench-operated extensions and manual actuators.

5. Before coupling the operated equipment to the actuator stub shaft, position the equipment as follows:

For push-down-to-activate (open) action, the equipment should be in the fully deactivated (closed) position.

For push-down-to-deactivate (close) action, the equipment should be in the fully activated (open) position.

6. Install the required shaft coupling and the operated equipment.

NOTICE

When adjusting the travel stops to limit rotation, be certain that the rotation produced does not exceed the safe limit of the operated equipment. Undertravel or overtravel may result in poor performance and/or damage to the equipment.

7. Adjust the up travel stop (see figure 3) so that the operated equipment is in the desired position.

⚠ WARNING

To avoid personal injury and equipment damage from moving parts, keep fingers and tools clear while stroking the actuator with the cover removed.

8. Stroke the actuator and adjust the down travel stop so that the operated equipment is in the desired position.
9. Make sure that the travel indicator pointer matches the ball or disk position. Remove and install in the proper position if necessary.
10. Refer to the table of contents for accessory installation procedures.

J Mounting Adaptation

Unless otherwise specified, key numbers referenced in the following procedures are shown in figure 9 for the 1051 actuator and in figure 10 for the 1052 actuator. Unique parts used for the J mounting adaptation are shown in figure 13 for single stub shaft construction and in figure 14 for dual stub shaft construction.

1. If the actuator is mounted on a valve body and it is necessary to change mounting style or position, the actuator must be separated from the valve body. Proceed to the disassembly portion of the Changing or Replacing Actuator Lever procedure, observe all warnings, perform steps 1 through 6, and return to step 2 which follows.
2. Refer to figure 2 for available mounting styles and positions. The actuator is normally mounted vertically on a valve body that is installed in a horizontal pipeline.
3. If it is necessary to install or change stub shaft(s), the actuator lever (key 27) must be removed. Perform all applicable operations in the Disassembly portion of the Changing or Replacing Actuator Lever procedure. Install the stub shafts for the construction desired as shown in figure 13 and reassemble the actuator.
4. Determine whether the actuator mounting yoke (key 22) will be mounted on the housing cover assembly (key 33) or on the actuator housing boss. If the desired mounting position and style requires moving the mounting yoke and travel indicator components to opposite sides of the actuator, remove the travel indicator components, the valve shaft coupling (key 80 for 1051, or key 90 for 1052), cap screws (key 23), and the mounting yoke. Install the mounting yoke in the desired position (on the housing cover assembly or on the actuator housing boss). See table 2 for recommended torque for the mounting cap screws. Install the valve shaft coupling on the actuator stub shaft.

Install the travel indicator components on the opposite side of the actuator. See figure 14 for travel indicator components used with wrench-operated extensions and manual actuators.

5. Before coupling the valve to the actuator, position the valve ball or disk as follows:

For push-down-to-close action, the valve ball or disk should be in the fully open position.

For push-down-to-open action, the valve ball or disk should be in the fully closed position (see the valve body instruction manual).

6. The valve shaft coupling (see figure 4) has two keyways lettered A and B (the letters C and D on the coupling are not used and may be disregarded). Align the appropriate keyway with the keyway in shaft of the operated equipment.

When used with a Fisher butterfly valve body, refer to the table and illustration in figure 4 for proper orientation of the coupling and valve shaft. Install the woodruff key (key 81 for 1051, key 91 for 1052) in the valve shaft keyseat, lubricate the inside of the coupling, and slide the valve shaft into the coupling.

7. Install the valve mounting cap screws, washers, and nuts and tighten to the torque value given in the appropriate valve body instruction manual.

NOTICE

When adjusting the travel stop for the closed position of the valve ball or disk, refer to the appropriate valve body instruction manual for detailed procedures. Undertravel or overtravel at the closed position may result in poor valve performance and/or damage to the equipment.

8. Adjust the up travel stop so that the valve ball or disk is in the desired position.

⚠ WARNING

To avoid personal injury and equipment damage from moving parts, keep fingers and tools clear while stroking the actuator with the cover removed.

9. Stroke the actuator and adjust the down travel stop so that the valve ball or disk is in the desired position.
10. Make sure that the travel indicator pointer matches the ball or disk position. Remove and install in the proper position if necessary.
11. Refer to the table of contents for accessory installation procedures.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

1051 and 1052 Size 33 Actuators

June 2023

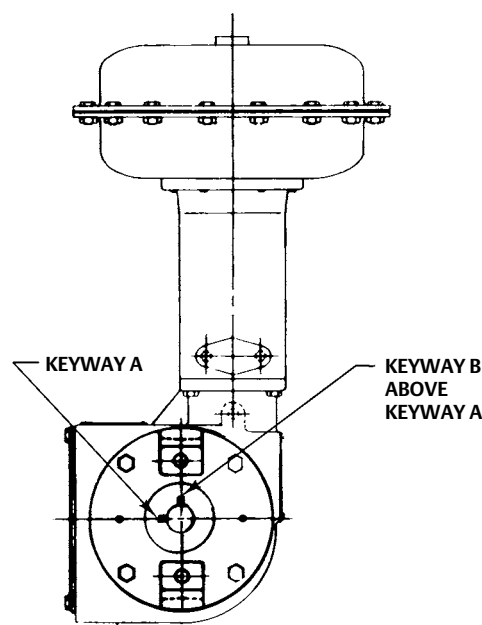
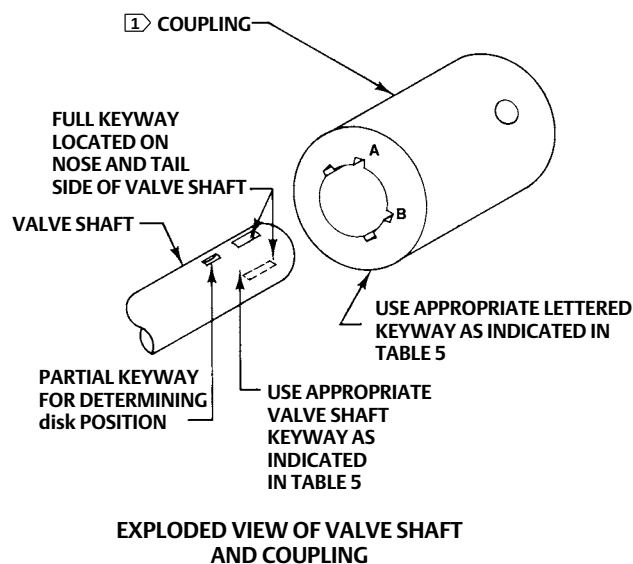
Instruction Manual

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DESIRED ACTUATOR ACTION	DESIRED SHAFT ROTATION, DEGREES	ACTUATOR MOUNTING POSITION	COUPLING KEYWAY TO USE ⁽³⁾	VALVE SHAFT KEYWAY TO USE FOR FISHTAIL™ DISK VALVE BODIES ⁽¹⁾ (SEE FIGURE 2)			
				Clockwise to Close Valve Action ⁽²⁾		Counterclockwise to Close Valve Action ⁽²⁾	
				Flow Left to Right ⁽²⁾	Flow Right to Left ⁽²⁾	Flow Left to Right ⁽²⁾	Flow Right to Left ⁽²⁾
Push Down to Open (PDTO)	60 or 90	1	B	Nose	Tail	Tail	Nose
		2	A	Tail	Nose	Nose	Tail
		3	B	Tail	Nose	Nose	Tail
		4	A	Nose	Tail	Tail	Nose
Push Down to Close (PDTC)	60 ⁽³⁾ or 90	1	A	Tail	Nose	Tail	Nose
		2	B	Tail	Nose	Tail	Nose
		3	A	Nose	Tail	Nose	Tail
		4	B	Nose	Tail	Nose	Tail

1. For conventional disk valve bodies, use either valve shaft keyway.
2. When viewed from actuator side of valve body.
3. For 60-degree rotation with PDTC action, the coupling and actuator output shaft assembly will offset 30 degrees clockwise (for actuator housing construction style B), or counterclockwise (for actuator housing construction style A) in the lever when viewed from the splined end of the actuator shaft. 30 degrees is one spline tooth for 9.5, 12.7, and 15.9 mm (3/8, 1/2, and 5/8 inch) valve shafts and two spline teeth for 19.1 mm (3/4 inch) valve shafts.

Figure 4. Valve Shaft Coupling for the J Mounting Adaptation



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REFERENCE COUPLING ORIENTATION FOR TABLE 5

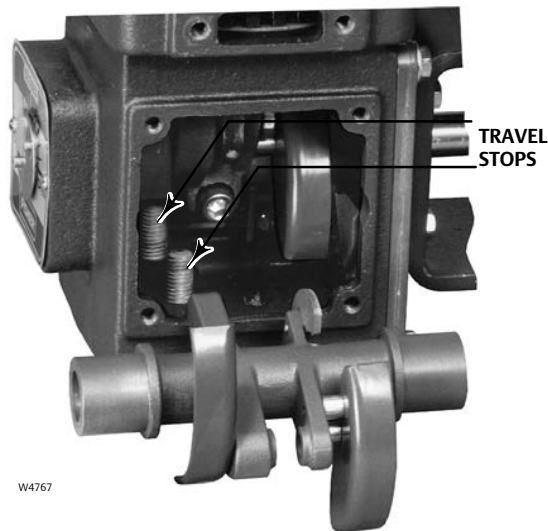
NOTES:

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FOR USE WITH J MOUNTING ADAPTATION.

Figure 5. Spring Adjustment



1052 Spring Compression Adjustment

Initial Compression

Key numbers referred to in this procedure are shown in figure 10 unless otherwise specified.

The 1052 nameplate specifies an initial set adjusted into the actuator spring. Initial set is the casing pressure at which the diaphragm (key 3) and diaphragm rod (key 10) begin to move away from the stop in the upper diaphragm case (key 1) when the actuator is disengaged from the control valve body or other operated equipment. The initial set was determined from the service conditions specified when the actuator was ordered, so that when the actuator and valve are in service, the valve ball or disk seats properly and full travel is obtained with the supply pressure specified on the order and shown on the nameplate.

Before adjusting spring tension to change initial set, the valve body or other operated equipment must be removed or otherwise disengaged from the actuator. Refer to the applicable steps given under the appropriate mounting adaptation in the Actuator Mounting and Changing Actuator Mounting procedure.

To gain access to the spring adjusting screw, either the spring adjuster cover (key 117) or the switch mounting plate (key 59) must be removed. If externally mounted switches are used, remove them as an assembly by removing the cap screws (key 75, figure 16) and the switch mounting plate (key 1, figure 16). In order to gain access to the cap screws, it may be necessary to loosen the hex nuts (key 77, figure 16) and slide the switches away from the actuator housing.

Note that the lower part of the spring adjusting screw (key 74) is notched so that it can be rotated with a screwdriver or other flat-bladed tool. To decrease spring compression, rotate the spring adjusting screw to the right (see figure 5). To increase spring compression, rotate the spring adjusting screw to the left (clockwise when viewed from above). Adjust the spring so that the diaphragm rod just starts to travel at the initial set pressure specified on the nameplate. When the desired initial set has been achieved, install the spring adjuster cover or switch mounting plate.

Table 3. Spring for Fisher 1052 Actuator⁽¹⁾

CASING PRESSURE		INITIAL SPRING COMPRESSION					
		60 Degree Rotation		90 Degree Rotation			
Bar	Psig	Push-down-to-open		Push-down-to-open		Push-down-to-close	
		Bar	Psig	Bar	Psig	Bar	Psig
0-1.2	0-18	0.3	3.9	0.2	2.7	0.2	2.7
		0.4	5.4	0.3	3.7	0.2	3
		0.4	6.1	0.3	4.9	0.2	3
0-2.3	0-33	0.3	3.9	---	---	0.2	2.7
		0.4	5.4	0.3	3.7	0.3	3.7
		0.5	7.1	0.3	4.9	0.3	4.9
		0.7	9.7	0.4	6.3	0.2	3
0-2.8	0-40	0.3	3.9	---	---	0.2	2.7
		0.4	5.4	0.3	3.7	0.3	3.7
		0.5	7.1	0.3	4.9	0.3	4.9
		0.7	9.7	0.4	6.3	0.2	3.5
0-3.8	0-55	---	---	0.3	4.9	0.3	4.9
		0.7	9.7	0.4	6.3	0.4	6.3
0.2-1	3-15	---	---	0.3	3.7	0.2	3
0.2-2.1	3-30	---	---	---	---	0.3	3.7
		---	---	0.3	4.9	0.3	4.9
		---	---	0.4	6.3	0.2	3

1. For more detailed information concerning proper spring selection to obtain the torque required, consult your [Emerson sales office](#).

Stroking Range

Key numbers referred to in this procedure are shown in figure 10 unless otherwise specified.

If, under operating conditions, the desired stroking range cannot be achieved with the casing pressure used, it may be possible to shift the stroking range by making a spring adjustment to change the initial spring compression. A spring adjustment shifts the casing pressure span and equally increases (or decreases) the casing pressure at which the actuator begins to stroke and the pressure at which the actuator reaches full travel.

To gain access to the spring adjusting screw, either the spring adjuster cover (key 117) or the switch mounting plate (key 59) must be removed. If externally mounted switches are used, remove them as an assembly by removing the cap screws (key 75, figure 16) and the switch mounting plate (key 1, figure 16). In order to gain access to the cap screws, it may be necessary to loosen the hex nuts (key 77, figure 16) and slide the switches away from the actuator housing.

Note that the lower part of the spring adjusting screw (key 74) is notched so that it can be rotated with a screwdriver or other flat bladed tool. To shift the casing pressure span downward, rotate the spring adjusting screw to the right (see figure 5). To shift the casing pressure span upward, rotate the spring adjusting screw to the left. When the desired stroking range has been achieved, replace the spring adjuster cover or the switch mounting plate.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given below for disassembly and assembly of parts. Key numbers referenced in the following steps are shown in figure 9 for the 1051 actuator and in figure 10 for the 1052, except as listed below or otherwise specified in the procedures.

Mounting Adaptations

F and G Adaptations

The procedures given in this instruction manual apply directly to F and G mounting adaptations. Refer to figures 9 and 10.

H Mounting Adaptations

Whenever the procedures require separating the actuator from the operated equipment, it may be necessary to remove brackets, couplings, and stub shafts before proceeding. Refer to figure 11 for parts used with the H mounting adaptation.

J Mounting Adaptations

Whenever the procedures require separating the actuator from the valve body, it may be necessary to remove couplings and keyways. Refer to figure 13 for parts used with the J mounting adaptation.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any hazards that may be present from exposure to process media.

Replacing Diaphragm

Disassembly

1. Bypass the control valve. Relieve all loading pressure, and remove the tubing or pipe from the upper diaphragm case (key 1).
2. Observe the position of the travel indicator pointer (key 37) and mark its position on the travel indicator scale (key 35).

⚠ WARNING

Failure to control spring tension against the upper diaphragm case as outlined in the following step could result in sudden spring decompression causing bodily injury or equipment damage. Control spring tension by following step 3 closely.

3. Loosen the hex jam nut (key 84 for 1051, or key 86 for 1052) on the up travel stop. This stop is nearest to the positioner or positioner cover (key 39; also see figure 3). Screw the travel stop in (turn it clockwise) until it can be verified that all spring tension has been removed from the diaphragm stop in the upper diaphragm case, i.e. when any movement of the travel indicator pointer is observed, all spring tension against the upper diaphragm case stop has been removed. Do not rotate the travel stop past this position as additional compression of the spring is not necessary or desirable.
4. Carefully remove all cap screws and hex nuts (keys 5 and 6) from the diaphragm case.
5. Remove the diaphragm case and the diaphragm (key 3).
6. Inspect the diaphragm plate (key 4). If the diaphragm plate is damaged or if further disassembly of the actuator is required, proceed to the Diaphragm Plate, Diaphragm Rod, Spring, and Spring Seat procedure.
7. Inspect the diaphragm and replace if necessary.

Assembly

1. Place the diaphragm (key 3) on the diaphragm plate (key 4), making certain that it is properly centered.
2. Make sure that the up travel stop (see figure 3) is screwed in sufficiently to eliminate interference of the diaphragm plate (key 4) with the upper diaphragm case.
3. Observe the correct position of the loading connection fitting and install the upper diaphragm case (key 1). Replace the cap screws and nuts (keys 5 and 6) which secure the upper diaphragm case to the actuator housing. Tighten the nuts in an alternating fashion (see table 2).

NOTICE

When adjusting the travel stop for the closed position of the valve ball or disk, refer to the appropriate valve body instruction manual for detailed procedures. Undertravel or overtravel of many valve types may result in poor valve performance and/or damage to the equipment.

4. Adjust the up travel stop (see figure 3). If the upper travel stop establishes the closed position of the valve ball or disk, refer to the valve body instruction manual and follow the procedures given for properly establishing the closed position. Proceed as appropriate:

For F, G, and J mounting adaptations, perform operations beginning with step 8 under the appropriate mounting adaptation section of the Actuator Mounting and Changing Actuator Mounting procedure.

For H mounting adaptations, perform operations beginning with step 7 under the appropriate mounting adaptation section of the Actuator Mounting and Changing Actuator Mounting procedure.

5. Return the travel indicator pointer to its original position as previously marked on the travel indicator scale.
6. Install the inlet piping to the upper diaphragm case.

Replacing Diaphragm Plate, Diaphragm Rod, Spring, and Spring Set

Disassembly

1. Perform steps 1 through 6 of the Disassembly portion of the Replacing Diaphragm procedure above.

For 1052 Actuators Only

- a. Before removing the diaphragm plate, spring compression must be relieved. Proceed as appropriate to gain access to the spring adjusting screw:

- Without lever-operated switches, remove the cap screws (key 21) and the spring adjuster cover (key 117).
- With lever-operated switches, remove the switches as an assembly by removing the cap screws (key 75, figure 16) and the switch mounting plate (key 1, figure 16). In order to gain access to the cap screws, it may be necessary to loosen the hex nuts (key 77, figure 16) and slide the switches away from the actuator housing.

⚠ WARNING

To avoid personal injury from precompressed spring force suddenly thrusting parts away from the actuator, spring compression must first be relieved by rotating the spring adjusting screw until the spring seat is bottomed against the spring adjuster. Closely follow the instructions below.

- b. To relieve spring compression, insert a screwdriver into the notches on the spring adjusting screw and rotate the spring adjusting screw to the right (counter-clockwise when viewed from the top of the actuator) until the spring seat (key 13) is bottomed against the spring adjuster.
2. For 1051 and 1052 Actuators, using a 5/16 inch hex wrench, unscrew and remove the socket head cap screw (key 9) which secures the diaphragm plate (key 4) to the diaphragm rod (key 10). Remove the diaphragm plate and the upper thrust washer (key 83 for 1051, or key 72 for 1052).
 3. For the 1051, remove the spring (key 11) and spring seat (key 14).
For the 1052, remove the spring (key 11), spring seat with adjusting screw (keys 74 and 14), and lower thrust washer (key 72).

Note

At this stage of disassembly, it may be determined that further disassembly is not necessary. If separation of the diaphragm rod from the lever is not warranted, proceed to the Assembly portion of this procedure.

4. To gain access to the cap screw (key 18) which secures the diaphragm rod to the lever, the housing cover assembly (key 33) must be removed. Before the housing cover assembly can be removed, one of the following procedures must be performed. Proceed as appropriate:

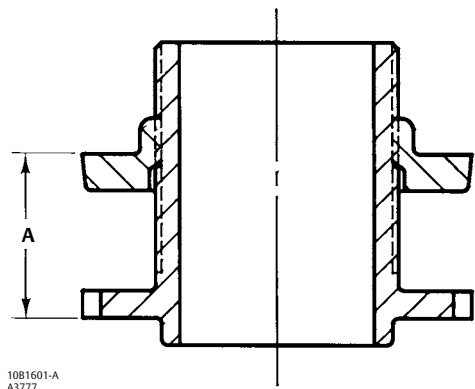
For actuators with valve bodies mounted on the housing cover assembly (key 33) side of the actuator, the actuator must be separated from the valve body to provide access to the cap screw (key 18). Proceed to the Disassembly portion of the Changing or Replacing Actuator Lever procedure and perform steps 2 through 6.

For actuators with valve bodies mounted on the actuator housing boss side of the actuator, remove the travel indicator pointer (key 37).

5. Remove the cap screws and washers (keys 34 and 63) and the housing cover assembly (key 33).
6. Remove the outer switch cam, if used, by removing the two hex head machine screws, spacers, and retaining washers (keys 119, 132, and 144, figures 15 and 16). Note that the retaining washers help to keep all parts together as an assembly.
7. Remove the cap screw (key 18) that secures the actuator lever (key 27) to the diaphragm rod. Remove the diaphragm rod.
8. Inspect all parts and replace if necessary.
9. If total disassembly of the actuator is required, or if the actuator will be assembled for use with a valve body with a different valve shaft diameter, proceed to the Changing or Replacing Actuator Lever procedure.

SPRING NO.	DIMENSION A	
	mm	Inches
10B1522	42.7	1.68
10B1523	42.7	1.68
10B1524	42.7	1.68
10B1525	36.6	1.44

Figure 6. Spring Seat Pre-Set Dimensions for the Fisher 1052 Size 33 Actuator



Assembly

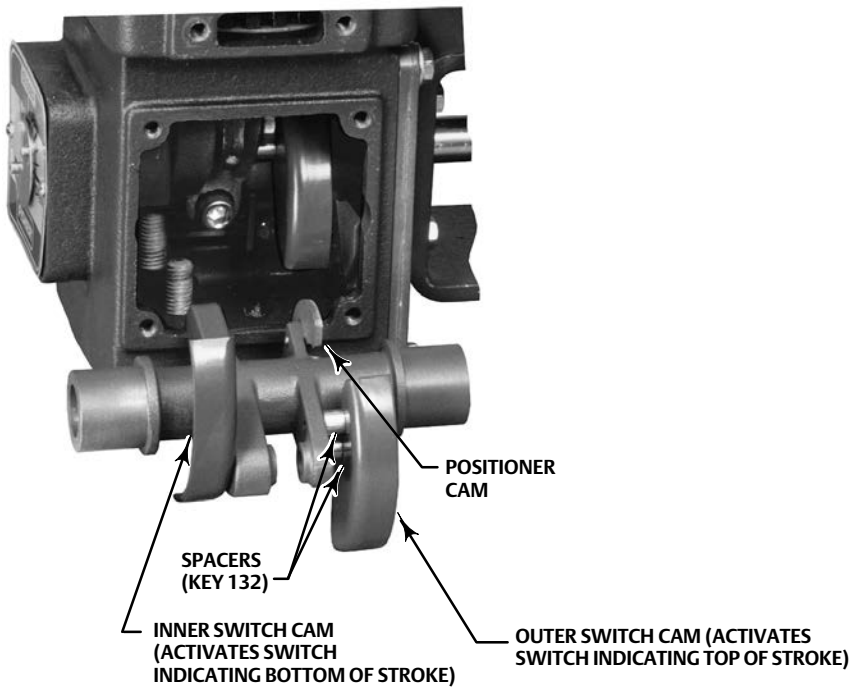
For the 1052 Only

- Lubricate the threads of the spring adjusting screw (key 74) with lithium grease. Also lubricate the bottom portion of the spring adjusting screw which contacts the lower thrust washer (key 72).
- Screw the spring adjusting screw onto the spring seat (key 14) to minimize spring seat adjustment after assembly, refer to figure 6 and pre-set the spring adjusting screw to the appropriate dimension.
- Place the lower thrust washer into the lower spring barrel area.

For 1051 and 1052

- Lubricate the threads of the socket head cap screw (key 9) with lithium grease. Also lubricate the bottom surface of the diaphragm plate which contacts the upper thrust washer (key 83 for 1051, or key 72 for 1052).
- Insert the socket head cap screw through the diaphragm plate (key 4) and into the diaphragm rod (key 10). Tighten the cap screw four or five turns.
- Install the spring seat (with spring adjusting screw for the 1052 actuator), spring, and upper thrust washer.
- Insert the diaphragm plate/diaphragm rod assembly into the spring barrel. Make sure that the notch in the diaphragm rod is oriented according to the view shown in figures 9 and 10, i.e. the notch in the diaphragm rod must face the positioner or positioner cover plate (key 39).
- Rotate the lever so that it straddles the spherical bearing in the diaphragm rod. It may be necessary to exert lateral pressure on the diaphragm rod to achieve alignment of the rod with the lever. Install the cap screw (key 18) (see table 2). Use the up travel stop (see figure 3) to keep the lever from rotating during tightening.
- If the actuator uses an outer switch cam, install the outer cam (key 170, figures 15 and 16) using the two hex head machine screws, spacers, and retaining washers (keys 119, 132, and 144). Note that the retaining washers help to keep all parts together as an assembly to ease installation. Make sure that the cam is mounted on the lever according to the orientation shown in figure 7.

Figure 7. Orientation of Switch and Positioner Cams on the Lever of the Fisher 1051 and 1052 Size 33 Actuator



7. Install the housing cover assembly (key 33) with cap screws and washers (keys 34 and 63).
 8. Tighten the socket head cap screw (key 9) with a 5/16 hex wrench until the diaphragm plate is fully seated against the diaphragm rod. Tighten the cap screw to the torque value in table 2.
 9. Perform steps 1 through 5 of the Assembly portion of the Replacing Diaphragm procedure.
 10. For 1052 actuators, refer to the 1052 Spring Compression Adjustment procedure and adjust the spring for the desired initial set.
 11. Install the cover plate or switch mounting plate (key 59) with cap screws (key 60). If switches are used, observe the marks made during removal of the cover plate.
 12. Install the spring adjuster cover (key 117) or the switch mounting plate (key 1, figure 16) with the appropriate cap screws.
 13. Install the travel indicator (key 37) if removed.
 14. If the actuator was removed from the valve body, refer to the appropriate section in the Actuator Mounting and Changing Actuator Mounting procedure and proceed as follows:
- For F and G mounting adaptations, perform all applicable steps beginning with step 3.
- For H and J mounting adaptations, perform all applicable steps beginning with step 4.

Changing or Replacing Actuator Lever

Note

The lever and associated parts may be removed as an independent procedure without disassembling the upper diaphragm casing or spring barrel components. Or, the lever may be removed after performing the operations given in the Replacing Diaphragm procedure and in the Diaphragm Plate, Diaphragm Rod, Spring, and Spring Seat procedure.

Disassembly

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

1. Isolate the valve body from the process. Release process pressure and vent all actuator pressure.
2. If externally mounted switches are used, remove them as an assembly by removing the cap screws (key 75, figure 16) and the switch mounting plate (key 1, figure 16). In order to gain access to the cap screws, it may be necessary to loosen the hex nuts (key 77, figure 16) and slide the switches away from the actuator housing.
3. If switches are used, mark the position of the switch mounting plate (key 59) on the actuator housing so it may be returned to the exact same position.
4. Remove the cap screws (key 60) and the cover plate or switch mounting plate (key 59). If switches are used, leave the push rod assemblies (keys 169 and 170, figure 16) or the proximity switch assemblies (key 7, figure 15) undisturbed.
5. Using a 5/16 inch hex wrench, loosen the socket head cap screw (key 28) which compresses the splined lever connection around the valve shaft.
6. Separate the actuator from the valve body by removing the cap screws and washers which secure the valve to the mounting yoke (key 22). For some constructions of H and J mounting adaptations, it may be necessary to remove other mounting and coupling parts.
7. If the valve body (or other operated equipment) is mounted on the housing cover (key 33) side of the actuator, remove the mounting yoke and travel indicator pointer.
8. Remove the cap screws and washers (keys 34 and 63) and the housing cover (key 33).
9. If the actuator is equipped with a positioner, remove the positioner cam (see figure 7) by removing the two hex head machine screws which secure the cam to the lever.
10. If the actuator is equipped with cam-operated switches, remove the outer cam (see figure 7) with the two hex head machine screws, spacers, and retaining washers (keys 119, 132, and 144, figures 15 and 16). Note that the retaining washers help to keep all parts together as an assembly.

⚠ WARNING

Failure to relieve spring tension on the diaphragm rod to lever connection before removing the cap screw (key 18) may result in personal injury and equipment damage from sudden and forceful movement of the diaphragm rod. Relieve spring tension by performing the operations described in the next step.

11. Relieve all spring loading on the diaphragm rod (key 10) to lever (key 27) connection by backing out (turning counter-clockwise) the up position travel stop (see figure 3). When the travel stop is no longer in direct contact with the lever (key 27), it can be determined that all spring compression is being contained by the stop in the upper diaphragm case (key 1).
12. Remove the cap screw (key 18) which secures the diaphragm rod (key 10) to the lever (key 27). Disconnect the lever from the diaphragm rod by rotating the lever away from the diaphragm rod.
13. Remove and inspect the lever. If the lever is worn or damaged, or if the actuator will be mounted to a valve body requiring a different size lever, replace the lever.
14. Inspect the bushings (key 31). If bushings are excessively worn or damaged, remove them with a press. Press in new bushings so that they are flush with the interior surfaces of the actuator housing boss and housing cover assembly.

Assembly

1. Refer to figure 7 for the correct orientation of the inner switch cam (if used); be sure that it is attached to the lever in the proper orientation.
2. Refer to figure 7 for the correct orientation of the lever during assembly. Insert the lever into the bushing in the actuator housing boss.
3. If the diaphragm rod has been removed, perform all operations through step 3 of the Assembly portion of the Diaphragm Plate, Diaphragm Rod, Spring and Spring Seat procedure.
4. Rotate the lever so that it straddles the spherical bearing in the diaphragm rod. It may be necessary to exert lateral pressure on the diaphragm rod to achieve alignment of the rod with the lever. Install the cap screw (key 18) and tighten to the torque value in table 2.
5. If an outer switch cam is used, install the cam using the two machine screws, spacers, and retaining washers. Note that the retaining washers help to keep all parts together as an assembly. Observe the orientation shown in figure 7.
6. If a positioner is used, install the positioner cam with machine screws. Be sure to observe the orientation shown in figure 7 and follow all procedures given in the positioner instruction manual.
7. Install the housing cover assembly (key 33).
8. If the diaphragm plate has been removed, tighten the socket head cap screw (key 9) with a 5/16 hex wrench until the diaphragm plate is fully seated against the diaphragm rod. Tighten the cap screw to the torque value in table 2.
9. If the upper diaphragm case has been removed, perform all applicable steps in the Assembly portion of the Replacing Diaphragm procedure.
10. Refer to the Actuator Mounting and Changing Actuator Mounting procedure and proceed as follows:
 - For F and G mounting adaptations, start with step 3.
 - For H and J mounting adaptations, start with step 4.
11. For 1052 actuators only, refer to the 1052 Spring Compression Adjustment procedure and adjust the spring for the desired initial set.

Proximity Switches, Lever Operated Switches, and Positioner

The proximity switches (see figure 15), lever operated switches (see figure 16), and positioner used with 1051 and 1052 size 33 actuator use cams (see figure 7) mounted on the lever to transmit valve ball or disk position feedback to the accessories. These cams must be attached to the lever before accessories can be installed.

Installing the Cam

Key numbers referred to in the following procedures are shown in figure 15 for proximity switch installation and in figure 16 for lever operated switch installation unless otherwise specified. Proceed as appropriate:

For switches which activate at the bottom of the actuator stroke, the inner cam (key 170; also see figure 7) is used. Installation of the inner cam requires removal of the actuator lever (key 27, figures 9 and 10). To remove the lever, refer to the Changing or Replacing Actuator Lever procedure and perform all applicable steps in the Disassembly portion. Install the inner cam with machine screws and retaining washers (keys 117 and 144). Note that the retaining washers help to keep all parts together as an assembly to ease installation. Reassemble the actuator and install the actuator on the valve body.

For switches which activate at the top of the actuator stroke, the outer cam (key 170; also see figure 7) is used. If the valve body or other operated equipment is mounted on the housing cover assembly side of the actuator, it will be necessary to remove the valve body and the mounting yoke. Refer to the Changing or Replacing Actuator Lever procedure and perform all applicable steps in the Disassembly portion. Remove the housing cover assembly (key 33). Install the outer cam with machine screws, spacers, and retaining washers (keys 119, 132, and 144). Note that the retaining washers help to keep all parts together as an assembly to ease installation. Follow the steps in the Installation section to reassemble the actuator and install the actuator on the valve body.

For actuators using a positioner, the positioner cam (see figure 7) must be installed on the lever. If the valve body or other operated equipment is mounted on the housing cover assembly side of the actuator, it will be necessary to remove the valve body and the mounting yoke. Refer to the Changing or Replacing Actuator Lever procedure and perform all applicable steps in the Disassembly portion. Remove the housing cover assembly (key 33). Install the cam on the lever with machine screws in the orientation shown in figure 7 and in the positioner instruction manual. Follow the steps in the Installation section to reassemble the actuator and install the actuator on the valve body.

Installing Proximity Switches

Key numbers referenced in the following procedures are shown in figure 15 unless otherwise specified.

Switches Indicating Bottom of Stroke

1. Apply inlet pressure to the diaphragm case (key 1, figures 9 and 10) until the actuator is at the bottom of its stroke. Make sure that the lever (key 27, figures 9 and 10) is against the down position travel stop (see figure 3).
2. Install one 5/8 inch UNF jam nut (key 78) onto the proximity switch (key 7). Screw the switch assembly into the mounting cover (key 59, figures 9 and 10) so that it is directly over the inner cam (refer to figure 3).
3. Carefully screw the switch into the mounting cover until the electrical contacts close. Maintain a minimum of 0.5 mm (0.02 inch) clearance between the switch and the cam.
4. Lock the switch in place by tightening the locknut (key 78) to the torque value in table 2. When tightening the locknut, be careful not to turn the switch and thereby reduce its clearance with the cam.

Switches Indicating Top of Stroke

1. Make sure that the air supply to the diaphragm case (key 1, figures 9 and 10) is totally vented and the lever (key 27, figures 9 and 10) is against the up position travel stop (see figure 3).
2. Install one 5/8 inch UNF jam nut (key 78) onto the proximity switch (key 7). Screw the switch assembly into the mounting cover (key 59, figures 9 and 10) so that it is directly over the outer cam (refer to figure 3).
3. Carefully screw the switch into the mounting cover until the electrical contacts close. Maintain a minimum of 0.5 mm (0.02 inch) clearance between the switch and the cam.
4. Lock the switch in place by tightening the locknut (key 78) to the torque value in table 2. When tightening the locknut, be careful not to turn the switch and thereby reduce its clearance with the cam.

Installing Lever-Operated Switch

Refer to figure 16 for the key numbers referenced in the following procedures and for proper orientation of switches and switch mounting accessories.

Installing the Push Rod

1. For **Switches Indicating Bottom of Stroke**, apply inlet pressure to the diaphragm case (key 1, figures 9 and 10) until the actuator is at the bottom of its stroke. Make sure that the lever (key 27, figures 9 and 10) is against the down position travel stop (see figure 3).

For **Switches Indicating Top of Stroke**, make sure that the air supply to the diaphragm case (key 1, figures 9 and 10) is totally vented and the lever (key 27, figures 9 and 10) is against the up position travel stop (key 8, figures 9 and 10).

2. For **Switches Indicating Bottom of Stroke**, install one jam nut (key 78) onto the push rod guide (key 169). Refer to figure 3 and screw the push rod guide into the mounting cover (key 59, figures 9 and 10) so that it is directly over the inner cam.

For **Switches Indicating Top of Stroke**, install one jam nut (key 78) onto the push rod guide (key 169). Screw the push rod guide into the mounting cover (key 59, figures 9 and 10) so that it is directly over the outer cam (refer to figure 3).

3. For both kinds of switches, insert the push rod (key 168) into the push rod guide with its head resting against the outer surface of the push rod guide.
4. Screw the push rod guide/push rod assembly in until the push rod contacts the cam (key 170).
5. Hold the push rod tightly against the push rod guide and screw the push rod guide into the mounting cover until a gap of 6.4 to 6.8 mm (0.25 to 0.27 inch) exists between the push rod head and the surface of the push rod guide.
6. Lock the push rod guide in place by tightening the locknut to the torque value in table 2. Be careful not to turn the push rod guide and thereby reduce its clearance with the push rod head.
7. Install the boot (key 163) over the push rod and the push rod guide.

Mounting Lever-Operated Switch and Adjustment

1. If used, remove the cap screws and spring adjuster cover (keys 21 and 85 for 1051, or keys 21 and 117 for 1052).
2. Attach the switch mounting plate (key 1) at this location with cap screws (key 75). Tighten the cap screws to the torque value in table 2.
3. Install the levers onto the switch shafts so that they are parallel to the centerline of the switch when they trip.
4. Insert the round head carriage bolts (key 4) into the switch mounting bracket (key 129). Mount the limit switch onto the bracket using machine screws and nuts (keys 8 and 9). Tighten the machine screws to 2.8 N•m (5 lbf•ft).
5. Attach the switch/mounting bracket assembly to the mounting plate using the nuts and washers (keys 77 and 154).
6. Adjust the switch lever on the shaft so that its roller is in the approximate center of the push rod.
7. With the actuator set at one end of its travel, slide the appropriate switch/bracket assembly toward the actuator until the roller on the switch lever is in contact with the push rod head and the switch contacts close. Stroke the actuator to the opposite end of its travel and repeat the adjustment procedure for the other switch.

Positioner Mounting

1. Before installing the positioner, the positioner cam must be installed on the lever (key 10, figures 9 and 10). Refer to the Installing the Cam procedure.
2. Refer to the positioner instruction manual for setup and calibration procedures.

Top-Mounted Handwheel

Key numbers used in this procedure are shown in figure 17 except where indicated.

The optional top-mounted handwheel can be used as a manual actuator for intermittent service or as an adjustable up travel stop to limit full retraction of the diaphragm rod (key 10, figures 9 and 10).

The handwheel assembly is attached to a special upper diaphragm casing (key 1, figures 9 and 10) with cap screws (key 141). A hex nut (key 137) locks the handwheel in position. For field installation of a handwheel, the special upper diaphragm case must be ordered as well as the handwheel.

Turning the handwheel (key 51) clockwise into the upper casing forces the pusher plate (key 135) against the diaphragm and diaphragm plate (keys 3 and 4) to compress the spring (key 11, figures 9 and 10) and move the diaphragm rod downward. Turning the handwheel counter-clockwise allows the actuator spring to move the diaphragm rod upward. If the valve is push-down-to-close, full opening can be restricted by positioning the handwheel at the desired position. If the valve is push-down-to-open, full closing of the valve ball or disk can be restricted by use of the handwheel.

Instructions are given below for complete disassembly and assembly required for inspection and parts replacement.

Disassembly

⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing away from the actuator, relieve spring compression before diaphragm casing bolting is loosened.

1. Remove the upper diaphragm casing (key 1, figures 9 and 10) by following steps 1 through 5 of the disassembly portion of the Replacing Diaphragm procedure.
2. Remove the cotter pin, hex nut, handwheel, and locknut (keys 247, 54, 51, and 137). Unscrew the stem (key 133) out through the actuator end of the handwheel body (key 142).
3. Remove cap screws (key 141), and separate the handwheel assembly from the upper casing.
4. Check the condition of the O-rings (keys 138 and 139); replace them if necessary.
5. If it is necessary to remove the pusher plate or spacer (key 135 or 171), drive out the groove pin (key 140).

Assembly

1. Before assembling, lubricate the thread of the stem (key 133) with anti-seize lubricant (key 244). Lubricate the bearing surfaces of the stem and pusher plate (key 135) with lithium grease (key 241).
2. If the pusher plate or spacer was removed, attach them to the stem and drive in a new groove pin (key 140).
3. With the O-ring (key 138) in place, thread the stem into the handwheel assembly.
4. Attach the handwheel assembly to the upper diaphragm casing (key 1, figures 9 and 10) with cap screws (key 141).
5. Install the locknut, handwheel, hex nut, and cotter pin (keys 137, 51, 54, and 247).
6. Install the diaphragm casing, making certain the warning tag is in place on the casing flange.
7. Tighten the cap screws (key 5, figures 9 and 10) evenly in a crisscross pattern (see table 2).
8. Adjust the initial set as described in the Spring Compression Adjustment procedure.

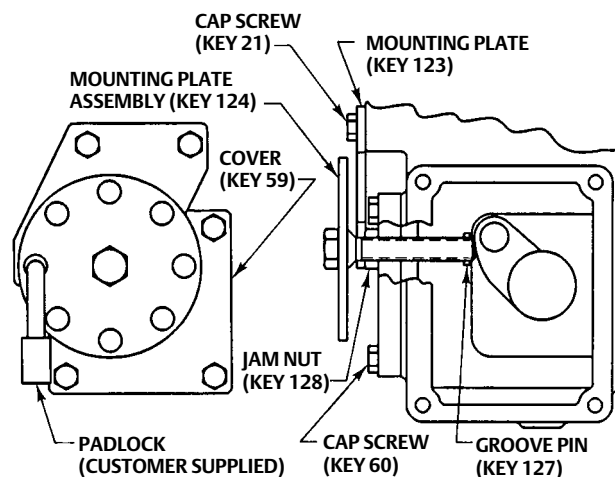
Locking Mechanism

Installing the Locking Mechanism

⚠ WARNING

To avoid personal injury, perform the steps in the WARNING at the beginning of the Maintenance section to isolate the control valve and actuator.

Figure 8. Fisher 1051 and 1052 Actuator Locking Mechanism



To add the locking mechanism to an existing actuator, purchase the required parts from Emerson Automation Solutions.

1. Remove cap screws, spring adjustor cover, and cover plate (keys 21 and 60, 85 or 117, and 59).
2. Thread jam nut (key 128) all the way onto the threaded bolt portion of the locking device before threading it into the cover (key 59).
3. After the bolt is threaded into the cover, drive the groove pin (key 127) into the threaded bolt. So the locking mechanism will not interfere with rotation of the lever (key 27), rotate the locking mechanism counterclockwise until it is stopped by the groove pin (key 127). Attach the cover to the actuator with cap screws (key 60).
4. Attach mounting plate (key 123) with cap screws (key 21).
5. Be sure the diaphragm rod is retracted fully. This will be the locked position of the valve.
6. Screw the threaded bolt into the cover until it contacts the actuator lever.
7. Rotate the locking device slightly until the hole in the mounting plate (key 123) aligns with a hole in the locking device.
8. Tighten the jam nut against the cover.
9. Insert the padlock (not furnished by Emerson Automation Solutions) to connect the mounting plate with the locking device.

Operating the Locking Mechanism

To Unlock the Actuator

1. Remove the padlock. Loosen the jam nut (key 128), and unscrew the threaded bolt until it is stopped by the groove pin (key 127) in the threaded bolt.

Note

For normal operation of the actuator, the threaded bolt must be unscrewed far enough that the actuator lever will not contact the bolt in normal actuator operation.

- If you are going to leave the bolt threaded into the cover, lock it with the jam nut (key 128) so that it cannot be screwed into the cover and interfere with normal actuator operation.

To Lock the Actuator

- Make sure the actuator diaphragm rod is retracted fully (the locked position of the valve). For a push-down-to-close valve and actuator, the valve will be fully open when locked. For a push-down-to-open valve and actuator, the valve will be fully closed when locked.
- Make sure the jam nut (key 128) is loose. Then, screw the threaded bolt into the cover until it contacts the actuator lever.
- Rotate the threaded bolt until one of the holes in the locking disk (which is welded to the bolt) is in line with the hole in the mounting plate (key 123). Tighten the jam nut against the cover.
- Lock the plate and disk together with a padlock (not furnished by Emerson).

Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, refer to the serial number found on the actuator nameplate.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Key	Description	Part Number
	Retrofit Kits	
	Kit provides parts to add a top-mounted handwheel.	
	Kit number 1 includes the handwheel assembly only.	
	Kit number 2 includes Kit number 1 and a new Upper Case (key 1) required to mount the handwheel assembly.	
	Kit Number 1	28A1205X082
	Kit Number 2	28A1205X092

Parts List

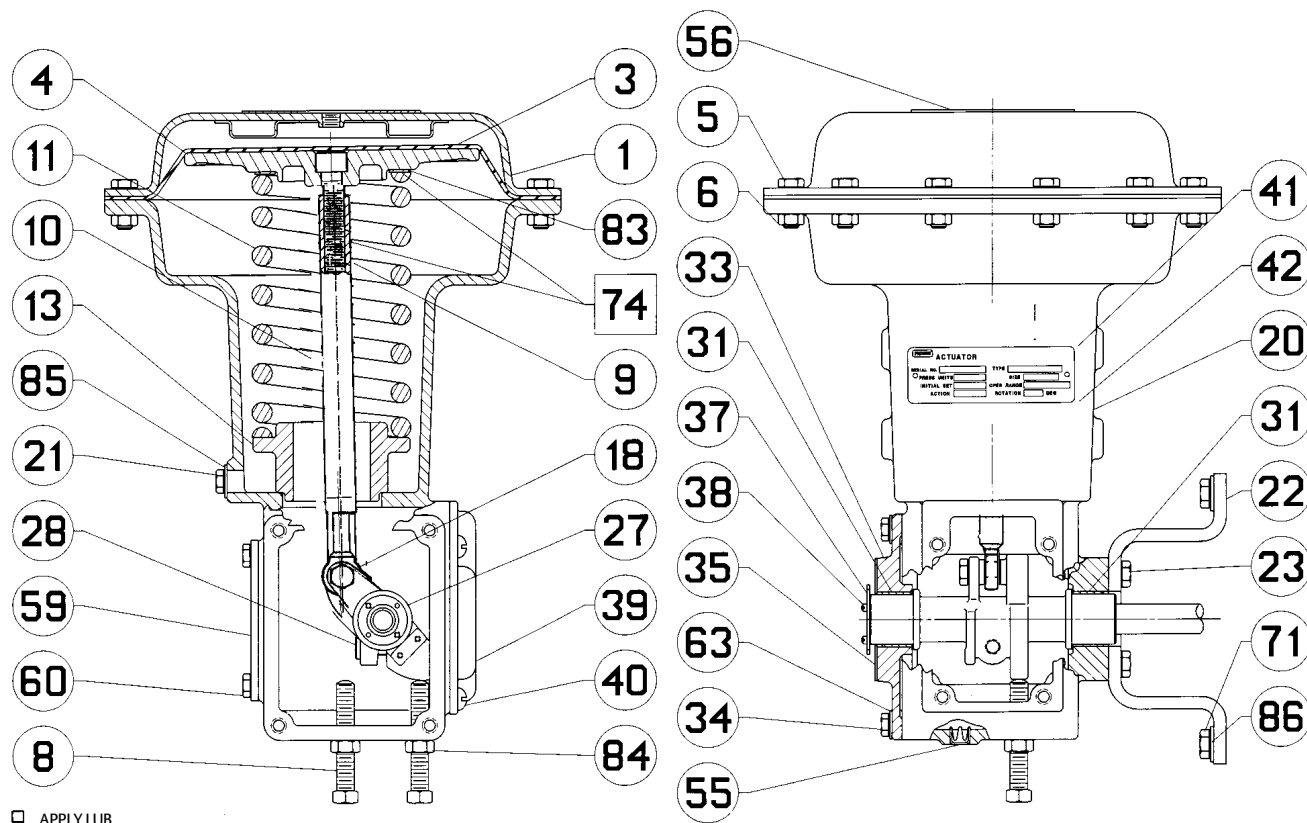
Note

Contact your [Emerson sales office](#) for Part Ordering information.

Basic Actuator With F and G Mounting Adaptations (figures 9 and 10)

Key	Description
1	Upper Diaphragm Case
3*	Diaphragm
4	Diaphragm Plate
5	Cap Screw (12 req'd)
6	Hex Nut (12 req'd)
8	Travel Stop (2 req'd)
9	Hex Socket Cap Screw
10	Diaphragm Rod/Bearing Assembly
11	Spring
13	Spring Seat
18	Cap Screw
20	Housing
20A	Housing Assembly
21	Cap Screw (2 req'd)
22	Mounting Yoke (not included w/ H mounting adaptation)
23	Cap Screw (4 req'd)
27	Lever
28	Hex Cap Screw

Figure 9. Fisher 1051 Size 33 Actuator with F or G Mounting Adaptation



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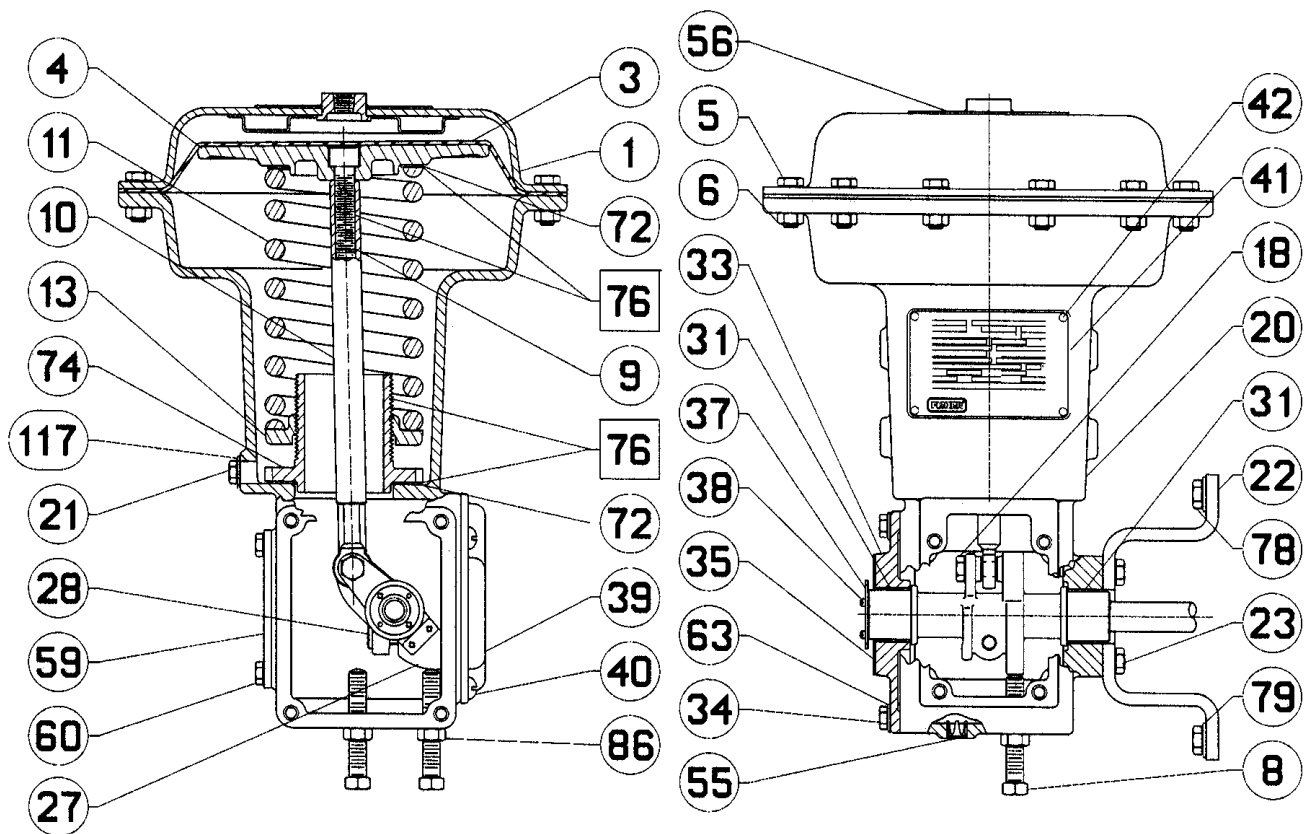
Key Description

31*	Bushing (2 req'd)
33A	Housing Cover
34	Cap Screw (4 req'd)
35	Travel Indicator Scale
36	Self Tapping Screw (not shown), for use with standard indicator scale (2 req'd)
37	Travel Indicator (not used with manual actuator, PMV, or 3710 positioner)
38	Machine Screw (2 req'd for use with key 37 travel indicator)
39	Cover Plate (not used with positioner)
40	Machine Screw (4 req'd) (required for use with key 39 cover plate)
41	Nameplate
42	Drive Screw (2 req'd)
55	Vent Screen
56	Warning Nameplate
59	Cover Plate
60	Cap Screw (4 req'd)
63	Washer (4 req'd)
71	For 1051 only Cap Screw

Key Description

72	For 1052 only Thrust Washer (2 req'd)
74	For 1052 only, Spring Adjuster
74	For 1051 only, lithium grease
76	For 1052 only
78	For 1052 only, Cap Screw
79	For 1052 only, Washer
83	For 1051 only, Thrust Washer
84	For 1051 only, Hex Jam Nut (2 req'd)
85	For 1051 only Spring Adjuster Cover not used with lever-operated switches
86	Hex Jam Nut (2 req'd), For 1052 only
86	Washer, For 1051 only
117	For 1052 only Spring Adjuster Cover for use without lever-operated switches
123	Mounting Plate,
124	Mounting Plate Assembly
127	Groove Pin
128	Jam Nut
144	Warning Plate

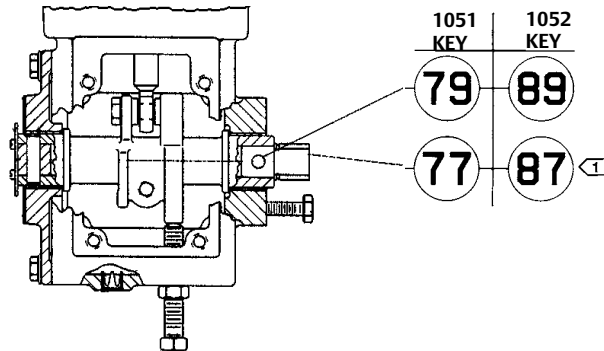
Figure 10. Fisher 1052 Size 33 Actuator with F or G Mounting Adaptation



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Figure 11. Parts Used for the H Mounting Adaptation

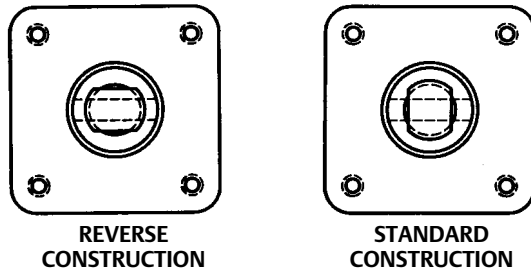


NOTE:

1. REQUIRES APPROPRIATE LEVER (KEY 27) FOR H MOUNTING ADAPTATION - SEE PARTS LIST.
2. STYLE A MOUNTING SHOWN. FOR STYLE B, ASSEMBLE PARTS LISTED AND TRAVEL INDICATOR COMPONENTS ON OPPOSITE ENDS OF LEVER.

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Figure 12. Standard and Reverse Constructions of the Stub Shaft Used for H Mounting Adaptations



5081581-B

Parts Used For H Mounting Adaptations (figure 11)

Key Description

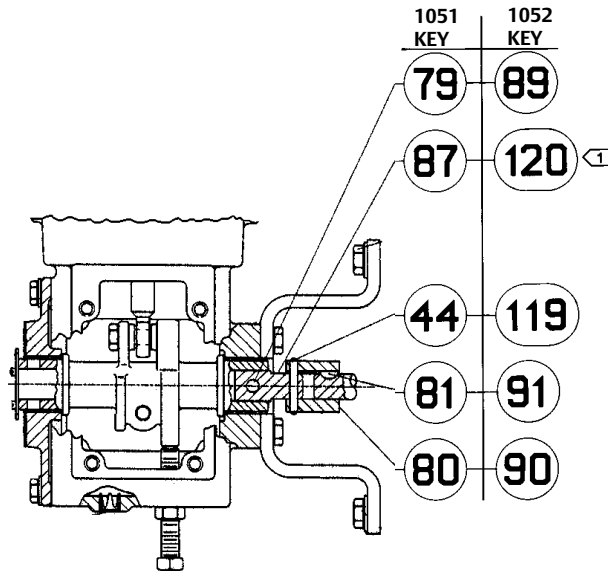
Parts For Use With 1051 Actuators Only

- 77 Stub Shaft (1 req'd for valve mounting; 2 req'd for use with manual actuator or wrench-operated extension)
- 79 Pin (1 req'd for each stub shaft)

Parts For Use With 1052 Actuators Only

- 87 Stub Shaft (1 req'd for valve mounting; 2 req'd for use with manual actuator or wrench-operated extension)
- 89 Pin (1 req'd for each stub shaft)

Figure 13. Parts Used for the J Mounting Adaptation



NOTE:

1. REQUIRES APPROPRIATE LEVER (KEY 27) FOR J MOUNTING ADAPTATION - SEE PARTS LIST.

2. STYLE A MOUNTING SHOWN. FOR STYLE B, ASSEMBLE PARTS LISTED AND TRAVEL INDICATOR COMPONENTS ON OPPOSITE ENDS OF LEVER.

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Parts Used For J Mounting Adaptations (figure 13)

Key Description

Parts For Use With 1051 Actuators Only

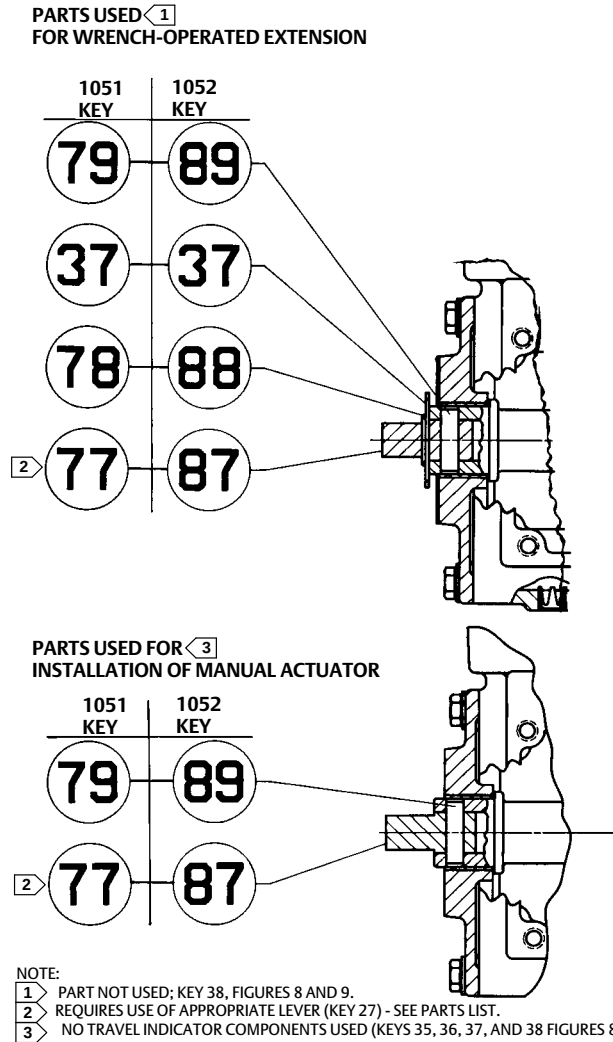
- 44 Pin (for coupler)
- 79 Pin (for stub shaft)
- 80 Coupling
- 81* Woodruff key
 - For 3/8, 1/2 inch valve shaft size
 - For 5/8 inch valve shaft size
- 87 Stub shaft

Key Description

Parts For Use With 1052 Actuators Only

- 89 Pin (for stub shaft)
- 90 Coupling
- 91* Woodruff key
 - For 3/8, 1/2 inch valve shaft size
 - For 5/8 inch valve shaft size
- 119 Pin (for coupler)
- 120 Stub shaft

Figure 14. Parts Used for Wrench-Operated Extension and Manual Actuator Installation on All Mounting Adaptations



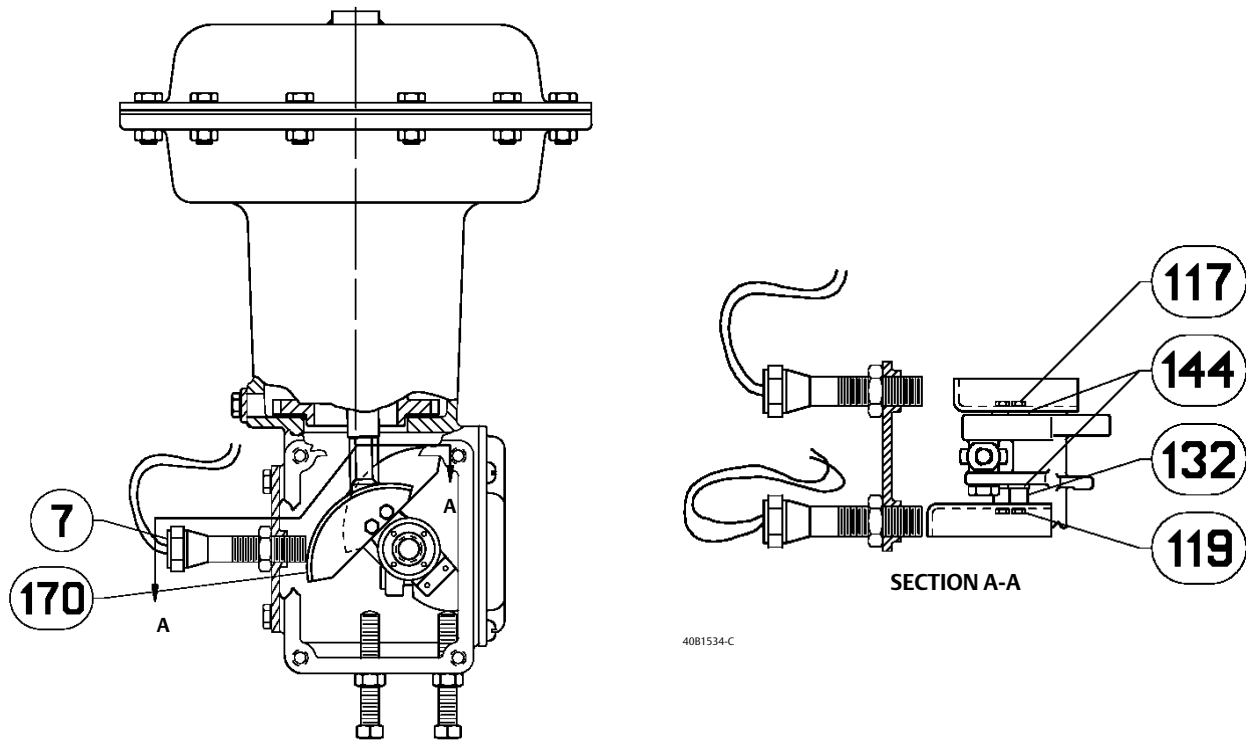
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Parts Used For Wrench-Operated Extension and For Manual Actuator Installation On All Mounting Adaptations (figure 14)

Key	Description
37	Travel Indicator (not used with manual actuator)

Parts For Use With 1051 Actuators Only	
77	Stub shaft
78	Retaining Ring, for use with travel indicator (key 37) above only
79	Pin
Parts For Use With 1052 Actuators Only	
87	Stub shaft
88	Retaining Ring, for use with travel indicator (key 37) above only
89	Pin

Figure 15. Proximity Switch Mounting on the Fisher 1051 and 1052 Size 33 Actuator

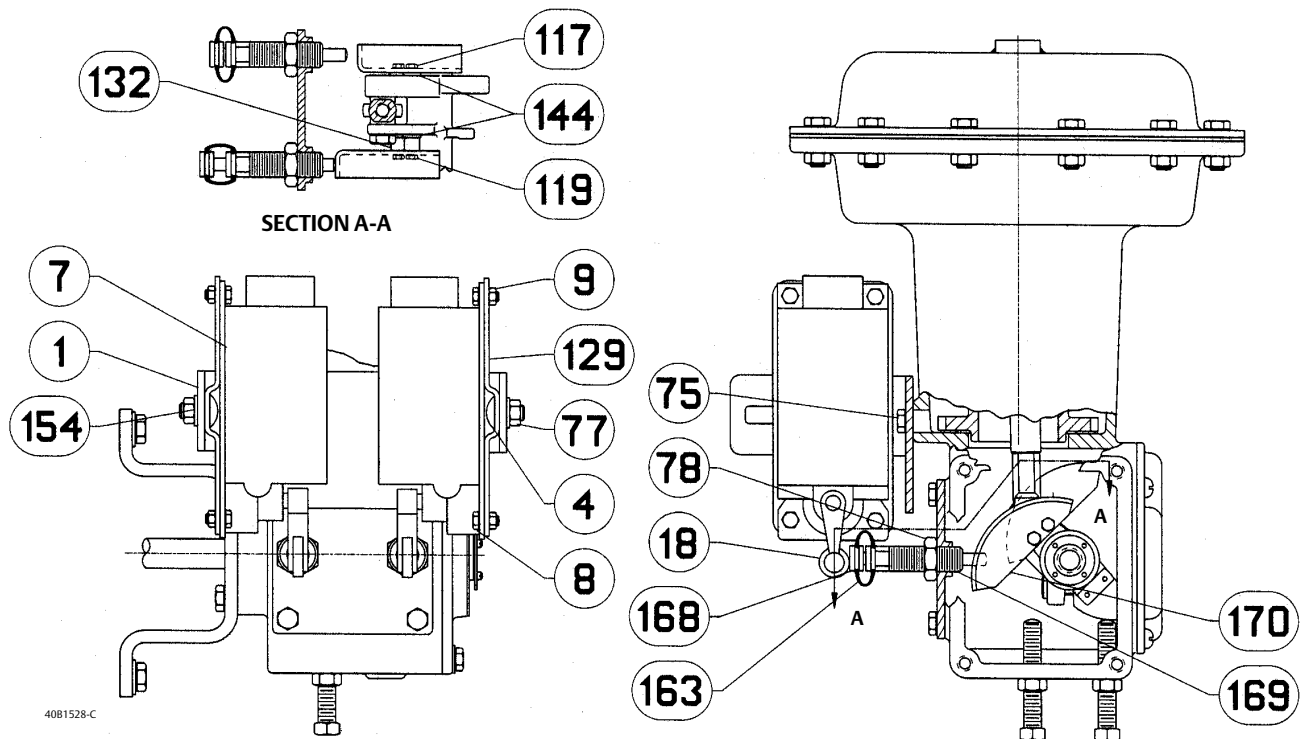


Proximity Switch Mounting Accessories (figure 15)

Key Description

7	Proximity Switch
117	Machine Screw for Inner Cam
119	Machine Screw for Outer Cam
132	Spacer for Outer Cam (2 req'd)
144	Retaining Washer (2 req'd)
170	Switch Cam (1 req'd for each)
171	Plug (used in single switch)

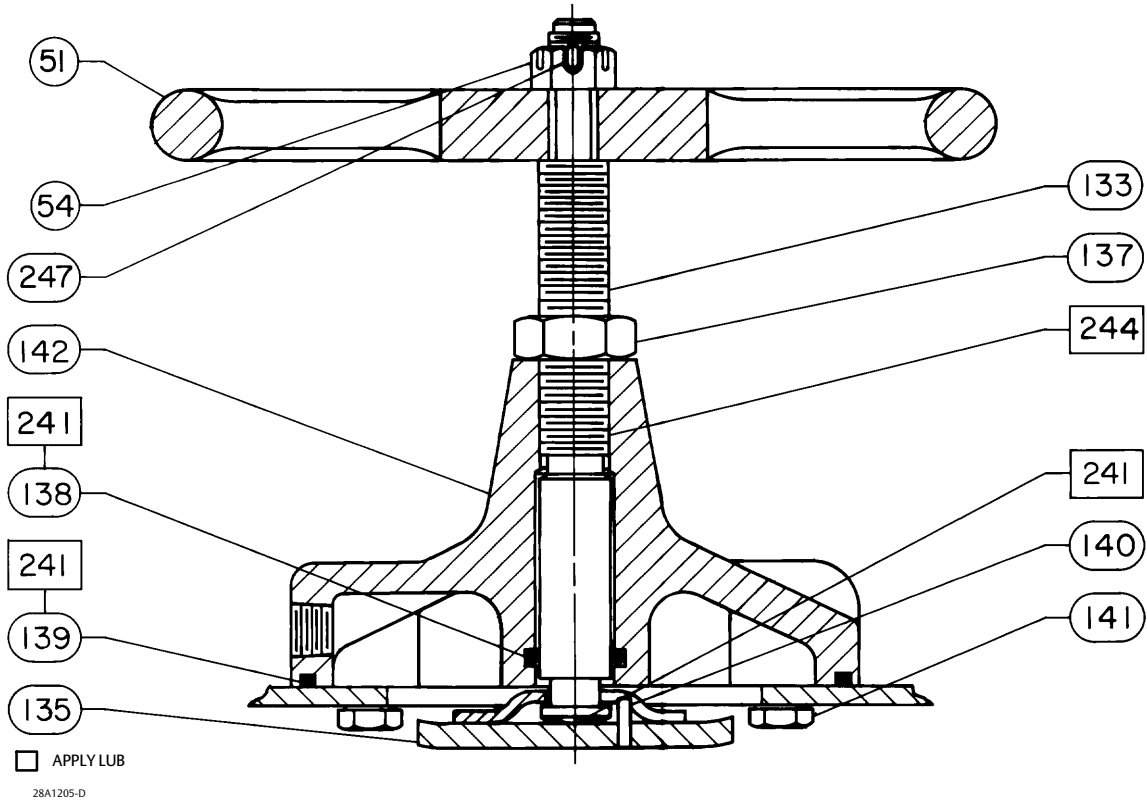
Figure 16. Typical Lever-Operated Switch Assembly



Lever-Operated Switch Mounting Accessories (figure 16)

Key	Description
1	Mounting Plate (1 req'd)
4	Square Neck Bolt (2 req'd)
7	Switch Contact your Emerson sales office
8	Cap Screw
9	Hex Nut (4 req'd for each)
18	Lever (for Namco switch only)
75	Cap Screw (2 req'd)
77	Hex Nut (2 req'd for each)
78	Hex Nut (1 req'd for each)
117	Machine Screw for Inner Cam
119	Machine Screw for Outer Cam
129	Mounting Bracket (1 req'd for each)
132	Spacer for Outer Cam (2 req'd)
144	Retaining Washer (2 req'd)
154	Washer (2 req'd for each)
163	Boot (1 req'd for each switch)
168	Push Rod (1 req'd for each switch)
169	Push Rod Guide (1 req'd for each)
170	Switch Cam (1 req'd for each)
171	Plug (used in single switch)

Figure 17. Top-Mounted Handwheel Assembly



Top Mounted Handwheel (figure 17)

Key Description

- 51 Handwheel
- 54 Hex Nut Slotted
- 133 Stem
- 135 Pusher

Key Description

- 137 Hex Nut
- 138* O-ring
- 139* O-ring
- 140 Groove Pin
- 141 Cap Screw, plated steel (6 req'd)
- 142 Body
- 241 Lithium grease
- 244 Anti-seize lubricant
- 247 Cotter Pin

*Recommended spare parts

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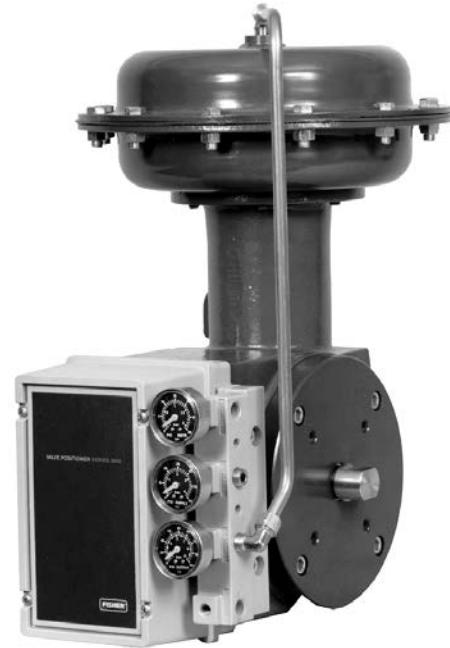


Fisher™ 1051 and 1052 Style H and J Sizes 40, 60 and 70 Rotary Actuators

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Figure 1. Fisher 1051 Actuator with H Mounting
Adaptation and 3610J Positioner



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Introduction

Scope of Manual

This manual provides installation, adjustment, operation, maintenance, and parts ordering information for Fisher 1051 (sizes 40 and 60) and 1052 (sizes 40, 60, and 70) diaphragm rotary actuators with H and J mounting adaptations (see figures 1 and 2). Also, this instruction manual provides information for the optional top-mounted handwheel, and both the optional up and down travel stops. Instructions for the control valve body, the positioner, accessories, and other sizes or constructions of this actuator are covered in separate manuals.

Table 1. Fisher 1051 and 1052 Actuator Specifications

Operation Direct Acting: Increasing loading pressure extends the diaphragm rod out of the spring barrel Service: 1051: For on-off or throttling service with positioner 1052: For on-off or throttling service with or without a positioner Actuator Sizes 1051: 40, and 60 1052: 40, 60, and 70 Maximum Diaphragm Sizing Pressure⁽²⁾ Size 40: 4.5 bar (65 psig) Size 60: 2.8 bar (40 psig) Size 70: 3.8 bar (55 psig) Maximum Diaphragm Casing Pressure⁽³⁾ Size 40: 5.2 bar (75 psig) Size 60: 3.4 bar (50 psig) Size 70: 4.5 bar (65 psig) Maximum Valve Shaft Rotation 90, 75, or 60 deg with optional stops Torque Limits⁽⁴⁾ Limited by maximum diaphragm sizing pressure or tables 2 and 3, whichever is less	Stroking Time Dependent on actuator size, rotation, spring rate, initial spring compression, and supply pressure. If stroking time is critical, consult your Emerson sales office Material Temperature Capabilities⁽³⁾ Nitrile Diaphragm or O-Rings⁽¹⁾: -40 to 82°C (-40 to 180°F) Silicone Diaphragm: -40 to 149°C (-40 to 300°F) Travel Indication Graduated disk and pointer combination located on actuator end of valve shaft Pressure Connections 1/4 NPT internal Mounting Positions See figure 10 Approximate Weights See table 8 Additional Specifications For casing pressure ranges and for material identification of the parts, see the Parts List
---	---

1. Nitrile O-rings are used in optional top-mounted handwheel, adjustable down travel stop, and adjustable up travel stop assemblies.

2. Use this value to determine the maximum torque output allowed.

3. The pressure / temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

4. Exceeding any torque limits could damage the actuator and impair safe operation.



Do not install, operate, or maintain a 1051 or 1052 actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

1051 and 1052 diaphragm rotary actuators are pneumatic spring-return actuators for use with rotary-control valves and other equipment. The 1051 actuator can be used for on-off service, or it can be used for throttling service when equipped with a valve positioner. The 1052 actuator can be used for on-off service, or it can be used for throttling service when equipped with or without a valve positioner. The 1052 actuator spring is adjustable.

The H mounting adaptation permits the actuator to be used with equipment other than Fisher valve bodies. The mounting brackets and couplings for rotary actuation are user-provided. This mounting adaptation includes a flat-surface mounting plate that is drilled and tapped for attaching the user-provided bracket. Cap screws for attaching the bracket are provided. H mounting also includes an output shaft (with milled flats) to provide the Double D rotary output either directly or through a user-provided coupling. Output shaft diameters and torque limits are listed in table 2. Dimensional information for the mounting plate and output shaft are shown in figures 4, 5, and 6.

Figure 2. Fisher 1052 Actuator with J Mounting Adaptation



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The **J mounting adaptation** permits the actuator to be used for rotary actuation of Fisher keyed-shaft butterfly valve bodies and other keyed-shaft equipment. This mounting adaptation uses the standard butterfly valve mounting bracket and provides an output shaft with an attached coupling for keyed equipment shafts. Coupling sizes and torque limits are listed in table 3. Dimensional information for the mounting bracket and stub shaft coupling is shown in figures 4, 5, and 7.

Additionally, a top-mounted handwheel can be applied for infrequent service as a manual handwheel actuator. For more frequent manual operation, a side-mounted handwheel actuator is available. Also, an adjustable up travel stop can be added to limit the actuator stroke in the upward direction, or an adjustable down travel stop can be added to limit actuator stroke in the downward direction.

Specifications

Specifications are shown in table 1 for 1051 and 1052 actuators. Specifications for a given 1051 or 1052 actuator as it originally comes from the factory are stamped on a nameplate attached to the actuator.

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Table 2. Output Shaft Diameters and Torque Limits for Actuators With H Mounting

ACTUATOR SIZE	OUTPUT SHAFT DIAMETER		TORQUE LIMIT FOR H MOUNTING	
	mm	Inches	N•m	Inch-Pounds
40	22.2	7/8	240	2120
	28.6	1-1/8	468	4140
	38.1	1-1/2	1110	9815
60	28.6	1-1/8	468	4140
	38.1	1-1/2	1210	10,680
70 ⁽¹⁾	38.1	1-1/2	1210	10,680

1. 1052 actuator only.

Table 3. Acceptable Shaft Diameters and Torque Limits for Actuators With J Mounting

ACTUATOR SIZE	COUPLING AVAILABILITY BY KEYED SHAFT DIAMETER		TORQUE LIMIT FOR J MOUNTING	
	mm	Inches	N•m	Inch-Pounds
40	9.5	3/8	52	460
	12.7	1/2	69	610
	15.9	5/8	114	1010
	19.1	3/4	207	1830
	25.4	1	468	4140
60	19.1	3/4	207	1830
	25.4	1	468	4140
	31.8	1-1/4	1030	9110
	38.1	1-1/2	1360	12,000
	50.8	2	2650	23,430
70 ⁽¹⁾	31.8	1-1/4	1030	9110
	38.1	1-1/2	1360	12,000
	50.8	2 ⁽²⁾	2650	23,430

1. 1052 actuator only.

2. Coupling supplied for mating with either 44.5 or 50.8 mm (1-3/4 or 2-inch) keyed shaft.

Principle of Operation

The diaphragm rod moves down as loading pressure is increased on top of the diaphragm. As the loading pressure is decreased, the spring forces the diaphragm rod upward.

The spring and diaphragm have been selected to meet the requirements of the application and, in service, the actuator should produce full travel of the valve or other operated equipment with the diaphragm pressure as indicated on the nameplate.

Consult the separate positioner instruction manual for actuator principle of operation with positioner.

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure retaining parts, do not apply pressure exceeding the Maximum Diaphragm Casing Pressure limit given in table 1 or on the nameplate. Use pressure limiting or pressure relieving devices to prevent the casing pressure from exceeding the maximum diaphragm casing pressure.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

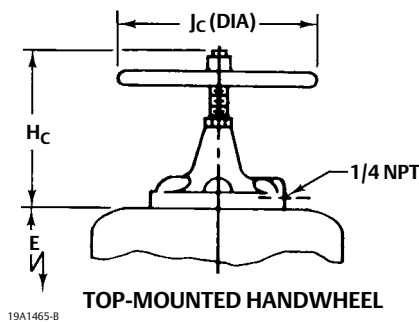
NOTICE

To avoid parts damage, do not apply pressure that exceeds the Maximum Diaphragm Sizing Pressure (table 1) or produces a torque greater than the Torque Limits (table 1, 2, or 3). Use pressure-limiting or pressure-relieving devices to prevent the diaphragm casing pressure from exceeding these limits.

Figure 3. Top Mounted Handwheel

ACTUATOR SIZE	H _c		J _c	
	mm	Inch	mm	Inch
40	281	11.06	356	14.00
60	359	14.12	432	17.00
70 ⁽¹⁾	335	13.62	356	14.00

1. Size 70 available in 1052 only.



Actuator Mounting

Use the following steps to connect the actuator to a valve body or other equipment. Unless otherwise specified, key numbers are shown in figures 12 and 13. Mounting dimensions are shown in figures 4, 5, 6, and 7.

Note

For an actuator with an H mounting adaptation and a 22.2 through 38.1 mm (7/8 through 1-1/2 inch) output shaft, find dimensions and center of gravity information in figures 3, 4, 5, 6, and 9, and approximate weights in table 8. This information is required for proper fabrication of the user-provided bracket and coupling.

1. For an actuator with an H mounting adaptation, attach an appropriate mounting bracket (not provided) to the mounting plate (key 22) with the cap screws (key 78). See figures 4, 5, and 6 for mounting dimensions on the mounting plate. Tighten the cap screws to the bolt torques listed in table 4.
2. Consult figure 10 for available mounting styles and positions. The actuator is normally positioned vertically with the valve body or other equipment in a horizontal pipeline.

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Note

If the milled flats or the coupling on the end of the actuator output shaft (key 87) are oriented such that the output shaft cannot accommodate the operated equipment shaft, refer to the Changing Positions portion of the Changing Actuator Mounting section. This procedure describes how the output shaft can be repositioned to accommodate the operated equipment shaft.

3. If using an actuator with a **J mounting** adaptation, note that the valve shaft coupling (key 90) is furnished with two keyways lettered A and B as shown in figure 8 and 12 (letters C and D on the coupling are not used and can be disregarded). Align the appropriate keyway with the keyway in the operated equipment shaft. If using a Fisher butterfly valve, align the appropriate keyway on the coupling with the valve shaft keyway indicated in table 9. Then install the woodruff key (key 91) in the shaft keyseat, and slide the coupling onto the shaft. It is helpful to apply a light coat of grease to the inside of the coupling before sliding it onto the shaft.
4. For an actuator with an **H mounting** adaptation, slide the actuator (with the user-provided mounting bracket attached) into the user-provided coupling on the operated shaft. Then, secure the actuator to the operated equipment in the desired mounting position with the appropriate fasteners, such as mounting cap screws. See figures 4, 5 and 6 for output shaft dimensions.
5. For an actuator with a **J mounting** adaptation, secure the mounting bracket (key 22) to the valve body with the cap screws (key 78, not shown). Tighten the cap screws to the bolt torques in table 4. For 31.8 and 38.1 mm (1-1/4 and 1-1/2 inch) valve shafts, also place the two spacers (key 92, not shown) between the mounting bracket and valve body during this step.
6. For an actuator with a **J mounting** adaptation and a **50.8 mm (2-inch) output shaft** (key 87, figure 14), note that the valve shaft coupling (key 90, figure 14) is furnished with two keyways lettered A and B as shown in figure 8 (letters C and D on the coupling are not used and can be disregarded). Align the appropriate keyway with the keyway in the operated equipment shaft. Then, install the woodruff key (key 91, not shown in figure 14) in the shaft keyseat, and slide the coupling onto the shaft using the appropriate coupling keyway (see table 9 and figure 8). It is helpful to apply a light coat of grease to the inside of the coupling before sliding it onto the shaft. Secure the actuator (user-provided mounting bracket) to the operated equipment in the desired mounting position with the appropriate fasteners, such as mounting cap screws.
7. Follow the instructions given in the Turnbuckle Adjustment section before proceeding to the Loading Connection portion of this section.

Table 4. Key 78 Cap Screw Torque Values

STYLE H MOUNTING						
Actuator Size	Valve Shaft Diameter		Bolt Size	Bolt Torque		Key 78 Part Number
	mm	Inch	Inch	N • m	lbf • ft	
40	22.2	7/8	5/16	22.6	16.7	1C5958X0042
40	28.6	1-1/8	3/8	39	29	1A353124052
60	28.6	1-1/8	3/8	39	29	1A353124052
40	38.1	1-1/2	1/2	92	68	1A582324052
60, 70	38.1	1-1/2	1/2	92	68	1A582324052
STYLE J MOUNTING - FLAT PLATE MOUNTING						
60, 70	44.5	1-3/4	1/2	92	68	1A582324052
60, 70	50.8	2	1/2	92	68	1A582324052
STYLE J MOUNTING - FISHER 7600, 9100, 9500 WITH KEYED SHAFT						
40	9.5	3/8	3/8	39	29	1A341824052
40	12.7	1/2	3/8	39	29	1A341824052
40	15.9	5/8	3/8	39	29	1A341824052
40	19.1	3/4	3/8	39	29	1A341824052
60	19.1	3/4	3/8	39	29	1A341824052
40	25.4	1	3/8	39	29	1A341824052
60	25.4	1	3/8	39	29	1A341824052
60, 70	31.8	1-1/4	5/8	163	120	1P1477X0012
60, 70	38.1	1-1/2	5/8	163	120	1P1477X0012

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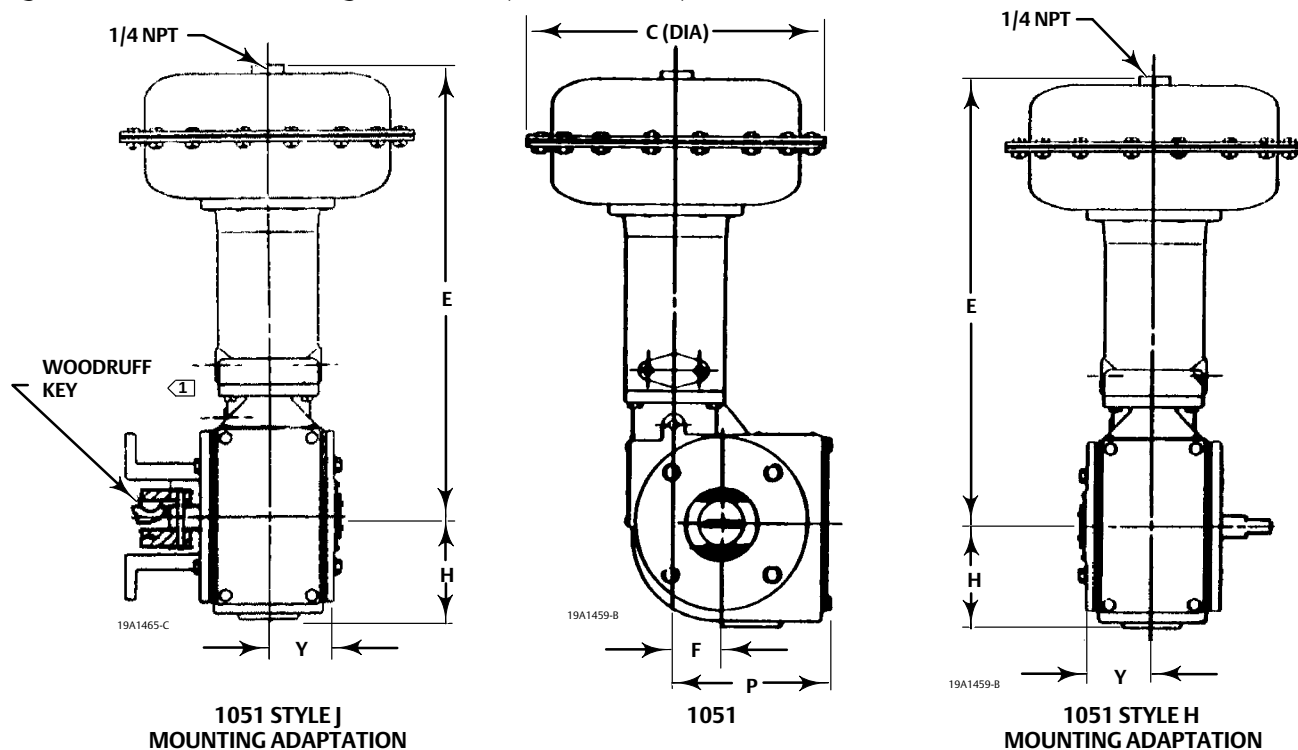
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Table 5. Style H or J Mounting Dimensions

ACTUATOR SIZE	C	E		F	H	P	Y
		1051	1052				
mm							
40	333	505	607	54	114	175	73
60	473	749	876	64	121	186	76
70 ⁽¹⁾	536	---	849	64	121	186	76
Inch							
40	13.12	19.88	23.88	2.12	4.50	6.88	2.88
60	18.62	29.50	34.50	2.50	4.75	7.31	3.00
70 ⁽¹⁾	21.12	---	33.44	2.50	4.75	7.31	3.00
1. Size 70 available in 1052 only.							

1. Size 70 available in 1052 only.

Figure 4. Fisher 1051 Mounting Dimensions (refer to table 5)

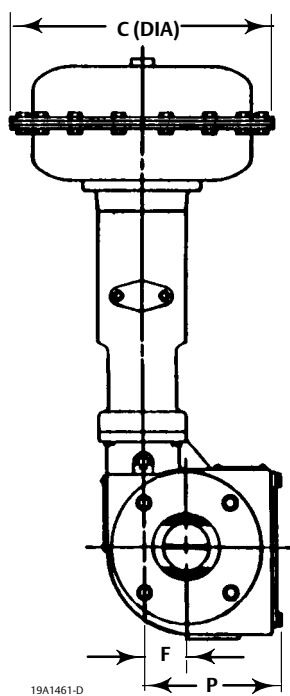


NOTE:

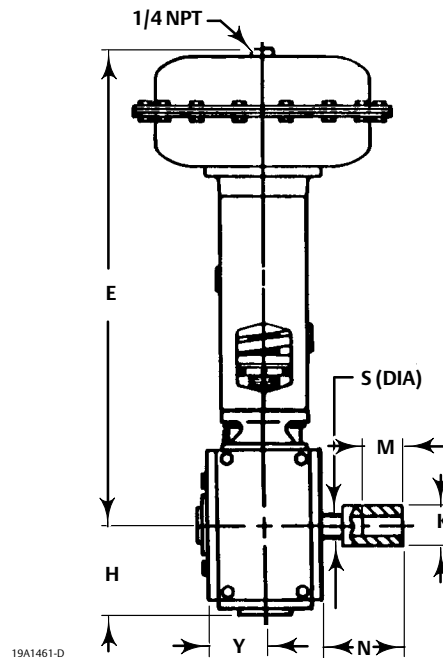
1 SEE PARTS LIST FOR WOODRUFF KEY NUMBERS

C0577-3

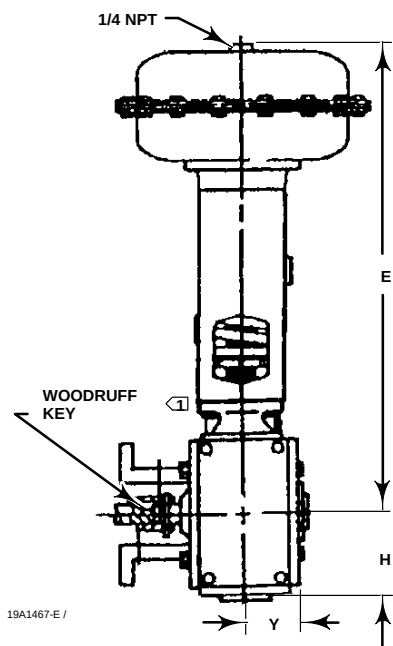
Figure 5. Fisher 1052 Mounting Dimensions (refer to table 5)



1052



1052 STYLE J MOUNTING ADAPTATION
FOR 44.5 AND 50.8 mm (1-3/4 AND 2-INCH)
KEYED EQUIPMENT SHAFT

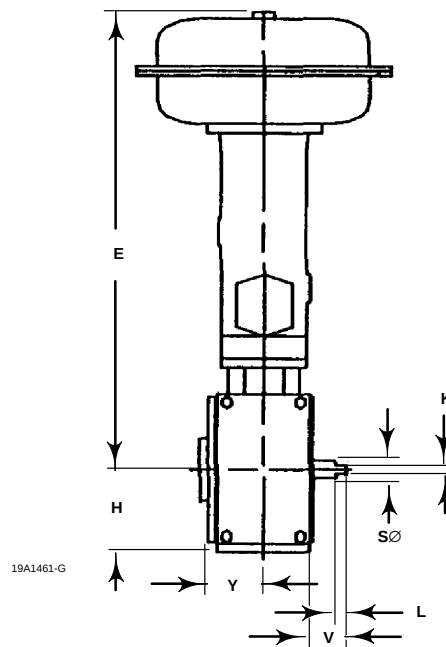


1052 STYLE J ADAPTATION
9.5 THRU 38.1 mm (3/8 THRU 1-1/2-INCH) OUTPUT SHAFTS

NOTE:

1 SEE PARTS LIST FOR WOODRUFF KEY NUMBERS

C0676-3



1052 STYLE H ADAPTATION
12.7 THRU 38.1 mm (1/2 THRU 1-1/2-INCH) OUTPUT SHAFTS

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1051 and 1052 H & J Actuators

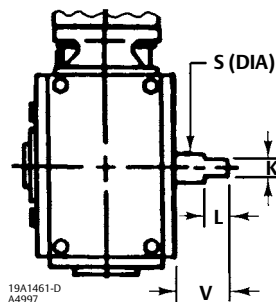
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Table 6. Style H Mounting Dimensions

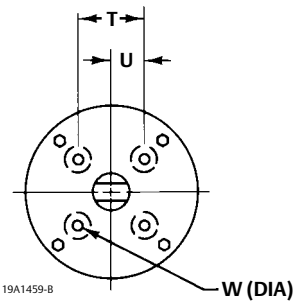
ACTUATOR SIZE 1051	ACTUATOR SIZE 1052	S ACTUATOR OUTPUT SHAFT DIAMETER		V		L		K ⁽¹⁾		T		U		W
		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	
40	40	22.2	7/8	26.2	1.03	19.1	0.75	<u>15.75</u> 15.62	<u>0.620</u> 0.615	57.2	2.25	28.4	1.12	5/16-18 UNC
40 & 60	40 & 60	28.6	1-1/8	26.2	1.03	19.1	0.75	<u>22.10</u> 21.97	<u>0.870</u> 0.865	76.2	3.00	38.1	1.50	3/8-16 UNC
	40, 60 & 70	38.1	1-1/2	28.4	1.50	28.4	1.12	<u>28.45</u> 28.32	<u>1.120</u> 1.115	88.9	3.50	44.5	1.75	1/2-13 UNC

1. Tolerance for the K dimension is indicated by showing maximum and minimum dimensions.

Figure 6. Fisher 1051 and 1052 Style H Mounting Dimensions (refer to table 6)



22.2 THRU 38.1 mm
(7/8 THRU 1-1/2 INCH)
OUTPUT SHAFTS WITH
STYLE H MOUNTING



22.2 THRU 38.1 mm
(7/8 THRU 1-1/2 INCH)
OUTPUT SHAFTS WITH
STYLE H MOUNTING

A3254-1

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

1051 and 1052 H & J Actuators

July 2023

Instruction Manual

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Table 7. Style J Mounting Dimensions

ACTUATOR SIZE 1051 & 1052	VALVE SHAFT DIAMETER		COUPLING ⁽¹⁾ INNER DIAMETER		V		L ⁽²⁾		K		T		U		W	
	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
40	9.5	3/8	<u>9.53</u> 9.58	<u>0.375</u> 0.377	137	5.38	39.6	1.56	15.7	0.62	117	4.62	---	---	11.2	0.44
	12.7	1/2	<u>12.70</u> 12.75	<u>0.500</u> 0.502	137	5.38	39.6	1.56	15.7	0.62	117	4.62	---	---	11.2	0.44
	15.9	5/8	<u>15.90</u> 15.95	<u>0.626</u> 0.628	160	6.31	49.3	1.94	25.4	1.00	146	5.75	31.8	1.25	11.2	0.44
40 & 60	19.1	3/4	<u>19.05</u> 19.10	<u>0.750</u> 0.752	160	6.31	47.8	1.88	20.6	0.81	146	5.75	31.8	1.25	11.2	0.44
	25.4	1	<u>25.43</u> 25.48	<u>1.0010</u> 1.0025	160	6.31	47.8	1.88	17.5	0.69	146	5.75	31.8	1.25	11.2	0.44
60 & 70 ⁽³⁾	31.8	1-1/4	<u>31.75</u> 31.80	<u>1.250</u> 1.252	148	5.81	68.3	2.69	30.2	1.19	210	8.25	50.8	2.00	17.5	0.69
	38.1	1-1/2	<u>38.13</u> 38.18	<u>1.501</u> 1.503	148	5.81	68.3	2.69	23.9	0.94	210	8.25	50.8	2.00	17.5	0.69
60 & 70 ⁽³⁾	44.5 & 50.8	1-3/4 & 2	<u>44.45</u> 44.50	<u>1.750</u> 1.752	123	4.84	69.9	2.75	---	---	88.9	3.50	44.5	1.75	1/2-13 UNC ⁽⁴⁾	1/2-13 UNC ⁽⁵⁾
	50.8	2	<u>50.83</u> 50.90	<u>2.001</u> 2.004	123	4.84	69.9	2.75	---	---	88.9	3.50	44.5	1.75	1/2-13 UNC ⁽⁴⁾	1/2-13 UNC ⁽⁵⁾

1. Tolerance for the Coupling Inner diameter is indicated by showing maximum and minimum dimensions.

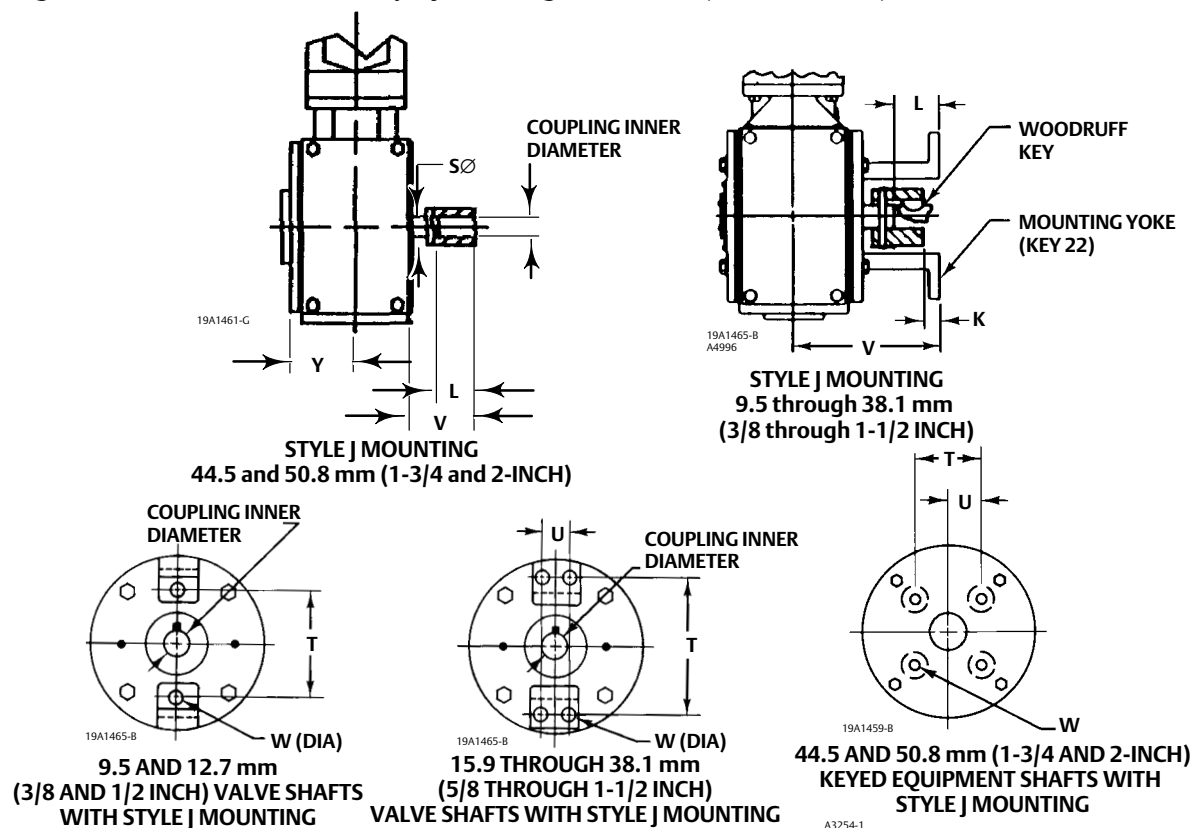
2. The L dimension is the matchline to the end of the actuator shaft.

3. Size 70 is only available for the 1052.

4. 25.4 mm deep.

5. 1 inch deep.

Figure 7. Fisher 1051 and 1052 Style J Mounting Dimensions (refer to table 7)



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Table 8. Approximate Actuator Weights

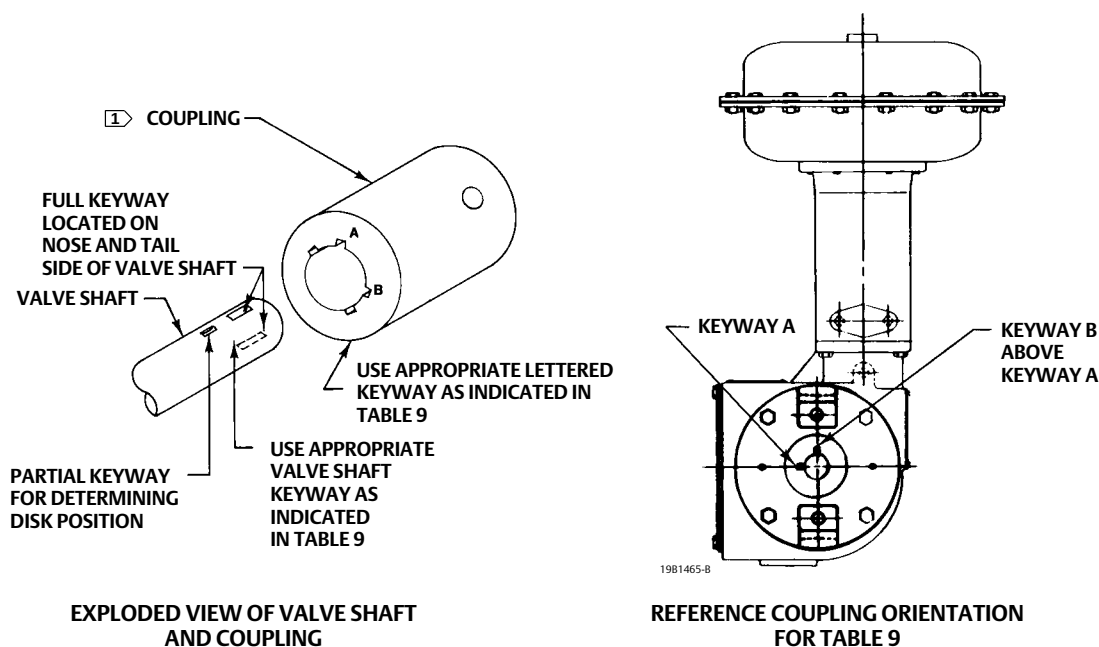
SIZE	1051		1052		TOP-MOUNTED HANDWHEEL	
	Kg	Lb	Kg	Lb	Kg	Lb
40	43	94	45	99	7.3	16
60	89	197	92	203	11	24
70	---	---	123	272	21.3	47

Table 9. Keyway Alignment Information⁽¹⁾

DESIRED ACTUATOR ACTION	DESIRED SHAFT ROTATION, DEGREES	ACTUATOR MOUNTING POSITION	COUPLING KEYWAY TO USE ⁽³⁾	VALVE SHAFT KEYWAY TO USE FOR FISHTAIL™ DISK VALVE BODIES ⁽²⁾ (SEE FIGURE 10)			
				Clockwise to Close Valve Action ⁽⁴⁾		Counterclockwise to Close Valve Action ⁽⁴⁾	
				Flow Left to Right ⁽⁴⁾	Flow Right to Left ⁽⁴⁾	Flow Left to Right ⁽⁴⁾	Flow Right to Left ⁽⁴⁾
Push Down to Open (PDTO)	60 or 90	1	B	Nose	Tail	Tail	Nose
		2	A	Tail	Nose	Nose	Tail
		3	B	Tail	Nose	Nose	Tail
		4	A	Nose	Tail	Tail	Nose
Push Down to Close (PDTC)	60 ⁽⁵⁾ or 90	1	A	Tail	Nose	Tail	Nose
		2	B	Tail	Nose	Tail	Nose
		3	A	Nose	Tail	Nose	Tail
		4	B	Nose	Tail	Nose	Tail

1. For actuators with J mounting.
2. For conventional disk valve bodies, use either valve shaft keyway.
3. See figure 10 for reference coupling orientation to use with this table.
4. When viewed from actuator side of valve body.
5. For 60-degree rotation with PDTC action, the coupling and actuator output shaft assembly will be offset 30 degrees clockwise (for actuator housing construction style B) or counterclockwise (for actuator housing construction Style A) in the lever when viewed from the splined end of the actuator shaft. 30 degrees is one spline tooth for 9.5, 12.7, and 15.9 mm (3/8, 1/2, and 5/8-inch) valve shafts and two spline teeth for 19.1 through 38.1 mm (3/4 through 1-1/2 inch) valve shafts.

Figure 8. Valve Shaft Coupling



NOTE:
1. FOR USE WITH J MOUNTING ADAPTATION (UP TO 50.8 mm (2-INCH) KEYED SHAFT DIAMETERS.
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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

1051 and 1052 H & J Actuators

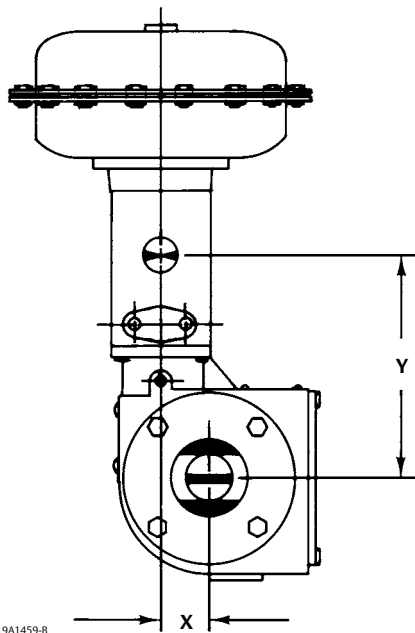
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Figure 9. Center of Gravity Dimensions

ACTUATOR TYPE	ACTUATOR SIZE	X		Y	
		mm	Inch	mm	Inch
1051	40	15	0.6	191	7.5
	60	10	0.4	361	14.2
1052	40	15	0.6	241	9.5
	60	10	0.4	432	17.0
	70	23	0.9	488	19.2



Loading Connection

1. Connect the loading pressure piping to the pressure connection in the top of the diaphragm casing.

For size 40 through 60 actuators, run either NPS 1/4 pipe or 3/8-inch tubing between the NPT 1/4 pressure connection and the positioner or automatic controller.

For size 70 actuators, run either pipe or tubing between the pressure connection and the positioner or automatic controller. If necessary, remove the 1/4-inch bushing in the pressure connection to increase connection size.

2. Keep the length of pipe or tubing as short as possible to avoid transmission lag in the control signal. If an accessory (such as a volume booster or a positioner) is used, be sure that the accessory is properly connected to the actuator. If a positioner is part of the assembly, the pressure connection to the actuator will normally be made at the factory.
3. When the actuator is completely installed and connected to the instrument, check for correct action (air-to-open or air-to-close) to match the controlling instrument. For successful operation, the actuator stem and operating shaft must move freely in response to the loading pressure change on the diaphragm.

Adjustment

⚠ WARNING

Before performing any adjustment steps, follow the steps in the **WARNING** at the beginning of the Maintenance section.

1051 and 1052 Turnbuckle Adjustment

Correct turnbuckle adjustment ensures that the valve body or other operated equipment is correctly closed when the actuator is against its travel stops. The turnbuckle adjustment is the only adjustment necessary on the 1051 actuator. Key numbers used in this procedure are shown in figure 12 for 1051 actuators and in figure 13 for 1052 actuators.

For accurate adjustment, remove the valve body or other operated equipment from the pipeline.

A regulated air supply will be required to stroke the actuator. Consult table 10 for the sizes of the three open end wrenches required for this procedure.

1. Remove the access plate (key 59). Also remove the machine screws (key 60), if present.

Note

For the most accurate adjustment of the actuator, do not remove the cover (key 33) during this procedure.

2. Loosen the lower locknut (key 16).

Table 10. Wrench Sizes Required for Turnbuckle Adjustment, Inches

Actuator	Size	Turnbuckle (Key 57)	Lower Locknut (Key 16)	Upper Locknut (Key 58)
1051 & 1052	40	1-1/8	3/4	1-1/8
	60	1-5/16	15/16	1-5/16
1052	70	1-5/16	1-1/8	1-5/16

3. Make sure the actuator housing (key 20) is clear of any tools or other instruments that could obstruct the actuator stroke path. Pressure the diaphragm casing enough to stroke the actuator down so that the left-hand threaded upper locknut (key 58) is accessible through the access opening. Loosen the locknut.
4. Use one of the following:
 - a. **For push-down-to-close action**—Slowly stroke the actuator to the down travel stop. Consult the appropriate instruction manual for determining the closed position of the valve body or other operated equipment. Adjust the turnbuckle (key 57) until the closed position is reached. Lock this adjustment with the left-hand threaded locknut (key 58). Stroke the actuator to the mid-travel position, and tighten the locknut (key 16). Tighten each locknut to the appropriate torque value listed in table 11.
 - b. **For push-down-to-open action**—Consult the appropriate instruction manual for determining the closed position of the valve or other operated equipment. Release all pressure from the diaphragm casing, making sure the diaphragm is against its up travel stop. Be sure that the optional handwheel is adjusted to its topmost position so that the closed position of the actuator and valve body or other operated equipment can be reached simultaneously. Check the position of the valve body or other operated equipment with respect to its properly closed position. Stroke the actuator so the turnbuckle (key 57) is accessible through the access opening. Adjust the linkage. Release pressure to the actuator, and check the new adjustment. Continue this procedure until the operated equipment is in the closed position when the actuator is resting on its up travel stop. Tighten locknut

(key 16). Stroke the actuator, and tighten the left-hand threaded locknut (key 58). Tighten each locknut to the appropriate torque value listed in table 11.

5. Replace the access plate (key 59). Also, replace the machine screws (key 60), if present.

6. Loosen the self-tapping screws (key 38), and adjust the travel indicator (key 37). Retighten the self-tapping screws.

1052 Spring Adjustment

Initial Compression

The 1052 nameplate specifies a spring set, which is the initial compression adjusted into the actuator spring. Initial compression is the casing pressure at which the diaphragm and diaphragm rod begin to move away from the up travel stop with the actuator disconnected from the valve body or other operated equipment. (With the actuator connected and pressure applied to the valve body or other operated equipment, a higher casing pressure will be required to start actuator travel). The initial compression was selected (based upon the service conditions specified when the actuator was ordered) so that when the actuator and valve body or other operated equipment are in service, the operated equipment will close properly and full travel will be obtained within a diaphragm casing pressure range of 0 to 1.2, 0 to 2.3, 0 to 2.8 or 0 to 3.8 bar (0 to 18, 0 to 33, 0 to 40, or 0 to 55 psig) depending on specific actuator size and construction.

If the actuator has been disassembled or if the spring adjustment was changed, and it is desired to match the initial compression stated on the nameplate, make sure the rod end bearing (key 17, figure 13) has been disconnected from the lever (key 27, figure 13). Adjust the spring so that the diaphragm rod just starts to travel at the spring set pressure specified on the nameplate. Be sure the rod end bearing does not hit the lever as the diaphragm and diaphragm rod move away from the up travel stop.

To adjust the spring, insert a round rod into one of the slots in the lower bearing seat (key 73, figure 13). Slot diameter is 9.5 mm (3/8-inch) for size 40 actuators, 15.9 mm (5/8-inch) for size 60 actuators, and 19.1 mm (3/4-inch) for size 70 actuators.

Rotate the bearing seat to move it toward the casings (keys 1 and 2, figure 13) to increase initial compression or away from the casings to decrease initial compression.

Table 11. Recommended Bolting Torques⁽¹⁾

KEY NUMBER	ACTUATOR SIZE					
	40		60		70	
	N•m	lbf•ft	N•m	lbf•ft	N•m	lbf•ft
6	27	20	27	20	27	20
7 & 8	41	30	41	30	102	75
9	34	25	102	75	102	75
16	34	25	61	45	102	75
18	81	60	163	120	271	200
21	23	17	68	50	68	50
23	34	25	81	60	81	60
28	81	60	163	120	271	200
34	34	25	81	60	81	60
40	9	7	9	7	9	7
54 handwheel	34	25	34	25	34	25
54 down stop	27	20	66	49	69	51
58	102	75	163	120	163	120
141	41	30	41	30	81	60

1. Exceeding any torque requirements could damage the actuator and impair safe operation.

Stroking Range

The initial spring set listed on the nameplate has been determined to be the optimum setting, and it is not recommended to make spring adjustments that will cause this value to change or be exceeded. For push-down-to-open (PDTO) action, the initial spring set is normally the maximum allowable to provide the maximum spring closing force. Any increase of this setting could over-stress the spring at full travel. For push-down-to-close (PDTC) action, the initial spring set has been determined to be the optimum balance between the air to close and the spring to open breakout torque.

If the 1052 actuator is to be changed from one action to another (i.e., from PDTC to PDTO), first refer to the initial spring compression values listed in the table for keys 11 and 13 in the Parts List section. Then adjust the unit according to the procedures in the Initial Compression portion of this section.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given below for disassembly and assembly of parts. Key numbers referenced in the following steps are shown in figure 12 for 1051 actuators and in figure 13 for 1052 actuators unless otherwise specified.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.

- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Disassembly

The following procedure describes how the actuator can be completely disassembled. When inspection or repairs are required, perform only those steps necessary to accomplish the procedure. Do not under ordinary circumstances remove the cap screws (keys 7, 8, and 21).

NOTICE

Cap screw (key 18) must be disengaged from the lever (key 27) before removing the diaphragm casing (key 1). Failure to do so will allow the spring precompression to rotate the valve body or other operated equipment beyond its fully open or closed position. This could cause damage to the operated equipment.

1. Bypass the valve or other operated equipment. Relieve all actuator loading pressure, and remove the tubing or pipe from the top of the actuator.
2. Remove the positioner, if one is used.
3. Mark the orientation of the travel indicator (key 37) with respect to the travel indicator scale (key 35). Then, unscrew the cap screws and washers (keys 34 and 63), and remove the cover (key 33).
4. Remove the retaining ring (key 30), and then remove the hub (key 29) from the cover.
5. Check the condition of the bearing (key 31). If replacement of the bearing is necessary, the travel indicator scale (key 35) must first be removed by removing the self-tapping screws (key 36). Mark the orientation of the travel indicator scale on the cover before removing it.

NOTICE

When removing the actuator from the valve body, do not use a hammer or similar tool to drive the lever (key 27) or actuator off the output shaft (key 87). Driving the lever or actuator could damage operated equipment. For valves, driving the lever (key 27) could move the valve disk and bearings away from the centered position causing subsequent damage to valve parts.

If necessary, use a wheel puller to remove the lever. It is permissible to tap the wheel puller screw lightly to loosen the lever, but hitting the screw with excessive force could also damage operated parts or disrupt the centered position of a valve disk or other equipment.

6. For an actuator with an H mounting adaptation and a 22.2 through 38.1 mm (7/8 through 1-1/2 inch) output shaft, unscrew the cap screws (key 78) and remove the actuator from the operated equipment. Mark the orientation of the lever (key 27) with respect to the output shaft (key 87). This marking is used during reassembly to allow for proper lever/output shaft positioning.

Then, loosen the cap screw (key 28) so that the output shaft is free to slide off the lever. With the lever and output shaft properly marked, unscrew the cap screws (key 23) and remove the mounting plate (key 22) and output shaft (key 87) assembly from the actuator housing (key 20). If necessary, remove the retaining ring (key 88) and separate the output shaft from the mounting plate.

7. For an actuator with a J mounting adaptation (see figures 12 and 13) with a 50.8 mm (2-inch) output shaft (see figure 14) and proceed as follows:
 - a. Remove the cap screws (key 78, not shown in figures 12 and 13) and remove the actuator from the operated equipment. For an actuator with J mounting and a 31.8 or 38.1 mm (1-1/4 or 1-1/2 inch) valve shaft diameter, two spacers (key 92, not shown in figures 12 and 13) are also removed with the cap screws (key 78).
 - b. When separating the output shaft (key 87) and coupling (key 90) from the operated shaft, remember to remove the woodruff key (key 91, not shown in figure 14) from the operated shaft keyway.
 - c. Mark the orientation of the lever (key 27, figures 12 and 13) with respect to the output shaft (key 87). This marking is used during reassembly to allow for proper lever/output shaft positioning.
 - d. Loosen the cap screw (key 28, figures 12 and 13) so that the output shaft is free to slide off the lever.
 - e. With the lever and output shaft properly marked, unscrew the cap screws (key 23) and remove either the mounting bracket (key 22, figures 12 and 13 for J mounting) or the mounting plate (key 22, figure 14 for H mounting) plus the attached output shaft (key 87) from the actuator housing (key 20).
 - f. If necessary, remove the retaining ring (key 88) and slide the mounting bracket or mounting plate off the output shaft.
8. Check the bearing (key 67) in the mounting bracket or mounting plate (key 22). Press out and replace the bearing if necessary.
9. Heat the hex nut (key 19) to 177°C (350°F) long enough for the thread-locking adhesive (high strength) (key 77) to lose its holding strength. Then, remove the cap screw and hex nut (keys 18 and 19), and remove the lever (key 27) from the housing.
10. Rotate the handwheel (if one is used) counter-clockwise until the handwheel is not compressing the spring (key 11).

⚠ WARNING

To avoid personal injury from precompressed spring force suddenly thrusting the upper diaphragm casing (key 1) away from the actuator, relieve 1052 spring compression, or carefully remove 1051 casing cap screws by following the instructions presented in the next two steps before proceeding further.

11. To relieve 1052 spring compression, insert a round rod into one of the slots in the lower bearing seat (key 73). Slot diameter is 9.5 mm (3/8 inch) for size 40 actuators, 15.9 mm (5/8 inch) for size 60 actuators, and 19.1 mm (3/4 inch) for size 70 actuators. Use the rod to rotate the lower bearing seat, and move it away from the actuator casings. Continue rotating the lower bearing seat until spring compression is completely removed.
12. Loosen, but do not remove, all casing cap screws (key 5). Make sure there is no spring force on the 1051 upper diaphragm casing. Unscrew and remove the cap screws and hex nuts (keys 5 and 6), and then remove the upper diaphragm casing and the diaphragm (key 3).
13. Proceed as appropriate:

For 1051 actuators,

- a. Read and follow the warning printed on the nameplate (key 56) located on the diaphragm plate (key 4).

- b. Pull the diaphragm plate (key 4) and attached parts out of the actuator. The spring (key 11), diaphragm rod (key 10), cap screw (key 9), spring seat (key 13), hex nut (key 58), turnbuckle (key 57), hex nut (key 16), and rod end bearing (key 17) will be attached to the diaphragm head.

⚠ WARNING

For 1051 actuators, the diaphragm plate (key 4) may be wedged against the diaphragm rod (key 10), thereby preventing the spring compression from being relieved as the cap screw (key 9) is loosened. Dislodge the diaphragm head from the diaphragm rod by loosening the cap screw (key 9) one full turn and tapping the underside of the diaphragm head until it follows the cap screw disassembly. Failure to check for this situation before removing the cap screw (key 9) could cause personal injury due to the sudden release of spring compression as the cap screw is disengaged.

- c. Slowly remove the cap screw (key 9) while making sure that the diaphragm head is following the cap screw removal. Note that spring load will be zero before the cap screw is completely removed. Then separate the remaining parts of the assembly.

For 1052 actuators,

- a. Remove the rod end bearing (key 17), the hex nut (key 16), the turnbuckle (key 57), and the hex nut (key 58) from the diaphragm rod (key 10).
 - b. Pull the diaphragm plate (key 4) and attached parts out of the actuator. Then remove the cap screw (key 9) to separate the diaphragm plate and the diaphragm rod.
 - c. Proceed as appropriate:
- For actuator designs **without** a set screw in the spring barrel (key 12), remove the actuator spring (key 11) from the actuator. If it is necessary to remove the adjustor (key 74) from the spring barrel during this procedure, heat the base of the adjustor to 177°C (350°F) long enough for the thread locking adhesive (high strength) (key 77) to lose its holding strength. Then, unscrew the adjustor from the spring barrel. If the spring seat and the lower bearing seat (key 13 and 73) are to be replaced, unscrew the lower bearing seat from the adjustor, and then remove the thrust bearing and the bearing races (keys 71 and 72) from the lower bearing seat.
 - For actuator designs **with** a set screw, (key 75), remove the actuator spring (key 11) from the actuator. If the spring seat and the lower bearing seat (keys 13 and 73) are to be replaced, unscrew the lower bearing seat from the adjustor, and then remove the thrust bearing and the bearing races (keys 71 and 72) from the lower bearing seat. If it is necessary to remove the spring adjustment parts, heat the set screw (key 75) to 177°C (350°F) long enough for the thread-locking adhesive (high strength) (key 77) to lose its holding strength, and then loosen the set screw (key 75). Unscrew the spring adjustor (key 74) from the spring barrel (key 12).

Assembly

This procedure assumes that the actuator is completely disassembled. If the actuator is not completely disassembled, start these instructions at the appropriate step. Key numbers used are shown in figure 12 for 1051 actuators and in figure 13 for 1052 actuators.

1. If the 1052 spring barrel (key 12) was removed from the housing (key 10), align the spring barrel to the housing as described below to ensure that the offset hole in the base of the spring barrel is located properly.

For size 40 and 60 actuators, note that one of the accessory mounting bosses on the spring barrel is closer to the diaphragm end of the spring barrel. Place the spring barrel on the housing with the upper boss (the one closer to the diaphragm end) on the same side as the boss located on the housing (see figure 13). This ensures proper positioning of the offset hole. Secure the spring barrel with the cap screws (key 21).

For size 70 actuators, the spring barrel need not be aligned in any particular position when placing it on the housing.

Note

Refer to table 11 for bolting torques for actuator bolts and cap screws.

2. Proceed as appropriate:

For 1051 actuators,

- a. Coat the thread of the cap screw (key 9) and the tapered end of the diaphragm rod (key 10) with lithium grease (key 76).
- b. Assemble the diaphragm rod, spring seat (key 13), spring (key 11), and diaphragm plate (key 4), and secure with the cap screw (key 9). Tightening the cap screw will compress the spring. Be certain the tapered end of the diaphragm rod is seated in the corresponding hole in the diaphragm plate, that the spring is seated in the spring seat, and that the cap screw is tightened to the torque specified in table 11.
- c. Install the hex nut (key 58), turnbuckle (key 57), hex nut (key 16), and rod end bearing (key 17) onto the diaphragm rod.
- d. Be certain the travel stops (key 8) are located as shown in figure 11.
- e. Install the diaphragm plate and attached parts into the actuator.
- f. Be sure the warning nameplate (key 56) is in place. Install the diaphragm (key 3) and the upper diaphragm casing (key 1). Install the cap screws and hex nuts (keys 5 and 6). Tighten the cap screws evenly in a crisscross pattern to compress the spring and secure the upper diaphragm casing. Tighten these cap screws to the torques shown in table 11.

For 1052 actuators,

- a. Proceed as appropriate:
- For actuator designs without a set screw in the spring barrel (key 12), if the adjustor and attached parts were removed, first clean and then lubricate the upper threads of the adjustor (key 74) with lithium grease (key 76) as shown in figure 13. Install the lower bearing seat (key 73), the thrust bearing (key 71), the thrust bearing races (key 72), and the spring seat (key 13) onto the adjustor. Then, first clean and then coat the lower end of the adjustor with thread-locking adhesive (high strength) (key 77) as shown in figure 13, and install the entire assembly into the spring barrel (key 12). Let the adjustor stand undisturbed for at least two hours after installation to allow the thread-locking compound to cure.

NOTICE

When applying lubricant to the upper threads and thread-locking compound to the lower threads of the adjustor, do not overlap the coat of lubricant with the coat of thread-locking compound since this will adversely affect the performance quality of both substances.

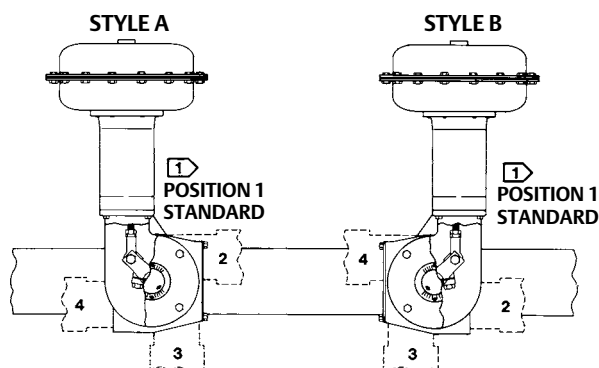
- For actuator designs with a set screw, (key 75), if the adjustor (key 74) and attached parts were removed, lubricate the threads of the adjustor with lithium grease (key 76). Install the lower bearing seat (key 73), the thrust bearing

- (key 71), the thrust bearing races (key 72), and the spring seat (key 13) onto the adjustor. Install this assembly into the spring barrel (key 12). After first cleaning and then coating the set screw (key 75) with thread-locking adhesive (high strength) (key 77), secure the adjustor with the set screw (key 75).
- b. Coat the tapered end of the diaphragm rod (key 10) and the threads of the cap screw (key 9) with lithium grease (key 76). Bolt the diaphragm plate (key 4) to the diaphragm rod with the cap screw (key 9). Tighten the cap screw to the torque value listed in table 11.
- c. Be certain the travel stops (key 8) are located as shown in figure 11.
- d. Install the spring (key 11) into the spring barrel. Install the diaphragm plate and diaphragm rod into the actuator. Attach the hex nut (key 58), turnbuckle (key 57), hex nut (key 16), and rod end bearing (key 17) to the diaphragm rod.
- e. Install the diaphragm (key 3).
- f. Place the upper diaphragm casing (key 1) on the lower diaphragm casing (key 2). If necessary, rotate the lower bearing seat (key 73) so that the upper diaphragm casing travel stop will not contact the diaphragm when the casing cap screws (key 5) are tightened. Secure the upper diaphragm casing with the cap screws and hex nuts (keys 5 and 6) in a criss-cross pattern to the torques shown in table 11. Be sure the warning nameplate is in place on the casing.
3. If the bearing (key 67) was removed, press in the new bearing. The end of the bearing should be flush with the outside of the mounting bracket or mounting plate (key 22).
4. For an actuator with an **H mounting** adaptation, install the output shaft (key 87) through the mounting plate (key 22) and secure it with the retaining ring (key 88). Then, attach the mounting plate and output shaft assembly to the actuator housing (key 20) with the cap screws (key 23). Tighten the cap screws to the appropriate torque value listed in table 11.
5. For an actuator with a **J mounting** adaptation, refer to figures 12 and 13. Install the output shaft (key 87) with attached coupling (key 90) through the mounting bracket (key 22) and secure it with the retaining ring (key 88). Attach the mounting bracket and output shaft assembly to the actuator housing (key 20) with the cap screws (key 23). Tighten the cap screws to the appropriate torque value listed in table 11.
6. For an actuator with a **J mounting** adaptation and a **50.8 mm (2-inch) output shaft**, refer to figure 14. Install the output shaft (key 87) with attached coupling (key 90) through the mounting plate (key 22) and secure it with the retaining ring (key 88). Attach the mounting plate and output shaft assembly to the actuator housing with the cap screws (key 23). Tighten the cap screws to the appropriate torque value listed in table 11.
7. Apply lithium grease (key 76) to the output shaft splines. Then, align the lever (key 27) and output shaft so that the marking that was made in step 6 or 7 of the Disassembly procedure is oriented correctly. Slide the lever into place. When installing the lever, align the bolt holes in the lever as close as possible with the hole in the rod end bearing (key 17). Temporarily rotate the lever and output shaft until the rod end bearing no longer interferes with further installation of the lever. Then, slide the lever as far as it can go onto the output shaft.
8. Clamp the lever to the output shaft with the cap screw (key 28). Tighten the cap screw to the torque value listed in table 11.
9. For 1052 actuators, complete the Initial Compression portion of the Adjustment section before proceeding.
10. Rotate the lever (key 27) to align with the rod end bearing (key 17). This connection can be aided by stroking the actuator off its up travel stop with a regulated air source.

Figure 10. Actuator Housing Construction Styles and Mounting Positions

DESIRED ACTION OF		HOUSING CONSTRUCTION TO SPECIFY
Actuator	Operated Equipment	
Push Down to Open ⁽¹⁾ (PDTO)	Clockwise to Close ⁽³⁾	Style A
	Counterclockwise to Close ⁽³⁾	Style B
Push Down to Close ⁽²⁾ (PDTC)	Clockwise to Close ⁽³⁾	Style B
	Counterclockwise to Close ⁽³⁾	Style A

1. This action uses the spring to close the valve body or other equipment.
2. This action uses the spring to open the valve body or other equipment.
3. When viewed from actuator side of valve body or other equipment.



NOTE:
1 DOTTED LINES INDICATE ALTERNATE MOUNTING POSITIONS 2, 3, AND 4.

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A1578-3

11. Apply thread-locking adhesive (high strength) (key 77) to the threads of the cap screw (key 18).
12. Connect the lever (key 27) and the rod end bearing (key 17) with the cap screw and hex nut (keys 18 and 19). Tighten the cap screw to the torque value listed in table 11.
13. If a positioner is to be used, consult the separate positioner instruction manual for proper positioner installation.
14. Coat the bearing surfaces of the hub (key 29) and cover (key 33) with lithium grease (key 76). Install the bearing (key 31) and hub into the cover. Secure with the retaining ring (key 30).
15. Install the travel indicator scale (key 35) so that the markings on the scale and cover that were made in step 5 of the Disassembly procedure are oriented correctly. Secure the travel indicator scale to the cover with the self-tapping screws (key 36). Then install the travel indicator (key 37), and secure it with the self-tapping screws (key 38).
16. Position the travel indicator (key 37) so that the markings on the travel indicator and travel indicator scale that were made in step 3 of the Disassembly procedure are oriented correctly. Then, replace the cover (key 33), and secure it with the cap screws and washers (keys 34 and 63). If the holes in the cover and housing (key 20) do not align, use a regulated air source to move the actuator slightly off the up travel stop. If hole alignment cannot be obtained in this manner, temporarily loosen the cap screws (key 23), and shift the housing slightly. Do not stroke the actuator while the cover is off. Tighten the cap screws to the torque value listed in table 11.
17. Follow the instructions in the Actuator Mounting section for correct actuator mounting and adjustment. Remember to replace the access plate (key 59) when performing this procedure.

Changing Actuator Mounting

The actuator is normally positioned vertically in a horizontal pipeline. However, each style can be mounted in two possible mounting styles and four possible positions (see figure 10).

Note

Due to its weight, the 1052, size 70 actuator must be externally supported if mounted in the horizontal position.

⚠ WARNING

Before performing any Actuator Mounting steps, follow the steps in the WARNING at the beginning of the Maintenance section.

Use the following procedures along with figures 12 and 13 for key number references to convert from style A to style B or vice versa or to change the mounting position.

Changing Styles

1. Unscrew the cap screws and washers (keys 34 and 63), and remove the cover (key 33).
2. Heat the hex nut (key 19) to 177°C (350°F) long enough for the thread-locking adhesive (high strength) (key 77) to lose its holding strength. Then, remove the cap screw and hex nut (keys 18 and 19).
3. Loosen the cap screw (key 28).

NOTICE

If necessary, use a wheel puller to remove the lever (key 27) from the output shaft (key 87). It is permissible to tap the wheel puller screw lightly to loosen the lever, but hitting the screw with excessive force could damage the operated equipment.

4. Mark the side of the lever (key 27) that is nearest to the end of the output shaft (key 87). This marking is used during reassembly to determine which side of the lever should be inserted into the actuator housing first. When the lever is marked, remove the lever.
5. For an actuator with a J mounting adaptation,
 - a. Unscrew the cap screws (key 23), and remove the actuator housing (key 20) from the mounting bracket (key 22).
 - b. Rotate the actuator housing 180 degrees, maintaining the appropriate position (1, 2, 3, or 4), and place the actuator onto the mounting bracket (key 22).
 - c. Secure the actuator housing to the mounting bracket with the cap screws (key 23). Tighten the cap screws to the torque value listed in table 11.
6. For an actuator with an H mounting adaptation,
 - a. Unscrew the cap screws (key 78) and remove the actuator assembly from its mounting bracket.

- b. Unscrew the cap screws (key 23) and remove the mounting plate (key 22) and output shaft (key 87) assembly from the actuator housing. Remount the assembly on the opposite side of the actuator, and secure it to the housing with the cap screws (key 23). Tighten the cap screws to the torque value listed in table 11.
 - c. Rotate the actuator housing 180 degrees, maintaining the appropriate position (1, 2, 3, or 4) and secure the actuator housing to the mounting bracket with the cap screws (key 78). Tighten the cap screws to the torque value listed in table 4.
7. Install the lever (key 27) as follows:
 - a. For push-down-to-open action, rotate the operated equipment to the fully closed position.
 - b. For push-down-to-close action, rotate the operated equipment to the fully open position.
 - c. With the operated equipment oriented correctly, slide the lever onto the output shaft (key 87) with the end marked in step 4 inserted first. When installing the lever, align the bolt holes in the lever as close as possible with the hole in the rod end bearing (key 17).
 - d. Temporarily rotate the lever and output shaft until the rod end bearing no longer interferes with further installation of the lever. Then, slide the lever as far as it can go onto the output shaft. Clamp the lever to the output shaft with the cap screw (key 28). Tighten the cap screw to the torque value listed in table 11.
 - e. Rotate the lever and output shaft back to the original position (i.e., operated equipment fully closed for push-down-to-open action or operated equipment fully open for push-down-to-close action). Then, adjust the rod end bearing so that it can be attached to the lever.
8. Apply thread-locking adhesive (high strength) (key 77) to the threads of the cap screw (key 18).
9. Connect the lever (key 27) and the rod end bearing (key 17) with the cap screw and hex nut (keys 18 and 19). This connection can be aided by stroking the actuator from its up travel stop with a regulated air source. Tighten the cap screw to the torque value listed in table 11.
10. Note the position of the valve body or other operated equipment and direction of rotation. Position the travel indicator (key 37) accordingly. Replace the cover (key 33), and secure it with the cap screws and washers (keys 34 and 63). If the holes in the cover and housing (key 20) do not align, use a regulated air source to move the actuator slightly off the up travel stop. If hole alignment cannot be obtained in this manner, temporarily loosen the cap screws (key 23), and shift the housing slightly. Do not stroke the actuator while the cover is off. Tighten both sets of cap screws to the torque values listed in table 11.
11. Follow the instructions in the Turnbuckle Adjustment section.

Changing Positions

1. Unscrew the cap screws and washers (keys 34 and 63), and remove the cover (key 33).
2. Mark the orientation of the lever (key 27) with respect to the output shaft (key 87). This marking is used during reassembly to allow for proper lever/output shaft positioning. When the lever and output shaft are properly marked, heat the hex nut (key 19) to 177°C (350°F) long enough for the thread-locking adhesive (high strength) (key 77) to lose its holding strength. Then, remove the cap screw and hex nut (keys 18 and 19).

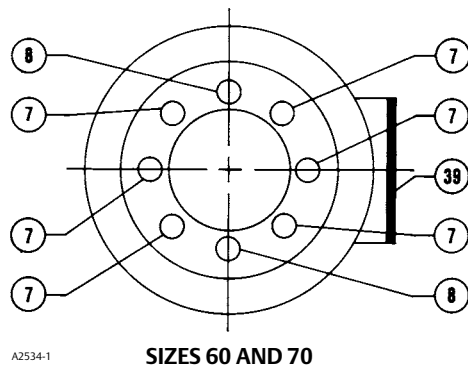
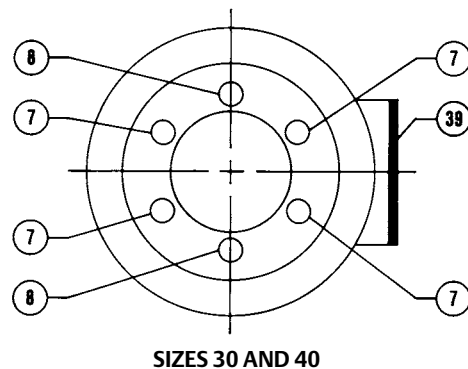
NOTICE

If necessary, use a wheel puller to remove the lever (key 27) from the output shaft (key 87). You may tap the wheel puller screw lightly to loosen the lever, but hitting the screw with excessive force could damage the operated equipment.

3. Loosen the cap screw (key 28) and remove the lever (key 27) from the output shaft (key 87).

4. For an actuator with a J mounting adaptation.
 - a. Unscrew the cap screws (key 23), and remove the actuator housing (key 20) from the mounting bracket (key 22).
 - b. Rotate the actuator housing to the new position (1, 2, 3, or 4).
 - c. Secure the actuator housing to the mounting bracket with the cap screws (key 23). Tighten the cap screws to the torque value listed in table 11.
5. For an actuator with an H mounting adaptation.
 - a. Unscrew the cap screws (key 78) and loosen the actuator assembly from its mounting bracket.
 - b. Rotate the actuator housing to the new position (1, 2, 3, or 4).
 - c. Secure the actuator housing to the mounting bracket with the cap screws (key 78). Tighten the cap screws to the torque value listed in table 4.
6. Referring to the alignment marks that were made in step 2, install the lever (Key 27) onto the output shaft (key 87) as follows:
 - a. If the new actuator position is 90 degrees clockwise from the previous actuator position, install the lever so that its orientation mark is located 90 degrees clockwise from the mark on the output shaft.
 - b. If the new actuator position is 90 degrees or 180 degrees counterclockwise from the previous position, install the lever so that its orientation mark is located either 90 degrees (for 90 degrees) or 180 degrees (for 180 degrees) counterclockwise (respectively) from the mark on the output shaft.
 - c. Slide the lever onto the output shaft with the bolt holes in the lever aligned as closely as possible with the hole in the rod end bearing (key 17). Then, temporarily rotate the lever and output shaft until the rod end bearing no longer interferes with further installation of the lever, and slide the lever as far as it can go onto the output shaft. Clamp the lever to the output shaft with the cap screw (key 28). Tighten the cap screw to the torque value listed in table 11.
 - d. Rotate the lever and output shaft back to the original position, and then adjust the rod end bearing so that it can be attached to the lever.
7. Apply thread-locking adhesive (high strength) (key 77) to the threads of the cap screw (key 18).
8. Connect the lever (key 27) and the rod end bearing (key 17) with the cap screw and hex nut (keys 18 and 19). This connection can be aided by stroking the actuator from its up travel stop with a regulated air source. Tighten the cap screw to the torque value listed in table 11.
9. Note the position of the valve body or other operated equipment and direction of rotation. Position the travel indicator (key 37) accordingly. Replace the cover (key 33), and secure it with the cap screws and washers (keys 34 and 63). If the holes in the cover and housing (key 20) do not align, use a regulated air source to move the actuator slightly off the up travel stop. If hole alignment cannot be obtained in this manner, temporarily loosen the cap screws (key 23), and shift the housing slightly. Do not stroke the actuator while the cover is off. Then, tighten both sets of cap screws to the torque values listed in table 11.
10. Follow the instructions in the Turnbuckle Adjustment section.

Figure 11. Travel Stop Orientation



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Top-Mounted Handwheels and Adjustable Travel Stops

Handwheel and Travel Stop Operation

Note

If repeated or daily manual operation is expected or desired, the unit should be equipped with a manual handwheel actuator. Refer to the separate manual handwheel actuator instruction manual for mounting instructions.

The top-mounted handwheel assembly is attached to a special upper diaphragm casing (key 1, figures 12 and 13) with cap screws (key 141, figure 15). A hex nut (key 137, figure 15) locks the handwheel in position.

Turning the handwheel (key 51, figure 15) clockwise into the upper diaphragm casing forces the pusher (key 135, figure 15) against the diaphragm and diaphragm plate (keys 3 and 4, figures 12 and 13) to compress the spring (key 11, figures 12 and 13) and move the diaphragm rod downward. Turning the handwheel counterclockwise allows the actuator spring to move the diaphragm rod upward. If the action is push-down-to-close, full opening can be restricted by positioning the handwheel at the desired position. If the action is push-down-to-open, full closing can be restricted by use of the handwheel.

The adjustable up travel stop (figure 16) limits the actuator stroke in the upward direction. To make adjustments, first relieve actuator loading pressure before removing the closing cap (key 187) as it is a pressure retaining part. Also, for size 70 actuators, the hex nut (key 137) must be loosened.

Turning the stem (key 133) clockwise into the diaphragm case moves the actuator stem downward or counterclockwise to allow the spring to move the actuator stem upward. If the action is push-down-to-close, full opening can be restricted; or if the action is push-down-to-open, full closing can be restricted by the position of the adjustable travel stop.

The adjustable down travel stop (figure 17) limits the actuator stroke in the downward direction. To make adjustments, first relieve actuator loading pressure before removing the closing cap (key 187) as it is a pressure retaining part. After removing the closing cap, loosen the hex jam nut (key 189) and either turn the hex nut (key 63 for size 40, and 70 actuators; or key 54 for size 60 actuators) down on the stem (key 133) to limit travel, or up on the stem to allow more travel. Lock the jam nut against the hex nut and replace the closing cap after the adjustment has been made. For size 70, tighten the hex nut and replace the closing cap after adjustment.

Handwheel and Travel Stop Maintenance

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If loading pressure seems to be leaking from either the handwheel or adjustable up stop, the O-rings (key 138 and 139, figures 15 and 16) may need replacement. If the adjustable down stop leaks, the O-ring (key 139, figure 17) may need replacement or possibly the closing cap (key 187, figure 17) is not tight. To tighten the closing cap, apply a good grade of thread sealant to the closing cap threads.

For ease of operation, the stem (key 133, figures 15, 16, and 17) threads may need an occasional application of lithium grease. A grease fitting (key 169, figures 15 and 16) is provided for this purpose in the size 70. The size 70 may also need to have the thrust bearing (key 175, figures 15 and 16) packed with lithium grease. Travel stops for the smaller casings can be lubricated between the stem and pusher (key 135, figures 15 and 16) with lithium grease.

1. Bypass the control valve, reduce loading pressure to atmospheric, and remove the tubing or pipe from the body (key 142, figures 15, 16, and 17).

⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1, figures 12 and 13) away from the actuator, either relieve 1052 spring compression, or carefully remove 1051 casing cap screws by following the instructions that are referenced in the steps below before removing the casing.

2. Relieve all actuator spring compression by following the procedures presented in the Disassembly portion of the Maintenance section. Then, rotate either the handwheel (key 51, figure 15) or the travel stop stem (key 133, figures 16 and 17) counterclockwise until the handwheel or travel stop assembly is no longer compressing the spring.
3. Proceed as appropriate:

For Top-Mounted Handwheels and Adjustable Up Travel Stops

- a. Remove the upper diaphragm casing (key 1, figures 12 and 13) by following steps 1, 3, 6, 7, 9, 11, and 12 of the Disassembly portion of the Maintenance section.
- b. Remove the cap screws (key 141, figures 15 and 16, and separate the assembly from the upper casing.
- c. Loosen the locknut (key 137, figure 15) or remove the closing cap (key 187, figure 16).
- d. Turn the stem (key 133, figures 15 and 16) clockwise out of the body. On handwheel assemblies, the cotter pin and slotted nut (keys 247 and 54, figure 15) will have to be removed so that the handwheel (key 51, figure 15) and locknut can be taken off the stem first.
- e. Remove and inspect the O-rings (keys 138 and 139, figures 15 and 16); replace them if necessary.
- f. To complete disassembly for sizes 40 and 60, drive out the groove pin (key 140, figures 15 and 16), and slide the pusher (key 135, figures 15 and 16) off the stem. The pusher of a size 70 unit is held to the stem by a retaining screw (key 174, figures 15 and 16). Removing the retaining screw and pusher exposes the thrust bearing (key 175, figures 15 and 16) for inspection.

For Adjustable Down Travel Stops

Refer to figure 17 for appropriate key numbers unless otherwise stated.

- a. Remove the closing cap (key 187), and unscrew the jam nut and hex nut (keys 189 and 63 for sizes 40, and 70 actuators; or keys 189 and 54 for size 60 actuators) off the stem (key 133).
 - b. Remove the upper diaphragm casing (key 1, figures 12 and 13) and travel stop body (key 142) by following steps 1, 3, 6, 7, 9, 11, and 12 of the Disassembly portion of the Maintenance section.
 - c. Unscrew cap screws (key 141), and remove the body from the diaphragm case.
 - d. Check the condition of the O-ring (key 139), and replace it if necessary.
 - e. Loosen the hex nut (key 54), and then unscrew the travel stop stem (key 133) out of the actuator stem. The lower diaphragm plate (key 82) can now be removed and the rest of the actuator disassembled.
4. Reassemble by reversing the order of the steps you took to disassemble, being sure to apply lubricant as previously mentioned and as shown by the lubrication boxes (key 241) in figures 15 and 16. For size 70 handwheels or up travel stop assemblies, coat the threads of the retaining screws (key 174, figures 15 and 16) with thread-locking adhesive (high strength) (key 242).

5. Adjust the spring to obtain the appropriate travel stop restriction by following the procedures presented in the introductory portion of this section, and then return the unit to operation.

Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, refer to the serial number found on the actuator nameplate (key 41, figure 12).

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Retrofit Kits

Kit provides parts to add a top-mounted handwheel. Kit number 1 includes the handwheel assembly only. Kit number 2 includes Kit number 1 and a new upper case (key 1) that is required to mount the handwheel assembly.

Key	Description	Part Number
	1052 Actuator	
	Kit Number 1	
	Size 40	38A1213X032
	Size 60, Push-Down-to-Close	38A1213X062
	Size 60, Push-Down-to-Open	38A1213X052
	Kit Number 2	
	Size 40	38A1213X072
	Size 60, Push-Down-to-Close	38A1213X022
	Size 60, Push-Down-to-Open	38A1213X042
	1052 Actuator	
	Kit Number 1	
	Size 40	38A1213X032
	Size 60, Push-Down-to-Close	38A1213X062
	Size 60, Push-Down-to-Open	38A1213X052
	Size 70	CV8010X0012
	Kit Number 2	
	Size 40	38A1213X072
	Size 60, Push-Down-to-Close	38A1213X022
	Size 60, Push-Down-to-Open	38A1213X042
	Size 70	CV8010X0022

Common Parts (figures 12 and 13)

Note

Contact your Emerson sales office for part ordering information.

The size 70 actuator is available only in 1052 actuators.

Key	Description
1	Casing, Upper
2	Diaphragm Casing, Lower
3*	Diaphragm
4	Diaphragm Head
5	Screw, Cap, Hex hd
	Size 40 (16 req'd)
	Size 60 (24 req'd)
	Size 70 (28 req'd)
6	Nut, hex
	Size 40 (16 req'd)
	Size 60 (24 req'd)
	Size 70 (28 req'd)
7	Screw, cap, Hex hd
	Size 40 (4 req'd)
	Size 60 (6 req'd)
	Size 70 (10 req'd)
8	Travel Stop (2 req'd)
9	Screw, cap, Hex socket
10	Diaphragm Rod
11	Spring
12	Spring barrel

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

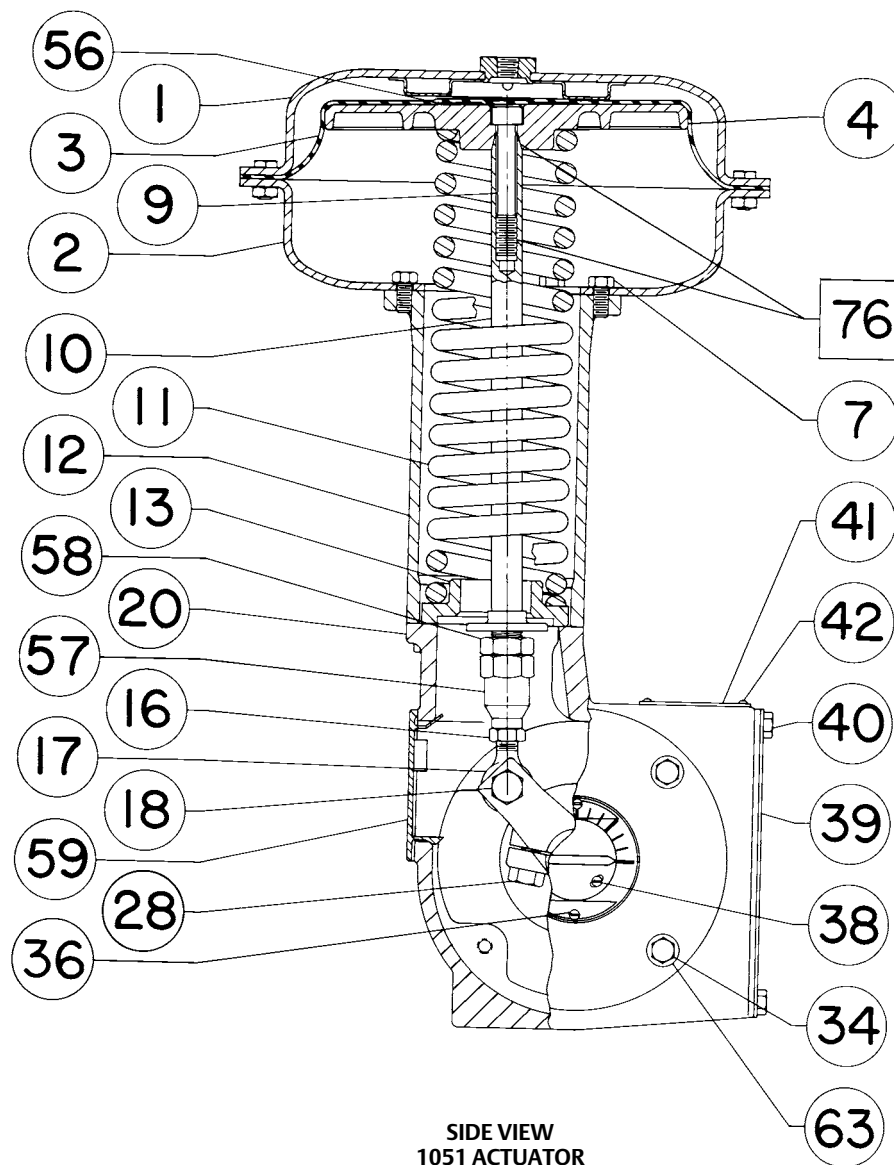
Instruction Manual

D100320X012

1051 and 1052 H & J Actuators

July 2023

Figure 12. Fisher 1051 Actuator with Typical H and J Mounting Adaptations



**SIDE VIEW
1051 ACTUATOR**

NOTES:

1. KEYS 12 AND 21 ARE NOT REQUIRED FOR SIZE 30 ACTUATORS.

2. KEYS 56, 82, 78, AND 92 ARE NOT SHOWN.

□ APPLY LUBRICANT / SEALANT

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Key	Description
-----	-------------

13	Spring seat
16	Nut, hex
17	Bearing, Rod End
18	Screw, cap, Hex hd
19	Nut, Hex, Jam
20	Housing
21	Screw, Cap, Hex Hd (4 req'd)
22	Plate, mounting

Key	Description
-----	-------------

23	Screw, Cap, Hex socket (4 req'd)
27	Lever
28	Screw cap, Hex Hd
29	Hub
30	Retaining Ring, Ext
31*	Bushing (2 req'd)
33	Cover
34	Screw, Cap, Hex Hd
34	Stud post (not shown)(w/ 3555T)(4 req'd)

Figure 12. Fisher 1051 Actuator with Typical H and J Mounting Adaptations (continued)

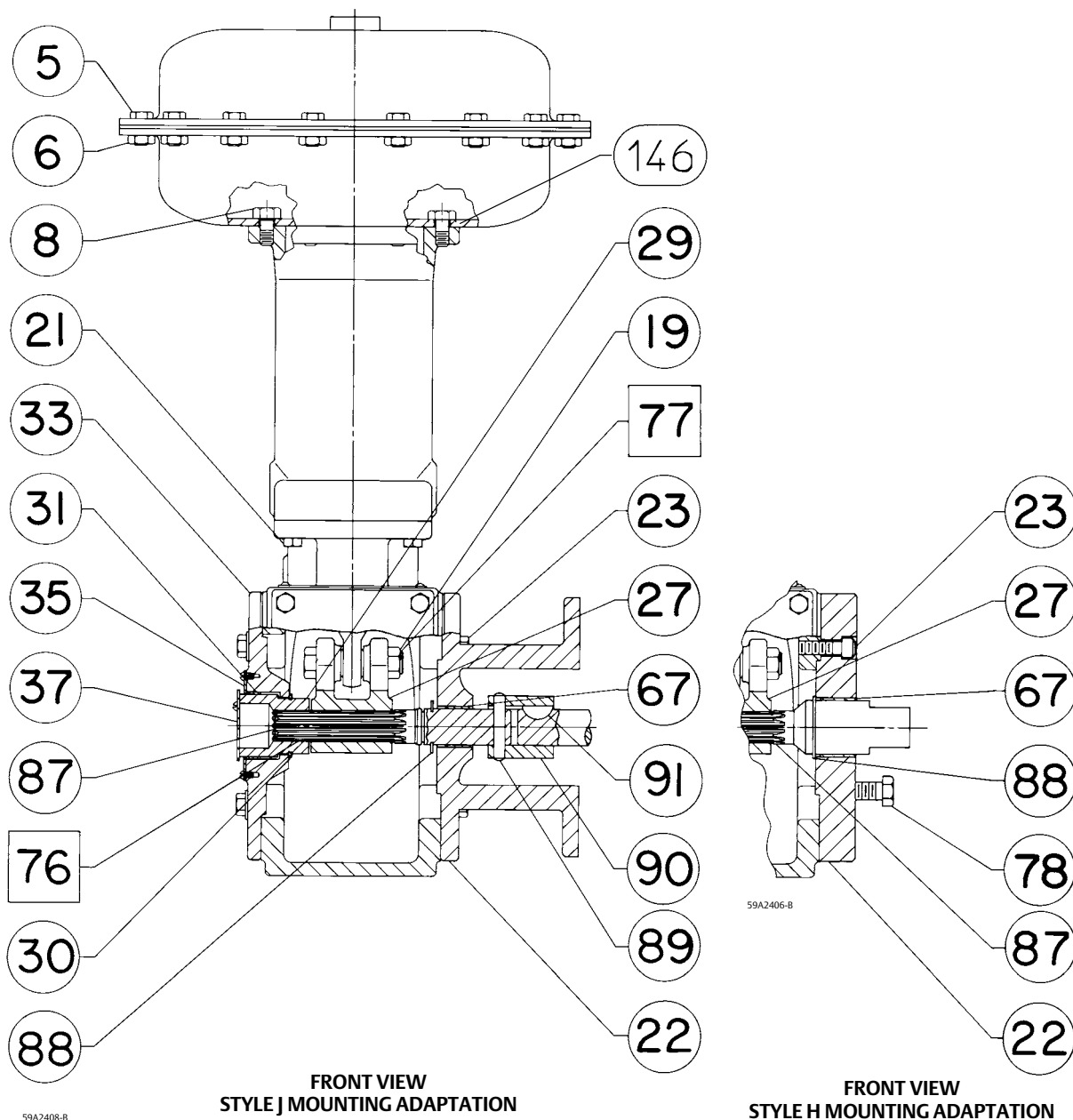
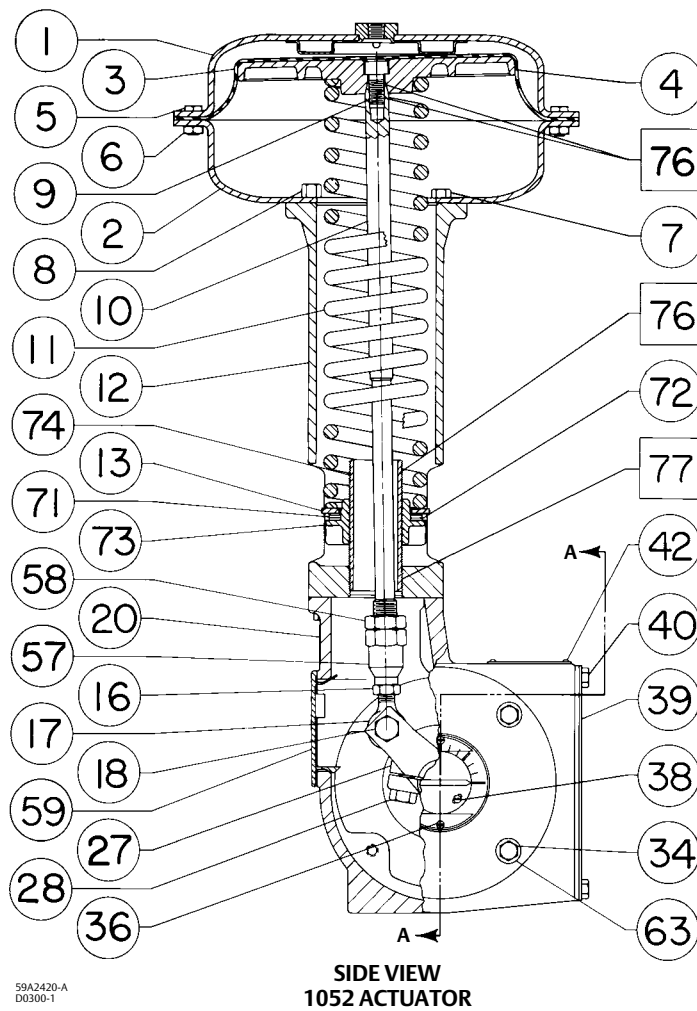


Figure 13. Fisher 1052 Actuator with Typical H and J Mounting Adaptations

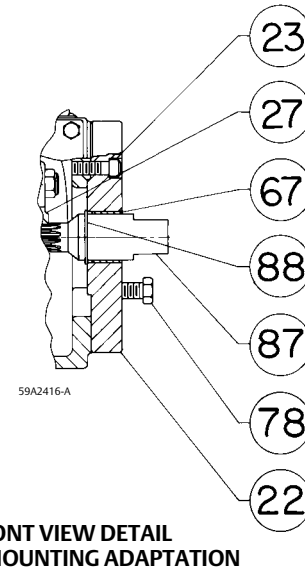
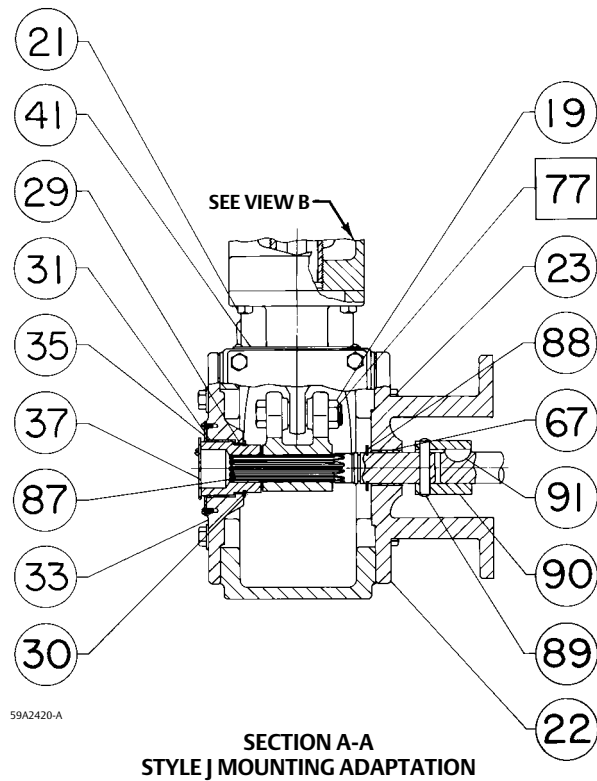


NOTES:

1. KEYS 56, 82, 78, AND 92 ARE NOT SHOWN.

□ APPLY LUBRICANT / SEALANT

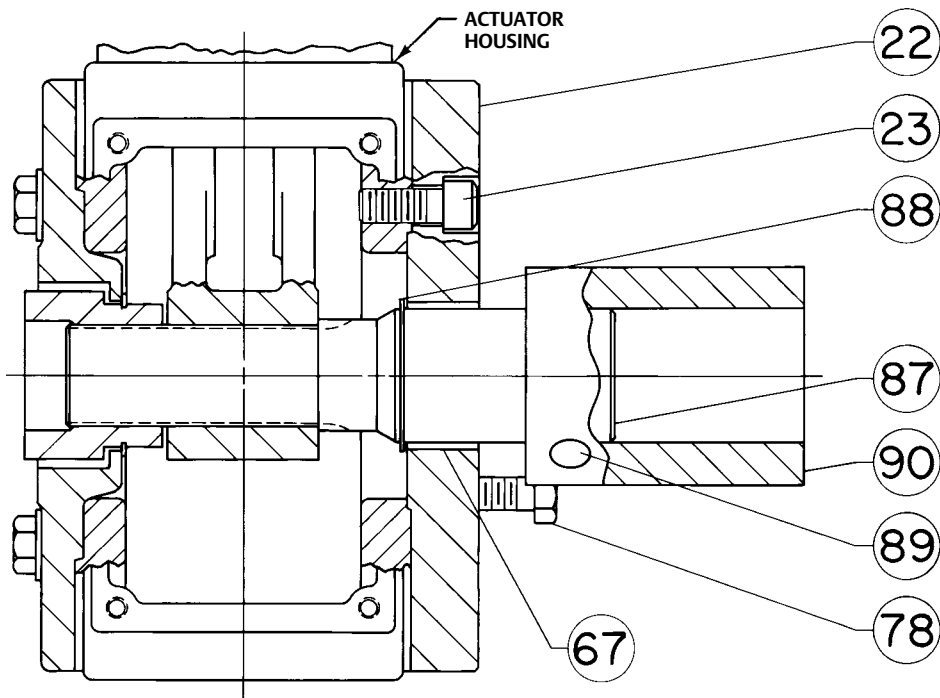
Figure 13. Fisher 1052 Actuator with Typical H and J Mounting Adaptations (continued)



Key	Description
35	Scale, Indicator (w/out handwheel or w/ 3555T)
36	Screw, Self Tap (2 req'd)
37	Travel Indicator
38	Self-Tapping Screw (2 req'd)
38	Machine Screw (2 req'd)
39	Plate, Cover
40	Screw, Cap, Hex hd w/o 3610J/3620J Positioner (4 req'd)
41	Nameplate
42	Screw, Drive (4 req'd)
56	Nameplate
57	Turnbuckle
58	Nut, Hex, Jam
59	Plate, Access
63	Washer, Plain Size 40 (4 req'd) Sizes 60 & 70 (2 req'd)
64	Ind, Travel (not shown)(w/ 3555T)
65	Screw, Mach, Fill hd (w/ 3555T)
66	Disk, Travel Indicator (w/ 3555T) (not shown)
67*	Bushing
71	Bearing, Thrust (1052)
72	Bearing race (1052) (2 req'd)
73	Bearing Seat (1052, Sizes 60 & 70)
74	Screw, adjusting (1052)

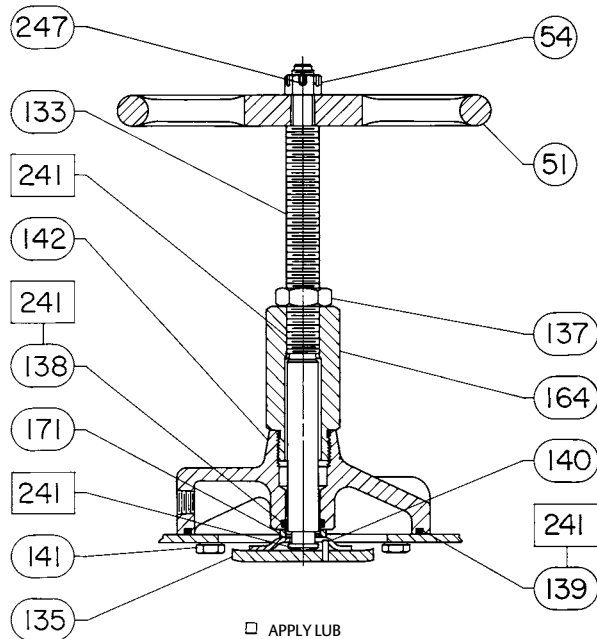
Key	Description
76	Lithium Grease (not furnished w/actuator)
77	Thread Locking Adhesive (High Strength) (not furnished w/actuator)
78	Cap Screw, Hex Hd Style H Size 40 (4 req'd) Size 60 (4 req'd) Style J Size 30/40 (2 req'd) w/15.9 mm (5/8-inch) actuator output shaft (4 req'd) Size 40 (4 req'd) Size 60 (4 req'd) w/50.4 mm (2-inch) actuator output shaft (1 req'd)
82	Diaphragm head, lower (1051 w/adj down stop)
83	Plug, protective (1052 Size 70)
87	Actuator Output Shaft
88	Retaining Ring
89*	Pin, Groove
90	Coupling
91*	Key, Woodruff
92	Spacer (not shown) (2 req'd)
---	Bushing, Pipe (not shown) (1052 Size 70)
146	Spacer (1 req'd)

Figure 14. H Mounting for 44.5 or 50.8 mm (1-3/4 or 2-Inch) Keyed Equipment Shafts

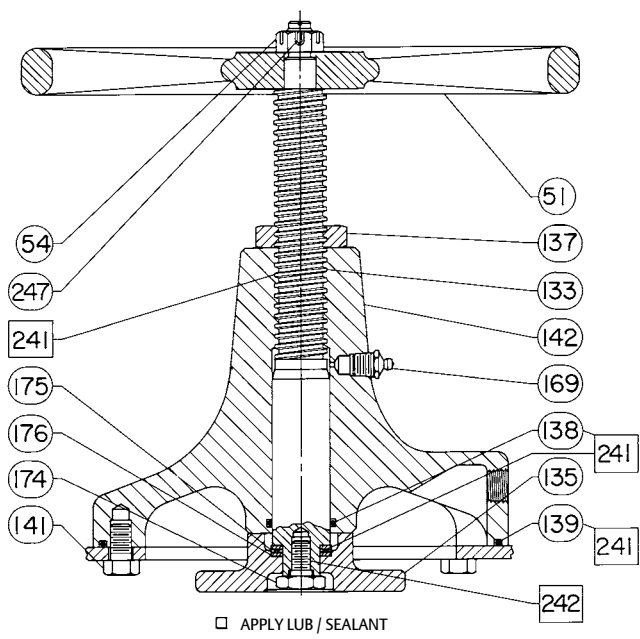


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Figure 15. Top-Mounted Handwheel Assemblies



**TOP-MOUNTED HANDWHEEL ASSEMBLY FOR
SIZE 30, 40, AND 60 ACTUATORS**



**TOP-MOUNTED HANDWHEEL ASSEMBLY FOR
SIZE 70 ACTUATORS**

Top-Mounted Handwheel (figure 15)

Key Description

51	Handwheel
54	Hex Nut, Slotted
133	Stem
135	Plate, Pusher
137	Hex Nut, Jam
138*	O-Ring
139*	O-Ring
140	Groove Pin (Sizes 40 & 60)
141	Cap Screw, Hex hd
	Size 40 (6 req'd)
	Size 60 (8 req'd)
	Size 70 (12 req'd)

Key Description

142	Body
164	Body Extension (Sizes 40 & 60)
169	Grease Fitting (Size 70)
171	Spacer (Size 60)
174	Retaining Screw (Size 70)
175	Thrust Bearing (Size 70)
241	Lithium Grease (not furnished w/travel stop)
242	Thread Locking Adhesive (High Strength)
	(not furnished w/travel stop)
	(1052 Size 70 only)
246	Spacer (Sizes 60 & 70)
247	Pin, Cotter

Adjustable Up Travel Stop (figure 16)

Key	Description
133	Stem
135	Plate, Pusher
137	Nut, Travel Stop (Size 70)
138*	O-Ring
139*	O-Ring
140*	Groove Pin
141	Cap Screw, Hex Hd Size 40 (6 req'd) Size 60 (8 req'd) Size 70 (12 req'd)
142	Body
164	Body Extension (Sizes 40 & 60)
169	Grease Fitting (Size 70)
171	Spacer (Size 60)
174	Retaining Screw (Size 70)
175	Thrust Bearing
176	Bearing Race, Thrust (1052, Size 70) (2 req'd)
187	Travel stop cap (Size 70)
241	Lithium Grease (not furnished w/travel stop)
242	Thread Locking Adhesive (High Strength) (not furnished w/travel stop) (1052 Size 70 only)

Adjustable Down Travel Stop (figure 17)

Key	Description
54	Hex Nut 1051 Size 40 (1 req'd) Size 60 (2 req'd) 1052 Size 40 (1 req'd) Sizes 60 & 70 (2 req'd)
63	Flange Nut (Sizes 40 & 70)
133	Travel Stop Stem
134	Washer, Plain
139*	O-Ring
141	Cap Screw, Hex hd Size 40 (6 req'd) Size 60 (8 req'd) Size 70 (12 req'd)
142	Travel Stop Body
187	Travel Stop Cap
189	Hex Nut, Jam Sizes 40 & 60 (1 req'd) Size 70 (2 req'd)
241	Lithium Grease (not furnished w/travel stop)

Figure 16. Adjustable Up Travel Stops

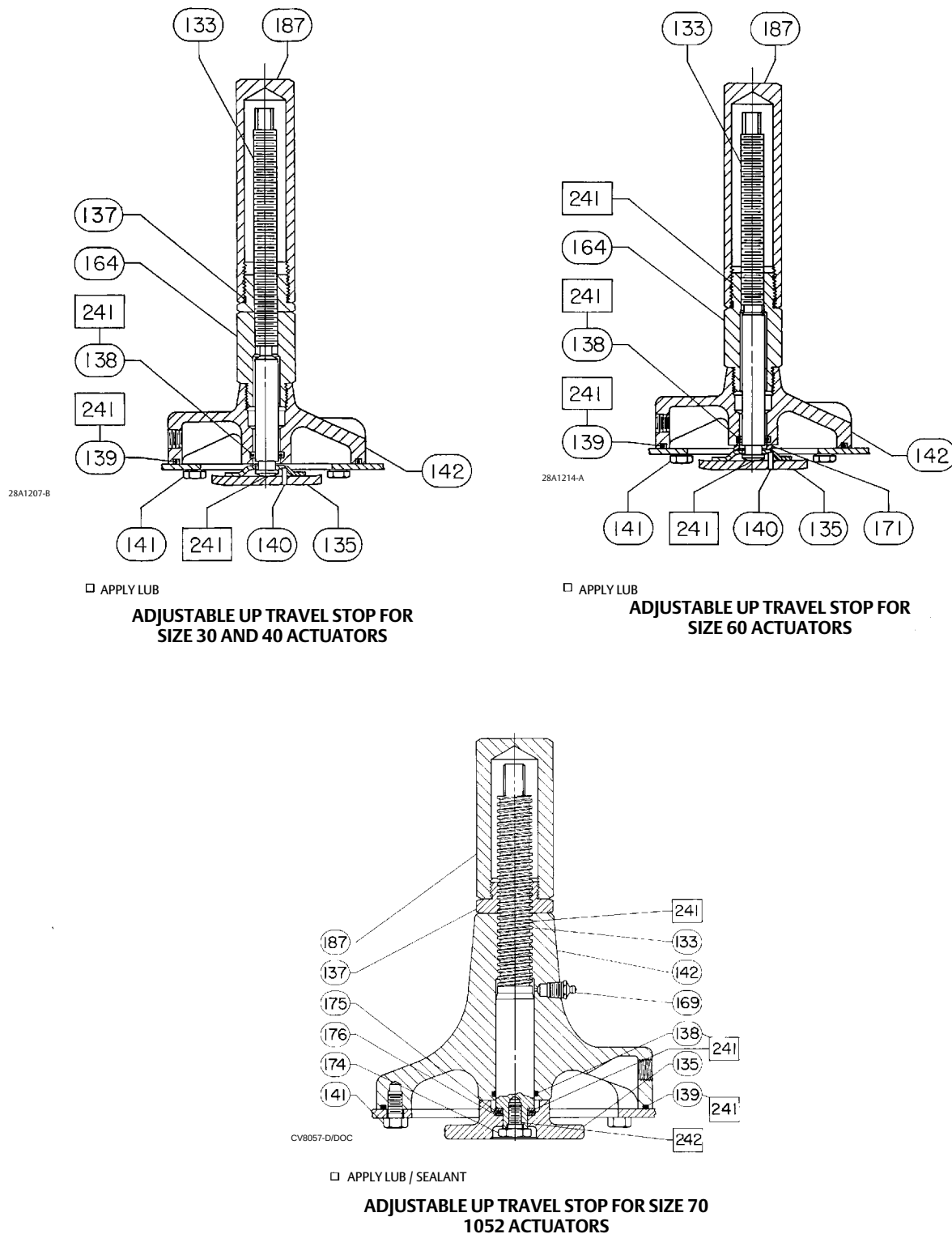
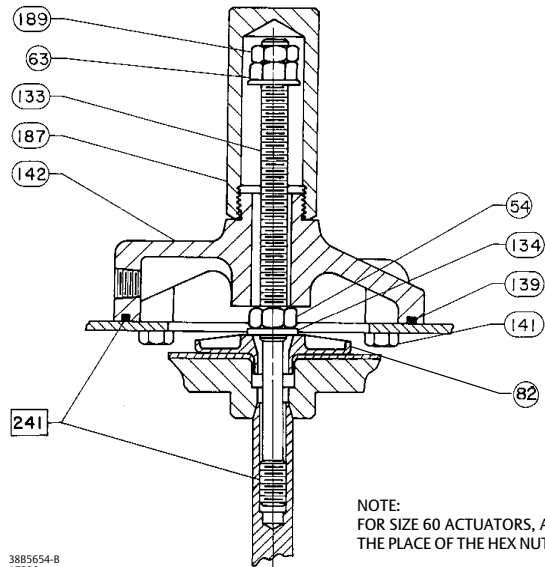


Figure 17. Adjustable Down Travel Stop



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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

1051 and 1052 H & J Actuators

July 2023

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1051 and 1052 H & J Actuators

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Fisher™ 1052 Size 20 Diaphragm Rotary Actuator with H Mounting Adaptation

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Figure 1. Fisher 1052 Size 20 Actuator with H Mounting Adaptation



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Introduction

Scope of Manual

This instruction manual includes installation, adjustment, operation, maintenance, and parts ordering information for the Fisher 1052 size 20 diaphragm rotary actuator with H mounting (figure 1) and the optional top-mounted handwheel (see figure 7). Instructions for the rotary positioner and other accessories are included in separate instruction manuals.



Do not install, operate, or maintain a 1052 actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

Operating Principle Direct-Increasing loading pressure forces the diaphragm rod from the top to the bottom of the casing Casing Pressure Ranges ■ 0 to 1.2 bar (10 to 18 psig), ■ 0 to 2.3 bar (0 to 33 psig), or ■ 0 to 2.8 bar (0 to 40 psig) depending on spring used for proportional control; up to 3.4 bar (50 psig) for on-off control Maximum Allowable Sizing Pressure⁽¹⁾ 3.4 bar (50 psig) Maximum Allowable Casing Pressure⁽²⁾ 4.1 bar (60 psig) Maximum Rotation 90 degrees (travel is adjustable between 60 degrees and 90 degrees by travel stops) Maximum Allowable Output Torque 58 N•m (515 lbf•in)	Stroking Time Depends on degrees of rotation, spring rate, initial spring compression, and supply pressure. If stroking time is critical, consult your Emerson sales office. Material Temperature Capabilities⁽²⁾ -40 to 180°F (-40 to 82°C) Pressure Connections 1/4 NPT internal Mounting Configurations See figure 5 Approximate Weight 13.6 kg (30 lb) Top-Mounted Handwheel Specifications Operating Principle: Can be used for manual operation of the actuator or as an adjustable up travel stop Diameter: 171 mm (6.75 inches)
--	---

1. Use this value to determine the maximum torque output.

2. The pressure-temperature limits in this manual and any applicable code or standard should not be exceeded.

Description

The 1052 size 20 spring-and-diaphragm actuator is used on small rotary shaft valves and other equipment for throttling or on-off control applications. This actuator accepts a 3610J, 3620J, or PMV positioner, and a top-mounted handwheel is available for the unit.

The Style H mounting adaptation permits the actuator to be used with user-provided mounting brackets and couplings for rotary actuation of equipment other than Fisher valves. This mounting adaptation includes a flat-surface actuator mounting plate that is drilled and tapped for attaching the user-provided bracket. Cap screws for attaching the bracket are provided. The H mounting also includes an output shaft (with two milled flats) to provide the rotary output, either directly or through a user-provided coupling.

Dimensional information for the mounting plate and output shaft are shown in figure 4.

Specifications

Specifications are shown in table 1 for 1052, Size 20, Style H actuators. Some specifications for a given actuator as it originally comes from the factory are stamped on a nameplate attached to the actuator.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure retaining parts, do not apply pressure exceeding the Maximum Allowable Casing Pressure limit given in table 1 or on the nameplate. Use pressure limiting or pressure relieving devices to prevent the casing pressure from exceeding the maximum allowable casing pressure.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

NOTICE

To avoid parts damage, do not apply pressure that exceeds the Maximum Allowable Sizing Pressure (table 1) or produces a torque greater than the Maximum Allowable Output Torque (table 1) or the Maximum Allowable Valve Shaft Torque (see Catalog 14). Use pressure-limiting or pressure-relieving devices to prevent the diaphragm casing pressure from exceeding these limits.

A 1/4 NPT pressure connection is located on top of the actuator. Run either NPS 1/4 pipe or 3/8-inch tubing between the pressure connection and the instrument. Keep the length of tubing or pipe as short as possible to avoid transmission lag in the control signal. If a positioner is used, the pressure connection to the actuator is normally made at the factory.

When the actuator is completely installed and connected to the instrument, check it for correct action (air-to-open or air-to-close) to match the controlling instrument. For successful operation, the actuator rod and equipment operating shaft must move freely in response to the loading pressure change on the diaphragm.

Spring Compression Adjustment

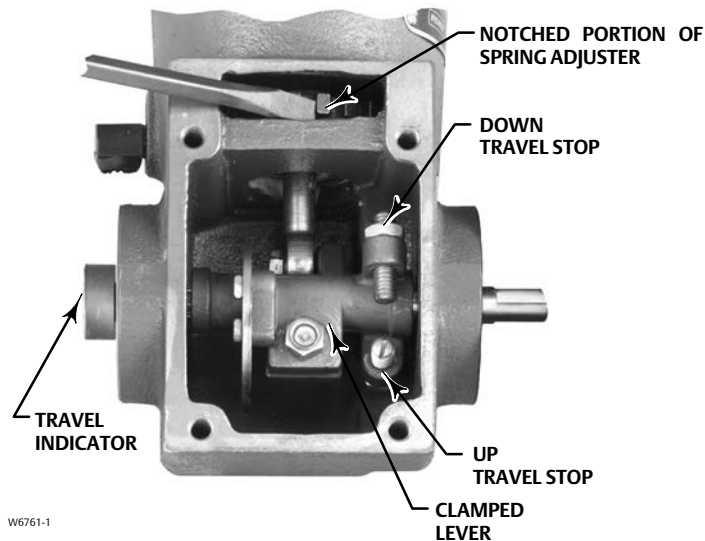
Spring adjustment is shown in figure 2. Key numbers are shown in figure 6.

Initial Spring Compression

The 1052 nameplate specifies a SPRING INITIAL SET, which is the initial compression adjusted into the actuator spring. Initial compression is the casing pressure at which the diaphragm (key 3) and diaphragm rod (key 10) begin to move away from the up travel stop. The initial compression is selected (based upon the service conditions specified when the actuator was ordered) so that when the actuator is in service on the operated equipment, the equipment closes properly and full travel is obtained within a specified casing range.

If the actuator has been disassembled, or if the spring adjustment was changed, do NOT adjust the initial compression to exceed the SPRING INITIAL SET value on the nameplate.

Figure 2. Spring Adjustment



Proper bench set of the spring can only be made when the actuator “up” travel stop has been approximately adjusted. Insert a shaft in the actuator and adjust the “up” travel stop before establishing spring compression (since there is no travel stop in the upper diaphragm casing). Considerable error in adjustment is certain if the above procedure is not followed. This error can result in under travel of the actuator when the spring goes solid or excess compression has been applied.

Adjust the spring so that the diaphragm rod just starts to travel at the SPRING INITIAL SET pressure specified on the nameplate. To adjust the spring, remove the positioner, if one is used, or the cover. The lower part of the spring adjuster is notched, as shown in figure 2. Using a screwdriver as shown in figure 2, rotate the notches to the right to decrease spring compression or to the left to increase spring compression. Replace the positioner or the cover when adjustment is complete.

Stroking Range

The SPRING INITIAL SET listed on the nameplate is the optimum setting, and spring adjustments that cause this value to change or be exceeded are not recommended. For push-down-to-open action, the initial spring set is normally the maximum allowable to provide the maximum spring closing force. Any increase in this setting may overstress the spring at full travel. For push-down-to-close action, the initial spring set is the optimum balance between the air-to-close and spring-to-open breakout torque.

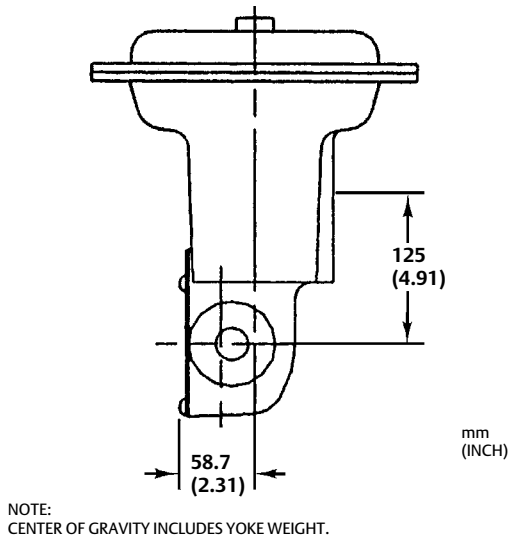
If, under operating conditions, the stroking range does not match the intended casing pressure, it may be possible to shift the stroking range by adjusting the spring to change the initial spring compression. A spring adjustment shifts the casing pressure span and equally increases (or decreases) the casing pressure at which the actuator begins to stroke and the pressure at which the actuator reaches full travel.

To adjust the spring, remove the positioner, if one is used, or the cover. The lower part of the spring adjuster is notched, as shown in figure 2. Using a screwdriver as shown in figure 2, rotate the notches to the right to shift the casing pressure span downward, or to the left to shift the casing pressure span upward. Replace the positioner or the cover.

Mounting Procedure

Use the following steps to connect the actuator to valve body or other equipment. Key numbers are shown in figure 6. Mounting dimensions are shown in figure 4.

Figure 3. Center of Gravity Dimensions



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Note

Find dimensions and center of gravity information in figures 3 and 4 and the approximate weight in table 1. This information is required for fabrication of the proper bracket and coupling.

1. Attach an appropriate mounting bracket (not provided) to the mounting plate (key 22) in the desired orientation with the cap screws (key 78). See figure 4 for mounting dimensions on the mounting plate. Tighten the cap screws to the value in table 2.
2. Consult figure 5 for available mounting styles and positions. The actuator is normally positioned vertically with the valve or other equipment in a horizontal pipeline.

Note

If the milled flats on the end of the actuator output shaft (key 87) are oriented so that the output shaft cannot accommodate the operated equipment shaft, refer to the Changing Positions procedure of the Changing Actuator Mounting section. This procedure describes how the output shaft can be repositioned to accommodate the operated equipment shaft.

3. Slide the actuator (with the user-provided mounting bracket attached) into the user-provided coupling on the operated shaft. Then, secure the actuator to the operated equipment in the desired mounting position with appropriate fasteners, such as mounting cap screws. See figure 4 for output shaft dimensions.

Principle of Operation

Refer to figure 6. The diaphragm rod (key 10) moves down as loading pressure is increased on top of the diaphragm (key 3). As the loading pressure is decreased, the spring (key 11) forces the diaphragm rod upward.

The spring and diaphragm are selected to meet the requirements of the application and, in service, the actuator should produce full travel of the operated equipment with the diaphragm pressure as indicated on the nameplate.

Consult the positioner instruction manual for actuator principle of operation with positioner.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Key numbers referenced in the following steps are shown in figure 6.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Disassembly

The following procedure describes how the actuator can be completely disassembled. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job.

1. Isolate the operated equipment from its process. Release process pressure, vent all actuator loading pressure, and remove the tubing or pipe from the top of the actuator.
2. Remove the positioner, if applicable, or unscrew the machine screws (key 40) and remove the cover (key 39).
3. Rotate the handwheel (if one is used) counter-clockwise to be sure the handwheel is not compressing the spring (key 11).

⚠ WARNING

Be sure to relieve spring compression before loosening the diaphragm casing cap screws and nuts (keys 5 and 6). Personal injury can occur if spring compression forces the upper diaphragm casing (key 1) from the actuator.

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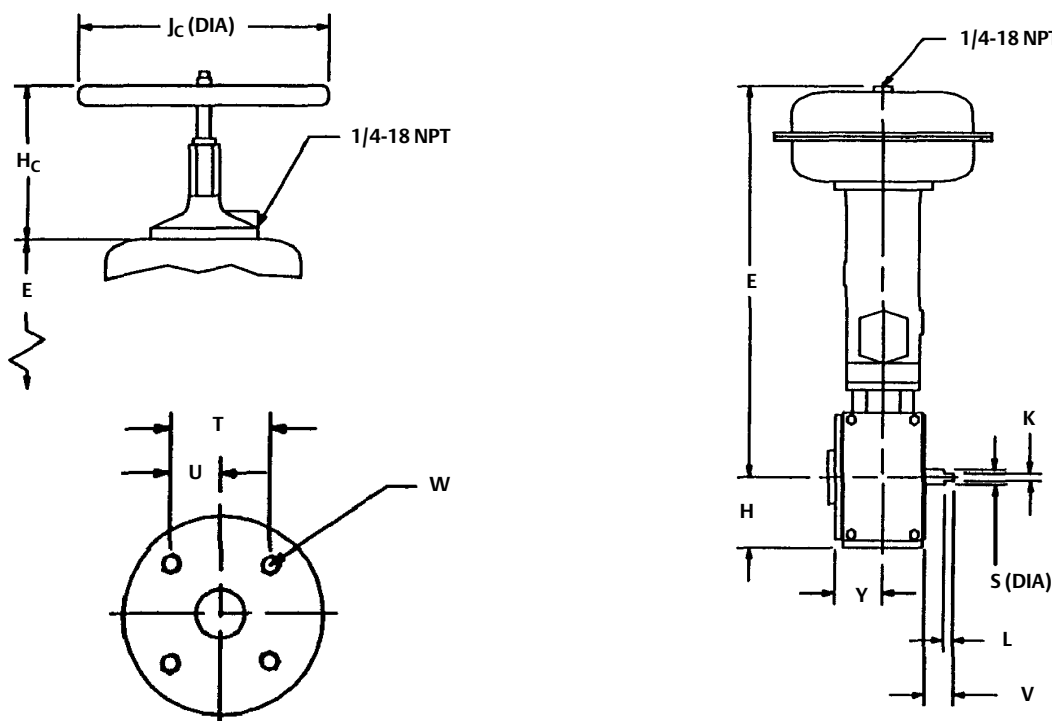
1052 Size 20 Actuator (H)

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E	H	H _C	J _C	K ⁽¹⁾	L	S (ACTUATOR OUTPUT SHAFT DIAMETER)	T	U	V	W	Y
mm											
255	57.2	184	171	$\frac{15.75}{15.62}$	19.1	22.2	57.2	28.4	26.2	5/16-18 UNC	63.5
Inches											
10.06	2.25	7.25	6.75	$\frac{0.620}{0.615}$	0.75	7/8	2.25	1.12	1.03	5/16-18 UNC	2.50

1. Tolerance for K dimension is indicated by showing maximum and minimum dimensions.

Figure 4. Mounting Dimensions



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- To relieve spring compression, insert a screwdriver blade between the notches at the bottom of the spring adjuster (key 74) as shown in figure 2. Push the screwdriver tip to the right to rotate the adjuster until a stop is reached.
- Unscrew the cap screws (key 78) and remove the actuator from the operated equipment. Then, with the actuator at the top of its stroke, mark the orientation of the flats on the end of the output shaft (key 87) with respect to the actuator housing (key 20). Also, mark the orientation of the travel indicator (key 37) with respect to the travel indicator scale (key 35). These markings are used during reassembly to allow for proper output shaft positioning.
- Loosen the hex nut (key 145) to allow the output shaft (key 87) to slide out of the clamped lever (key 27).
- With the housing, output shaft, travel indicator, and travel indicator scale properly marked, unscrew the cap screws (key 23) and remove the mounting plate (key 22) and output shaft (key 87) assembly from the actuator housing. If necessary, remove the retaining ring (key 88) and separate the output shaft (key 87) from the mounting plate.
- Unscrew and remove the casing cap screws and hex nuts (keys 5 and 6) and the warning plate (key 56). Then, remove the upper diaphragm casing (key 1) and the diaphragm (key 3).
- Heat the cap screw (key 18) to 177°C (350°F) long enough for the thread locking adhesive (medium strength) (key 77) to lose its holding strength. Then, remove the cap screw (key 18). This separates the diaphragm rod/bearing

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assembly (key 10) from the lever (key 27). Remove the lever with the attached travel stops and hex nuts (keys 8 and 86).

10. Pull the diaphragm plate (key 4) and attached diaphragm rod (key 10) out of the actuator. Remove the cap screw (key 9) and washer (key 79) and separate the diaphragm plate and diaphragm rod.
11. Remove the actuator spring (key 11) from the actuator, lift out the spring adjuster (key 74), the spring seat (key 13), and the thrust washer (key 71).
12. Check the condition of the bearing (key 31). If replacement of the bearing is necessary, the travel indicator (key 37) must first be removed by removing the machine screws (key 38). Then, the hub (key 29) and travel indicator scale (key 35) must be removed by removing the self-tapping screws or cap screws (key 36). Mark the orientation of the travel indicator scale with respect to the actuator housing before removing it.

Assembly

This procedure assumes that the actuator is completely disassembled. If the actuator is not completely disassembled, start these instructions at the appropriate step. Key numbers referenced in the following procedure are shown in figure 6. Before assembling the actuator, apply lithium grease (key 76) to the threads of the spring adjuster (key 74), to the inside of the lever (key 27), and to the equipment operating shaft.

1. Replace the bearing (key 31) if it was removed. If necessary, install the travel indicator scale (key 35) with attached hub (key 29) and retaining ring (key 30) to the actuator housing (key 20) with the self-tapping screws or cap screws (key 36). When installing the travel indicator scale, make sure that the markings on the scale and housing that were made in step 10 of the Disassembly procedure are oriented correctly.

Table 2. Recommended Bolting Torques

DESCRIPTION KEY NUMBER	Bolt Size	TORQUE	
		Lbf•ft	N•m
Diaphragm Casing 5/6	3/8-24	20	27
Travel Stop 86	5/16-18	20	27
Diaphragm to rod 9	5/16-18	16	22
Rod end to lever 18	5/16-18	16	22
Housing to yoke 23	3/8-16	25	34
Clamped lever 28/145	5/16-18	20	27

2. If necessary, install the travel indicator (key 37) to the hub so that the markings on the travel indicator and travel indicator scale that were made in step 5 of the Disassembly procedure are oriented correctly. Attach the travel indicator to the hub with the machine screws (key 38).
3. If the diaphragm rod/bearing assembly (key 10) was removed from the actuator and separated, thread the rod into the rod end bearing.
4. Attach the diaphragm plate (key 4) to the diaphragm rod with the cap screw and washer (keys 9 and 79). Apply lithium grease (key 76) to the threads of the cap screw and to the portion of the rod that fits into the diaphragm plate.
5. Install the thrust washer (key 71), followed by the spring adjuster (key 74), the spring seat (key 13) and the spring (key 11) into the diaphragm housing.
6. Coat the threads of the cap screw (key 18) with thread locking adhesive (medium strength) (key 77).
7. Place the diaphragm plate, diaphragm rod and rod end bearing assembly into the actuator. Bolt the rod end bearing to the lever (key 27) with the cap screw (key 18).
8. Replace the diaphragm (key 3). Position the diaphragm casing (key 1) in place on the housing (key 20). Secure the diaphragm casing with cap screws and hex nuts (keys 5 and 6). Ensure that the warning plate (key 56) is replaced on the casing.
9. If necessary, assemble the lever using two travel stops studs (key 8) and locking nuts (key 86) for old and new style levers. Newer levers that can be clamped also require that you install the cap screw (key 28) and thread the lock nut (key 145) in place, but do not tighten it at this time.

10. Attach the output shaft (key 87) to the mounting plate (key 22) with the retaining ring (key 88). Then, with the actuator at the top of its stroke, attach the mounting plate and output shaft assembly to the actuator housing (key 20) with the cap screws (key 23) so that the markings that were made in step 5 of the Disassembly procedure are oriented correctly (output shaft to actuator housing and travel indicator to travel indicator scale).
11. For newer clamping levers, torque the cap screw and nut (keys 28 and 145) on the output shaft (key 87). See table 2 for torque values.
12. Adjust the initial spring compression as described in the spring compression adjustment procedure of the Installation section. Remember to replace the cover and cap screws (keys 39 and 40) after performing this procedure.
13. With the initial spring compression adjusted, slide the actuator onto the equipment operating shaft and secure it to the mounting bracket in the desired mounting position with mounting cap screws (key 78). Tighten the cap screws to the value in table 2.

Changing Actuator Mounting

The actuator is normally positioned vertically in a horizontal pipeline. However, each style can be mounted in two possible housing construction styles and four possible positions. See figure 5.

⚠ WARNING

Avoid personal injury from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the power actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Use the following procedures along with figure 6 for key number references to convert from style A to style B or vice versa or to change the mounting position.

Changing Styles

1. Perform steps 1 through 4 of the Disassembly portion of the Maintenance section.
2. Remove the self-tapping screws or cap screws (key 36), and then remove the hub with attached travel indicator (keys 29 and 37) and the travel indicator scale (key 35).
3. Unscrew the cap screws (key 78) and remove the actuator assembly from its mounting bracket.
4. Unscrew the cap screws (key 23) and remove the mounting plate (key 22) and output shaft (key 87) assembly from the actuator housing.

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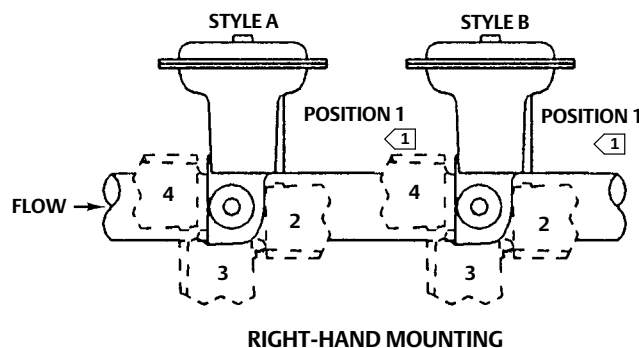
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- Rotate the actuator housing 180 degrees while maintaining the appropriate position (1, 2, 3, or 4).

DESIRED ACTION OF		HOUSING CONSTRUCTION TO SPECIFY
Actuator	Valve Body or Other Equipment	
Push Down To Open ⁽¹⁾	Clockwise to Close ⁽³⁾	Style A
	Counterclockwise to Close ⁽³⁾	Style B
Push Down To Close ⁽²⁾	Clockwise to Close ⁽³⁾	Style B
	Counterclockwise to Close ⁽³⁾	Style A

1. This action uses the spring to close the valve or other equipment.
 2. This action uses the spring to open the valve or other equipment.
 3. When viewed from actuator side of valve or other equipment.

Figure 5. Actuator Housing Construction Styles and Mounting Positions



NOTES:

1

DOTTED LINES INDICATE ALTERNATE MOUNTING POSITIONS 2, 3, AND 4.

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Note

In order to obtain a positive point of reference, position the actuator at the top of its stroke when performing the following two steps (steps 6 and 7).

- Position the lever (key 27) inside the actuator housing so that it is aligned with the holes at each end of the housing (key 20). Compare the position of the lever with the position shown in figure 2. Notice that when the lever is in the correct position to receive the output shaft, the down travel stop is nearly vertical.
- Before sliding the output shaft into the lever, make sure that the flats that are milled on the end of the output shaft are positioned appropriately. The flats may be positioned either parallel with or perpendicular to the spring barrel of the actuator housing when the actuator is at the top of its stroke. With the output shaft positioned appropriately, slide the output shaft and mounting plate assembly into the lever, and secure the mounting plate the the actuator housing with the cap screws (key 23). Tighten the cap screws to the value in table 2.
- Adjust the initial spring compression as described in the spring compression adjustment portion of the installation section.
- Secure the actuator housing in the desired position (1, 2, 3, or 4) to the mounting bracket with the cap screws (key 78). Tighten the cap screws to the torque in table 2.
- Separate the travel indicator (key 37) from the hub (key 29) by removing the machine screws (key 38). Slide the hub, with attached travel indicator scale (key 35), onto the splined output shaft so that the travel indicator screw holes align with the offset portion of the lever (where the diaphragm rod/bearing assembly (key 10) connects). With the hub positioned properly, the travel indicator can show the correct position of the operated equipment and can point in the direction of flow when the operated equipment is in the open position. Then, fasten the travel indicator to the hub with the machine screws (key 38), and fasten the travel indicator scale to the actuator housing

with the self-tapping screws or cap screws (key 36). When attaching the travel indicator scale, make certain that it is properly aligned with the travel indicator.

11. Replace the cover and machine screws (keys 40 and 39).

Changing Positions

1. Perform steps 1 through 4 of the Disassembly portion of the Maintenance section.
2. Unscrew the cap screws (key 78) and remove the actuator assembly from its mounting
3. Unscrew the cap screws (key 78) and remove the actuator assembly from its mounting bracket.
4. Mark the orientation of the output shaft (key 87) with respect to the actuator housing (key 20). This marking is used during re-assembly to allow for proper output shaft positioning. When the output shaft and housing are properly marked, unscrew the cap screws (key 23) and remove the mounting plate (key 22) and output shaft (key 87) assembly from the actuator housing.
5. Rotate the actuator housing (key 20) to the new position (1, 2, 3, or 4).
6. Position the lever inside the actuator housing so that it is aligned with the holes at each end of the housing. Compare the position of the lever with the position shown in figure 2. Notice that when the lever is in the correct position to receive the output shaft, the down travel stop is nearly vertical.
7. To install the output shaft into the lever, proceed as appropriate:
 - a. If the new actuator position is 90 degrees clockwise from the previous actuator position, align the output shaft so that its orientation mark is located 90 degrees counterclockwise from the mark on the actuator housing.
 - b. If the new actuator position is 90 degrees or 180 degrees counterclockwise from the previous position, align the output shaft so that its orientation mark is located either 90 degrees (for 90 degrees) or 180 degrees (for 180 degrees) clockwise (respectively) from the mark on the actuator housing.
8. Slide the output shaft and mounting plate assembly into the lever, and secure the mounting plate to the actuator housing with the cap screws (key 23). Tighten the cap screws to the torque in table 2.
9. Adjust the initial spring compression as described in the spring compression adjustment portion of the Installation section.
10. Secure the actuator housing to the mounting bracket with the cap screws (key 78). Tighten the cap screws to the torque in table 2.
11. Note the position of the valve body or other operated equipment and direction of rotation. Remove the machine screws (key 38) and position the travel indicator (key 37) accordingly. Replace the machine screws.
12. Replace the cover and machine screws (keys 40 and 39).

Top-Mounted Handwheel

Key numbers used in this section are shown in figure 7 except where indicated. The optional top-mounted handwheel, shown in figure 7, can be used as a manual actuator or as an adjustable up travel stop to limit full retraction of the diaphragm rod (key 10, figure 6).

The handwheel assembly is attached to a special upper diaphragm casing (key 1, figure 6) with cap screws (key 141). A hex nut (key 137) locks the handwheel in position.

Turning the handwheel (key 151) clockwise into the upper casing forces the pusher plate (key 135) against the diaphragm and diaphragm plate (keys 3 and 4, figure 6) to compress the spring (key 11, figure 6) and move the diaphragm rod downward. Turning the handwheel counterclockwise allows the actuator spring to move the diaphragm rod upward. If the action is push-down-to-close, full opening of the operated equipment can be restricted

by positioning the handwheel at the desired position. If the action is push-down-to-open, full closing of the operated equipment can be restricted by use of the handwheel.

Instructions are given below for complete disassembly and assembly required for inspection and parts replacement.

Disassembly

⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1, figure 4) away from the actuator, relieve spring compression before diaphragm casing bolting is loosened.

1. Remove the upper diaphragm casing (key 1, figure 6) by following steps 1 through 4, and 6 of the Disassembly portion of the Maintenance section.
2. Remove the cotter pin, hex nut, handwheel, and hex nut (keys 247, 54, 51, and 137). Unscrew the stem (key 133) out through the actuator end of the handwheel body (key 142).
3. Remove the cap screws (key 141), and separate the handwheel assembly from the upper casing.
4. Check the condition of the O-rings (keys 138 and 139); replace them if necessary.
5. If it is necessary to remove the pusher plate (key 135), drive out the groove pin (key 140).

Assembly

1. Before assembling, lubricate the threads of the stem (key 133) and the bearing surfaces of the stem and pusher plate (key 135) with lithium grease (key 241).
2. If the pusher plate was removed, re-attach it to the stem, and drive in a new groove pin (key 140).
3. Apply lithium grease (key 241) to the O-rings (keys 138 and 139). With the O-rings in place, thread the stem into the handwheel assembly.
4. Attach the handwheel assembly to the upper diaphragm casing (key 1, figure 6) with cap screws (key 141).
5. Install the hex nut, handwheel, hex nut, and cotter pin (keys 137, 51, and 247).
6. Install the diaphragm casing, making certain the warning tag is in place on the casing flange.
7. Tighten the cap screws (key 5, figure 6) evenly in a criss-cross pattern to the torque shown in table 2.
8. Adjust the initial spring compression as described in the Spring Compression Adjustment section.

Parts Ordering

Each actuator has a nameplate attached to the actuator housing and a serial number stamped on it. Always refer to this serial number when corresponding with your [Emerson sales office](#) regarding replacement parts or technical information.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D100323X012

1052 Size 20 Actuator (H)

July 2023

Parts Kits

Key	Description	Part Number
---	Retrofit kit to add a top-mounted handwheel. Kit number 1 includes the handwheel assembly only. Kit number 2 includes kit number 1 and a new diaphragm casing (key 1) that is required to mount the new handwheel	
	Kit number 1	28A1205X012
	Kit number 2	28A1205X112

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Actuator

Key	Description
1	Diaphragm Casing W/o handwheel W/handwheel
3*	Diaphragm
4	Diaphragm Plate
5	Cap Screw (12 req'd)
6	Hex Nut (12 req'd)
8	Adjustable Travel Stop (2 req'd)
9	Cap Screw
10	Diaphragm Rod/bearing assy
11	Spring 0 to 18 psig (0 to 1.2 bar) initial set 60 degrees rotation 90 degrees rotation 0 to 33 psig (0 to 2.3 bar) initial set 0 to 40 psig (0 to 2.8 bar) initial set 3 to 15 psig (0.2 to 1.0 bar) initial set
13	Spring Seat
18	Cap Screw
20	Housing
22	Mounting Plate
23	Cap Screw (4 req'd)
27	Clamped Lever W/ or W/O switches Positioner with 3/8-inch nominal shaft Positioner with 1/2-inch nominal shaft Note: If you order the old lever part number, it is replaced with the clamped lever (key 27), nut (key 145), and cap screw (key 28).
28	Cap screw
29	Hub W/o switches W/switches
30	Retaining Ring
31	Bearing (2 req'd)

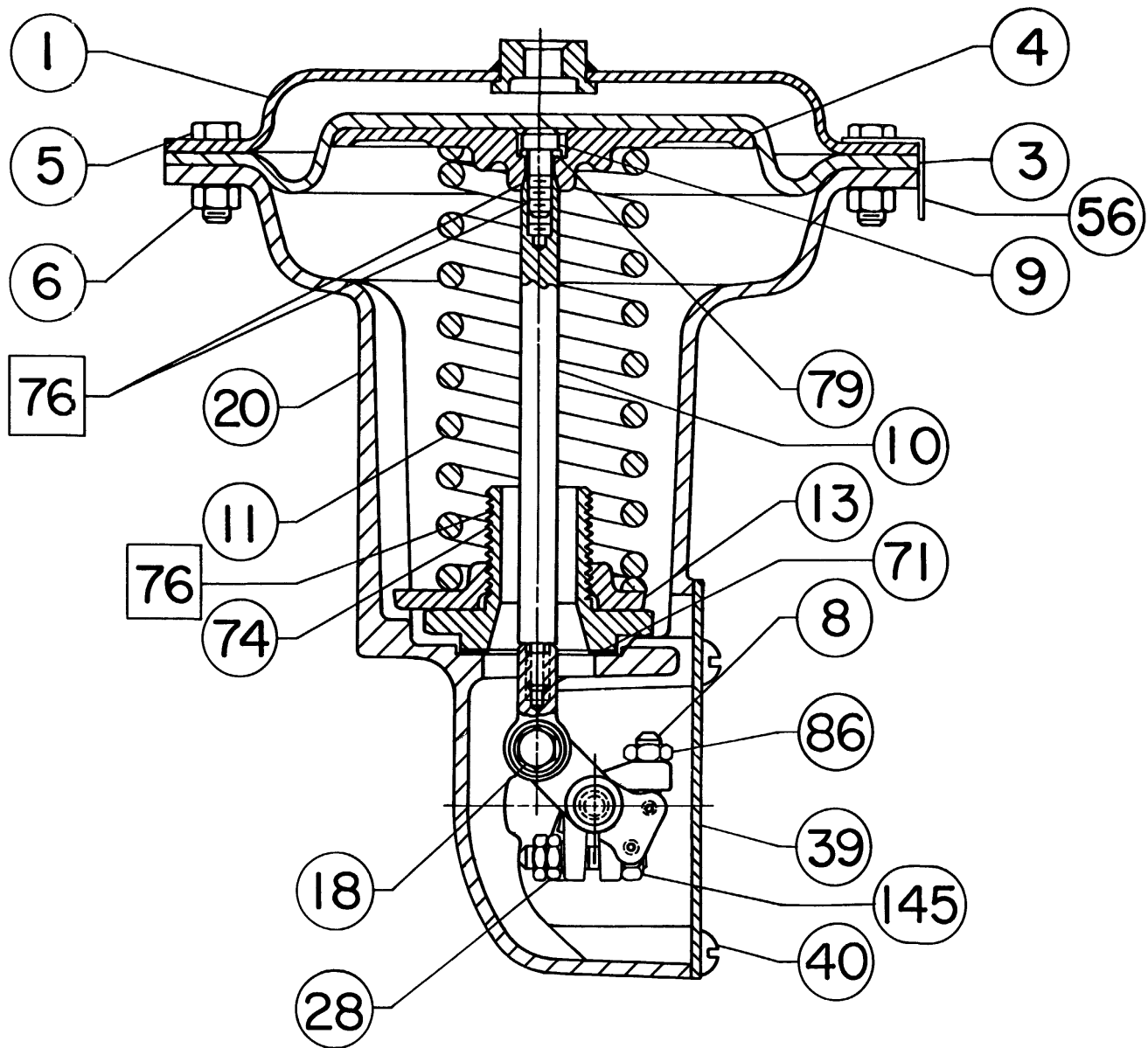
Key	Description
35	Travel Indicator Scale W/o switches W/switches
36	Self Tapping Screw (2 req'd) (none req'd w/switches)
36	Cap Screw (for use w/GO™ switch) switch only One switch (3 req'd) Two switches (2 req'd)
36	Cap Screw (2 req'd) (for use w/ 304 switch)
37	Travel Indicator
37	Travel Indicator (for use w/ 304 switch)
38	Machine Screw (2 req'd) W/o switches W/switches
38	Cap Screw (2 req'd) (for use w/GO switch only)
38	Cap Screw (2 req'd) (for use w/ 304 Switch)
39	Cover Plate (used w/o positioner)
40	Machine Screw (4 req'd) W/o positioner
41	Nameplate (specify manufacturing location--Marshalltown, Sherman, etc., from nameplate being replaced)
42	Drive Screw (4 req'd)
55	Y602-12 Vent
55	Vent Screen (for use w/GO switch only)
56	Warning Plate, sticker
71	Thrust Washer
74	Spring Adjustor
76	Lithium grease (not furnished with the actuator)
77	Thread locking adhesive (medium strength) (not furnished with the actuator)
78	Cap Screw (4 req'd)
79	Washer
86	Hex Nut (2 req'd)
87	Output Shaft (heat treated)
88	Retaining Ring
121	Screw, Self Tap (2 req'd) (W/o switches only)
145	Hex nut

Top-Mounted Handwheel

51	Handwheel
54	Hex Nut
133	Stem
135	Pusher Plate
137	Hex Nut
138*	O-Ring
139*	O-Ring
140	Groove Pin
141	Cap Screw (6 req'd)
142	Handwheel Body
145	Hex Nut
241	Lithium grease (not furnished with the actuator)
244	Anti-seize lubricant (not furnished with the actuator)
247	Cotter Pin

* Recommended spare parts

Figure 6. Actuator Assembly with H Mounting Adaptation

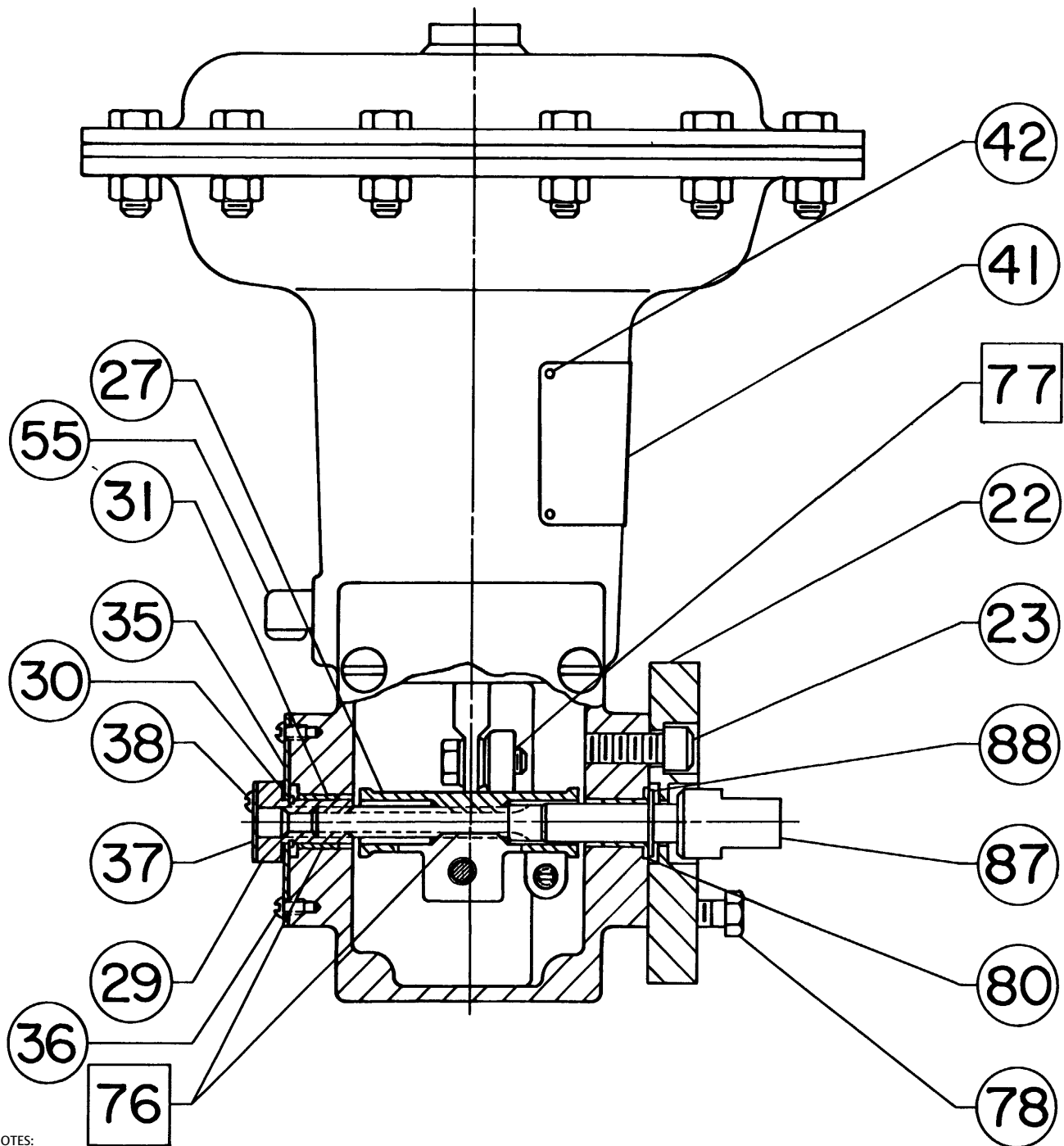


NOTES:

[76] APPLY LITHIUM GREASE.

49A2404-C

Figure 6. Actuator Assembly with H Mounting Adaptation (continued)



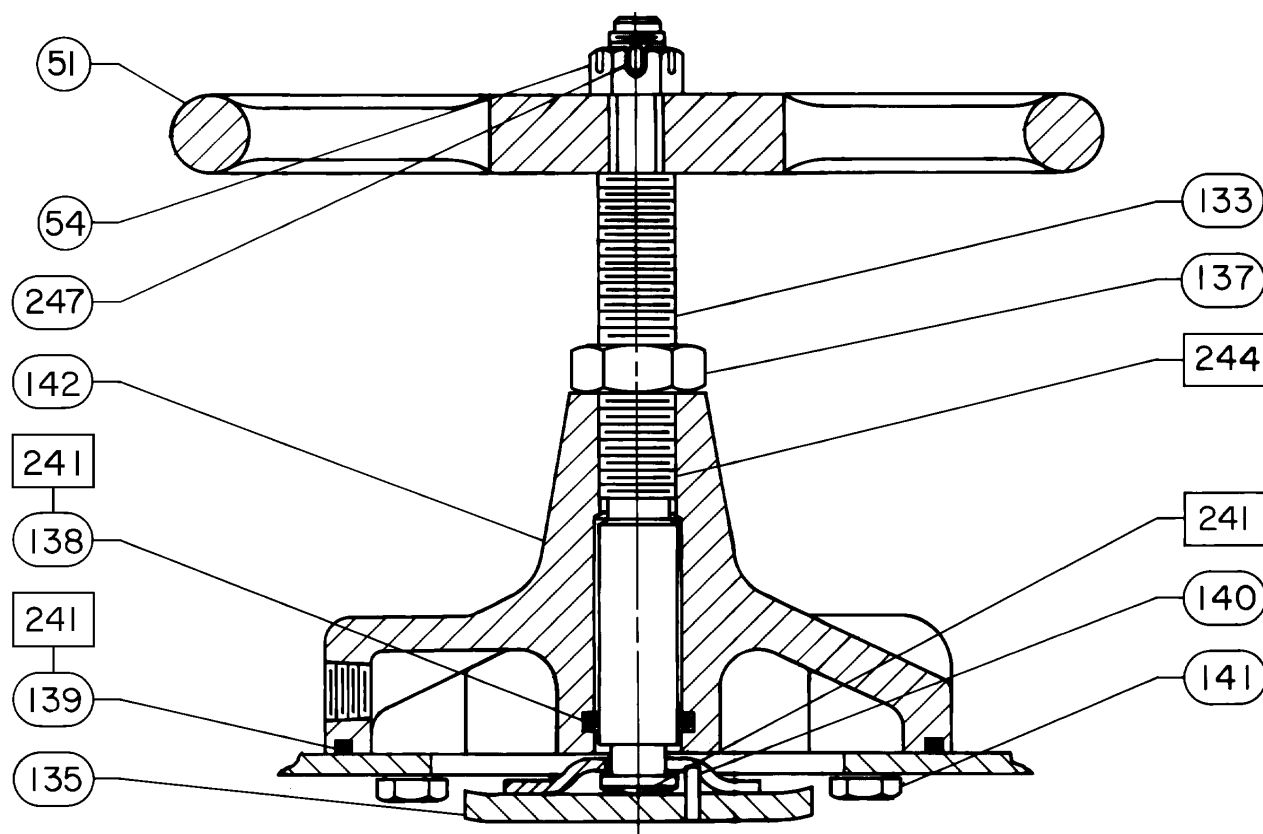
NOTES:

[76] APPLY LITHIUM GREASE.

[77] APPLY THREAD LOCKING ADHESIVE (MEDIUM STRENGTH)

49A2404-C

Figure 7. Top Mounted Handwheel Assembly



□ APPLY LITHIUM GREASE TO KEY 241, ANTI-SEIZE LUBRICANT TO KEY 244

28A1205-D

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Fisher™ 1052 Size 20 Diaphragm Rotary Actuator with F and G Mounting Adaptation

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Figure 1. Fisher 1052 Size 20 Actuator with Positioner



W5030

Introduction

Scope of Manual

This instruction manual includes installation, adjustment, operation, maintenance, and parts information for the 1052, size 20, Style F and G diaphragm rotary actuator (figure 1), and the optional top-mounted handwheel (figure 4). Instructions for the control valve, rotary positioners, and accessories are included in separate manuals.



Do not install, operate, or maintain a 1052 actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The spring-and-diaphragm actuator is used on small rotary shaft valves for throttling or on-off applications. It mounts to V150 Vee-Ball™ valves, V500 valves, eccentric disk valves, and butterfly valves with 3/8 inch and 1/2 inch splined shafts. The actuator accepts a 3610J, 3620J, or PMV positioner. A top-mounted handwheel is available for the unit.

Specifications

Specifications are shown in table 1 for 1052 Style F & G size 20 actuators. Some specifications for a given actuator, as it originally comes from the factory, are shown on the nameplate attached to the actuator.

Table 1. Specifications

Operating Principle Direct Acting: Increasing loading pressure forces the diaphragm rod from the top to the bottom of the casing Casing Pressure Ranges ■ 0 to 1.2 bar (0 to 18 psig), ■ 0 to 2.3 bar (0 to 33 psig), or ■ 0 to 2.8 bar (0 to 40 psig) depending on spring used Maximum Allowable Sizing Pressure⁽¹⁾ 3.5 bar (50 psig) Maximum Allowable Casing Pressure⁽²⁾ 4.1 bar (60 psig) Maximum Rotation 90 degrees (travel is adjustable between 60 degrees and 90 degrees by travel stops) Acceptable Valve Shaft Diameters, Inches ■ 9.5 mm (3/8 inch) or ■ 12.7 mm (1/2 inch)	Stroking Time Depends on rotation, spring rate, initial spring compression, and supply pressure. If stroking time is critical, consult your Emerson Automation Solutions sales office Material Temperature Capabilities⁽²⁾ –40 to 82°C (–40 to +180°F) Pressure Connections 1/4 NPT internal Mounting Configurations See figures 2 and 3 Approximate Weight 13.6 kg (30 lb) Top-Mounted Handwheel Specifications Operating Principle: Can be used for manual operation of the actuator or as an adjustable “up” travel stop Diameter: 121 mm (6.75 inch)
---	---

1. Use this value to determine the maximum torque output.

2. The pressure-temperature limits in this manual and any applicable code or standard should not be exceeded.

Principle of Operation

Key numbers refer to figure 5. The diaphragm rod (key 10) moves down as loading pressure is increased on top of the diaphragm (key 3). As the loading pressure is decreased, the spring (key 11) forces the diaphragm rod upward.

The spring and diaphragm are selected to meet the requirements of the application and, in service, the actuator should produce full travel of the valve with the diaphragm pressure as indicated on the nameplate.

Consult the positioner instruction manual for actuator principle of operation with positioner.

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure retaining parts, do not apply pressure exceeding the Maximum Allowable Casing Pressure limit given in table 1 or on the nameplate. Use pressure limiting or pressure relieving devices to prevent the casing pressure from exceeding the maximum allowable casing pressure.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

NOTICE

To avoid parts damage, do not apply pressure that exceeds the Maximum Allowable Sizing Pressure (table 1) or produces a torque greater than the Maximum Allowable Valve Shaft Torque (see Catalog 14). Use pressure-limiting or pressure-relieving devices to prevent the diaphragm casing pressure from exceeding these limits.

The actuator, as it comes from the factory, is normally mounted on a valve. Follow valve instructions when installing the control valve in the pipeline.

A 1/4 NPT pressure connection is located on top of the actuator. Run either 1/4 NPT pipe or 3/8 inch tubing between the pressure connection and the instrument. Keep the length of tubing or pipe as short as possible to avoid transmission lag in the control signal. If a valve positioner is used, the pressure connection to the actuator will normally be made at the factory.

When the control valve is completely installed and connected to the actuator, check it for correct action (air-to-open or air-to-close) to match the controlling instrument. For successful operation, the actuator stem and valve shaft must move freely in response to the loading pressure change on the diaphragm.

Use the following steps to connect a valve and an actuator that have been ordered separately. Because the procedures in the Mounting Procedure section require removal of initial spring compression, it is necessary to read the Adjusting Spring Compression section before completing the installation.

Mounting Procedure

This procedure assumes that the style ordered from the factory (A, B, C or D) was correct. Key numbers refer to figure 5.

1. Remove the positioner if one is used, and unscrew machine screws (key 40) to remove the positioner bracket or the cover (key 39).
2. Consult figure 2 for available mounting styles and positions. The actuator is normally mounted vertically with the valve in a horizontal pipe run.
3. Ensure all the initial spring compression has been removed from the spring. To relieve spring compression, insert a screwdriver blade between the notches at the base of the spring adjusting screw (key 74) as shown in figure 3. Push the tip of the screwdriver blade to the right. This rotates the spring adjusting screw counterclockwise. Continue until the stop is reached which occurs when the spring seat (key 13) is lowered to the adjusting screw base.
4. Before sliding the valve shaft into the lever, position the valve as follows:
 - For push-down-to-close action, the valve should be fully open.
 - For push-down-to-open action, the valve should be fully closed (see the valve instruction manual).
5. Position the lever in the housing to align with the holes at each end of the housing. Compare the position of the lever to the position shown in figure 2. Notice that when the lever is in the correct position to receive the valve shaft, the "down" travel stop is nearly vertical, as shown in figures 3 and 5.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

1052 Size 20 Actuator (F & G)

July 2023

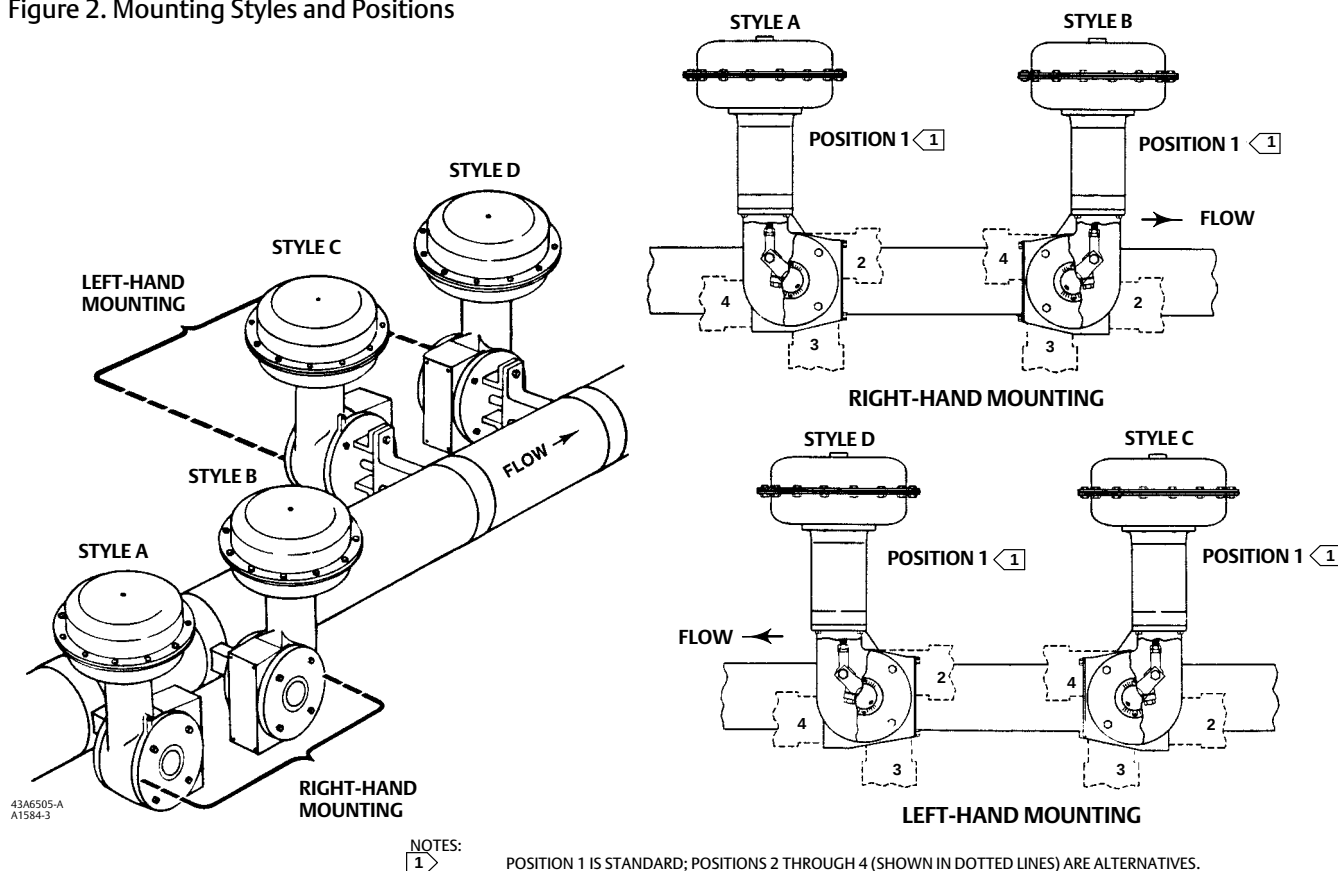
Instruction Manual

D100322X012

MOUNTING	ACTION ⁽¹⁾	VALVE SERIES OR DESIGN				VALVE SERIES OR DESIGN		
		Ball/Plug Rotation To Close ⁽³⁾	V250	V150, V200 & V300	CV500 V500	Disk/Ball Rotation to Close	V250	8510B, 8532, 8560 9500
Right-Hand	PDTC PDTO	CCW CW	A B	A B	A B	CW CW	NA NA	B A
Left-Hand	PDTC PDTO	CCW CCW	NA NA	D C	D C	CW CW	C D	C D
Left-Hand (Optional) ⁽²⁾	PDTC PDTO	CW CW	NA NA	C D	NA NA	NA NA	NA NA	NA NA

1. PDTC—Push-down-to-close, and PDTO—Push-down-to-open.
2. A left hand ball will be required for the NPS 3 through 12 Series B and the NPS 14 to 20, with or without attenuator.
3. CCW—Counterclockwise, and CW—Clockwise.

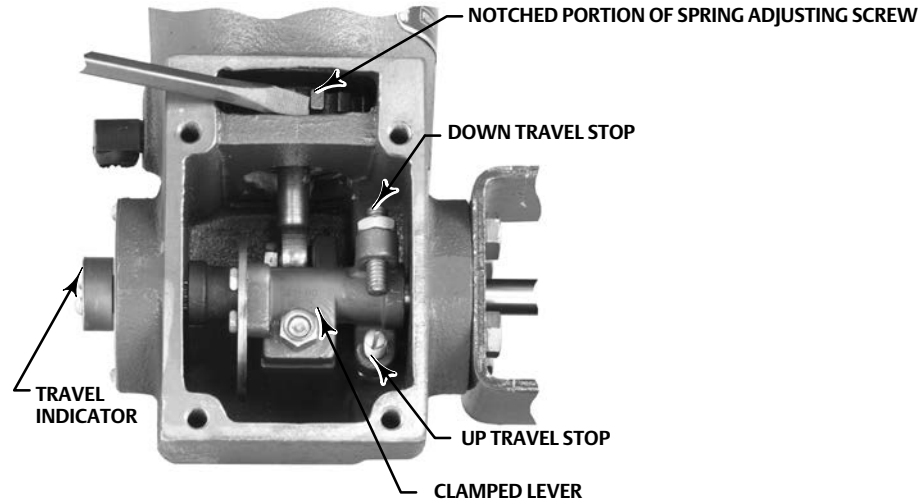
Figure 2. Mounting Styles and Positions



- Slide the valve shaft into the lever. Insert the lever in the opening. Tighten the valve mounting cap screws (see table 2).
- Remove machine screws (key 36) and remove the hub (key 29) and the travel indicator scale (key 35).
- Reposition the hub on the splined valve shaft so that the travel indicator screw holes align with the offset portion (where the rod end bearing connects) of the lever.
- Loosen the hex nut (key 145) to allow the valve shaft to slide out of the clamped lever (key 27).
- Center the lever in the opening. For newer clamping levers, torque the cap screw and nut (keys 28 and 145) to a torque listed in table 2.
- With the hub positioned properly, the travel scale and indicator can show the correct position of the valve and point in the direction of flow when the valve is open. Replace the machine screws, fastening the travel indicator scale to the housing and the travel indicator to the hub.

12. Adjust the "up" travel stop (key 8) so that it touches the housing, and then lock the travel stop in position with the hex nut (key 86).

Figure 3. Spring Adjustment



⚠ WARNING

To avoid personal injury and equipment damage from moving parts within the actuator, keep fingers and tools away from the actuator when stroking the valve with the actuator cover removed.

13. Fully stroke the valve, and adjust the "down" travel stop so that it touches the housing. Then lock the travel stop in position with the hex nut (key 86).

Adjusting Spring Compression

Spring adjustment is shown in figure 3. Key numbers are shown in figure 5.

Initial Compression

NOTICE

To avoid adjustment error which could lead to possible product damage, comply with the following bench set adjustment procedure.

The 1052 nameplate specifies a Spring Initial Set, which is the initial compression adjusted into the actuator spring. Initial compression is the casing pressure at which the diaphragm (key 3) and diaphragm rod (key 10) begin to move away from the "up" travel stop. The initial compression was selected (based upon the service conditions specified when the actuator was ordered) so that when the actuator and valve are in service, the valve will seat properly and full travel will be obtained within a standard casing range of 0 to 1.2 bar (0 to 18 psig) or 0 to 2.3 bar (0 to 33 psig).

If the actuator has been disassembled or if the spring adjustment was changed, the initial compression may be adjusted to not exceed the Spring Initial Set value on the nameplate.

Proper bench set of the spring can only be made when the actuator "up" travel stop has been approximately adjusted. Insert a shaft in the actuator and adjust the "up" travel stop before establishing spring compression (since there is no travel stop in the upper diaphragm casing). Considerable error in adjustment is certain if the above procedure is not followed. This error can result in under travel of the actuator when the spring goes solid or excess spring compression has been applied.

Adjust the spring so that the diaphragm rod just starts to travel at the Spring Initial Set pressure specified on the nameplate. To adjust the spring, remove the positioner, if one is used, or the cover. The lower part of the spring adjusting screw is notched, as shown in figure 3. Using a screwdriver as shown in figure 3, rotate the notches to the right to decrease spring compression or to the left to increase spring compression. Replace the positioner or the cover.

Stroking Range

If, under operating conditions, the stroking range does not match the intended casing pressure, it may be possible to shift the stroking range by making a spring adjustment to change the initial spring compression. A spring adjustment will shift the casing pressure span and will equally increase (or decrease) the casing pressure at which the actuator begins to stroke and the pressure at which the actuator reaches full travel.

To adjust the spring, remove the positioner, if one is used, or the cover. The lower part of the spring adjusting screw is notched. Using a screwdriver as shown in figure 3, rotate the notches to the right to shift the casing pressure span downward, or to the left to shift the casing pressure span upward. Replace the positioner or the cover.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given below for disassembly and assembly of parts. Key numbers are shown in figure 5, unless otherwise noted.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you are working on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Table 2. Recommended Bolting Torques

DESCRIPTION KEY NUMBER	TORQUE		
	Sizes	N•m	Lbf•ft
Casing Diaphragm 5/6	3/8-24	27	20
Diaphragm to rod 9	5/16-18	22	16
Rod end to lever 18	5/16-18	22	16
To Yoke 23	3/8-16	34	25
Travel Stop nut 86	5/16-18	27	20
Clamped lever 145/28	5/16-18	27	20

Disassembly

The following procedure describes how the actuator can be completely disassembled. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job.

1. Isolate the operating equipment from its process. Release process pressure, vent all actuator loading pressure, and remove the tubing or pipe from the top of the actuator.
2. Remove positioner, if applicable, or remove the machine screws (key 40) and remove the cover (key 39).
3. Rotate the handwheel (if one is used) counterclockwise to be sure the handwheel is not compressing the spring (key 11).

⚠ WARNING

Be sure to relieve spring compression before loosening the diaphragm casing cap screws and nuts (keys 5 and 6). Personal injury can occur if spring compression forces the upper diaphragm casing (key 1) from the actuator.

4. To relieve spring compression, insert a screwdriver blade between the notches at the bottom of the spring adjusting screw (key 74) as shown in figure 3. Push the screwdriver tip to the right to rotate the adjusting screw until a stop is reached.
5. Loosen the hex nut (key 145) to allow the valve shaft to slide out of the clamped lever (key 27).
6. Remove the valve mounting cap screws. Slide the valve shaft out of the lever.
7. Unscrew and remove casing cap screws and nuts (keys 5 and 6). Remove the upper casing and the diaphragm (key 3).
8. Heat the cap screw (key 18) to 177°C (350°F) long enough for the medium strength thread-locking compound (key 77) to lose its holding strength. Then, remove the cap screw (key 18). This separates the actuator rod and rod end bearing from the lever.
9. Pull the diaphragm plate (key 4) and attached diaphragm rod out of the actuator. Remove the cap screw (key 9) to separate the diaphragm plate and diaphragm rod.
10. Remove the actuator spring (key 11) from the actuator, lift out the spring adjusting screw (key 74), the spring seat (key 13), and the thrust washer (key 71).
11. Check the condition of the bearing (key 31). If replacement of the bearing is necessary, the travel indicator (key 37) must first be removed by removing the machine screws (key 38). Then, the hub (key 29) and travel indicator scale (key 35) must be removed by removing the self-tapping screws or cap screws (key 36). Mark the orientation of the travel indicator scale with respect to the actuator housing before removing it.

Assembly

This procedure assumes that the actuator was completely disassembled. If not, start these instructions at the appropriate step. Key numbers are shown in figure 5. Use bolt torques in table 2. Before assembly, apply lithium grease to the threads of the spring adjusting screw (key 74), to the inside of the lever (key 27), and to the valve shaft.

1. Replace the bushing (key 31) if it was removed.
2. If the diaphragm rod/bearing assembly (key 10) was removed from the actuator and separated from each other, thread the rod into the bearing.
3. Bolt the rod end bearing to the lever (key 27) with cap screw (key 18). Coat the threads of the cap screw with medium strength thread-locking compound.
4. If necessary, assemble the lever using two travel stop studs (key 8) and locking nuts (key 86) for old and new style levers. Newer levers are clamped, and will also require that you install the cap screw (key 28) and thread the lock nut (key 145) in place, but do not tighten it at this time.
5. Place the lever, rod end bearing, and diaphragm rod into the actuator with the diaphragm rod inside the diaphragm housing (key 20).
6. Install the thrust washer (key 71), followed by the spring adjusting screw (key 74), the spring seat (key 13), and the spring (key 11) into the diaphragm housing.
7. Attach the diaphragm plate (key 4) to the diaphragm rod with cap screw (key 9) and washer (key 79). Apply lithium grease (key 76) to the portion of the rod that fits into the diaphragm plate.
8. Replace the diaphragm (key 3). Position the diaphragm casing (key 1) in place on the diaphragm housing (key 20). Secure the diaphragm casing with cap screws and nuts (keys 5 and 6). Ensure that the warning plate (key 56) is replaced on the casing.
9. Attach the valve to the actuator, and position the travel indicator as described in the Mounting Procedure section.
10. Adjust the initial spring compression as described in the Adjusting Spring Compression section.

Changing Actuator Mounting

The actuator is normally positioned vertically in a horizontal pipeline. However, each style can be mounted in four possible mounting styles and four possible positions. See figure 2.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you are working on the equipment.
- The valve box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Style A is right-hand mounted while style D is left-hand mounted. In all other ways the styles A and D are identical.

Style B is right-hand mounted while style C is left-hand mounted. In all other ways the styles B and C are identical.

Use the following procedure to convert from styles A and D to styles B and C (or vice versa) or to change the mounting position.

1. Follow steps 1 through 6 in the Disassembly portion of the Maintenance section.
2. If changing styles,
 - a. Unscrew cap screws (key 23), and remove the actuator housing (key 20) from the mounting yoke (key 22).
 - b. Rotate the housing 180 degrees, maintaining the appropriate position (1, 2, 3, 4), and place the actuator onto the mounting yoke.
3. If changing position, unscrew cap screw (key 23), and rotate the actuator housing to the desired position. Consult table 2 for appropriate bolt torques.
4. Secure actuator housing (key 20) to the mounting yoke (key 22) with cap screws (key 23). Consult table 2 for appropriate bolt torques.
5. Follow steps in the Mounting Procedure section to connect the actuator to the valve.
6. Adjust initial spring compression as described in the Adjusting Spring Compression section.

Top-Mounted Handwheel

Key numbers used in this section are shown in figure 4 except where indicated.

The optional top-mounted handwheel, shown in figure 4, can be used as a manual actuator or as an adjustable "up" travel stop to limit full retraction of the diaphragm rod (key 10, figure 5).

The handwheel assembly is attached to a special upper diaphragm casing (key 1, figure 5) with cap screws (key 141). A hex nut (key 137) locks the handwheel in position.

Turning the handwheel (key 51) clockwise into the upper casing forces the pusher plate (key 135) against the diaphragm and diaphragm plate (keys 3 and 4, figure 5) to compress the spring (key 11, figure 5) and move the diaphragm rod downward. Turning the handwheel counterclockwise allows the actuator spring to move the diaphragm rod upward. If the valve is "push-down-to-close", full opening can be restricted by positioning the handwheel at the desired position. If the valve is "push-down-to-open", full closing of the valve can be restricted by using the handwheel.

Instructions are given below for complete disassembly and assembly required for inspection and parts replacement.

Disassembly

WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing (key 1, figure 5) away from the actuator, relieve spring compression before diaphragm casing bolting is loosened.

1. Remove the upper diaphragm casing (key 1, figure 5) by following steps 1 through 5, and 7 of the Disassembly part of the Maintenance section.
2. Remove the cotter pin, hex nut, handwheel, and locknut (keys 247, 54, 51, and 137). Unscrew the stem (key 133) out through the actuator end of the handwheel body (key 142).

3. Remove cap screws (key 141), and separate the handwheel assembly from the upper casing.
4. Check the condition of the O-rings (keys 138 and 139); replace them if necessary.
5. If it is necessary to remove the pusher plate (key 135), drive out the groove pin (key 140).

Assembly

1. Before assembling the actuator, lubricate the thread of the stem (key 133) and the bearing surfaces of the stem and pusher plate (key 135) with lithium grease.
2. If the pusher plate was removed, re-attach it to the stem, and drive in a new groove pin (key 140).
3. Apply lithium grease (key 241) to the O-rings (keys 138 and 139). With the O-rings in place, thread the stem into the handwheel assembly.
4. Attach the handwheel assembly to the upper diaphragm casing (key 1, figure 5) with cap screws (key 141).
5. Re-install the locknut, handwheel, hex nut, and cotter pin (keys 137, 51, 54, and 247).
6. Re-install the diaphragm casing, making certain the warning tag is in place on the casing flange.
7. Tighten the cap screws (key 5, figure 5) evenly in a criss-cross pattern to the torque shown in table 2.
8. Adjust the initial spring compression as described in the Adjusting Spring Compression section.

Parts Ordering

Each actuator has a nameplate attached to the actuator housing and a serial number stamped on it. Always refer to this serial number when corresponding with your [Emerson sales office](#) regarding replacement parts or technical information.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

11

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

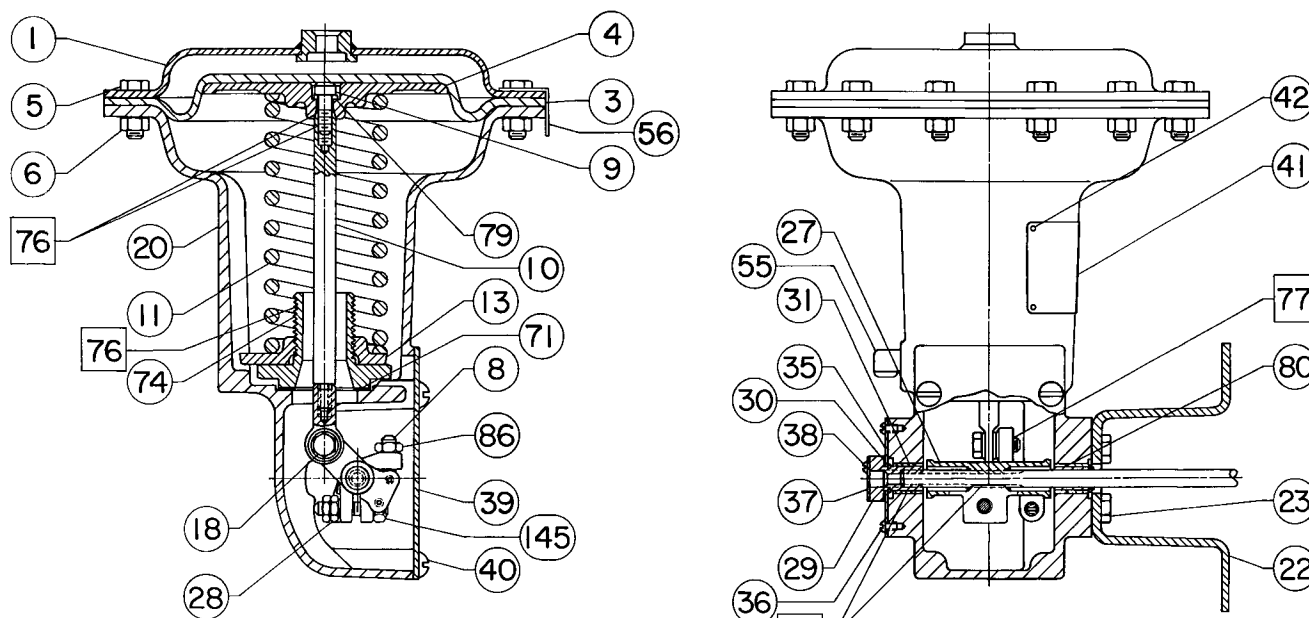
1052 Size 20 Actuator (F & G)

July 2023

Instruction Manual

D100322X012

Figure 5. Fisher 1052 Size 20 With F and G Mounting



NOTES:
[76] APPLY LITHIUM GREASE.
[77] APPLY MEDIUM STRENGTH THREAD LOCKING ADHESIVE.

46A4683-F

Top-Mounted Handwheel

Key	Description
51	Handwheel
54	Hex Nut
133	Stem
137	Hex Nut
138*	O-Ring

Part Number

1D237506992

Key Description

139*	O-Ring
140	Groove Pin
141	Cap Screw (6 req'd)
142	Handwheel Body
241	Lithium Grease
244	Anti-Seize Lubricant
247	Cotter Pin

Part Number

1D267306992

*Recommended spare parts

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Fisher™ 1052 Size 70 Diaphragm Rotary Actuator

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Figure 1. Fisher Vee-Ball™ Valve with 1052 Actuator and FIELDVUE™ DVC6200 Digital Valve Controller



W8502-3

Introduction

Scope of Manual

This instruction manual includes installation, adjustment, maintenance, and parts ordering information for the Fisher 1052 (Size 70) pneumatic piston rotary actuator (see figure 1).

This instruction manual also provides information for the optional top-mounted handwheel, up and down travel stops, locking mechanism, and pipe-away vent.

Table 1. 1052 Actuator Specifications

Operation Direct Acting: Increasing loading pressure extends the diaphragm rod out of the spring barrel Service: For on-off or throttling service with or without a positioner Actuator Sizes 70 Maximum Diaphragm Sizing Pressure⁽¹⁾ 3.8 bar (55 psig) Maximum Diaphragm Casing Pressure⁽³⁾ 4.5 bar (65 psig) Maximum Valve Shaft Rotation Standard: 90 degrees rotation travel stop Optional: 60 or 75 degrees rotation travel stop Valve Shaft Diameters, mm (Inches) ■ 31.8 (1-1/4), ■ 38.1 (1-1/2), ■ 44.5 (1-3/4), or ■ 50.8 (2) Stroking Time Dependent on actuator size, rotation, spring rate, initial spring compression, and supply pressure. If stroking time is critical, consult your Emerson Automation Solutions sales office	Material Temperature Capabilities⁽²⁾ NBR (Nitrile) Diaphragm: -40 to 82°C (-40 to 180°F) VMQ (Silicone) Diaphragm: -40 to 149°C (-40 to 300°F) NBR O-Rings: -40 to 82°C (-40 to 180°F), NBR O-rings are used in optional top-mounted handwheel, adjustable down travel stop, and adjustable up travel stop assemblies Travel Indication Graduated disk and pointer combination located on actuator end of valve shaft Pressure Connections Standard: 1/4 NPT internal thread Optional: ■ 1/2 or ■ 3/4 NPT internal, and ■ 3/4 NPT internal thread for pipe-away vent Mounting Positions See figure 3. Approximate Weights See table 2. Additional Specifications For casing pressure ranges and for material identification of the parts, see the Parts List
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1. Use this value to determine the maximum torque output allowed.

2. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

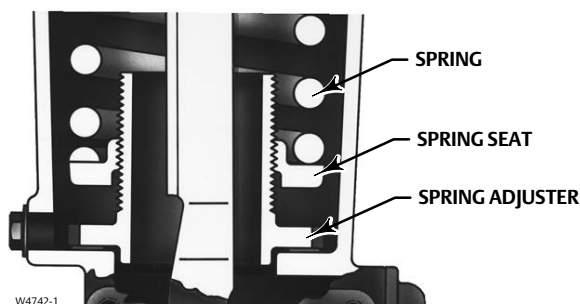
3. This maximum casing pressure is not to be used for normal operating pressure. Its purpose is to allow for typical regulator supply settings and/or relief valve tolerances.

Instructions for the control valve, positioner, accessories, and other sizes of actuators are covered in separate instruction manuals.

Top-Mounted handwheels can be applied for infrequent service as a manual handwheel actuator. Also, an adjustable up travel stop can be added to the actuator to limit its stroke in the upward direction, or an adjustable down travel stop can be added to limit actuator stroke in the downward direction.

Do not install, operate, or maintain a 1052 actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Figure 2. Typical 1052 Actuator Adjustable Spring Seat



Description

1052 diaphragm rotary actuators are pneumatic spring-return actuators for use with rotary-shaft control valves. It can be used for on-off service, or it can be used for throttling service when equipped with or without a valve positioner. The 1052 actuator spring is adjustable (see figure 2).

Table 2. Approximate Actuator Weights

SIZE	1052		TOP-MOUNTED HANDWHEEL	
	Kg	Lb	Kg	Lb
70	123	272	21	47

Specifications

Specifications are shown in table 1. Specifications for actuator operation, as it originally comes from the factory, are stamped on the nameplate attached to the actuator.

Educational Services

For information on available courses for Fisher 1052 size 70 rotary actuators, as well as a variety of other products, contact:

Emerson Automation Solutions
 Educational Services - Registration
 Phone: 1-641-754-3771 or 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

When an actuator and valve body are shipped together, the actuator is normally mounted on the valve. Follow the valve body instructions when installing the control valve in the pipeline, and then perform the procedures presented in the Loading Connection section. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the procedures presented in the Actuator Mounting section. And, if the actuator requires a pipe-away vent, or if a retrofit pipe-away kit needs to be installed, refer to the Pipe-Away Vent section.

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations. Be aware of pinching parts during installation operations.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

1052 Size 70 Actuators

June 2017

Instruction Manual

D104083X012

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Table 3. Recommended Bolting Torques

Description, Key Number	Size	N•m	lbf•ft
Diaphragm Casing, 5	3/8-24	27	20
Casing to spring barrel, 7	1/2-13	102	75
Diaphragm to rod, 9	3/4-16	102	75
Rod end bearing, 16	3/4-16	102	75
Turnbuckle to lever, 18	3/4-10	271	200
Spring barrel to housing, 21	5/8-18	68	50
Housing to yoke, 23	1/2-13	81	60
Travel stop to lever, 28	3/4-10	271	200
Side of housing, 34 4200/PMV	1/2-13	81	60
Handwheel top, 54	---	34	25
Diaphragm head to rod/Adjustable down travel stop, 54	3/4-16	69	51
Rod end to turnbuckle, 58	7/8-14-LH	163	120
Handwheel to actuator, 141	1/2-13	81	60

CAUTION

To avoid parts damage, do not use an operating pressure that exceeds the Maximum Diaphragm Casing Pressure (table 1) or produces a torque greater than the Maximum Allowable Valve Shaft Torque. Use pressure-limiting or pressure-relieving devices to prevent the diaphragm casing pressure from exceeding its limit.

To avoid parts damage, do not stroke the actuator while cover (key 33) is off.

Actuator Mounting

Use the following steps to connect a valve and an actuator. Key numbers are shown in figure 8.

⚠ WARNING

To avoid personal injury, perform the steps in the WARNING at the beginning of the Maintenance section to isolate the control valve and actuator.

1. Unscrew cap screws and washers (keys 34 and 63), and remove the cover (key 33).
2. Refer to figure 3 for available mounting styles and positions. When mounting on a Vee-Ball V150, V200 or V300 valve, check the valve manual to determine if it is Series B. The actuator is normally positioned vertically with the valve in a horizontal pipeline (see figure 3).

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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1052 Size 70 Actuators

June 2017

MOUNTING	ACTION(1)	VALVE SERIES OR DESIGN				VALVE SERIES OR DESIGN		
		BALL/PLUG ROTATION TO CLOSE	V250	V150, V200 & V300	CV500 and V500	DISK/BALL ROTATION TO CLOSE	V250	8532, 8560 8580, and 8590
Right-Hand	PDTC	CCW ⁽³⁾	A	A	A	CW	NA	B
	PDTO	CCW	B	B	B	CW	NA	A
Left-Hand	PDTC	CCW	NA	D	D	CW	C	C
	PDTO	CCW	NA	C	C	CW	D	D
Left-Hand (Optional) ⁽²⁾	PDTC	CW ⁽⁴⁾	NA	C	NA	NA	NA	NA
	PDTO	CW	NA	D	NA	NA	NA	NA

1. PDTC—Push-down-to-close, and PDTO—Push-down-to-open.
 2. A left hand ball will be required for the NPS 3 through 12 Series B and the NPS 14 to 20, with or without attenuator.
 3. CCW = counterclockwise
 4. CW = clockwise

⚠ WARNING

To avoid personal injury or property damage, the 1052 size 70 actuator, due to its weight, must be externally supported if mounted in the horizontal position.

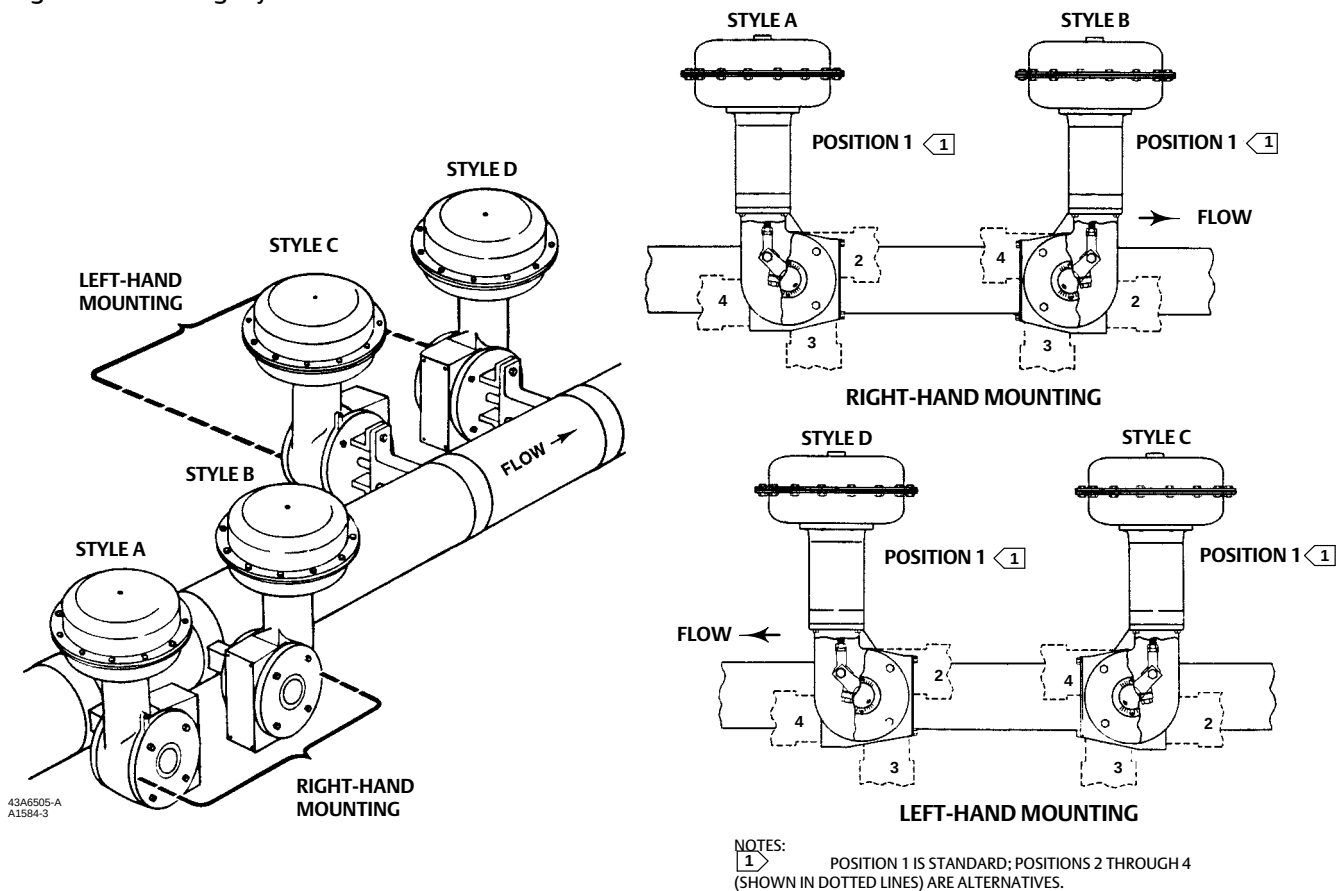
- When mounting the actuators, make sure that the bushing (key 67) and valve shaft are in-line so that the bushing will slide onto the valve shaft without damage.
- Mount the actuator on the valve body and secure it with the valve mounting screws. The torque for 1/2 to 1-inch shafts is 88 N•m (65 lbf•ft); for 1-1/4 to 1-1/2 inch shafts is 136 N•m (100 lbf•ft); for 1-3/4 to 2-inch shafts is 183 N•m (135 lbf•ft).

CAUTION

Exceeding any torque requirement may impair the safe operation of this actuator by causing broken or damaged parts. Refer to table 3 for the bolting torque requirements.

- Screw the left-hand threaded locknut (key 58) onto the diaphragm rod (key 10) as far as possible.
- Screw the turnbuckle (key 57) as far as it will go onto the actuator rod.
- Screw the locknut (key 16) as far as it will go onto the rod end bearing (key 17). Thread this assembly completely into the turnbuckle (key 57).
- If the lever (key 27) is attached to the rod end bearing, remove the cap screw and hex nut (keys 18 and 19).
- If the 1052 spring adjustment has been changed, complete the Initial Setting portion of the 1052 Spring Adjustment section before proceeding.
- Consult the appropriate valve instruction manual's Installation section for lever/valve shaft orientation marks, and slide the lever into place (see figure 4). Clamp with the cap screw (key 28).
- Rotate the lever (key 27) to align with the rod end bearing (key 17). This connection can be aided by moving the actuator off its up travel stop with a regulated air source and adjusting the turnbuckle (key 57) slightly.
- Apply sealant (key 77) or equivalent thread-locking compound to the threads of the cap screw (key 18).
- Connect the lever (key 27) and the rod end bearing (key 17) with the cap screw and hex nut (keys 18 and 19). Tighten the cap screw to the recommended bolt torque shown in table 3.
- Note the valve position and direction of rotation. Position the travel indicator (key 37) accordingly.
 - If no handwheel actuator is to be used, position the travel indicator (key 37) according to the valve position just noted. Replace the cover (key 33), and secure with washers and cap screws (keys 34 and 63). If holes in the cover and housing (key 20) do not align, temporarily loosen the cap screws (key 23), and shift the housing slightly.

Figure 3. Mounting Styles and Positions for the 1052 Actuator

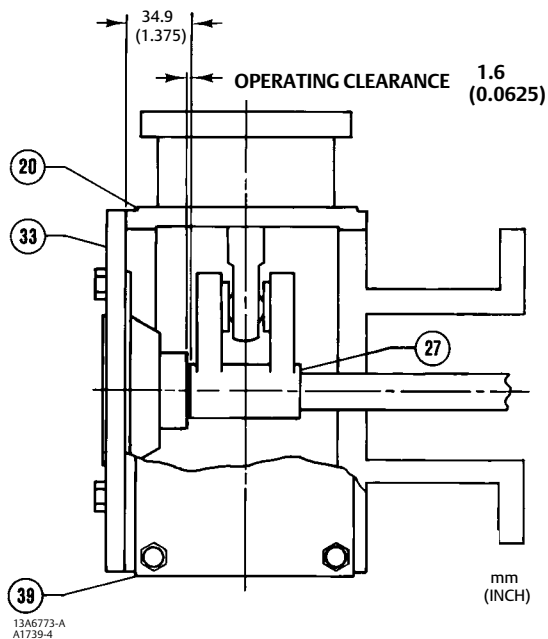


CAUTION

To avoid parts damage, do not stroke the actuator while the cover (key 33) is off.

- b. If a manual handwheel actuator is to be used, refer to the separate handwheel actuator instruction manual for mounting instructions.
15. Replace the cover (key 33), and secure with cap screws and washers (keys 34 and 63). If the holes in the cover and housing (key 20) do not align, use a regulated air source to move the actuator slightly off the up travel stop. If the hole alignment cannot be obtained in this manner, temporarily loosen the cap screws (key 23), and shift the housing slightly.

Figure 4. Lever Operating Clearance



CAUTION

To avoid parts damage, do not stroke the actuator while the cover (key 33) is off.

- Follow the instructions given in the Turnbuckle Adjustment section before proceeding to the Loading Connection section.

Valve Flow Direction

Valve construction can change the flow direction for a control valve assembly. It is important to observe the flow direction in all valve applications **before** installing the valve in the pipeline (see figure 3). Refer to the appropriate valve bulletin or instruction manual.

Note

Observe all warnings and cautions provided in the appropriate valve instruction manual Installation section.

Loading Connection

- Connect the loading pressure piping to the pressure connection in the top of the diaphragm casing. Run either pipe or tubing between the pressure connection and the instrument. If necessary, remove the 1/4 inch bushing in the pressure connection to increase connection size.

- Keep the length of pipe or tubing as short as possible to avoid transmission lag in the control signal. If an accessory (such as a volume booster or a valve positioner) is used, be sure that the accessory is properly connected to the actuator. If a valve positioner is part of the assembly, the pressure connection to the actuator will normally be made at the factory.

Table 4. Wrench Size Required for Turnbuckle Adjustment, Inches

ACTUATOR		TURNBUCKLE (KEY 57)	LOWER LOCKNUT (KEY 16)	UPPER LOCKNUT (KEY 58)
Type	Size			
1052	70	1-5/16	1-1/8	1-5/16

- When the control valve is completely installed and connected to the instrument, check for correct action (air-to-open or air-to-close) to match the controlling instrument. For successful operation, the actuator stem and valve shaft must move freely in response to the loading pressure change on the diaphragm.

Adjustment

Turnbuckle Adjustment

Correct turnbuckle adjustment ensures that the valve is correctly closed when the actuator is against its travel stops. Key numbers are shown in figure 8.

For accurate adjustment to the zero-degree valve disk or ball position, remove the valve from the pipeline. Refer to the valve instruction manual for instructions.

A regulated air supply will be required to stroke the actuator. Refer to table 4 for the sizes of the three open-end wrenches required for this procedure.

- Remove the access plate (key 59). Also remove the machine screws (key 60), if present.

Note

For the most accurate adjustment of the actuator, do not remove the cover (key 33) during this procedure.

- Loosen the lower locknut (key 16).
- Make sure the actuator housing (key 20) is clear of any tools or other instruments that could obstruct the actuator stroke path. Pressure the diaphragm casing enough to stroke the actuator down so that the left-hand threaded upper locknut (key 58) is accessible through the access opening. Loosen the locknut.
- Consult the appropriate valve instruction manual for determining the closed position of the valve. Then use one of the following:
 - Push-down-to-close**—Slowly stroke the actuator to the down travel stop. Adjust the turnbuckle (key 57) until the valve is in the closed position. Lock this adjustment with the left-hand threaded locknut (key 58). Stroke the actuator to the mid-travel position, and tighten the locknut (key 16).
 - Push-down-to-open**—Release all pressure from the diaphragm casing, making sure the diaphragm is against its up travel stop. Be sure that the optional handwheel is adjusted to its topmost position so that the zero position of the actuator and valve can be reached simultaneously. Check the valve position. Stroke the actuator so the turnbuckle (key 57) is accessible through the access opening. Adjust the linkage. Release pressure to the actuator, and check the new adjustment. Continue this procedure until the valve is in the closed position when the actuator is resting on its up travel stop. Stroke the actuator to the mid-travel position, and tighten the locknut (key 16). Stroke the actuator, and tighten the left-hand threaded locknut (key 58).

5. Replace the access plate (key 59).
6. Loosen the self-tapping screws (key 38), adjust the travel indicator (key 37), and re-tighten the self-tapping screws.

1052 Spring Adjustment

Initial Setting

The 1052 nameplate specifies an initial spring setting, which is the initial setting adjusted into the actuator spring. Initial setting is the casing pressure at which the diaphragm and diaphragm rod begin to move away from the up travel stop **with the actuator disconnected from the valve**. (With the actuator connected to the valve and pressure applied to the valve, a higher pressure will be required to start actuator travel).

The initial setting was selected (based upon the service conditions specified when the actuator was ordered) so that, when the actuator and valve are in service, the valve will seat properly and full travel will be obtained within a diaphragm casing range of 0 to 2.3, 0 to 2.8, or 0 to 3.8 bar (0 to 33, 0 to 40, or 0 to 55 psig) depending on specific actuator size and construction.

If the actuator has been disassembled or if the spring adjustment was changed, and it is desired to match the initial setting stated on the nameplate, make sure the rod end bearing (key 17, figure 8) has been disconnected from the lever (key 27, figure 8). Adjust the spring so that the diaphragm rod just starts to travel at the spring set pressure specified on the nameplate.

Be sure the rod end bearing does not hit the lever as the diaphragm and diaphragm rod move away from the up travel stop. To adjust the spring, insert a round rod into one of the holes in the lower bearing seat (key 73, figure 8). Hole diameter is 19.1 mm (3/4 inch) for size 70 actuators. Rotate the bearing seat to move it toward the casing to increase initial setting or away from the casing to decrease initial setting (keys 1 and 2, figure 8).

Stroking Range

The initial spring setting listed on the nameplate has been determined to be the optimum setting, and it is not recommended to make spring adjustments that will cause this value to change or be exceeded. For push-down-to-open valve action, the initial spring setting is the maximum allowable to provide the maximum spring closing force.

CAUTION

Any increase of this setting will over-stress the spring at full travel and may shorten the fatigue life of the spring.

For push-down-to-close valve action, the initial spring set has been determined to be the optimum balance between the air-to-close and the spring-to-open breakout torque.

If the 1052 actuator is to be changed from one valve action to another (i.e., push-down-to-close to push-down-to-open), first, refer to the table for key 11 in the Parts List section to determine the proper initial spring setting; then, adjust the unit according to the procedures in the Initial Settings portion of the 1052 Spring Adjustment section.

Principle of Operation

The diaphragm rod moves down as loading pressure is increased on top of the diaphragm. As the loading pressure is decreased, the spring forces the diaphragm rod upward.

The spring and diaphragm have been selected to meet the requirements of the application and, in service, the actuator should produce full travel of the valve with the diaphragm pressure as indicated on the nameplate.

Consult the separate positioner instruction manual for actuator principle of operation with positioner.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Key numbers are shown in figure 8.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury. Be aware of pinching parts during maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

CAUTION

To avoid parts damage, do not stroke the actuator while cover (key 33) is off.

Disassembly

The following procedure describes how to completely disassemble the actuator. When inspecting and replacing parts, perform only those steps necessary to accomplish the repair.

Do not, under ordinary circumstances, remove the cap screws (keys 7, 8, and 21) at this time.

CAUTION

Cap screw (key 18) must be disengaged from the lever (key 27) before removing the diaphragm casing (key 1). Failure to do so will allow the spring precompression to rotate the valve beyond its fully open or closed position. This could cause damage to the valve components and/or seal.

1. Perform the steps in the **WARNING** at the beginning of the Maintenance section to isolate the control valve and actuator.
2. Remove the tubing or piping from the top of the actuator.
3. Remove the positioner, if used. If necessary, refer to the positioner instruction manual for removal instructions.
4. Unscrew the cap screws and washers (keys 34 and 63), and remove the cover (key 33).
5. Remove the retaining ring (key 30), and slide the hub (key 29) from the cover. If necessary, remove the travel indicator (key 37) from the hub (key 29).
6. Inspect, and if necessary, replace the cover bushing (key 31). Remove the travel indicator scale (key 35) by removing the self-tapping screws (key 36). Press the bushing out of the cover (key 33).
7. Remove the cap screw and hex nut (keys 18 and 19).
8. Make note of the lever/valve shaft orientation, and then loosen the cap screw (key 28).

CAUTION

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever (key 27) off the valve shaft. Driving the lever could damage internal valve parts. On some valve types, driving the lever off the shaft could move the valve disk or ball and bearings away from the centered position, causing subsequent damage to valve parts as the valve is operated.

A wheel puller may be used to remove the lever. It is okay to tap the wheel puller screw lightly to loosen the lever, but hitting the screw with excessive force could also damage valve parts or disrupt the centered position of the valve disk and bearings.

9. Rotate the handwheel (if one is used) counterclockwise until the handwheel is not compressing the spring (key 11).

⚠ WARNING

To avoid personal injury from pre-compressed spring force suddenly thrusting the upper diaphragm casing (key 1) away from the actuator, relieve 1052 spring compression, or carefully remove 1051 casing cap screws before proceeding further.

10. To relieve spring compression:
 - Insert a round rod into one of the holes in the lower bearing seat (key 73). Use the rod to rotate the lower bearing seat, and move it away from the actuator casings. Continue rotating the lower bearing seat until spring compression is completely removed. Rod hole diameter is 19.1 mm (3/4 inch) for size 70 actuators.
 - Unscrew and remove the cap screws and hex nuts (keys 5 and 6), and then remove the upper diaphragm casing and the diaphragm (key 3).
11. Removing the diaphragm plate (key 4):
 - (1.) Remove the rod end bearing (key 17), the hex nut (key 16), turnbuckle (key 57), and the hex nut (key 58) from the diaphragm rod (key 10).
 - (2.) Pull the diaphragm plate (key 4) and attached parts out of the actuator. Then remove the cap screw (key 9) to separate the diaphragm plate and the diaphragm rod.
 - *For Size 70 actuators:* Remove the actuator spring (key 11) from the actuator. Remove the cap screws (key 21), then remove the spring barrel (key 12) from the actuator housing. If it is necessary to remove the spring adjustment parts, loosen the set screw (key 75), and unscrew the spring adjusting screw (key 74) from the spring barrel (key 12).

12. Unscrew the cap screws (key 23), and remove the actuator housing assembly (key 20).
13. Unbolt the mounting yoke (key 22) from the valve.
14. Check the bushing (key 67) in the mounting yoke. Press out and replace the bushing if necessary.

Assembly

This procedure assumes that the actuator was completely disassembled. If the actuator was not completely disassembled, start these instructions at the appropriate step. This procedure also assumes that the valve is removed from the pipeline for ease in actuator assembly and adjustment.

Key numbers are shown in figure 8.

1. **Installing the spring barrel (key 12):** If the spring barrel (key 12) was removed from the housing (key 20), align the spring barrel to the housing as described below to ensure that the offset hole in the base of the spring barrel will be located properly. The spring barrel need not be aligned in any particular position when placing it on the housing.
2. If the bushing (key 67) was removed, press in the new bushing. The end of the bushing should be flush with the bottom of the recess in the mounting yoke (key 22).
3. Slide the mounting yoke over the valve shaft, and secure it to the valve with the valve mounting cap screws.
4. Tighten the valve mounting cap screws to the bolting torque listed in step 6 of the Installation procedures.

⚠ WARNING

Exceeding any torque requirement may impair the safe operation of the actuator and lead to possible personal injury or property damage.

5. Refer to figure 4 for the desired orientation of the housing (key 20). Secure the housing to the mounting yoke with cap screws (key 23).
6. Coat with lithium grease (key 93) on the cap screw threads (key 9), and the tapered end of the diaphragm rod (key 10).
7. See figure 8.
- If the adjusting screw and attached parts were removed, first clean and then lubricate the upper threads of the adjusting screw (key 74) with lithium grease (key 76) as shown in figure 8. Install the lower bearing seat (key 73), the thrust bearing (key 71), the thrust bearing races (key 72), and the spring seat (key 13) onto the adjusting screw.
- First, clean and then coat the lower end of the adjusting screw with sealant (key 77) or equivalent thread-locking compound as shown in figure 8, and install the entire assembly into the spring barrel (key 12). Let the adjusting screw stand undisturbed for at least two hours after installation to allow the thread-locking compound to cure.

CAUTION

Apply lubricant to the upper threads and thread-locking compound to the lower threads of the adjusting screw. Do not overlap the coat of lubricant with the coat of thread-locking compound since this will adversely affect the performance quality of both substances.

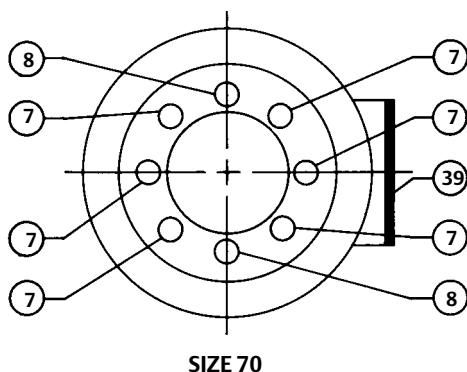
8. Coat the tapered end of the diaphragm rod (key 10) and the threads of the cap screw (key 9) with lithium grease (key 76). Bolt the diaphragm plate to the diaphragm rod.
9. Be certain the travel stops (key 8) are located as shown in figure 5.

10. Install the spring (key 11) into the spring barrel. Install the diaphragm plate and diaphragm rod into the actuator. Attach the hex nut (key 58), turnbuckle (key 57), hex nut (key 16), and rod end bearing (key 17) to the diaphragm rod.

11. Installing the diaphragm:

- Install the diaphragm (key 3) and place the upper diaphragm casing (key 1) onto the lower diaphragm casing (key 2). If necessary, rotate the lower bearing seat (key 73) so that the upper diaphragm casing travel stop will not contact the diaphragm when the casing cap screws and nuts (key 5 and 6) are tightened.
- Secure the upper diaphragm casing with the cap screws and hex nuts (keys 5 and 6). Be sure the warning nameplate is in place on the casing. Tighten the nuts on the cap screws to the torque value shown in table 3.

Figure 5. Travel Stop Orientation



- Complete the Initial Setting portion of the 1052 Spring Adjustment section before proceeding.
- Refer to the appropriate valve instruction manual for lever/valve shaft orientation marks, and slide the lever (key 27) into place; see figure 4 for correct lever operating clearance. Clamp with the cap screw (key 28, figure 8).
- Rotate the lever (key 27) to align with the rod end bearing (key 17). This connection can be aided by carefully stroking the actuator off its up travel stop with a regulated air source.
- Apply sealant (key 77) or equivalent thread-locking compound to the threads of the cap screw (key 18).
- Connect the lever (key 27) and the rod end bearing (key 17) with the cap screw and hex nut (keys 18 and 19). Tighten the nut on the cap screw (see table 3).
- Coat the bearing surfaces of the hub (key 29), and cover (key 33) with lithium grease (key 76). Install the bushing (key 31) and hub into the cover. Secure with the retaining ring (key 30).
- Install the travel indicator scale (key 35), and secure it with the self-tapping screws (key 36). Then install the travel indicator (key 37), and secure it with the self-tapping screws (key 38).
- Note the valve disk or ball position, and direction of rotation. Position the travel indicator (key 37) accordingly.
- Replace the cover (key 33), and secure with cap screws and washers (keys 34 and 63). If the holes in the cover and housing (key 20) do not align, use a regulated air source to move the actuator slightly off the up travel stop. If hole alignment cannot be obtained in this manner, temporarily loosen cap screws (key 23), and shift the housing slightly.

CAUTION

To avoid parts damage, do not stroke the actuator while cover (key 33) is off.

21. If a valve positioner is to be used, consult the separate valve positioner instruction manual for proper positioner installation.
22. Follow the instructions in the Turnbuckle Adjustment section.

Changing Actuator Mounting

The actuator is normally positioned vertically in a horizontal pipeline. However, four mounting styles and four positions for each style are possible (see figure 3).

Note

Due to its weight, the 1052, size 70 actuator must be externally supported if mounted in the horizontal position.

Correct lever/valve shaft positioning is important to ensure proper valve action. Consult the appropriate valve instruction manual.

Style A is right-hand mounted, while style D is left-hand mounted. In all other ways, the styles A and D are identical.

Style B is right-hand mounted, while style C is left-hand mounted. In all other ways, the styles B and C are identical.

Use the following procedure along with figure 8, for key number references, to convert from styles A and D to styles B and C or vice versa or to change the mounting position.

WARNING

To avoid personal injury, perform the steps in the WARNING at the beginning of the Maintenance section to isolate the control valve and actuator.

1. Remove the tubing or piping from the top of the actuator.
2. Remove the cover (key 33) by unscrewing and removing the cap screws and washers (keys 34 and 63).
3. Unscrew cap screw (key 18). Loosen cap screw (key 28).

CAUTION

When removing the actuator from the valve body, do not use a hammer or similar tool to drive the lever (key 27) or actuator off the valve shaft. Driving the lever or actuator could damage internal valve parts. On some valve types, driving the lever (key 27) could move the valve disk and bearings away from the centered position causing subsequent damage to valve parts.

A wheel puller may be used to remove the lever. It is okay to tap the wheel puller screw lightly to loosen the lever, but hitting the screw with excessive force could also damage valve parts or disrupt the centered position of the valve disk and bearings.

4. If changing styles,
 - Unscrew cap screws (key 23), and remove the actuator housing (key 20) from the mounting yoke (key 22).

- Rotate the housing 180 degrees, maintaining the appropriate position (1, 2, 3, or 4), and place the actuator onto the mounting yoke (key 22).
- 5. If changing positions, unscrew cap screws (key 23), and rotate the actuator housing to the desired position.
- 6. Secure actuator housing (key 20) to the mounting yoke (key 22) with cap screws (key 23). Consult table 3 for appropriate bolt torques.
- 7. Consult the appropriate valve instruction manual for lever/valve shaft orientation marks, and slide the lever (key 27) into place; see figure 4 for correct lever operating clearance. Clamp with the cap screw (key 28).
- 8. Rotate the lever (key 27) to align with the rod end bearing (key 17). This connection can be aided by stroking the actuator off its up travel stop with a regulated air source.
- 9. Apply sealant (key 77) or equivalent thread-locking compound to the threads of the cap screw (key 18).
- 10. Connect the lever (key 27) and the rod end bearing (key 17) with the cap screw and hex nut (keys 18 and 19). Tighten cap screw to the recommended bolt torque shown in table 3. This connection can be aided by stroking the actuator from its up travel stop with a regulated air source.
- 11. Note the valve position and direction of rotation. Position the travel indicator (key 37) accordingly. Replace the cover (key 33), and secure it with cap screws and washers (keys 34 and 63).
- If the holes in the cover and housing (key 20) do not align, use a regulated air source to move the actuator slightly off the up travel stop.
- If hole alignment cannot be obtained in this manner, temporarily loosen cap screws (key 23) and shift the housing slightly.

CAUTION

To avoid parts damage, do not stroke the actuator while cover (key 33) is off.

- 12. Follow the instructions given in the Turnbuckle Adjustment section.

Top-Mounted Handwheels and Adjustable Travel Stops

Principle of Operation for Handwheels

Note

If repeated or daily manual operation is expected or desired, the unit should be equipped with a manual handwheel actuator. Refer to the separate manual handwheel actuator instruction manual for mounting instructions.

Top-Mounted Handwheel Assembly is attached to a special upper diaphragm casing (key 1, figure 8) with cap screws (key 141, figure 9). A hex nut (key 137, figure 10) locks the handwheel in position. Turning the handwheel (key 51, figure 9) clockwise into the upper diaphragm casing forces the pusher (key 135, figure 9) against the diaphragm and diaphragm plate (keys 3 and 4, figure 8) to compress the spring (key 11, figure 8) and move the diaphragm rod downward.

Turning the handwheel counterclockwise allows the actuator spring to move the diaphragm rod upward.

- If the valve is push-down-to-close, full opening can be restricted by positioning the handwheel at the desired position.
- If the valve is push-down-to-open, full closing of the valve can be restricted by use of the handwheel.

Adjustable Up Travel Stop (figure 10) limits the actuator stroke in the upward direction. To make adjustments, first relieve actuator loading pressure before removing the closing cap (key 187) as it is a pressure retaining part. Remove the closing cap (key 187). Also, for size 70 actuators, the hex nut (key 137) must be loosened. Then turn the stem (key 133) clockwise into the diaphragm case to move the actuator stem downward or counterclockwise to allow the spring to move the actuator stem upward.

- If the valve has push-down-to-close action, full opening can be restricted by the position of the adjustable travel stop. Or,
- If the valve has push-down-to-open action, full closing can be restricted by the position of the adjustable travel stop.

Tighten the hex nut and replace the closing cap after adjustment.

Adjustable Down Travel Stop (figure 11) limits the actuator stroke in the downward direction. To make adjustments, first relieve actuator loading pressure before removing the closing cap (key 187) as it is a pressure retaining part. Remove the closing cap (key 187). Loosen the hex jam nut (key 189) and turn the hex nut (key 63) down on the stem (key 133) to limit travel, or up on the stem to allow more travel. Lock the jam nut against the hex nut, and replace the closing cap after the adjustment has been made.

Handwheel Maintenance and Adjustable Travel Stop

If loading pressure seems to be leaking from either the handwheel or adjustable up stop, the O-rings (key 138 and 139, figures 9 and 10) may need replacement. If the adjustable down stop leaks, the O-ring (key 139, figure 11) may need replacement or possibly the closing cap (key 187, figure 10) is not tight. To tighten the closing cap, apply a good grade of thread sealant to the closing cap threads.

For ease of operation, the stem threads (key 133, figures 9, 10, and 11) may need an occasional application of lithium grease (key 241). A grease fitting (key 169, figures 9 and 10) is provided for this purpose in the size 70. The size 70 may also need to have the thrust bearing (key 175, figures 9 and 10) packed with lithium grease (key 241). Travel stops for the smaller casings can be lubricated between the stem and pusher (key 135, figures 9 and 10) with lithium grease (key 241).

The following disassembly procedures are separated where appropriate between the top-mounted handwheel and adjustable up travel stop assemblies (figures 9 and 10) and the adjustable down travel stop assembly (figure 11).

WARNING

To avoid personal injury, perform the steps in the WARNING at the beginning of the Maintenance section to isolate the control valve and actuator.

1. Remove the tubing or pipe from the handwheel body (key 142, figures 9, 10, and 11).

WARNING

To avoid personal injury from the pre-compressed spring force thrusting the upper diaphragm casing (key 1, figure 8) away from the actuator, relieve 1052 spring compression by following the instructions that are referenced in the steps below before removing the casing.

2. Relieve all actuator spring compression by following the procedures presented in the Disassembly portion of the Maintenance section. Then, rotate either the handwheel (key 51, figure 9) or the travel stop stem (key 133, figures 10 and 11) counterclockwise until the handwheel or travel stop assembly is no longer compressing the spring.
3. Proceed as appropriate:

For Adjustable Up Travel Stops:

- a. Remove the upper diaphragm casing (key 1, figure 8) by following steps 1, 3, 7, 9, 10, and 11 of the Disassembly portion of the Maintenance section.
- b. Remove the cap screws (key 141, figures 9 and 10), and separate the assembly from the upper casing.
- c. Loosen the locknut (key 137, figure 9), or remove the closing cap (key 187, figure 10).
- d. Turn the stem (key 133, figures 9 and 10) clockwise out of the valve body. On handwheel assemblies, the cotter pin and hex nut (keys 247 and 54, figure 9) will have to be removed so that the handwheel (key 51, figure 9) and locknut can be taken off the stem first.
- e. Remove and inspect the O-rings (keys 138 and 139, figures 9 and 10); replace them if necessary.
- f. To complete disassembly:

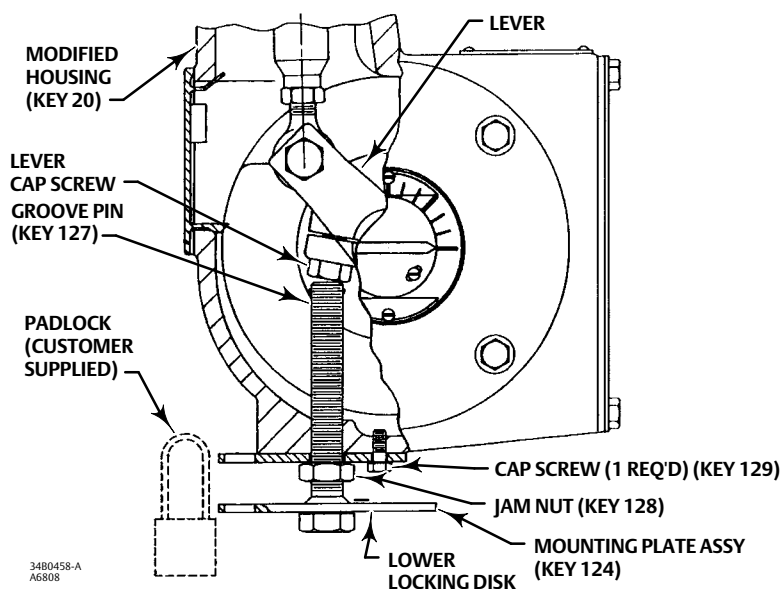
The pusher unit is held to the stem by a retaining screw (key 174, figures 9, 10 or 11). Removing the retaining screw and pusher exposes the thrust bearing (key 175, figures 9 and 10) for inspection.

For Adjustable Down Travel Stops:

Key numbers are shown in figure 11 unless otherwise noted. For ease of operation, the stem (key 133) threads may need an occasional application of lubricant.

- a. Remove the closing cap (key 187), and unscrew the jam nut and hex nut (keys 189 and 63) off the stem (key 133).
 - b. Remove the upper diaphragm casing (key 1, figure 8) and travel stop body (key 142) by following steps 1, 3, 7, 9, 10, and 11 of the Disassembly portion of the Actuator Maintenance section.
 - c. Unscrew cap screws (key 141), and remove the body from the diaphragm case.
 - d. Check the condition of the O-ring (key 139), and replace it if necessary.
 - e. Loosen the hex nut (key 54), and then unscrew the travel stop stem (key 133) out of the actuator stem. The lower diaphragm plate (key 82) can now be removed and the rest of the actuator disassembled.
4. Reassemble by reversing the order of the disassembly steps, being sure to apply lubricant as previously mentioned and as shown by the lubrication boxes (key 241) in figures 9 and 10. For size 70 handwheels or up travel stop assemblies, coat the threads of the retaining screws (key 174, figures 9 and 10) with sealant (key 242) or equivalent thread-locking compound.

Figure 6. Actuator Locking Mechanism



5. Readjust the spring to obtain the appropriate travel stop restriction by following the steps in the Top Mounted Handwheel Assembly section, and then return the unit to operation.

Locking Mechanism

Refer to figure 6 when installing, operating, and locking the mechanism. Key numbers are shown in figure 6 unless otherwise noted.

Installing the Locking Mechanism

⚠ WARNING

To avoid personal injury, perform the steps in the **WARNING** at the beginning of the Maintenance section to isolate the control valve and actuator.

1. To add the locking mechanism to an existing actuator, contact your [Emerson sales office](#) or Local Business Partner to purchase the required parts. The required parts are the locking mechanism and a modified actuator housing.
2. To remove the old housing, use the Disassembly procedures in the Maintenance section.
3. Attach the mounting plate (key 123) to the modified housing (key 20) as shown in figure 6. Attach it with the cap screw (key 129). Make sure the hole in the center of the mounting plate lines up with the large tapped hole in the housing.
4. Make sure the jam nut (key 128) is threaded onto the threaded bolt before threading it into the housing.
5. After the bolt is threaded into the housing, install the groove pin (key 127) into the end of the bolt. (Note: The groove pin will prevent the threaded bolt from being totally unthreaded from the actuator housing.)

6. Make sure that the bolt is not threaded in so far that it will interfere with reassembly of the actuator.
7. Reassemble actuator using the Assembly procedure in the Maintenance section.
8. Make sure the actuator diaphragm rod is retracted fully. This will be the locked position of the valve. For a push-down-to-close valve and actuator, the valve will be fully open when locked. For a push-down-to-open valve and actuator, the valve will be fully closed when locked.
9. Screw the threaded bolt into the housing until it contacts the head on the lever cap screw (see figure 6).
10. Insert the padlock (customer supplied) to connect the mounting plate (key 123) with the lower locking disk on the mounting plate assembly (key 124). You might have to back off the lower locking disk a slight amount to line up the holes for the padlock.

CAUTION

The layers of the mounting plate assembly may be far enough apart that you will need to purchase a padlock with a longer loop. Do not attempt to force the layers closer to fit a small looped padlock, as property damage may result.

11. Tighten the jam nut (key 128) against the mounting plate.

Operating the Locking Mechanism

To Unlock the Actuator

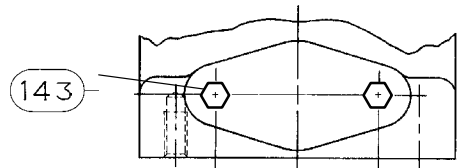
1. Remove the padlock. Loosen the jam nut (key 128), and unscrew the threaded bolt until it is stopped by the groove pin (key 127) in the threaded bolt.

CAUTION

For normal operation of the actuator, the threaded bolt must be unscrewed far enough so that the actuator lever will not contact the bolt, which could lead to property damage.

2. If you are going to leave the bolt threaded into the housing, lock it by tightening the jam nut (key 128) against the mounting plate so that it cannot be screwed into the housing and interfere with normal actuator operation.

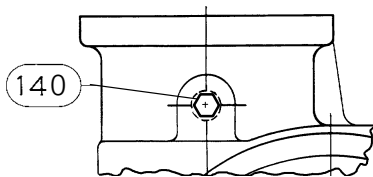
Figure 7. Pipe Away Vent Assembly



32A9325-F

NOTE:
IF ACCESSORIES ARE NOT INSTALLED ON THE MOUNTING BOSS, INSTALL CAP SCREWS (KEY 143) TO PLUG OPENINGS. A MOUNTING BOSS IS LOCATED ON BOTH SIDES OF THE SPRING BARREL.

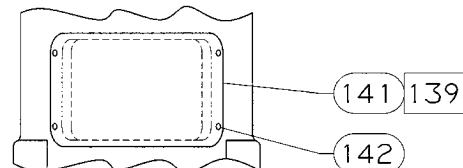
ACCESSORIES MOUNTING BOSS



40B3945-B

NOTE:
INSTALL THE HEX HEAD PLUG (KEY 140) INTO THE VENT OPENING LOCATED IN THE ACTUATOR HOUSING.

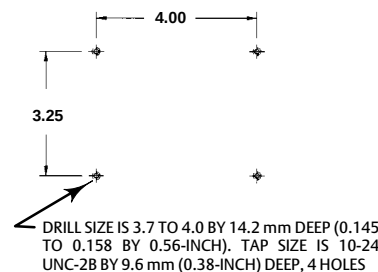
HOUSING VENT PLUG LOCATION



34B4646-B

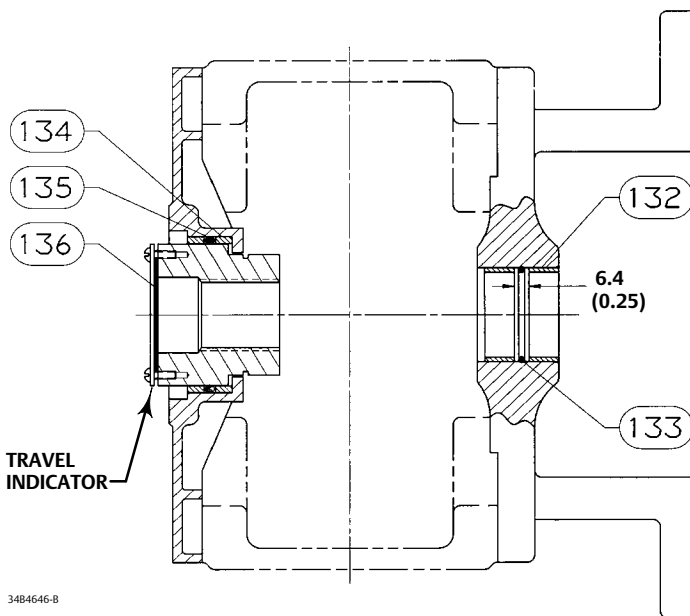
NOTE:
FOR FIELD CONVERSION OF 1052 ACTUATORS, ATTACH COVER (KEY 141) OVER THE SPRING BARREL ADJUSTMENT OPENING WITH SELF-TAPPING SCREWS (KEY 142). USE KEY 141 AS A DRILLING TEMPLATE. USE DRILL SIZE 2.6 mm (A #37 DRILL) (0.104-INCH) BY 9.6 mm (0.38-INCH) DEEP.
☐ APPLY SEALANT

1052 SPRING BARREL ACCESS COVER



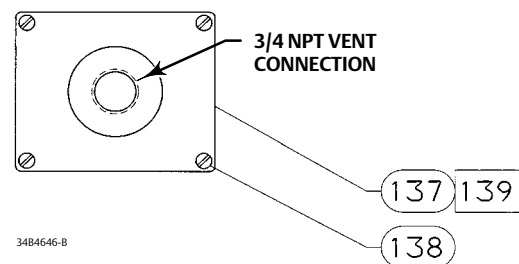
34B4646-B

DRILLING AND TAPPING PATTERN ACCESS PLATE ASSEMBLY



34B4646-B

MOUNTING YOKE AND COVER ASSEMBLY



34B4646-B

NOTE:
FOR FIELD CONVERSION, DRILL AND TAP HOLE PATTERN IF HOUSING HAS A NON-METALLIC ACCESS PLATE. USE KEY 137 AS A DRILLING TEMPLATE IF DESIRED. OR, USE THE DIMENSIONS PROVIDED IN THIS FIGURE FOR DRILLING AND TAPPING.
☐ APPLY SEALANT

ACCESS PLATE ASSEMBLY

mm
(INCH)

To Lock the Actuator

1. Make sure the actuator diaphragm rod is retracted fully. This will be the locked position of the valve. For a push-down-to-close valve and actuator, the valve will be fully open when locked. For a push-down-to-open valve and actuator, the valve will be fully closed when locked.
2. Make sure the jam nut (key 128) is loose. Screw the threaded bolt into the housing until it contacts the head on the lever cap screw (see figure 6).
3. Rotate the threaded bolt until one of the holes in the lower locking disk (which is welded to the bolt) is in line with the hole in the mounting plate (key 123). Tighten the jam nut against the mounting plate.
4. Lock the plate and disk together with a padlock. (The padlock is customer supplied.)

Pipe-Away Vent

⚠ WARNING

If a flammable or hazardous gas is being used as a supply medium, personal injury, or property damage could result from fire or explosion of accumulated gas. A remote vent pipe cannot be relied upon to vent all gases from the installed location. Provide adequate ventilation for the actuator/positioner assembly. Comply with local and regional codes, and keep the vent pipeline as short as possible with few bends.

Some applications require venting of gas from the rotary actuator housing. The 3610 Series positioners vent into the actuator housing, and from there, the gas has numerous avenues of escape.

Note

This modification is NOT intended to be a leak-proof or pressure-tight design. It is intended to aid in containing the gas that vents from the positioner and allow for connection of piping to carry it away.

Take care that an adequate vent pipe size is used. This is particularly important with the larger size actuators that have fast stroking speed requirements. In these situations, large quantities of gas can be vented very quickly through the positioner, and adequate pipe-away capability must be obtained. Keep the vent piping as short as possible with few bends.

Refer to the Disassembly and Assembly steps in the Maintenance section to gain access to the following parts. Key numbers are shown in figure 7 unless otherwise noted.

Bushings—Remove the mounting yoke bushing (key 67), and the end plate cover bushing (key 31, figure 8). Replace them with the pipe-away vent parts, as shown in figure 7. The mounting yoke bushing (key 132) is a two-piece bushing with an O-ring (key 133). The end plate cover completes the assembly with a two-piece bushing (key 134) with an O-ring (key 135).

Travel Indicator—A gasket (key 136) is placed under the travel indicator plate. Remove the indicator plate (key 37, figure 8), install the gasket (key 136) as shown in figure 7.

Access Plate Assembly—A modified metal access plate assembly (key 137) is provided with a 3/4 NPT vent connection as shown in figure 7. If the actuator had a plastic access plate, it will be necessary to drill and tap the actuator housing

to install the machine screws (key 138) as shown in figure 7. Use the drilling and tapping pattern shown in figure 7, or use the holes in the access plate as a template to mark holes.

When finished with all maintenance procedures requiring the access plate assembly (key 137) to be removed, use the sealant (key 139) provided with the kit to seal the plate in place.

Housing Vent Plug—A vent is provided in the housing design. To plug this opening, the pipe-away vent kit provides a hex pipe plug (key 140) for this opening, as shown in figure 7. Install the hex plug (key 140) into this opening and tighten it.

Accessories Mounting Boss—If accessories are not installed on the mounting boss, install cap screws (key 143) to plug openings. The location to install the cap screws (key 143) is shown in figure 7. A mounting boss is located on both sides of the spring barrel (key 12, figure 8).

1052 Spring Barrel Access Cover—For field conversion of 1052 actuators, attach the cover (key 141) over the spring barrel adjustment opening with self-tapping screws (key 142). Use key 141 as a drilling template. Drill size is 2.6 mm (A #37 drill) (0.104-inches) by 9.6 mm (0.38-inches) deep.

Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, refer to the serial number found on the actuator nameplate (key 41, figure 9).

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Top-Mounted Handwheel Retrofit Kits

Kit provides parts to add a top-mounted handwheel. Kit Number 1 includes the handwheel assembly only. Kit Number 2 includes Kit Number 1 and a new upper case (key 1) that is required to mount the handwheel assembly.

Kit Number 1

Key	Description	Part Number
	Size 70	CV8010X0052

Kit Number 2

Key	Description	Part Number
	Size 70	CV8010X0062

Pipe-Away Vent Retrofit Kit

Vent-away kits include: access plate, two-piece bushing, two O-rings, gasket, and the application of a sealant (sealant supplied with retrofit kit). For 1052, an additional cover plate and screws are required for the spring adjustment access.

See figure 7.

Pipe-Away Vent Retrofit Kit Numbers

SHAFT DIAMETER		1052 SIZE	KIT PART NUMBER
mm	Inches		
31.8	1-1/4	70	34B4646X282
38.1	1-1/2	70	34B4646X302
44.5	1-3/4	70	34B4647X322
50.8	2	70	34B4647X342

Parts List

Note

Contact your [Emerson sales office](#) or Local Business Partner for Part Ordering information.

Common Parts (figure 8)

Key Description

- 1 Casing, upper
- 2 Diaphragm Casing, lower (steel zn pl)
- 3* Diaphragm, molded (NBR/nylon)
Standard
w/handwheel, or w/adj up stop
Size 70
w/adj down stop
Size 70
VMQ/polyester
Standard
w/handwheel, or w/adj up stop
Size 70
w/adj down stop
Size 70
- 4 Diaphragm Head
- 5 Screw, Cap, Hex Hd,
Size 70 (24 req'd)
- 6 Nut, Hex
Size 70 (28 req'd)
- 7 Screw, Cap, Hex Hd
Size 70 (10 req'd)
- 8 Stop, Travel (2 req'd)
- 9 Screw, Cap, Hex Socket
- 10 Diaphragm Rod
- 11 Spring
- 12 Spring Barrel
- 13 Spring Seat
- 16 Nut, Hex
- 17 Bearing Rod End
- 18 Screw, Cap, Hex Hd

Key Description

- 19 Nut, Hex, Jam
- 20 Housing
- 20 Modified Housing
- 21 Screw, Cap, Hex Hd (4 req'd)
- 22 Yoke, Mounting
- 23 Screw, Cap, Hex Hd (4 req'd)
- 27 Lever
- 28 Screw, Cap, Hex Hd
- 29 Hub
- 30 Ring, Retaining, Ext
- 31* Bushing
Size 70
- 33 Cover
- 34 Screw, Cap, Hex Hd
w/o switches, w/ TopWorx™ DXP M21GNEB, 4200,
w/BZE6-2RN or DTE6-2RN SW,
w/micro switch w/90 deg, or w/ 3710 positioner
(4 req'd)
w/NAMCO or LSA/LSX switches,
w/ LSA/LSX sw, or w/NAMCO or LSA/LSX switch
(2 req'd)
- 35 Scale, Indicator
- 36 Screw, Self Tapping (2 req'd)
- 37 Travel Indicator
- 38 Self-Tapping Screw (2 req'd)
- 38 Machine Screw (2 req'd)
- 39 Plate, Cover
- 40 Screw, Cap, Hex Hd (4 req'd)
- 41 Nameplate
- 42 Screw, Drive (4 req'd)
- 56 Warning Label
- 57 Turnbuckle
- 58 Nut, Hex, Jam
- 59 Plate, Access
- 63 Washer, Plain
Size 70 (2 req'd)
- 67* Bushing
- 71 Bearing, Thrust
- 72 Bearing Race (2 req'd)
- 73 Bearing Seat
- 74 Screw, Adjusting
- 76 Lithium grease lubricant
- 77 Thread locking sealant
- 78 Screw, Cap
15.9 thru 50.4 mm (5/8 thru 2-inch) Shafts (4 req'd)

Key	Description
82	Diaphragm Head, lower
83	Plug, Protective
---	Pipe Bushing (not shown)
144	Warning Nameplate
146	Spacer

Top-Mounted Handwheel (Figure 9)

51	Handwheel
54	Nut, Hex, Slotted
133	Stem
135	Plate, Pusher
137	Nut, Hex, Jam
138*	O-Ring, (NBR) Size 70
139*	O-ring, (NBR) Size 70
140*	Pin, Groove
141	Screw, Cap, Hex Hd Size 70 (12 req'd)
142	Body
164	Body Extension
169	Grease Fitting
171	Washer, plain
174	Retaining Screw
175	Bearing, Thrust
176	Bearing Race, Thrust (2 req'd)
241	Lithium grease lubricant
242	Thread locking sealant
244	Anti-seize lubricant
246	Spacer
247	Pin, Cotter

Adjustable Up Travel Stop (Figure 10)

133	Stem
135	Plate, Pusher
137	Nut, travel stop
138*	O-Ring, (NBR) Size 70
139*	O-Ring, (NBR) Size 70
140*	Pin, Groove
141	Screw, Cap, Hex Hd Size 70 (12 req'd)
142	Body
164	Body Extension
169	Grease Fitting
171	Spacer
174	Retaining Screw
175	Bearing, Thrust
176	Bearing Race, Thrust (2 req'd)
187	Travel Stop Cap
241	Lithium grease lubricant
242	Thread locking sealant

Adjustable Down Travel Stop (Figure 11)

Key	Description
54	Nut, Hex
63	Flange Nut
133	Travel Stop Stem
134	Washer (plain carbon steel)
139*	O-Ring (NBR) Size 70
141	Screw, Cap, Hex Hd (steel zn pl) Size 70 (12 req'd)
142	Travel Stop Body
187	Travel Stop Cap
189	Nut, Hex, Jam Size 70 (2 req'd)
241	Lithium grease lubricant

Locking Assembly (Figure 6)

123	Mounting Plate
124	Mounting Plate Assembly
127	Groove Pin
128	Jam Nut
129	Cap Screw

Pipe-Away Vent (Figure 7)

Note

Complete retrofit kits are listed at the beginning of the parts list.

132*	Lined Bushing (steel/PTFE) yoke side 31.8 mm (1-1/4 inch) dia. shaft (2 req'd) 38.1 mm (1-1/2 inch) dia. shaft (2 req'd) 44.5 mm (1-3/4 inch) dia. shaft (2 req'd) 50.8 mm (2-inch) dia. shaft (2 req'd)
133*	O-Ring (NBR) 31.8 mm (1-1/4 inch) dia. shaft 38.1 mm (1-1/2 inch) dia. shaft 44.5 mm (1-3/4 inch) dia. shaft 50.8 mm (2-inch) dia. shaft
134*	Bushing (steel/PTFE) hub side
135*	O-Ring, hub side
136	Travel Indicator Gasket
137	Access Plate assembly
138	Machine screw (4 req'd)
139	Blue RTV or equivalent
140	Plug
141	Spring Barrel Cover, 1052 only (2 req'd)
142	Self-tapping Screw Size 70 (8 req'd)
143	Cap Screw Size 70 (4 req'd)

Figure 8. Typical 1052 Assembly

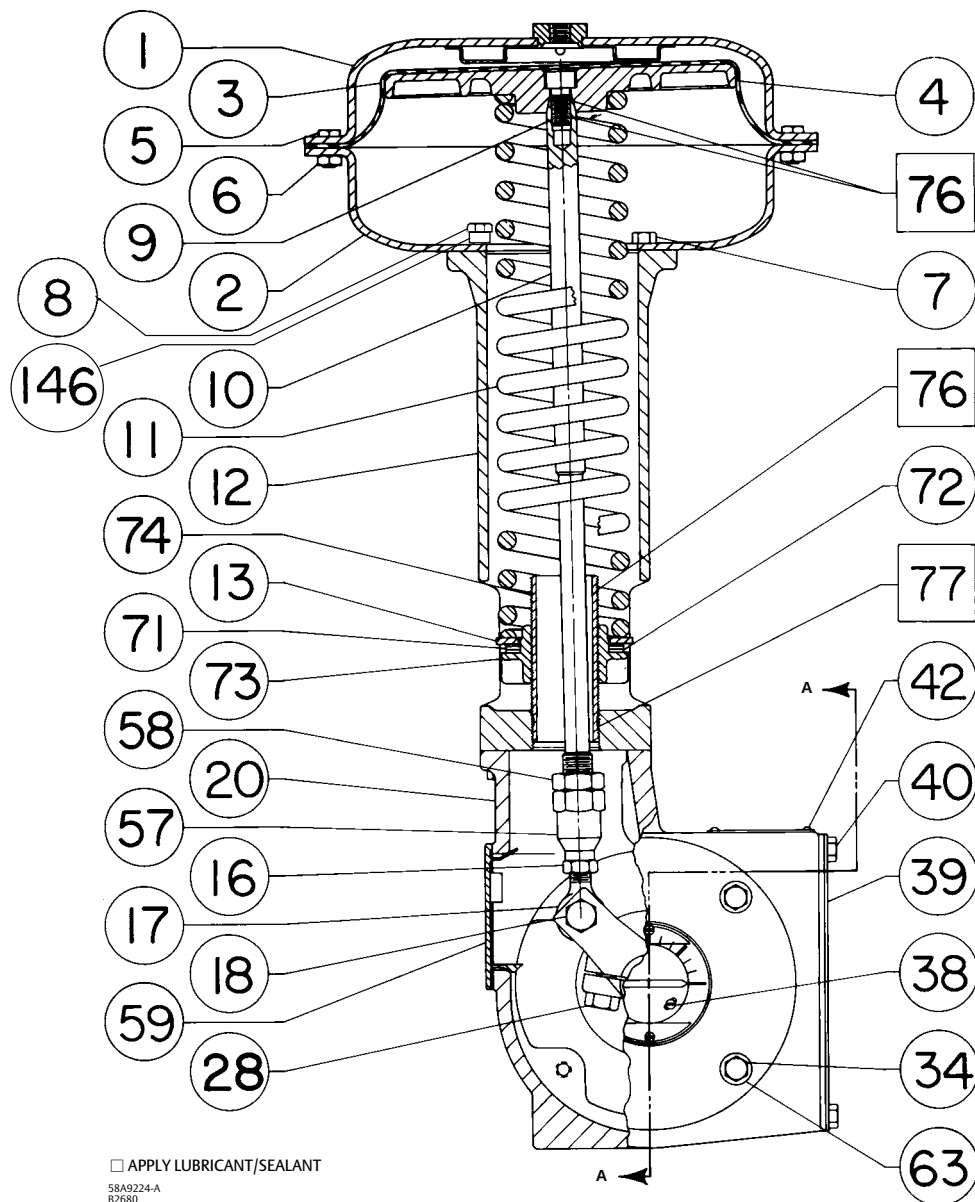


Figure 8. Typical 1052 Assembly (continued)

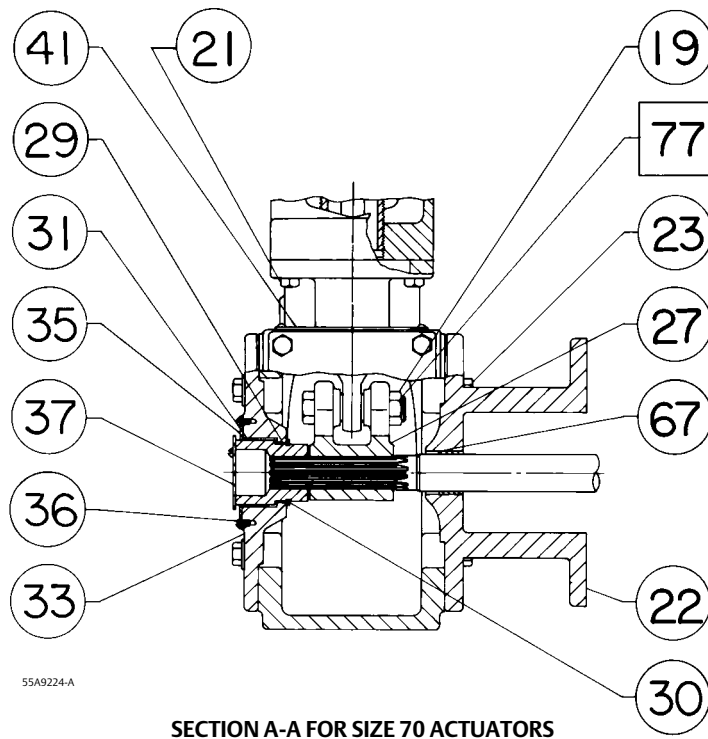


Figure 9. Handwheel Assemblies

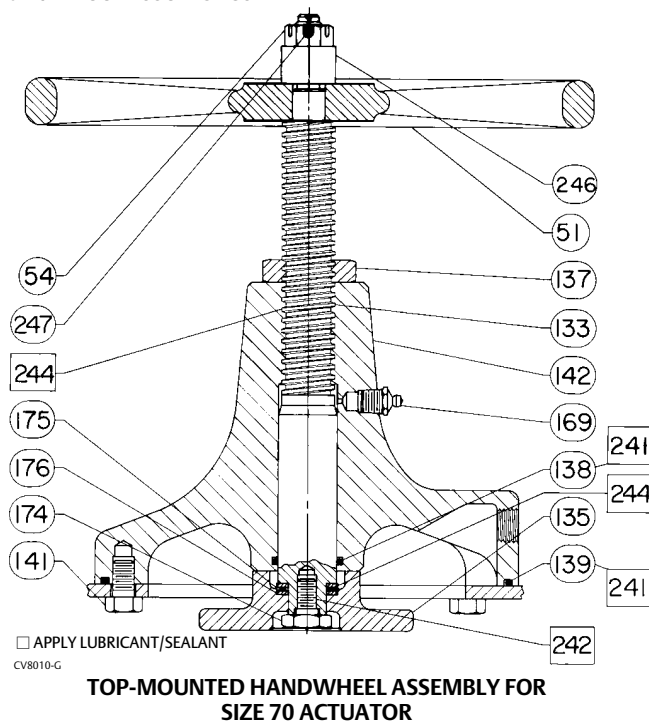
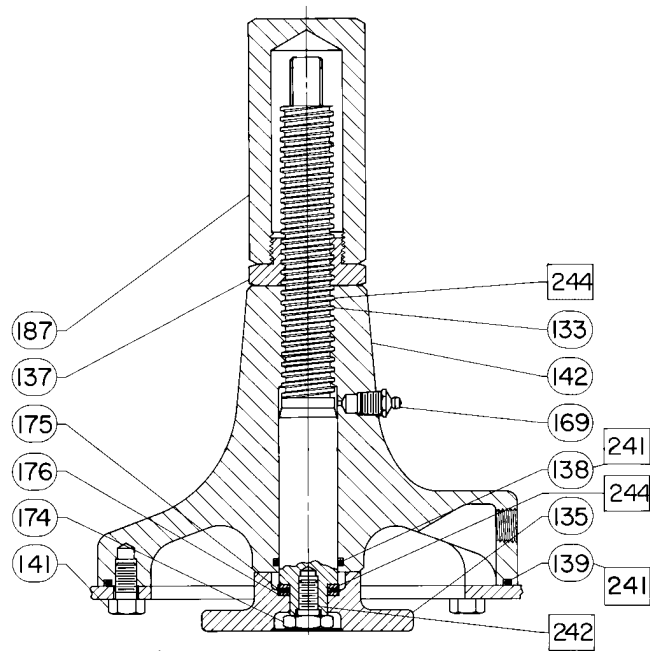


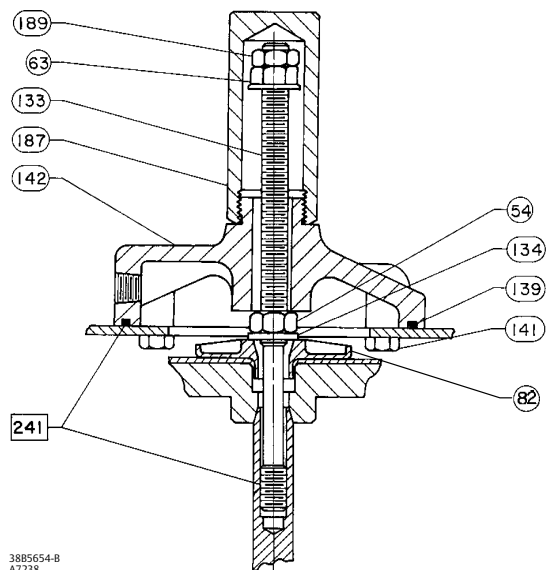
Figure 10. Adjustable Up Travel Stops



□ APPLY LUBRICANT/SEALANT
CV8057-E

ADJUSTABLE UP TRAVEL STOP FOR SIZE 70 1052 ACTUATORS

Figure 11. Adjustable Down Travel Stop



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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

1052 Size 70 Actuators

June 2017

Instruction Manual

D104083X012

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Fisher™ 1061 Pneumatic Piston Rotary Actuator with Style F & G Mounting Adaptations

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Figure 1. Fisher 1061 Actuator with V500 Valve and DVC6200 FIELDVUE™ Digital Valve Controller



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Introduction

Scope of Manual

This instruction manual includes installation, adjustment, maintenance, and parts ordering information for the Fisher 1061 pneumatic piston rotary actuator with F and G mounting adaptations (see figure 1). Instructions for the control valve, the auxiliary declutchable handwheel actuator, the valve positioner, and accessories are covered in separate instruction manuals.

Do not install, operate, or maintain a 1061 actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Table 1. Specifications

Available Configuration Double-acting pneumatic piston rotary actuator for ■ throttling service when used with positioner, or ■ on-off service when used with switching devices Actuator Sizes ■ 30, ■ 40, ■ 60, ■ 68, ■ 80, ■ 100, ■ and ■ 130, Cylinder Operating Pressure Minimum Recommended: ■ 1.4 bar (20 psig) without positioner or ■ 0.3 bar (5 psig) above actuator requirement with positioner Maximum Allowable⁽¹⁾: Size 30 and 60: 6.9 bar (100 psig) Size 40: 10.3 bar (150 psig) Size 68: 5.9 bar (85 psig) Size 80: 10.3 bar (150 psig) Size 100: 10.3 bar (150 psig) Size 130: 10.3 bar (150 psig) Valve Shaft Diameters, mm (Inches) Size 30: ■ 12.7 (1/2), ■ 15.9 (5/8), ■ 19.1 (3/4), ■ 22.2 (7/8), ■ 25.4 (1), and ■ 31.8 (1-1/4) Size 40, 60, and 68: ■ 19.1 (3/4), ■ 22.2 (7/8), ■ 25.4 (1), ■ 31.8 (1-1/4), ■ 38.1 (1/2), ■ 44.5 (1-3/4), and ■ 50.8 (2) Size 80 and 100: ■ 44.5 (1-3/4), ■ 50.8 (2), and ■ 63.5 (2-1/2)	Size 130: ■ 76.2 (3), ■ 88.9 (3-1/2) Maximum Valve Shaft Rotation ■ 90 degrees or ■ 60 degrees (travel stop required for 60 degree rotation limit) Material Temperature Capabilities with Standard Elastomers⁽¹⁾ -34 to 82°C (-30 to 180°F) Pressure Connections ■ 1/4 NPT internal (standard) ■ 1/2 and 3/4 NPT internal (optional on sizes 68, 80, and 100) ■ 3/4 NPT internal for Pipe-Away Vent option ■ 1 NPT internal for size 130 Travel Indication Graduated scale and pointer located on actuator cover at actuator end of valve shaft Mounting Positions See figure 2 Approximate Weights Size 30: 22 kg (49 lb) Size 40: 29 kg (63 lb) Size 60: 39 kg (86 lb) Size 68: 56 kg (123 lb) Size 80: 122 kg (246 lb) Size 100: 135 kg (298 lb) Size 130: 299 kg (660 lb)
--	--

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valves should not be exceeded.

Description

The 1061 actuator is a double-acting pneumatic piston rotary actuator for use with rotary-shaft valves having splined valve shafts. The 1061 actuator can be used for either throttling or on-off applications.

The style G mounting bracket is for Fisher 9500 valves only. The style F mounting bracket is for all other rotary valves.

Specifications

Specifications are shown in table 1 for 1061 actuators. Specifications are stamped on the nameplate. Refer to the actuator nameplate for the construction setting and serial number for the actuator when it originally came from the factory.

Educational Services

For information on available courses for 1061 Style F and G actuators, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Principle of Operation

Piston movement is accomplished by loading air pressure on one side of the piston, and unloading air pressure from the other side of the piston. If no positioner is used with the control valve, a loading device, such as a 4-way switching valve, must be provided. Such a device is not furnished with the actuator.

Refer to the separate valve positioner instruction manual for the 1061 actuator principle of operation with positioner.

Installation

When an actuator and valve are shipped together, the actuator is normally mounted on the valve. Follow the valve instructions when installing the control valve in the pipeline. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the procedures presented in the Actuator Mounting section.

WARNING

To avoid personal injury, always wear protective gloves, clothing, and eyewear when performing any installation operations.

To avoid personal injury or property damage caused by bursting of pressure retaining parts, be certain the service conditions do not exceed the limits given in table 1 or on the nameplate. Use pressure limiting or pressure relieving devices to prevent the cylinder pressure from exceeding the maximum allowable cylinder operating pressure.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Actuator Mounting

Use the following steps to connect a valve and actuator that have been ordered separately, or if the valve or actuator were separated for maintenance purposes.

Key numbers used in this procedure are shown in figures 8, 9 and 11.

WARNING

Perform the steps in the WARNING at the beginning of the Maintenance section.

1. Refer to instructions in the appropriate valve instruction manual.
2. If a valve positioner is installed on the actuator, remove the positioner.

On the travel indicator side of the actuator:

3. Remove the cap screws and washers (keys 35 and 76), and remove the actuator cover (key 34). If an optional manual handwheel actuator is being used, it will be removed with the cover.
4. If the lever (key 28) is attached to the rod end bearing (key 12), remove the cap screw and hex nut:
 - For size 30, 40, 60, and 68 actuators, remove the cap screw and hex nut (keys 13 and 14).
 - For size 80 and 100 actuators, remove the cap screw, washer, and hex nut (keys 13, 84, and 85).
 - For size 130 actuators, remove the cap screw and locknut (keys 13 and 85).

On the valve side of the actuator:

5. The actuator is normally positioned vertically with the valve in a horizontal pipeline. Refer to figure 2 for available mounting styles and positions that match your application. Also, refer to the lever/shaft orientation provided in the valve instruction manual.

CAUTION

It is important, when installing the actuator on the valve, to be sure that the valve is positioned correctly.

- **Note the actuator style, position, and lever in relationship to the valve body and drive shaft end marks (see step 13, below).**
- **The valve internal components can be damaged if forced past its fully open or fully closed position.**

6. Screw the mounting yoke (key 23) onto the actuator, and tighten the screws (key 24). Slide the actuator onto the valve shaft, and secure the mounting yoke to the valve body with the valve mounting screws.
7. Tighten the valve mounting cap screws to the bolting torque values given in table 2.
8. Hold the valve in the correct position, and secure it with the cap screws (key 24).

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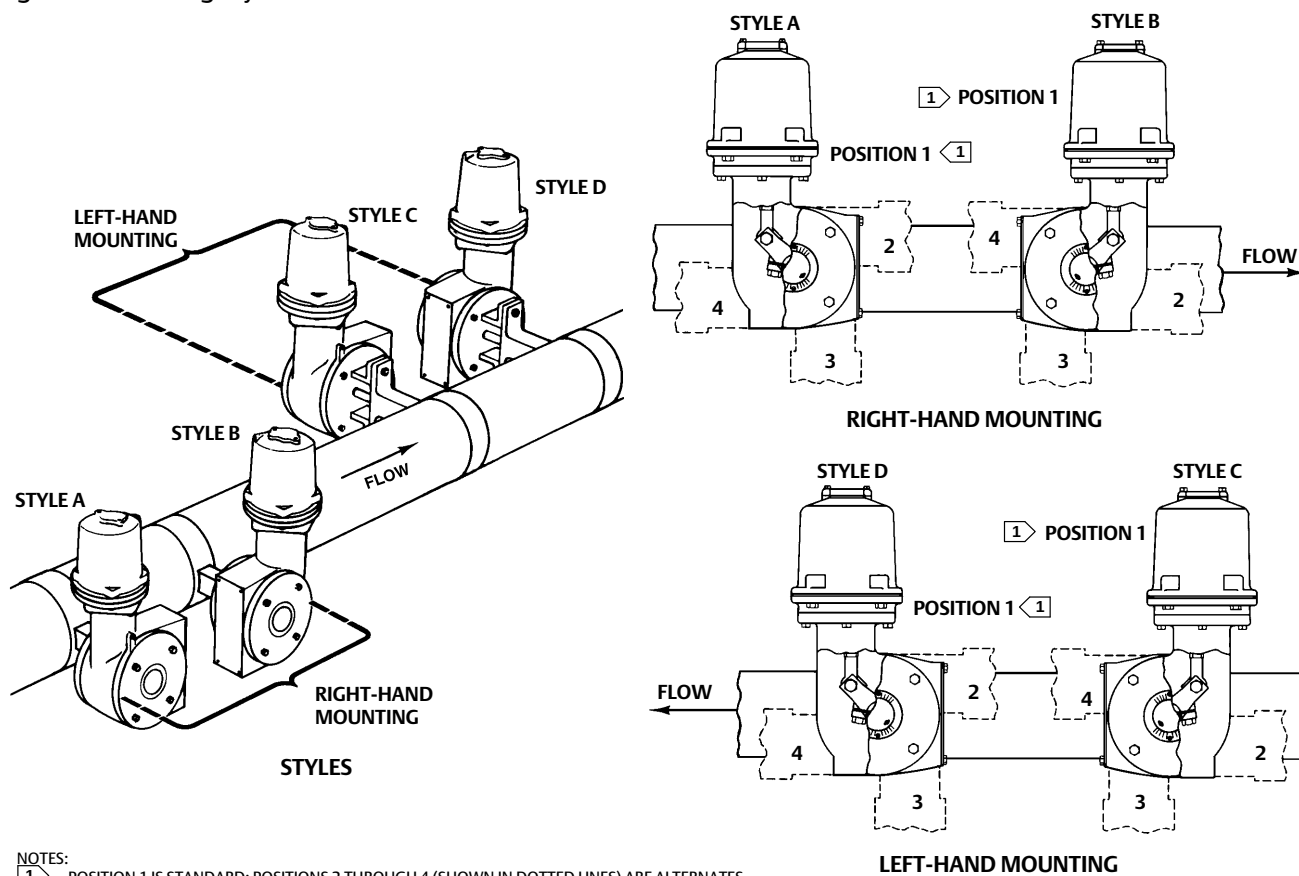
1061 F & G Actuator

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MOUNTING	ACTION ⁽¹⁾	VALVE SERIES OR DESIGN				VALVE SERIES OR DESIGN		
		BALL/PLUG ROTATION TO CLOSE	V250	V150, V200 & V300	CV500 V500	DISK/BALL ROTATION TO CLOSE	V250	8510B, 8532, 8560 & 9500
Right-Hand	PDTC	CCW	A	A	A	CW	NA	B
	PDTO	CCW	B	B	B	CW	NA	A
Left-Hand	PDTC	CCW	NA	D	D	CW	C	C
	PDTO	CCW	NA	C	C	CW	D	D
Left-Hand (Optional) ⁽²⁾	PDTC	CW	NA	C	NA	NA	NA	NA
	PDTO	CW	NA	D	NA	NA	NA	NA

1. PDTC—Push-down-to-close, and PDTO—Push-down-to-open.
2. A left hand ball will be required for the NPS 3 through 12 Series B and the NPS 14 to 20, with or without attenuator.

Figure 2. Mounting Styles and Positions



NOTES:

1. POSITION 1 IS STANDARD; POSITIONS 2 THROUGH 4 (SHOWN IN DOTTED LINES) ARE ALTERNATES.

2. BY Emerson Automation Solutions DEFINITION:

● FORWARD FLOW IS INTO THE FACE SIDE OF DISK, OR BALL SEALING SURFACE.

● REVERSE FLOW IS INTO THE HUB SIDE OF THE DISK OR BALL.

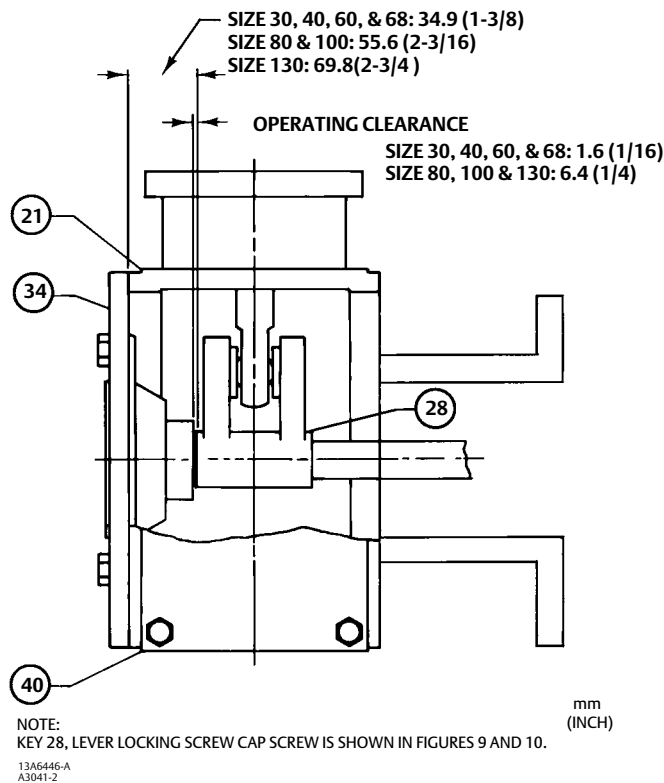
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Table 2. Bolting Torque Values for Valve Mounting Cap Screws

VALVE SHAFT DIAMETER		VALVE MOUNTING CAP SCREWS	
mm	Inch	N•m	lbf-ft
12.7 to 25.4	1/2 to 1	80	65
31.8 & 38.1	1-1/4 & 1-1/2	135	100
44.5 & 50.8	1-3/4 & 2	183	135
63.5	2-1/2	390	290
76.2 & 88.9	3 & 3-1/2	745	550

On the travel indicator side of the actuator:

9. Screw the left-hand threaded hex nut (key 71) onto the piston rod (key 10) as far as possible.
10. Screw the turnbuckle (key 70) onto the piston rod as far as possible. Only finger-tighten it, as this adjustment will be changed in a later step.
11. Screw the hex nut (key 11) onto the rod end bearing. Then thread this assembly completely into the turnbuckle.

Figure 3. Lever Operating Clearance


12. To aid installation of the lever, apply lithium grease lubricant (key 93) to the valve shaft spline.

For size 80, 100 and 130 actuators, it may be necessary to rotate the set screw (key 82) clockwise slightly to spread the split portion of the lever and allow installation on the valve shaft.

13. Refer to the appropriate valve instruction manual for lever/shaft orientation marks, and slide the lever into place. Refer to figure 3 for the appropriate lever operating clearance.

- For size 80, 100 and 130 actuators, when the lever is in place, back off the set screw (key 82) so the lever can be clamped onto the valve shaft.

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- For all sizes: Hold the lever in position, and secure the assembly with the cap screw (key 29).

14. Rotate the lever until the cap screw hole is aligned with the rod end bearing (key 12). You may need to adjust the turnbuckle to make this alignment.

15. For all actuator sizes, apply thread locking sealant (high strength) (key 83) to the cap screw (key 13) threads.

Table 3. Recommended Bolting Torques

KEY NUMBER	ACTUATOR SIZE				
	30	40 & 60	68	80 & 100	130
	N•m				
3	102	102	102	102	123
6	14	14	14	---	91
9	61	136	248	---	1763
11	34	102	102	475	542
13	80	271	271	271	1763
22	23	68	68	169	162
24	34	81	81	271	257
29	81	271	271	271	970
35	34	81	81	271	257
41	14	14	14	14	14
71	102	163	253	475	542
86	---	---	---	861	---
KEY NUMBER	lbf•ft				
3	75	75	75	75	75
6	10	10	10	---	67
9	45	100	257	---	1300
11	25	75	75	350	400
13	60	200	200	200	1300
22	17	50	50	125	120
24	25	60	60	200	190
29	60	200	200	200	715
35	25	60	60	200	190
41	10	10	10	10	10
71	75	120	260	350	400
86	---	---	---	635	---

WARNING

Refer to table 3 for bolt torque requirements. Exceeding any torque requirements could damage actuator parts and impair safe operation. Refer to the Warning at the beginning of the Installation section in this manual.

Note

If the cap screw key number is shown in table 3, torque the cap screws to the value shown in the table for final assembly.

16. Connect the lever to the rod end bearing with the cap screw and hex nut (keys 13 and 14) for size 30, 40, 60, and 68 actuators; with the cap screw, washer, and locknut (keys 13, 84, and 85) for size 80 and 100 actuators; or with the cap screw and hex nut (keys 13 and 85) for size 130. Torque cap screw and hex nut to the value listed in table 3.

17. Note the valve disk or ball position and direction of rotation.

⚠ WARNING

To avoid possible personal injury, do not stroke the actuator while the cover (key 34) is off.

a. If no handwheel actuator is to be used, position the travel indicator (key 38) according to the valve disk or ball position just noted. Replace the cover (key 34), and secure it with the washers and cap screws (keys 76 and 35). If the holes in the cover and housing (key 21) do not align, temporarily loosen the cap screws (key 24) and shift the housing slightly. Do not stroke the actuator while the cover is off.

b. If a manual handwheel actuator is to be used, refer to the separate instruction manual for mounting instructions.

18. If the 1061 actuator is equipped with an auxiliary handwheel actuator, make certain that a cylinder bypass valve (key 68, figure 10) is also used to equalize cylinder pressure during handwheel operation. Operating the handwheel actuator by itself against the force of differential cylinder pressures is difficult or even impossible. Install a bypass valve as shown in figure 10. If the actuator was equipped with a valve positioner, refer to the positioner instruction manual mounting procedures.

Changing Actuator Mounting

The actuator is normally positioned vertically in a horizontal pipeline. However, four mounting styles and four positions are possible for each style. See figure 2.

Be sure to refer to the appropriate valve instruction manual for lever/valve shaft orientation, when changing styles and/or positions. Most mounting changes will require the actuator lever to change position in relationship to the valve splined shaft. It is possible to damage the valve if the actuator drives the valve disk or ball past its fully open or fully closed position.

Refer to the Actuator Mounting section, to disassemble and assemble the actuator when changing the style or position of the actuator.

CAUTION

Do not use a hammer or similar tool to drive the lever (key 28) off the valve shaft. Driving the lever could damage internal valve parts. On some valves, driving the lever off the shaft could move the valve disk or ball and bearings away from the centered position, causing subsequent damage to valve parts as the valve is operated.

If necessary, use a wheel puller to remove the lever from the valve shaft. It is permissible to tap the wheel puller screw lightly to loosen the lever, but hitting the screw with excessive force could damage valve parts or disrupt the centered position of the valve disk or ball and bearings.

When changing styles and/or positions, most mounting changes will require the actuator lever to change position in relationship to the valve splined shaft. It is possible to damage the valve if the actuator drives the valve disk or ball past its fully open or fully closed position.

Key numbers referenced in the following procedures are shown in figures 8, 9 and 11.

Changing Styles

Style A is right-hand mounted while Style D is left-hand mounted. In all other ways, styles A and D are identical.

Style B is right-hand mounted while Style C is left-hand mounted. In all other ways, styles B and C are identical.

The actuator housing, for style A & D is turned 180 degrees to convert it to a style B & C, or vice versa. In other words, the actuator cover (key 34) is removed and placed on the mounting yoke (key 23) side.

The mounting yoke is placed on the cover side of the actuator housing (key 21). The lever (key 28) must be removed and replaced during the procedure. Refer to figure 2 and note the relationship of the valve style and the pipeline.

Table 4. Open-End Wrench Size Required for Turnbuckle Adjustments, Inches

ACTUATOR SIZE	TURNBUCKLE (KEY 70)	LOWER LOCKNUT (KEY 11)	UPPER LOCKNUT (KEY 71)
30	1-1/8	3/4	1-1/8
40 & 60	1-5/16	1-1/8	1-5/16
68	1-7/8	1-1/8	(1)
80 & 100	1-7/8	1-7/8	1-7/8
130	2-3/4	2-3/4	2-3/4

1. A 3/8-inch diameter rod is used for tightening.

Changing Positions

The actuator housing (key 21) position, and its orientation with the mounting yoke (key 23) can be changed into four different positions. Refer to figure 2 and note the possible positions for each style.

Pressure Connections

1. Connect either pipe or tubing between the actuator pressure connections and the instrument. Keep the length of pipe or tubing as short as possible to avoid transmission lag in the control signal.
2. When the control valve is completely installed and connected to the instrument, check for correct action (air-to-open or air-to-close) to match the controlling instrument. For successful operation, the actuator stem and valve shaft must move freely in response to the loading pressure change on the piston.

Adjustment

The only adjustment on the 1061 actuator is to make sure that the valve disk or ball is correctly closed when the actuator piston is against the travel stop. For accurate adjustment to the zero-degree valve disk or ball position, you must remove the control valve from the pipeline. Refer to the valve instruction manual for instructions during this procedure.

If the actuator is equipped with a manual handwheel actuator, make sure that the manual actuator is disengaged from the valve shaft and that the bypass valve (key 68, figure 10) is closed before you perform adjustment procedures.

Perform the following steps to adjust the actuator turnbuckle. A regulated air supply will be required to stroke the actuator during this procedure. Also, when you perform this adjustment, refer to table 4 for the sizes of open-end wrenches required to loosen and tighten the hex nuts and turnbuckle.

Key numbers referenced in this procedure are shown in figures 8, 9, and 11.

WARNING

Perform the steps in the WARNING at the beginning of the Maintenance section.

1. Refer to instructions in the appropriate valve instruction manual.

2. Remove the access plate (key 72). Also remove the machine screws (key 73) if present.

Note

The cover (key 34) supports the outer end of the valve shaft and should not be removed during actuator adjustment.

3. Stroke the actuator until you can reach the lower hex nut (key 11) through the access opening. Loosen the hex nut.
4. Stroke the actuator until you can reach the left-hand threaded upper hex nut (key 71) through the access opening. Loosen the hex nut.
5. Perform one of the following:
 - a. **Push-down-to-close** (extending piston rod closes the valve): Slowly stroke the actuator to the down travel stop. Refer to the appropriate valve instruction manual to determine the closed position of the valve. Adjust the turnbuckle (key 70) until the valve is in the closed position. Lock this adjustment with the left-hand threaded hex nut (key 71). Stroke the actuator to the up travel stop, and tighten the lower hex nut (key 11). Check thread engagement distance. The thread engagement should be the distance of the diameter of the thread. Tighten the lower hex nut (key 11) using the torque values shown in table 3.
 - b. **Push-down-to-open** (extending piston rod opens the valve): Stroke the actuator to the up travel stop. Refer to the appropriate valve instruction manual to determine the closed position of the valve. Check the valve position. Stroke the actuator until you reach the turnbuckle (key 70) through the access opening. Adjust the linkage. Stroke the actuator to the up travel stop again, and check the new adjustment. Continue this procedure until the valve is in the closed position when the actuator piston is resting against the up travel stop. Check thread engagement distance. The thread engagement should be the distance of the diameter of the thread. Tighten the lower hex nut (key 11) using the torque values shown in table 3.
6. Replace the access plate (key 72).
7. Loosen the self-tapping screws (key 39), and adjust the travel indicator (key 38). Re-tighten the self-tapping screws.

CAUTION

If using a handwheel actuator, the valve shaft spline could be damaged if excessive torque is applied to the valve shaft by the manual actuator while the 1061 power actuator is stopped at either end of travel. To protect the valve shaft, perform the travel stop adjustment procedure found in the separate handwheel actuator instruction manual.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given below for disassembly and replacement of parts.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Key numbers are shown in figures 8, 9 and 11.

Disassembly

The following procedure describes how to completely disassemble the actuator. When inspecting and replacing parts, perform only those steps necessary to accomplish the repair.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment. Refer to instructions in the appropriate valve instruction manual.
2. Remove the positioner, if one is used. If necessary, refer to the positioner instruction manual for removal instructions.
3. Unscrew the cap screws and washers (keys 35 and 76), and remove the cover (key 34). If an optional manual handwheel actuator is used, it will be removed with the cover. Refer to the separate handwheel actuator instruction manual for instructions.
4. Remove the retaining ring (key 31). If necessary, remove the travel indicator (key 38), by removing the screws (key 29) from the hub (key 30).
5. Inspect, and if necessary, replace the cover bushing (key 32). Remove the travel indicator scale (key 36) by removing the self-tapping screws (key 37). Press the bushing out of the cover (key 34).
6. Remove the cap screw and hex nut (keys 13 and 14) for size 30, 40, 60, and 68 actuators; the hex nut and washer (keys 85 and 84) for size 80 and 100 actuators; or the cap screw and heavy hex nut for size 130 (key 13 and 85).
7. Note the lever/valve shaft orientation. Loosen cap screw (key 29). For size 80, 100 and 130 actuators, rotate set screw (key 82) clockwise slightly to spread the split portion of the lever (key 28).

CAUTION

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever (key 28) off the valve shaft. Driving the lever could damage internal valve parts. On some valves, driving the lever off the shaft could move the valve disk or ball and bearings away from the centered position, causing subsequent damage to valve parts as the valve is operated.

If necessary, use a wheel puller to remove the lever from the valve shaft. It is permissible to tap the wheel puller screw lightly to loosen the lever, but hitting the screw with excessive force could damage valve parts or disrupt the centered position of the valve disk or ball and bearings.

8. For size 30, 40, and 68 actuators, unscrew cap screws (key 6) and remove cylinder cap (key 4). Inspect and, if necessary, replace the O-ring (key 5).
9. Remove rod end bearing (key 12) and hex nut (key 11), remove the turnbuckle (key 70) and hex nut (key 71).
10. Remove cap screws (key 3) and slide the cylinder assembly (key 1) from the cylinder flange (key 2).
11. Pull the piston (key 7) and piston rod (key 10) from the cylinder assembly.
12. Inspect and, if necessary, replace the O-rings (keys 8 and 16).
13. To separate the piston (key 7) from the piston rod (key 10), unscrew the cap screw or hex nut and washer (keys 9 and 77) for size 30, 40, 60 and 68 actuators or the hex nut (key 86) for size 80 and 100 actuators.
14. For the size 130 actuator, a piston rod disassembly fixture (figure 4) is recommended to properly disassemble the piston from the piston rod. Consult your [Emerson sales office](#) or Local Business Partner if this assembly must be disassembled.
15. Unscrew the cap screws (key 22) and remove the cylinder flange (key 2), sliding seal (key 19), and seal support cylinder (key 20).
16. Inspect, and if necessary, replace the O-rings (keys 17 and 18) and thrust washer (key 74).
17. Unscrew the cap screws (key 24) from the mounting yoke, and remove the actuator housing assembly (key 21).
18. Unscrew the mounting yoke (key 23) from the valve by removing the valve mounting cap screws. Slide the yoke off the valve shaft.
19. Inspect, and if necessary replace the mounting yoke bushing (key 81). It may be necessary to press out the bushing.

Assembly

This procedure assumes that the actuator was completely disassembled. If the actuator was not completely disassembled, start these instructions at the appropriate step. This procedure also assumes that the valve is removed from the pipeline for ease in actuator assembly and adjustment.

Key numbers used in the following procedures are shown in figures 8, 9, and 11.

Note

Many of the replacement mounting yokes (key 23) are available only as assemblies that also include the bushing (key 81). However, replacement bushings are also available separately (see the Parts List).

1. If the bushing (key 81) was removed, press in the new bushing. The end of the bushing should be flush with the bottom of the recess in the mounting yoke (key 23).
2. Slide the mounting yoke over the valve shaft, and secure it to the valve with the valve mounting cap screws.
3. Tighten the valve mounting cap screws to the bolting torque values given in table 2.

WARNING

Refer to table 3 for bolt torque requirements. Exceeding any torque requirements could damage actuator parts and prevent safe operation. Refer to the Warning at the beginning of the Installation section in this manual.

Note

The cap screws torque values shown in table 3 are for final assembly.

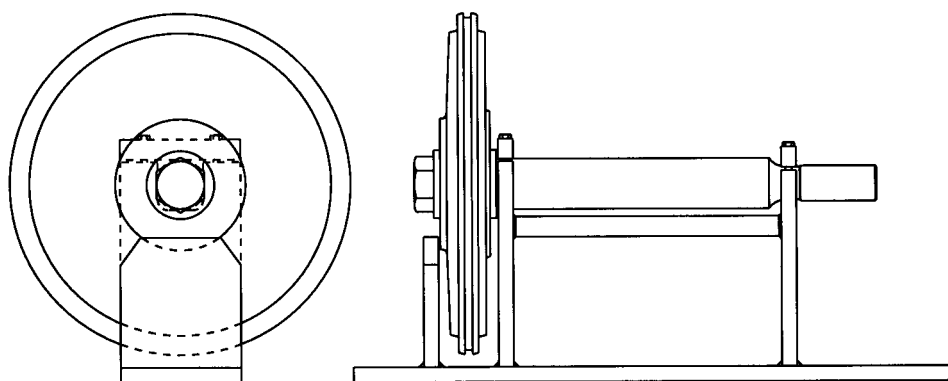
4. Refer to figure 2 for the desired orientation of the housing (key 21). Secure the housing to the mounting yoke with the cap screws (key 24).
5. Apply lithium grease lubricant (key 93) to the surfaces of the sliding seal (key 19). Refer to torque values shown in table 3. Be sure the O-rings (keys 17 and 18) are inserted correctly.

Note

When assembling parts, make sure that all O-rings are positioned correctly as shown in figures 8, 9, and 11.

6. Install the seal support cylinder (key 20), the thrust washer (key 74), the sliding seal, and the cylinder flange (key 2) and secure these parts with the cap screws (key 22).
7. If 60-degree rotation is specified, a travel stop (key 15) will be threaded into the cylinder flange on size 30 to 100. For size 130, a travel stop and travel stop sleeve (keys 15 and 6) will be put into the cylinder flange.
8. Apply lithium grease lubricant (key 93) to the valve shaft. Refer to the appropriate valve instruction manual for lever/valve shaft orientation marks, and slide the lever (key 28) into place. See figure 3 for correct lever operating clearance.

Figure 4. Piston Rod Assembly Fixture for Size 130 Actuator



58B3070
E0577

For Size 80, 100 and 130 actuators, rotate the set screw (key 82) clockwise slightly to spread the split portion of the lever and allow easy installation onto the shaft. After the lever is properly positioned, back-off the set screw so that the lever can be clamped to the shaft.

9. Hold the lever in place (see figure 3), and clamp the lever to the valve shaft with the cap screw (key 29).
10. Apply lithium grease lubricant (key 93) to the sealing surface of the piston rod (key 10) and apply anti-seize sealant (key 91) to the tapered end of the piston rod on all sizes except 130.
11. Attach the piston (key 7) to the piston rod, applying thread locking adhesive (medium strength) (key 92) to the threads (key 9 or 10):
 - a. For Size 30, 40, and 60 actuators: Secure it with the cap screw and washer (keys 9 and 77).
 - b. For Size 68 actuators: Secure it with the hex nut and washer (keys 9 and 77).
 - c. For Size 80 and 100 actuators: Secure it with the hex nut (key 86).
 - d. For the Size 130 actuator a piston rod assembly fixture (figure 4) is recommended to properly assemble the piston to the piston rod because of the high torque required and the need to properly protect the sealing surface of the

piston rod. Consult your [Emerson sales office](#) or Local Business Partner for additional information to properly assemble these parts.

- e. Tighten the screw or nut to the torque specified in table 3.
 12. Insert the piston and piston rod assembly down through the sliding seal (key 19). Attach the hex nut (key 71), turnbuckle (key 70), hex nut (key 11), and rod end bearing (key 12) to the piston rod assembly.
 13. Rotate the lever to align with the rod end bearing. This connection can be aided by carefully moving the piston/rod assembly up or down.
 14. Apply thread locking adhesive (medium strength) (key 92) or equivalent thread-locking compound to the threads of the cap screw (key 13).
 15. **Connecting the lever to the rod:**
 - *For Size 30, 40, 60, and 68 actuators:* Connect the lever and the rod end bearing with the cap screw and hex nut (keys 13 and 14).
 - *For Size 80, 100, and 130 actuators:* Connect the lever and the rod end bearing with the cap screw, washer, and hex nut (keys 13, 84, and 85). Size 130 does not require the washer (key 84).
 16. Install the O-ring (key 8 or 16) on the piston edge. Apply lithium grease lubricant (key 93) to the inside wall of the cylinder. Install the cylinder (key 1).
 17. Attach the cylinder assembly (key 1) to the cylinder flange with the cap screws (key 3).
- Size 130 has a mark on the cylinder flange that must align with a mark near the top of the housing flange.
18. *For Size 30, 40, and 68 actuators,* Place the O-ring (key 5) in the cylinder cap, replace the cylinder cap (key 4), and secure it to the cylinder assembly with the cap screws (key 6). Tighten all cap screws to the torques specified in table 3.
 19. Install the hub (key 30) plus bushing (key 32) into the cover (key 34), and secure with the retaining ring (key 31).
 20. Replace the travel indicator scale (key 36), and secure it with the self-tapping screws (key 37). Install the travel indicator (key 38), and secure it with the self-tapping screws (key 39).
 21. Note the valve disk or ball position and direction of rotation.

WARNING

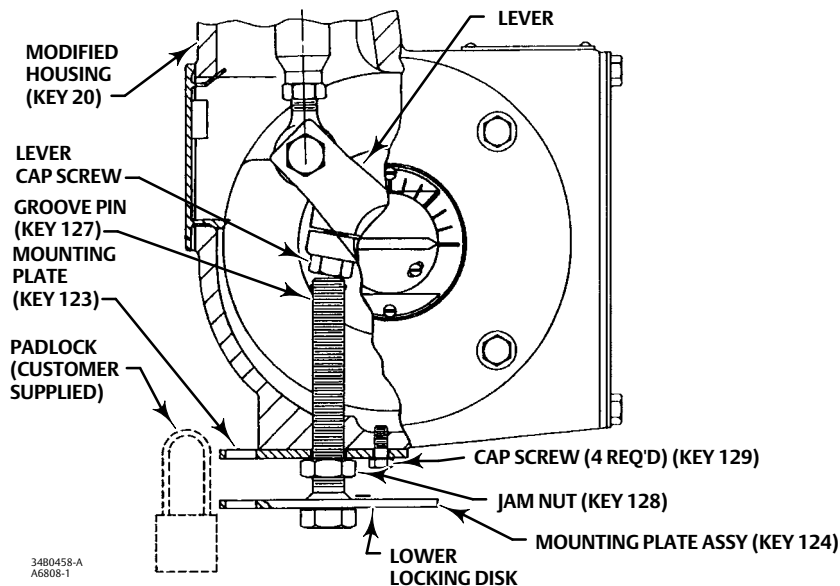
To avoid possible personal injury, do not stroke the actuator while the cover (key 34) is off.

- a. If no handwheel actuator is to be used, position the travel indicator (key 38) according to the valve disk or ball position just noted. Replace the cover (key 34) and secure it with the cap screws and washers (key 35 and 76). If the holes in the cover and housing do not align, temporarily loosen the cap screws (key 24) and shift the housing slightly. Do not stroke the actuator while the cover is off.
 - b. If the actuator is equipped with a manual handwheel actuator, refer to the separate instruction manual for mounting procedures.
22. If a positioner is to be used, refer to the separate valve positioner instruction manual for proper installation.
 23. Follow the instructions in the Adjustment section for correct actuator turnbuckle adjustment.

Locking Mechanism

To add the locking mechanism to an existing actuator, purchase the retrofit kit to install this modification or order individual parts from your [Emerson sales office](#) or Local Business Partner. Replacement parts are shown in the Parts List section.

Figure 5. Locking Mechanism (Size 30, 40, 60, and 68)



Installing the Locking Mechanism

Refer to figures 5 and 6 for locking mechanism details and key number locations.

⚠ WARNING

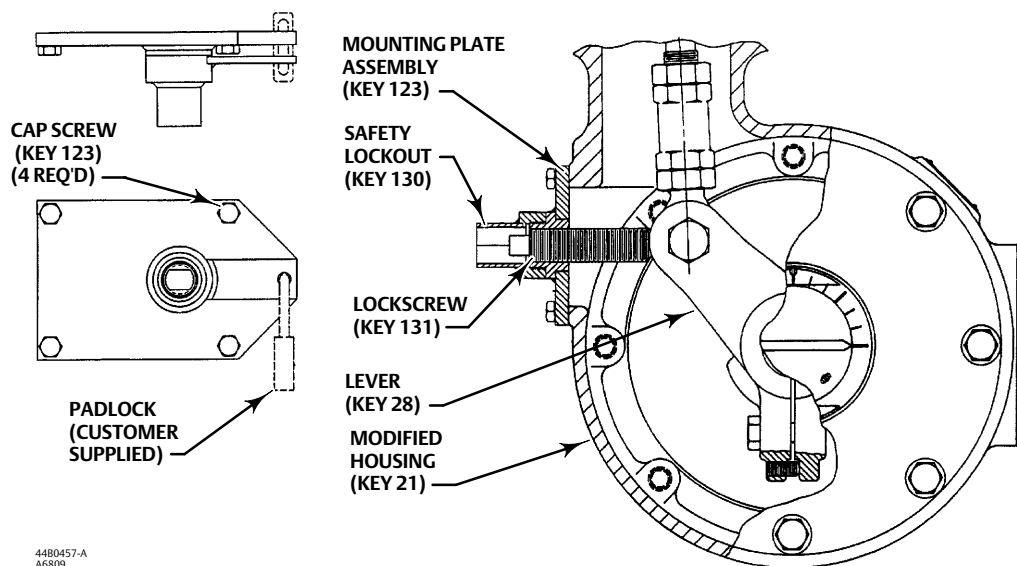
Perform the steps in the **WARNING** at the beginning of the Maintenance section.

1. Refer to instructions in the appropriate valve instruction manual.
2. Disassemble the actuator by following the procedures in the Disassembly section.

For Size 30, 40, 60, & 68 Actuators

1. Attach the mounting plate (key 123) to the modified housing (key 21) as shown in figure 5. Attach it with the cap screw (key 129). Be sure the hole in the center of the mounting plate lines up with the large tapped hole in the housing.
2. Be sure the jam nut (key 128) is threaded onto the threaded bolt on the mounting plate assembly (key 124) before threading it into the housing.
3. After the bolt is threaded into the housing, install the groove pin (key 127) into the end of the bolt. (The groove pin will prevent the threaded bolt from being totally unthreaded from the actuator housing.)

Figure 6. Locking Mechanism (Size 80 and 100)



4. Make sure that the bolt is not threaded in so far that it will interfere with re-assembly of the actuator.
5. Be sure the actuator piston rod is retracted fully. This will be the locked position of the valve. For a push-down-to-close valve and actuator, the valve will be fully open when locked. For a push-down-to-open valve and actuator, the valve will be fully closed when locked.
6. Screw the threaded bolt into the housing until it contacts the actuator lever cap screw.
7. Insert the padlock (not furnished) to connect the mounting plate (key 123) with the lower locking disk on the mounting plate assembly (key 124). You might have to back off the lower locking disk a slight amount to line up the holes for the padlock.
8. Tighten the jam nut (key 128) against the mounting plate.
9. Refer to the Operating the Locking Mechanism section.

For Size 80 & 100 Actuators

1. Attach the mounting plate (key 123) to the modified housing (key 21) as shown in figure 6. Attach it with the four cap screws (key 129).
2. Thread the lock screw (key 131) into the mounting bracket.
3. Make sure that the lock screw is not threaded in so far that it will interfere with re-assembly of the actuator.
4. Be sure the actuator piston rod is retracted fully. This will be the locked position of the valve. For a push-down-to-close valve and actuator, the valve will be fully open when locked. For a push-down-to-open valve and actuator, the valve will be fully closed when locked.
5. Screw the lock screw into the housing until it contacts the actuator lever (key 28).
6. Screw the safety lockout (key 130) onto the mounting plate (key 123) until finger-tight. Then back it off until the hole in the arm of the safety lockout aligns with the hole in the mounting plate for the padlock.
7. Insert the padlock (not furnished) to connect the mounting plate (key 123) with the arm of the safety lockout (key 130). If the shackle of the padlock does not seem long enough, do not attempt to modify the actuator. The larger 1061 sizes may require a padlock with a longer shackle.
8. Refer to the Operating the Locking Mechanism section.

Operating the Locking Mechanism

Key numbers are located in figures 5 and 6.

To Unlock the Actuator (Size 30, 40, 60, & 68)

1. Remove the padlock. Loosen the jam nut (key 128, figure 5), and unscrew the threaded bolt until it is stopped by the groove pin (key 127) in the threaded bolt.

Note

For normal operation of the actuator, the threaded bolt must be unscrewed far enough so that the actuator lever will not contact the bolt in normal actuator operation.

2. If you are going to leave the bolt threaded into the housing, lock it with the jam nut (key 128) so that it cannot be screwed into the housing and interfere with normal actuator operation.

To Unlock the Actuator (Size 80 & 100)

1. Remove the padlock. Remove the safety lockout (key 130, figure 6) and unscrew the lockscrew until it is free of the lever path.

Note

For normal operation of the actuator, the threaded bolt must be unscrewed far enough so that the actuator lever will not contact the bolt in normal actuator operation. A good rule of thumb is to unscrew the lockscrew until it is approximately even with the outward edge of the safety lockout when installed.

2. If you are going to leave the bolt threaded into the housing, reinstall the safety lockout and padlock.

To Lock the Actuator (Size 30, 40, 60, & 68)

1. Be sure the actuator piston rod is retracted fully. This will be the locked position of the valve. For a push-down-to-close valve and actuator, the valve will be fully open when locked. For a push-down-to-open valve and actuator, the valve will be fully closed when locked.
2. Be sure the jam nut (key 128, figure 5) is loose. Then, screw the threaded bolt into the housing until it contacts the head on the cap screw of the actuator lever.
3. Rotate the threaded bolt until one of the holes in the lower locking disk (which is welded to the bolt) is in line with the hole in the mounting plate (key 123). Tighten the jam nut against the mounting plate.
4. Lock the plate and disk together with a padlock (not furnished).

To Lock the Actuator (Size 80 & 100)

1. Be sure the actuator piston rod is retracted fully. This will be the locked position of the valve. For a push-down-to-close valve and actuator, the valve will be fully open when locked. For a push-down-to-open valve and actuator, the valve will be fully closed when locked.
2. Screw the lockscrew (key 131) into the housing until it contacts the actuator lever (key 28, figure 9).
3. Screw the safety lockout (key 130) onto the mounting plate (key 123) until finger-tight. Then back it off until the hole in the arm of the safety lockout aligns with the hole in the mounting plate for the padlock.
4. Insert and lock the padlock (not furnished) to connect the mounting plate (key 123) with the arm of the safety lockout (key 130). The larger 1061 sizes may require a padlock with a longer shackle.

Pipe-Away Vent

Some applications require venting of gas from the rotary actuator housing. The 3610 Series positioners vent into the actuator housing, and from there, the gas has numerous avenues of escape.

⚠ WARNING

If a flammable, hazardous, or reactive gas is used as the supply pressure medium, personal injury or property damage could result from fire or explosion of accumulated gas or from contact with hazardous or reactive gas.

The positioner on the control valve assembly does not form a gas-tight seal. If the assembly is in an enclosed area, use a remote vent line, and use other safety measures to adequately ventilate the assembly. A remote vent pipe alone cannot be relied upon to remove all hazardous gas.

Vent line piping should comply with local and regional codes. It should be as short as possible with adequate inside diameter and few bends to remove exhaust gases to a ventilated area.

Note

This modification is NOT intended to be a leak-proof or pressure-tight design. It is intended to aid in containing the gas that vents from the positioner and allow for connection of piping to carry it away.

The Parts List section, at the end of this manual, provides...

- Retrofit kit numbers to modify an actuator for the vent piping
- Replacement parts for pipe-away vents
- Retrofit kit numbers for modification of units in the field

Take care that adequate vent pipe size is used. This is particularly important with the larger size actuators with fast stroking speed requirements. In these situations, large quantities of gas can be vented very quickly through the positioner, and you must have adequate pipe-away capability. Keep the vent piping as short as possible with few bends.

Key numbers are shown in figure 7 unless otherwise noted. Refer to the actuator Disassembly and Assembly steps to gain access to the following parts.

For installation and maintenance of the pipe-away vent system, be sure to do the following:

⚠ WARNING

Perform the steps in the WARNING at the beginning of the Maintenance section.

Refer to instructions in the appropriate valve instruction manual.

Bushings—Remove the mounting yoke bushing (key 67), and the end plate cover bushing (key 31, figures 9 and 11), then replace them with the pipe-away vent parts. As shown in figure 7, the mounting yoke bushing (key 132) has two pieces with an O-ring (key 133) between them. The end plate cover repeats the assembly with a two-piece bushing (key 134) with an O-ring between them (key 135).

Travel Indicator—A gasket (key 136) is placed under the travel indicator plate. Remove the indicator plate (key 37, figures 8, 9 and 11), install the gasket (key 136) as shown in figure 7.

Housing Vent Plug—A vent is provided in the housing design. To plug this opening, the pipe-away vent kit provides a hex pipe plug (key 140) for this opening as shown in figure 7. Install the hex plug (key 140) into this opening and tighten it.

Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, refer to the serial number found on the actuator nameplate.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Repair Kits

Actuator Repair Kits

Key	Description	Part Number
Actuator Repair Kits Include Keys 5, 8, 16, 17, 18, 56, and 74.		
	Size 30	R1061X00302
	Size 40	R1061X00402
	Size 60	R1061X00602
	Size 68	R1061X00682
	Size 80	R1061X00802
	Size 100	R1061X01002

Pipe-Away Vent Retrofit Kit

Pipe-Away Vent Kit Includes: Access Plate assembly, Two-Piece Bushing, Two O-Rings, Gasket, and Sealant. See Figure 7.

Pipe-Away Vent Retrofit Kit Numbers

SHAFT DIAMETER		ACTUATOR SIZE	KIT PART NUMBER
mm	Inches		
12.7	1/2	30	34B4646X022
15.9	5/8	30	34B4646X032
19.1	3/4	30	34B4646X042
		40, 60, & 68	34B4646X052
22.2	7/8	30	34B4646X062
		40, 60 & 68	34B4646X072
25.4	1	30	34B4646X082
		40, 60, & 68	34B4646X092
31.8	1-1/4	30	34B4646X102
		40, 60 & 68	34B4646X112
38.1	1-1/2	40, 60 & 68	34B4646X122
44.5	1-3/4	40, 60, & 68	34B4646X132
50.8	2	40, 60 & 68	34B4646X142
50.8	2	80 & 100	34B4647X032
54.0	2-1/8	80 & 100	34B4647X042
63.5	2-1/2	80 & 100	34B4647X052
69.9 x 63.5 to 101.6 x 63.5	2-3/4 x 2-1/2 to 4 x 2-1/2	100	34B4647X052

Parts List

Actuator Common Parts (figures 8, 9, & 11)

Note

Contact your [Emerson sales office](#) or Local Business Partner for Part Ordering information.

Key	Description
1	Cylinder Assembly
2	Cylinder Flange
3	Cap Screw
4	Cylinder Cap
5*(1)	O-Ring, nitrile
6	Cap Screw
7	Piston
8*(1)	O-Ring, nitrile
9	Cap Screw (for size 30, 40 & 60 only)
9	Hex Nut (for size 68 & 130 only)
10	Piston Rod
11	Hex Nut
12	Rod End Bearing
13	Cap Screw
14	Hex Nut
15	Travel Stop (not required for 90 degree rotation)
16*(1)	O-Ring, nitrile
17*(1)	O-Ring, nitrile
18*(1)	O-Ring, nitrile
19	Sliding Seal
20	Seal Support Cylinder
21	Housing
22	Cap Screw
23	Mounting Yoke
24	Cap Screw
28	Lever
29	Cap Screw
30	Hub
31	Retaining Ring
32*	Bushing, fiberglass
34	Cover
35	Cap Screw
36	Travel Indicator Scale
37	Self Tapping Screw

* Recommended spare parts
1. Included in repair kit.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

1061 F & G Actuator

June 2017

Instruction Manual

D100324X012

Key	Description
38	Travel Indicator
39	Self-Tapping Screw
39	Cap Screw
40	Positioner plate
41	Cap Screw
42	Nameplate
43	Drive Screw
55	Vent Screen (Not shown)
56*(1)	O-Ring, nitrile (for size 30, 40 & 68 only) (not shown)

Note

Key numbers 62 thru 68 and key 83 are used with bypass only (figure 10).

62	Connector
63	Elbow
64	Pipe Nipple
65	Pipe Plug
66	Pipe Cross
67	Tubing
68	Bypass Valve
70	Turnbuckle
71	Hex Nut
72	Access Plate
73	Machine Screw
74	Thrust Washer
76	Washer
77	Washer
81*	Bushing (See following table)
82	Set Screw
83	Thread Locking Sealant (high strength)
84	Washer
85	Hex Nut
86	Hex Nut
87	Cap Screw

Key	Description
90*	O Ring
91	Anti-Seize Sealant
92	Thread Locking Adhesive (medium strength)
93	Lithium Grease Lubricant
122	Thrust Washer

Locking Mechanism Parts (figure 5 or 6)

123	Mounting Plate
124	Mounting Plate Assy
127	Groove Pin
128	Jam Nut
129	Cap Screw
130	Safety Lockout
131	Lockscrew

Pipe-Away Vent Parts (figure 7)

Note

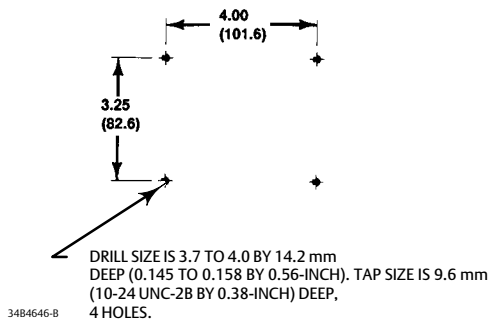
Complete Retrofit Kits are Listed at the Beginning of the Parts List. Use This Listing for Individual Replacement Parts

132*	Lined Bushing (Steel/PTFE) Yoke Side
133*	O-Ring (Nitrile)
134*	Bushing (Steel/PTFE) Hub Side
135*	O-Ring (Nitrile) Hub Side
136	Travel Indicator Gasket
137	Access Plate Assembly
138	Machine Screw
139	RTV Blue or Equivalent Silicon Gasket, #6B
140	Plug

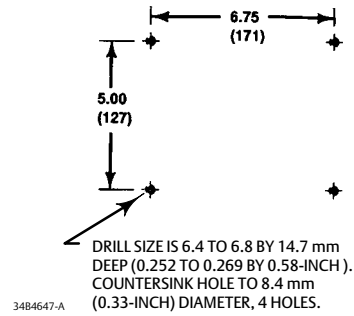
Piston/Piston Rod Torquing Fixture

Size 130

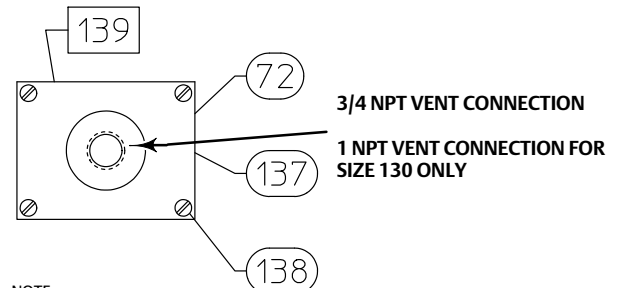
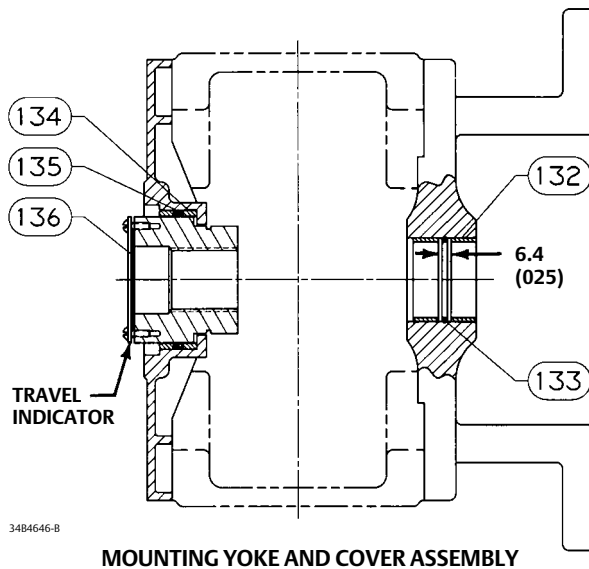
Figure 7. Pipe-Away Vent Assembly



**DRILLING AND TAPPING PATTERN
ACCESS PLATE ASSEMBLY
SIZE 30, 40, 60, & 68 ACTUATORS**



**DRILLING AND TAPPING PATTERN
ACCESS PLATE ASSEMBLY
SIZE 80 AND 100 ACTUATORS**

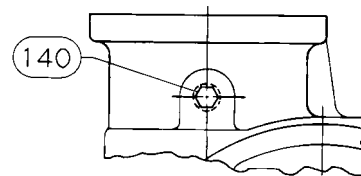


NOTE:
FOR FIELD CONVERSION, DRILL AND TAP HOLE PATTERN IF HOUSING HAS A NON-METALLIC ACCESS PLATE. USE KEY 137 AS A DRILLING TEMPLATE IF DESIRED OR, USE THE DIMENSIONS PROVIDED IN THIS FIGURE FOR DRILLING AND TAPPING.

□ APPLY SEALANT

3484646-B

ACCESS PLATE ASSEMBLY



NOTE:
INSTALL THE HEX HEAD PLUG (KEY 140) INTO THE VENT OPENING LOCATED IN THE ACTUATOR HOUSING.

40B3945-B

HOUSING VENT PLUG LOCATION

mm
(INCH)

Figure 8. Typical Assembly for Fisher 1061 Sizes 30 through 68 Actuators

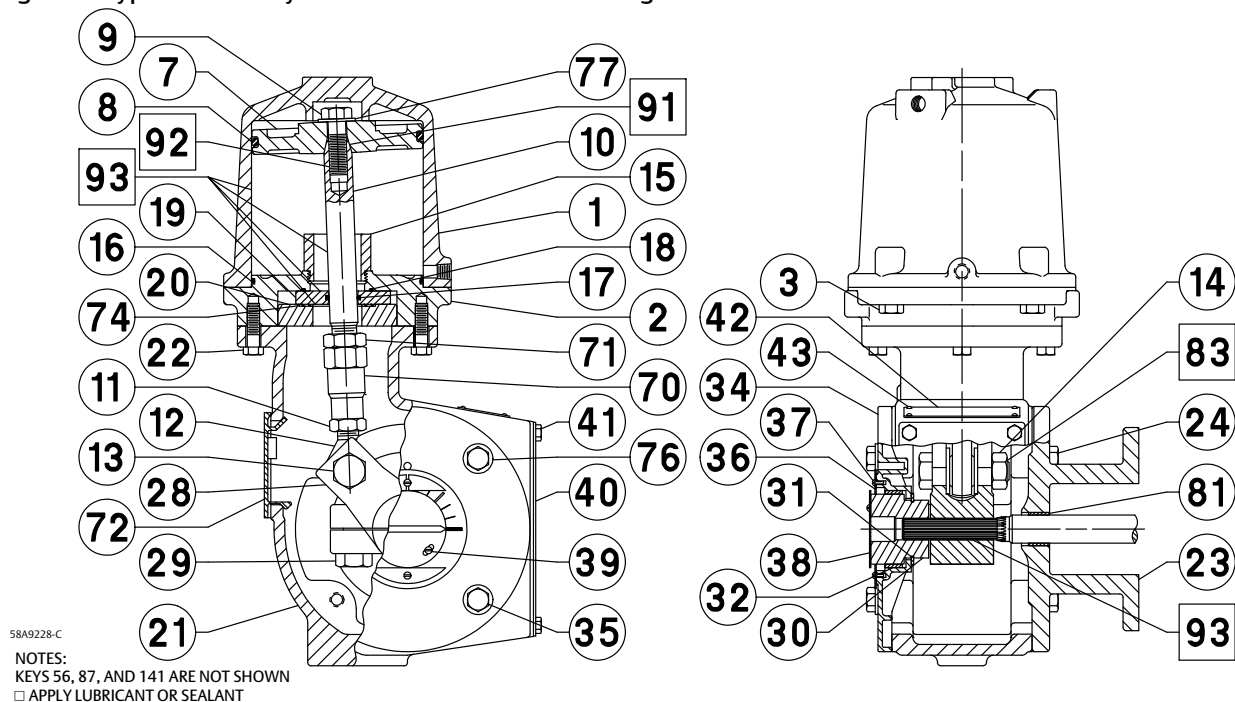


Figure 9. Typical Assembly for Fisher 1061 Size 80 and 100 Actuators

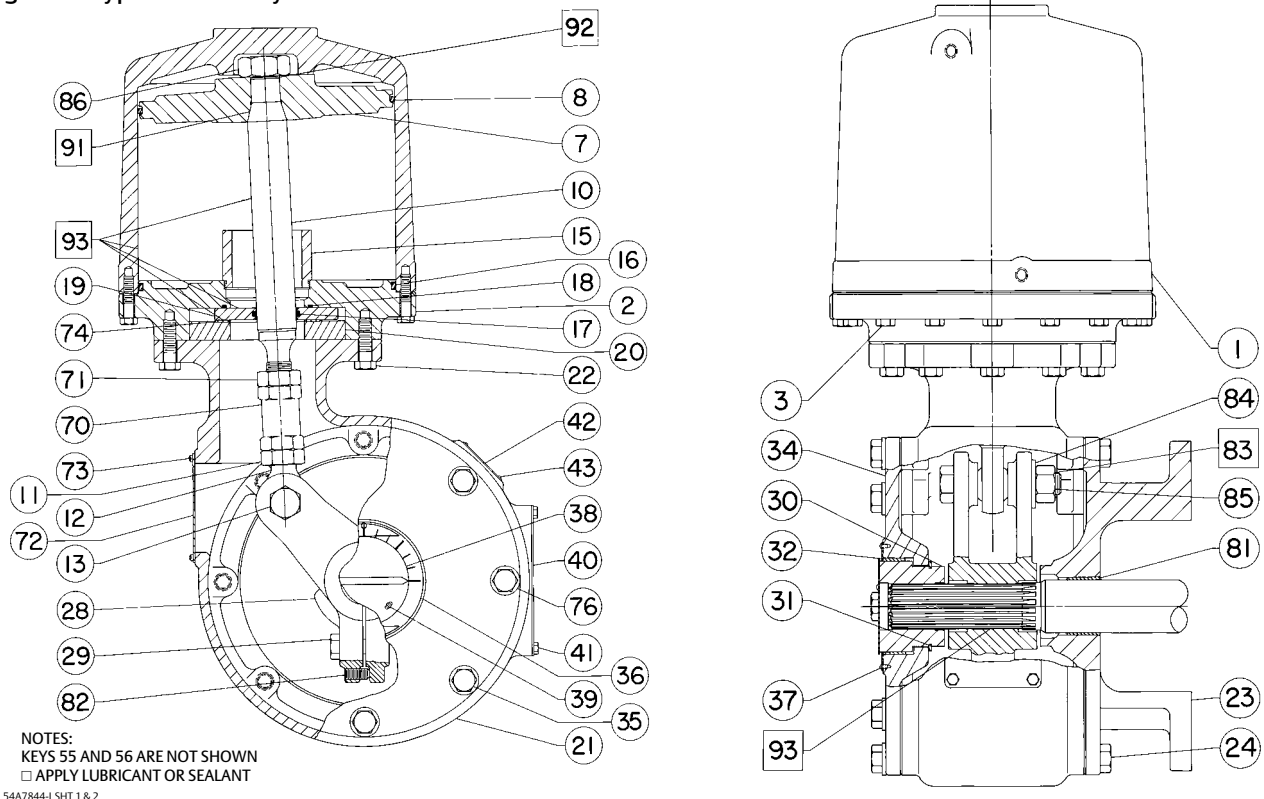
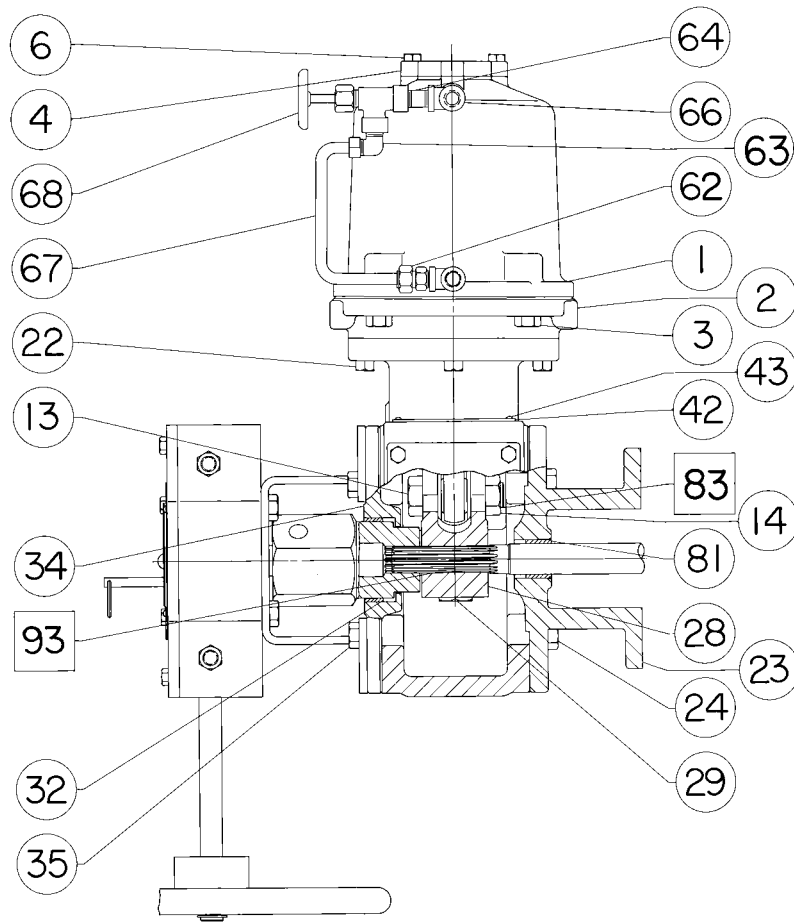
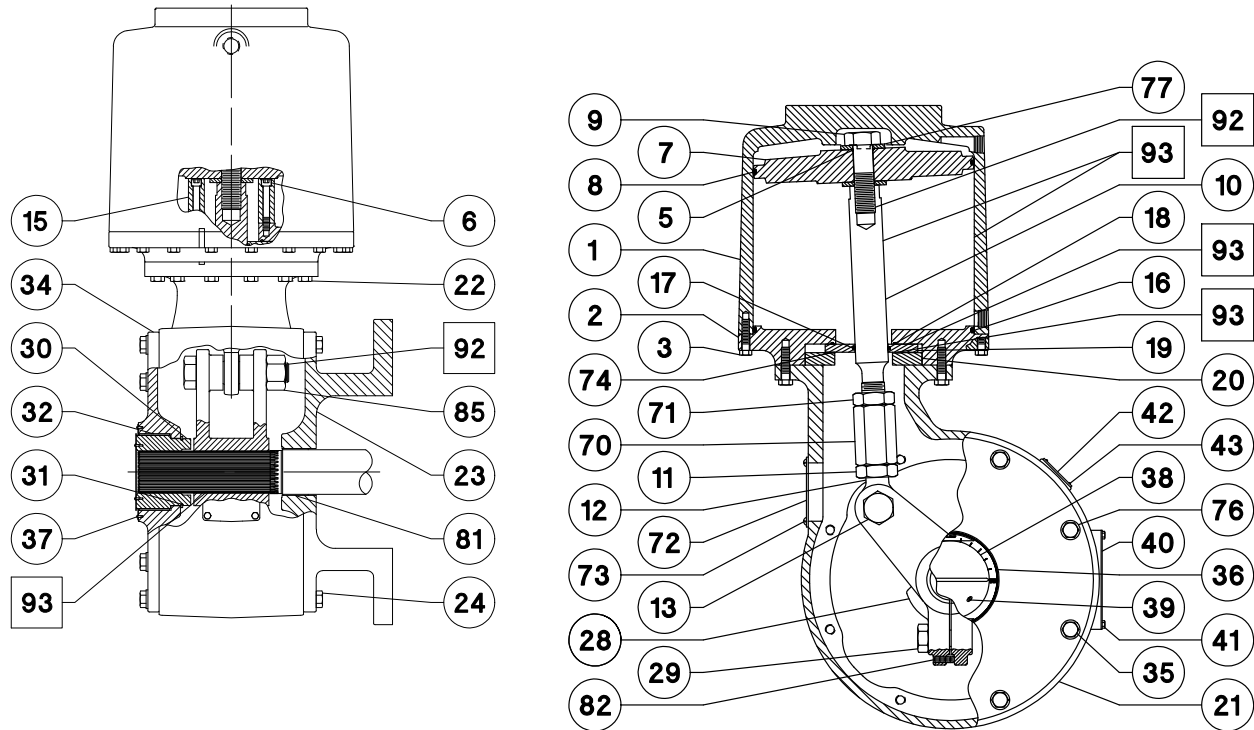


Figure 10. Partial View of Actuator with Bypass Valve



54A5326-K

Figure 11. Typical Assembly for Fisher 1061 Size 130 Actuators



NOTES:
KEY 55 IS NOT SHOWN.
□ APPLY LUBRICANT OR SEALANT.
58B3057-B SHT 1 AND SHT 2

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Fisher™ 1061 Pneumatic Piston Rotary Actuator with Style H & J Mounting Adaptations

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Figure 1. Fisher 1061 Actuator



W4142

H Mounting Adaptation

W4257-1

J Mounting Adaptation
and Fisher 3610JP Positioner

Introduction

Scope of Manual

This instruction manual includes installation, adjustment, maintenance, and parts ordering information for the Fisher 1061 pneumatic piston rotary actuator (sizes 30, 40, 60, and 68) with H and J mounting adaptations (see figure 1). Instructions for the positioner, accessories, and, if used, the auxiliary handwheel actuator are covered in separate instruction manuals.

Do not install, operate, or maintain a 1061 actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Table 1. Specifications

Available Configuration Double-acting pneumatic piston rotary actuator for ■ throttling service when used with positioner or ■ on-off service when used with switching devices. Mounting adaptations include ■ H mounting for rotary actuation of equipment other than Fisher valves or ■ J mounting for rotary actuation of Fisher keyed-shaft butterfly valves and other keyed-shaft equipment Actuator Sizes ■ 30, ■ 40, ■ 60, and ■ 68 Cylinder Operating Pressure Minimum Recommended: ■ 1.4 bar (20 psig) without positioner or ■ 0.3 bar (5 psig) above actuator requirement with positioner⁽¹⁾ Maximum Allowable: Sizes 30 and 40: 10.3 bar (150 psig) Size 60: 6.9 bar (100 psig) Size 68: 5.9 bar (85 psig) Torque Limits Limited by maximum cylinder operating pressure or by tables 2 and 3, whichever is less	Maximum Valve Shaft Rotation ■ 90 degrees or ■ 60 degrees (travel stop required for 60 degrees rotation) Stroking Time Dependent on actuator size, degrees of rotation, and positioner if used. If stroking time is critical, contact your Emerson sales office or Local Business Partner. Material Temperature Capabilities With Standard Elastomers -34 to 82°C (-30 to 180°F) Pressure Connections ■ 1/4 NPT internal (Standard) ■ 1/2 and 3/4 optional on size 68 Travel Indication Graduated scale and pointer located on actuator cover at actuator end of valve shaft Mounting Positions See figure 4 Approximate Weights See table 4
--	--

1. See separate manual for positioner specifications.

Description

The 1061 actuator is a pneumatic piston rotary actuator for use with rotary control valves and other equipment. The H mounting adaptation permits the actuator to be used with user-provided mounting brackets and couplings for rotary actuation of equipment other than Fisher valves. The J mounting adaptation permits the actuator to be used for rotary actuation of Fisher keyed-shaft butterfly valves and other keyed-shaft equipment that can mount on the actuator yoke.

The H mounting adaptation includes a flat-surface mounting plate that is drilled and tapped for attaching the user-provided bracket. Cap screws for attaching the bracket are provided. H mounting also includes an output shaft (with milled flats) to provide the rotary output either directly or through a user-provided coupling⁽¹⁾. Output shaft diameters and torque limits are listed in table 2. Dimensional information for the mounting plate and output shaft are shown in figure 2.

The J mounting adaptation uses the standard butterfly valve mounting bracket and provides an output shaft with an attached coupling for keyed equipment shafts. Coupling sizes and torque limits are listed in table 3. Dimensional information for the mounting yoke and output shaft coupling is shown in figure 2.

Additionally, the 1061 actuator can be used for either throttling or on-off applications. For auxiliary manual operation of the equipment, a side-mounted handwheel actuator is available.

Specifications

Specifications are shown in table 1 for 1061 actuators. Specifications for a given 1061 actuator as it originally comes from the factory are stamped on a nameplate (key 42, figure 6) attached to the actuator.

Educational Services

For information on available courses for 1061 Style H and J actuators, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

When an actuator and valve are shipped together, the actuator is normally mounted on the valve. Follow the valve instructions when installing the control valve in the pipeline. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the procedures presented in the Actuator Mounting section.

⚠ WARNING

To avoid personal injury, always wear protective gloves, clothing, and eyewear when performing any installation operations.

To avoid personal injury or property damage caused by bursting of pressure retaining parts, be certain the service conditions do not exceed the limits given in table 1 or on the nameplate. Use pressure limiting or pressure relieving devices to prevent the cylinder pressure from exceeding the maximum allowable cylinder operating pressure.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Table 2. Output Shaft Diameters and Torque Limits for Actuators With H Mounting

ACTUATOR SIZE	OUTPUT SHAFT DIAMETER		TORQUE LIMIT FOR H MOUNTING	
	mm	Inches	N•m	Lbf•in
30	22.2	7/8	240	2120
	28.6	1-1/8	468	4140
	38.1	1-1/2	1110	9815
40, 60 & 68	28.6	1-1/8	468	4140
	38.1	1-1/2	1210	10,680
	50.8	2 ⁽¹⁾	2650	23,430

1. Coupling supplied for mating with either 44.5 or 50.8 mm (1-3/4 or 2-inch) keyed shaft.

Table 3. Acceptable Shaft Diameters and Torque Limits for Actuators with J Mounting

ACTUATOR SIZE	COUPLING AVAILABILITY BY KEYED SHAFT DIAMETER		TORQUE LIMIT FOR J MOUNTING	
	mm	Inches	N•m	Lbf•in
30	9.5	3/8	52	460
	12.7	1/2	69	610
	15.9	5/8	114	1010
	19.1	3/4	207	1830
	25.4	1	468	4140
40, 60, & 68	19.1	3/4	207	1830
	25.4	1	468	4140
	31.8	1-1/4	1030	9110
	38.1	1-1/2	1360	12,000

Table 4. Approximate Actuator Weights

ACTUATOR SIZE	ALUMINUM HOUSING CONSTRUCTION		CAST IRON HOUSING CONSTRUCTION	
	kg	Pounds	kg	Pounds
30	18	39	22	49
40	23	50	29	63
60	33	73	39	86
68	50	110	56	123

Actuator Mounting

Use the following steps to connect the actuator to a valve or other equipment. Unless otherwise specified, key numbers are shown in figure 6.

WARNING

Perform the steps in the WARNING at the beginning of the Maintenance section.

Note

For an actuator with an H mounting adaptation and a 22.2 through 38.1 mm (7/8 through 1-1/2 inch) output shaft, find dimensions and center of gravity information in figures 2 and 3, and approximate weights in table 4. This information is required for proper fabrication of the user-provided bracket and coupling.

1. For an actuator with an H mounting adaptation, attach an appropriate mounting bracket (not provided) to the mounting plate (key 23) with the cap screws (key 87). See figure 2 for mounting dimensions on the mounting plate.
2. Consult figure 4 for available mounting styles and positions. The actuator is normally positioned vertically with the valve or other equipment in a horizontal pipeline.

Note

If the milled flats or the coupling on the end of the actuator output shaft (key 94) are oriented such that the output shaft cannot accommodate the operated equipment shaft, refer to the Changing Positions portion of the Changing Actuator Mounting section. This procedure describes how the output shaft can be repositioned to accommodate the operated equipment shaft.

3. If using an actuator with a J mounting adaptation, note that the valve shaft coupling (key 97) is furnished with two keyways lettered A & B as shown in figure 5 (letters C and D on the coupling are not used and can be disregarded).

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Align the appropriate keyway with the keyway in the operated equipment shaft. If using a Fisher butterfly valve, align the appropriate keyway on the coupling with the valve shaft keyway indicated in table 5. Then, install the woodruff key (key 98) in the shaft keyseat, and slide the coupling onto the shaft. It is helpful to apply a light coat of grease to the inside of the coupling before sliding it onto the shaft.

4. For an actuator with a J mounting adaptation, secure the mounting yoke (key 23) to the valve with the cap screws (key 87, not shown). For 31.8 and 38.1 mm (1-1/4 and 1-1/2 inch) valve shafts, place two spacers (key 99, not shown) between the mounting yoke and valve or other equipment during this step.
5. For an actuator with an H mounting adaptation and a 22.2 through 38.1 mm (7/8 through 1-1/2 inch) output shaft, slide the actuator (with the user-provided mounting bracket attached) into the user-provided coupling on the operated shaft. Then, secure the actuator to the operated equipment in the desired mounting position with appropriate fasteners, such as mounting cap screws. See figure 2 for output shaft dimensions.
6. For an actuator with an H mounting adaptation and a 50.8 mm (2-inch) output shaft (key 94, figure 7), note that the valve shaft coupling (key 97, figure 7) is furnished with two keyways lettered A and B as shown in figure 5 (letters C and D on the coupling are not used and can be disregarded). Align the appropriate keyway with the keyway in the operated equipment shaft. Then, install the woodruff key (key 98, not shown in figure 7) in the shaft keyseat, and slide the coupling onto the shaft using the appropriate coupling keyway (see table 5 and figure 5). It is helpful to apply a light coat of grease to the inside of the coupling before sliding it onto the shaft. Secure the actuator (user-provided mounting bracket) to the operated equipment in the desired mounting position with appropriate fasteners, such as mounting cap screws.
7. If the 1061 actuator is equipped with an auxiliary handwheel actuator, make certain that a cylinder bypass valve (key 68, figure 8) is used to equalize cylinder pressure during handwheel operation. Operating the handwheel actuator by itself against the force of differential cylinder pressures is difficult or even impossible. An installation of a bypass valve is shown in figure 8.

CAUTION

Attempting to pneumatically operate the 1061 actuator while an auxiliary manual actuator is engaged could damage the actuator shaft. Be certain the manual actuator is disengaged before pneumatically operating the 1061 actuator.

8. Follow the instructions given in the Adjustment section before proceeding to the loading connection portion of this section.

Table 5. Keyway Alignment Information⁽¹⁾

DESIRED ACTUATOR ACTION	DESIRED SHAFT ROTATION, DEGREES	ACTUATOR MOUNTING POSITION	COUPLING KEYWAY TO USE ⁽³⁾	VALVE SHAFT KEYWAY TO USE FOR FISHTAIL™ DISK VALVES ⁽²⁾ (SEE FIGURE 6)			
				Clockwise to Close Valve Action ⁽⁴⁾		Counterclockwise to Close Valve Action ⁽⁴⁾	
				Flow Left to Right ⁽⁴⁾	Flow Right to Left ⁽⁴⁾	Flow Left to Right ⁽⁴⁾	Flow Right to Left ⁽⁴⁾
Push Down to Open (PDTO)	60 or 90	1	B	Nose	Tail	Tail	Nose
		2	A	Tail	Nose	Nose	Tail
		3	B	Tail	Nose	Nose	Tail
		4	A	Nose	Tail	Tail	Nose
Push Down to Close (PDTC)	60 ⁽⁵⁾ or 90	1	A	Tail	Nose	Tail	Nose
		2	B	Tail	Nose	Tail	Nose
		3	A	Nose	Tail	Nose	Tail
		4	B	Nose	Tail	Nose	Tail

1. For actuators with H mounting and 50.8 mm (2-inch) output shafts, and for actuators with J mounting.

2. For conventional disk valves, use either valve shaft keyway.

3. See figure 6 for reference coupling orientation to use with this table.

4. When viewed from actuator side of valve.

5. For 60-degree rotation with PDTC action, the coupling and actuator output shaft assembly will be offset 30 degrees clockwise (for actuator housing construction style B) or counterclockwise (for actuator housing construction style A) in the lever when viewed from the splined end of the actuator shaft. 30 degrees is one spline tooth for 19.1 through 38.1 mm (3/8 through 1-1/2 inch) valve shafts.

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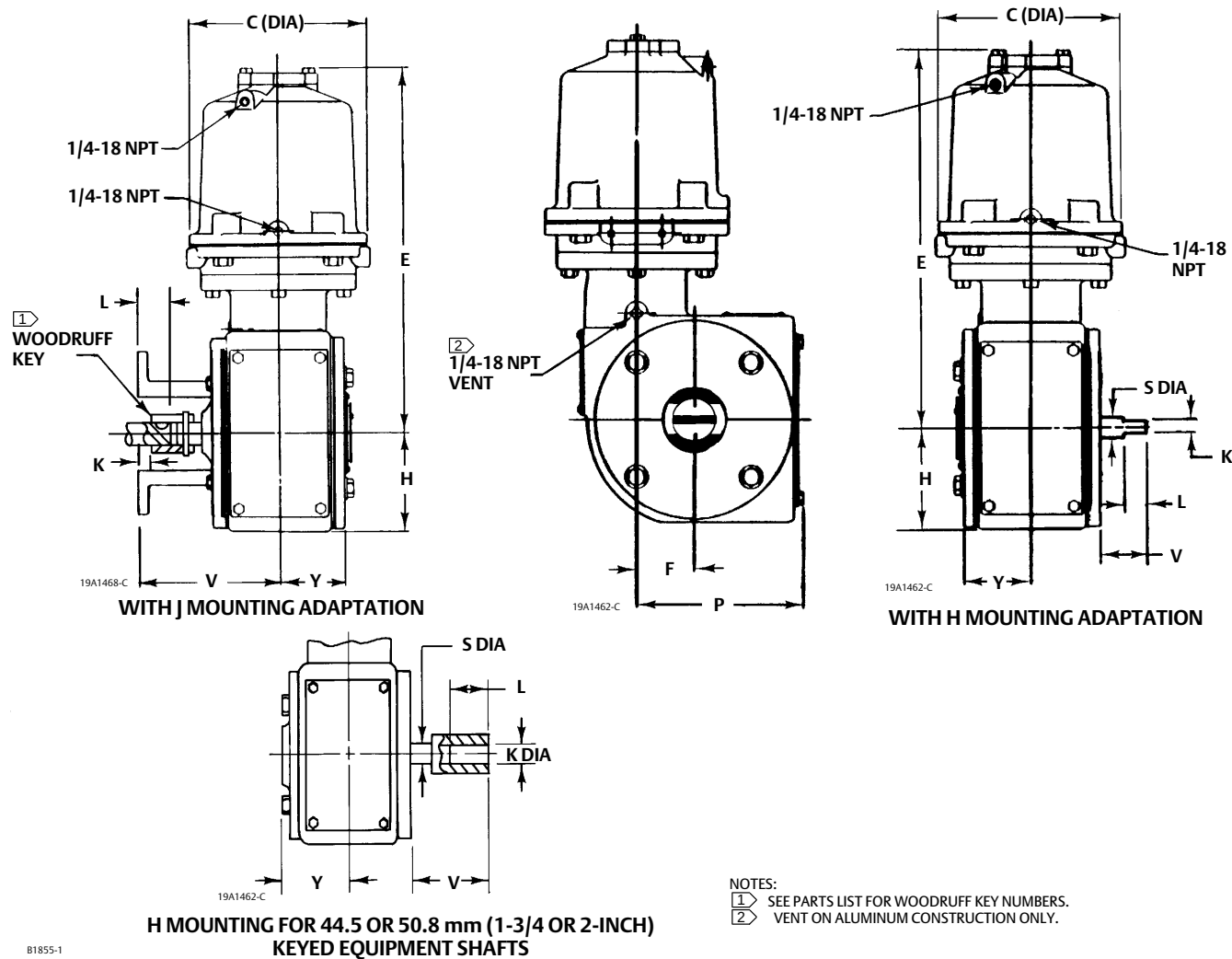
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Figure 2. Fisher 1061 Mounting Dimensions

H OR J MOUNTING						
ACTUATOR SIZE	C	E	F	H	P	Y
mm						
30	171	378	54	114	175	73
40	206	425	64	121	186	73
60	267	406	64	121	186	76
68	324	483	64	121	186	76
Inches						
30	6.75	14.88	2.12	4.50	6.88	2.88
40	8.12	16.75	2.50	4.75	7.31	2.88
60	10.50	16.00	2.50	4.75	7.31	3.00
68	12.75	19.00	2.50	4.75	7.31	3.00



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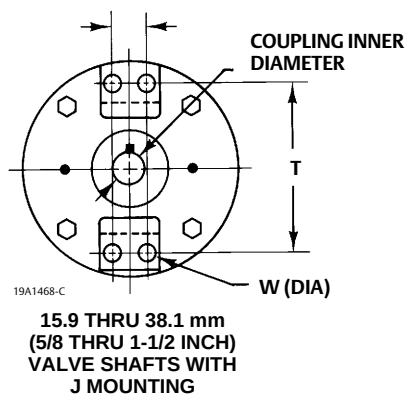
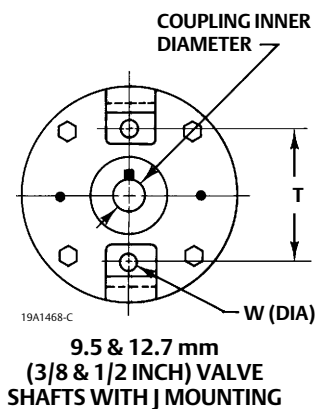
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Figure 2. Fisher 1061 Mounting Dimensions (Continued)

J MOUNTING ⁽¹⁾								
Actuator Size	S (Valve Shaft Diameter)	Coupling Inner Diameter	V	L	K	T	U	W
mm								
30	9.5	$\frac{9.53}{9.58}$	136.7	33.3	15.7	117.3	---	11.2
	12.7	$\frac{12.70}{12.75}$	136.7	33.3	15.7	117.3	---	11.2
	15.9	$\frac{15.90}{15.95}$	160.3	42.9	25.4	146.1	31.8	11.2
30, 40, 60, & 68	19.1	$\frac{19.05}{19.10}$	160.3	42.9	20.6	146.1	31.8	11.2
	25.4	$\frac{25.43}{25.48}$	160.3	42.9	17.5	146.1	31.8	11.2
40, 60, & 68	31.8	$\frac{31.75}{31.80}$	147.6	63.5	30.2	209.6	50.8	17.5
	38.1	$\frac{38.13}{38.18}$	147.6	63.5	23.9	209.6	50.8	17.5
Inches								
30	3/8	$\frac{0.375}{0.377}$	5.38	1.31	0.62	4.62	---	0.44
	1/2	$\frac{0.500}{0.502}$	5.38	1.31	0.62	4.62	---	0.44
	5/8	$\frac{0.626}{0.628}$	6.31	1.69	1.00	5.75	1.25	0.44
30, 40, 60, & 68	3/4	$\frac{0.750}{0.752}$	6.31	1.69	0.81	5.75	1.25	0.44
	1	$\frac{1.0010}{1.0025}$	6.31	1.69	0.69	5.75	1.25	0.44
40, 60, & 68	1-1/4	$\frac{1.250}{1.252}$	5.81	2.50	1.19	8.25	2.00	0.69
	1-1/2	$\frac{1.501}{1.503}$	5.81	2.50	0.94	8.25	2.00	0.69

1. Tolerance for the coupling inner diameter is indicated by showing maximum and minimum dimensions.



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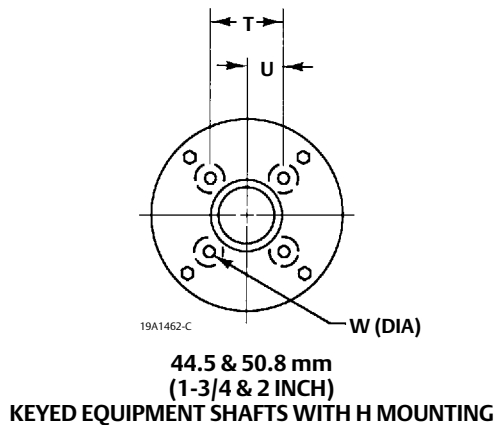
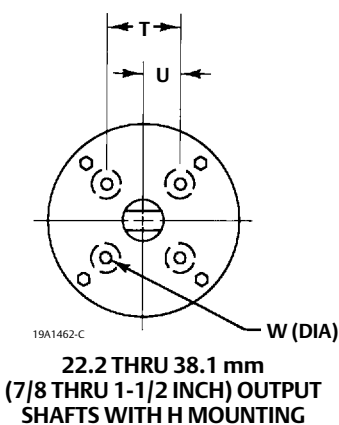
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Figure 2. Fisher 1061 Mounting Dimensions (Continued)

H MOUNTING ⁽¹⁾							
Actuator Size	S (Actuator Output Shaft Diameter)	V	L	K	T	U	W
mm							
30	22.2	26.2	19.1	$\frac{15.75}{15.62}$	57.2	28.4	5/16-18 UNC
30, 40, 60, & 68	28.6	26.2	19.1	$\frac{22.10}{21.97}$	76.2	38.1	3/8-16 UNC
	38.1	38.1	28.4	$\frac{28.45}{28.32}$	88.9	44.5	1/2-13 UNC
40, 60, & 68	44.5 x 50.8	122.9	69.9	$\frac{44.45}{44.50}$	88.9	44.5	1/2-13 UNC
	50.8	122.9	69.9	$\frac{50.83}{50.90}$	88.9	44.5	1/2-13 UNC
Inches							
30	7/8	1.03	0.75	$\frac{0.620}{0.615}$	2.25	1.12	5/16-18 UNC
30, 40, 60, & 68	1-1/8	1.03	0.75	$\frac{0.870}{0.865}$	3.00	1.50	3/8-16 UNC
	1-1/2	1.50	1.12	$\frac{1.120}{1.115}$	3.50	1.75	1/2-13 UNC
40, 60, & 68	1-3/4 X 2	4.84	2.75	$\frac{1.750}{1.752}$	3.50	1.75	1/2-13 UNC
	2	4.84	2.75	$\frac{2.001}{2.004}$	3.50	1.75	1/2-13 UNC

1. Tolerance for the K dimension is indicated by showing maximum and minimum dimensions.



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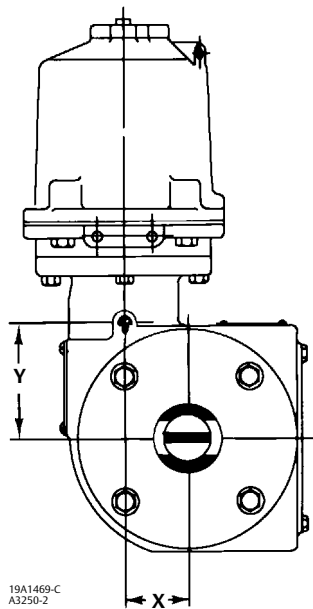
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Figure 3. Center of Gravity Dimensions

ACTUATOR SIZE	CENTER OF GRAVITY DIMENSIONS			
	X		Y	
	mm	Inches	mm	Inches
30	54	2.12	137	5.4
40	64	2.50	112	4.4
60	64	2.50	91	3.6
68	64	2.50	155	6.1

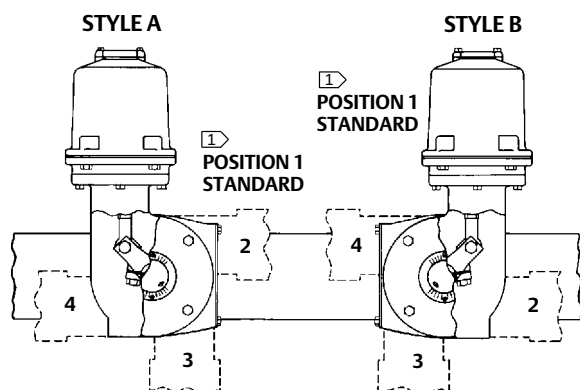


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Figure 4. Actuator Housing Construction Styles and Mounting Positions

DESIRED ACTION OF		HOUSING CONSTRUCTION TO SPECIFY
Actuator	Valve Body or Other Equipment	
Push Down to Open (PDTO)	Clockwise to Close ⁽¹⁾	Style A
	Counterclockwise to Close ⁽¹⁾	Style B
Push Down to Close (PDTC)	Clockwise to Close ⁽¹⁾	Style B
	Counterclockwise to Close ⁽¹⁾	Style A

1. When viewed from actuator side of valve or other equipment.

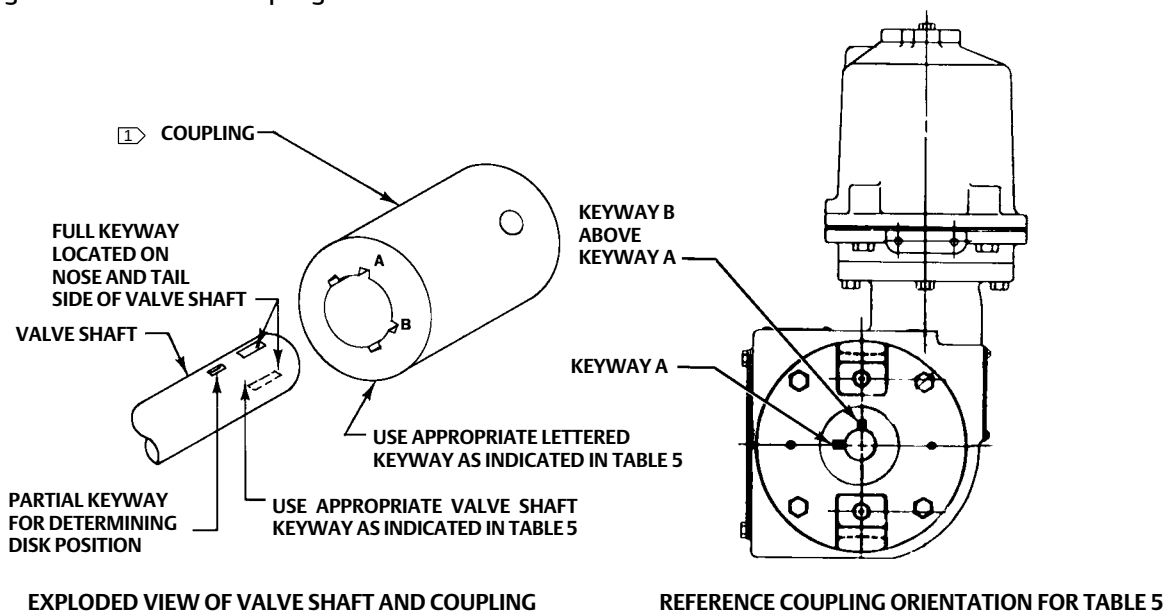


NOTE:

1 DOTTED LINES INDICATE ALTERNATE MOUNTING POSITIONS 2, 3, AND 4.

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Figure 5. Valve Shaft Coupling



NOTE:

1 FOR USE WITH J MOUNTING ADAPTATION [UP TO 38.1 mm (1-1/2 INCH) KEYED SHAFT DIAMETERS] AND H MOUNTING ADAPTATION [FOR 44.5 AND 50.8 mm (1-3/4 AND 2 INCH) KEYED SHAFT DIAMETERS].

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Pressure Connections

1. If a positioner is used, the pressure connections to the actuator are normally made at the factory. Actuators without positioners should have either a 4-way solenoid valve or a switching valve connected to the pressure connections located at the top and bottom of the actuator cylinder.
2. Connect either pipe or tubing between the actuator pressure connections and the positioner or automatic controller. Keep the length of pipe or tubing as short as possible to avoid transmission lag in the control signal.

Table 6. Wrench Sizes Required for Actuator Adjustment, Inches

Actuator Size	Turnbuckle (Key 70)	Hex Nut (Key 11)	Hex Nut (Key 71)
30	1-1/8	3/4	1-1/8
40 & 60	1-5/16	1-1/8	1-5/16
68	1-7/8	1-1/8	1-7/8

3. When the actuator is completely installed and connected to the instrument, check for correct action (air-to-open or air-to-close) to match the controlling instrument. For successful operation, the actuator stem and operating shaft must move freely in response to the loading pressure change on the piston.

Adjustment

WARNING

Perform the steps in the **WARNING** at the beginning of the Maintenance section.

The only adjustment on the 1061 actuator is to make sure that the valve or other operated equipment is correctly closed when the actuator piston is against the travel stop. For accurate adjustment, the valve or other operated equipment must be removed from the pipeline.

If the actuator is equipped with an auxiliary manual handwheel actuator, make sure that the manual actuator is disengaged from the operated shaft and that the bypass valve (key 68, figure 8) is closed before performing adjustment procedures.

Perform the following steps to adjust the actuator turnbuckle. A regulated air supply will be required to stroke the actuator during this procedure. Also, when performing adjustment, refer to table 6 for the sizes of open-end wrenches required to loosen and tighten the hex nuts and turnbuckle. Key numbers referenced in this procedure are shown in figure 6.

1. Remove the access plate (key 72). Also remove the machine screws (key 73) if present.

Note

The cover (key 34) supports the outer end of the output shaft and should not be removed during actuator adjustment.

2. Stroke the actuator until the lower hex nut (key 11) can be reached through the access opening. Loosen the hex nut.
3. Stroke the actuator until the left-hand threaded upper hex nut (key 71) can be reached through the access opening. Loosen the hex nut.

4. Perform one of the following:
 - a. For push-down-to-close action (extending piston rod closes operated equipment)-- Slowly stroke the actuator to the down travel stop. Consult the appropriate instruction manual for determining the closed position of the valve or other operated equipment. Adjust the turnbuckle (key 70) until the closed position is reached. Lock this adjustment with the left-hand threaded hex nut (key 71). Stroke the actuator to the up travel stop, and tighten the lower hex nut (key 11). Tighten each hex nut to the torque value listed in table 7.
 - b. For push-down-to-open action (extending piston rod opens operated equipment)-- Stroke the actuator to the up travel stop. Consult the appropriate instruction manual for determining the closed position of the valve or other operated equipment. Check the valve position with respect to its properly closed position. Stroke the actuator until the turnbuckle (key 70) can be reached through the access opening. Adjust the linkage. Stroke the actuator to the up travel stop again, and check the new adjustment. Continue this procedure until the operated equipment is in the closed position when the actuator piston is resting against the up travel stop. Tighten the lower hex nut (key 11). Stroke the actuator down, and tighten the left-hand threaded hex nut (key 71). Tighten each hex nut to the torque value listed in table 7.
5. Replace the access plate (key 72) and install the machine screws (key 73) if used.

Note

Skip the following step if an auxiliary handwheel actuator is mounted on the 1061 actuator.

6. Loosen the self-tapping screws (key 39), and adjust the travel indicator (key 38). Retighten the self-tapping screws.

CAUTION

If using a handwheel actuator, the splines of the 1061 actuator shaft could be damaged if excessive torque is applied to the shaft by the manual actuator while the 1061 actuator is stopped at either end of travel. To protect the shaft, perform the travel stop adjustment procedure found in the separate handwheel actuator instruction manual.

Principle of Operation

Piston movement is accomplished by loading air pressure on one side of the piston, and unloading air pressure from the other side of the piston. If no positioner is used, a loading device, such as a 4-way switching valve, must be provided. Such a device is not furnished as part of the actuator.

Consult the separate positioner instruction manual for the 1061 actuator principle of operation with positioner.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given below for disassembly and replacement of parts.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Disassembly

The following procedure describes how the actuator can be disassembled for inspection and replacement of parts. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job. Key numbers referenced in this procedure are shown in figure 6 unless otherwise specified.

1. Bypass the valve or other operated equipment. Relieve all actuator loading pressure, and remove the tubing or pipe from the top of the actuator.
2. Remove the positioner, if one is used.
3. Mark the orientation of the travel indicator (key 38) with respect to the travel indicator scale (key 36). Then, unscrew the cap screws and washers (keys 35 and 76), and remove the cover (key 34). If a manual handwheel actuator is used, it will be removed with the cover.
4. Remove the retaining ring (key 31), and slide the hub (key 30) from the cover (key 34) or, if a manual handwheel actuator is used, remove the cover from the manual handwheel actuator connector. If disassembly of the manual handwheel actuator is required, refer to the separate manual actuator instruction manual for instructions.
5. Check the condition of the bearing (key 32). If replacement of the bearing is necessary, the travel indicator scale (key 36) must first be removed by removing the self-tapping screws (key 37). Mark the orientation of the travel indicator scale on the cover before removing it.

CAUTION

Do not use a hammer or similar tool to drive the lever (key 28) off the output shaft. Driving the lever could damage operated equipment. For valves, driving the lever could move the valve disk and bearings away from the centered position causing subsequent damage to valve parts.

If necessary, use a wheel puller to remove the lever. It is permissible to tap the wheel puller screw lightly to loosen the lever, but hitting the screw with excessive force could damage the operated equipment.

6. For an actuator with an H mounting adaptation and a 22.2 through 38.1 mm (7/8 through 1-1/2 inch) output shaft, unscrew the cap screws (key 87) and remove the actuator from the operated equipment. Mark the orientation of the lever (key 28) with respect to the output shaft (key 94). This marking is used during reassembly to allow for proper lever/output shaft positioning. Then, loosen the cap screw (key 29) so that the output shaft is free to slide off the lever. With the lever and output shaft properly marked, unscrew the cap screws (key 24) and remove the

mounting plate (key 23) and output shaft (key 94) assembly from the actuator housing (key 21). If necessary, remove the retaining ring (key 95) and separate the output shaft from the mounting plate. For 50.8 mm (2-inch) output shafts, refer to step 7 for this procedure.

7. For an actuator with either a J mounting adaptation (see figure 6), or an H mounting adaptation with a 50.8mm (2-inch) output shaft (see figure 7), proceed as follows:

Remove the cap screws (key 87, not shown in figure 6) and remove the actuator from the operated equipment. For an actuator with J mounting and a 31.8 or 38.1 mm (1-1/4 or 1-1/2 inch) valve shaft diameter, two spacers (key 99, not shown in figure 6) are also removed with the cap screws (key 87). When separating the output shaft (key 94) and coupling (key 97) from the operated shaft, remember to remove the woodruff key (key 98, not shown in figure 7) from the operated shaft keyway. Mark the orientation of the lever (key 28, figure 6) with respect to the output shaft (key 94). This marking is used during reassembly to allow for proper lever/output shaft positioning. Then, loosen the cap screw (key 29, figure 6) so that the output shaft is free to slide off the lever. With the lever and output shaft properly marked, unscrew the cap screws (key 24) and remove either the mounting yoke (key 23, figure 6 for J mounting) or the mounting plate (key 23, figure 7 for H mounting) plus the attached output shaft (key 94) from the actuator housing (key 21). If necessary, remove the retaining ring (key 95) and slide the mounting yoke or mounting plate off the output shaft.

8. Check the bearing (key 81) in the mounting yoke or the mounting plate (key 23). Press out and replace the bearing if necessary.
9. Heat the hex nut (key 14) to 177°C (350°F) long enough for the thread-locking adhesive (medium strength (key 92) to lose its holding strength. Then, remove the cap screw and hex nut (keys 13 and 14), and remove the lever (key 28) from the housing.
10. Remove the rod end bearing and the hex nut (keys 12 and 11), and then the turnbuckle and the hex nut (keys 70 and 71).
11. For size 30, 40, and 68 actuators only, unscrew the cap screws (key 6) and remove the cylinder cap (key 4). Inspect and, if necessary, replace the O-ring (key 5).
12. Remove the cap screws (key 3) and slide the cylinder assembly (key 1) from the cylinder flange (key 2).
13. Pull the piston (key 7) and the piston rod (key 10) from the cylinder assembly.
14. Check and, if necessary, replace the O-rings (keys 8 and 16).
15. To separate the piston (key 7) from the piston rod (key 10), unscrew the cap screw to hex nut (key 9) and remove the washer (key 77).
16. Unscrew the cap screws (key 22) and remove the cylinder flange (key 2), the sliding seal (key 19), and the seal support cylinder (key 20). For actuators with 60-degree rotation, a travel stop (key 15) will also be removed with these parts.
17. Check and, if necessary, replace the O-rings (keys 17 and 18) and the thrust washer (key 74).

Assembly

1. Apply lithium grease (key 93) to the surfaces of the sliding seal (key 19). Then, install the seal support cylinder (key 20), the thrust washer (key 74), the sliding seal, and the cylinder flange (key 2) and secure these parts with the cap screws (key 22). Tighten the cap screws to the torque value listed in table 7. For actuators with 60-degree rotation, a travel stop (key 15) will be threaded into the cylinder flange.
2. Apply lithium grease (key 93) to the cylindrical surface of the piston rod (key 10) and apply anti-seize sealant (key 91) to the tapered end of the piston rod. Attach the piston and washer (keys 7 and 77) to the piston rod, and secure them with the cap screw or hex nut (key 9). Tighten the cap screw or hex nut to the torque value listed in table 7.
3. Insert the piston and piston rod assembly down through the sliding seal (key 19). Attach the hex nut (key 71), the turnbuckle (key 70), the hex nut (key 11), and the rod end bearing (key 12) to the piston rod assembly. Tighten both hex nuts to the torque value listed in table 7.
4. Apply lithium grease (key 93) to the inside wall of the cylinder, and then attach the cylinder assembly (key 1) to the cylinder flange with the cap screws (key 3). For size 30, 40, and 68 actuators only, replace the cylinder cap (key 4),

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and secure it to the cylinder assembly with the cap screws (key 6). Tighten all cap screws to the torque value listed in table 7.

5. If the bearing (key 81) was removed, press in the new bearing. The end of the bearing should be flush with the outside of the mounting yoke or mounting plate (key 23).
6. For an actuator with an H mounting adaptation and a 22.2 through 38.1 mm (7/8 through 1-1/2 inch) output shaft, install the output shaft (key 94) through the mounting plate (key 23) and secure it with the retaining ring (key 95). Then, attach the mounting plate and output shaft assembly to the actuator housing (key 21) with the cap screws (key 24). Tighten the cap screws to the appropriate torque value listed in table 7.
7. For an actuator with an H mounting adaptation and a 50.8mm (2-inch) output shaft, refer to figure 7. Install the output shaft (key 94) with attached coupling (key 97) through the mounting plate (key 23) and secure it with the retaining ring (key 95). Attach the mounting plate and output shaft assembly to the actuator housing with the cap screws (key 24). Tighten the cap screws to the appropriate torque value listed in table 7.

Table 7. Bolting Torques

KEY NUMBER	SIZE 30		SIZE 40 & 60		SIZE 68	
	N•m	Lbf•ft	N•m	Lbf•ft	N•m	Lbf•ft
3	102	75	102	75	102	75
6	14	10	14	10	14	10
9	61	45	136	100	248	257
11	34	25	102	75	102	75
13	81	60	271	200	271	200
22	23	17	68	50	68	50
24	34	25	81	60	81	60
29	81	60	271	200	271	200
35	34	25	81	60	81	60
41	14	10	14	10	14	10
71	102	75	163	120	253	260

8. For an actuator with a J mounting adaptation, refer to figure 6. Install the output shaft (key 94) with attached coupling (key 97) through the mounting yoke (key 23) and secure it with the retaining ring (key 95). Attach the mounting yoke and output shaft assembly to the actuator housing (key 21) with the cap screws (key 24). Tighten the cap screws to the appropriate torque value listed in table 7.
9. Apply lithium grease (key 93) to the output shaft splines. Then, align the lever (key 28) and output shaft so that the marking that was made in step 6 or 7 of the disassembly procedure is oriented correctly. Slide the lever into place. When installing the lever, align the bolt holes in the lever as close as possible with the hole in the rod end bearing (key 12). Temporarily rotate the lever and output shaft until the rod end bearing no longer interferes with further installation of the lever. Then, slide the lever as far as it can go onto the output shaft.
10. Clamp the lever to the output shaft with the cap screw (key 29). Tighten the cap screw to the torque value listed in table 7.
11. Rotate the lever to align with the rod end bearing (key 12). This connection can be aided by carefully stroking the actuator with a regulated air source.
12. Apply thread-locking adhesive (medium strength) (key 92) to the threads of the cap screw (key 13). Then, connect the lever and the rod end bearing with the cap screw and hex nut (keys 13 and 14). Tighten the cap screw to the torque value listed in table 7.
13. If a positioner is used, consult the separate positioner instruction manual for proper installation.
14. Install the hub (key 30) and the bearing (key 32) into the cover (key 34), and secure them with the retaining ring (key 31).
15. Install the travel indicator scale (key 36) so that the markings on the scale and cover that were made in step 5 of the disassembly procedure are oriented correctly. Secure the travel indicator scale to the cover with the self-tapping screws (key 37). Then install the travel indicator (key 38), and secure it with the self-tapping screws (key 39).
16. Note the position of the valve or other operated equipment and the direction of rotation.
 - a. If no handwheel actuator is used, position the travel indicator (key 38) so that the markings on the travel indicator and travel indicator scale that were made in step 3 of the disassembly procedure are oriented correctly.

Then, replace the cover (key 34) and secure it with the cap screws and washers (key 35 and 76). If the holes in the cover and housing do not align, temporarily loosen the cap screws (key 24) and shift the housing slightly. Tighten the cap screws to the torque value listed in table 7.

- b. If the actuator is equipped with a manual handwheel actuator, refer to the separate instruction manual for mounting instructions.

17. Follow the instructions in the Actuator Mounting portion of the Installation section for correct actuator mounting and adjustment. Remember to replace the access plate (key 72) when performing these procedures.

Changing Actuator Mounting

The actuator is normally positioned vertically in a horizontal pipeline. However, there are two possible mounting styles and four possible positions for each style (see figure 4). Key numbers referenced in the following procedures are shown in figure 6 unless otherwise specified.

⚠ WARNING

Perform the steps in the WARNING at the beginning of the Maintenance section.

Use the following procedures along with figure 6 for key number references to convert from style A to style B or vice-versa or to change the mounting position.

Changing Styles

1. Unscrew the cap screws and washers (key 35 and 76), and remove the cover (key 34). If an optional manual handwheel actuator is used, it will be removed with the cover.
2. Heat the hex nut (key 14) to 177°C (350°F) long enough for the thread locking adhesive (medium strength) (key 92) to lose its holding strength. Then, remove the cap screw and hex nut (keys 13 and 14).
3. Loosen the cap screw (key 29).

CAUTION

Do not use a hammer or similar tool to drive the lever (key 28) off the output shaft. Driving the lever could damage operated equipment. For valves, driving the lever could move the valve disk and bearings away from the centered position causing subsequent damage to valve parts.

If necessary, use a wheel puller to remove the lever. It is permissible to tap the wheel puller screw lightly to loosen the lever, but hitting the screw with excessive force could damage the operated equipment.

4. Mark the side of the lever (key 28) that is nearest to the end of the output shaft (key 94). This marking is used during reassembly to determine which side of the lever should be inserted into the actuator housing first. When the lever is marked, remove the lever.
5. For an actuator with a J mounting adaptation,
 - a. Unscrew the cap screws (key 24), and remove the actuator housing (key 21) from the mounting yoke (key 23).
 - b. Rotate the actuator housing 180 degrees, maintaining the appropriate position (1, 2, 3, or 4), and place the actuator onto the mounting yoke (key 23).

- c. Secure the actuator housing to the mounting yoke with the cap screws (key 24). Tighten the cap screws to the torque value listed in table 7.
6. For an actuator with an H mounting adaptation,
 - a. Unscrew the cap screws (key 87) and remove the actuator assembly from its mounting bracket.
 - b. Unscrew the cap screws (key 24) and remove the mounting plate (key 23) and output shaft (key 94) assembly from the actuator housing. Remount the assembly on the opposite side of the actuator, and secure it to the housing with the cap screws (key 24). Tighten the cap screws to the torque value listed in table 7.
 - c. Rotate the actuator housing 180 degrees, maintaining the appropriate position (1, 2, 3, or 4) and secure the actuator housing to the mounting bracket with the cap screws (key 87). Tighten the cap screws to the torque value listed in table 7.
7. Install the lever (key 28) as follows:
 - a. For push-down-to-open action, rotate the operated equipment to the fully closed position.
 - b. For push-down-to-close action, rotate the operated equipment to the fully open position.
 - c. With the operated equipment oriented correctly, slide the lever onto the output shaft (key 94) with the end marked in step 4 inserted first. When installing the lever, align the bolt holes in the lever as close as possible with the hole in the rod end bearing (key 12).
 - d. Temporarily rotate the lever and output shaft until the rod end bearing no longer interferes with further installation of the lever. Then, slide the lever as far as it can go onto the output shaft. Clamp the lever to the output shaft with the cap screw (key 29). Tighten the cap screw to the torque value listed in table 7.
 - e. Rotate the lever and output shaft back to the original position (i.e., operated equipment fully closed for push-down-to-open action or operated equipment fully open for push-down-to-close action). Then, adjust the rod end bearing so that it can be attached to the lever.
8. Apply thread-locking adhesive (medium strength) (key 92) to the threads of the cap screw (key 13).
9. Connect the lever (key 28) and the rod end bearing (key 12) with the cap screw and hex nut (keys 13 and 14). This connection can be aided by stroking the actuator from its up travel stop with a regulated air source. Tighten the cap screw to the torque value listed in table 7.
10. Note the position of the valve or other operated equipment and direction of rotation.
 - a. Position the travel indicator (key 38) accordingly. Replace the cover (key 34), and secure it with the cap screws and washers (keys 35 and 76). If the holes in the cover and housing (key 21) do not align, use a regulated air source to move the actuator slightly off the up travel stop. If hole alignment cannot be obtained in this manner, temporarily loosen the cap screws (key 24), and shift the housing slightly. Do not stroke the actuator while the cover is off. Tighten both sets of cap screws to the torque values listed in table 7.
 - b. If a manual handwheel actuator is used, refer to the separate instruction manual for mounting instructions.
11. Follow the instructions in the Adjustment section for turnbuckle adjustment.

Changing Positions

1. Unscrew the cap screws and washers (keys 35 and 76), and remove the cover (key 34). If an optional manual handwheel actuator is used, it will be removed with the cover.
2. Mark the orientation of the lever (key 28) with respect to the output shaft (key 94). This marking is used during reassembly to allow for proper lever/output shaft positioning. When the lever and output shaft are properly marked, heat the hex nut (key 14) to 177°C (350°F) long enough for the thread locking adhesive (medium strength) (key 92) to lose its holding strength. Then, remove the cap screw and hex nut (keys 13 and 14).

CAUTION

Do not use a hammer or similar tool to drive the lever (key 28) off the output shaft. Driving the lever could damage operated equipment. For valves, driving the lever could move the valve disk and bearings away from the centered position causing subsequent damage to valve parts.

If necessary, use a wheel puller to remove the lever. It is permissible to tap the wheel puller screw lightly to loosen the lever, but hitting the screw with excessive force could damage the operated equipment.

3. Loosen the cap screw (key 29) and remove the lever (key 28) from the output shaft (key 94).
4. For an actuator with a J mounting adaptation,
 - a. Unscrew the cap screws (key 24), and remove the actuator housing (key 21) from the mounting yoke (key 23).
 - b. Rotate the actuator housing to the new position (1, 2, 3, or 4).
 - c. Secure the actuator housing to the mounting yoke with the cap screws (key 24). Tighten the cap screws to the torque value listed in table 7.
5. For an actuator with an H mounting adaptation,
 - a. Unscrew the cap screws (key 87) and loosen the actuator assembly from its mounting bracket.
 - b. Rotate the actuator housing to the new position (1, 2, 3, or 4).
 - c. Secure the actuator housing to the mounting bracket with the cap screws (key 87). Tighten the cap screws to the torque value listed in table 7.
6. Referring to the alignment marks that were made in step 2, install the lever (key 28) onto the output shaft (key 94) as follows:
 - a. If the new actuator position is 90 degrees clockwise from the previous actuator position, install the lever so that its orientation mark is located 90 degrees clockwise from the mark on the output shaft.
 - b. If the new actuator position is 90 degrees or 180 degrees counterclockwise from the previous position, install the lever so that its orientation mark is located either 90 degrees (for 90 degrees) or 180 degrees (for 180 degrees) counterclockwise (respectively) from the mark on the output shaft.
 - c. Slide the lever onto the output shaft with the bolt holes in the lever aligned as closely as possible with the hole in the rod end bearing (key 12). Then, temporarily rotate the lever and output shaft until the rod end bearing no longer interferes with further installation of the lever, and slide the lever as far as it can go onto the output shaft. Clamp the lever to the output shaft with the cap screw (key 29). Tighten the cap screw to the torque value listed in table 7.
 - d. Rotate the lever and output shaft back to the original position, and then adjust the rod end bearing so that it can be attached to the lever.
7. Apply thread-locking adhesive (medium strength) (key 92) to the threads of the cap screw (key 13).
8. Connect the lever (key 28) and the rod end bearing (key 12) with the cap screw and hex nut (keys 13 and 14). This connection can be aided by stroking the actuator from its up travel stop with a regulated air source. Tighten the cap screw to the torque value listed in table 7.
9. Note the position of the valve or other operated equipment and direction of rotation.
 - a. Position the travel indicator (key 38) accordingly. Replace the cover (key 34), and secure it with the cap screws and washers (keys 35 and 76). If the holes in the cover and housing (key 21) do not align, use a regulated air

source to move the actuator slightly off the up travel stop. If hole alignment cannot be obtained in this manner, temporarily loosen the cap screws (key 24), and shift the housing slightly. Do not stroke the actuator while the cover is off. Then, tighten both sets of cap screws to the torque values listed in table 7.

b. If a manual handwheel actuator is used, refer to the separate instruction manual for mounting instructions.

10. Follow the instructions in the Adjustment section for turnbuckle adjustment.

Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, refer to the serial number found on the actuator nameplate (key 42, figure 6).

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Repair Kits

Key	Description	Part Number
	Kits include keys 5, 8, 16, 17, 18, and 56.	
	Size 30	R1061X00302
	Size 40	R1061X00402
	Size 60	R1061X00602
	Size 68	R1061X00682

Parts List

Note

Contact your Emerson sales office or Local Business Partner for Part Ordering information.

Key	Description
-----	-------------

Actuator

- | | |
|-------|--|
| 1 | Cylinder Assembly, aluminum/stainless steel |
| 2 | Cylinder Flange, aluminum |
| 3 | Cap Screw, pl steel |
| 4 | Cylinder Cap, aluminum (for sizes 30, 40, & 68 only) |
| 5*(1) | O-Ring, nitrile (for sizes 30, 40, & 68 only) |

Key	Description
6	Cap Screw, pl steel (2 req'd) (for sizes 30, 40, & 68 only)
7	Piston, aluminum
8*(1)	O-Ring, nitrile
9	Cap Screw, pl steel
9	Hex Nut, pl steel
	Size 68 only
10	Piston Rod, pl S41600 (416 SST), heat treated
11	Hex Nut, pl steel
12	Rod End Bearing, pl steel/stainless steel
13	Cap Screw, pl steel
14	Hex Nut, pl steel
15	Travel Stop, steel (for 60-degree rotation only)
16*(1)	O-Ring, nitrile
17*(1)	O-Ring, nitrile
18*(1)	O-Ring, nitrile
19	Sliding Seal, alum/PTFE anodize
20	Seal Support Cylinder, aluminum
21	Housing, cast iron
22	Cap Screw, pl steel
23	Mounting Plate, steel
23	Mounting Yoke, cast iron
24	Cap Screw, pl steel (4 req'd)
28	Lever, ductile iron
29	Cap Screw, pl steel
30	Hub, S41600 (416 SST) (not req'd w/handwheel)
31	Retaining Ring, pl steel (not req'd w/handwheel)
32*	Bearing, fiberglass
34	Cover
35	Cap Screw, pl steel W/o handwheel

*Recommended spare parts
1. Included in repair kit.

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Key	Description
-----	-------------

36	Travel Indicator Scale, stainless steel (not req'd w/handwheel)
37	Self Tapping Screw, pl steel (2 req'd)
38	Travel Indicator, stainless steel (not req'd w/handwheel)
39	Self-Tapping Screw, pl steel (2 req'd) (not req'd w/ handwheel)
39	Cap Screw, pl steel (2 req'd)
40	Plate, steel (not req'd w/ positioner)
41	Cap Screw, steel pl (4 req'd) (not req'd w/ positioner)
42	Nameplate, stainless steel
43	Drive Screw, stainless steel (2 req'd)
55	Vent Screen (not shown)
56*(1)	O-Ring, nitrile (for sizes 30, 40 & 68 only) (not shown)

Note

Key numbers 62 thru 68 and key 83 are used with bypass only.

62	Connector, brass
63	Elbow, brass
64	Pipe Nipple, steel

Key	Description
-----	-------------

65	Pipe Plug, steel (2 req'd) (not req'd w/positioner)
66	Pipe Cross, malleable iron (2 req'd)
67	Tubing, copper 3/8 in O.D.
68	Bypass Valve, brass
70	Turnbuckle, pl steel
71	Hex Nut, pl steel
72	Access Plate
73	Machine Screw, pl steel(4 req'd)
74	Thrust Washer, PTFE
76	Washer, pl steel
77	Washer, pl steel
81*	Bearing, PTFE
83	Pipe Tee, galvanized malleable iron (use w/ 376 trip valve) (not shown)
87	Cap Screw, pl steel(4 req'd)
91	Anti-seize sealant (not furnished with actuator)
92	Thread Locking Adhesive (Medium Strength) (not furnished with actuator)
93	Lithium Grease (not furnished with actuator)
94	Output Shaft, S17400 (17-4PH SST) (heat-treated)
95	Retaining Ring, pl carbon steel
96	Pin, alloy steel
97	Coupling, stainless steel
98*	Woodruff Key
99	Spacer, steel (not shown)

Figure 6. Fisher 1061 Actuator with Typical H and J Mounting Adaptations

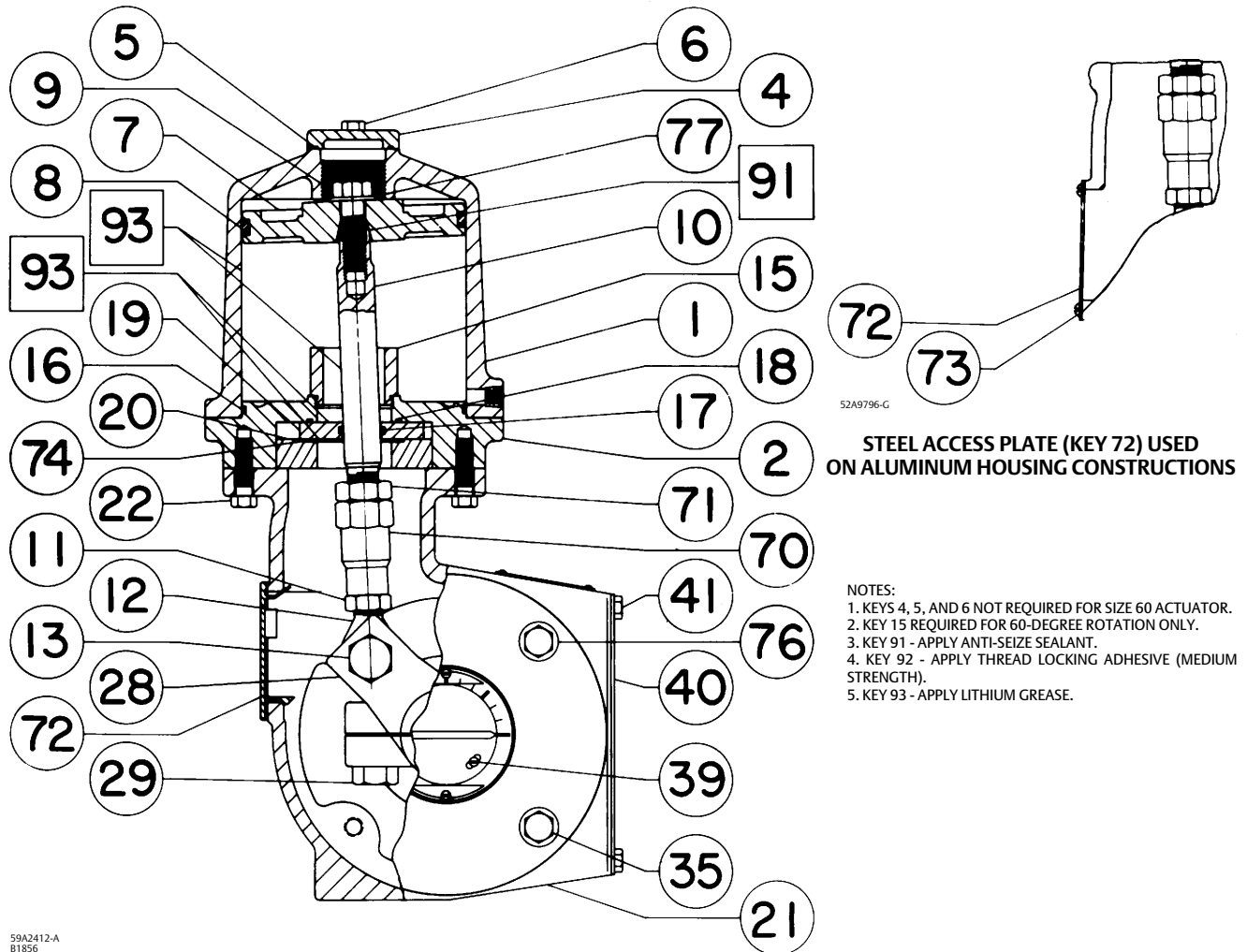


Figure 6. Fisher 1061 Actuator with Typical H and J Mounting Adaptations (Continued)

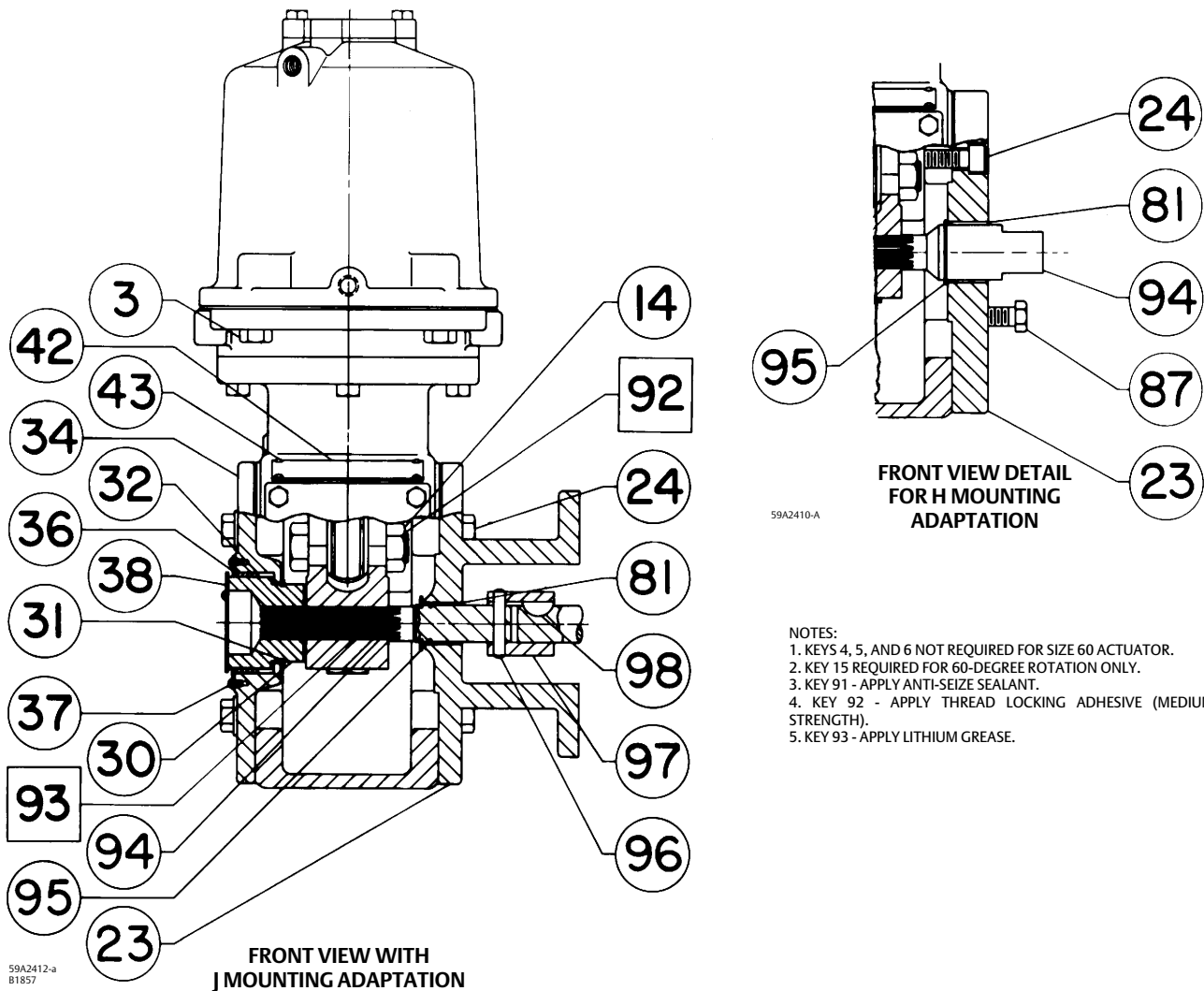


Figure 7. H Mounting for 44.5 or 50.8 mm (1-3/4 or 2-Inch) Keyed Equipment Shafts

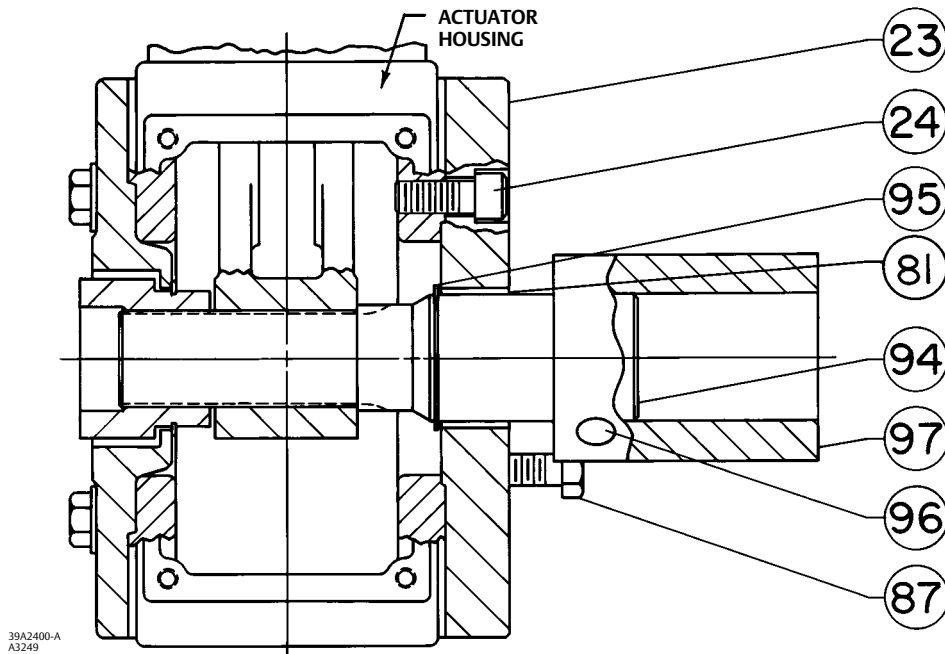
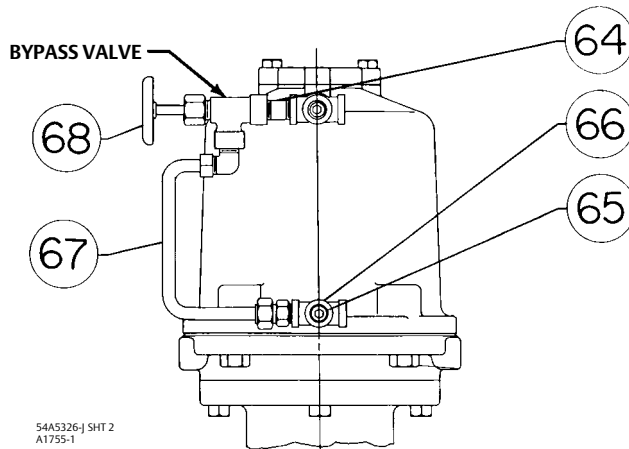


Figure 8. Partial View of Actuator with Bypass Valve



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Fisher™ 1078 Declutchable Manual Actuator

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Figure 1. Fisher 1078 Manual Actuator Mounted on a 2052 Size 1 Actuator



X0178

Introduction

Scope of Manual

This instruction manual includes installation, operation, and maintenance information for the Fisher 1078 declutchable manual actuator (figure 1). Refer to separate instruction manuals for instructions covering the power actuator and control valve.

Do not install, operate, or maintain a 1078 declutchable manual actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Table 1. Specifications

Available Configurations Direct and reverse acting; see Handwheel Rotation in this specification table Actuator Sizes See tables 2, 3, and 4 Acceptable Coupling Shaft Diameters See tables 2, 3, and 4 Power Actuator Compatibility See tables 2, 3, and 4 Output Torque See tables 2, 3, and 4 Wheel-Rim Force See tables 2, 3, and 4 Handwheel Turns Required For Full Rotation See tables 2, 3, and 4 Handwheel Rotation Direct Acting Construction: Clockwise handwheel rotation closes the valve (produces clockwise valve shaft rotation) Reverse Acting Construction: Clockwise handwheel rotation closes the valve (produces counterclockwise valve shaft rotation) Decide whether Direct or Reverse Action is required by referring to the appropriate valve or power actuator instruction manual and determining valve rotation.	Maximum Output Rotation 90 degrees; limited by travel stops in the power actuator Standard Mounting Positions 1052 (size 70)⁽¹⁾: handwheel down (std) or handwheel right-hand or left-hand mount (optional) 1061 (sizes 30, 40, 60, 68, 80, and 100)⁽¹⁾: handwheel down (std) or handwheel right-hand or left-hand mount (optional) 2052 (sizes 1, 2, and 3)⁽¹⁾: handwheel down (std) or handwheel right-hand or left-hand mount (optional) Approximate Weights without Handwheel Size AAA: 2.7 kg (6 lb) Size AA: 6.8 kg (15 lb) Size A: 9.5 kg (21 lb) Size 2A: 13.6 kg (30 lb) Size 1A: 15.9 kg (35 lb) Size B: 23.1 kg (51 lb) Size C: 29.9 kg (66 lb) Size D: 63.5 kg (140 lb) Size II-FA: 81.6 kg (180 lb) Handwheel Weight 6-inch: 1.8 kg (4 lb) 8-inch: 2.3 kg (5 lb) 12-inch: 3.2 kg (7 lb) 16-inch: 6.8 kg (15 lb) 24-inch: 5.4 kg (12 lb) 30-inch: 6.4 kg (14 lb) 36-inch: 7.3 kg (16 lb)
---	---

1. If a positioner is used, the right-hand or left-hand mounting option will be limited to the side away from the positioner.

Description

The 1078 manual actuator, shown in figures 1 and 2, is a declutchable unit for manual operation of control valves and equipment that use power actuators. The 1078 manual actuator mounts directly to Fisher 1052 size 70; 1061 sizes 30, 40, 60, 68, 80, and 100; and to all sizes of 2052 actuators. The 1078 manual actuator can be engaged to allow manual operation of the valve when the power actuator is not in use. It can be disengaged to allow automatic operation of the valve by the power actuator. The mechanism used allows manual actuator engagement at any point of power actuator rotation.

Figure 2. Fisher 1078 Declutchable Manual Actuator Mounted on a 2052 Size 1 Actuator and V300 Valve with FIELDVUE™ DVC6200 Digital Valve Controller



X0177

Specifications

1078 manual actuator specifications are given in table 1. Specifications for a control valve assembly as it comes from the factory appear on a nameplate attached to the power actuator.

Educational Services

For information on available courses for Fisher 1078 manual actuators, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

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Table 2. Fisher 2052 Actuator Size Selection and Specifications for Sizes AAA, A, and C

MANUAL ACTUATOR SIZE	SHAFT SIZE		POWER ACTUATOR		STANDARD HANDWHEEL DIAMETER		MAXIMUM TORQUE		WHEEL-RIM-FORCE				HANDWHEEL TURNS FOR ROTATION	
									For Maximum Torque		For Less Than Maximum Torque		Degrees	
	mm	Inch	Type	Size	mm	Inch	N•m	Lbf•in	N	Pounds	N	Pounds	60	90
AAA (2400 in•lbs)	12.7	1/2	2052	1	203	8	131	1156	144	32	Divide N•m req'd by 0.91	Divide lbf•in req'd by 36	4	6
	14.2x15.9 15.9	9/16x5/8 5/8					211	1866	232	52				
	19.1	3/4					271	2400	298	67				
A (8000 in•lbs)	14.3x15.9 15.9	9/16x5/8 5/8	2052	2	406	16	489	4326	204	45	Divide N•m req'd by 2.4	Divide lbf•in req'd by 96	5.3	8
	19.1	3/4					590	5221	246	54				
	22.2 25.4	7/8 1					818	7241	341	75				
	28.6x31.8 31.8	1-1/8x1-1/4 1-1/4					904	8000	377	83				
C (18000 in•lbs)	19.1	3/4	2052	3	610	24	1338	11842	279	61	Divide N•m req'd by 4.8	Divide lbf•in req'd by 194	9	13.5
	22.2 25.4	7/8 1					1566	13862	326	71				
	28.6x31.8 31.8	1-1/8x1-1/4 1-1/4					2034	18000	424	93				
	38.1 39.7x44.5 44.5 50.8	1-1/2 1-9/16x1-3/4 1-3/4 2												

Table 3. Fisher 1052 Actuator Size Selection and Specifications for Sizes 2A, 1A, B, and C

MANUAL ACTUATOR SIZE (max output torque)	SHAFT SIZE		POWER ACTUATOR ⁽¹⁾		GEAR RATIO	HANDWHEEL DIAMETER		MAXIMUM TORQUE ⁽²⁾		WHEEL-RIM-FORCE				HANDWHEEL TURNS FOR ROTATION	
										For Maximum Torque		For Less Than Maximum Torque		Degrees	
	mm	Inch	Type	Size		mm	Inch	N•m	Lbf•in	N	Pounds	N	Pounds	60	90
1A (8200 in•lbs)	31.8, 28.6x 31.8	1-1/4, 1-1/8x 1-1/4	1052	70	32:1	610	24	929	8200	378	85	Divide N•m req'd by 2.4	Divide lbf•in req'd by 96	5.3	8
	38.1 31.8x 38.1	1-1/2, 1-1/4x 1-1/2													
	(44.4, 50.8), 39.7 x44.5	(1-3/4, 2), 1-9/16 x1-3/4													
B (12,000 in•lbs)	31.8	1-1/4	1052	70	40:1	610	24	1356	12,000	369	83	Divide N•m req'd by 3.6	Divide lbf•in req'd by 144	6.7	10
	38.1, (44.4, 50.8)	1-1/2, (1-3/4, 2)													
C (18,000 in•lbs)	31.8	1-1/4	1052	70	54:1	610	24	2034	18,000	414	93	Divide N•m req'd by 4.8	Divide lbf•in req'd by 194	9	13.5
	(44.4, 50.8)	(1-3/4, 2)													

1. Field conversion of actuators for F and G mounting adaptations requires installation of new parts.

2. Compare table value with torque requirements of the valve plus the torque required to compress the power actuator spring (from Fisher Catalog 14). Note that dynamic torque of the valve may have a positive or negative effect on total torque required.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D101329X012

1078 Actuator

June 2017

Table 4. Fisher 1061 Actuator Size Selection and Specifications for Sizes 2A, 1A, B, C, D, and II-FA

MANUAL ACTUATOR SIZE (max output torque)	SHAFT SIZE		POWER ACTUATOR		GEAR RATIO	HANDWHEEL DIAMETER		MAXIMUM TORQUE ⁽¹⁾		WHEEL-RIM-FORCE				HANDWHEEL TURNS FOR ROTATION	
										For Maximum Torque		For Less Than Maximum Torque		Degrees	
	mm	Inch	Type	Size		mm	Inch	N•m	Lbf•in	N	Pounds	N	Pounds	60	90
2A (4800 in.lbs)	12.7	1/2	1061	30	34:1	152	6	58	515	89	20	Divide N•m req'd by 0.66	Divide lbf•in req'd by 26	5.7	8.5
	15.9, 14.3x 9.5	5/8, 9/16x 5/8						138	1225	214	48				
	19.1	3/4 ⁽³⁾				203	8	239	2120	276	62	Divide N•m req'd by 0.86	Divide lbf•in req'd by 34		
	(22.2, 25.4)	(7/8, 1)				305	12	467 ⁽⁴⁾	4140 ⁽⁴⁾	360	81	Divide N•m req'd by 1.3	Divide lbf•in req'd by 51		
	31.8	1-1/4						541	4800	416	94				
1A (8200 in.lbs)	(22.2, 25.4)	(7/8, 1)	1061	40, 60, 68	32:1	305	12	467	4140	382	86	Divide N•m req'd by 1.2	Divide lbf•in req'd by 48	5.3	8
	31.8, 28.6x 31/8	1-1/4, 1-1/8x 1-1/4				610	24	929	8200	378	85	Divide N•m req'd by 2.4	Divide lbf•in req'd by 96		
	38.1 31.8x 38.1	1-1/2, 1-1/4x 1-1/2													
	(44.4, 50.8), 39.7 x44.5	(1-3/4, 2), 1-9/16 x1-3/4													
B (12,000 in.lbs)	31.8	1-1/4	1061	40, 60, 68	40:1	610	24	1109	9815	308	68	Divide N•m req'd by 3.6	Divide lbf•in req'd by 144	6.7	10
	38.1, (44.4, 50.8)	1-1/2, (1-3/4, 2)						1356	12,000	377	83				
C (18,000 in.lbs)	31.8	1-1/4	1061	40, 60, 68	54:1	610	24	1109	9815	231	51	Divide N•m req'd by 4.8	Divide lbf•in req'd by 194	9	13.5
	(44.4, 50.8)	(1-3/4, 2)						2034	18,000	424	93				
D (30,000 in.lbs)	(44.4, 50.8)	(1-3/4, 2)	1061	80, 100	64:1	762	30	2658	23,524	369	82	Divide N•m req'd by 7.2	Divide lbf•in req'd by 287	10.7	16
	54, 63.5 57.2x 63.5	2-1/8, 2-1/2, 2-1/4x 2-1/2				914	36	3390	30,000	394	87	Divide N•m req'd by 8.6	Divide lbf•in req'd by 345		
II-FA (60,000 in.lbs)	54, 63.5	2-1/8, 2-1/2	1061	80, 100	288:1 ⁽²⁾	406	16	6301	55,762	400	90	Divide N•m req'd by 15.7	Divide lbf•in req'd by 619	48	72
1. Compare table value with torque requirements of the valve plus the torque required to compress the power actuator spring (from Fisher Catalog 14). Note that dynamic torque of the valve may have a positive or negative effect on total torque required. 2. Has spur gear. 3. 2A 3/4 inch shaft will also mount on the 1061 size 40, 60, and 68. 4. Maximum torque of connection between power and manual actuator.															

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

The 1078 manual actuator is normally shipped mounted on a power actuator. If the manual actuator has been shipped separately for installation on a power actuator, or if the manual actuator was removed for maintenance, mount the manual actuator by following the instructions presented in this section.

Converting An Existing Power Actuator For Use With The Fisher 1078 Manual Actuator

Field conversion of a power actuator for use with the 1078 manual actuator may require replacement and/or removal of some parts. The procedures which follow apply only to power actuators which were not ordered specifically for use with the 1078 manual actuator. Proceed as appropriate:

Installing the Manual Actuator

⚠ WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
 - Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
 - Disconnect any operating lines providing air pressure, electric power, or a control signal to the power actuator. Be sure the actuator cannot suddenly open or close the valve.
 - Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
 - Vent the power actuator loading pressure and relieve any actuator spring precompression.
 - Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
 - The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
 - Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
-

CAUTION

Undertravel or overtravel of the valve ball or disk, especially at the closed position, may result in poor valve performance and/or damage to the equipment. Make certain that the power actuator travel stops are properly set before installing and adjusting the manual actuator. Refer to the instruction manuals for the valve and the power actuator for information about setting travel stops.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Also shut off all pressure lines to the power actuator and release all

pressure from the power actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

2. Make certain that the power actuator travel stops have been properly set according to the caution given above.
3. For spring-return power actuators, allow the power actuator to remain in the position where the spring is relaxed. For double-acting power actuators, apply supply pressure as appropriate to position the valve disk or ball in either the open or closed position.
4. Note whether the valve disk or ball is in the open or closed position.
5. Rotate the handwheel to move the drive sleeve gear and travel indicator to the position that corresponds with the position of the valve disk or ball. For both direct and reverse acting manual actuators, clockwise handwheel rotation sets the manual actuator to the closed position. Counterclockwise handwheel rotation sets the manual actuator to the open position.

Installing the Manual Actuator on a 1061 Size 30, 40, 60, 68, 80, or 100 and 1052 Size 70

For manual actuator installation on 1061 sizes 30, 40, 60, 68, 80, and 100; and 1052 size 70, remove the actuator cover (key 34) and attached parts from 1061 or 1052. Replace with 1078. Most assemblies require installation of a new lever and splined adaptor to complete the installation. When used, the splined adaptor slides inside the new lever and the lever is then clamped onto the splined adaptor. See figure 5.

1. Remove the lever and add a new lever and splined adaptor when needed. See figure 5.

The splined adaptor slides inside the new lever and the lever is then clamped onto the splined adaptor.

2. Disengage the manual actuator.
3. Install the manual actuator.
4. Tighten the cap screws to the final torque value.
5. For double-acting power actuators, be certain the power actuator is equipped with a bypass valve. Operating the handwheel mechanism against the force of differential cylinder pressures will be difficult or impossible.

Installing the Manual Actuator on a 2052 Size 1, 2, or 3

1. Remove the travel scale and travel indicator. They will no longer be required since the 1078 has it's own scale and indicator.
2. Mount the manual actuator on the surface where the travel scale was.
3. Position the manual actuator on the 2052 so that the drive square fits into the quad square spline of the 2052 lever.
4. Bolt the manual actuator onto the 2052.

Operation

After the travel indicator pointer has been adjusted and the control valve assembly installed, the manual actuator is ready for operation.

CAUTION

Applying too much torque to the actuator and valve parts could cause damage to the parts. To avoid such damage, do not exceed the maximum allowable torques listed in table 2, 3, or 4 or any other torque limitation of internal valve parts. Also, do not use wrenches or other devices on the handwheel or handwheel shaft to increase operating force.

If the force required to rotate the handwheel exceeds the wheel-rim force listed in tables 2, 3, and 4, refer to the maintenance procedure.

Engaging and Disengaging the Manual Actuator

Engaging the Manual Actuator

1. Shut off the supply pressure to the power actuator.
2. Pull the ring on the detent mechanism to unlock the lever. Move the lever into the engaged position until it is against the stop pin and locked in position by the detent mechanism. (Note that stop pins are not available on 1078 size II-FA actuators.)
3. If applicable, open the power actuator bypass valve.

Disengaging the Manual Actuator

CAUTION

Disengaging the manual actuator when forces such as spring compression, cylinder pressure, and dynamic torque are present may cause sudden, extreme movement of all control valve components. This can result in damage to equipment and violent disturbance of the process. Before disengaging the manual actuator, take appropriate steps to ensure that the return to automatic operation will not result in an extreme repositioning of control valve components. Procedures to determine approximate system balance are given in the following steps.

1. Before disengaging the manual actuator, approximate system balance should be achieved. The system is in balance when the actual valve ball or disk position is approximately the same as the position requested by the automatic control system. Under balanced system conditions, the manual actuator disengaging lever moves freely without use of excessive force. If after releasing the detent mechanism, the lever does not move freely toward the disengaged position, some system force is causing an imbalance. A forced return to automatic operation under these conditions can cause serious damage to the equipment and violent disturbance of the process.
2. If possible, determine whether the automatic control system is tending to open or close the valve ball or disk, and rotate the handwheel in the appropriate direction until friction in the manual operator is reduced and the lever can be easily moved by hand. As an alternate approach, local manipulation of the supply pressure to the power actuator may bring the set point of the automatic system closer to the actual valve ball or disk position.
3. If a smooth transition from manual to automatic operation cannot be ensured, isolate the valve from the process. Position the manual actuator so that it matches the position of the ball or disk when no supply pressure is applied to the power actuator.
4. Pull the ring on the detent mechanism to unlock the lever. Push the lever into the disengaged position until it is against the stop pin and locked in position by the detent mechanism. (Note that stop pins are not available on 1078 size II-FA actuators.)
5. Close the bypass valve and return supply pressure to the power actuator.

Maintenance

If the force required to rotate the handwheel exceeds the wheel-rim force listed in tables 2, 3, and 4, check for the following conditions:

- Insufficient lubrication,
- Seized actuator parts,

- Excessive pressure drop across the valve body, or
- Obstruction to the valve disk or ball rotation.

If the manual actuator does not seem to control the process fluid, the worm or drive sleeve gear teeth may be broken, the pin (key 3) may be sheared, or the internal power actuator or valve parts may be broken. Purchase a replacement manual actuator if necessary. Refer to the power actuator and valve instruction manuals if power actuator or valve maintenance is needed.

Lubrication

The interior parts of the 1078 manual actuator should be lubricated on a regular schedule with a quality gear lubricant. The interior parts should also be lubricated whenever difficulty in handwheel rotation indicates a need for lubrication.

⚠ WARNING

Avoid personal injury from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power, or a control signal to the power actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Mark the position of the travel indicator pointer on the indicator dial. The travel indicator pointer must be returned to its original position when assembling the manual actuator. Remove the machine screws and the travel indicator pointer.
3. Remove the manual actuator cover screws.
4. Remove the travel indicator scale and the gearbox cover plate. Coat the worm, the drive sleeve gear teeth, and the bearing surfaces of the gearbox housing and worm with a quality gear lubricant.
5. Install the cover plate and the travel indicator scale on the gearbox.
6. Replace the manual actuator cover screws.

Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner, indicate the type number and size of the power actuator and the mounting adaptation used. If the manual actuator was shipped separately (not attached to a power actuator), give the serial number of the unit, which is shown on a tag attached to the manual actuator.

For 1052 (size 70), and 1061 (sizes 30, 40, 60, 68, 80, and 100), indicate valve shaft size.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your [Emerson sales office](#) or Local Business Partner for Part Ordering information.

Manual Actuator Assembly (figures 3 and 4)

Key	Description
1	Actuator
2	Handwheel
3	Pin, steel

Note

A new lever and splined adaptor (figure 5) are needed on most assemblies for field installation of the 1078 onto the 1052 size 70, and 1061 sizes 30, 40, 60, 68, 80, & 100 actuators.

Key	Description
4	Travel Indicator scale, stainless steel
5	Travel Indicator Pointer, stainless steel
6	Machine Screw, steel (2 required)
9	Shaft Adaptor

Field Mounting Parts

For 1061; and 1052 Size 70 Actuators

Note

Most assemblies require installation of a new lever to complete the installation. Contact your Emerson sales office.

Description
Lever

Figure 3. Fisher 1078 Declutchable Manual Actuator, Sizes 2A, 1A, B, C, and D

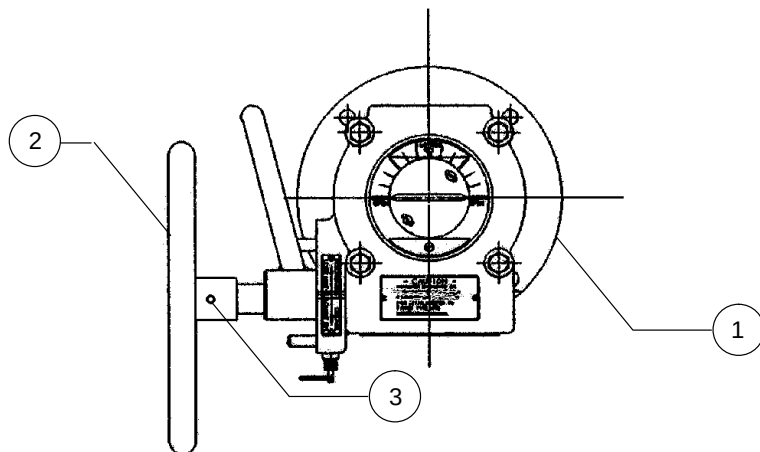


Figure 4. Fisher 1078 Declutchable Manual Actuator, Size II-FA

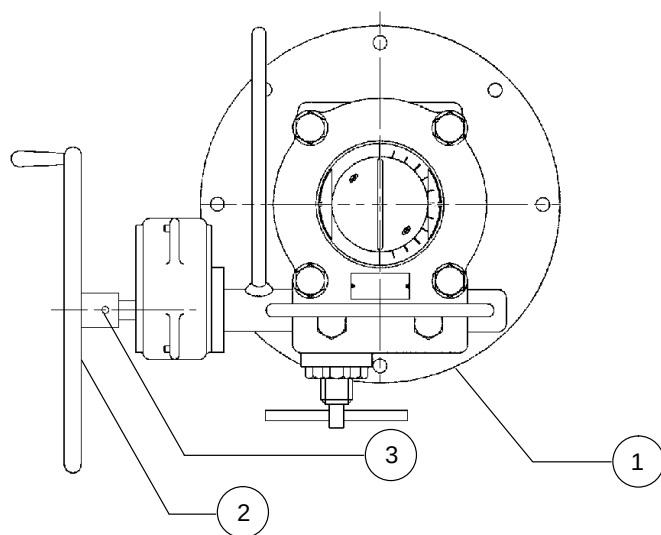
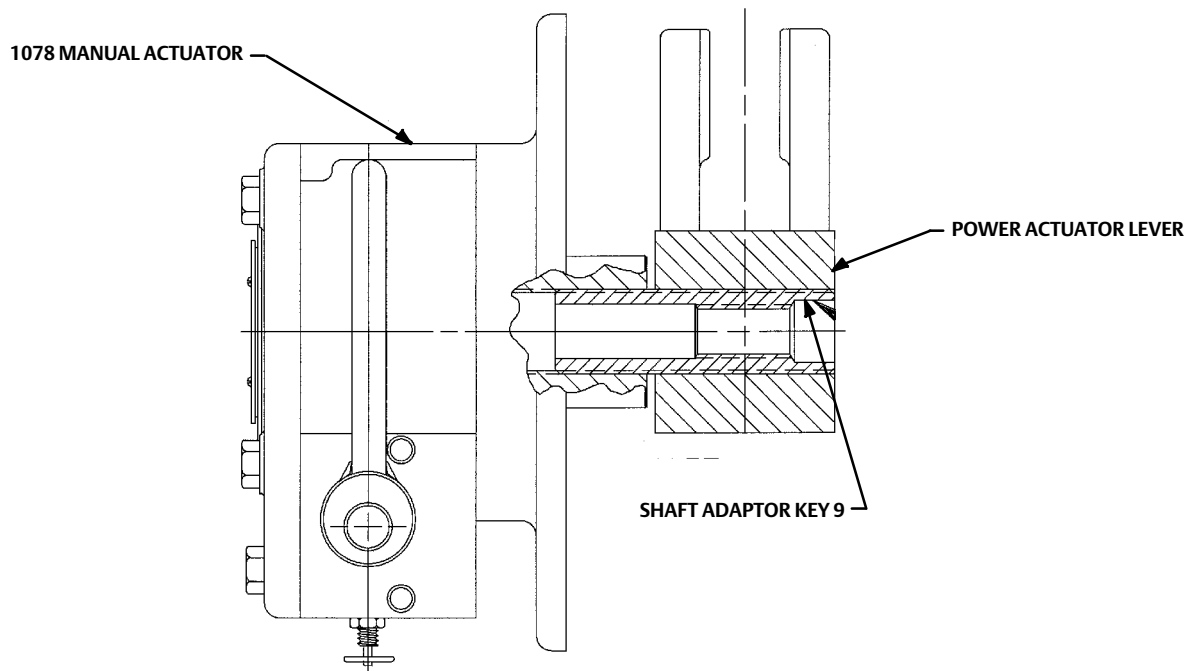


Figure 5. Lever and Splined Adaptor



NOTE:
PROPER ASSEMBLY OF SHAFT ADAPTOR KEY 9 WHEN REQUIRED
B2458

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Fisher™ 1078 Declutchable Manual Actuator

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Figure 1. Fisher 1078 Manual Actuator Mounted on a 2052 Size 1 Actuator



X0178

Introduction

Scope of Manual

This instruction manual includes installation, operation, and maintenance information for the Fisher 1078 declutchable manual actuator (figure 1). Refer to separate instruction manuals for instructions covering the power actuator and control valve.



Do not install, operate, or maintain a 1078 declutchable manual actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

Available Configurations Direct and reverse acting; see Handwheel Rotation in this specification table Actuator Sizes See tables 2, 3, and 4 Acceptable Coupling Shaft Diameters See tables 2, 3, and 4 Power Actuator Compatibility See tables 2, 3, and 4 Output Torque See tables 2, 3, and 4 Wheel-Rim Force See tables 2, 3, and 4 Handwheel Turns Required For Full Rotation See tables 2, 3, and 4 Handwheel Rotation Direct Acting Construction: Clockwise handwheel rotation closes the valve (produces clockwise valve shaft rotation) Reverse Acting Construction: Clockwise handwheel rotation closes the valve (produces counterclockwise valve shaft rotation) Decide whether Direct or Reverse Action is required by referring to the appropriate valve or power actuator instruction manual and determining valve rotation.	Maximum Output Rotation 90 degrees; limited by travel stops in the power actuator Standard Mounting Positions 1052 (size 70)⁽¹⁾: handwheel down (std) or handwheel right-hand or left-hand mount (optional) 1061 (sizes 30, 40, 60, 68, 80, and 100)⁽¹⁾: handwheel down (std) or handwheel right-hand or left-hand mount (optional) 2052 (sizes 1, 2, and 3)⁽¹⁾: handwheel down (std) or handwheel right-hand or left-hand mount (optional) Approximate Weights without Handwheel Size AAA: 2.7 kg (6 lb) Size AA: 6.8 kg (15 lb) Size A: 9.5 kg (21 lb) Size 2A: 13.6 kg (30 lb) Size 1A: 15.9 kg (35 lb) Size B: 23.1 kg (51 lb) Size C: 29.9 kg (66 lb) Size D: 63.5 kg (140 lb) Size II-FA: 81.6 kg (180 lb) Handwheel Weight 6-inch: 1.8 kg (4 lb) 8-inch: 2.3 kg (5 lb) 12-inch: 3.2 kg (7 lb) 16-inch: 6.8 kg (15 lb) 24-inch: 5.4 kg (12 lb) 30-inch: 6.4 kg (14 lb) 36-inch: 7.3 kg (16 lb)
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1. If a positioner is used, the right-hand or left-hand mounting option will be limited to the side away from the positioner.

Description

The 1078 manual actuator, shown in figures 1 and 2, is a declutchable unit for manual operation of control valves and equipment that use power actuators. The 1078 manual actuator mounts directly to Fisher 1052 size 70; 1061 sizes 30, 40, 60, 68, 80, and 100; and to all sizes of 2052 actuators. The 1078 manual actuator can be engaged to allow manual operation of the valve when the power actuator is not in use. It can be disengaged to allow automatic operation of the valve by the power actuator. The mechanism used allows manual actuator engagement at any point of power actuator rotation.

Figure 2. Fisher 1078 Declutchable Manual Actuator Mounted on a 2052 Size 1 Actuator and V300 Valve with FIELDVUE™ DVC6200 Digital Valve Controller



X0177

Specifications

1078 manual actuator specifications are given in table 1. Specifications for a control valve assembly as it comes from the factory appear on a nameplate attached to the power actuator.

Educational Services

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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

1078 Actuator

June 2023

Instruction Manual

D101329X012

Table 2. Fisher 2052 Actuator Size Selection and Specifications for Sizes AAA, A, and C

MANUAL ACTUATOR SIZE	SHAFT SIZE		POWER ACTUATOR		STANDARD HANDWHEEL DIAMETER		MAXIMUM TORQUE		WHEEL-RIM-FORCE				HANDWHEEL TURNS FOR ROTATION	
									For Maximum Torque		For Less Than Maximum Torque		Degrees	
	mm	Inch	Type	Size	mm	Inch	N•m	Lbf•in	N	Pounds	N	Pounds	60	90
AAA (2400 in•lbs)	12.7	1/2	2052	1	203	8	131	1156	144	32	Divide N•m req'd by 0.91	Divide lbf•in req'd by 36	4	6
	14.2x15.9 15.9	9/16x5/8 5/8					211	1866	232	52				
	19.1	3/4					271	2400	298	67				
A (8000 in•lbs)	14.3x15.9 15.9	9/16x5/8 5/8	2052	2	406	16	489	4326	204	45	Divide N•m req'd by 2.4	Divide lbf•in req'd by 96	5.3	8
	19.1	3/4					590	5221	246	54				
	22.2 25.4	7/8 1					818	7241	341	75				
	28.6x31.8 31.8	1-1/8x1-1/4 1-1/4					904	8000	377	83				
C (18000 in•lbs)	19.1	3/4	2052	3	610	24	1338	11842	279	61	Divide N•m req'd by 4.8	Divide lbf•in req'd by 194	9	13.5
	22.2 25.4	7/8 1					1566	13862	326	71				
	28.6x31.8 31.8	1-1/8x1-1/4 1-1/4					2034	18000	424	93				
	38.1 39.7x44.5 44.5 50.8	1-1/2 1-9/16x1-3/4 1-3/4 2												

Table 3. Fisher 1052 Actuator Size Selection and Specifications for Sizes 2A, 1A, B, and C

MANUAL ACTUATOR SIZE (max output torque)	SHAFT SIZE		POWER ACTUATOR ⁽¹⁾		GEAR RATIO	HANDWHEEL DIAMETER		MAXIMUM TORQUE ⁽²⁾		WHEEL-RIM-FORCE				HANDWHEEL TURNS FOR ROTATION	
										For Maximum Torque		For Less Than Maximum Torque		Degrees	
	mm	Inch	Type	Size		mm	Inch	N•m	Lbf•in	N	Pounds	N	Pounds	60	90
1A (8200 in•lbs)	31.8, 28.6x 31.8	1-1/4, 1-1/8x 1-1/4	1052	70	32:1	610	24	929	8200	378	85	Divide N•m req'd by 2.4	Divide lbf•in req'd by 96	5.3	8
	38.1 31.8x 38.1	1-1/2, 1-1/4x 1-1/2													
	(44.4, 50.8), 39.7 x44.5	(1-3/4, 2), 1-9/16 x1-3/4													
B (12,000 in•lbs)	31.8	1-1/4	1052	70	40:1	610	24	1356	12,000	369	83	Divide N•m req'd by 3.6	Divide lbf•in req'd by 144	6.7	10
	38.1, (44.4, 50.8)	1-1/2, (1-3/4, 2)													
C (18,000 in•lbs)	31.8	1-1/4	1052	70	54:1	610	24	2034	18,000	414	93	Divide N•m req'd by 4.8	Divide lbf•in req'd by 194	9	13.5
	(44.4, 50.8)	(1-3/4, 2)													

1. Field conversion of actuators for F and G mounting adaptations requires installation of new parts.

2. Compare table value with torque requirements of the valve plus the torque required to compress the power actuator spring (from Fisher Catalog 14). Note that dynamic torque of the valve may have a positive or negative effect on total torque required.

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June 2023

Table 4. Fisher 1061 Actuator Size Selection and Specifications for Sizes 2A, 1A, B, C, D, and II-FA

MANUAL ACTUATOR SIZE (max output torque)	SHAFT SIZE		POWER ACTUATOR		GEAR RATIO	HANDWHEEL DIAMETER		MAXIMUM TORQUE ⁽¹⁾		WHEEL-RIM-FORCE				HANDWHEEL TURNS FOR ROTATION	
										For Maximum Torque		For Less Than Maximum Torque		Degrees	
	mm	Inch	Type	Size		mm	Inch	N•m	Lbf•in	N	Pounds	N	Pounds	60	90
2A (4800 in.lbs)	12.7	1/2	1061	30	34:1	152	6	58	515	89	20	Divide N•m req'd by 0.66	Divide lbf•in req'd by 26	5.7	8.5
	15.9, 14.3x 9.5	5/8, 9/16x 5/8						138	1225	214	48				
	19.1	3/4 ⁽³⁾				203	8	239	2120	276	62	Divide N•m req'd by 0.86	Divide lbf•in req'd by 34		
	(22.2, 25.4)	(7/8, 1)				305	12	467 ⁽⁴⁾	4140 ⁽⁴⁾	360	81	Divide N•m req'd by 1.3	Divide lbf•in req'd by 51		
	31.8	1-1/4						541	4800	416	94				
1A (8200 in.lbs)	(22.2, 25.4)	(7/8, 1)	1061	40, 60, 68	32:1	305	12	467	4140	382	86	Divide N•m req'd by 1.2	Divide lbf•in req'd by 48	5.3	8
	31.8, 28.6x 31/8	1-1/4, 1-1/8x 1-1/4				610	24	929	8200	378	85	Divide N•m req'd by 2.4	Divide lbf•in req'd by 96		
	38.1 31.8x 38.1	1-1/2, 1-1/4x 1-1/2													
	(44.4, 50.8), 39.7 x44.5	(1-3/4, 2), 1-9/16 x1-3/4													
B (12,000 in.lbs)	31.8	1-1/4	1061	40, 60, 68	40:1	610	24	1109	9815	308	68	Divide N•m req'd by 3.6	Divide lbf•in req'd by 144	6.7	10
	38.1, (44.4, 50.8)	1-1/2, (1-3/4, 2)						1356	12,000	377	83				
C (18,000 in.lbs)	31.8	1-1/4	1061	40, 60, 68	54:1	610	24	1109	9815	231	51	Divide N•m req'd by 4.8	Divide lbf•in req'd by 194	9	13.5
	(44.4, 50.8)	(1-3/4, 2)						2034	18,000	424	93				
D (30,000 in.lbs)	(44.4, 50.8)	(1-3/4, 2)	1061	80, 100	64:1	762	30	2658	23,524	369	82	Divide N•m req'd by 7.2	Divide lbf•in req'd by 287	10.7	16
	54, 63.5 57.2x 63.5	2-1/8, 2-1/2, 2-1/4x 2-1/2				914	36	3390	30,000	394	87	Divide N•m req'd by 8.6	Divide lbf•in req'd by 345		
II-FA (60,000 in.lbs)	54, 63.5	2-1/8, 2-1/2	1061	80, 100	288:1 ⁽²⁾	406	16	6301	55,762	400	90	Divide N•m req'd by 15.7	Divide lbf•in req'd by 619	48	72
1. Compare table value with torque requirements of the valve plus the torque required to compress the power actuator spring (from Fisher Catalog 14). Note that dynamic torque of the valve may have a positive or negative effect on total torque required. 2. Has spur gear. 3. 2A 3/4 inch shaft will also mount on the 1061 size 40, 60, and 68. 4. Maximum torque of connection between power and manual actuator.															

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

The 1078 manual actuator is normally shipped mounted on a power actuator. If the manual actuator has been shipped separately for installation on a power actuator, or if the manual actuator was removed for maintenance, mount the manual actuator by following the instructions presented in this section.

Converting An Existing Power Actuator For Use With The Fisher 1078 Manual Actuator

Field conversion of a power actuator for use with the 1078 manual actuator may require replacement and/or removal of some parts. The procedures which follow apply only to power actuators which were not ordered specifically for use with the 1078 manual actuator. Proceed as appropriate:

Installing the Manual Actuator

⚠ WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
 - Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
 - Disconnect any operating lines providing air pressure, electric power, or a control signal to the power actuator. Be sure the actuator cannot suddenly open or close the valve.
 - Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
 - Vent the power actuator loading pressure and relieve any actuator spring precompression.
 - Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
 - The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
 - Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
-

NOTICE

Undertravel or overtravel of the valve ball or disk, especially at the closed position, may result in poor valve performance and/or damage to the equipment. Make certain that the power actuator travel stops are properly set before installing and adjusting the manual actuator. Refer to the instruction manuals for the valve and the power actuator for information about setting travel stops.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Also shut off all pressure lines to the power actuator and release all

pressure from the power actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

2. Make certain that the power actuator travel stops have been properly set according to the caution given above.
3. For spring-return power actuators, allow the power actuator to remain in the position where the spring is relaxed. For double-acting power actuators, apply supply pressure as appropriate to position the valve disk or ball in either the open or closed position.
4. Note whether the valve disk or ball is in the open or closed position.
5. Rotate the handwheel to move the drive sleeve gear and travel indicator to the position that corresponds with the position of the valve disk or ball. For both direct and reverse acting manual actuators, clockwise handwheel rotation sets the manual actuator to the closed position. Counterclockwise handwheel rotation sets the manual actuator to the open position.

Installing the Manual Actuator on a 1061 Size 30, 40, 60, 68, 80, or 100 and 1052 Size 70

For manual actuator installation on 1061 sizes 30, 40, 60, 68, 80, and 100; and 1052 size 70, remove the actuator cover (key 34) and attached parts from 1061 or 1052. Replace with 1078. Most assemblies require installation of a new lever and splined adaptor to complete the installation. When used, the splined adaptor slides inside the new lever and the lever is then clamped onto the splined adaptor. See figure 5.

1. Remove the lever and add a new lever and splined adaptor when needed. See figure 5.

The splined adaptor slides inside the new lever and the lever is then clamped onto the splined adaptor.

2. Disengage the manual actuator.
3. Install the manual actuator.
4. Tighten the cap screws to the final torque value.
5. For double-acting power actuators, be certain the power actuator is equipped with a bypass valve. Operating the handwheel mechanism against the force of differential cylinder pressures will be difficult or impossible.

Installing the Manual Actuator on a 2052 Size 1, 2, or 3

1. Remove the travel scale and travel indicator. They will no longer be required since the 1078 has it's own scale and indicator.
2. Mount the manual actuator on the surface where the travel scale was.
3. Position the manual actuator on the 2052 so that the drive square fits into the quad square spline of the 2052 lever.
4. Bolt the manual actuator onto the 2052.

Operation

After the travel indicator pointer has been adjusted and the control valve assembly installed, the manual actuator is ready for operation.

NOTICE

Applying too much torque to the actuator and valve parts could cause damage to the parts. To avoid such damage, do not exceed the maximum allowable torques listed in table 2, 3, or 4 or any other torque limitation of internal valve parts. Also, do not use wrenches or other devices on the handwheel or handwheel shaft to increase operating force.

If the force required to rotate the handwheel exceeds the wheel-rim force listed in tables 2, 3, and 4, refer to the maintenance procedure.

Engaging and Disengaging the Manual Actuator

Engaging the Manual Actuator

1. Shut off the supply pressure to the power actuator.
2. Pull the ring on the detent mechanism to unlock the lever. Move the lever into the engaged position until it is against the stop pin and locked in position by the detent mechanism. (Note that stop pins are not available on 1078 size II-FA actuators.)
3. If applicable, open the power actuator bypass valve.

Disengaging the Manual Actuator

NOTICE

Disengaging the manual actuator when forces such as spring compression, cylinder pressure, and dynamic torque are present may cause sudden, extreme movement of all control valve components. This can result in damage to equipment and violent disturbance of the process. Before disengaging the manual actuator, take appropriate steps to ensure that the return to automatic operation will not result in an extreme repositioning of control valve components. Procedures to determine approximate system balance are given in the following steps.

1. Before disengaging the manual actuator, approximate system balance should be achieved. The system is in balance when the actual valve ball or disk position is approximately the same as the position requested by the automatic control system. Under balanced system conditions, the manual actuator disengaging lever moves freely without use of excessive force. If after releasing the detent mechanism, the lever does not move freely toward the disengaged position, some system force is causing an imbalance. A forced return to automatic operation under these conditions can cause serious damage to the equipment and violent disturbance of the process.
2. If possible, determine whether the automatic control system is tending to open or close the valve ball or disk, and rotate the handwheel in the appropriate direction until friction in the manual operator is reduced and the lever can be easily moved by hand. As an alternate approach, local manipulation of the supply pressure to the power actuator may bring the set point of the automatic system closer to the actual valve ball or disk position.
3. If a smooth transition from manual to automatic operation cannot be ensured, isolate the valve from the process. Position the manual actuator so that it matches the position of the ball or disk when no supply pressure is applied to the power actuator.
4. Pull the ring on the detent mechanism to unlock the lever. Push the lever into the disengaged position until it is against the stop pin and locked in position by the detent mechanism. (Note that stop pins are not available on 1078 size II-FA actuators.)
5. Close the bypass valve and return supply pressure to the power actuator.

Maintenance

If the force required to rotate the handwheel exceeds the wheel-rim force listed in tables 2, 3, and 4, check for the following conditions:

- Insufficient lubrication,
- Seized actuator parts,

- Excessive pressure drop across the valve body, or
- Obstruction to the valve disk or ball rotation.

If the manual actuator does not seem to control the process fluid, the worm or drive sleeve gear teeth may be broken, the pin (key 3) may be sheared, or the internal power actuator or valve parts may be broken. Purchase a replacement manual actuator if necessary. Refer to the power actuator and valve instruction manuals if power actuator or valve maintenance is needed.

Lubrication

The interior parts of the 1078 manual actuator should be lubricated on a regular schedule with a quality gear lubricant. The interior parts should also be lubricated whenever difficulty in handwheel rotation indicates a need for lubrication.

⚠ WARNING

Avoid personal injury from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power, or a control signal to the power actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Mark the position of the travel indicator pointer on the indicator dial. The travel indicator pointer must be returned to its original position when assembling the manual actuator. Remove the machine screws and the travel indicator pointer.
3. Remove the manual actuator cover screws.
4. Remove the travel indicator scale and the gearbox cover plate. Coat the worm, the drive sleeve gear teeth, and the bearing surfaces of the gearbox housing and worm with a quality gear lubricant.
5. Install the cover plate and the travel indicator scale on the gearbox.
6. Replace the manual actuator cover screws.

Parts Ordering

When corresponding with your [Emerson sales office](#) indicate the type number and size of the power actuator and the mounting adaptation used. If the manual actuator was shipped separately (not attached to a power actuator), give the serial number of the unit, which is shown on a tag attached to the manual actuator.

For 1052 (size 70), and 1061 (sizes 30, 40, 60, 68, 80, and 100), indicate valve shaft size.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your [Emerson sales office](#) or for Part Ordering information.

Manual Actuator Assembly (figures 3 and 4)

Key Description

1	Actuator
2	Handwheel
3	Pin

Note

A new lever and splined adaptor (figure 5) are needed on most assemblies for field installation of the 1078 onto the 1052 size 70, and 1061 sizes 30, 40, 60, 68, 80, & 100 actuators.

Key	Description
4	Travel Indicator scale
5	Travel Indicator Pointer
6	Machine Screw, steel (2 required)
9	Shaft Adaptor

Field Mounting Parts

For 1061; and 1052 Size 70 Actuators

Note

Most assemblies require installation of a new lever to complete the installation. Contact your Emerson sales office.

Description

Lever

Figure 3. Fisher 1078 Declutchable Manual Actuator, Sizes 2A, 1A, B, C, and D

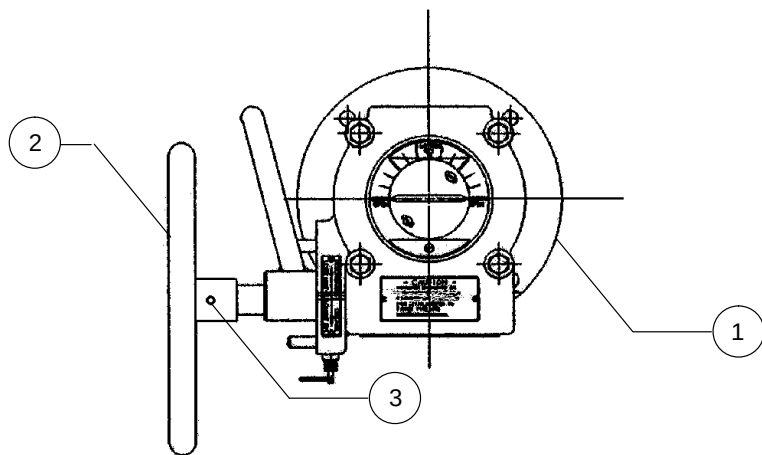


Figure 4. Fisher 1078 Declutchable Manual Actuator, Size II-FA

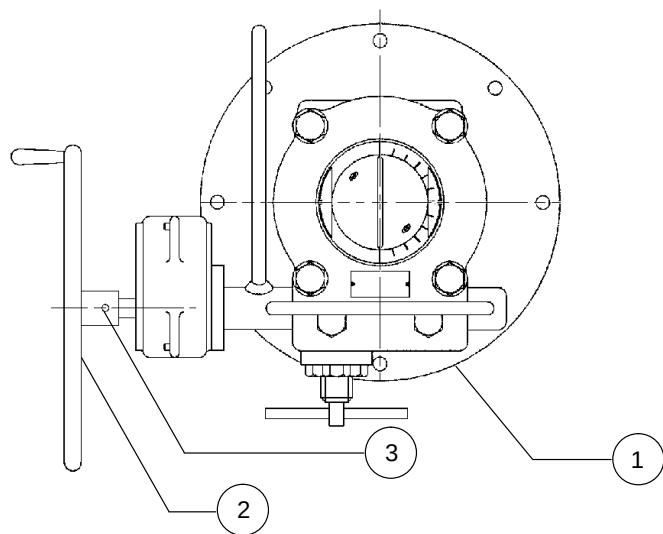
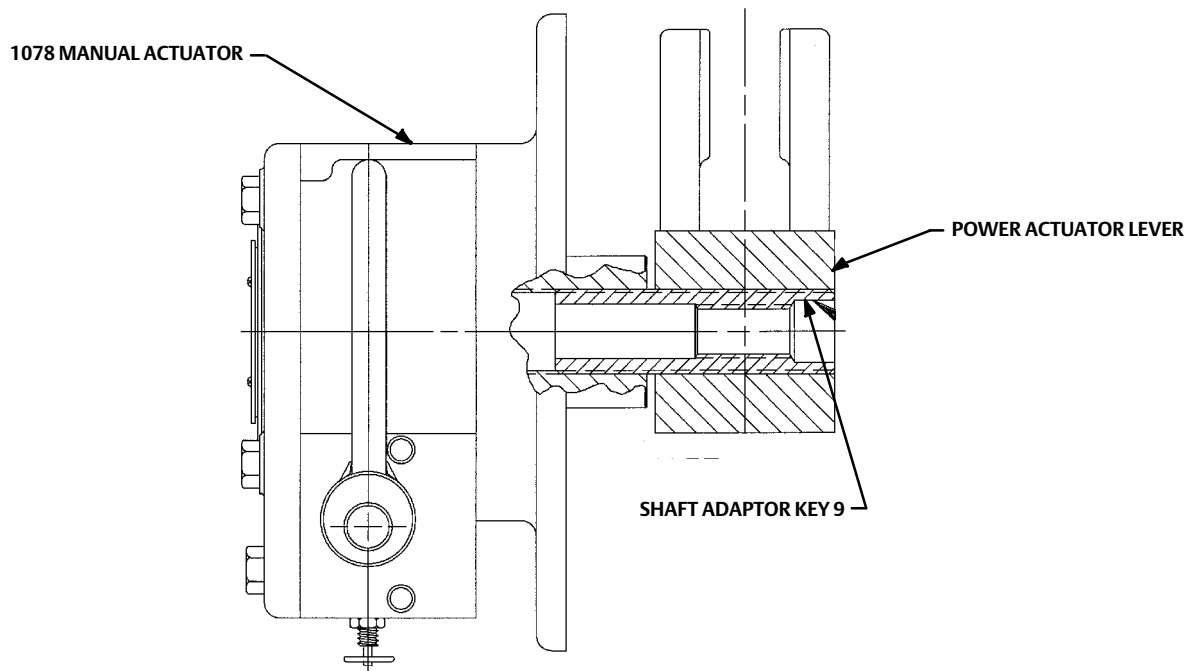


Figure 5. Lever and Splined Adaptor



NOTE:
PROPER ASSEMBLY OF SHAFT ADAPTOR KEY 9 WHEN REQUIRED
82458

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Fisher™ 1079 Declutchable Manual Actuator

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Figure 1. Fisher 1079 Manual Actuator Mounted on a Hytork Actuator and A41 Double D Valve



W6214

Introduction

Scope of Manual

This instruction manual includes installation, operation, and maintenance information for the Fisher 1079 declutchable manual actuator. Refer to separate instruction manuals for instructions covering the Hytork actuator and the control valve.



Do not install, operate, or maintain a 1079 manual actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

Available Configurations	Standard Mounting Positions (see figure 2)
Direct acting; see Handwheel Rotation	■ Standard mounting is with the input shaft perpendicular to the Hytork piston travel, with the handwheel opposite the actuator supply connections; ■ Optional mounting is with the handwheel on the same side as the Hytork actuator supply connections.
Manual Actuator Sizes	Approximate Weight without Handwheel
See tables 2, 3, and 4	Size AAA: 7.3 kg (16 lb) Size AA: 10 kg (22 lb) Size A: 14 kg (31 lb) Size B: 16 kg (35 lb) Size C: 24 kg (52 lb) Size D: 33 kg (72 lb)
Power Actuator Compatibility	Handwheel Weight
Compatible with all sizes of Hytork actuator; see tables 2, 3, and 4	6-inch: 1.0 kg (2.25 lb) 8-inch: 2.0 kg (4.50 lb) 12-inch: 4.0 kg (8.75 lb) 24-inch: 5.4 kg (12.00 lb) 30-inch: 6.7 kg (14.75 lb) 36-inch: 7.8 kg (17.25 lb)
Maximum Torque Output	
See tables 2, 3, and 4	
Wheel-Rim Force	
See tables 2, 3, and 4	
Handwheel Rotation	
Clockwise handwheel rotation closes valve (produces clockwise valve shaft rotation; as viewed from the actuator end of the shaft)	

Description

The 1079 manual actuator, shown in figure 1, is a declutchable unit for manual operation of keyed or square shaft control valves and equipment that use a Hytork actuator. The 1079 manual actuator mounts directly on the Hytork actuator and can be engaged to allow manual operation of the valve when the power actuator is not in use or disengaged to allow automatic operation of the valve by the power actuator. The mechanism used allows manual actuator engagement at any point of power actuator rotation.

Specifications

The 1079 manual actuator specifications are given in table 1.

Educational Services

Emerson Educational Services
 Phone: + 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/mytraining

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations.

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given on the valve and actuator nameplates. Use pressure-relieving devices as required by accepted industry, local, state, or Federal codes, and good engineering practices.

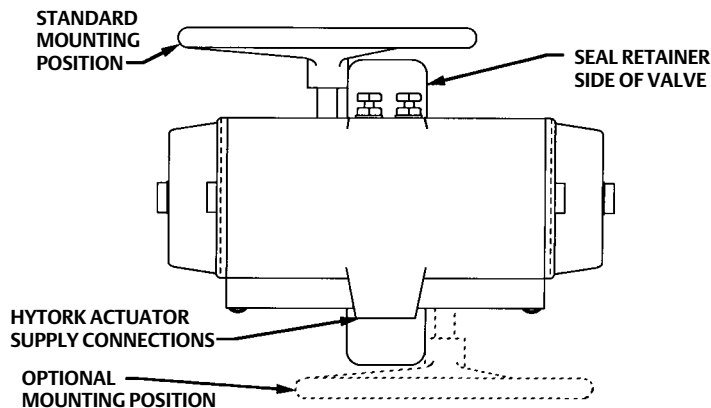
Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

The 1079 manual actuator is normally shipped mounted on the Hytork actuator. If the manual actuator is shipped separately for installation on the Hytork actuator, or if the manual actuator was removed for maintenance, mount the manual actuator by following the instructions in this section.

Field conversion of the Hytork actuator for use with the 1079 manual actuator requires fastening a mounting plate, included with the manual actuator, to the Hytork actuator. The 1079 actuator is installed between the valve and the Hytork actuator. Figure 2 shows the manual actuator standard and optional mounting positions. Typically the manual actuator is mounted with the input shaft perpendicular to the power actuator piston travel. However, the manual actuator can be mounted in any of four positions, provided there is sufficient clearance between the handwheel and the power actuator end caps. Fasten the mounting plate to the power actuator with the four mounting bolts provided with the manual actuator. Do not exceed the torque values given in table 5.

Figure 2. Fisher 1079 Actuator Mounting Positions



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Installing the Manual Actuator

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

NOTICE

Undertravel or overtravel of the valve disk, especially at the closed position, may result in poor valve performance and/or damage to the equipment. Make certain that the power actuator travel stops are properly set before installing and adjusting the manual actuator. Refer to the instruction manuals for the valve and the power actuator for information about setting travel stops.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Also shut off all pressure lines to the power actuator and release all pressure from the power actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Make certain that the power actuator travel stops have been properly set.
3. For spring-return power actuators, allow the power actuator to remain in the position where the spring is relaxed. For double-acting power actuators, apply supply pressure as appropriate to position the valve disk in either the open or closed position.
4. Note whether the valve disk is in the open or closed position.
5. Engage the handwheel on the manual actuator. See the Engaging and Disengaging the Manual Actuator section in this manual for instructions. Perform one or the other of the following procedures.
 - If the valve disk is in the closed position: Rotate the handwheel clockwise until it stops.
 - If the valve disk is in the open position: Rotate the handwheel counterclockwise until it stops.
6. Disengage the manual actuator.
7. Slide the manual actuator shaft into the power actuator.
8. Rotate either the manual actuator or the power actuator slightly so that the mounting holes on the manual actuator align with the mounting holes in the mounting plate on the power actuator.
9. Fasten the manual actuator to the power actuator with the bolts, lockwashers, and nuts provided.
10. Install the power actuator and manual actuator assembly on the valve as described in the installation section of the power actuator instruction manual.

Operation

After the actuator and control valve assembly are installed, the manual actuator is ready for operation.

NOTICE

Applying too much torque to the actuator and valve parts could cause damage to the parts. To avoid such damage, do not exceed the maximum allowable torques listed in table 2, 3, or 4 or any other torque limitation of internal valve parts. Also, do not use wrenches or other devices on the handwheel or handwheel shaft to increase operating force.

If the force required to rotate the handwheel exceeds the wheel-rim force listed in table 2, 3, or 4, refer to the maintenance procedures.

Engaging and Disengaging the Manual Actuator

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

Engaging the Manual Actuator

1. Shut off supply pressure to the power actuator.
2. Pull the ring on the detent mechanism to unlock the lever. Move the lever into the engaged position until it is against the stop pin and locked in position by the detent mechanism.
3. If applicable, open the power actuator bypass valve.

Disengaging the Manual Actuator

NOTICE

Disengaging the manual actuator when forces such as spring compression, cylinder pressure, and dynamic torque are present may cause sudden, extreme movement of all control valve components. This can result in damage to equipment and violent disturbance of the process. Before disengaging the manual actuator, approximate system balance should be achieved. Take appropriate steps to ensure that the return to automatic operation will not result in a extreme repositioning of control valve components.

1. Before disengaging the manual actuator, approximate system balance should be achieved. The system is in balance when the actual valve disk position is approximately the same as the position requested by the automatic control system. Under balanced system conditions, the manual actuator disengaging lever moves freely without use of excessive force. If after releasing the detent mechanism, the lever does not move freely toward the disengaged position, some system force is causing an imbalance. A forced return to automatic operation under these conditions can cause serious damage to the equipment and violent disturbance of the process.

2. If possible, determine whether the automatic control system is tending to open or close the valve disk, and rotate the handwheel in the appropriate direction until friction in the manual operator is reduced and the lever can be easily moved by hand. As an alternate approach, local manipulation of the supply pressure to the power actuator may bring the set point of the automatic system closer to the actual valve disk position.
3. If a smooth transition from manual to automatic operation cannot be ensured, isolate the valve from the process. Position the manual actuator so that it matches the position of the disk when no supply pressure is applied to the power actuator.
4. Pull the ring on the detent mechanism to unlock the lever. Push the lever into the disengaged position until it is against the stop pin and locked in position by the detent mechanism.
5. Close the bypass valve and return supply pressure to the power actuator.

Maintenance

WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the power actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If the force required to rotate the handwheel exceeds the wheel-rim force listed in table 2, 3, or 4, check for the following conditions:

- Insufficient lubrication
- Seized actuator parts
- Excessive pressure drop across the valve, or
- Obstruction to the valve disk rotation.

If the manual actuator does not seem to control the process fluid, the worm or drive sleeve gear teeth may be broken, the handwheel pin may be sheared, or the internal power actuator or valve parts may be broken. Purchase a replacement manual actuator if necessary. Refer to the power actuator and valve instruction manuals if power actuator or valve maintenance is needed.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D500208X012

1079 Manual Actuator

May 2023

Table 2. Actuator Size Selection and Specifications for Keyed Shaft Valves (Fisher A31A)

ACTUATOR SIZE	HYTORK ACTUATOR SIZE	GEAR RATIO	HANDWHEEL DIAMETER		VALVE SHAFT DIAMETER ⁽¹⁾		MAXIMUM ALLOWABLE TORQUE ⁽²⁾		WHEEL-RIM FORCE FOR MAXIMUM TORQUE	
			mm	Inches	mm	Inches	N•m	lbf•in	N	lbf
AAA	70 thru 280	24:1	203	8	14.3	0.5625	129	1145	214	48
			305	12	17.5 23.8	0.6875 0.9375	245 271	2165 2400 ⁽³⁾	267 298	60 67
AA	70 thru 280	24:1	203	8	14.3 17.5	0.5625 0.6875	129 245	1145 2165	151 298	34 64
					23.8 28.6	0.9375 1.125	542 542	4800 ⁽³⁾ 4800 ⁽³⁾	418 418	94 94
			305	12	30.2 31.8	1.1875 1.25 ⁽⁴⁾	542 542	4800 ⁽³⁾ 4800 ⁽³⁾	418 418	94 94
					41.3	1.625	542	4800 ⁽³⁾	418	94
A	680A	40:1	610	24	14.3 17.5 23.8	0.5625 0.6875 0.9375	129 245 671	1145 2165 5941	44 80 222	10 18 50
					28.6 30.2	1.125 1.1875	834 926	7383 8200 ⁽³⁾	276 302	62 68
					31.8 41.3	1.25 ⁽⁴⁾ 1.625	926 926	8200 ⁽³⁾ 8200 ⁽³⁾	302 302	68 68
B	1125	40:1	610	24	23.8 28.6 31.8	0.9375 1.125 1.25 ⁽⁴⁾	671 834 927	5941 7383 8205	182 227 254	41 51 57
					30.2 31.8	1.1875 1.25 ⁽⁵⁾	1171 1233	10,360 10,911	320 338	72 76
					38.1 41.3	1.5 1.625	1582 1582	14,000 ⁽³⁾ 14,000 ⁽³⁾	431 431	97 97
					44.5 47.6	1.75 1.875	1582 1582	14,000 ⁽³⁾ 14,000 ⁽³⁾	431 431	97 97
C	1370	54:1	610	24	23.8 28.6 31.8	0.9375 1.125 1.25 ⁽⁴⁾	671 834 927	5941 7383 8205	138 169 187	31 38 42
					30.2 31.8	1.1875 1.25 ⁽⁵⁾	1171 1233	10,360 10,911	236 249	53 56
					38.1	1.5	2203	19,494	445	100
			762	30	41.3 44.5	1.625 1.75	2530 2568	22,396 22,728	409 418	92 94
					47.6	1.875	2712	24,000 ⁽³⁾	440	99
D	2585 & 4580	64:1	610	24	31.8 30.2 31.8	1.25 ⁽⁴⁾ 1.1875 1.25 ⁽⁵⁾	927 1171 1233	8205 10,360 10,911	160 200 209	36 45 47
					38.1	1.5	2203	19,494	378	85
			762	30	41.3 44.5	1.625 1.75	2530 2568	22,396 22,728	347 351	78 79
			914	36	47.6 57.2	1.875 2.25	4067 4067	36,000 ⁽³⁾ 36,000 ⁽³⁾	463 463	104 104

1. Shaft diameter at the keyway.

2. Unless otherwise noted, torque is limited by S17400 stainless steel (17-4PH H1025) shaft material at 38°C (100°F). For other shaft materials, consult your [Emerson sales office](#).

3. Maximum manual actuator output.

4. NPS 12 CL150 A31A and NPS 8 CL300 A31A.

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Table 3. Actuator Size Selection and Specifications for Valves (Fisher A41)

ACTUATOR SIZE	HYTORK ACTUATOR SIZE	GEAR RATIO	HANDWHEEL DIAMETER		VALVE SHAFT DIAMETER ⁽¹⁾		MAXIMUM ALLOWABLE TORQUE ⁽²⁾		WHEEL-RIM FORCE FOR MAXIMUM TORQUE	
			mm	Inches	mm	Inches	N•m	lbf•in	N	lbf
AAA	70 thru 280	24:1	152	6	12.7 15.9	0.500 0.625	58 138	515 1225	127 305	29 69
			203	8	15.9	0.625	138	1225	229	51
			305	12	15.9	0.625	138	1225	152	34
			152	6	12.7 15.9	0.500 0.625	58 138	515 1225	127 305	29 69
			203	8	19.1	0.750	240	2120	392	88
AA	70 thru 280	24:1	203	8	19.1 25.4 31.8	0.750 1.000 1.250	240 468 542	2120 4140 4800 ⁽³⁾	280 546 629	63 123 141
			305	12	31.8 38.1	1.250 1.500	542 542	4800 ⁽³⁾ 4800 ⁽³⁾	418 418	94 94
A	680A	40:1	610	24	19.1 25.4 31.8 38.1	0.750 1.000 1.250 1.500	240 468 926 926	2120 4140 8200 ⁽³⁾ 8200 ⁽³⁾	78 153 303 303	18 34 68 68
B	1125	40:1	610	24	31.8 38.1 44.5	1.250 1.500 1.750	1110 1356 1582	9820 12000 14,000 ⁽³⁾	303 371 431	68 83 97
C	1370	54:1	610	24	31.8 38.1	1.250 1.500	1110 1356	9820 12000	227 278	51 63
			762	30	44.5	1.750	2658	23524	433	97
D	2585 & 4580	64:1	610	24	31.8 38.1	1.250 1.500	1110 1356	9820 12000	190 231	43 52
			762	30	44.5	1.750	2658	23524	365	82

1. Shaft diameter at packing box.
2. Unless otherwise noted, torque is limited by S17400 (17-4 PH H1025) stainless steel shaft. For other shaft materials, contact your [Emerson sales office](#).
3. Maximum manual actuator output. For AAA, C, and D, the maximum output is 2400, 24000, and 36000 in-lb, respectively.

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Table 4. Actuator Size Selection and Specifications for Square Shaft Valves (Fisher A11)

ACTUATOR SIZE	HYTORK ACTUATOR SIZE	GEAR RATIO	HANDWHEEL DIAMETER		VALVE SHAFT DIAMETER ⁽¹⁾		MAXIMUM ALLOWABLE TORQUE ⁽²⁾		WHEEL-RIM FORCE FOR MAXIMUM TORQUE	
			mm	Inches	mm	Inches	N•m	lbf•in	N	lbf
AAA	70 thru 280	24:1	203	8	10.3	0.40625	89	790	147	33
			305	12	15.9	0.625	271	2400 ⁽³⁾	298	67
AA	70 thru 280	24:1	203	8	10.3	0.40625	89	790	102	23
			305	12	15.9 22.2	0.625 0.875	318 542	2813 4800 ⁽³⁾	245 418	55 94
A	680A	40:1	610	24	15.9 22.2 25.4	0.625 0.875 1	318 782 926	2813 6922 8200 ⁽³⁾	102 254 302	23 57 68
					15.9 22.2 25.4	0.625 0.875 1	318 782 1351	2813 6922 11,956	85 214 369	19 48 83
					34.9 34.9	1.375 1.375	1582 1582	14,000 ⁽³⁾ 14,000 ⁽³⁾	431 431	97 97
B	1125	40:1	610	24	15.9 22.2 25.4	0.625 0.875 1	318 782 1351	2813 6922 11,956	67 160 276	15 36 62
					34.9 34.9	1.375 1.375	2712 2712	24,000 ⁽³⁾ 24,000 ⁽³⁾	440 440	99 99
					34.9 34.9	1.375 1.375	3520 3520	31,157 31,157	400 400	90 90
C	1370	54:1	610	24	15.9 22.2 25.4	0.625 0.875 1	318 782 1351	2813 6922 11,956	53 133 231	12 30 52
					34.9 34.9	1.375 1.375	3520 3520	31,157 31,157	400 400	90 90
					34.9 34.9	1.375 1.375	3520 3520	31,157 31,157	400 400	90 90
D	2585 & 4580	64:1	610	24	15.9 22.2 25.4	0.625 0.875 1	318 782 1351	2813 6922 11,956	53 133 231	12 30 52
					34.9 34.9	1.375 1.375	3520 3520	31,157 31,157	400 400	90 90
					34.9 34.9	1.375 1.375	3520 3520	31,157 31,157	400 400	90 90

1. Shaft diameter at square connection.
2. Unless otherwise noted, torque is limited by S17400 stainless steel (17-4 PH H1025) shaft material at 38°C (100°F). For other shaft materials, consult your [Emerson sales office](#).
3. Maximum manual actuator output.

Table 5. Fisher 1079 Manual Actuator Mounting Plate to Hytork Actuator Bolt Torque

HYTORK ACTUATOR MODEL NUMBER ⁽¹⁾	ACTUATOR MOUNTING HOLE SIZE	BOLT TORQUE	
		N•m	Lbf•ft
45	0.25-20 UNC	5	4
70 130 185 280	0.625-18 UNC	11	8
425A 680A	0.375-16 UNC	20	15
1125 1370	0.5-13 UNC	42	31
2585 4580	0.75-10 UNC	100	74

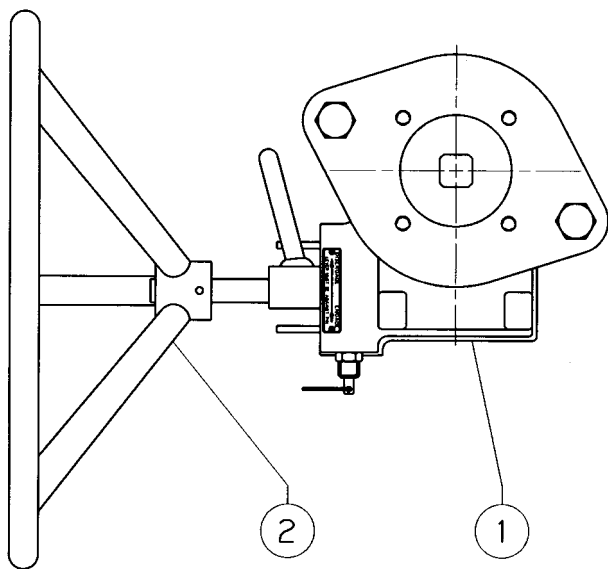
1. Applies to both double-acting and spring-return models.

Lubrication

The interior parts of the 1079 manual actuator should be lubricated on a regular schedule with a quality gear lubricant. The interior parts should also be lubricated whenever difficulty in handwheel rotation indicates a need for lubrication.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the bolts that secure the power actuator to the manual actuator, and remove the power actuator.
3. Remove the four cap screws that secure the gearbox cover plate and remove the gearbox cover plate.
4. Coat the worm, the drive sleeve gear teeth, and the bearing surfaces of the gearbox housing and worm with a quality gear lubricant.
5. Install the cover plate and four cap screws.
6. Install the power actuator on the manual actuator.

Figure 3. Fisher 1079 Declutchable Manual Actuator



24B0392-A

Parts Ordering

When corresponding with your [Emerson sales office](#), indicate the size of the Hytork actuator. If the manual actuator was shipped separately (not attached to a Hytork actuator), give the serial number of the unit, which is shown on a tag attached to the manual actuator.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Manual Actuator Assembly (figure 3)

Key	Description
-----	-------------

- | | |
|---|---|
| 1 | Gearbox, cast iron |
| 2 | Handwheel Assembly (includes handwheel and pin) |

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Fisher™ 1080 Declutchable Manual Actuator

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Figure 1. Fisher 1080 Manual Actuator
Mounted on a FieldQ Actuator



W9126

Introduction

Scope of Manual

This instruction manual includes installation, operation, and maintenance information for the Fisher 1080 Declutchable Manual Actuator. Refer to separate instruction manuals for instructions covering the FieldQ actuator and the control valve.



Do not install, operate, or maintain a 1080 manual actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#).

Table 1. Specifications

Available Configurations Direct acting; see Handwheel Rotation	handwheel opposite the actuator supply connections (see figure 2). Right hand or left hand mounting is specified when ordered. Mounting position 1 is standard.
Manual Actuator Sizes See table 2	
Power Actuator Compatibility Compatible with FieldQ actuator; see table 2	Approximate Weight without Handwheel Size AAA: 5.4 kg (12 lb) Size AA: 10 kg (22 lb) Size A: 14 kg (31 lb) Size B: 22 kg (49 lb) Size C: 34 kg (76 lb) Size D: 52 kg (115 lb) Size F: 68 kg (150 lb)
Maximum Torque Output See table 2	
Wheel-Rim Force See table 2	
Handwheel Rotation Clockwise handwheel rotation closes valve (produces clockwise valve shaft rotation)	Handwheel Weight 8-inch: 2.0 kg (4.50 lb) 12-inch: 4.0 kg (8.75 lb) 16-inch: 6.8 kg (15.00 lb) 24-inch: 5.4 kg (12.00 lb) 30-inch: 6.8 kg (15.00 lb) 36-inch: 7.8 kg (17.25 lb)
Mounting Positions Standard mounting is with the input shaft perpendicular to the FieldQ piston travel and the	

Description

The 1080 manual actuator, shown in figure 1, is a declutchable unit for manual operation of Fisher control valves that use a FieldQ power actuator. The 1080 manual actuator mounts directly on the FieldQ actuator. It can be engaged to allow manual operation of the valve when the power actuator is not in use or disengaged to allow automatic operation of the valve by the power actuator. The mechanism used allows manual actuator engagement at any point of power actuator rotation.

Specifications

The 1080 manual actuator specifications are given in table 1.

Educational Services

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emerson.com/mytraining

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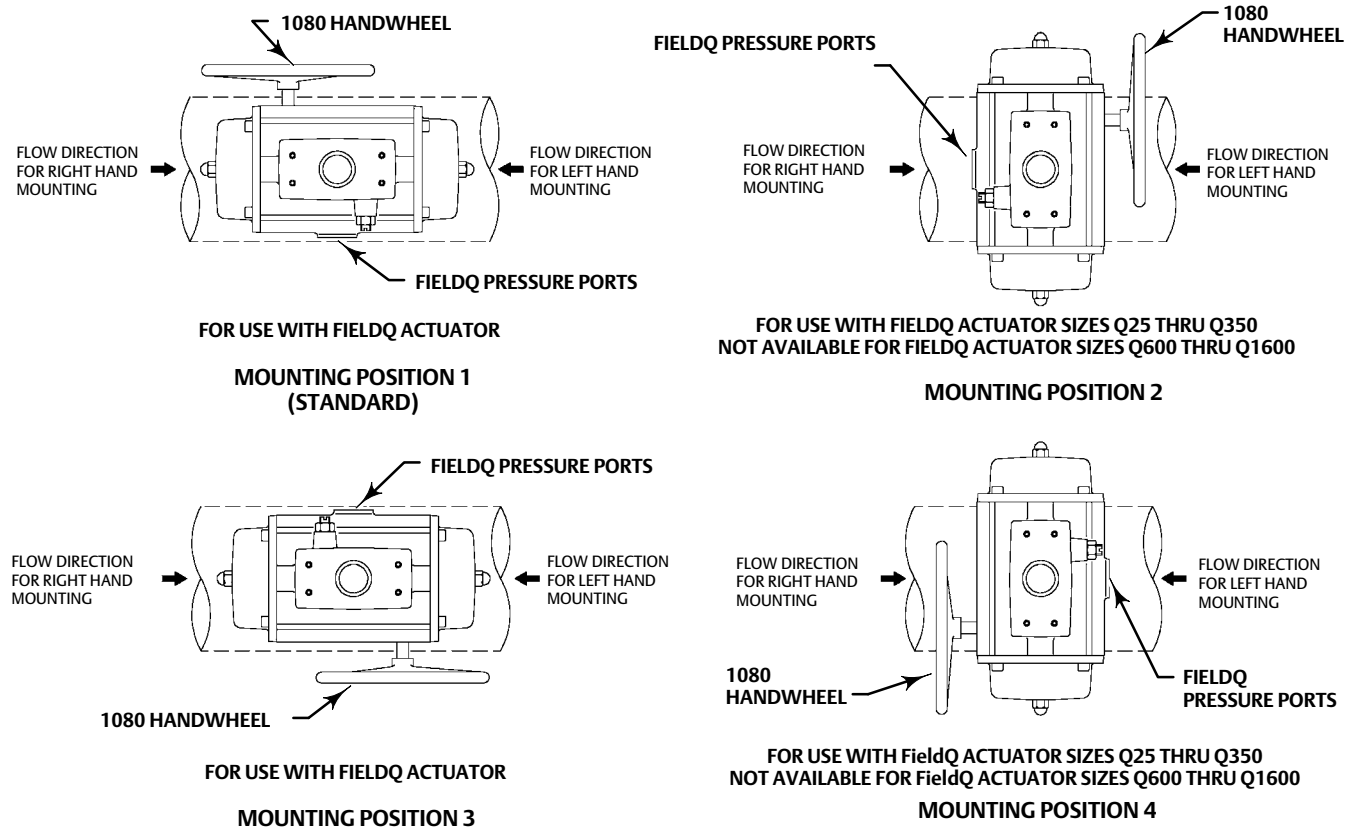
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Figure 2. Fisher 1080 Actuator Mounting Positions



NOTE:
RIGHT AND LEFT HAND MOUNTING IS BASED ON THE 8580 VALVE DRIVE SHAFT BEING MOUNTED IN THE RECOMMENDED HORIZONTAL POSITION.

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Installation

The 1080 manual actuator is normally shipped mounted between the valve assembly and the FieldQ actuator. If the manual actuator is shipped separately for installation on the FieldQ actuator, or if the manual actuator was removed for maintenance, mount the manual actuator by following the instructions in this section.

Field conversion of the FieldQ actuator for use with the 1080 manual actuator requires fastening an adaptor plate, included with the manual actuator, to the FieldQ actuator. The 1080 actuator is installed between the valve and the FieldQ actuator.

Figure 2 shows the manual actuator mounting positions. Positions 1 and 3 are possible with all sizes of the FieldQ. Positions 2 and 4 are only possible for FieldQ sizes Q40 through Q350 and Q1600. Fasten the adaptor plate to the power actuator with the mounting bolts provided with the manual actuator. Use the torque values given in table 3.

Installing the Manual Actuator

If you purchased the 1080 actuator as part of a valve and power actuator assembly, step 13 is the only step you will need to perform in the following procedures. If you purchased the 1080 actuator separately, perform all the steps and read all warnings and cautions below.

⚠ WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Also shut off all pressure lines to the power actuator and release all pressure from the power actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. For spring-return power actuators, allow the power actuator to remain in the position where the spring is relaxed. For double-acting power actuators, apply supply pressure as appropriate to position the valve disk in either the open or closed position.
3. Note whether the valve disk is in the open or closed position.
4. Engage the handwheel on the manual actuator. See the Engaging and Disengaging the Manual Actuator section in this manual for instructions.
5. If using position 1 or 3 from figure 2, rotate the handwheel to line up the index mark on the top of the manual actuator shaft and the drive shaft on the top of the power actuator. If using position 2 or 4 from figure 2, the index mark on top of the power actuator input drive on the 1080 must be perpendicular to the face of the valve disk and the slot in the top of the power actuator shaft (see figure 3).
6. Determine the correct relative positions of the power and manual actuators (see figure 2).
7. Remove the adaptor plate on the top of the gear box (see figure 3).
8. Attach the adaptor plate to the bottom of the power actuator with bolts furnished with the adaptor plate.
9. Slide the power actuator input drive into the power actuator (see figure 3).
10. Rotate either the manual actuator or the power actuator slightly so that the mounting holes on the manual actuator align with the mounting holes in the mounting plate on the power actuator.
11. Fasten the manual actuator to the mounting plate with the bolts, washers and nuts provided (see table 3).
12. Install the power actuator and manual actuator assembly on the valve as described in the installation section of the power actuator instruction manual. Remember the positions noted in steps 3 and 6, because you will need them when aligning the drive shaft on the top of the power actuator and the valve shaft.

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NOTICE

Undertravel or overtravel of the valve disk, especially at the closed position, may result in poor valve performance and/or damage to the equipment. Make certain that the power actuator travel stops are properly set before installing the valve. Refer to the instruction manuals for the power actuator for information about setting travel stops.

13. Make certain that the power actuator travel stops have been properly set. FieldQ actuator travel stops, the travel stop adjustments are made in the power actuator. The adjusting travel stops procedure is in the FieldQ [Instruction Manual](#).
14. Install the valve in the line using the instructions in the valve instruction manual.

Operation

After the actuator and control valve assembly are installed, the manual actuator is ready for operation.

⚠ WARNING

Applying too much torque to the actuator and valve parts could cause damage to the parts and result in loss of control of key internal valve components (e.g. disk or ball). This loss of control may result in personal injury due to a sudden increase or decrease of pressure within -- or release of pressure from -- the pipeline. To avoid such damage or personal injury, do not exceed the wheel rim force listed in table 2. Also, do not use wrenches or other devices on the handwheel or handwheel shaft to increase operating force.

If the force required to rotate the handwheel exceeds the wheel-rim force listed in table 2, refer to the Maintenance procedures.

Table 2. Actuator Size Selection and Specifications⁽¹⁾

ACTUATOR SIZE	FIELDQ ACTUATOR SIZE	GEAR RATIO	NUMBER OF TURNS TO CLOSE	HANDWHEEL DIAMETER		1080 MAXIMUM TORQUE ⁽²⁾		FIELDQ TORQUE ⁽³⁾		WHEEL RIM FORCE FOR MAXIMUM TORQUE ⁽⁴⁾	
				mm	Inches	N•m	lb•in	N•m	lb•in	N	lbf
AAA/S2	Q40	24:1	6	203	8	271	2,400	58	513	93	21
	Q65							89	788	147	33
AAA/S3	Q100							132	1,168	218	49
AA/S4	Q200	34:1	8.5	305	12	542	4,800	289	2,558	222	50
	Q350							502	4,443	387	87
A/S4	Q600	32:1	8	610	24	926	8,200	866	7,550	276	62
B/S5	Q950	40:1	10			1,356	12,000	1,290	11,300	271	61
C/S6	Q1600	54:1	13.5	762	30	2,034	18,000	2,140	18,600	298	67

¹. Only the 1080/FieldQ combinations shown are available.
². Maximum torque output of the 1080 actuator only.
³. Torque output of the FieldQ actuator at 100 psig and required 1080 torque output for use with the FieldQ.
⁴. Amount of force necessary at rim of the handwheel to match torque output of the FieldQ at 100 psig.

Engaging and Disengaging the Manual Actuator

Engaging the Manual Actuator

1. Engage the manual actuator **before** venting the power actuator loading pressure. Releasing the air pressure prior to engaging could result in undesirable valve rotation.

⚠ WARNING

Undesirable valve rotation or loss of control of key internal valve components (e.g. disk/ball), may result in personal injury due to a sudden increase or decrease of pressure within - or release of pressure from - the pipeline.

2. Pull the ring on the detent mechanism to unlock the lever. At the same time, move the lever into the engaged position until it is against the stop pin and locked in position by the detent mechanism. See figure 3.
3. If the lever sticks midway, turn the handwheel 1/3 turn (2 full turns for units with additional gearbox between the handwheel and lever). Then try the detent lever again. Repeat this step as necessary, turning the handwheel in the same direction, until the lever moves freely (see figure 4). The reason the lever may stick is that the worm is not in proper alignment with the gear (see figure 4). Rotation of the worm will allow for proper alignment. Excessive force should not be required.
4. Shut off supply pressure to the power actuator and bleed off or equalize pressure in the cylinders. If applicable, open the power actuator bypass valve.

Note

If the loading pressure in the power actuator has already been released, you will not need to use the optional bypass relief valve.

Disengaging the Manual Actuator

⚠ WARNING

Disengaging the manual actuator when forces, such as spring compression, cylinder pressure, and dynamic torque, are present may cause sudden, extreme movement of all control valve components. Disengaging the lever with excessive force can result in damage to equipment and violent disturbance of the process.

Damage to equipment resulting in loss of control of internal valve components (e.g. disk/ball) - or violent disturbance of the process may result in personal injury due to a sudden increase or decrease of pressure within - or release of pressure from - the pipeline.

Before disengaging the manual actuator, take appropriate steps to ensure that the return to automatic operation will not result in an extreme repositioning of control valve components. Procedures to determine approximate system balance are given in the following steps.

1. Approximate system balance should be achieved, before disengaging the manual actuator. The system is in balance when the actual valve disk position is approximately the same as the position requested by the automatic control system. Under balanced system conditions, the manual actuator disengaging lever moves freely without use of excessive force.

If after releasing the detent mechanism, the lever does not move freely toward the disengaged position, some system force is causing an imbalance. A forced return to automatic operation under these conditions can cause serious damage to the equipment and violent disturbance of the process.

2. If possible, determine whether the automatic control system is tending to open or close the valve disk, and rotate the handwheel in the appropriate direction until the lever can be easily moved by hand. As an alternate approach, local manipulation of the supply pressure to the power actuator may bring the set point of the automatic system closer to the actual valve disk position.
3. If a smooth transition from manual to automatic operation cannot be ensured, isolate the valve from the process. On Spring Return actuators, position the manual actuator and the disk to the spring fail open or close (whichever is applicable) end of travel so that no position changes will happen when supply pressure is applied to the power actuator. On double-acting actuators, this positioning will not be necessary.
4. Pull the ring on the detent mechanism to unlock the lever. Push the lever into the disengaged position until it is against the stop pin and locked in position by the detent mechanism.
5. Close the bypass valve, if needed, and return supply pressure to the power actuator.

Maintenance

⚠ WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the power actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression. If using a Spring Return actuator, first check to make sure the valve has been moved to the fail safe position to prevent unexpected actuator movement.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If the force required to rotate the handwheel exceeds the wheel-rim force listed in table 2 check for the following conditions:

- Insufficient lubrication
- Seized actuator parts
- Excessive pressure drop across the valve, or
- Obstruction to the valve disk rotation.

If the manual actuator does not seem to control the process fluid, the worm or drive sleeve gear teeth may be broken, the handwheel pin may be sheared, or the power actuator or internal valve parts may be broken.

Refer to the power actuator and valve instruction manuals if power actuator or valve maintenance is needed.

Lubrication

The interior parts of the 1080 manual actuator should be lubricated on a regular schedule with a quality gear lubricant. The interior parts should also be lubricated whenever difficulty in handwheel rotation indicates a need for lubrication.

⚠ WARNING

Before performing any of these lubrication procedures, observe the steps in the WARNING at the beginning of the Maintenance section.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the bolts that secure the power actuator to the manual actuator adaptor plate and remove the power actuator.
3. Remove the cap screws that secure the gearbox lid and remove the gearbox lid.
4. Coat the worm, the drive sleeve gear teeth, and the bearing surfaces of the gearbox housing and worm with a quality gear lubricant.
5. Replace the cover plate and cap screws using the bolt torques listed in table 5.
6. Replace the power actuator on the manual actuator. Fasten the manual actuator to the adaptor plate using the torque values in table 3.

Table 3. Fisher1080 Adaptor Plate to Gearbox

1080 Actuator	Bolt Size	Bolt Torque N•m	Bolt Torque lb•f
AAA/S2	3/8	39	29
AAA/S3	3/8	39	29
AA/S4	1/2	91	67
A/S4	5/8	163	120
B/S5	5/8	163	120
C/S6	3/4	258	190

Table 4. Fisher 1080 Mounting Bracket to FieldQ Actuator

1080 Actuator	Bolt Size	Bolt Torque N•m	Bolt Torque lb•f
AAA/S2	5/16	22.4	16.5
AAA/S3	5/16	22.4	16.5
AA/S4	3/8	39.3	29
A/S4	1/2	90.8	67
B/S5	5/8	122	90
C/S6	3/4	203	150

Table 5. Fisher 1080 Gearbox Lid

1080 Actuator	Bolt Size	Bolt Torque N•m	Bolt Torque lb•f
AAA/S2	5/16	31.2	23.0
AAA/S3	5/16	31.2	23.0
AA/S4	3/8	56.3	41.5
A/S4	1/2	138	102
B/S5	5/8	277	204
C/S6	3/4	494	364

Figure 3. Typical Fisher 1080 Assembly

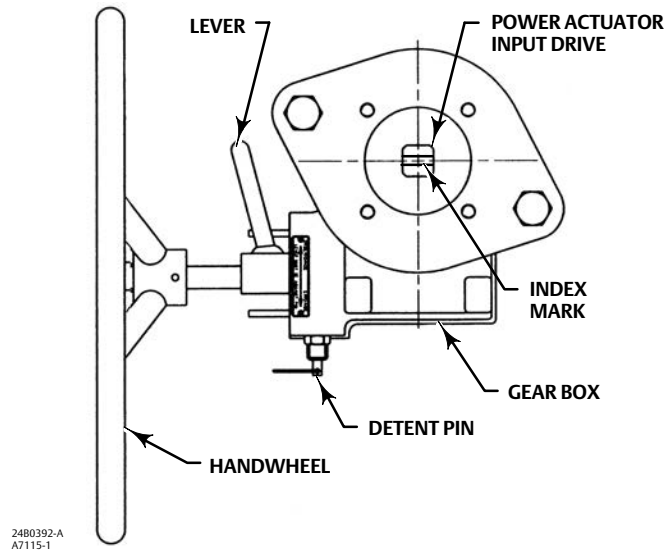
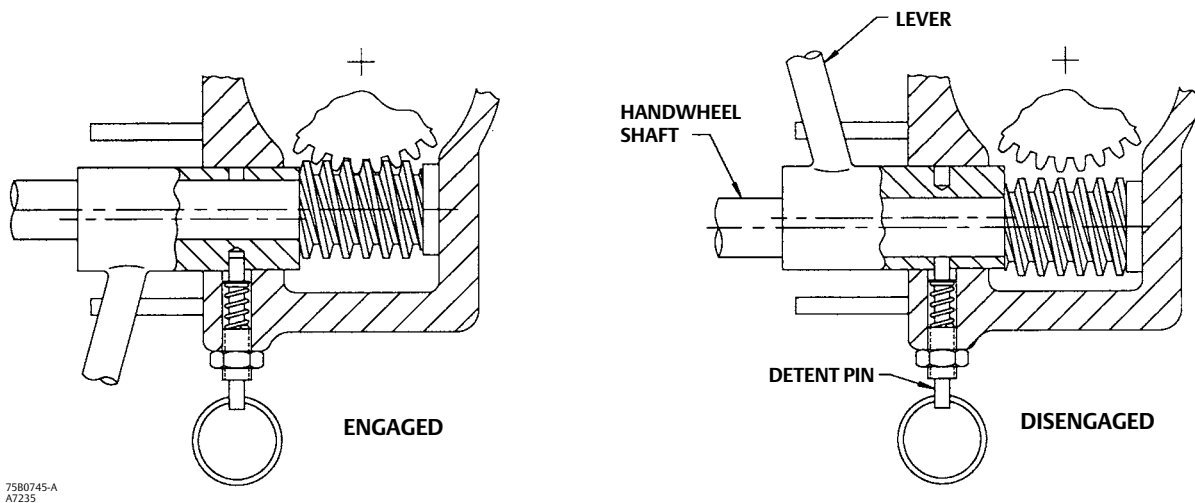


Figure 4. Worm Gear Mechanism



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Fisher™ 2052 Diaphragm Rotary Actuator



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, adjustment, operation, maintenance and parts information for the Fisher 2052 diaphragm rotary actuator (Figure 1). Instructions for the control valve, positioner, manual actuator and other accessories are included in separate manuals.



WARNING



Do not install, operate or maintain a 2052 actuator without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson sales office before proceeding.

1.2 Description

2052 spring-and-diaphragm rotary actuators are used on rotary-shaft valve bodies for throttling or on-off applications. The 2052 may be used for on-off service without a positioner or it may be used for throttling service with a positioner, depending on service conditions. The 2052 has an ISO 5211 mating interface that allows installation to non-Fisher valves. Refer to separate bulletins for valve and positioner information.

A top-mounted handwheel option is available for infrequent service as a manual actuator. For repeated or daily manual operation, the unit should be equipped with a side-mounted declutchable 1078 manual actuator. Externally adjustable travel stops are used to limit the degree of rotation at both ends of the actuator stroke.

The lever for the 2052 actuator is supported by bushings. The lever may be changed to accommodate valve bodies with different size valve shafts.

Optional stainless steel lever available for use in corrosive environments. Standard ductile iron levers required for use with 1078 Declutchable Manual Operator, lockout and ISO 5211 square insert.

2052 levers are available with or without a quad square feature, see Figure 3. This feature is needed for options like 1078 side-mounted handwheels, lockout devices on sizes 2 and 3 and square shaft insert for ISO 5211 mounting. Verify whether this feature is present on the existing lever prior to ordering parts to add one of these options. A replacement lever may need to be ordered as well. See Section 3.3 on how to replace the lever.

Figure 1. Fisher Control-Disk™ Valve with 2052 Actuator and DVC6200 Digital Valve Controller

W9418-2

Table 1. Fisher 2052 Actuator Specifications

Specifications	
Actuator Mounting Connections	Splined shaft connection, ISO 5211 actuator-to-bracket connection Size 1: F07, Size 2: F10, Size 3: F14
Actuator Sizes	See Table 2
Operating Pressure ⁽¹⁾	See Table 3
Maximum Diaphragm Casing Pressure	Sizes 1, 2 and 3 Actuators: 5 barg / 73 psig
Pressure Connection	See Table 5
Torque Output	See Table 3
Actuator Temperature Capabilities ⁽¹⁾	Standard: -45 to 80°C / -50 to 176°F Optional: -45 to 100°C / -50 to 212°F ⁽³⁾ or -60 to 80°C / -76 to 176°F ⁽⁴⁾
Operation	Field reversible between PDTC and PDT0; right- and left-hand mounting, any angle of orientation
Approximate Weight	Size 1: 22.2 kg / 49 lb Size 2: 54.4 kg / 120 lb Size 3: 113 kg / 250 lb
Controller/Positioners Available	DVC2000, DVC6020, DVC6030, DVC6200, 3610J, 3620J, 4190, C1
Adjustable Travel Stops	Standard adjustable up and down stops capable of 30 degrees of adjustment per stop.

- continued -

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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2052 Actuator

September 2025

Table 1. Fisher 2052 Actuator Specifications (continued)

Specifications	
Accessories Available	846, 646, 2625 and 67C Series, switches, i2P-100, VBL, DXP, GO Switch™
Handwheel	Top-mounted handwheel: Optional on Sizes 1, 2 and 3 actuators Declutchable handwheel: Optional on Sizes 1, 2 and 3 actuators
Operational Lockout ⁽²⁾	Available for customer-supplied padlock to lock the actuator in the spring-fail position
1. The pressure/temperature limits in this manual should not be exceeded. The current SIL certification for the 2052 actuator is only relevant for the standard temperature ratings shown. 2. Lockout and declutchable handwheel cannot be used together on sizes 2 and 3 actuators. 3. Temperature range only applies when using silicone diaphragm material. Silicone diaphragm is not available with the top-mounted handwheel option. 4. Temperature range requires use of stainless steel bolting for yoke and travel stops. Not available with top-mounted handwheel.	

Table 2. Actuator and Lever Availability for Shaft Sizes

SHAFT SIZE		DUCTILE IRON LEVER			STAINLESS STEEL LEVER		
		Actuator Size					
mm	in.	1	2	3	1	2	3
12.7	1/2	X ¹	---	---	X	---	---
14.3 x 15.9	9/16 x 5/8	X ¹	X ¹	---	X	X	---
15.9	5/8	X ¹	X ¹	---	X	X	---
19.1	3/4	X ¹	X ¹	X ¹	X	X	---
22.2	7/8	---	X ¹	X ¹	---	X	X
25.4	1	---	X ¹	X ¹	---	X	X
28.6 x 31.8	1-1/8 x 1-1/4	---	X ¹	X ¹	---	X	X
31.8	1-1/4	---	X ¹	X ¹	---	X	X
31.8 x 38.1	1-1/4 x 1-1/2	---	---	X ¹	---	---	X
38.1	1-1/2	---	---	X ¹	---	---	X
39.7 x 44.5	1-9/16 x 1-3/4	---	---	X ¹	---	---	X
44.5	1-3/4	---	---	X ¹	---	---	X
50.8	2	---	---	X ¹	---	---	X
Note: Ductile iron lever has quad square feature.							

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Table 3. Torque Versus Actuator Size

ACTUATOR SIZE AND ACTION	OPERATING PRESSURE							
	2 barg / 29 psig ⁽¹⁾		3 barg / 44 psig ⁽¹⁾		4 barg / 58 psig ⁽¹⁾		4.7 barg / 68 psig ⁽¹⁾	
	Torque							
	N•m	lbf•in	N•m	lbf•in	N•m	lbf•in	N•m	lbf•in
1 (PDTO)	25.5	226	25.5	226	51.2	453	51.2	453
1 (PDTC)	25.5	226	36.2	320	51.2	453	72.4	641
2 (PDTO)	105	930	105	930	210	1860	210	1860
2 (PDTC)	105	930	175	1550	210	1860	320	2840
3 (PDTO)	327	2890	327	2890	631	5580	631	5580
3 (PDTC)	280	2480	557	4930	584	5170	930	8230

1. Do not interpolate between operating pressures. Consult your [Emerson sales office](#) for assistance.

Table 4. Fisher 2052 Actuator Mounting Styles

MOUNTING	ACTION ⁽¹⁾	VALVE SERIES OR DESIGN			VALVE SERIES OR DESIGN	
		Ball/Plug Rotation to Close	V150, V200 and V300	CV500 V500	Disk/Ball Rotation to Close	A11, 8510B, 8532, 8560, 8580, 9500 and Control-Disk Valve
Right-Hand	PDTC PDTO	CCW CCW	A B	A B	CW CW	B A
Left-Hand	PDTC PDTO	CCW CCW	D C	D C	CW CW	C D
Left-Hand (Optional) ⁽²⁾	PDTC PDTO	CW CW	C D	N/A N/A	N/A N/A	N/A N/A

1. PDTC—Push-down-to-close and PDTO—Push-down-to-open.
 2. A left-hand mounted ball will be required for the NPS 3 through 12 Vee-Ball Series B and the NPS 14 and 16, with or without attenuator.

Figure 2. Fisher 2052 Actuator Mounting Styles

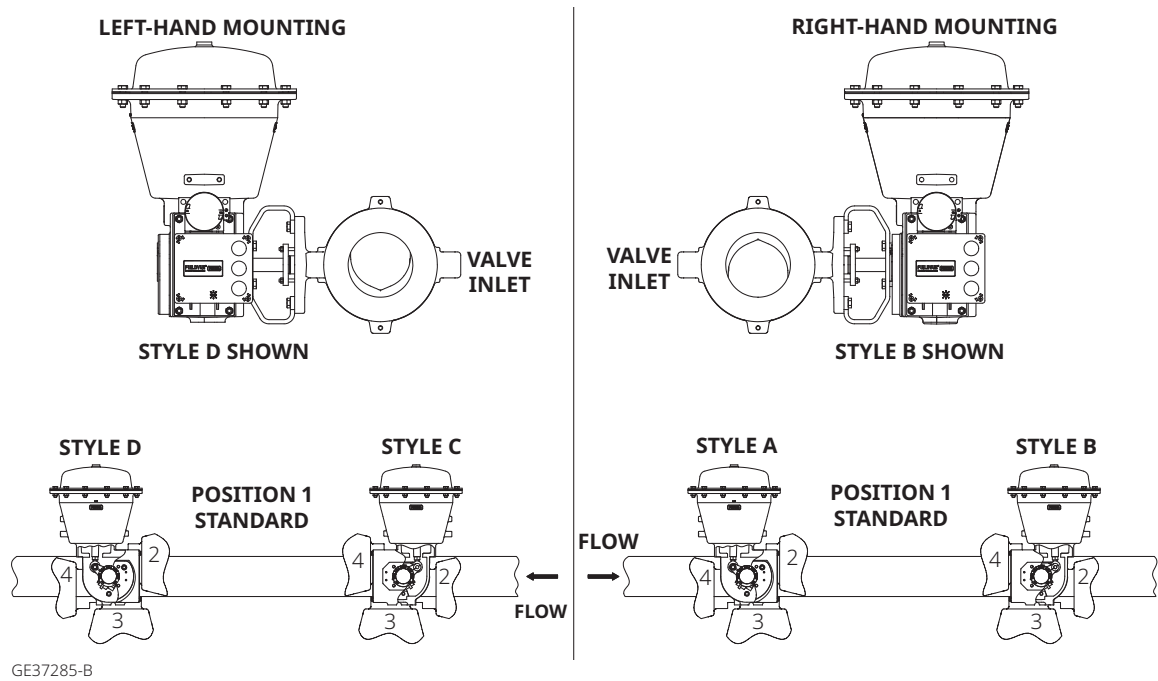


Figure 3. Fisher 2052 Lever Options

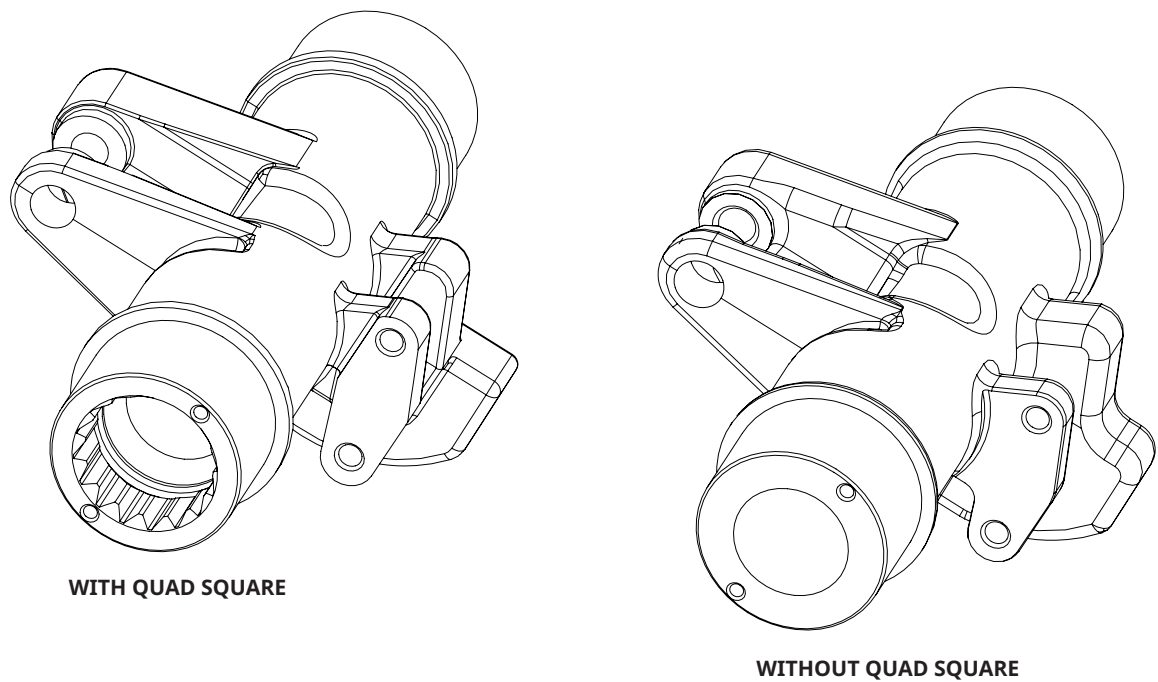


Table 5. Pressure Connections

ACTUATOR SIZE	PRESSURE CONNECTION			
	1/4 NPT	1/2 NPT	3/4 NPT	G 1/4
1	Standard	Optional	Not available	Optional
2	Standard	Optional	Not available	Optional
3	Not available	Standard	Optional	Not available

1.3 Education Services

Emerson Education Services

Phone: 800-338-8158

Email: education@emerson.com

emerson.com/mytraining

1.4 Specifications

Specifications are shown in Table 1 for 2052 actuators. Specifications for actuator operation are stamped on a metal nameplate attached to the actuator.

Table 6. Bolting Torque Requirements^(1, 2)

DESCRIPTION KEY NUMBER	ACTUATOR SIZE	TORQUE		FASTENER LUBRICATION
		N•m	Lbf•ft	
Rod End Bearing Clamping Bolt Torque, Key 16	1	38	28	Threadlocker
	2	180	130	
	3	400	295	
End Plate to Housing Bolt Torque, Key 4	1	68	50	None
	2	120	90	
	3	210	155	
Diaphragm Plate to Rod Bolt Torque, Key 7	1	27	20	Anti-Seize Lubricant
	2	115	85	
	3	300	220	
Casing Bolt Torque, Key 8	1	55	40	None
	2	55	40	
	3	55	40	
Housing to Yoke Bolt Torque, Key 28	1	27	20	None
	2	68	50	
	3	245	180	
Lever-Spline Clamping Bolt Torque, Key 15	1	38	28	None
	2	115	85	
	3	175	130	
Optional Lockout Kit Mounting Bolt Torque, Key 53	1	N/A	N/A	None
	2	88	65	
	3	340	250	

1. Exceeding any torque requirements could damage the actuator and impair safe operation.

2. For other lubricants, contact your [Emerson sales office](#) for torques.

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations.

Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

To avoid personal injury and parts damage, do not apply pressure that exceeds the Maximum Diaphragm Casing Pressure in Table 1. Use pressure-limiting or pressure-relieving devices to prevent the Operating Pressure from exceeding the values shown in Table 3.

The actuator, as it comes from the factory, is normally mounted on a valve body. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the procedures presented in the Actuator Mounting section. Follow the procedures given in the valve instruction manual when installing the control valve in the pipeline.

If a positioner is ordered with the actuator, the pressure connection to the actuator is normally made at the factory. If it is necessary to make this connection, run tubing of the appropriate size for the diaphragm casing pressure connection (reference Table 5) between the pressure connection and the instrument. Keep the length of tubing or pipe as short as possible to avoid transmission lag in the control signal.

When the control valve is completely installed and connected to the controlling instrument, check to make sure that the action is correct (air-to-open or air-to-close) and that the controlling instrument is properly configured for the desired action. For successful operation, the diaphragm rod assembly, lever and valve shaft must move freely in response to changes in the loading pressure on the diaphragm.

2.1 Actuator Mounting

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Safely vent the power actuator loading pressure.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.**
- **Check with your process or safety engineer for any hazards that may be present from exposure to process media.**

Use the following steps to mount the actuator or to change actuator mounting style or position.

Unless otherwise specified, key numbers referenced in the following procedures are shown in Figure 8 for the 2052 actuator.

If the actuator is mounted on a valve body and it is necessary to change mounting style or position, the actuator must first be separated from the valve body.

1. Isolate the valve body from the process. Release process pressure and vent all actuator pressure.
2. Remove the cover or plug (key 2).

WARNING

To avoid personal injury and equipment damage from moving parts, keep fingers and tools clear while stroking the actuator with the cover removed.

3. Loosen the cap screw (key 15).

4. Separate the actuator from the valve body by removing the cap screws and nuts which secure the valve to the mounting yoke (key 27). Proceed to step 5.

If the actuator is not mounted on a valve body, ensure the up and down travel stops (see Figure 4) are adjusted correctly to achieve the desired actuator rotation. Use the travel indicator (key 21) and travel scale (key 19) as reference.

NOTE

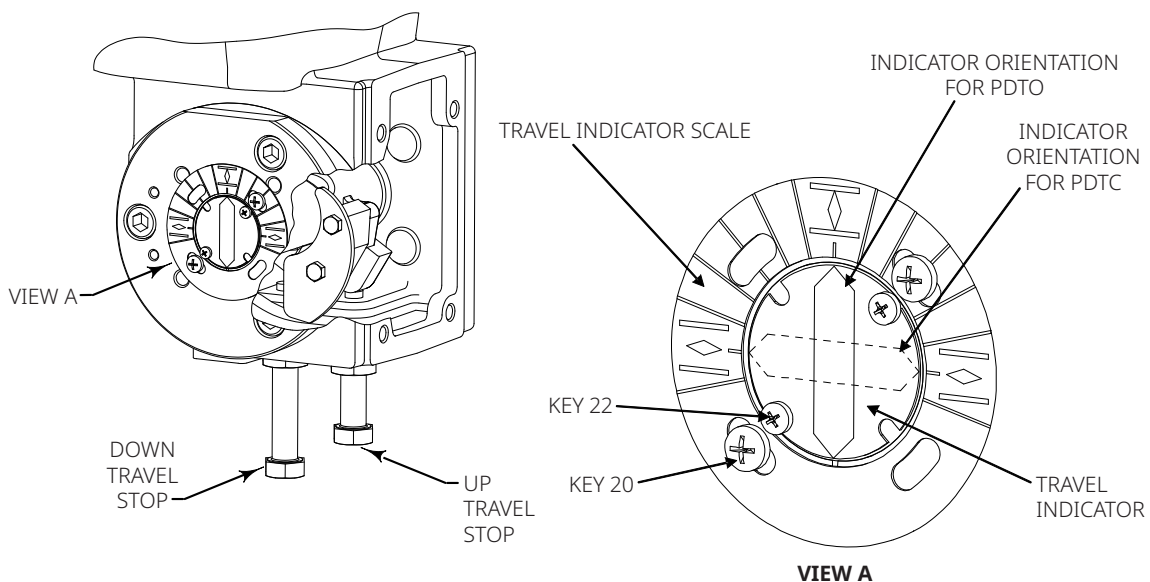
Once each travel stop is properly positioned, adequately tighten the hex nut (key 24) to lock the travel stop in place.

5. Refer to Figure 2 and Table 4 for available mounting styles and positions. The actuator is normally positioned vertically with the valve in a horizontal pipeline.
6. Determine whether the actuator mounting yoke (key 27) will be mounted on the end plate assembly (key 3) side or on the actuator housing boss side of the actuator. If the desired mounting position and style require moving the mounting yoke (key 27) and travel indicator components to opposite sides of the actuator, remove the machine screws (keys 20 and 22), the travel indicator scale (key 19) and the travel indicator (key 21). Remove the cap screws (key 28) and the mounting yoke (key 27). Install the mounting yoke in the desired position (on the end plate assembly or on the actuator housing boss). Tighten the mounting cap screws to the torque specified in Table 6. Install the travel indicator components on the opposite side of the actuator.

⚠ WARNING

To avoid personal injury or property damage, ensure the travel indicator is installed correctly to coincide with the desired actuator action. Refer to Figure 4 for more information.

Figure 4. Fisher 2052 Actuator Travel Stops and Travel Indication



7. Before sliding the valve shaft into the lever, position the valve ball or disk as follows:
For push-down-to-close action, the valve ball or disk should be in the fully open position.
For push-down-to-open action, the valve ball or disk should be in the fully closed position (see the valve body instruction manual).
8. Make sure that the index markings on the valve shaft are properly aligned with either the markings on the lever or the travel indicator scale mounting holes. Slide the valve shaft into the lever. (See Figure 5 for one possible orientation.) Install the valve mounting cap screws and nuts. Tighten to the torque value given in the appropriate valve body instruction manual.
9. Ensure all end play in the valve shaft is removed by directing the valve shaft and control element toward the actuator as much as possible.
10. Tighten the socket head cap screw (key 15) which compresses the splined lever connection to the valve shaft (see Table 6). Install the cover or plug (key 2) into the access hole in the housing.

NOTICE

When adjusting the travel stop for the closed position of the valve ball or disk, refer to the appropriate valve instruction manual for detailed procedures. Undertravel or overtravel at the closed position may result in poor valve performance and/or damage to the equipment.

Over-rotation of the lever could result in the diaphragm stroking to the point where the diaphragm seals off against the air signal connection. This could prevent an air signal from being able to stroke the valve.

11. Adjust the up travel stop (see Figure 4) so that the valve ball or disk is in the desired position. When adjusting the up travel stop, ensure the stop is not backed out too far, causing the lever to over-rotate. Over-rotation of the lever may cause damage to valve components. Avoid over-rotation by adjusting the up travel stop so that the travel indicator screws (key 22) align with the travel scale screws (key 20). See Figure 4.
12. Stroke the actuator and adjust the down travel stop so that the valve ball or disk is in the desired position.

NOTE

Once each travel stop is properly positioned, adequately tighten the hex nut (key 24) to lock the travel stop in place.

13. Make sure that the travel indicator pointer matches the ball or disk position. Remove and install in the proper position if necessary.
14. Refer to the table of contents for accessory installation procedures.

Section 3: Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given below for disassembly and assembly of parts. Key numbers referenced in the following steps are shown in Figure 8 for the 2052, except as listed below or otherwise specified in the procedures.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Safely vent the power actuator loading pressure.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **Check with your process or safety engineer for any hazards that may be present from exposure to process media.**

3.1 Replacing Diaphragm

Isolate the valve body from the process. Release process pressure and vent all actuator pressure.

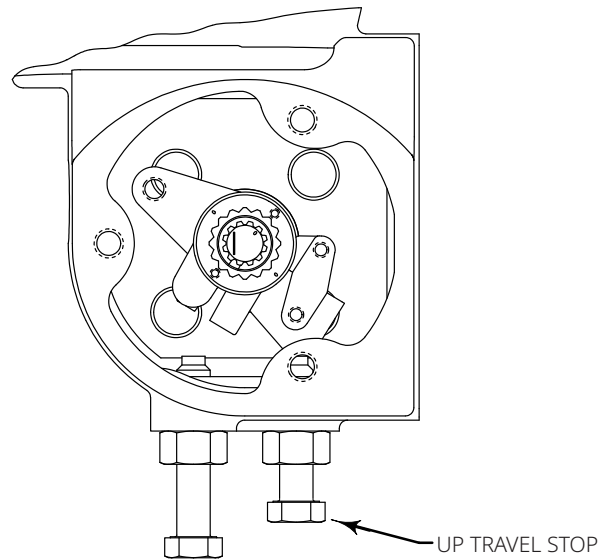
Disassembly

1. Remove the supply tubing or pipe from the top casing assembly (key 5).

WARNING

To avoid personal injury from precompressed spring force suddenly thrusting parts away from the actuator, spring compression must first be relieved. Closely follow the instructions below.

Figure 5. Orientation of the Fisher 2052 Actuator Lever into the Housing and Aligning the Actuator to the Valve Shaft Markings



2. Loosen, but do not remove, all casing cap screws and hex nuts (keys 8 and 9). Ensure there is no spring force to the top casing assembly (key 5). If spring force is detected against the top casing assembly, ensure the up travel stop cap screw (key 23) is adjusted correctly to prevent over-rotation of the lever (key 14). Refer to Figure 4. The travel indicator screws (key 22) in the end of the lever should be in alignment with the travel scale screws (key 20). If the up travel stop is confirmed to be adjusted correctly and force is still detected against the top casing assembly, contact your local Emerson service center. Alternatively, replace two oppositely located casing cap screws (key 8) with 100 mm / 4 in. long fully threaded M10 cap screws of ISO 898-1 Property Class 8.8 material or equivalent. Loosen the nuts (key 9) on the two fasteners in an equivalent manner to relieve spring force.
3. Carefully remove all cap screws and hex nuts (keys 8 and 9) from the top casing assembly. The spring forces are retained by the diaphragm rod assembly (key 10), allowing quick removal of the pressure retaining components.
4. Remove the top casing assembly and the diaphragm (key 11).
5. Inspect the diaphragm plate (key 6). If the diaphragm plate is damaged or if further disassembly of the actuator is required, proceed to the Replacing Diaphragm Plate, Diaphragm Rod Assembly and Spring(s) procedure.
6. Inspect the diaphragm and replace if necessary.

Assembly

1. Place the diaphragm (key 11) on the diaphragm plate (key 6), making certain that it is properly centered.
2. Observe the correct position of the loading connection fitting and install the top casing assembly (key 5). Replace the cap screws and nuts (keys 8 and 9) which secure the top casing assembly to the actuator housing. Tighten the nuts in an alternating fashion (see Table 6).
3. Install the inlet piping to the top casing assembly.

3.2 Replacing Diaphragm Plate, Diaphragm Rod Assembly and Spring(s)

Isolate the valve body from the process. Release process pressure and vent all actuator pressure.

Disassembly

1. Remove the supply tubing or pipe from the top casing assembly (key 5).

WARNING

To avoid personal injury from precompressed spring force suddenly thrusting parts away from the actuator, spring compression must first be relieved. Closely follow the instructions below.

2. Loosen, but do not remove, all casing cap screws and hex nuts (keys 8 and 9). Ensure there is no spring force to the top casing assembly (key 5). If spring force is detected against the top casing assembly, ensure the up travel stop cap screw (key 23) is adjusted correctly to prevent over-rotation of the lever (key 14). Refer to Figure 4. The travel indicator screws (key 22) in the end of the lever should be in alignment with the travel scale screws (key 20). If the up travel stop is confirmed to be adjusted correctly and force is still detected against the top casing assembly, contact your local Emerson service center. Alternatively, replace two oppositely located casing cap screws (key 8) with 100 mm / 4 in. long fully threaded M10 cap screws of ISO 898-1 Property Class 8.8 material or equivalent. Loosen the nuts (key 9) on the two fasteners in an equivalent manner to relieve spring force.
3. Carefully remove all cap screws and hex nuts (keys 8 and 9) from the top casing assembly. The spring forces are retained by the diaphragm rod assembly (key 10), allowing quick removal of the pressure retaining components.
4. Remove the top casing assembly and the diaphragm (key 11).

5. Inspect the diaphragm plate (key 6).
 - a. To relieve spring compression, using a hex wrench, unscrew and remove the socket head cap screw (key 7) which secures the diaphragm plate (key 6) to the diaphragm rod assembly (key 10). Remove the diaphragm plate.
6. Remove the spring (key 13) or springs (keys 12 and 13).
7. The guide assembly (key 48) may be removed for inspection (size 3 only).

NOTE

At this stage of disassembly, it may be determined that further disassembly is not necessary. If separation of the diaphragm rod assembly from the lever is not warranted, proceed to the Assembly portion within this section of the procedure.

8. To gain access to the cap screw (key 16) which secures the diaphragm rod assembly to the lever, the end plate assembly (key 3) must be removed. Before the end plate assembly can be removed, one of the following procedures must be performed. Proceed as appropriate:
 - For actuators with valve bodies mounted on the end plate assembly (key 3) side of the actuator, the actuator must be separated from the valve body. Perform steps 1 through 4 of the Actuator Mounting section, remove the mounting yoke (key 27) and then return to step 9 of this section.
 - For actuators with valve bodies mounted on the actuator housing boss side of the actuator [opposite of the endplate (key 3)], remove the travel indicator pointer (key 21). Proceed to step 9.
9. Remove the socket head cap screws (key 4) and the end plate assembly (key 3).
10. Remove the cap screw (key 16) and nut (key 17) if applicable (size 3 only), that secures the actuator lever (key 14) to the diaphragm rod assembly (key 10). Remove the diaphragm rod assembly.
11. Inspect all parts and replace if necessary.
12. If total disassembly of the actuator is required or if the actuator will be assembled for use with a valve body with a different valve shaft diameter, proceed to the Changing or Replacing Actuator Lever procedure.

Assembly

1. Fasten the diaphragm rod assembly (key 10) to the lever using the cap screw (key 16) and nut (key 17) if applicable. Tighten per Table 6.
2. Install the housing end plate (key 3).
3. Adjust the travel stop bolts to the correct position so that the travel indicator screws (key 22) align with the travel scale screws (key 20). See Figure 4.
4. Install the guide assembly (key 48 - size 3 only).
5. Install the spring(s). The outer (larger diameter) spring is standard for the single spring sizes 1 and 2 constructions. The inner spring is standard for the single spring size 3 construction.
6. Place the diaphragm plate (key 6) onto the spring(s). It is important that the springs be properly seated in their respective counterbores on the bottom side of the plate. If necessary, push or pull the diaphragm plate toward center to ensure the springs are engaged into their respective seats.
7. Lubricate the socket head capscrew (key 7) and tighten per Table 6.
8. Place the diaphragm (key 11) on the diaphragm plate (key 6), making certain that it is properly centered.
9. Observe the correct position of the loading connection fitting and install the top casing assembly (key 5). Replace the cap screws and nuts (keys 8 and 9) which secure the top casing assembly to the actuator housing. Tighten the nuts in an alternating fashion (see Table 6).
10. Install the inlet piping to the top casing assembly.
11. Install the travel indicator (key 19) if removed.
12. If the actuator was removed from the valve body, refer to the appropriate section in the Actuator Mounting procedure and proceed as applicable.

3.3 Changing or Replacing Actuator Lever



WARNING

Avoid personal injury or property damage. The end plate assembly (key 3) and lever (key 14) may only be removed after the actuator spring compression forces are safely relieved. Refer to the instructions below.

Disassembly

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Safely vent the power actuator loading pressure.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **Check with your process or safety engineer for any other hazards that may be present from exposure to process media.**

1. Isolate the valve body from the process. Release process pressure and vent all actuator pressure.
2. Remove the cover or plug (key 2).

WARNING

To avoid personal injury and equipment damage from moving parts, keep fingers and tools clear while stroking the actuator with the cover removed.

3. Loosen the cap screw (key 15).
4. Follow steps 2 through 10 in the Replacing Diaphragm Plate, Diaphragm Rod Assembly and Spring(s) section.
5. Remove and inspect the lever (key 14). If the lever is worn or damaged or if the actuator will be mounted to a valve body requiring a different size lever, replace the lever.
6. Inspect the bushings located in the end plate (key 3) and housing (key 1) assemblies. If bushings are excessively worn or damaged, remove them with a press. Press in new bushings so that they are flush with the exterior surfaces of the actuator housing and the end plate assembly.

Assembly

1. Refer to Figure 5 for the correct orientation of the lever during assembly.
2. If a cam-operated positioner is used, install the cam to the lever with the parts provided by the appropriate instrument mounting kit. Be sure to observe the orientation shown in Figure 5 and follow all procedures given in the positioner instruction manual.
3. Insert the lever into the bushing in the actuator housing.
4. Fasten the rod end bearing diaphragm rod assembly to the lever using the cap screw (key 16) and nut (key 17) if applicable. Tighten per Table 6.
5. Install the end plate assembly (key 3).
6. Adjust the travel stop bolts to the correct position so that the travel indicator screws (key 22) align with the travel scale screws (key 20). See Figure 4.
7. Install the guide assembly (key 48) size 3 only.
8. Install the spring(s). The outer (larger diameter) spring is standard for the single spring sizes 1 and 2 constructions. The inner spring is standard for the single spring size 3 construction.
9. Place the diaphragm plate (key 6) onto the spring(s). It is important that the springs be properly seated in their respective counterbores on the bottom side of the plate. If necessary, push or pull the diaphragm plate toward center to ensure the springs are engaged into their respective seats.
10. Lubricate the socket head capscrew (key 7) and tighten per Table 6.
11. Place the diaphragm (key 11) on the diaphragm plate (key 6), making certain it is properly centered.
12. Observe the correct position of the loading connection fitting and install the top casing assembly (key 5). Replace the cap screws and nuts (keys 8 and 9) which secure the top casing assembly to the actuator housing. Tighten the nuts in an alternating fashion (see Table 6).
13. Install the inlet piping to the top casing assembly.
14. Refer to the Actuator Mounting procedure and proceed as applicable.

3.4 Positioner Mounting (3610, DVC6020 or DVC6200)

1. Before installing the positioner, the positioner cam must be installed on the lever.
2. Refer to assembly step 2 in the previous section on Changing or Replacing Actuator Lever.
3. Refer to the positioner instruction manual for setup and calibration procedures.

3.5 Top-Mounted Handwheel (All Sizes)

Key numbers used in this procedure are shown in Figures 10 (Sizes 1 and 2) and 11 (Size 3) except where indicated.

The optional top-mounted handwheel can be used as a manual actuator for intermittent service. It is not to be used as an adjustable travel stop. This is built into the housing.

The handwheel assembly is welded to a special top casing assembly (key 5, Figures 10 and 11). A hex nut (key 43) locks the handwheel in position. For field installation of a handwheel, the special upper diaphragm casing is supplied with the handwheel.

Turning the handwheel (key 32) clockwise into the upper casing forces the pusher plate (key 36) against the diaphragm and diaphragm plate (keys 11 and 6, Figure 8) to compress the inner and outer springs (keys 12 and 13, Figure 8) and move the diaphragm rod assembly downward. Turning the handwheel counter-clockwise allows the actuator spring(s) to move the diaphragm rod assembly upward.

NOTICE

Damage to the handwheel screw can occur if the handwheel is over-rotated in the counter-clockwise direction. The handwheel should not continue to be rotated once the actuator reaches the up stop and resistance to turning the handwheel significantly drops.

Instructions are given below for complete disassembly and assembly required for inspection and parts replacement.

Disassembly



WARNING

To avoid personal injury from the precompressed spring force thrusting the upper diaphragm casing away from the actuator, fully turn the handwheel counterclockwise.

1. Perform steps 1 through 6 of the Replacing Diaphragm procedure.
2. Remove the cotter pin, hex nut, handwheel and locknut (keys 34, 33, 32 and 43). Unscrew the stem (key 35) out through the actuator end of the handwheel body (key 5). Size 3 also requires removal of spacer (key 42).
3. Check the condition of the O-ring (key 44); replace if necessary.
4. For Sizes 1 and 2, if it is necessary to remove the pusher plate or spacer (key 36 or 42), drive out the groove pin (key 37).
5. For the Size 3, remove cap screw (key 59) if the pusher plate or thrust bearing needs to be removed.

Assembly (Sizes 1 and 2)

1. Before assembling, lubricate the thread of the stem (key 35) with anti-seize lubricant. Lubricate the bearing surfaces of the stem and rounded end with lithium grease.
2. If the pusher plate or spacer was removed, attach them to the stem and drive in a new groove pin (key 37).
3. With the O-ring (key 44) in place, thread the stem into the handwheel assembly.
4. Install the locknut, handwheel, hex nut and cotter pin (keys 43, 32, 33 and 34).

NOTE

Be sure to install the handwheel so that the arrow of operation on the top side coincides with the action of the actuator, as stated on the nameplate. (The arrow should point clockwise for PDO. The arrow should point counter-clockwise for PDTCT).

5. Install the top casing assembly, making certain the warning tag is in place on the casing flange.

Assembly (Size 3)

1. Before assembling, lubricate the thread and bearing surfaces of the handwheel screw (key 35) with grease (key 60).
2. If the pusher plate was removed, lubricate thrust bearing (key 56) and thrust bearing races (key 55) with grease (key 60) and place inside top of pusher plate (key 36).
3. Insert the bottom of handwheel screw (key 35) through the pusher plate, thrust bearing, and thrust bearings races. Apply thread sealant (key 59) to screw (58) to capture the pusher plate onto the end of the handwheel screw.
4. Lubricate O-ring (key 44) with grease (key 60) and install into top casing assembly.
5. With the O-ring (key 44) in place, thread the stem into the handwheel assembly.
6. Install the locknut, handwheel, hex nut, spacer and cotter pin (keys 43, 32, 33, 42 and 34).

NOTE

Be sure to install the handwheel so that the arrow of operation on the top side coincides with the action of the actuator, as stated on the nameplate (The arrow should point clockwise for PDO. The arrow should point counter-clockwise for PDTCT).

7. Install the top casing assembly, making certain the warning tag is in place on the casing flange.

Section 4: Locking Mechanism

Refer to Figure 6 or 7 for the appropriate size locking mechanism when installing or planning to operate the device.

WARNING

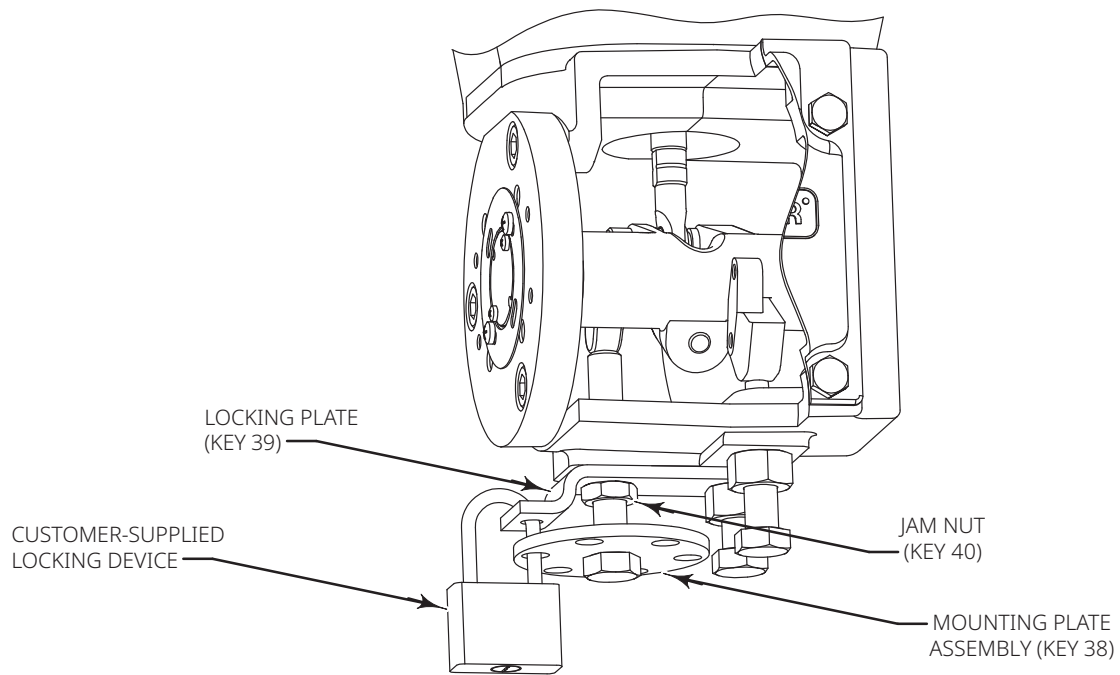
Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Safely vent the power actuator loading pressure.**
- **Check with your process or safety engineer for any hazards that may be present from exposure to process media.**

4.1 Installing the Size 1 Locking Mechanism

To add the locking mechanism (Figure 6) to an existing actuator, purchase the required kit from Emerson.

1. Ensure the diaphragm rod assembly (key 10) is in the upward position and the lever (key 14) is against the up travel stop (spring fail position).
2. Thread the supplied jam nut (key 40) all the way onto the threaded bolt portion of the mounting plate assembly.
3. Loosen the down travel stop hex nut (key 24) and remove the travel stop cap screw (key 23).
4. Remove the vent screen (key 47) from the threaded hole in the bottom of the actuator housing.
5. Secure the locking plate (key 39) to the bottom of the housing assembly by reinstalling the down travel stop (key 23) and hex nut (key 24). Ensure the clearance hole in the locking plate is aligned with the threaded hole in the bottom of the housing.
6. Ensure the down travel stop is adjusted correctly to achieve the desired actuator rotational output.
7. Install the mounting plate assembly (key 38) by inserting it through the clearance hole in the locking plate and threading it into the hole in the actuator housing.

Figure 6. Size 1 Locking Mechanism

GE51941_A

Operating the Locking Mechanism (Size 1)

To Lock the Actuator

1. Screw the mounting plate assembly into the housing until it contacts the actuator lever.
2. Align the hole in the locking plate (key 39) with one of the holes in the disk of the mounting plate assembly.
3. Tighten the jam nut (key 40) against the locking plate.
4. Insert a padlock (not furnished by Emerson) to prevent the mounting plate assembly from rotating.

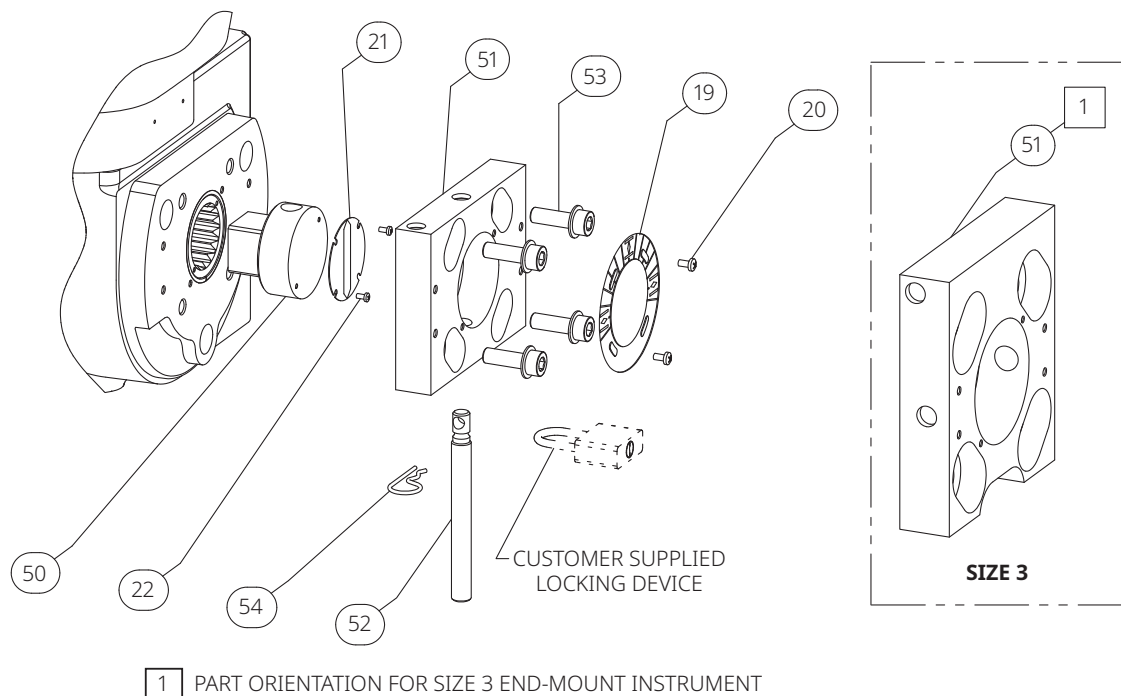
To Unlock the Actuator

1. Remove the padlock. Loosen the jam nut (key 40) and unscrew the threaded bolt until it no longer protrudes inside the housing.

NOTE

Ensure the mounting plate assembly bolt is unthreaded far enough that the actuator lever will not contact the bolt during normal actuator operation.

2. If the mounting plate assembly is to be left partially threaded into the housing, lock it with the jam nut (key 40) so that it cannot be screwed further into the housing and interfere with normal actuator operation.

Figure 7. Sizes 2 and 3 Locking Mechanism

4.2 Installing the Sizes 2 and 3 Locking Mechanism

To add the locking mechanism (Figure 7) to an existing actuator, purchase the required kit from Emerson. Verify the actuator lever has the quad square feature. The lever will need to be replaced to install a lockout on an actuator that has a lever without the quad square. See the section for "Changing or Replacing Actuator Lever".

1. The actuator should be mounted to the valve body and both travel stops (key 23) properly positioned prior to installing the locking mechanism.
2. Ensure the actuator lever (key 14) is in the spring-fail position (against the up travel stop).
3. Assemble the lockout kit by positioning the locking shaft (key 50) within the center through-hole of the mounting plate (key 51), as shown in Figure 7. Insert the locking pin (key 52) through the center pinhole of the mounting plate and through the pin hole in the locking shaft. Install the hairpin cotter pin (key 54) for retention.
4. If installing the lockout kit on an existing actuator, remove the travel indicator (key 21) and travel indicator scale (key 19) from the actuator by loosening the appropriate screws.

5. Position the lockout kit against the actuator outboard end. The locking shaft will insert and engage the lever end geometry.

Size 2 actuator: The standard size 2 lockout kit orientation shown in Figure 7 will accommodate the use of window-mount and end-mount digital valve controllers, positioners and accessories. This orientation requires removal of the locking pin in the direction of the bottom side of the actuator.

Size 3 actuator: For the window mounted DVC6200 digital valve controller, the size 3 lockout kit should be oriented such that locking pin removal is in the direction of the bottom side of the actuator. This mounting plate position provides necessary clearance with the integral supply pressure regulator. For the end-mount digital valve controller or accessory option, the size 3 lockout kit should be oriented as shown in the inset picture of Figure 7.

6. Loosely install the four flanged cap screws (key 53). Prior to tightening the fasteners, ensure the through-hole in the mounting plate is centered around the outside diameter of the locking shaft (key 50). Rotate the assembly by hand in the appropriate direction opposite of anticipated lever rotation to eliminate initial clearance among parts.
7. Tighten the cap screws (key 53) per the recommended torque values in Table 6.
8. Install the travel indicator (key 21) and travel indicator scale (key 19) to the lockout parts as illustrated in Figure 7.



WARNING

To avoid personal injury or property damage, ensure the travel indicator is installed correctly to coincide with the desired actuator action. Refer to Figure 4 for more information.

9. For normal actuator operation, remove the hairpin cotter pin (key 54) and locking pin (key 52) from the center pinhole of the mounting plate and reinstall these parts in the second pinhole for storage.

4.3 Operating the Locking Mechanism (Sizes 2 and 3)

To Lock the Actuator

1. With the actuator lever (key 14) against the up travel stop (spring-fail position), insert the locking pin (key 52) through the center pinhole of the mounting plate and through the pin hole in the locking shaft. Install the hairpin cotter pin (key 54) for retention.
2. Install the customer-supplied locking device to further prevent removal of the locking pin.

To Unlock the Actuator

1. Remove the customer-supplied locking device.
2. Remove the hairpin cotter pin (key 54) and locking pin (key 52) from the center pinhole of the mounting plate and reinstall these parts in the second pinhole for storage.

WARNING

To avoid personal injury or property damage, be aware the travel indicator scale (key 19) retains the locking shaft (key 50) during normal actuator operation. Removal of the travel indicator scale could allow the locking shaft to fall out in certain actuator orientations.

Section 5: Parts

5.1 Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, refer to the serial number found on the actuator nameplate.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

5.2 Parts List

NOTE

Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description	Key	Description
1	Housing assembly	5	Top casing assembly
1a*	Bushing	6	Diaphragm plate
2	Cover or plug	7	Cap screw
3	End plate assembly	8	Cap screw
3a*	Bushing	9	Hex nut
4	Cap screw	10	Diaphragm rod assembly

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D103296X012

2052 Actuator

September 2025

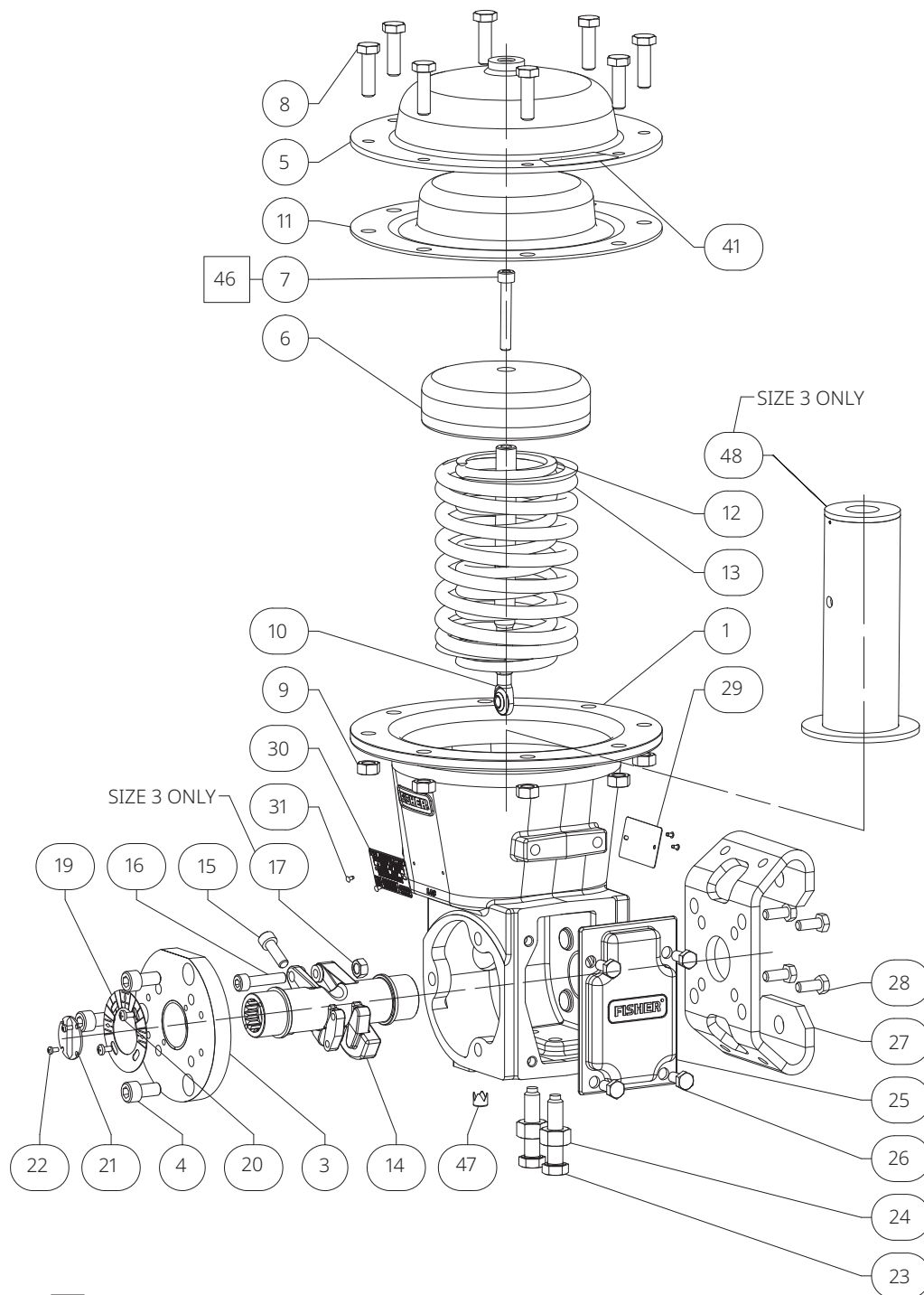
Key	Description	Key	Description
11*	Diaphragm	35	Screw
12	Spring, inner	36	Pusher assembly
13	Spring, outer	37	Groove pin
14	Lever	41	Warning label
15	Cap screw	42	Washer
16	Cap screw	43	Hex nut
17	Hex nut	44*	O-ring
18	Insert	45	Lubricant
19	Travel indicator scale	46	Lubricant
20	Self tapping screw	47	Vent screen
21	Travel indicator	48*	Guide assembly
22	Machine screw	49	Lockout kit
23	Cap screw	50	Locking Shaft
24	Hex nut	51	Mounting Plate
25	Cover plate	52	Locking Pin
26	Cap screw	53	Flanged Cap Screw
27	Mounting yoke	54	Hairpin Cotter Pin
28	Cap screw	55	Thrust Bearing Race
29	Label	56	Thrust Bearing
30	Nameplate	57	Lubricator Fitting
31	Drive screw	58	Retaining Screw
32	Handwheel	59	Thread Lock
33	Slotted hex nut	60	Lubricant (not included)
34	Cotter pin		
*Recommended spare parts			

Kits for Actuator Locking Mechanisms are available to keep the actuator in a locked position, the same as spring-fail, during maintenance. (Padlock is customer supplied). Not compatible with the declutchable handwheel on sizes 2 and 3 actuators. Some levers shipped with new 2052 actuators are not compatible with a lockout, and may need to be replaced with a compatible lever. Contact your [Emerson sales office](#) to confirm compatibility of the lever when adding a locking kit.

Kits

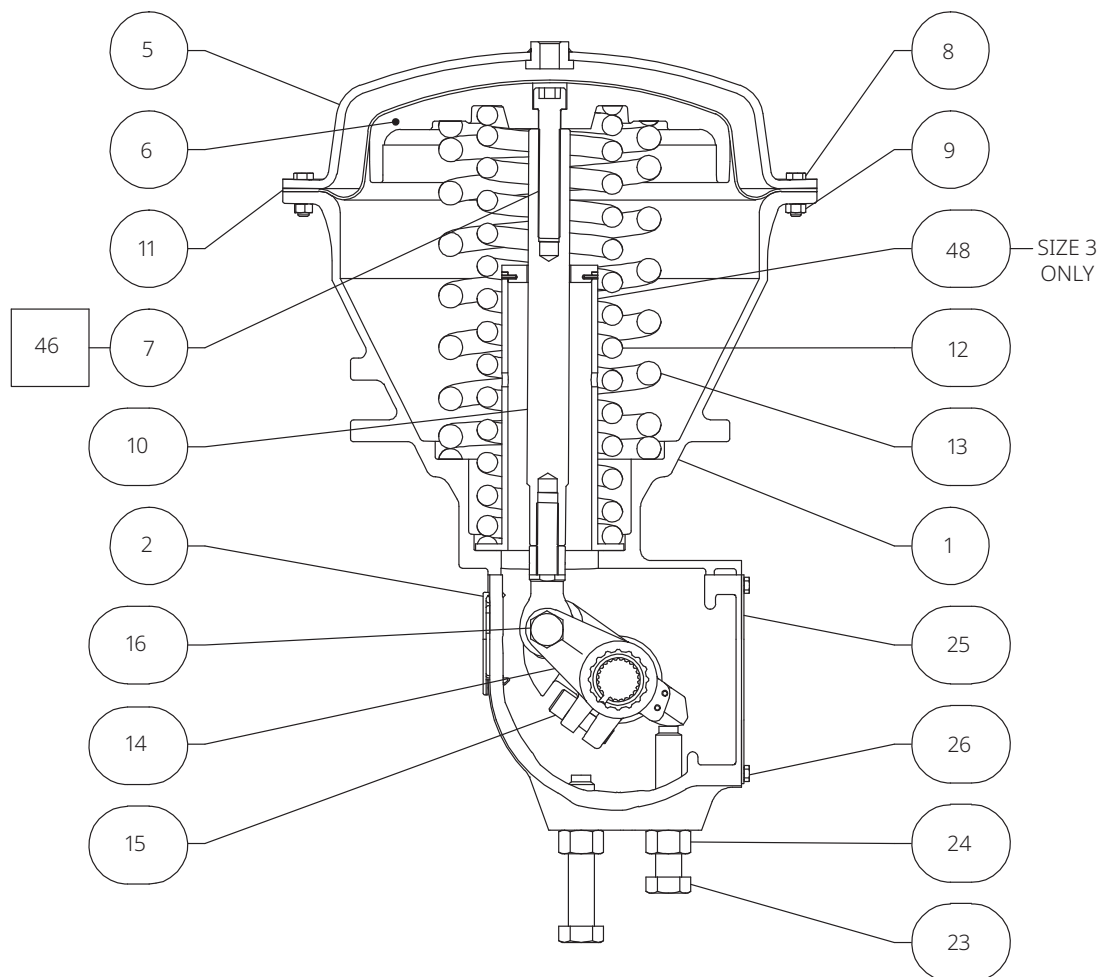
Description	Part Number
Size 1	GE51941X012
Size 2	GE52968X012
Size 3	GE52968X022

Figure 8. Fisher 2052 Actuator Assembly



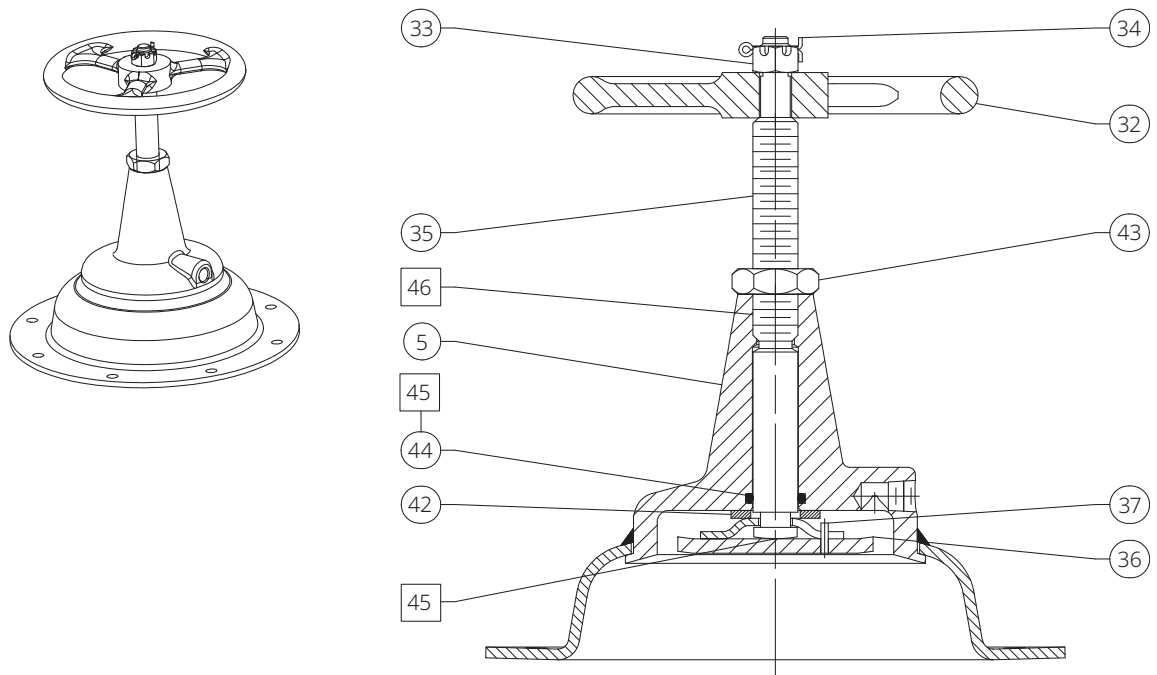
GE42779-C

Figure 9. Fisher 2052 Size 3 Actuator Assembly



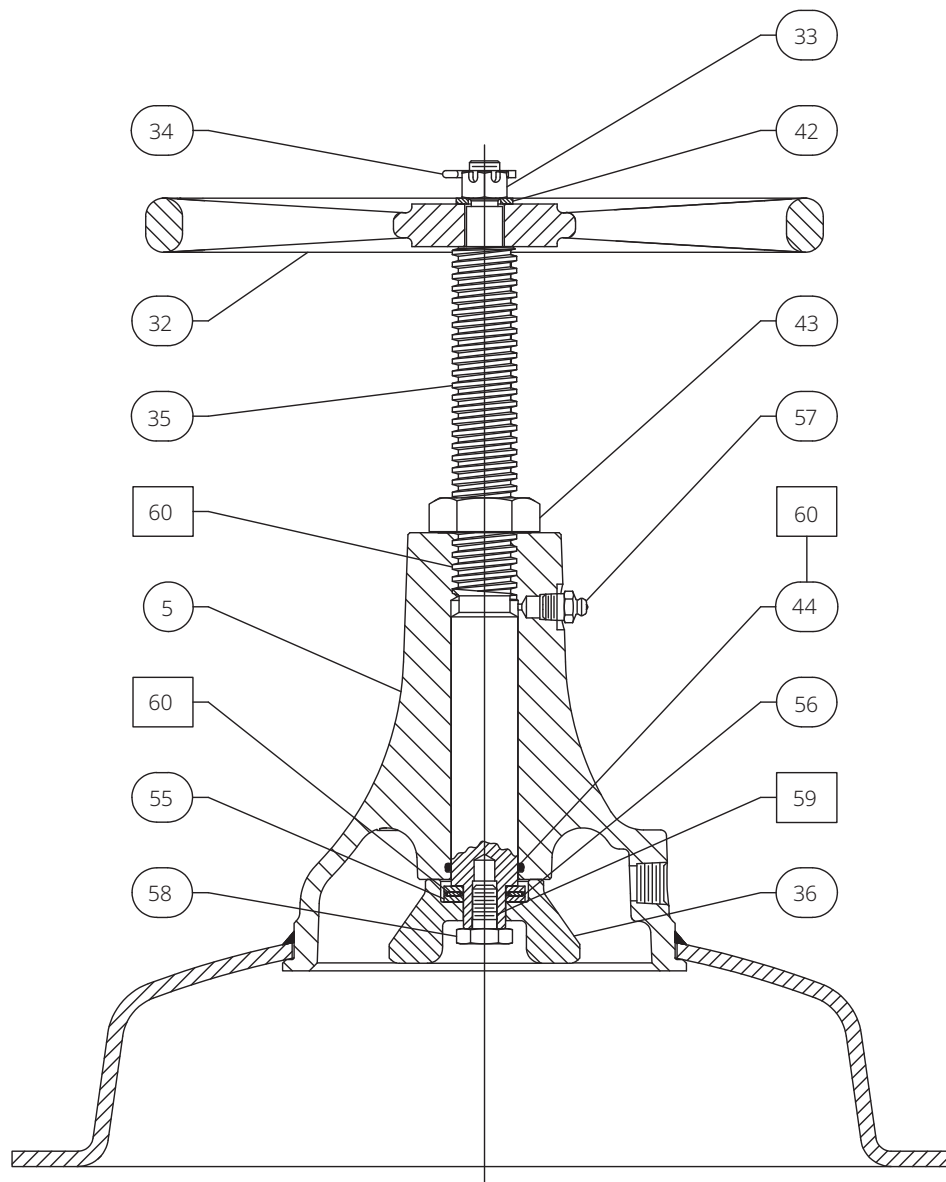
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Figure 10. Fisher 2052 Size 1 Handwheel Assembly



GE33241_A

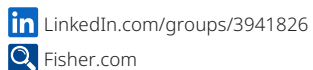
Figure 11. Fisher 2052 Size 3 Handwheel Assembly



 APPLY LUBRICANT

GE55612

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS



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FISHER™



Fisher™ 2625, 2625SST, and 2625NS Volume Boosters

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Figure 1. Fisher 2625 Volume Booster



W4727-1

Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for Fisher 2625 Series (2625, 2625SST, and 2625NS) volume boosters (figure 1). Refer to separate instruction manuals for information regarding the valve body, actuator, and other accessories.



Do not install, operate, or maintain a 2625, 2625SST, or 2625NS volume booster without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings. If you have any questions regarding these instructions contact your [Emerson sales office](#) before proceeding.

Description

The 2625 and 2625SST are certified for use in Safety Instrumented System (SIS) applications. Certification is by EXIDA Consulting LLC, a global provider of functional safety and control system security. SIS certification is identified on the product by the EXIDA logo on the 2625 nameplate.

The 2625, 2625SST, and 2625NS volume boosters are used in conjunction with a positioner on a throttling control valve to increase stroking speed. The booster has a fixed deadband (controlled by the seat-to-seat dimension of the supply and exhaust plugs) which is factory set during assembly and testing. In addition, the booster incorporates soft-seat construction and an integral bypass restriction to eliminate positioner saturation problems that can occur with volume boosters that do not have these features. Adjustment of the integral bypass restriction is necessary for system stability. This adjustment does not affect the deadband of the booster, but does permit the control valve to respond to small input signal changes from the positioner without sacrificing steady-state accuracy.

It also allows the booster to deliver high-volume output for fast stroking when large, rapid input signal changes occur.

The volume booster is used to improve stroking speed. If precision valve control is required, the use of a positioner is recommended. If the volume booster is used for on/off control, the integral bypass restriction on the volume booster must be closed (turned fully clockwise).

To facilitate diagnostic testing, connectors and piping may be installed with each 2625, 2625SST, and 2625NS volume booster.

The 2625NS volume booster is designed for nuclear power applications. The 2625NS construction includes materials that provide superior performance at elevated temperature and radiation levels.

The O-rings in the 2625NS are EPDM (ethylene propylene) and the diaphragms are EPDM/meta-aramid. EPDM demonstrates superior temperature capability and shelf life over nitrile. The meta-aramid diaphragm fabric demonstrates improved strength retention at elevated temperature and radiation conditions.

NOTICE

Use a clean, dry, oil-free air supply with instruments containing EPDM components. EPDM is subject to degradation when exposed to petroleum based lubricants.

Under the 10CFR50, Appendix B, quality assurance program, the 2625NS volume booster is qualified “commercial grade dedicated”. These can be supplied as 10CFR, Part 21 items.

Specifications

Specifications for the 2625, 2625SST, and 2625NS volume booster are listed in table 1. Information for an individual unit as it comes from the factory appears on the product nameplate.

Educational Services

Emerson Automation Solutions
Educational Services - Registration
Phone: +1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Table 1. Specifications

Port Diameters⁽¹⁾

Supply Port: ■ 9.5 mm (0.375 inch) or ■ 12.7 mm (0.5 inch)

Exhaust Port: ■ 2.4 mm (0.094 inch)⁽²⁾, ■ 9.5 mm (0.375 inch) or ■ 12.7 mm (0.5 inch)

Input Signal

Positioner output

Maximum Input Signal Pressure

10.3 bar (150 psig)

Input to Output Pressure Ratio

Fixed at 1 to 1

Supply Pressure Ranges⁽³⁾

When used in conjunction with a positioner or other pneumatic accessory, always pipe the positioner and booster with one common supply through a Fisher 67D, 67DR, or MR95H regulator (see figure 3). A high-capacity filter, such as the Fisher 262K, should be installed in the supply line to the regulator. Supply pressure also must not exceed the maximum pressure rating of the actuator. Constructions are available in two maximum supply ranges.

When Normally Used With Diaphragm Actuators: Up to 2.8 bar (40 psig)

When Normally Used With Piston Actuators: Up to 10.3 bar (150 psig)

Nominal Deadband⁽⁴⁾

Percent of Positioner Output Span⁽⁶⁾:

2.4 mm (0.094 inch) exhaust port: 2%

9.5 mm (0.375 inch) exhaust port: 3.5%

12.7 mm (0.5 inch) exhaust port: 5%

Operative Temperature Limits^(3,4)

2625/2625SST

Standard: -40 to 71 °C (-40 to 160 °F)

High Temperature: 0 to 121 °C (32 to 250 °F)

2625

Low Temperature⁽⁵⁾: -60 to 65 °C (-76 to 149 °F)

2625NS: -40 to 93 °C (-40 to 200 °F)

Maximum Flow Coefficients

See table 2

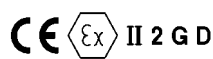
Connections

Input Signal: 1/4 NPT

Supply and Output Signal: 3/4 NPT

Hazardous Area Classification

Complies with the requirements of ATEX Group II Category 2 Gas and Dust

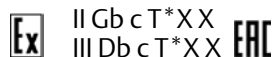
 Ex h IIC Tx Gb
Ex h IIIC Tx Db

Maximum surface temperature (Tx) depends on operating conditions

Gas: T4, T5, T6

Dust: T85...T121

Meets Customs Union technical regulation TP TC 012/2011 for Groups II/III Category 2 equipment



Safety Instrumented System Classification

SIL3 capable - certified by exida Consulting LLC

Approximate Weight

Aluminum: 2.3 kg (5 pounds)

Stainless Steel: 4.8 kg (10.6 pounds)

Declaration of SEP

Fisher Controls International LLC declares this product to be in compliance with Article 4 paragraph 3 of the PED Directive 2014/68/EU. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.

However, the product *may* bear the CE marking to indicate compliance with *other* applicable EC Directives.

1. May be used in any combination.

2. Aluminum 2625 volume booster only.

3. The pressure/temperature limits in this document, and any applicable code or standard limitation should not be exceeded.

4. This term defined in ISA Standard S51.1

5. Low Temperature option only available with CUTR approval.

6. Zero psig to maximum supply.

Table 2. Maximum Flow Coefficients

PORT SIZE COMBINATIONS				SUPPLY PORT COEFFICIENTS	EXHAUST PORT COEFFICIENTS
Supply Port		Exhaust Port			
mm	Inch	mm	Inch	C _v	C _v
9.5	0.375	2.4	0.094	3.74	0.23
		9.5	0.375	3.74	2.29
		12.7	0.5	3.74	3.40
12.7	0.5	2.4	0.094	4.98	0.24
		9.5	0.375	4.98	2.30
		12.7	0.5	4.98	3.40
FIELDVUE™ DVC6200, DVC6200 SIS, DVC6200f, DVC6200p, DVC6000, DVC6000 SIS, DVC6000f digital valve controllers				0.37	0.31
FIELDVUE DVC2000 digital valve controller					
Low Pressure Relay				0.13	0.15
High Pressure Relay				0.19	0.20
Fisher 3570 valve positioner				0.25	0.25
Fisher 3582 valve positioner				0.17	0.19
Fisher 3610J, 3610JP, 3611JP, 3620J, 3620JP, 3621JP valve positioner				0.37	0.30

Installation

⚠ WARNING

Always wear protective clothing, gloves, and eyewear when performing any maintenance procedures to avoid personal injury.

System damage may result if a volume booster is installed in a way that it can be physically damaged.

Personal injury or system damage may result when service conditions exceed booster or other equipment ratings. Exceeding the pressure specifications in table 1 may cause leakage, parts damage, or personal injury due to bursting of pressure-containing parts or explosion of accumulated gas.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

NOTICE

Do not use sealing tape on pneumatic connections. This instrument contains small passages that may become obstructed by detached sealing tape. Thread sealant paste should be used to seal and lubricate pneumatic threaded connections.

Note

Do not use separate pressure supplies for the volume booster and associated positioner.

The volume booster may not exhaust immediately upon loss of a separate pressure supply. However, if the system is in a transient state at the time of pressure supply loss or if changes to the booster's input signal are sufficient to overcome the deadband, the booster will exhaust.

A loss of a pressure supply (either separate or common) to a 3582 or 3610J positioner will cause the positioners output pressure (booster's input pressure) to decay.

Always pipe the positioner and the volume booster with one common supply. See figure 3 for typical installation examples. A 67D, 67DR, or MR95H regulator is required to provide sufficient capacity to supply both components. A high-capacity filter, such as the 262K, should be installed in the supply line to the 67D, 67DR, or MR95H regulator.

Mounting

The volume booster is typically nipple-mounted between the pneumatic supply source and the actuator, and may be used with piston or diaphragm actuators. Many actuators require larger casing or cylinder connections and modifications to allow the booster to deliver the higher volume output.

The booster may also be directly mounted to the actuator by using an actuator yoke mounting bracket (see figure 5) or casing mounting bracket.

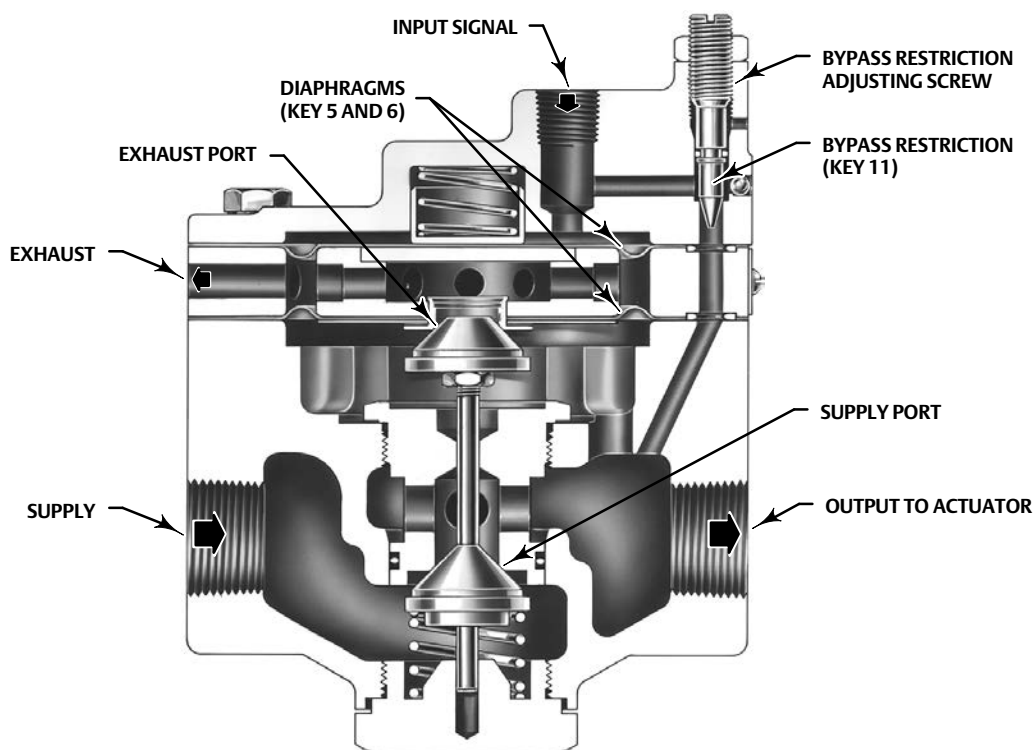
Pressure Connections

NOTICE

Do not use sealing tape on pneumatic connections. This instrument contains small passages that may become obstructed by detached sealing tape. Thread sealant paste should be used to seal and lubricate pneumatic threaded connections.

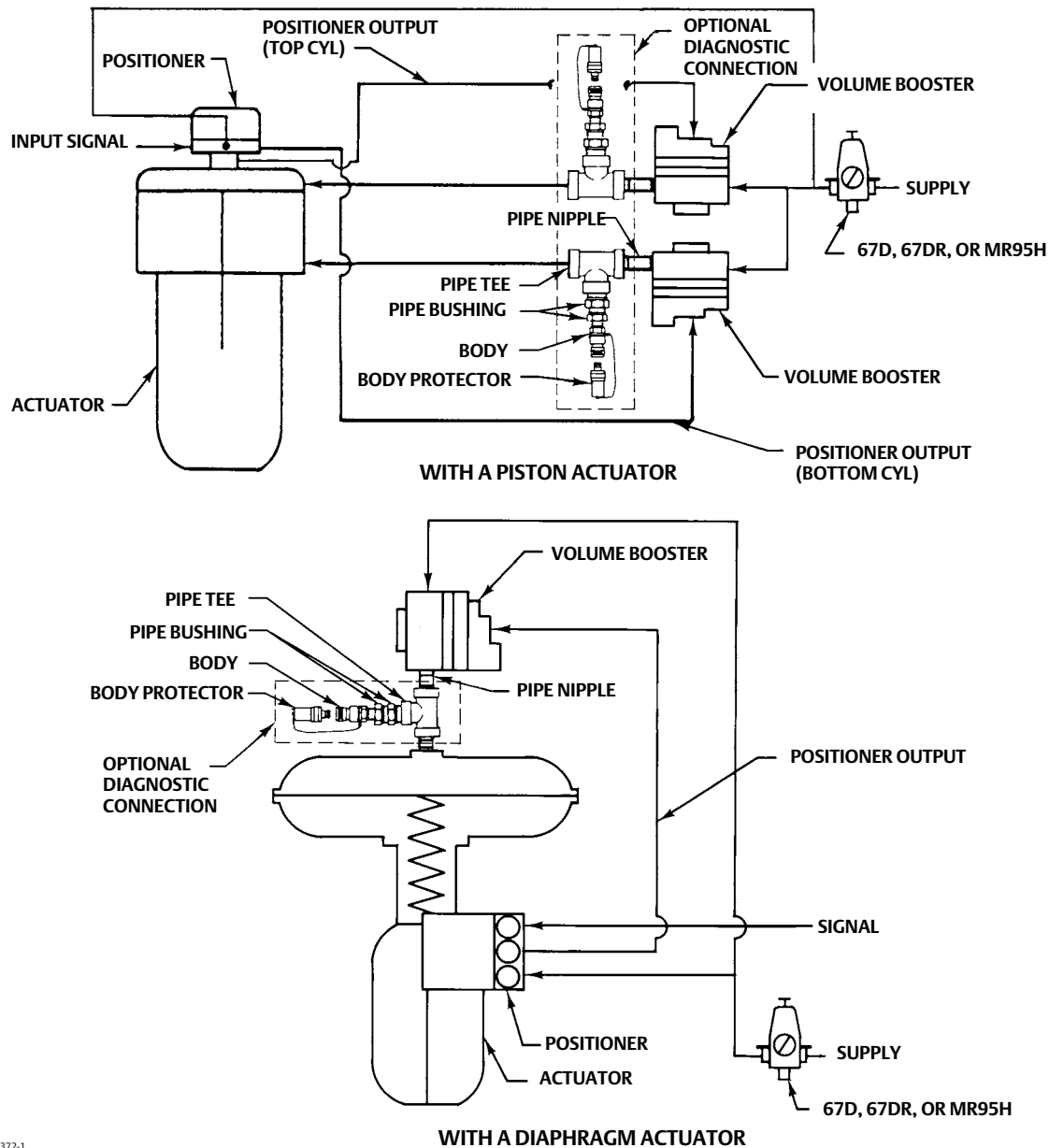
The input signal connection is 1/4 NPT. The supply and output connections are 3/4 NPT (minimum pipe size recommended for nipple mounting is 1/2 NPT for 2625 and 3/4 NPT for 2625SST). Connections to the volume booster should be made as indicated in figure 2. Connections for two typical applications are shown in figure 3. Ensure that the piping is of proper size to meet the capacity demands of the booster and that you equip the actuator with properly sized input connections.

Figure 2. Volume Booster Sectional View



W0679-1

Figure 3. Typical Installations



B2372-1

Diagnostic Connections

To support diagnostic testing of valve/actuator/positioner packages, install connectors and hardware between the 2625, 2625SST, or 2625NS volume booster and the actuator. Typical connector installations are shown in figure 3.

The hardware used includes a 3/4 NPT pipe nipple, pipe tee, and pipe bushings with an 1/8 NPT pipe bushing for the connector. The connector consists of an 1/8 NPT body and body protector.

See separate instructions for diagnostic connections to the positioner.

Supply Pressure

Supply pressure must be clean dry air or noncorrosive gas. A high capacity filter, such as the 262K is recommended for use with the 2625 volume booster.

NOTICE

Use a clean, dry, oil-free air supply with instruments containing EPDM components. EPDM is subject to degradation when exposed to petroleum based lubricants.

⚠ WARNING

If a flammable or hazardous gas is to be used as the supply pressure medium, personal injury, property damage or equipment damage could result from fire or explosion of accumulated gas or from contact with hazardous gas. The optional pipe away vent construction should be used in applications using a flammable or hazardous gas as the supply pressure medium. This option will allow the flammable or hazardous gas to be collected or remotely vented to a safe location.

Exhaust Ports

Exhaust to the atmosphere is through exhaust ports in the side of the unit. Keep the exhaust ports free of any obstructions or foreign materials that might clog them.

The optional pipe away vent construction exhausts through a single 1/2 NPT port on the side of the unit. Remote vent piping can be installed in this port to route the booster exhaust to a desired remote vent or collection location.

Operating Information

The only operating requirement of the volume booster is the adjustment of the bypass restriction for stable actuator performance. Although systems with different characteristics may require different adjusting techniques, the following adjustment procedure is recommended when using the actuator for throttling control.

Note

When sizing the booster, select the lowest C_g that will meet the stroking speed specifications. Oversizing the booster in a closed loop may lead to stability problems, thus requiring the bypass to be opened so far that the booster will never operate.

Prior to operation, turn the bypass restriction adjusting screw (figure 2) four turns counterclockwise from the fully closed position. With the actuator in operation, slowly turn the restriction clockwise until the booster operates in response to large changes in the input signal, yet allows small changes to move the actuator without initiating booster operation.

If the actuator is to be used for on-off control, the restriction should be closed (turned fully clockwise).

Principle of Operation

Refer to figures 2 and 3.

Because of the restriction, large input signal changes register on the booster input diaphragm sooner than in the actuator. A large, sudden change in the input signal causes a pressure differential to exist between the input signal and the output of the booster. When this occurs, the diaphragms move to open either the supply port or the exhaust port, whichever action is required to reduce the pressure differential. The port remains open until the difference between the booster input and output pressures returns to within the deadband limits of the booster. With the bypass restriction adjusted for stable operation, signals having small magnitude and rate changes pass through the bypass restriction and into the actuator without initiating booster operation. Both the supply and exhaust ports remain closed, preventing unnecessary air consumption and possible saturation of positioner relays.

Maintenance

⚠ WARNING

Always wear protective clothing, gloves, and eyewear when performing any maintenance procedures to avoid personal injury.

Maintenance requires taking the volume booster out of service periodically. To avoid personal injury or equipment damage, disconnect or bypass any pressure lines to the booster, and vent any pressure locked in the unit before you begin maintenance.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Diaphragm Assembly Replacement

Key numbers refer to figure 4.

1. Remove the six cap screws (key 15) from the perimeter of the spring case assembly (key 3), and lift off the assembly, taking care you do not lose the input spring (key 8) or the spring seat (key 9).
2. Remove the upper diaphragm (key 6), diaphragm spacer (key 2), diaphragm assembly (key 5), (which includes the lower diaphragm), and the O-rings (key 14). Inspect these parts for damage and replace if necessary.
3. Replace the O-rings (key 14) after coating with lubricant (key 21). Then replace the diaphragm assembly (key 5), diaphragm spacer (key 2), and the upper diaphragm (key 6).

Note

To ensure proper operation of the bypass restriction, make certain that the holes in the diaphragm and the bypass restriction are in line with the holes in the diaphragm spacer (key 2).

4. Install the spring case assembly (key 3) on the upper diaphragm (key 6). Make sure the spring seat (key 9) and the upper spring (key 8) are installed in the spring case assembly (key 3). Press on the bottom of the spring seat with

your finger. If the spring seat (key 9) does not move freely in the spring case assembly (key 3), remove the spring seat (key 9), and apply lubricant (key 23). Reinstall the spring seat (key 9) in the spring case assembly (key 3).

NOTICE

To avoid damage to the diaphragms, do not overtighten the screws.

- Replace the six cap screws (key 15) and tighten them in a crisscross manner.

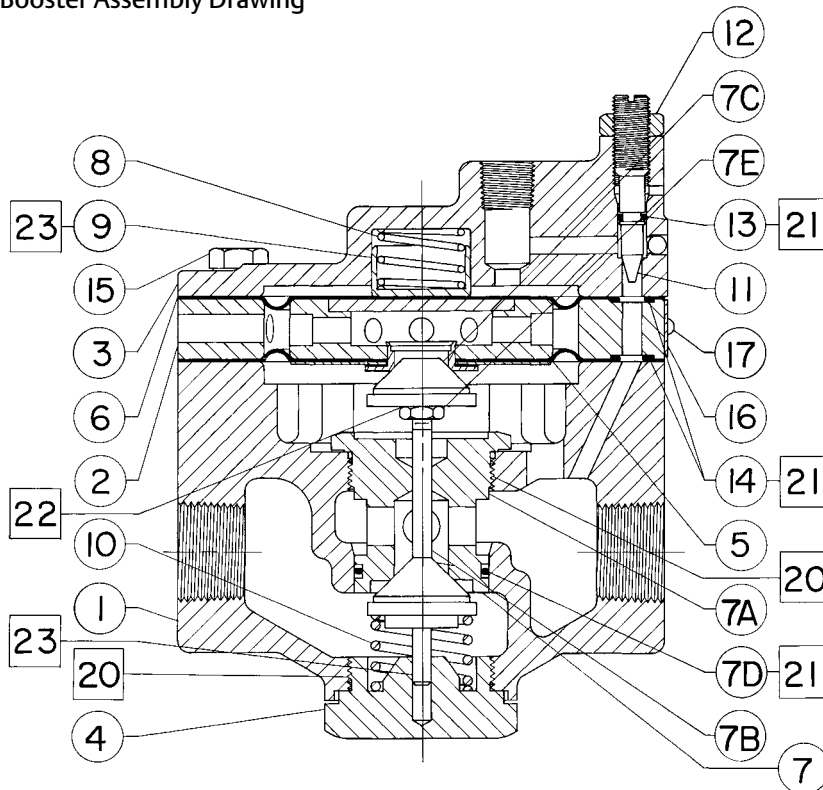
Valve Assembly Replacement

Note

The distance between the exhaust port seat line on the upper valve (key 7C) and the supply port seat line on the lower valve and stem (key 7B) is critical to ensure the deadband requirements of the volume booster. This distance is set at the factory and is not field adjustable. If replacement is necessary, use the proper factory authorized repair kit listed in the parts section below. All components of the repair kits are factory set and tested and are not field adjustable.

For key numbers refer to figure 4.

Figure 4. Volume Booster Assembly Drawing



1. Remove the six cap screws (key 15) from the perimeter of the spring case assembly (key 3) and lift off the assembly, taking care you do not lose the upper spring (key 8) or the spring seat (key 9).
2. Remove the upper diaphragm (key 6), the diaphragm spacer (key 2), the diaphragm assembly (key 5), (which includes the lower diaphragm), and the O-rings (key 14).
3. Unscrew the valve assembly (key 7) from the body. The seat ring (key 7A) has a 1-1/2 inch hex for removal.
4. Apply lubricant (key 21) to the O-ring (key 7D), lubricant (key 23) to the lower valve and stem (key 7B), and sealant (key 20) to the thread of the seat ring (key 7A).
5. Install the valve assembly (key 7) into the body (key 1)—making sure the lower valve and stem (key 7B) engages over the lower spring (key 10)—and into the bottom plug (key 4).
6. Install the diaphragm assembly (key 5) onto the upper valve (key 7C).
7. Install the diaphragm spacer (key 2) onto the body (key 1).

Note

To ensure proper operation of the bypass restriction, make certain that the holes in the diaphragm and the bypass restriction are in line with the holes in the diaphragm spacer (key 2).

8. Make sure the O-rings (key 14) are installed in the diaphragm spacer (key 2) and coated with lubricant (key 21).
9. Install the upper diaphragm (key 6).
10. Install the spring case assembly (key 3) on the upper diaphragm (key 6). Make sure the spring seat (key 9) and upper spring (key 8) are installed in the spring case assembly. Press on the bottom of the spring seat with your finger. If the spring seat does not move freely in the spring case assembly, remove the spring seat, apply lubricant (key 23), and reinstall in the spring case assembly.

NOTICE

To avoid damage to the diaphragms, do not overtighten the screws.

11. Replace the six cap screws (key 15) and tighten them in a crisscross manner.

Installation of Diagnostic Connections

See figure 3 for part names and order of installation.

1. Before you assemble the pipe nipple, pipe tee, pipe bushings, actuator piping, and connector body, apply sealant to all threads.
2. Turn the pipe tee to position the connector body and body protector for easy access when doing diagnostic testing.

Parts Ordering

Whenever corresponding with your [Emerson sales office](#) about this equipment, mention the serial number of the volume booster. This serial number can be found on the nameplate (key 16, figure 4).

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher instrument. The use of components not manufactured by Emerson may void your warranty, might adversely affect the performance of the instrument, and could cause personal injury and property damage.

Parts Kits

Parts Kits		Description	Part Number
Description	Part Number	2625SST	
2625		Repair kits for diaphragms [Kit contains keys 5, 6, 13, 14] SST boosters with:	
Repair kits for diaphragms [Kit contains keys 5, 6, 13, 14] Boosters with:		3/8 inch exhaust high temperature	R2625SD3812 R2625SD3822
Blocked exhaust port	R2625DBLK12		
3/32 inch exhaust port	R2625D33212	1/2 inch exhaust high temperature	R2625SD1212 R2625SD1222
3/8 inch exhaust port no brass high temperature low temperature (also includes key 7) low temperature, no brass	R2625D38012 R2625D38B12 R2625D38022 R2625D38032 R2625D38B32	Repair kits for valve assemblies [Kit contains key 7] SST boosters with:	
		3/8 inch supply high temperature	R2625SV3812 R2625SV3822
1/2 inch exhaust port no brass high temperature low temperature (also includes key 7) low temperature, no brass	R2625D12012 R2625D12B12 R2625D12022 R2625D12032 R2625D12B32	1/2 inch supply high temperature	R2625SV1212 R2625SV1222
Repair kits for valve assemblies [Kit contains key 7] For boosters with:		Note Repair kits for nuclear and pipeaway constructions are also available. Contact your Emerson sales office for kit information.	
3/8 inch supply no brass high temperature low temperature, no brass	R2625V38012 R2625V38B12 R2625V38022 R2625V38B32		
1/2 inch supply no brass high temperature low temperature, no brass	R2625V12012 R2625V12B12 R2625V12022 R2625V12B32	2625 and 2626SST Repair kits for springs [Kit contains keys 8, 9, 10] 2.8 bar (40 psig) Maximum Supply 10.3 bar (150 psig) Maximum Supply	R2625S40012 R2625S15012

Parts List (figure 4)

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description
1	Body
2	Diaphragm Spacer
3	Spring Case Assembly
4	Body Cap
5*	Diaphragm Assembly For 2625 With blocked exhaust With 2.4 mm (0.094 inch) exhaust With 9.5 mm (0.375 inch) exhaust With 12.7 mm (0.5 inch) exhaust For 2625SST With 9.5 mm (0.375 inch) exhaust With 12.7 mm (0.5 inch) exhaust For 2625NS With 9.5 mm (0.375 inch) exhaust With 12.7 mm (0.5 inch) exhaust
6*	Upper Diaphragm For 2625 and 2625SST For 2625NS
7*	Valve Assembly (includes keys 7A, 7B, 7C, 7D, and 7E)
7A*	Seat Ring 9.5 mm (0.375 inch) supply port 12.7 mm (0.5 inch) supply port
7B*	Lower Valve and Stem For 2625 and 2625SST For 2625NS
7C*	Upper Valve For 2625 and 2625SST For 2625NS
7D*	Valve O-Ring For 2625 and 2625SST For 2625NS

Key	Description
7E	Hex Nut
8	Upper Spring
9	Spring Seat
10	Lower Spring
11	Restriction
12	Hex Nut
13*	O-Ring For 2625 and 2625SST For 2625NS
14*	O-Ring (2 req'd) For 2625 and 2625SST For 2625NS
15	Cap Screw (6 req'd) Standard With 1/2 NPT vent connection
16	Nameplate
17	Drive Screw (2 req'd)
20	Anti-seize sealant
21	Lubricant, silicone sealant
22	Thread locking adhesive, mild strength
23	PTFE petroleum-based lubricant (see note immediately below)

Note

PTFE petroleum-based lubricant is only for use with 2625 and 2625SST. For 2625NS use a medium grade silicone-based lubricant.

26	Mounting Bracket For yoke mounting (see figure 5 and 6) For casing mounting (see figure 7) (Use two brackets, stacked, for seismic mounting)
----	---

Diagnostic Connections

FlowScanner™ diagnostic system hook-up
Includes pipe tee, pipe nipple, pipe bushings, connector body, and body protector.

For diaphragm actuator
For piston actuator

Figure 5. Volume Booster with Yoke Mounting Bracket

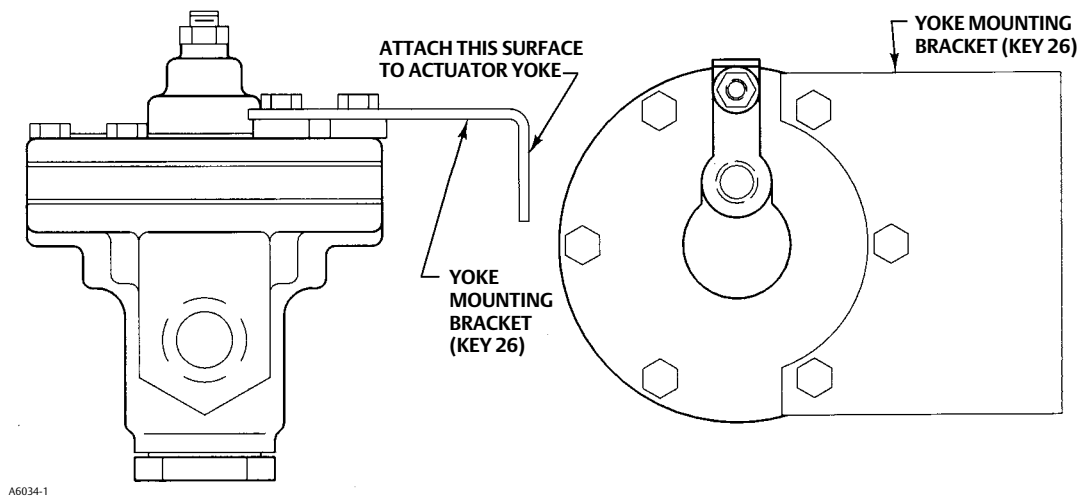


Figure 6. Stainless Steel Volume Booster with Yoke Mounting Bracket

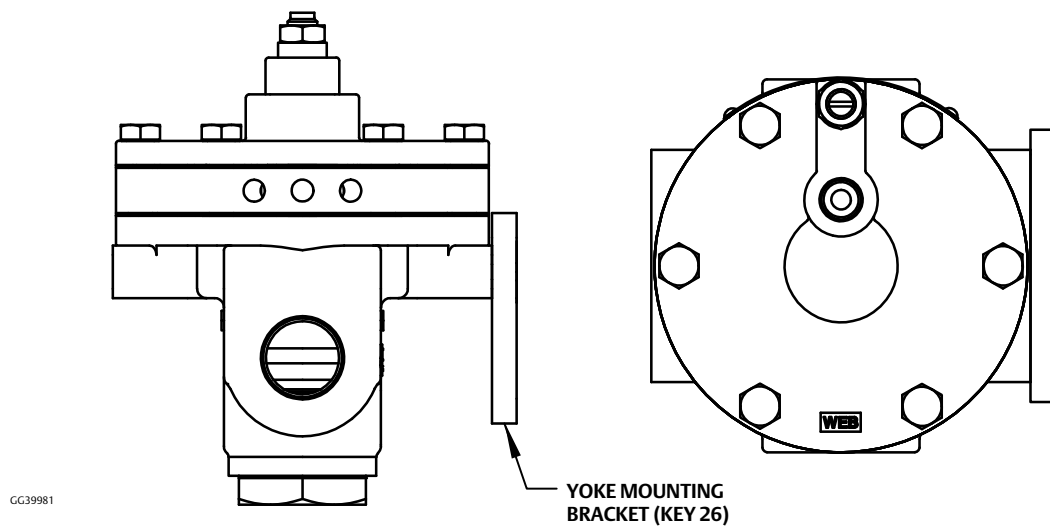
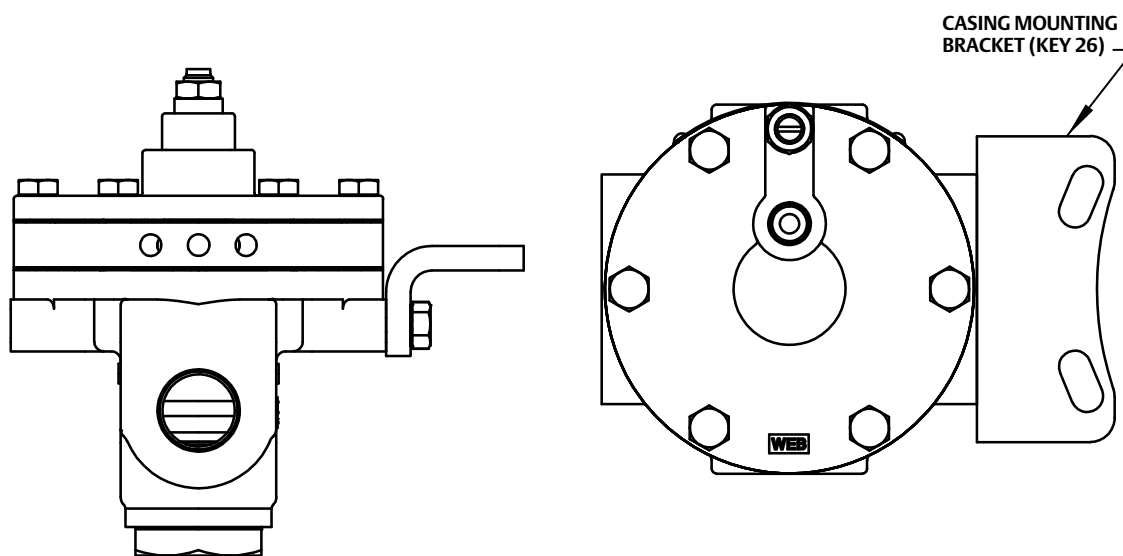


Figure 7. Stainless Steel Volume Booster with Case Mounting Bracket



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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D100348X012

2625, 2625SST, and 2625NS Volume Booster

September 2022

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

2625, 2625SST, and 2625NS Volume Booster

September 2022

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Fisher™ 3024C Diaphragm Actuator

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Figure 1. Fisher 3024C Actuator with Sliding-Stem Valve



W8488

Introduction

Scope of Manual

This instruction manual provides information on installation, adjustment, maintenance, and parts ordering for the Type 3024C actuator (figure 1) for sizes 30 to 45 and 30E to 45E.

Note

This manual assumes throughout that the valve construction is “push-down-to-close.”



Do not install, operate, or maintain a 3024C actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

3024C Actuator

June 2023

Instruction Manual

D103048X012

Table 1. Specifications

Specification		Actuator Size							
		30	30E	34	34E	40	40E	45	45E
Nominal Effective Area		See tables 2 and 3.							
Maximum Operating Pressure to Diaphragm	Bar	6							
	psig	87							
Maximum Travel	mm	16	---	16	---	32	---	32	---
	Inch	---	0.75	---	0.75	---	2	---	2
Yoke Boss Diameter	Inch (mm)	2-1/8 (54 mm)	2-1/8 (54 mm)	2-1/8 (54 mm)	2-1/8 (54 mm)	2-13/16 (71 mm)	2-13/16 (71 mm)	2-13/16 (71 mm)	2-13/16 (71 mm)
Valve Stem Connector Thread	mm	M12 x 1.75	---	M12 x 1.75	---	M16 x 2	---	M16 x 2	---
	Inch	---	3/8-24	---	3/8-24	---	1/2-20	---	1/2-20
Temperature Range	°C	Nitrile diaphragm and steel studs and nuts: -40 to +82							
	°F	Nitrile diaphragm and steel studs and nuts: -40 to +180							
Pressure Connections	Inch	1/4 - 18 NPT							
Maximum Approximate Weight (without handwheel)	kg	9.5	9.5	18.0	18.0	19.5	21.5	33.5	35.5
	lb	20.9	20.9	39.7	39.7	43.0	47.4	73.9	78.3
Maximum Approximate Weight (with handwheel)	kg	16.5	16.5	25.0	25.0	26.5	28.5	40.5	42.5
	lb	36.4	36.4	55.1	55.1	58.4	62.8	89.3	93.7

Figure 2. Schematic of Fisher 3024C

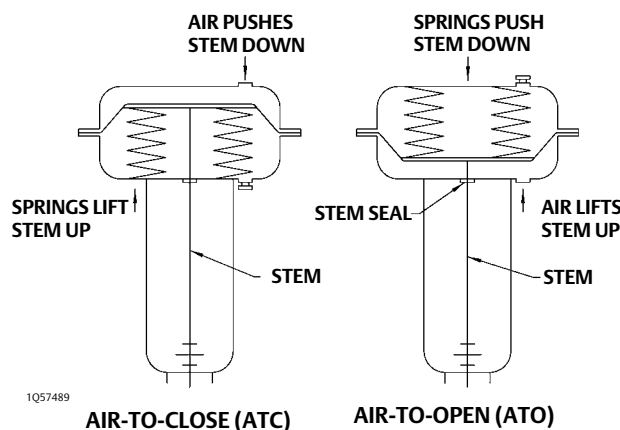


Figure 3. Fisher 3024C Actuator Nameplate

SERIAL		TAG	
VALVE		TRAVEL	
BODY		TRIM	
ACTUATOR		PORT	
SPRING RANGE		AIR	
		MAX. CASING PRESSURE	

FISHER

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Description

The 3024C direct acting (extends stem/air-to-close) actuator (figure 8) and the reverse acting (retracts stem/air-to-open) actuator (figure 9) are spring-opposed pneumatic diaphragm actuators that provide automatic throttling or on-off operation of sliding-stem control valves.

The actuator will position the valve plug in response to varying pneumatic loading pressure on the actuator diaphragm. Figure 2 shows the operation of an ATC (air-to-close) actuator and an ATO (air-to-open) actuator.

The 3024C ATC (air-to-close) actuator springs are located under the diaphragm plate and they fully retract the actuator stem for fail action upon loss of diaphragm casing pressure. The 3024C ATO (air-to-open) actuator springs are located on top of the diaphragm plate and they fully extend the actuator stem upon loss of diaphragm casing pressure. The actuator is mounted on the valve by means of a cast yoke.

The 3024C can be equipped with a side mounted handwheel if required (figure 10). An adjustable up travel stop can also be fitted (figures 11 and 12).

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3024C Actuator

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Table 2. Additional Specifications (Action Air-to-Close)

Size	Spring Set/ Quantity	Travel		Spring Range		Effective Diaphragm Area (1)		Maximum Output Thrust (Maximum Actuator Stem Force) (2)	
		mm	Inch	Bar	Psig	cm ²	Inches ²	N	Lb
30	217/3 218/5 218/7	16	---	0.3 - 1.1	4 - 16	160	24.8	7840	1760
				1.3 - 2.0	19 - 29	160	24.8	6400	1440
				1.8 - 2.9	26 - 42	160	24.8	4960	1120
30E	217/3 218/5 218/7	---	0.75	0.3 - 1.3	4 - 19	160	24.8	7520	1690
				1.3 - 2.2	19 - 32	160	24.8	6080	1360
				1.8 - 3.0	26 - 44	160	24.8	4800	1070
34	219/3 212/5 212/7	16	---	0.3 - 1.1	4 - 16	400	62.0	19,600	4400
				0.9 - 1.7	13 - 25	400	62.0	17,200	3840
				1.3 - 2.3	19 - 33	400	62.0	14,800	3350
34E	219/3 212/5 212/7	---	0.75	0.3 - 1.3	4 - 19	400	62.0	18,800	4220
				0.9 - 1.8	13 - 26	400	62.0	16,800	3780
				1.3 - 2.5	19 - 36	400	62.0	14,000	3160
40	212/3 213/6 214/7	32	---	0.4 - 1.3	6 - 19	390	60.5	18,300	4110
				0.8 - 1.8	12 - 26	390	60.5	16,400	3690
				1.2 - 2.4	17 - 35	390	60.5	14,000	3150
40E	212/3 213/6 214/7	---	1.125	0.4 - 1.2	6 - 17	390	60.5	18,700	4230
				0.8 - 1.7	12 - 25	390	60.5	16,800	3750
				1.2 - 2.3	17 - 33	390	60.5	14,400	3270
				0.3 - 1.0	4 - 15	380	58.9	19,000	4240
	213/4 214/5 214/7	---	1.5	0.6 - 1.5	9 - 22	380	58.9	17,100	3830
				0.9 - 2.1	13 - 30	380	58.9	14,800	3360
				0.2 - 1.2	3 - 17	370	57.4	17,800	4220
	213/4 214/5 214/7	---	2	0.5 - 1.7	7 - 25	370	57.4	15,900	3560
				0.7 - 2.4	10 - 35	370	57.4	13,300	2980
45	221/8 221/12 223/12	32	---	0.8 - 1.6	12 - 23	790	122	34,800	7810
				1.2 - 2.5	17 - 36	790	122	27,600	6220
				1.5 - 3.1	22 - 45	790	122	22,900	5120
45E	221/8 221/12 223/12	---	1.125	0.8 - 1.6	12 - 23	790	122	34,800	7810
				1.2 - 2.3	17 - 33	790	122	29,200	6590
				1.5 - 3.0	22 - 44	790	122	23,700	5250
	221/8 221/12 223/12	---	1.5	0.5 - 1.4	7 - 20	780	121	35,900	8110
				0.8 - 2.2	12 - 32	780	121	29,600	6650
				1.0 - 2.7	15 - 39	780	121	25,700	5810
	221/8 221/12 223/12	---	2	0.5 - 1.7	7 - 25	770	119	33,100	7380
				0.7 - 2.5	10 - 36	770	119	26,900	6070
				0.9 - 3.1	12 - 45	770	119	22,300	5000

1. Effective diaphragm area at 0% valve travel from seat.

2. Based upon 6 bar operating pressure to the diaphragm and valve travel at 0% from seat. This does not consider limitation to the valve such as stem buckling load. Consult your [Emerson sales office](#) for details.

Specifications

Refer to table 1 for Specifications of the 3024C actuator. See the actuator nameplate (figure 3) for specific information about your actuator.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

3024C Actuator

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Table 3. Additional Specifications (Action Air-to-Open)

Size	Spring Set/ Quantity	Travel		Spring Range		Effective Diaphragm Area (1)		Maximum Output Thrust (Maximum Actuator Stem Force) (2)	
		mm	Inch	Bar	Psig	cm ²	Inches ²	N	Lb
30	217/3 218/5 218/7	16	---	0.5 - 1.3	7 - 19	170	26.4	780	170
				1.4 - 2.2	20 - 32	170	26.4	2360	530
				2.0 - 3.1	29 - 45	170	26.4	3360	760
30E	217/3 218/5 218/7	---	0.75	0.3 - 1.3	4 - 19	175	27.1	550	120
				1.2 - 2.2	17 - 32	175	27.1	2180	490
				1.8 - 3.1	26 - 45	175	27.1	3110	700
34	219/3 212/5 212/7	16	---	0.6 - 1.4	9 - 20	410	63.6	2450	550
				1.1 - 1.9	16 - 28	410	63.6	4610	1040
				1.6 - 2.7	23 - 39	410	63.6	6560	1480
34E	219/3 212/5 212/7	---	0.75	0.4 - 1.4	6 - 20	420	65.1	1880	420
				1.0 - 1.9	15 - 28	420	65.1	4120	930
				1.4 - 2.7	20 - 39	420	65.1	5870	1320
40	212/3 213/6 214/7	32	---	0.4 - 1.3	6 - 19	450	69.8	1880	420
				0.8 - 1.8	12 - 26	450	69.8	3640	820
				1.2 - 2.4	17 - 35	450	69.8	5530	1240
40E	212/3 213/6 214/7	---	1.125	0.5 - 1.3	7 - 19	440	68.2	2200	500
				0.9 - 1.8	13 - 26	440	68.2	3970	890
				1.3 - 2.4	19 - 35	440	68.2	5920	1330
	213/4 214/5 214/7	---	1.5	0.4 - 1.1	6 - 16	410	63.6	1560	350
				0.7 - 1.6	10 - 23	410	63.6	3010	680
				1.0 - 2.3	15 - 33	410	63.6	4270	960
	213/4 214/5 214/7	---	2	0.2 - 1.2	3 - 17	440	68.2	1060	240
				0.5 - 1.8	7 - 26	440	68.2	2390	540
				0.8 - 2.5	12 - 36	440	68.2	3400	760
45	221/8 221/12 223/12	32	---	0.8 - 1.7	12 - 25	940	146	7790	1750
				1.2 - 2.5	17 - 36	940	146	11,700	2630
				1.6 - 3.2	23 - 46	940	146	14,700	3300
45E	221/8 221/12 223/12	---	1.125	0.9 - 1.7	13 - 25	910	141	8350	1880
				1.4 - 2.5	20 - 36	910	141	12,500	2810
				1.7 - 3.2	25 - 46	910	141	15,700	3530
	221/8 221/12 223/12	---	1.5	0.7 - 1.6	10 - 23	870	135	6150	1380
				1.1 - 2.4	16 - 35	870	135	9230	2080
				1.3 - 3.1	19 - 45	870	135	11,500	2590
	221/8 221/12 223/12	---	2	0.5 - 1.7	7 - 25	940	146	4740	1070
				0.8 - 2.6	12 - 38	940	146	7110	1600
				0.9 - 3.2	13 - 46	940	146	8800	1980

1. Effective diaphragm area at 0% valve travel from seat.

2. Based on zero operating pressure to the diaphragm and valve travel at 0% from valve seat. This does not consider limitations such as stem buckling load. Consult your [Emerson sales office](#) or Local Business Partner for details.

Table 4. Handwheel Specifications

ACTUATOR SIZE	HANDWHEEL DIAMETER		TURNS PER mm/INCH TRAVEL		RIM FORCE ^(1,2)		HANDWHEEL OUTPUT FORCE	
	mm	In.	mm	In.	N	lb	N	lb
30 and 30E	200	7.87	0.24	6.1	179	40	5000	1125
34, 34E, 40, and 40E	250	9.84	0.21	5.4	286	64	10,000	2250
45 and 45E	250	9.84	0.21	5.5	400	90	14,000	3150

1. Tangential handwheel force required to produce the handwheel output force shown.

2. Brass operating nut and stainless steel screw.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operation to avoid personal injury.

To avoid personal injury and parts damage, do not apply pressure that exceeds the Maximum Operating Diaphragm Pressure (table 1) or produces a output thrust on the stem greater than the Maximum Actuator Stem Force (table 2 and 3). Use pressure-limiting or pressure-relieving devices to prevent the operating pressure from exceeding the Maximum Operating Diaphragm Pressure.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions.

Responsibility for the safety of process media and the compatibility of valve materials with the process media rests solely with the purchaser and end user. Since some valve body/trim materials combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson Automation Solutions sales office.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

A 3024C diaphragm actuator is normally shipped mounted on a valve. Refer to the appropriate valve instruction manual when installing the valve in the pipeline. If the actuator is shipped separately or if it is necessary to mount the actuator on the valve, perform the Actuator Mounting procedure given below. For information on mounting the positioner, refer to the appropriate positioner instruction manual.

Note

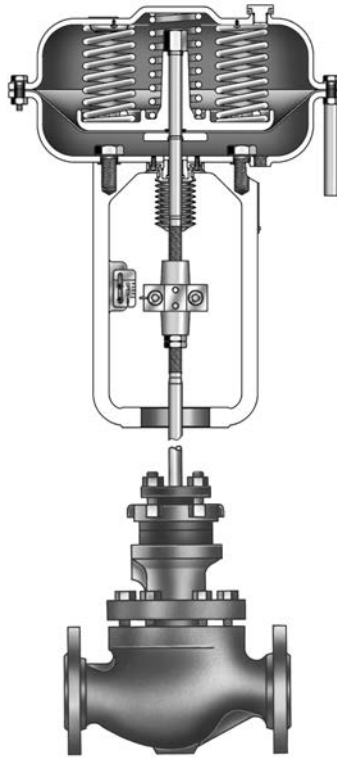
The 3024C actuators are designed to mount on push-down- to-close valves. Do not mount these actuators on any other type of valve without first contacting your [Emerson sales office](#).

Mounting the Actuator on the Valve

The following procedure describes how to mount a 3024C actuator on a push-down-to-close valve so that the actuator stem and valve stem thread engagement allows full travel and proper shut-off. Refer to table 4 and figures 6 and 7 for actuator dimensions. Key numbers referenced in the following steps are shown in figures 8 and 9.

1. Provide a temporary method of applying diaphragm air loading pressure to the diaphragm to move the actuator stem during adjustments.
2. Provide a vice or some other method of supporting the valve and the weight of the actuator during assembly.
3. Push the valve stem down until the valve plug is fully closed.
4. Screw the two stem locknuts (key 52) to the lower end of the valve stem thread.

Figure 4. Actuator Mounting Components for Assembly with a Valve



W8484-1

⚠ WARNING

When moving the actuator stem with diaphragm loading pressure use caution to keep hands and tools out of the actuator stem travel path. Personal injury and/or property damage is possible if something is caught between the actuator stem and other parts of the valve assembly.

Perform one of the following procedures as appropriate:

For a 3024C Air-To-Close Actuator with a Push-Down-to-Close Valve:

- a. Carefully place the actuator on the valve so that the yoke boss fits over the valve bonnet.
- b. Screw the yoke lock nut onto the bonnet and tighten.
- c. Lift the valve plug off the seat by the correct valve travel for the valve. This is stated on the nameplate or in table 1.
- d. Place the stem connector half (key 50) approximately halfway between the actuator and valve stems but observing the F dimension in table 5 so that any positioner lever (if fitted) is horizontal at mid-travel. Be sure that the actuator and valve stem threads are engaging the threads of the stem connector by at least the distance of one diameter of the stem.

NOTICE

Be sure that the length of the actuator stem and the valve stem in the connector (key 50) is equal to or greater than the diameter of that stem. Incomplete engagement of either the valve or actuator stem in the stem connector can result in stripped threads or improper operation.

In the following procedure do not rotate the valve plug while it is seated. This may damage the seating surface and cause excessive leakage. While making adjustments, use tools carefully to avoid damaging the valve stem. A damaged stem could cut the packing and allow leakage through the packing box.

- e. Install the other half of the stem connector and insert the socket screws and nuts and tighten them.
- f. Screw the two stem locknuts (key 52) up the valve stem to the stem connector and tighten. Do not over tighten.
- g. Slowly decrease and then increase the diaphragm pressure several times stroking the valve from the lower end to the upper end of the spring range.
- h. Apply air pressure to the diaphragm until the valve is in the closed position. Loosen the screws of the travel scale (key 26) and align it with the indicator on the stem connector.
- i. Stroke the valve full travel to ensure that the travel matches the valve travel on the travel indicator plate.
- j. If the valve travel is not correct, repeat the stem connector procedure. Remove the air pressure from the diaphragm, remove the stem connector and repeat steps c to i.

For a 3024C Air-to-Open Actuator with a Push-Down-to-Close Valve:

- a. Apply approximately 0.5 bar pressure above the upper setting of the spring pressure range to the bottom of the diaphragm. This positions the actuator stem (key 8) at the highest point. The spring range is stated on the nameplate or in table 3.
- b. Carefully place the actuator on the valve so that the yoke boss fits over the valve bonnet.
- c. Screw the yoke lock nut onto the bonnet and tighten.
- d. Lift the valve plug off the seat by the correct travel for the valve. The travel is stated on the nameplate or in table 1.
- e. Place the stem connector half (key 50) approximately halfway between the actuator and valve stems but observing the F dimension in table 5 so that any positioner lever (if fitted) is horizontal at mid-travel. Be sure that the actuator and valve stem threads are engaging the threads of the stem connector by at least the distance of one diameter of the stem.
- f. Install the other half of the stem connector and insert the socket screws and nuts and tighten them.
- g. Screw the two stem locknuts (key 52) up the valve stem to the stem connector and tighten. Do not over tighten.
- h. Slowly decrease and then increase the diaphragm pressure several times stroking the valve from the lower end to the upper end of the spring range.
- i. Remove all air pressure from the diaphragm so that the valve is in its closed position. Loosen the screws of the travel scale (key 26) and align it with the indicator on the stem connector.
- j. Stroke the valve full travel to ensure that the valve travel matches the valve travel on the travel indicator plate.

- k. If the valve travel is not correct repeat the stem connector procedure. Apply approximately 0.5 bar pressure above the upper setting of the spring range to the bottom of the diaphragm, remove the stem connector and then repeat steps d to j.

Note

When disassembling the stem connector on Air-to-Open constructions it is essential to apply enough air pressure to the underside of the diaphragm to lift the valve plug off its seat. This will ensure that all residual spring compression in the actuator is supported while the stem connector is removed.

Actuator Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of the service conditions.

This section describes how the actuator can be completely disassembled and assembled. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job; then start to assemble at the appropriate step.

Key numbers refer to figures 8 and 9.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
 - Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
 - Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
 - Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
 - Vent the power actuator loading pressure and relieve any actuator spring precompression.
 - Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
 - The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
 - Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
-

Disassembly

1. For complete disassembly, the positioner and all accessories (if attached) must be removed from the actuator. Follow appropriate removal procedures in the instruction manuals supplied with the positioner and accessories.

2. Bypass the control valve. For a top-loaded 3024C Air-to-Close actuator, reduce the diaphragm air pressure to zero and remove the piping or tubing from the connection in the upper diaphragm casing (key 16). For a bottom loaded 3024C Air-to-Open, apply air pressure to the diaphragm to open the valve.

Note

When disassembling the stem connector on Air-to-Open constructions, it is essential to apply enough air pressure to the underside of the diaphragm to lift the valve plug off its seat. This will ensure that all residual spring compression in the actuator is supported while the stem connector is removed.

3. Undo the stem connector by first slackening the valve stem locknuts and then removing the socket bolts.
4. Undo the yoke locknut on the valve bonnet and carefully lift the actuator off the valve. As you undo the yoke locknut, ensure that the actuator is properly supported. If the actuator is a bottom loaded Air-to-Open type, reduce the diaphragm pressure to zero and remove the piping or tubing from the connection in the lower diaphragm casing (key 1).
5. Slightly loosen all diaphragm casing cap screws (key 19 and 21). Remove the plastic hose (key 22). Unscrew the short and long diaphragm casing cap screws and nuts (keys 19, 20 and 21) alternately, until only the long casing cap screws (key 21) remain engaged. Then allow the remaining spring compression to be slowly released by alternately unscrewing the long casing cap screws.
6. When removing the diaphragm and actuator springs perform one of the following procedures as appropriate:

For a 3024C Air-to-Open Actuator (figure 9)

- a. Lift off the upper diaphragm casing (key 16), the casing spacer (key 29) and seal ring (key 30) if fitted (see figure 13), and remove the springs (Key 15).
- b. Using a strap wrench or soft-jawed vice, hold the actuator stem (key 8) and remove the travel stop nut (key 14).
- c. Remove the diaphragm plate (key 13), diaphragm (key 11), O-Ring (key 12), pressure plate (key 10) and the split ring halves (key 9).

For a 3024C Air-to-Close Actuator (figure 8)

- a. Lift off the upper diaphragm casing (key 16) and casing spacer (key 29) and seal ring (key 30) if fitted (see figure 13).
 - b. Using a strap wrench or soft-jawed vice, hold the actuator stem (key 8) and remove the travel stop nut (key 14).
 - c. Remove the pressure plate (key 10), O-ring (key 12), diaphragm (key 11), diaphragm plate (key 13) and the split ring halves (key 9).
7. Carefully slide the actuator stem (key 8) out of the bottom of the lower diaphragm casing (key 1) and set it on a protective surface to prevent damage to the O-ring sealing surface.
 8. Remove the bellows (key 31), if used.
 9. Unscrew the cheese head screws (key 7), then remove the bushing (key 6).
 10. With the actuator disassembled, inspect all parts for excessive wear and replace as necessary.

Assembly

This procedure assumes that the actuator is completely disassembled. If it is not, start the instructions at the appropriate step.

1. Before starting assembly, apply lithium grease (key 200) to the O-ring in the bushing (key 6 and key 12). Install the new bushing (key 6) and assemble with the cheese head screws (key 7) onto the lower diaphragm casing (key 1). Use a torque of 0.4 N•m (3 lbf•in).
2. Assemble the ring halves (key 9), pressure plate (key 10), O-ring (key 12), diaphragm (key 11) and diaphragm plate (key 13) on to the actuator stem as shown in figure 9 for Air-to-Open or figure 8 for Air-to-Close.
3. Apply thread locking adhesive (high strength) (key 201) to the thread on the upper end of the actuator stem, fit the travel stop nut (key 14) but do not tighten. Then perform one of the following procedures as appropriate.

For a 3024C Air-to-Open Actuator (figure 9)

- a. Carefully slide the actuator stem (key 8) (with the assembled parts) down through the bushing (key 6).
- b. Position the actuator springs (key 15) symmetrically on the diaphragm plate (key 13) as shown in figure 5.
- c. Install the upper diaphragm casing (key 16) so that the springs fit correctly over the seat bosses of the spring locator (key 17). Rotate the upper diaphragm casing along with the diaphragm/diaphragm plate assembly so that the air connection in the upper diaphragm casing is located directly above the air connection in the lower diaphragm casing. Then rotate the diaphragm without moving either the upper diaphragm casing or the diaphragm plate so that the diaphragm holes line up with those in the casings.
- d. Lift off the upper diaphragm casing and remove the springs. Tighten the travel stop nut (key 14) as follows: Sizes 30, 30E, 34, and 34E, tighten to 36 N•m (27 lbf•ft); Sizes 40, 40E, 45, and 45E, tighten to 87 N•m (64 lbf•ft).
- e. Replace the spring as previously.
- f. For actuator sizes 40E and 45E with 1.5 and 2 inch travels, a casing spacer is fitted between the upper and lower diaphragm casings. Place the casing spacer (key 29) on the diaphragm and then the gasket (key 30) as shown in figure 13.

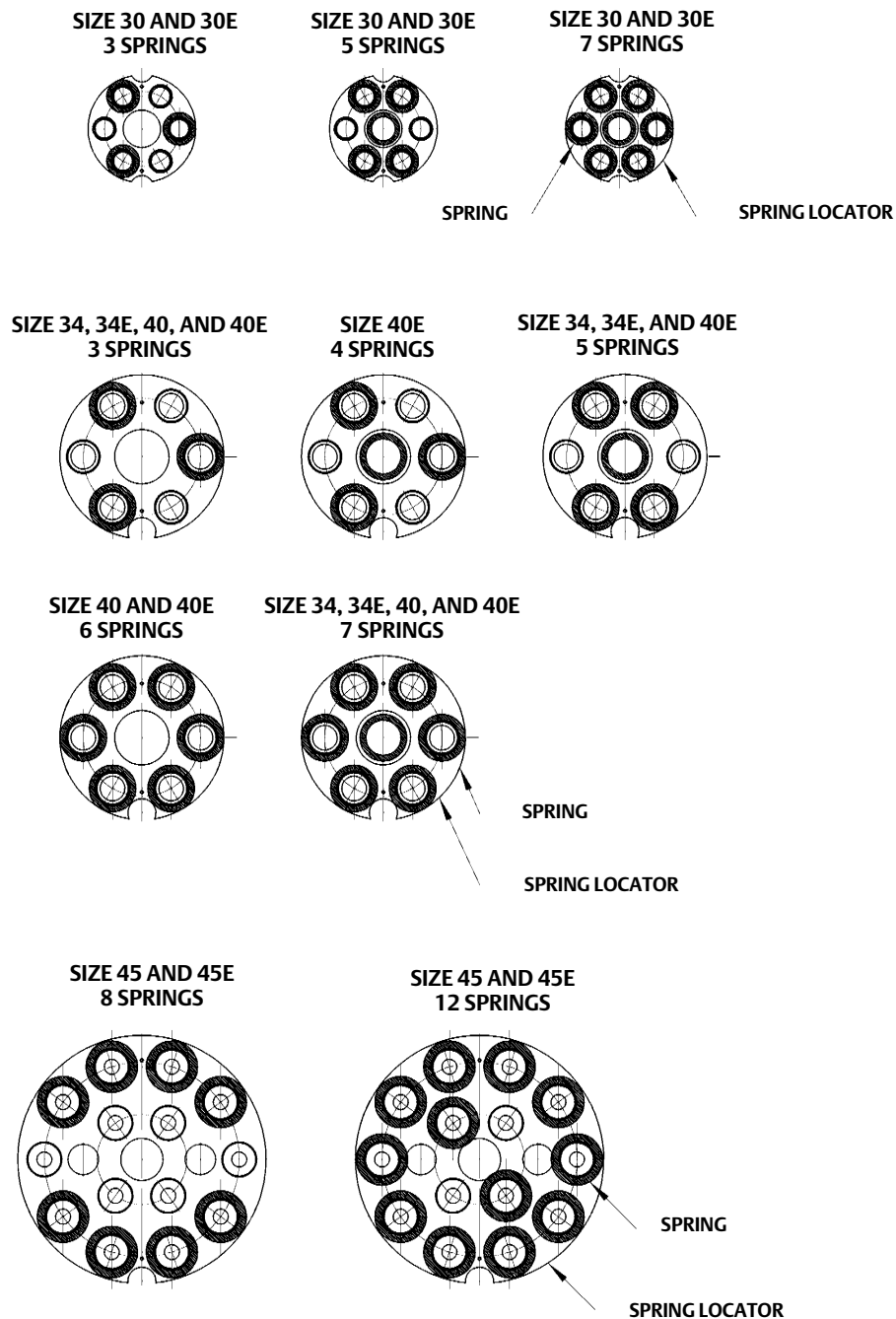
For a 3024C Air-to-Close Actuator (figure 8)

- a. Position the actuator springs symmetrically on the spring locator (key 17) as shown in figure 5.
 - b. For actuator sizes 40E and 45E with 1.5 and 2 inch travels, a casing spacer (key 29) is fitted between the upper and lower diaphragm casings. Place the gasket (key 30) on the lower casing and then the casing spacer (key 29) as shown in figure 13.
 - c. Carefully slide the actuator stem with the assembled parts down through the bushing and position it so that the springs fit correctly over the seat bosses on the upper side of the diaphragm plate (key 13). Rotate the diaphragm (key 11) without moving the diaphragm plate (key 13) so that the diaphragm holes line with the lower diaphragm casing holes.
 - d. Tighten the travel stop nut (key 14) as follows: Sizes 30, 30E, 34 and 34E tighten to 36 N•m (27 lbf•ft); Sizes 40, 40E, 45 and 45E tighten to 87 N•m (64 lbf•ft).
4. Install the upper diaphragm casing (key 16) so that the air connection is located directly above the air connection in the lower diaphragm casing (key 1). Using the long cap screws (key 21) and hex nuts (key 20) first, and then the shorter cap-screws (key 19) and hex nuts (key 20), bolt the two diaphragm casings together. Fit the safety plastic hose (key 22) over the exposed thread of the long cap-screws (key 21).

NOTICE

Over tightening the diaphragm cap screws and nuts can damage the diaphragm. Do not exceed the torque of 13 N•m (10 lbf•ft) for sizes 30, 30E, 34 and 34E and 17 N•m (12 lbf•ft) for sizes 40, 40E, 45, and 45E.

Figure 5. Fisher 3024C Spring Arrangements



Note

Be sure to use the long cap screws (key 21) first, installing them on opposite sides of the diaphragm casing. Tighten them evenly, using a criss-cross pattern to ensure a proper seal.

5. Mount the actuator on the valve in accordance with the Installation Procedures.

Changing the Actuator Action

The actuator can be changed from a 3024C Air-to-Open to a 3024C Air-to-Close action or vice versa. Remove the pressure plate, diaphragm, O-ring, diaphragm plate, travel stop nut, springs, spring locator, self tapping screws and vent assembly (keys 10, 11, 12, 13, 14, 15, 17, 18 and 23) and reinstall them for the appropriate action. Follow the instructions in the section on Assembly on page 8.

Side-Mounted Handwheel

A side-mounted handwheel assembly (figure 10) is usually used as a manual operator. When mounted on an Air-to-Close 3024C actuator, turning the handwheel clockwise always closes the valve. When mounted on an Air-to-Open actuator, turning the handwheel clockwise always opens the valve. A lever (key 101, figure 10) on the handwheel assembly opens or closes the valve by moving the valve stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as is necessary to accomplish the required maintenance; then begin the assembly at the appropriate step.

Refer to figure 10 for key numbers.

Disassembly

1. If desired, the handwheel assembly can be removed from the actuator yoke. To do this, remove the eight hex cap screws (key 113) that hold the assembly to the yoke.
2. Loosen the lock (key 115) that secures the drive screw assembly (key 103).
3. Remove the retaining ring (key 110) and screw out the drive screw assembly (key 103).
4. Remove the retaining ring (key 108) and drive out the pivot pin (key 104).
5. Remove the bushings (key 107) from the body (key 100).
6. There is a cap screw (key 111), hex nut (key 112) and spacer (key 105) that hold the two levers (key 101) together. Remove the cap-screw and hex nut and the two levers can be separated in order to remove the operating nut (key 102).

Assembly

1. Assemble the operator nut (key 102), the two levers (key 101) and the spacer (key 105) using the cap-screw (key 111) and hex nut (key 112).
2. Install the bushings (key 107) in the body (key 100).
3. Attach the levers (key 101) to the body (key 100) using the pivot pin (key 104) and the retaining ring (key 108).
4. Apply lithium grease (key 200) to the drive screw assembly (key 103) and screw it on to the operating nut (key 102).
5. Install the retaining ring (key 110) to secure the collar to the body (key 100).

6. If the handwheel assembly was removed from the actuator yoke, position the assembly within the yoke so that the eight mounting holes on the assembly align with those on the yoke and fit the cap-screws (key 113) tightening to 28 N•m (20 lbf•ft). Should difficulty be experienced fitting the levers (key 101) over (for ATC) or under (for ATO) the actuator/valve stem connector, then partially stroke the actuator/valve by applying air pressure to the actuator diaphragm.

Adjustable Travel Stops

The adjustable up travel stop (figures 11 and 12) limits the actuator stroke in the upward direction (limits retraction of the actuator stem).

⚠ WARNING

When performing the following adjustment procedures, take care to avoid injury when positioning components.

For Sizes 30, 30E, 34, 34E, 40, and 40E

1. Relieve the air pressure on the diaphragm. Loosen the hex nut (key 25) and turn the adjuster (key 24) clockwise into the diaphragm case to move the actuator stem downward or counter-clockwise to allow the actuator stem to move upward. Since the valve has push-down-to-close action, full opening can be restricted. Check the actuator travel and then tighten the hex nut (key 25).

Note

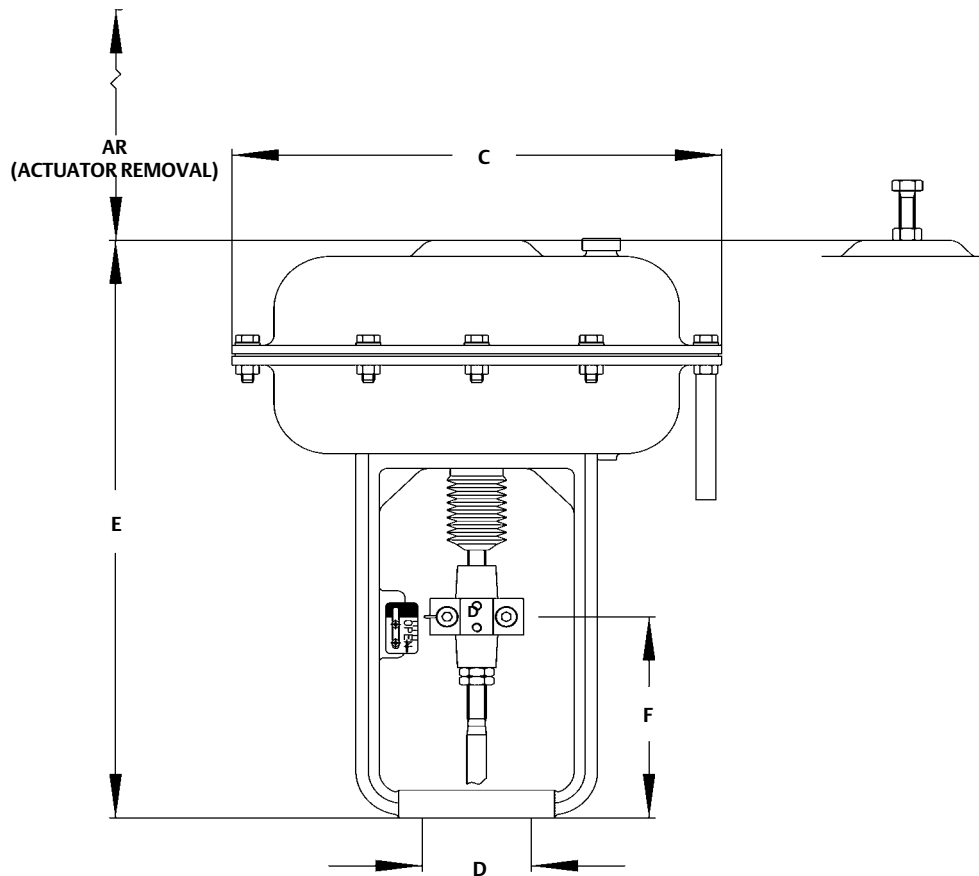
The travel stop hex nut (key 25) has an elastic stop on its underside to provide an air seal around the travel stop thread. It is therefore important, before slackening this nut, to release any air pressure on the diaphragm.

For Sizes 45 and 45E

The adjustable up travel stop for the sizes 45 and 45E is shown in figure 12. For sizes 45 and 45E, the adjustable up travel stop cannot be used with a side mounted handwheel.

1. Remove the screws (key 41) and nuts (key 42) which hold the protective covers (key 40) to the actuator yoke and remove the covers.
2. Loosen the machined cheese head screw (key 37) and turn the adjustment nut (key 38) clockwise into the bushing (key 36) to increase travel or counter-clockwise to shorten the actuator travel.
3. Check the actuator travel and then tighten the machined cheese head screw (key 37).
4. Assemble the protective cover plates (key 40) to the actuator yoke with the screws (key 41) and nuts (key 42) taking care to ensure that there is no gap between the cover plate and the diaphragm casing.

Figure 6. Actuator Dimensions



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Actuator Dimensions

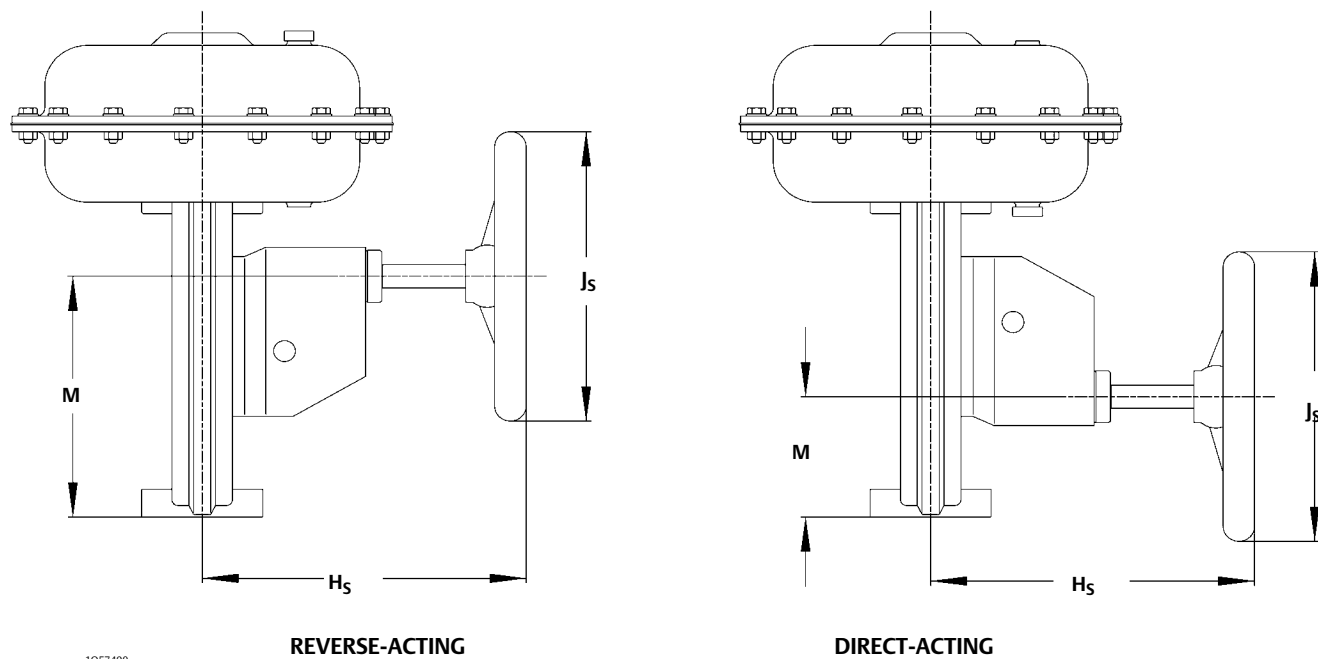
Refer to figures 6 and 7 and table 5 for dimensions.

Table 5. Dimensions

Actuator Size	Valve Travel	Yoke Boss, Inches	C	E	F ⁽¹⁾	AR	Js	Hs	M (ATO)	M (ATC)
			Millimeters							
30	16 mm	2-1/8 (54 mm)	215	370	140	105	205	280	185	80
34	16 mm	2-1/8 (54 mm)	315	400	140	105	250	280	185	80
40	32 mm	2-13/16 (71 mm)	315	420	170	133	250	280	210	100
45	32 mm	2-13/16 (71 mm)	420	450	170	133	250	280	210	100
Inches										
30E	0.75	2-1/8	8.5	14.6	5.6	4.7	8.1	11.0	7.3	3.1
34E	0.75	2-1/8	12.4	15.8	5.6	4.7	9.8	11.0	7.3	3.1
40E	1.125	2-13/16	12.4	17.9	8.1	6.6	9.8	11.0	9.6	5.5
40E	1.5	2-13/16	12.4	18.9	8.3	6.6	---	---	---	---
40E	2	2-13/16	12.4	18.9	8.5	6.2				
45E	1.125	2-13/16	16.5	19.3	8.1	6.6	9.8	11.0	9.6	5.5
45E	1.5	2-13/16	16.5	20.1	8.3	6.6	---	---	---	---
45E	2	2-13/16	16.5	20.1	8.5	6.2				

1. This is the distance between the base of the yoke to the centre of the stem connector at the fully-up position. This ensures the positioner feedback arm, if fitted, is horizontal at mid-travel.

Figure 7. Actuator Dimensions with Handwheel



Parts Ordering

Each actuator has a serial number stamped on the nameplate (figure 2 and key 34 on figures 8 and 9). Refer to the serial number when ordering replacement parts or when corresponding with your [Emerson sales office](#) for technical assistance.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 8. Direct-Acting Actuator (Air-to-Close)

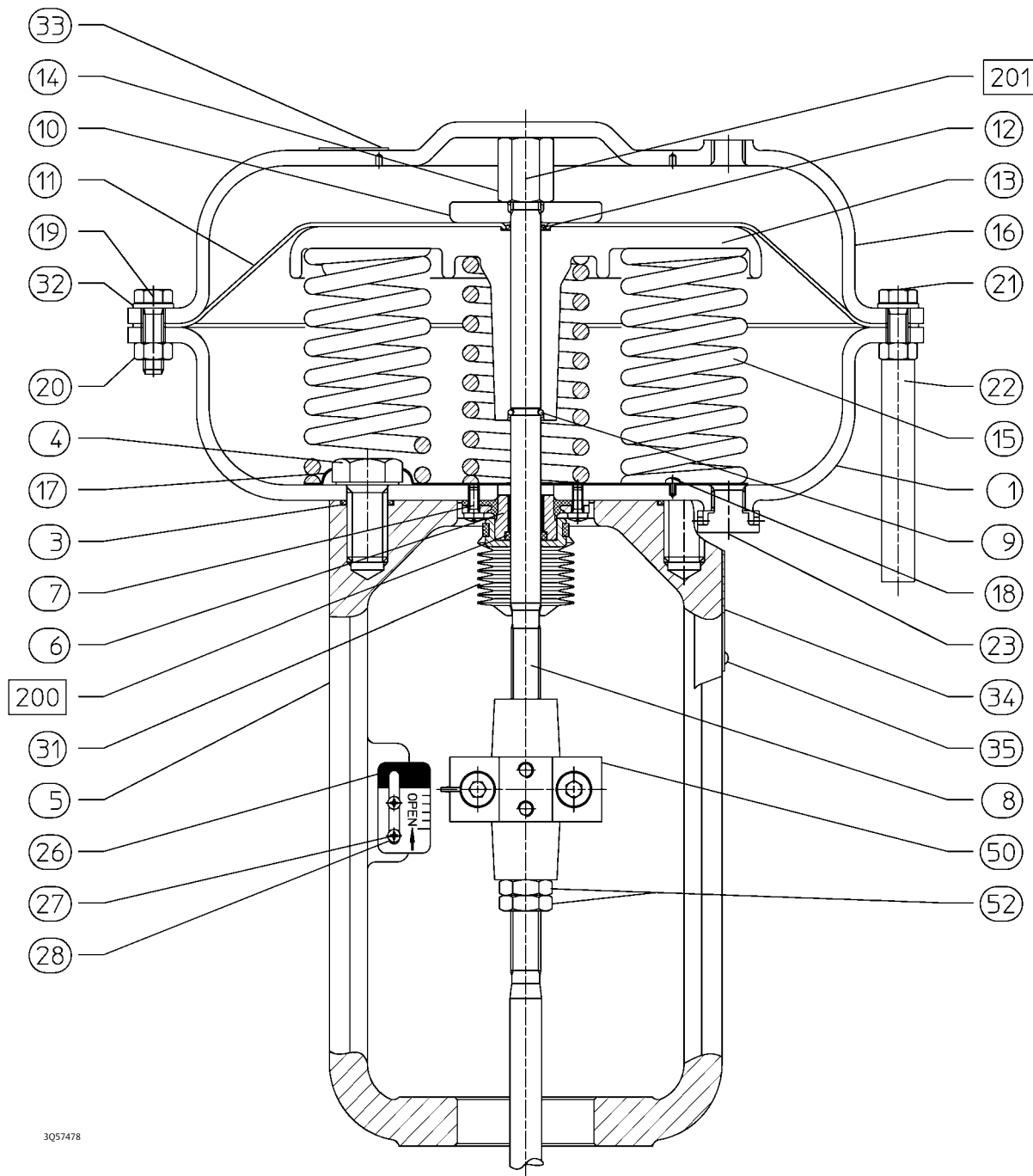
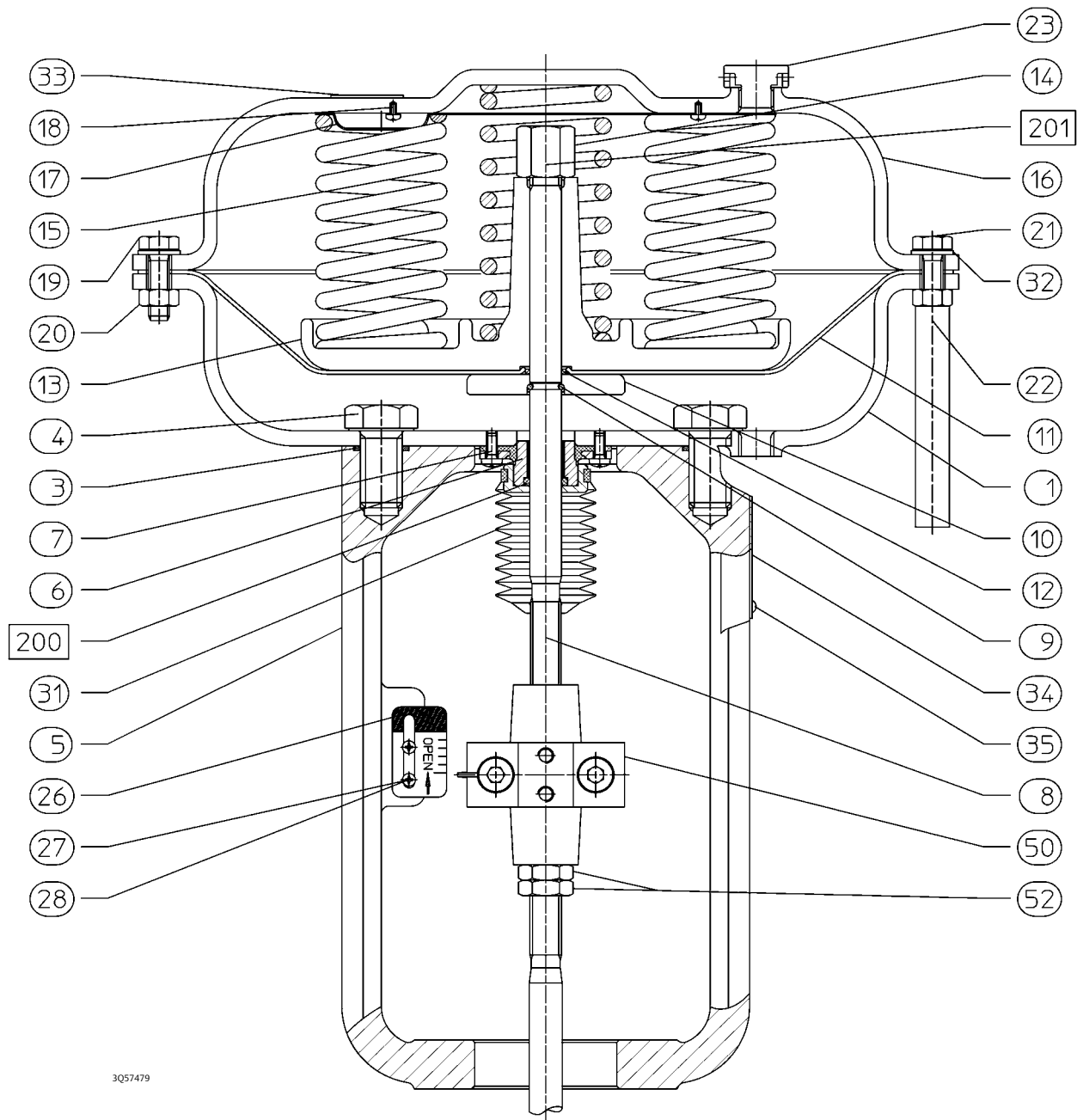


Figure 9. Reverse-Acting Actuator (Air-to-Open)



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Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Actuator

Key	Description
1	Lower Diaphragm Casing, steel
3*	O-Ring (2 required) Sizes 30 & 30E Sizes 34, 34E, 40, 40E, 45 & 45E
4	Cap-Screw, hex head (2 required)
5	Yoke, steel
6*	Bushing Assembly Sizes 30, 30E, 34, 34E, 40 and 40E Sizes 45 and 45E
7	Machined Screw, pan head (6 required)
8	Actuator Stem
9	Split Ring, half (2 required)
10	Pressure Plate
11*	Diaphragm Sizes 30, 30E, 34, 34E, 40 and 40E Sizes 34, 34E, 40 and 40E Sizes 45 and 45E
12*	O-Ring Sizes 30, 30E, 34, 34E, 40 and 40E Sizes 45 & 45E
13	Diaphragm Plate
14	Nut, Hex
15	Springs (see tables 2 and 3 for quantity, set number & color)
16	Upper Diaphragm Casing, Steel
17	Spring Locator
18	Drive Screw (2 required)
19	Hex Head Cap Screw Sizes 30, 30E (10 required) Sizes 34, 34E, 40, and 40E (15 required) Size 45, 45E (20 required)
20	Hex Nut Sizes 30, 30E (7 required) Sizes 34, 34E, 40, and 40E (12 required) Size 45, 45E (17 required)
21	Hex Head Cap Screw (3 required)
22	Plastic Hose (3 required)
23	Vent
26	Travel Indicator Scale
27	Twin-Speed Nut
28	Self-Tapping Screw (2 required)
29	Casing Spacer (Size 40E and 45E only)
30	Seal Ring (Size 40E and 45E only)
30*	Gasket Size 40E Size 45E

Key	Description
31*	Bellows
32	Plain Washer Size 30, 30E (10 required) Size 34, 34E, 40, and 40E (15 required) Size 45, 45E (20 required)
33	Warning Label
34	Nameplate
35	Drive Screw (2 required)
50	Stem Connector Assembly
52	Hex Jam Nut (2 required)
200	Lithium Grease
201	Thread Locking Adhesive (High Strength)

Side Mounted Handwheel

Key	Description
100	Body
101	Lever (2 required)
102	Operating Nut
103	Drive Screw Assembly
104	Pivot Pin
105	Spacer
106	Shim Ring
107	Bushing (2 required)
108	Retaining Ring (2 required)
109	Thrust Washer
110	Retaining Ring
111	Cap-Screw, hex head
112	Nut, hex
113	Cap-Screw, hex head (8 required)
115	Lock
117	Nut, hex
200	Lithium Grease

Adjustable Up Travel Stop

Sizes 30, 30E, 34, 34E, 40 and 40E

Key	Description
16	Upper Diaphragm Casing
24	Cap-Screw, hex head
25	Hex Nut

Sizes 45 and 45E

Key	Description
16	Upper Diaphragm Casing
36	Adjustment Nut
37	Machined Screw, cheese head
38	Bushing
40	Protective Cover (2 required)
41	Hex Cap Screw (2 required)
42	Hex Nut (2 required)

Figure 10. Side-Mounted Handwheel for Type 3024C Actuators

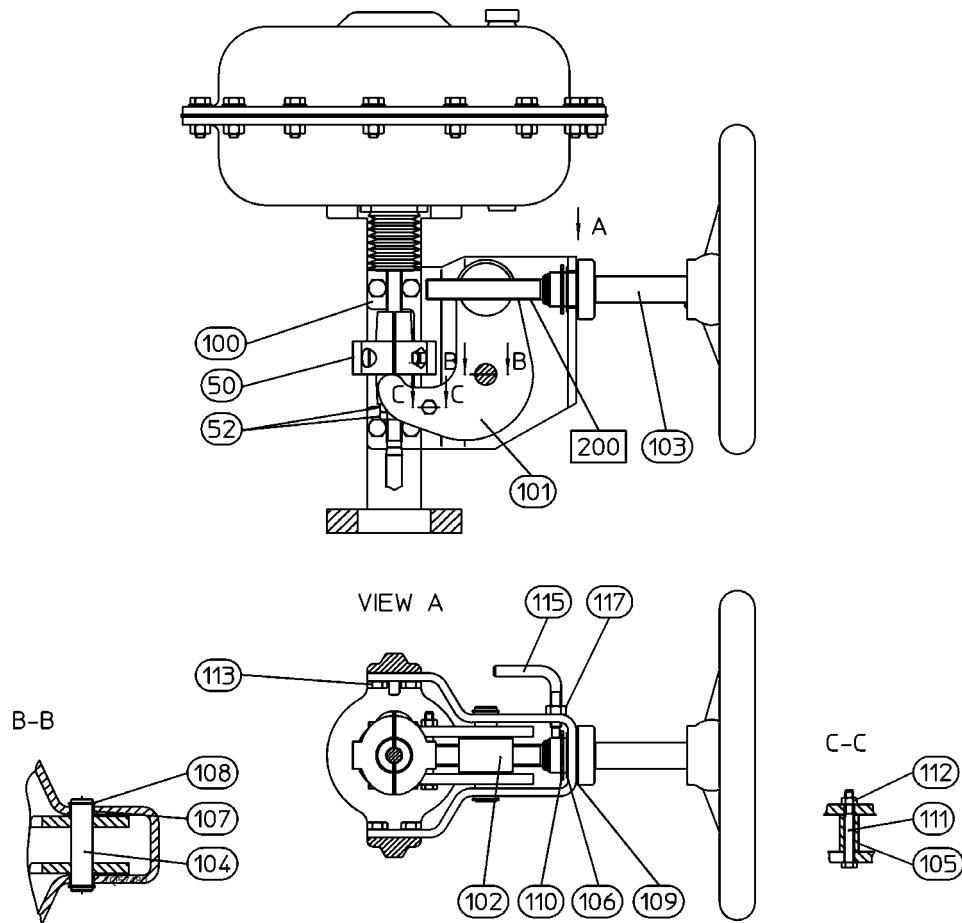
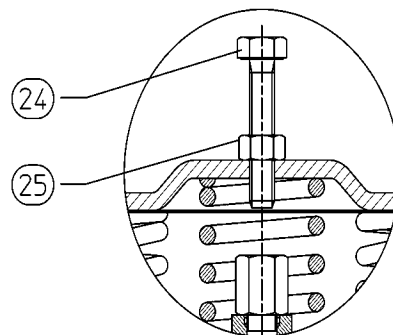


Figure 11. Adjustable Up Travel Stop for Sizes 30 to 40E



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Figure 12. Adjustable Up Travel Stop for Sizes 45 to 45E

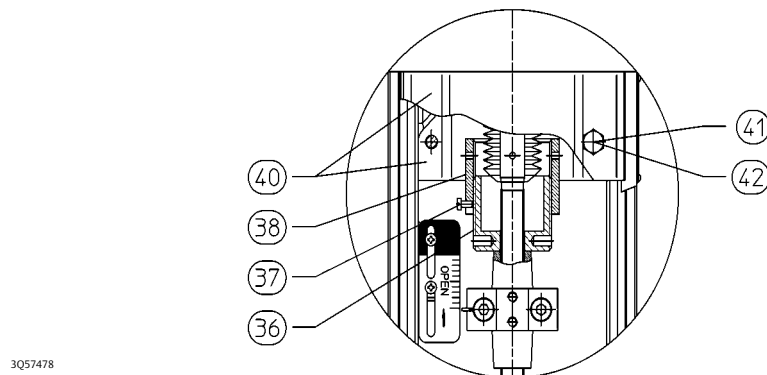
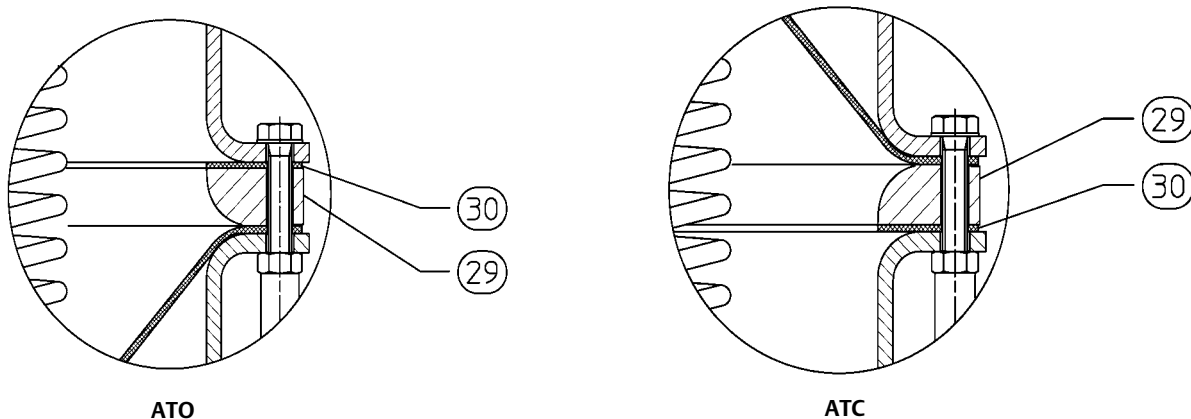


Figure 13. Casing Spacer Detail



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Fisher™ 3025 Diaphragm Actuator Sizes 1 and 2

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Figure 1. Fisher 3025 Actuator



X1861_03

Introduction

Scope of Manual

This instruction manual provides information on installation, adjustment, maintenance, and parts ordering for the Fisher 3025 actuators in sizes 1 and 2. Refer to separate instruction manuals for information about the valve positioner and other accessories used with these actuators.



Do not install, operate, or maintain a 3025 actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

3025 Actuator

September 2022

Instruction Manual

D104736X012

Table 1. Specifications

SPECIFICATION		ACTUATOR SIZE	
		1	2
Nominal Effective Area	cm ²	1860	3710
	Inch ²	288	575
Yoke Boss Diameter		3-9/16	---
		5	5
		5H	5H
Acceptable Valve Stem Connection		3/4-16UNF	---
		1-14UNS	1-14UNS
		1 1/4-12UNF	1 1/4-12UNF
Maximum Travel	mm	203.2	139.7
	inch	8	5.5
Maximum Diaphragm Casing Pressure ⁽¹⁾	bar	4	
	Psig	58	
Temperature Capabilities	°C	-30 to 82°C	
	°F	-22 to 180°F	
Pressure Connections (internal)		1/2 NPT	
		3/4 NPT	
		1 NPT	
Approximate Actuator Weights	kg	210 to 360	370 to 480
	lb	465 to 795	815 to 1,060
Approximate Side Handwheel Weights	kg	100	70
	lb	220	150
Maximum Allowable Output Thrust ⁽¹⁾	N	52,910	87,750
	lbs	11,895	19,725

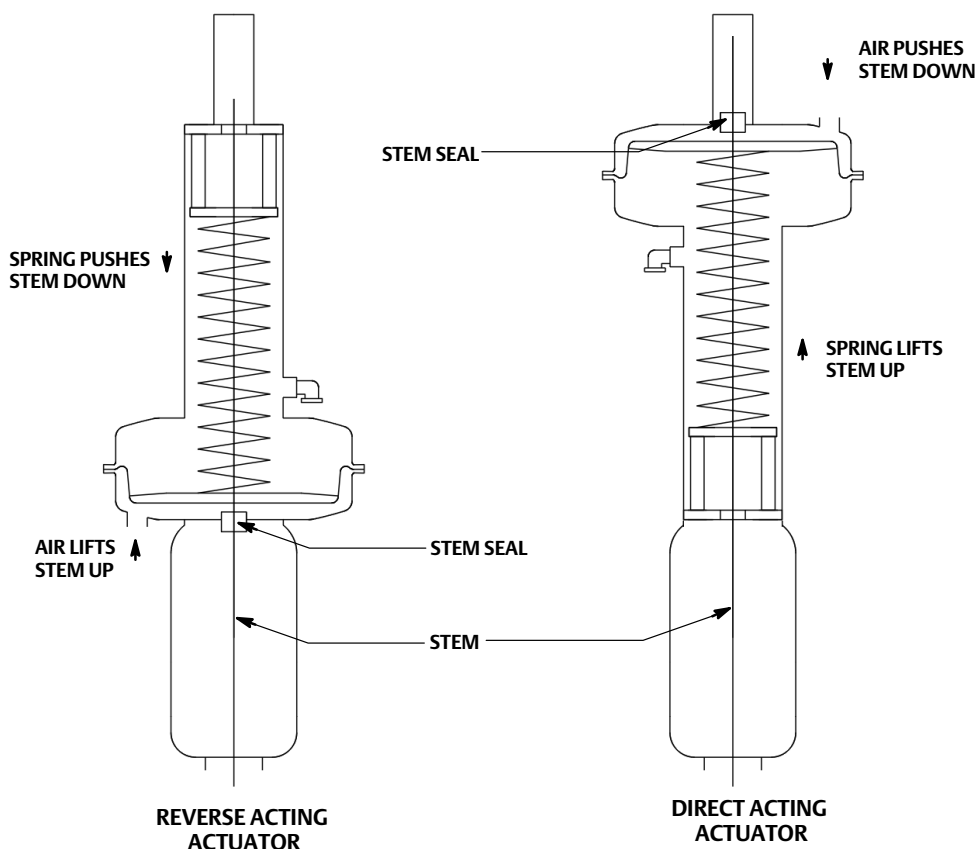
1. Normal operating diaphragm pressure must not exceed maximum diaphragm casing pressure and must not produce a force on the actuator stem greater than the maximum allowable output thrust or the maximum allowable valve stem load. Contact your [Emerson sales office](#) with questions concerning maximum allowable valve stem load.

Description

The Fisher 3025 spring-opposed diaphragm actuators position the valve plug in the valve body in response to varying controller or valve positioner pneumatic output signals applied to the actuator diaphragm. They can be specified either direct or reverse acting. The 3025 size 1 actuator offers 203.2 mm (8 in) maximum travel. The 3025 size 2 actuator provides 139.7 mm (5.5 in) maximum travel.

The 3025 actuator can be equipped with a side-mounted handwheel assembly. It is usually used as an auxiliary manual actuator. Casing-mounted adjustable up and down travel stops are also available on this actuator.

Figure 2. Schematic of Fisher 3025 Actuator in Reverse and Direct Acting



Specifications

Refer to table 1 for Specifications of the 3025 actuator. See the actuator nameplate for specific information about your actuator.

Educational Services

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Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

Key number locations are shown in figures 5 through 15, unless otherwise noted. Also, refer to figure 4 for location of parts.

NOTICE

To avoid parts damage, do not use an operating pressure that exceeds the Maximum Diaphragm Casing Pressure of 4 bar (58 psi) or produces a force on the actuator stem greater than the Maximum Allowable Valve Stem Load.

- **Valve/Actuator Assembly:** If the actuator and valve are shipped together as a control valve assembly, it has been adjusted at the factory, and may be installed in the pipeline. After installing the valve in the pipeline, refer to the Loading Connection procedures.
- **Actuator Mounting:** If the actuator is shipped separately or the actuator has been removed from the valve, it is necessary to mount the actuator on the valve before placing the valve in the pipeline. Refer to the following actuator mounting procedures before placing the valve in service.
- **Positioner:** If a positioner is installed, or is to be installed on the actuator, refer to the positioner instruction manual for installation. During the adjustment procedures, it will be necessary to provide a temporary loading pressure to the actuator diaphragm.

Lifting Actuator Assembly

⚠ WARNING

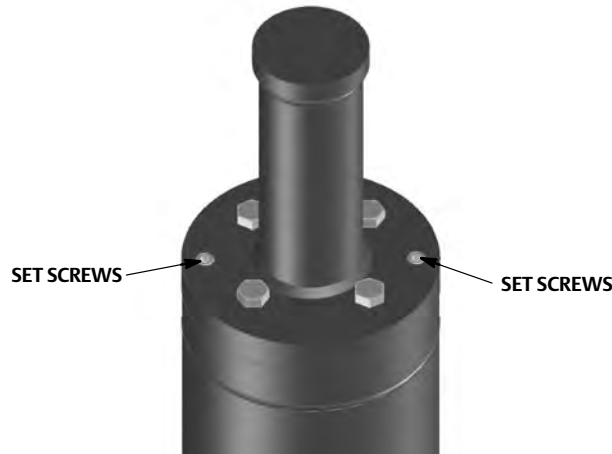
To avoid personal injury or equipment damage, use proper lifting and rigging practices while lifting the actuator assembly. For all mounting procedures use an adequately sized lifting and rigging equipment to handle the actuator and any attached accessories. Use caution during lifting and handling to prevent slippage, swinging, faulty equipment connections, or sudden shock loads.

To avoid personal injury or equipment damage, do not lift or support a complete valve and actuator assembly or any attached piping using the two threaded holes provided on the actuator. The threaded holes are provided for lifting of the actuator and accessories only.

NOTICE

Care must be taken when lifting the actuator assembly to ensure all accessories and tubing are not damaged in the process. Accessories and tubing may need to be removed prior to lifting to prevent damage and properly reinstalled before use.

Figure 3. Threaded Holes for Hoist Rings



The two threaded holes (M16x2 for Size 1 actuator or M20x2.5 for Size 2 actuator) located on the actuator protective cap can be used to install hoist rings and lift the actuator assembly with appropriate lifting and rigging equipment. The actuator assembly weight is provided in table 1. Consult the appropriate actuator accessory instruction manuals for the weight of each additional component.

Mounting the Actuator on the Valve

NOTICE

If the valve stem is allowed to remain in the up position (towards the actuator) during mounting, it can interfere with the actuator mounting, possibly damage valve stem threads or bend the valve stem. Be sure the valve stem is pushed down (into the valve body), away from the actuator while mounting.

⚠ WARNING

When moving the actuator stem with loading pressure applied, exercise caution to keep hands and tools out of the actuator stem travel path. If the loading pressure is accidentally disconnected, personal injury and property damage may result if something is caught between the actuator stem and other control valve parts.

Provide a temporary method of applying diaphragm loading pressure to the diaphragm to extend the actuator stem during bench set spring adjustments.

1. Provide a vise or some other method of supporting the valve and the weight of the actuator during assembly. For direct or reverse acting valves, push the valve stem down away from the actuator while mounting the actuator.
2. Screw the stem locknuts all the way onto the valve stem.
3. Lift or hoist the actuator onto the valve bonnet:

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

3025 Actuator

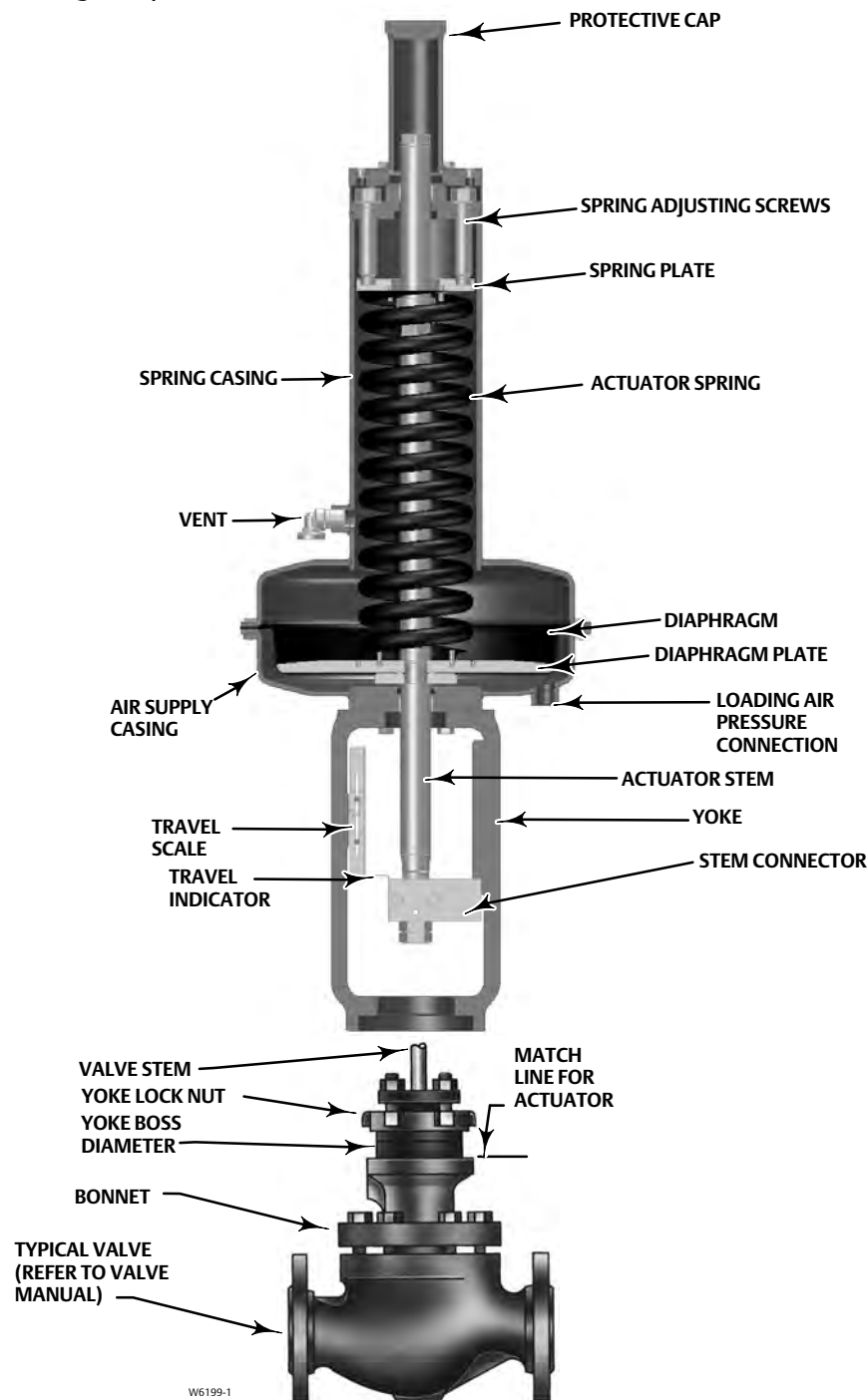
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Instruction Manual

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- a. For size 3-9/16 yoke boss, slowly lower the actuator down onto the valve. As the yoke passes over the end of the valve stem, place the yoke locknut over the valve stem. Continue to lower the actuator while guiding the valve stem into the opening in the end of the actuator stem. Once the actuator is in place, screw the yoke locknut onto the valve bonnet and tighten the locknut.
- b. For 5 and 5H yoke boss, slowly lower the actuator down onto the valve while guiding the valve stem into the opening in the end of the actuator stem. Once the actuator is in place, insert the cap screws and tighten the hex nuts, securing the actuator to the bonnet.

Figure 4. Actuator Mounting Components for 3025 Actuator



Installing the Stem Connector Assembly

When installing the stem connector assembly (key 26), the actuator and valve stem threads should engage the threads of the stem connector by the distance equal to the diameter of the stem.

⚠ WARNING

Install the stem connector securely before a positioner is mounted to the actuator and pressurized, using only a regulator-controlled air supply, not the positioner, to move the actuator stem.

To avoid personal injury or property damage, keep hands and tools out of the actuator stem travel path while applying loading pressure to move the actuator stem in the following steps.

NOTICE

To avoid damaging the seating surfaces, do not rotate the valve plug while it is seated. Exercise care while installing the stem connector assembly to avoid damage to the valve plug stem and valve stem threads.

Note

Replacement stem connectors are an assembly of two stem connector halves, cap screws, and a spacer between the connector halves. Remove the spacer and discard, if present, before clamping the actuator and valve stems together. Use only a mated pair of stem connectors.

1. If the actuator is equipped with a side-mounted handwheel, be sure that it is in the neutral position. If the actuator is equipped with casing-mounted travel stops, be sure that they do not limit the actuator travel.
2. If necessary, push the valve stem down so that it is touching the seat ring on direct-acting valves. For reverse acting valves, push the stem down to the open position.
3. If necessary, screw the valve stem locknuts down, away from the connector location.
4. Perform one of the following procedures (a or b as appropriate):
 - a. **For direct acting actuator**, increase slowly the diaphragm pressure until the actuator stem (key 6) moves down the specified travel.
 - b. **For reverse acting actuator**, set the diaphragm loading pressure to approximately 0.5 bar (7 psi) over the upper bench set pressure. Then release slowly the diaphragm pressure until the actuator stem (key 6) moves down the specified travel.
5. Place the stem connector half with the upper threaded hole fully engaged onto the actuator stem and align the actuator stem and valve stem with threads from both stems mated root-to-crest with the stem connector. A slight change to loading pressure may be necessary to align the threads. If the actuator is a size 2 equipped with a side-mounted handwheel, ensure that the anti-rotation plate (key 151) is pointed towards the neutral indicator (key 108) and that the holes in the anti-rotation plate are aligned with the tapped holes on the top of the stem connector half.
6. Install the other half of the stem connector and insert the cap screws and tighten them while ensuring even spacing between the stem connector halves on all sides. If installing a positioner, also attach the feedback bracket at the same time.
7. Screw the valve stem locknuts up against the stem connector. If the actuator is a size 2 equipped with a side-mounted handwheel, install the 4 cap screws (key 131) of the anti-rotation plate and tighten them. Verify that the pointer of the anti-rotation plate (key 151) is aligned with the neutral indicator (key 108).
8. Slowly stroke the actuator and verify full rated travel is achieved.

9. Be sure that the valve is in the closed position. Loosen the screws on the travel indicator scale (key 29) and align it with the travel indicator (key 30).
10. If the actuator is a size 2 equipped with a side-mounted handwheel, rotate the handwheel full travel to ensure that the travel of the side-mounted handwheel matches the rated valve travel on the nameplate. If travel is not correct, refer to the assembly procedures in the Side-Mounted-Handwheel Assembly for Size 2 Actuator Maintenance section to adjust the handwheel travel.
11. Stroke the actuator full travel to ensure that the travel matches the rated valve travel on the nameplate. If valve travel is not correct, repeat the stem connector procedure.

Loading Connection

The loading pressure connections are made at the factory if the valve, actuator, and positioner come as a unit. Keep the length of tubing or piping as short as possible to avoid transmission lag in the control signal. If a volume booster, valve positioner or other accessory is used, be sure that it is properly connected to the actuator. Refer to the positioner instruction manual or other manuals as necessary.

For actuators shipped separately or whenever the actuator pressure connections are installed, use the following steps:

1. Connect the loading pressure piping to the NPT internal connection in the diaphragm casing.
2. Cycle the actuator several times to be sure that the valve stem travel is correct when the correct pressure ranges are applied to the diaphragm.

WARNING

If valve stem travel appears to be incorrect, refer to the Stem Connector Assembly procedures at the beginning of this section. To avoid personal injury or product damage, do not place the valve into service if it is not reacting correctly to diaphragm loading pressure changes.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

The maintenance instructions are divided into several sections: Actuator Maintenance, Side-Mounted Handwheel Assembly for Size 1 Actuator, Side-Mounted Handwheel Assembly for Size 2 Actuator, and Casing-Mounted Travel Stops.

Actuator Maintenance

This procedure describes how the actuator can be completely disassembled and assembled. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job; then, start the assembly at the appropriate step.

Key numbers refer to figures 5 through 10. Figures 5 and 6 show the Size 1 actuator for travel up to and including 139.7mm (5.5 inch), figures 7 and 8 show the Size 1 actuator for travel above 139.7mm (5.5 in) and up to 203.2mm (8 inch), figures 9 and 10 show the Size 2 actuator.

It may be necessary to apply a temporary loading pressure to the actuator during the disassembly.

Actuator Disassembly

Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

1. If equipped, remove the tubing or piping from the connection in the diaphragm casing(s).
2. If equipped with adjustable travel stops, refer to the disassembly procedures in the Casing-Mounted Travel Stops Maintenance section to remove travel stop parts
3. **For reverse acting actuator only:** slightly pressurize the actuator diaphragm until movement of the actuator stem is detected and the spring force applied to the stem connector is relieved.

⚠ WARNING

To avoid personal injury due to the sudden uncontrolled movement of parts, do not loosen the stem connector cap screws when the stem connector has spring force applied to it.

4. Separate the stem connector by loosening the stem locknuts (keys 27 and 28) and unscrewing the two stem connector cap screws. **For reverse acting actuator only:** slowly exhaust the diaphragm pressure.
5. If necessary, separate the actuator from the valve body by removing the yoke locknut or the bolts.
6. **For direct acting actuator only:** it will be necessary to separate the actuator from the yoke (key 1) or from the side-mounted handwheel if equipped. If equipped with side-mounted handwheel, refer to the disassembly procedures in the Side-Mounted-Handwheel Maintenance section to separate the actuator from the side-mounted handwheel. For actuator without side-mounted-handwheel, remove the cap screws (key 24) of the yoke and lift off the actuator.
7. Remove the cap screws (key 24) of the protective cap (key 5) and lift off the protective cap.

⚠ WARNING

To avoid personal injury from the pre-compressed spring force thrusting the diaphragm casing away from the actuator, relieve the spring compression (step 8 below).

8. Relieve the spring compression by unscrewing alternately and slowly the 4 spring adjusting screws (key 16).

NOTICE

Be careful when pulling the threads of the actuator stem through the casings to avoid damaging the bushing (key 20) and O-ring (key 19).

9. Remove the cap screws and nuts (keys 22 and 23) of the spring casing (key 3) and lift off the spring casing.
10. Remove the spring plate (key 15) and actuator spring(s) (keys 13 and 14).
11. For size 2 actuator only: remove the cap screws and nuts (keys 22 and 23) of the air supply casing (key 2) and pull off the air supply casing. Unscrew the actuator stem pieces to separate the 2 diaphragm plates (key 8).
12. Lift off the stems and diaphragm plate assembly.
13. Unscrew the actuator stem pieces. Inspect diaphragm (key 17) and O-ring (key 18) and replace if necessary.
14. Inspect bushings (key 20), O-ring (key 19) and replace if necessary.

Table 2. Actuator Assembly Recommended Torque Values

DESCRIPTION, KEY NUMBER	ACTUATOR SIZE	THREAD SIZE, INCH	TORQUE	
			N • m	Lbf • ft
Actuator stems, keys 6, 9, 10, 12	1 and 2	1-1/2-12	300	221
Yoke and protective cap, key 24	1	M16x2	195	144
	2	M20x2.5	380	280
Diaphragm casing, keys 22 and 23 ⁽¹⁾	1 and 2	M10x1.5	32	24
Spring adjusting screws, key 16	1 and 2	M30x3.5	185	136
Valve stem connector cap screws, key 26 ⁽²⁾	1 and 2	1/2-13	92	68
Handwheel to casing, key 125	1	M16x2	195	144
	2	M20x2.5	380	280
Handwheel housing, keys 126 and 127	1	M16x2	150	111
Handwheel stem connector, key 124	2	1/2-13	92	68

1. Observe tightening patterns and procedure described in the appropriate Actuator Assembly section.
2. Torque values when lithium grease is used on the threads.

Actuator Assembly

Refer to table 2 as appropriate.

1. If removed, coat the bushings (key 20) with lithium grease (key 50) and slide them into the casings.
2. Coat the O-ring(s) (key 19) with lithium grease (key 50) and place into the air supply casing (key 2) and for size 2 actuator into the middle casing (key 4).
3. Ensure that the pins (key 21) are installed in the diaphragm plate (key 8) and spring plate (key 15).
4. Install the travel stop (key 11) on the actuator upper stem end (key 12) for reverse acting actuator or on the actuator lower stem end (key 6) for direct acting actuator, apply thread lock (key 52) to the threads and tighten this assembly into the stop stem (key 10) to 300 N • m (221 lbf • ft).
5. Perform one of the following procedures (a or b as appropriate):
 - a. For size 1 actuator: assemble the actuator lower stem end (key 6) for reverse acting actuator or the actuator upper stem end (key 12) for direct acting actuator, the thrust plate (key 7), the o-ring (key 18), the diaphragm (key 17), the diaphragm plate (key 8). Apply thread lock (key 52) to the actuator stem threads and install the stop stem assembly (keys 10, 11 and 6 or 12) and tighten to 300 N • m (221 lbf • ft). If equipped with a side-mounted handwheel, the pin hole in the lower actuator stem (key 6) shall be aligned with the middle of 2 bolt holes of the

diaphragm and it might be necessary for a good alignment to fully tighten the stem and diaphragm plate stem assembly only when the actuator is installed on the side-mounted handwheel with the pin (key 146) inserted through the sleeve and actuator stem. Then place the stem and diaphragm plate assembly in the air supply casing (key 2). Align the holes of the diaphragm with the holes of the casing and if equipped with side-mounted handwheel align the hole in the lower actuator stem (key 6) with the hole in the sleeve (key 101).

- b. For size 2 actuator: first assemble the parts located in the air supply casing (key 2): assemble the actuator lower stem (key 6) for reverse acting actuator or the actuator upper stem end (key 12) for direct acting actuator, the thrust plate (key 7), the O-ring (key 18), the diaphragm (key 17), the diaphragm plate without pin (key 8). Apply thread lock (key 52) to the actuator stem threads and tighten the middle stem (key 9) to 300 N•m (221 lbf•ft). Install this assembly in the air supply casing (key 2). Place the middle casing (key 4) with the bushing (key 20) towards the air supply casing (key 2) and with the vent (key 25) connection diametrically opposed to the air connection of the air supply casing (key 2). Install the cap screws and nuts (keys 22 and 23) and tighten slightly. Lift up the stem and diaphragm plate assembly and install the second thrust plate (key 7), O-ring (key 18), diaphragm (key 17) and diaphragm plate (key 8). Align the holes of the diaphragm with the holes of the casing. Apply thread lock (key 52) to the thread of the middle stem (key 9) and install the stop stem assembly (keys 10, 11 and 6 or 12) and tighten to 300 N•m (221 lbf•ft).

NOTICE

Be careful when pulling the threads of the actuator stem through the casings to avoid damaging the bushing (key 20) and O-ring (key 19).

6. Install the actuator spring(s) (keys 13 and 14).
7. Apply anti-seize lubricant (key 51) into the 4 bores of the spring plate (key 15) and install the spring plate with the bores aligned with the air connection of the air supply casing (key 2).
8. Place the spring casing (key 3) with the vent connection diametrically opposed to the air connection of the air supply casing (key 2). Ensure that the 4 tapped holes of the spring casing flange are aligned with the 4 bores on the spring plate (key 15).
9. Install the cap screws and nuts (keys 22 and 23). Tighten the diaphragm casing cap screws and nuts in the following manner. For the size 2 actuator tighten the cap screws and nuts of the 2 diaphragm casing joints.
10. The first 4 bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these 4 bolts to 16 N•m (12 lbf•ft).
11. Tighten the remaining bolts in a clockwise, criss-cross pattern to 16 N•m (12 lbf•ft).
12. Repeat this procedure by tightening 4 bolts, diametrically opposed and 90 degrees apart, to a torque of 32 N•m (24 lbf•ft).
13. Tighten the remaining bolts in a clockwise, criss-cross pattern to 32 N•m (24 lbf•ft).
14. After the last bolt is tightened to 32 N•m (24 lbf•ft), all of the bolts should be tightened again to 32 N•m (24 lbf•ft) in a circular pattern around the bolt circle.
15. Once completed, no more tightening is recommended.
16. Coat the threads of the spring adjusting screws (key 16) with anti-seize lubricant (key 51). Be sure that the 4 bores into the spring plate are aligned with the threaded holes of the spring casing. Then install and screw alternately and slowly the 4 cap screws to compress the spring(s). Tighten to the appropriate torque shown in table 2.
17. Place the protective cap (key 5) onto the casing, insert the cap screws (key 24) and tighten to the appropriate torque as shown in table 2.
18. If equipped with a side-mounted handwheel, refer to the assembly procedures in the Side-Mounted Handwheel Maintenance section.
19. Lift the actuator and place it on the yoke (key 1), insert the cap screws (key 24) and tighten to the appropriate torque as shown in table 2.

20. Install the vent(s) (key 25) on the casing(s).
21. If equipped with adjustable travel stops, refer to the assembly procedures in the Casing-Mounted Travel Stops Maintenance section.
22. Mount the actuator onto the valve in accordance with the procedures in the Installation section.

Side-Mounted Handwheel for Size 1 Actuator

A side-mounted handwheel (figure 11) is normally used as a manual actuator. The handwheel can be mounted in either of two position orientations so that, regardless of valve plug action, counter-clockwise rotation always opens the valve.

Instructions are given below for complete disassembly and assembly of the side-mounted handwheel assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Key numbers are shown in figure 11.

Disassembly for Size 1 Side-Mounted Handwheel

1. Complete steps 1 through 5 of the disassembly portion of the Actuator Maintenance section.
2. Unscrew the pointer (key 149) from the sleeve (key 101). Remove the cap screws (key 24) of the yoke and lift off the actuator and handwheel assembly.
3. Unscrew the 6 cap screws (key 127). Remove the gear case and handwheel assembly.
4. If necessary, remove the handwheel housing (key 102) by unscrewing the 4 cap screws (key 125).
5. Turn the handwheel so that the sleeve (key 101) extends out of the bottom of the worm gear (key 112). Do not lose the key (key 111).
6. Loosen the set screws (key 128) of the retaining flange (key 1120). Unscrew the 2 cap screws (key 126) and remove the retaining flange. Lift out the retainer (key 115), the thrust bearings (key 113) and the worm gear (key 112).
7. The worm shaft (key 116) and associated parts can be removed in order to replace or lubricate them. First, loosen the set screw (key 148), unscrew the handwheel cap (key 122) and remove the handwheel (key 121). Do not lose the small ball or spring (keys 142 and 143).
8. Loosen the two set screws (key 129) and unscrew the two worm retainers (keys 119 and 120). The ball bearings (key 117) will come out with the retainers. Remove the worm shaft (key 116).

Assembly for Size 1 Side-Mounted Handwheel

1. Pack the ball bearings (key 117) with lithium grease (key 50) and insert one ball bearing in the back worm retainer (key 120).
2. Thread the back worm retainer and ball bearing (keys 50 and 120) into the gear case (109). Align the set screw slot in the worm retainer with the set screw hole in the gear case, insert the set screw (key 129) and tighten.
3. Coat the worm shaft (key 116) threads with lithium grease lubricant (key 50) and slide the shaft into the gear case (key 109) so that the end of the shaft fits snugly in the back worm retainer.
4. Insert the bearing in the front worm retainer (key 119) and thread the retainer and ball bearing into the gear case. Align the set screw slot in the retainer with the set screw hole in the gear case, insert the set screw (key 129) and tighten.
5. Put the spring and ball (keys 142 and 143) in the handwheel (key 121). Slide the handwheel onto the worm shaft (key 116). Thread the handwheel cap (key 122) onto the worm shaft, insert the set screw (key 148) in the cap and tighten.
6. Pack the 2 thrust bearings (key 113) with lithium grease (key 50). Install one thrust bearing; then install the worm gear (key 112), followed by the second thrust bearing and the bearing retainer (key 115).

7. Coat the key (key 111) with lithium grease (key 50) and install it on the retaining flange (key 110).
8. Insert the set screws (key 128) in the retaining flange (key 110). Install the 2 cap screws (key 126) and tighten to the appropriate torque as shown in table 2. Adjust the set screws (key 128) to eliminate free play in the bearings. Note over-tightening the set screws will make handwheel operation difficult.
9. Coat the sleeve (key 101) threads and slot with lithium grease (key 50), slide the sleeve into the retaining flange with the slot aligned with the key (key 11), turn the handwheel and feed the sleeve through the worm gear. Continue turning the handwheel until the threads of the sleeve are fully engaged in the gear case.
10. If removed, install the handwheel housing (key 102) on the actuator, insert the cap screws (key 125) and tighten to the appropriate torque as shown in table 2.
11. Install the gear case and handwheel assembly on the handwheel housing (key 102), insert the cap screws (key 127) and tighten to the appropriate torque as shown in table 2.
12. Place the handwheel and actuator assembly on the yoke, insert the cap screws (key 125) and tighten to the appropriate torque as shown in table 2.
13. Install the pointer (key 149) onto the sleeve (key 101). Turn the handwheel until the pointer is around 20mm below the yoke upper flange. In this location the sleeve will not interfere with the stem connector during the stroking of the actuator. Align the neutral position indicator (key 108) with the pointer.
14. Mount the actuator and handwheel assembly in accordance with the procedures in the Installation section.
15. Mount the actuator on the valve following the procedures in the Installation section.

Side-Mounted Handwheel for Size 2 Actuator

A side-mounted handwheel (figure 12) is normally used as a manual actuator. The power screws (keys 103 and 105) and stem nut (key 104) can be mounted in either of two position orientations so that, regardless of valve plug action, counter-clockwise rotation always opens the valve.

NOTICE

Automatic operation is possible only when the side-mounted handwheel is in the neutral position.

To avoid damage to actuator parts, release all pressure from the casings before using the side-mounted handwheel.

Travel stop, if any installed on the actuator, will not limit the travel when the side-mounted handwheel is operated.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then begin the assembly at the appropriate step.

It may be necessary to apply a temporary loading pressure to the actuator during the disassembly. Key numbers are shown in figure 12.

Disassembly for Side 2 Side-Mounted Handwheel

1. Complete steps 1 through 5 of the disassembly portion of the Actuator Maintenance section.
2. Unscrew the protective cover cap screws (key 134), remove the washers (key 133) and the protective covers (key 107).
3. Unscrew the locknuts (key 132) of the neutral indicator (key 108). Unscrew the cap screws (key 131) of the anti-rotation plate (key 150). Separate the stem connector (key 124) by unscrewing the two stem connector cap screws.
4. If necessary, separate the actuator from the handwheel assembly by removing the cap screws (key 125) and lift off the actuator.

5. Turn clockwise the handwheel to unscrew the upper power screw (key 103 or 105).
6. Remove the lower power screw (key 103 or 105) and stem nut (key 104).
7. If necessary, separate the actuator yoke (key 1) from the handwheel assembly by removing the cap screws (key 24).
8. Remove the handwheel and drive shaft assembly (keys 121 and 109) by unscrewing the cap screws (key 137).
9. If required, the drive shaft assembly can be broken down by removing the nut (key 140), the washer (key 139), the rotation indicator (key 155), the handwheel (key 121), and the worm shaft (key 116) and the bearings and bushings (keys 117 and 118). If required, remove the cap screws and nuts (keys 135 and 136) of the anti-rotator clamped on the drive shaft housing, the anti-rotator (key 153), the spacer (154) and the two clamps (key 152).
10. Remove the worm gear (key 112), the key (key 111), the bearing (key 113) and if required remove the bushing (key 114) from the handwheel yoke (key 106).

Assembly for Size 2 Side-Mounted Handwheel

1. If the drive shaft assembly was separated, coat the bushings (key 118) with lithium grease (key 50) and slide them into the gear case (key 109). Coat the bearings (key 117) and the worm shaft (key 116) with lithium grease (key 50). Place the bearing, insert the worm shaft into the gear case (key 109) and place the second bearing. Install the handwheel (key 121), the rotation indicator (key 155), the washer (key 139) and tighten the nut (key 140). Place the two clamps (key 152), the spacer and the anti-rotator (keys 153 and 154), insert the cap screws and nuts (keys 135 and 136) and tighten.
2. If bushing (key 114) was removed, coat it with lithium grease (key 50) and slide it into the handwheel yoke (key 106).
3. Coat the bearing (key 113), the key (key 111) and the worm gear (key 112) with lithium grease (key 50). Install the key in the worm gear. Place the bearing and slide the worm gear in the handwheel yoke (key 106).
4. If used, apply thread lock (key 52) to the threads of the screw(s) (key 156) and tighten into the power screw(s) (key 103 and/or 105). Coat the threads of the power screws (keys 103 and 105) with lithium grease (key 50). Slide the anti-rotation plate (key 151) onto the lower power screw. Screw the lower power screw into the stem nut (key 104) until the threads of the power screw are fully engaged. Slide the assembly into the worm gear (key 112) with the slot aligned with the key (key 111). Slide the anti-rotation plate (key 150) onto the upper power screw and screw the upper power screw into the stem nut (key 104) until the threads of the power screw are fully engaged.
5. If the actuator yoke (key 1) was removed, slide the neutral indicator (key 108) in the actuator yoke, install the handwheel yoke (key 106) on the actuator yoke, insert the cap screws (key 24) and tighten to the appropriate torque as shown in table 2.
6. If the actuator was separated from the handwheel yoke (key 106), lift the actuator and place it on the handwheel yoke, insert the cap screws (key 125) and tighten to the appropriate torque as shown in table 2.
7. Place the stem connector (key 124) half with the threaded hole fully engaged onto the actuator stem (key 6) and onto the upper power screw (key 103 or 105). Ensure that the anti-rotation plate (key 150) is pointed towards the neutral indicator (key 108) and ensure that the holes in the anti-rotation plate are aligned with the tapped holes on the bottom of the stem connector half.
8. Install the other half of the stem connector and insert the cap screws and tighten them while ensuring even spacing between the stem connector halves on all sides. Install the 4 cap screws (key 131) of the anti-rotation plate and tighten them. Install a nut (key 132) on the neutral indicator (key 106), slide the indicator in the hole of the anti-rotation plate and place the 2 other nuts (key 132).
9. Place the handwheel and drive shaft assembly. Insert the cap screws (keys 137 and 138) and adjust the cap screws (key 138) to eliminate free play between the worm shaft and worm gear. Tighten the cap screws (key 137).

Note

To prevent rotation of the lower power screw during the travel adjustment, before turning the handwheel, assemble the valve stem connector around the lower power screw end the anti-rotating lug on the yoke.

10. Ensure that the 2 power screws have the same threads engagement in the stem nut (key 104), then preventing the rotation of the lower power screw (key 103 or 105) turn the handwheel (key 121) until the 2 power screws are in contact.
11. Perform one of the following procedures (a or b as appropriate):
 - a. For **direct acting actuator**, slightly rotate the handwheel in the opposite direction to have a small gap between the 2 power screws.
 - b. For **reverse acting actuator**, rotate the handwheel in the opposite direction until the lower power screw move down the specified travel and mark the position of the lower power screw. Set the diaphragm loading pressure to approximately 0.5 bar over the upper bench set pressure, release slowly the diaphragm pressure until the actuator stem moves down the specified travel, then rotate the handwheel until the position mark is reached.
12. Align the pointer of the neutral indicator (key 108) with the anti-rotation plate (key 151). Place the protective covers (key 107), the washers (key 133) and tighten the cap screws (key 134).
13. Mount the actuator and handwheel assembly in accordance with the procedures in the Installation section.

Casing-Mounted Adjustable Travel Stops

Casing-mounted adjustable travel stops (shown in figures 13 through 15) are available to limit travel in the down direction (extending the actuator stem) or in the up direction (retracting the actuator stem). The travel stop in figure 13 is a down travel stop, the travel stop in figure 14 is an up and down travel stop, and the travel stop in figure 15 is an up travel stop.

Use the nut (key 206, figures 13 and 14), screw (key 203, figure 14) or cap screw (key 202, figure 15) to set the point at which the travel stop limits travel. Be sure to tighten the locknuts and replace the cap (key 201) after setting the travel stop.

Instructions are given below for disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the reassembly at the appropriate step.

It may be necessary to apply a temporary loading pressure to the actuator during the disassembly.

Key numbers are shown in figures 13 through 15.

1. Bypass the control valve, reduce loading pressure to atmospheric, and remove the tubing or piping from the connection in the diaphragm casing(s).
2. Remove the cap (key 201). For reverse acting actuator, ensure that the travel stop in the down direction is not causing any spring compression. For direct acting actuator, ensure that the travel stop in the up direction is not causing any spring compression. If travel stop is causing spring compression, slightly pressurize the actuator diaphragm until movement of the actuator stem is detected and the spring force applied to the travel stop is relieved.
3. For down travel stop (figure 13) and up and down travel stop (figure 14), unscrew the hex nuts (key 205 and 206). For up and down travel stop (figure 14), loosen the locknut (key 204) and unscrew the screw (key 203). For up travel stop (figure 15), loosen the locknut (key 204) and unscrew the cap screw (key 202).
4. Remove the cap screws (key 24) of the protective cap (key 5) and lift off the protective cap.
5. Reassemble parts in the reverse order of removal.
6. Re-adjust the travel stop(s).

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always mention this number when corresponding with your [Emerson sales office](#) regarding technical information or replacement parts.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your [Emerson sales office](#) for part numbers.

Actuator Assembly (figures 5, 6, 7, 8, 9, and 10)

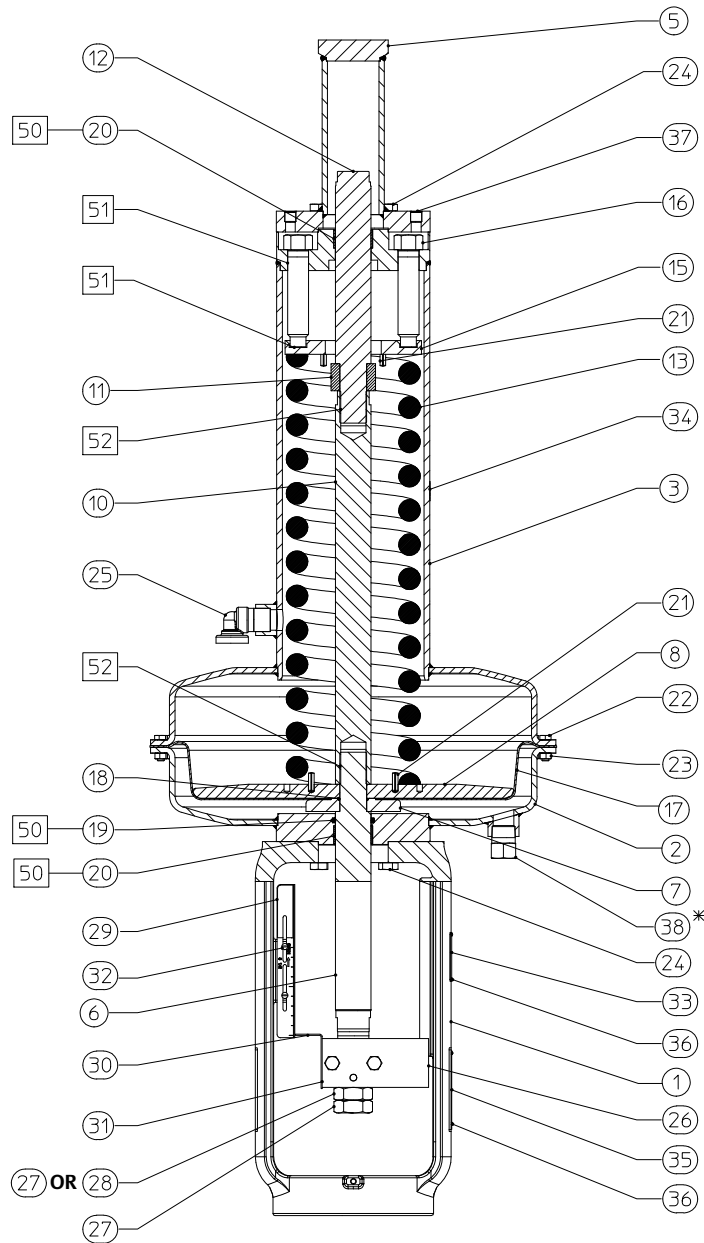
Key Description

1	Yoke
2	Casing Air Supply
3	Casing Spring
4	Middle Casing
5	Protective Cap
6	Lower Stem
7	Thrust Plate
8	Diaphragm Plate
9	Middle Stem
10	Stop Stem
11	Travel Stop
12	Upper Stem
13	Spring
14	Spring
15	Spring Plate
16	Hex Hd Screw Cap
17*	Diaphragm
18*	O-ring
19*	O-ring
20*	Bushing
21	Pin
22	Hex Hd Screw Cap
23	Hex Nut

Key Description

24	Hex Hd Screw Cap
25	Vent
26	Stem Connector
27	Jam Hex Nut
28	Hex Nut
29	Travel Scale Indicator
30	Travel Indicator
31	Flat Hd Machine Screw
32	Round Hd Machine Screw
33	Warning Tag
34	Warning Label
35	Nameplate
36	Drive Screw
37	Hex Socket Screw Set
38	Reducing Bushing
50	Lubricant
51	Anti-Seize Lubricant
52	Thread Lock

Figure 5. Fisher 3025 Actuator Size 1
(Travels Up to 139.7 mm (5.5 in) Reverse Acting)



GF10442

Figure 6. Fisher 3025 Actuator Size 1
(Travels Up to 139.7 mm (5.5 in) Direct Acting)

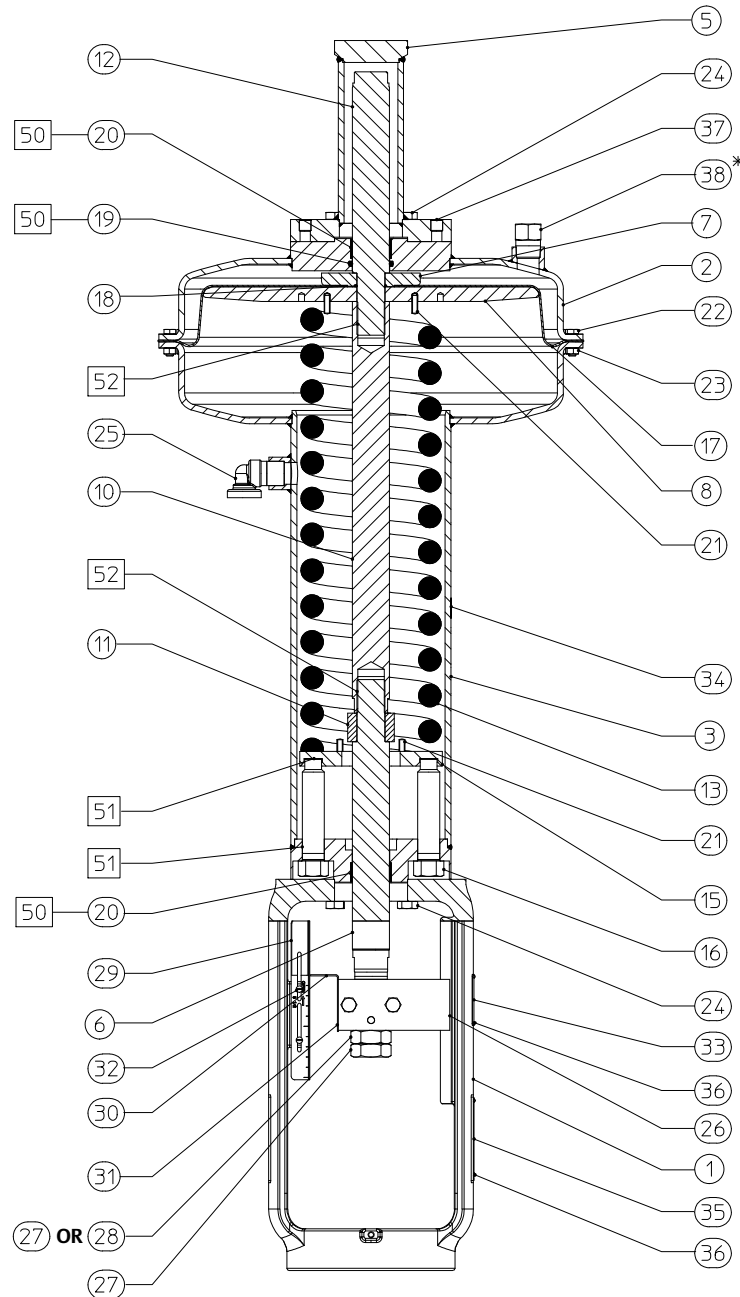
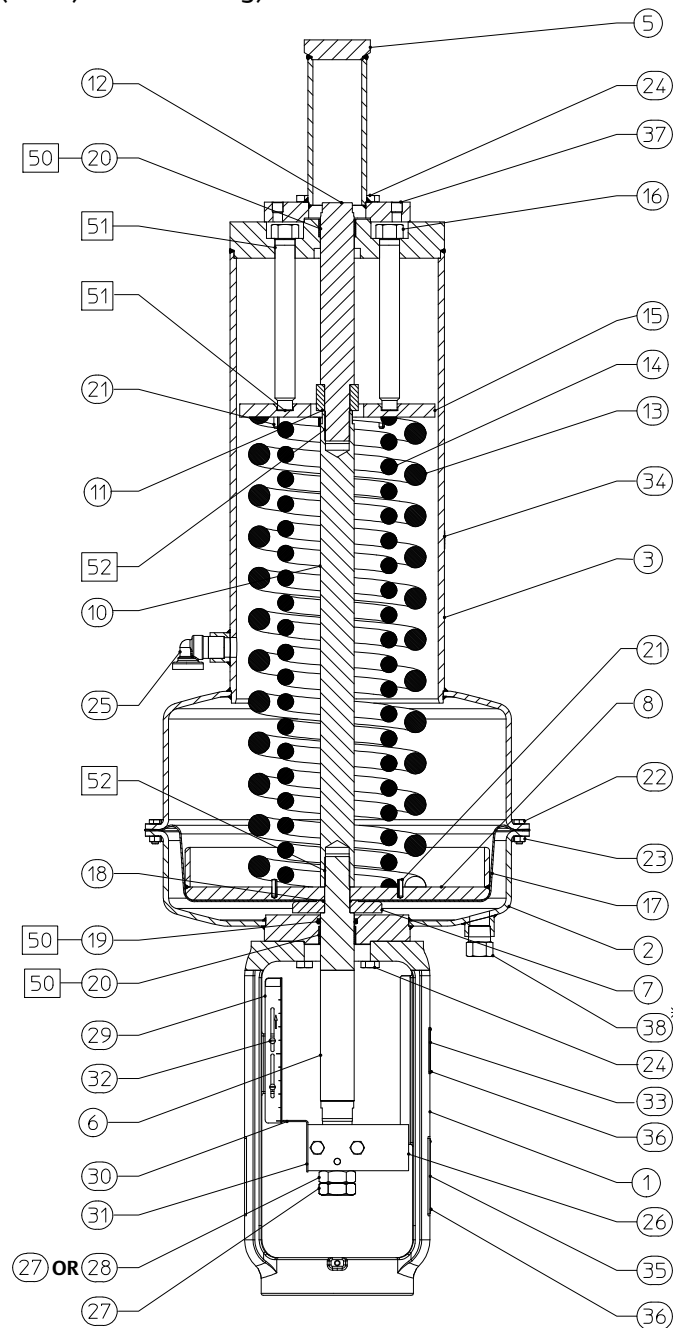


Figure 7. Fisher 3025 Actuator Size 1
(Travels Above 139.7 mm (5.5 in) Reverse Acting)

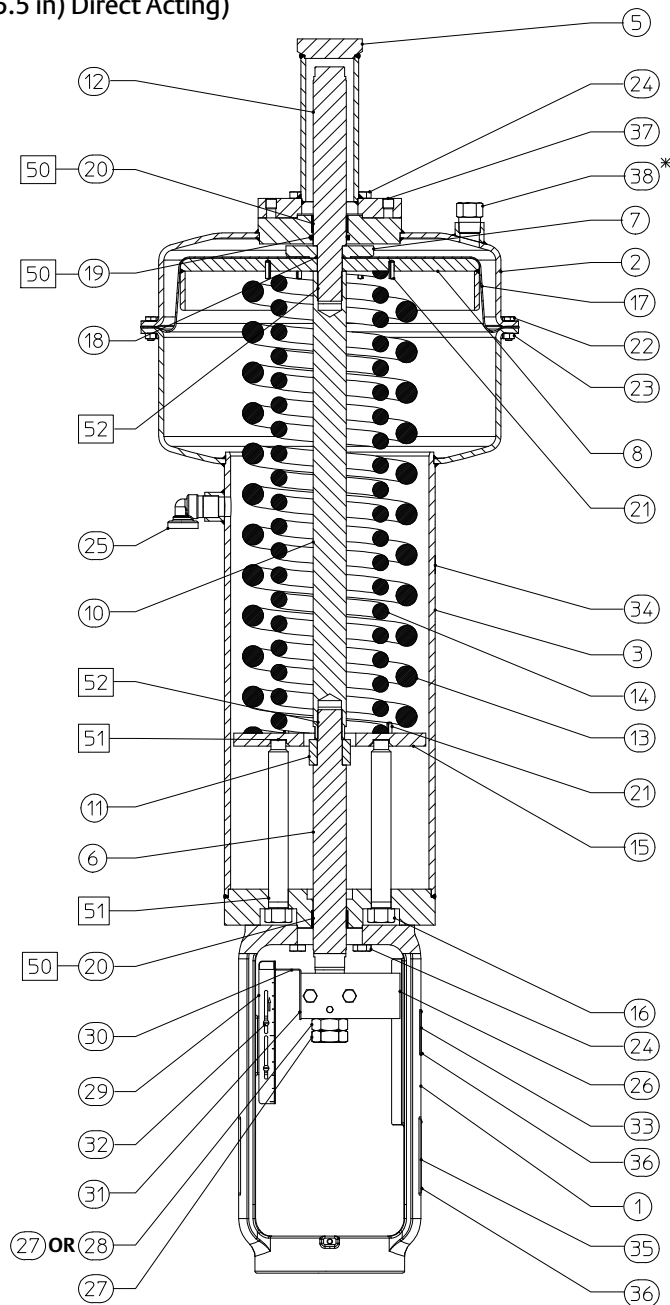


□ APPLY LUB

* IF USED

GF15018

Figure 8. Fisher 3025 Actuator Size 1
(Travels Above 139.7 mm (5.5 in) Direct Acting)

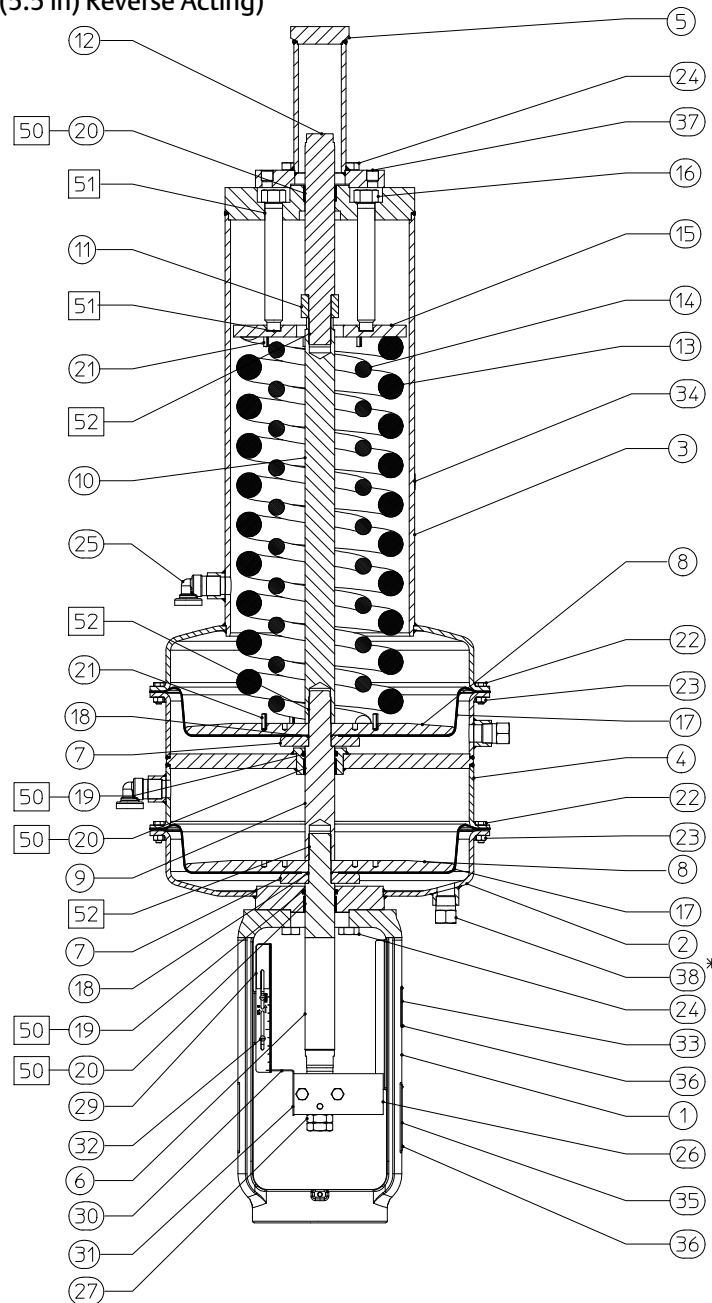


□ APPLY LUB

* IF USED

GF17501

Figure 9. Fisher 3025 Actuator Size 2
(Travels Up to 139.7 mm (5.5 in) Reverse Acting)

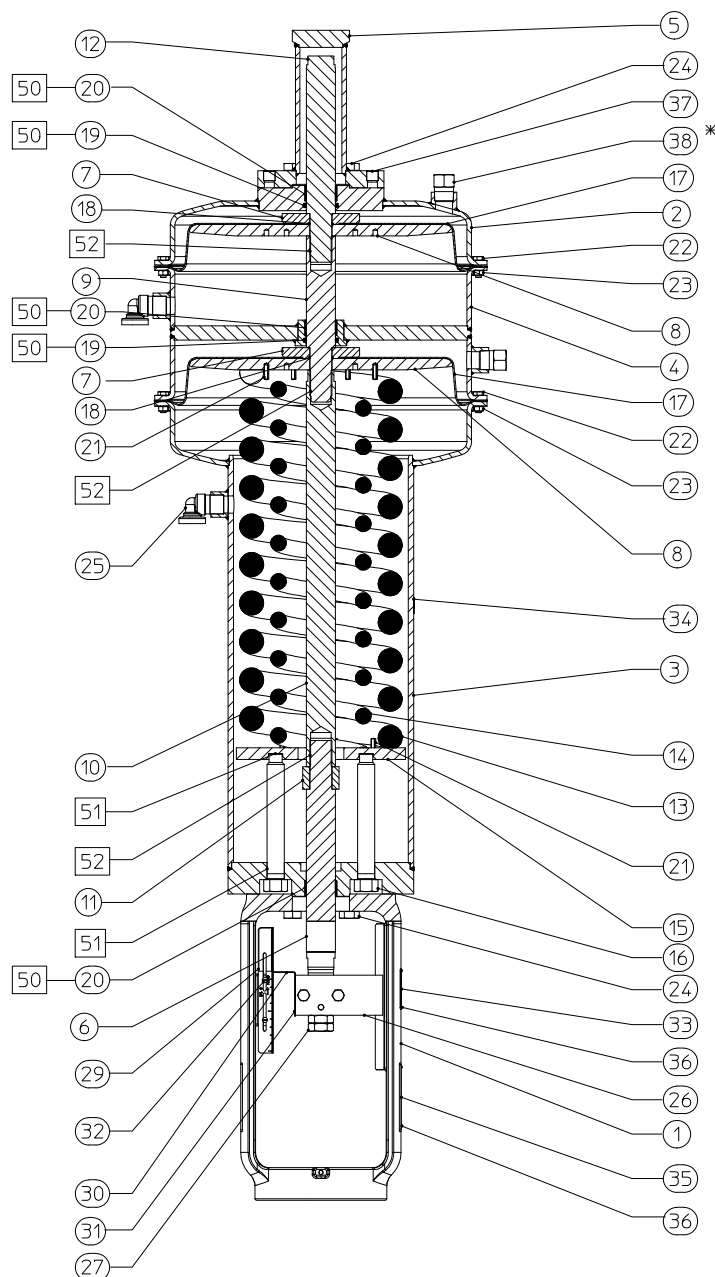


□ APPLY LUB

* IF USED

GF11920

Figure 10. Fisher 3025 Actuator Size 2
(Travels Up to 139.7 mm (5.5 in) Direct Acting)



□ APPLY LUB

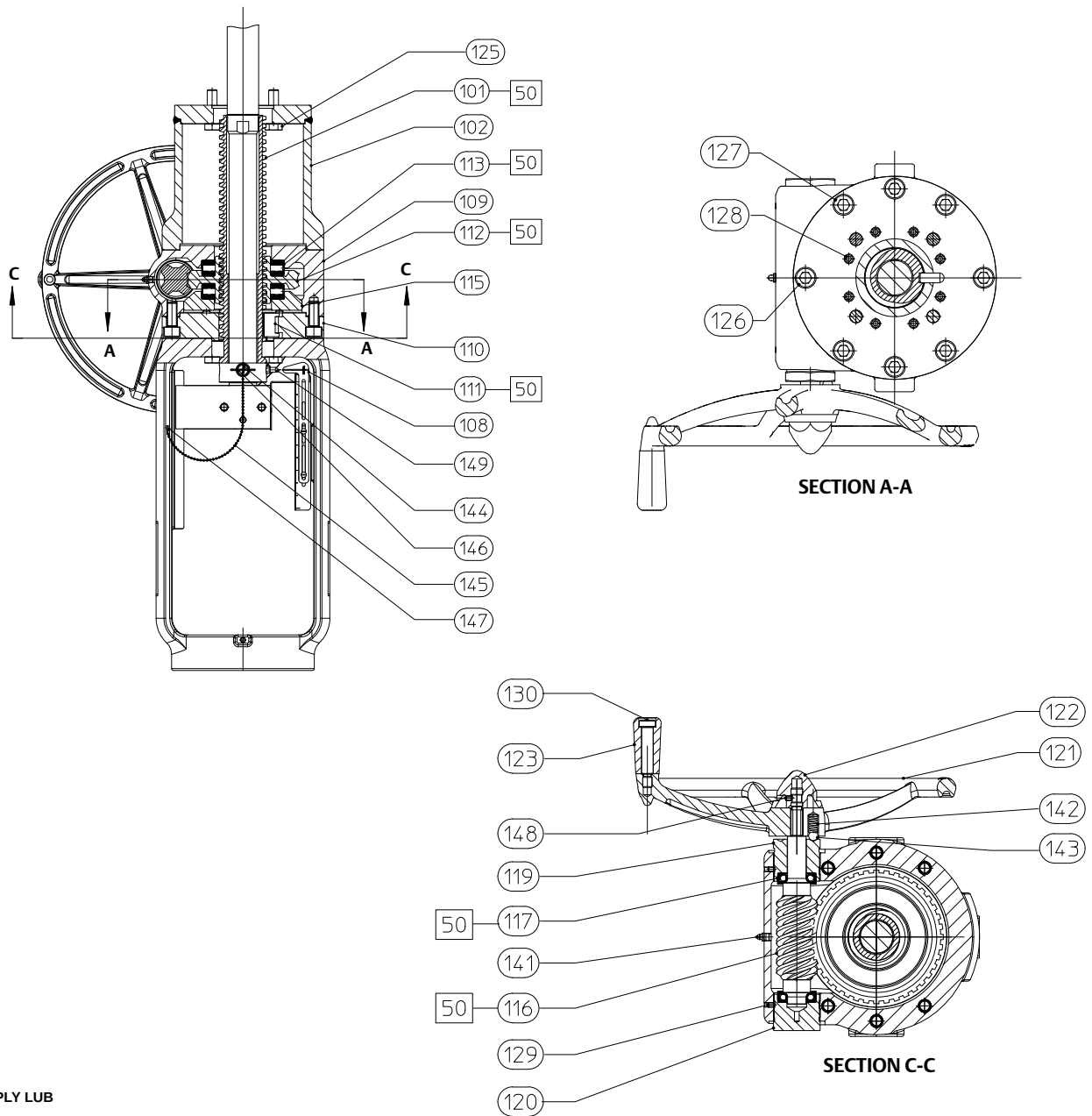
* IF USED

GF17492

Side-Mounted Handwheel (figures 11 and 12)

Key	Description	Key	Description
101	Sleeve	128	Hex Socket Set Screw
102	Handwheel Housing	129	Slotted Set Screw
103	Power Screw, LH	130	Shoulder Screw
104	Stem Nut	131	Hex Hd Screw Cap
105	Power Screw, RH	132	Hex Nut
106	Handwheel Yoke	133	Plain Washer
107	Cover	134	Hex Hd Screw Cap
108	Handjack Indicator	135	Hex Hd Screw Cap
109	Gear Case	136	Hex Nut
110	Flange	137	Hex Hd Screw Cap
111	Key	138	Hex Hd Screw Cap
112	Worm Gear	139	Plain Washer
113	Bearing	140	Hex Nut
114	Bushing	141	Lub Fitting
115	Retainer	142	Spring
116	Worm Shaft	143	Ball
117	Bearing	144	Split Ring
118	Bushing	145	Chain
119	Front Worm Retainer	146	Lock Pin
120	Back Worm Retainer	147	Drive Screw
121	Handwheel	148	Slotted Screw Set
122	Handwheel Cap	149	Pointer
123	Handgrip	150	Anti-rotation Plate
124	Stem Connector	151	Anti-rotation Plate
125	Hex Hd Screw Cap	152	Clamp
126	Hex Socket Screw Cap	153	Anti-rotator
127	Hex Socket Screw Cap	154	Spacer
		155	Rotation Indicator
		156	Screw
		50	Lubricant

Figure 11. Side-Mounted Handwheel for Size 1 Actuator



□ APPLY LUB

GF12250

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

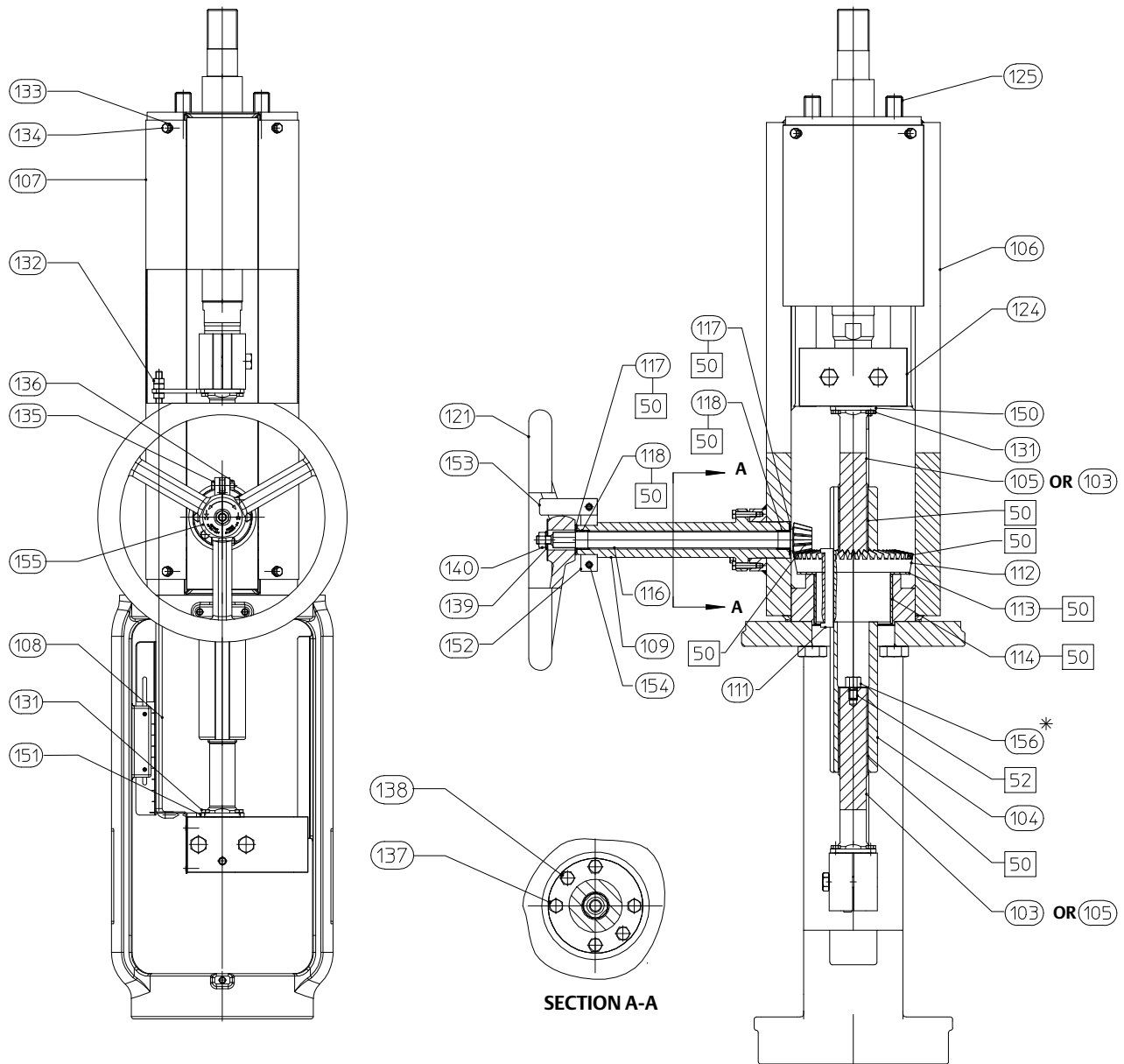
3025 Actuator

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Instruction Manual

D104736X012

Figure 12. Side-Mounted Handwheel for Size 2 Actuator

☐ **APPLY LUB**

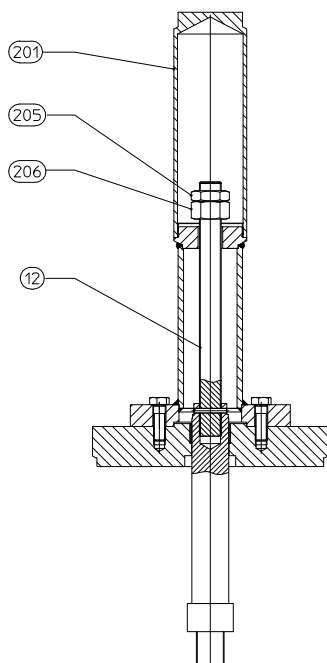
* IF USED

Gf16920

Casing-Mounted Travel Stops (figures 13, 14, and 15)

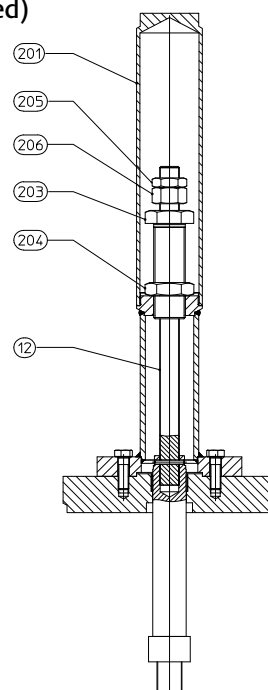
Key	Description
201	Protective Cap
202	Hex Hd Cap Screw
203	Adjusting Screw
204	Jam Hex Nut
205	Hex Nut
206	Jam Hex Nut

Figure 13. Style 10 Down Travel Stop
(Casing-Mounted)



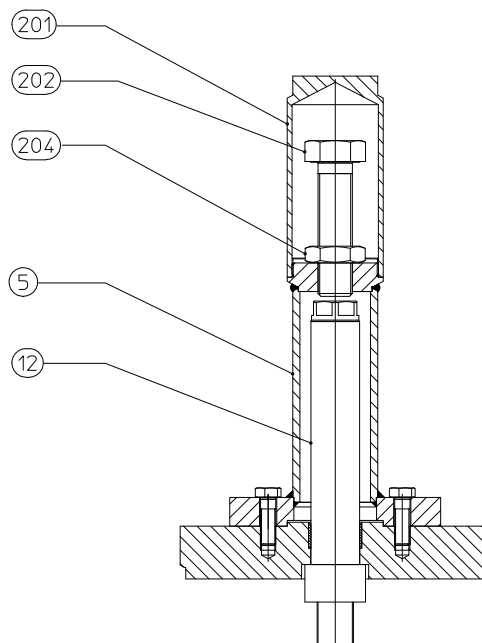
GF16916

Figure 14. Style 11 Up and Down Travel Stop
(Casing-Mounted)



GF16916

Figure 15. Style 12 Up Travel Stop
(Casing-Mounted)



GF16916

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

3025 Actuator

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D104736X012

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Fisher™ 3025 Sizes P460, P462, P460-200, and P900 Diaphragm Actuator

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Figure 1. Fisher 3025 Size P460-200 Actuator



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for Fisher 3025 actuators in sizes P460, P462, P460-200, and P900. Refer to separate manuals for instructions covering the positioner and other accessories used with these actuators.



Do not install, operate, or maintain 3025 actuators without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The Fisher 3025 size P460, P462, P460-200 and P900 spring-opposed diaphragm actuators position the valve plug in the valve body in response to varying controller or valve positioner pneumatic output signals applied to the actuator diaphragm. They can be specified either direct (air-to-close) or reverse acting (air-to-open). The size P460 offers 65 mm maximum actuator travel. The sizes P462 and P900 provide 120 mm maximum actuator travel. The size P460-200 offers 203 mm maximum actuator travel. The 3025 actuator can be equipped with a side-mounted assembly. It is usually used as an auxiliary manual actuator.

Table 1. Specifications

SPECIFICATION		ACTUATOR SIZE			
		P460	P462	P460-200	P900
Nominal Effective Area	cm ²	1800	1800	1800	3600
	inch ²	279	279	279	558
Yoke Boss Diameter	3-9/16 inch	x	x	x	---
	5 inch	x	x	x	x
	5H inch	x	x	x	x
	75 mm	x	x	---	---
	120 mm	x	x	---	x
	130 mm	---	---	---	x
Acceptable Valve Stem Connection	3/4-16UNF	x	x	x	---
	1-14UNS	x	x	x	x
	1-1/4-12UNF	x	x	x	x
	M16	x	x	---	---
	M20	x	x	---	x
	M30	x	x	---	x
Maximum Travel	mm	65	120	203	120
	inch	2-5/8	4-3/4	8	4-3/4
Maximum Diaphragm Casing Pressure	bar	4			
	Psig	58			
Temperature Capabilities	°C	-30 to 80°C			
	°F	-22 to 176°F			
Pressure Connections (female)	1/2 NPT	x	x	x	x
	3/4 NPT	x	x	---	x
	1 NPT	---	---	x	---
Approximate Actuator Weights	kg	140	190	250	430
	lb	310	420	640	1000
Approximate Side Handwheel Weights	kg	40	40	100	65
	lb	90	90	220	140

Specifications

Refer to table 1 for Specifications of the 3025 actuator. See the actuator nameplate for specific information about your actuator.

Educational Services

Emerson Educational Services
Phone: + 1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Installation

Key number locations are shown in figures 3 through 12, unless otherwise indicated. Figures 3 and 4 show the size P460 actuator, figures 5 and 6 the size P462, figures 7 and 8 the size P460-200 and figures 9, 10, 11 and 12 illustrate the size P900.

If the actuator is equipped with a side-mounted handwheel, also refer to the figures 13, 14, 15 and 16. Figure 13 shows the size P460 and the size P462 side-mounted handwheel, figure 14 the size P460-200 and figure 15 illustrates the size P900.

⚠ WARNING

To avoid personal injury or parts damage, do not apply operating pressure that exceeds the Maximum Diaphragm Casing Pressure of 4 bar or produces a force on the actuator stem greater than the Maximum Allowable Valve Stem Load. Use pressure-limiting or pressure-relieving devices to prevent the Operating Pressure from exceeding the Maximum Diaphragm Casing Pressure.

- **Valve/Actuator Assembly:** If the actuator and valve are shipped together as a control valve assembly, it has been adjusted at the factory, and may be installed in the pipeline. After installing the valve in the pipeline, refer to the Loading Connection procedures.
- **Actuator Mounting:** If the actuator is shipped separately or the actuator has been removed from the valve, it is necessary to mount the actuator on the valve before placing the valve in the pipeline. Refer to the actuator mounting procedures before placing the valve in service.
- **Positioner:** If a positioner is installed, or is to be installed on the actuator, refer to the positioner instruction manual for installation. During the adjustment procedures, it will be necessary to provide a temporary loading pressure to the actuator diaphragm.

Note

The 3025 diaphragm actuators are designed to mount on push-down-to close valves. Do not mount these actuators on any other type of valve without first contacting your [Emerson sales office](#).

Mounting the Actuator on the Valve

NOTICE

If the valve stem is allowed to remain in the up position (towards the actuator) during mounting, it can interfere with the actuator mounting, possibly damage valve stem threads or bend the valve stem. Be sure the valve stem is pushed down (into the valve body), away from the actuator while mounting.

NOTICE

If the actuator is equipped with a side-mounted handwheel, during mounting it can interfere with the valve stem (even if the valve stem is pushed completely down into the valve body), possibly damage valve stem threads or bend the valve

stem. Be sure the actuator stem is sufficiently retracted (into the side-mounted handwheel), away from the valve while mounting. If not, the actuator stem can be retracted by turning counterclockwise the handwheel. Be sure the actuator stem does not rotate while turning the handwheel (use the anti-rotator to prevent rotation).

1. Provide a vise or some other method of supporting the valve and the weight of the actuator during assembly. Push the valve stem down away from the actuator while mounting the actuator.
2. Lift or hoist the actuator onto the valve bonnet:
 - a. For the 3-9/16 yoke boss: Slowly lower the actuator down onto the valve. As the yoke passes over the end of the valve stem, place the yoke locknut over the valve stem. Once the actuator is in place, screw the yoke locknut onto the valve bonnet and tighten the locknut.
 - b. For all other yoke bosses: Slowly lower the actuator down onto the valve. Once the actuator is in place, insert the cap screws and tighten the hex nuts, securing the actuator to the bonnet.

Travel Stop Adjustment

The actuator is normally shipped adjusted at the factory and you may refer directly to the Installing the Stem Connector Assembly procedures.

If the actuator has been disassembled, it is necessary to adjust the travel stop. You may perform the following procedure before connecting the actuator stem to the valve stem.

WARNING

When moving the actuator stem with loading pressure applied, exercise caution to keep hands and tools out of the actuator stem travel path. If the loading pressure is accidentally disconnected, personal injury and property damage is possible if something is caught between the actuator stem and other control valve parts.

Also provide a certified pressure gauge suitable to accurately read the diaphragm pressure from 0 through the upper bench set pressure marked on the nameplate. Apply loading pressure to the diaphragm.

Stroke the actuator a few times to ensure that the pressure gauge is working correctly, and that the actuator is functioning properly. It is important to be sure that the actuator assembly is not binding or producing any loading friction on the actuator stem movement.

Note

For push-down-to-close valves, the valve plug is the limit for downward travel and the actuator up-stop is the limit for upward travel (away from the valve).

1. If not already accomplished, provide a temporary means of applying adjustable loading pressure to the actuator during the travel stop adjustments.
2. Remove the cap (key 43, figures 3 through 6) or loosen the locknut (key 42, figures 7 through 12). Unscrew the travel stop (key 41).
3. Perform one of the following procedures as appropriate:
 - a. **For an air-to-open actuator:** apply the upper bench set loading pressure to the diaphragm. Adjust the travel stop (key 41) so that it touches the actuator stem. Then lock the travel stop by replacing the cap (key 43) or by tightening the locknut (key 42).

- b. For an air-to-close actuator: apply the lower bench set loading pressure. The actuator should show movement at the lower bench set pressure. Adjust the travel stop (key 41) so that it touches the actuator stem. Then lock the travel stop by replacing the cap (key 43) or tightening the locknut (key 42).
4. Stroke the actuator and check that the actuator is capable of the travel shown on the travel indicator scale (key 74). If the travel span is correct, travel stop adjustment is complete. Proceed to the Installing the Stem Connector Assembly subsection.
5. If the travel span is not correct, a wrong or damaged spring has been installed in the actuator. To obtain the correct spring sizing information, refer to Fisher Catalog 14, Actuator Sizing and Sample Calculations to determine the correct spring selection for your application. Or contact your Emerson sales office for assistance. After replacing the spring, repeat the steps above.

Installing the Stem Connector Assembly

When installing the stem connector assembly, the actuator and valve stem threads should engage the threads of the stem connector by a distance of the diameter of the stem.

1. If necessary, push the valve stem down so that it is touching the seat ring.
2. For an air-to-open actuator only, set the diaphragm loading pressure to approximately 0.5 bar over the upper bench set pressure. The actuator stem should be contacting the upper travel stop.
3. For the size P900 only, screw the actuator and valve stem locknuts away from the connector halves locations.
4. Screw the two stem connectors halves (keys 78 and 79) onto the valve stem and actuator stem. Then place the travel indicator (key 84), the spacer if used (key 86) and the anti-rotator (key 85) on the valve stem connector half.
5. To adjust the travel, perform one of the following procedures as appropriate:
 - a. If the actuator is equipped with a side-mounted handwheel: turn the handwheel so that the distance between the anti-rotator and the actuator stem connector half is equal to the valve travel. Be sure the actuator stem does not rotate while turning the handwheel (use the anti-rotator to prevent rotation). Be sure that the actuator and valve stem threads are engaging the threads of the stem connectors by the distance of at least one diameter of the stem.
 - b. If the actuator is not equipped with a side-mounted handwheel: rotate the connector halves so that the distance between the anti-rotator and the actuator stem connector half is equal to the valve travel. Be sure that the actuator and valve stem threads are engaging the threads of the stem connectors by the distance of at least one diameter of the stem.

NOTICE

Incomplete engagement of the stem connector onto either the valve stem or actuator stem can result in stripped threads or improper operation. Be sure that the length of the actuator stem or the valve stem in the connector is equal or greater than the diameter of that stem. Damage to threads on either stem or in the stem connector can cause the parts to be replaced prematurely.

6. Perform one of the following procedures as appropriate:
 - a. For an air-to-open actuator: Slowly decrease the diaphragm pressure and line up the stem connector halves.
 - b. For an air-to-close actuator: Slowly increase the diaphragm pressure and line up the stem connector halves.
7. Install the cap screws (key 87) with the lock washers if used and tighten them.
8. For sizes P460, P462 and P460-200, install the cap screws (key 80) and the nuts (key 81) and tighten them. For the size P900, screw the valve and actuator stem locknuts against the stem connector halves.

9. Slowly increase and decrease pressure several times, stroking the valve from the lower bench set pressure to the upper pressure.
10. Adjust the travel indicator scale (key 74) to correspond with the travel indicator. Stroke the valve full travel to ensure that the travel matches the valve travel on the travel indicator plate. If travel is not correct repeat the stem connector procedure.
11. If the actuator is equipped with a side-mounted handwheel, insert the screw (key 139) and the nut (key 140) into the stem connector half (key 78). Then screw the nut against the stem connector half. Adjust the handwheel travel indicator (key 113) to correspond with the screw (key 139) used as neutral position indicator. It may be necessary to take off the protective covers (key 119) by removing the cap screws and washers (keys 120 and 128). Once adjusted, replace the protective covers, washers and tighten the screws.

Loading Connection

The loading pressure connections are made at the factory if the valve, actuator, and positioner come as a unit. Keep the length of tubing or piping as short as possible to avoid transmission lag in the control signal. If a volume booster, valve positioner or other accessory is used, be sure that it is properly connected to the actuator. Refer to the positioner instruction manual or other manuals as necessary.

For actuators shipped separately or whenever the actuator pressure connections are installed, use the following steps:

1. Connect the loading pressure piping to the NPT internal connection at the side of the diaphragm casing.
2. Cycle the actuator several times to be sure that the valve stem travel is correct when the correct pressure ranges are applied to the diaphragm.
3. If valve stem travel appears to be incorrect, refer to the travel stop adjustment procedures at the beginning of this section. Do not place the valve in service if it is not reacting correctly to diaphragm loading pressure changes.

Maintenance

Actuator parts are subject to normal wear and must be inspected and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

When performing maintenance procedures, isolate the control valve from the process line pressure from both sides of the valve. Use the lock-out procedures to be sure that the above measures stay in effect while you are working on the actuator.

Actuator Maintenance

This procedure describes how the actuator can be completely disassembled and assembled. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job; then, start the assembly at the appropriate step.

Key numbers refer to figures 3 through 12 unless otherwise indicated. Figure 3 and 4 show the size P460, figure 5 and 6 the size P462, figure 7 and 8 the size P460-200 and figures 9 through 12 illustrate the size P900.

It may be necessary to apply a temporary loading pressure to the actuator during the disassembly.

Size P460 Actuator

Size P460 Actuator Disassembly

1. Bypass the control valve. Reduce the loading pressure to atmospheric, and remove the tubing or piping from the diaphragm casing (key 1).
2. If the actuator is equipped with a side-mounted handwheel, refer to the Side-Mounted Handwheel Disassembly procedures in the Side-Mounted Handwheel Maintenance section to separate the actuator and handwheel (steps 2 to 7). Then continue the Size P460 Actuator Disassembly procedure from the step 8.
3. For an air-to-open actuator only: slightly pressurize the actuator diaphragm until movement of the actuator stem is detected and the spring force applied to the stem connector is relieved.

⚠ WARNING

To avoid personal injury due to sudden uncontrolled movement of parts, do not loosen yoke locknut or cap screws and do not remove parts of the stem connector when the stem connector has spring force applied to it.

4. Remove the stem connector cap screws (key 87), the anti-rotator (key 85), the spacer if used (key 86) and the travel scale indicator (key 84). Loosen the stem connector halves cap screws and nuts (keys 80 and 81). Remove the stem connector halves.
5. For an air-to-open actuator only: slowly exhaust the diaphragm pressure.
6. To separate the actuator from the valve body, remove the yoke locknut or the bolts and then lift off the actuator.
7. Remove the yoke cap screws (key 77) and then lift the actuator off the yoke.
8. Remove the lifting lug cap screws (key 44), the lifting lug (key 40) and the gasket (key 71). If required remove the cap (key 43) and the travel stop (key 41).

⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the diaphragm casing away from the actuator, carefully remove casing cap screws and nuts (keys 45 and 46) (step 9 below) and then relieve the spring compression by unscrewing the nut (key 16) (step 11 below).

9. Remove all the diaphragm casing cap screws and nuts (keys 45 and 46). If required remove the vent (key 49).
10. Remove the set screws (key 57) and if used the travel stop and locknut (keys 65 and 66).
11. Relieve the spring compression by unscrewing slowly the nut (key 16).
12. Remove the washer (key 53), then lift off the diaphragm casing (key 3).
13. Remove the actuator springs (keys 30 and 31).
14. Lift off the stem and diaphragm plate assembly.
15. Unscrew the travel stop (key 54), remove ring (key 17), the wave washers (key 12), the tube (key 51), the diaphragm plate (key 26), the diaphragm (key 47), the O-ring (key 6), the washers if used (key 64) and the travel stop (key 14). Unbend the tab washer (key 13), remove the retaining ring (key 11) and the two nut halves (key 10).

16. From the diaphragm casing (key 1) remove the retaining ring (key 8), the wiper ring and the seal retainer (keys 4 and 5) and the O-ring (key 6).
17. If required remove the casing bushings (keys 7 and 33), the pins (key 28) from the diaphragm casing and diaphragm plate, the hellicoil (key 58), the travel scale, screw and nuts (keys 74, 75 and 76).

Size P460 Actuator Assembly

1. If removed, coat the bushings (keys 7 and 33) with lithium grease (key 201) and slide them into the diaphragm casings.
2. Place the wiper ring (key 4) into the seal retainer (key 5). Apply lithium grease (key 201) to the O-ring (key 6), the wiper ring and seal retainer assembly and install them into the diaphragm casing (key 1). Then place the retaining ring (key 8).
3. If removed, insert the pins (key 28) into the diaphragm casing (key 3) and diaphragm plate (key 26).
4. If removed, insert the hellicoil (key 58) into the nut (key 16).
5. Coat the threads of the stem (key 9) with anti-seize lubricant (key 202).
6. Apply anti-seize lubricant (key 202) to the internal thread of the two nut halves (key 10). Install the nut halves and the retaining ring (key 11). Place the tab washer (key 13) and bend it on the retaining ring. Slide the travel stop (key 14), the washers if used (key 64), the O-ring (key 6), the diaphragm (key 47), the diaphragm plate (key 26), the tube (key 51), the wave washers (key 12) and the ring (key 17).
7. Coat the internal thread of the travel stop (key 54) with anti-seize lubricant (key 202), screw it onto the stem and tighten until the wave washers are completely compressed.
8. Place this stem assembly into the diaphragm casing (key 1). Take care when pushing the actuator stem through the diaphragm casing so that the threads do not damage the bushing, O-ring or wiper ring.
9. Place the actuator springs (keys 30 and 31).
10. Install the diaphragm casing (key 3) so that the vent and air connections are diametrically opposed. Take care when lowering the casing around the stem so that the thread do not damage the bushing. Apply lithium grease (key 201) to the washer (key 53) and place it.
11. Apply anti-seize lubricant (key 202) on the nut internal thread (key 16) and screw it slowly to compress the springs until the two diaphragm casings touch the diaphragm.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following sequence with a manual torque wrench.

NOTICE

Over-tightening the diaphragm cap screws and nuts (keys 45 and 46) can damage the diaphragm. Do not exceed 16 N•m (12 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

12. Align the diaphragm casings and diaphragm holes. Be sure the vent and air connections on the diaphragm casings are still diametrically opposed. Install the cap screws and nuts (keys 45 and 46). Tighten the diaphragm cap screws and nuts in the following manner.

13. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 8 N•m (6 lbf•ft).
14. Tighten the remaining bolts in a clockwise, crisscross pattern to 8 N•m (6 lbf•ft).
15. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 16 N•m (12 lbf•ft).
16. Tighten the remaining bolts in a clockwise, crisscross pattern to 16 N•m (12 lbf•ft).
17. After the last bolt is tightened to 16 N•m (12 lbf•ft) all of the bolts should be tightened again to 16 N•m (12 lbf•ft) in a circular pattern around the bolt circle.
18. Once completed, no more tightening is recommended.
19. Tighten the set screws (key 57) into the nut (16).
20. If used, place the locknut and travel stop on the stem (keys 65 and 66) and screw the locknut against the travel stop.
21. Place the gasket (71) and the lifting lug cap (40) onto one of the diaphragm casings according to the actuator action (air-to-close: key 1, air-to-open: key 3). Insert the cap screws (key 44) and tighten them.
22. If removed, place the travel stop (key 41) into the lifting lug cap.
23. If the actuator is equipped with a side-mounted handwheel, it is necessary to adjust the actuator travel stop before mounting the actuator onto the side-mounted handwheel. Perform the Travel Stop Adjustment in accordance with the procedures in the Installation section. Then refer to the Side-Mounted Handwheel Assembly procedures in the Side-Mounted Handwheel Maintenance section to complete the actuator assembly (from step 9).
24. Lift the actuator and place it onto the yoke. Insert the cap screws (key 77) and tighten them.
25. If removed, screw the vent (key 49) into the diaphragm casing (key 3).
26. Mount the actuator onto the valve in accordance with the procedures in the Installation section.

Size P462 Actuator

Size P462 Actuator Disassembly

1. Bypass the control valve. Reduce the loading pressure to atmospheric, and remove the tubing or piping from the diaphragm casing (key 1).
2. If the actuator is equipped with a side-mounted handwheel, refer to the Side-Mounted Handwheel Disassembly procedures in the Side-Mounted Handwheel Maintenance section to separate the actuator and handwheel (steps 2 to 7). Then continue the Size P462 Actuator Disassembly procedure from the step 8.
3. For an air-to-open actuator only: slightly pressurize the actuator diaphragm until movement of the actuator stem is detected. The spring force applied to the stem connector is relieved.

⚠ WARNING

To avoid personal injury due to sudden uncontrolled movement of parts, do not loosen yoke locknut or cap screws and do not remove parts of the stem connector when the stem connector has spring force applied to it.

4. Remove the stem connector cap screws (key 87), the anti-rotator (key 85), the spacer if used (key 86) and the travel scale indicator (key 84). Loosen the stem connector halves cap screws and nuts (keys 80 and 81). Remove the stem connector halves.
5. For an air-to-open actuator only: slowly exhaust the diaphragm pressure.
6. To separate the actuator from the valve body, remove the yoke locknut or the bolts and then lift off the actuator.
7. Remove the yoke cap screws (key 77), then lift the actuator off the yoke.

8. Remove the lifting lug cap screws (key 44), the lifting lug (key 40), the gasket (key 71) and the spacer if used (key 67). If required remove the cap (key 43) and the travel stop (key 41).
9. Unscrew the cap screws (key 36) and remove the flange (key 34) and gasket (key 72).
10. Unbend the ring retaining (key 59) and slide towards the casing. Remove the 2 ring halves (key 61) and then the ring retaining.

⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the diaphragm casing away from the actuator, relieve the spring compression (step 11 below) and carefully remove casing cap screws and nuts (keys 45 and 46) (step 12 below)

11. Relieve the spring compression by unscrewing alternately and slowly the four cap screws (key 32).
12. Remove all the diaphragm casing cap screws and nuts (keys 45 and 46). If required remove the vent (key 49).
13. Lift off the diaphragm casing (key 3).
14. Remove the spring seat (key 29) and actuator spring (key 30).
15. Lift off the stem and diaphragm plate assembly.
16. Unscrew the set screw (key 57) and remove the travel stop (key 52). Loosen the nut (key 10). Remove the ring retaining (key 11), the wave washers (key 12), the tube (key 51), the diaphragm plate (key 26), the diaphragm (key 47), the O-ring (key 6), the travel stop (key 14), the ring retaining (key 60) and the 2 ring halves.
17. From the diaphragm casing (key 1) remove the retaining ring (key 8), the wiper ring and the seal retainer (keys 4 and 5) and the O-ring (key 6).
18. If required, remove the casing bushings (keys 7 and 33), the pins (key 28) from the diaphragm plate and spring seat, thread the travel stop if used (key 66) out of the stem. If required, remove the travel scale, the screws and nuts (keys 74, 75 and 76).

Size P462 Actuator Assembly

1. If removed, coat the bushings (keys 7 and 33) with lithium grease (key 201) and slide them into the diaphragm casings.
2. Place the wiper ring (key 4) into the seal retainer (key 5). Apply lithium grease (key 201) to the O-ring (key 6), the wiper ring and seal retainer assembly and install them into the diaphragm casing (key 1). Then place the retaining ring (key 8).
3. If removed, insert the pins (key 28) into the spring seat (key 29) and diaphragm plate (key 26).
4. Coat the threads of the stem (key 9) with anti-seize lubricant (key 202).
5. Place the two ring halves (key 61) and the retaining ring (key 60). Slide the travel stop (key 14), the O-ring (key 6), the diaphragm (key 47), the diaphragm plate (key 26), the tube (key 51), the wave washers (key 12) and the retaining ring (key 11).
6. Coat the internal thread of the 2 nut halves (key 10) with anti-seize lubricant (key 202) and tighten them until the wave washers are completely compressed.
7. Slide the travel stop (key 52) and tighten the set screw (key 57).
8. Place this stem assembly into the diaphragm casing (key 1). Take care when pushing the actuator stem through the diaphragm casing so that the threads do not damage the bushing, O-ring or wiper ring.
9. Place the actuator spring (key 30). Apply anti-seize lubricant (key 202) into the four cap screw beds of the spring seat. Place the spring seat (key 29) so that the cap screw beds will be aligned with the internal threads of the diaphragm casing (key 3).

10. Install the diaphragm casing (key 3) so that the vent and air connection are diametrically opposed. Take care when lowering the casing around the stem so that the threads do not damage the bushing.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following sequence with a manual torque wrench.

NOTICE

Over-tightening the diaphragm cap screws and nuts (keys 45 and 46) can damage the diaphragm. Do not exceed 16 N•m (12 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

11. Align the diaphragm casings and diaphragm holes. Be sure the vent and air connection on the diaphragm casings are still diametrically opposed. Install the cap screws and nuts (keys 45 and 46). Tighten the diaphragm cap screws and nuts in the following manner.
12. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 8 N•m (6 lbf•ft).
13. Tighten the remaining bolts in a clockwise, crisscross pattern to 8 N•m (6 lbf•ft).
14. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 16 N•m (12 lbf•ft).
15. Tighten the remaining bolts in a clockwise, crisscross pattern to 16 N•m (12 lbf•ft).
16. After the last bolt is tightened to 16 N•m (12 lbf•ft) all of the bolts should be tightened again to 16 N•m (12 lbf•ft) in a circular pattern around the bolt circle.
17. Once completed, no more tightening is recommended.
18. Coat the thread of the four cap screws (key 32) and the internal threads of the diaphragm casing (key 3) with anti-seize lubricant (key 202). Be sure that the cap screw beds into the spring seat are still aligned with the internal threads of the diaphragm casing. Then install and screw alternately and slowly the four cap screws to compress the spring.
19. Place the retaining ring (key 59) onto the stem. Install the ring (key 61) and slide the retaining ring and bend it on the ring.
20. Place the gasket (key 72) and the flange (key 34). Insert the cap screws (key 36) and tighten them.
21. If used, screw travel stop on the stem (keys 66).
22. Place the spacer if used (key 67), the gasket (key 71) and the lifting lug cap (key 40) onto one of the diaphragm casings according to the actuator action (air-to-close: key 1, air-to-open: key 3). Insert the cap screws (key 44) and tighten them.
23. If removed, place the travel stop (key 41) into the lifting lug cap.
24. If the actuator is equipped with a side-mounted handwheel, it is necessary to adjust the actuator travel stop before mounting the actuator onto the side-mounted handwheel. Perform the Travel Stop Adjustment in accordance with the procedures in the Installation section. Then refer to the Side-Mounted Handwheel Assembly procedures in the Side-Mounted Handwheel Maintenance section to complete the actuator assembly (from step 9).

25. Lift the actuator and place it onto the yoke. Insert the cap screws (key 77) and tighten them.
26. If removed, screw the vent (key 49) into the diaphragm casing (key 3).
27. Mount the actuator onto the valve in accordance with the procedures in the Installation section.

Size P460-200 Actuator

Size P460-200 Actuator Disassembly

1. Bypass the control valve. Reduce the loading pressure to atmospheric, and remove the tubing or piping from the diaphragm casing (key 1).
2. If the actuator is equipped with a side-mounted handwheel, refer to the Side-Mounted Handwheel Disassembly procedures in the Side-Mounted Handwheel Maintenance section to separate the actuator and handwheel (steps 2 to 7). Then continue the Size P460-200 Actuator Disassembly procedure from the step 8.
3. For an air-to-open actuator only: slightly pressurize the actuator diaphragm until movement of the actuator stem is detected. The spring force applied to the stem connector is relieved.

⚠ WARNING

To avoid personal injury due to sudden uncontrolled movement of parts, do not loosen yoke locknut or cap screws and do not remove the parts of the stem connector when the stem connector has spring force applied to it.

4. Remove the stem connector cap screws (key 87), the anti-rotator (key 85), the spacer if used (key 86) and the travel scale indicator (key 84). Loosen the stem connector halves cap screws and nuts (keys 80 and 81). Remove the stem connector halves.
5. For an air-to-open actuator only: slowly exhaust the diaphragm pressure.
6. To separate the actuator from the valve body, remove the yoke locknut or the bolts and then lift off the actuator.
7. Remove the yoke cap screws (key 77), then lift the actuator off the yoke.
8. Remove the bellows (key 68). Remove the lifting lug cap screws (key 44), the lifting lug (key 40) and the gasket (key 71). If required, loosen the locknut (key 42) and remove the travel stop (key 41).

⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the diaphragm casing away from the actuator, carefully remove casing cap screws and nuts (keys 45 and 46) (step 9 below) and then relieve the spring compression by unscrewing the nut (key 16) (step 11 below).

9. Remove all the diaphragm casing cap screws and nuts (keys 45 and 46). If required remove the vent (key 49).
10. Unscrew the locknut (key 62).
11. Relieve the spring compression by unscrewing slowly the nut (key 16).
12. Remove the washer (key 53), then lift off the diaphragm casing (key 3).
13. Remove the actuator springs (keys 30 and 31).
14. Lift off the stem and diaphragm plate assembly.
15. Unscrew the travel stop (key 54), remove the wave washers (key 12), the tube (key 51), the O-ring (key 6), the diaphragm and diaphragm plate assembly (keys 24, 25, 26 and 47). Remove the retaining ring (key 11) and the two nut halves (key 10).

16. Unscrew the cap screws (key 25), disassemble the ring (key 24), the diaphragm (key 47) and the diaphragm plate (key 26).
17. Unscrew the cap screws (key 70), remove the wiper ring and the seal retainer (key 4 and 5) and the O-ring (key 6).
18. If required, remove the casing bushings (keys 7 and 33) and the pins (key 28) from the diaphragm plate and casing. If required, remove the travel scale, screw and nuts (keys 74, 75 and 76).

Size P460-200 Actuator Assembly

1. If removed, coat the bushings (keys 7 and 33) with lithium grease (key 201) and slide them into the diaphragm casings.
2. Place the wiper ring (key 4) into the seal retainer (key 5). Apply lithium grease (key 201) to the O-ring (key 6), the wiper ring and seal retainer assembly and install them into the diaphragm casing (key 1). Then insert the cap screws (key 70) and tighten them.
3. If removed, insert the pins (key 28) into the diaphragm casing (key 3) and diaphragm plate (key 26).
4. Place the diaphragm (key 47) on the diaphragm plate (key 26). Install the ring (key 24) and the cap screws (key 25) and tighten them.
5. Coat the threads of the stem (key 9) with anti-seize lubricant (key 202).
6. Apply anti-seize lubricant (key 202) to the internal thread of the two nut halves (key 10). Install the nut halves and the retaining ring (key 11). Slide the diaphragm and diaphragm plate assembly (keys 24, 25, 26 and 47), the O-ring (key 6), the tube (key 51), the wave washers (key 12).
7. Coat the internal thread of the travel stop (key 54) with anti-seize lubricant (key 202), screw it onto the stem and tighten until the wave washers are completely compressed.
8. Place this stem assembly into the diaphragm casing (key 1). Take care when pushing the actuator stem through the diaphragm casing so that the threads do not damage the bushing, O-ring or wiper ring.
9. Place the actuator springs (key 30 and 31).
10. Install the diaphragm casing (key 3) so that the vent and air connection are diametrically opposed. Take care when lowering the casing around the stem so that the thread do not damage the bushing. Apply lithium grease to the washer (key 53) and place it.
11. Apply anti-seize lubricant (key 202) on the nut internal thread (key 16) and screw it slowly to compress the springs.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following sequence with a manual torque wrench.

NOTICE

Over-tightening the diaphragm cap screws and nuts (keys 45 and 46) can damage the diaphragm. Do not exceed 16 N•m (12 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

12. Align the diaphragm casings and diaphragm holes. Be sure the vent and air connection on the diaphragm casings are still diametrically opposed. Install the cap screws and nuts (keys 45 and 46). Tighten the diaphragm cap screws and nuts in the following manner.

13. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 8 N•m (6 lbf•ft).
14. Tighten the remaining bolts in a clockwise, crisscross pattern to 8 N•m (6 lbf•ft).
15. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 16 N•m (12 lbf•ft).
16. Tighten the remaining bolts in a clockwise, crisscross pattern to 16 N•m (12 lbf•ft).
17. After the last bolt is tightened to 16 N•m (12 lbf•ft) all of the bolts should be tightened again to 16 N•m (12 lbf•ft) in a circular pattern around the bolt circle.
18. Once completed, no more tightening is recommended.
19. Screw the locknut (key 62) against the nut (key 16).
20. Place the bellows (key 68 and 69).
21. Place the gasket (key 71) and the lifting lug cap (key 40) onto one of the diaphragm casings according to the actuator action (air-to-close: key 1, air-to-open: key 3). Coat the cap screws (key 44) with lithium grease and tighten them.
22. If removed, place the travel stop and the locknut (keys 41 and 42) into the lifting lug cap.
23. If the actuator is equipped with a side-mounted handwheel, it is necessary to adjust the actuator travel stop before mounting the actuator onto the side-mounted handwheel. Perform the Travel Stop Adjustment in accordance with the procedures in the Installation section. Then refer to the Side-Mounted Handwheel Assembly procedures in the Side-Mounted Handwheel Maintenance section to complete the actuator assembly (from step 9).
24. Lift the actuator and place it onto the yoke. Insert the cap screws (key 77) and tighten them.
25. If removed, screw the vent (key 49) into the diaphragm casing (key 3).
26. Mount the actuator onto the valve in accordance with the procedures in the Installation section.

Size P900 Actuator

Size P900 Actuator Disassembly

1. Bypass the control valve. Reduce the loading pressure to atmospheric, and remove the tubing or piping from the diaphragm casings (key 1).
2. If the actuator is equipped with a side-mounted handwheel, refer to the Side-Mounted Handwheel Disassembly procedures in the Side-Mounted Handwheel Maintenance section to separate the actuator and handwheel (steps 2 to 7). Then continue the Size P900 Actuator Disassembly procedure from the step 8.
3. **For an air-to-open actuator only:** slightly pressurize the actuator diaphragm until movement of the actuator stem is detected. The spring force applied to the stem connector is relieved.

WARNING

To avoid personal injury due to sudden uncontrolled movement of parts, do not loosen yoke cap screws and do not remove the parts of the stem connector when the stem connector has spring force applied to it.

4. Remove the stem connector cap screws (key 87), the anti-rotator (key 85) and the spacer if used (key 86). Loosen the stem connector halves locknuts (keys 82 and 83). Remove the stem connector halves.
5. **For an air-to-open actuator only:** slowly exhaust the diaphragm pressure.
6. To separate the actuator from the valve body, remove the yoke locknut or the bolts and then lift off the actuator.
7. Remove the yoke-to-actuator cap screws (key 77), then lift the actuator off the yoke.
8. Remove the lifting lug cap screws (key 44), the lifting lug (key 40) and the gasket (key 71). If required, loosen the locknut (key 42) and remove the travel stop (key 41).

9. Unscrew the cap screws (key 35) and remove the flange (key 34) and gasket (key 72).
10. Unbend the ring retaining (key 59) and slide towards the casing. Remove the 2 ring halves (key 61) and then the ring retaining.

⚠ WARNING

To avoid personal injury from the precompressed spring force thrusting the diaphragm casing away from the actuator, relieve the spring compression (step 11 below) and carefully remove casing cap screws and nuts (keys 45 and 46) (steps 12 and 16 below).

11. Relieve the spring compression by unscrewing alternately and slowly the three cap screws (key 32).

Note

The size P900 is a double stacked diaphragm casings actuator. First disassemble the stack composed of two short diaphragm casings (keys 1 and 2). Then disassemble the stack made of one short and one long diaphragm casings (keys 1 and 3).

12. Remove all the cap screws and nuts (keys 45 and 46) of the short diaphragm casings assembly (keys 1 and 2). If required, remove the vent (key 49).
13. Lift off the diaphragm casing (key 1).
14. Unscrew the nut (key 10). Remove the ring retaining (key 11), the washer (key 55), the O-ring (key 20), the diaphragm (key 48), the diaphragm plate (key 27), the lock washer (key 50), the ring retaining (key 11) and the two nut halves (key 10).
15. Remove the cap screws, the washers (keys 22 and 23) and the diaphragm casing (key 2).
16. Remove all the cap screws and nuts (keys 45 and 46) of the long diaphragm casings assembly (keys 1 and 3). If required, remove the vent (key 49).
17. Lift off the diaphragm casing (key 3).
18. Remove the spring seat with the discs (keys 29 and 39) and actuator spring (key 30).
19. Lift off the stem and diaphragm plate assembly.
20. Unscrew the set screw (key 57) and remove the travel stop (key 52). Loosen the nut (key 10). Remove the ring retaining (key 11), the wave washer (key 50), the tube if used (key 51), the diaphragm plate and diaphragm assembly (keys 24, 25, 26 and 47), the O-ring (key 6), the travel stop assembly (keys 14, 15, 18 and 19), the retaining (key 11) and the two nut halves (key 10).
21. Unscrew the cap screws (key 25), disassemble the ring (key 24), the diaphragm (key 47) and the diaphragm plate (key 26).
22. If required, remove the cap screws (key 18), lock washers (key 19) and disassemble the travel stop (keys 14 and 15).
23. Unscrew the cap screws (key 21), remove the wiper ring and the seal retainer (keys 4 and 5) and the O-ring (key 6).
24. If required, remove the casing bushings (keys 7 and 33), the pins (key 28) from the diaphragm plate and spring seat. If required, remove the travel scale, the screws and nuts (keys 74, 75 and 76).

Size P900 Actuator Assembly

1. If removed, coat the bushing (keys 7 and 33) with lithium grease (key 201) and slide them into the diaphragm casings.
2. Place the wiper rings (key 4) into the seal retainers (key 5). Apply lithium grease (key 201) to the O-rings (key 6), the wiper ring and seal retainer assemblies and install them into the diaphragm casings (key 1). Then insert the cap screws (key 21) and tighten them.

3. If removed, insert the pins (key 28) into the spring seat (key 29) and diaphragm plate (key 26).
4. Assemble the two travel stop parts (keys 14 and 15), install the lock washers (key 18) and the cap screws (key 18) and tighten them.
5. Place the diaphragm (key 47) on the diaphragm plate (key 26). Install the ring (key 24) and the cap screws (key 25) and tighten them.

Note

The size P900 is a double stacked diaphragm casings actuator. First assemble the stack made of a short and a long diaphragm casing (keys 1 and 3). Then mount the stack composed of two short diaphragm casings (keys 1 and 2).

6. Coat the threads of the stem (key 9) with anti-seize lubricant (key 202).
7. Apply anti-seize lubricant (key 202) to the internal thread of the two nut halves (key 10). Install the nut halves and the retaining ring (key 11). Slide the travel stop assembly (keys 14, 15, 18 and 19), the O-ring (key 6), the diaphragm plate assembly (keys 24, 25, 26 and 47), the tube if used (key 51), the lock washer (key 50) and the ring (key 11).
8. Coat the internal thread of the two nut halves (key 10) with anti-seize lubricant (key 202) and tighten them until the lock washer is completely compressed.
9. Slide the travel stop (key 52) and tighten the set screws (key 57).
10. Place this stem assembly into the diaphragm casing (key 1). Take care when pushing the actuator stem through the diaphragm casing so that the threads do not damage the bushing, O-ring or wiper ring.
11. Install the actuator springs (key 30 and 31). Apply anti-seize lubricant (key 202) into the three cap screw beds of the spring seat. Coat the disc (key 39) with anti-seize lubricant (key 202). Install the discs into the spring seat and place the spring seat so that the cap screw beds will be aligned with the internal threads of the diaphragm casing (key 3).
12. Install the diaphragm casing (key 3) so that the vent and air connection are diametrically opposed. Take care when lowering the casing around the stem so that the threads do not damage the bushing.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following sequence with a manual torque wrench.

NOTICE

Over-tightening the diaphragm cap screws and nuts (keys 45 and 46) can damage the diaphragm. Do not exceed 16 N•m (12 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

13. Align the diaphragm casings and diaphragm holes. Be sure the vent and air connection on the diaphragm casings are still diametrically opposed. Install the cap screws and nuts (keys 45 and 46). Tighten the diaphragm cap screws and nuts in the following manner.

14. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 8 N•m (6 lbf•ft).
15. Tighten the remaining bolts in a clockwise, crisscross pattern to 8 N•m (6 lbf•ft).
16. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 16 N•m (12 lbf•ft).
17. Tighten the remaining bolts in a clockwise, crisscross pattern to 16 N•m (12 lbf•ft).
18. After the last bolt is tightened to 16 N•m (12 lbf•ft) all of the bolts should be tightened again to 16 N•m (12 lbf•ft) in a circular pattern around the bolt circle.
19. Once completed, no more tightening is recommended.
20. Coat the thread of three cap screws (key 32) and the internal threads of the diaphragm casing (key 3) with anti-seize lubricant (key 202). Be sure that the cap crew beds into the spring seat are still aligned with the internal threads of the diaphragm casing. Then install and screw alternately and slowly the three cap screws to compress the springs.
21. Place the retaining ring (key 59) onto the stem. Install the ring (key 61) and slide the retaining ring and bend it on the ring.
22. Place the gasket (key 72) and the flange (key 34). Insert the cap screws (key 34) and tighten them.
23. Place the diaphragm casing (key 2) so that the vent connection is diametrically opposed to the air connection of the diaphragm casing (key 1) next to. Install the lock washers (key 23) and the cap screws (key 22) and tighten them.
24. Apply anti-seize lubricant (key 202) to the internal thread of the two nut halves (key 10). Install the nut halves and the retaining ring (key 11). Slide the lock washer (key 50), the diaphragm plate (key 27), the diaphragm (key 48), the O-ring (key 20), the washer (key 55), the retaining ring (key 11).
25. Coat the internal thread of the two nut halves (key 10) with anti-seize lubricant (key 202) and tighten them until the lock washer is completely compressed.
26. Place the diaphragm casing (key 1) so that the vent and air connection are diametrically opposed. Take care when sliding the diaphragm casing around the stem so that the threads do not damage the bushing, O-ring or wiper ring.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following sequence with a manual torque wrench.

NOTICE

Over-tightening the diaphragm cap screws and nuts (keys 45 and 46) can damage the diaphragm. Do not exceed 16 N•m (12 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

27. Align the diaphragm casings and diaphragm holes. Be sure the vent and air connection on the diaphragm casings are still diametrically opposed. Install the cap screws and nuts (keys 45 and 46). Tighten the diaphragm cap screws and nuts in the following manner.
28. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 8 N•m (6 lbf•ft).

29. Tighten the remaining bolts in a clockwise, crisscross pattern to 8 N•m (6 lbf•ft).
30. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 16 N•m (12 lbf•ft).
31. Tighten the remaining bolts in a clockwise, crisscross pattern to 16 N•m (12 lbf•ft).
32. After the last bolt is tightened to 16 N•m (12 lbf•ft) all of the bolts should be tightened again to 16 N•m (12 lbf•ft) in a circular pattern around the bolt circle.
33. Once completed, no more tightening is recommended.
34. Place the gasket (71) and the lifting lug cap (40) onto one of the diaphragm casings according to the actuator action (air-to-close: key 1, air-to-open: key 3). Insert the cap screws (key 44) and tighten them.
35. If removed, place the travel stop and the lock nut (keys 41 and 42) into the lifting lug cap.
36. If the actuator is equipped with a side-mounted handwheel, it is necessary to adjust the actuator travel stop before mounting the actuator onto the side-mounted handwheel. Perform the Travel Stop Adjustment in accordance with the procedures in the Installation section. Then refer to the Side-Mounted Handwheel Assembly procedures in the Side-Mounted Handwheel Maintenance section to complete the actuator assembly (from step 9).
37. Lift the actuator and place it onto the yoke. Insert the cap screws (key 77) and tighten them.
38. If removed, screw the vents (key 49) into the diaphragm casings (keys 2 and 3).
39. Mount the actuator onto the valve in accordance with the procedures in the Installation section.

Side-Mounted Handwheel Maintenance

Instructions are given below for complete disassembly and assembly of a side-mounted handwheel. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

If it is only necessary to separate the actuator from the side-mounted handwheel, perform the eight first steps of the following Side-Mounted Handwheel Disassembly procedure. Then to mount the actuator on the side-mounted handwheel begin at the step 9 of the Side-Mounted Handwheel Assembly procedure.

Key numbers refer to figures 13, 14, 15 and 16 unless otherwise indicated. Figure 13 shows the sizes P460 and P462 Handwheel, figure 14 the size P900, figure 15 the size P460-200 and figure 16 illustrates the driving shaft assembly.

It may be necessary to apply a temporary loading pressure to the actuator during the assembly.

Side-Mounted Handwheel Disassembly

1. Bypass the control valve. Reduce the actuator loading pressure to atmospheric, and remove the tubing or piping from the diaphragm casing.
2. For an air-to-open actuator only: Turn counterclockwise until movement of the handwheel stem is detected. The spring force applied to the stem connector is relieved.

⚠ WARNING

To avoid personal injury due to sudden uncontrolled movement of parts, do not loosen yoke cap screws and do not remove the parts of the stem connector when the stem connector has spring force applied to it.

Figure 2. Side Mounted Handwheel



3. Remove the stem connector cap screws (key 87), the anti-rotator (key 78), the spacer if used (key 86) and the travel scale indicator (key 85). For the sizes P460, P462 and P460-200, loosen stem connector halves cap screws and nuts (keys 80 and 81) and unscrew the connector halves. For the size P900, unscrew the stem connector locknuts (keys 82 and 83) and then the connector halves.
4. To separate the actuator from the valve body, remove the yoke locknut or the bolts and then lift off the actuator.
5. For the sizes P460, P462 and P900 remove the cap screws (key 122). For the size P460-200 remove the bolts (keys 122 and 132). Then lift the actuator and handwheel assembly off the yoke.
6. Unscrew the protective cover cap screws (key 120), remove the washers (key 128) and the protective covers (key 119).
7. Remove the stem connector cap screws (key 125 or 137). For the sizes P460 and P462, loosen the stem connector cap screws and nuts (keys 130 and 131) and unscrew the connector half. For the sizes P900 and P460-200, unscrew the stem connector locknut (key 136) and then the connector half (key 124).
8. Remove the cap screws (key 77), then lift the actuator off the handwheel.

Note

To disassemble the actuator, refer to the Actuator Disassembly procedures in the Actuator Maintenance section (from step 8). Following steps describe only how the side-mounted handwheel can be completely disassembled.

9. Remove the travel scale indicator (key 113) by loosening the cap screw that maintain it or for the size P460-200 by unscrewing the two nuts (key 129).
10. For the size P460-200, remove the two bellows (keys 133, 134 and 135).
11. Turn clockwise the handwheel to unscrew the upper threaded shaft (key 111).
12. Remove the lower threaded shaft and shaft connector assembly (keys 109 and 110). Remove the upper threaded shaft and bridge (keys 111 and 112). For the size P460-200, if required disassemble the upper threaded shaft by removing the pin (key 127) and unscrewing the bridge (key 112).
13. Remove the driving shaft assembly (keys 114, 116, 117 and 118) by loosening the cap screws that hold it in place (keys 115 and 126).

14. If required, the driving shaft assembly can be broken down by removing the nut (key 118), the washer (key 117), the rotation indicator (key 114.5), the handwheel (key 116), and then the driving shaft (key 114.4) and the bearing (key 114.3). If required, remove the cap screws and nuts (keys 114.9 and 114.10) of the anti-rotator clamped on the driving shaft housing (key 114.1), the anti-rotator (key 114.7), the spacer (114.8) and the two clamps (key 114.6).
15. Remove the screws (key 108), the washer (key 107), the key (key 106), the gear ring (key 105) and the bearing (key 104). If required, remove the bushing (key 103) from the gear housing (key 102).

Side-Mounted Handwheel Assembly

1. If the driving shaft assembly was separated, coat the bushings (key 114.2), the bearing (key 114.3) and the shaft (key 114.4) with lithium grease (key 201). Place the bearing, and then insert the shaft into the housing (key 114.1). Place the handwheel (key 116), the rotation indicator (key 114.5), the washer (key 117) and then insert and tighten the nut (key 118). Place the two clamps (key 114.6), the spacer and the anti-rotator at the opposite (keys 114.7 and 114.8), insert the cap screws and nuts (key 114.9 and 114.10) and tighten them.
2. If removed, coat the bushing (key 103) with lithium grease (key 201) and slide it into the housing (key 102).
3. Coat the bushing (key 103), the bearing (key 104) and the gear ring (key 105) with lithium grease (key 201). Place the gear housing (key 102) onto the yoke, install the bearing (key 104), and the gear ring (key 105).
4. Coat the thread of the shafts (keys 110 and 111) and the internal threads of the shaft connector (key 109) with anti-seize lubricant (key 202). Insert the lower threaded shaft (key 110) into the shaft connector (key 109) by engaging three or four threads.
5. For the size P460-200, if the upper threaded shaft (key 111) was separated from the bridge (key 112), screw the shaft into the bridge. Align the holes and insert the pin (key 127).
6. Apply lithium grease (key 201) to the inside of the gear ring (key 105). Place the shaft assembly (keys 109 and 110) into the gear ring and align the grooves. Apply lithium grease (key 201) to the key (key 106) and insert it. Place the washer (key 107), insert the screws (key 108) and tighten them.
7. Coat the handwheel assembly cog (key 114) and the gear ring cog (key 105) with anti-seize lubricant (key 202). Place the handwheel assembly. Insert the cap screws (keys 115 and 126) and adjust the gap between the gear cogs by screwing or unscrewing the cap screws. Then tighten the cap screws (key 115).
8. Place the bridge (key 112) and the upper shaft (key 111). Insert the upper shaft into the shaft connector (key 109) by turning counter-clockwise the handwheel. Engage three or four threads as done previously for the lower shaft.

Note

The actuator is normally shipped adjusted at the factory and you may refer directly to the following steps. If the actuator has been disassembled, it is necessary to adjust the travel stop. You may perform the Travel Stop Adjustment in accordance with the procedures in the Installation section.

9. Lift the actuator and place it onto the handwheel. Insert the cap screws (key 77) and tighten them.

WARNING

When moving the actuator stem with loading pressure applied, exercise caution to keep hands and tools out of the actuator stem travel path. If the loading pressure is accidentally disconnected, personal injury and property damage is possible if something is caught between the actuator stem and other control valve parts.

10. For an air-to-open actuator only: set the diaphragm loading pressure to approximately 0.5 bar over the upper bench set pressure. The actuator should be contacting the upper travel stop.
11. For sizes P900 and P460-200 only, screw the actuator stem locknut away from the from the connector half location.

12. Screw the stem connector half (key 124) onto the actuator stem.
13. Perform one of the following procedures as appropriate:
 - a. For an air-to-open actuator: position the bridge (key 112) at the lower location and wedge it by inserting the stoppage part (key 121) into the two holes. Rotate the connector half so that the distance between the bridge and the connector half is equal to the valve travel. Be sure that the actuator stem threads are engaging the threads of the stem connector by the distance of at least one diameter of the stem. Then slowly decrease the diaphragm pressure until the connector half is contacting the bridge and line up the stem connector half.
 - b. For an air-to-close actuator: position the bridge (key 112) at the upper location and wedge it by inserting the stoppage part (key 121) into the two holes. Rotate the connector half so that it is contacting the bridge and line it up.
14. Install the cap screws (key 125 or 137) and tighten them.
15. For the sizes P460 and P462, install the cap screw and nut (key 130 and 131) and tighten them. For the sizes P900 and P460-200, screw the actuator stem locknut against the stem connector half.
16. For an air-to-open actuator only: slightly pressurize the actuator diaphragm until movement of actuator stem is detected.

WARNING

To avoid personal injury due to sudden uncontrolled movement of parts, do not remove the stoppage part of the bridge when the connector has spring force applied to it.

17. Remove the stoppage part from the bridge and install it into the protective cover for the sizes P460, P462 and P900 or into the top holes of the handwheel yoke for the size P460-200.
18. For the size P460-200 only, Place the two bellows (keys 134, 135 and 133).
19. Install the travel indicator (key 113) by tightening the cap screw or nuts.
20. Lift the actuator and handwheel assembly and place it onto the yoke. For the sizes P460, P462 and P900 insert the cap screws (key 122). For the size P460-200 insert the cap screws and nuts (keys 122 and 132). Then tighten them.
21. Mount the actuator and handwheel assembly in accordance with the procedures in the Installation section.

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always mention this number when corresponding with your [Emerson sales office](#) regarding technical information or replacement parts. Also, reference the complete part number of each part needed as part as found in the following Parts List.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your [Emerson sales office](#).

Actuator Assembly (figures 3 through 12)

Key	Description	Part Number
1	Lower Diaphragm Casing	
2	Upper Diaphragm Casing	
3	Upper Diaphragm Casing	
4	Wiper Ring	
	Size P460	1269208
	Size P462	0161080
	Size P460-200	1234722
	Size P900	1230174
5	Seal Retainer	
6	O-Ring	
	Size P460	1269224
	Size P462	1269666
	Size P460-200	0156922
	Size P900	1230212
7	Bushing	
8	Retaining Ring	
9	Stem	
10	Nut (2 parts)	
11	Retaining Ring	
12	Spring Wave Washer	
13	Tab Washer	
14	Travel Stop	
15	Travel Stop	
16	Nut	
17	Ring	
18	Hex Socket Cap Screw	
19	Spring Lock Washer	
20	O-Ring	
	Size P900	0277711
21	Hex Socket Cap Screw	
22	Hex Socket Cap Screw	
23	Spring Lock Washer	
24	Back-Up Plate	
25	Hex Head Cap Screw	
26	Diaphragm Plate	
27	Diaphragm Plate	
28	Groove Pin	
29	Spring Seat	
30	Spring	See following table
31	Spring	See following table
32	Hex Head Cap Screw	
33	Bushing	
34	Flange	
35	Hex Head Cap Screw	
36	Hex Socket Cap Screw	
39	Disc	

Key	Description	Part Number
40	Lifting Lug Cap	
41	Hex Head Cap Screw	
42	Jam Hex Nut	
43	Cap	
	Size P460 and P462	0296759
44	Hex Head Cap Screw	
45	Hex Head Cap Screw	
46	Hex Nut	
47	Diaphragm	
	Size P460	0161420
	Size P462	1269739
	Size P460-200	0413860
	Size P900	1221728
48	Diaphragm	
	Size P900	1221701
49	Elbow Vent	
50	Spring Lock Washer	
51	Tube	
52	Travel Stop	
53	Washer	
54	Travel Stop	
55	Washer	
56	Plain Washer	
57	Hex Socket Set Screw	
58	Hellicoil	
59	Retaining Ring	
	Size P462	1269828
	Size P900	1261088
60	Retaining Ring	
61	Ring (2 parts)	
62	Jam Hex Nut	
64	Washer	
65	Jam Hex Nut	
66	Travel Stop	
67	Spacer	
68	Bellows	
	Size P460-200	0264571
69	Ring	
70	Hex Head Cap Screw	
71	Gasket	
	Size P460 and P462	1607596
	Size P460-200	1630342
	Size P900	1632205
72	Gasket	
	Size P462	1630369
	Size P900	1632191
73	Yoke	
74	Travel Indicator Scale	
75	Pan Head Screw	
76	Speed Nut	
77	Hex Head Cap Screw	
78	Nut Half Stem Connector	
79	Bolt Half Stem Connector	
80	Hex Socket Cap Screw	
81	Hex Nut	
82	Jam Hex Nut	
83	Jam Hex Nut	
84	Travel Indicator	
85	Anti-Rotator	
86	Spacer	
87	Hex Socket Cap Screw	
88	Spring Lock Washer	
89	Nameplate	
90	Drive Screw	

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Key	Description	Key	Description	Part Number
201	Lithium Grease	114.9	Hex Head Cap Screw	
202	Anti-Seize Lubricant	114.10	Hex Nut	
		115	Hex Head Cap Screw	
		116	Handwheel	
		117	Plain Washer	
		118	Hex Nut	
		119	Protective Cover	
		120	Hex Head Cap Screw	
		121	Stoppage Part	
		122	Hex Head Cap Screw	
		124	Stem Connector	
		125	Hex Socket Cap Screw	
		126	Hex Head Cap Screw	
		127	Pin	
		128	Plain Washer	
		129	Hex Nut	
		130	Hex Socket Cap Screw	
		131	Hex Nut	
		132	Hex Nut	
		133	Bellows	
			Size P460-200	0264571
		134	Ring	
		135	Bellows	
			Size P460-200	0142948
		136	Jam Hex Nut	
		137	Hex Head Cap Screw	
		138	Bellows Holder	
		139	Slotted Headless Screw	
		140	Jam Hex Nut	
		201	Lithium Grease	
		202	Anti-Seize Lubricant	

Side-Mounted Handwheel (figures 13 through 16)

101	Yoke
102	Gear Housing
103	Bushing
104	Bearing
105	Gear Ring
106	Key
107	Washer
108	Countersunk Head Screw
109	Shaft Connector
110	Threaded Shaft
111	Threaded Shaft
112	Bridge
113	Travel Indicator
114	Driving Shaft Assembly
114.1	Driving Shaft Housing
114.2	Bushing
114.3	Bearing
114.4	Driving Shaft
114.5	Handwheel Rotation Indicator
114.6	Clamp
114.7	Anti-Rotator
114.8	Spacer

Keys 30 and 31 Size P460 Actuator Spring

TRAVEL	DIAPHRAGM PRESSURE RANGE					
mm (Inches)	bar					
29 (1-1/8)	0.2-0.9	0.4-0.8	0.7-1.2	---	1.0-1.7	1.3-2.0
32	0.2-1.0	0.4-0.8	0.7-1.2	---	1.0-1.8	1.3-2.1
38 (1-1/2)	---	0.4-0.9	---	0.8-2.1	1.0-2.0	---
45	---	0.4-0.9	---	0.8-2.2	1.0-2.2	---
51 (2)	---	0.4-1.0	---	---	---	---
55	---	0.4-1.1	---	---	---	---
65	---	0.4-1.2	---	---	---	---
Key 30 Spring	1340387	1269356	1285548	1280023	1285548	1285548
Key 31 Spring	---	---	---	1280058	1285556	1285556

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Key 30 Size P462 Actuator Spring

TRAVEL	DIAPHRAGM PRESSURE RANGE			
mm (Inches)	bar			
29 (1-1/8)	---	---	---	1.7-2.2
32	---	---	---	1.7-2.3
38 (1-1/2)	---	---	---	1.7-2.4
45	---	---	---	1.7-2.5
51 (2)	---	1.1-1.8	---	1.6-2.5
55	---	1.1-1.9	---	1.6-2.5
65	---	1.1-2.0	---	1.4-2.5
76 (3)	0.5-0.9	1.1-2.2	1.5-2.4	---
80	0.5-0.9	1.1-2.3	1.5-2.4	---
100	0.5-0.9	---	1.3-2.5	---
102 (4)	0.5-1.1	---	1.3-2.5	---
120 (4-3/4)	0.5-1.2	---	1.2-2.6	---
Key 30 Spring	1269771	1280155	1280171	1389971

Key 30 Size P460-200 Actuator Spring

TRAVEL	DIAPHRAGM PRESSURE RANGE			
mm (Inches)	bar			
127 (5)	0.6-1.2	0.8-1.9	1.5-2.8	
152 (6)	0.6-1.3	0.8-2.1	1.5-3.0	
165 (6-1/2)	0.6-1.4	0.8-2.2	1.5-3.1	
178 (7)	0.6-1.5	0.8-2.3	1.5-3.3	
203 (8)	0.6-1.6	0.8-2.5	1.5-3.5	
Key 30 Spring	0265144	0265144	0413917	
Key 31 Spring	---	0265152	0413925	

Keys 30 and 31 Size P900 Actuator Spring

TRAVEL	DIAPHRAGM PRESSURE RANGE			
mm (Inches)	bar			
32	1.1-1.6	---	---	---
45	1.1-1.8	---	---	---
51 (2)	1.1-1.9	---	---	---
55	1.1-2.0	---	---	---
65	1.1-2.2	---	---	---
76 (3)	1.1-2.3	1.7-2.8	---	---
80	1.1-2.4	1.7-2.9	---	---
102 (4)	---	---	1.2-2.4	1.7-3.1
120 (4-3/4)	---	---	1.2-2.6	1.7-3.3
Key 30 Spring	1261029	1280732	1280821	1230328
Key 31 Spring	1261037	1280759	1280848	1230344

Figure 3. Fisher 3025 Size P460 Air-to-Open Actuator

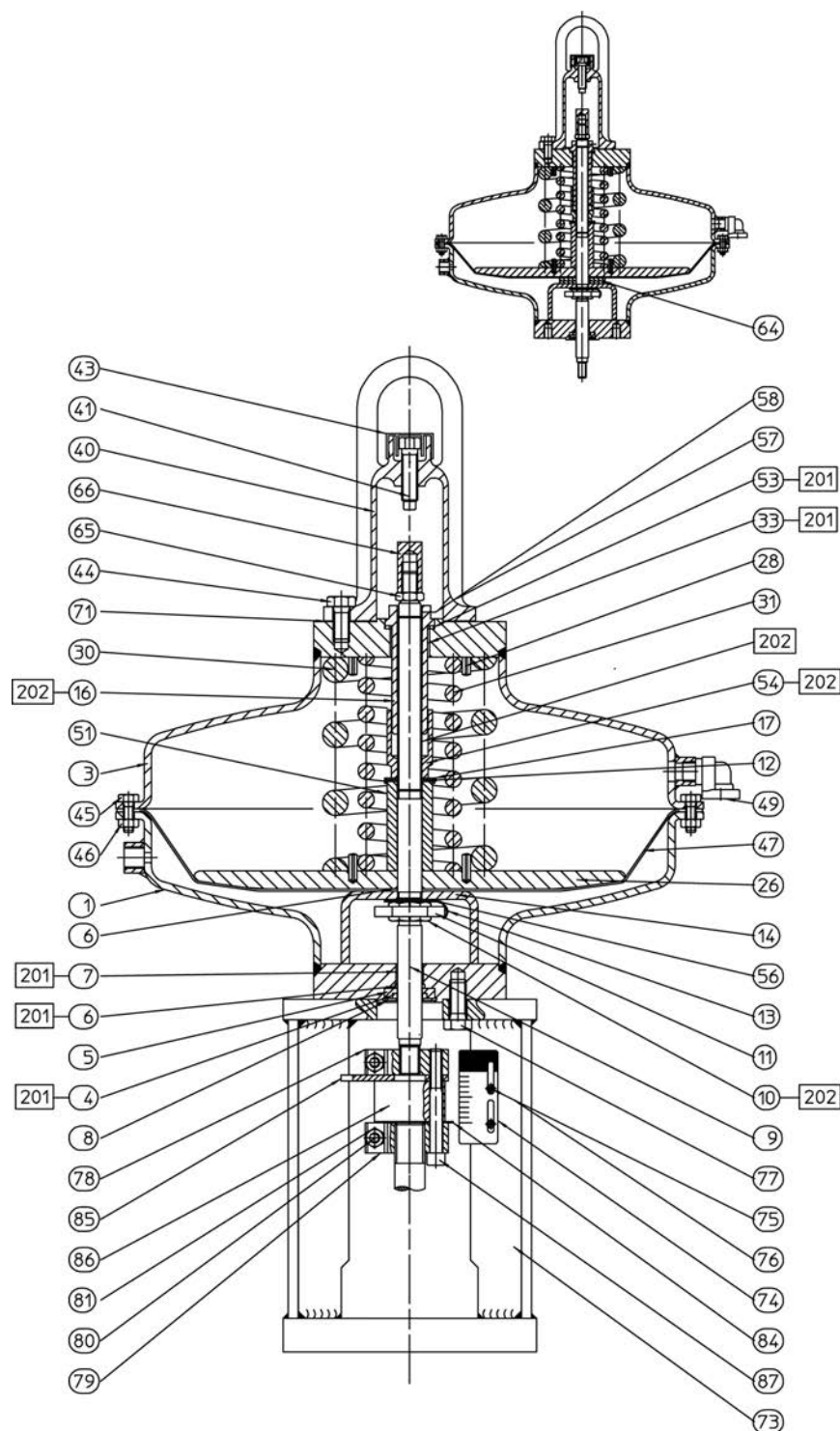
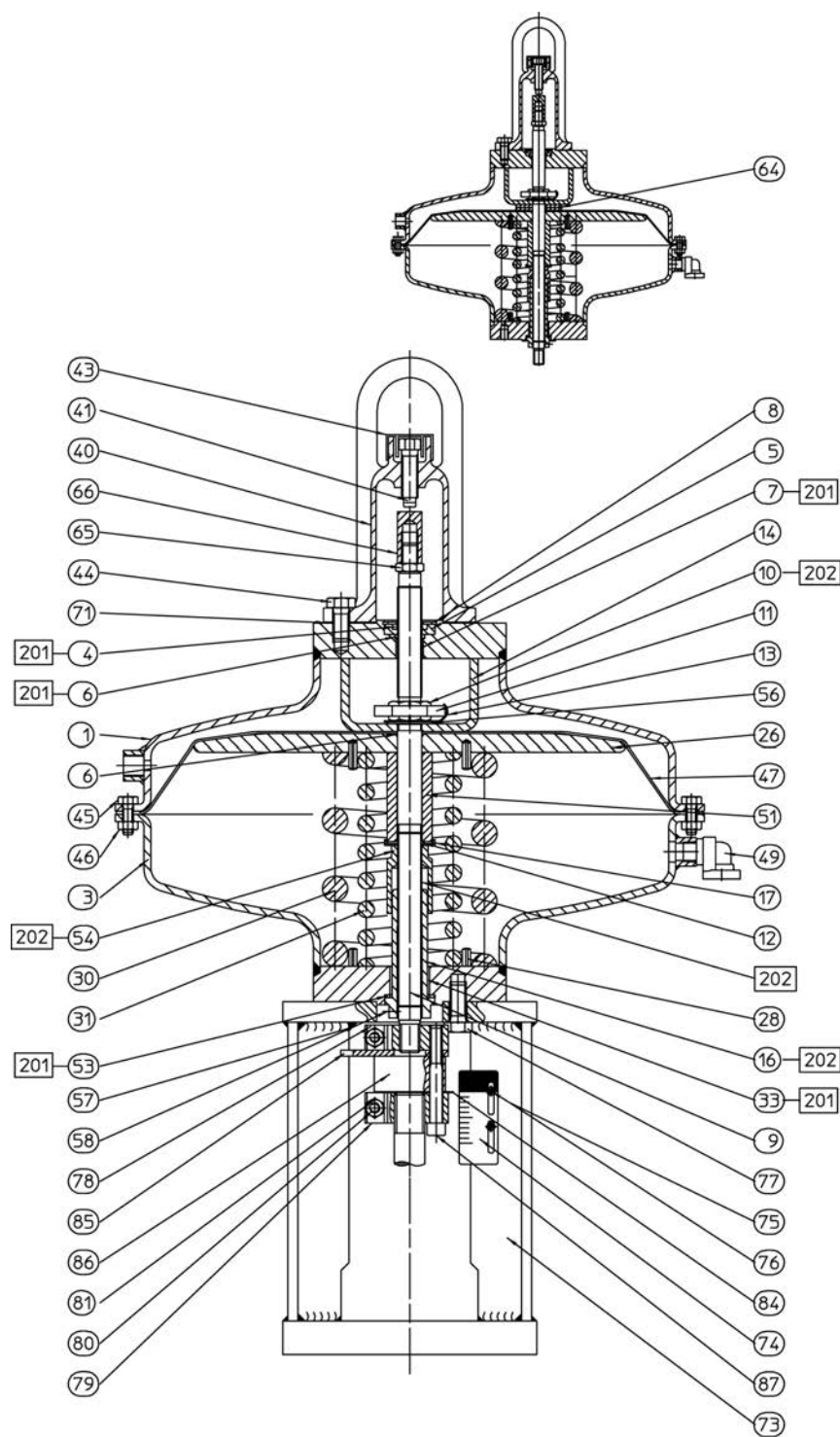


Figure 4. Fisher 3025 Size P460 Air-to-Close Actuator



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Figure 5. Fisher 3025 Size P462 Air-to-Open Actuator

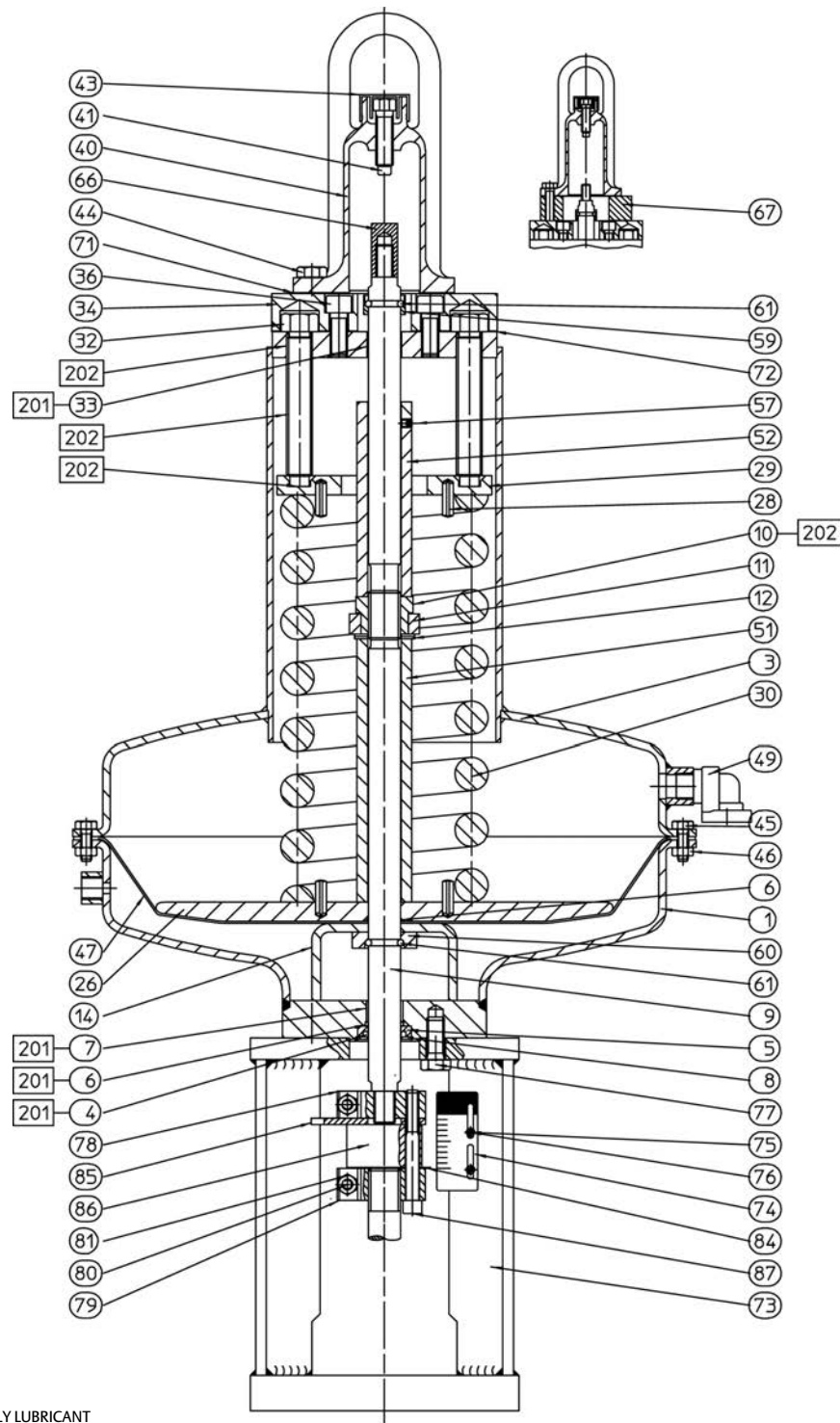


Figure 6. Fisher 3025 Size P462 Air-to-Close Actuator

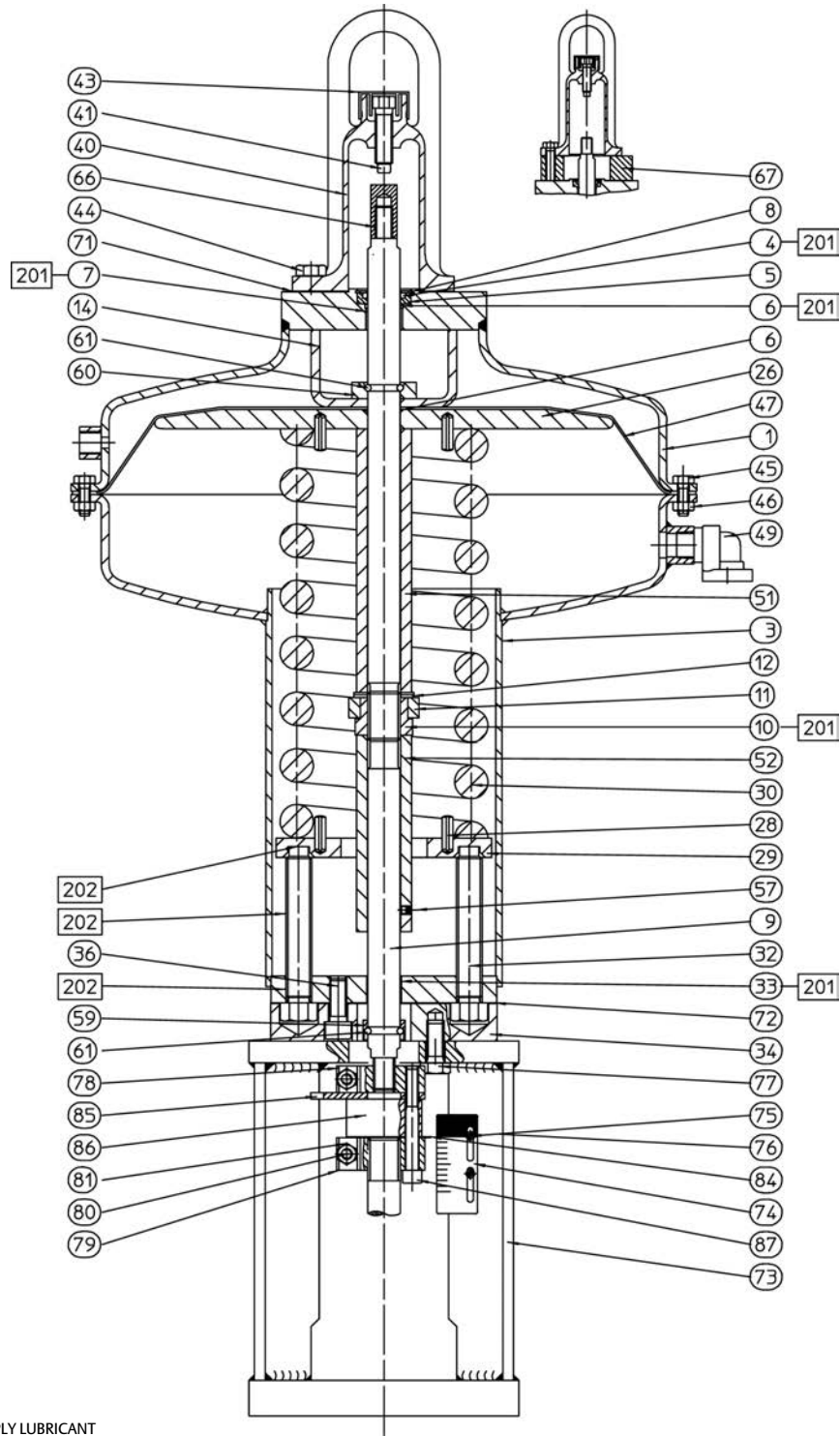
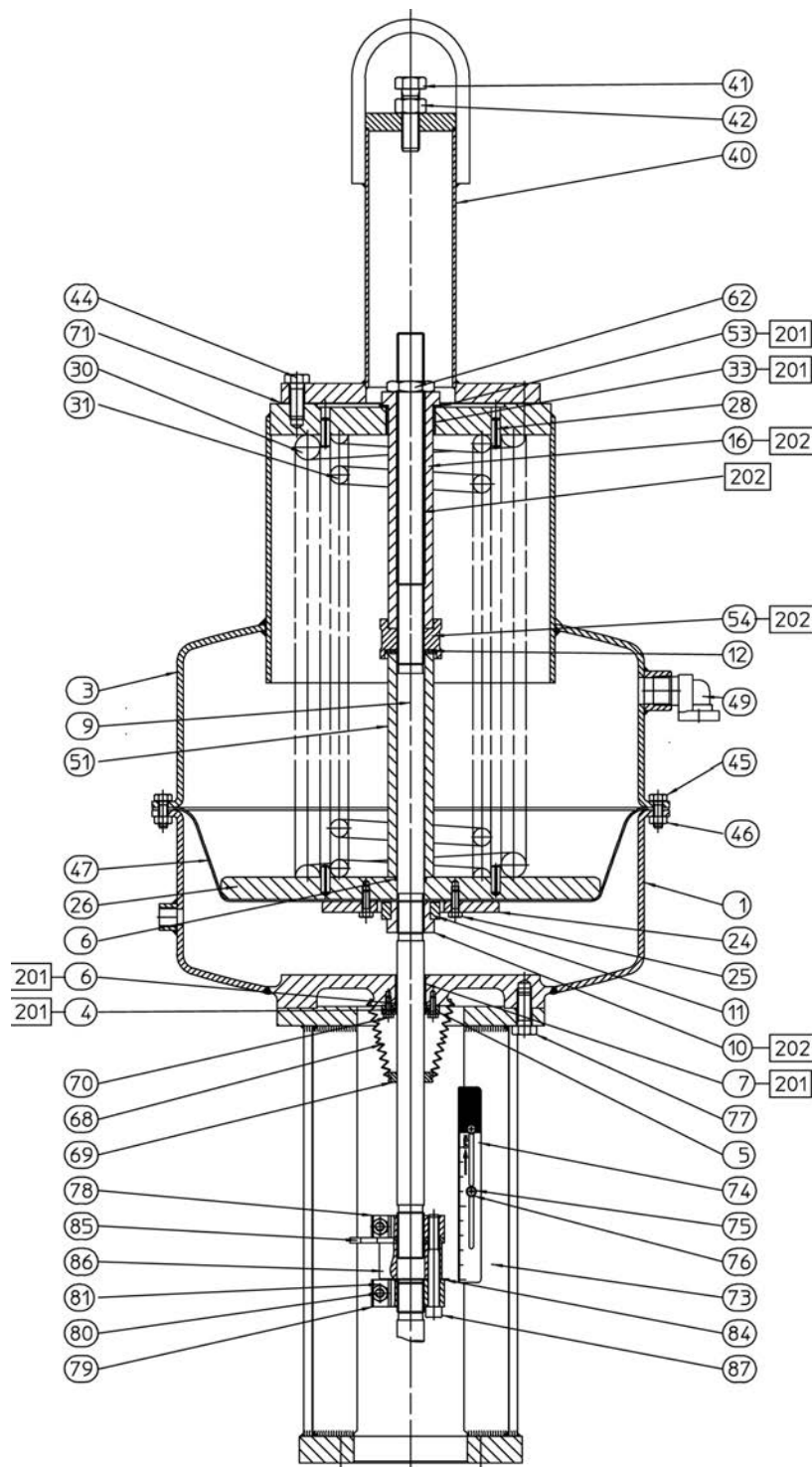
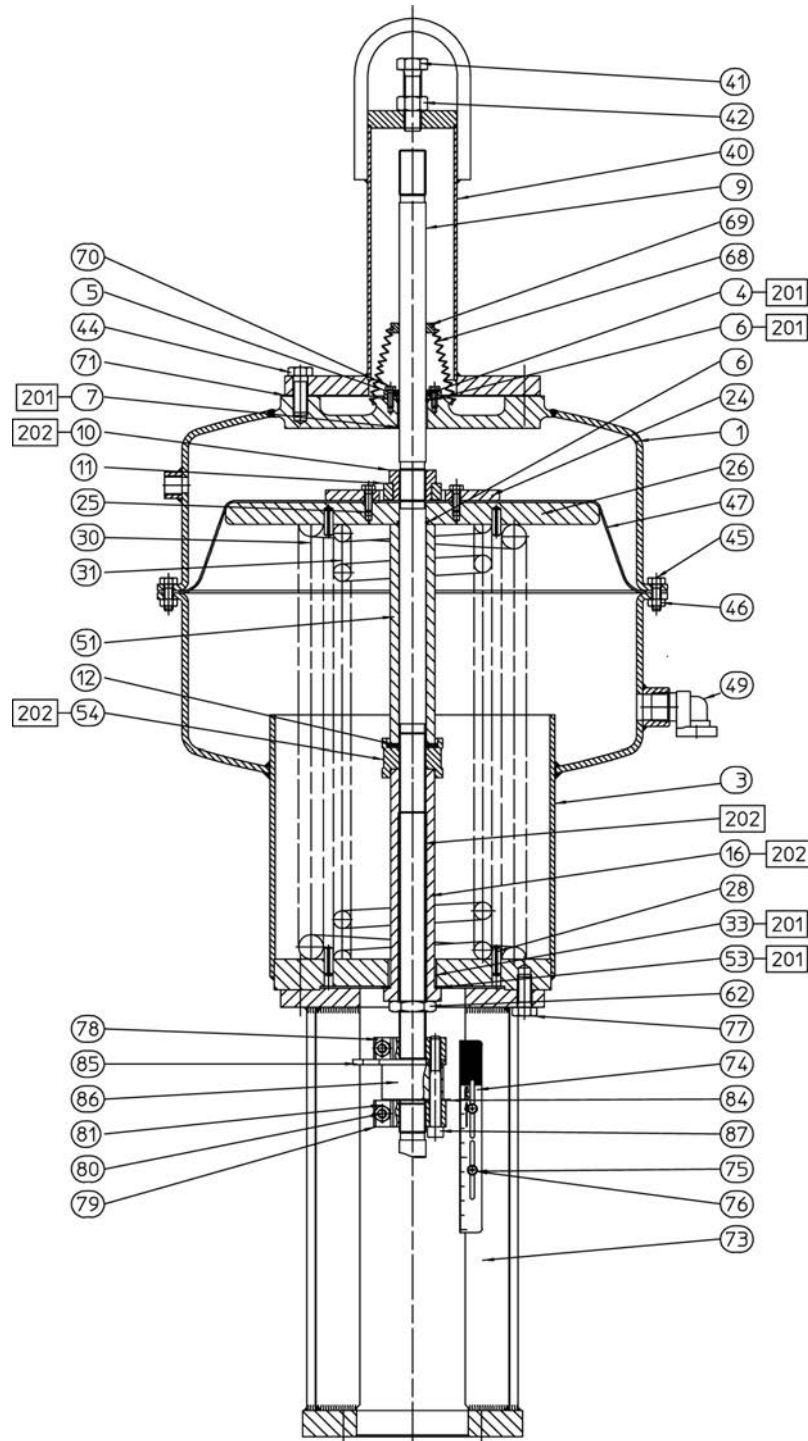


Figure 7. Fisher 3025 Size P460-200 Air-to-Open Actuator



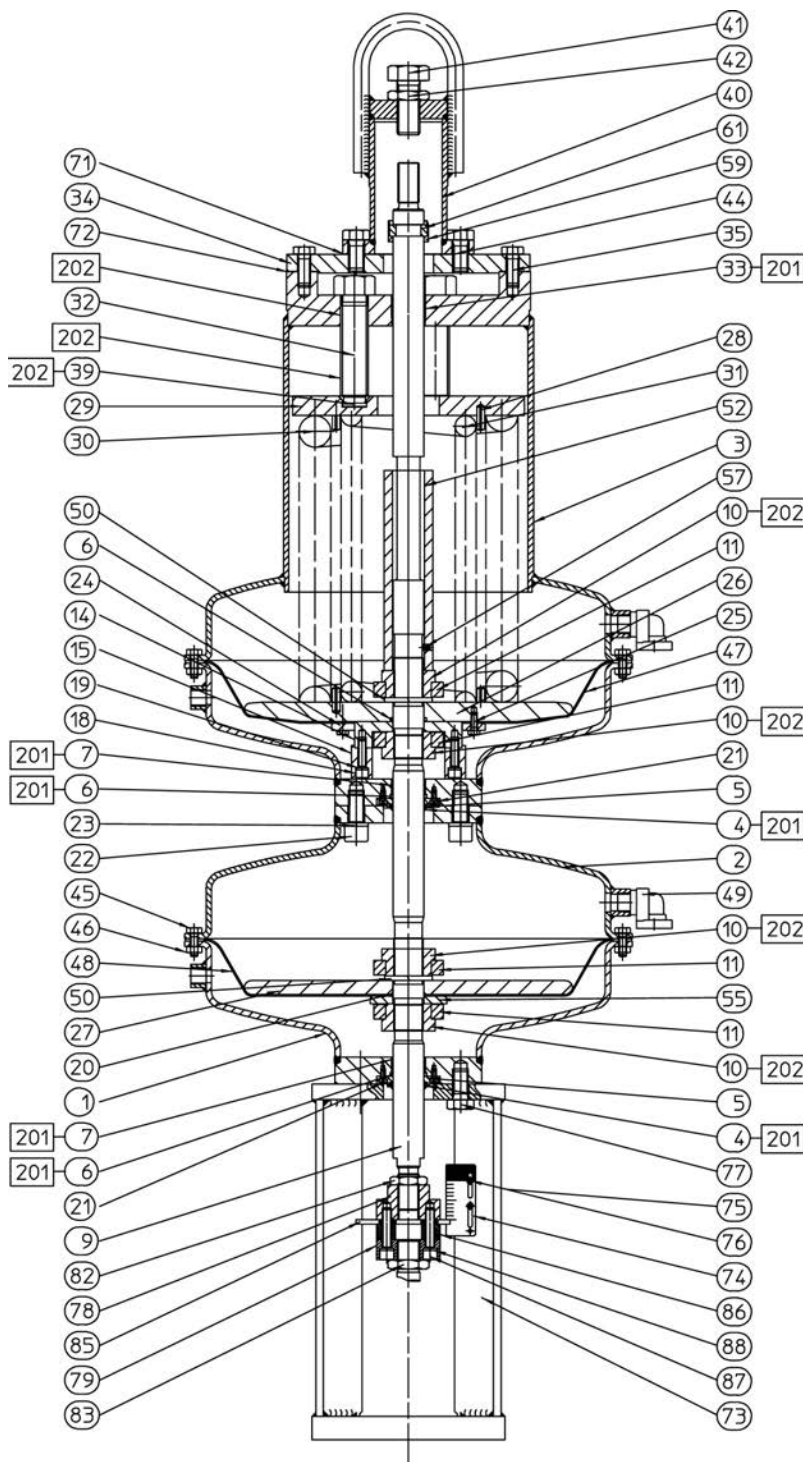
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Figure 8. Fisher 3025 Size P460-200 Air-to-Close Actuator



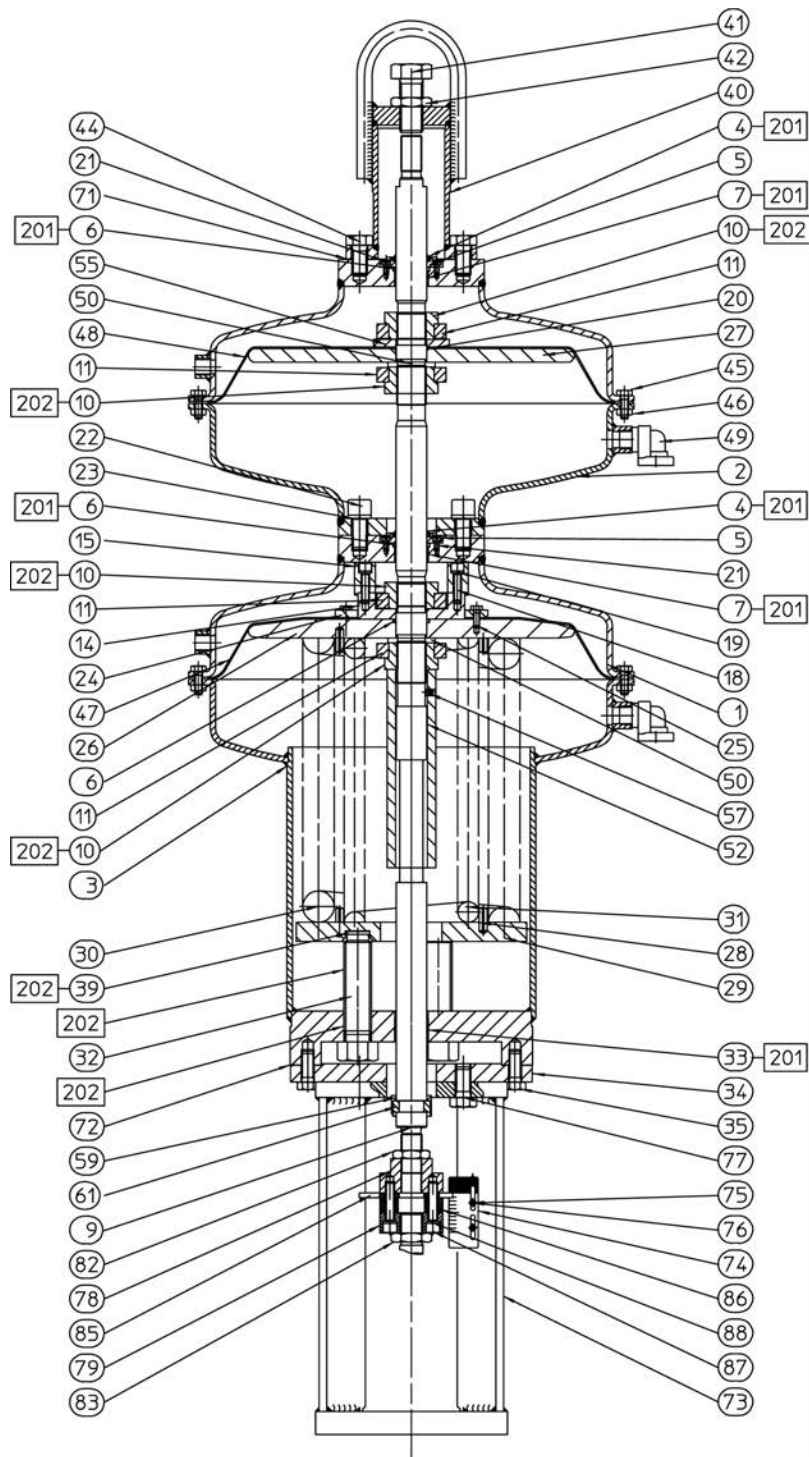
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Figure 9. Fisher 3025 Size P900 Air-to-Open Actuator



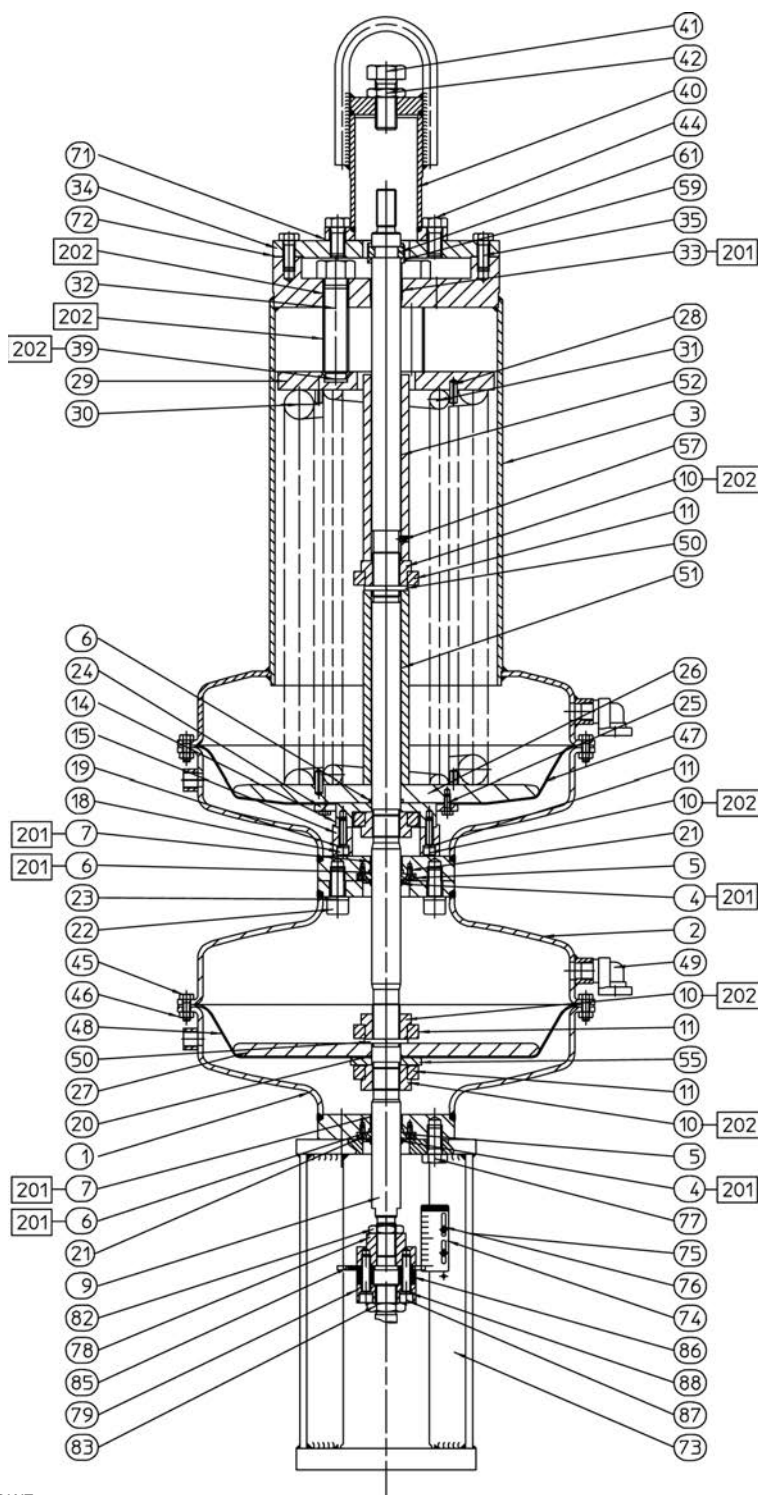
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Figure 10. Fisher 3025 Size P900 Air-to-Close Actuator



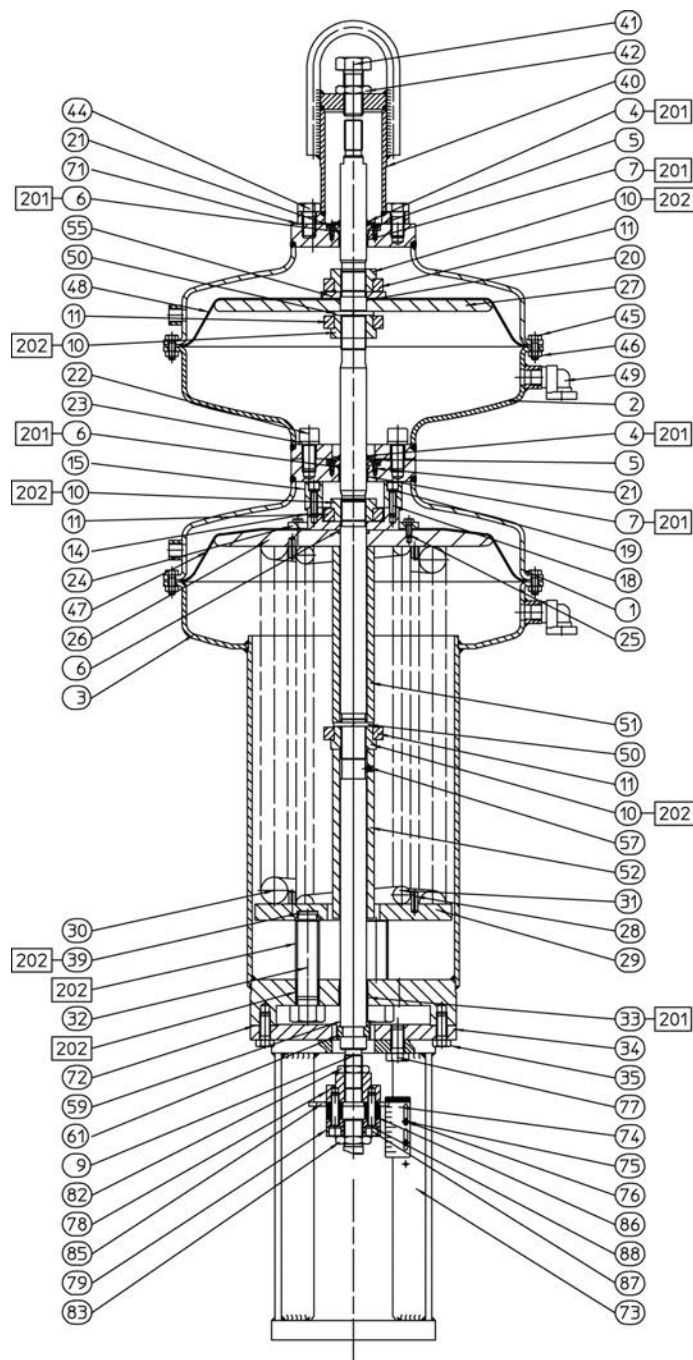
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Figure 11. Fisher 3025 Size P900 Air-to-Open Actuator (long stroke high bench set)



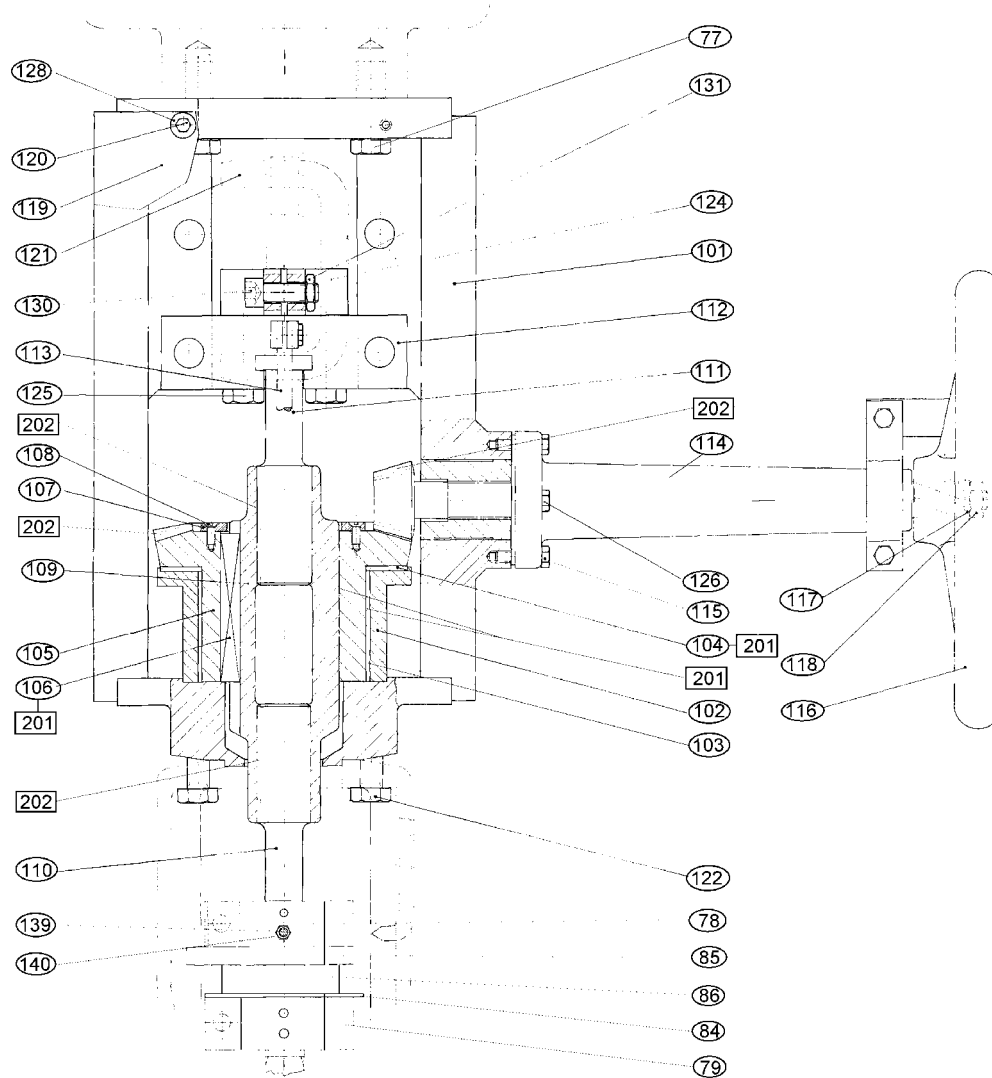
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Figure 12. Fisher 3025 Size P900 Air-to-Close Actuator (long stroke high bench set)



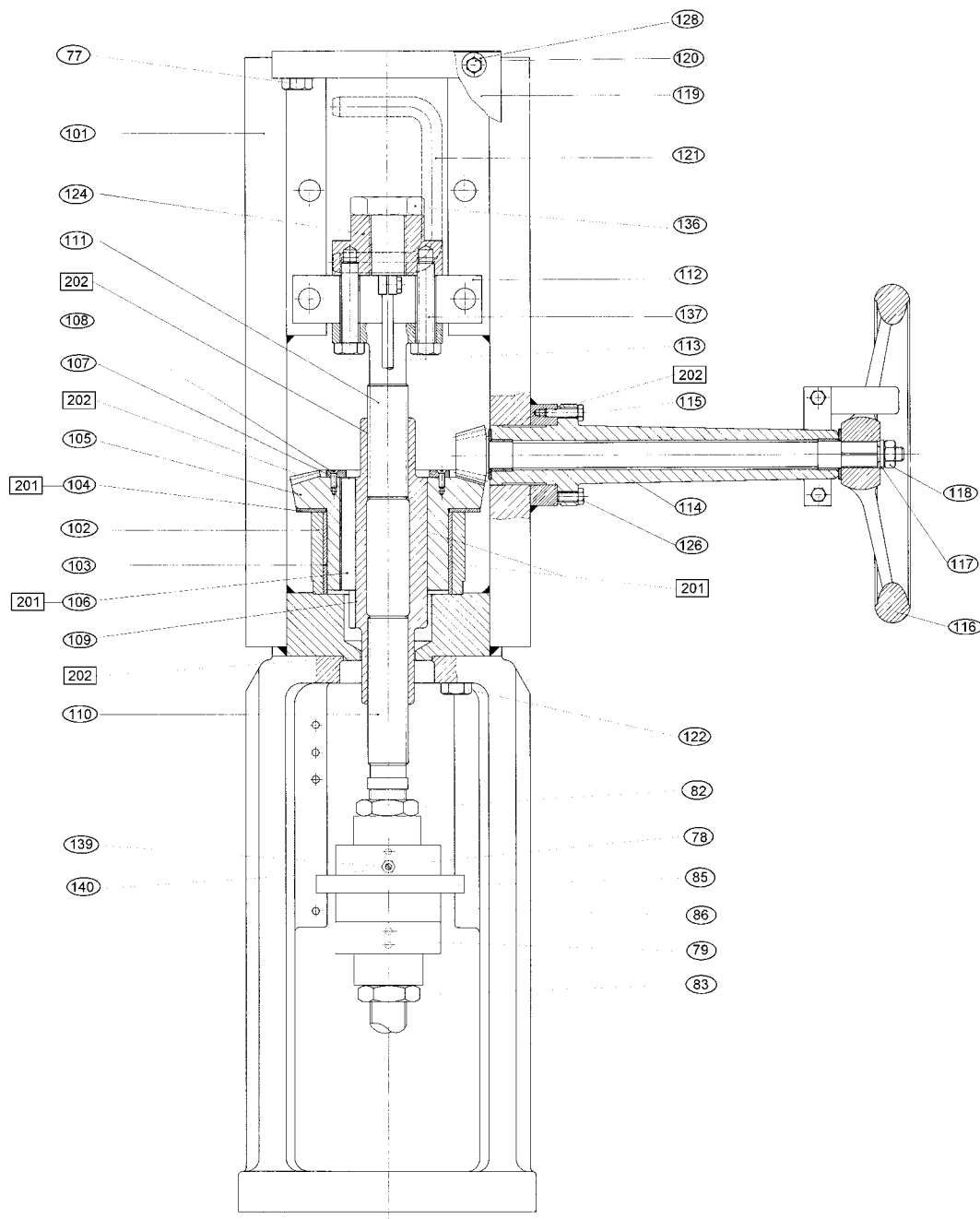
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Figure 13. Fisher 3025 Size P460 and P462 Side Mounted Handwheel



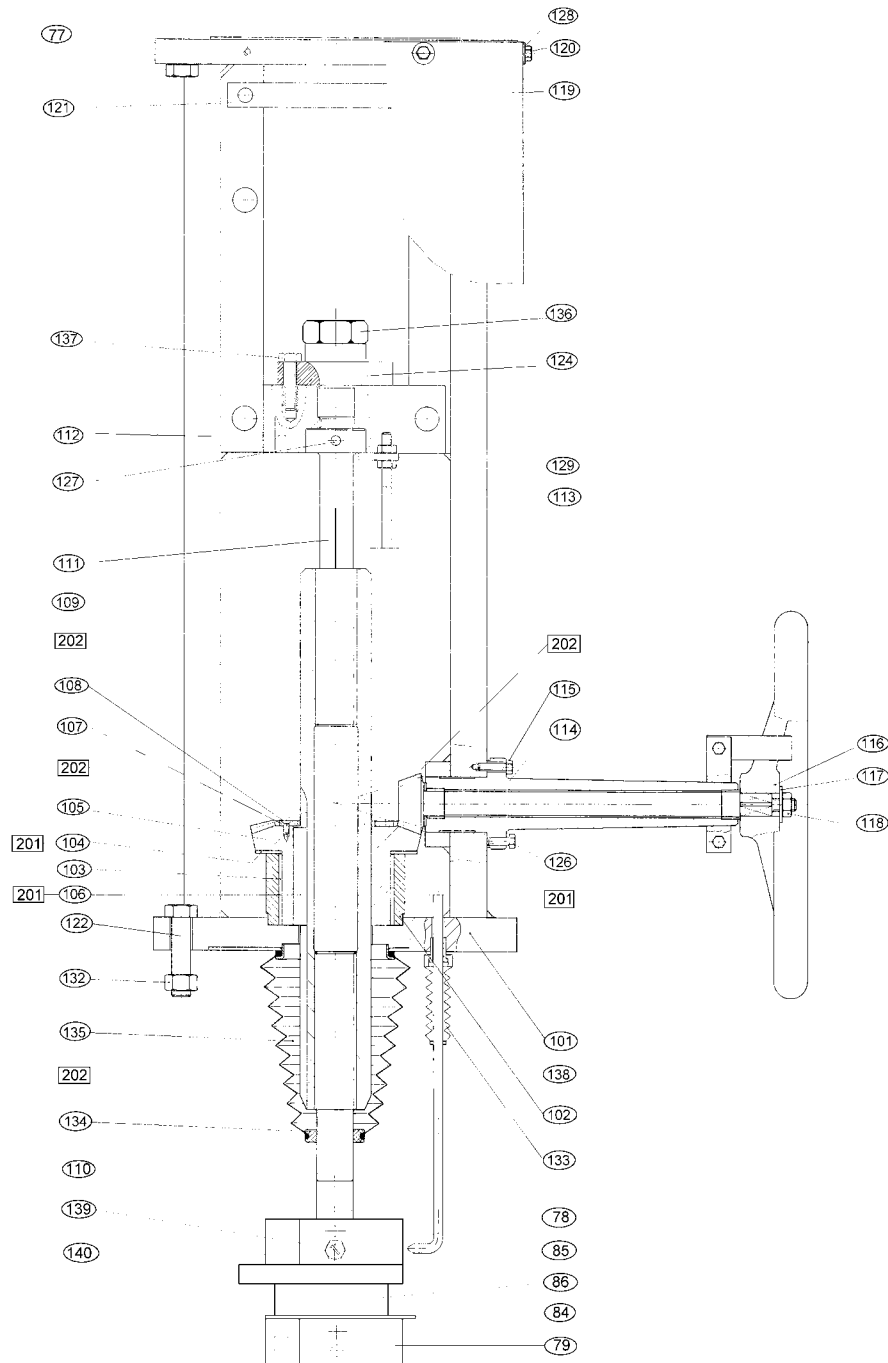
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Figure 14. Fisher 3025 Size P900 Side Mounted Handwheel



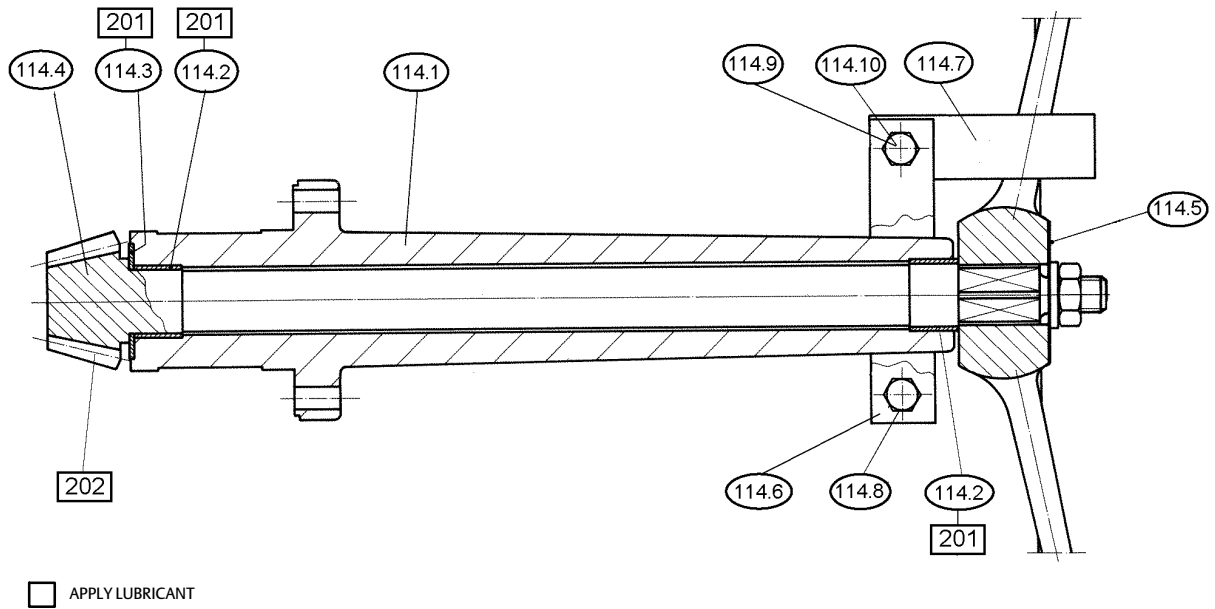
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Figure 15. Fisher 3025 Size P460-200 Side Mounted Handwheel



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Figure 16. Fisher Driving Shaft Assembly for all Side Mounted Handwheel Sizes



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Fisher™ 6010 -- 6015 and Whisper Disk Diffusers

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Figure 1. Typical Fisher Inline and Vent Diffusers



Table 1. Specifications (for Standard Designs)

Available Configurations 6010: Inline diffuser (with integral outlet head) 6011: Inline diffuser (pipe-style) Whisper Disk: Inline diffuser (flat plate) 6012: Drilled-hole Vent diffuser 6013: Drilled-hole Vent diffuser (with outer shell) 6014: WhisperFlo disc style 6015: WhisperFlo disc style (with outer shell) Sizes 6010: NPS 1 x 3 to NPS 26 x 48 (inlet x outlet) 6011: NPS 2 to NPS 30 Whisper Disk: NPS 2 to NPS 24 6012: NPS 2 to NPS 26 6013: NPS 2 to NPS 26 (outer shell NPS 4 to 36) 6014: Sizes are available to meet your application (see bulletin 80.3:6014)	6015: With outer shell. Sizes are available to meet your application (see bulletin 80.3:6014) End Connections 6010: Any combination of flanged (raised-face, ring-type joint, and flat-face) or welded end (buttweld or socket weld) 6011: Wafer flanged Whisper Disk: Raised-face or ring-type joint flanged 6012 and 6013: Raised-face flanged, ring-type joint flanged, or buttweld end 6014 and 6015: Raised-face flanged, ring-type joint flanged, or buttweld end Note Inline and vent diffusers are not hydrostatically tested.
---	---

Introduction

Scope of Manual

This instruction manual includes operation, installation, and maintenance information for the following diffusers:

- 6010, 6011, and Whisper Disk Inline Diffusers. See figure 1
- 6012 and 6013 drilled-hole vent diffusers. See figures 2 and 3
- 6014 and 6015 WhisperFlo disc style vent diffusers. See figures 4 and 5

Do not install, operate, or maintain these diffusers without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

Inline and vent diffusers are installed to provide backpressure for control valves, which greatly reduces control valve noise generated by steam, gas, or vapor flow applications. Inline diffusers are placed downstream of the valve and are either placed in or between pipe. Vent diffusers are placed downstream of the valve and vent process to the atmosphere. Fisher inline and vent diffusers are used in gas, vapor, and steam applications.

Principle of Operation

Inline and vent diffusers are custom designed to match a wide range of valve outlet and/or pipeline size. Furthermore these diffusers are selected to match the application specific conditions including temperature, pressure, and flow capacity. The flexibility of the diffuser types and placement provide a range of installation possibilities. The diffuser is not required to be installed adjacent to the control valve.

The 6010 is an inline diffuser that fits between two different sizes of pipe to meet both downstream and upstream pipe sizes with an integral outlet head. The 6011 is a pipe-style inline diffuser that extends into existing pipe using a wafer flange connection. The Whisper Disk is a flat plate-style inline diffuser that is available with a raised-face flanged connection. The 6012, 6013, 6014, and 6015 are vent diffusers that are designed to reduce noise during process venting applications.

Piping Considerations

Upstream piping should be the same nominal diameter as the diffuser inlet connection and vice versa.

The drilled hole pattern of the Whisper Disk inline diffuser must be within the inside diameter of the mating flange schedule.

Reducers or elbows are not recommended downstream unless they are at least four to five downstream pipe diameters downstream of the diffuser outlet.

Installation

Before installation, all piping to the diffuser must be blown clean, so that no particles, such as welding beads, dirt or other foreign matter, are left in the pipeline. Keep foreign matter away from the line openings while preparing the diffuser for installation.

CAUTION

Cleanliness of the upstream piping is critical. Debris in the piping can damage the diffuser and severely restrict flow, causing overpressure.

Inspect the inside of the diffuser and clean if necessary.

Arrange a lifting sling around the diffuser to safely place it into the mounting position.

Note

To avoid flow interaction and reduce noise in 6012, 6013, 6014, and 6015 vent diffuser applications, do not install diffusers in close proximity to support structures and ensure that adjacent diffusers are installed at different heights.

6013 and 6015 diffusers with shell are provided with mounting brackets for wind and side loads. These mounting brackets also provide support, so the entire weight of the diffuser is not on the inlet connection. The end-user shall provide the necessary support structure to interface with the provided mounting brackets on the diffuser.

Flanged Connections—For high temperature applications, grease the flange connection bolts with a high temperature thread lubricant. Install flange gaskets and connection bolts per accepted practices and tighten securely.

Re-tighten bolts after the diffuser has been pressurized. Do not expose the diffuser to undue stresses by installing it in bent pipes or bent flanges.

Welded Connections—Welding procedures should be in accordance with the applicable codes and the base materials. For preheat, welding electrodes, and post-weld heat treatment, refer to the standard applicable codes and practices. Materials are specified on the diffuser specification sheet that is delivered together with the diffuser.

Maintenance

Servicing

The diffuser has no serviceable parts. However, during routine maintenance intervals it is important to inspect the diffuser for damaged or cracked welds (exclusive of the Whisper Disk diffuser). Your local Emerson Automation Solutions Instrument and Valve Services office can help determine the correct course of action if damage is present. The diffuser is normally welded or bolted in line and not removed unless it requires cleaning or replacement due to damage or wear.

In the event the diffuser is not performing as expected, a bore scope can be used to examine the flow passages for blockages without the need for disassembly and removal. If blockages are present, cleaning can be performed by removing the unit by either cutting of the welds or removal of bolting and using a pressurized water stream to clear any blockages. If blockages are still present after cleaning, the unit will need to be replaced.

Troubleshooting

Table 2 is intended as a basic first line troubleshooting guide. Contact your [Emerson sales office](#) or Local Business Partner for assistance if you are unable to resolve your field operation problem.

Table 2. Troubleshooting Guide

Problem	Possible Solution
Anticipated backpressure is not reached.	Review valve conditions and opening percentage
	Check for process flow changes and/or Inspect unit.
	Inspect flow passages in diffuser for blockage, clean if necessary
System noise and vibration have suddenly increased above previous levels.	Review operating history to check for process flow changes. Inspect unit.

Parts Ordering

There are no serviceable spare parts for this unit.

Note

Each diffuser is assigned a serial number that can be found on the unit. Refer to the serial number when contacting your [Emerson sales office](#) or Local Business Partner for technical assistance.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

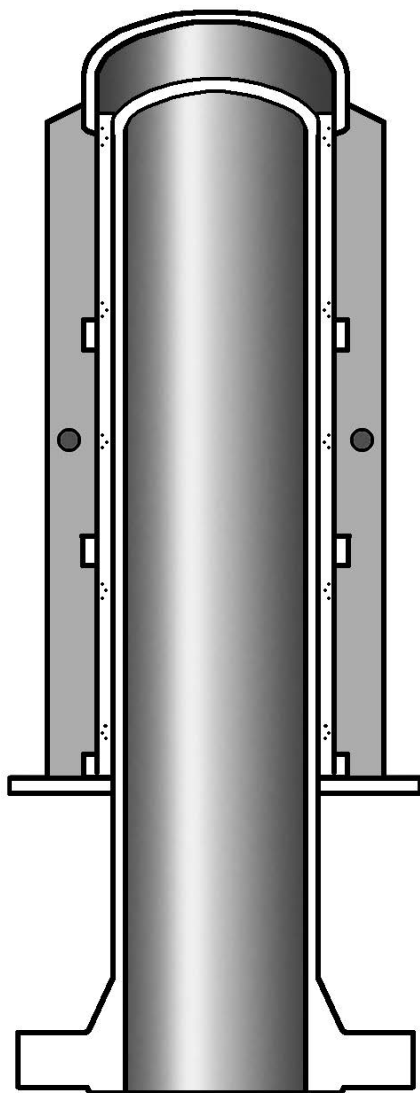
Inline and Vent Diffusers

June 2017

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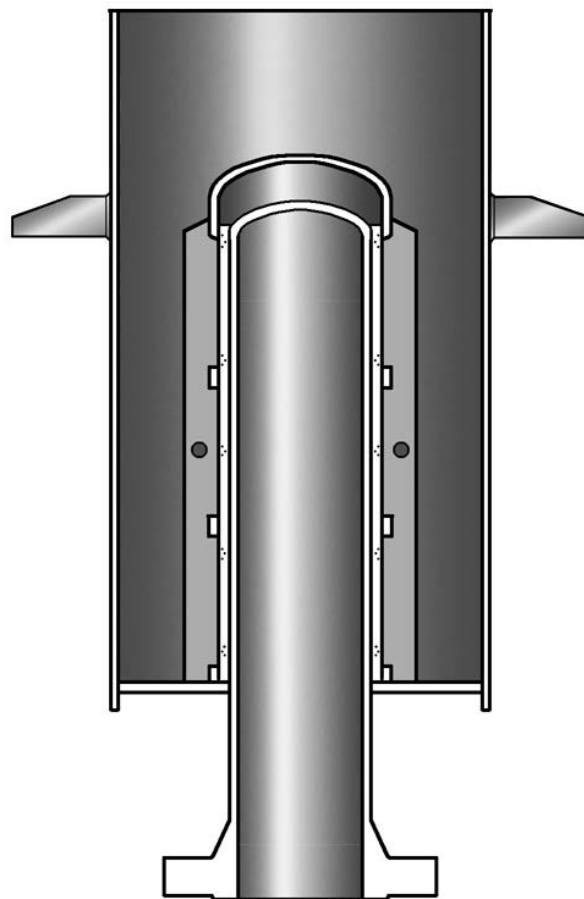
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Figure 2. Fisher 6012 Vent Diffuser



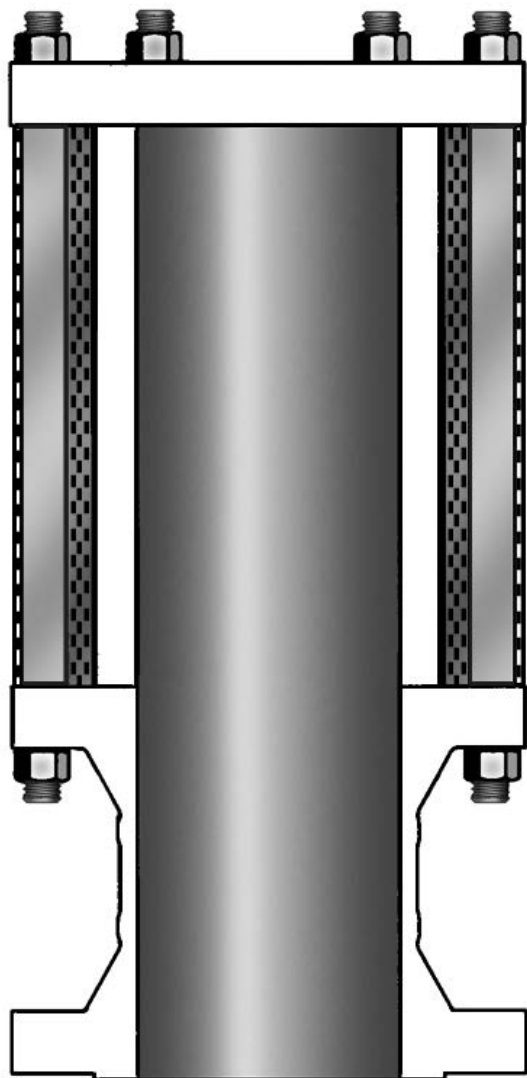
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Figure 3. Fisher 6013 Vent Diffuser



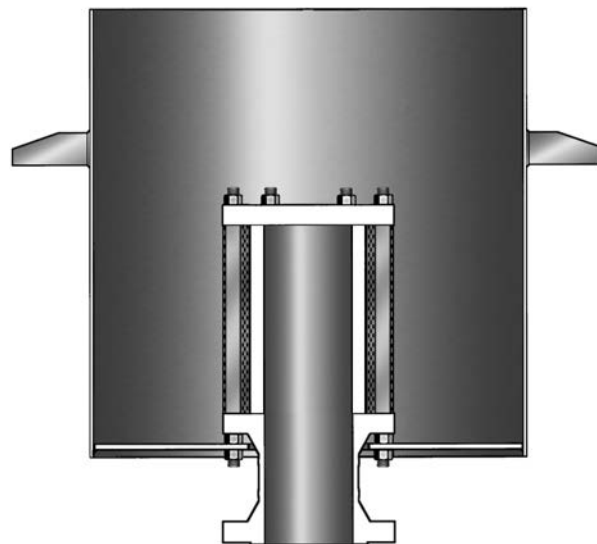
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Figure 4. Fisher 6014 Vent Diffuser



W8798-1

Figure 5. Fisher 6015 Vent Diffuser



W8799-1

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Inline and Vent Diffusers

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D103195X012

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Fisher™ 6060 WhisperTube Model Attenuator



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual provides installation, maintenance and parts ordering information for the NPS 2 through 12 Fisher WhisperTube modal attenuator.

1.2 Description

The WhisperTube is a passive reactive silencer designed for installation downstream of the control valve or other equipment contributing to system noise. Requiring negligible pressure drop across the device, the WhisperTube achieves system noise reduction across a wide range of fluid flow rates, pressures and temperatures.

Figure 1. Fisher 6060 WhisperTube



Table 1. Specifications

Valve Sizes and End Connection Style	Temperature Capability
NPS 2, 3, 4, 6, 8 and 12 with CL150, CL300 or CL600 raised-face flanges compatible with ASME B16.5	-46 to +371°C / -50 to +700°F
Maximum Inlet Pressure ⁽¹⁾	Weights and Threaded Lifting Provision Size
Consistent with CL150, CL300 or CL600 pressure-temperature ratings per ASME B16.34	See Table 3
Construction Materials	Design Standards
See Table 2	The WhisperTube pressure boundary is designed in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 2.
1. The pressure/temperature limits in this manual and any applicable standard limitations should not be exceeded.	

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Table 2. Construction Materials

PART	MATERIAL	TEMPERATURE LIMITS	
		°C	°F
Body	WCC / LCC ⁽¹⁾	-46 to +427	-50 to +800
Retainer ⁽²⁾	LF2	-46 to +427	-50 to +800
Retainer gasket ⁽²⁾	Laminated Graphite	-254 to +427	-425 to +800
Screen	S30400	-254 to +427	-425 to +800
Wave spring	N07750	-254 to +371	-425 to +700
Studs ⁽³⁾	B7M	-48 to +427	-55 to +800
Nuts ⁽³⁾	2HM	-48 to +427	-55 to +800
Spiral wound gasket ⁽³⁾	N06600/Graphite	-254 to +454	-425 to +850

1. WCC and LCC dual certified.
 2. NPS 2 through NPS 6 constructions only.
 3. NPS 8 through NPS 12 constructions only.

Table 3. Assembly Weight and Threaded Lifting Provision Size

VALVE SIZE, NPS	PRESSURE CLASS	WEIGHT		THREADED LIFTING PROVISION	
		kg	lbs	Size	Quantity
2	150	30	67	3/8-16 UNC	1
	300	32	70		
	600	33	73		
3	150	48	105	3/8-16 UNC	1
	300	52	115		
	600	55	120		
4	150	102	224	3/8-16 UNC	2
	300	109	239		
	600	118	259		
6	150	205	452	1/2-13 UNC	2
	300	224	492		
	600	246	542		
8	150	464	1020	1/2-13 UNC	2
	300	500	1100		
	600	614	1350		
10	150	750	1650	5/8-11 UNC	2
	300	811	1785		
	600	966	2125		
12	150	1025	2255	3/4-10 UNC	2
	300	1109	2440		
	600	1264	2780		

Table 4. Recommended Line Bolting Lengths

WHISPERTUBE SIZE, NPS	PRESSURE CLASS	NUMBER OF STUDS	BOLTING SIZE, IN.	LENGTH OF STUDS	
				mm	in.
2	150	8	5/8	82	3.25
	300	16	5/8	88	3.50
	600	16	5/8	107	4.25
3	150	8	5/8	95	3.75
	300	16	3/4	107	4.25
	600	16	3/4	127	5.00
4	150	16	5/8	95	3.75
	300	16	3/4	114	4.50
	600	16	7/8	146	5.75
6	150	16	3/4	101	4.00
	300	24	3/4	127	5.00
	600	24	1	177	7.00
8 ⁽¹⁾	150	16	3/4	107	4.25
	300	24	7/8	139	5.50
	600	24	1-1/8	196	7.75
10 ⁽¹⁾	150	24	7/8	120	4.75
	300	32	1	158	6.25
	600	32	1-1/4	222	8.75
12 ⁽¹⁾	150	24	7/8	120	4.75
	300	32	1-1/8	177	7.00
	600	40	1-1/4	228	9.00

1. Two-piece body constructions (NPS 8 to 12) use larger size bolting to connect the two body halves, see Table 5 for body flange bolting information.

1.3 Specifications

Specifications for the WhisperTube Model Attenuator are listed in Tables 1, 2, 3 and 4.

1.4 Education Services

Emerson's Education Services
 Phone: 800-338-8158
 Email: education@emerson.com
emerson.com/mytraining

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the WhisperTube assembly where service conditions could exceed the limits given on the 6060 nameplate. Use pressure-relieving devices as required by accepted industry, local, state or federal codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Use proper lifting and rigging practices while moving the WhisperTube. Failure to utilize safe lifting practices may result in equipment damage and/or personal injury.

Avoid personal injury or property damage caused by uncontrolled movement or dropping of the WhisperTube assembly.

The threaded lifting provisions are for installation of hoist rings or lifting eye bolts and are sized for lifting the 6060 only. Do not use lifting provisions to lift the WhisperTube if piping or other equipment is attached.

1. If the WhisperTube will be placed in storage prior to installation, protect the flanges and keep the inside of the body dry and clear of foreign material.
2. Install a three-valve bypass around the 6060 assembly if continuous operation will be necessary during inspection and maintenance.
3. Inspect the WhisperTube body for damage and be certain the body internal cavities are free of foreign material.
4. Be certain that adjacent pipelines are free of any foreign material, such as pipe scale or welding slag, that could damage the WhisperTube.
5. The standard flow direction is with the wave spring (key 4) facing upstream.
6. The WhisperTube may be installed in any orientation and achieve system noise reduction. The recommended orientation for a horizontal pipeline is with the pipe plug and drain port facing down to allow removal of any potential process liquid buildup.
7. Install suitable line flange gaskets and insert the 6060 assembly between the pipeline flanges.
8. Center the WhisperTube by making sure the mating flanges are aligned. Insert flange studs and tighten nuts in a star pattern to ensure the flange gaskets are compressed evenly.

Section 3: Maintenance



WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Use bypass valves or completely shut off the process to isolate the WhisperTube from process pressure.**
- **Remove process pressure and drain the WhisperTube if necessary.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

Disassembly

1. Isolate the WhisperTube from the process pressure, relieve all process pressure and drain any internal liquid buildup if necessary.
2. Remove the WhisperTube from the pipeline.

Follow steps 3 to 5 for a single piece body construction (NPS 2 to 6).

3. Remove the screen retainer (key 8) by loosening the two retainer screws (key 11).
4. Remove the wave spring (key 4) and perforated screen tube (key 2).
5. Inspect the perforated screen tube, wave spring and internal surfaces of the WhisperTube body (key 1) and replace damaged components as necessary. Visually inspect the flange serrated surfaces for any damage that may prevent proper sealing.

Follow steps 6 to 9 for the two-piece body construction (NPS 8 to 12).

6. Set the WhisperTube in a vertical position with one flange resting on a clean soft surface. Use caution to protect the flange serrated surfaces. Separate the two body halves by removing the body flange studs and nuts (keys 13 and 14).
7. Remove the spiral wound gasket (key 12) and perforated screen tube (key 3).
8. The wave spring (key 4) may be accessed and removed from the inlet flange end of the WhisperTube body.
9. Inspect the perforated screen tube, wave spring and internal surfaces of the WhisperTube body (key 1) and replace damaged components as necessary. Visually inspect the flange serrated surfaces for any damage that may prevent proper sealing.

Assembly

Follow steps 10 to 13 for a single piece body construction (NPS 2 to 6).

10. Ensure the old flat sheet gasket (key 9) is removed.
11. Re-insert the perforated screen tube into the body bore until the end of the tube seats against an internal ledge in the body at the outlet flange end.
12. Re-install the wave spring.
13. Center a new flat sheet gasket (key 9) on the screen retainer sealing surface and install on the body. Secure the retainer with washers (key 10) and retainer screws (key 11).

Follow steps 14 to 20 for the two-piece body construction (NPS 8 to 12).

14. Install the wave spring (key 4) in the groove at the flange end of the inlet body half.
15. Assembly is easiest if the parts are oriented vertically. Place the inlet body half flange end down on a clean soft surface. Use caution to protect the flange end serrated surfaces.
16. Install the perforated screen tube in the inlet body half until it contacts the wave spring.
17. Center the spiral wound gasket (key 12) on the inlet body flange serrated surface.
18. Lower the outlet body half over the screen. Ensure the drain pipe plugs and the threaded lifting lugs are aligned and located on the same side of the body in both the inlet and outlet halves.
19. Apply anti-seize lubricant compound to the face and threads of the hex nuts and to the threads of the studs. Install the nuts and studs. Use an appropriate torque device to apply the final torque specification (see Table 5). Tighten nuts in a star pattern to ensure the spiral wound gasket is compressed evenly.

Table 5. Body Flange Torque Specifications

Valve Size, NPS	Pressure Class	Stud Material	Stud Size, in.	Torque, ft-lbs
8	150, 300	B7M	1-1/8 to 8 x 6.75	525
	600		1-1/4 to 8 x 8.75	695
10	150, 300		1-1/4 to 8 x 7.50	695
	600		1-1/2 to 8 x 10.00	1220
12	150, 300		1-1/4 to 8 x 7.70	695
	600		1-5/8 to 8 x 10.75	1570

Section 4: Parts

4.1 Parts Ordering

Always mention the WhisperTube serial number when corresponding with your [Emerson sales office](#) regarding this equipment.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

4.2 Parts List

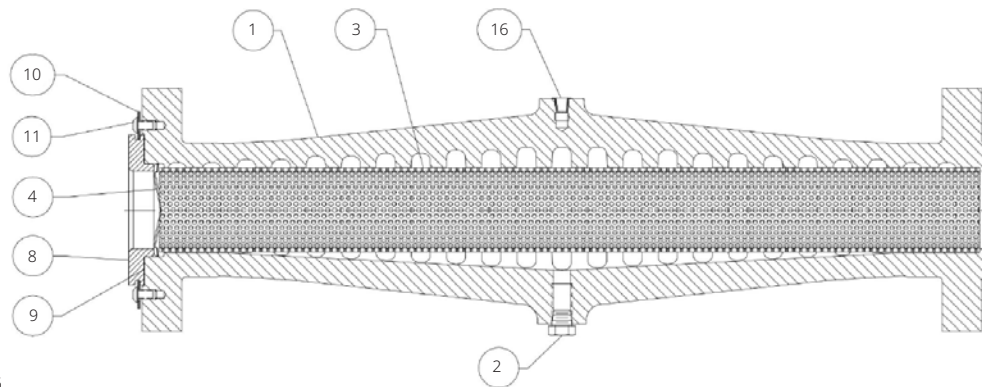
NOTE

Contact your [Emerson sales office](#) for Part Ordering information.

Table 6. Parts List

Key	Description	Key	Description
1	Body If a WhisperTube body is needed as a replacement part, order by size, pressure class, serial number and desired material.	10	Washer
2	Pipe plug	11	Socket head cap screw
3	Screen	12*	Spiral wound gasket
4	Wave spring	13	Stud
5	Nameplate (not shown)	14	Heavy hex nut
6	Drive screw (not shown)	15	Anti-seize lubricant
7	NACE tag (not shown)	16	Thread protector plug
8	Retainer	17	Flow arrow (not shown)
9*	Retainer gasket	---	---
*Recommended spare parts			

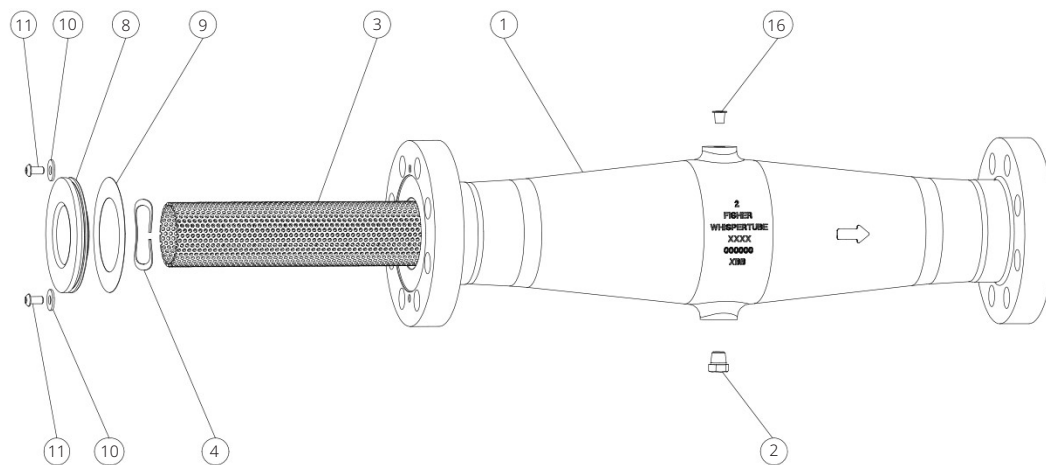
Figure 2. Fisher WhisperTube Cross Sectional View, NPS 2 through 6



GH13406

NOTE: KEY NUMBERS NOT SHOWN ARE 5, 6 AND 7.

Figure 3. Fisher WhisperTube Exploded View, NPS 2 through 6



GG75242

NOTE: KEY NUMBERS NOT SHOWN ARE 5, 6 AND 7.

Figure 4. Fisher WhisperTube Cross Sectional View, NPS 8 through 12

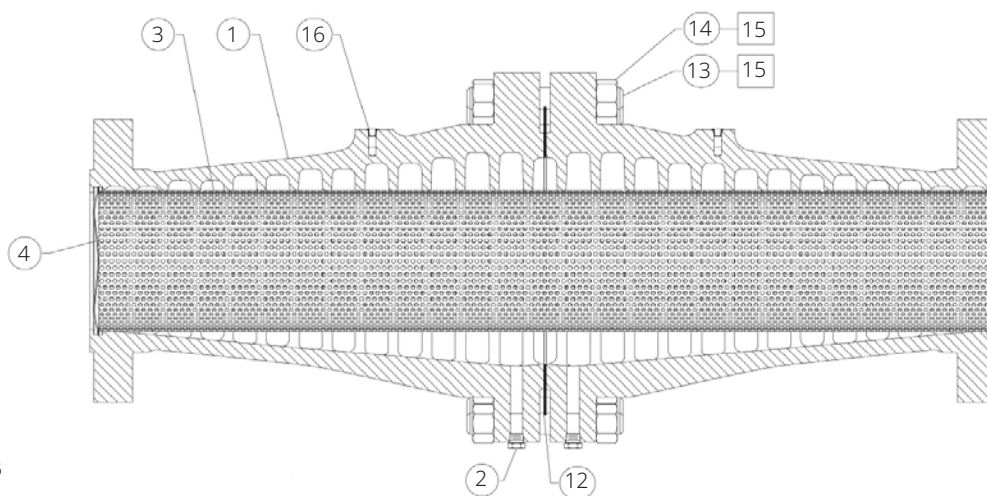
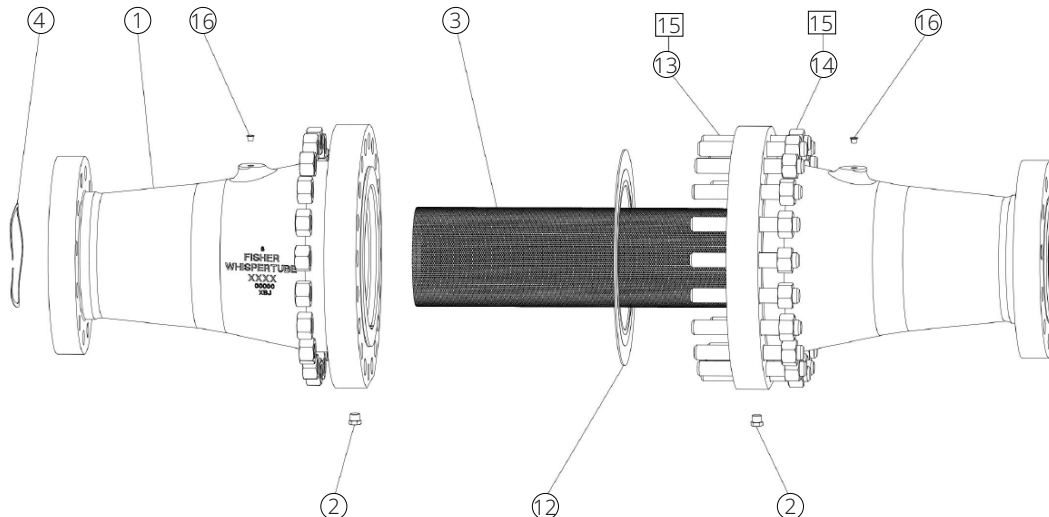
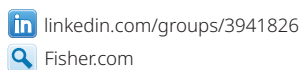


Figure 5. Fisher WhisperTube Exploded View, NPS 8 through 12



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS



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FISHER™



Fisher™ 8532 High-Performance Butterfly Valve



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual provides installation, maintenance and parts information for NPS 14 through 48 Fisher 8532 high-performance butterfly valves.



WARNING



Do not install, operate or maintain an 8532 valve without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

1.2 Description

The valve is available in either a wafer (flangeless), lugged (single-flange) or double flange body design, with a variety of seals and internal components. The pressure-assisted seal provides tight shutoff. The spline or keyed drive shaft combines with a variety of actuators. Maximum inlet pressure/temperature ratings are consistent with CL150 and CL300.

Figure 1. Fisher 8532 Valve with 1061 Actuator and FIELDVUE™ DVC6200 Digital Valve Controller



W9138-2

Table 1. Specifications

Valve Size and End Connection Styles	Flow Coefficients
■ NPS 14, ■ 16, ■ 18, ■ 20, ■ 24, ■ 30, ■ 36, ■ 42 or ■ 48 valves in wafer (flangeless), ■ lugged (single-flange) or ■ double-flange valve bodies with raised-face flanges, CL150 or CL300	See Fisher Catalog 12
Maximum Pressure Drop ⁽¹⁾	Flow Coefficient Ratio ⁽²⁾
Consistent with CL150 and CL300 pressure/temperature ratings per ASME B16.34 NPS 30 to 48: CL150/150 construction has CL150 rated pressure retaining parts and 150 psid rated trim	100 to 1
Shutoff Classification Per ANSI/FCI 70-2 and IEC 60534-4	Noise Levels
Standard Soft Seal: Bidirectional shutoff Class VI (bubble-tight) NOVEX Seal: Unidirectional shutoff Class IV (preferred flow direction only ⁽³⁾), Class VI optional (excluding NPS 42 and 48) Phoenix III Seal: Bidirectional shutoff Class VI (bubble-tight) Phoenix III Seal for Fire-Tested Applications: Unidirectional shutoff Class VI (reverse flow direction only) (bubble-tight). Fire Tested per API 607 Rev. 4. For more information contact your Emerson sales office . Cryogenic: For cryogenic seal applications, consult your Emerson sales office .	See Fisher Catalog 12 for sound/pressure level prediction
Available Seal Configurations	Valve Body Classification
Standard Constructions See Figure 2 and Table 2	Wafer and Lugged face-to-face dimensions are in compliance with MSS SP68 and API 609 standards through NPS 24. Double Flange valve bodies comply with API 609 short face-to-face dimensions. Valve bodies are designed for installation between ASME B16.5 CL150 and CL300 raised-face flanges
Standard Construction Materials	Disk Rotation
See Table 2	Clockwise to close (when viewing from the drive shaft end) through 90 degrees rotation
Flow Characteristic	Shaft Diameter and Approximate Weight
Modified equal percentage	See Tables 4 and 5
	ENVIRO-SEAL™ Packing
	This optional packing system provides improved sealing, guiding and transmission of loading force to control liquid and gas emissions. Contact your Emerson sales office for availability of ENVIRO-SEAL packing.
1. The pressure/temperature limits in this manual and any applicable code or standard limitation should not be exceeded. 2. Ratio of maximum flow coefficient to minimum usable flow coefficient may also be called rangeability. 3. For optimum seal performance, the preferred valve orientation at shutoff is with the retaining ring downstream from the high pressure side of the valve.	

1.3 Education Services

Emerson Education Services

Phone: 800-338-8158

Email: education@emerson.com

emerson.com/en/final-control/services/valve-training

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D101550X012

8532 Valve

May 2026

Table 2. Material Temperature Ratings

COMPONENT AND MATERIAL OF CONSTRUCTION ⁽¹⁾		TEMPERATURE RANGE	
		°C	°F
Valve Body⁽²⁾ Carbon steel (WCC or SA 516-70) ⁽⁷⁾ CF8M (316 SST) CF8M/CF10M (316/316H) ⁽³⁾ dual-certified		-29 to +427 -198 to +538 over 538 to 816	-20 to +800 -325 to +1000 over 1000 to 1500
Disk CF8M (316 SST) CF8M/CF10M (316/316H) ⁽³⁾ dual-certified		-198 to +538 over 538 to 816	-325 to +1000 over 1000 to 1500
Disk Coating Chromium carbide Chrome plating Chromium coating		-198 to +916 -254 to +427 -254 to +593	-325 to +1500 -425 to +800 -425 to +1100
Shaft S20910 S17400 (17-4 pH 1025) N07718 N07750 N05500		-198 to +538 -73 to +427 -254 to +704 over 593 to 816 -198 to +482	-325 to +1000 -100 to +800 -425 to +1300 over 1100 to 1500 -325 to +900
Bearings⁽⁶⁾ PEEK (standard) S31600 ⁽⁴⁾ R30006 (Alloy 6) Bronze		-73 to +260 -198 to +816 -198 to +816 -254 to +302	-100 to +500 -325 to +1500 -325 to +1500 -425 to +575
Packing PTFE packing and PTFE ENVIRO-SEAL packing Graphite packing Graphite packing with oxidizing media Graphite ENVIRO-SEAL packing		-148 to +232 -198 to +916 -198 to +538 -148 to +315	-325 to +450 -325 to +1500 -325 to +1000 -325 to +600
Seal Ring and Backup Ring	PTFE Seal Ring Nitrile backup O-ring Chloroprene backup O-ring EPR backup O-ring Fluorocarbon backup O-ring PTFE backup O-ring	-29 to +93 -43 to +149 -54 to +182 -29 to +204 -73 to +204	-20 to +200 -45 to +300 -65 to +360 -20 to +400 -100 to +400
	UHMWPE⁽⁵⁾ Seal Ring (CL150 Only) EPR backup O-ring Fluorocarbon backup O-ring	-54 to +93 -29 to +93	-65 to +200 -20 to +200
	Phoenix III and/or Fire Tested Construction S31600 and PTFE seal ring with Nitrile backup O-ring Chloroprene backup O-ring EPR backup O-ring Fluorocarbon backup O-ring	-40 to +149 -54 to +149 -62 to +204 -40 to +232	-40 to +300 -65 to +300 -80 to +400 -100 to +200
Seal Ring	NOVEX S31600 seal ⁽⁴⁾ ring (CL150) NOVEX S31600 seal ⁽⁴⁾ ring (CL300) NOVEX S21800 seal ⁽⁴⁾ ring (CL300)	-29 to +538 -29 to +816 -29 to +816	-20 to +1000 -20 to +1500 -40 to +1500
	Cryogenic seal ring	Contact your Emerson Sales office	
Gaskets	Flexible graphite	-254 to +816	-425 to +1500
	Aramid with Neoprene	-254 to +538	-425 to +1000
1. NACE trim constructions are available; consult your Emerson sales office . 2. Special gasket retainer bolts are required for over 482°C / 900°F. 3. Special retaining ring screws for lugged valves over 538°C / 1000°F. 4. For a complete material description, contact your Emerson sales office . 5. UHMWPE stands for ultra high molecular weight polyethylene. 6. Special thrust bearings are required for high temp. applications over 343°C / 650°F (with 6- and 12-in. shaft extensions). Constructions with carbon steel valves and SST disks may require special thrust bearings at temperatures less than 343°C / 650°F. 7. Cast or wrought /plate grades used interchangeably, depending upon availability - unless requested by customer.			

Section 2: Installation

The valve is normally shipped as part of a control valve assembly, with the power actuator mounted on the valve. If the valve or actuator has been purchased separately or if the actuator has been removed for maintenance, mount the actuator on the valve and adjust actuator travel before installing the valve into the line. This is necessary due to the measurements that must be made during the actuator calibration adjustment process. Refer to the Actuator Mounting section of this manual and to the separate actuator instruction manual for mounting and adjusting instructions before proceeding.

WARNING

To avoid personal injury or property damage resulting from the sudden release of pressure:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operation.**
- **Do not install the valve assembly where service conditions could exceed the limits given in this manual or on the nameplates.**
- **Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices to protect from over-pressurizing the system.**
- **Check with your process or safety engineer for any other hazards that may be present from exposure to process media.**
- **If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.**

WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions indicated when the valve was ordered. Because some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines to the power actuator, release pressure from the actuator and disconnect the pressure lines from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you are working on the equipment. See the WARNING at the beginning of the Maintenance section for more information before removing the valve from the pipeline.

2. Install a three-valve bypass around the control valve assembly if continuous operation is necessary during inspection and maintenance of the valve.
3. Inspect the valve to be certain that it is free of foreign material.
4. Be certain that adjacent pipelines are free of any foreign material, such as pipe scale or welding slag, that could damage the valve sealing surfaces.

NOTICE

Damage to the disk will occur if any pipe flanges or piping connected to the valve interfere with the disk rotation path. Minimum inside diameters for flanges or pipe mating with valves are shown in Tables 4 and 5.

2.1 Valve Orientation

The valve can be installed in any orientation, however it is recommended that the valve drive shaft be horizontal and the actuator vertical as shown in Figure 4.

Install the valve with the high-pressure shutoff side in the direction noted by the flow arrow for proper installation and see Figure 4 for more information.

2.2 Before Installing the Valve



WARNING

The edges of a rotating valve disk (key 2, Figure 10 or 11) close with a shearing, cutting motion. To avoid personal injury, keep hands, tools and other objects away from the disk while stroking the valve.

If the 8532 valve is equipped with a fail-open actuator, cycle the valve into the fully closed position. Ensure the valve cannot open during installation by using travel stops, a manual actuator, a constant supply pressure to the pneumatic actuator or other steps as necessary.

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Table 3. Valve Body Data, CL150

VALVE SIZE, NPS	SHAFT DIA. AT YOKE BEARING	FACE-TO-FACE DIMENSION ⁽¹⁾		MINIMUM I.D. ⁽²⁾	APPROXIMATE WEIGHT, kg		
		Wafer and Lugged	Double- Flange				
	mm				Wafer	Lugged	Double- Flange
14	30.2	92.1	191	331.2	71.7	94.8	152
16	31.75	101.6	216	375.2	93.9	137.9	201
18	38.1	114.3	222	418.8	139.3	178.3	243
20	44.45	127.0	229	464.1	166.9	223.6	277
24	57.15	154.0	267	580.9	255.4	350.6	434
30	76.2	158.8	---	717	528	736	---
36	95.3	177.8	---	865.9	806	1120	---
42	101.6	228.6	---	1007.4	1302	1550	---
48	114.3	260.4	---	1147.3	1904	2248	---
VALVE SIZE, NPS	SHAFT DIA. AT YOKE BEARING	FACE-TO-FACE DIMENSION ⁽¹⁾		MINIMUM I.D. ⁽²⁾	APPROXIMATE WEIGHT, lbs		
		Wafer and Lugged	Double- Flange				
	in.				Wafer	Lugged	Double- Flange
14	1-3/16	3.625	7.50	13.04	158	209	335
16	1-1/4	4	8.50	14.77	207	304	443
18	1/2	4.5	8.75	16.49	307	393	535
20	1-3/4	5	9.00	18.27	368	493	611
24	2-1/4	6.0625	10.50	22.87	563	773	956
30	3	6.25	---	28.23	1164	1623	---
36	3.75	7	---	34.09	1778	2470	---
42	4	9	---	39.66	2871	3418	---
48	4.5	10.25	---	45.17	4198	4955	---
1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications. 2. Minimum I.D. is the minimum pipe or flange I.D. required for disk swing clearance. Applies to wafer and lugged valve bodies only.							

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Table 4. Valve Body Data, CL150/150

VALVE SIZE, NPS	SHAFT DIA. AT YOKE BEARING	FACE-TO-FACE DIMENSION ⁽¹⁾		MINIMUM I.D. ⁽²⁾	APPROXIMATE WEIGHT, kg		
		Wafer and Lugged	Double- Flange		Wafer	Lugged	Double- Flange
	mm						
30	63.5	120.7	---	723.9	365	525	---
36	69.9	149.4	---	871.5	626	897	---
42	82.6	209.6	---	1011.9	1100	1328	---
48	95.3	228.6	---	1158.0	1604	1907	---
VALVE SIZE, NPS	SHAFT DIA. AT YOKE BEARING	FACE-TO-FACE DIMENSION ⁽¹⁾		MINIMUM I.D. ⁽²⁾	APPROXIMATE WEIGHT, lbs		
		Wafer and Lugged	Double- Flange		Wafer	Lugged	Double- Flange
	in.						
30	2.50	4.75	---	28.50	805	1157	---
36	2.75	5.88	---	34.31	1380	1978	---
42	3.25	8.25	---	39.84	2425	2928	---
48	3.75	9	---	45.59	3537	4204	---
1. Minimum ID is the minimum pipe or flange ID required for disk swing clearance. Applies to wafer and lugged valve bodies only.							

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Table 5. Valve Body Data, CL300

VALVE SIZE, NPS	SHAFT DIA. AT YOKE BEARING	FACE-TO-FACE DIMENSION ⁽¹⁾		MINIMUM I.D. ⁽²⁾	APPROXIMATE WEIGHT, kg		
		Wafer and Lugged	Double- Flange				
	mm				Wafer	Lugged	Double- Flange
14	44.45	117.5	290	304.3	125.2	231.3	345
16	44.45	133.4	310	346.2	189.2	300.7	563
18	57.15	149.2	330	389.4	237.7	411.4	591
20	69.9	155.6	350	442.0	370.6	551.1	706
24	69.9	181.0	390	523.2	477.2	828.7	1307
30	114.3	241.3	---	653.3	953	1406	---
36	127.0	273.1	---	810.8	1315	1989	---
42	133.4	295.4	---	916.2	2263	2726	---
VALVE SIZE, NPS	SHAFT DIA. AT YOKE BEARING	FACE-TO-FACE DIMENSION ⁽¹⁾		MINIMUM I.D. ⁽²⁾	APPROXIMATE WEIGHT, lbs		
		Wafer and Lugged	Double- Flange				
	in.				Wafer	Lugged	Double- Flange
14	1-3/4	4.625	11.41	11.98	276	510	760
16	1-3/4	5.25	12.20	13.63	417	663	1240
18	2-1/4	5.875	13.00	15.32	524	907	1303
20	2-3/4	6.125	13.78	17.40	817	1215	4556
24	2-3/4	7.125	15.35	20.59	1052	1827	2881
30	4.5	9.5	---	25.72	2100	3100	---
36	5	10.75	---	31.92	2900	4385	---
42	5.25	11.63	---	36.07	4989	6009	---
1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications. 2. Minimum I.D. is the minimum pipe or flange I.D. required for disk swing clearance. Applies to wafer and lugged valve bodies only.							

NOTICE

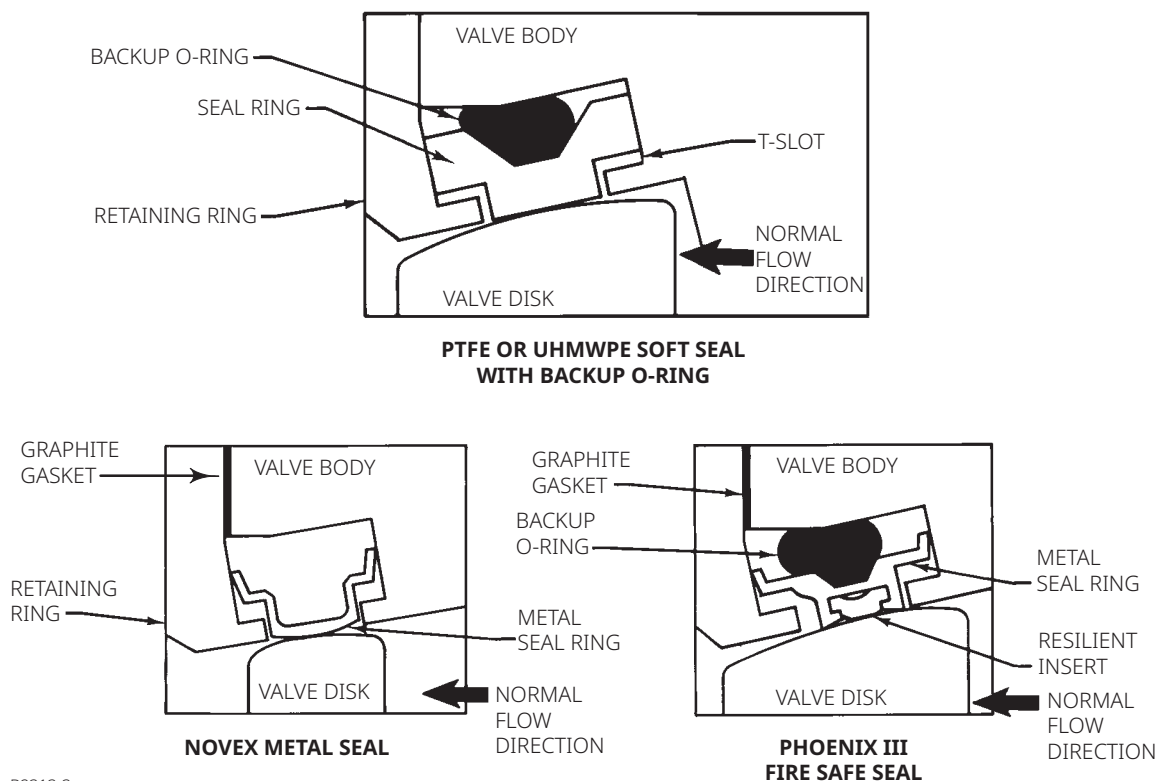
When using an actuator, the actuator travel stop (or actuator travel, for actuators without adjustable stops) must be adjusted so the disk stop in the valve does not absorb the output of the actuator. Failure to limit the actuator travel as described in the Adjusting the Actuator Travel Stops or Travel steps can result in damage to the valve, shaft(s) or other valve components.

An 8532 valve is normally shipped as part of an assembly with an actuator and other accessories such as a valve positioner. If the valve and actuator have been purchased separately or if the actuator has been removed for maintenance, properly mount the actuator and adjust valve/actuator travel and all travel stops before inserting the valve into the line.

NOTICE

Damage to the disk will occur if any pipe flanges or piping connected to the valve interfere with the disk rotation path. Be certain to align the valve accurately to avoid contact between the disk (key 2) and the flanges.

Figure 2. Available Seal Configurations



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2.3 Adjusting the Actuator Travel Stops or Travel

Key number locations are shown in Figures 10 and 11, unless otherwise noted.

1. Refer to the actuator instruction manual to locate the actuator travel stop that controls the closed position of the valve disk (key 2). When adjusting the travel stop or travel, make sure that the disk is from 0 to 0.76 mm / 0 to 0.030 in. away from the internal stop in the valve body (see Figure 5). This adjustment is necessary to be certain that the actuator output torque is fully absorbed by the actuator travel stop or by the actuator. The internal travel stop in the valve body should not absorb any of the actuator torque.
2. Before installing the valve/actuator assembly in the process line, cycle the valve several times to be sure the valve disk returns to the proper position.

2.4 Installing the Valve

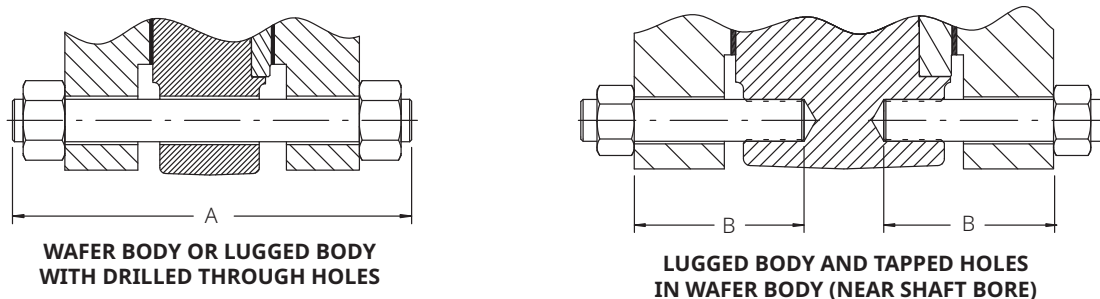
The maximum allowable inlet pressures for 8532 valves are consistent with the applicable ASME pressure/temperature ratings except where limited by the material capabilities as shown in Table 2 or Figure 2.

Refer to Table 6 for the quantity and size of line bolting required to install the valve in the pipeline.

NOTICE

To avoid damage to the valve disk during installation, the valve must be in the fully closed position. If the 8532 valve is equipped with a fail-open actuator, remove the actuator before installing the valve/actuator assembly or cycle the valve into the fully closed position. Then, take appropriate steps to be sure that the actuator does not cause the valve to open during installation.

Figure 3. Stud Bolts for Installation (also see Table 6)



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Table 6. Hex Head Screw, Stud Bolt and Cap Screw Data⁽¹⁾⁽²⁾

Wafer Bodies or Lugged Bodies with Drilled Through Holes										
Valve Size, NPS	Valve Rating	Number of Through Holes	Number of Tapped Holes	Thread Size	Number of Studs	Length of Studs (A)		Number of Cap Screws	Length of Cap Screws (B)	
						mm	in.		mm	in.
14	150	12	0	1 - 8 UNC	12	241	9.50	0	---	---
	300	16	8	1-1/8 - 8 UN	16	305	12.00	8	89	3.50
16	150	16	0	1 - 8 UNC	16	254	10.00	0	---	---
	300	16	8	1-1/4 - 8 UN	16	343	13.50	8	95	3.75
18	150	16	0	1-1/8 - 8 UN	16	279	11.00	0	---	---
	300	20	8	1-1/4 - 8 UN	20	349	13.75	8	101	4.00
20	150	20	0	1-1/8 - 8 UN	20	305	12.00	0	---	---
	300	20	8	1-1/4 - 8 UN	20	368	14.50	8	101	4.00
24	150	20	0	1-1/4 - 8 UN	20	356	14.00	0	---	---
	300	20	8	1-1/2 - 8 UN	20	419	16.50	8	114	4.50
30	150/150	24	8	1-1/4 - 8 UN	24	394	15.50	8	114	4.50
	150	24	8	1-1/4 - 8 UN	24	394	15.50	8	114	4.50
	300	24	8	1-3/4 - 8 UN	24	546	21.50	8	146	5.75
36	150/150	28	8	1-1/2 - 8 UN	28	457	18.00	8	133	5.25
	150	28	8	1-1/2 - 8 UN	28	457	18.00	8	133	5.25
	300	28	8	2.00 - 8 UN	28	616	24.25	8	165	6.50
42	150/150	32	8	1-1/2 - 8 UN	32	527	20.75	8	152	6.00
	150	32	8	1-1/2 - 8 UN	32	527	20.75	8	152	6.00
	300	28	8	1-5/8 - 8 UN	28	660	26.00	8	184	7.25
48	150/150	40	8	1-1/2 - 8 UN	40	578	22.75	8	165	6.50
	150	40	8	1-1/2 - 8 UN	40	578	22.75	8	165	6.50
1. Threaded engagement in accordance with ASME B31.3 "Chemical Plant and Petroleum Refinery Piping". 2. Bolting lengths are base on installation of valve between standard raised face flanges utilizing flange gaskets with a final compression thickness of 0.125 in. When gaskets used have a final compression thickness less than 0.125 in., reduce bolting lengths shown by 0.25 in.										

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Table 6. Hex Head Screw, Stud Bolt and Cap Screw Data⁽¹⁾⁽²⁾ (continued)

Lugged Bodies with Threaded Holes										
Valve Size, NPS	Valve Rating	Number of Through Holes	Number of Tapped Holes	Thread Size	Number of Studs	Length of Studs (A)		Number of Cap Screws	Length of Cap Screws (B)	
						mm	in.		mm	in.
14	150	0	24	1 - 8 UNC	0	---	---	24	70	2.75
	300	0	40	1-1/8 - 8 UN	0	---	---	40	89	3.50
16	150	0	32	1 - 8 UNC	0	---	---	32	76	3.00
	300	0	40	1-1/4 - 8 UN	0	---	---	40	95	3.75
18	150	0	32	1-1/8 - 8 UN	0	---	---	32	82	3.25
	300	0	48	1-1/4 - 8 UN	0	---	---	48	101	4.00
20	150	0	40	1-1/8 - 8 UN	0	---	---	40	89	3.50
	300	0	48	1-1/4 - 8 UN	0	---	---	48	101	4.00
24	150	0	40	1-1/4 - 8 UN	0	---	---	40	95	3.75
	300	0	48	1-1/2 - 8 UN	0	---	---	48	114	4.50
30	150/150	0	28	1-1/4 - 8 UN	0	---	---	28	114	4.50
	150	0	28	1-1/4 - 8 UN	0	---	---	28	114	4.50
	300	0	28	1-3/4 - 8 UN	0	---	---	28	146	5.75
36	150/150	0	32	1-1/2 - 8 UN	0	---	---	32	133	5.25
	150	0	32	1-1/2 - 8 UN	0	---	---	32	133	5.25
	300	0	32	2.00 - 8 UN	0	---	---	32	165	6.50
42	150/150	0	36	1-1/2 - 8 UN	0	---	---	36	152	6.00
	150	0	36	1-1/2 - 8 UN	0	---	---	36	152	6.00
	300	0	36	1-5/8 - 8 UN	0	---	---	36	184	7.25
48	150/150	0	44	1-1/2 - 8 UN	0	---	---	44	165	6.50
	150	0	44	1-1/2 - 8 UN	0	---	---	44	165	6.50

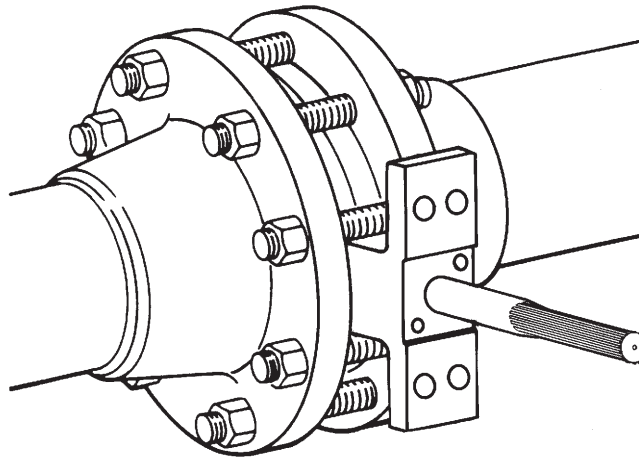
1. Threaded engagement in accordance with ASME B31.3 "Chemical Plant and Petroleum Refinery Piping".
 2. Bolting lengths are base on installation of valve between standard raised face flanges utilizing flange gaskets with a final compression thickness of 0.125 in. When gaskets used have a final compression thickness less than 0.125 in., reduce bolting lengths shown by 0.25 in.

- continued -

Table 6. Hex Head Screw, Stud Bolt and Cap Screw Data⁽¹⁾⁽²⁾ (continued)

Double Flange Bodies										
Valve Size, NPS	Valve Rating	Number of Through Holes	Number of Tapped Holes	Thread Size	Number of Studs	Length of Studs (A)		Number of Cap Screws	Length of Cap Screws (B)	
						mm	in.		mm	in.
14	150	16	8	1 - 8 UNC	16	146	5.75	8	70	2.75
	300	32	8	1-1/8 - 8 UN	32	191	7.50	8	102	4.00
16	150	24	8	1 - 8 UNC	24	152	6.00	8	76	3.00
	300	32	8	1-1/4 - 8 UN	32	203	8.00	8	108	4.25
18	150	24	8	1-1/8 - 8 UN	24	159	6.25	8	82	3.25
	300	40	8	1-1/4 - 8 UN	40	216	8.50	8	108	4.25
20	150	32	8	1-1/8 - 8 UN	32	165	6.50	8	82	3.25
	300	40	8	1-1/4 - 8 UN	40	222	8.75	8	114	4.50
24	150	32	8	1-1/4 - 8 UN	32	187	7.38	8	95	3.75
	300	40	8	1-1/2 - 8 UN	40	248	9.75	8	127	5.00

1. Threaded engagement in accordance with ASME B31.3 "Chemical Plant and Petroleum Refinery Piping".
 2. Bolting lengths are base on installation of valve between standard raised face flanges utilizing flange gaskets with a final compression thickness of 0.125 in. When gaskets used have a final compression thickness less than 0.125 in., reduce bolting lengths shown by 0.25 in.

Figure 4. Installation of Wafer-Style Valves

A5557

1. See Figure 4 for recommended valve orientation.
 - For Wafer-Style Valves: Install the lower flange bolts first to form a cradle for the valve (see Figure 5). See Table 6 for flange bolt specifications.
 - For Lugged Valves: Position the valve between the flanges. Be sure to leave enough room for the flange gaskets. Install the lower flange bolts.
2. For all Valves: Select the appropriate gaskets for the application. Flat sheet, spiral wound or other gasket types, made to the ASME B16.5 standard or user's standard, can be used on 8532 valves depending on the service conditions of the application.
3. For Wafer-Style Valves: Properly orient the valve according to the specific application. Place the valve in the line so the flow properly enters the valve as indicated by the flow tag. Then, install the valve and the gaskets between the flanges into the cradle formed by the flange bolts.
4. Install the remaining flange bolts.
 - For Wafer-Style Valves: Make sure the gaskets are centered on the gasket sealing surfaces of the flange and body.
5. For all Valves: Tighten the flange bolts in an alternating criss-cross fashion to a torque value of one-fourth of the final bolting torque. Repeat this procedure several times, increasing the torque value each time by a fourth of the final desired torque. After applying the final torque value, tighten each flange bolt again to allow for gasket compression.

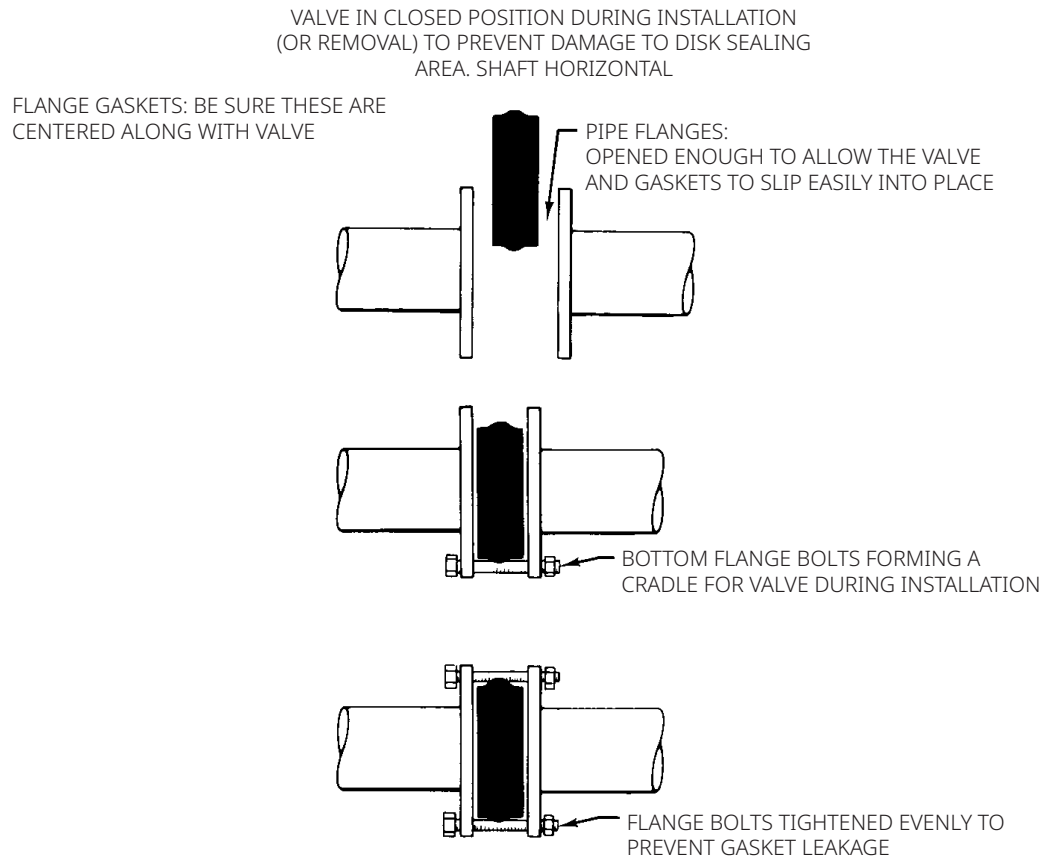
Packing Adjustment and Shaft Bonding



WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

Figure 5. Proper Installation Steps



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NOTICE

For non-ENVIRO-SEAL packing: Tighten the packing follower nuts only enough to prevent shaft leakage. Excessive tightening will accelerate wear of the packing and could produce higher friction loads on the valve stem.

1. For PTFE or graphite packing: Tighten standard packing follower nuts only enough to prevent shaft leakage. Excessive tightening of packing will accelerate wear and could produce higher rotating friction loads on the valve stem. If necessary, refer to the Packing Maintenance section.
2. The ENVIRO-SEAL Packing Systems will not require this initial re-adjustment. Refer to the separate instruction manual Fisher ENVIRO-SEAL Packing System for Rotary Valves (D101643X012) for repair and adjustment procedures.

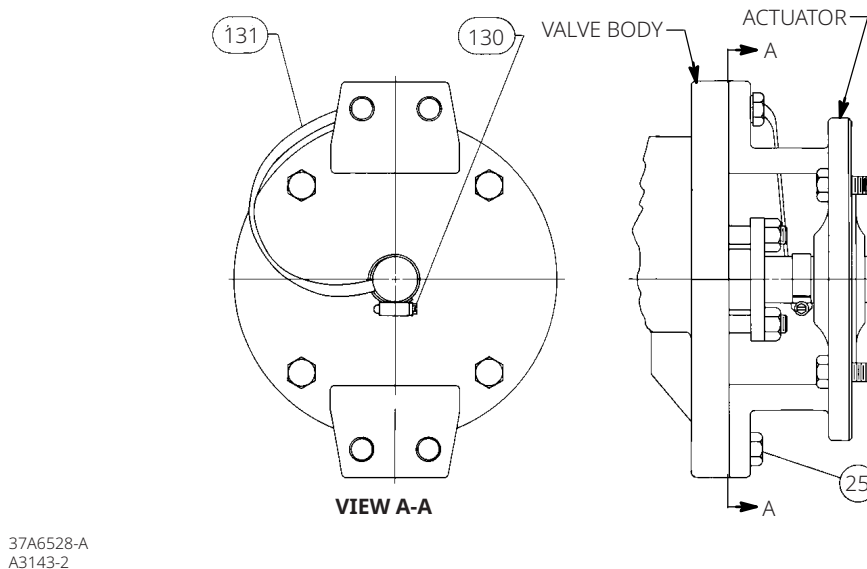
3. For hazardous atmosphere or oxygen service valves, read the following warning and provide the bonding strap assembly mentioned below if the valve is used in an explosive atmosphere.

⚠ WARNING

The valve shaft is not necessarily grounded when installed in a pipeline unless the shaft is electrically bonded to the valve.

To avoid personal injury or property damage resulting from the effects of a static electricity discharge from valve components in a hazardous atmosphere or where the process fluid is combustible, electrically bond the drive shaft (key 3) to the valve according to the following step.

Figure 6. Optional Shaft-to-Valve Body Bonding Strap Assembly

**NOTE**

Standard PTFE packing is composed of a partially conductive carbon-filled PTFE female adaptor with PTFE V-ring packing. Standard graphite packing is composed of all conductive graphite ribbon packing. Alternate shaft-to-valve body bonding is available for hazardous service areas where the standard packing is not sufficient to bond the shaft to the valve (see the following step).

For oxygen service applications, provide alternate shaft-to-valve body bonding according to the following step.

4. Attach the bonding strap assembly (key 131, Figure 6) to the shaft with the clamp (key 130, Figure 6).
5. Connect the other end of the bonding strap assembly to the valve flange cap screws.
6. For more information, refer to the Packing Maintenance section.

Section 3: Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

Key numbers in this procedure are shown in Figures 10 and 11 unless otherwise indicated.

WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure.**
- **Use lockout procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any other hazards that may be present from exposure to process media.**

3.1 Removing and Replacing the Actuator

Refer to the appropriate actuator instruction manual for actuator removal and replacement procedures. The actuator stops or travel stops must limit the rotation of the valve shaft. See the caution below.

NOTICE

When using an actuator, the actuator travel stop (or actuator travel, for actuators without adjustable stops) must be adjusted so the disk stop in the valve does not absorb the output of the actuator. Failure to limit the actuator travel can result in damage to the valve, shaft(s) or other valve components.

3.2 Packing Maintenance

The 8532 control valve is designed so the packing can be replaced without removing the valve from the process pipeline.

NOTICE

For non-ENVIRO-SEAL packing: Tighten the packing follower nuts only enough to prevent shaft leakage. Excessive tightening will accelerate wear of the packing and could produce higher friction loads on the valve stem.

Usually, packing leakage can be eliminated by merely tightening the hex nuts (key 15) located above the packing follower (key 11) while the valve is in the pipeline. However, if leakage continues, the packing must be replaced.

For PTFE ENVIRO-SEAL packing systems, refer to the separate instruction manual, Fisher ENVIRO-SEAL Packing System for Rotary Valves (D101643X012) (see Figure 12).



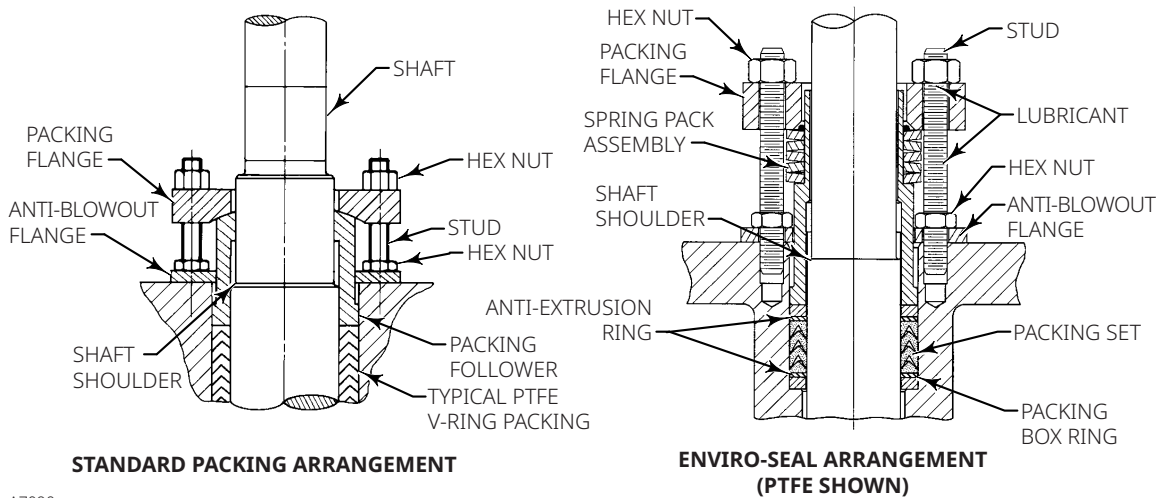
WARNING

Never use a wrench or pliers on the splined (upper) shaft (key 3). A damaged shaft could cut the packing and allow leakage.

1. Before loosening any parts on the valve, release the pressure from the pipeline. Then, remove the hex nuts (key 15) and lift off the packing follower (key 11).

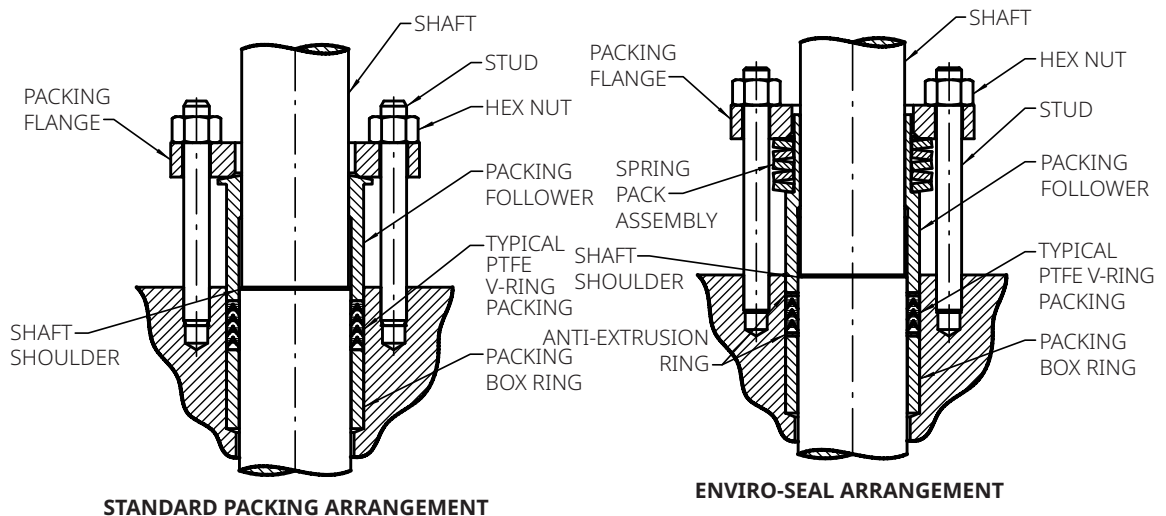
2. Remove the hex jam nuts (key 17) and the anti-blowout flange (key 10). Remove the packing follower (key 12). Refer to Figure 8 for details of the anti-blowout design parts. The packing is now accessible.
3. Use a packing extractor to remove packing. Insert the corkscrew-like end of the tool into the first piece of packing and pull firmly to remove the packing. Repeat this process until all packing parts have been removed.

Figure 7. Blowout Protection NPS 14 through 24



A7090

Figure 8. Blowout Protection NPS 30 through 48



E1771

⚠ WARNING

Be careful when cleaning the packing box. Scratches to the upper shaft (key 3) or inside diameter of the packing bore might cause leakage.

4. Before installing new packing, clean the packing box.
5. Install new packing one ring at a time, using the packing follower as a driver. If using split-ring packing, stagger the splits in the rings to avoid creating a leak path.
6. Reinstall packing parts. Refer to Figures 10 and 11 for sequence of packing parts.

3.3 Removing the Valve

1. Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open the valve. Vent the power actuator loading pressure.
2. Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from either side of the valve.

NOTICE

Damage to the valve disk can occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, stroke the actuator to place the disk in the closed position while removing the valve from the pipeline.

3. Loosen the flange bolting that holds the valve. Make sure the valve cannot slip or twist while loosening and removing the bolting.
4. Before removing the valve from the pipeline, make sure the valve disk is closed. Removing the valve with the disk open could cause damage to the disk, piping or pipe flanges.
5. After removing the valve from the pipeline, move the valve to an appropriate work area. Always support the valve properly.
6. When valve maintenance is complete, refer to the Installation procedures in this manual.

3.4 Seal Maintenance

NOTE

For larger valves, it is possible to replace the seal (key 5) while the actuator is mounted to the valve and can be accomplished by cycling the valve to 90 degrees open.

Key numbers in this procedure are shown in Figures 10 and 11 unless otherwise indicated.

1. After removing the valve from the pipeline, remove the manual or power actuator. Manually rotate the upper shaft (key 3) counterclockwise until the disk has moved a full 180 degrees away from the closed position.



WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping of a large valve. Support large valves during maintenance.

2. Lay the valve flat on a work bench in a secure position with the retaining ring (key 18) and retaining ring screws (key 19) facing up. Properly secure the valve on a suitable worktable so it cannot slip, twist or fall during maintenance. Remove all retaining ring screws.
3. Remove the retaining ring by placing a socket head cap screw from the retaining ring in each of the two retaining ring jacking screw holes. Slowly turn the screws until the retaining ring has been lifted from the valve body. Remove the retaining ring to expose the seal in the T-slot area of the valve body.

NOTE

The 8532 valve is available with different seal designs and components. See Figure 2 to identify the specific seal design.

NOTICE

In the following procedure, take care not to damage the seal or T-slot area of the valve body during removal of the seal.

4. Insert a regular screwdriver or other similar tool under the top edge of the seal and gently pry the seal out of the T-slot area in the valve body. Take care not to damage the seal or T-slot area of the valve body. After the seal has been removed, clean the T-slot area, retaining ring and, if required, polish the disk (key 2) thoroughly with fine steel wool or other appropriate material.

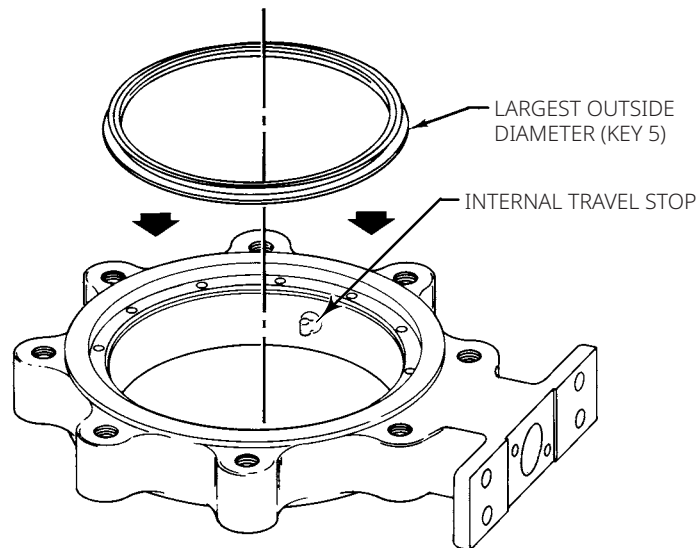
To install a new seal, O-ring (key 6) and retaining ring gasket, follow the appropriate instructions given below.

Table 7. Torque Values for Fasteners

FASTENER NOMINAL SIZE	RETAINING RING SCREWS		GASKET RETAINING BOLTS ⁽¹⁾	
	N•m	in•lbs	N•m	in•lbs
#10	4.6	41	4.0	35
1/4	11	100	9.2	81
5/16	25	220	19	167
3/8	45	400	33	295
Fastener Nominal Size	N•m	ft•lbs	N•m	ft•lbs
7/16	72	53	53	39
1/2	112	83	80	59
9/16	161	119	117	86
5/8	225	166	161	119
3/4	401	296	286	210
7/8	651	480	447	330
1	976	720	651	480
1-1/8	1356	1000	837	617
1. Torque values provided for gasket retaining bolting require lubrication of threads with a dry film lubricant. Use of other lubricants may change torque recommendation. Note: These values are based upon standard materials, S66286/N07718 screws and ASTM A193GRB6 bolts. For other special fastener materials, please contact your Emerson sales office .				

PTFE Seals

1. Locate the replacement seal ring (key 5) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter. Around the outside circumference is one wide groove.
Before installing the seal ring into the valve body, place the O-ring (key 6) into the wide, outer groove of the seal ring. Refer to Figure 9.
2. Install the seal ring and O-ring assembly in the valve body. The wider outside diameter of the seal ring goes into the T-slot area of the body (see Figure 5). Start the edge with the wider diameter into the T-slot of the valve body using a blunt-end screwdriver.
3. Carefully tuck the O-ring downward into the body T-slot until the seal ring is completely entrapped in the body T-slot and it completely covers the backup O-ring.
4. Re-install the retaining ring and the socket head cap screws. Tighten the cap screws just enough to eliminate any movement of the retaining ring. Do not over-tighten the retaining ring screws. Using a blunt-end tool, carefully tuck the lip of the seal ring under the retaining ring.

Figure 9. Typical Seal Installation

A5251-1

5. When the seal is under the lip of the retaining ring, continue to tighten the cap screws according to standard procedures. Do not fully torque the screws at this time. Final tightening of the screws is accomplished in step 7 of this procedure.
6. Manually rotate the upper shaft clockwise 180 degrees to return the disk (key 2) to its closed position.
7. The final seating of the retaining ring cap screws can now be done. For the screw torque values, refer to Table 7. The seal is now fully installed. Refer to the Installation procedures in this manual.

NOVEX, Phoenix III and/or Phoenix III Fire-Tested Seals

1. Locate the replacement seal ring (key 5) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in Figure 9. Around the outside circumference is one wide groove.

Install the seal ring (key 5) in the valve body by first placing the wider outside diameter of the seal ring into the T-slot area of the valve body which is shown in Figure 2.

The backup O-ring (key 6) for the Phoenix III seal will have to be installed after placement of the seal ring in the valve body using a blunt-end screwdriver. Do not use the screwdriver directly on the metal seat. Use tools on the O-ring only.

2. With the seal ring inserted all the way around the body T-slot now lay the O-ring into the opening between the valve body and the seal ring. Use the screwdriver to apply pressure to the O-ring and carefully tuck the O-ring down into the T-slot between the valve body and the seal ring.

NOTE

On larger valves, it may be more efficient to have someone hold down the seal ring while you push the O-ring into the T-slot.

3. Once the seal ring and backup O-ring have been fully installed into the body T-slot, the retaining ring gasket can be installed. This gasket is a thin graphite material. Punch one initial screw hole through the gasket for alignment, being careful not to cause additional damage to the gasket.
4. Install the retaining ring and align the screw holes in the retaining ring with the holes in the valve body. Install the first retaining ring screw through the punched hole in the ring gasket. Install the other ring screws by pushing the screws through the graphite gasket and threading them into the valve body.
5. Tighten the retaining ring socket head cap screws just enough to eliminate any movement of the retaining ring. Do not over-tighten the retaining ring screws.

**WARNING**

Avoid personal injury or property damage caused by the impact of a falling or tipping of a large valve. Support large valves during maintenance.

6. To complete this step, stand the valve up. Support the valve securely using methods appropriate for the valve size. If a vise or other clamps are being used, be sure to not damage the flange gasket sealing area of the valve body.
7. Manually rotate the upper shaft (key 3) to turn the disk clockwise to meet the seal.
8. Tap the disk with a rubber mallet to drive it against the internal travel stop. When the disk makes contact with the stop, manually rotate the disk counterclockwise back out of the seal to a 90-degree open position. Repeat steps 7 and 8 three times.

NOTE

When attaching the actuator to the valve, make sure the valve disk is not in contact with the valve internal travel stop (see Figure 9). The valve disk should be positioned from 0 to 0.76 mm / 0 to 0.030 in. away from the internal stop in the valve body (see Figure 9).

9. Use an appropriate tool (such as a feeler gauge) to position the disk (key 2) from 0 to 0.76 mm / 0 to 0.030 in. away from the internal stop in the valve body.
This adjustment is necessary to be certain that the actuator output torque is fully absorbed by the actuator travel stop or by the actuator. The internal travel stop in the valve body should not absorb any of the actuator torque.
10. The final seating of the retaining ring screws can now be done. For the screw torque values, refer to Table 7.

3.5 Anti-Blowout Design, Packing, Valve Shaft, Disk and Bearing Maintenance

NOTE

The 8532 valve has a two-piece shaft. In these procedures, the shaft (with the splined end) is called the upper shaft (key 3). The shaft opposite the upper shaft is called the lower (follower) shaft (key 4).

NOTICE

When using an actuator, the actuator travel stop (or actuator travel adjustment, for actuators without adjustable stops) must be adjusted so the disk stop in the valve does not absorb the output of the actuator. Failure to limit the actuator travel as described in the next step can result in damage to the valve, shaft(s) or other valve components.

NOTICE

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever off the valve shaft. Driving the lever or actuator off the valve shaft could damage the valve internal parts.

If necessary, use a wheel puller to remove the lever or actuator from the valve shaft. It is okay to tap the wheel puller screw lightly to loosen the lever or actuator, but hitting the screw with excessive force could also damage internal valve parts.

Key numbers in this procedure are shown in Figures 10 and 11 unless otherwise indicated.

1. Remove the valve from the pipeline. Remove the actuator from the valve.

WARNING

Never use a wrench, pliers or similar tool to turn the upper shaft. A damaged shaft can cut the packing and allow leakage.

NOTE

It is not necessary to remove the retaining ring and valve seal when removing the shaft(s) and disk.

⚠ WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping of a large valve. Support large valves during maintenance.

2. Properly secure the valve on a suitable worktable so it cannot slip, twist or fall during maintenance.
3. Removing the Anti-Blowout Design:
 - a. For PTFE or Graphite Packing: Remove the hex nuts (key 15) and pull off the packing follower (key 11). Remove the hex jam nuts (key 17) and the anti-blowout flange (key 10). Remove the anti-blowout gland (key 12). See Figure 8.
 - b. For ENVIRO-SEAL Packing System: Remove the hex nuts (key 101), the packing follower (key 102), jam nuts (key 17), anti-blowout flange (key 10) and the spring pack assembly (key 103). See Figure 12.
4. Remove the packing from around the upper shaft.
5. Remove the tangential pins or disk pins. Locate the pins (key 9) in the upper shaft (key 3) and the pin in the lower shaft (key 4), if the valve has a two-piece shaft.
 - a. If a maintenance kit is available, use the pin extractor to remove the disk pins. Select the correct size pin extractor tip with screws of proper thread size to match the thread size in the disk pins. If you do not have a kit, see steps c and d below.
 - b. Screw the pin extractor tip into the pin as far as possible. With an upward, straight sliding motion, pull out the pin. Repeat the same procedure for the other pins.
 - c. You can use a threaded rod with an appropriate spacer (tube) and nut as an extractor tool. If you use a threaded rod, choose a rod with threads that fit the inside thread of the pins. The rod should extend several inches above the disk when it is screwed into a pin.
 - d. After screwing the rod into the pin, slide the spacer over the rod and pin. Thread a nut onto the rod and tighten it. As you tighten the nut, the nut will drive the spacer against the disk. The increasing force will draw the pin from the disk.
6. The gasket retainer (key 20) on the side of the valve opposite the upper shaft must be removed before removing the lower shaft.

Remove the hex head bolts (key 23) and lockwashers (key 22) from the gasket retainer and remove the gasket retainer and gasket (key 21) to expose the end of the lower shaft.
7. Before removing the lower shaft (key 4), be sure the valve disk is properly supported. Pull the lower shaft from the valve body. Use a shaft extractor screwed into the puller hole in the end of the lower shaft.
8. Before removing the upper shaft (key 3), be sure the valve disk is properly supported. Pull out the upper shaft (key 3) by hand-pulling or by using a shaft extractor screwed into the end of the shaft.

NOTICE

To avoid damage to the disk, seal and T-slot area, do not force the disk past the seal or T-slot area. Remove the disk from the opposite side of the valve body.

NOTE

Both the upper shaft and the lower shaft have a thrust bearing (key 24) between the disk and the bearings (key 7). The thrust bearing is located outside of the bearing bore which holds the bearings. Use care when removing the valve disk to avoid loss of or damage to the thrust bearings.

9. After removing the shaft(s), remove the disk. Do not force the disk past the seal or T-slot area. Collect the thrust bearings.
10. Remove the bearings (key 7). Using a suitable punch or puller, drive or pull the bearings into the valve body bore from the upper shaft bearing bore. Remove the bearing from the lower shaft bearing bore.
11. Inspect the valve body bore, bearings, bearing bores and packing box for damage.

NOTE

In these instructions, the drive shaft (with splined end) is called the upper shaft (key 3). The shaft opposite the upper shaft is called the lower (follower) shaft (key 4).

Installing the Two-Piece Shaft

Key numbers in this procedure are shown in Figures 10 and 11 unless otherwise indicated.

⚠ WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping of a large valve. Support large valves during maintenance.

1. Properly secure the valve on a suitable worktable so it cannot slip, twist or fall during maintenance. Be prepared to support the valve disk.

NOTE

Replacement disk and shafts are provided as a matched set and both should be replaced at the same time.

2. Inspect all parts removed from the valve for wear or damage. Replace any worn or damaged parts. Clean the valve body and all parts to be installed with an appropriate solvent or degreaser.

NOTE

When installing the bearings, apply lubricant to the outside diameter of the bearing for ease of installation.

NOTICE

Premature valve failure and loss of process control may result if bearings are improperly installed or are damaged during installation.

3. When installing the lower bearings (key 4), insert one or more bearings into the lower shaft bearing bore so it is flush with the body bore.
The number of bearings required changes with valve size and construction. Two bearings are required in the upper shaft and two bearings in the lower shaft. If using an NPS 14 CL150 valve with metal bearings, four bearings in the upper and four in the lower shaft will be required.
4. Hold the lower shaft thrust bearing (key 24) in the valve body bore against the counterbore of the lower shaft bearing bore. Push the lower shaft into the bearing bore just enough to hold the thrust bearing.
5. When installing the upper bearing (key 7), insert one or more bearings into the upper shaft from the body bore into the bearing bore below the packing box. Use caution to prevent damage to the bearing.
6. Hold the upper shaft thrust bearing (key 24) in the valve body bore against the counterbore of the upper shaft bearing bore. Push the upper shaft through the packing box side into the bearing bore just enough to hold the thrust bearing.
7. When installing the lower bearing (key 4), insert one or more bearings into the lower shaft bearing bore so it is flush with the body bore.
8. Insert the lower shaft through the bore in the valve body uncovered by removal of the gasket retainer. Hold the lower shaft thrust bearing (key 24) in the valve body bore against the counterbore of the lower shaft bearing bore. Push the lower shaft into the bearing bore just enough to hold the thrust bearing.

NOTICE

To avoid damage to the disk, seal and T-slot area, do not force the disk past the seal or T-slot area. Install the disk from the opposite side of the valve body.

9. Place the flat side of the disk on a flat surface and insert wooden blocks to raise the disk approximately 51 mm / 2 in. from the worktable surface. Then, suspend the valve body over the disk so the seal/T-slot area is facing up. Align the shaft bores through the disk with the upper shaft and lower shaft bores. Lower the valve body over the disk using caution not to dislodge or damage the thrust bearings placed on the ends of the shafts.
10. With the disk (key 2) properly positioned in the valve body (key 1), push the upper shaft and lower shaft the rest of the way through the thrust bearings and into the shaft bores in the valve disk.
11. Align the holes in the shafts with the holes in the disk.

NOTICE

To avoid damage to the tangential pins, disk pins, valve disk or shaft(s) resulting from the application of excessive force, use appropriate care when driving the pins into the disk hub and shaft(s). Use the right tool. Do not use excessive force.

12. Install the appropriate tangential pins and disk pins. Use 2 tangential pins that will go through the upper shaft and 1 disk pin that will go through the lower shaft.
13. Refer to the Anti-Blowout Design, Packing, Valve Shaft, Disk and Bearing Maintenance procedures in this manual to re-install the packing and anti-blowout design.

3.6 Gasket Retainer

Valves with a two-piece shaft use a gasket retainer and gasket (keys 20 and 21) to cover the lower shaft opening in the valve body. The gasket is held in place by the gasket retainer and four hex head bolts and lockwashers (keys 23 and 22). When re-assembling the valve, use a new gasket.

Be sure to center the gasket over the lower shaft bore before retightening bolts. Tighten down bolts evenly in a crossover or star pattern. Refer to Table 7 for proper torque values.

Section 4: Parts

4.1 Parts Ordering

Typical parts are shown in Figures 10 and 11.

When corresponding with your [Emerson sales office](#) about an 8532 valve, identify the valve as a Fisher 8532 and provide the valve serial number. For valve/actuator combinations assembled at the factory, the valve serial number may be stamped on the nameplate attached to the actuator.

**WARNING**

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

Retrofit Kits

Retrofit kits include all parts required for installation of the ENVIRO-SEAL packing system into existing high-performance butterfly valves. Retrofit kits are available for single PTFE packing.

See Table 9 for retrofit kit part numbers.

Table 8. Retrofit Kits

RETROFIT KIT INCLUDED PARTS		
Key	Description	Quantity
10	Anti-blowout follower	1
17	Jam nut	1
100	Packing stud	2
101	Packing nut	2
102	Packing flange	1
103	Spring pack assembly	1
105	Packing set	1
106	Anti-extrusion washer	2 ⁽¹⁾
107	Packing box ring	2 ⁽²⁾
111	Tag	1
112	Cable	1
1. Not included in graphite packing kit.		
2. Only 1 req'd for NPS 18 CL300, NPS 20 CL150 and NPS 24 CL150.		

NOTE

Key 103, the spring pack assembly, is made up of the packing spring stack held in place by an O-ring on the packing follower.

Repair Kits

PTFE Repair kits include a single PTFE packing set and anti-extrusion washers. Graphite packing sets include graphite packing rings and carbon anti-extrusion rings. See Table 9 for PTFE repair kit part numbers.

Table 9. Retrofit and Repair Kit Part Numbers

VALVE SIZE, NPS	PRESSURE RATING	SHAFT DIAMETER ^(1, 2) , mm / in.	RETROFIT KITS	REPAIR KITS
			PTFE	PTFE
14	CL150	34.9 / 1-3/8	RRTYXRT0592	RRTYX000172
	CL300	50.8 / 2	RRTYXRT0602	RRTYX000182
16	CL150	38.1 / 1-1/2	RRTYXRT0612	RRTYX000192
	CL300	57.2 / 2-1/4	RRTYXRT0622	RRTYX000202
18	CL150	44.5 / 1-3/4	RRTYXRT0632	RRTYX000212
	CL300	63.5 / 2-1/2	RRTYXRT0642	RRTYX000222
20	CL150	50.8 / 2	RRTYXRT0652	RRTYX000182
24	CL150	63.5 / 2-1/2	RRTYXRT0662	RRTYX000222
1. Shaft diameter: Diameter through the packing box. 2. For larger shaft sizes, consult your Emerson sales office .				

4.2 Parts List

NOTE

Contact your [Emerson sales office](#) for Part Ordering information.

Table 10. Parts List

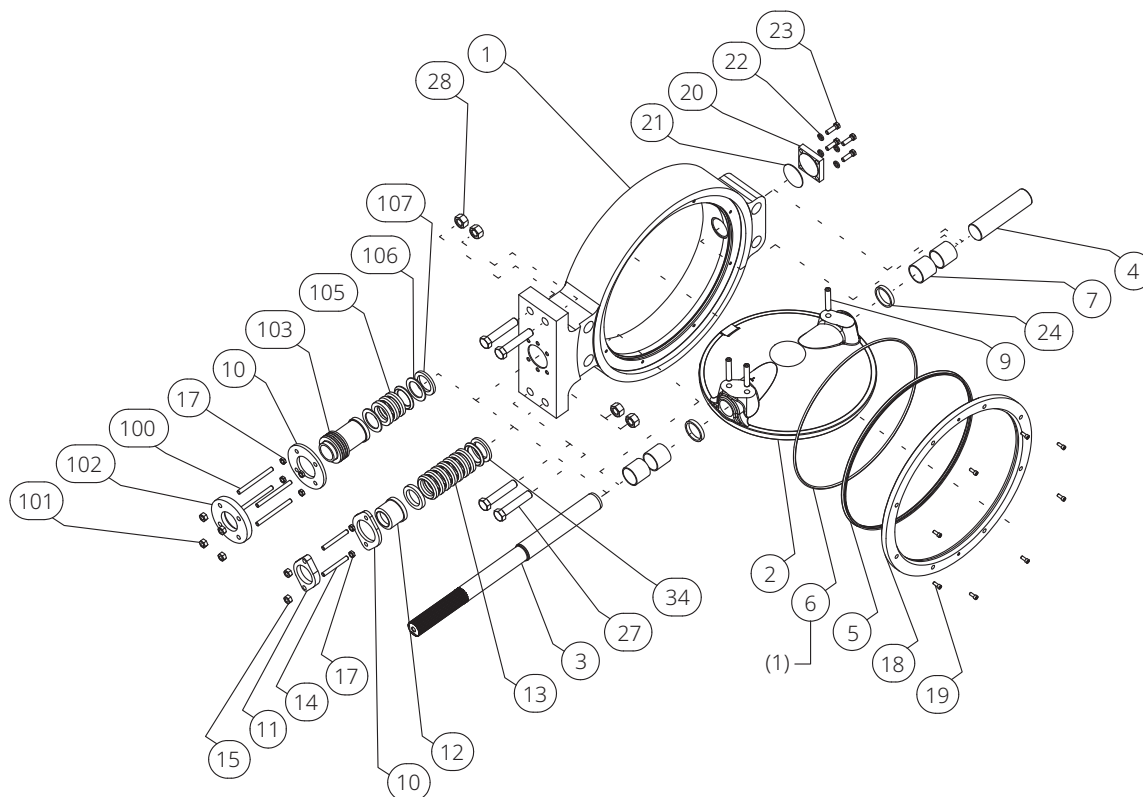
Key	Description	Key	Description
1	Valve body	18	Retaining ring
2*	Disk	19	Retaining ring screw (8 req'd)
3*	Drive shaft	20	Gasket retainer
4*	Follower shaft	21*	Gasket
5*	Seal ring	22	Lockwasher (4 req'd)
6*	Backup ring	23	Cap screw (4 req'd)
7*	Bearing	24*	Thrust bearing
9*	Disk pin	26*	Retaining ring gasket
10	Anti-blowout flange (not used in NPS 30 to 48)	27	Cap screw - actuator (4 req'd) (not shown)
11	Packing flange	28	Hex nut - actuator (4 req'd) (not shown)
12	Packing follower	29	Nameplate (not shown)
13*	Packing set	32	Drive screw (2 req'd)
14	Stud (2 req'd)	33	Flow direction arrow (not shown)
15	Hex nut (2 req'd)	34	Packing box ring
17	Hex jam nut (2 req'd)	35*	Disk/Shaft/Pin assembly (not shown)
*Recommended spare parts.			

ENVIRO-SEAL Packing System (See Figure 12)

Table 11. ENVIRO-SEAL Packing System (See Figure 12)

Key	Description	Key	Description
10	Anti-blow flange	105*	Packing set
17	Hex jam nut (4 req'd)	106*	Anti-extrusion ring (2 req'd)
100	Packing flange stud (4 req'd)	107	Packing box ring
101	Packing flange nut (4 req'd)	111	Tag (not shown)
102	Packing flange	112	Cable tie (not shown)
103	Spring pack assembly	113	Lubricant
*Recommended spare parts.			

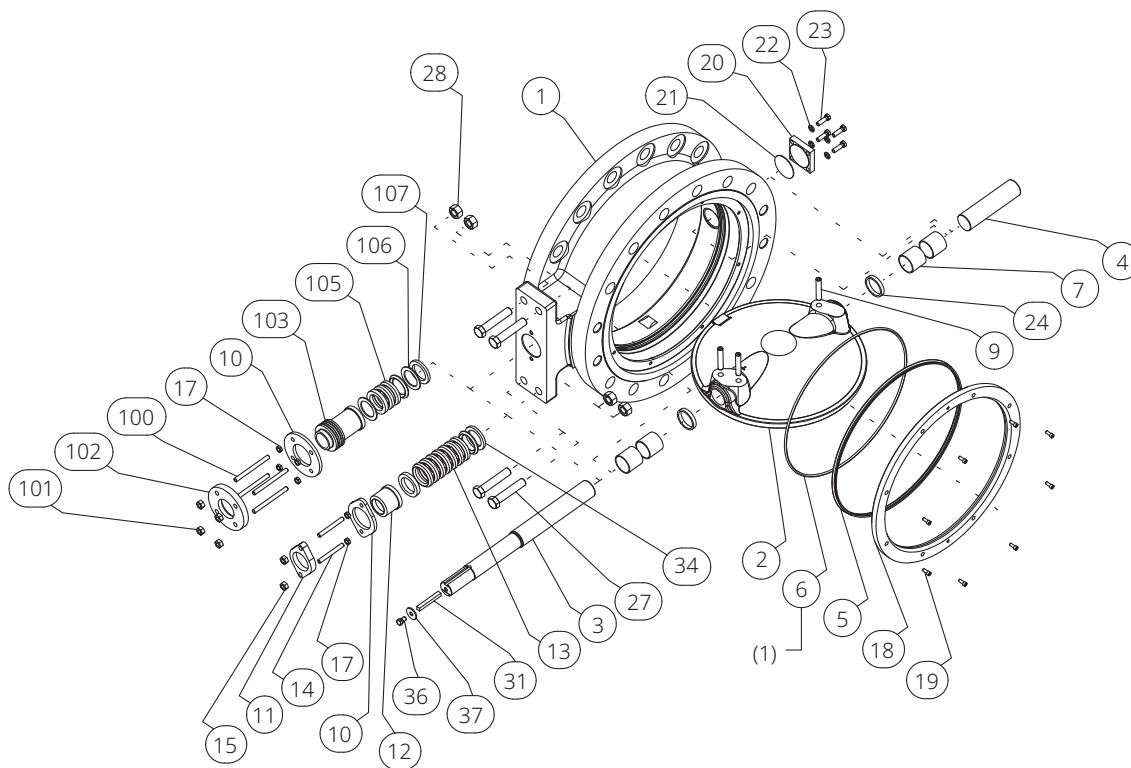
Figure 10. Fisher 8532, NPS 14 to 48, CL150 to 300



PARTS NOT SHOWN: KEYS 26, 29, 32, 33, 38, 111, 112 AND 113
 1. USE ONLY WITH SOFT SEAL AND PHOENIX III SEAL.

GE58725-A

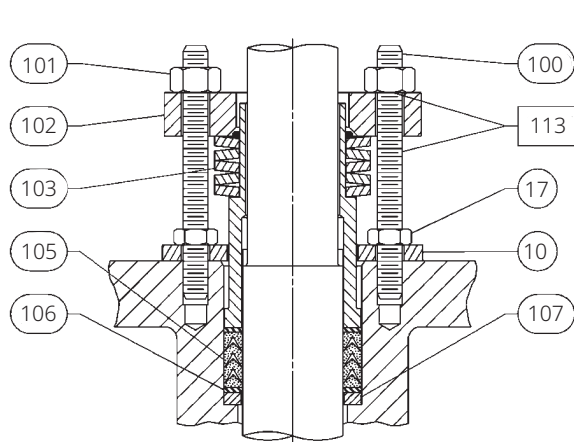
Figure 11. Fisher 8532, NPS 14 to 24, CL150 to 300, Double Flange Valve Body



PARTS NOT SHOWN: KEYS 26, 29, 32, 33, 38, 111, 112 AND 113
 1. USE ONLY WITH SOFT SEAL AND PHOENIX III SEAL.

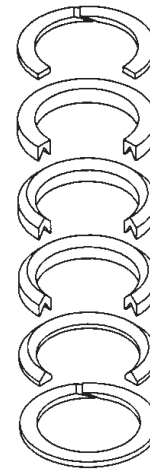
GE58760-A

Figure 12. ENVIRO-SEAL Packing Systems



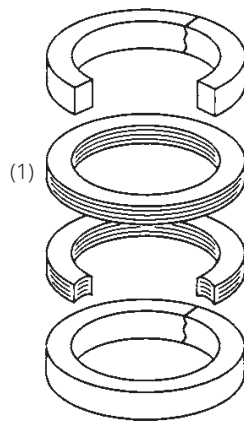
PTFE PACKING SYSTEM

34B7524-B



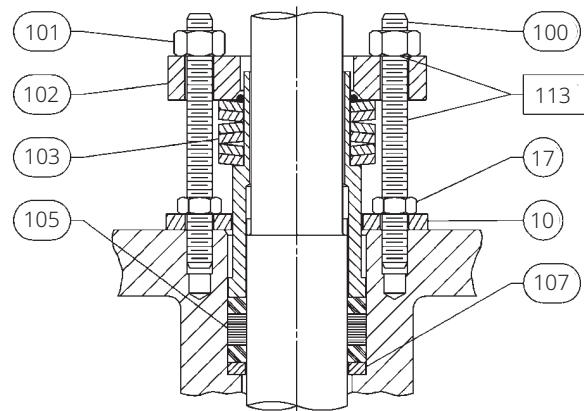
**STACKING ORDER OF
PTFE PACKING RINGS**

14B0095-A



**STACKING ORDER OF
GRAPHITE PACKING RINGS**

14B0086-A



GRAPHITE PACKING SYSTEM

34B7524-B

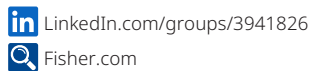
NOTE:

1. VALVES WITH SHAFTS LARGER THAN 38.1 mm / 1-1/2 in. USE GRAPHITE RINGS.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS



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FISHER™



Fisher™ 8540 Eccentric Disk Butterfly Control Valve

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Figure 1. Fisher 8540 Butterfly Valve with Bettis RPE Actuator and 3720 Positioner



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher 8540 valve, NPS 3 through NPS 12 or DN80 through DN300 (see figure 1). Refer to separate instruction manuals for information covering the actuator and accessories.



Do not install, operate, or maintain 8540 valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The seal design of the 8540 eccentric disk high performance butterfly valve provides excellent shutoff capability. This valve has a square drive shaft end and soft seal rings for use in a wide variety of applications.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

8540 Valve

May 2023

Instruction Manual

D104709X012

Table 1. Specifications

Valve Size and End Connection Styles NPS ■ 3, ■ 4, ■ 6, ■ 8, ■ 10, and ■ 12 wafer body valves DN ■ 80, ■ 100, ■ 150, ■ 200, ■ 250, and ■ 300 Maximum Inlet Pressure⁽¹⁾ Carbon Steel and Stainless Steel Valve Bodies: Consistent with CL150 and 300 pressure/temperature ratings per ASME B16.34 and PN 10 to 40 per EN 12516-1 unless limited by material temperature capabilities. Shutoff Classifications ■ PTFE Seal: Bidirectional shutoff to Class VI per ANSI/FCI 70-2 and IEC 60534-4. Flow Characteristics Approximately linear	Disk Rotation Clockwise to close (when viewing from the drive shaft end) through 90 degrees of disk rotation (see figure 8) Flow Direction See figure 3 Actuator/Valve Action With the diaphragm or piston actuators, the valve action is field-reversible. Refer to information in the Installation section. Valve Classification Face-to-face dimensions meet API 609, MSS-SP-68, or EN 558 standards for face-to-face dimensions of wafer-style valves. Shaft Diameters See table 2 Approximate Weights See table 2
---	--

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valves should not be exceeded.

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Table 2. Valve Size, Shaft Diameter, and Approximate Weight

VALVE SIZE		CLASS		SHAFT DIAMETER		APPROXIMATE WEIGHT	
NPS	DN	ASME	EN	mm	Inches	Wafer-Style	
						kg	lbs
3	80	CL150	PN10-16	12.7	1/2	4.5	10
		CL300	PN25-40	15.9	5/8	5.9	13
4	100	CL150	PN10-16	15.9	5/8	8.6	19
		CL300	PN25-40	19.1	3/4	10	23
6	150	CL150	PN10-16	19.1	3/4	13	39
		CL300	PN25-40	25.4	1	15	33
8	200	CL150	PN10-16	25.4	1	21	47
		CL300	PN25-40	31.8	1-1/4	24	53
10	250	CL150	PN10-16	31.8	1-1/4	34	75
		CL300	PN25-40	38.1	1-1/2	44	96
12	300	CL150	PN10-16	38.1	1-1/2	49	107
		CL300	PN25-40	44.5	1-3/4	64	141

Installation

The valve is normally shipped as part of a control valve assembly, with the power actuator mounted on the valve. If the valve or actuator have been purchased separately, or if the actuator has been removed for maintenance, mount the actuator on the valve, and adjust actuator travel before inserting the valve body into the line. This is necessary due to the measurements that must be made during the actuator calibration adjustment process. Refer to the Actuator Mounting section of this manual to mount the actuator on the valve. Refer to the actuator instruction manual for mounting and adjusting instructions before proceeding.

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given in this manual, the limits on the appropriate nameplates, or the matching pipe flange rating. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. To avoid possible personal injury and because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

Table 3. Construction Material Temperature Limits⁽¹⁾

COMPONENTS AND MATERIALS OF CONSTRUCTION	TEMPERATURE LIMITS	
	°C	°F
Valve Body Material		
Carbon Steel	-29 to 427	-20 to 800
CF8M	-198 to 538	-325 to 1000
CF8M/1.4408	-196 to 580	-321 to 1076
WCC/1.0619	-10 to 480	-14 to 896
Disk Material		
CF8M	-198 to 538	-325 to 1000
Shaft Material		
S17400	-62 to 427	-80 to 800
Bearing Material		
PEEK / PTFE lined	-46 to 232	-50 to 450
Packing Material		
PTFE V-Rings	-46 to 232	-50 to 450
Seal Ring		
PTFE (standard) Soft Seal Ring	-46 to 232	-50 to 450
1. Refer to Ordering Matrix for 8540 Valves. For selection temperatures not shown above, contact your Emerson sales office .		

1. Install a three-valve bypass around the control valve assembly if continuous operation is necessary during inspection and maintenance of the valve.
2. Inspect the valve to be certain that it is free of foreign material.

CAUTION

Be certain that adjacent pipelines are free of any foreign material, such as pipe scale or welding slag, that could damage the valve sealing surfaces.

Table 4. Maximum Allowable Pressure Drops at Temperature

TEMPERATURE		PRESSURE DROP	
°C	°F	bar	psi
-46	-50	52	750
-32	-25		
-18	0		
38	100		
66	150		
93	200	43	620
121	250	35	510
149	300	27	390
204	400	11	160
232	450	3	50

Valve Orientation

When installing the valve, it is recommended that the valve drive shaft be horizontal as shown in figure 1.

Valve Direction

The high performance butterfly valve is designed to allow flow in either direction when in the open position. When in the closed position, high pressure should be applied to a specific side of the disk to provide best performance and optimal valve life (see seal types below). See figure 2.

The PTFE soft seal is bi-directional under normal operating conditions can (at different times) experience pressure in both directions; the highest of the two pressures should be exerted on the preferred side of the disk. If the two pressures are equal, then the one lasting the longest period of time should be applied to the preferred side.

1. For PTFE seal ring: This seal is bidirectional. For optimal performance, high pressure should be applied to the front (retaining ring side) of the disk.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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8540 Valve

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Figure 2. Flow Direction Arrow

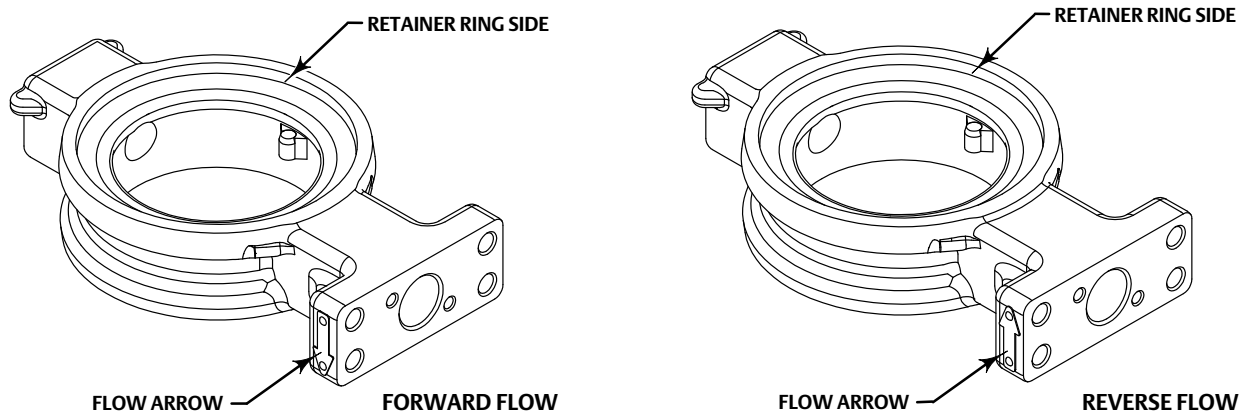


Figure 3. Flow Direction

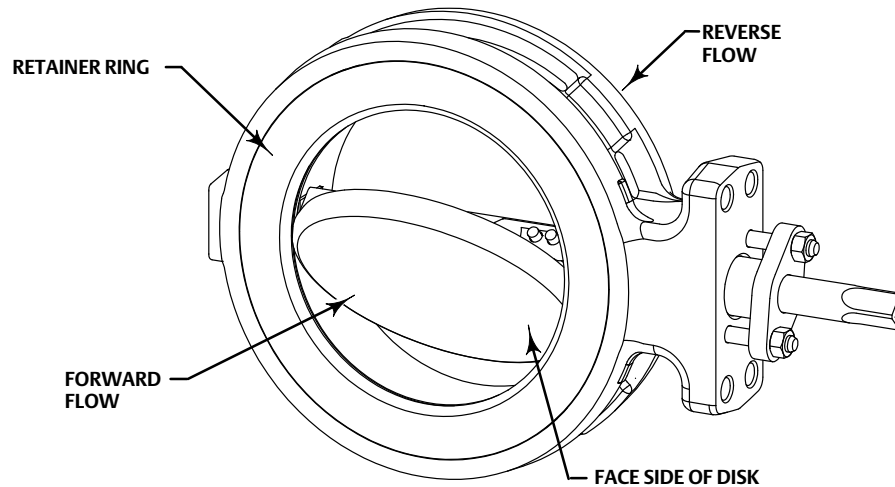


Table 5. Stud Bolt Data, NPS⁽¹⁾

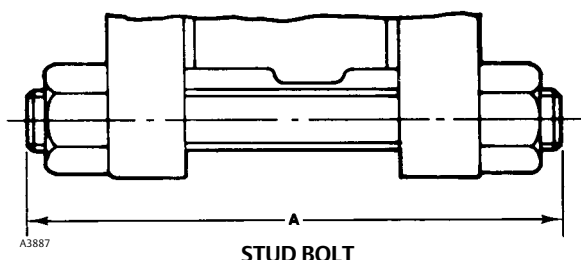
VALVE SIZE, NPS	WAFER STYLE					
	CL150			CL300		
	No. of Stud Bolts	Size Dia Inch & Thread	A Dimension, Inch	No. of Stud Bolts	Size Dia Inch & Thread	A Dimension, Inch
3	4	5/8-11	5.75	8	3/4-10	6.5
4	8	5/8-11	6	8	3/4-10	7
6	8	3/4-10	6.5	12	3/4-10	7.5
8	8	3/4-10	7	12	7/8-9	9
10	12	7/8-9	8	16	1-8	10
12	12	7/8-9	8.5	16	1-1/8-8	11

1. Thread engagement in accordance with ASME B31.3.

Table 6. Stud Bolt Data, DN

VALVE SIZE, DN	WAFFER STYLE											
	PN10			PN16			PN25			PN40		
	No. of Stud Bolts	Size Dia Inch & Thread	A Dim, mm	No. of Stud Bolts	Size Dia Inch & Thread	A Dim, mm	No. of Stud Bolts	Size Dia Inch & Thread	A Dim, mm	No. of Stud Bolts	Size Dia Inch & Thread	A Dim, mm
80	8	M16 X 2	140	8	M16 X 2	140	8	M16 X 2	150	8	M16 X 2	150
100	8	M16 X 2	150	8	M16 X 2	150	8	M20 X 2.5	160	8	M20 X 2.5	160
150	8	M20 X 2.5	160	8	M20 X 2.5	160	8	M24 X 3	180	8	M24 X 3	180
200	8	M20 X 2.5	170	12	M20 X 2.5	170	12	M24 X 3	190	12	M24 X 3	210
250	12	M20 X 2.5	180	12	M24 X 3	190	12	M24 X 3	210	12	M30 X 3.5	230
300	12	M20 X 2.5	190	12	M24 X 3	200	16	M24 X 3	230	16	M30 X 3.5	250

Figure 4. Stud Bolts for Installation (also see table 5)



Installing the Valve in the Pipeline

⚠ WARNING

The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 3, figure 12).

CAUTION

Damage to the disk will occur if any pipe flanges or piping connected to the valve interfere with the disk rotation path. If the piping flange has a smaller inner diameter than what is specified for schedule 80 piping, measure carefully to be certain the disk rotates without interference before putting the valve into operation.

CAUTION

Damage to the disk (key 3) sealing surfaces may occur if the disk is not closed when the valve is being installed or removed from the pipeline. If necessary, use a temporary pressure source on the actuator to retain the disk in the closed position while installing or removing the valve from the pipeline.

1. For Fail-Open Actuators: It will be necessary to provide a temporary loading pressure to the actuator diaphragm to move the valve disk to the closed position. Observe the above **Warning** when closing the valve. If a loading pressure is required, use caution when working with the valve. If the loading pressure is disconnected, the disk will open rapidly.
2. With the disk in the closed position, install line flange gaskets, and install the valve between the pipeline flanges.

Note

The wafer style valves use the standard size spiral wound gaskets.

Select the appropriate gaskets for the application. Gasket types made to ASME 16.5 group or a user's standards can be used for 8540 valves depending on the service conditions and applications.

3. Install the flange studs:

Note

Lubricate line flange studs or bolts before inserting them into flanges. If necessary, provide additional support for the control valve assembly because of its combined weight.

- **Flange studs:** Install two or more line flange studs into the line flanges to help hold the valve in position while centering the valve. Carefully center the valve on the flanges to ensure disk clearance.
 - Select and install two pipe line gaskets.
4. Install the remaining line flange bolting to secure the valve in the pipeline. Tighten the nuts to the line flange studs in a crisscross pattern to ensure proper alignment of valve, gaskets, and flanges.

Packing Adjustment and Shaft Bonding

WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

CAUTION

Use caution when tightening packing follower nuts because over-tightening the nuts will accelerate wear and could produce higher rotating friction loads on the valve stem.

- **PTFE packing:** tighten standard packing follower nuts only enough to prevent shaft leakage. Excessive tightening of packing will accelerate wear and could produce higher rotating friction loads on the valve stem. If necessary, refer to the Packing Maintenance section.

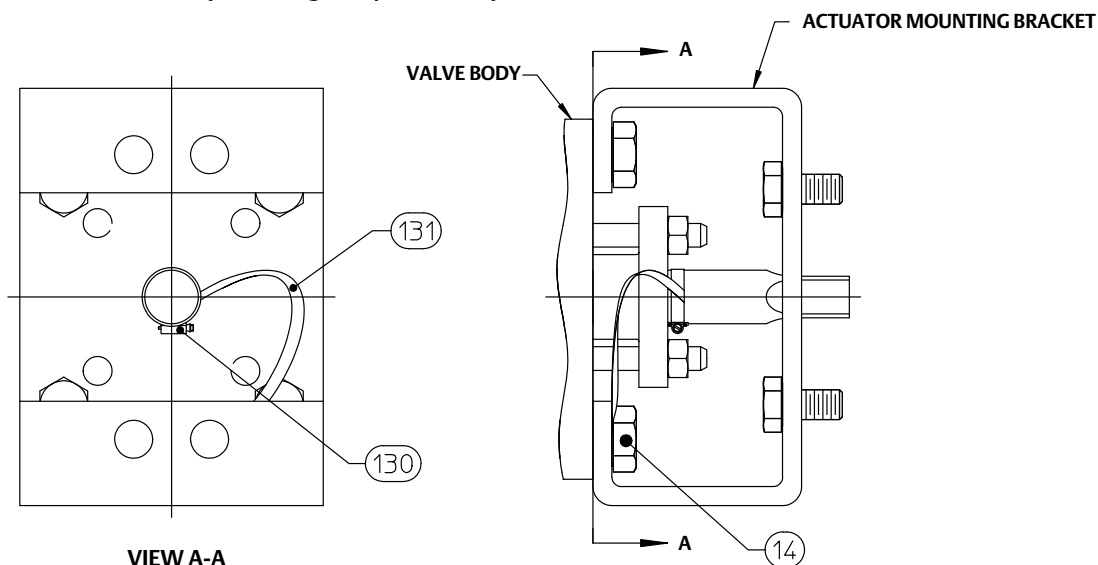
⚠ WARNING

The valve drive shaft is not necessarily grounded to the pipeline when installed. Personal injury or property damage could result from an explosion caused by a discharge of static electricity from the valve components if the process fluid or the atmosphere around the valve is flammable. To avoid personal injury or property damage, make sure the valve is grounded to the pipeline before placing the valve assembly into service.

Standard PTFE packing is composed of a partially conductive carbon-filled PTFE female adaptor with PTFE V-ring packing. Alternate shaft-to-valve body bonding is available for hazardous service areas where the standard packing is not sufficient to bond the shaft to the valve (see the following step).

1. Attach the bonding strap assembly (key 131, figure 5) to the shaft with the clamp (key 130, figure 5), and connect the other end of the bonding strap assembly to the valve with the cap screw (key 14, figure 5).
2. For more information, refer to the Packing Maintenance subsection below.

Figure 5. Optional Shaft-to-Valve Body Bonding Strap Assembly



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Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given in this section for replacing packing, seal ring, disk, shaft, bearings, and other valve parts. Also, instructions are provided for changing valve action, mounting, and adjusting the actuator. Refer to the actuator instruction manual for additional information for mounting and adjusting the actuator.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- It is possible to damage the valve if the actuator travel stops are not properly adjusted before stroking the valve.

CAUTION

During any of the following steps, do not rotate the disk past 90 degrees in the open direction. Rotating the disk past 90 degrees can damage the seal ring.

Packing Maintenance

PTFE-filled packing has a partially conductive packing ring (such as a carbon-filled PTFE female adaptor) to electrically bond the shaft to the valve body.

When replacing the packing, it is recommended to remove the control valve assembly from the pipeline because valve/actuator adjustments must be made with the valve out of the pipeline.

Disassembly

Key numbers and part locations are shown in figure 12 unless otherwise noted.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shutoff all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
2. Note the position of the mark on the end of the valve shaft, and its relationship to the actuator shaft.
3. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws (key 14, figure 5). Remove the clamp if the strap is used.
4. Remove the packing nuts (key 101) and packing follower (key 114). For NPS12 CL300 and DN300 PN25 and PN40, remove the packing flange and follower (key 102 and 114).
5. Remove the old packing rings, using a formed hook.

CAUTION

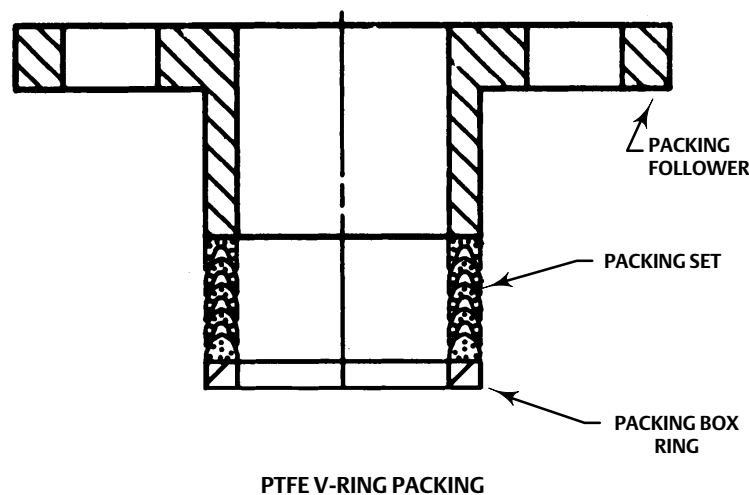
Carefully use the hook. Avoid damaging the drive shaft or packing box wall. Scratches on valve surfaces can cause leakage. (Note: The packing box ring (key 107) can remain in place when replacing packing only.)

6. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing.

Assembly

Inspect the shaft: If it is damaged, it cannot make a good seal with the packing, and it must be replaced. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. Inspect the packing box wall for nicks and scratches when performing the following procedures.

Figure 6. Typical Packing Arrangement



C0785*A

1. Install the new packing parts (see figure 6). Install the packing follower and finger tighten the packing flange nuts onto the studs only enough to stop leakage.
2. If the valve was equipped with a bonding strap assembly (figure 5), re-install the assembly.
3. Refer to the Actuator Mounting section of this manual. If necessary, refer to the separate actuator instruction manual for adjustment procedures.
4. When the control valve is being placed into operation, check around the packing follower for leakage.

Leakage from the PTFE packing can often be stopped by tightening the packing flange nuts just enough to stop the leak.

CAUTION

Use caution when tightening the nuts. Overtightening the nuts can damage packing box parts and result in increased drive shaft friction.

Seal Ring Maintenance

Perform this procedure if the control valve is not shutting-off properly (if it is leaking downstream). It is recommended, but not required, to remove the actuator for easier handling of the valve during the following procedures.

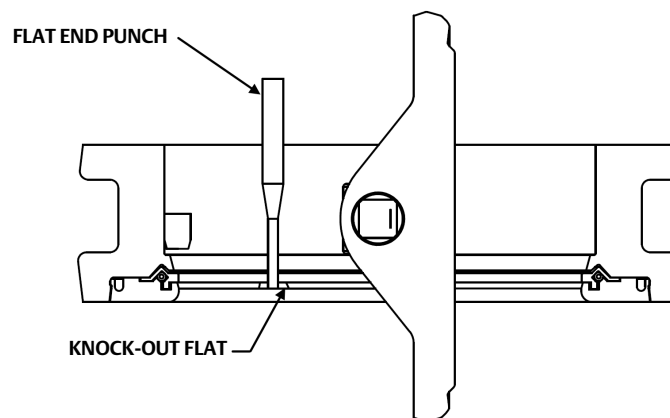
⚠ WARNING

The edges of a rotating disk close with a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 3).

CAUTION

During any of the following steps, do not rotate the disk past 90 degrees in the open direction. Rotating the disk past 90 degrees can damage the seal ring.

Figure 7. Retainer Ring Knock-Out Flat



Key numbers are shown in figure 12 unless otherwise noted.

Disassembly

Most maintenance procedures will require the actuator to be removed.

1. Isolate the control valve from line pressure, and relieve pressure from the valve body. Shut off and disconnect all lines from the power actuator.
2. Be sure the disk is in the closed position before attempting to remove the valve from the pipeline or flanges.
 - For Fail-Open Actuators: It will be necessary to provide a temporary loading pressure to the actuator diaphragm to move the valve disk to the closed position. Observe the above Warning when closing the valve. If a loading pressure is required, use caution when working with the valve. If the loading pressure is disconnected, the disk will open rapidly.
3. With the disk in the closed position, remove line bolting, then remove the control valve assembly from the pipeline.
4. Remove the actuator as described in the Packing Maintenance section.
5. Remove the retainer ring (key 2, figure 8):

- Place the valve on blocks with the seal retainer facing down. (Note: Position blocks so they do not restrict the retainer ring removal.)
- Rotate the disk to the open position as shown in figure 7.
- Locate one of the knock-out points machined on the retainer ring. Using a hammer and flat end punch the knock-out point, pop out the retainer ring from the valve body.

CAUTION

When popping out the retainer ring, be very careful to hit only the knock-out points. Hitting anywhere else can cause non-repairable damage to the t-slot area.

- Clean all sealing surfaces and parts before re-assembly.
6. Remove the seal ring from the valve body seal ring slot. Remove the spring from the PTFE seal ring (key 5) as it may be necessary to re-install the spring into the new PTFE seal ring.
 7. If it is necessary to replace the disk, drive shaft, and the bearings, refer to that section below before proceeding with the assembly procedures for the seal ring and retainer. The seal ring could be damaged if it is in place while removing the disk.

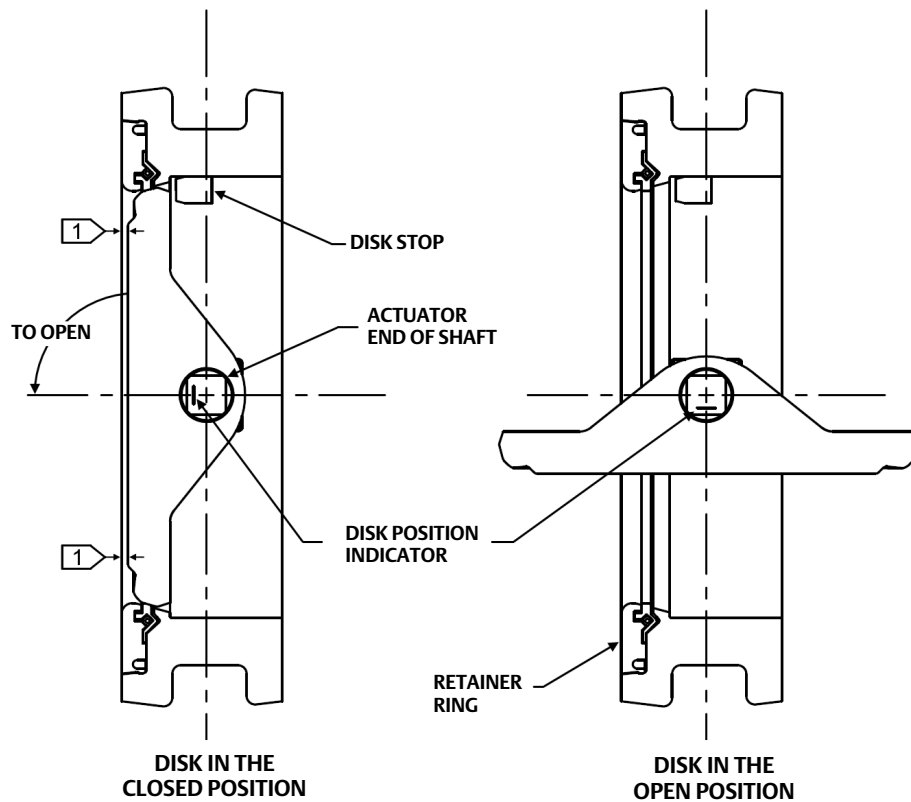
Assembly

Place the valve on blocks with the seal retainer facing up. If the replacement disk, shaft, and bearings have not been installed in the valve body, go to the proper assembly procedures to install them.

CAUTION

Do not install the seal ring without the disk being in place. The seal ring could be damaged while installing the disk.

Figure 8. Disk Rotation Indication



NOTE:

1 SET ACTUATOR TRAVEL STOPS TO OBTAIN AN EQUAL DISTANCE TO DISK SURFACE AS SHOWN.

CAUTION

Do not rotate the disk past 90 degrees in the open direction. Rotating the disk past 90 degrees can damage the seal ring or other component parts.

Note

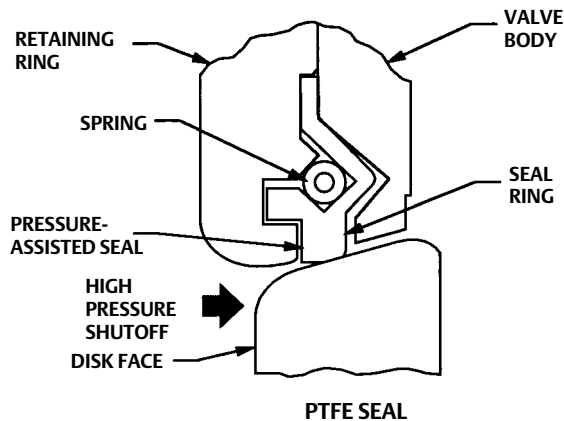
PTFE, NOVEX, and Phoenix III seal rings used in other valve types are not interchangeable with seal rings used in the 8540 valve. The 8540 seal rings are not interchangeable with seal rings in any other valve type. To order seal rings for this valve, provide the serial number on the valve.

1. Installing PTFE seal rings:

- The valve disk should be closed while installing the seal ring. If not, rotate the disk to the closed position as shown in figure 8.
- Hook the spring ends together, insert the spring (see figure 9) into the groove in the seal ring, and work the spring into the recess in the PTFE seal ring.

- c. Install the seal ring assembly into the slot in the valve body as shown in figure 9. Refer to Installing the retainer ring steps below.

Figure 9. Available Seal Configurations



2. Installing the retainer ring:

- a. Wipe excessive oil off the retainer ring outside diameter, and off the retainer counterbore in the valve body.
- b. Rotate the disk to the open position.
- c. Lay the retainer ring on the valve body.
- d. Use a press, or a soft-faced hammer to press the retainer ring into its groove in the valve body.

CAUTION

It takes a considerable amount of force with a hammer to drive the retainer ring into place. Be sure not to damage retainer ring surfaces when installing the ring.

- e. The retainer ring is properly seated when the face of the retainer ring is flush with the face of the valve body.
- f. To ensure proper seal performance for metal seals, you may need to use the hammer to drive the disk open for the first few times. When closing the valve, use the C-clamps discussed in the next few steps.

CAUTION

Do not damage the gasket seating surfaces on either the valve body or the retainer ring when installing or removing the C-clamps. Protect the gasket surface by using a soft material between the clamp and valve body/retaining ring serrations to avoid damage.

- g. Use three C-clamps to hold the retainer in place. Locate one of the C-clamps near the travel stop in the valve body, and the other two at 120 degrees from the stop.
- h. When cycling the disk for the first three times, use a dead-blow hammer with a soft head to drive the disk closed. Also, you may need to use the hammer to drive the disk open for the first few times.

3. Turn the disk into and out of the seal ring several times, to help break in the seal and reduce actuator torque requirements during adjustment.
4. If replacing the packing, remove all packing parts from the valve body. Upon re-assembly of the valve, refer to the Packing Maintenance procedures to replace the packing.

Disk, Drive Shaft, and Bearing Maintenance

This procedure is to be performed when replacing the valve disk, drive shaft, taper pins, hollow pins, and bearings due to wear or damage to one or more component parts.

Key numbers are shown in figure 12 unless otherwise noted.

Disassembly

1. Isolate control valve from line pressure, relieve pressure and drain process fluid, then remove control valve assembly from the pipeline as described in Seal Ring Maintenance section.
2. Loosen the packing flange nuts (key 101). This allows the drive shaft (key 8) to turn without the friction caused by the packing.
3. Remove the actuator using the steps provided in the Packing Maintenance section and separate actuator instruction manuals, and remove the seal ring using the steps provided in the seal ring maintenance procedures above.
4. Place the valve on a flat working surface with the seal ring slot facing down.
5. Use blocks to raise the valve body high enough to allow the disk to be rotated to the fully open position (see figure 8).
6. Rotate the disk (key 3) to the fully open position.
7. Locate the small ends of the taper pins. Drive the two taper pins (key 10) out towards the larger end of the pins. (Note: Attempting to drive the taper pins in the opposite direction only tightens the pins.) Also, remove the hollow pins (key 9) from the disk/shaft connection using the tool shown in figure 11.

Note

Make the tools for removal and installation of the hollow pin shown in figure 11.

8. Unscrew and remove the packing flange nuts (key 101), and the packing flange (key 102).

⚠ WARNING

Once the shaft has been removed in the following step, the disk may fall out of the valve body cavity. To avoid personal injury and property damage, support the disk to prevent it from falling as the shaft is being removed.

9. Pull the shaft out of the valve body, and remove the disk (key 3) from the valve body bore.
10. If the packing is to be replaced, remove all the packing parts from the valve body. Upon re-assembly of the valve, refer to the Packing Maintenance procedures to replace the packing parts.
11. Remove both of the bearings (key 6) from the valve body.
12. Clean all the sealing surfaces and parts, and inspect and/or obtain replacements before assembly.

Assembly

1. Install the bearings (key 6):

When installing the bearings in the opposite side of the valve body bore, repeat the following procedures.

- Position the bearing edge to match the valve body bore, and insert the one piece bearing/disk spacer into the bearing bore with the bearing tab facing away from the disk stop as shown in figure 10.

CAUTION

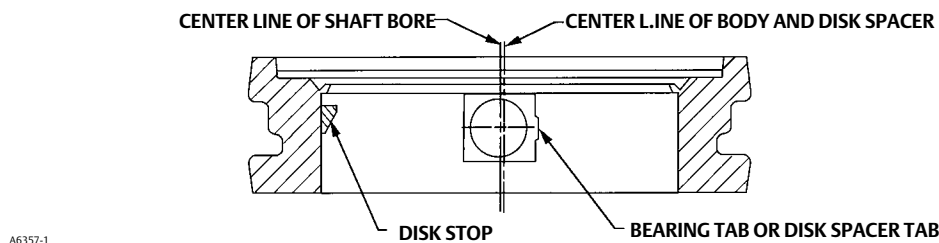
To avoid product damage, protect the disk sealing surfaces while inserting the disk into the valve body bore.

2. Position the disk to be certain that the holes in the disk are towards the actuator side of the valve. Carefully insert the disk into the valve body bore while protecting the disk sealing surfaces. Install the shaft (key 8):
3. Slide the shaft through the valve body bore and bearing. Position the disk as stated above and slide the shaft through the disk and outer bearing. Refer to step 4 below.

Installing the hollow pin and taper pin

4. Place the valve body on a flat working surface with the slot for the seal ring facing up. Block the valve body high enough to allow the disk to be rotated into the open position as shown in figure 11.

Figure 10. Orientation of Bearing/Spacer Tab



A6357-1

5. Rotate the disk to the open position. On the end of the drive shaft, locate the disk position mark on the end of the drive shaft. Rotate the shaft until it is in the appropriate disk position as shown in figure 11.

Note

Make sure the taper and hollow pins are free of particulate matter before continuing.

6. Line-up both holes in the disk hub with the holes in the drive shaft (key 8). (Note: The hole in the drive shaft is offset to prevent the shaft from being installed in the wrong position. Be sure the hole in the shaft is lined up with the hole in the disk hub.)
7. Insert the hollow pins (key 9), into the disk hub as shown in figure 11.
Using the tool shown in figure 11, tap the hollow pin down into the disk hub and shaft until the hollow pin bottoms on the stop in the disk.
8. Insert the taper pins (key 10) into the hollow pins. Using a flat end punch, drive the taper pins into the hollow pins until solid contact is felt. Anchor the pins in place by staking them with a center-punch and hammer. The disk and shaft should rotate smoothly.

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9. Install the seal ring assembly using the appropriate instructions in the Seal Ring Maintenance procedures.
10. Install the packing parts using the appropriate instructions provided in the Packing Maintenance procedures. Refer to the Actuator Mounting procedures before installing the valve in the pipeline.

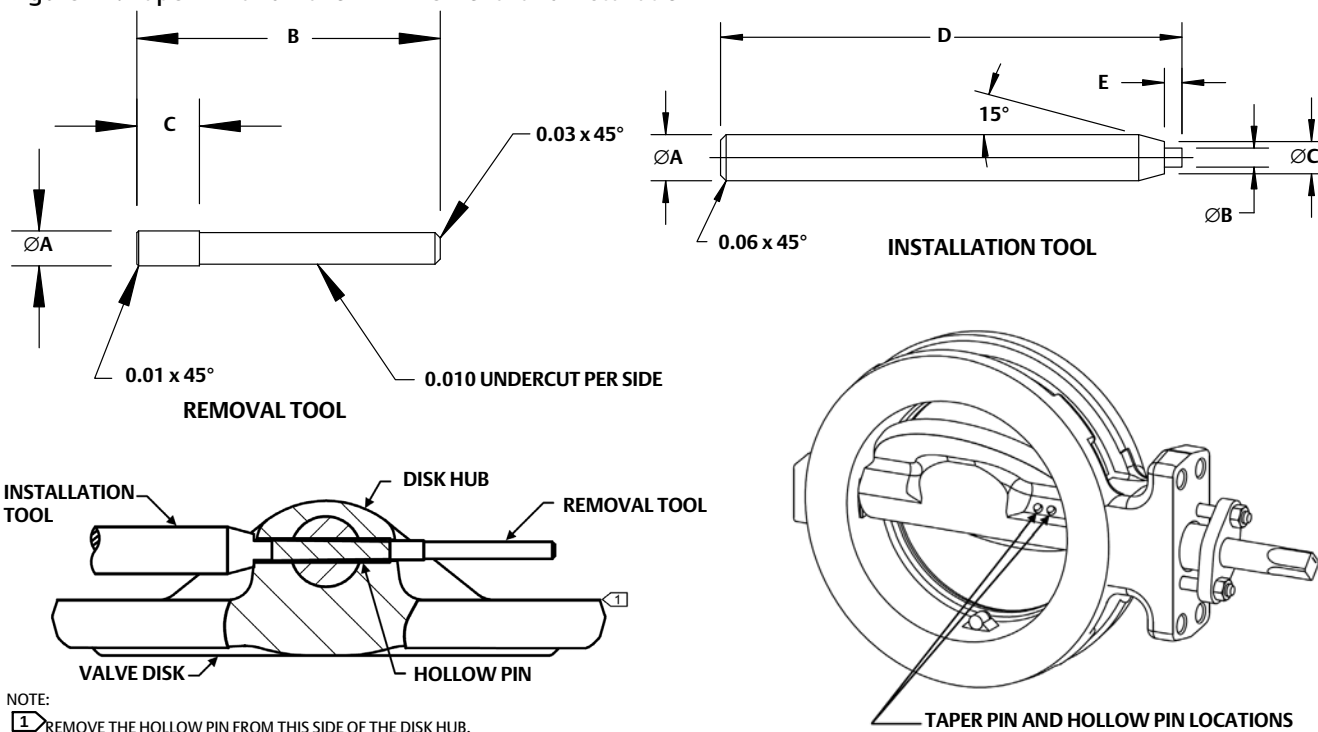
Table 7. Removal Tool Dimensions

SHAFT DIAMETER	ØA	B	C	ØD
mm				
12.7	3.91	28.43	6.35	4.19
15.88	4.60	38.10	7.87	23.37
19.05	5.13	44.45	9.65	5.41
25.4	7.00	59.44	12.70	7.26
31.75	9.50	76.20	19.05	9.78
38.1	10.82	88.90	19.05	11.10
44.45	12.37	114.30	22.35	12.65
Inch				
1/2	0.154	1.12	0.25	0.165
5/8	0.181	1.50	0.31	0.192
3/4	0.202	1.75	0.36	0.213
1	0.275	2.34	0.50	0.286
1-1/4	0.374	3.00	0.75	0.385
1-1/2	0.426	3.50	0.75	0.437
1-3/4	0.487	4.50	0.88	0.498

Table 8. Installation Tool Dimensions

SHAFT DIAMETER	ØA	ØB	ØC	D	E
mm					
12.7	12.7	3.68	6.35	127.0	4.83
15.88	12.7	4.57	7.62	127.0	4.83
19.05	12.7	5.23	8.89	127.0	4.83
25.4	12.7	7.00	10.41	127.0	4.83
31.75	19.05	10.00	13.59	146.0	6.35
38.1	19.05	11.56	15.24	146.0	6.35
44.45	19.05	31.21	16.76	146.0	6.35
Inch					
1/2	0.50	0.145	0.250	5.00	0.19
5/8	0.50	0.180	0.300	5.00	0.19
3/4	0.50	0.206	0.350	5.00	0.19
1	0.50	0.275	0.410	5.00	0.19
1-1/4	0.75	0.395	0.535	5.75	0.25
1-1/2	0.75	0.455	0.600	5.75	0.25
1-3/4	0.75	0.520	0.660	5.75	0.25

Figure 11. Taper Pin and Hollow Pin Removal and Installation



Actuator Mounting

Re-install the seal ring and packing rings using the appropriate procedures before installing the actuator on the valve. Mount the actuator on the valve body in accordance with the instructions in the actuator instruction manual and this section.

In the Packing Maintenance steps, you should have noted the position of the mark on the end of the valve shaft, and its relationship to the actuator shaft. If not, determine the configuration needed to match your application.

Be certain that the disk is rotating counterclockwise to open when viewed from the actuator side of the valve, and that the disk is not rotated beyond its limits.

1. Orientate the valve drive shaft correctly to match the actuator or handlever position, and install it into the actuator and actuator lever arm until the mounting pads mate with each other.
2. Tighten the actuator-mounting cap screws to the appropriate bolt torque from table 9.

CAUTION

The valve disk stop, in the valve body bore is not to be used as a power actuator travel stop (see figure 10). Use the actuator travel stops to limit the rotation of the valve disk. It is possible to damage the valve component parts if full actuator thrust is applied to the valve disk stop.

For actuators with an adjustable travel stop, the travel stop must be adjusted so that the valve is closed (determined by measuring as shown in figure 7) when the diaphragm or piston is against the actuator at the travel stop.

For manually operated actuators or actuators without adjustable linkage, make certain that the travel of the actuator stops before the disk rotates past the closed position.

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Table 9. Recommended Bolt Torques for Actuator/Mounting Cap Screws and Nuts

VALVE SIZE, NPS	VALVE SIZE, DN	RECOMMENDED BOLT TORQUE	
		N•m	lb•ft
		CL150 / PN 10-16	
3, 4, 6, and 8	80, 100, 150, and 200	88	65
10 and 12	250 and 300	135	100
		CL300 / PN 25-40	
3, 4, and 6	80, 100, and 150	88	65
8 and 10	200 and 250	135	100
12	300	183	135

Note

To obtain proper shutoff, the closed position of the 8540 valves must be set with the disk parallel to the retaining ring. Do not use the disk stop to set the actuator travel stops.

- Adjust the actuator travel stop to limit the open and closed positions of the valve disk. (If necessary, refer to the actuator instruction manual for more information about adjustments.) Do not use the disk stop as a actuator travel stop as discussed in the **Caution** above.
- For actuators with adjustable turnbuckles, adjust the turnbuckle to bring the disk to the fully closed position at the end of the actuator stroke. If necessary, refer to the appropriate actuator instruction manual for assistance.
- If using a manual handwheel or handlever actuator, refer to the appropriate actuator instruction manual for mounting positions and adjustments.
- To determine the fully closed disk position (zero degrees of disk rotation), measure the distances between the positions on the disk face as shown in figure 8. Use the actuator to rotate the disk while re-checking the two measurements. Repeat adjustment until the two measurements are equal.

Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

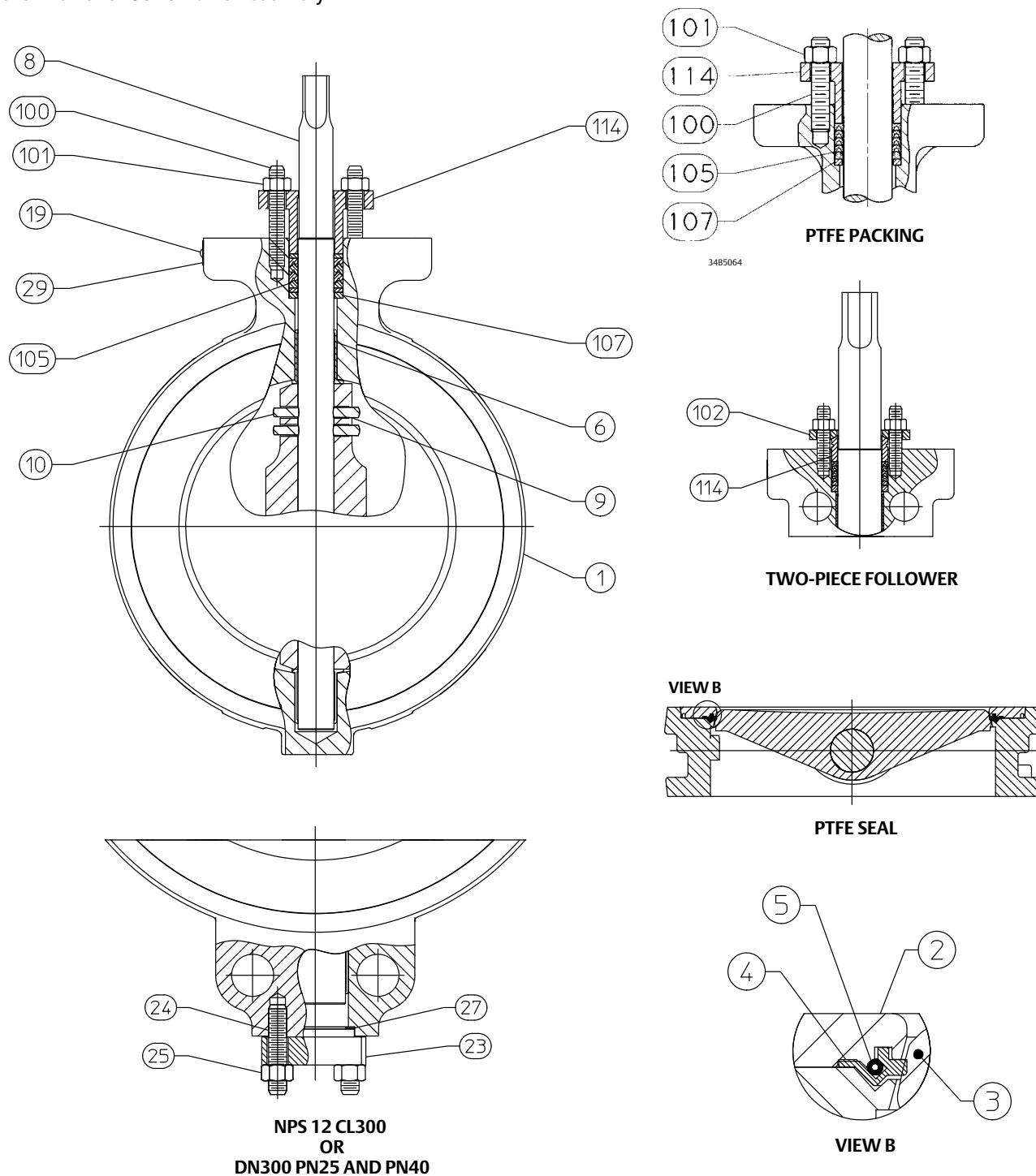
For part ordering information contact your [Emerson sales office](#).

Key Description

- 1 Valve Body
If you need a new valve body, order by valve size, serial number and desired material.
- 2* Seal Retainer
- 3 Valve Disk
- 4* Seal Ring
- 5* Spring
- 6* Bearing (2 req'd)
- 8* Drive Shaft

- 9* Hollow Pin
- 10* Taper Pin
- 18 Mfg Label
- 19 Drive Screw, w/ nameplate
- 21 Nameplate
- 22 Lead Seal & Wire (not shown)
- 23 Bottom Cap, 12-inch only
- 24 Bottom Cap Stud, 12-inch only
- 25 Bottom Cap Hex Nut, 12-inch only
- 27 Bottom Cap Gasket, 12-inch only
- 29 Flow Arrow
- 100 Packing Stud (2 req'd)
- 101 Packing Nut (2 req'd)
- 102 Packing Flange
- 105* Packing Set
- 107 Packing Box Ring
- 108* Packing Ring (4 req'd)
- 111 Tag
- 114 Packing Follower
- 115* Packing Washer (3 req'd)

Figure 12. Fisher 8540 Valve Assembly



NOTE:
KEYS 21, 22, 28, AND 115 ARE NOT SHOWN.

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Fisher™ 8560 Eccentric Disk Butterfly Control Valve

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Figure 1. Fisher 8560 Valve with 1052 Actuator and DVC6000 Series Digital Valve Controller



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 2 through 12 8560 Eccentric Disk Butterfly Control Valves (see figure 1). Refer to separate instruction manuals for information covering the actuator and accessories.

Do not install, operate, or maintain 8560 valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The seal design of the 8560 eccentric disk high performance butterfly valve provides excellent shutoff capability. The valve includes PTFE-filled or graphite packing rings that electrically bond the shaft to the valve body. This valve has a spline drive shaft end, and soft or metal seal rings for use in a wide variety of applications.

Table 1. Specifications

Valve Size and End Connection Styles

NPS ■ 2, ■ 3, ■ 4, ■ 6, ■ 8, ■ 10, and ■ 12 valves and in Wafer or Single flanged style (NPS 2 available in wafer only)

Maximum Inlet Pressure⁽¹⁾

Carbon Steel and Stainless Steel Valve Bodies:
Consistent with CL150 and 300 pressure/temperature ratings per ASME B16.34 unless limited by material temperature capabilities. NPS 2 is also consistent with CL600.

Maximum Pressure Drops⁽¹⁾

Consistent with CL150 and 300 pressure-temperature ratings per ASME B16.34 except for PTFE, UHMWPE and Phoenix III seals which are derated at some higher pressure-temperature values. Refer to figure 2

Shutoff Classifications

■ PTFE, Reinforced PTFE, and UHMWPE⁽³⁾ Seals: Bidirectional shutoff to Class VI per ANSI/FCI 70-2 and IEC 60534-4.

■ NPS 2 Metal Seal: Bidirectional shutoff. 0.001% of maximum valve capacity (1/10) of Class IV per ANSI/FCI 70-2 and IEC 60534-4. Maximum Pressure drop is 51 bar (740 psi) forward and 6.9 bar (100 psi) reverse.

■ NOVEX Seal: For NPS 3 through 12. Unidirectional shutoff is 0.0001% of maximum valve capacity (1% of Class IV) in the reverse flow direction per ANSI/FCI 70-2 and IEC 60534-4.

■ Phoenix III Seal: For NPS 3 through 12. Bidirectional shutoff to Class VI per ANSI/FCI 70-2 and IEC 60534-4. For the optional Phoenix III Fire-Tested seal, consult your [Emerson sales office](#).

Flow Characteristics

Approximately linear

Disk Rotation

Clockwise to close (when viewing from the drive shaft end) through 90 degrees of disk rotation (see figure 10)

Flow Direction

See figure 3

Actuator/Valve Action

With the diaphragm or piston actuators, the valve action is field-reversible. Refer to information in the Installation section.

Valve Classification

Face-to-face dimensions of NPS 3 through 12 are in CL150 and 300, and meet API 609 or MSS-SP-68 standards for face-to-face dimensions of wafer-style and single flange valves.

Shaft Diameters

See table 2

Approximate Weights

See table 2

ENVIRO-SEAL Packing

This optional PTFE or graphite packing system provides excellent sealing, guiding, and transmission of loading forces to control liquid and gas emissions (see figure 8). See bulletin 59.3:041 ENVIRO-SEAL Packing System for Rotary Valves ([D101638X012](#)) for more information.

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valves should not be exceeded.

2. For components selection and applicable fire tested standards and codes, consult your Emerson sales office.

3. UHMWPE stands for ultra high molecular weight polyethylene.

Table 2. Valve Size, Shaft Diameter, and Approximate Weight

VALVE SIZE, NPS	CLASS	SHAFT DIAMETER		APPROXIMATE WEIGHT			
				Wafer-Style		Single-Flange	
		mm	Inches	kg	Pounds	kg	Pounds
2	150/300/600	12.7	1/2	4.3	9.5	---	---
3	150	12.7	1/2	4.5	10	6.4	14
	300	15.9	5/8	5.9	13	11	25
4	150	15.9	5/8	8.6	19	11	24
	300	19.1	3/4	10	23	18	39
6	150	19.1	3/4	13	29	16	35
	300	25.4	1	15	33	27	59
8	150	25.4	1	21	47	27	59
	300	31.8	1-1/4	24	53	42	93
10	150	31.8	1-1/4	34	75	40	88
	300	38.1	1-1/2	44	96	78	172
12	150	38.1	1-1/2	49	107	62	137
	300	44.5	1-3/4	64	141	131	288

Installation

The valve is normally shipped as part of a control valve assembly, with the power actuator mounted on the valve. If the valve or actuator have been purchased separately, or if the actuator has been removed for maintenance, mount the actuator on the valve, and adjust actuator travel before inserting the valve body into the line. This is necessary due to the measurements that must be made during the actuator calibration adjustment process. Refer to the Actuator Mounting section of this manual to mount the actuator on the valve. Refer to the actuator instruction manual for mounting and adjusting instructions before proceeding.

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given in this manual, the limits on the appropriate nameplates, or the matching pipe flange rating. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

The valve configuration and construction materials are selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some valve body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

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Table 3. Maximum Allowable Inlet Pressure for M35-1 and CW2M Valve Bodies⁽¹⁾

TEMPERATURE	M35-1			CW2M		
	150	300	600 ⁽²⁾	150	300	600 ⁽²⁾
°C	Bar					
-46 to 38	15.8	41.3	82.7	20.0	51.7	103.4
93	13.8	36.5	72.7	17.9	51.7	103.4
149	13.1	34.1	68.2	15.9	50.3	100.3
204	12.7	33.1	65.8	13.8	48.6	97.2
260	11.7	32.8	65.5	11.7	45.9	91.7
°F	Psig					
-50 to 100	230	600	1200	290	750	1,500
200	200	530	1055	260	750	1,500
300	190	495	990	230	730	1,455
400	185	480	955	200	705	1,410
500	170	475	950	170	665	1,330

1. M35-1 and CW2M valve material are not included in ASME B16.34 pressure/temperature ratings. The designations 150 and 300 for this valve material are used only to indicate relative pressure/retaining capabilities and are not ASME pressure/temperature rated classes.
2. CL600 is only available in the NPS 2.

Table 4. Construction Material Temperature Limits⁽¹⁾

COMPONENTS AND MATERIALS OF CONSTRUCTION	TEMPERATURE LIMITS	
	°C	°F
Valve Body Material / Disk / Shaft Material		
Carbon Steel / CF8M / S17400	-29 to 427	-20 to 800
Carbon Steel / CF8M / S20910	-29 to 427	-20 to 800
CF8M / CF8M / S17400	-73 to 427	-100 to 800
CF8M / CF8M / S20910	-198 to 538	-325 to 1000
CG8M / CG8M / S20910	-198 to 538	-325 to 1000
Bearing Material		
PEEK / PTFE lined	-73 to 260	-100 to 500
Metal (NOVEX or Phoenix III only)	-198 to 538	-325 to 1000
Packing Material		
PTFE V-Rings	-46 to 232	-50 to 450
Graphite rings (NOVEX or Phoenix III only)	-198 to 538	-325 to 1000
Seal Ring		
PTFE (Standard) Soft Seal Ring	-46 to 232	-50 to 450
Reinforced PTFE Soft Seal Ring	-46 to 232	-50 to 450
UHMWPE Soft Seal Ring	-18 to 93	0 to 200
NOVEX Metal Seal Ring	-46 to 538	-50 to 1000
Phoenix III Metal Seal Ring	-40 to 232	-40 to 450
Fluorocarbon backup ring	-40 to 232	-40 to 450
Phoenix III Fire-Tested ⁽²⁾ Metal Seal Ring	-40 to 232 ⁽²⁾	-40 to 450 ⁽²⁾
Fluorocarbon backup ring (Specify metal bearings and graphite packing)	-40 to 232 ⁽²⁾	-40 to 450 ⁽²⁾

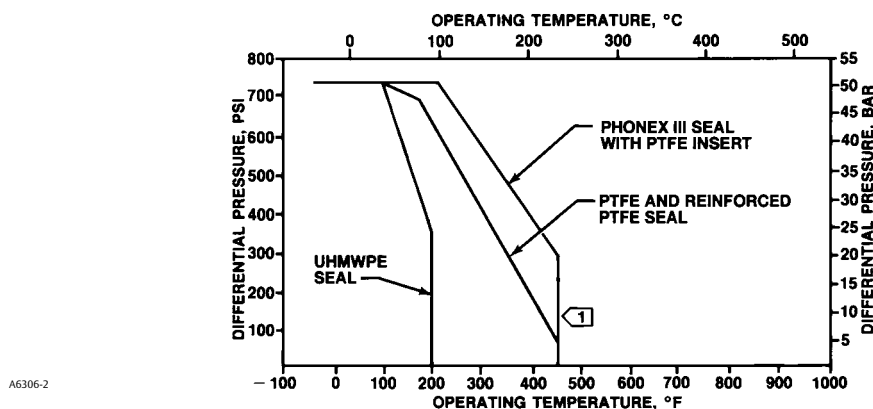
1. Refer to Ordering Matrix for 8560 Valves. For selection temperatures not shown above, contact your [Emerson sales office](#).
2. For component selection and applicable fire-tested standards and codes, consult your Emerson sales office.

1. Install a three-valve bypass around the control valve assembly if continuous operation is necessary during inspection and maintenance of the valve.
2. Inspect the valve to be certain that it is free of foreign material.

CAUTION

Be certain that adjacent pipelines are free of any foreign material, such as pipe scale or welding slag, that could damage the valve sealing surfaces.

Figure 2. Maximum Pressure/Temperature Ratings



NOTE:

TEMPERATURE LIMITATIONS DO NOT ACCOUNT FOR THE ADDITIONAL LIMITATIONS IMPOSED BY THE BACKUP RING USED WITH THIS SEAL. TO DETERMINE THE EFFECTIVE TEMPERATURE LIMITATION OF THE APPROPRIATE SEAL/BACKUP RING COMBINATION, REFER TO TABLE 4.

Valve Orientation

When installing the valve, it is recommended that the valve drive shaft be horizontal as shown in figure 1.

Note

Due to its weight, the 1052 size 70 actuator must be externally supported when mounted in a horizontal position.

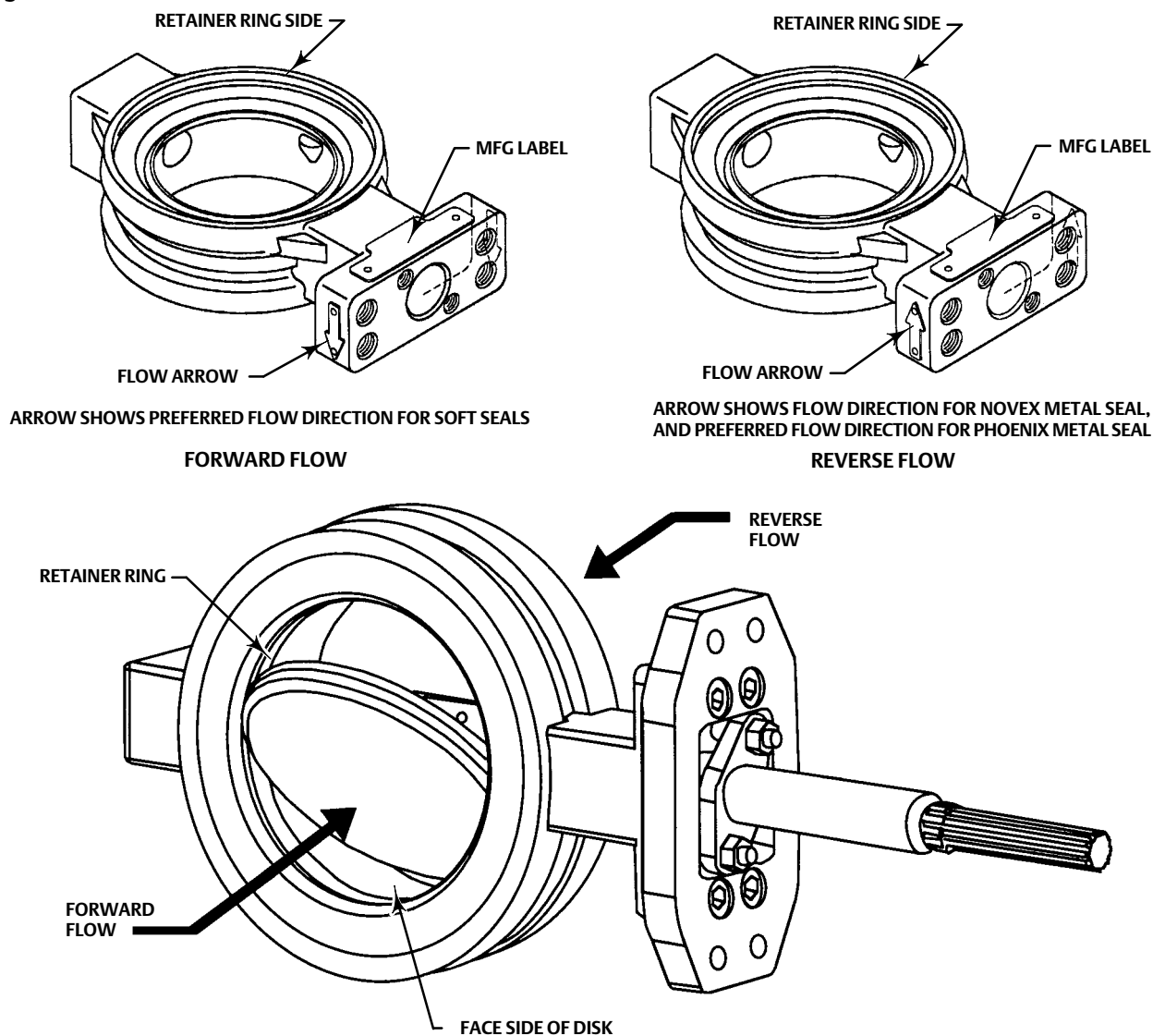
Valve Direction

The high performance butterfly valve is designed to allow flow in either direction when in the open position. When in the closed position, high pressure should be applied to a specific side of the disk to provide best performance and optimal valve life (see list of seal types below). See figure 3.

Applications with bi-directional seals, such as soft or Phoenix III, under normal operating conditions can (at different times) experience pressure in both directions; the highest of the two pressures should be exerted on the preferred side of the disk. If the two pressures are equal, then the one lasting the longest period of time should be applied to the preferred side.

1. For PTFE, Reinforced PTFE, and UHMWPE seal rings: This seal is bidirectional. For optimal performance, high pressure should be applied to the front (retaining ring side) of the disk.
2. For metal seal rings:
 - a. NOVEX seal: The NOVEX seal is uni-directional. High pressure at the closed position MUST be at the back (waterway side) of the disk.
 - b. Phoenix III Seal: This seal is bidirectional. For best performance, high pressure at the closed position should be applied to the back (waterway side) of the disk.
 - c. NPS 2 Seal: The preferred direction of installation is with high pressure at the front (retaining ring side) of the disk. Reverse shutoff is permissible at lower pressure (see the specifications table).

Figure 3. Flow Direction



NOTES:

1. BY Emerson Automation Solutions DEFINITION:
- FORWARD FLOW IS INTO THE FACE SIDE OF THE DISK.
 - REVERSE FLOW IS INTO THE HUB SIDE OF THE DISK.

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Table 5. Special Spiral Wound Gasket Dimensions, Inches

Valve Size, NPS	Class	Gasket Internal Diameter	Gasket Outside Diameter	Centering Outside Diameter ⁽¹⁾
3	150	4.25	5.00	5.375
3	300	4.25	5.00	5.875
4	150	5.25	6.125	6.875
4	300	5.25	6.125	7.125

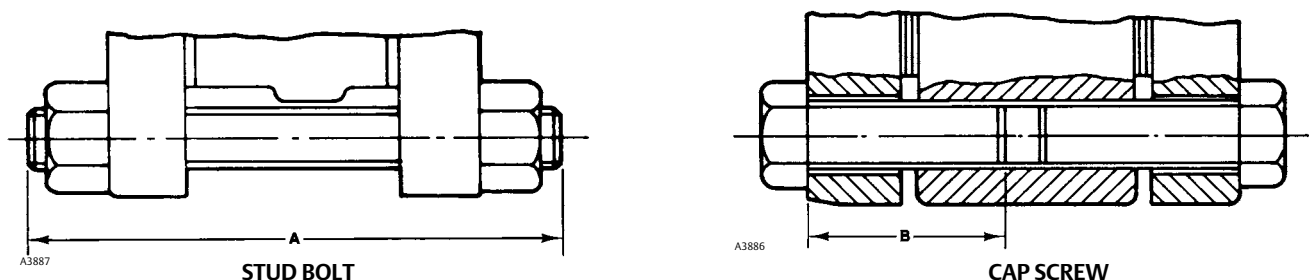
1. Dimension per API 601 and ASME 16.5 Flanges.

Table 6. Stud Bolt and Hex Head Cap Screw Data⁽¹⁾

VALVE SIZE, NPS	WAFER STYLE						SINGLE FLANGE STYLE					
	CL150			CL300			CL150			CL300		
	No. of Stud Bolts	Size Dia Inch & Thread	A Dimen- sion, Inch	No. of Stud Bolts	Size Dia Inch & Thread	A Dimen- sion, Inch	No. of Cap Screws	Size Dia Inch & Thread	B Dimen- sion, Inch	No. of Cap Screws	Size Dia Inch & Thread	B Dimen- sion, Inch
2 ⁽²⁾	4	5/8-11	5	8	5/8-11	5.25	---	---	---	---	---	---
3	4	5/8-11	5.75	8	3/4-10	6.5	8	5/8-11	1.875	16	3/4-10	2
4	8	5/8-11	6	8	3/4-10	7	16	5/8-11	2	16	3/4-10	2.25
6	8	3/4-10	6.5	12	3/4-10	7.5	16	3/4-10	2	24	3/4-10	2.5
8	8	3/4-10	7	12	7/8-9	9	16	3/4-10	2.25	24	7/8-9	3
10	12	7/8-9	8	16	1-8	10	24	7/8-9	2.5	32	1-8	3.5
12	12	7/8-9	8.5	16	1-1/8-8	11	24	7/8-9	2.75	32	1-1/8-8	3.75

1. Thread engagement in accordance with ASME B31.3.
2. The NPS 2 valve is only available in wafer style and is multirated to CL150, 300 and 600. The CL600 stud bolts require 8 bolts, have a dia. of 5/8-11, and are 6 inches long.

Figure 4. Stud Bolts and Cap Screws for Installation (also see table 6)



Installing the Valve in the Pipeline

⚠ WARNING

The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 3, figure 14).

CAUTION

Damage to the disk will occur if any pipe flanges or piping connected to the valve interfere with the disk rotation path. If the piping flange has a smaller inner diameter than what is specified for schedule 80 piping, measure carefully to be certain the disk rotates without interference before putting the valve into operation.

CAUTION

Damage to the disk (key 3) sealing surfaces may occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, use a temporary pressure source on the actuator to retain the disk in the closed position while removing the valve from the pipeline.

1. For Fail-Open Actuators: It will be necessary to provide a temporary loading pressure to the actuator diaphragm to move the valve disk to the closed position. Observe the above Warning when closing the valve. If a loading pressure is required, use caution when working with the valve. If the loading pressure is disconnected, the disk will open rapidly.
2. With the disk in the closed position, install line flange gaskets, and install the valve between the pipeline flanges.

⚠ WARNING

If spiral wound gaskets are to be used with an NPS 3 or 4 CL150 or 300 single flange valve, special spiral wound gaskets conforming to the dimensions listed in the table 5 MUST be used. Improperly sized gaskets may increase the likelihood of 1) excessive seat leakage, 2) damage due to contact with valve internals, and 3) external leakage; which may result in personal injury and/or property damage due to a sudden increase or decrease of pressure within - or release of pressure from - the pipeline. The special dimension spiral wound gaskets can be obtained from your local spiral wound gasket vendor.

Note

The remaining single flange valve sizes (NPS 6 through 12) and all wafer style valves (NPS 2 through 12) use the standard size spiral wound gaskets. Only the single flange valves in the sizes and pressures listed in table 5 require special spiral wound gaskets.

Select the appropriate gaskets for the application. Flat sheet, spiral wound (NPS 6 through 12), or other gasket types made to ASME 16.5 group or a user's standards can be used for 8560 valves depending on the service conditions and applications.

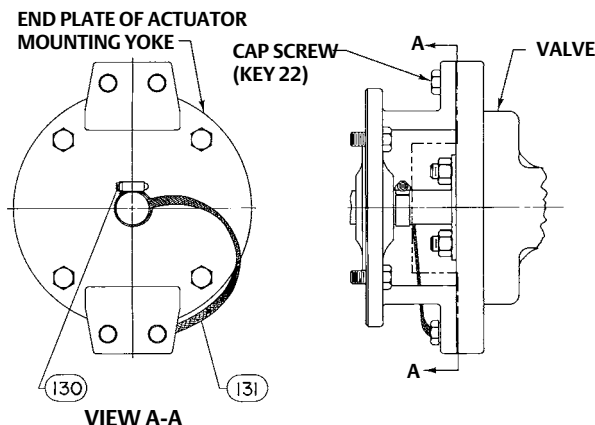
3. Install the flange studs:

Note

Lubricate line flange studs or bolts before inserting them into flanges. If necessary, provide additional support for the control valve assembly because of its combined weight.

- **Flange studs:** Install two or more line flange studs into the line flanges to help hold the valve in position while centering the valve. Carefully center the valve on the flanges to ensure disk clearance.

Figure 5. Optional Shaft-to-Valve Body Bonding Strap Assembly



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- Select and install two pipe line gaskets.
 - **Flange Cap Screws:** If line flange cap screws are used, be certain the cap screw threads engage the tapped holes to a depth equal to the flange cap screw diameter.
4. Install the remaining line flange bolting to secure the valve in the pipeline. Tighten the nuts to the line flange studs, or cap screws, in a crisscross pattern to ensure proper alignment of valve, gaskets, and flanges.

Packing Adjustment and Shaft Bonding

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

CAUTION

Use caution when tightening packing follower nuts because over-tightening the nuts will accelerate wear and could produce higher rotating friction loads on the valve stem.

1. For PTFE or graphite packing: tighten standard packing follower nuts only enough to prevent shaft leakage. Excessive tightening of packing will accelerate wear and could produce higher rotating friction loads on the valve stem. If necessary, refer to the Packing Maintenance section.
2. ENVIRO-SEAL Packing System will not require this initial re-adjustment. Refer to the separate ENVIRO-SEAL Packing System for Rotary Valves instruction manual (D101643X012) for repair and replacement procedures.
3. For hazardous atmosphere or oxygen service valves, read the following Warning, and provide the bonding strap assembly mentioned below if the valve is used in an explosive atmosphere.

⚠ WARNING

The valve drive shaft is not necessarily grounded to the pipeline when installed. Personal injury or property damage could result from an explosion caused by a discharge of static electricity from the valve components if the process fluid or the atmosphere around the valve is flammable. To avoid personal injury or property damage, make sure the valve is grounded to the pipeline before placing the valve assembly into service.

Standard PTFE packing is composed of a partially conductive carbon-filled PTFE female adaptor with PTFE V-ring packing. Standard graphite packing is composed of all conductive graphite ribbon packing rings. Alternate shaft-to-valve body bonding is available for hazardous service areas where the standard packing is not sufficient to bond the shaft to the valve (see the following step).

For oxygen service applications it is necessary to provide alternate shaft-to-valve body bonding according to the following step.

4. Attach the bonding strap assembly (key 131, figure 5) to the shaft with the clamp (key 130, figure 5), and connect the other end of the bonding strap assembly to the valve with the cap screw (key 22, figure 5).
5. For more information, refer to the Packing Maintenance subsection below.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given in this section for replacing

packing, seal ring, disk, shaft, bearings, and other valve parts. Also, instructions are provided for changing valve action, mounting, and adjusting the actuator. Refer to the actuator instruction manual for additional information for mounting and adjusting the actuator.

CAUTION

It is possible to damage the valve if the actuator travel stops are not properly adjusted before stroking the valve.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 3).
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

CAUTION

During any of the following steps, do not rotate the disk past 90 degrees in the open direction. Rotating the disk past 90 degrees can damage the seal ring.

Stopping Leakage

For PTFE-filled or graphite standard packing arrangements covered in this manual, often leakage from the packing can be stopped by tightening the packing flange nuts just enough to stop the leak.

CAUTION

Use caution when tightening the nuts because over-tightening the nuts can damage packing box parts.

- If tightening the packing flange nuts does not stop the leakage, use the following procedures to remove the control valve assembly from the pipeline. Remove the actuator when removing and replacing packing parts.
- If the leakage comes from the outside diameter of the packing box, it is possible that the leakage is caused by nicks or scratches on the packing box wall. Carefully inspect the packing box bore and valve drive shaft when the packing is removed. Use the following steps to remove the actuator and to remove and replace the packing parts.

Removing the Actuator

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

CAUTION

Damage to the disk (key 3) sealing surfaces may occur if the disk is not closed when the valve is being removed from the pipeline. If necessary to overcome spring force, use a temporary pressure source on the actuator to close the disk. Also, maintain the pressure to retain the disk in the closed position while removing the valve from the pipeline.

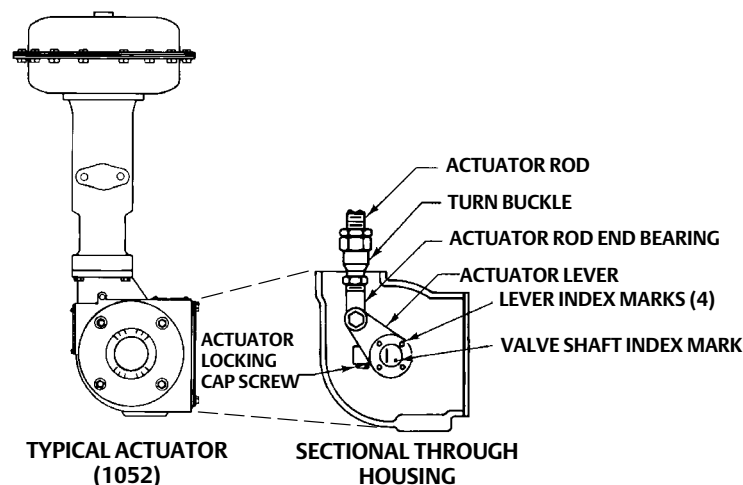
2. Be sure the disk is in the closed position before attempting to remove the valve from the pipeline or flanges.

⚠ WARNING

The edges of a rotating disk close with a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 3).

For Fail-Open Actuators: It will be necessary to provide a temporary loading pressure to the actuator diaphragm to move the valve disk to the closed position. Observe the above Warning when closing the valve. If a loading pressure is required, use caution when working with the valve. If the loading pressure is disconnected, the disk will open rapidly.

Figure 6. Lever-Shaft Orientation



C0784

3. With the disk in the closed position, remove line bolting, remove the control valve assembly from the pipeline, and place it on a flat working surface with the seal retainer ring facing up.
4. If a grounding strap is used (see figure 5), remove the hex nut to release the end of the strap. Remove the clamp (key 130) and strap (key 131).
5. Note the orientation of the actuator with respect to the valve body (see figure 6), and remove the actuator cover to note the lever orientation with respect to the valve drive shaft (see figure 7).

When re-assembling the control valve assembly, you will need to correctly position the marks on the end of the valve drive shaft and the valve body with respect to the actuator case and lever arm. Refer to the Actuator Mounting section and figure 7 for the location of the marks on the valve drive shaft end. Additional information is provided in the actuator manual to assist with disassembly, re-assembly, and travel adjustments. When removing the valve drive shaft from the actuator lever, do not loosen the actuator turnbuckle adjustment. Remove the cap screw from the actuator lever (figure 7).

CAUTION

When removing the actuator from the valve, do not use a hammer or similar tool to drive the actuator lever off the valve shaft. Driving the lever off the valve shaft could damage the disk, seal ring, bearings or valve body.

If necessary, use a wheel puller to remove the actuator lever from the valve shaft. It is okay to tap the wheel puller screw lightly to loosen the lever, but hitting the screw with excessive force could damage the disk, seal ring, bearings or valve body.

6. Remove the actuator mounting screws (key 14, figure 14).
7. Remove the valve from the actuator.

Packing Maintenance

Standard graphite packing is composed of all conductive packing rings. PTFE-filled packing has a partially conductive packing ring (such as a carbon-filled PTFE female adaptor) to electrically bond the shaft to the valve body.

If the valve is equipped with the optional ENVIRO-SEAL Packing System, refer to the separate ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)) for packing maintenance procedures.

When replacing the packing, it is recommended to remove the control valve assembly from the pipeline because valve/actuator adjustments must be made with the valve out of the pipeline.

Disassembly

Key numbers and part locations are shown in figure 8 unless otherwise noted.

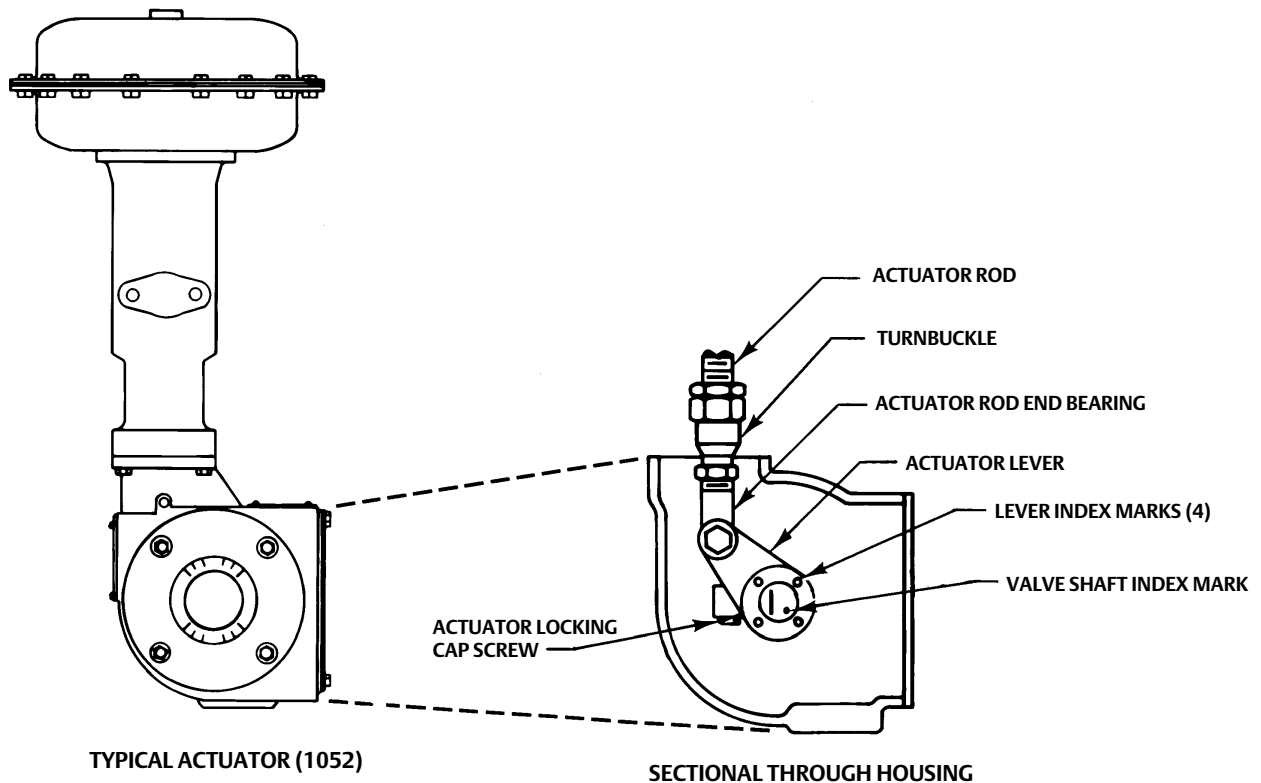
1. Remove the packing flange nuts (key 101) and the packing flange (key 102).
2. Remove the old packing rings, using a formed hook.

CAUTION

Carefully use the hook. Avoid damaging the drive shaft or packing box wall. Scratches on valve surfaces can cause leakage. (Note: the packing box ring (Key 107) can remain in place when replacing packing only.)

3. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing.

Figure 7. Actuator Mounting Styles and Positions



C0784

Assembly

Inspect the shaft: If it is damaged, it cannot make a good seal with the packing, and it must be replaced. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. Inspect the packing box wall for nicks and scratches when performing the following procedures.

If the valve is equipped with the ENVIRO-SEAL packing system refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual for assembly.

Note

Except with oxygen service, lightly lubricate new PTFE V-rings with a silicone-base lubricant to aid in assembly.

⚠ WARNING

Do not lubricate parts when used in oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

Figure 7. Actuator Mounting Styles and Positions (continued)

ACTUATOR		VALVE CLOSED	MOUNTING POSITION 1	MOUNTING POSITION 2	MOUNTING POSITION 3	MOUNTING POSITION 4
MOUNTING	STYLE					
RIGHT - HAND	STYLE A					
	STYLE B					
LEFT - HAND	STYLE C					
	STYLE D					

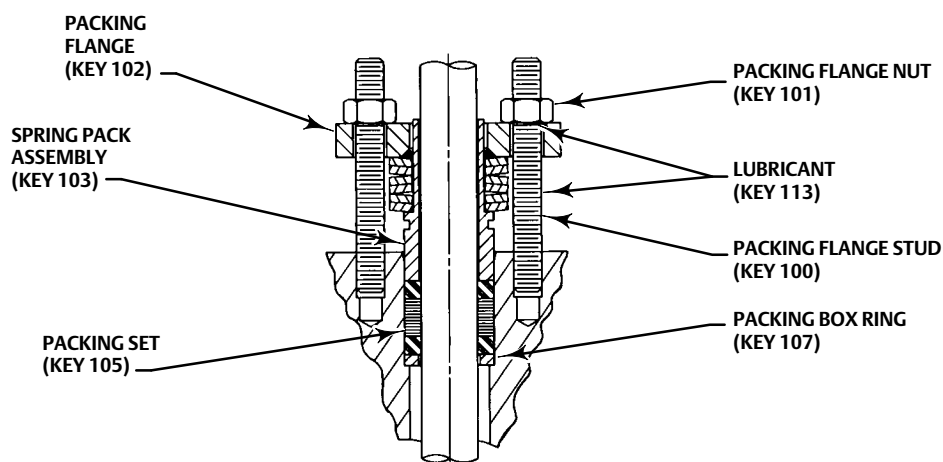
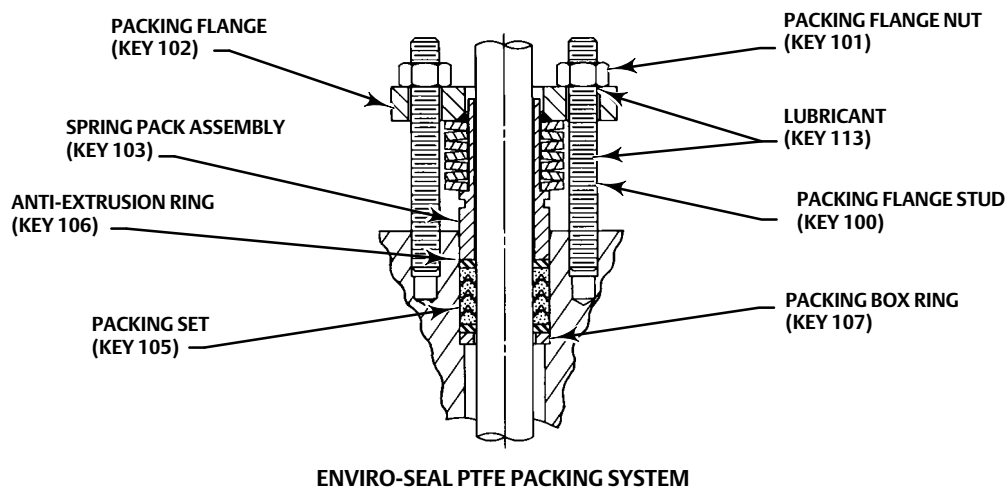
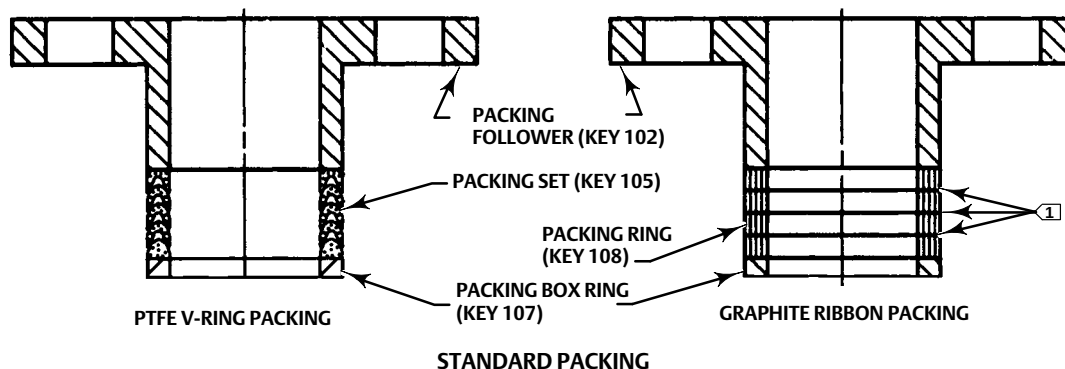
NOTES:

1. ARROW ON LEVER INDICATES DIRECTION OF ACTUATOR THRUST TO OPEN VALVE.

2. F - FORWARD FLOW; R - REVERSE FLOW

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Figure 8. Packing Arrangements



NOTE:
 [1] INCLUDES ZINC WASHERS FOR GRAPHITE
 RIBBON PACKING ONLY

1185895-A
 1086817-A
 4238445-B
 C0785-1

ENVIRO-SEAL GRAPHITE PACKING SYSTEM

1. Install the new packing parts (see figure 8). Install the packing follower and finger tighten the packing flange nuts onto the studs only enough to stop leakage.
2. If the valve was equipped with a bonding strap assembly (figure 5), re-install the assembly.
3. Refer to the Actuator Mounting section of this manual. If necessary, refer to the separate actuator instruction manual for adjustment procedures.
4. When the control valve is being placed into operation, check around the packing follower for leakage.

For PTFE-filled or graphite standard packing arrangements covered in this manual, leakage from the packing can often be stopped by tightening the packing flange nuts just enough to stop the leak.

CAUTION

Use caution when tightening the nuts. Overtightening the nuts can damage packing box parts and result in increased drive shaft friction.

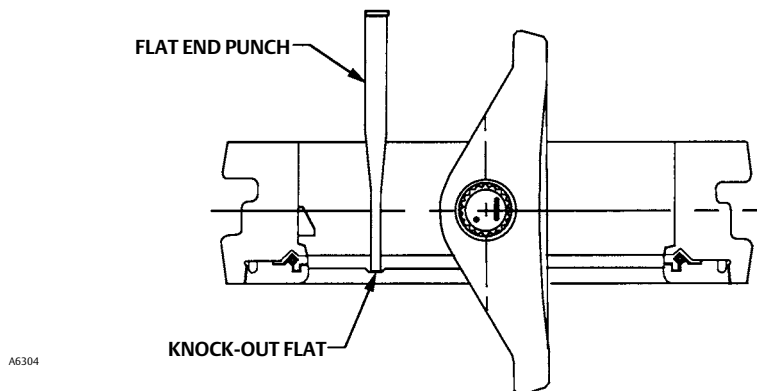
Seal Ring Maintenance for NPS 3 through 12

Perform this procedure if the control valve is not shutting-off properly (if it is leaking downstream). It is recommended, but not required, to remove the actuator for easier handling of the valve during the following procedures.

CAUTION

During any of the following steps, do not rotate the disk past 90 degrees in the open direction. Rotating the disk past 90 degrees can damage the seal ring.

Figure 9. Retainer Ring Knock-Out Flat



Key numbers are shown in figure 14 unless otherwise noted.

Disassembly

Refer to the Removing the Actuator section. Most maintenance procedures will require the actuator to be removed.

1. Remove the retainer ring (key 2, figure 10):

For valves with press-fit retainer rings:

- Place the valve on blocks with the seal retainer facing down. (Note: Position blocks so they do not restrict the retainer ring removal.)
- Rotate the disk to the open position as shown in figure 9.
- Locate one of the knock-out points machined on the retainer ring. Using a hammer and flat end punch on the knock-out point, pop out the retainer ring from the valve body.

CAUTION

When popping out the retainer ring, be very careful to hit only the knock-out points. Hitting anywhere else can cause non-repairable damage to the t-slot area.

- Clean all sealing surfaces and parts before re-assembly.

For valves with screwed retainer rings

- Place the valve on blocks with the seal retainer facing up.
- Remove the retainer ring screws (key 17). If necessary, use two of the retainer screws in the tapped holes in the retainer ring (key 2, figure 14) to jack the retainer ring loose from the valve body surface.

2. Remove the seal ring from the valve body seal ring slot.

For valves with PTFE seal rings, remove the spring (key 5) as it may be necessary to re-install the spring into the new PTFE seal ring.

For valves with metal seals, remove the gasket (key 16) from the valve body surface, and discard it as replacement is recommended.

- 3. If it is necessary to replace the disk, drive shaft, and the bearings, refer to that section below before proceeding with the assembly procedures for the seal ring and retainer. The seal ring could be damaged if it is in place while removing the disk.

Assembly

Place the valve on blocks with the seal retainer facing up. If the replacement disk, shaft, and bearings have not been installed in the valve body, go to the proper assembly procedures to install them.

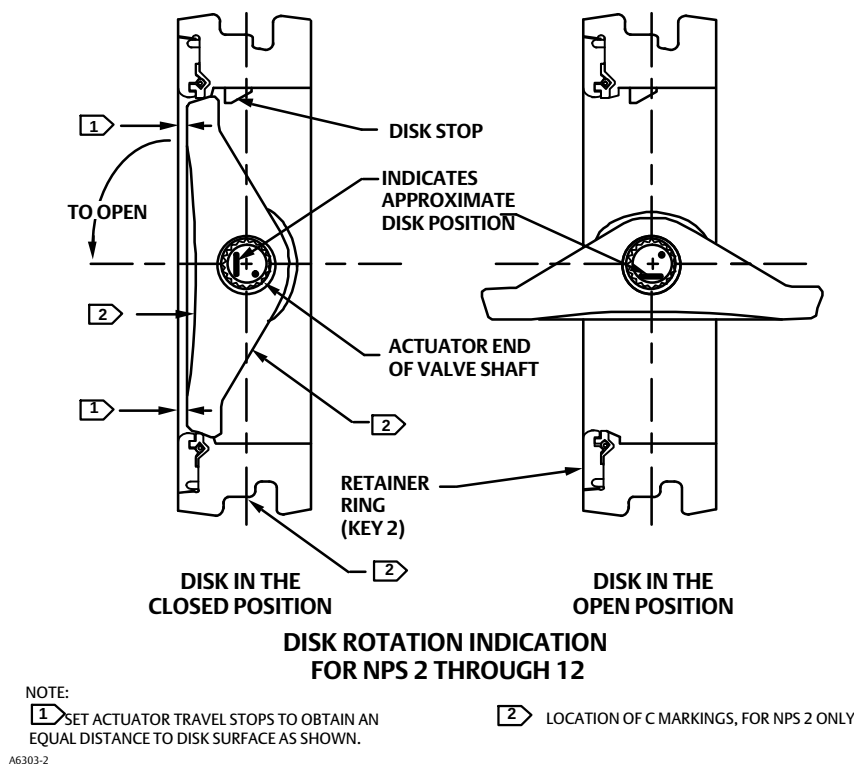
CAUTION

Do not install the seal ring without the disk being in place. The seal ring could be damaged while installing the disk.

⚠ WARNING

Do not lubricate parts when used in oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

Figure 10. Disk Rotation Indication



CAUTION

Do not rotate the disk past 90 degrees in the open direction. Rotating the disk past 90 degrees can damage the seal ring or other component parts.

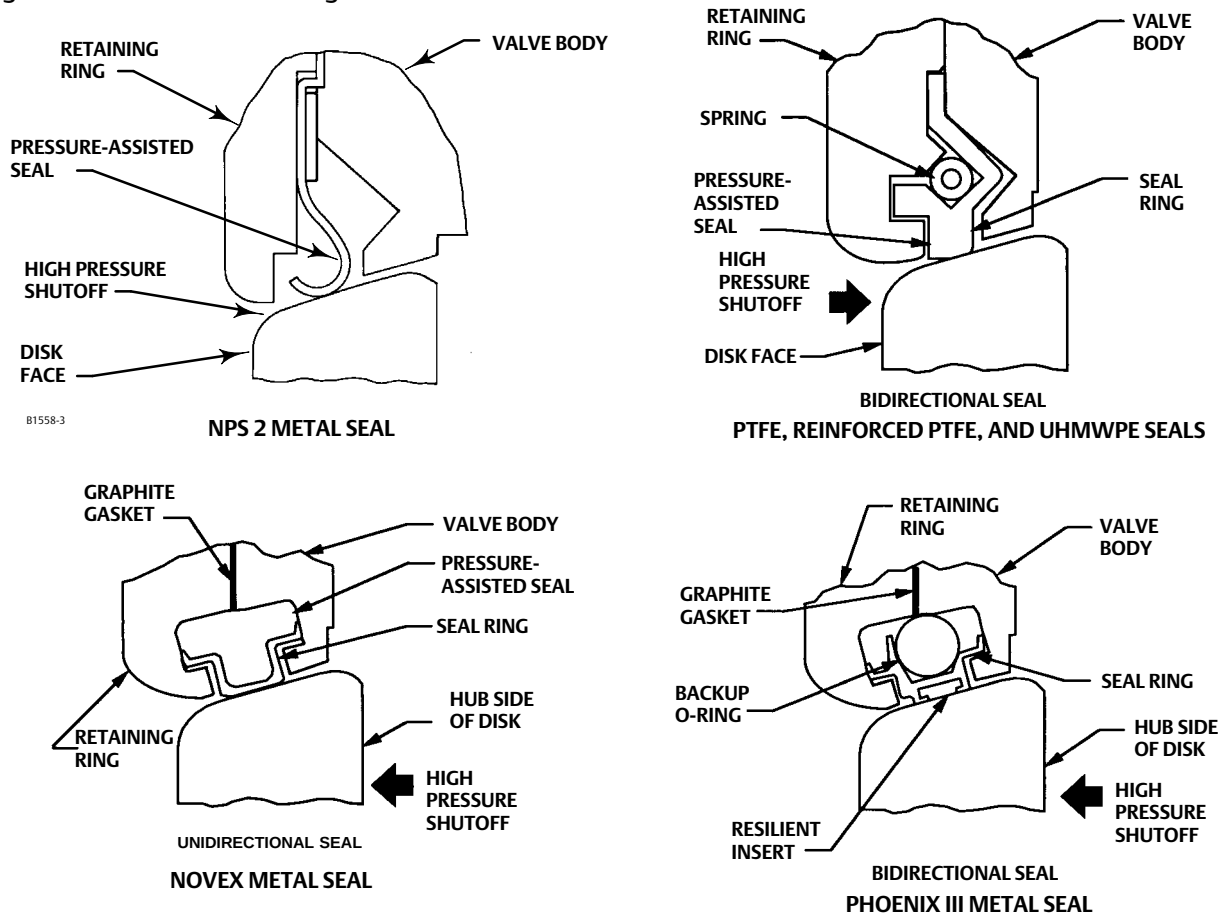
Note

PTFE, NOVEX, and Phoenix III seal rings used in other valve types are not interchangeable with seal rings used in the 8560 valve. The 8560 seal rings are not interchangeable with seal rings in any other valve type. To order seal rings for this valve, provide the serial number on the valve.

1. Installing PTFE seal rings:

- The valve disk should be open while installing the seal ring. If not, rotate the disk to the open position as shown in figure 10.
- Hook the spring ends together, insert the spring (see figure 11) into the groove in the seal ring, and work the spring into the recess in the PTFE seal ring.
- Install the seal ring assembly into the slot in the valve body as shown in figure 11. Refer to Installing the retainer ring steps below.

Figure 11. Available Seal Configurations



2. Installing metal seals:

Note

For metal seals only, it may be necessary to apply a dry film lubricant or equivalent moly disulfide to the sealing surfaces of the disk, seal and the seal retainer groove. Prior to applying the lubricant the sealing surfaces should be inspected for injurious defects. Surfaces can be polished using a scuffing hand pad or equivalent. The edge of the seal that contacts the retaining ring groove should also be inspected and polished if necessary.

Note

Use the appropriate lubrication on parts when used in oxygen service, or where the lubrication is incompatible with the process media.

- a. Rotate the disk to the open position as shown in figure 10.

CAUTION

The seal ring will be damaged if the disk remains in the closed position during seal and retainer ring assembly.

b. Install the metal seal ring assembly (see figure 11).

3. Installing the retainer ring:

a. Valves with PTFE seal rings do not require a retainer ring gasket (key 16).

b. Valves with metal seals require a retainer ring gasket (key 16).

CAUTION

When handling the new retainer ring gasket, be sure to avoid kinking, cracking, or breaking the gasket. Damage to the gasket can cause leakage between the seal retainer and valve body.

c. Lay the gasket (key 16) down so that it is accurately centered on the valve body.

4. For valves with press-fit retainer rings

a. Wipe excessive oil off the retainer ring outside diameter, and off the retainer counterbore in the valve body.

b. Rotate the disk to the open position.

c. Lay the retainer ring on the valve body.

d. Use a press, or a soft-faced hammer to press the retainer ring into its groove in the valve body.

CAUTION

It takes a considerable amount of force with a hammer to drive the retainer ring into place. Be sure not to damage retainer ring surfaces when installing the ring.

e. The retainer ring is properly seated when the face of the retainer ring is flush with the face of the valve body.

f. To ensure proper seal performance for metal seals, you may need to use the hammer to drive the disk open for the first few times. When closing the valve, use the C-clamps discussed in the next few steps.

CAUTION

Do not damage the gasket seating surfaces on either the valve body or the retainer ring when installing or removing the C-clamps. Protect the gasket surface by using a soft material between the clamp and valve body/retaining ring serrations to avoid damage.

- g. Use three C-clamps to hold the retainer in place. Locate one of the C-clamps near the travel stop in the valve body, and the other two at 120 degrees from the stop.
 - h. When cycling the disk for the first three times, use a dead-blow hammer with a soft head to drive the disk closed. Also, you may need to use the hammer to drive the disk open for the first few times.
5. For valves with screwed retainer rings
 - a. Match the retainer ring with the holes in the valve by punching two holes in the gasket to locate where the screw holes are in the valve.
 - b. Lay the retainer ring over the gasket, while lining it up with the punched holes. Also insert two retainer screws (key 17). Finger tighten them.
 - c. Press the remaining screws through the gasket material and finger tighten them. When all retainer screws are in place, tighten them in a crisscross pattern.
 - d. The retainer ring is properly seated when the retainer face is nearly flush with the face of the valve.
6. Turn the disk into and out of the seal ring several times, to help break in the seal and reduce actuator torque requirements during adjustment.
7. If replacing the packing, remove all packing parts from the valve body. Upon re-assembly of the valve, refer to the Packing Maintenance procedures to replace the packing.

Seal Ring Maintenance for NPS 2

This procedure is to be performed if the control valve is not shutting off properly (that is, leaking downstream). This procedure does not require removing the actuator from the valve body. Part key numbers are shown in figure 15.

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

1. Isolate the control valve from line pressure, and relieve pressure from the valve body. Shut off and disconnect all lines from the power actuator.

⚠ WARNING

The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 3).

CAUTION

Damage to the disk (key 3) may occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, pressure the actuator temporarily to retain the disk in the closed position while removing the valve from the pipeline.

2. Unscrew the flange bolts, and remove the valve from the pipeline.

3. Unscrew the machine screws (key 17), and remove the seal retainer (key 2). Also remove the retainer clip (key 30).
4. Remove the seal ring or seal ring assembly (key 4). The spring (key 5) is removed with a PTFE seal ring.
5. For 316 stainless steel seal ring assemblies, replace the gaskets (key 4C) if the entire seal ring assembly is not replaced. Scrape off the old gaskets from both sides of the seal ring and the seal ring sides of the valve body (key 1) and seal retainer. Clean the gasket surfaces.
6. Reconnect or mount the actuator (if it was removed) before proceeding.

For an actuator with adjustable travel, also adjust the actuator before proceeding. This is necessary due to the measurements that must be made during the actuator adjustment process.

Refer to the Actuator Mounting section of this manual and to the separate actuator instruction manual for mounting and adjusting instructions.

7. The valve should be closed during seal ring installation to permit accurate centering of the seal. To install the new seal ring:

For a PTFE seal, if the spring (key 5) was disassembled, hook the spring ends together. Work the spring into the recess in the seal ring (key 4). Install the seal ring and spring assembly into the recess in the valve body as shown in figure 15. For a complete 316 stainless steel seal ring assembly, install the seal ring assembly as shown in figure 15.

CAUTION

New seal ring gaskets (key 4C) are very fragile and must be handled very carefully to avoid gasket kinking, cracking, or breakage that can cause leakage between the seal ring, seal retainer, and valve body. To avoid gasket damage, make sure that the valve body is lying flat so that the gaskets do not shift before the following steps are completed.

8. For a 316 stainless steel seal ring on which the gaskets will be replaced, lay the following parts down in order so that they are accurately centered on the valve body: one new gasket; the seal ring oriented as shown in figure 15; and the second new gasket.
9. Attach the seal retainer and, if used, the retainer clips and washers to the valve body and secure with the machine screws. Tighten the machine screws evenly so as not to crack or break the 316 stainless steel seal ring gaskets, if used.

Be certain the disk is closed before installing the valve according to the Installation section of this instruction manual.

Disk, Drive Shaft, and Bearing Maintenance for NPS 3 through 12

This procedure is to be performed when replacing the valve disk, drive shaft, taper pins, hollow pins, and bearings due to wear or damage to one or more component parts.

Key numbers are shown in figure 14 unless otherwise noted.

Disassembly

1. Loosen the packing flange nuts (key 101). This allows the drive shaft (key 8) to turn without the friction caused by the packing.
2. Remove the actuator using the steps provided in the Removing the Actuator procedures above, and remove the seal ring using the steps provided in the seal ring maintenance procedures above.
3. Place the valve on a flat working surface with the seal ring slot facing down.
4. Use blocks to raise the valve body high enough to allow the disk to be rotated to the fully open position (see figure 10).

5. Rotate the disk (key 3) to the fully open position.
6. Locate the small ends of the taper pins. Drive the two taper pins (key 10) out towards the larger end of the pins. (Note: Attempting to drive the taper pins in the opposite direction only tightens the pins.) Also, remove the hollow pins (key 9) from the disk/shaft connection using the tool shown in figure 13.

Note

Make the tools for removal and installation of the hollow pin shown in figure 13.

7. Unscrew and remove the packing flange nuts (key 101), and the packing flange (key 102).

⚠ WARNING

Once the shaft has been removed in the following step, the disk may fall out of the valve body cavity. To avoid personal injury and property damage, support the disk to prevent it from falling as the shaft is being removed.

8. Pull the shaft out of the valve body, and remove the disk (key 3) from the valve body bore.
9. If the packing is to be replaced, remove all the packing parts from the valve body. Upon re-assembly of the valve, refer to the Packing Maintenance procedures to replace the packing parts.
10. Remove both of the bearings (key 6) from the valve body. For CL150 valves with metal bearings, refer to the following note.

Note

CL150 valves with metal bearing assemblies have three parts. A disk spacer, bearing, and bearing spacer (keys 7, 6, and 13) are used in place of a single piece bearing. The disk spacers may fall out of the valve when the disk is removed. If needed for re-assembly, retain disk spacer and bearing spacer parts.

11. Clean all the sealing surfaces and parts, and inspect and/or obtain replacements before assembly.

Assembly

1. Install the bearings (key 6):

When installing the bearings in the opposite side of the valve body bore, repeat the following procedures.

- For PEEK/PTFE CL150 and CL300 metal bearings, one piece bearings: Position the bearing edge to match the valve body bore, and insert the one piece bearing/disk spacer into the bearing bore with the bearing tab facing away from the disk stop as shown in figure 12.
- For CL150 metal bearings, three piece assemblies: Bearings for CL150 valves are an assembly made up of three parts: disk spacer, bearing, and bearing spacer (keys 7, 6, and 13) as shown in the metal bearing detail shown in figure 14.
 - a. Install the bearing spacer (key 13) into the bearing bore.
 - b. Install the bearing into the bearing bore until the bearing is flush with the valve body bore.

- c. When installing the disk spacer (key 7) position the curved side to match the valve body bore, and position it with the tab on the spacer pointing away from the disk stop as shown in figure 12.

Note

The disk spacer will have to be held in place when installing the disk and inserting the shaft through the valve body, bearings, bearing spacer, and disk. To help hold the spacer in place, apply some lubricant.

CAUTION

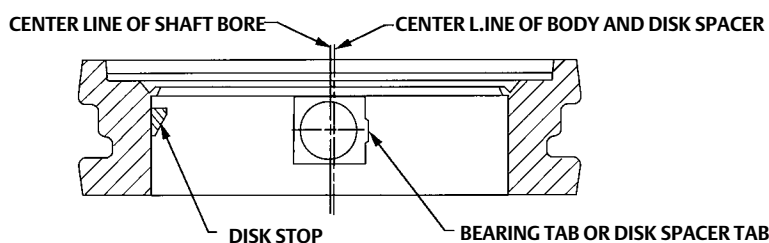
To avoid product damage, protect the disk sealing surfaces while inserting the disk into the valve body bore.

2. Position the disk to be certain that the holes in the disk are towards the actuator side of the valve. Carefully insert the disk into the valve body bore while protecting the disk sealing surfaces.
3. Install the shaft (key 8):
 - For PEEK/PTFE CL150 and CL300 metal bearings, one piece bearings: Slide the shaft through the valve body bore and bearing. Position the disk as stated above and slide the shaft through the disk and outer bearing. Refer to step 4 below.
 - For CL150 metal bearings, three piece assemblies: Slide the shaft into the valve body bore and bearing spacer. Position the disk spacer as stated above and hold it in place. Slide the shaft through the bearing and into the disk. Position the second disk spacer, and hold it in place. Slide the shaft through the disk spacer and into the outer bearing.

Installing the hollow pin and taper pin

4. Place the valve body on a flat working surface with the slot for the seal ring facing *up*. Block the valve body high enough to allow the disk to be rotated into the open position as shown in figure 13.

Figure 12. Orientation of Bearing/Spacer Tab



A6357-1

5. Rotate the disk to the open position. On the end of the drive shaft, locate the disk position mark on the end of the drive shaft. Rotate the shaft until it is in the appropriate disk position as shown in figure 13.

Note

Make sure the taper and hollow pins are free of particulate matter before continuing.

6. Line-up both holes in the disk hub with the holes in the drive shaft (key 8). (Note: The hole in the drive shaft is off-set to prevent the shaft from being installed in the wrong position. Be sure the hole in the shaft is lined up with the hole in the disk hub.)
7. Insert the hollow pins (key 9), into the disk hub as shown in figure 13.

Using the tool shown in figure 13, tap the hollow pin down into the disk hub and shaft until the hollow pin bottoms on the stop in the disk.
8. Insert the taper pins (key 10) into the hollow pins. Using a flat end punch, drive the taper pins into the hollow pins until solid contact is felt. Anchor the pins in place by staking them with a center-punch and hammer. The disk and shaft should rotate smoothly.
9. Install the seal ring assembly using the appropriate instructions in the Seal Ring Maintenance procedures.
10. Install the packing parts using the appropriate instructions provided in the Packing Maintenance procedures. Refer to the Actuator Mounting procedures before installing the valve in the pipeline.

Disk, Shaft Assembly and Bearing Maintenance for NPS 2

This procedure is to be performed to replace the valve disk, shaft, and taper pin assembly if the disk does not rotate in response to rotation of the actuator end of the valve shaft. Unless otherwise indicated, part key numbers are shown in figure 15.

Disassembly

1. Remove the seal ring according to steps 1 through 5 of the Replacing Seal Ring section.

CAUTION

Use a wheel puller to separate actuator parts from the valve shaft. Driving the parts off the valve shaft could move the valve bearings and disk away from the centered position, damaging the disk and valve body.

2. Remove the cap screws and, if used, the hex nuts. Remove the clamp if the strap is used. Remove the actuator from the valve body while referring to the separate actuator instruction manual for assistance.
3. Rotate the disk (key 3) to the fully open position.
4. Locate the half of the disk that has two C markings cast into it as shown in figure 10. Drive the two taper pins (key 3C) out toward the C-marked side of the disk. Attempting to drive the taper pins in the opposite direction only tightens the pins.
5. Unscrew and remove the packing flange nuts (key 101), packing followers (key 114), and packing flanges (key 102) if used, from both sides of the valve.

⚠ WARNING

Once the shaft has been removed in the following step, the disk may fall from the valve. To avoid personal injury and disk damage, support the disk to prevent it from falling as the shaft is being removed.

6. Pull the shaft out through the actuator side of the valve.
7. Remove the disk from the valve body.
8. Remove the packing rings (key 108), the packing washers (key 115) if used, and the packing box ring (key 107).

9. If either of the bearings (key 6) require maintenance or replacement, remove them.

CAUTION

When replacing a valve disk or shaft, a new disk/shaft/taper pin assembly (key 3) should be used. Using a new disk with a used shaft requires drilling and reaming new taper pin holes in the shaft. The extra set of taper pin holes weakens the shaft and may cause it to fail in service.

10. Clean the packing boxes and metal packing box parts.

Assembly

1. Drop in the new bearings. Make sure to orient the tab in the bearing with the slot in the seal.
2. Insert the disk into the valve body. Be certain the taper pin holes in the disk are on the actuator side of the valve. Also be certain the letter C stamped on either face of the disk is on the same side of the valve as the letter C stamped on the outside of the valve (figure 10).
3. Slide the shaft through the valve body and disk.
4. Install the disk and spacers into the valve body. Insert the shaft into the valve body and through the disk.
5. Slide the shaft all the way into the valve body.
6. To ensure that the direction of taper in the shaft taper pin holes matches that of the disk taper pin holes, temporarily install the packing follower (key 114) or, if used, the packing flange (key 102) with rotation tag (key 19). With the disk fully opened, rotate the shaft until the line on the end of the shaft indicates the open position, as shown in figure 10. Insert the taper pins (key 3C), small end first, into the taper pin holes on the C-marked side of the disk. Do not drive in the pins. Remove the packing follower or flange.

Actuator Mounting

Re-install the seal ring and packing rings using the appropriate procedures before installing the actuator on the valve. Mount the actuator on the valve body in accordance with the instructions in the actuator instruction manual and this section.

In the Packing Maintenance/Removing the Actuator steps, you should have noted the position of the mark on the end of the valve shaft, and its relationship to the actuator shaft. If not, determine the configuration needed to match your application.

Be certain that the disk is rotating counterclockwise to open when viewed from the actuator side of the valve, and that the disk is not rotated beyond its limits.

1. Orientate the valve drive shaft correctly to match the actuator or handlever position, and install it into the actuator and actuator lever arm until the mounting pads mate with each other.
2. Tighten the actuator-mounting cap screws (key 14, figure 14) to the appropriate bolt torque from table 7.

CAUTION

The valve disk stop, in the valve body bore is not to be used as a power actuator travel stop (see figure 9). Use the actuator travel stops to limit the rotation of the valve disk. It is possible to damage the valve component parts if full actuator thrust is applied to the valve disk stop.

For actuators with an adjustable turnbuckle, such as the 1051, 1052, or 1061 actuator, the turnbuckle must be adjusted so that the valve is closed (determined by measuring as shown in figure 7) when the diaphragm or piston is against the actuator travel stop.

For manually operated actuators or actuators without adjustable linkage, such as the 1066 or 1066SR actuator, make certain that the travel of the actuator stops before the disk rotates past the closed position.

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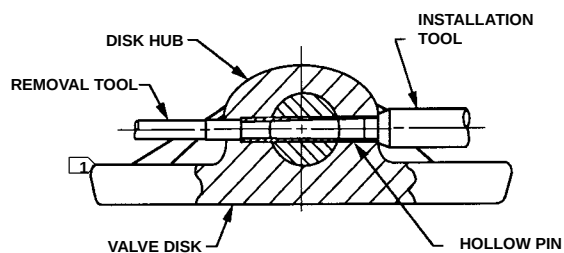
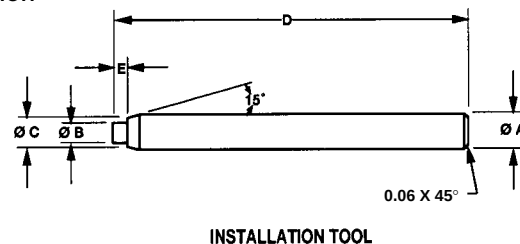
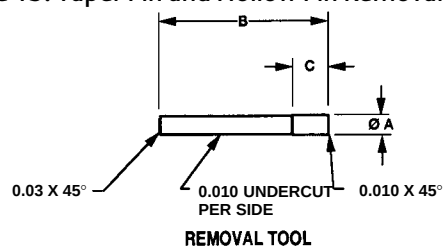
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REMOVAL TOOL DIMENSIONS				
Shaft Diameter	ØA	B	C	ØD
mm				
12.7	3.91	28.43	6.35	4.19
15.88	4.60	38.10	7.87	23.37
19.05	5.13	44.45	9.65	5.41
25.4	7.00	59.44	12.70	7.26
31.75	9.50	76.20	19.05	9.78
38.1	10.82	88.90	19.05	11.10
44.45	12.37	114.30	22.35	12.65
Inch				
1/2	0.154	1.12	0.25	0.165
5/8	0.181	1.50	0.31	0.192
3/4	0.202	1.75	0.36	0.213
1	0.275	2.34	0.50	0.286
1-1/4	0.374	3.00	0.75	0.385
1-1/2	0.426	3.50	0.75	0.437
1-3/4	0.487	4.50	0.88	0.498

INSTALLATION TOOL DIMENSIONS					
Shaft Diameter	ØA	ØB	ØC	D	E
mm					
12.7	12.7	3.68	6.35	127.0	4.83
15.88	12.7	4.57	7.62	127.0	4.83
19.05	12.7	5.23	8.89	127.0	4.83
25.4	12.7	7.00	10.41	127.0	4.83
31.75	19.05	10.00	13.59	146.0	6.35
38.1	19.05	11.56	15.24	146.0	6.35
44.45	19.05	31.21	16.76	146.0	6.35
Inch					
1/2	0.50	0.145	0.250	5.00	0.19
5/8	0.50	0.180	0.300	5.00	0.19
3/4	0.50	0.206	0.350	5.00	0.19
1	0.50	0.275	0.410	5.00	0.19
1-1/4	0.75	0.395	0.535	5.75	0.25
1-1/2	0.75	0.455	0.600	5.75	0.25
1-3/4	0.75	0.520	0.660	5.75	0.25

Figure 13. Taper Pin and Hollow Pin Removal and Installation



NOTE:
1. REMOVE THE HOLLOW PIN FROM THIS SIDE OF THE DISK HUB.
INSTALL THE HOLLOW PIN FROM THE OPPOSITE SIDE OF DISK HUB.

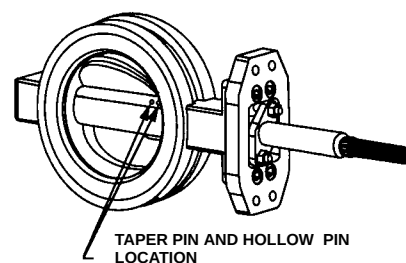


Table 7. Recommended Bolt Torques for Actuator/Mounting Cap Screws and Nuts

VALVE SIZE, NPS	RECOMMENDED BOLT TORQUE	
	N•m	lb•ft
CL150 Valves		
2 ⁽¹⁾ , 3, 4, 6, & 8	88	65
10 & 12	135	100
CL300 Valves		
2, 3, 4, & 6	88	65
8 & 10	135	100
12	183	135

1. Value for NPS 2 also applies to CL600 Valves.

Note

To obtain proper shutoff, the closed position of the A41/8560 valves must be set with the disk parallel to the retaining ring. Don't use the disk stop to set the actuator travel stops.

3. Adjust the actuator travel stop to limit the open and closed positions of the valve disk. (If necessary, refer to the actuator instruction manual for more information about adjustments.) Do not use the disk stop as a actuator travel stop as discussed in the **Caution** above.
4. For actuators with adjustable turnbuckles, adjust the turnbuckle to bring the disk to the fully closed position at the end of the actuator stroke. If necessary, refer to the appropriate actuator instruction manual for assistance.
5. If using a manual handwheel or handlever actuator, refer to the appropriate actuator instruction manual for mounting positions and adjustments.
6. To determine the fully closed disk position (zero degrees of disk rotation), measure the distances between the positions on the disk face as shown in figure 10. Use the actuator to rotate the disk while re-checking the two measurements. Repeat adjustment until the two measurements are equal.

Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

ENVIRO-SEAL Packing Arrangements

Retrofit kits and repair kits are listed in the tables below. For additional parts and repair information, refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)) or contact your Emerson sales office for assistance.

Repair Kits for ENVIRO-SEAL Packing

Repair Kits include replacement parts for key 105 and 106 for the shaft diameters listed below.

ENVIRO-SEAL Packing Repair Kits

SHAFT DIAMETER ⁽¹⁾	
mm	Inches
12.7	1/2
15.9	5/8
19.1	3/4
25.4	1
31.8	1-1/4
38.1	1-1/2
Parts Included in Kit	
Key	Description
105	Packing set
106	Anti-extrusion washer

1. Diameter through the packing box.

Retrofit Kits for ENVIRO-SEAL Packing

Retrofit kits include new parts for the key numbers listed in the table below (see figure 8 for part locations).

ENVIRO-SEAL Packing Retrofit Kits

SHAFT DIAMETER ⁽¹⁾	
mm	Inches
12.7	1/2
15.9	5/8
19.1	3/4
25.4	1
31.8	1-1/4
38.1	1-1/2
Parts Included in Kit	
Key	Description
100	Packing stud
101	Packing nut
102	Packing flange
103	Spring pack assembly
105	Packing set
106	Anti-extrusion washer
107	Packing box ring
111	Tag
112	Tie cable

1. Diameter through the packing box.

Parts List

Note

For part ordering information contact your [Emerson sales office](#).

Key	Description
1	Valve Body If you need a new valve body, order by valve size, serial number and desired material.
2*	Seal Retainer
3	Valve Disk, NPS 3 through 12
3	Disk/Shaft Assembly, NPS 2 only
3A	Shaft, NPS 2 only
3B	Valve Disk, NPS 2 only
3C	Taper Pin, NPS 2 only (2 req'd)
4*	Seal Ring
4C	Gasket, Included in 2-inch NOVEX Seal Ring
5*	Spring
6*	Bearing (2 req'd)
7*	Disk Spacer (2 req'd) w/ Metal Bearings, CL150 only
8*	Drive Shaft
9*	Hollow Pin
10*	Taper Pin
11	Adaptor Plate
12	Socket Head Cap Screw (4 req'd)
13*	Bearing Spacer (2 req'd) w/ Metal Bearings, CL150 only
14	Hex Head Cap Screw (4 req'd)
14	Stud Bolt (4 req'd)
15*	Backup Ring
16*	Gasket, w/ Metal and Phoenix III seals
17	Hex Socket Cap Screw
18	Mfg Label
19	Drive Screw, w/ nameplate
20	Hex Nut (4 req'd)
21	Nameplate
22	Lead Seal & Wire
23	Bottom Cap, 12-inch only
24	Bottom Cap Stud, 12-inch only
25	Bottom Cap Hex Nut, 12-inch only
27	Bottom Cap Gasket, 12-inch only
29	Flow Arrow, 3- through 12-inch
30	Retainer Clip, 2-inch only

Packing

Note

Parts in this section are listed by shaft diameter (inches).

SHAFT DIAMETER	VALVE SIZE	
	CL150	CL300
1/2	2 & 3	2
5/8	4	3
3/4	6	4
1	8	6
1-1/4	10	8
1-1/2	12	10
1-3/4	---	12

Key Description

- 100 Packing Stud (2 req'd)
- 101 Packing Nut (2 req'd)
- 102 Packing Flange
- 103 Spring Pack Assembly, ENVIRO-SEAL & FFKM
- 105* Packing Set
- 106* Anti-Extrusion Ring, ENVIRO-SEAL PTFE (2 req'd)
- 107* Packing Box Ring
- 108* Packing Ring (4 req'd)
- 111 Tag
- 114 Packing Follower
- 115* Packing Washer (3 req'd)

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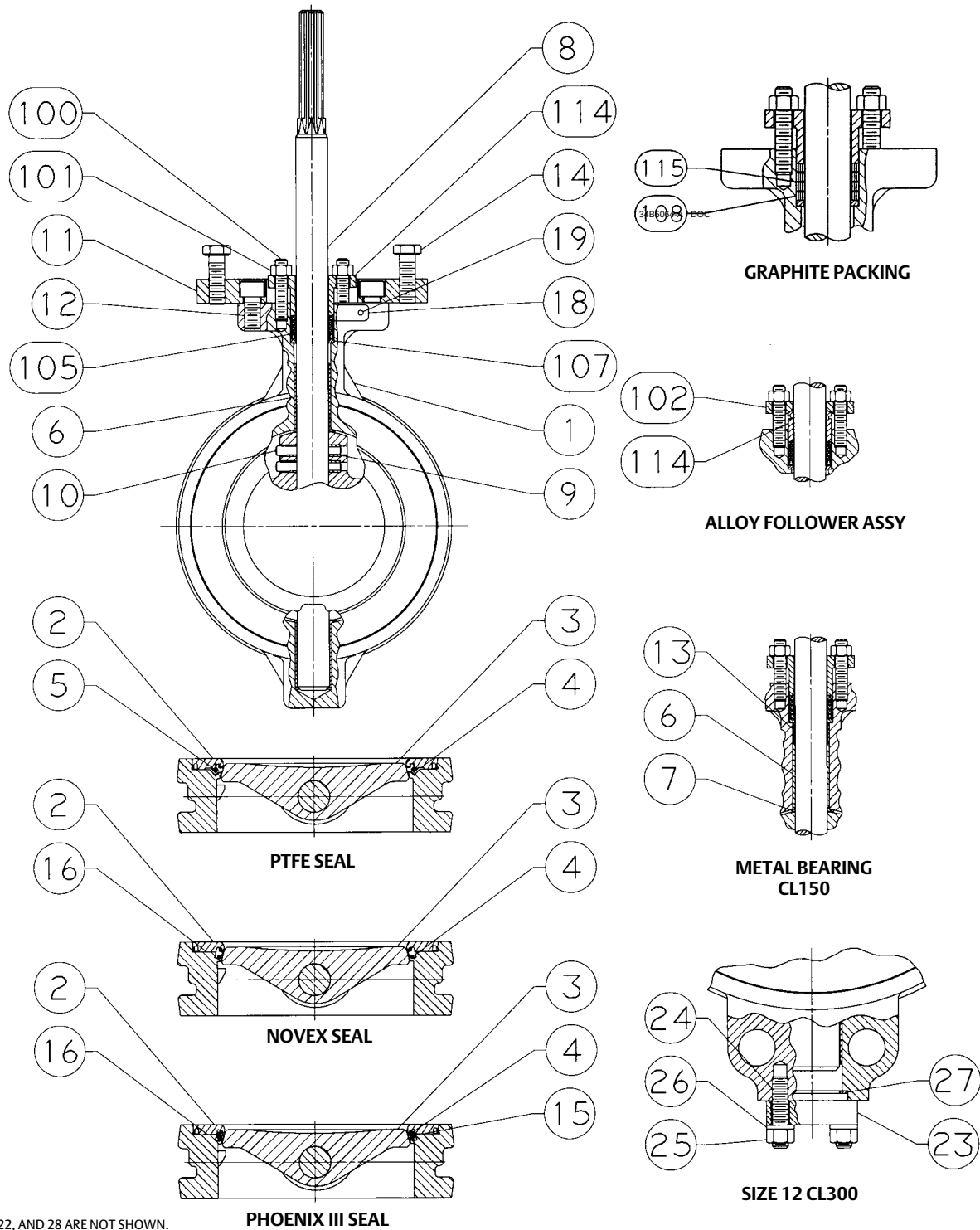
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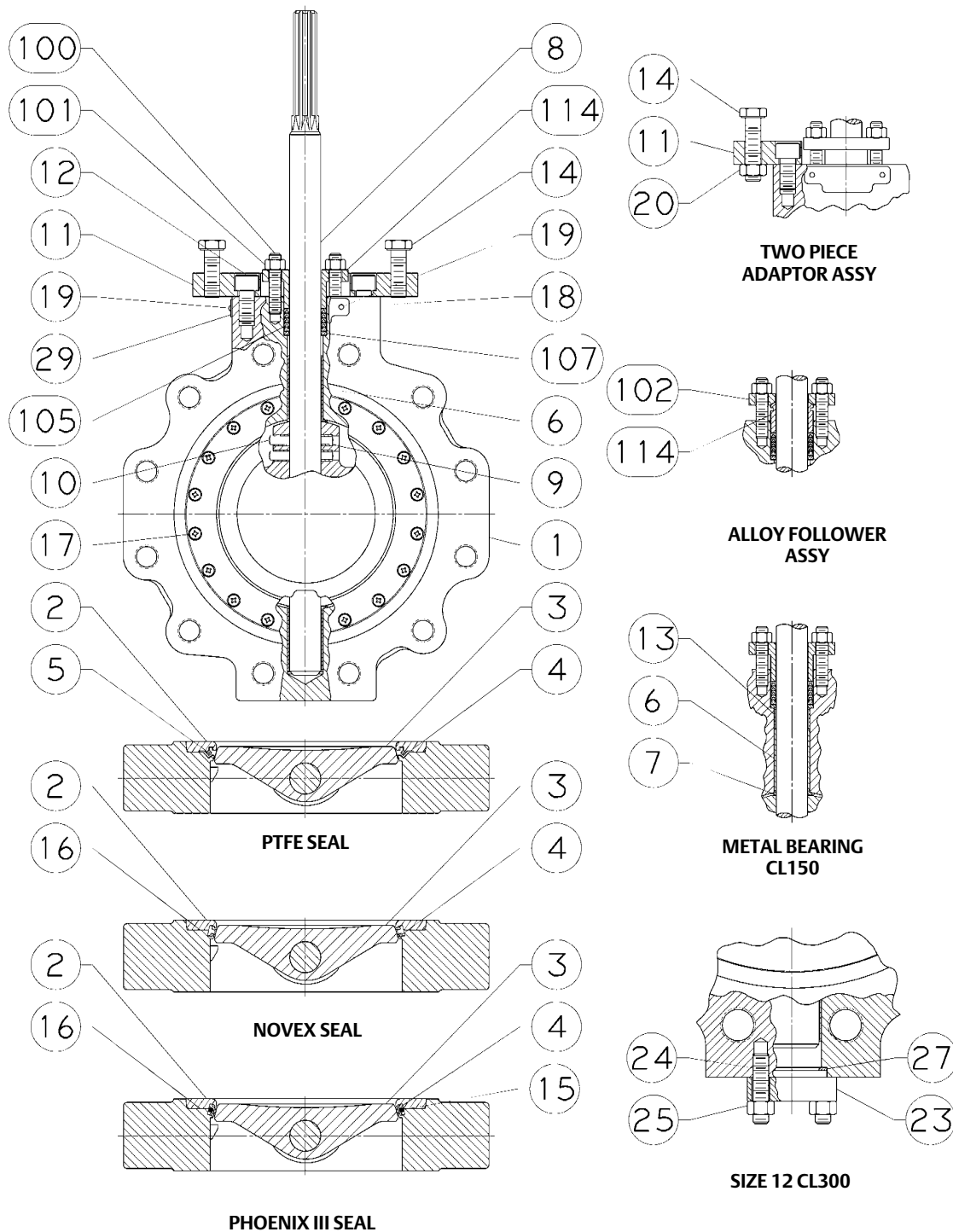
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Figure 14. Valve Assembly for NPS 3 through 12



NOTE:
KEYS 21, 22, AND 28 ARE NOT SHOWN.

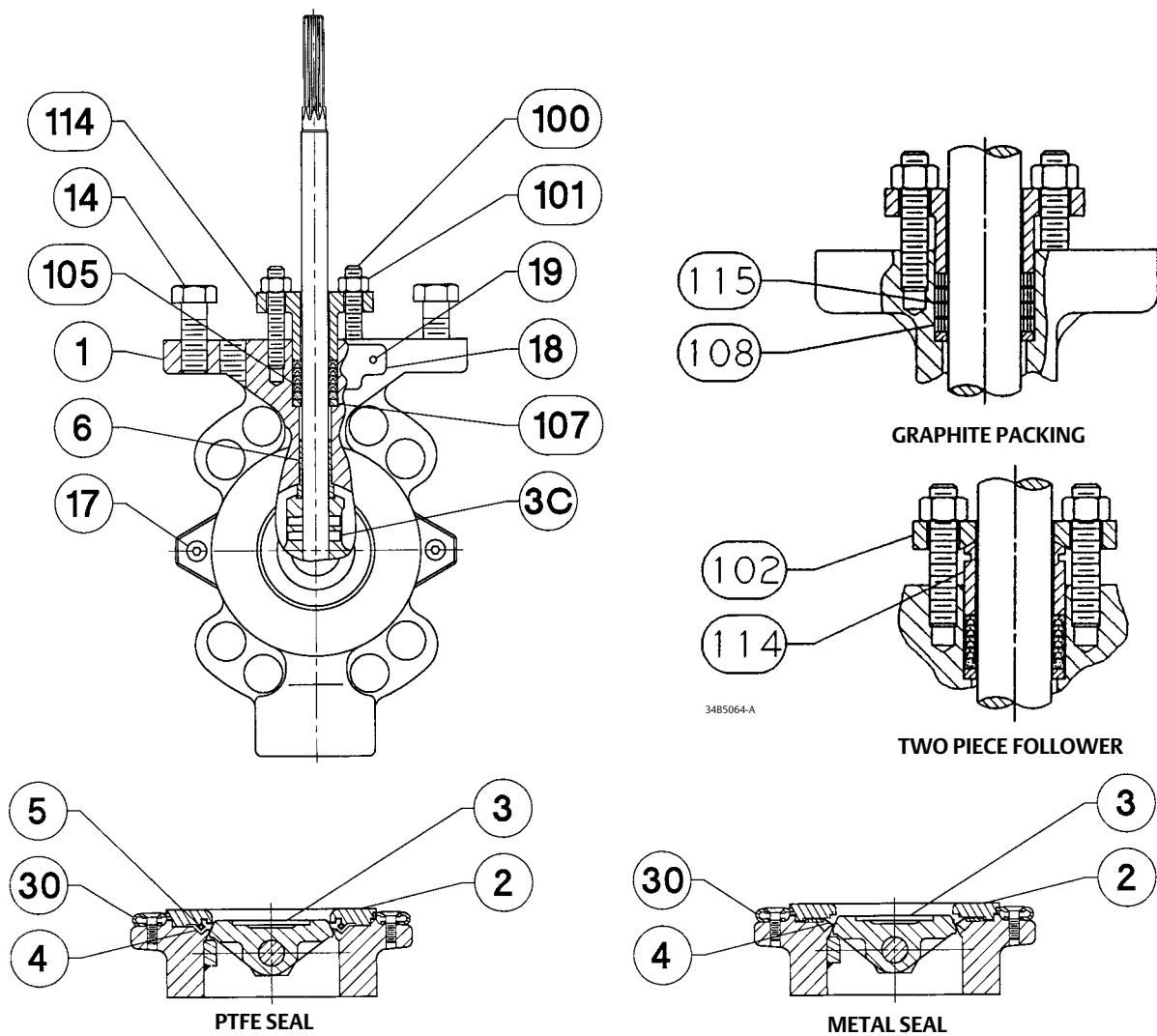
Figure 14. Valve Assembly for NPS 3 through 12 (Continued)



NOTE:
KEY NUMBERS NOT SHOWN ARE 21, 22, AND 115
75B0092-B

SINGLE FLANGE-STYLE VALVE

Figure 15. Valve Assembly for NPS 2



NOTE: PARTS 21 AND 22 NOT SHOWN
75B0625

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Fisher™ 8580 Rotary Valve

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Figure 1. Fisher 8580 Valve with 2052 Actuator and DVC6200 Digital Valve Controller



W9498-3

LUGGED STYLE

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher 8580 valve, DN50 through DN300 or NPS 2 through NPS 12 (figure 1). Refer to separate instruction manuals for information covering the power on-off actuator and accessories.



Do not install, operate, or maintain an 8580 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The 8580 rotary valve offers excellent throttling and quarter-turn performance. An approximately linear flow characteristic provides precise throttling control. The 8580 valve offers high cycle life and rugged reliability.

Retainer clips provide for versatility to mount and align the same wafer style valve body in different piping configurations (ASME and EN ratings). The valve body is compatible with PN 10 through PN 40, CL150, and CL300 ratings. Face-to-face dimensions meet EN 558, API 609, and MSS-SP68 standards.

The 8580 rotary valve features an eccentrically-mounted, double-offset disk with either soft or metal seal, providing capability for enhanced shutoff. The interchangeable sealing technology allows for the same valve body to accept both soft and metal seals.

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Educational Services

For information on available courses for Fisher 8580 valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Table 1. Fisher 8580 Valve Specifications

Specifications		EN	ASME
Valve Body Size		DN 50, 80, 100, 150, 200, 250, and 300	NPS 2, 3, 4, 6, 8, 10, and 12
Pressure Rating		PN 10 to 40 per EN 12516-1	CL150 / 300 per ASME B16.34, CL150 - 600 for NPS 2
Valve Body Materials		EN 1.0619 steel	WCC steel
		EN 1.4409 stainless steel	CF3M (316L) stainless steel
		CW2M ⁽¹⁾	CW2M ⁽¹⁾
		M35-2 ⁽⁴⁾	M35-2
Disk Materials	PTFE or RPTFE Seal ⁽³⁾	EN 1.4409 stainless steel	CF3M stainless steel
		CW2M	CW2M
		M35-2	M35-2
	Metal or UHMWPE ⁽²⁾ Seal	Chrome-plated EN 1.4409 Stainless Steel	Chrome-plated CF3M Stainless Steel
		Chrome-carbide EN 1.4409 Stainless Steel	Chrome-carbide CF3M Stainless Steel
End Connections		Mates with raised-face flanges per EN 1092-1	Mates with raised-face flanges per ASME B16.5
Valve Body Style		Lugged with threaded or through holes, Double-Flange with through holes, and Wafer (for select sizes)	
Face-to-Face Dimensions		Meets MSS SP68, API 609, and EN 558 standards	
Shutoff		PTFE, RPTFE, or UHMWPE seal ring - Class VI per ANSI/FCI 70-2 and IEC 60534-4	
		S31600 (316 SST) seal ring - Class IV per ANSI/FCI 70-2 and IEC 60534-4	
Flow Direction		Standard (forward flow) is with the seal retainer facing upstream; reverse flow is permissible for soft seals only	
Flow Characteristic		Approximately linear	
Disk Rotation		Counterclockwise to open (when viewed from actuator side of valve body) through 90 degrees of disk rotation	
1. This material is not listed in EN 12516-1 or ASME B16.34. See table 4 for pressure/temperature ratings. 2. UHMWPE stands for ultra high molecular weight polyethylene. 3. RPTFE is a reinforced PTFE seal. 4. This material is not listed in EN 12516-1. See table 4 for pressure/temperature ratings.			

Table 2. Valve Size, Shaft Diameter, and Approximate Weight

VALVE SIZE		PRESSURE RATING		SHAFT DIAMETER		APPROXIMATE WEIGHT					
DN	NPS	EN	ASME	mm	Inches	Wafer-Style		Lugged		Double-Flanged	
						kg	lbs	kg	lbs	kg	lbs
50	2	PN10-40	CL150/300/600	12.7	1/2	4.7	10	6.7	15	---	---
80	3	PN10-40	CL150	15.9	5/8	---	---	11.2	25	17.6	39
		PN25-40	CL300							29.0	64
100	4	PN10-40	CL150	19.1	3/4	---	---	17.6	39	28.9	64
		PN25-40	CL300							47.8	105
150	6	PN10-40	CL150	25.4	1	15.7	35	26.5	58	40.2	89
		PN25-40	CL300							76.4	168
200	8	PN10-16	CL150	31.8	1-1/4	---	---	40.9	90	71.3	157
		PN25-40	CL300	31.8	1-1/4	34.6	76	46.7	103	124	273
250	10	PN10-16	CL150	31.8	1-1/4	---	---	50.7	112	80.0	176
		PN25-40	CL300	31.8	1-1/4	52	115	79.4	175	203	448
300	12	PN10-16	CL150	38.1	1-1/2	---	---	98.6	217	144	317
		PN25-40	CL300	38.1	1-1/2	---	---	104.9	231	275	606

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Table 3. Material Temperature Capabilities

MATERIAL					TEMPERATURE LIMITS ⁽¹⁾	
EN Materials						
Valve Body	Shaft	Bearing Lining and Jacket	Seal	Packing	°C	°F
1.0619 Steel	S17400 or S20910	PEEK / PTFE	PTFE or RPTFE	PTFE or Graphite	-10 to 232	14 to 450
			UHMWPE	PTFE or Graphite	-10 to 93	14 to 200
			Metal	PTFE or Graphite	-10 to 232	14 to 450
		R30006 (Alloy 6) or S31600 Nitride	Metal	Graphite	-10 to 400	14 to 752
1.4409 Stainless Steel	S20910	PEEK / PTFE	PTFE or RPTFE	PTFE or Graphite	-10 to 232	14 to 450
			UHMWPE	PTFE or Graphite	-10 to 93	14 to 200
			Metal	PTFE or Graphite	-10 to 232	14 to 450
		R30006 (Alloy 6) or S31600 Nitride	Metal	Graphite	-10 to 500 ⁽²⁾	14 to 932 ⁽²⁾
CW2M	N10276	PEEK / PTFE	PTFE or RPTFE	PTFE	-10 to 232	14 to 450
M35-2	N05500	PEEK / PTFE	PTFE or RPTFE	PTFE	-10 to 232	14 to 450
ASME Materials						
Valve Body	Shaft	Bearing Lining and Jacket	Seal	Packing	°C	°F
WCC steel	S17400 or S20910	PEEK / PTFE	PTFE or RPTFE	PTFE or Graphite	-29 to 232	-20 to 450
			UHMWPE	PTFE or Graphite	-18 to 93	0 to 200
			Metal	PTFE or Graphite	-29 to 232	-20 to 450
		R30006 (Alloy 6) or S31600 Nitride	Metal	Graphite	-29 to 427	-20 to 800
CF3M Stainless Steel	S20910	PEEK / PTFE	PTFE or RPTFE	PTFE or Graphite	-46 to 232	-50 to 450
			UHMWPE	PTFE or Graphite	-18 to 93	0 to 200
			Metal	PTFE or Graphite	-46 to 232	-50 to 450
		R30006 (Alloy 6) or S31600 Nitride	Metal	Graphite	-46 to 454 ⁽²⁾	-50 to 850 ⁽²⁾
CW2M	N10276	PEEK / PTFE	PTFE or RPTFE	PTFE	-46 to 232	-50 to 450
M35-2	N05500	PEEK / PTFE	PTFE or RPTFE	PTFE	-46 to 232	-50 to 450

1. Minimum allowable temperature for PN series flanges is -10°C (14°F). See requirements of EN 13445-2 Annex B for applications below -10°C (14°F) with PN series flanges.

2. For applications exceeding 427°C (800°F), consult your [Emerson sales office](#) for appropriate disk edge coating material selection.

Table 4. Maximum Allowable Inlet Pressure for CW2M and M35-2 Valves

TEMPERATURE	CW2M ⁽¹⁾						M35-2 ⁽³⁾			
	150 ⁽²⁾	300 ⁽²⁾	PN 10 ⁽²⁾	PN 16 ⁽²⁾	PN 25 ⁽²⁾	PN 40 ⁽²⁾	PN 10 ⁽²⁾	PN 16 ⁽²⁾	PN 25 ⁽²⁾	PN 40 ⁽²⁾
°C	Bar						Bar			
-46 to 38	20.0	51.7	10.0	16.0	25.0	40.0	9.3	15.2	23.8	37.9
50	19.5	51.7	9.9	15.9	24.8	39.6	9.3	15.2	23.8	37.9
100	17.7	51.5	9.4	15.1	23.6	37.8	9.3	15.1	23.7	37.8
150	15.8	50.3	9.4	15.1	23.6	37.8	9.3	14.8	23.4	37.2
200	13.8	48.3	9.1	14.6	22.9	36.6	9.0	14.5	22.5	36.3
232	12.7	47.0	9.1	14.6	22.9	36.6	9.0	14.5	22.4	36.2
°F	Psig						Psig			
-50 to 100	290	750	145	232	362	580	135	220	345	550
200	260	750	144	230	359	575	135	220	345	540
300	230	730	137	219	342	548	135	215	340	525
400	200	700	133	212	331	530	130	210	325	525
450	185	680	133	212	331	530	130	210	325	525

1. This material is not listed in EN 12516-1 or ASME B16.34. Also see the Installation section.
2. The designations PN or 150 and 300 are used only to indicate relative pressure-retaining capabilities and are not EN or ASME pressure-temperature rating class designations.
3. This material is not listed in EN 12516-1. Also see the Installation section.

Installation

Key numbers in this procedure are shown in figure 11 unless otherwise indicated.

⚠ WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the bursting of pressure retaining parts, be certain the service conditions do not exceed either the valve body rating or the flange joint rating, or other limits given in table 1 or on the nameplate. Use pressure-relieving or pressure-limiting devices to prevent the service conditions from exceeding these limits.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section on page 8 in this manual.

CAUTION

The valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions specified in the customer's order. Because some valve body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

The maximum allowable inlet pressures for steel and stainless steel valve bodies are consistent with the pressure-temperature ratings shown in table 1, except where further limited by the trim and packing material temperature capabilities given in table 3. Valves are also available in CW2M and M35-2 valve body materials. The CW2M valve body material is not listed in EN 12516-1 or in ASME B16.34. The M35-2 valve body material is listed in ASME B16.34, but is not listed in EN 12516-1. Valve bodies constructed of these materials mate with EN and ASME flanges, but must not be installed in systems requiring conformance to EN or ASME standards if not included in EN or ASME pressure/temperature ratings. Maximum allowable inlet pressures for 8580 valve bodies made of CW2M or M35-2 construction materials are shown in table 4.

1. Install a three-valve bypass around the control valve assembly if continuous operation is necessary during inspection and maintenance of the valve body.
2. Inspect the valve body to be certain it is free of foreign material.
3. The valve is normally shipped as part of a control valve assembly, with an actuator mounted on the valve body.

If the valve body and actuator have been purchased separately or if the actuator has been removed for maintenance, mount the actuator, and adjust actuator travel before inserting the valve body into the line. This is necessary due to the measurements that must be made during the actuator adjustment process. Refer to the Actuator Mounting section on page 17 of this manual and to the separate actuator instruction manual for mounting and adjusting instructions before proceeding.

4. Inspect adjacent pipelines to be certain they are free of any foreign material, such as pipe scale or welding slag, that could damage the valve body seating surfaces.

CAUTION

Damage to the disk (key 3) will occur if any pipe flanges or piping connected to the valve body interfere with the disk rotation path. However, the disk can be rotated without interference when the valve body is installed between adjacent pipe flanges or piping that has an inside diameter equal to or greater than either schedule 80 pipe or compatible EN pipe

sizes. If piping with a smaller inner diameter than specified above is connected to the valve, measure carefully to be certain the disk rotates without interference before putting the valve into operation.

5. Flow is in the standard direction when the seal retainer (key 2) is facing upstream. Standard flow direction is also indicated by the flow direction arrow cast into the valve body. Flow in the reverse direction is permissible within allowable pressure drop limits for the soft seal. The metal seal is forward flow only.

CAUTION

8580 disk rotation is counterclockwise to open (when viewed from the actuator side of the valve body, see figure 8) through 90 degrees of disk rotation. Rotating the disk (key 3) past either the open or closed position could damage the seal and disk sealing surfaces and could cause the disk to jam in the seal retainer.

6. With the disk in the closed position, install line flange gaskets, and insert the valve between the pipeline flanges. Use either flat sheet gaskets or spiral-wound gaskets with compression-controlling centering rings. Spiral-wound gaskets without compression-controlling centering rings are not recommended for this purpose.
 7. Depending on valve size and pressure rating, the wafer style valve is centered in the pipeline using either retainer clips or the flange bolt holes. (For valves that have four flange bolt holes in the valve body (key 1), each hole engages one corresponding line flange stud.) Insert the valve between the flanges and use either the retainer clips or install two or more line flange studs into the line flanges to help hold the valve in position while centering the valve. Carefully center the valve on the flanges to ensure disk clearance.
- Select and install two pipeline gaskets.

Note

Lubricate line flange studs before inserting them into flanges. If necessary, provide additional support for the control valve assembly because of its combined weight.

⚠ WARNING

For lugged valve bodies with threaded line bolt holes, personal injury and property damage could result from sudden release of process pressure if line bolts are not properly installed. To ensure proper line bolt thread engagement, line studs must be centered in the threaded section of the valve body so that each stud has equal thread engagement in the body. See figure 2.

8. After centering the valve body, first lubricate and then install the remaining line flange bolting to secure the valve in the pipeline. Tighten the nuts to the line flange studs in a crisscross pattern to ensure proper alignment of valve, gaskets, and flanges.

⚠ WARNING

An 8580 valve body is not necessarily grounded when installed in a pipeline. If the valve is used in a flammable or hazardous atmosphere or for oxygen service, an explosion could result due to a discharge of static electricity from the valve components. To avoid personal injury or property damage, always make sure the valve body is grounded to the pipeline before putting the control valve assembly into operation in a flammable or hazardous atmosphere.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

8580 Valve

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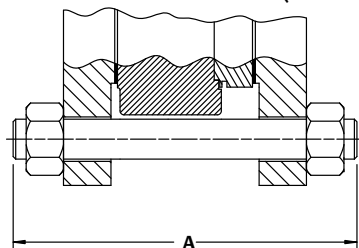
Instruction Manual

D103300X012

Table 5. Stud Bolt Data

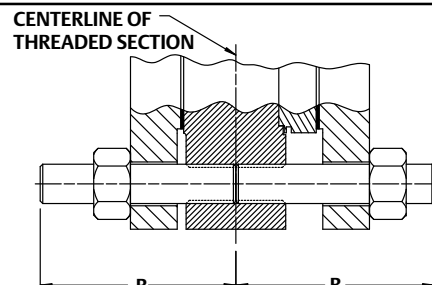
VALVE SIZE	WAFER STYLE AND LUGGED STYLE WITH THROUGH DRILLED HOLES											
	PN 10			PN 16			PN 25			PN 40		
DN	No. of Stud Bolts	Size Dia & Thread, mm	A Dimension, mm	No. of Stud Bolts	Size Dia & Thread, mm	A Dimension, mm	No. of Stud Bolts	Size Dia & Thread, mm	A Dimension, mm	No. of Stud Bolts	Size Dia & Thread, mm	A Dimension, mm
50	4	M16X2	125	4	M16X2	125	4	M16X2	130	4	M16X2	130
80	8	M16X2	140	8	M16X2	140	8	M16X2	150	8	M16X2	150
100	8	M16X2	150	8	M16X2	150	8	M20X2.5	160	8	M20X2.5	160
150	8	M20X2.5	160	8	M20X2.5	160	8	M24X3	180	8	M24X3	180
200	8	M20X2.5	170	12	M20X2.5	170	12	M24X3	190	12	M27X3	210
250	12	M20X2.5	180	12	M24X3	190	12	M27X3	210	12	M30X3.5	230
300	12	M20X2.5	190	12	M24X3	200	16	M27X3	230	16	M30X3.5	250
VALVE SIZE	LUGGED STYLE (THREADED HOLES)											
	PN 10			PN 16			PN 25			PN 40		
DN	No. of Stud Bolts	Size Dia & Thread, mm	B Dimension, mm	No. of Stud Bolts	Size Dia & Thread, mm	B Dimension, mm	No. of Stud Bolts	Size Dia & Thread, mm	B Dimension, mm	No. of Stud Bolts	Size Dia & Thread, mm	B Dimension, mm
50	---	---	---	---	---	---	---	---	---	---	---	---
80	16	M16X2	85	16	M16X2	85	16	M16X2	90	16	M16X2	90
100	16	M16X2	90	16	M16X2	90	16	M20X2.5	100	16	M20X2.5	100
150	16	M20X2.5	110	16	M20X2.5	110	---	---	---	---	---	---
200	16	M20X2.5	110	24	M20X2.5	110	24	M24X3	120	---	---	---
250	24	M20X2.5	120	24	M24X3	120	24	M27X3	130	---	---	---
300	24	M20X2.5	120	24	M24X3	130	24	M27X3	140	24	M30X3.5	150
VALVE SIZE	WAFER STYLE AND LUGGED STYLE WITH THROUGH DRILLED HOLES						LUGGED STYLE (THREADED HOLES)					
	CL150			CL300			CL150			CL300		
NPS	No. of Stud Bolts	Size Dia & Thread, Inch	A Dimension, Inch	No. of Stud Bolts	Size Dia & Thread, Inch	A Dimension, Inch	No. of Stud Bolts	Size Dia & Thread, Inch	B Dimension, Inch	No. of Stud Bolts	Size Dia & Thread, Inch	B Dimension, Inch
2	4	5/8-11	5	8	5/8-11	5.25	---	---	---	---	---	---
3	4	5/8-11	5.75	8	3/4-10	6.5	8	5/8-11	4.00	16	3/4-10	4.25
4	8	5/8-11	6	8	3/4-10	7	16	5/8-11	4.00	16	3/4-10	4.50
6	8	3/4-10	6.5	12	3/4-10	7.5	16	3/4-10	4.25	24	3/4-10	4.75
8	8	3/4-10	7	12	7/8-9	9	16	3/4-10	4.50	24	7/8-9	5.50
10	12	7/8-9	8	16	1-8	10	24	7/8-9	5.00	32	1-8	6.50
12	12	7/8-9	8.5	16	1-1/8-8	11	24	7/8-9	5.25	32	1-1/8-8	7.00

Figure 2. Stud Bolts for Installation (also see table 5)



A3887-1

WAFER-STYLE VALVE BODY



A3886-1

LUGGED-STYLE VALVE BODY (THREADED HOLES)

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8580 Valve

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Table 6. Stud Bolt Data

VALVE SIZE	DOUBLE FLANGE STYLE									
	CL150					CL300				
	Size Dia & Thread, Inch	Through Holes		Threaded Holes		Size Dia & Thread, Inch	Through Holes		Threaded Holes	
NPS		No. of Stud Bolts	C Dimension, Inch	No. of Stud Bolts	B Dimension, Inch		No. of Stud Bolts	C Dimension, Inch	No. of Stud Bolts	B Dimension, Inch
3	5/8-11	8	3.75	---	---	5/8-11	12	4.25	4	3.25
4	5/8-11	12	4.00	4	3.00	3/4-10	12	4.75	4	3.75
6	3/4-10	12	4.50	4	3.50	3/4-10	12	5.25	4	4.00
8	3/4-10	12	4.50	4	3.75	7/8-9	20	6.00	4	4.5
10	7/8-9	20	5.00	4	4.00	1-8	28	6.50	4	5.25
12	7/8-9	20	5.25	4	4.00	1 1/8-8	28	7.00	4	5.25

Figure 3. Stud Bolts for Installation (also see table 6)

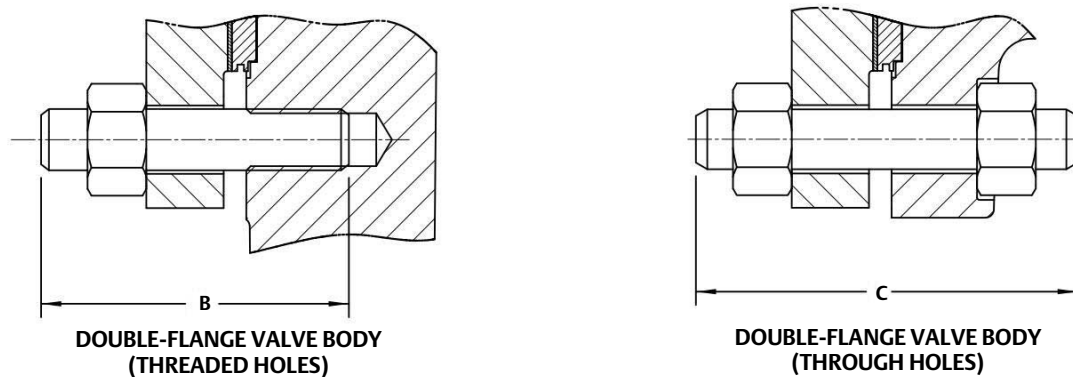
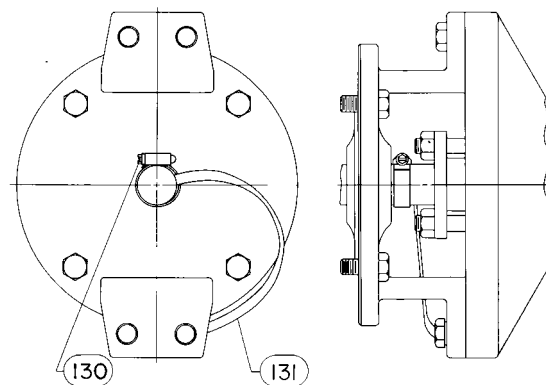


Figure 4. Optional Shaft-to-Valve Body Bonding Strap Assembly



Note

Standard packings for the 8580 valve are composed of all conductive packing rings (graphite ribbon packing) or partially conductive packing rings (such as a carbon-filled PTFE female adaptor with PTFE V-ring packing) to electrically bond the shaft to

the valve body for hazardous area service. For oxygen service applications, provide alternate shaft-to-valve body bonding according to the following step.

9. For oxygen service applications, attach the bonding strap assembly (key 131, figure 4) to the shaft with the clamp (key 130, figure 4), and connect the other end of the bonding strap assembly to the valve body with the cap screw (key 35). Secure each cap screw with a hex nut (key 36).

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however, the packing might require some re-adjustment to meet specific service conditions.

Valves with ENVIRO-SEALT™ packing systems will not require this initial re-adjustment. See ([D101643X012](#)) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section on page 20 of this manual.

Maintenance

Valve body parts are subject to normal wear and must be inspected regularly and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given in this section for: replacing trim components, changing disk rotation or valve action, and mounting and adjusting the actuator.

As used in these instructions, actuator refers to power actuators (such as pneumatic diaphragm, piston actuators, and rack and pinion actuators).

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any spring precompression.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Packing Maintenance

Refer to figure 5 for available packing configurations. All maintenance operations in this section may be performed with the valve in the line. Packing may be PTFE V-ring or graphite.

An ENVIRO-SEAL packing system is also available with the 8580 valve. To install the ENVIRO-SEAL packing system in an existing valve, follow the instructions in the instruction manual included with the packing system ([D101643X012](#)). To remove packing parts in a valve with the ENVIRO-SEAL packing system, follow the procedures for valves with the ENVIRO-SEAL packing system in this section. Install the replacement packing following the instructions in the packing system instruction manual (D101643X012).

Stopping Leakage

For valves with PTFE or graphite packing:

CAUTION

Tighten the packing flange only enough to prevent shaft leakage. Excessive tightening will only accelerate wear of the packing and could produce higher torques on the valve.

Leakage around the packing followers can be stopped by tightening the packing flange nuts (key 28, figure 11).

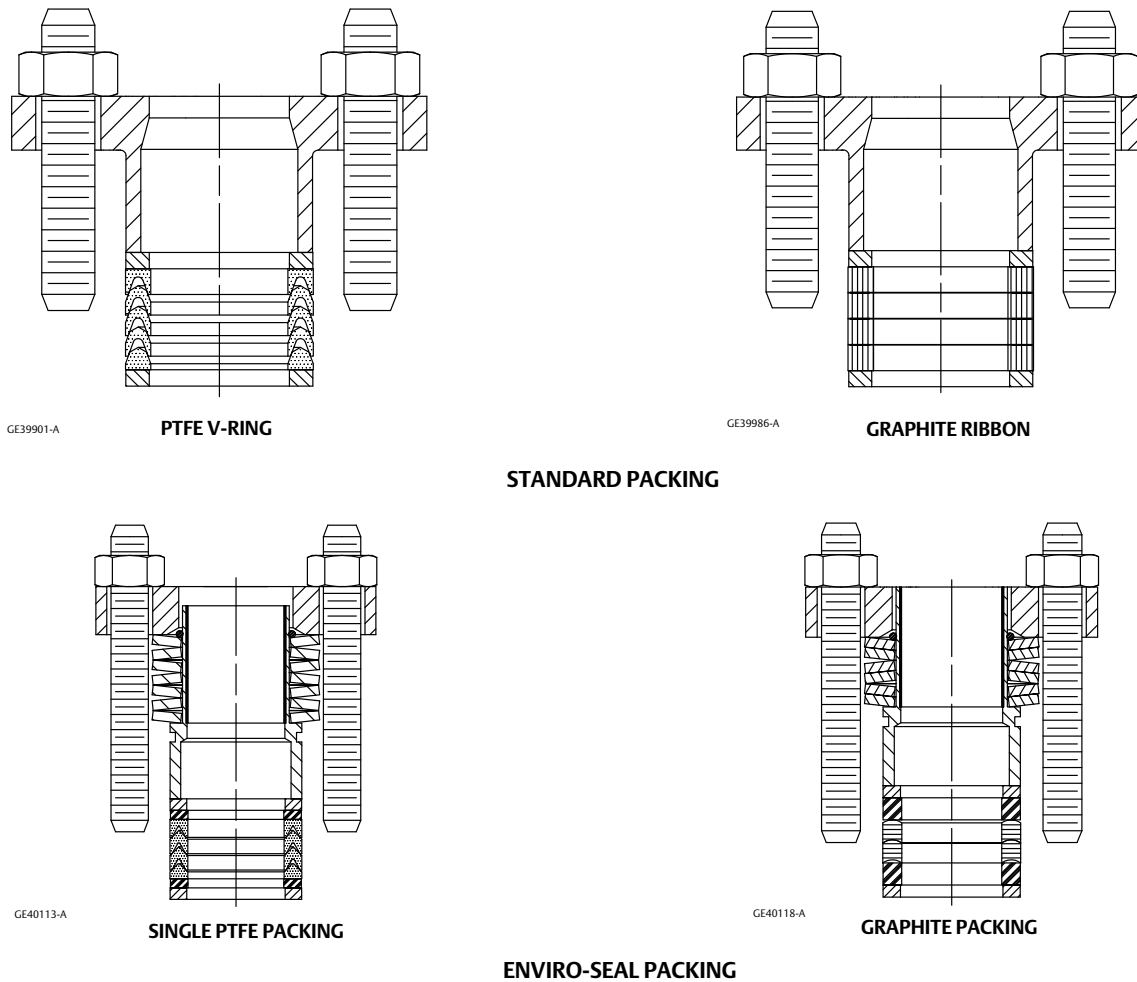
If the packing is relatively new and tight on the shaft, and if tightening the packing flange nuts does not stop leakage, the shaft may be worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches around the packing box wall. Inspect the shaft and packing box wall for nicks and scratches when performing the packing replacement procedures.

For valves with the ENVIRO-SEAL packing system:

Optimum performance of the ENVIRO-SEAL packing system is obtained when the Belleville springs are tightened to their “target load.” The target load is the point where the springs are compressed to 85% of their maximum deflection, or nearly flat. Maximum deflection is when the springs are 100% compressed, or completely flat.

Under normal conditions, the packing nuts should not require re-tightening. However, when servicing, if the springs do not remain at the target load of 85% compression, retighten the packing box nuts according to the following procedure:

Figure 5. Packing Arrangement Details



NOTES:

1. WITH CONDUCTIVE PACKING, THE FEMALE ADAPTOR IN PTFE V-RING PACKING IS CARBON-FILLED PTFE.
2. APPLY LUBRICANT.
3. THESE TWO SURFACES SHOULD REMAIN PARALLEL AS YOU ALTERNATELY AND EVENLY TIGHTEN THE PACKING NUTS (KEY 28).

1. Tighten the packing flange nuts alternately and evenly, keeping the packing flange parallel with the valve flange (see figure 5), until the Belleville springs are compressed 100% (or completely flat).

- For PTFE packing, loosen each packing flange nut one half turn (180° of rotation).
- For Graphite packing, loosen each packing flange nut one quarter turn (90° of rotation).

The target load of 85% compression has now been reached. If leakage continues, replace the packing components as described in the following procedures.

Replacing the Packing

To replace the packing, the actuator must be removed. Also, the valve should be removed from the pipeline to allow proper readjustment of the disk position.

⚠ WARNING

The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 3).

CAUTION

Damage to the disk (key 3) may occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, apply operating pressure to the actuator temporarily to retain the disk in the closed position while removing the valve from the pipeline.

For valves with PTFE or graphite packing:

Key numbers in this procedure are shown in figure 11 unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shutoff all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.

CAUTION

When removing the actuator in the following step, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws and nuts (keys 35 and 36). Remove the clamp (key 130, figure 4) if the strap (key 131, figure 4) is used.
3. Remove the packing flange nuts and the packing flange (key 26) if used and pull out the packing follower (key 25).
4. Remove the anti-blowout ring (key 40) from the drive shaft (key 10).
5. Remove the old packing rings (key 24) and, if used, the packing washers (key 31). Carefully avoid scratching the shaft or packing box wall to avoid damage that could cause leakage around the shaft. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing.

⚠ WARNING

Do not lubricate parts when used in oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

6. Use the appropriate procedures below for installing packing.

- Install the packing as shown in figure 5.
- With graphite ribbon packing, stack the packing rings and packing washers together, and slide the stack into the packing box as far as it will go while carefully avoiding trapping air between the rings.

- Install the anti-blowout ring (key 40) in the groove on the drive shaft (key 10).
 - Install the packing follower and, if used, the packing flange.
 - Install the packing flange nuts, and tighten them only far enough to stop leakage under normal operating conditions.
 - For oxygen service applications, attach the bonding strap assembly (key 131, figure 4) to the shaft with the clamp (key 130, figure 4), and connect the other end of the bonding strap assembly to the valve body with a cap screw (key 35). Secure each cap screw with a hex nut (key 36).
7. Mount the actuator and adjust the closed position of the valve, per the Actuator Mounting section on page 17 of this manual, before returning the valve to service.
 8. When placing the control valve into operation, check around the packing follower for leakage; retighten the packing flange nuts as required according to accepted bolting procedures.

For valves with ENVIRO-SEAL packing systems:

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shutoff all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

CAUTION

When removing the actuator, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws and nuts (keys 35 and 36). Remove the clamp (key 130, figure 4) if the strap (key 131, figure 4) is used.
3. Loosen the two packing hex nuts evenly to remove spring tension, then remove the nuts.
4. Remove the packing flange and spring pack assembly. The spring pack assembly consists of the spring stack and packing follower. The spring stack is retained on the packing follower by an O-ring. Remove the anti-blowout ring (key 40) from the driveshaft (key 10). Remove the anti-extrusion washer, the packing set, and the packing ring.

CAUTION

The valve shaft surface condition is critical in making and maintaining a good seal. If the valve shaft surface is scratched, nicked, dented, or worn, replace the valve shaft before replacing the packing system.

5. Inspect the existing valve shaft. If necessary, replace the valve shaft as described in the Replacing the Disk, Shafts, or Bearings section.
6. Install the new packing system components as described in the ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)).
7. Install the anti-blowout ring (key 40) onto the drive shaft (key 10) before installing the packing follower.
8. Mount the actuator and adjust the closed position of the valve, per the Actuator Mounting section on page 17 of this manual, before returning the valve to service.

Replacing the Seal Ring Assembly

Perform this procedure only if the control valve is not shutting off properly (that is, leaking downstream). This procedure does not require removing the actuator from the valve body.

Key numbers in this procedure are shown in figure 11 unless otherwise indicated.

1. Isolate the control valve from line pressure, and relieve pressure from the valve body. Shut off and disconnect all lines from the power actuator.

⚠ WARNING

The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 3).

CAUTION

Damage to the disk (key 3) may occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, apply operating pressure to the actuator temporarily to retain the disk in the closed position while removing the valve from the pipeline.

2. Unscrew the flange bolts, and remove the valve from the pipeline.
3. Unscrew the machine screws (key 14), remove the retainer clip (key 13), and remove the seal retainer (key 2).
4. Remove the seal ring assembly (key 4).
5. The valve must be closed during seal ring installation to permit accurate centering of the seal. To install the new seal ring assembly:
 - For a soft seal, if the spring (key 5) was disassembled, hook the spring ends together. Work the spring into the recess in the seal ring (key 4). Place the seal ring assembly onto the disk. Set the retainer onto the seal, making sure proper alignment between the seal and retainer has been achieved.
 - For the metal seal ring assembly, place the seal ring assembly onto the disk. Set the retainer onto the seal, making sure proper alignment between the seal and retainer has been achieved.
6. Attach the seal retainer (key 2) and the retainer clips (key 13) to the valve body and secure with the machine screws (key 14).
7. Be certain the disk is closed before installing the valve according to the Installation section on page 4 of this manual.

Replacing the Disk, Shafts, or Bearings

Key numbers in this procedure are shown in figure 11 unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shutoff all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

CAUTION

When removing the actuator in the following step, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.

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- Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws and nuts (keys 35 and 36). Remove the clamp (key 130, figure 4) if the strap (key 131, figure 4) is used.
- Remove the packing flange nuts and the packing flange (key 26) if used and pull out the packing follower (key 25).

Figure 6. Orientation of Bearing Tabs

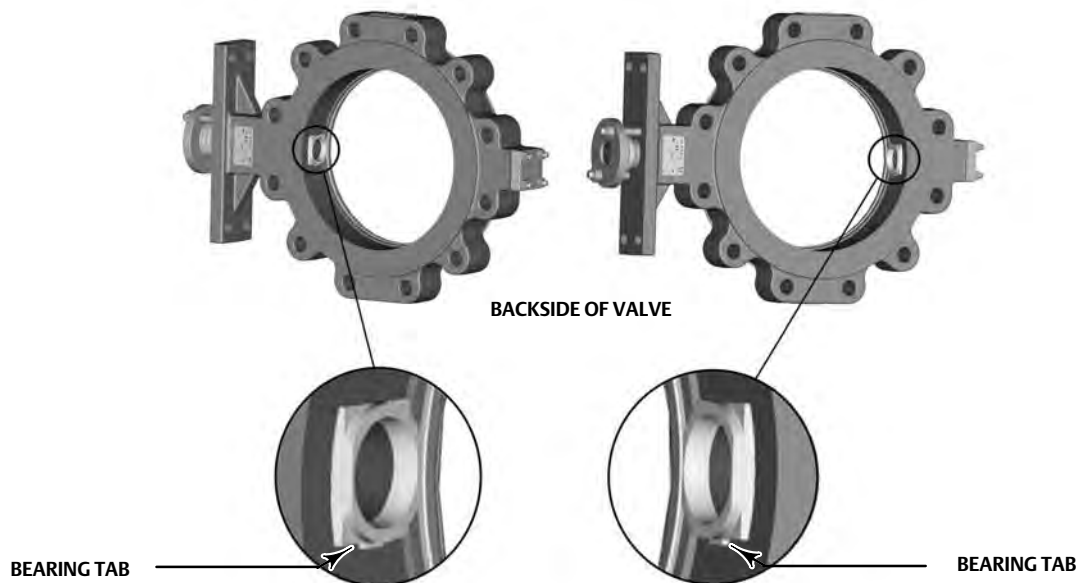


Table 6. Follower Shaft Internal Threads

VALVE SIZE		THREAD SIZE
DN	NPS	
50	2	M8 X 1.25
80	3	M10 X 1.50
100	4	M12 X 1.75
180	6	M16 X 2.00
200	8	M20 X 2.50 ⁽¹⁾
250	10	M20 X 2.50 ⁽¹⁾
300	12	M24 X 3.00 ⁽¹⁾

1. For valves with a two-piece, split-shaft design only. DN200 – 300 (NPS 8–12) valves changed to a one-piece, through-shaft design in 2015.

Table 7. Recommended Blind Flange Bolt Torque

VALVE SIZE		TORQUE	
DN	NPS	N•m	lbf•ft
50 to 150	2 to 6	9.5	7.0
200, 250	8, 10	23	17
300	12	45	33

Disassembly

1. Remove the seal ring assembly according to steps 3 and 4 of the Replacing Seal Ring section on page 12 of this manual.
2. Remove hex nuts, blind flange, gasket, spacer (if present), follower spring seats, and follower spring (keys 19, 17, 16, 15, 9, and 12).
3. Clean the gasket surfaces on the blind flange (key 17) and on the end of the valve body (key 1).
4. Rotate the disk (key 3) to the fully open position.
5. Refer to figure 7 and determine the location of the smaller end of the taper pins (key 8). Drive out the taper pins and expansion pins (key 7) towards the larger end.

⚠ WARNING

Once the shafts have been removed in the following step, the disk may fall from the valve body. To avoid personal injury and disk damage, support the disk to prevent it from falling as the shafts are being removed.

6. For valves with a two-piece, split shaft, pull the follower shaft (key 11) out through the outboard end of the valve body. If the follower shaft cannot be pulled free, the end of the follower shaft is internally threaded (see table 6) for screwing in a bolt or stud to aid in pulling the follower shaft.
7. Pull the drive shaft (key 10) out through the actuator end of the valve body and remove the anti-blowout ring (key 40) from the drive shaft.
8. Remove the disk (key 3) from the valve body.
9. Remove the packing (key 24, figure 5) and the packing box ring (key 23, figure 5).
10. If either of the bearings (key 6) require replacement, remove them.
11. Clean the packing box and [metal packing box parts].

Assembly

⚠ WARNING

Do not lubricate bearings that will be used for oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

CAUTION

To avoid possible product damage, ensure the bearing tabs are oriented correctly when installing in the following procedure. See figure 6 for proper orientation of the bearings.

1. If new bearings (key 6) are required, install and orient them in the valve body, as shown in figure 6. Ensure the bearings are fully seated, contacting the inside diameter of the valve body.
2. Insert the disk into the valve body as shown in figure 7, ensuring the “T” stamped on the disk hub is oriented toward the actuator end of the valve body.
3. Install the drive shaft (key 10) through the valve body into the disk. The disk/shaft connection utilizes taper and expansion pins. The hole for the drive shaft connection is slightly off-center to prevent the drive shaft from being

installed in the wrong orientation. Orient the position indication mark on the end of the shaft with the face of the disk as shown in figure 8. For assemblies using a two-piece, split shaft, the hole for the follower shaft connection is on-center. Insert the expansion pins into the disk until they are seated, as shown in figure 7. Once in place, insert the taper pins. The taper pins must be driven into the disk/shaft/expansion pin assemblies until “solid contact” is felt. “Solid contact” can be identified by the sound of the hammer blow and the bounce felt in the hammer. NPS 8-12 valves changed to a one-piece, through-shaft design in October 2015 and utilize only one pin connection. NPS 8-12 valves shipped prior to October 2015 used a two-piece, split-shaft design with two pin connections - same as the NPS 2-6 valves.

Figure 7. Taper / Expansion Pin Installation



NOTES:
1 INSTALL THE PINS FROM THIS SIDE OF THE DISK.

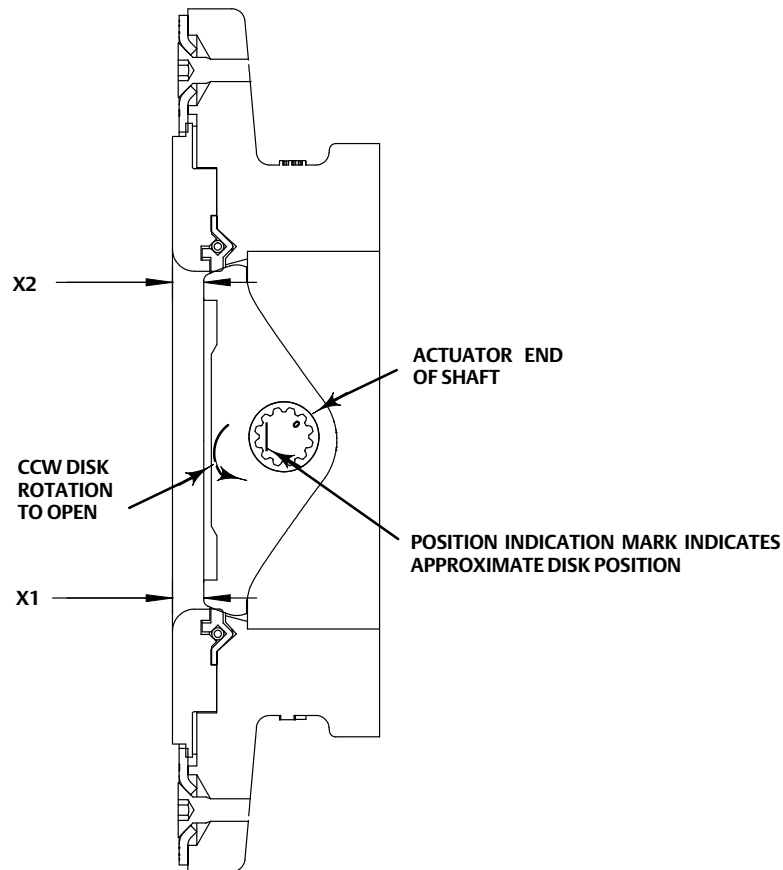
4. Reinstall the follower spring/spring seat assembly (keys 9, 12, and 9, figure 9) inside the follower shaft or follower side of the drive shaft for valves with a one-piece, through-shaft design.
5. Install the spacer (key 15) if used, and the gasket, blind flange, and hex nuts (keys 16, 17, and 19). Ensure the blind flange is oriented so the serrations face the gasket and valve body. Tighten the hex nuts (key 19) per table 7.
6. The valve must be closed during seal ring installation to permit accurate centering of the seal. To install the new seal ring assembly or flow ring:

Table 8. Recommended Actuator-Mounting Bolt Torque

VALVE SIZE		TORQUE	
DN	NPS	N•m	lbf•ft.
50, 80, 100, and 150	2, 3, 4, and 6	120	88
200, 250, and 300	8, 10, and 12	250	185

- For a soft seal, if the spring (key 5) was disassembled, hook the spring ends together. Work the spring into the recess in the seal ring (key 4). Place the seal ring assembly onto the disk. Set the retainer onto the seal, making sure proper alignment between the seal and retainer has been achieved.
 - For the metal seal ring assembly, place the seal ring assembly onto the disk. Set the retainer onto the seal.
 - For the flow ring construction, place the gasket (key 41) onto the valve body. Set the retainer onto the gasket.
7. Attach the seal retainer (key 2) and the retainer clips (key 13) to the valve body and secure with the machine screws (key 14).
 8. Insert a packing box ring (key 23) into the packing box.

Figure 8. Sectional of Typical Valve Body



9. For **standard packing**, install the packing according to the appropriate instructions presented in step 5 of the Replacing Packing section on page 11 of this manual.
For **ENVIRO-SEAL packing**, install the new packing system components as described in [D101643X012](#).
10. Install the anti-blowout ring (key 40) in the groove in the drive shaft.
11. Rotate the disk to the approximate closed position.
12. Mount and adjust the actuator per the following Actuator Mounting section on page 17 of this manual.

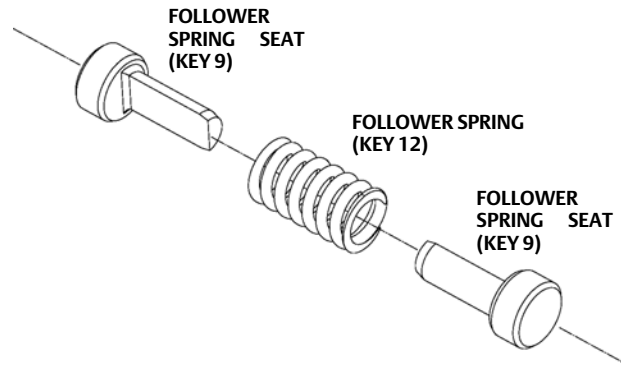
Actuator Mounting

With the valve body out of the line, mount the actuator on the valve body in accordance with the instructions in the actuator instruction manual. Mount the actuator yoke to the valve body, and tighten the actuator-mounting cap screws and nuts (keys 35 and 36) to the appropriate torque from table 8.

Key numbers in this procedure are shown in figure 11 unless otherwise indicated.

1. Determine the actuator mounting style and position from figure 10.

Figure 9. Follower Spring/Spring Seat Assembly



CAUTION

8580 valve disk rotation is counterclockwise to open (when viewed from the actuator side of the valve body, see figure 8). Rotating the disk (key 3) past the fully closed position will damage the seal ring (key 4). To prevent this damage, use the following procedures:

- For actuators with adjustable travel stops, such as a Fisher 2052, 1051/1052 size 33, 1066 or 1066SR actuator, make certain the actuator travel stop prevents the disk from rotating past the fully closed position.
- For actuators with an adjustable turnbuckle, such as the Fisher 1051/1052 size 40, 60, and 70, or 1061 actuator, the turnbuckle must be adjusted so that the valve is closed when the diaphragm plate or piston is against the actuator travel stop.

2. Adjust the actuator to bring the disk to the fully closed position at the end of the actuator stroke. To determine the fully closed disk position, measure the distances between the disk face and the seal retainer face at the top and bottom of the valve (X1 and X2) as shown in figure 8. Adjust the travel stops or turnbuckle to rotate the disk slightly until the two measurements are within 0.8 mm (0.032 inch) of each other. Refer to the appropriate actuator instruction manual for assistance.

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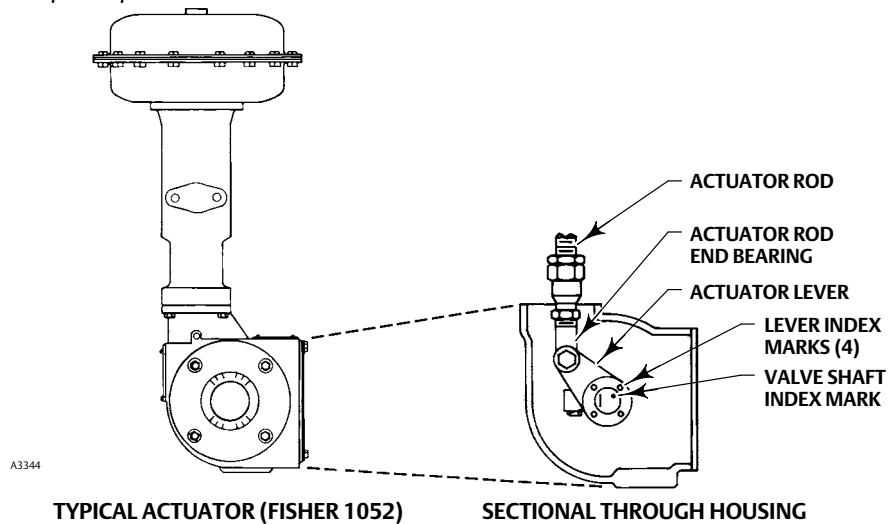
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Figure 10. Lever/Shaft/Disk Orientation with Valve Closed



ACTUATOR		VALVE CLOSED 4	MOUNTING POSITION 1 5	MOUNTING POSITION 2 5	MOUNTING POSITION 3 5	MOUNTING POSITION 4 5
MOUNTING	STYLE					
RIGHT-HAND 1	STYLE A (PDTC)					
	STYLE B (PDTC) 3					
LEFT-HAND 2	STYLE C (PDTC) 3					
	STYLE D (PDTC)					

NOTES:

- 1 WHEN ONE IS FACING THE INLET, THE ACTUATOR IS TO THE RIGHT OF THE VALVE BODY.
 - 2 WHEN ONE IS FACING THE INLET, THE ACTUATOR IS TO THE LEFT OF THE VALVE BODY.
 - 3 FOR 60-DEGREE OPERATION WITH PUSH-DOWN-TO-CLOSE ACTION (EXTENDING ACTUATOR ROD CLOSSES VALVE), ROTATE ACTUATOR LEVER COUNTERCLOCKWISE SO THAT LEVER INDEX MARK IS OFFSET 1 SPLINE TOOTH FROM VALVE SHAFT INDEX MARK FOR NPS 2 THROUGH 4 VALVES AND 2 SPLINE TEETH FROM VALVE SHAFT INDEX MARK FOR NPS 6 THROUGH 12 VALVES.
 - 4 CURVED ARROWS IN "VALVE CLOSED" COLUMN INDICATE ROTATION REQUIRED TO OPEN VALVE (COUNTERCLOCKWISE WHEN VIEWED FROM ACTUATOR SIDE OF VALVE).
 - 5 ARROWS IN "MOUNTING POSITION" COLUMNS INDICATE DIRECTION OF ACTUATOR ROD TRAVEL REQUIRED TO OPEN VALVE.
6. PDTC—PUSH DOWN TO CLOSE; PDTO—PUSH DOWN TO OPEN.

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Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Retrofit Kits for ENVIRO-SEAL Packing

Retrofit kits are available for replacing the packing in an existing valve with an ENVIRO-SEAL packing system. These kits are available for single PTFE or graphite packing. All parts required for installation of the ENVIRO-SEAL packing system into an existing 8580 valve are included in the kits.

Worn shafts, packing box damage, or other components that do not meet Emerson Automation Solutions finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of the retrofit kit.

ENVIRO-SEAL Packing System Retrofit Kits

SHAFT DIAMETER		SINGLE PTFE PACKING	GRAPHITE PACKING
mm	Inches		
12.7	1/2	RPACKXRT482	RPACKXRT422
15.9	5/8	RPACKXRT492	RPACKXRT432
19.1	3/4	RPACKXRT502	RPACKXRT442
25.4	1	RPACKXRT512	RPACKXRT452
31.8	1-1/4	RPACKXRT522	RPACKXRT462
38.1	1-1/2	RPACKXRT532	RPACKXRT472

Repair Kits for ENVIRO-SEAL Packing

Repair kits for ENVIRO-SEAL PTFE packing include one packing set and two anti-extrusion washers. Repair kits for ENVIRO-SEAL graphite packing include two packing rings and two anti-extrusion rings.

Worn shafts, packing box damage, or other components that do not meet Emerson Automation Solutions finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of the repair kit.

ENVIRO-SEAL Packing System Repair Kits

SHAFT DIAMETER		FOR PTFE PACKING	FOR GRAPHITE PACKING
mm	Inches		
12.7	1/2	RRTYX000012	13B8816X012
15.9	5/8	RRTYX000022	13B8816X032
19.1	3/4	RRTYX000032	13B8816X052
25.4	1	RRTYX000052	13B8816X092
31.8	1-1/4	RRTYX000062	13B8816X112
38.1	1-1/2	RRTYX000072	13B8816X142

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Key Description

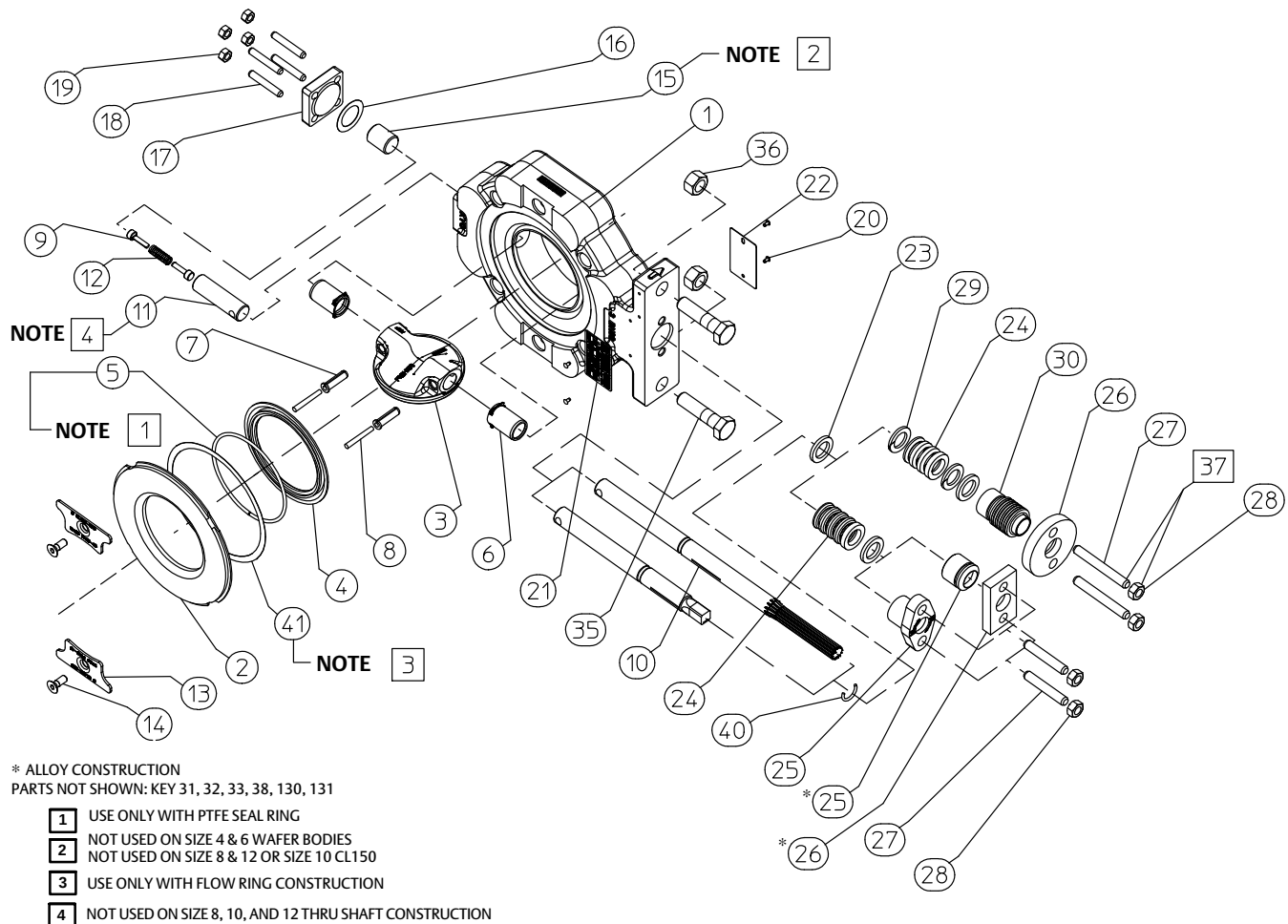
1	Valve Body If you need a new valve body, please order by valve size, serial number and desired material.
2	Seal Retainer / Flow Ring
3*	Disk
4*	Seal Ring
5*	Spring
6*	Bearing (2 req'd)
7*	Expansion Pin (NPS 2-6, 2 req'd) (NPS 8-12, 1 req'd ⁽¹⁾)
8*	Taper Pin (NPS 2-6, 2 req'd) (NPS 8-12, 1 req'd ⁽¹⁾)
9	Follower Spring Seats
10*	Drive Shaft
11*	Follower Shaft (when used)
12	Follower Spring
13	Retainer Clip
14	Machine Screw, Flat Head, Hex Socket

Key Description

15	Spacer
16*	Gasket
17	Blind Flange
18	Stud
19	Hex Nut
20	Drive Screw
21	Nameplate
22	Mfg Label
23*	Packing Box Ring
24*	Packing Set
24*	Packing Ring (4 req'd)
24*	Packing Set, ENVIRO-SEAL
24*	Packing Set, ENVIRO-SEAL
25	Packing Follower
26	Packing Flange
27	Packing Stud
28	Packing Nut
29*	Anti-extrusion Ring
30	Spring Pack Assy
31*	Packing Washer
32	Tag
33	Cable Tie
34	Mounting Bracket
35	Cap Screw
36	Hex Nut
37	Lubricant
39	Machine Screw, Flat Head, Hex Socket
40	Anti-blowout Ring
41*	Gasket, Flow Ring
130	Clamp
131	Bonding Strap Assy

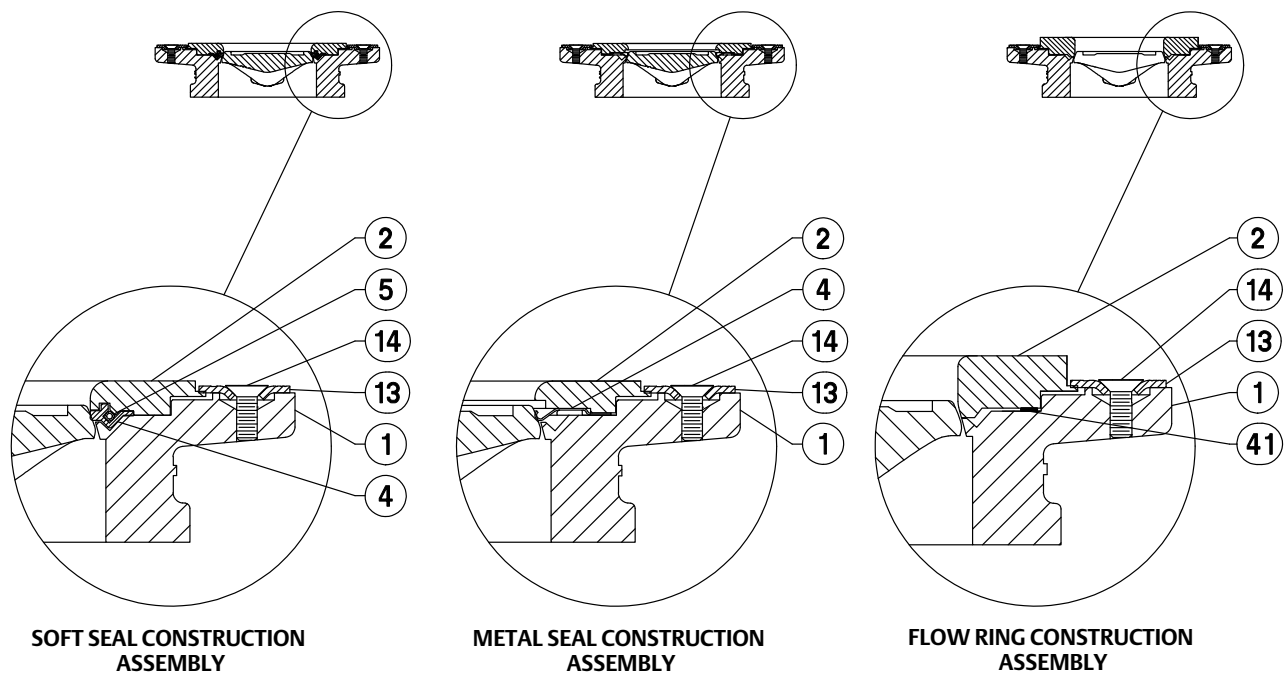
1. 2 required for split-shaft design.
*Recommended spare parts

Figure 11. Fisher 8580 Valve Assembly



GE36048-F

Figure 12. Fisher 8580 Seal Assembly Detail



GE36048_D_2

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Fisher™ 8590 Rotary Valve

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Figure 1. Fisher 8590 Valve with 2052 Actuator and DVC6200 Digital Valve Controller



X0955-1

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher 8590 valve, NPS 3 through NPS 24 (figure 1). Refer to separate instruction manuals for information covering the power actuator and accessories.

Do not install, operate, or maintain an 8590 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The Fisher 8590 High-Performance Butterfly Valve maintains tight shutoff, and can be specified for a wide range of pressure and temperature conditions.

The 8590 valve is available in a lugged or double flanged body design. A splined shaft can combine with a variety of spring-and-diaphragm or pneumatic piston actuators. A square or keyed shaft can combine with a variety of hand levers, handwheels, or pneumatic piston actuators. These combinations help make the 8590 valve a reliable, high-performance butterfly valve for both throttling and on-off applications in the process industries.

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Table 1. Fisher 8590 Valve Specifications

Specifications	ASME
Valve Body Size	NPS 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24
Pressure Rating	CL600 per ASME B16.34
Valve Body Materials	WCC or CF8M (std)
	LCC, CD3MN, M35-2, and CW2M
Disk Materials	CF8M (std), CD3MN, M35-2, and CW2M
Disk Edge Coating	Chrome Plate (std)
	Chrome Coat
	Chromium Carbide Coating
End Connections	Mates with RF Flanges per ASME B16.5 Optional construction mates with RTJ Flanges per ASME B16.5
Valve Body Style	Lugged (Single Flange), Lugged with drilled through flange holes, Double Flanged with through holes
Shaft Connection Style	NPS 3-24: Splined (std) NPS 3-12: Square NPS 14-24: Keyed
Face-to-Face Dimensions	Meets MSS SP68, API 609, ASME B16.10, and EN 558 standards
Shutoff	Soft Seal: Class VI
	Metal Seal: Class IV, reverse direction only
	Phoenix III Seal: Class VI; reverse direction preferred, forward direction optional
	High Pressure Seal: Class VI, reverse direction only
Flow Direction	Standard (reverse flow) is with the flow into the shaft side of the disk
Flow Characteristic	Linear
Disk Rotation	Clockwise (CW) to close

Educational Services

For information on available courses for Fisher 8590 valves, as well as a variety of other products, contact:

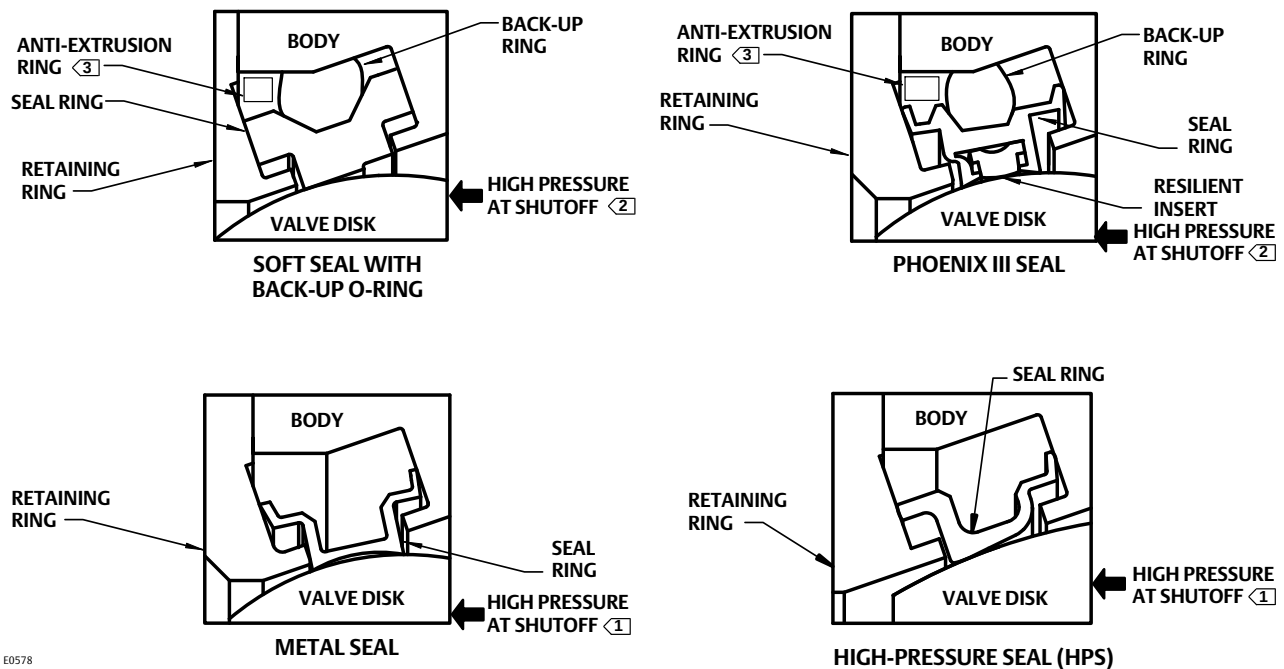
Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Table 2. Valve Size, Shaft Diameter, and Approximate Weight

VALVE SIZE, NPS	SHAFT DIAMETER AT PACKING		SHAFT DIAMETER AT ACTUATOR ⁽¹⁾		SINGLE FLANGE APPROXIMATE WEIGHT		DOUBLE FLANGE APPROXIMATE WEIGHT	
	mm	Inches	mm	Inches	kg	Pounds	kg	Pounds
3	15.9	5/8	15.9	5/8	10.8	24	25.9	57
4	19.1	3/4	19.1	3/4	21.6	48	48.1	106
6	31.8	1-1/4	31.8	1-1/4	45.5	101	97.1	214
8	38.1	1-1/2	38.1	1-1/2	80.2	178	145.6	321
10	50.8	2	44.5	1-3/4	157	348	247.7	546
12	57.2	2-1/4	50.8	2	213	473	316.6	698
14	63.5	2-1/2	63.5	2-1/2	281	624	410	904
16	76.2	3	63.5	2-1/2	395	876	571.5	1260
18	88.9	3-1/2	76.2	3	563	1250	817.4	1802
20	101.6	4	76.2	3	721	1600	989.3	2181
24	114.3	4-1/2	76.2	3	1000	2220	1422	3135

1. Fisher actuator

Figure 2. Available Seal Configurations



E0578

Notes:

- ① This unidirectional seal must be installed so that the retaining ring is downstream from the high pressure side of the valve at shutoff, as shown.
- ② For this bidirectional seal, the "preferred" valve orientation places the retaining ring downstream from the high pressure side of the valve at shutoff.
- ③ NPS 3 only.

Table 3. Maximum Allowable Inlet Pressure for CW2M Valves

TEMPERATURE	CW2M ⁽¹⁾
	600 ⁽²⁾
	Bar
°C	
-29 to 38	103.4
93	103.4
149	100.3
204	96.2
260	91.7
316	83.4
371	78.3
427	70.0
482	62.1
538	50.0
°F	Psig
-20 to 100	1500
200	1500
300	1455
400	1395
500	1330
600	1210
700	1135
800	1015
900	900
1000	725

1. This material is not listed in ASME B16.34. Also see the Installation section.

2. The designation 600 is used only to indicate relative pressure-retaining capabilities and is not an ASME pressure-temperature rating class designation.

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Table 4. Material Temperature Ranges

PART NAME	MATERIAL	TEMP °C	TEMP °F
Valve Body	WCC Steel	-29 to 427	-20 to 800
	CF8M ⁽¹⁾	-254 to 538	-425 to 1000
	LCC	-45 to 343	-50 to 650
	CD3MN	-51 to 316	-60 to 600
	M35-2	-198 to 482	-325 to 900
	CW2M ⁽¹⁾	-198 to 538	-325 to 1000
Disk	CF8M with Chrome Plated Disk Edge	-254 to 427	-425 to 800
	CF8M with Chrome Coated Disk Edge ⁽¹⁾	-254 to 538	-425 to 1000
	CF8M with Chromium Carbide Disk Edge ⁽¹⁾	-254 to 538	-425 to 1000
	CD3MN (no plating) ⁽²⁾	-51 to 316	-60 to 600
	M35-2 (no plating) ⁽²⁾	-198 to 482	-325 to 900
	CW2M (no plating) ⁽¹⁾⁽²⁾	-198 to 538	-325 to 1000
Shaft	S17400 (H1025)	-46 to 427	-50 to 800
	S20910 ⁽¹⁾	-198 to 538	-325 to 1000
	S31803	-51 to 316	-60 to 600
	N05500	-198 to 482	-325 to 900
	N10276	-198 to 538	-325 to 1000
	N07718 ⁽¹⁾	-254 to 538	-425 to 1000
Bearings	PEEK ⁽¹⁾	-73 to 149	-100 to 300
	S31600 Nitrided ⁽¹⁾	-254 to 538	-425 to 1000
	R30006 (Alloy 6) ⁽¹⁾	-198 to 538	-325 to 1000
Seal	ETFE Soft Seal Ring		
	ETFE Soft Seal Ring with FKM Backup Ring	-29 to 149	-20 to 300
	ETFE Soft Seal Ring with EPB Backup Ring	-54 to 149	-65 to 300
	S20910/ETFE Phoenix III Seal Ring		
	S20910/ETFE Phoenix III Seal Ring with FKM Backup Ring	-40 to 149	-40 to 300
	S20910/ETFE Phoenix III Seal Ring with EPB Backup Ring	-62 to 149	-80 to 300
	Metal Seal		
	S21800 ⁽¹⁾	-198 to 538	-325 to 1000
	S20910 ⁽¹⁾	-198 to 538	-325 to 1000
	High Pressure Seal		
	S21800 Nitrided ⁽¹⁾	-198 to 538	-325 to 1000
	S20910 Nitrided ⁽¹⁾	-198 to 538	-325 to 1000
Packing	PTFE /Carbon-filled PTFE (standard)	-45 to 232	-50 to 450
	ENVIRO-SEAL™ PTFE	-45 to 232	-50 to 450
	Graphite Die-molded Ribbon	-198 to 538	-325 to 1000
	ENVIRO-SEAL Graphite	-198 to 371	-325 to 700

1. The maximum temperature for a standard design of the 8590 valve is 538°C (1000°F). Contact your [Emerson sales office](#) for use in higher temperature applications.
2. For use with soft seal only.

Installation

Key numbers in this procedure are shown in figures 13, 14, and 15 unless otherwise indicated.

⚠ WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the bursting of pressure retaining parts, be certain the service conditions do not exceed either the valve body rating or the flange joint rating, or other limits given in table 4 or on the nameplate. Use pressure-relieving or pressure-limiting devices to prevent the service conditions from exceeding these limits.

If installing into an existing application, also refer to the warning at the beginning of the Maintenance section on page 10 in this manual.

CAUTION

The valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions specified in the customer's order. Because some valve body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

The maximum allowable inlet pressures for steel and stainless steel valve bodies are consistent with the pressure-temperature ratings shown in table 1, except where further limited by the trim and packing material temperature capabilities given in table 4. Valves are also available in CW2M valve body materials. The CW2M valve body material is not listed in ASME B16.34. Valve bodies constructed of this material mates with ASME flanges, but must not be installed in systems requiring conformance to ASME standards if not included in ASME pressure/temperature ratings. Maximum allowable inlet pressures for 8590 valve bodies made of CW2M construction materials are shown in table 3.

1. Install a three-valve bypass around the control valve assembly if continuous operation is necessary during inspection and maintenance of the valve body.
2. Inspect the valve body to be certain it is free of foreign material.
3. The valve is normally shipped as part of a control valve assembly, with an actuator mounted on the valve body.

If the valve body and actuator have been purchased separately or if the actuator has been removed for maintenance, mount the actuator, and adjust actuator travel to close the valve before inserting the valve body into the line. This is necessary due to the measurements that must be made during the actuator adjustment process. Refer to the Actuator Mounting section on page 22 of this manual and to the separate actuator instruction manual for mounting and adjusting instructions before proceeding.

4. Inspect adjacent pipelines to be certain they are free of any foreign material, such as pipe scale or welding slag, that could damage the valve body seating surfaces.

CAUTION

Damage to the disk (key 6) will occur if any pipe flanges or piping connected to the valve body interfere with the disk rotation path. However, the disk can be rotated without interference when the valve body is installed between adjacent pipe flanges or piping that has an inside diameter equal to or greater than either schedule 80 pipe or compatible EN pipe sizes. If piping with a smaller inner diameter than specified above is connected to the valve, measure carefully to be certain the disk rotates without interference before putting the valve into operation.

5. Flow is in the standard direction when the seal retainer (key 16) is facing downstream. Standard flow direction is also indicated by the flow direction arrow cast into the valve body. Flow in the forward direction is permissible within allowable pressure drop limits with the proper seal.

CAUTION

8590 disk rotation is counterclockwise to open (when viewed from the actuator side of the valve body, see figure 12) through 90 degrees of disk rotation.

6. With the disk in the closed position, install line flange gaskets, and insert the valve between the pipeline flanges. Use either flat sheet gaskets or spiral-wound gaskets with compression-controlling centering rings. Spiral-wound gaskets without compression-controlling centering rings are not recommended for this purpose.

Lifting Guidelines

Threaded holes for lifting are standard on the NPS 3 - 24 valve bodies. It is required that swivel hoists rings be used to lift the valve or valve and actuator assembly. An eyebolt cannot accommodate all lifting angles required to install or maintain the valve. The load carrying capability of an eyebolt decreases dramatically if used in any other orientation than axially. Therefore, the use of eyebolts is not permitted.

CAUTION

Care must be taken when lifting the valve/actuator assembly to ensure the accessories and tubing are not damaged in the process. The valve weight is listed in table 2. For the actuator weight, refer to the appropriate instruction manual. Make sure to use appropriate lifting straps/hoists capable of lifting this combined weight.

⚠ WARNING

Avoid personal injury or property damage caused by uncontrolled movement or dropping of the valve assembly.

Ensure the disk is secure from rotating during lifting process. Failure to do so could result in personal injury if the disk rotates uncontrolled during lifting.

Swivel Hoist rings are sized to lift only the valve and actuator. Do not attach piping or other structures to the valve and actuator assembly when lifting with swivel hoists rings.

Take appropriate precautions to avoid unbalanced loading which may result in sudden swinging or movement of the assembled unit, including additional lifting and/or support methods when necessary.

Do not use eyebolts when lifting the valve or valve and actuator assembly due to variable loading angles inherent to valve maintenance and installation.

Failure to utilize safe lifting practices may result in equipment damage and/or personal injury.

Lifting Valve/Actuator Assembly

To lift the assembly, install swivel hoist rings into one or two of the threaded holes on the valve body (see figure 3). Thread sizes are listed in table 5. When lifting the valve and actuator assembly, a strap around the actuator may be required to ensure lifting stability. If straps are used on the actuator, ensure the lifting location is above the center of gravity (CG) for the actuator to prevent load shifting during lifting. Refer to the appropriate assembly drawings for the CG for your assembly.

Lifting Valve Only

To lift the valve, insert two swivel hoist rings into the body. Thread sizes are listed in table 5. Ensure the valve is closed and that the packing is tightened to prevent shaft rotation during lifting. Without an actuator, the valve disk is free to rotate if enough momentum is generated during the lifting process by a sudden stop. The packing and seal friction should prevent the disk from rotating; however take proper precaution when lifting the valve.

7. Insert the valve between the flanges and install two or more line flange studs into the line flanges to help hold the valve in position while centering the valve. Carefully center the valve on the flanges to ensure disk clearance.

Note

Lubricate line flange studs before inserting them into flanges. If necessary, provide additional support for the control valve assembly because of its combined weight.

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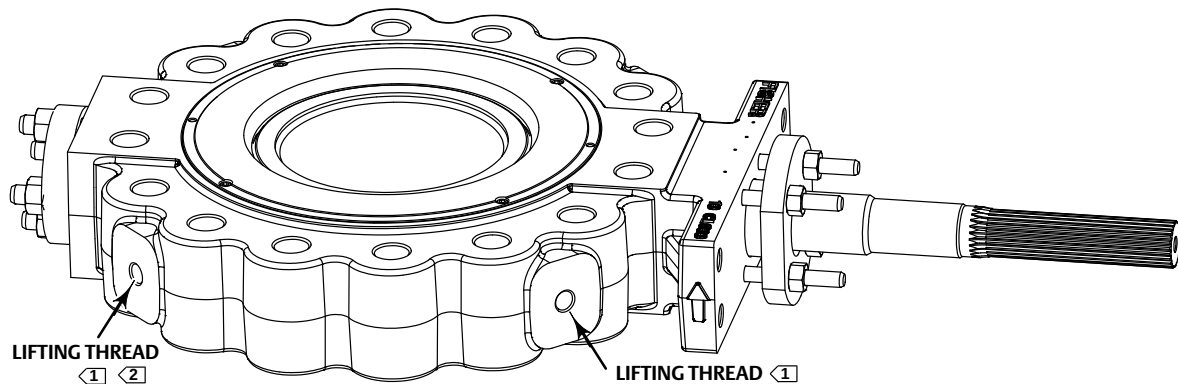
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Figure 3. Lugged Valve Body Lifting Thread Locations (NPS 10 shown)



Notes:

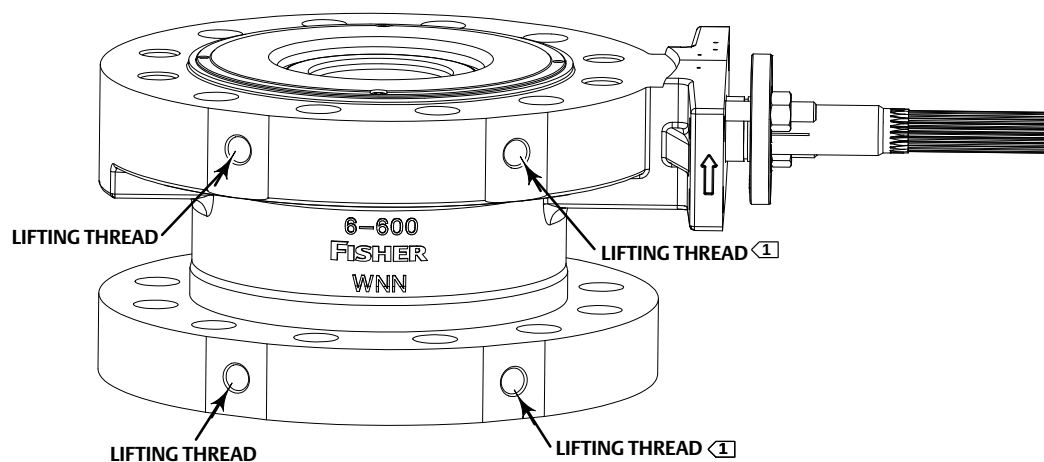
① Holes on opposite side are identical.

② NPS 10-24 only.

Table 5. Lugged Valve Body Lifting Thread Information

VALVE SIZE, NPS	NUMBER OF THREADED HOLES	THREAD SIZE	THREAD DEPTH	
		Inches	mm	Inches
6	2	3/4 - 10	41.9	1.65
8				
10				
12	4	1 - 8	55.9	2.20
14				
16		1-1/4 - 7	68.8	2.71
18				
20		1-1/2 - 6	82.8	3.26
24				

Figure 4. Double Flange Lifting Thread Locations



Note:

① Holes on opposite side are identical.

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Table 6. Double Flange Valve Body Lifting Thread Information

VALVE SIZE, NPS	NUMBER OF THREADED HOLES	THREAD SIZE	THREAD DEPTH	
		Inches	mm	Inches
3	8	3/8-16	14.2	0.56
4		1/2-13	19.1	0.75
6		3/4-10	41.9	1.65
8				
10		1-8	61	2.4
12			44.5	1.75
14		1-1/4-7	69	2.72
16				
18		1-1/2-6	72.6	2.86
20				
24				

Table 7. Lugged Valve Recommended Line Bolting Lengths

VALVE SIZE, NPS	LUGGED BODY WITH THROUGH HOLES					LUGGED BODY WITH THREADED HOLES					
	Size Dia & Thread, Inch	No. of Stud Bolts	A Dimension, Inch	Next to Shaft Bore		No. of Stud Bolts	C Dimension, Inch	No. of Stud Bolts	B Dimension ⁽¹⁾ , Inch	Next to Shaft Bore	
				No. of Stud Bolts	B Dimension ⁽¹⁾ , Inch					No. of Stud Bolts	B Dimension ⁽¹⁾ , Inch
3	3/4-10	8	7.5	---	---	8	7.5	---	---	---	---
4	7/8-9	8	9	---	---	8	9	---	---	---	---
6	1-8	12	10.5	---	---	12	10.5	---	---	---	---
8	1-1/8-8	12	12.5	---	---	12	12.5	---	---	---	---
10	1-1/4-8	12	13.5	8	6	---	---	24	7.5	8	6
12	1-1/4-8	16	14.5	8	6	---	---	32	7.5	8	6
14	1-3/8-8	16	15.75	8	6.5	---	---	32	8	8	6.5
16	1-1/2-8	16	17.25	8	7	---	---	32	8.5	8	7
18	1-5/8-8	16	19	8	7.5	---	---	32	9	8	7.5
20	1-5/8-8	20	20	8	8	---	---	40	9.5	8	8
24	1-7/8-8	20	22.25	8	9	---	---	40	11	8	9

1. Full stud thread engagement as shown in figure 5.

Table 8. Double Flange Recommended Line Bolting Lengths

VALVE SIZE, NPS	Size Dia & Thread, Inch	DOUBLE FLANGE WITH THROUGH HOLES		DOUBLE FLANGE WITH THREADED HOLES	
		No. of Stud Bolts	D Dimension, Inch	No. of Stud Bolts	E Dimension, Inch
3	3/4-10	12	5.25	4	4
4	7/8-9	12	6	4	4.5
6	1-8	20	7.25	4	5.5
8	1 1/8-8	20	8.25	4	5.75
10	1 1/4-8	28	8.75	4	6
12	1 1/4-8	36	9.25	4	6
14	1 3/8-8	32	9.75	8	6.75
16	1-1/2-8	32	10.25	8	7
18	1-5/8-8	24	11.25	16	7.75
20	1-5/8-8	32	11.75	16	8
24	1-7/8-8	32	13.5	16	9

Figure 5. Stud Bolts for Installation (also see table 7)

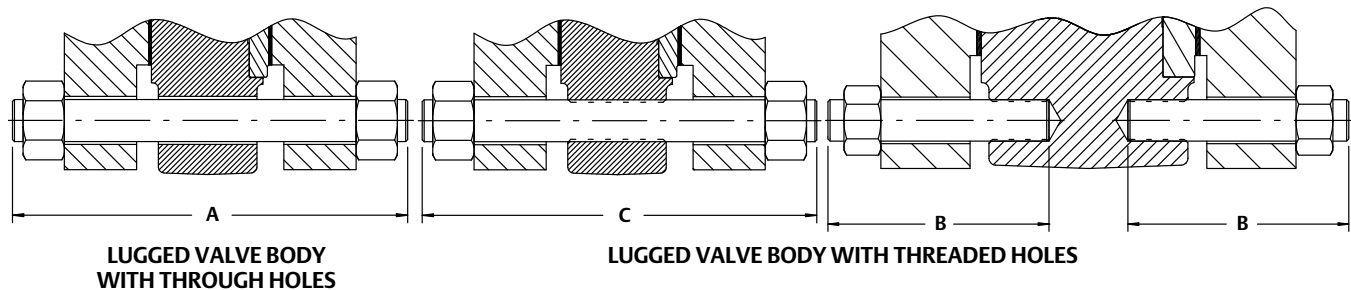
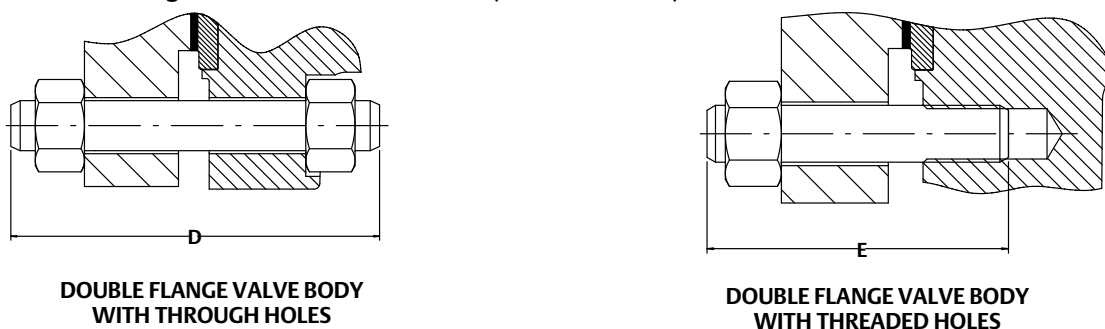


Figure 6. Double Flange Stud Bolts for Installation (also see table 8)



⚠ WARNING

For lugged valve bodies with threaded line bolt holes, personal injury and property damage could result from sudden release of process pressure if line bolts are not properly installed. To ensure proper line bolt thread engagement, line studs must be centered in the threaded section of the valve body so that each stud has equal thread engagement in the body. See figure 5.

8. After centering the valve body, first lubricate and then install the remaining line flange bolting to secure the valve in the pipeline. Tighten the nuts to the line flange studs in a crisscross pattern to ensure proper alignment of valve, gaskets, and flanges.

⚠ WARNING

An 8590 valve body is not necessarily grounded when installed in a pipeline. If the valve is used in a flammable or hazardous atmosphere or for oxygen service, an explosion could result due to a discharge of static electricity from the valve components. To avoid personal injury or property damage, always make sure the valve body is grounded to the pipeline before putting the control valve assembly into operation in a flammable or hazardous atmosphere.

Note

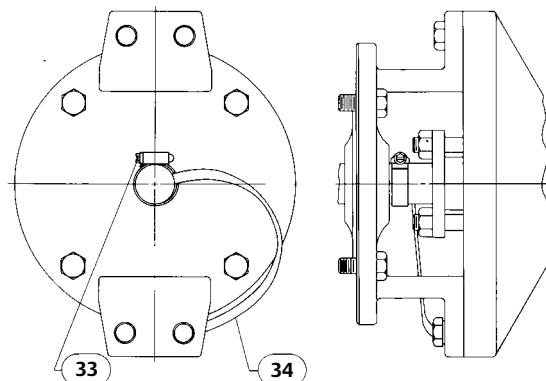
Standard packings for the 8590 valve are composed of all conductive packing rings (graphite ribbon packing) or partially conductive packing rings (such as a carbon-filled PTFE female adaptor with PTFE V-ring packing) to electrically bond the shaft to the valve body for hazardous area service. For oxygen service applications, provide alternate shaft-to-valve body bonding according to the following step.

9. For oxygen service applications, attach the bonding strap assembly (key 34, figure 7) to the shaft with the clamp (key 33, figure 7), and connect the other end of the bonding strap assembly to the valve body with the cap screw (key 31).

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however, the packing might require some readjustment to meet specific service conditions.

Figure 7. Optional Shaft-to-Valve Body Bonding Strap Assembly



Valves with ENVIRO-SEAL packing systems will not require this initial re-adjustment. See ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section on page 23 of this manual.

Maintenance

Valve body parts are subject to normal wear and must be inspected regularly and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given in this section for: replacing trim components, changing disk rotation or valve action, and mounting and adjusting the actuator.

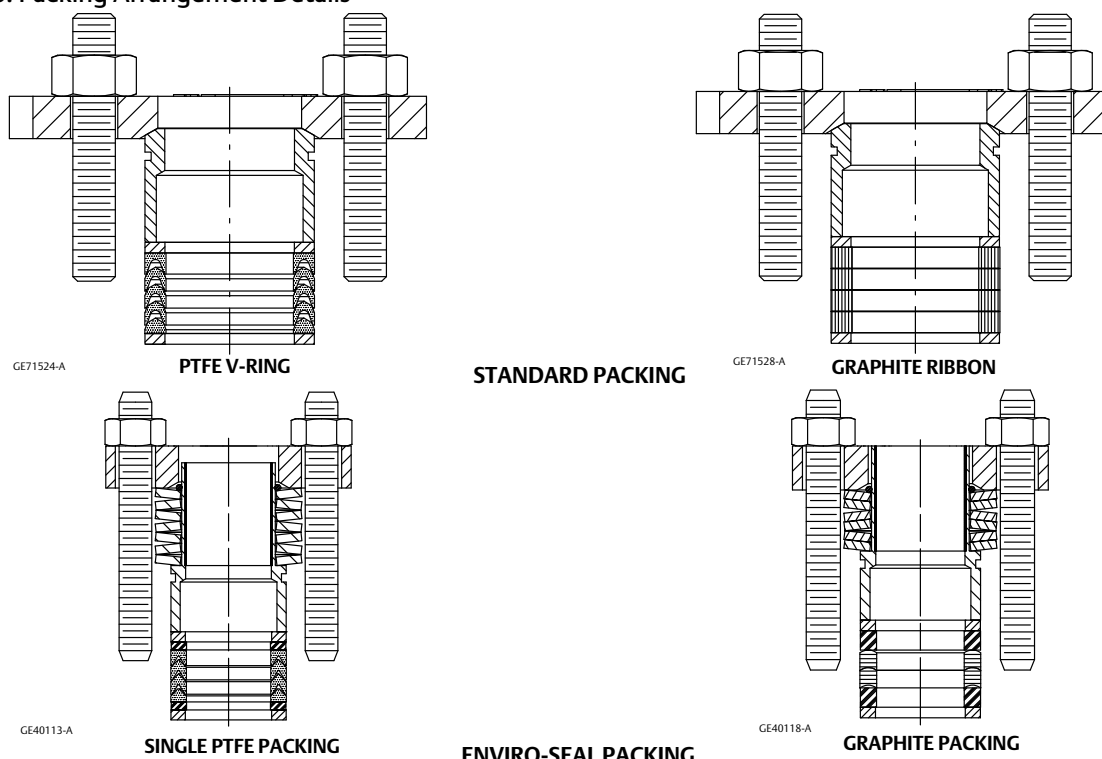
As used in these instructions, actuator refers to power actuators (such as pneumatic diaphragm, piston actuators, and rack and pinion actuators).

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any spring precompression.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Figure 8. Packing Arrangement Details



NOTES:

1. WITH CONDUCTIVE PACKING, THE FEMALE ADAPTOR IN PTFE V-RING PACKING IS CARBON-FILLED PTFE.

Packing Maintenance

Refer to figure 8 for available packing configurations. All maintenance operations in this section may be performed with the valve in the line. Packing may be PTFE V-ring or graphite.

An ENVIRO-SEAL packing system is also available with the 8590 valve. To install the ENVIRO-SEAL packing system in an existing valve, follow the instructions in the instruction manual included with the packing system ([D101643X012](#)). To remove packing parts in a valve with the ENVIRO-SEAL packing system, follow the procedures for valves with the ENVIRO-SEAL packing system in this section. Install the replacement packing following the instructions in the packing system instruction manual (D101643X012).

Stopping Leakage

For valves with PTFE or graphite packing:

CAUTION

Tighten the packing flange only enough to prevent shaft leakage. Excessive tightening will only accelerate wear of the packing and could produce higher torques on the valve.

Leakage around the packing followers can be stopped by tightening the packing flange nuts (key 27).

If the packing is relatively new and tight on the shaft, and if tightening the packing flange nuts does not stop leakage, the shaft may be worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches around the packing box wall. Inspect the shaft and packing box wall for nicks and scratches when performing the packing replacement procedures.

For valves with the ENVIRO-SEAL packing system:

Optimum performance of the ENVIRO-SEAL packing system is obtained when the Belleville springs are tightened to their “target load.” The target load is the point where the springs are compressed to 85% of their maximum deflection, or nearly flat. Maximum deflection is when the springs are 100% compressed, or completely flat.

Under normal conditions, the packing nuts should not require re-tightening. However, when servicing, if the springs do not remain at the target load of 85% compression, retighten the packing box nuts according to the following procedure:

1. Tighten the packing flange nuts alternately and evenly, keeping the packing flange parallel with the valve flange (see figure 8), until the Belleville springs are compressed 100% (or completely flat).
 - For PTFE packing, loosen each packing flange nut one half turn (180° of rotation).
 - For Graphite packing, loosen each packing flange nut one quarter turn (90° of rotation).

The target load of 85% compression has now been reached. If leakage continues, replace the packing components as described in the following procedures.

Replacing the Packing

To replace the packing, the actuator must be removed. Also, the valve should be removed from the pipeline to allow proper readjustment of the disk position.

⚠ WARNING

The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 6).

CAUTION

Damage to the disk (key 6) may occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, apply operating pressure to the actuator temporarily to retain the disk in the closed position while removing the valve from the pipeline.

For valves with PTFE or graphite packing:

Key numbers in this procedure are shown in figures 13, 14, and 15 unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shutoff all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.

CAUTION

When removing the actuator in the following step, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws (key 31). Remove the clamp (key 33, figure 7) if the strap (key 34, figure 7) is used.
3. Remove the packing flange nuts (key 27) and the packing flange (key 25) and pull out the packing follower (key 24).
4. Remove the anti-blowout ring, if used (NPS 3-8) (key 23) from the drive shaft (key 7).
5. Remove the old packing rings (key 22) and the packing box ring (key 21). Carefully avoid scratching the shaft or packing box wall to avoid damage that could cause leakage around the shaft. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing.

⚠ WARNING

Do not lubricate parts when used in oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

6. Use the appropriate procedures below for installing packing.
 - Install the packing as shown in figure 8. For NPS 3-8, two packing box rings (key 21) are used on the top and bottom of the packing set (see figures 8, 13, and 14 for details). For NPS 10-24, only one packing box ring (key 21) is used on the bottom of the packing set, at the end closest to the disk (see figure 15 for details).
 - With graphite ribbon packing, stack the packing rings and packing washers together, and slide the stack into the packing box as far as it will go while carefully avoiding trapping air between the rings.
 - Install the anti-blowout ring, if used (NPS 3-8) (key 23) in the groove on the drive shaft (key 7).
 - Install the packing follower and the packing flange.
 - Install the packing flange nuts, and tighten them only far enough to stop leakage under normal operating conditions.
 - For oxygen service applications, attach the bonding strap assembly (key 34, figure 7) to the shaft with the clamp (key 33, figure 7), and connect the other end of the bonding strap assembly to the valve body with a cap screw (key 31).
7. Mount the actuator and adjust the closed position of the valve, per the Actuator Mounting section on page 22 of this manual, before returning the valve to service.
8. When placing the control valve into operation, check around the packing follower for leakage; retighten the packing flange nuts as required according to accepted bolting procedures.

For valves with ENVIRO-SEAL packing systems:

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shutoff all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

CAUTION

When removing the actuator, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws (key 31). Remove the clamp (key 33, figure 7) if the strap (key 34, figure 7) is used.
3. Loosen the two packing hex nuts evenly to remove spring tension, then remove the nuts.
4. Remove the packing flange and spring pack assembly. The spring pack assembly consists of the spring stack and packing follower. The spring stack is retained on the packing follower by an O-ring. Remove the anti-blowout ring, if used (NPS 3-8) (key 23) from the drive shaft (key 7). Remove the anti-extrusion washer, the packing set, and the packing ring.

CAUTION

The valve shaft surface condition is critical in making and maintaining a good seal. If the valve shaft surface is scratched, nicked, dented, or worn, replace the valve shaft before replacing the packing system.

5. Inspect the existing valve shaft. If necessary, replace the valve shaft as described in the Replacing the Disk, Shafts, or Bearings section.
6. Install the new packing system components as described in the ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)). For NPS 3-8, two packing box rings (key 21) are used on the top and bottom of the packing set (see figures 8, 13, and 14 for details). For NPS 10-24, only one packing box ring (key 21) is used on the bottom of the packing set, at the end closest to the disk (see figure 15 for details).
7. Install the anti-blowout ring, if used (NPS 3-8) (key 23) onto the drive shaft (key 7) before installing the packing follower.
8. Mount the actuator and adjust the closed position of the valve, per the Actuator Mounting section on page 22 of this manual, before returning the valve to service.

Replacing the Seal Ring Assembly

Perform this procedure only if the control valve is not shutting off properly (that is, leaking downstream). This procedure does not require removing the actuator from the valve body.

Key numbers in this procedure are shown in figures 13, 14, and 15 unless otherwise indicated.

1. Isolate the control valve from line pressure, and relieve pressure from the valve body. Shut off and disconnect all lines from the power actuator.

⚠ WARNING

The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 6).

CAUTION

Damage to the disk (key 6) may occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, apply operating pressure to the actuator temporarily to retain the disk in the closed position while removing the valve from the pipeline.

2. Unscrew the flange bolts, and remove the valve from the pipeline.
3. Rotate the disk 180° from the closed position per figure 10.
4. Unscrew the retainer screws (key 17) and remove the seal retainer (key 16).
5. Thread the retainer screws into the jack screw retainer holes to unseat the retainer. These threaded holes may be used to lift the retainer. The thread size is listed in table 9.
6. Remove the retainer gasket and clean the body gasket groove and retainer surface.
7. Remove the seal ring assembly (key 19).

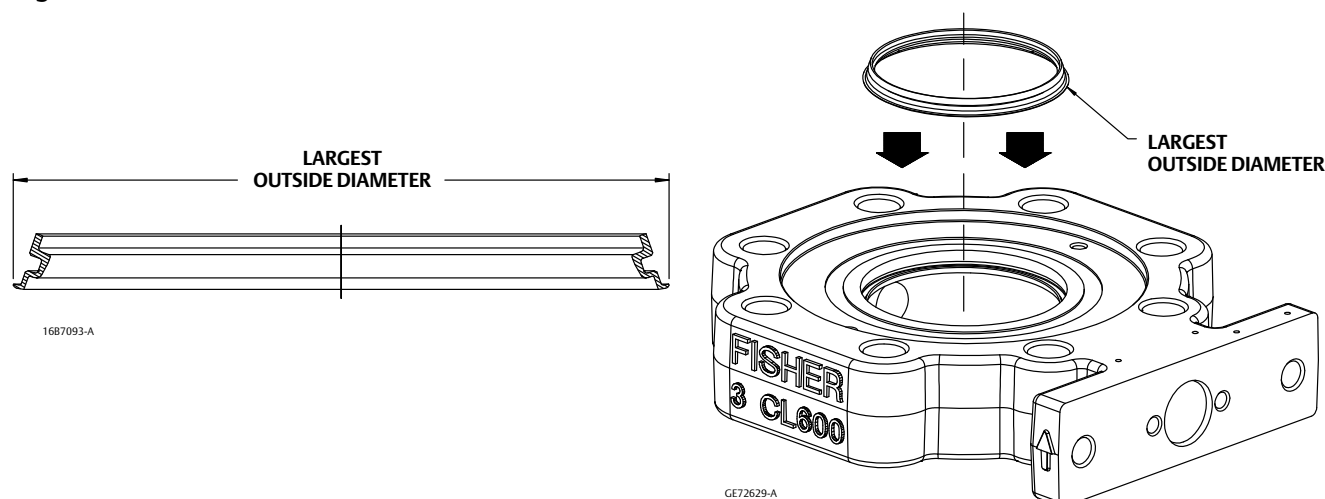
Soft Seal Installation

1. Locate the replacement seal ring (key 19) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 9. Around the outside circumference is one wide groove.

Before installing the seal ring into the valve body, the backup ring (key 20) must first be placed onto the wide, outer groove of the seal ring.

2. The seal ring and backup ring assembly must be installed in the valve. The wider outside diameter of the seal ring goes into the T-slot area of the valve body, shown in figure 9. Start the wider diameter edge of the seal ring into the T-slot of the valve body using a blunt end screwdriver.

Figure 9. Seal Installation Orientation



3. Carefully tuck the backup ring downward into the valve body T-slot until the seal ring and backup ring are completely entrapped in the valve body T-slot. Install the anti-extrusion ring per figure 2 (for NPS 3 only).
4. Place the retainer gasket (key 18) in the groove in the valve body.

CAUTION

The retainer gasket (key 18) is a thin graphite material. Take care to avoid damaging the gasket during handling.

- When the seal and gasket are seated, re-install the seal retainer (key 16) and screws (key 17). Tighten the retainer screws just enough to eliminate vertical movement of the seal retainer. With the use of the blunt end tool, carefully tuck the lip of the seal ring under the seal retainer.
- When the seal is under the lip of the seal retainer, tighten the screws according to table 9. Manually rotate the valve shaft clockwise 180° to return the disk to its closed position. Ensure these screws are tightened prior to installation.
- Be certain the disk is closed before installing the valve according to the Actuator Mounting section of this manual.

Metal Seal Installation

- With the disk in the closed position, place the seal ring (key 19) onto the disk (key 6). Set the retainer onto the seal, making sure proper alignment between the seal and retainer has been achieved. Install the anti-extrusion ring per figure 2 (for NPS 3 Phoenix III seal only).
- Place the retainer gasket (key 18) in the groove in the valve body.

CAUTION

The retainer gasket (key 18) is a thin graphite material. Take care to avoid damaging the gasket during handling.

- Attach the seal retainer (key 16) to the valve body and tighten the retainer screws (key 17). Tighten just enough to eliminate vertical movement of the retainer.
- Rotate the valve shaft 90° open/closed 3 times.
- With the disk in the closed position, tighten the retainer screws per table 9.
- Be certain the disk is closed before installing the valve according to the Actuator Mounting section of this manual.

Replacing the Disk, Shafts, or Bearings

Key numbers in this procedure are shown in figures 13, 14, and 15 unless otherwise indicated.

Table 9. Recommended Retainer Screw Torque

RAISED FACE FLANGE					RTJ FLANGE				
Valve Size, NPS	Number of Screws	Screw Size	Torque		Valve Size, NPS	Number of Screws	Screw Size	Torque	
			CL 12.9 / NCF1 Screws					B8M CL2 and B7M Screws	
		Inch	N • m	Lbf • ft			Inch	N • m	Lbf • ft
3	2	1/4 - 20	14	10.5	3	10	1/4 - 20	9	6.75
4					4	8	1/4 - 20	9	6.75
6					6	12	1/4 - 20	9	6.75
8					8	16	5/16 - 18	19	14
10	4				10	22			
12	2	1/2 - 13	88	65	12	12	1/2 - 13	80	59
14					14	20			
16					16	24			
18	4				18	22	5/8 - 11	161	119
20					20	24			
24					24	12	1 - 8	651	480

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104016X012

8590 Valve

January 2019

Table 10. Follower Shaft Internal Threads

VALVE SIZE, NPS	THREAD SIZE
3	10 - 24
4	1/4 - 20
6	3/8 - 16
8	
10	
12	1/2 - 13
14	
16	
18	5/8 - 11
20	
24	

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shutoff all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

CAUTION

When removing the actuator in the following step, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws (key 31). Remove the clamp (key 33, figure 7) if the strap (key 34, figure 7) is used.
3. Remove the packing flange nuts (key 27) and the packing flange (key 25) and pull out the packing follower (key 24 or 29).

Disassembly

1. Remove the seal ring assembly according to steps 3 through 7 of the Replacing Seal Ring Assembly section of this manual.
2. Remove hex nuts, blind flange, gasket, when used (keys 5, 2, and 3).
3. Clean the gasket surfaces on the blind flange (key 2) and on the end of the valve body (key 1).
4. Rotate the disk (key 6) 180° from the closed position, as shown in figure 10.
5. Remove shaft pins (key 9) from the disk. Pins can be removed by their internal thread tapping in table 11.

Table 11. Pin Removal Thread

VALVE SIZE	THREAD SIZE
NPS	Inch
3	6 - 32
4	10 - 24
6	
8	
10	3/8 - 16
12	
14	
16	
18	
20	
24	

⚠ WARNING

Once the shafts have been removed in the following step, the disk may fall from the valve body. To avoid personal injury and disk damage, support the disk to prevent it from falling as the shafts are being removed.

6. Pull the follower shaft (key 8), when used, out through the outboard end of the valve body. If the follower shaft cannot be pulled free, the end of the follower shaft is internally threaded (see table 10) for screwing in a bolt or stud to aid in pulling the follower shaft.
7. Pull the drive shaft (key 7) out through the actuator end of the valve body and remove the anti-blowout ring, when used (key 23), from the drive shaft. The end of the shaft is internally threaded (shown in table 10) for screwing in a bolt or stud to aid in pulling the drive shaft.
8. Remove the disk (key 6) from the valve body through the side opposite the seal.
9. Remove the packing (key 22, figure 8) and the packing box ring (key 21, figure 8).
10. If any of the bearings (keys 14 and 15) require replacement, remove them.
11. Clean the packing box.

Assembly

⚠ WARNING

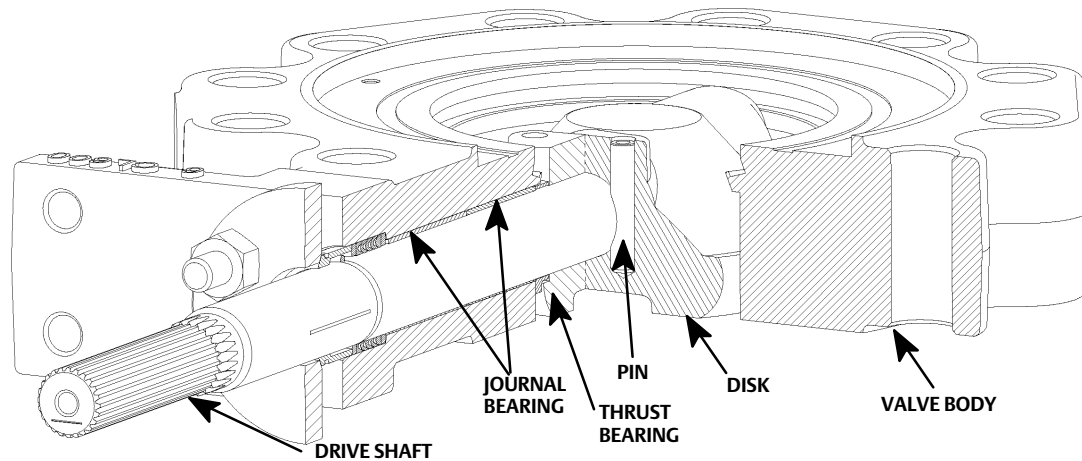
Do not lubricate bearings that will be used for oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

Table 12. Required Blind Flange Bolt Torque

VALVE SIZE	STUD SIZE	STUD MATERIAL ⁽¹⁾			
		SA193 B8M CL2, SA193 B7M/NCF2, SA453 660, & SB164 N05500 Studs		N07718 Studs	
NPS	Inch	N•m	lbf•ft	N•m	lbf•ft
8	1/2 - 13	95	70	149	110
10	5/8 - 11	190	140	298	220
12	3/4 - 10	325	240	508	375
14	7/8 - 9	481	355	827	610
16					
18	1 - 8	719	530	1261	930
20	1-1/8 - 8	1044	770	1627	1200
24					

1. Stud and nut threads must be lubricated to achieve proper preload.

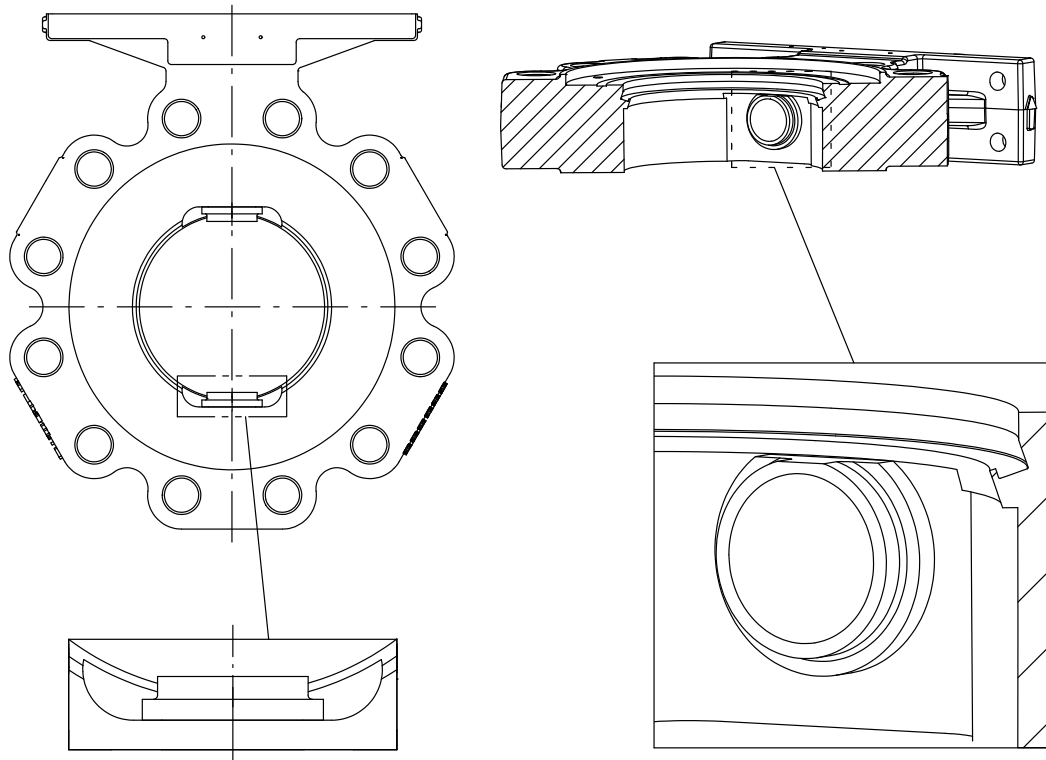
Figure 10. Disk Orientation for Pin Removal and Soft Seal Installation



CAUTION

To avoid possible product damage, ensure the NPS 3, 4, and 6 thrust bearings are oriented correctly when installing in the following procedure. See figure 11 for proper orientation of the thrust bearings.

Figure 11. Orientation of NPS 3, 4, and 6 Thrust Bearings



1. If new bearings (keys 14 and 15) are required, install them in the valve body. Install the journal bearings (key 14) before installing the thrust bearing (key 15). If installing a thrust bearing into NPS 3-6 valves, ensure the thrust bearing flat is oriented under the seal cavity, as shown in figure 9. If installing a NPS 8-24 thrust bearing, ensure the circular thrust bearing is fully seated in the body thrust bearing counterbore. For NPS 3-6 valves, three journal bearings (key 14 in figure 11) and two thrust bearings (key 15 in figure 11) are required per assembly. For NPS 8-24 valves, four journal bearings (key 14 in figures 12 and 13) and two thrust bearings (key 15 in figures 12 and 13) are required per assembly.
2. Insert the disk (key 6) into the valve body as shown in figure 10, ensuring the drive side pins are oriented toward the actuator end of the valve body.
3. Install the drive shaft (key 7) and the follower shaft (key 8, when used) through the valve body and into the disk.
4. Align the holes in the shafts with the pin holes in the disk and drive the disk pins (key 9) into the disk. Once the pins are fully seated in the disk, use a punch or small chisel to stake the pins at three points.

CAUTION

To prevent the disk pin from sliding out during operation, ensure the staking operation deforms the disk pin hole diameter sufficiently.

5. Install the blind flange gasket, blind flange, and hex nuts (keys 2, 3, and 5). Ensure the blind flange is oriented so the serrations face the gasket and valve body. Tighten the hex nuts (key 5) per table 12.

CAUTION

Once the final preload torque is applied, do not loosen or remove the blind flange nuts (key 5). If nut removal is necessary, a new gasket is required.

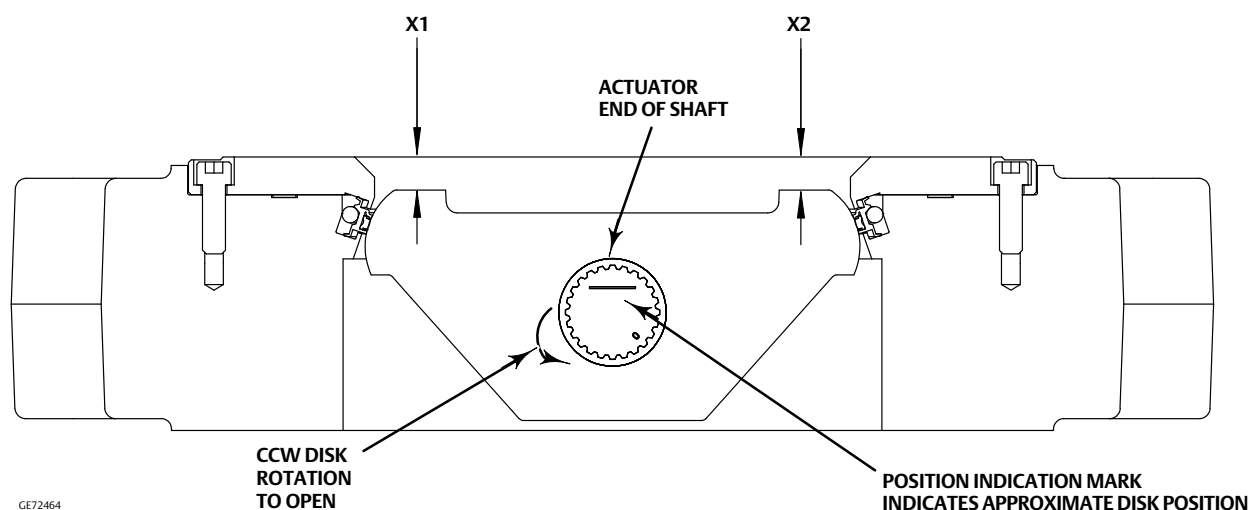
Soft Seal Installation

1. Locate the replacement seal ring (key 19) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 9. Around the outside circumference is one wide groove, as shown in figure 2.

Before installing the seal ring into the valve body, the backup ring (key 20) must first be placed onto the wide, outer groove of the seal ring. Rotate the disk 180° from closed before installing the seal ring (shown in figure 10).

2. The seal ring and backup ring assembly must be installed in the valve. The wider outside diameter of the seal ring goes into the T-slot area of the valve body, shown in figure 9. Start the wider diameter edge of the seal ring into the T-slot of the valve body using a blunt end screwdriver.
3. Carefully tuck the backup ring downward into the valve body T-slot until the seal ring and backup ring are completely entrapped in the valve body T-slot. If installing for NPS 3, install the anti-extrusion ring per figure 2.
4. Place the retainer gasket (key 18) in the groove in the valve body.
5. When the seal and gasket are seated, install the seal retainer (key 16) and screws (key 17). Tighten the retainer screws just enough to eliminate vertical movement of the seal retainer. With the use of the blunt end tool, carefully tuck the lip of the seal ring under the seal retainer.
6. When the seal is under the lip of the seal retainer, tighten the screws according to table 9. Manually rotate the valve shaft clockwise 180° to return the disk to its closed position.

Figure 12. Sectional of Typical Valve Body



Metal Seal Installation

1. With the disk in the closed position, place the seal ring (key 19) onto the disk (key 6). Set the retainer (key 16) onto the seal, making sure proper alignment between the seal and retainer has been achieved.
2. Place the retainer gasket (key 18) in the groove in the valve body.
3. Attach the seal retainer (key 16) to the valve body and tighten the retainer screws (key 17) just enough to eliminate the vertical movement of the retainer.
4. Rotate the valve shaft 90° open/closed 3 times.
5. Tighten the retainer screws per table 9.
6. Be certain the disk is closed before installing the valve according to the Actuator Installation section of this manual.

General Valve Assembly

1. For **standard packing**, install the packing according to the appropriate instructions presented in step 5 of the Replacing Packing section of this manual.
For **ENVIRO-SEAL packing**, install the new packing system components as described in the ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)).
2. Install the anti-blowout ring (key 23) when used, in the groove in the drive shaft.

Actuator Mounting

With the valve body out of the line, mount the actuator on the valve body in accordance with the instructions in the actuator instruction manual. Mount the actuator yoke to the valve body, and tighten the actuator-mounting cap screws (key 31) to the appropriate torque from table 13.

Table 13. Required Actuator-Mounting Bolt Torque

VALVE SIZE NPS	SCREW SIZE Inch	SAE J429 GRADE 5/NCF3 ⁽¹⁾	
		N•m	lbf•ft.
3	1/2 - 13	102	75
4			
6	5/8 - 11	190	140
8			
10	3/4 - 10	339	250
12			
14	7/8 - 9	508	375
16			
18	1-1/4 - 8	1491	1100
20			
24			

1. Screws must be lubricated to achieve proper preload.

CAUTION

8590 valve disk rotation is counterclockwise to open (when viewed from the actuator side of the valve body, see figure 12). Rotating the disk (key 6) past the fully closed position will damage the seal ring (key 18).

Adjusting the Valve Closed Position

Adjust the actuator to bring the disk to the fully closed position at the end of the actuator stroke. To determine the fully closed disk position, measure the distances between the disk face and the seal retainer face at the top and bottom of the valve (X1 and X2) as shown in figure 12. Adjust the travel stops or turnbuckle to rotate the disk slightly until the two measurements are equal, but are allowed to be within 0.25 mm (0.010 inch) of each other. Refer to the appropriate actuator instruction manual for assistance.

Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name, desired material, using the Parts List.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Retrofit Kits for ENVIRO-SEAL Packing

Retrofit kits are available for replacing the packing in an existing valve with an ENVIRO-SEAL packing system. These kits are available for single PTFE or graphite packing. All parts required for installation of the ENVIRO-SEAL packing system into an existing 8590 valve are included in the kits.

Worn shafts, packing box damage, or other components that do not meet Emerson finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of the retrofit kit.

ENVIRO-SEAL Packing System Retrofit Kits

SHAFT DIAMETER		SINGLE PTFE PACKING	GRAPHITE PACKING
mm	Inches		
15.9	5/8	RPACKXRT752	RPACKXRT862
19.1	3/4	RPACKXRT762	RPACKXRT872
31.8	1-1/4	RPACKXRT772	RPACKXRT882
38.1	1-1/2	RPACKXRT782	RPACKXRT892
50.8	2	RPACKXRT792	RPACKXRT902
57.2	2-1/4	RPACKXRT802	RPACKXRT912
63.5	2-1/2	RPACKXRT812	RPACKXRT922
76.2	3	RPACKXRT822	RPACKXRT932
88.9	3-1/2	RPACKXRT832	RPACKXRT942
101.6	4	RPACKXRT842	RPACKXRT952
114.3	4-1/2	RPACKXRT852	RPACKXRT962

Parts List

Note

Contact your [Emerson sales office](#) for part ordering information.

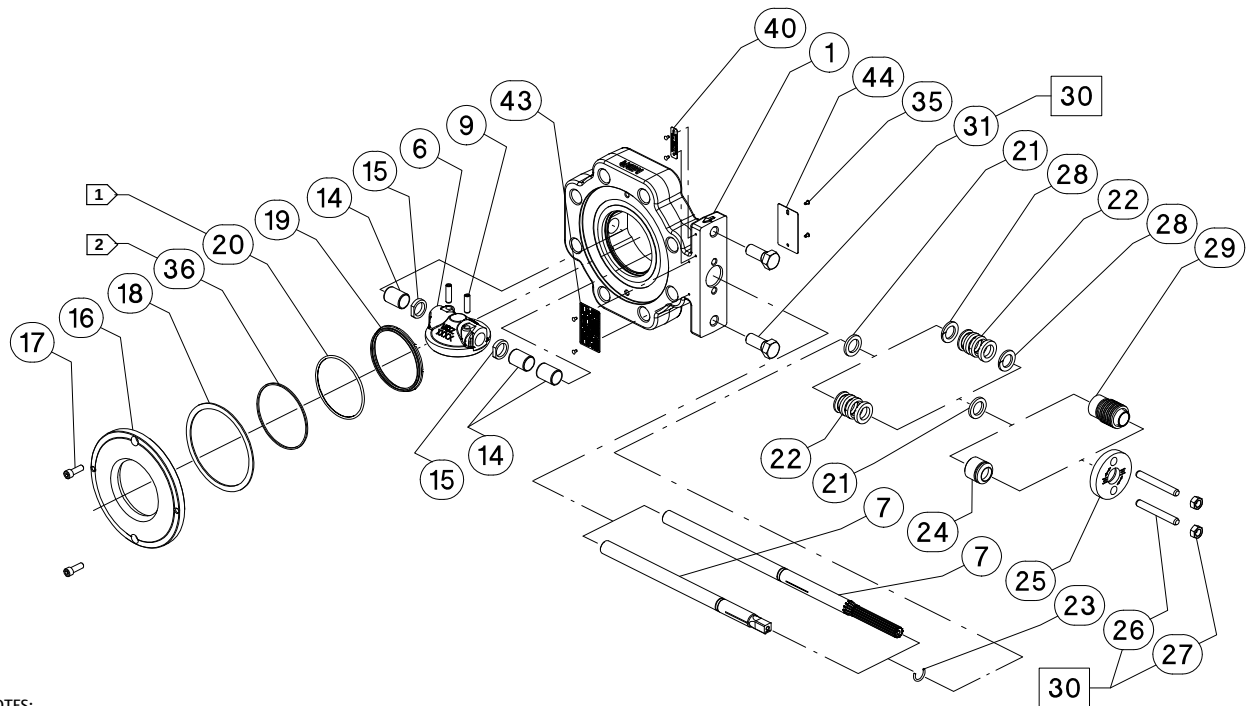
Key Description

1	Valve Body
2	Blind Flange
3*	Gasket, Blind Flange
4	Stud, Blind Flange (4 req'd)
5	Nut, Blind Flange (4 req'd)
10*	Disk/Shaft Assy
6	Disk
7	Drive Shaft
8	Follower Shaft
9	Pin, Disk/Shaft (NPS 3-8, 2 req'd, NPS 10-24, 3 req'd)
11*	Key
12	Washer
13	Cap Screw
14*	Journal Bearing (NPS 3-6, 3 req'd, NPS 8-24, 4 req'd)
15*	Thrust Bearing (2 req'd)
16	Seal Retainer
17	Retainer Screw (NPS 3-8 & 12-16, 2 req'd, NPS 10 & 18-24, 4 req'd)
18*	Gasket, Retainer
19*	Seal

Key Description

20*	O-ring, PTFE Seal
21*	Packing Box Ring
22*	Packing Set
23	Anti Blowout Ring
24	Packing Follower
25	Packing Flange
26	Packing Stud (NPS 3-8, 2 req'd, NPS 10-24, 4 req'd)
27	Packing Nut (NPS 3-8, 2 req'd, NPS 10-24, 4 req'd)
28*	Anti-Extrusion Ring
29	Spring Pack (PTFE ENVIRO-SEAL)
30	Lubricant
31	Mounting Cap Screw (NPS 3, 2 req'd, NPS 4-24, 4 req'd)
32*	Packing Washer (3 req'd)
33	Clamp
34	Ground Strap
35	Drive Screw
36*	Anti-Extrusion Ring (NPS 3 soft seal only)
37	Cable Tie (ENVIRO-SEAL Tag)
38	Tag, Warning (Packing)
39	Tag, ENVIRO-SEAL
40	Tag, Not Dead End
41	Tag, Phoenix III
42	Tag, Notice
43	Nameplate, Fisher
44	Nameplate, Mfr, CD
45	Mounting Bracket

Figure 13. Fisher 8590, NPS 3-6, CL600 Valve Assembly

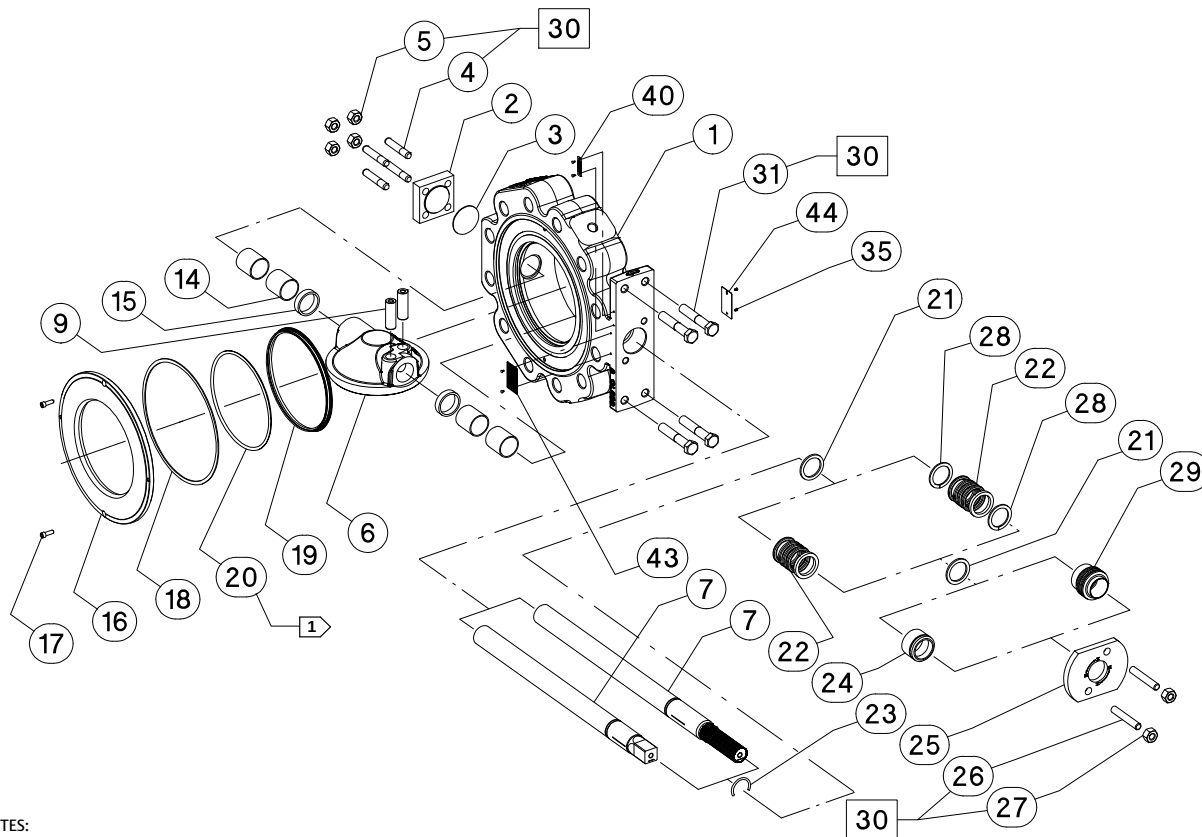


NOTES:

- 1 > USE ONLY WITH PHOENIX III AND SOFT SEAL
- 2 > USE ONLY WITH NPS 3 SOFT SEAL AND PHOENIX III SEAL

PARTS NOT SHOWN: 32, 33, 34, 37, 38, 39, 41, 42

Figure 14. Fisher 8590, NPS 8, CL600 Valve Assembly

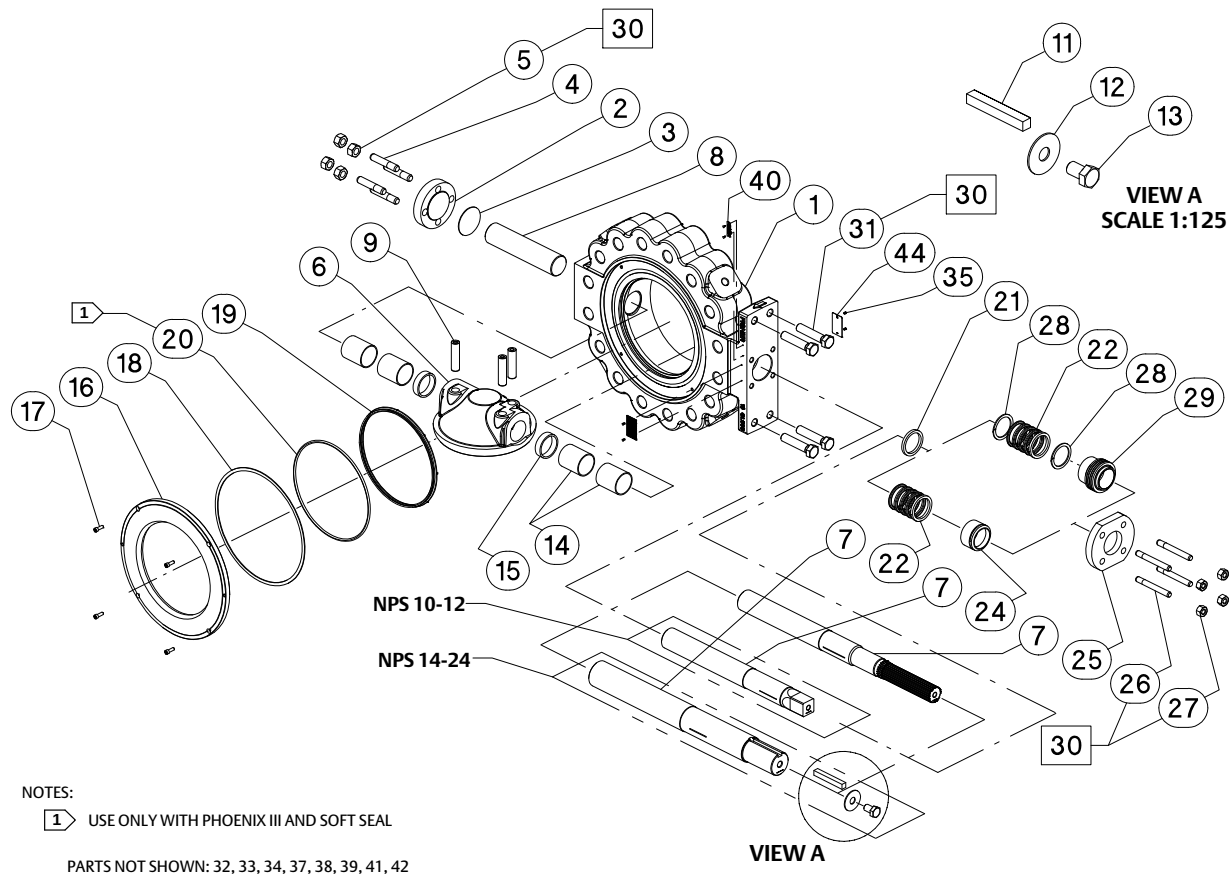


NOTES:

1 USE ONLY WITH PHOENIX III AND SOFT SEAL

PARTS NOT SHOWN: 32, 33, 34, 37, 38, 39, 41, 42

Figure 15. Fisher 8590, NPS 10-24, CL600 Valve Assembly



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

8590 Valve

January 2019

Instruction Manual

D104016X012

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Fisher™ 9500 Butterfly Control Valve

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Figure 1. Fisher 9500 Valve with 1052 Actuator and DVC6200 Digital Valve Controller



W9224-2

Introduction

Scope of Manual

This manual provides installation, adjustment, and maintenance information for Fisher 9500 butterfly valves. These valves use splined shafts with actuator-mounted brackets and linear-motion actuators (see figure 1). Refer to separate manuals for instructions covering the power actuator or the manual handwheel actuator, positioner, and other accessories.

Do not install, operate, or maintain 9500 valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The 9500 valve is a fully lined butterfly valve for use with corrosive process fluids or wherever stringent shutoff is required. The nitrile or PTFE liner completely isolates the valve body and shaft from the process fluid. The valve is available with conventional or FISHTAIL™ disk designs.

Table 1. Specifications

Valve Sizes NPS ■ 2, ■ 3, ■ 4, ■ 6, ■ 8, ■ 10, or ■ 12 Valve Body Style Flangeless (wafer-type) valve body to be installed between pipeline flanges End Connection Styles Flangeless (wafer-style) valve body mates with CL125 flat-face flanges per ASME B16.1, with CL150 and 300 raised-face flanges per ASME B16.34, or EN flanges Maximum Allowable Inlet Pressure⁽¹⁾ Consistent with applicable pressure/temperature ratings for ■ CL125B per ASME B16.1, or ■ CL150 and 300 per ASME B16.34 unless limited by maximum allowable pressure drop specification or by material temperature capabilities in table 2 Vacuum Service The valve is suitable for vacuum service to approximately 10^{-7} mm Hg absolute (3.4×10^{-12} mbar, absolute) Maximum Shutoff Pressure Drop⁽¹⁾ Standard Operation Cast Iron Valve: 12.1 bar (175 psi) Steel or Stainless Steel Valve: 15.2 bar (220 psi) Material Temperature Capabilities⁽¹⁾ See table 2 Flow Characteristic Conventional Disk: Approximately equal percentage through 60 degrees of disk rotation	FISHTAIL Disk: Approximately equal percentage through 90 degrees of disk rotation Flow Direction Conventional Disk: Bidirectional FISHTAIL Disk: Forward flow - The tail of the disk opens into the downstream end of the valve (see figure 2). Disk Rotation Conventional Disk On/Off Service: ■ 0 to 60 or ■ 0 to 90 degrees Throttling Service: 0 to 60 degrees FISHTAIL Disk: 0 to 60 or 0 to 90 degrees for on/off or throttling Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4 Nitrile Liner or PTFE Liner: Class VI Mating Flange Capabilities All sizes compatible with welding-neck flanges; also see Installation section for slip-on flanges Code Classifications Dimensions meet MSS SP-67 specifications for face-to-face dimensions for flangeless valves Approximate Weights (Valve Body Assemblies Only) NPS 2: 9 kg (20 lb) NPS 3: 11 kg (25 lb) NPS 4: 14 kg (30 lb) NPS 6: 20 kg (45 lb) NPS 8: 27 kg (60 lb) NPS 10: 32 kg (70 lb) NPS 12: 54 kg (120 lb)
---	--

1. The pressure/temperature limits in this manual and any applicable standard or code limitation should not be exceeded.

Table 2. Operative Temperature

Disk Type	Liner Material	Operative Temperature
Conventional or FISHTAIL	Nitrile	-7 to 93°C (20 to 200°F)
	PTFE	-18 to 121°C (0 to 250°F)

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

These valves may be installed in many positions by referring to the Actuator Mounting procedures and figure 6 in this manual. For conventional disks, flow may be in either direction. For FISHTAIL disks, the leading edge of the disk must be located in the upstream end of the valve (see figure 2).

CAUTION

As noted in the following paragraphs, improper use of additional gasketing materials will damage the valve liner.

The valve body liner extends past or overlaps the valve face producing the partial O-ring shown in figure 3. It also acts as the flange gasket. Improper use of additional gasketing materials will damage the valve liner.

Care must be taken during installation to ensure that the pipe flanges are properly supported. Pipe flange support is required to avoid liner flange joint leakage or problems during valve operation. Slip-on pipe flanges may be used with NPS 2, 3, or 4 valves. An NPS 6 valve or larger will require flange adapters for complete liner support.

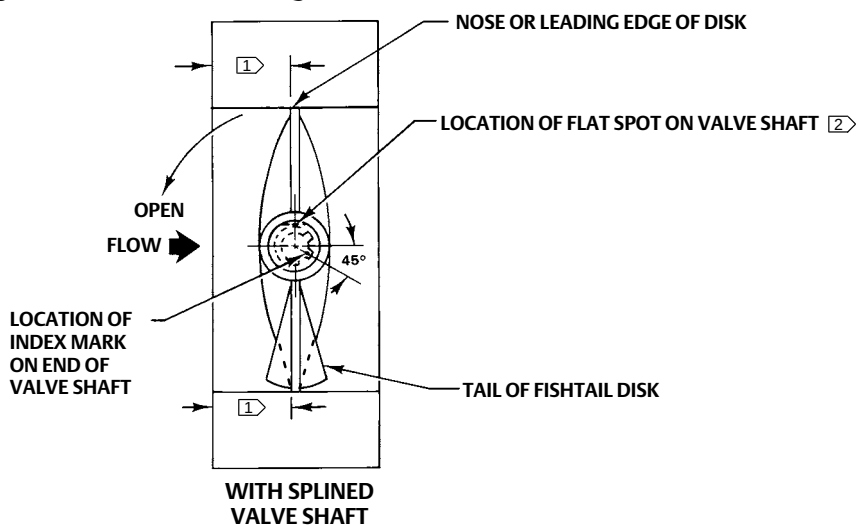
Mating flanges or pipe flanges with inside diameters smaller than the minimum shown (see table 3) may interfere with the opening of the disk. Flanges or pipes with an inside diameter larger than the maximum shown (see table 3) may not be in full contact with the liner. Install flange adapters in each case, either to provide disk clearance or to fully contact the liner.

Flexible, plastic flanges, fiberglass, slip-on, or weld-neck with other than standard inside diameters may not provide adequate support for the liner. Also, flexible mating flanges can be warped with excessive line bolt load. They may fail to support the liner at the inside diameter of the valve body. Use flange adapters, available from Emerson Automation Solutions, during installation to avoid these problems. Whenever a flange adapter is used, a standard flange gasket must be installed between the line flange and flange adapter. Do not use a flange gasket between the valve and flange adapter. The partial O-ring on the liner acts as the flange gasket and any additional gasket here will damage the liner.

The 9500 valve may be used as part of a three-way valve assembly. The actuator-valve linkage is adjusted at the factory; you won't need to adjust the linkage before placing the valve in service. If the valve and actuator are being re-installed, after removal, or if you suspect that the linkage is out of adjustment, refer to the Linkage portion of the Adjustments section before installing the valve in the pipeline. If the valve has been purchased separately, or if the actuator has been removed, complete the procedures in the Actuator Mounting section of this manual before proceeding.

Table 3. Maximum and Minimum Allowable Mating Flange Diameters

VALVE SIZE, NPS	MAXIMUM AND MINIMUM DIAMETER OF MATING PIPING OR FLANGES			
	Minimum		Maximum	
	mm	Inches	mm	Inches
2	30	1.20	64	2.50
3	64	2.50	92	3.62
4	89	3.50	117	4.62
6	145	5.70	171	6.75
8	196	7.70	222	8.75
10	246	9.70	273	10.75
12	297	11.70	330	13.00

Figure 2. Valve Shaft Marking


[1] EQUAL MEASUREMENTS BETWEEN VALVE FACE AND DISK EDGE AT TOP AND BOTTOM ENSURE FULLY CLOSED DISK.

[2] FOR FISHTAIL DISK, PARTIAL KEYWAY OR FLAT SPOT IS ON SAME SIDE AS NOSE OF DISK.

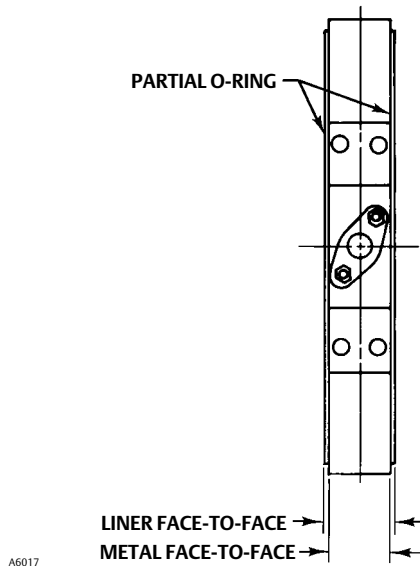
A2755-1

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.

Figure 3. Partial O-Ring Location



1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
2. Be certain the pipeline flanges are in line with each other and supported.

CAUTION

To avoid damaging valve seating surfaces, make sure the adjacent piping is free of pipe scale, welding slag, and any other damaging material.

3. Inspect the valve body to be sure it is free of foreign material. Make sure the adjacent piping is free of pipe scale, welding slag, and any other material that could damage valve seating surfaces.
4. Measure to be sure the distance between the pipeline flanges is approximately 1/4 inch greater than the valve face-to-face dimension. This will ensure easy installation without distorting the liner (figure 3).
5. For conventional disks, flow may be in either direction; for FISHTAIL disks, flow must be such that the tail of the disk (as shown in figure 2) will rotate into the downstream side of the valve.

CAUTION

To avoid damaging valve parts, observe the following precautions before inserting the valve in the line.

- a. The inside diameter of the mating piping or flanges must be large enough to allow the valve disk to rotate freely into the upstream and downstream piping, or the disk could be damaged. Do not use piping or flanges having an inside diameter smaller than the minimum shown in table 3.
- b. The inside of the mating flange must also be small enough to be in full contact with the partial O-rings on the liner faces. Leakage through the flange connections and damage to the liner could result if the partial O-ring

faces are not properly supported. Do not use flanges having an inside diameter larger than the maximum shown in table 3.

NPS 6 to 10 valves must not be used with slip-on flanges unless flange adaptors are used to support the liner. When using slip-on flanges with other sizes, be certain the valve is carefully centered to ensure that the partial O-ring faces are in full contact with the adjacent flanges.

- c. When a flange adapter is necessary, a flange gasket must be installed between the line flange and the flange adapter. Do not use a flange gasket between the valve and the flange adapter. Additional gasketing material at this location could damage the liner.
 - d. The valve disk must be in the closed position when the valve is being inserted into the pipeline. If the valve disk is not closed, it could be damaged against the mating piping or flanges.
6. Insert the valve into the pipeline. Insert four flange studs or bolts through the flanges to support the valve.
 7. Center the valve carefully on the flanges by measuring equal distances at the top and bottom and equal distances at the sides.
 8. Insert the remaining flange studs or bolts. Tighten the studs or bolts evenly. Normal flange bolt torques may be used because liner compression is limited by metal-to-metal contact between flanges and the valve body.
 9. Rotate the valve disk manually to be certain the disk clears the adjacent piping or flanges as it opens. If necessary, disconnect the power actuator-valve linkage, but do not disturb the adjustment of the turnbuckle or adjustable linkage. If the disk hits the flange, loosen flange bolting temporarily while re-centering the valve. If the problem cannot be corrected in this manner, it will be necessary to use line flanges with larger inside diameters adjacent to the valve.
 10. For hazardous atmosphere or oxygen service valves, read the following Warning, and provide the following bonding strap assembly if the valve is used in an explosive atmosphere.

⚠ WARNING

The valve drive shaft is not necessarily grounded to the pipeline when installed. Personal injury or property damage could result, if the process fluid or the atmosphere around the valve is flammable, from an explosion caused by a discharge of static electricity from the valve components. If the valve is installed in a hazardous area, electrically bond the drive shaft to the valve.

11. Attach the bonding strap assembly (key 131, figure 4) to the shaft with the clamp (key 130, figure 4).
12. Connect the other end of the bonding strap assembly to the valve flange cap screws.

Adjustments

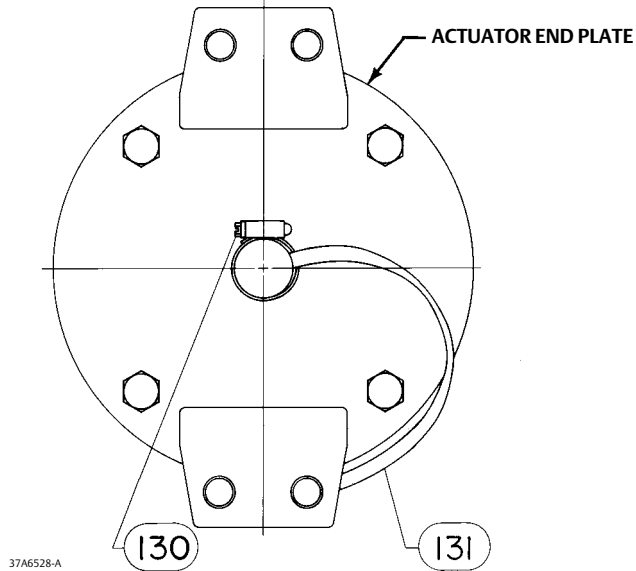
Hub Seals

Key number locations are shown in figure 7.

Thrust sleeve assemblies (key 6) seal the disk hubs. In time, especially with frequent valve disk rotation, these seals may require adjustment.

Adjust the seals if there is leakage through the valve body around the valve shaft. A small amount of leakage downstream (between the bushings and disk hubs) may also indicate a need for hub seal adjustment.

Figure 4. Grounding Assembly



To adjust the hub seals:

1. Tighten both thrust-plate cap screws (key 10) 1/4 turn on one side (the side where shaft leakage is occurring).

CAUTION

To avoid excessive side thrust on the disk and possible liner damage, tighten cap screws on both sides of the valve alternately and in 1/4-turn increments. Do not over-tighten by continuous turning or by tightening one side only. Over-tightening the cap screws will cause the liner to fail.

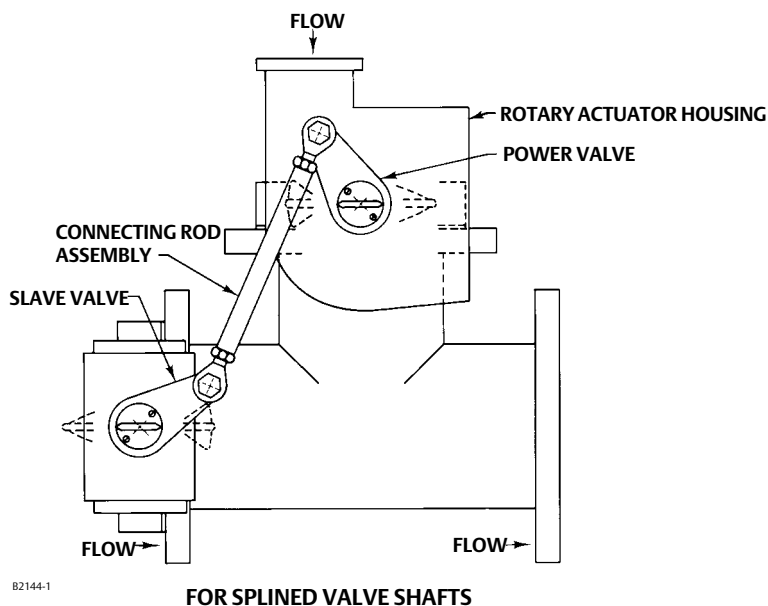
2. Tighten both thrust-plate cap screws 1/4 turn on the other side of the valve.
3. Repeat steps 1 and 2 until leakage stops.

Note

If this adjustment is being performed to stop minor leakage past the disk, check the leakage after turning the cap screws enough to move the thrust plates 0.8 mm (1/32 inch) closer to the valve body. If leakage has not stopped or diminished, the leakage is probably due to incorrect linkage adjustment or damaged valve parts. Refer to the Linkage section to check linkage adjustment; refer to the Maintenance section to inspect and replace parts.

4. If leakage around the shaft cannot be stopped by adjusting hub seals, refer to the Maintenance section to inspect and replace damaged parts.

Figure 5. Tandem Linkage Adjustment for Three-Way Valve Assemblies



Linkage

If the linkage between the power actuator and valve is improperly adjusted, the actuator may reach the end of travel before (or after) the disk reaches the fully closed position. This could result in leakage past the disk. The linkage adjustment is set at the factory, and it should not be necessary to adjust linkage unless the actuator and valve have been separated and the adjustment altered.

To check the linkage adjustment on FISHTAIL disks, the flat is on the same side of the shaft as the nose or leading edge of the valve disk (as shown in figure 2). When the valve disk is at the fully closed position, the flat will be either top-dead-center or bottom-dead-center in relation to the valve body. The top-dead-center position is shown in figure 2. A more accurate check of the fully closed disk position is obtained by removing the valve from the pipeline.

⚠ WARNING

To avoid personal injury and damage to the process system caused by the sudden release of pressure, isolate the control valve from all pressure and relieve pressure from the valve body before removing the valve from the line. Be sure the disk is closed so that it will not hit the mating flanges when being removed from the line.

With the valve removed from the line, position the actuator to the valve-closed end of the travel. Measure the distance between the valve face and the top and bottom edges of the disk as shown in figure 2. The disk is at the fully closed position if the two measurements are equal.

To adjust linkage, refer to the actuator instruction manual.

Three-Way Valve Tandem Linkage

If the valve is used as part of a three-way valve assembly, adjustment of the tandem linkage (see figure 5) may be necessary to ensure proper rotation of the slave valve disk.

If the adjustment is being performed with the three-way valve assembly out of the line, temporarily bolt the valve bodies to the tee to compress the liner faces until there is metal-to-metal contact between the valve bodies and the tee.

Check the rotation of the power valve disk per instructions in the Linkage section. If necessary, adjust the linkage between the actuator and the power valve.

To check the fully closed position of the slave valve disk, use the partial keyway on the slave valve shaft or measure equal distances between the slave valve face and the top and bottom of the slave valve disk as described in the Linkage section. Tighten the locknuts on the tandem linkage when adjustment is complete.

Maintenance

Use table 4 to locate and correct possible leakage or mechanical linkage problems with the valve.

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve.

Disassembly

Key numbers locations are shown in figure 7.

1. Loosen all flange studs or bolts. Remove all but the bottom flange studs or bolts.

CAUTION

To avoid damage to the valve disk caused by the disk hitting the mating flange, be certain the disk is closed before removing the valve from the pipeline.

Table 4. Troubleshooting Guide

Fault	Possible Cause	Correction
1. Leakage out sides of valve (at thrust plates) between thrust bushings and shaft.	a. Hub seals require adjustment. b. Taper pins are not sealed.	a. Adjust using Hub Seals portion of Adjustments procedures. b. Remove valve from line and re-seat taper pins or install new taper pins using Maintenance procedures.
2. Leakage out sides of valve (at thrust plates) between valve body and thrust bushings, leakage at flanges, faces, or both	a. Flange gaskets used. b. Partial O-ring bead on liner faces damaged.	a. Check to see if flange gaskets are being used; if so, remove gaskets. b. Replace liner using Maintenance procedures.
3. Leakage through disk/liner seal	a. Hub seals require adjustment. b. Linkage requires adjustment. c. Actuator has insufficient torque output to close disk against pressure drop. (Actuators are selected to have sufficient torque output to shut off the flow against a specific pressure drop, not necessarily against the maximum allowable pressure drop. Be sure that the pressure drop for which the actuator is selected is not being exceeded.) d. Liner has been damaged by flowing medium or other valve parts damaged by being subjected to service conditions beyond those for which valve is designed.	a. Adjust seals using Hub Seals portion of Adjustments procedures. b. Refer to Linkage portion of Adjustments procedures. c. If possible, check shutoff at lower pressure drops. If shutoff is obtained at low pressure drops, but actuator stalls and does not produce full disk rotation at service pressure drop, actuator output torque is too low. For piston actuators, it may be possible to increase output torque by increasing supply pressure. Do not exceed maximum allowable supply pressure of actuator. d. Inspect and replace parts using Maintenance procedures.
4. Valve shaft will not rotate	a. If actuator does not stall, but shaft does not rotate, the spline teeth on the valve shaft are sheared. b. If actuator stalls, shaft is binding in bushings due to linkage misalignment caused by excessive wear of linkage parts. c. If actuator stalls and linkage is not misaligned, actuator may have insufficient output torque to rotate disk against flow.	a. Refer to the actuator instruction manual to remove actuator cover plate. Replace valve shaft using Maintenance procedures if spline teeth are sheared. b. Replace linkage parts. c. Check actuator operation with no pressure applied to the valve. If valve now functions properly, actuator is too small.
5. Valve shaft rotates, but valve does not control process fluid	Taper pins (or drive shaft spline for coated-disk constructions) have been sheared due to obstruction to disk rotation or other internal parts damaged by being subjected to service conditions beyond those for which the valve was designed.	Inspect and replace parts using the Maintenance procedures.

- If necessary, pry flanges apart so that liner faces will not be damaged when the valve is being removed. Inspect the disk (key 3) and liner (key 2) for wear or damage.
- Remove the actuator from the valve. Follow instructions in the appropriate actuator instruction manual.
- From both sides of valve, unscrew thrust-plate cap screws (key 10) and remove thrust plates (key 9).
- If taper pin (key 15) ends are peened, grind off the peened portions. Driving from the smaller end of the pins, drive the pins out of the disk (key 3) and shaft (key 4).

⚠ WARNING

Once the shaft has been removed, the disk may fall from the valve body, causing personal injury or disk damage. Support the disk before removing the shaft.

- Pull the shaft out of the valve body. If the shaft cannot be pulled from the valve body, drive the shaft out but use care to avoid upsetting the end of the shaft.
- Remove the disk from the valve body.

8. Remove the liner (key 2) from the valve body.

Some 9500 valves have the liner bonded to the valve body. If the valve has a bonded liner, burn or chip out the liner.

To strip the liner out with solvent, use Dynasolve 185, or equivalent solvent. (Dynasolve is a product of DYNALLOY™ Inc.). Cover the valve with solvent bath or enclose the solvent bath around the liner. Remove all adhesive after the liner has been removed.

Table 5. Taper Pin Details for 9500 Series Valves

VALVE SIZE, NPS	SHAFT DIAMETER mm (Inches)	AMERICAN STANDARD TAPER PIN SIZE	DRILL SIZE
2	12.7 (1/2)	2	#20 (0.161 Inches)
3, 4	15.9 (5/8)	3	#16 (0.177 Inches)
6	19.1 (3/4)	4	13/64 Inches
8, 10	25.4 (1)	6	9/32 Inches
12	31.8 (1-1/4)	7	21/64 Inches

Reassembly

Before reassembling the valve, clean and inspect all parts. Key number locations are shown in figure 7. Refer to the Parts List section to obtain replacement parts.

WARNING

Do not lubricate parts when used in oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

1. Insert the liner (key 2) into the valve body. A small amount of silicone grease applied to the outside surface of the liner will aid insertion of the liner. However, do not use grease if the valve is to be used for oxygen service.

In vacuum service applications, upon customer request, you may use Eccobond® 285/24LV bonding agent (Fisher part number G1414006992) to bond the liner to the valve. Though bonding is not required, use the lettered steps below when bonding the liner to the valve body. If a different agent is to be used, follow instructions furnished by the bonding agent manufacturer. In absence of instructions, consult your [Emerson sales office](#).

- a. Roughen bonding surface of liner with a stiff wire brush. De-grease bonding surfaces of the liner and valve body with solvent.
 - b. Mix the two epoxy components thoroughly and spread a thin coat [approximately 0.38 mm (0.015 inches) thick] of the mixture over all bonding surfaces of the valve body and liner.
 - c. Insert the liner into the valve body. Align the liner shaft holes with valve body shaft holes. Remove excess bonding agent from shaft holes and exposed liner surfaces.
 - d. Insert the disk (key 3), thrust sleeve assemblies (key 6), and shaft (key 4) into the valve body. Be sure the thrust sleeve assemblies engage the liner recesses to ensure proper liner positioning. Rotate the disk to the closed position.
 - e. Lay the valve on one valve face and add weights to the other face to ensure a tight bond. Allow to cure for 24 hours. Then, proceed with the following reassembly steps.
2. Insert the thrust sleeve assemblies into the valve body. Be sure that the thrust sleeve assemblies enter the liner recesses to align the shaft holes, by temporarily inserting the shaft(s) (key 4).

3. A new disk and shaft should be installed if the taper pin holes have been widened by loosening of the taper pins (key 15).

Omit the following steps 4 through 8 if a new disk and shaft assembly is to be installed or if the old disk and shaft are to be reused. Use new taper pins whenever the disk has been removed.

CAUTION

If a new disk is required, a complete disk/shaft assembly must be purchased to avoid damage to valve parts. The old valve shaft cannot be used with a new disk.

If a new shaft (without disk) has been purchased, be sure to mark the shaft to indicate the disk position as shown in figure 2.

4. Making certain the taper pin holes are on the actuator side of the valve body, insert the disk into the valve body. Position the disk at the fully closed position.
5. Installing splined shaft:
 - a. If the old shaft is available, insert it into the valve body and disk. Line up the taper pin holes in the disk and shaft; measure and record the distance between the valve body and the splined end of the shaft. Remove the old shaft and insert the new, un-drilled shaft. Position the shaft so that there is the same distance between the valve body and the end of the shaft as noted above.
 - b. If installing a new shaft, insert the new shaft into the valve body and disk. Measure between the valve body and the splined end of the shaft. Make certain that the distance is correct to engage the actuator coupling lever.

Be certain that the flat spot or index mark on the end of the shaft is positioned as shown in figure 2.

6. Use a drill or center punch to mark the taper pin holes in the shaft. Remove the shaft and disk from the valve body.
7. Taper pins used in the 9500 valve shaft and disk are American Standard taper pins, as shown in table 5. Using the disk as a guide, drill taper pin holes through the shaft using drill size shown in table 5.
8. Use an American Standard taper pin reamer to ream the shaft holes. Be certain the reamer is of sufficient length for the disk hub thickness. Insert the shaft into the disk when reaming so the disk holes can be used as a gauge for reaming. Allow the reamer to just begin reaming the disk holes. This will ensure proper seating of the pins.
9. Install the disk and shaft into the valve body. Be sure the splined end of the shaft is on the actuator side of the valve body, that the direction of taper in the taper pin holes match, and that the flat spot or zero mark is positioned as shown in figure 2.
10. Using a metal sealing compound on the pins for a positive seal, insert the taper pins into the larger end of the taper pin holes. Drive the pins with a hammer to seat the pins.
11. Attach the thrust plates (key 9) with cap screws (key 10). When tightening the cap screws, do so in small increments, alternating from one cap screw to another and from one valve side to the other. Tighten the cap screws until the thrust plates contact the thrust sleeve assemblies snugly. Then rotate the cap screws enough to move the thrust plates 0.8 mm (1/32 inch) closer to the valve body.
12. Re-attach the actuator according to the steps in the Actuator Mounting section; then install the valve according to the steps in the Installation section.

Actuator Mounting

1. Refer to the appropriate actuator instruction manual to determine the desired actuator mounting style and position. With the valve out of the line, mount the actuator on the valve per instructions in the actuator instruction manual.
2. To determine the fully closed disk position, measure the distances between the valve face and the top and bottom edges of the disk as shown in figure 2. The disk is at the fully closed position when the two measurements are equal. Rotate the disk slightly if necessary to make the measurements equal.
3. Refer to figure 6 and locate the view that depicts the mounting style and position that is being used. In the appropriate view on the right of figure 6, note the positions of the index marks on the end of the valve shaft and actuator lever. For all positions and styles with 90-degree disk rotation, the shaft index mark is to be aligned with the appropriate lever index mark as shown in figure 6. This is also true for push-down-to-open action with 60-degree maximum disk rotation. However, for push-down-to-close action with 60-degree maximum disk rotation, the appropriate lever index mark must be offset one or two spline teeth counterclockwise from the shaft index mark.

Refer to the appropriate actuator instruction manual for instructions covering attaching the lever and adjusting the turnbuckle. For FISHTAIL disks, be certain that the direction of rotation will be such that the tail of the disk (see figure 2) will rotate into the downstream side of the valve.

Changing Disk Rotation and Action

Disk rotation can be changed from 0-90 degrees or vice versa by changing travel stops in the actuator and, if necessary, changing the position of the lever on the splined valve shaft. Action can be changed from push-down-to-open to push-down-to-close by removing the actuator and remounting it in the alternate mounting style. Refer to the appropriate actuator instruction manual for assistance in disassembly and reassembly to change travel stops and for instructions to change mounting style.

Note

Action for valves using a splined valve shaft can also be changed, without changing mounting style, by repositioning the actuator lever on the valve shaft. For FISHTAIL disks, it will be necessary to rotate the disk 180 degrees so that the tail of the disk will rotate into the downstream side of the valve.

Use the following procedure.

1. Refer to the appropriate actuator instruction manual for assistance in disconnecting and removing the actuator lever. Avoid disturbing the actuator turnbuckle adjustment, if possible.
2. If the valve disk is a FISHTAIL disk, rotate the disk 180 degrees from the original position.
3. Position the disk in its fully closed position. To ensure that disk is fully closed, measure equal distances between valve face and top and bottom of the disk as shown in figure 2 or check to be sure that the flat spot or index mark on the valve shaft is in top-dead-center or bottom-dead-center in relation to the valve.

WARNING

To avoid personal injury, keep hands away from the actuator rod in the following procedure.

4. Note the position of the valve shaft index mark. Index mark alignments for reversed action are not shown in figure 6. To determine proper index mark alignment, proceed as follows:
 - a. Stroke the actuator to the valve-closed end of travel and retain that position while performing the next step.
 - b. Keeping hands away from the actuator rod, hold the actuator lever up to the valve shaft so that the lever end is in line with the actuator rod end bearing. The lever index mark that is most nearly in line with the valve shaft index mark is the index mark that must be used during reassembly. If changing to push-down-to-close action with 60-degree operation, the lever index mark will be offset 1 spline tooth from the valve shaft index mark for 12.7 through 19.1 mm (1/2 through 3/4-inch) valve shafts and 2 spline teeth from the valve shaft index mark for 25.4 and 31.8 mm (1 and 1-1/4 inch) valve shafts. This offset must be maintained during reassembly.
5. Record the alignment determined in step 4, remove the actuator lever, and shut off operating pressure to actuator.
6. Reassemble the lever to the actuator and adjust the actuator travel, if necessary, referring to the steps in the appropriate actuator instruction manual. Be sure to use the index mark alignment determined above rather than those shown in figure 6.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

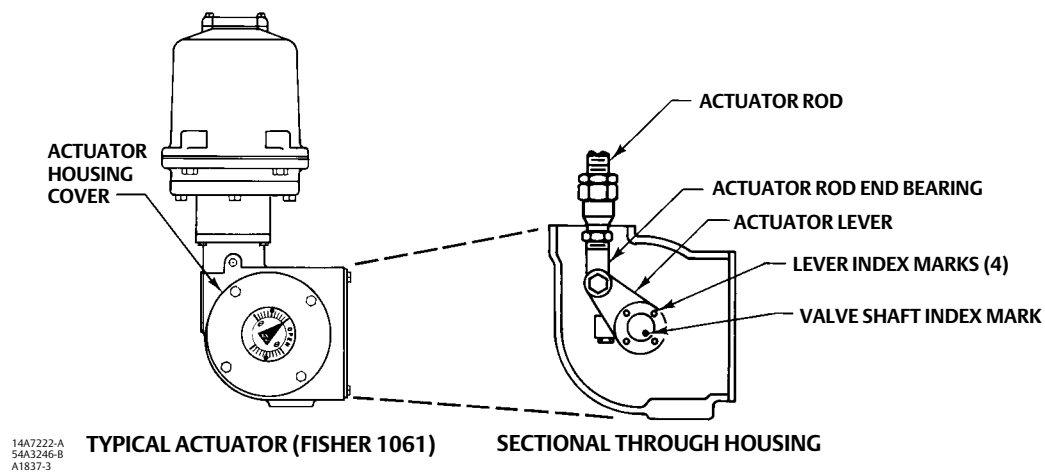
Instruction Manual

D100380X012

9500 Valve

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Figure 6. Splined-Shaft Index Mark Alignment for Standard Mounting Position-Valve Action Combinations



DISK	ACTUATOR		2 VALVE CLOSED POSITION	3 MOUNTING POSITION 1	3 MOUNTING POSITION 2	3 MOUNTING POSITION 3	3 MOUNTING POSITION 4
	MOUNTING	STYLE					
FISHTAIL	RIGHT-HAND MOUNTING (VIEWED FROM VALVE INLET)	STYLE A PUSH-DOWN-TO-OPEN 60- OR 90-DEG OPERATION	FLOW →				
		STYLE B PUSH-DOWN-TO-CLOSE 90-DEG OPERATION 1	FLOW →				
	LEFT-HAND MOUNTING (VIEWED FROM VALVE INLET)	STYLE C PUSH-DOWN-TO-CLOSE 90-DEG OPERATION 1	← FLOW				
		STYLE D PUSH-DOWN-TO-OPEN 60- OR 90-DEG OPERATION	← FLOW				
CONVENTIONAL	RIGHT OR LEFT-HAND MOUNTING (VIEWED FROM VALVE INLET)	STYLE A OR D PUSH-DOWN-TO-OPEN 60- OR 90-DEG OPERATION	← FLOW				
		STYLE B OR C PUSH-DOWN-TO-CLOSE 90-DEG OPERATION 1	FLOW →				

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1 FOR 60-DEGREE OPERATION WITH PUSH-DOWN-TO-CLOSE ACTION (EXTENDING ACTUATOR ROD CLOSING VALVE), ROTATE ACTUATOR LEVER COUNTERCLOCKWISE SO THAT LEVER INDEX MARK IS OFFSET 1 SPLINE TOOTH FROM VALVE SHAFT INDEX MARK FOR ½ THROUGH ¾ INCH VALVE SHAFTS AND 2 SPLINE TEETH FROM VALVE SHAFT INDEX MARK FOR 1 INCH AND LARGER VALVE SHAFTS.

2 CURVED ARROWS INDICATE ROTATION REQUIRED TO OPEN VALVE (COUNTERCLOCKWISE WHEN VIEWED FROM ACTUATOR SIDE OF VALVE).

3 ARROWS INDICATE DIRECTION OF ACTUATOR ROD TRAVEL REQUIRED TO OPEN VALVE.

Parts Ordering

A serial number is assigned to each valve body and stamped on the nameplate. Always refer to the serial number when corresponding with your [Emerson sales office](#) regarding spare parts or technical information. When ordering replacement parts, also specify the complete 11-character part number from the parts list information.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your [Emerson sales office](#) for parts ordering information.

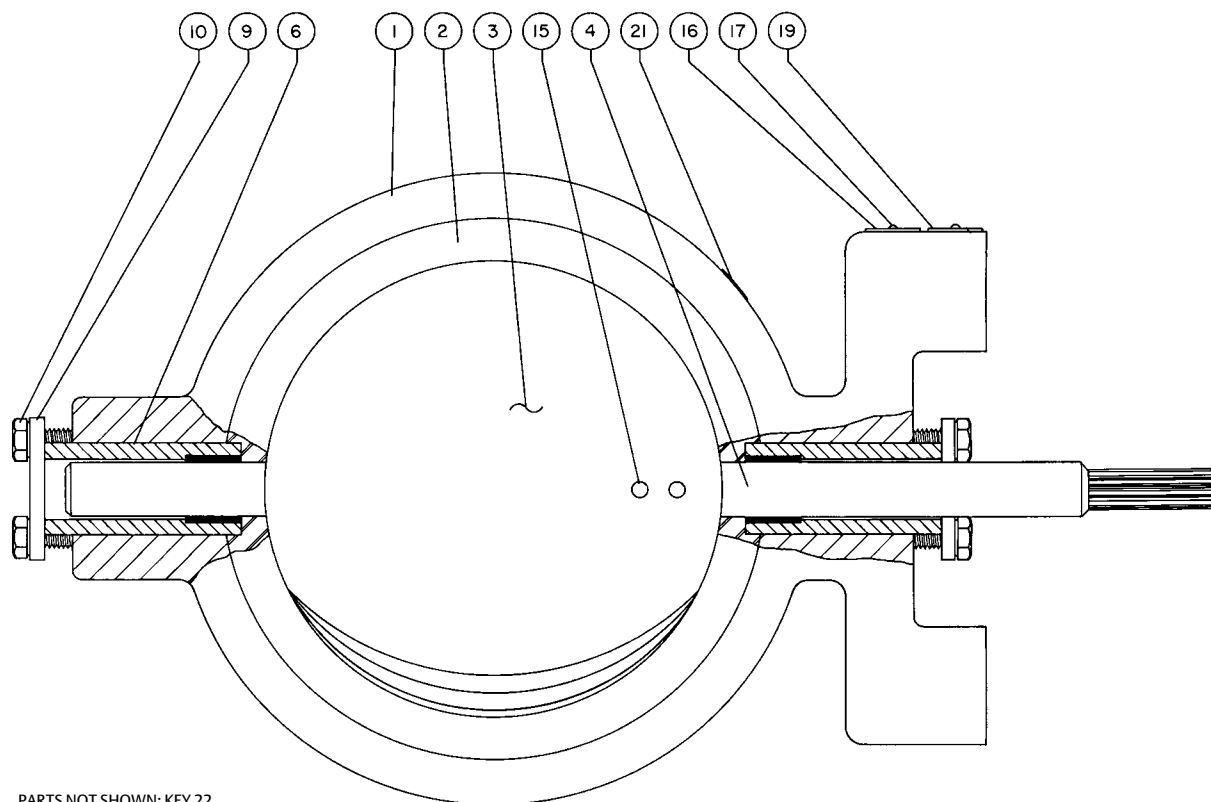
Key Description

1	Valve Body
	If you need a valve body as a replacement part, order by valve size, serial number, and desired material.
2*	Liner Assy
3	Disk
4*	Shaft

Key Description

6*	Sleeve/Bushing Assy (2 req'd)
9	Plate, Thrust (2 req'd)
10	Screw,Cap, hex hd (4 req'd)
15*	Taper Pin (2 req'd)
16	Nameplate
17	Drive Screw (2 req'd)
19	Flow Tag (FISHTAIL disk only)
21	FISHTAIL Disk Tag (FISHTAIL disk only)
22	Flange Tag (not shown)
26	Seal & Wire (not shown)
130	Clamp
131	Bounding strap assembly
132	Flange Adapter (not shown) (2 req'd)

Figure 7. Fisher 9500 Valve Body Assembly



PARTS NOT SHOWN: KEY 22
G34171-B

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Fisher™ A11 High-Performance Butterfly Valve CL900-2500

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Figure 1. Fisher A11 Valve



W9570-1

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher A11 High-Performance Butterfly Valves (figure 1) in CL900 and 1500. For CL2500 valves, contact your [Emerson sales office](#).

For information about the actuator and accessories, please refer to the separate instruction manuals for these items.

Do not install, operate, or maintain an A11 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson sales office before proceeding.

Description

A11 High-Performance Butterfly Valves are available in a lugged body design, with a variety of seal, valve body, and internal components. These valves feature a dynamic sealing design that is used in a variety of demanding applications.

Specifications

Specifications are listed in table 1 and the specifications for a given valve are stamped on a nameplate attached to the valve.

Educational Services

For information on available courses for the A11 High Pressure valve, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Table 1. Specifications

Available Configurations Valve Sizes Class 900 and 1500^{(1) (2)}: Size ■ 3, ■ 4, ■ 6, ■ 8, ■ 10, ■ 12, ■ 14, ■ 16, ■ 18, ■ 20 and ■ 24-inch Valve Body: Lugged style in Class ■ 900 and ■ 1500 Consult your Emerson sales office for other sizes and pressure classes Maximum Inlet Pressure Consistent with applicable ASME class pressure/temperature ratings per ASME B16.34 unless such ratings are limited by material temperature capabilities. Construction Materials Refer to Bulletin 56.1:A11 CL900-2500 High-Performance Butterfly Valve (D104222X012) Disk Rotation Clockwise (CW) to close Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4 Class VI Soft Seal: Bubble-tight shutoff (exceeds Class VI) High Pressure Seal: Standard Class V	Cryogenic Seal (Reverse direction only) <i>CTFE with Aluminum Backup Ring: Class VI</i> Consult Emerson sales office for other shutoff classifications Valve Body Classification Valve bodies are designed for installation between standard pipe flanges: for 3 inch through 24-inch sizes (ASME B16.5) Approximate Weights See table 2 Actuator Types Available ■ Locking-lever manual actuators, ■ worm-gear manual actuators, ■ spring-return pneumatic actuators, ■ double-acting pneumatic actuators, and ■ electric actuators ENVIRO-SEAL™ Packing This optional ■ PTFE or ■ graphite packing system provides improved sealing, guiding, and transmission of loading force to control liquid and gas emissions (see figure 9). See Bulletin 59.3:041 ENVIRO-SEAL Packing Systems for Rotary Valves (D101638X012) for more information. Contact your Emerson sales office for larger sizes; they may require a special valve body.
--	--

NOTE:

1. Sizes NPS 3 and 4 are CL900 bodies with CL600 internals.

2. Sizes NPS 3 and 4 are CL1500 bodies with CL600 internals. Sizes NPS 6 and 8 are CL1500 bodies with CL900 internals.

Table 2. Approximate Weight for Size 3 through 24-Inch Valves

VALVE SIZE	CLASS	
	900	1500
kg		
3	---	---
4	---	---
6	59	---
8	120	---
10	210	311
12	450	663
14	444	810
16	513	1152
18	703	1613
20	991	2250
24	1626	---
lbs		
3	---	---
4	---	---
6	130	---
8	264	---
10	463	685
12	993	1462
14	976	1785
16	1132	2540
18	1550	3555
20	2185	4960
24	3590	---

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Note

When installing a valve after it has been in long-term storage, cycle the valve at least ten times to re-energize the dynamic seal. Please contact your [Emerson sales office](#) if you have any questions about preparing a valve for storage or if you are planning to put into service a valve that has been stored for some time.

Adjusting the Travel Stops

CAUTION

When using manual or power actuators, adjust the actuator travel stops so the disk stop in the valve body does not absorb the output of the actuator.

For actuators without travel stops, the actuator must be properly mounted to prevent it from driving the valve disk against the valve disk travel stop.

Failure to limit actuator travel as described in this section can result in damage to the valve shafts or other valve parts

Note

An "S" is visible on both the valve shaft and valve body. When the valve disk is closed, the "S" on the shaft aligns with the "S" on the valve body.

1. Locate the actuator travel stop that establishes the closed position of the valve disk. When adjusting the travel stop make sure that the disk is from 0 to 0.76 mm (0 to 0.030 inch) away from the internal stop in the valve body. This adjustment is necessary to be certain that the actuator output torque is fully absorbed by the actuator travel stop rather than the stop in the valve body.

For actuators without travel stops, the actuator must be properly mounted to prevent it from driving the valve disk against the valve disk travel stop.

2. To mount an actuator without travel stops, first, if necessary, remove the actuator from the valve. Then, position the valve disk from 0 to 0.76 mm (0 to 0.030 inch) away from the internal stop in the valve body.
3. Now, travel the actuator to the maximum position. Keep the actuator in the maximum travel position. Return the actuator to the valve, taking care not to disturb the position of the valve disk.
4. Mount the actuator on the valve using proper bolts with locking washers to achieve a secure fit.
5. Before installing the valve/actuator assembly in the process line, cycle the valve several times to be sure the valve disk returns to the proper position.

Preparing for Installation

⚠ WARNING

If the A11 valve is equipped with a fail-open actuator, remove the actuator before installing the valve/actuator assembly or cycle the valve into the fully closed position. Then, to avoid possible personal injury or property damage, take appropriate steps to ensure that the actuator does not cause the valve to open during installation.

1. If the valve and actuator have been purchased separately or if the actuator has been removed for storage, travel stop adjustment, or maintenance, mount the actuator before inserting the valve/actuator assembly into the line. Refer to the actuator instruction manual for mounting and adjustment procedures.

CAUTION

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag, or other foreign material from the pipeline.

- Remove the protective end covers from the valve and inspect the valve body to be certain that it is free of foreign material. Also, be certain that adjacent pipelines are free of any foreign material, such as pipe scale or welding slag that could damage the valve seating surfaces.

⚠ WARNING

The A11 valve is designed for use with the appropriate piping schedule for the ASME class. However, before putting the valve into operation, measure carefully to ensure disk rotation without interference from piping or flanges. Be certain to center the valve accurately to prevent interference of the disk with the flanges.

The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injuries, stay clear of the disk edges when rotating the disk.

Damage to the disk will occur if any pipe flanges or piping connected to the valve interfere with the disk rotation path. Compare the disk chordal swing diameter from the dimensional tables in Bulletin 51.6:A11 CL900-2500 A11 High Performance Butterfly Valve ([D104222X012](#)) to the ID of the pipe to be certain the disk rotates without interference before putting the valve into operation. Consult with your [Emerson sales office](#) for any constructions not listed in the bulletin.

- Select the appropriate gaskets for the application. flexible graphite, spiral wound, or other gasket types, made to ASME B16.5 group or user's standard, can be used on A11 valves depending on the service conditions of the application. Note: spiral wound gaskets, when properly centered, will cover more than 60 percent of the gasket area at the retaining ring screws.

For metal-seated and cryogenic valve gasket recommendations, please contact your Emerson sales office.

- Refer to the appropriate table for the quantity and size of flange bolts required (table 3) and proceed with the following instructions.

Valve Orientation

A11 valve bodies are designed for installation with the shaft in any orientation around the pipeline: horizontal, vertical, or at an angle. However, when installing an A11 valve, please follow these recommendations.

Table 3. Cap Screw Data for Lugged Valves

CL900/600	
Valve Size, NPS	4
Number of Cap Screws	16
Size-Diameter Inch - Thread	1-1/8 - 8
B-Length of Cap Screw, Inch	3.38

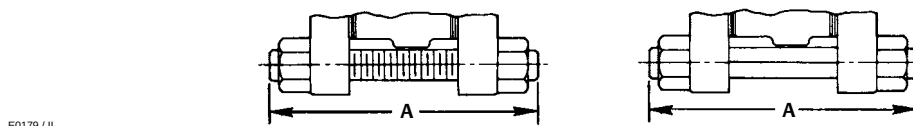
CL900									
Valve Size, NPS	6	8	10	12	14	16	18	20	24
Number of Cap Screws	24	24	32	40	40	40	40	40	40
Size-Diameter Inch - Thread	1-1/8 - 8	1-3/8 - 8	1-3/8 - 8	1-3/8 - 8	1-1/2 - 8	1-5/8 - 8	1-7/8 - 8	2 - 8	2-1/2 - 8
B-Length of Cap Screw, Inch	3.63	4.25	4.63	5	5.32	5.75	6.38	6.75	8.5

CL1500/600	
Valve Size, NPS	4
Number of Cap Screws	16
Size-Diameter Inch - Thread	1-1/4 - 8
B-Length of Cap Screw, Inch	3.88

CL1500/900		
Valve Size, NPS	4	8
Number of Cap Screws	24	24
Size-Diameter Inch - Thread	1-3/8 - 8	1-5/8 - 8
B-Length of Cap Screw, Inch	5.13	6

CL1500						
Valve Size, NPS	10	12	14	16	18	20
Number of Cap Screws	24	32	32	32	32	32
Size-Diameter Inch - Thread	1-7/8 - 8	2 - 8	2-1/4 - 8	2-1/2 - 8	2-3/4 - 8	3 - 8
B-Length of Cap Screw, Inch	6.63	7.38	8	8.75	9.63	10.5

Figure 2. View of Stud Bolts



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- In certain services (process fluids with high concentrations of entrained solids, abrasive slurries, or polymerizing media), valve performance will be enhanced by installing the valve with the shaft horizontal to the pipeline.
- Valves supplied for unidirectional shutoff should be installed with the high pressure at the back (shaft side) of the disk. A flow tag with an arrow is provided for proper installation.

The High Performance Butterfly Valve is designed to allow flow in either direction when in the open position. When in the closed position, high pressure should be applied to a specific side of the disk to provide best performance and optimal service life.

- Valves supplied for bidirectional shutoff, such as soft seal constructions, under normal operating conditions can (at different times) experience pressure in both directions; the highest of the two pressures should be exerted on the preferred side of the disk. If the two pressures are equal, then the one lasting the longest period of time should be applied to the preferred side. A flow tag with an arrow is provided for proper installation.

If you have questions about proper valve orientation in a specific application, contact your [Emerson sales office](#).

Installing the Valve

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given in this manual, the limits on the appropriate nameplates, or the matching pipe flange rating. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

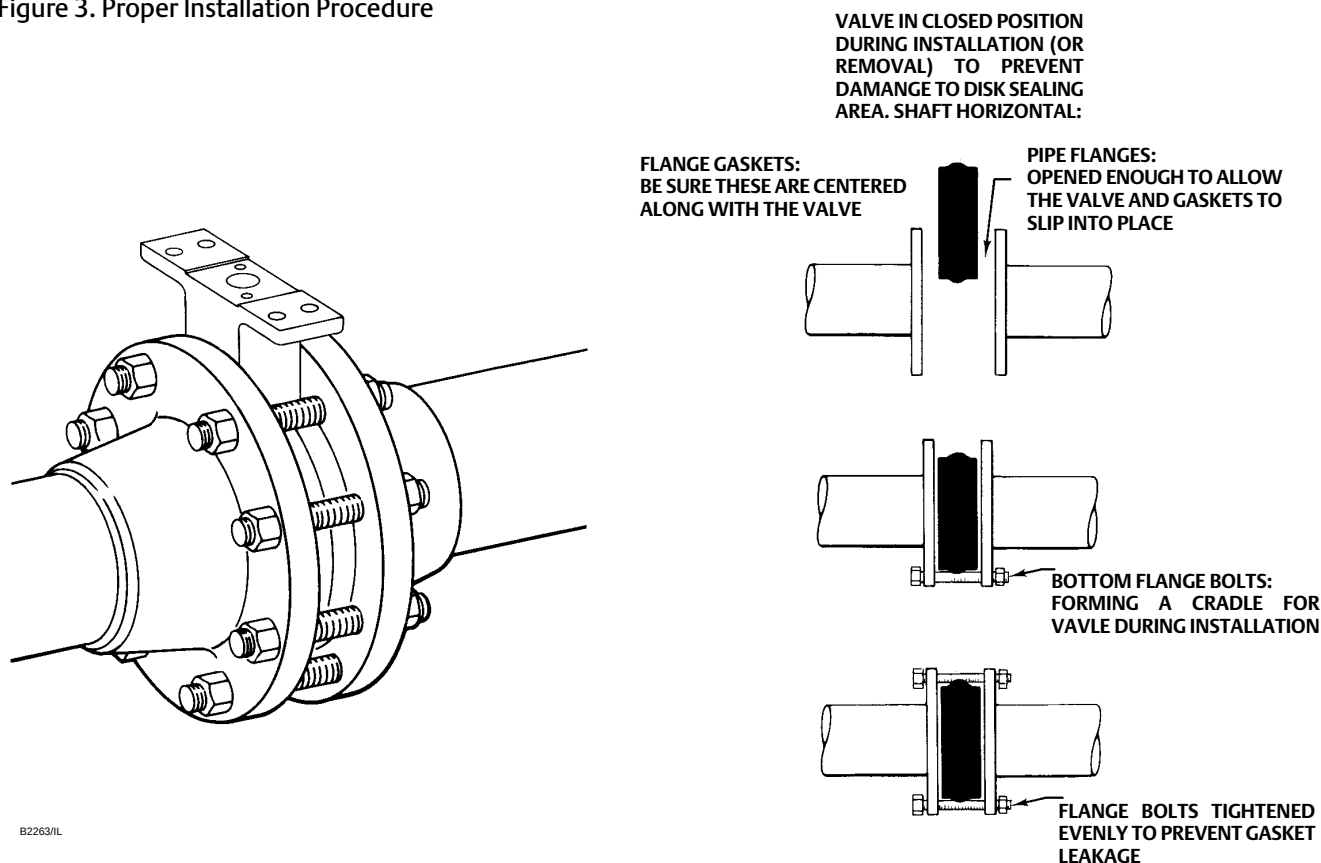
If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user.

Because some valve/body trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

Figure 3. Proper Installation Procedure



For Lugged Valves:

1. Position the valve between the flanges. Be sure to leave enough room for the flange gaskets; then install the lower flange bolts.
2. Install the gaskets and align the valve and the gaskets.
3. Install the remaining bolts.
4. Tighten the flange bolts in an alternating criss-cross fashion to a torque value of one-fourth of the final bolting torque. Repeat this procedure several times increasing the torque value each time by a fourth of the final desired torque. When the final torque value has been applied, tighten each flange bolt again to allow for gasket compression.

Packing Adjustment and Shaft Bonding

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

1. For PTFE or graphite packing: Tighten standard packing follower nuts only enough to prevent shaft leakage. Excessive tightening of packing will accelerate wear and could produce higher rotating friction loads on the valve shaft. If necessary, refer to the Packing Maintenance section.
2. For ENVIRO-SEAL Packing Systems: These packing systems will not require this initial re-adjustment. Refer to the separate ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)).
3. For hazardous atmosphere or oxygen service valves, read the following Warning, and provide the bonding strap assembly mentioned below if the valve is used in an explosive atmosphere.

⚠ WARNING

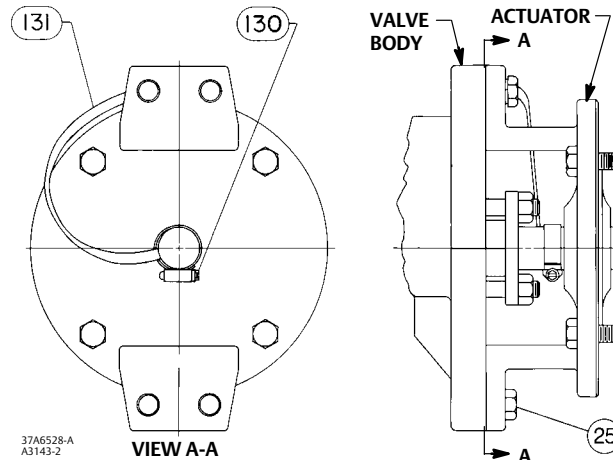
The valve drive shaft is not necessarily grounded to the pipeline when installed. Personal injury or property damage could result, if the process fluid or the atmosphere around the valve is flammable, from an explosion caused by a disk's charge of static electricity from the valve components. If the valve is installed in a hazardous area, electrically bond the drive shaft to the valve body.

Note

The packing is composed of all conductive packing rings (graphite ribbon packing) or partially conductive packing rings (carbon-filled PTFE female adaptor with PTFE V-ring packing or graphite-composition packing ring with PTFE/composition packing) to electrically bond the shaft to the valve for hazardous area service. For oxygen service applications, and hazardous area service where the standard packing doesn't provide sufficient shaft-to-valve body bonding, provide alternate shaft-to-valve body bonding according to the following step.

4. Attach the bonding strap assembly (key 131, figure 4) to the shaft with the clamp (key 130, figure 4).
5. Connect the other end of the bonding strap assembly to the valve flange cap screws.
6. For more information, refer to the Packing Maintenance section below.

Figure 4. Optional Shaft-to-Body Bonding Strap Assembly



Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure.
- Use lockout procedures to be sure the above measures stay in effect while you work on the equipment.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- The valve packing area may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

CAUTION

When using an actuator, the actuator travel stop (or actuator, for actuators without adjustable stops) must be adjusted so the disk stop in the valve does not absorb the output of the actuator. Failure to limit the actuator travel can result in damage to the valve, shaft(s), or other valve components.

Removing the Valve

⚠ WARNING

Using the procedures listed in the above WARNING, loosen the flange bolting that holds the valve. Make sure the valve cannot slip or twist while the bolting is being loosened and removed.

For field repair, remove the valve from the pipeline.

CAUTION

Damage to the disk can occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, stroke the actuator to place the disk in the closed position while removing the valve from the pipeline.

7. Before removing the valve from the pipeline, make sure the valve disk is closed. See figure 3. Rotate the shaft clockwise until the disk makes contact with the internal stop or actuator travel stop (if still installed). The “S” stamped on the shaft should be aligned with the “S” on the valve body.
8. After removing the valve from the pipeline, move it to an appropriate work area. Remove the actuator from the valve.

Packing Maintenance

The A11 valve is designed so the shaft packing can be replaced without removing the valve from the process pipeline.

CAUTION

The packing flange should be tightened only enough to prevent shaft leakage. Excessive tightening will only accelerate wear of the packing and could produce higher torques on the valve.

In most cases, packing leakage can be eliminated by merely tightening the hex nuts located above the packing flange while the valve is in the pipeline. However, if leakage continues, the packing must be replaced.

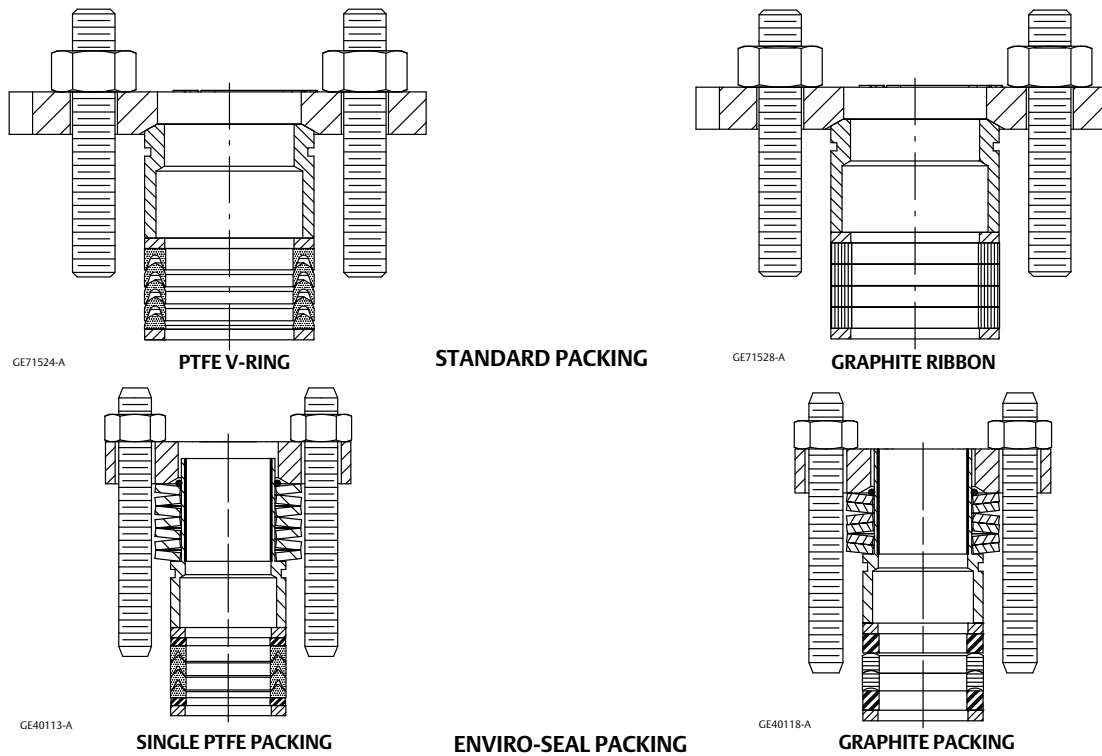
1. Before loosening any parts on the valve, be sure the pipeline has been depressurized. Then, remove packing nuts (key 16), lift off the packing flange (key 12) and packing follower (key 13). The packing (key 14) is now accessible.
2. Use a packing extractor to remove packing. Insert the corkscrew-like end of the tool into the first piece of packing and firmly remove. Repeat this process until all has been removed.

CAUTION

Be careful when cleaning the packing bore. Scratches to the valve shaft (key 4) or inside diameter of packing bore may cause leakage.

3. Before installing new packing, clean the packing bore.
4. Install new packing one ring at a time, using the packing follower as a driver. If split packing is used, stagger seams every 90°.
5. Reinstall the packing follower and packing flange, secure nuts, and tighten as needed.

Figure 5. Standard Packing Configurations



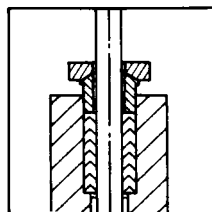
Note:

1 With conductive packing, the female adaptor in PTFE v-ring packing is carbon-filled PTFE.

Figure 6. 7-Ring, Reverse, Leak-off, and Lubricated Packing Configurations

THE FOLLOWING PACKING CONFIGURATIONS
ARE AVAILABLE FOR SPECIFIC APPLICATIONS:

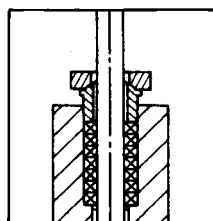
**CODE 1: PTFE STANDARD ON SOFT SEATED
AND CRYOGENIC VALVES**



**STANDARD 'V'
TYPE PACKING**

**CODE 2: GRAPHITE STANDARD ON METAL
SEATED AND FIRE SAFE VALVES**

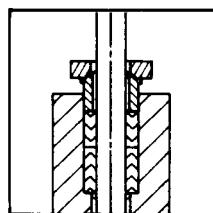
**CODE 3: PTFE STANDARD ON SOFT
SEATED VALVES**



**STANDARD SQUARE
TYPE JAM PACKING**

CODE 4: PTFE

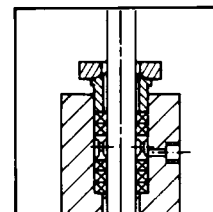
TO BE USED IN VACUUM SERVICE
BELOW 20 MICRONS



**STANDARD REVERSE 'V'
TYPE PACKING**

CODE 5: GRAPHITE

CODE 6: PTFE

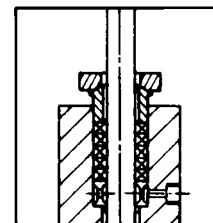


**STANDARD SQUARE
TYPE JAM PACKING
WITH LANTERN RING/
BLEED OFF CONNECTION**

CODE 7: GRAPHITE

CODE 8: PTFE

TO BE USED WHEN BEARING
GREASE CONNECTIONS ARE
REQUIRED

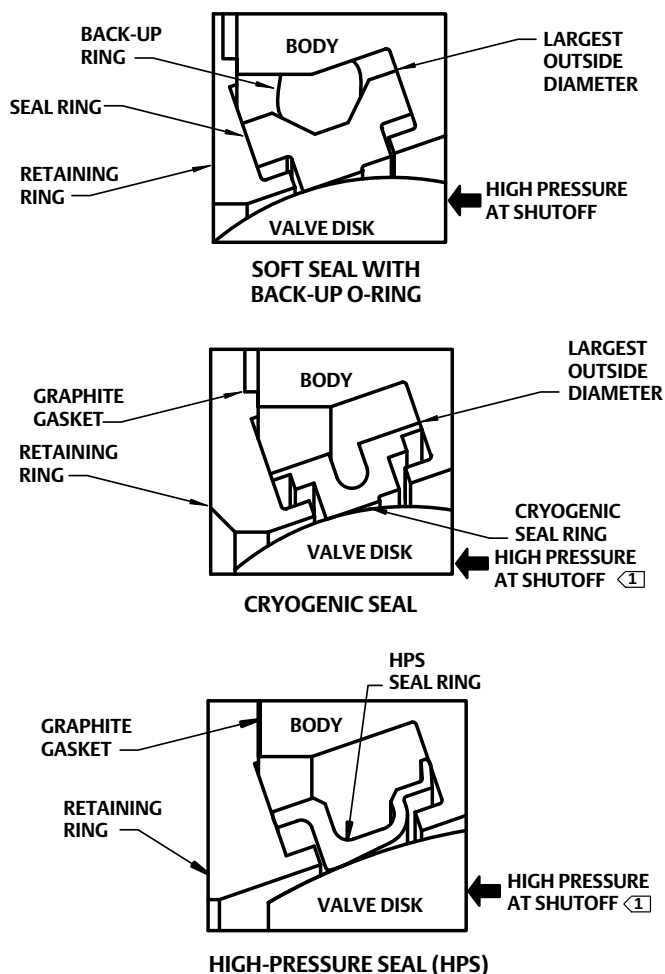


**STANDARD SQUARE
TYPE JAM PACKING
WITH LANTERN RING/
BEARING LUBRICATION
CONNECTION**

Seal Maintenance

1. After the valve has been removed from the line and the manual or power actuator has been removed, manually rotate the shaft (key 4) counter-clockwise until the disk has moved a full 180°. Note the “S” on the shaft is 180° from the “S” on the valve body.

Figure 7. Seal Configurations



E1701

Notes:

- ① This unidirectional seal must be installed so the ring is downstream from the high pressure side of the valve at shutoff, as shown.

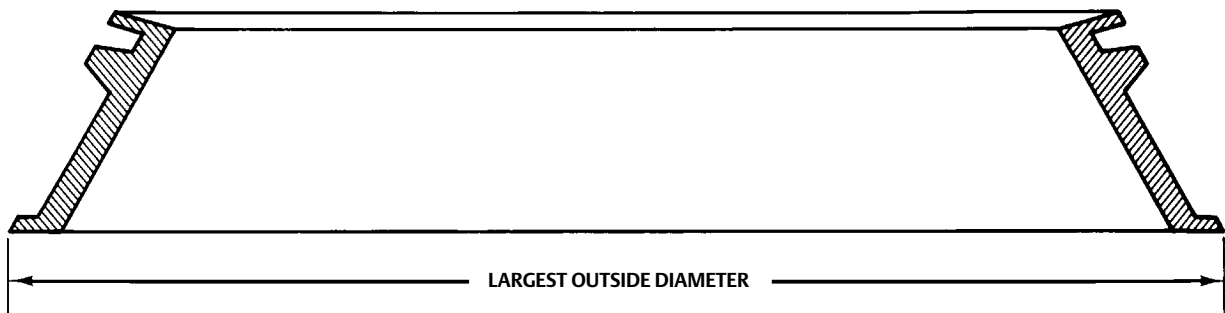
2. Lay the valve flat on a work bench in a secure position with the retaining ring (key 2) and retaining ring screws (key 22) facing up. Use blocks or other appropriate techniques to support the valve. Remove all retaining ring screws.
3. Remove the retaining ring by placing a retaining ring screw in each of the two retaining ring jack screw holes. With the appropriate tool, slowly rotate the screws until the retaining ring has been lifted from the valve body.

CAUTION

In the following step, use the appropriate tool to avoid damage to the seal or T-slot area of the valve.

4. Different valve types have different seal designs and components. To see the appropriate seal, refer to figure 7. Insert the appropriate tool under the top edge of seal and gently pry the seal out. Take care not to damage the seal or T-slot area of the valve body. After the seal has been removed, clean the T-slot area, retaining ring and, if required, polish the disk thoroughly with fine steel wool or other appropriate material.

Figure 8. Typical Seal Ring (Sectional)



Soft Seal Installation

1. Locate the replacement seal ring (key 8) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 8. Around the outside circumference is one wide groove.

Before installing the seal ring into the valve body, the backup ring (key 9) must first be placed onto the wide, outer groove of the seal ring.

2. The seal ring and backup ring assembly must be installed in the valve. The wider outside diameter of the seal ring goes into the T-slot area of the valve body, shown in figure 9. Start the wider diameter edge of the seal ring into the T-slot of the valve body using a blunt end screwdriver.
3. Carefully tuck the backup ring downward into the valve body T-slot until the seal ring and back-up ring are completely entrapped in the valve body T-slot.
4. When the seal is thoroughly seated, re-install the retaining ring and screws. Tighten the retaining screws just enough to eliminate vertical movement of the retaining ring. With the use of the blunt end tool, carefully tuck the lip of the seal ring under the retaining ring.
5. When the seal is under the lip of the retaining ring, tighten the screws according to standard procedures. Manually rotate the valve shaft clockwise 180° to return the disk to its closed position against the internal stop.
6. The final seating of the retaining ring screws can now be done. For the screw torque values, refer to table 6. The seal is now fully installed and the valve may be closed for installation or storage.

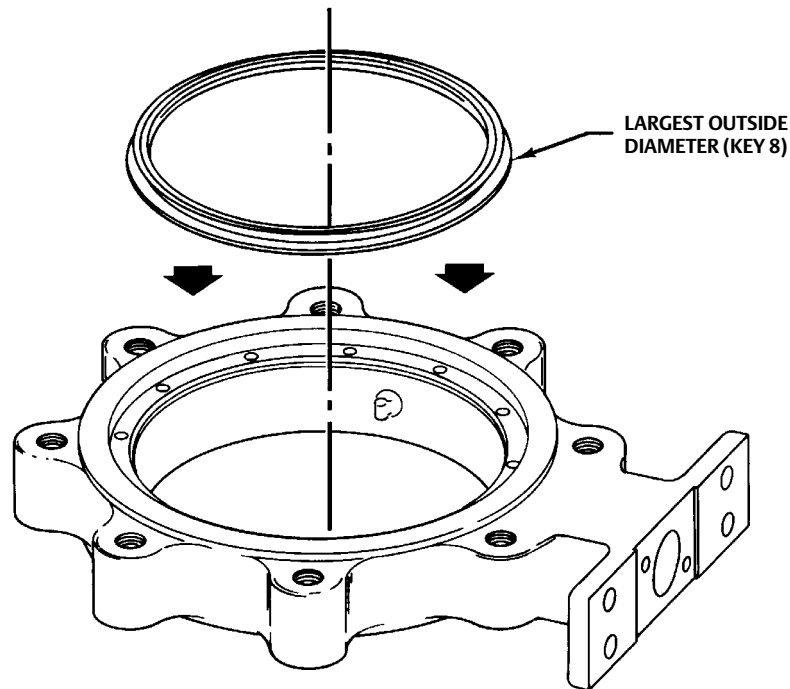
Seal Installation

For HPS seal installation:

Locate the replacement seal ring (key 8) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 8. Around the outside circumference is one wide groove.

Install the seal ring (key 8) into the valve body by first placing the wider outside diameter of the seal ring into the T-slot area of the valve body which is shown in figure 9.

Figure 9. Typical Seal Installation



A5251/JL

For Soft seal installation:

1. Locate the replacement seal ring (key 8) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 8. Around the outside circumference is one wide groove.

Install the seal ring in the valve body by first placing the wider outside diameter of the seal ring, as marked in figure 8, into the T-slot area of the valve body which is shown in figure 9. Seal rings without a back-up ring will fall into place. The back-up ring will have to be installed after placing the seal ring in the valve using a blunt end screwdriver. Do not use the screwdriver or seal tool directly on the seal ring. Use a tool only on the backup ring.

2. With the seal ring inserted all the way around the valve body T-slot now lay the backup ring into the opening between the valve body and the seal ring. Use the seal tool to apply pressure to the backup ring and carefully tuck the backup ring down into the T-slot between the valve body and the seal ring. Note: On larger valves, it may be more efficient to have someone hold down the seal ring while the backup ring is pushed into the T-slot.
3. Once the seal ring or seal and backup ring has been fully installed into the valve body T-slot, the retaining ring gasket (key 17) can be installed.

CAUTION

This gasket is a thin graphite material. Take care to avoid damaging the gasket. However, punch one initial screw hole through the gasket for alignment purposes.

4. Install the retaining ring and align the screw holes in the retaining ring with the holes in the valve body. Install the first retaining ring screw through the punched hole in the ring gasket. Install the other ring screws by pushing the screws through the graphite gasket and threading them into valve body.
5. Tighten the retaining ring screws just enough to eliminate vertical movement of the retaining ring. Do not tighten the retaining ring screws.

⚠ WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping large valve. Large valves must be properly supported during maintenance.

6. To complete this step, stand the valve up. Support the valve securely using methods appropriate for the valve size.

CAUTION

If a vise or other clamps are being used, be sure damage is not done to the flange gasket sealing area of the valve body.

7. Manually rotate the valve shaft to turn the disk clockwise to meet the seal.
8. Tap the disk with a rubber mallet to drive it against the internal travel stop. When the disk makes contact with the stop, manually rotate the disk counter-clockwise back out of the seal to a 90° open position. Repeat steps 7 and 8 three times.
9. The final seating of the retaining ring screws can be done. For the screw torque values, refer to table 6. The seal is now fully installed and the valve may be closed for installation or storage.

Cryogenic Seal Installation

1. Locate the replacement seal ring (key 8) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 8. Around the outside circumference is one wide groove.

For Kel-F seals with aluminum backup rings only: Now, locate the replacement V-ring. Please notice that the V-ring is similar in diameters to the seal ring. Place the V-ring down onto the seal ring with the larger diameter of the V-ring going first. Be sure the larger diameters on both rings are down.

2. **For all types:** Install the seal ring (or seal ring and V-ring) in the valve body by first placing the wider outside diameter of the seal ring into the T-slot area of the valve body. The seal ring with or without a back-up ring will fall into place.
3. Once the seal ring (or seal ring and V-ring) have been fully installed into the valve body T-slot, the retaining ring gasket can be installed.

CAUTION

This gasket is a thin graphite material. Take care to avoid damaging the gasket. However, punch one initial screw hole through the gasket for alignment purposes.

4. Install the retaining ring and align the screw holes in the retaining ring with the holes in the valve body. Install the first retaining ring screw through the punched hole in the ring gasket. Install the other ring screws by pushing the screws through the graphite gasket and threading them into the screw holes in the valve body.
5. Tighten the retaining ring screws just enough to eliminate vertical movement of the retaining ring. Do not tighten the retaining ring screws.

⚠ WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping large valve. Large valves must be properly supported during maintenance.

6. To complete this step, stand the valve up. Support the valve securely using methods appropriate for the valve size.

CAUTION

If a vise or other clamps are being used, be sure damage is not done to the flange gasket sealing area of the valve body.

7. Manually rotate the valve shaft to turn the disk clockwise to meet the seal.
8. Tap the disk with a rubber mallet to drive it against the internal travel stop. When the disk makes contact with the stop, manually rotate the disk counter-clockwise back out of the seal to a 90° open position. Repeat steps 7 and 8 three times.
9. The final seating of the retaining ring screws can be done. For the screw torque values, refer to table 4. The seal is now fully installed and the valve may be closed for installation or storage.

Valve Shaft/Disk Pin Unit Maintenance

Valve Shaft/Disk Pin Unit Removal

1. Rotate the disk (key 3) 180° counterclockwise from the full closed position.
2. Place the open valve horizontally on a suitable work surface with the retaining ring (key 2) facing upward. Be sure to properly support the valve with blocks while the shaft is being removed.

Note

The disk must be removed from the waterway side of the valve body, which is the side opposite the T-slot area. Support the valve and disk so the disk can be easily removed from the valve when the shaft is removed.

3. Use a pin extractor to remove the disk pins (key 6). Select the proper pin extractor tip with screws of proper thread size to match the thread size in the disk pins.
4. Screw the pin extractor tip into the pin as far as possible. With an upward, straight sliding motion, extract the pin. Repeat the same procedure for the other pins.

A threaded rod with an appropriate spacer and nut can also be used as an extractor tool. If using a threaded rod, choose a rod with threads that fit the inside threads of the pins. The rod should extend several inches above the disk when screwed into a pin.

5. After screwing the rod into the pin, slide the spacer over the rod and pin. Thread the nut onto the rod and tighten. As the nut is tightened, it will drive the spacer against the disk and the increasing pressure will draw the pin from the disk.
6. Loosen the packing nuts (key 16).

7. Extract the shaft (key 4) by hand-pulling or by using the pin extractor screwed into the end of the shaft.

Table 4. Torque Values for Fasteners

Fastener Nominal Size	N•m	In•lb	Ft•lb
#10	4	35	---
1/4	9	81	---
5/16	19	167	---
3/8	33	295	---
7/16	53	---	39
1/2	80	---	59
9/16	117	---	86
5/8	161	---	119
3/4	286	---	211
7/8	447	---	330
1	651	---	480
1-1/8	837	---	617

CAUTION

In the following step, remove the disk from the waterway side of the valve to avoid damage to the disk or T-slot area.

8. Remember: the disk must be removed from the waterway side of the valve. Do not try to force the disk through the seal side of the valve. This could cause severe damage to the disk and T-slot area.

After removing the shaft, remove the disk.

Valve Shaft/Disk Pin Unit Installation

Note

Replacement disk and shaft(s) are provided as a matched set. When replacing either the disk or shaft(s), a matched set is required.

To replace the disk pin assembly (key 6), reverse the removal steps used above.

Before placing disk into a valve body, properly align the top of the disk with the top of the valve. A "T" is stamped on the disk to indicate alignment. Be sure holes in the shaft are exactly aligned with the holes in the disk before re-installing pins. After pins are fully seated in the disk, use a punch or small chisel to stake the pins at three points. This will prevent the pins from working free and out of the disk due to vibration.

Bearing Maintenance

Bearing Removal

To get access to the bearings (key 10), the disk and shaft assembly (keys 3, 4 and 5) must be removed from the valve. The bearings (key 10) may be removed by using a brass drift punch and lightly tapping them out. In valves without lower bonnets, the lower bearing is removed by grasping it and pulling upwards. Also, cryogenic valves have an outboard bearing under the packing. Refer to the Packing Maintenance section for instructions.

Bearing Installation

Before installation of the bearings, bearing bores should be solvent cleaned and bearings will slip in.

Parts Ordering

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher instrument. The use of components not manufactured by Emerson Automation Solutions may void your warranty, might adversely affect the performance of the instrument, and could result in personal injury or property damage.

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

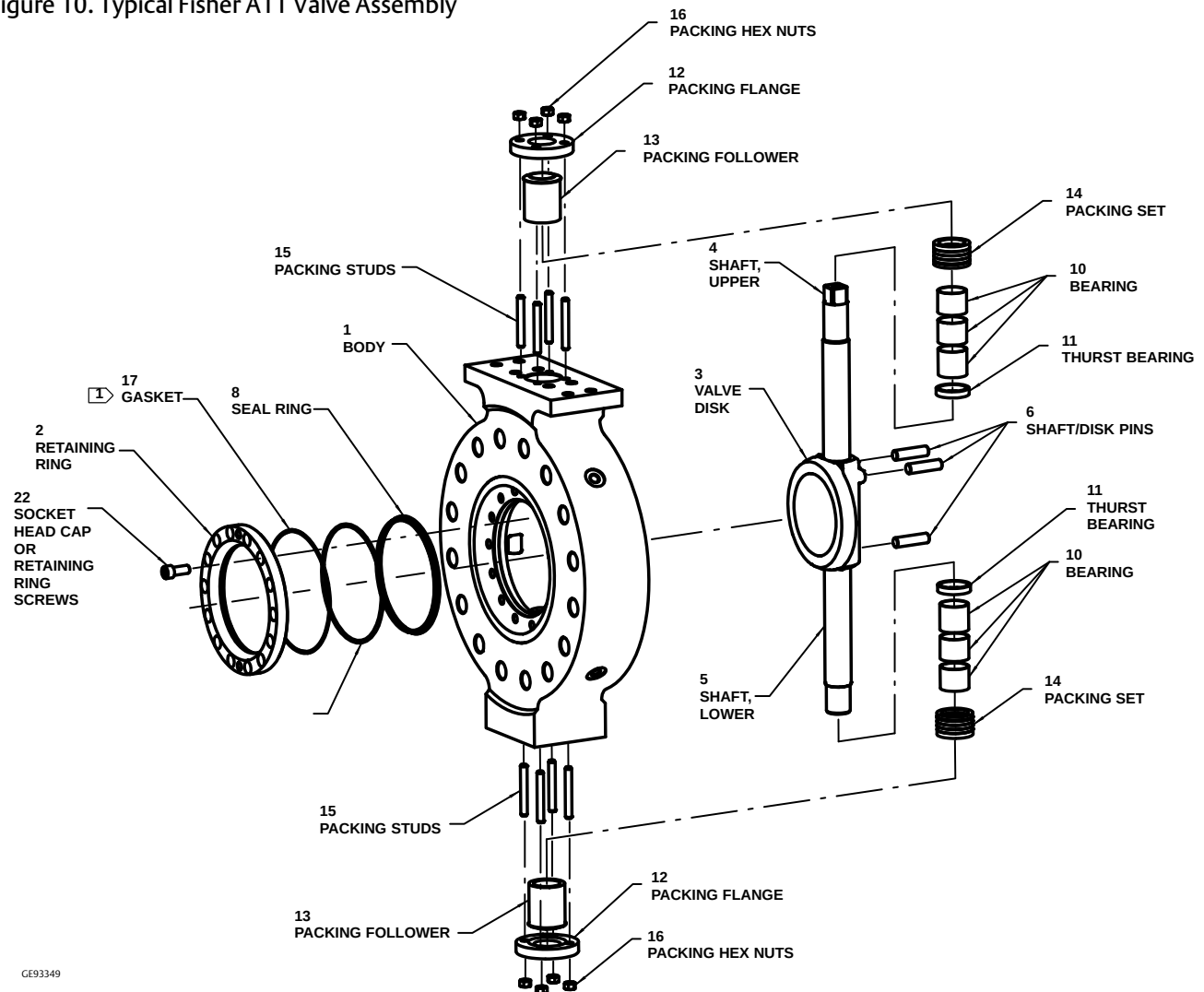
Key	Description
1	Valve Body
2	Retaining Ring
7*	Key (Not Shown)
8*	Seal Ring
9	Back-up Ring
10*	Bearing
11*	Thrust Bearing (Not Shown)
12	Packing Flange
13	Packing Follower
14*	Packing Set
15	Stud
16	Hex Nut
17*	Gasket (Retainer Ring) w/Metal and Phoenix III Seals
20	Lockwasher, retaining ring assembly S31600
20	Lockwasher, packing assembly
21	Hex Head Bolt (Not Shown)
22	Socket Head Cap or Retaining Ring Screws
24	Nameplate (Not shown)
26	Packing Spacer (Not shown)
27	Drive Screw (Not Shown)
28*	Disk/Shaft Assembly
29	Label
33	Flow Arrow (Not Shown)
---	Line Bolting

ENVIRO-SEAL Packing Parts

Parts shown are used in standard and NACE constructions.

Key	Description
100	Stud
101	Hex Nut
102	Packing Flange
103	Spring Pack
105*	Packing Set
106*	Anti-Extrusion Ring (2 req'd)
107	Packing Box Ring
111	Tag
112	Cable Tie
113	Lubricant

Figure 10. Typical Fisher A11 Valve Assembly



GE93349

Note:
 1 Not required for soft seated valves.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

A11 Valve
February 2019

Instruction Manual
D104223X012

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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A11 Valve

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A11 Valve

February 2019

Instruction Manual

D104223X012

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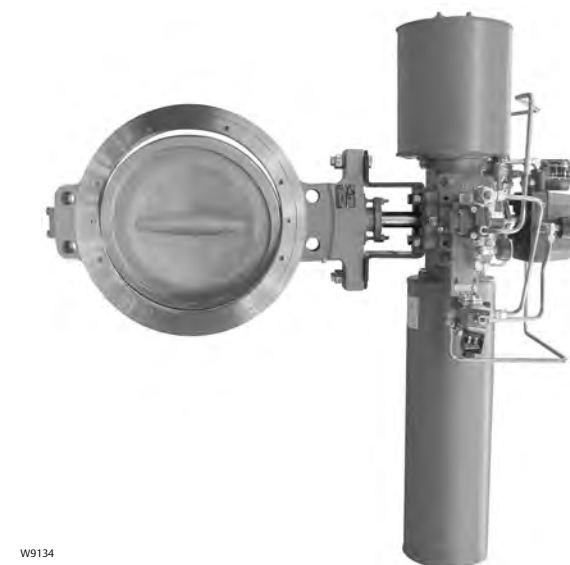


Fisher™ A11 High-Performance Butterfly Valve, NPS 30-72

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Figure 1. Fisher A11 Valve



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for Fisher A11 High Performance Butterfly Valves (figure 1) in CL150 and 300. For information about the actuator and accessories, please refer to the separate instruction manuals for these items.



Do not install, operate, or maintain an A11 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

Available Configurations**Valve Sizes**

CL150 and 300: Size ■ 30, ■ 36, ■ 42 and ■ 48-inch

Valve Body: Wafer-style and lugged style in ■ CL150/150, ■ 150, and ■ 300

Consult your [Emerson sales office](#) for larger sizes.

Maximum Inlet Pressure

Consistent with applicable ASME class pressure/temperature ratings per ASME B16.34 unless such ratings are limited by material temperature capabilities.

Construction Materials

Refer to Bulletin 51.6:A11, A11 High-Performance Butterfly Valve, NPS 30-72, (D104165X012)

Disk Rotation

Clockwise (CW) to close

Valve Body Classification

Valve bodies are designed for installation between standard pipe flanges: ASME B16.47 Class A and

MSS-SP-44

NPS 30 through 48: CL150 and 300

Consult your Emerson sales office for ASME B16.47 Series B (API 605).

Seal Temperature Capabilities

PTFE (Standard) Seal: For application ranges from -62 to 232°C (-80 to 450°F)

Phoenix III Seal: For application ranges from -73 to 232°C (-100 to 450°F)

High-Temperature Seals:

Standard: Metal or NOVEX to 820°C (1500°F)

Optional: 17-4PH H1150M to 454°C (850°F)

Cryogenic Seals:

CTFE: -254 to 149°C (-425 to 300°F)

NOVEX: -254 to 260°C (-425 to 500°F)

Approximate Weights

See table 2

Available Actuators

- Spring-return pneumatic actuators,
- double-acting pneumatic actuators,
- electric actuators, and
- handwheel

Description

A11 High Performance Butterfly Valves are available in either a flangeless wafer or a lugged design, with a variety of seal, valve body, and internal components. These valves feature a dynamic sealing design that is used in a variety of demanding applications.

Educational Services

Emerson
Educational Services - Registration
Phone: 1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104166X012

A11 Valve

April 2023

Table 2. Approximate Weight for NPS 30 through 72 Valves

VALVE SIZE, NPS	CL150		CL150/150		CL300	
	Wafer	Lugged	Wafer	Lugged	Wafer	Lugged
kg						
30	528	736	365	525	952	1406
36	806	1120	626	897	1315	1989
42	1302	1550	1100	1328	2263	2726
48	1904	2248	1604	1907	3056	4177
54	2197	2790	2150	2893	---	---
60	(1)	(1)	2417	3267	---	---
66	(1)	(1)	3903	5117	---	---
72	(1)	(1)	(1)	(1)	---	---
lbs						
30	1164	1623	805	1157	2100	3100
36	1778	2470	1380	1978	2900	4385
42	2871	3418	2425	2928	4989	6009
48	4198	4955	3537	4204	6737	9209
54	4844	6151	4747	6379	---	---
60	(1)	(1)	5329	7203	---	---
66	(1)	(1)	8604	11,282	---	---
72	(1)	(1)	(1)	(1)	---	---

1. Consult your Emerson Automation Solutions sales office for information.

Specifications

Specifications are shown in table 1 and the specifications for a given valve are stamped on a nameplate attached to the valve.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Note

When installing a valve after it has been in long-term storage, cycle the valve at least ten times to re-energize the dynamic seal.

Please contact your [Emerson sales office](#) if you have any questions about preparing a valve for storage or if you are planning to put into service a valve that has been stored for some time.

Adjusting the Travel Stops

NOTICE

When using manual or power actuators, adjust the actuator travel stops so the disk stop in the valve body does not absorb the output of the actuator.

For actuators without travel stops, the actuator must be properly mounted to prevent it from driving the valve disk against the valve disk travel stop.

Failure to limit actuator travel as described in this section can result in damage to the valve shafts or other valve parts.

Note

An “S” is visible on both the valve shaft and valve body. When the valve disk is closed, the “S” on the shaft aligns with the “S” on the valve body.

Locate the actuator travel stop that establishes the closed position of the valve disk. When adjusting the travel stop make sure that the disk is from 0 to 0.76 mm (0 to 0.030 inch) away from the internal stop in the valve body. This adjustment is necessary to be certain that the actuator output torque is fully absorbed by the actuator travel stop rather than the stop in the valve body.

For actuators without travel stops, the actuator must be properly mounted to prevent it from driving the valve disk against the valve disk travel stop.

1. To mount an actuator without travel stops, first, if necessary, remove the actuator from the valve. Then, position the valve disk from 0 to 0.76 mm (0 to 0.030 inch) away from the internal stop in the valve body.
2. Now, travel the actuator to the maximum position. Keep the actuator in the maximum travel position. Return the actuator to the valve, taking care not to disturb the position of the valve disk.
3. Mount the actuator on the valve using proper bolts with locking washers to achieve a secure fit.
4. Before installing the valve/actuator assembly in the process line, cycle the valve several times to be sure the valve disk returns to the proper position.

Preparing for Installation

⚠ WARNING

If the A11 valve is equipped with a fail-open actuator, remove the actuator before installing the valve/actuator assembly or cycle the valve into the fully closed position. Then, to avoid possible personal injury or property damage, take appropriate steps to ensure that the actuator does not cause the valve to open during installation.

1. If the valve and actuator have been purchased separately or if the actuator has been removed for storage, travel stop adjustment, or maintenance, mount the actuator before inserting the valve/actuator assembly into the line. Refer to the actuator instruction manual for mounting and adjustment procedures.

NOTICE

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag, or other foreign material from the pipeline.

- Remove the protective end covers from the valve and inspect the valve body to be certain that it is free of foreign material. Also, be certain that adjacent pipelines are free of any foreign material, such as pipe scale or welding slag that could damage the valve seating surfaces.

NOTICE

The A11 valve is designed for use with the appropriate piping schedule for the ASME class. However, before putting the valve into operation, measure carefully to ensure disk rotation without interference from piping or flanges. Be certain to center the valve accurately to prevent interference of the disk with the flanges.

Damage to the disk will occur if any pipe flanges or piping connected to the valve interfere with the disk rotation path. Measure carefully to be certain the disk rotates without interference before putting the valve into operation.

⚠ WARNING

The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injuries, stay clear of the disk edges when rotating the disk.

- Select the appropriate gaskets for the application. flexible graphite, spiral wound, or other gasket types, made to ASME B16.5 group or user's standard, can be used on A11 valves depending on the service conditions of the application. Note: spiral wound gaskets, when properly centered, will cover more than 60 percent of the gasket area at the retaining ring screws.

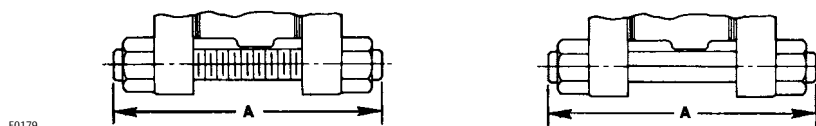
For metal-seated and cryogenic valve gasket recommendations, please contact your [Emerson sales office](#).

- Refer to the appropriate table for the quantity and size of flange bolts required (table 3 or 4) and proceed with the following instructions.

Valve Orientation

A11 valve bodies are designed for installation with the shaft in any orientation around the pipeline: horizontal, vertical, or at an angle. However, when installing an A11 valve, please follow these recommendations.

Figure 2. View of Stud Bolts



- In certain services (process fluids with high concentrations of entrained solids, abrasive slurries, or polymerizing media), valve performance will be enhanced by installing the valve with the shaft horizontal to the pipeline.
- Valves supplied for unidirectional shutoff should be installed with the high pressure at the back (waterway side) of the disk. A flow tag with an arrow is provided for proper installation.

The High Performance Butterfly Valve is designed to allow flow in either direction when in the open position. When in the closed position, high pressure should be applied to a specific side of the disk to provide best performance and optimal service life.

- Valves supplied for bidirectional shutoff, such as soft or Phoenix III, under normal operating conditions can (at different times) experience pressure in both directions; the highest of the two pressures should be exerted on the preferred side of the disk. If the two pressures are equal, then the one lasting the longest period of time should be applied to the preferred side. A flow tag with an arrow is provided for proper installation.

If you have questions about proper valve orientation in a specific application, contact your [Emerson sales office](#).

Table 3. Stud Bolt and Cap Screw Data for Wafer Style Valves

CL150 and 150/150				
Valve Size, NPS	30	36	42	48
Number of Stud Bolts	24	28	32	40
Number of Cap Screws	8	8	8	8
Size-Diameter Inch - Thread	1-1/4 - 8	1-1/2 - 8	1-1/2 - 8	1-1/2 - 8
A-Length of Stud Bolts, Inch	15-1/2	18	20-3/4	22-3/4
B-Length of Cap Screw, Inch	4-1/2	5-1/4	6	6-1/2
CL300				
Valve Size, NPS	30	36	42	48
Number of Stud Bolts	24	28	28	28
Number of Cap Screws	8	8	8	8
Size-Diameter Inch - Thread	1-3/4 - 8	2 - 8	1-5/8 - 8	1-7/8 - 8
A-Length of Stud Bolts, Inch	21-1/2	24-1/4	26	32
B-Length of Cap Screw, Inch	5-3/4	6-1/2	7-1/4	8

Table 4. Stud Bolt and Cap Screw Data for Lugged Style Valves

CL150 and 150/150				
Valve Size, NPS	30	36	42	48
Number of Cap Screws	56	64	72	88
Size-Diameter Inch - Thread	1-1/4 - 8	1-1/2 - 8	1-1/2 - 8	1-1/2 - 8
B-Length of Cap Screw, Inch	4-1/2	5-1/4	6-1/4	6-1/2
CL300				
Valve Size, NPS	30	36	42	48
Number of Cap Screws	56	64	64	64
Size-Diameter Inch - Thread	1-3/4 - 8	2 - 8	1-5/8 - 8	1-7/8 - 8
B-Length of Cap Screw, Inch	5-3/4	6-1/2	6	8-1/4

Installing the Valve

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given in this manual, the limits on the appropriate nameplates, or the matching pipe flange rating. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

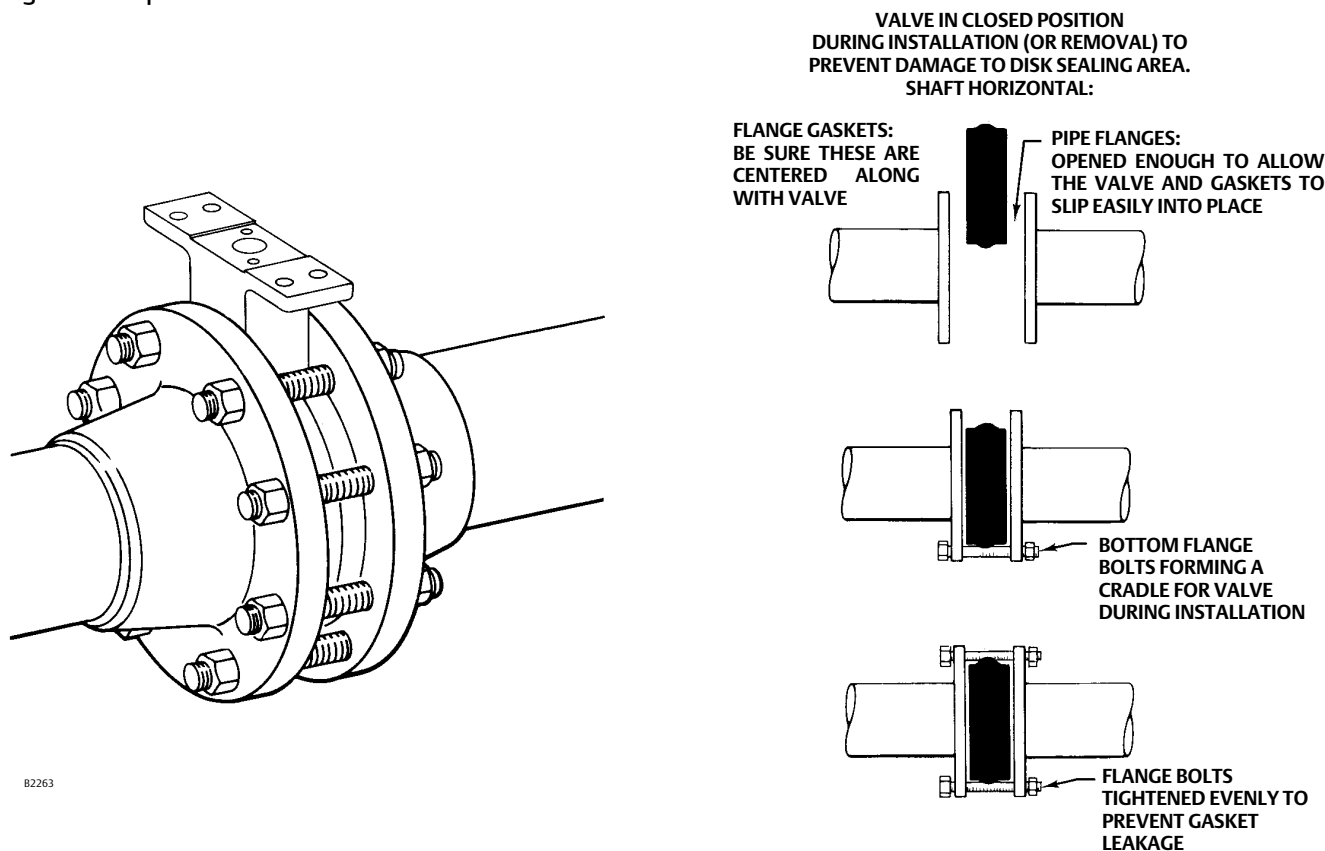
Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions indicated when the valve was ordered. Because some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

Figure 3. Proper Installation Procedure



For Wafer Style Valves:

1. See figure 3. Install the lower flange bolts first to form a cradle for the valve.
2. Properly orient the valve according to the specific application. Be sure the valve is placed in the line so the flow properly enters the valve. Then, install the valve and the gaskets between the flanges into the cradle formed by the flange bolts.
3. Install the remaining flange bolts, making sure that the gaskets are centered on the gasket sealing surfaces of the flange and valve body.
4. Tighten the flange bolts in an alternating criss-cross fashion to a torque value of one-fourth of the final bolting torque. Repeat this procedure several times increasing the torque value each time by a fourth of the final desired torque. When the final torque value has been applied, tighten each flange bolt again to allow for gasket compression.

For Lugged Valves:

1. Position the valve between the flanges. Be sure to leave enough room for the flange gaskets; then install the lower flange bolts.
2. Install the gaskets and align the valve and the gaskets.
3. Install the remaining bolts.
4. Tighten the flange bolts in an alternating criss-cross fashion to a torque value of one-fourth of the final bolting torque. Repeat this procedure several times increasing the torque value each time by a fourth of the final desired torque. When the final torque value has been applied, tighten each flange bolt again to allow for gasket compression.

Packing Adjustment and Shaft Bonding

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

1. For PTFE or graphite packing: Tighten standard packing follower nuts only enough to prevent shaft leakage. Excessive tightening of packing will accelerate wear and could produce higher rotating friction loads on the valve shaft. If necessary, refer to the Packing Maintenance section.
2. For live-loaded packing: These packing systems will not require this initial re-adjustment.
3. For hazardous atmosphere or oxygen service valves, read the following Warning, and provide the bonding strap assembly mentioned below if the valve is used in an explosive atmosphere.

⚠ WARNING

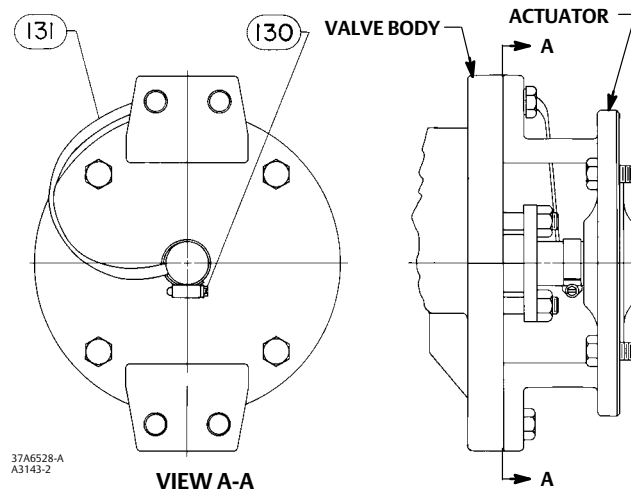
The valve drive shaft is not necessarily grounded to the pipeline when installed. Personal injury or property damage could result, if the process fluid or the atmosphere around the valve is flammable, from an explosion caused by a discharge of static electricity from the valve components. If the valve is installed in a hazardous area, electrically bond the drive shaft to the valve body.

Note

The packing is composed of all conductive packing rings (graphite ribbon packing) or partially conductive packing rings (carbon-filled PTFE female adaptor with PTFE V-ring packing or graphite-composition packing ring with PTFE/composition packing) to electrically bond the shaft to the valve for hazardous area service. For oxygen service applications, and hazardous area service where the standard packing doesn't provide sufficient shaft-to-valve body bonding, provide alternate shaft-to-valve body bonding according to the following step.

4. Attach the bonding strap assembly (key 131, figure 4) to the shaft with the clamp (key 130, figure 4).
5. Connect the other end of the bonding strap assembly to the valve flange cap screws.
6. For more information, refer to the Packing Maintenance section below.

Figure 4. Optional Shaft-to-Body Bonding Strap Assembly



Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure.
- Use lockout procedures to be sure the above measures stay in effect while you work on the equipment.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- The valve packing area may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

NOTICE

When using an actuator, the actuator travel stop (or actuator, for actuators without adjustable stops) must be adjusted so the disk stop in the valve does not absorb the output of the actuator. Failure to limit the actuator travel can result in damage to the valve, shaft(s), or other valve components.

Removing the Valve

For field repair, remove the valve from the pipeline.

⚠ WARNING

Using the procedures listed in the above **WARNING**, loosen the flange bolting that holds the valve. Make sure the valve cannot slip or twist while the bolting is being loosened and removed.

NOTICE

Damage to the disk can occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, stroke the actuator to place the disk in the closed position while removing the valve from the pipeline.

7. Before removing the valve from the pipeline, make sure the valve disk is closed. See figure 3. Rotate the shaft clockwise until the disk makes contact with the internal stop or actuator travel stop (if still installed). The “S” stamped on the shaft should be aligned with the “S” on the valve body.
8. After removing the valve from the pipeline, move it to an appropriate work area. Remove the actuator from the valve.

Packing Maintenance

The A11 valve is designed so the shaft packing can be replaced without removing the valve from the process pipeline. Refer to figure 8 for available packing configurations and figure 9 for part key numbers.

NOTICE

The packing flange should be tightened only enough to prevent shaft leakage. Excessive tightening will only accelerate wear of the packing and could produce higher torques on the valve.

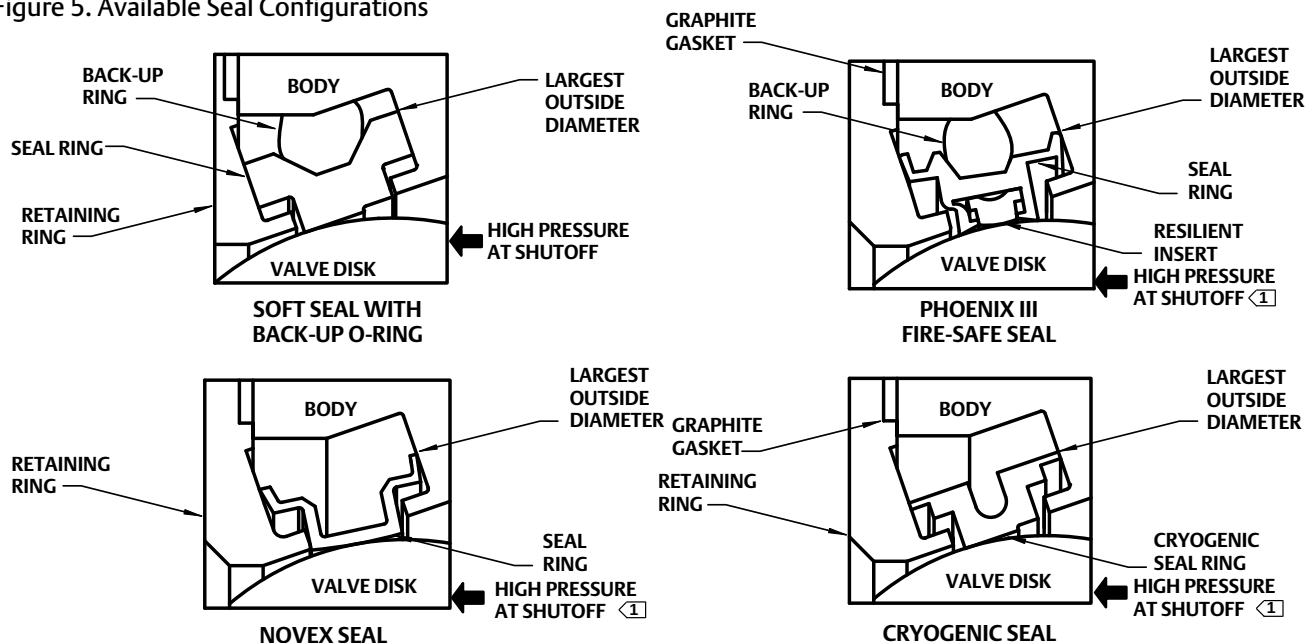
In most cases, packing leakage can be eliminated by merely tightening the hex nuts located above the packing flange while the valve is in the pipeline. However, if leakage continues, the packing must be replaced.

1. Before loosening any parts on the valve, be sure the pipeline has been depressurized. Then, remove packing nuts (key 16), lift off the packing flange (key 12) and packing follower (key 13). The packing (key 14) is now accessible.
2. Use a packing extractor to remove packing. Insert the corkscrew-like end of the tool into the first piece of packing and firmly remove. Repeat this process until all has been removed.

⚠ WARNING

Be careful when cleaning the packing bore. Scratches to the valve shaft (key 4) or inside diameter of packing bore may cause leakage.

Figure 5. Available Seal Configurations



E0578

Note:

⏏ This unidirectional seal must be installed so that the retaining ring is downstream from the high pressure side of the valve at shutoff, as shown.

- Before installing new packing, clean the packing bore.
- Install new packing one ring at a time, using the packing follower as a driver. If split packing is used, stagger seams every 90°.
- Reinstall the packing follower and packing flange, secure nuts, and tighten as needed.

Seal Maintenance

- After the valve has been removed from the line and the manual or power actuator has been removed, manually rotate the shaft (key 4) counter-clockwise until the disk has moved a full 180°. Note that the “S” on the shaft is 180° from the “S” on the valve body.
- Lay the valve flat on a work bench in a secure position with the retaining ring (key 2) and retaining ring screws (key 22) facing up. Use blocks or other appropriate techniques to support the valve. Remove all retaining ring screws.
- Remove the retaining ring by placing a retaining ring screw in each of the two retaining ring jack screw holes. With the appropriate tool, slowly rotate the screws until the retaining ring has been lifted from the valve body.

NOTICE

In the following step, use the appropriate tool to avoid damage to the seal or T-slot area of the valve.

- Different valve types have different seal designs and components. To see the appropriate seal, refer to figure 5. Insert the appropriate tool under the top edge of seal and gently pry the seal out. Take care not to damage the seal or T-slot area of the valve body. After the seal has been removed, clean the T-slot area, retaining ring and, if required, polish the disk thoroughly with fine steel wool or other appropriate material.

Soft Seal Installation

1. Locate the replacement seal ring (key 8) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 6. Around the outside circumference is one wide groove.

Before installing the seal ring into the valve body, the backup ring (key 9) must first be placed onto the wide, outer groove of the seal ring.

2. The seal ring and backup ring assembly must be installed in the valve. The wider outside diameter of the seal ring goes into the T-slot area of the valve body, shown in figure 7. Start the wider diameter edge of the seal ring into the T-slot of the valve body using a blunt end screwdriver.
3. Carefully tuck the backup ring downward into the valve body T-slot until the seal ring and back-up ring are completely entrapped in the valve body T-slot.
4. When the seal is thoroughly seated, re-install the retaining ring and screws. Tighten the retaining screws just enough to eliminate vertical movement of the retaining ring. With the use of the blunt end tool, carefully tuck the lip of the seal ring under the retaining ring.
5. When the seal is under the lip of the retaining ring, tighten the screws according to standard procedures. Manually rotate the valve shaft clockwise 180° to return the disk to its closed position against the internal stop.
6. The final seating of the retaining ring screws can now be done. For the screw torque values, refer to table 6. The seal is now fully installed and the valve may be closed for installation or storage.

Metal and Phoenix III Seal Installation

For metal seal installation:

Locate the replacement seal ring (key 8) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 6. Around the outside circumference is one wide groove.

Install the seal ring (key 8) into the valve body by first placing the wider outside diameter of the seal ring into the T-slot area of the valve body which is shown in figure 7. Metal seals without a back-up ring will fall into place. Metal seals with a back-up ring (key 9) will have to be installed following the instructions given below for the Phoenix III seal with back-up ring.

Figure 6. Typical Seal Ring (Sectional)

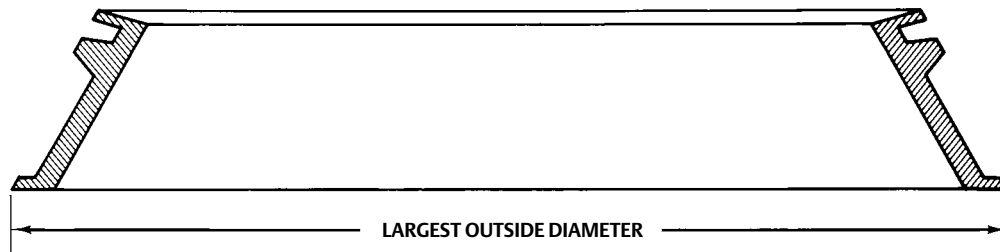
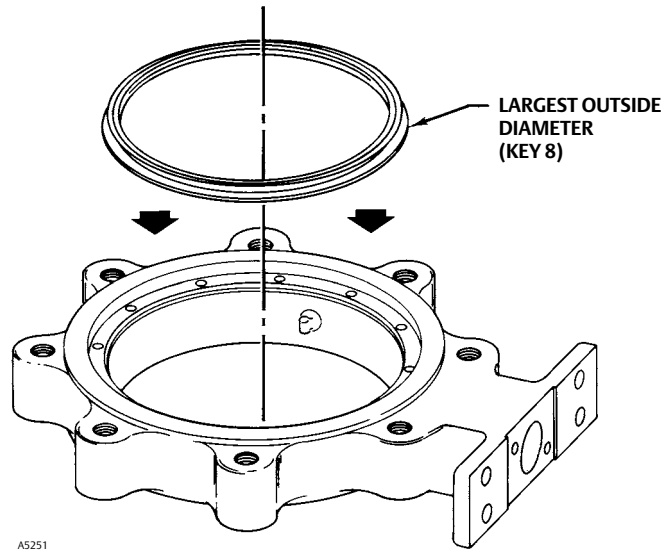


Figure 7. Typical Seal Installation



For Phoenix III seal installation:

1. Locate the replacement seal ring (key 8) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 6. Around the outside circumference is one wide groove.

Install the seal ring in the valve body by first placing the wider outside diameter of the seal ring, as marked in figure 6, into the T-slot area of the valve body which is shown in figure 7. Phoenix III seal rings without a back-up ring will fall into place. If the Phoenix III seal uses a back-up ring (key 9), the back-up ring will have to be installed after placing the seal ring in the valve using a blunt end screwdriver. Do not use the screwdriver directly on the metal seat. Use a tool only on the backup ring.

2. With the seal ring inserted all the way around the valve body T-slot now lay the backup ring into the opening between the valve body and the seal ring. Use the screwdriver to apply pressure to the backup ring and carefully tuck the backup ring down into the T-slot between the valve body and the seal ring. Note: On larger valves, it may be more efficient to have someone hold down the seal ring while the backup ring is pushed into the T-slot.
3. Once the seal ring or seal and backup ring has been fully installed into the valve body T-slot, the retaining ring gasket (key 17) can be installed.

NOTICE

This gasket is a thin graphite material. Take care to avoid damaging the gasket. However, punch one initial screw hole through the gasket for alignment purposes.

4. Install the retaining ring and align the screw holes in the retaining ring with the holes in the valve body. Install the first retaining ring screw through the punched hole in the ring gasket. Install the other ring screws by pushing the screws through the graphite gasket and threading them into valve body.
5. Tighten the retaining ring screws just enough to eliminate vertical movement of the retaining ring. Do not tighten the retaining ring screws.

⚠ WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping large valve. Large valves must be properly supported during maintenance.

6. To complete this step, stand the valve up. Support the valve securely using methods appropriate for the valve size.

NOTICE

If a vise or other clamps are being used, be sure damage is not done to the flange gasket sealing area of the valve body.

7. Manually rotate the valve shaft to turn the disk clockwise to meet the seal.
8. Tap the disk with a rubber mallet to drive it against the internal travel stop. When the disk makes contact with the stop, manually rotate the disk counter-clockwise back out of the seal to a 90° open position. Repeat steps 7 and 8 three times.
9. The final seating of the retaining ring screws can be done. For the screw torque values, refer to table 6. The seal is now fully installed and the valve may be closed for installation or storage.

Cryogenic Seal Installation

1. Locate the replacement seal ring (key 8) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 6. Around the outside circumference is one wide groove.

For Kel-F seals with aluminum backup rings only: Now, locate the replacement V-ring. Please notice that the V-ring is similar in diameters to the seal ring. Place the V-ring down onto the seal ring with the larger diameter of the V-ring going first. Be sure the larger diameters on both rings are down.

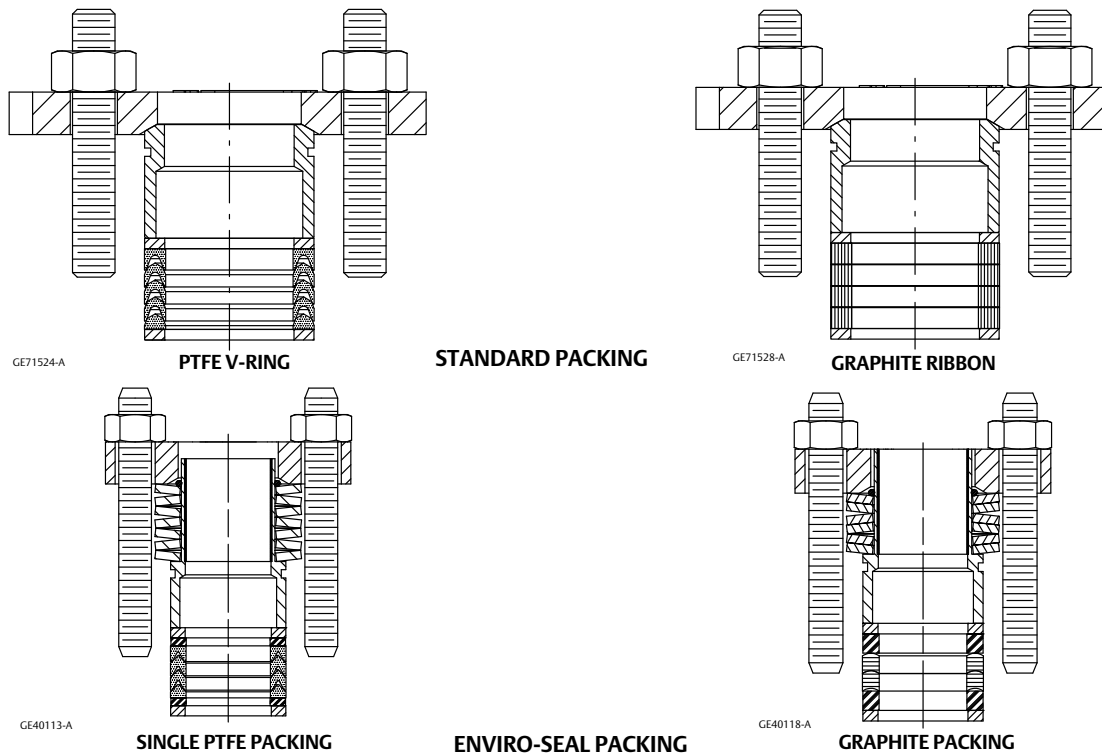
2. **For all types:** Install the seal ring (or seal ring and V-ring) in the valve body by first placing the wider outside diameter of the seal ring into the T-slot area of the valve body. The seal ring with or without a back-up ring will fall into place.
3. Once the seal ring (or seal ring and V-ring) have been fully installed into the valve body T-slot, the retaining ring gasket can be installed.

NOTICE

This gasket is a thin graphite material. Take care to avoid damaging the gasket. However, punch one initial screw hole through the gasket for alignment purposes.

4. Install the retaining ring and align the screw holes in the retaining ring with the holes in the valve body. Install the first retaining ring screw through the punched hole in the ring gasket. Install the other ring screws by pushing the screws through the graphite gasket and threading them into the screw holes in the valve body.
5. Tighten the retaining ring screws just enough to eliminate vertical movement of the retaining ring. Do not tighten the retaining ring screws.

Figure 8. Packing Configurations



Note:

1 With conductive packing, the female adaptor in PTFE v-ring packing is carbon-filled PTFE.

⚠ WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping large valve. Large valves must be properly supported during maintenance.

6. To complete this step, stand the valve up. Support the valve securely using methods appropriate for the valve size.

NOTICE

If a vise or other clamps are being used, be sure damage is not done to the flange gasket sealing area of the valve body.

7. Manually rotate the valve shaft to turn the disk clockwise to meet the seal.
8. Tap the disk with a rubber mallet to drive it against the internal travel stop. When the disk makes contact with the stop, manually rotate the disk counter-clockwise back out of the seal to a 90° open position. Repeat steps 7 and 8 three times.
9. The final seating of the retaining ring screws can be done. For the screw torque values, refer to table 5. The seal is now fully installed and the valve may be closed for installation or storage.

Valve Shaft/Disk Pin Unit Maintenance

Valve Shaft/Disk Pin Unit Removal

1. Rotate the disk (key 3) 180° counterclockwise from the full closed position.
2. Place the open valve horizontally on a suitable work surface with the retaining ring (key 2) facing upward. Be sure to properly support the valve with blocks while the shaft is being removed.

Note

The disk must be removed from the waterway side of the valve body, which is the side opposite the T-slot area. Support the valve and disk so the disk can be easily removed from the valve when the shaft is removed.

3. Use a pin extractor to remove the disk pins (key 6). Select the proper pin extractor tip with screws of proper thread size to match the thread size in the disk pins.
4. Screw the pin extractor tip into the pin as far as possible. With an upward, straight sliding motion, extract the pin. Repeat the same procedure for the other pins.

A threaded rod with an appropriate spacer and nut can also be used as an extractor tool. If using a threaded rod, choose a rod with threads that fit the inside threads of the pins. The rod should extend several inches above the disk when screwed into a pin.

5. After screwing the rod into the pin, slide the spacer over the rod and pin. Thread the nut onto the rod and tighten. As the nut is tightened, it will drive the spacer against the disk and the increasing pressure will draw the pin from the disk.
6. Loosen the packing nuts (key 16).
7. Valves with a two-piece shaft use a gasket retainer, which must be removed before removing the lower shaft.
8. Extract the shaft (key 4) by hand-pulling or by using the pin extractor screwed into the end of the shaft.

Table 5. Torque Values for Fasteners

Fastener Nominal Size	N•m	In•lb	Ft•lb
#10	4	35	---
1/4	9	81	---
5/16	19	167	---
3/8	33	295	---
7/16	53	---	39
1/2	80	---	59
9/16	117	---	86
5/8	161	---	119
3/4	286	---	211
7/8	447	---	330
1	651	---	480
1-1/8	837	---	617

NOTICE

In the following step, remove the disk from the waterway side of the valve to avoid damage to the disk or T-slot area of the valve.

9. Remember: the disk must be removed from the waterway side of the valve. Do not try to force the disk through the seal side of the valve. This could cause severe damage to the disk and T-slot area.

After removing the shaft, remove the disk.

Valve Shaft/Disk Pin Unit Installation

Note

Replacement disk and shaft(s) are provided as a matched set. When replacing either the disk or shaft(s), a matched set is required.

To replace the disk pin assembly (key 6), reverse the removal steps used above.

Before placing disk into a valve body, properly align the top of the disk with the top of the valve. A “T” is stamped on the disk to indicate alignment. Be sure holes in the shaft are exactly aligned with the holes in the disk before re-installing pins. After pins are fully seated in the disk, use a punch or small chisel to stake the pins at three points. This will prevent the pins from working free and out of the disk due to vibration.

Gasket Retainer

A gasket retainer assembly must be used. The gasket is held in place by a gasket retainer and four hex head bolts and lockwashers. When re-assembling the valve, this gasket should always be replaced. Be sure the gasket is centered over the shaft bore before retightening bolts. Tighten down bolts evenly in a cross over pattern or in a star pattern. Refer to table 5 for proper torque values.

Bearing Maintenance

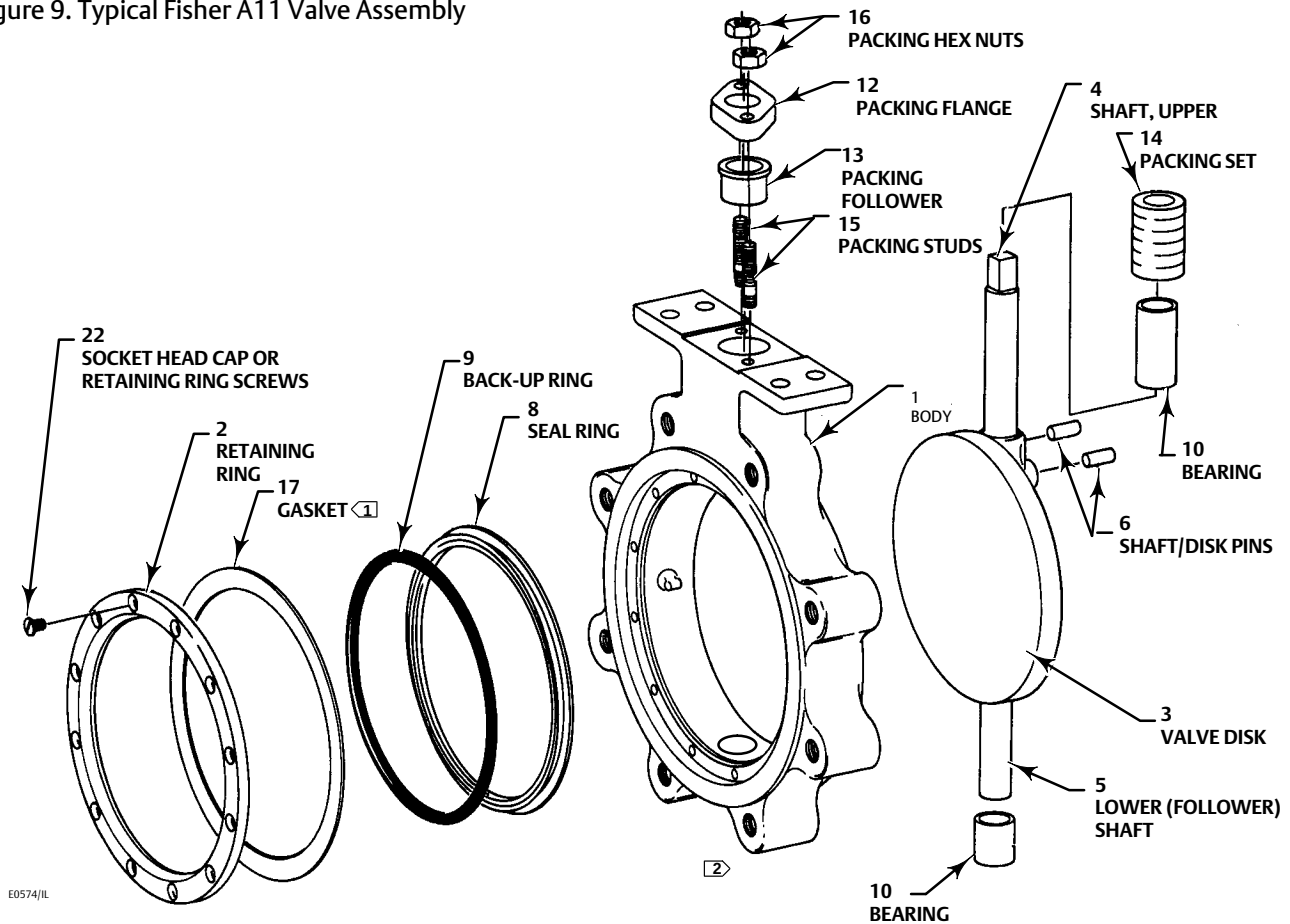
Bearing Removal

To get access to the bearings (key 10), the disk and shaft assembly (keys 3, 4 and 5) must be removed from the valve. The bearings (key 10) may be removed by using a brass drift punch and lightly tapping them out. In valves without lower bonnets, the lower bearing is removed by grasping it and pulling upwards. Also, cryogenic valves have an outboard bearing under the packing. Refer to the Packing Maintenance section for instructions.

Bearing Installation

Before installation of the bearings, bearing bores should be solvent cleaned and bearings will slip in.

Figure 9. Typical Fisher A11 Valve Assembly



Note:

¹ Required for fire safe, metal seated and cryogenic valves.

² Gasket, gasket retainer, and thrust bearings are not shown.

Parts Ordering

When corresponding with your [Emerson sales office](#) about an A11 valve, please mention the valve serial number which is stamped on the nameplate.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your Emerson sales office for Part Ordering information.

Key Description

1	Valve Body
2	Retaining Ring
7*	Key (Not Shown)
8*	Seal Ring
9	Back-up Ring
10*	Bearing
11*	Thrust Bearing (Not Shown)
12	Packing Flange
13	Packing Follower
14*	Packing Set
15	Stud
16	Hex Nut
17*	Gasket (Retainer Ring) w/Metal and Phoenix III Seals
18*	Gasket Retainer (Not Shown)
19*	Retainer Gasket (not shown)
20	Lockwasher, retaining ring assembly
20	Lockwasher, packing assembly

Key Description

21	Hex Head Bolt (Not Shown)
22	Socket Head Cap or Retaining Ring Screws
24	Nameplate (Not shown)
26	Packing Spacer (Not shown)
27	Drive Screw (Not Shown)
28*	Disk/Shaft Assembly
	Disk
	Shaft
	Pins (3 req'd)
29	Label
33	Flow Arrow (Not Shown)
---	Line Bolting

Live-Loaded Packing Parts

Parts shown are used in standard and NACE constructions.

100	Stud
101	Hex Nut
102	Packing Flange
103	Spring Pack
105*	Packing Set
106*	Anti-Extrusion Ring (2 req'd)
107	Packing Box Ring
111	Tag
112	Cable Tie
113	Lubricant

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

A11 Valve

April 2023

Instruction Manual

D104166X012

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Fisher™ POSI-SEAL™ A31A Cryogenic High Performance Butterfly Valve

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Figure 1. Fisher A31A Cryogenic Valve with 1035 Actuator



W7451 / IL

Introduction

Scope of Manual

This instruction manual provides installation, maintenance, and parts ordering information for the POSI-SEAL A31A Cryogenic high-performance butterfly valves (see figure 1). The Series C (3- through 6-inch Class 150 & 300 and 8-inch Class 150) feature a cast one-piece extension. The 8-inch Class 300, and 10- through 24-inch Class 150 & 300 designs have a two-piece extension. For information regarding actuators and accessories, refer to separate instruction manuals.

Do not install, operate, or maintain an A31A Cryogenic valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#).

Table 1. Specifications

Available Valve Configurations ■ Flangeless, wafer-style or ■ single-flange (lugged) control valve with a one-piece extension housing and either NOVEX seal (standard), Kel-F seal (optional) or Kel-F seal with Aluminum backup V-ring (optional) Valve Sizes ■ 3, ■ 4, ■ 6, ■ 8, ■ 10, ■ 12, ■ 14, ■ 16, ■ 18, ■ 20, or ■ 24-inch End Connection Style ■ Flangeless, wafer-style or ■ single flange valve body designed to fit between raised-face mating flanges per ASME B16.5 Class 150 or 300 Maximum Inlet Pressure/Temperature⁽¹⁾ Consistent with ANSI Class ■ 150 and ■ 300 pressure/temperature ratings per ASME B16.34, except that 38°C (100°F) rating is applicable to -254°C (-425°F). NOVEX seal maximum	pressure/temperature rating is the same as the valve body. See figure 2 for rating of Kel-F seal. Valve Classification Face-to-face dimensions are in compliance with MSS SP68 and API 609 standards; valve bodies are designed for installation between ASME B16.5 Class 150 or 300 raised-face flanges Materials of Construction See Bulletin 21.1:Cryogenic-Rotary Installed Valve Orientation See figure 3 for orientation guidelines Available Actuators ■ 1035, ■ Bettis Pneumatic or ■ 1051/1052 Disk Rotation Clockwise to close
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1. The pressure/temperature limits in this manual, and any applicable code or standard limitation, should not be exceeded.

Description

The A31A Cryogenic Series C (3- through 6-inch Class 150 & 300 and 8-inch Class 150) High Performance Butterfly Valve features either a double D drive shaft to allow direct coupling to the 1035 actuator or keyed shaft (optional). The A31A Cryogenic is a reliable, high-performance butterfly valve for cryogenic applications.

The A31A Cryogenic is available in either a flangeless (wafer) or a single-flange (lugged) valve body style and a variety of seals.

The standard seal for the A31A Cryogenic valve is the NOVEX™ metal seal which provides tight shutoff, low operating torques and the ruggedness required for cryogenic service. Kel-f and Kel-f/aluminum seals are also available.

Installation

⚠ WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid injury.

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given in this manual or on appropriate nameplates. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

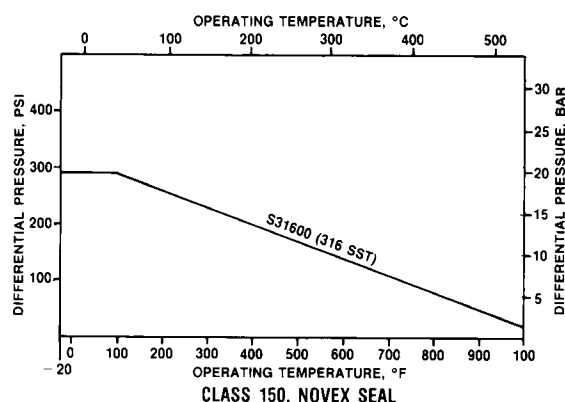
If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

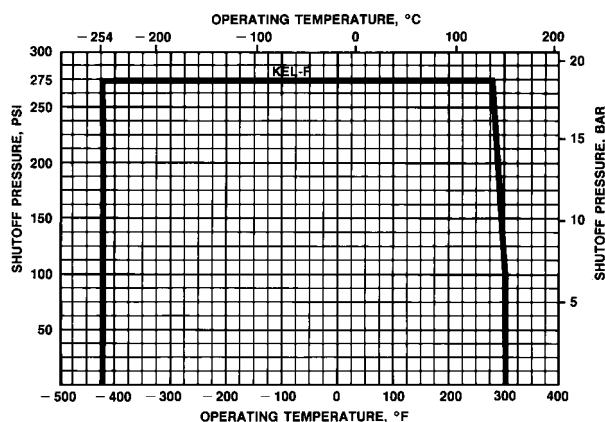
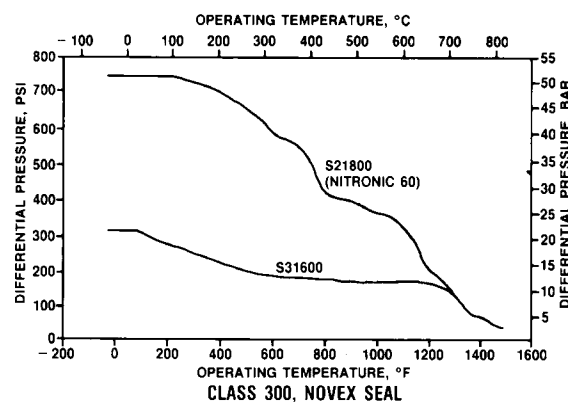
Responsibility for the safety of process media and compatibility of valve materials rests solely with the purchaser and end-user. When ordered, the valve configuration and construction materials were selected to meet particular pressure, pressure drop, temperature, and controlled fluid conditions. Because pressure drop and temperature range capabilities limit some combinations of materials, do not apply any other conditions to the valves without first contacting your [Emerson sales office](#).

Before installation check the maximum allowable inlet pressures for A31A Cryogenic valves shown in figure 2 and the Specifications table.

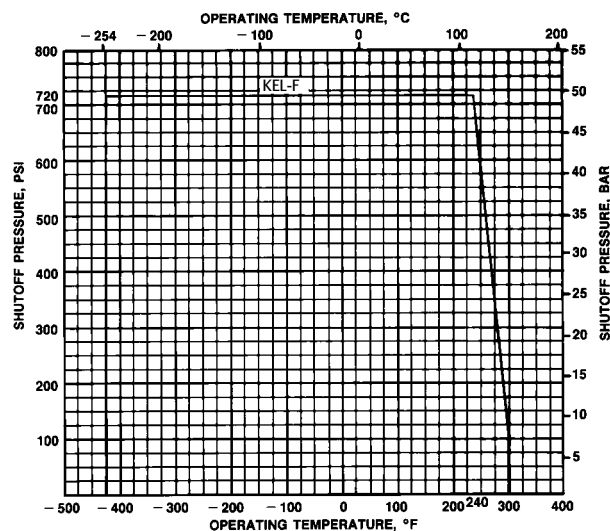
Figure 2. Maximum Pressure/Temperature Ratings



C0759-1 / IL



A4132-1 / IL



A3715-2 / IL

Adjusting the Actuator Travel Stops

⚠ WARNING

The edges of a rotating valve disk have a shearing effect that may result in personal injury. To avoid personal injury, keep clear of the disk edges when rotating the disk.

CAUTION

When using an actuator, the actuator travel stops or the actuator travel (for actuators without adjustable stops) must be adjusted so that the disk stop in the valve body does not absorb the output of the actuator. Failure to limit actuator travel as described in the next step can result in damage to the valve shaft or other valve parts.

1. Locate the actuator travel stop that establishes the closed position of the valve disk. When adjusting the travel stop or travel, make sure that the disk is from 0.03 to 0.76 mm (0.001 to 0.030 inch) away from the internal stop in the valve body. This adjustment is necessary to be certain that the actuator output torque is fully absorbed by the actuator travel stop or by the actuator. The internal travel stop in the valve body should not absorb any of the actuator torque.
2. Before installing the valve/actuator assembly in the process line, cycle the valve several times to be sure the valve disk returns to the proper position.

Valve Orientation

Note

When the process flow is gas, install the valve with the shaft in the horizontal position.

When the process flow is liquid the valve should be installed at an incline above horizontal of at least 20 degrees, as shown in figure 3. Inclined installation can enhance valve performance by preventing direct cryogenic liquid contact with the packing.

The A31A Cryogenic valve is designed for installation with the shaft(s) in any orientation around the pipeline: horizontal, vertical, or at an intermediate angle. However, when installing the valve in cryogenic service, follow the recommendations below, which are based on application experience:

- Installing the valve with the extension housing or bonnet four to six inches beyond the cold box (see figure 3) provides space for slight boil-off of cryogenic liquids.
- When installed with the extension stem inclined 20 degrees above horizontal, the vapor pocket resulting from cryogenic liquid boil-off prevents the colder liquid from contacting the stem packing area.
- Recommended installation for optimum seal performance of the NOVEX and Kel-F seals is reverse flow (into the back of the disk).
- A flow tag with an arrow is provided for proper installation.

Preparing for Installation

CAUTION

To avoid damage to the valve disk during installation, the valve must be in the fully-closed position. If the A31A Cryogenic valve is equipped with a fail-open actuator, remove the actuator before installing the valve/actuator assembly or cycle the

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valve into the fully closed position. Then, take appropriate steps to ensure that the actuator does not cause the valve to open during installation.

1. The A31A Cryogenic valve is normally shipped as part of an assembly with an actuator and other accessories. If the valve and actuator have been purchased separately or if the actuator has been removed for maintenance, properly mount the actuator and adjust valve/actuator travel and all travel stops before inserting the valve into the line.

Follow the instructions in this manual for Adjusting Travel stops. Also, refer to a separate actuator instruction manual for detailed actuator mounting and adjustment procedures.

2. If not previously removed, remove the protective end covers from the valve and inspect the valve body to be certain that it is free of foreign material. Also, be certain that adjacent pipelines are free of any foreign material, such as pipe scale or welding slag that could damage the valve seating surfaces.

CAUTION

The A31A Cryogenic valve is designed for use with the appropriate piping schedule for the specified ANSI class. Minimum inside diameters for flanges or pipe mating with valves are shown in tables 2 and 3. Be certain to align the valve accurately to avoid contact between the disk and the flanges. Improper alignment or insufficient space for disk rotation could result in damage to the disk.

Additionally, be certain that the valve body and any adjacent pipelines are free of foreign material, such as pipe scale or welding slag that could damage the valve seating surfaces.

Table 2. Valve Body Data, Class 150

VALVE SIZE, INCHES	SHAFT DIAMETER AT YOKE BEARING	FACE-TO-FACE DIMEN- SION ⁽¹⁾	MINIMUM I.D. ⁽²⁾	APPROXIMATE WEIGHT	
				Wafer	Single Flange
	mm				Kilograms
3	16	47.6	71.4	12	16
4	19	54.0	93.7	21	22
6	25	57.2	147.6	24	28
8	25	63.5	196.9	34	40
10	32	71.4	254.0	57	67
12	38	81.0	298.5	74	93
14	30	92	330	87	120
16	32	102	378	133	182
18	38	114	429	170	231
20	44	127	470	210	302
24	57	154	575	326	455
Inches				Pounds	
3	5/8	1-7/8	2.81	27	36
4	3/4	2-1/8	3.69	46	48
6	1	2-1/4	5.81	53	61
8	1	2-1/2	7.75	75	89
10	1-1/4	2-13/16	10.00	125	148
12	1-1/2	3-3/16	11.75	164	206
14	1-3/16	3-5/8	13	191	265
16	1-1/4	4	14-7/8	294	401
18	1-1/2	4-1/2	16-7/8	374	510
20	1-3/4	5	18-1/2	463	665
24	2-1/4	6-1/16	22-5/8	719	1004
1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications. 2. Minimum I.D. is the minimum pipe or flange I.D. required for disk swing clearance.					

1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications.

2. Minimum I.D. is the minimum pipe or flange I.D. required for disk swing clearance.

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Table 3. Valve Body Data, Class 300

VALVE SIZE, INCHES	SHAFT DIAMETER AT YOKE BEARING	FACE-TO-FACE DIMEN- SION ⁽¹⁾	MINIMUM I.D. ⁽²⁾	APPROXIMATE WEIGHT	
				Wafer	Single Flange
		mm			Kilograms
3	16	47.6	71.4	12	16
4	19	54.0	93.7	21	24
6	25	57.2	146.1	24	28
8	32	73.0	186.2	47	52
10	38	85.3	230.1	80	100
12	44	94.1	281.7	103	135
14	44	117	305	142	249
16	44	133	349	213	325
18	57	149	391	259	434
20	70	159	442	401	582
24	70	181	523	512	863
	Inches			Pounds	
3	5/8	1-7/8	2.82	27	35
4	3/4	2-1/8	3.69	46	52
6	1	2-1/4	5.75	53	61
8	1-1/4	2-7/8	7.32	104	115
10	1-1/2	3-23/64	9.06	176	220
12	1-3/4	3-45/64	11.09	227	298
14	1-3/4	4-5/8	12	314	548
16	1-3/4	5-1/4	13-3/4	470	716
18	2-1/4	5-7/8	15-3/8	570	956
20	2-3/4	6-1/4	17-13/32	884	1282
24	2-3/4	7-1/8	20-19/32	1128	1903
1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications. 2. Minimum I.D. is the minimum pipe or flange I.D. required for disk swing clearance.					

3. Select the appropriate gaskets for the application. Flat sheet, spiral wound, or other gasket types, made to ANSI B16.5 group or user's standard, can be used on the valves depending on the service conditions of the application.
4. Refer to table 4 for the quantity and size of flange bolts required.

Installing Wafer-Style Valves

WARNING

The edges of a rotating valve disk have a shearing effect that may result in personal injury. To avoid personal injury, keep clear of the disk edges when rotating the disk.

1. See figure 3 for recommended valve orientation. See table 4 for flange bolt specifications. Install the lower flange bolts first to form a cradle for the valve.

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Table 4. Hex Head Screw, Stud Bolt and Cap Screw Data⁽¹⁾

VALVE SIZE, INCH	NUMBER		SIZE DIA. INCH & THREAD		LENGTH, INCH	
	Class 150	Class 300	Class 150	Class 300	Class 150	Class 300
Wafer Style with Stud Bolts						
3	4	8	5/8-11	3/4-10	5-3/4	6
4	8	8	5/8-11	3/4-10	6	6-1/2
6	8	12	3/4-10	3/4-10	6-1/2	7-1/2
8	8	12	3/4-10	7/8-9	7	9
10	12	16	7/8-9	1-8	8	10
12	12	16	7/8-9	1-1/8-8	8-1/2	11
14	12	16	1-8	1-1/8-8	9-1/2	12
16	16	16	1-8	1-1/4-8	10	13-1/2
18	16	20	1-1/8-8	1-1/4-8	11	13-3/4
20	20	20	1-1/8-8	1-1/4-8	12	14-1/2
24	20	20	1-1/4-8	1-1/2-8	14	16-1/2
Wafer Style with Cap Screws						
14	---	8	---	1-1/8-8	---	3-1/2
16	---	8	---	1-1/4-8	---	3-3/4
18	---	8	---	1-1/4-8	---	4
20	---	8	---	1-1/4-8	---	4
24	---	8	---	1-1/2-8	---	4-1/2
Single Flange Style with Cap Screws						
3	8	16	5/8-11	3/4-10	1-7/8	2
4	16	16	5/8-11	3/4-10	2	2-1/4
6	16	24	3/4-10	3/4-10	2	2-1/2
8	16	24	3/4-10	7/8-9	2-1/4	3
10	24	32	7/8-9	1-8	2-1/2	3
12	24	32	7/8-9	1-1/8-8	2-3/4	3-3/8
14	24	40	1-8	1-1/8-8	2-3/4	3-1/2
16	32	40	1-8	1-1/4-8	3	3-3/4
18	32	48	1-1/8-8	1-1/4-8	3-1/4	4
20	40	48	1-1/8-8	1-1/4-8	3-1/2	4
24	40	48	1-1/4-8	1-1/2-8	3-1/2	4-1/2

1. Thread engagement in accordance with ANSI B31.3 "Chemical Plant and Petroleum Refinery Piping".

2. Properly orient the valve according to the specific application. For optimum performance, install the valve so that the shaft will be on the high pressure side of the valve at shutoff (reverse flow). Install the valve and the gaskets between the flanges into the cradle formed by the flange bolts.
3. Install the remaining flange bolts, making sure to center the gaskets on the gasket sealing surfaces of the flange and valve body.
4. Tighten the flange bolts in an alternating criss-cross fashion to a torque value of one-fourth of the final bolting torque. Repeat this procedure several times increasing the torque value each time by a fourth of the final desired torque. When the final torque value has been applied, tighten each flange bolt again to allow for gasket compression.

Note

The optional graphite ribbon packing and metal bearings are composed of all conductive material to electrically bond the shaft to the valve for hazardous area service, as opposed to the non-conductive PTFE packing and bearings.

5. For more information, refer to the Packing Maintenance section below.

Installing Single-Flange Valves

⚠ WARNING

The edges of a rotating valve disk have a shearing effect that may result in personal injury. To avoid personal injury, keep clear of the disk edges when rotating the disk.

1. See figure 3 for recommended valve orientation. See table 4 for hex head cap screw specifications.
2. Properly orient the valve according to the specific application. For optimum shutoff, install the valve for reverse flow.
3. Position the valve between the flanges. Be sure to leave enough room for the flange gaskets. Install the lower flange bolts.
4. Select the appropriate gaskets for the application. Flat sheet, spiral wound, or other gasket types, made to the ANSI B16.5 group standard or user's standard, can be used on the valve depending on the service conditions of the application. Install the gaskets and align the valve and the gaskets.
5. Install the remaining bolts.
6. Tighten the flange bolts in an alternating criss-cross fashion to a torque value of one-fourth of the final bolting torque. Repeat this procedure several times increasing the torque value each time by a fourth of the final desired torque. When you get to the final torque value, tighten each flange bolt again to allow for gasket compression.

Note

The optional graphite ribbon packing and metal bearings are composed of all conductive material to electrically bond the shaft to the valve for hazardous area service, as opposed to the non-conductive PTFE packing and bearings.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

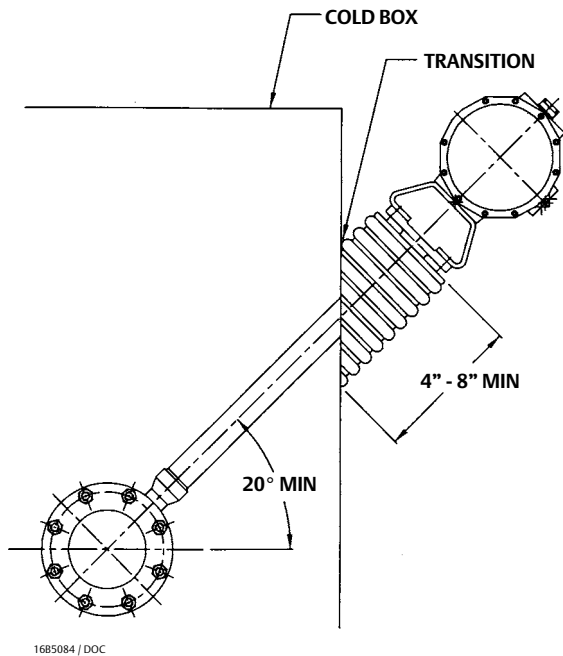
⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from either side of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.

- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Figure 3. Properly Installed Cryogenic Valve



Replacing Packing

The A31A Cryogenic valve is designed so the packing can be replaced without removing the valve from the process pipeline, provided there is no internal pressure. Packing may be PTFE V-rings or graphite.

Key numbers for the parts in this section may be found in figures 7 and 8.

CAUTION

Tighten the packing flange only enough to prevent shaft leakage. Excessive tightening will only accelerate wear of the packing and could produce higher torques on the valve than expected.

Usually, packing leakage can be eliminated by merely tightening the hex nuts (key 15) located above the packing flange while the valve is in the pipeline. However, if leakage continues, replace the packing.

CAUTION

Never use a wrench or pliers on the valve shaft. A damaged shaft could cut the packing and allow leakage.

1. Before loosening any parts, isolate the valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve.
2. Then, remove the hex nuts (key 18) and lift off the packing follower (key 11). The packing (key 13) is now accessible. Refer to figure 6 for details of the blowout protection.
3. Use a packing extractor to remove the packing. Insert the corkscrew-like end of the tool into the first piece of packing and pull firmly to remove the packing. Repeat this process until all packing has been removed.

Note

For valves equipped with non-metallic (PTFE composition) bearings, perform the following step to inspect and/or replace the outboard bearing (key 10).

4. Using a formed hook or probe, carefully remove the packing ring (key 12) and inspect the outboard bearing (key 10) for excessive intrusion or wear. Outboard bearings are only found on the 3- through 12-inch sizes. If necessary, remove the bearing carefully using needle-nose pliers and install a new bearing and existing packing ring using the packing follower (key 11) as a driver.

CAUTION

Be careful when cleaning the packing box. Scratches to the shaft or inside diameter of packing bore might cause leakage.

5. Before installing new packing, clean the packing box.
6. Install new packing (key 13) one ring at a time, using the packing follower (key 11) as a driver. If using split-ring packing, stagger the splits in the rings to avoid creating a leak path.
7. Reinstall all parts. Tighten the packing follower nuts (key 18) as needed to stop leakage under operating conditions.

Removing the Valve from the Pipeline

1. Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open the valve. Vent the power actuator loading pressure.
2. Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from either side of the valve.

CAUTION

Damage to the valve disk, piping or pipe flanges can occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, stroke the actuator to place the disk in the closed position while removing the valve from the pipeline.

3. Loosen the flange bolting that holds the valve. Make sure the valve cannot slip or twist while loosening and removing the bolting.
4. Make certain the valve disk is closed and remove the valve from the pipeline. Support the valve properly and move the valve to an appropriate work area.

Removing/Installing the Seal Ring

Unless otherwise indicated, key numbers and part names are listed in figures 7 and 8.

Note

For valves large enough to be safely placed on a flat surface without tipping, it is possible to replace the seal ring (key 7) while the actuator is mounted to the valve and can be accomplished by cycling the valve to 90 degrees open.

1. After removing the valve from the pipeline, remove the manual or power actuator. Manually rotate the drive shaft (key 4) counterclockwise until the disk has moved a full 180 degrees away from the closed position.
2. Lay the valve flat on a work bench in a secure position with the retaining ring (key 2) and retaining ring screws (key 19) facing up. Properly secure the valve on a suitable worktable so it can not slip, twist, or fall during maintenance. Remove all retaining ring screws.
3. Remove the retaining ring by placing a socket head retaining ring screw from the retaining ring in each of the two retaining ring jacking screw holes. Slowly turn the screws until the retaining ring has been lifted from the valve body. Remove the retaining ring to expose the seal ring in the T-slot area of the valve body.

Note

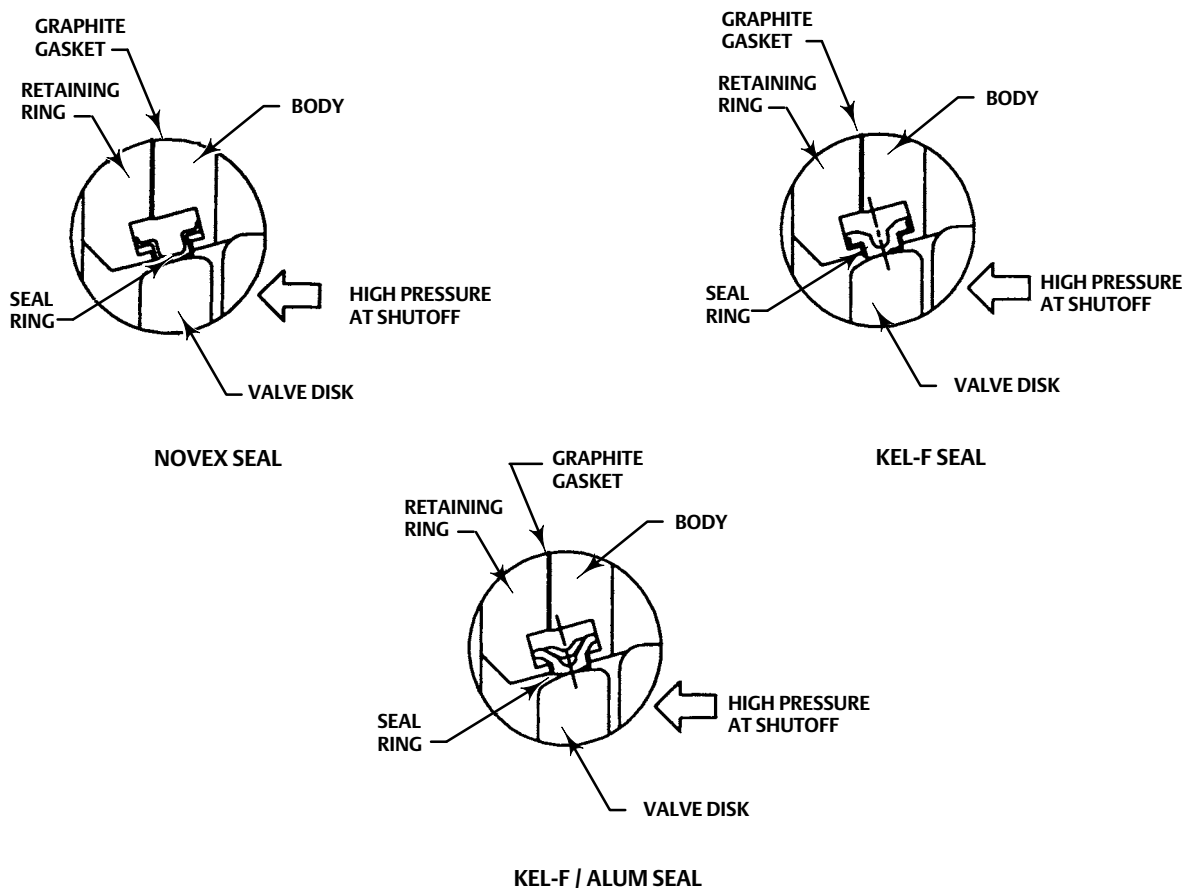
The A31A Cryogenic valve is available with different seal designs and components. See figure 4 to identify the specific seal design.

CAUTION

To avoid possible leakage, be careful not to damage the gasket sealing surface, the seal ring, or the T-slot area in the valve body while performing the next two steps.

4. Remove and discard the retaining ring gasket (key 16). Be careful to not scratch the gasket seating surface.
5. Insert a regular screw driver or other similar tool under the top edge of the seal ring (key 7), and gently pry it out of the T-slot area in the valve body. Take care not to damage the seal ring or T-slot area of the valve body. After the seal ring has been removed, clean the T-slot area, retaining ring, and, if required, polish the disk thoroughly with fine steel wool or other appropriate material.

Figure 4. Available Seal Configurations



1685083 / DOC

NOVEX Seal Installation

Unless otherwise indicated, key numbers and part names are listed in figures 7 and 8. Seal installation is shown in figure 5.

A maintenance kit with installation tools is available through your [Emerson sales office](#).

1. Locate the replacement seal ring (key 7) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter. Also, note the wide groove around the outside circumference.

Before installing the seal ring into the valve body, place the backup ring, if applicable, (key 8) into the wide, outer groove of the seal ring.

2. Install the seal ring and backup ring assembly in the valve body. The wider outside diameter of the seal ring goes into the T-slot area of the valve body as shown in figure 5. Start the edge with the wider diameter into the T-slot of the valve body.

CAUTION

Use extreme care to avoid damaging the gasket while punching one initial screw hole through the gasket for alignment in the following step.

3. Once the seal ring and backup ring have been fully installed into the valve body T-slot, the retaining ring gasket can be installed. This gasket is a thin graphite material. Use extreme care to avoid damaging the gasket while punching one initial screw hole through the gasket for alignment.
4. Install the retaining ring, and align the screw holes in the retaining ring with the holes in the valve body. Install the first retaining ring screw through the punched hole in the retaining ring gasket. Install the other retaining ring screws by pushing them through the graphite gasket and threading them into the valve body.
5. Tighten the retaining ring screws just enough to eliminate any movement of the retaining ring. Do not over-tighten the retaining ring screws.

⚠ WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping valve. Support large valves during maintenance.

6. To complete this step, stand the valve up. Support the valve securely using methods appropriate for the valve size. If a vise or other clamps are being used, make certain the flange gasket sealing area of the valve body is not damaged.
7. Manually rotate the drive shaft (key 4) to turn the disk clockwise to meet the seal ring.
8. Place a piece of rubber, or other soft material, between the disk and internal travel stop to protect the disk. With a rubber mallet, tap the disk until it contacts the internal travel stop. When the disk makes contact with the stop, manually rotate the disk counterclockwise back out of the seal ring to a 90-degree open position.
9. The final seating of the retaining ring screws can now be done. For the screw torque values, refer to table 5.
10. Repeat steps 8 and 9 two more times.

Note

When attaching the actuator to the valve, make sure the valve disk is not in contact with the internal travel stop. The valve disk should be positioned from 0.03 to 0.76 mm (0.001 to 0.030 inch) away from the internal stop in the valve body.

CAUTION

When using an actuator, the actuator travel stops or the actuator travel (for actuators without adjustable stops) must be adjusted so that the disk stop in the valve body does not absorb the output of the actuator. Failure to limit actuator travel as described in the next step can result in damage to the valve shaft or other valve parts.

11. Use an appropriate tool (such as a feeler gauge) and position the disk from 0.03 to 0.76 mm (0.001 to 0.030 inch) away from the internal stop in the valve body.

This adjustment is necessary to be certain that the actuator output torque is fully absorbed by the actuator travel stop or by the actuator. The internal travel stop in the valve body should not absorb any of the actuator torque.

Kel-F and Kel-F/Aluminum Seal Installation

Unless otherwise indicated, key numbers and part names are listed in figures 7 and 8.

A maintenance kit with installation tools is available through your [Emerson sales office](#).

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1. Locate the replacement seal ring (key 7) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter. Also, note the wide groove around the outside circumference. If an aluminum backup ring (key 8) is provided, fit this over the back of the seal ring (matching seal and backup ring angles) prior to installation in the valve.

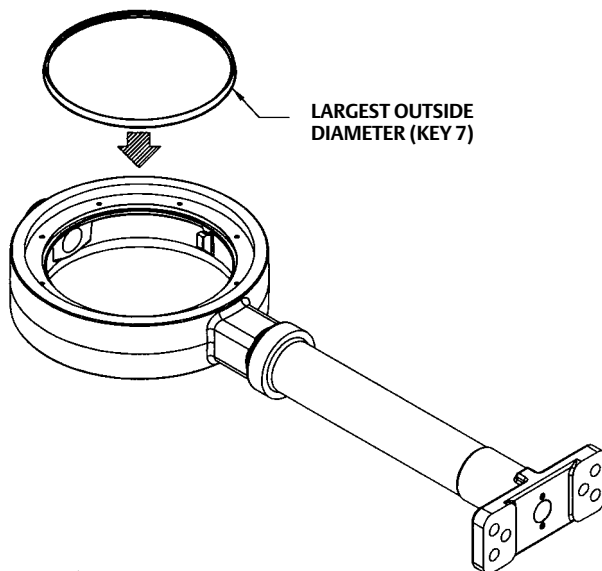
Table 5. Torque Values for Fasteners

FASTENER NOMINAL SIZE	RETAINING RING SCREWS		GASKET RETAINING BOLTS	
	N•m	In•lbs	N•m	In•lbs
#10	4.6	41	4.0	35
1/4	11	100	9.2	81
5/16	25	220	19	167
3/8	45	400	33	295
	N•m	ft•lbs	N•m	ft•lbs
7/16	72	53	53	39
1/2	112	83	80	59
9/16	161	119	117	86
5/8	225	166	161	119
3/4	401	296	286	210
7/8	651	480	447	330
1	976	720	651	480
1-1/8	1356	1000	837	617

Note: These values are based upon standard materials, S66286/Inconel screws and ASTM A193GRB6 bolts. For other special fastener materials, please contact your Emerson sales office.

2. Install the seal ring, and if applicable back-up ring, in the valve body by first placing the wider outside diameter of the seal ring into the T-slot area of the valve body as shown in figure 5.

Figure 5. Typical Seal Installation



3. Once the seal ring has been fully installed into the valve body T-slot, the retaining ring gasket can be installed. This gasket is a thin graphite material. Use extreme care to avoid damaging the gasket while punching one initial screw hole through the gasket for alignment.

4. Install the retaining ring, and align the screw holes in the retaining ring with the holes in the valve body. Install the first retaining ring screw through the punched hole in the retaining ring gasket. Install the other retaining ring screws by pushing them through the graphite gasket and threading them into the valve body.
5. Tighten the retaining ring screws just enough to eliminate any movement of the retaining ring. Do not over-tighten the retaining ring screws.

⚠ WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping valve. Support large valves during maintenance.

6. To complete this step, stand the valve up. Support the valve securely using methods appropriate for the valve size. If a vise or other clamps are being used, make certain the flange gasket sealing area of the valve body is not damaged.
7. Manually rotate the drive shaft (key 4) to turn the disk clockwise to meet the seal ring.
8. Place a piece of rubber, or other soft material, between the disk and internal travel stop to protect the disk. With a rubber mallet, tap the disk until it contacts the internal travel stop. When the disk makes contact with the stop, manually rotate the disk counterclockwise back out of the seal ring to a 90-degree open position.
9. The final seating of the retaining ring screws can now be done. For the screw torque values, refer to table 5.
10. Repeat steps 7 and 8 two more times.

Note

When attaching the actuator to the valve, make sure the valve disk is not in contact with the internal travel stop. The valve disk should be positioned from 0.03 to 0.76 mm (0.001 to 0.030 inch) away from the internal stop in the valve body.

CAUTION

When using an actuator, the actuator travel stops or the actuator travel (for actuators without adjustable stops) must be adjusted so that the disk stop in the valve body does not absorb the output of the actuator. Failure to limit actuator travel as described in the next step can result in damage to the valve shaft or other valve parts.

11. Use an appropriate tool (such as a feeler gauge) and position the disk from 0.03 to 0.76 mm (0.001 to 0.030 inch) away from the internal stop in the valve body.

This adjustment is necessary to be certain that the actuator output torque is fully absorbed by the actuator travel stop or by the actuator. The internal travel stop in the valve body should not absorb any of the actuator torque.

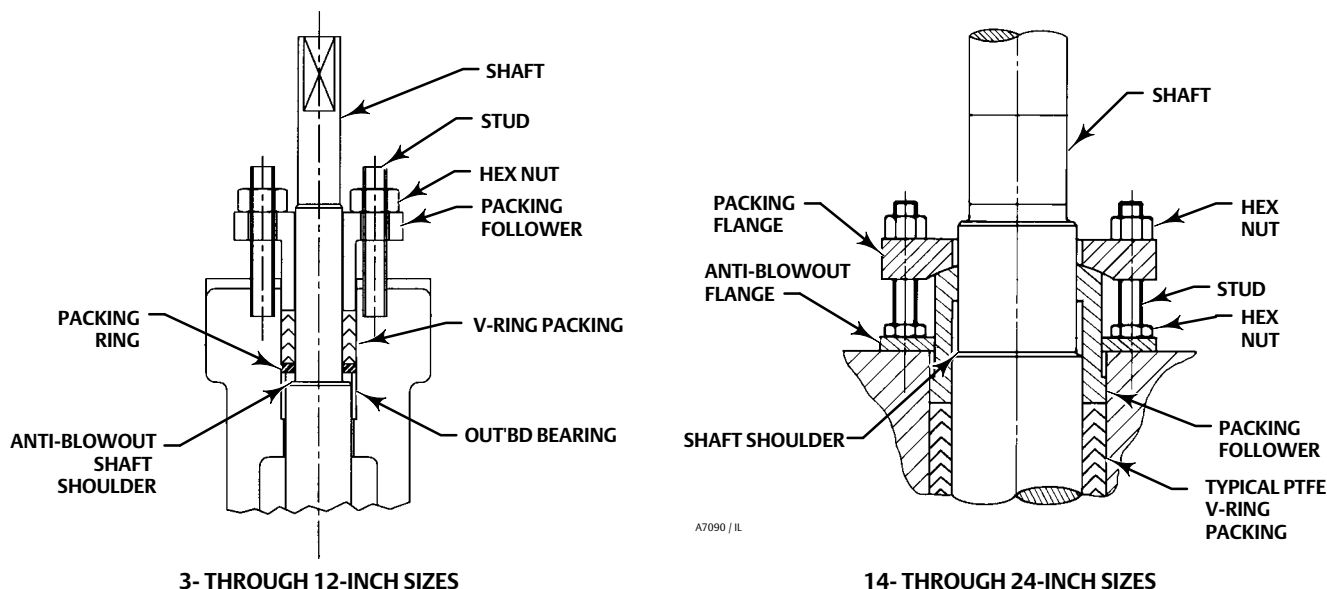
Anti-Blowout Protection, Packing, Valve Shaft(s), Disk, and Bearing Maintenance

Note

The 10- through 24-inch Class 150 valves and 8- through 24-inch Class 300 valves have a two-piece shaft. The shaft with the double D or keyed end is called the drive shaft.

The 3- through 8-inch Class 150 valves and 3 through 6-inch Class 300 valves have a one-piece shaft.

Figure 6. Anti-Blowout Protection Detail



16B5082 / DOC

Disassembly

⚠ WARNING

The edges of a rotating valve disk (key 3) have a shearing effect that might result in personal injury. To avoid personal injury, keep clear of the disk edges when rotating the disk.

CAUTION

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever off the valve shaft. Driving the lever or actuator off the valve shaft could damage the valve internal parts.

If necessary, use a wheel puller to remove the lever or actuator from the valve shaft. It is okay to tap the wheel puller screw lightly to loosen the lever or actuator, but hitting the screw with excessive force could also damage internal valve parts.

Never use a wrench or pliers on the drive shaft. A damaged shaft could cut the packing and allow leakage.

Unless otherwise indicated, key numbers and part names are listed in figures 7 and 8.

1. Remove the actuator and valve, as an assembly, from the pipeline, and then remove the actuator from the valve.

Note

It is not necessary to remove the retaining ring and seal ring when removing the shaft(s) and disk.

2. Secure the valve in an upright position. Rotate the disk (key 3) 180 degrees counterclockwise from the fully closed position by manually turning the drive shaft.
3. Remove the Anti-Blowout Protection (refer to figure 6). Remove the hex nuts and pull out the packing follower.

Note

Class 150 and 300 3- through 24-inch valve sizes have a bearing stop pressed into the bearing bore of the valve body below the extension housing.

Do not attempt to remove the bearing stop. If the bearing stop needs replacement, contact your [Emerson sales office](#) for more information.

4. Remove the packing from around the drive shaft.

Note

Different valves require slightly different procedures because different valve sizes/ pressure classes have different methods of connecting the disk and shaft(s). To identify the proper procedures, refer to the list below.

- Class 150, 3- through 8-inch sizes: One-piece shaft with 1 taper key.
 - Class 150, 10- and 12-inch sizes: Two-piece shaft. 1 taper key in the drive shaft; 1 disk pin in the follower shaft.
 - Class 300, 3- through 6-inch sizes: One-piece shaft with 1 taper key.
 - Class 300, 8- and 10-inch sizes: Two-piece shaft. 1 taper key in the drive shaft; 1 disk pin in the follower shaft.
 - Class 300, 12-inch size: Two-piece shaft with 2 tangential pins in the drive shaft; 1 disk pin in the follower shaft.
 - Class 150 and 300, 14- through 24-inch sizes: Two-piece shaft with 2 tangential pins in the drive shaft; 1 disk pin in the follower shaft.
-

5. Proceed as appropriate, using the following instructions.

For valves with taper key(s), locate the taper key(s) (key 6) which runs through the drive shaft boss on the back of the valve disk. Using a pin punch on the smaller end of the key, drive it out of the disk and shaft. Driving a taper key in the wrong direction will tighten it.

Note

Certain valve sizes may have a taper key that is arc spot welded in place. To remove the key, use a punch on the smaller end of the taper key and drive it out of the disk and shaft, breaking the weld.

For valves with tangential pins and/or disk pins, locate the tangential pins (key 6) in the drive shaft (key 4) and the disk pin (key 6) in the follower shaft (key 5).

- a. If a maintenance kit is available, use the pin extractor to remove the disk pins. Select the correct size pin extractor tip with screws of proper thread size to match the thread size in the disk pins. If a maintenance kit is not available, see steps c and d below.
- b. Screw the pin extractor tip into the pin as far as possible. With an upward, straight sliding motion, pull out the pin. Repeat the same procedure for the other pins.

- c. Use a threaded rod with an appropriate spacer and nut as an extractor tool. If using a threaded rod, choose a rod with threads that fit the inside thread of the pins. The rod should extend several inches above the disk when it is screwed into a pin.
- d. After screwing the rod into the pin, slide the spacer over the rod and pin. Thread the nut onto the rod and tighten it. As the nut is tightened, the nut will drive the spacer against the disk. The increasing force will draw the pin from the disk.
6. Valves with a two-piece shaft have a gasket retainer and gasket (keys 14 and 15) on the follower shaft side of the valve. Remove the hex head bolts and lockwashers (keys 21 and 20) from the gasket retainer and remove the gasket retainer and gasket to expose the end of the follower shaft.
7. Support the valve disk properly, and remove the follower shaft. Pull the follower shaft from the valve body. Use a shaft extractor screwed into the puller hole in the end of the follower shaft.
8. Support the valve disk properly, and remove the drive shaft. Pull out the drive shaft (key 4) by hand-pulling or by using a shaft extractor screwed into the end of the shaft. Keep the packing box ring (key 12) which will come out with the drive shaft.

CAUTION

To avoid damage to the disk, seal ring, and T-slot area, do not force the disk past the seal or T-slot area. Remove the disk from the opposite side of the valve body.

9. After removing the shaft(s), remove the disk and the thrust bearings (key 28). Do not force the disk past the seal ring or T-slot area.
10. Remove the journal bearings (key 9). Using a suitable punch or puller, drive or pull the journal bearing(s) into the valve body bore from the drive shaft bearing bore. Do not attempt to remove the bearing stop. Remove the journal bearing from the follower shaft bearing bore. Also, remove the outboard bearing from the extension housing (if applicable).
11. Inspect the valve body bore, bearings, bearing bores and packing box for damage.

Installing a One-Piece Shaft

Unless otherwise indicated, key numbers and part names are listed in figures 7 and 8.

1. Secure the valve in an upright position. Allow for easy access to the valve body bore. Allow for easy access to the drive shaft bearing bore.
2. Inspect all parts removed from the valve for wear or damage. Replace any worn or damaged parts. Clean the valve body and all parts to be installed with an appropriate solvent or degreaser.

CAUTION

Premature valve failure and loss of process control may result if bearings are improperly installed or are damaged during installation.

3. Using caution to prevent damage to the bearing, insert one journal bearing (key 9) from the valve body bore into the drive shaft bearing bore until it hits the bearing stop. When properly installed, a portion of the journal bearing will extend into the valve body bore.
4. Insert one journal bearing from the valve body bore into the shaft bearing bore opposite the journal bearing installed in step 3. When correctly installed, this journal bearing will be flush with the valve body bore.

5. Insert the outboard journal bearing (key 10) into the bore on top of the extension housing.
6. Install the valve disk by placing the disk into the valve body bore so the curved side of the disk passes through the end of the valve body that does not contain the T-slot. Align the shaft bore in the disk with the bearing bores.
7. Insert the drive shaft end opposite the double D or keyed end into the valve body through the packing box. Push the shaft through the bearing stop. Taking care not to dislodge the journal bearing, push the shaft through the journal bearing and the valve disk and into the bore on the opposite side of the valve body.

CAUTION

To avoid damage to the taper key, tangential pins, disk pins, valve disk, or shaft(s) resulting from the application of excessive force, use appropriate care when driving the key or pins into the disk hub and shaft(s). Use the right tool. Do not use excessive force.

8. Be sure the taper key disk shaft joint is free of oil or grease. If necessary, remove any excess welding material from the taper key.
9. Align the taper key hole in the shaft with the holes in the shaft boss on the disk. Insert the taper key. Use a flat-end punch to drive the taper key until solid contact is felt. Measure the depth of the taper key head for a reference during the following steps.
 - a. Drive the taper key in farther as follows:

Valve Size, Inches	Minimum Depth to Drive Taper key After Initial Solid Contact, mm (Inches)
ANSI Class 150 and 300, size 3, 4, 6-inch valves, and 8-inch ANSI Class 150 valves	5 (0.188)

- b. The disk, shaft, and taper key assembly must be inspected to verify that the taper key spans the entire shaft flat width. If so, this procedure is complete. If not, the taper key must be driven in farther until this condition is satisfied. However, do not exceed the following depth limits:

Valve Size, Inches	Maximum Allowable Depth to Drive Taper key After Initial Solid Contact, mm (Inches)
3, and 4-inch ANSI Class 150/300	7 (0.281)
6-inch ANSI Class 300, and 8-inch ANSI Class 150	8 (0.312)

10. After driving the taper key in place, arc spot weld the head of the taper key to the disk. For valve sizes 3-, 4-, and 6-inch, use an arc spot weld bead of 1/8-inch diameter. For valve sizes 8-, 10-, and 12-inch sizes, use an arc spot weld bead of 3/16-inch diameter.
11. Install the packing as described in the Packing Replacement section.

Installing a Two-Piece Shaft

Unless otherwise indicated, key numbers and part names are listed in figures 7 and 8.

1. Secure the valve in an upright position. Allow for easy access to the valve body bore. Allow for easy access to the drive shaft bearing bore and the follower shaft bearing bore.
2. Inspect all parts removed from the valve for wear or damage. Replace any worn or damaged parts. Clean the valve body and all parts to be installed with an appropriate solvent or degreaser.

CAUTION

Premature valve failure and loss of process control may result if bearings are improperly installed or are damaged during installation.

3. Using caution to prevent damage to the bearings, insert the required number of journal bearings (key 9) from the valve body bore into the drive shaft bearing bore. When properly installed, one end of the journal bearing(s) will be flush with the interior end of the extension housing, the other end of the journal bearing(s) will be flush with the valve body bore.

The drive shaft thrust bearing (key 28) will be installed in step 6.

4. Insert one journal bearing from the valve body bore into the follower shaft bearing bore so it is flush with the valve body bore.
5. Insert the outboard journal bearing (key 10) into the bore on top of the extension housing.
6. Insert the drive shaft into the valve body through the extension housing. Push the drive shaft through the journal bearing(s). Hold the drive shaft thrust bearing (key 28) in the valve body bore against the opening of the drive shaft bearing bore. Push the drive shaft through the bearing bore just enough to hold the thrust bearing.
7. Insert the follower shaft through the bore in the valve body uncovered by removal of the gasket retainer. Hold the follower shaft thrust bearing (key 28) in the valve body bore against the opening of the follower shaft bearing bore. Push the follower shaft through the bearing bore just enough to hold the thrust bearing.
8. Install the valve disk. Place the flat side of the disk on a flat surface. Then, move the valve body from its upright position and suspend the valve body over the disk so the seal ring/T-slot area is facing up. Align the shaft bores through the disk with the drive shaft and follower shaft bores. Lower the valve body over the disk using caution not to dislodge or damage the thrust bearings placed on the ends of the shafts.
9. With the valve disk properly positioned in the valve body, push the drive shaft and follower shaft the rest of the way through the thrust bearings and into the shaft bores in the valve disk.
10. Align the holes in the shafts with the holes in the disk.

CAUTION

To avoid damage to the taper key, tangential pins, disk pins, valve disk, or shaft(s) resulting from the application of excessive force, use appropriate care when driving the key or pins into the disk hub and shaft(s). Use the correct tool, and do not use excessive force.

11. Before installing the taper key, be sure the taper key disk shaft joint is free of oil or grease. If necessary, remove any excess welding material from the taper key.
12. Install the appropriate taper key, tangential pins, and disk pins. Install the taper key by aligning the taper key hole in the shaft with the holes in the shaft boss on the disk. Insert the taper key. Use a pin punch to drive the taper key until solid contact is felt. Measure the depth of the taper key head for a reference during the following steps.
 - a. Drive the taper key in farther as follows:

Valve Size, Inches	Minimum Depth to Drive Taper key After Initial Solid Contact, mm (Inches)
8-inch ANSI Class 300, 10- and 12-inch ANSI Class 150, and 10-inch ANSI Class 300 valves	6 (0.219)

- b. The disk, shaft, and taper key assembly must be inspected to verify that the taper key spans the entire shaft flat width. If so, this procedure is complete. If not, the taper key must be driven in farther until this condition is satisfied. However, do not exceed the following depth limits:

Valve Size, Inches	Maximum Allowable Depth to Drive Taper key After Initial Solid Contact, mm (Inches)
8-inch ANSI Class 300, and 10- and 12-inch ANSI Class 150	10 (0.375)
10-inch ANSI Class 300	11 (0.406)

13. After driving the taper key in place, arc spot weld the head of the taper key to the disk. For valve sizes 8-, 10- and 12-inch, use an arc spot weld bead of 3/16-inch in diameter.
14. Install the packing as described in the Packing Replacement section.

Installing the Gasket Retainer

Valves with a two-piece shaft use a gasket retainer and gasket to cover the follower shaft opening in the valve body.

1. Replace the gasket (key 15) and gasket retainer (key 14) over the end of the follower shaft. Use a new gasket.
2. Replace the four hex head bolts (key 21) and lockwashers (key 20) to hold the gasket retainer in place.
3. Be sure to center the gasket over the follower shaft bore before retightening the bolts. Tighten down the bolts evenly in a crossover or star pattern. Refer to table 5 for proper torque values.

Parts Ordering

When corresponding with your [Emerson sales office](#) about the A31A Cryogenic valve, always provide the valve serial number. For valve/actuator combinations assembled at the factory, the valve serial number is stamped on the nameplate attached to the actuator. For parts information on the 14- through 24-inch sizes, please contact your Emerson sales office.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

For part ordering information contact your [Emerson sales office](#).

Key Description

- | | |
|-----|---|
| 1 | Valve Body |
| | If you need a valve body as a replacement part, order by valve size, serial number, and desired material. Contact your Emerson sales office for assistance. |
| 2 | Retaining Ring |
| 3 | Disk |
| 4 | Shaft |
| 5 | Follower Shaft (8-inch size, Class 300 only) |
| 6* | Taper Key |
| 7* | Seal Ring |
| 8* | Backup Ring |
| 9* | Bearing, Journal (2 req'd) (4 req'd for 8-inch Class 300) |
| 10* | Bearing, Outboard |
| 11 | Packing Follower |
| 12* | Packing Box Ring |
| 13* | Packing Set |
| 13* | Packing Ring (4 req'd) |
| 13* | Packing Washer (3 req'd) |
| 14 | Gasket Retainer |
| | 8-inch, Class 300 and larger |

Key Description

- | | |
|-----|--------------------------------------|
| 15* | Gasket |
| | 8-inch, Class 300 only |
| 16* | Retaining Ring Gasket |
| 17 | Stud (2 req'd) |
| 18 | Hex Nut (2 req'd) |
| 19 | Retaining Ring Screw |
| 20* | Lock Washer |
| | 8-inch, Class 300 only |
| 21 | Hex Head Bolt |
| | 8-inch, Class 300 and larger |
| 22 | Pipe Plug, optional |
| 23 | Nameplate (not shown) |
| 24 | Drive Screw (2 req'd) (not shown) |
| 25 | Flow Direction Arrow (not shown) |
| 26 | Assembly, Disk/Shaft |
| 27 | Key |
| 28* | Thrust Bearing (2 req'd) (not shown) |
| 29 | Key Retainer Bolt |
| 30 | Key Retainer Washer |

Figure 7. Fisher A31A Cryogenic 3 through 12-inch Typical Assembly

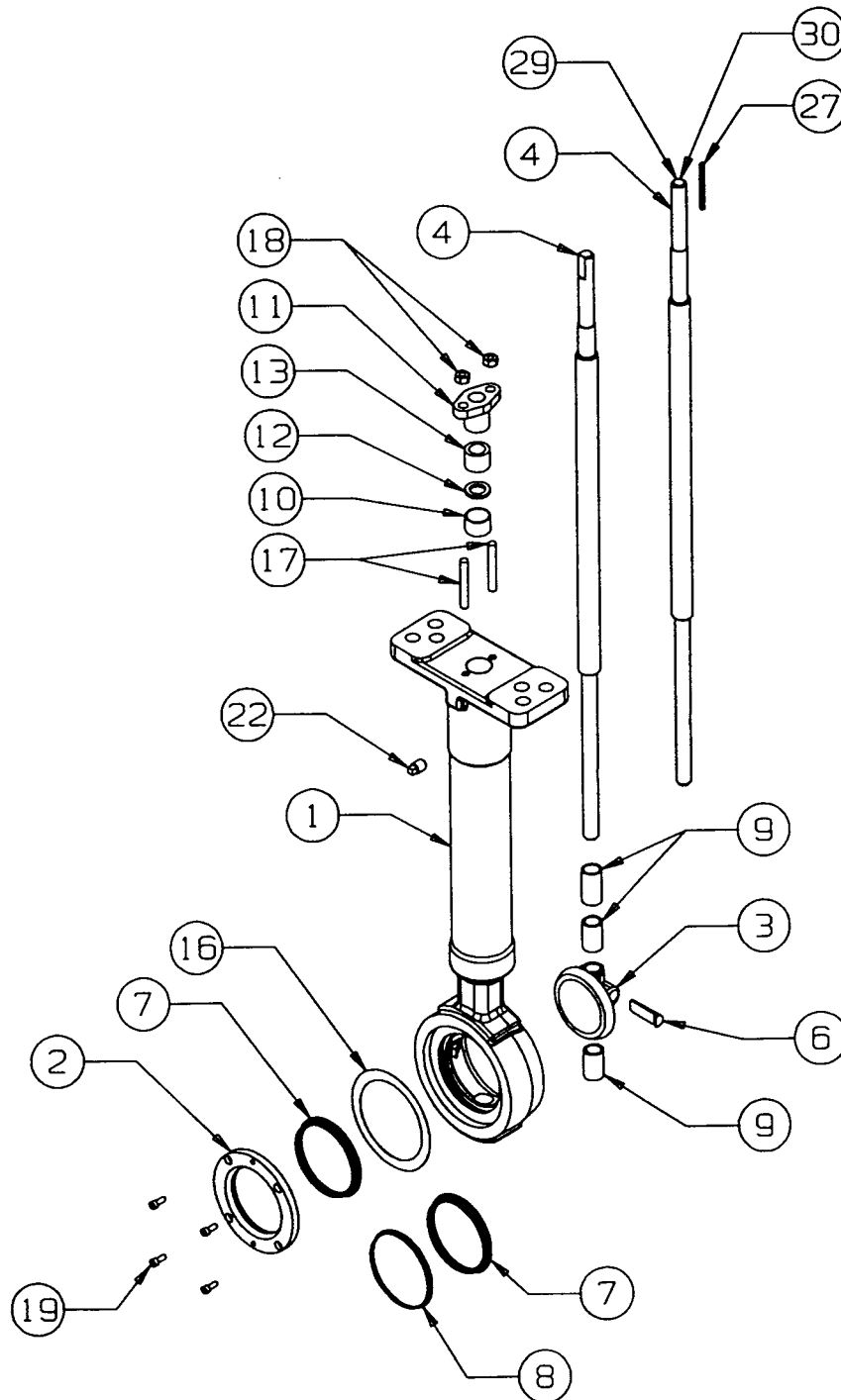


Figure 7. Fisher A31A Cryogenic 3 through 12-inch Typical Assembly (continued)

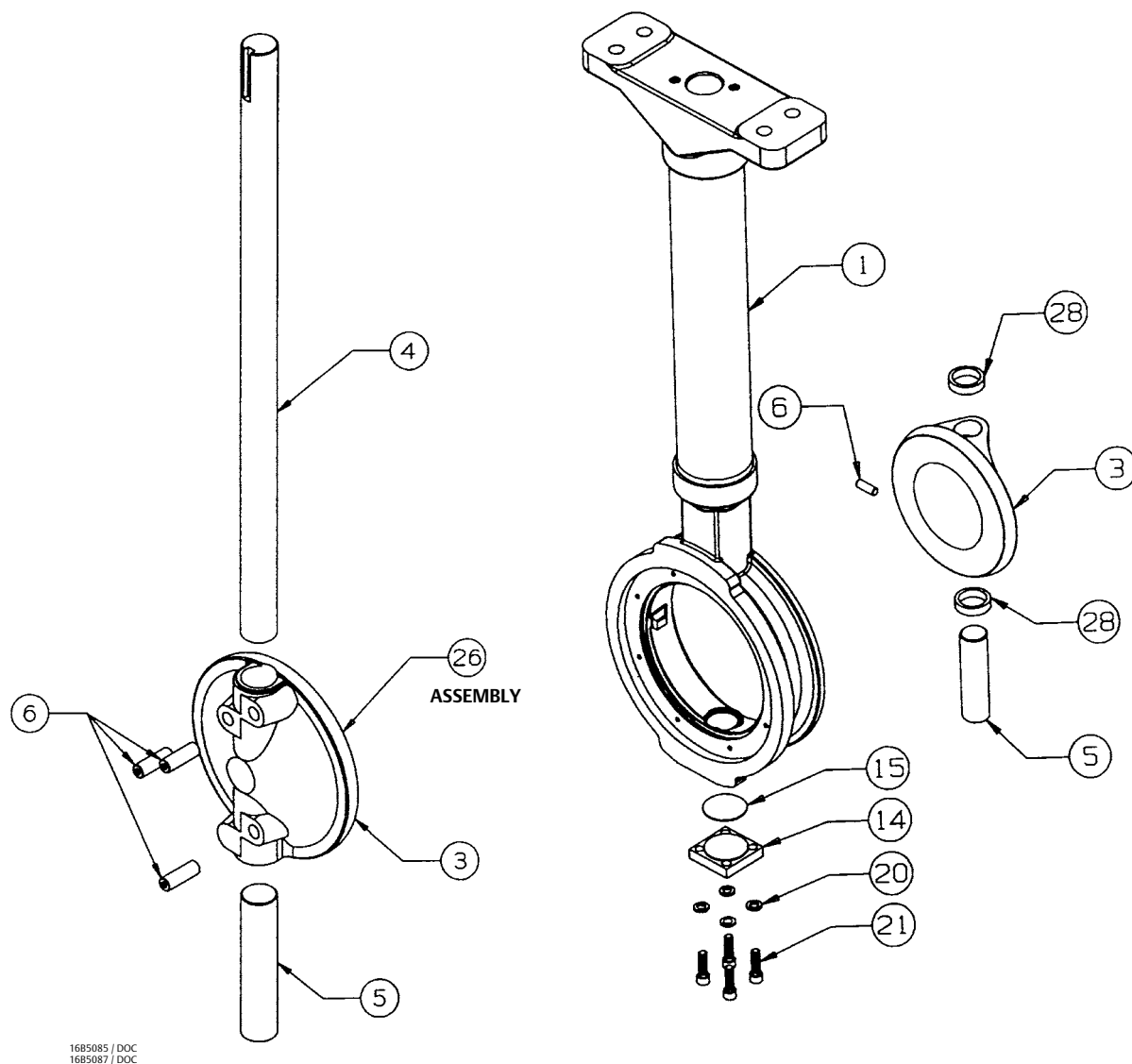
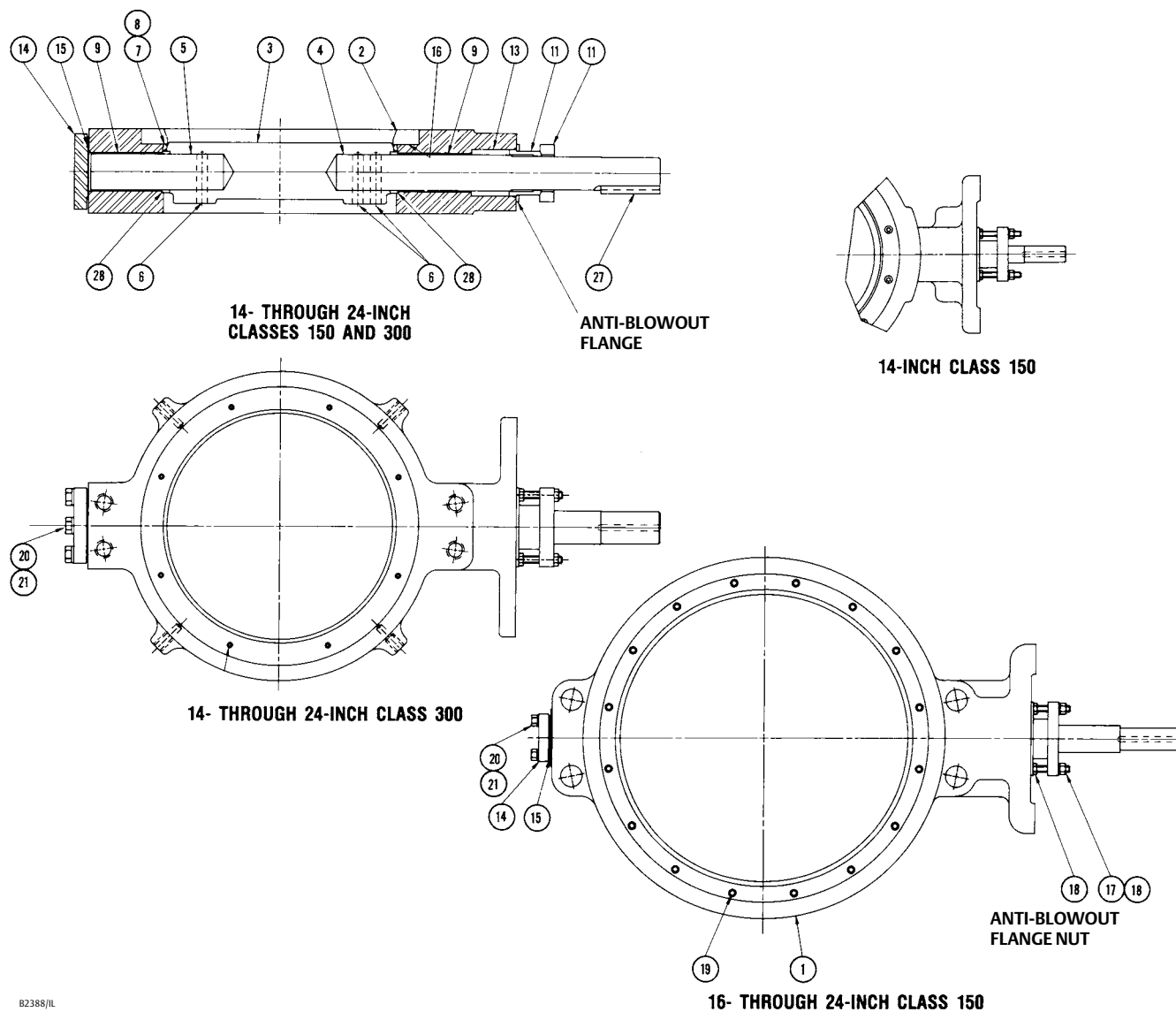


Figure 8. 14- through 24-Inch Fisher A31A Cryogenic Valves (Wafer Style Shown)
(Shown without 2-piece Extension Housing)



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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

A31A Cryogenic-Rotary Valve

February 2019

Instruction Manual

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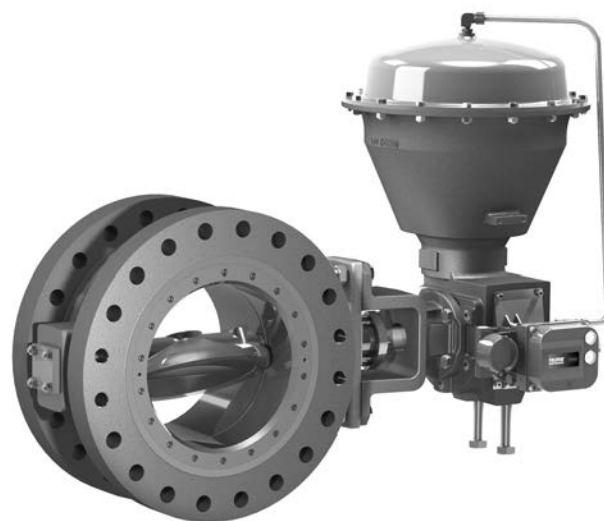


Fisher™ POSI-SEAL™ A31D Double-Flange High-Performance Butterfly Valve

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Figure 1. Fisher A31D Valve with 2052 Actuator



X0704

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts ordering information for Fisher POSI-SEAL A31D double-flange high-performance butterfly valves (see figure 1). Refer to separate instruction manuals for information covering the actuator and accessories.

Do not install, operate, or maintain an A31D valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

A31D Valve Specifications and Materials of Construction

Table 1. Fisher A31D Valve Specifications

	SPECIFICATION
Valve Body Size	NPS 3, 4, 6, 8, 10, 12
Pressure Rating	Consistent with CL150 and 300 per ASME B16.34
Valve Body Materials	WCC Steel
	CF8M Stainless Steel
Disk Materials	CF8M Stainless Steel
End Connections	Mates with RF flanges per ASME B16.5
Valve Body Style	Double Flange
Shaft Connection	Spline (standard)
	Keyed (optional)
Face-to-Face Dimensions	CL150: ISO 5752 Butterfly Valve Short Series
	CL300: ISO 5752 Butterfly Valve Long Series
Shutoff	Soft Seal: Bidirectional ANSI/FCI 70-2 Class VI
	NOVEX Seal: Unidirectional MSS SP-61 ⁽¹⁾
	Phoenix III Seal: ANSI/FCI 70-2 Class VI
Flow Direction	Reverse (flow direction is into the shaft side of the disk)
Flow Characteristic	Approximately Linear
Disk Rotation	Clockwise (CW) to close

1, 0.1 scfh per unit of NPS at 80 psi.

Description

The valve is available in a double-flanged valve body design, with a variety of seals and internal components. The pressure-assisted seal provides tight shutoff against the full class pressure range for the specific type. The splined shaft combines with a variety of Fisher spring-and-diaphragm or pneumatic double-acting or spring-return piston actuators. Maximum inlet pressure/temperature ratings are consistent with ASME CL150 and CL300.

Educational Services

For information on available courses for the Fisher POSI-SEAL A31D valve, as well as a variety of other products, contact:

Emerson Automation Solutions
 Educational Services - Registration
 Phone: 1-641-754-3771 or 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

Recommended or "preferred" installation for the A31D valve is with the flow into the shaft side of the disk (retaining ring downstream from the high pressure side of the valve).

The standard soft seal and standard Phoenix III seal offer ANSI/FCI 70-2 Class VI, bidirectional shutoff. The Phoenix III seal for fire-tested applications must be installed in the preferred direction. The Novex seal is unidirectional and should be installed in the preferred direction. See table 3.

For assistance in selecting the appropriate combination of actuator action and open valve position, consult your [Emerson sales office](#) or Local Business Partner.

WARNING

To avoid personal injury or property damage resulting from the sudden release of pressure:

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Do not install the valve assembly where service conditions could exceed the limits given in this manual or on the nameplates.
- Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices to protect from over-pressurizing the system.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your Emerson sales office or Local Business Partner.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines to the power actuator, release pressure from the actuator, and disconnect the pressure lines from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you are working on the equipment.

WARNING

See the WARNING at the beginning of the Maintenance section for more information before removing the valve from the pipeline.

2. Install a three-valve bypass around the control valve assembly if continuous operation is necessary during inspection and maintenance of the valve.
3. Inspect the valve to be certain that it is free of foreign material.

CAUTION

Damage to the disk will occur if any pipe flanges or piping connected to the valve interfere with the disk rotation path. If piping flange has a smaller inner diameter than specified for schedule 80 piping, measure carefully to be certain the disk rotates without interference before placing the valve into operation.

Be certain that adjacent pipelines are free of any foreign material, such as pipe scale or welding slag, that could damage the valve sealing surfaces.

Installing Double-Flange Valves

WARNING

The edges of a rotating valve disk have a shearing effect that may result in personal injury. To avoid personal injury, keep clear of the disk edges when rotating the disk.

CAUTION

To avoid damage to the valve disk during installation, the valve must be in the fully closed position. If the A31D valve is equipped with a fail-open actuator, remove the actuator before installing the valve/actuator assembly or cycle the valve into the fully closed position. Then, take appropriate steps to ensure that the actuator does not cause the valve to open during installation.

1. See table 2 for flange bolt specifications.
2. Properly orient the valve according to the specific application. For optimum performance, install the valve so that the shaft will be on the high pressure side of the valve at shutoff.
3. Position the valve between the flanges. Be sure to leave enough room for the flange gaskets. Install the lower flange bolts.
4. Select the appropriate gaskets for the application. Flat sheet, spiral wound, or other gasket types, made to the ASME B16.5 group standard or user's standard, can be used on the valve depending on the service conditions of the application. Install the gaskets and align the valve and the gaskets.
5. Install the remaining bolts.
6. Tighten the flange bolts in an alternating criss-cross fashion to a torque value of one-fourth of the final bolting torque. Repeat this procedure several times increasing the torque value each time by a fourth of the final desired torque. When the final torque value has been applied, tighten each flange bolt again to allow for gasket compression.

WARNING

An A31D valve body is not grounded when installed in a pipeline. To avoid personal injury or property damage, always make sure that the valve body is grounded to the pipeline before putting the valve assembly into operation in a flammable or hazardous atmosphere. To provide shaft and disk-to-body grounding, attach a grounding strap to the shaft with a clamp and connect the other end of the grounding strap assembly to the valve body.

7. If necessary, attach a grounding strap from the valve body or pipeline to the valve shaft. For additional information on grounding procedures, contact your [Emerson sales office](#) or Local Business Partner.

Table 2. Stud Bolt and Cap Screw Chart for Double-Flange Valves

VALVE SIZE, NPS	A31D, CL150, ISO 5752 BUTTERFLY SHORT SERIES					
	3	4	6	8	10	12
No. of Through Holes	8	8	8	8	16	16
No. of Tapped Holes	---	8	8	8	8	8
Size-Dia. Inch & Thread	5/8 - 11	5/8 - 11	3/4 - 10	3/4 - 10	7/8 - 9	7/8 - 9
No. of Stud Bolts	8	8	8	8	16	16
A-Length of Stud Bolts ⁽¹⁾ , Inch	4	4-1/2	4-3/4	4-3/4	5-1/2	5-1/2
No. of Cap Screws	---	8	8	8	8	8
B-Length of Cap Screws ⁽²⁾ , Inch	---	2-1/2	2-1/2	2-3/4	3	3
No. of Heavy Hex Nuts	16	16	16	16	32	32
VALVE SIZE, NPS	A31D, CL300, ISO 5752 BUTTERFLY LONG SERIES					
	3	4	6	8	10	12
No. of Through Holes	16	16	24	24	32	24
No. of Tapped Holes	---	---	---	---	---	8
Size-Dia. Inch & Thread	3/4 - 10	3/4 - 10	3/4 - 10	7/8 - 9	1 - 8	1-1/8 - 8
No. of Stud Bolts	16	16	24	24	32	24
A-Length of Stud Bolts ⁽¹⁾ , Inch	4-1/2	5	5-1/4	6	6-3/4	7-1/4
No. of Cap Screws	---	---	---	---	---	8
B-Length of Cap Screws ⁽²⁾ , Inch	---	---	---	---	---	4-3/4
No. of Heavy Hex Nuts	32	32	48	48	64	48

1. Based on 1/8-inch gasket

2. Optional Alternative for Cap Screws

Valve Orientation

The valve can be installed in any orientation, however, it is recommended that the valve drive shaft be horizontal and the actuator vertical.

Before Installing the Valve

⚠ WARNING

The edges of a rotating valve disk (key 2, figure 9 and 10) close with a shearing, cutting motion. To avoid personal injury, keep hands, tools, and other objects away from the disk while stroking the valve.

If the A31D valve is equipped with a fail-open actuator, cycle the valve into the fully closed position. Ensure the valve cannot open during installation by using travel stops, a manual actuator, a constant supply pressure to the pneumatic actuator, or other steps as necessary.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

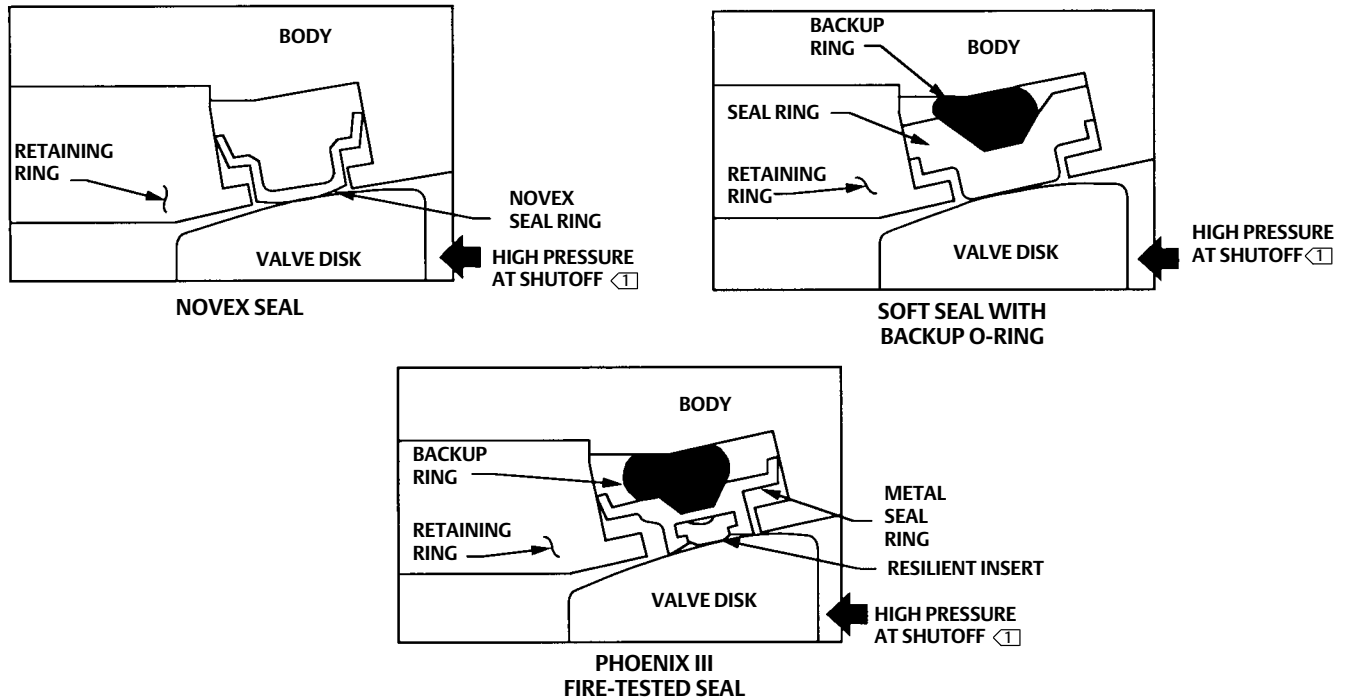
A31D Valve

June 2017

Instruction Manual

D500248X012

Figure 2. Available Seal Configurations



NOTE:

1 FOR OPTIMUM SEAL PERFORMANCE, THE PREFERRED VALVE ORIENTATION AT SHUTOFF IS WITH THE RETAINING RING DOWNSTREAM FROM THE HIGH PRESSURE SIDE OF THE VALVE.

Table 3. Valve Orientation for Optimal Seal Performance

SEAL TYPE	SHUTOFF DIRECTION	INSTALLED ORIENTATION
Standard soft seal	Bidirectional	Preferred
Novex seal	Unidirectional	Preferred only
Phoenix III seal	Bidirectional	Non Fire-Tested Preferred
	Unidirectional	Fire-Tested Preferred

Recommended or "preferred" installation for the A31D valve is with the flow into the shaft side of the disk (retaining ring downstream from the high pressure side of the valve).

Table 4. Valve Weights

SIZE NPS	CL150		CL300	
	kg	lb	kg	lb
3	15	33	28	63
4	25	56	35	77
6	34	76	65	143
8	54	118	156	343
10	81	178	176	388
12	110	243	294	649

An A31D valve is normally shipped as part of an assembly with an actuator and other accessories such as a valve positioner. If the valve and actuator have been purchased separately or if the actuator has been removed for maintenance, properly mount the actuator and adjust valve/actuator travel and all travel stops before inserting the valve into the line.

CAUTION

Damage to the disk will occur if any pipe flanges or piping connected to the valve interfere with the disk rotation path. Be certain to align the valve accurately to avoid contact between the disk (key 2) and the flanges.

Adjusting the Actuator Travel Stops or Travel

Key number locations are shown in figure 9 and 10, unless otherwise noted.

1. Refer to the actuator instruction manual to locate the actuator travel stop that controls the closed position of the valve disk (key 2). When adjusting the travel stop or travel, make sure that the disk is from 0.25 to 0.76 mm (0.010 to 0.030 inch) away from the internal stop in the valve body (see figure 5). This adjustment is necessary to be certain that the actuator output torque is fully absorbed by the actuator travel stop or by the actuator. The internal travel stop in the valve body should not absorb any of the actuator torque.

CAUTION

When using an actuator, the actuator travel stop (or actuator travel, for actuators without adjustable stops) must be adjusted so the disk stop in the valve does not absorb the output of the actuator. Failure to limit the actuator travel as described in the Adjusting the Actuator Travel Stops or Travel steps can result in damage to the valve, shaft(s), or other valve components.

2. Before installing the valve/actuator assembly in the process line, cycle the valve several times to be sure the valve disk returns to the proper position.

Installing the Valve

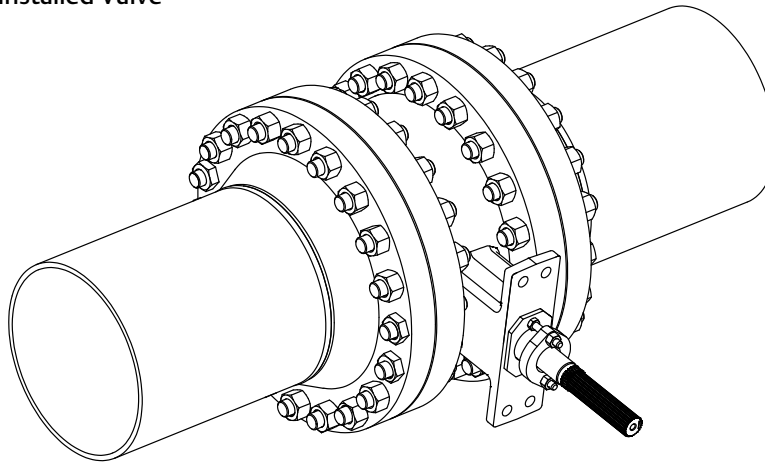
The maximum allowable inlet pressures for A31D valves are consistent with the applicable ASME pressure/temperature ratings except where limited by the material capabilities.

Refer to table 2 for the quantity and size of line bolting required to install the valve in the pipeline.

CAUTION

To avoid damage to the valve disk during installation, the valve must be in the fully closed position. If the A31D valve is equipped with a fail-open actuator, remove the actuator before installing the valve/actuator assembly or cycle the valve into the fully closed position. Then, take appropriate steps to be sure that the actuator does not cause the valve to open during installation.

Figure 3. Properly Installed Valve



GE62595-A

1. See figure 3 for recommended valve orientation.
2. Position the valve between the flanges. Be sure to leave enough room for the flange gaskets. Install the lower flange bolts.
3. Select the appropriate gaskets for the application. Flat sheet, spiral wound, or other gasket types, made to the ASME B16.5 standard or user's standard, can be used on A31D valves depending on the service conditions of the application.
4. Install the remaining flange bolts.
5. Tighten the flange bolts in an alternating criss-cross fashion to a torque value of one-fourth of the final bolting torque. Repeat this procedure several times, increasing the torque value each time by a fourth of the final desired torque. After applying the final torque value, tighten each flange bolt again to allow for gasket compression.

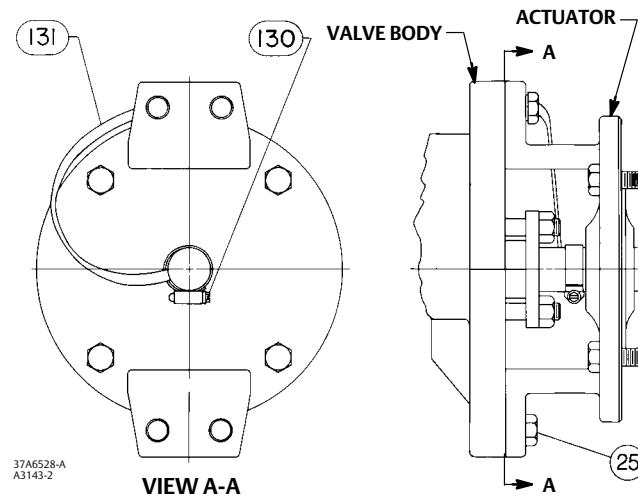
Packing Adjustment and Shaft Bonding

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

1. For PTFE or graphite packing: Tighten standard packing follower nuts only enough to prevent shaft leakage. Excessive tightening of packing will accelerate wear and could produce higher rotating friction loads on the valve stem. If necessary, refer to the Packing Maintenance section.

Figure 4. Optional Shaft-to-Valve Body Bonding Strap Assembly



CAUTION

For non-ENVIRO-SEAL packing: Tighten the packing follower nuts only enough to prevent shaft leakage. Excessive tightening will accelerate wear of the packing and could produce higher friction loads on the valve stem.

2. ENVIRO-SEAL Packing Systems: will not require this initial re-adjustment. Refer to the separate instruction manual, Fisher ENVIRO-SEAL Packing System for Rotary Valves ([D101643X012](#)), for repair and adjustment procedures.
3. For hazardous atmosphere or oxygen service valves, read the following **Warning**, and provide the bonding strap assembly mentioned below if the valve is used in an explosive atmosphere.

⚠ WARNING

The valve shaft is not necessarily grounded when installed in a pipeline unless the shaft is electrically bonded to the valve. To avoid personal injury or property damage resulting from the effects of a static electricity discharge from valve components in a hazardous atmosphere or where the process fluid is combustible, electrically bond the drive shaft (key 3) to the valve according to the following step.

Note

Standard PTFE packing is composed of a partially conductive carbon-filled PTFE female adaptor with PTFE V-ring packing. Standard graphite packing is composed of all conductive graphite ribbon packing. Alternate shaft-to-valve body bonding is available for hazardous service areas where the standard packing is not sufficient to electrically bond the shaft to the valve (see the following step).

4. Attach the bonding strap assembly (key 131, figure 4) to the shaft with the clamp (key 130, figure 4).
5. Connect the other end of the bonding strap assembly to the valve flange cap screws.
6. For more information, refer to the Packing Maintenance section below.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

Key numbers in this procedure are shown in figure 9 and 10, unless otherwise indicated.

WARNING

The valve closes with a shearing action. To avoid personal injury, keep hands, tools, and other objects away from the valve while its being stroked.

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
 - Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
 - Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
 - Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
 - Vent the power actuator loading pressure.
 - Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
 - The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
 - Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
-

Removing and Replacing the Actuator

Refer to the appropriate actuator instruction manual for actuator removal and replacement procedures. The actuator stops or travel stops must limit the rotation of the valve shaft. See the CAUTION below.

CAUTION

When using an actuator, the actuator travel stop (or actuator travel stop, for actuators without adjustable stops) must be adjusted so the disk stop in the valve does not absorb the output of the actuator. Failure to limit the actuator travel can result in damage to the valve, shaft(s), or other valve components.

Packing Maintenance

The A31D valve is designed so the packing can be replaced without removing the valve from the process pipeline.

CAUTION

For non-ENVIRO-SEAL packing: Tighten the packing follower nuts only enough to prevent shaft leakage. Excessive tightening will accelerate wear of the packing and could produce higher friction loads on the valve stem.

Usually, packing leakage can be eliminated by merely tightening the hex nuts (key 15) located above the packing follower (key 12) while the valve is in the pipeline. However, if leakage continues, the packing must be replaced.

For PTFE ENVIRO-SEAL packing system, refer to instruction manual, Fisher ENVIRO-SEAL Packing System for Rotary Valves ([D101643X012](#)) (see figure 8).

CAUTION

Never use a wrench or pliers on the drive shaft (key 3). A damaged shaft could cut the packing and allow leakage.

1. Before loosening any parts on the valve, release the pressure from the pipeline. Then, remove the hex nuts (key 15) and lift off the packing follower (key 12).
2. Remove the hex jam nuts (key 17) and the anti-blowout flange (key 10). Remove the packing follower (key 12). Refer to figure 10 for details of the anti-blowout protection parts.

The packing is now accessible.

3. Use a packing extractor to remove packing. Insert the corkscrew-like end of the tool into the first piece of packing and pull firmly to remove the packing. Repeat this process until all packing parts have been removed.

CAUTION

Be careful when cleaning the packing box. Scratches to the drive shaft (key 3) or inside diameter of the packing bore might cause leakage.

4. Before installing new packing, clean the packing box.
5. Install new packing one ring at a time, using the packing follower as a driver. If using split-ring packing, stagger the splits in the rings to avoid creating a leak path.
6. Reinstall the packing parts. Refer to figure 8 for the sequence of packing parts.

Removing the Valve

1. Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open the valve. Vent the power actuator loading pressure.
2. Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from either side of the valve.

CAUTION

Damage to the valve disk can occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, stroke the actuator to place the disk in the closed position while removing the valve from the pipeline.

3. Loosen the flange bolting that holds the valve. Make sure the valve cannot slip or twist while loosening and removing the bolting.
4. Before removing the valve from the pipeline, make sure the valve disk is closed. Removing the valve with the disk open could cause damage to the disk, piping, or pipe flanges.
5. After removing the valve from the pipeline, move the valve to an appropriate work area. Always support the valve properly.
6. When valve maintenance is complete, refer to the Installation procedures in this manual.

Seal Maintenance

Note

For larger valves, it is possible to replace the seal (key 5) while the actuator is mounted to the valve and can be accomplished by cycling the valve to 90 degrees open.

Key numbers in this procedure are shown in figure 9 and 10, unless otherwise indicated.

1. After removing the valve from the pipeline, remove the manual or power actuator. Manually rotate the drive shaft (key 3) counterclockwise until the disk has moved a full 180 degrees away from the closed position.

WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping of a large valve. Support large valves during maintenance.

2. Lay the valve flat on a work bench in a secure position with the retaining ring (key 18) and retaining ring screws (key 19) facing up. Properly secure the valve on a suitable worktable so it cannot slip, twist, or fall during maintenance. Remove all retaining ring screws.
3. Remove the retaining ring by placing a socket head cap screw from the retaining ring into each of the two retaining ring jacking screw holes. Slowly turn the screws until the retaining ring has been lifted from the valve body. Remove the retaining ring to expose the seal in the T-slot area of the valve body.

Note

The A31D is available with different seal designs and components. See figure 2 to identify the specific seal design.

4. Insert a regular screwdriver or other similar tool under the top edge of seal and gently pry the seal out of the T-slot area in the valve body. Take care not to damage the seal or T-slot area of the valve body. After the seal has been removed, clean the T-slot area, retaining ring and, if required, polish the disk (key 2) thoroughly.

To install a new seal, O-ring (key 6), and retaining ring gasket, follow the appropriate instructions given below.

Table 5. Torque Values for Retaining Ring Screws

ASME CLASS AND VALVE SIZE, NPS	RETAINING RING SCREWS		
	Fastener Nominal Size	N • m	Lbf • in
CL150: NPS 3, 4, 8, and 10; NPS 3 and 4	#10	4.6	41
CL150: NPS 6 and 12; CL300: NPS 6, 8, 10, and 12	1/4	11	100

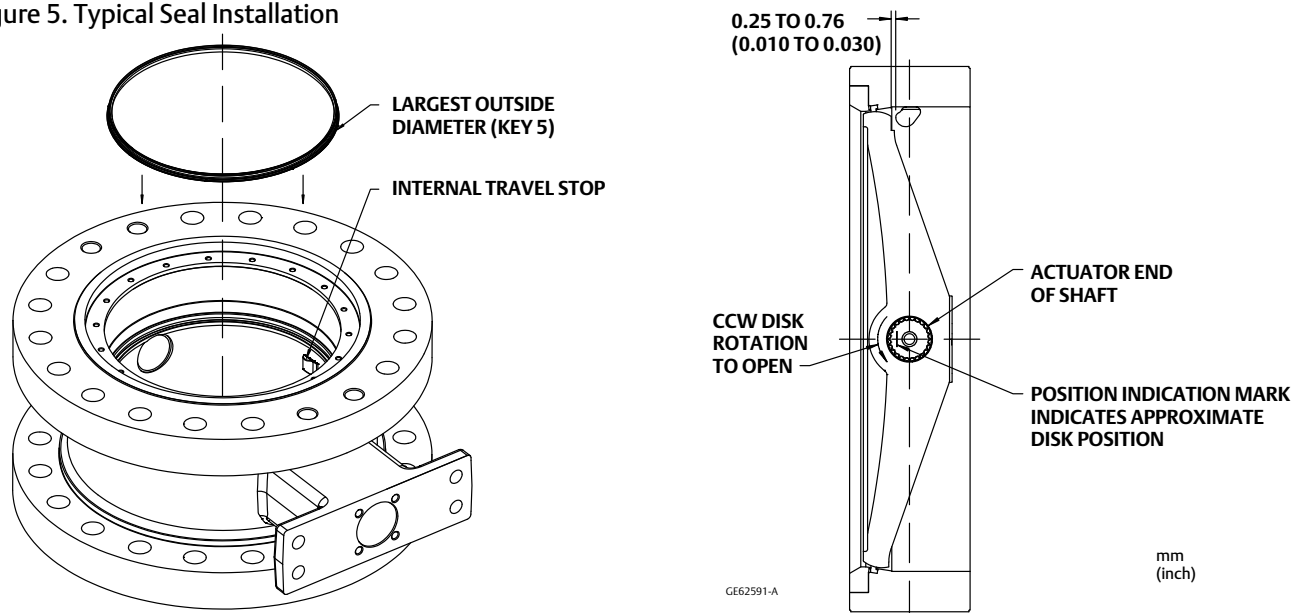
Note: These values are based upon standard materials, S66286/N07718 screws and ASTM A193GRB6 bolts. For other special fastener materials, please contact your Emerson Automation Solutions sales office.

Table 6. Torque Values for Gasket Retainer Bolts

ASME CLASS AND VALVE SIZE, NPS	GASKET RETAINER BOLTS		
	Fastener Nominal Size	N • m	Lbf • in
CL150: NPS 3 and 10; NPS 3	5/16	19	167
CL150: NPS 4, 6, 8, 12; CL300: NPS 4, 6, 8, 10, 12	3/8	33	295

Note: These values are based upon standard materials, S66286/N07718 screws and ASTM A193GRB6 bolts. For other special fastener materials, please contact your Emerson Automation Solutions sales office.

Figure 5. Typical Seal Installation



PTFE Seals

1. Locate the replacement seal ring (key 5) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 5. Around the outside circumference is one wide groove.

Before installing the seal ring into the valve body, place the O-ring (key 6) into the wide, outer groove of the seal ring. Refer to figure 5.

2. Install the seal ring and O-ring assembly in the valve body. The wider outside diameter of the seal ring, as marked in figure 5, goes into the T-slot area of the body. Start the edge with the wider diameter into the T-slot of the valve body using a blunt-end tool.
3. Carefully tuck the O-ring downward into the body T-slot until the seal ring is completely entrapped in the body T-slot, and it completely covers the backup O-ring.
4. Re-install the retaining ring and the socket head cap screws. Tighten the cap screws just enough to eliminate any movement of the retaining ring. Do not over-tighten the retaining ring screws. Using a blunt-end tool, carefully tuck the lip of the seal ring under the retaining ring.

5. When the seal is under the lip of the retaining ring, continue to tighten the cap screws according to standard procedures. Do not fully torque screws at this time. Final tightening of screws is accomplished in step 7 of this procedure.
6. Manually rotate the drive shaft clockwise 180 degrees to return the disk (key 2) to its closed position.
7. The final seating of the retaining ring cap screws can now be done. For the screw torque values, refer to table 5. The seal is now fully installed. Refer to the Installation procedures in this manual.

NOVEX, Phoenix III and/or Phoenix III Fire-Tested Seals

1. Locate the replacement seal ring (key 5) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 5. Around the outside circumference is one wide groove.

Install the seal ring (key 5) in the valve body by first placing the wider outside diameter of the seal ring into the T-slot area of the valve body which is shown in figure 2.

The backup O-ring (key 6) for the Phoenix III seal will have to be installed after placement of the seal ring in the valve body using a blunt-end tool. Do not use the seal tool directly on the metal seat. Use tools on the O-ring only.

2. With the seal ring inserted all the way around the body T-slot now lay the O-ring into the opening between the valve body and the seal ring. Use the seal tool to apply pressure to the O-ring and carefully tuck the O-ring down into the T-slot between the valve body and the seal ring.

Note

On larger valves, it may be more efficient to have someone hold down the seal ring while you push the O-ring into the T-slot.

3. Once the seal ring and backup O-ring have been fully installed into the body T-slot, the retaining ring gasket can be installed. This gasket is a thin graphite material. Punch one initial screw hole through the gasket for alignment, being careful not to cause additional damage to the gasket.

CAUTION

The retaining ring gasket is a thin graphite material. When you punch one initial screw hole through the gasket for alignment, be careful not to cause additional damage to the gasket.

4. Install the retaining ring and align the screw holes in the retaining ring with the holes in the valve body. Install the first retaining ring screw through the punched hole in the ring gasket. Install the other ring screws by pushing the screws through the graphite gasket and threading them into the valve body.
5. Tighten the retaining ring socket head cap screws just enough to eliminate any movement of the retaining ring. Do not over-tighten the retaining ring screws.

⚠ WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping of a large valve. Support large valves during maintenance.

6. To complete this step, stand the valve up. Support the valve securely using methods appropriate for the valve size. If a vise or other clamps are being used, be sure to not damage the flange gasket sealing area of the valve body.

7. Manually rotate the drive shaft (key 3) to turn the disk clockwise to meet the seal.
8. Tap the disk with a rubber mallet to drive it against the internal travel stop. When the disk makes contact with the stop, manually rotate the disk counterclockwise back out of the seal to a 90-degree open position. Repeat steps 7 and 8 three times.

Note

When attaching the actuator to the valve, make sure the valve disk is not in contact with the valve internal travel stop (see figure 5). The valve disk should be positioned from 0.25 to 0.76 mm (0.010 to 0.030 inch) away from the internal stop in the valve body (see figure 5).

9. Use an appropriate tool (such as a feeler gauge) to position the disk (key 2) from 0.25 to 0.76 mm (0.010 to 0.030 inch) away from the internal stop in the valve body.

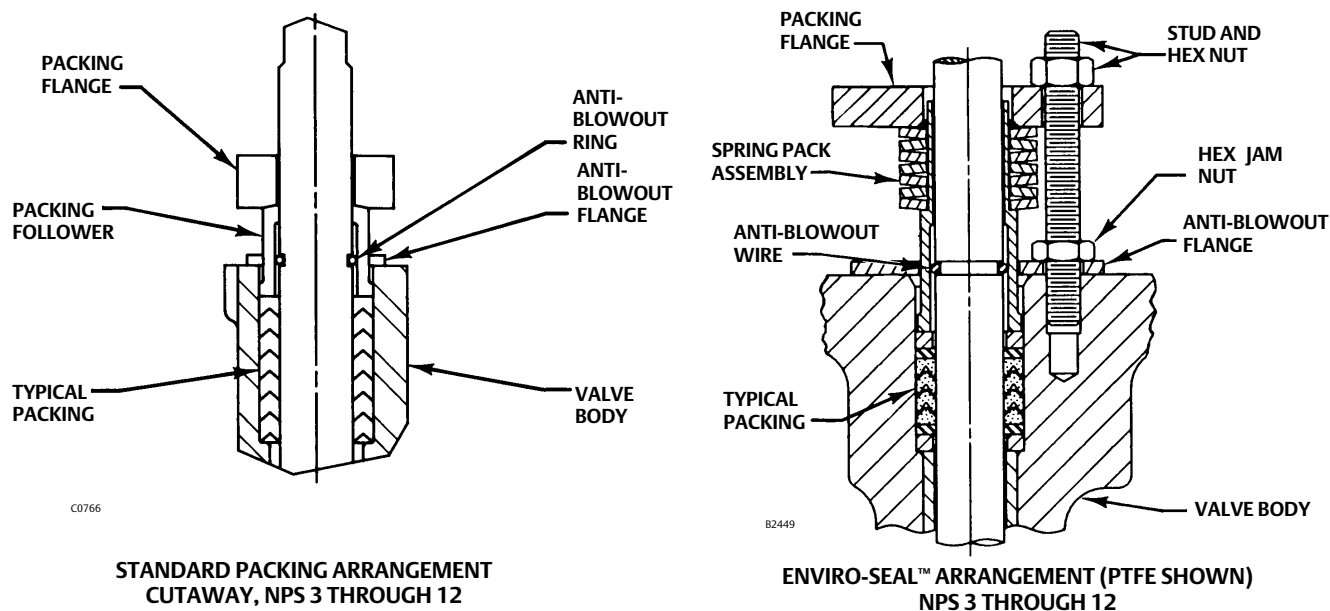
This adjustment is necessary to be certain that the actuator output torque is fully absorbed by the actuator travel stop or by the actuator. The internal travel stop in the valve body should not absorb any of the actuator torque.

CAUTION

When using an actuator, the actuator travel stop (or actuator travel, for actuators without adjustable stops) must be adjusted so the disk stop in the valve does not absorb the output of the actuator. Failure to limit the actuator travel as described in the Adjusting the Actuator Travel Stops or Travel steps can result in damage to the valve, shaft(s), or other valve components.

10. The final seating of the retaining ring screws can now be done. For the screw torque values, refer to table 5.

Figure 6. Blowout Protection (NPS 3 through 12)



Anti-Blowout Protection, Packing, Valve Shaft(s), Disk, and Bearing Maintenance

Removal

Note

NPS 3 through 8 valves (CL150) and NPS 3 through 6 valves (CL300) have a bearing stop pressed into the bearing bore immediately after the packing box.

Do not attempt to remove the bearing stop which is found in the drive shaft bearing bore immediately after the packing box. The bearing stop is pressed into the bearing bore. If the bearing stop needs replacement, contact your [Emerson sales office](#) or Local Business Partner for more information.

Note

The A31D valve has a two-piece shaft. In these procedures, the drive shaft is key 3. The shaft opposite the drive shaft is called the follower shaft (key 4).

CAUTION

When using an actuator, the actuator travel stop (or actuator travel adjustment, for actuators without adjustable stops) must be adjusted so the disk stop in the valve does not absorb the output of the actuator. Failure to limit the actuator travel as described in the next step can result in damage to the valve, shaft(s), or other valve components.

CAUTION

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever off the valve shaft. Driving the lever or actuator off the valve shaft could damage the valve internal parts.

If necessary, use a wheel puller to remove the lever or actuator from the valve shaft. It is okay to tap the wheel puller screw lightly to loosen the lever or actuator, but hitting the screw with excessive force could also damage internal valve parts.

Key numbers in this procedure are shown in figure 9 and 10, unless otherwise indicated.

1. Remove the valve from the pipeline. Remove the actuator from the valve.

WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping of a large valve. Support large valves during maintenance.

CAUTION

Never use a wrench, pliers, or similar tool to turn the drive shaft. A damaged shaft can cut the packing and allow leakage.

Note

It is not necessary to remove the retaining ring and valve seal when removing the shaft(s) and disk.

2. Properly secure the valve on a suitable worktable so it cannot slip, twist, or fall during maintenance.
3. Removing the Anti-Blowout Design:
 - a. **For PTFE or Graphite Packing:** Remove the hex nuts (key 15) and pull off the packing flange (key 11). Remove the hex jam nuts (key 17) and the anti-blowout flange (key 10). Remove the packing follower (key 12). For NPS 3 through 12, remove the anti-blowout ring (key 16), see figure 6.
 - b. **For ENVIRO-SEAL Packing System:** Remove the hex nuts (key 101), the packing flange (key 102), jam nuts (key 17), anti-blowout flange (key 10), and the spring pack assembly (key 103). For NPS 3 through 12, remove the anti-blowout ring (key 16), see figures 6 and 8.
4. Remove the packing from around the drive shaft.

Note

Different valves require slightly different procedures because different valve sizes/ pressure classes have different methods of connecting the disk and shaft(s). To identify the proper procedures, refer to the list below.

- CL150, NPS 3 through 8: One-piece shaft with 1 taper key, (see figure 9).
 - CL150, NPS 10 and 12: Two-piece shaft. 1 taper key in the drive shaft; 1 tangential pin in the follower shaft, (see figure 10).
 - CL300, NPS 3 through 6: One-piece shaft with 1 taper key, (see figure 9).
 - CL300, NPS 8 and 10: Two-piece shaft. 1 taper key in the drive shaft; 1 tangential pin in the follower shaft, (see figure 10).
 - CL300, NPS 12 : Two-piece shaft with 2 tangential pins in the drive shaft; 1 in the follower shaft, (see figure 10).
-

5. Proceed as appropriate, using the following instructions.

For valves with taper key, locate the taper key (key 9, figure 7) which runs through the drive shaft boss on the back of the valve disk. Using a pin punch on the smaller end of the key, drive it out of the disk and shaft. Driving a taper key in the wrong direction will tighten it.

Note

Certain valve sizes may have a taper key that is arc spot welded in place. To remove the key, use a punch on the smaller end of the taper key and drive it out of the disk and shaft, breaking the weld.

For valves with tangential pins, locate the tangential pins (key 25) in the drive shaft (key 3) and the tangential pin (key 25) in the follower shaft (key 4).

- a. Use a threaded rod with an appropriate spacer and nut as an extractor tool to remove the tangential pins. If using a threaded rod, choose a rod with threads that fit the inside thread of the pins. The rod should extend several inches above the disk when it is screwed into a pin.
- b. After screwing the rod into the pin, slide the spacer over the rod and pin. Thread the nut onto the rod and tighten it. As the nut is tightened, the nut will drive the spacer against the disk. The increasing force will draw the pin from the disk.

1. Valves with a two-piece shaft have a gasket retainer and gasket (keys 20 and 21) on the follower shaft side of the valve. Remove the hex head bolts and lockwashers (keys 23 and 22) from the gasket retainer and remove the gasket retainer and gasket to expose the end of the follower shaft.
2. Support the valve disk properly, and remove the follower shaft. Pull the follower shaft from the valve body. Use a shaft extractor screwed into the puller hole in the end of the follower shaft.
3. Support the valve disk properly, and remove the drive shaft. Pull out the drive shaft (key 3) by hand-pulling or by using a shaft extractor screwed into the end of the shaft.

CAUTION

To avoid damage to the disk, seal ring, and T-slot area, do not force the disk past the seal or T-slot area. Remove the disk from the opposite side of the valve body.

4. After removing the shaft(s), remove the disk and the thrust bearings. Do not force the disk past the seal ring or T-slot area.
5. Remove the journal bearings (key 7). Using a suitable punch or puller, drive or pull the journal bearing(s) into the valve body bore from the drive shaft bearing bore. Do not attempt to remove the bearing stop (key 8). Remove the journal bearing from the follower shaft bearing bore.
6. Inspect the valve body bore, bearings, bearing bores, and packing box for damage.

Installing a One-Piece Shaft

Unless otherwise indicated, key numbers and part names are listed in figure 7.

1. Secure the valve in an upright position. Allow for easy access to the valve body bore. Allow for easy access to the drive shaft bearing bore.
2. Inspect all parts removed from the valve for wear or damage. Replace any worn or damaged parts. Clean the valve body and all parts to be installed with an appropriate solvent or degreaser.

CAUTION

Premature valve failure and loss of process control may result if bearings are improperly installed or are damaged during installation.

3. Using caution to prevent damage to the bearing, insert one journal bearing (key 7) from the valve body bore into the drive shaft bearing bore until it hits the bearing stop (key 8). When properly installed, a portion of the journal bearing will extend into the valve body bore.
4. Insert one journal bearing from the valve body bore into the shaft bearing bore opposite the journal bearing installed in step 3. When correctly installed, this journal bearing will be flush with the valve body bore.
5. Install the valve disk by placing the disk into the valve body bore so the curved side of the disk passes through the end of the valve body that does not contain the T-slot. Align the shaft bore in the disk with the bearing bores.
6. Insert the drive shaft end opposite the splined end into the valve body through the packing box. Push the shaft through the bearing stop. Taking care not to dislodge the journal bearing, push the shaft through the journal bearing and the valve disk and into the bore on the opposite side of the valve body.

CAUTION

To avoid damage to the taper key, tangential pins, valve disk, or shaft(s) resulting from the application of excessive force, use appropriate care when driving the key or pins into the disk hub and shaft(s). Use the right tool. Do not use excessive force.

7. Be sure the taper key disk shaft joint is free of oil or grease. If necessary, remove any excess welding material from the taper key.
8. Align the taper key hole in the shaft with the holes in the shaft boss on the disk. Insert the taper key. Use a flat-end punch to drive the taper key until solid contact is felt. Measure the depth of the taper key head for a reference during the following steps.
 - a. Drive the taper key in farther as follows:

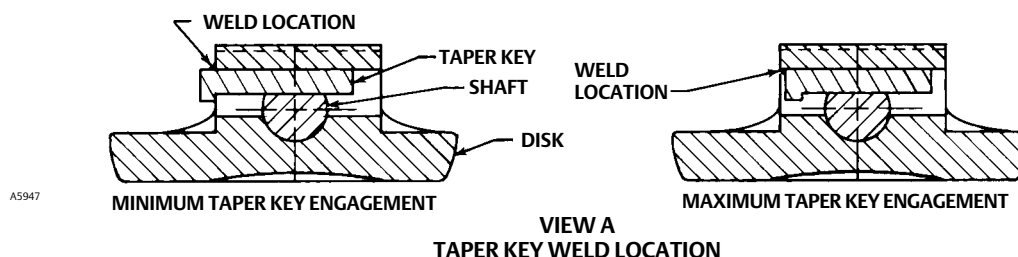
VALVE SIZE, NPS	MINIMUM DEPTH TO DRIVE TAPER KEY AFTER INITIAL SOLID CONTACT
CL150 and 300, NPS 3, 4, 6 valves, & NPS 8 CL150 valves	5 mm (0.188 INCHES)

- b. The disk shaft, and taper key assembly must be inspected to verify that the taper key spans the entire shaft flat width. If so, this procedure is complete. If not, the taper key must be driven in farther until this condition is satisfied. However, do not exceed the following depth limits:

VALVE SIZE, NPS	MAXIMUM ALLOWABLE DEPTH TO DRIVE TAPER KEY AFTER INITIAL SOLID CONTACT
NPS 3 and 4 CL150/300	7 mm (0.281 INCHES)
NPS 6 CL300, and NPS 8 CL150	8 mm (0.312 INCHES)

9. After driving the taper key in place, arc spot weld the head of the taper key to the disk as shown in figure 7. For NPS 3, 4, and 6 valves, use an arc spot weld bead of 1/8-inch diameter. For NPS 8, 10, and 12 valves, use an arc spot weld bead of 3/16-inch diameter.
10. Install the packing as described in the Packing Replacement section or in the ENVIRO-SEAL Rotary Packing Instruction Manual ([D101643X012](#)).

Figure 7. Fisher A31D Taper Key Weld Location



Installing the Two-Piece Shaft

Note

In these instructions, the drive shaft (with splined or keyed end) is key 3. The shaft opposite the drive shaft is called the follower shaft (key 4).

Key numbers in this procedure are shown in figure 9 and 10, unless otherwise indicated.

1. Properly secure the valve on a suitable worktable so it cannot slip, twist, or fall during maintenance. Be prepared to support the valve disk. Allow for easy access to the valve body bore, drive shaft bearing bore and follower shaft bearing bore.

⚠ WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping of a large valve. Support large valves during maintenance.

Note

Replacement disk and shafts are provided as a matched set and both should be replaced at the same time.

2. Inspect all parts removed from the valve for wear or damage. Replace any worn or damaged parts. Clean the valve body and all parts to be installed with an appropriate solvent or degreaser. Note: When installing the bearings, apply lubricant to the outside diameter of the bearing for ease of installation.

CAUTION

Premature valve failure and loss of process control may result if bearings are improperly installed or are damaged during installation.

3. When installing the lower bearings (key 4), insert one or more bearings into the follower shaft bearing bore so it is flush with the body bore.

The number of bearings required changes with valve size and construction. Two bearings are required in the drive shaft and two bearings in the follower shaft.

4. Hold the follower shaft thrust bearing (key 24) in the valve body bore against the counterbore of the follower shaft bearing bore. Push the follower shaft into the bearing bore just enough to hold the thrust bearing.
5. When installing the upper bearing (key 7), insert one or more bearings into the drive shaft from the body bore into the bearing bore below the packing box. Use caution to prevent damage to the bearing.

CAUTION

Use caution to prevent damage to the bearing when installing the upper bearing in the previous step.

6. Hold the drive shaft thrust bearing (key 24) in the valve body bore against the counterbore of the drive shaft bearing bore. Push the drive shaft through the packing box side into the bearing bore just enough to hold the thrust bearing.

CAUTION

To avoid damage to the disk, seal, and T-slot area, do not force the disk past the seal or T-slot area. Install the disk from the opposite side of the valve body.

7. Place the flat side of the disk on a flat surface and insert wooden blocks to raise the disk approximately 50.8 mm (2 inches) from the worktable surface. Then, suspend the valve body over the disk so the seal/T-slot area is facing up. Align the shaft bores through the disk with the drive shaft and follower shaft bores. Lower the valve body over the disk using caution not to dislodge or damage the thrust bearings placed on the ends of the shafts.

8. With the disk (key 2) properly positioned in the valve body (key 1), push the drive shaft and follower shaft the rest of the way through the thrust bearings and into the shaft bores in the valve disk.
9. Align the holes in the shafts with the holes in the disk.

CAUTION

To avoid damage to the taper key, tangential pins, valve disk, or shaft(s) resulting from the application of excessive force, use appropriate care when driving the key or pins into the disk hub and shaft(s). Use the correct tool, and do not use excessive force.

10. Before installing the taper key, be sure the taper key disk shaft joint is free of oil or grease. If necessary, remove any excess welding material from the taper key.
11. Install the appropriate taper key and tangential pins.
12. Install the taper key by aligning the taper key hole in the shaft with the holes in the shaft boss on the disk. Insert the taper key. Use a pin punch to drive the taper key until solid contact is felt. Measure the depth of the taper key head for a reference during the following steps.
 - a. Drive the taper key in farther as follows:

VALVE SIZE, NPS	MINIMUM DEPTH TO DRIVE TAPER KEY AFTER INITIAL SOLID CONTACT
NPS 8 CL300, NPS 10 and 12 CL150, & NPS 10 CL300 valves	6 mm (0.219 INCHES)

- b. The disk shaft, and taper key assembly must be inspected to verify that the taper key spans the entire shaft flat width. If so, this procedure is complete. If not, the taper key must be driven in farther until this condition is satisfied. However, do not exceed the following depth limits:

VALVE SIZE, NPS	MAXIMUM ALLOWABLE DEPTH TO DRIVE TAPER KEY AFTER INITIAL SOLID CONTACT
NPS 8 CL300, and NPS 10 and 12 CL150	10 mm (0.375 INCHES)
NPS 10 CL300	11 mm (0.406 INCHES)

13. After driving the taper key in place, arc spot weld the head of the taper key to the disk as shown in figure 7. For NPS 10 and 12 valves, use an arc spot weld bead of 3/16-inch in diameter.
14. Refer to Packing Maintenance and the Anti-Blowout Design procedures in this manual to re-install the packing and anti-blowout design.

Gasket Retainer

Valves with a two-piece shaft use a gasket retainer and gasket (keys 20 and 21) to cover the follower shaft opening in the valve body. The gasket is held in place by the gasket retainer and four hex head bolts and lockwashers (keys 23 and 22). When reassembling the valve, use a new gasket.

Be sure to center the gasket over the follower shaft bore before retightening bolts. Tighten down bolts evenly in a crossover or star pattern.

Refer to table 6.

Installing the Gasket Retainer

All A31D valves use a gasket retainer and gasket to cover the follower shaft opening in the valve body.

1. Replace the gasket (key 21) and gasket retainer (key 20) over the end of the follower shaft. Use a new gasket.

2. Replace the four hex head bolts (key 23) and lockwashers (key 22) to hold the gasket retainer in place.
3. Be sure to center the gasket over the follower shaft bore before retightening the bolts. Tighten down the bolts evenly in a crossover or star pattern. Refer to table 6 for proper torque values.

Parts Ordering

When replacement parts are required, always use genuine Fisher parts.

Typical parts are shown in figure 9 and 10.

When corresponding with your [Emerson sales office](#) or Local Business Partner about an A31D valve, please identify the valve as an A31D and provide the valve serial number. For valve/actuator combinations assembled at the factory, the valve serial number is stamped on the nameplate attached to the actuator.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Retrofit Kits

Retrofit kits include all parts required for installation of the ENVIRO-SEAL packing system into existing high-performance butterfly valves. Retrofit kits are available for single PTFE packing. See table 7 for retrofit kit included parts.

Note

Key 103, the spring pack assembly, is made up of the packing spring stack held in place by an O-ring on the packing follower.

See table 8 for retrofit kit part numbers.

Table 7. Retrofit Kit Included Parts

Key	Description	Quantity
10	Anti-blowout follower	1
17	Jam nut	1
100	Packing stud	2
101	Packing nut	2
102	Packing flange	1
103	Spring pack assembly	1
105	Packing Set	1
106	Anti-extrusion washer	2 ⁽¹⁾
107	Packing box ring	2
111	Tag	1
112	Cable	1

1. Not included in graphite packing kit.

Repair Kits

PTFE Repair kits include a single PTFE packing set and anti-extrusion washers. Graphite packing sets include graphite packing rings and carbon anti-extrusion rings. See table 8 for PTFE repair kit part numbers.

Table 8. Retrofit and Repair Kit Part Numbers

VALVE SIZE, NPS	PRESSURE RATING	SHAFT DIAMETER ⁽¹⁾ , mm (Inch)	RETROFIT KITS	REPAIR KITS
			PTFE	PTFE
3	CL150	14.3 (9/16)	---	RRTYX000112
	CL300	14.3 (9/16)	---	RRTYX000112
4	CL150	17.5 (11/16)	RRTYXRT0212	RRTYX000122
	CL300	17.5 (11/16)	RRTYXRT0212	RRTYX000122
6	CL150	23.8 (15/16)	RRTYXRT0222	RRTYX000132
	CL300	23.8 (15/16)	RRTYXRT0222	RRTYX000132
8	CL150	23.8 (15/16)	RRTYXRT0232	RRTYX000132
	CL300	31.8 (1-1/4)	RRTYXRT0242	RRTYX000142
10	CL150	28.6 (1-1/8)	RRTYXRT0252	RRTYX000092
	CL300	41.3 (1-5/8)	⁽²⁾	RRTYX000152
12	CL150	31.8 (1-1/4)	RRTYXRT0262	RRTYX000142
	CL300	47.6 (1-7/8)	⁽²⁾	RRTYX000162

1. Shaft diameter: Diameter through the packing box.
2. Contact your Emerson sales office.

Parts List

Note

Contact your [Emerson sales office](#) or Local Business Partner for Part Ordering information.

Key Description

1	Valve Body If you need a valve body as a replacement part, order the valve size, ASME rating and desired material. Contact your Emerson Automation Solutions sales office.
2	Disk
3	Drive Shaft
4	Follower Shaft
5*	Seal Ring
6*	Backup Ring
7*	Bearing
8	Bearing Stop
9*	Taper Key NPS 3 NPS 4 NPS 6 NPS 8 NPS 10 NPS 12 CL300 NPS 3 NPS 4 NPS 6 NPS 8 NPS 10
10	Anti-Blowout Flange
11	Packing Flange
12	Packing Follower
13*	Packing Set PTFE, V-Ring CL150 NPS 3 NPS 4 NPS 6 NPS 8 NPS 10 NPS 12 CL300 NPS 3 NPS 4 NPS 6 NPS 8 NPS 10 NPS 12

Key Description

	Graphite CL150 NPS 3 NPS 4 NPS 6 NPS 8 NPS 10 NPS 12 CL300 NPS 3 NPS 4 NPS 6 NPS 8 NPS 10 NPS 12
14	Stud (2 req'd)
15	Hex nut (2 req'd)
16	Anti-blowout ring
17	Hex Jam Nut (2 req'd)
18	Retaining Ring
19	Retaining Ring Screw
20	Gasket Retainer
21*	Gasket
22	Lockwasher (4 req'd)
23	Cap Screw (4 req'd)
24*	Thrust Bearing
25	Tangential Pin
26*	Retaining Ring Gasket NOVEX and Phoenix III Seal CL150 NPS 3 NPS 4 NPS 6 NPS 8 NPS 10 NPS 12 CL300 NPS 3 NPS 4 NPS 6 NPS 8 NPS 10 NPS 12

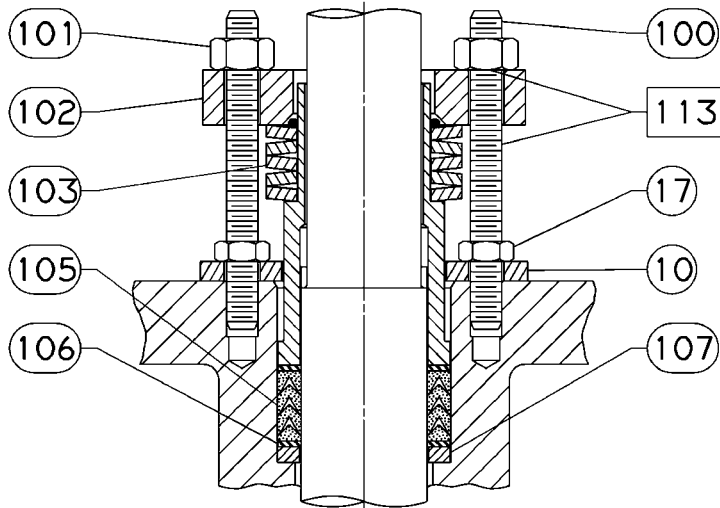
Key	Description
27	Cap Screw - Actuator (4 req'd) (not shown)
28	Hex Nut - Actuator (4 req'd) (not shown)
29	Nameplate (not shown)
30	Drive Screw (2 req'd) (not shown)
31	Key
33	Flow Direction Arrow (not shown)
34	Packing Box Ring
35	Disk/Shaft/Pin Assembly (not shown)

ENVIRO-SEAL Packing System (See figure 8)

10	Anti-Blow Flange
17	Hex Jam Nut (4 req'd)
100	Packing Flange Stud (4 req'd)
101	Packing Flange Nut (4 req'd)
102	Packing Flange, SST
103	Spring Pack Assembly
105*	Packing Set
	Use with PTFE packing
	CL150
	NPS 3
	NPS 4
	NPS 6
	NPS 8
	NPS 10
	NPS 12
	CL300
	NPS 3
	NPS 4
	NPS 6
	NPS 8
	NPS 10
	NPS 12
	Use with Graphite packing
	CL150
	NPS 3

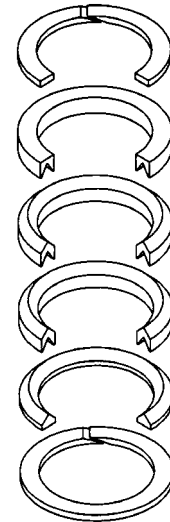
Key	Description
	NPS 4
	NPS 6
	NPS 8
	NPS 10
	NPS 12
	CL300
	NPS 3
	NPS 4
	NPS 6
	NPS 8
	NPS 10
	NPS 12
106*	Anti-Extrusion Ring, Composition/graphite filled PEEK (2 req'd)
	Single PTFE packing w/std packing box
	CL150
	NPS 3
	NPS 4
	NPS 6
	NPS 8
	NPS 10
	NPS 12
	CL300
	NPS 3
	NPS 4
	NPS 6
	NPS 8
	NPS 10
	NPS 12
111	Tag (not shown)
112	Cable Tie (not shown)
113	Lubricant

Figure 8. ENVIRO-SEAL Packing Systems



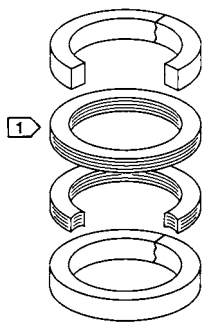
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PTFE PACKING SYSTEM



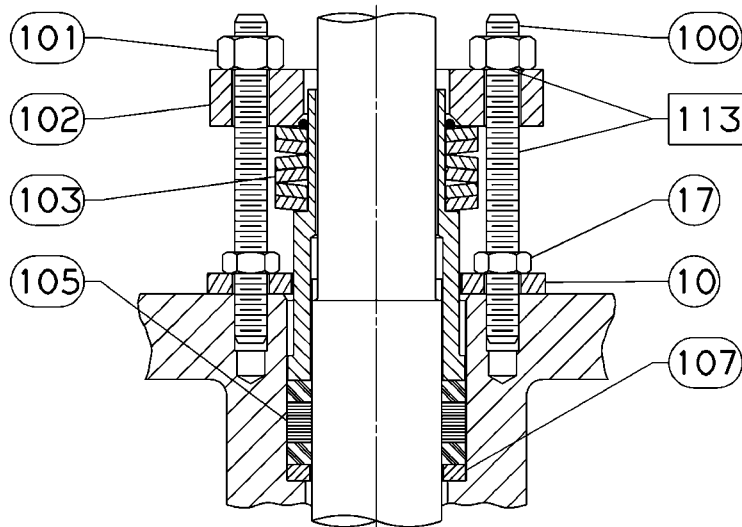
14B0095-A

STACKING ORDER OF
PTFE PACKING RINGS



14B0086-A

STACKING ORDER OF
GRAPHITE PACKING RINGS



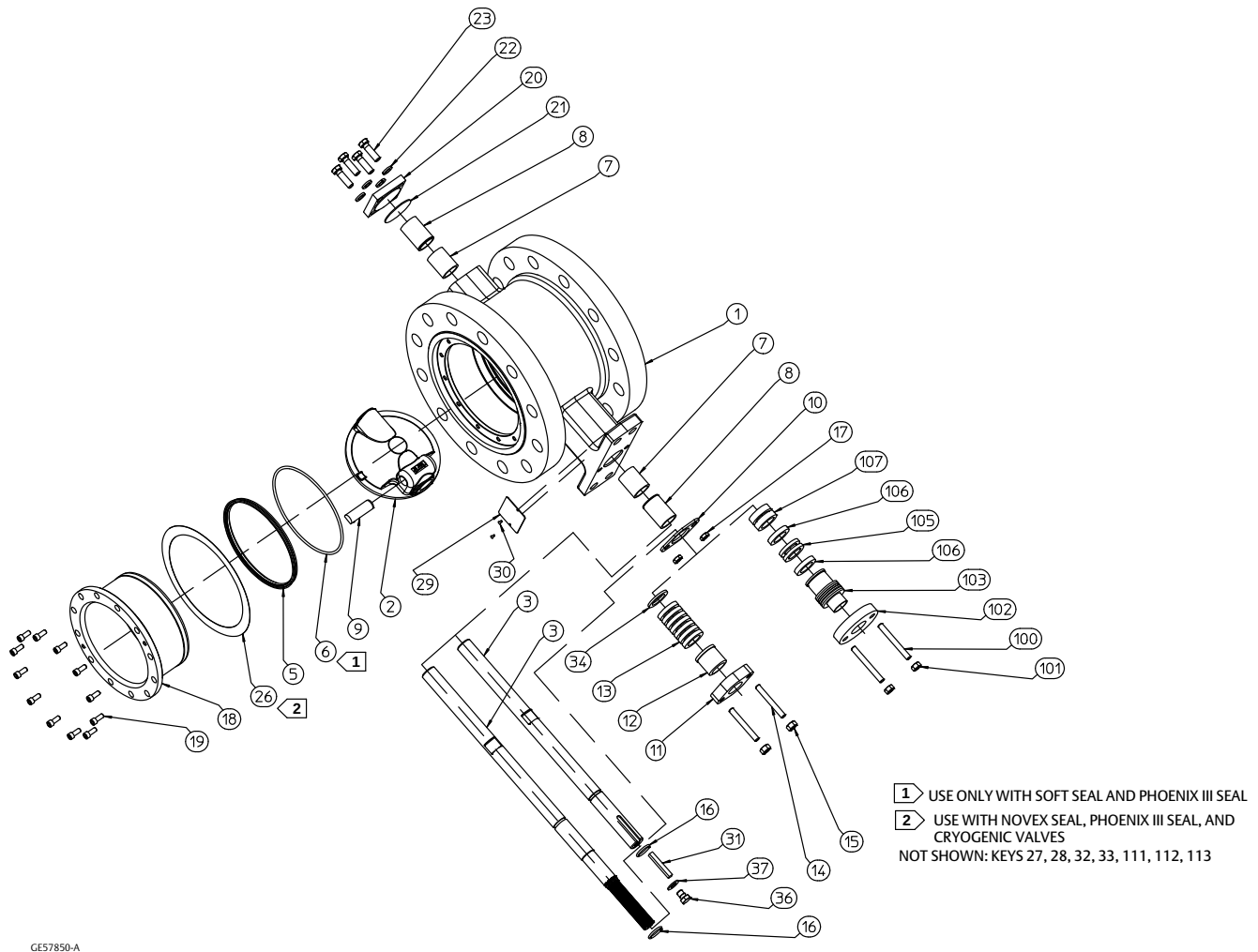
34B7524-B

GRAPHITE PACKING SYSTEM

NOTE:

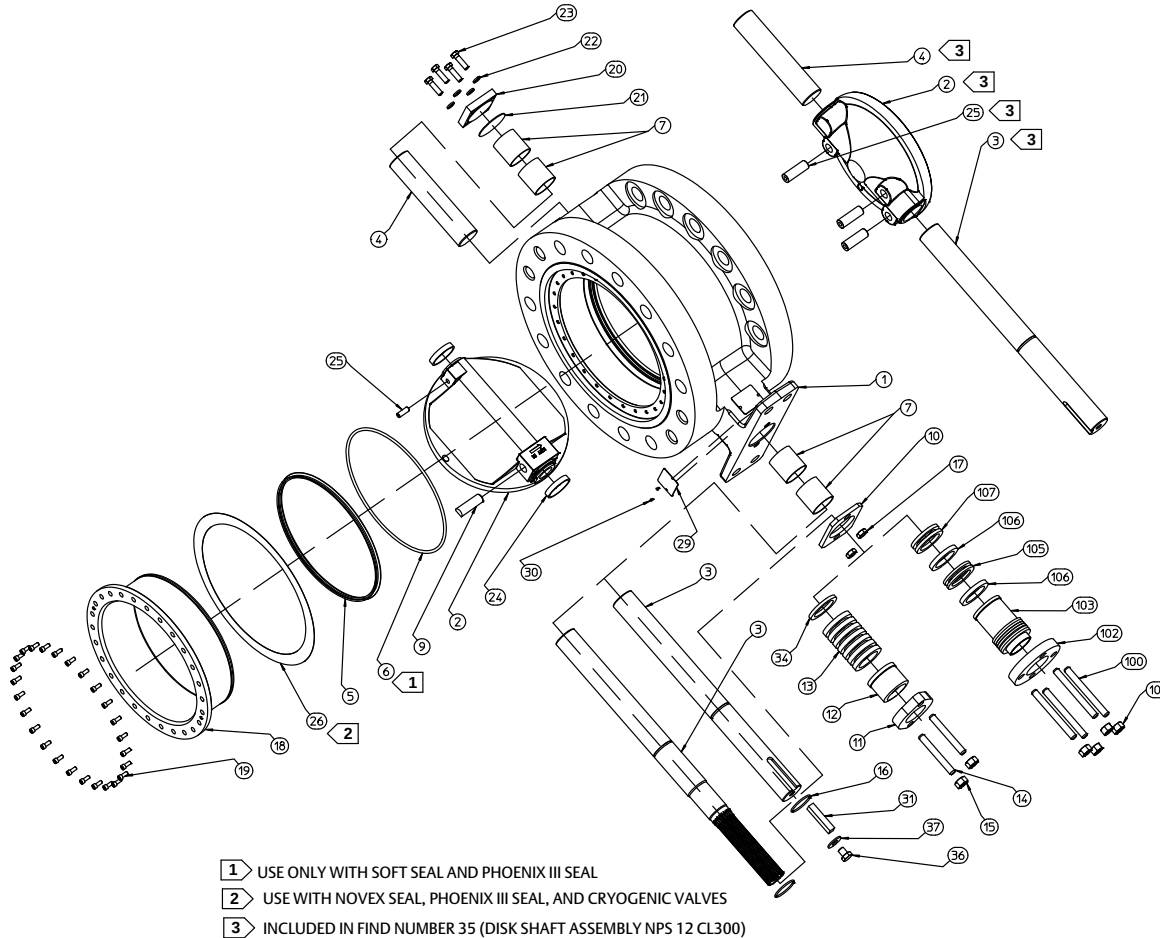
1 VALVES WITH SHAFTS LARGER THAN 38.1 mm (1-1/2 INCH) USE GRAPHITE RINGS

Figure 9. Fisher A31D Valve Body Assembly, NPS 3-8 CL150 and NPS 3-6 CL300



GE57850-A

Figure 10. Fisher A31D Valve Body Assembly, NPS 10-12 CL150 and NPS 8-12 CL300



GE57889-A

NOT SHOWN: KEYS 27, 28, 32, 33, 111, 112, 113

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Fisher™ ATST Desuperheater

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Figure 1. Fisher ATST Desuperheater



X1892

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and operation information for the Fisher ATST desuperheater.



Do not install, operate, or maintain an ATST desuperheater without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

Water atomization and vaporization are key elements in any steam conditioning application. The ATST design incorporates a manifold of patented nozzles to inject atomizing steam and spraywater into process steam. These specialized nozzles produce an optimized spray pattern over a wide operating range. These nozzles are strategically placed to achieve optimal mixing and quick vaporization at all flowing conditions. Years of experience with other steam atomized desuperheater designs went into the development of this construction. Extensive use of computational analysis, in addition to field performance feedback, was used to validate spray system performance.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

ATST Desuperheater

July 2022

Instruction Manual

D104734X012

Table 1. Specifications

Connections⁽¹⁾⁽³⁾

Steam Line: NPS 8 through NPS 60
(DN 200 through 1500)
Spraywater: NPS 1 through 4 (DN 25 through 100)
Atomizing Steam: NPS 1 (DN 25)

Connection Types⁽¹⁾⁽³⁾

Steam Line (all sizes): ■ Butt weld, ■ Raised Face Flanges, ■ Ring Type Joint Flanges
Spraywater: ■ ASME Butt weld (all sizes), ■ Raised Face Flanges (all sizes), ■ Ring Type Joint Flanges (all sizes), ■ Socket Weld
Atomizing Steam (all sizes): ■ Raised Face Flanges, ■ Ring Type Joint Flanges

Pressure Class⁽¹⁾⁽³⁾

Steam Line: According to the customer design pressure and temperature
Spraywater and Atomizing Steam: ASME CL150 to CL2500⁽⁴⁾

Construction Materials⁽⁵⁾

Desuperheater Body and Liner (if applicable):

■ Carbon Steel, ■ 2-1/4 Cr-1 Mo ■ 9 Cr-1 Mo-V
■ 9 Cr-2 W-V

Spray Nozzles: ■ R31233 Cobalt-Chrome Alloy

Gaskets: ■ N06600/Graphite

Bolting: ■ SA193 Grade B7, ■ SA193 Grade B16, ■ N07718

Maximum Inlet Pressures⁽¹⁾

Consistent with applicable pressure-temperature ratings per ASME B16.34

Maximum Unit Cv (for Spraywater Flow)

Contact your [Emerson sales office](#)

Spraywater Pressure Required⁽²⁾

3.5 to 35 bar (50 to 500 psi) greater than steam line pressure

Atomizing Steam Pressure Required

Atomizing steam source pressure typically should be at least 2 times the pressure of the steam to be desuperheated

1. Do not exceed the pressure or temperature limits in this manual, nor any applicable code or standard limitations.

2. A function of required turndown and equipment selection.

3. Offerings meet ASME standards. Consult your Emerson sales office for additional options.

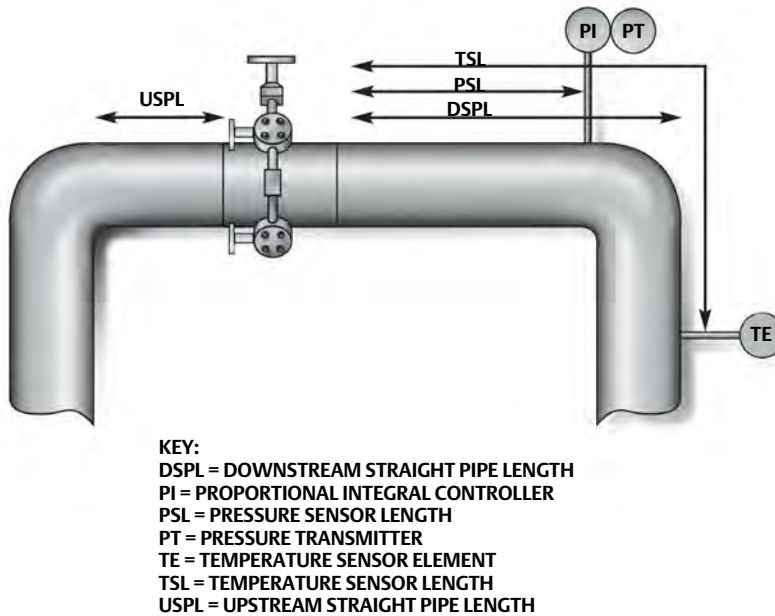
4. Intermediate rating above CL2500 available upon request. PN ratings also available per pressure requirements of EN1092-1. Consult your Emerson sales office for additional information.

5. EN material options available upon request, consult your Emerson sales office for additional information.

Educational Services

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Figure 2. Typical Fisher ATST Installation



X0355A-1

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the ATST desuperheater is installed where service conditions could exceed the limits of the pressure rating noted on the nameplate. To avoid such injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the desuperheater configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and fluid conditions. Do not apply any other conditions to the desuperheater without first contacting your [Emerson sales office](#).

1. Before installation, all piping upstream of the desuperheater must be cleaned so that no loose materials such as welding slag, dirt or other foreign matter are left in the pipe. Use care to keep foreign matter out of the line openings while preparing the desuperheater installation.

⚠ WARNING

Do not lift the desuperheater by its cooler manifold piping. Personal injury or damage to equipment could occur if the desuperheater is improperly lifted into place.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Only personnel trained in proper lifting and rigging practices shall perform desuperheater assembly lifting, rigging and installation. Because each lift will be unique, the method of lifting the desuperheater assembly, the correct location for attaching and lifting the desuperheater assembly, and what the desuperheater assembly will do when lifted shall be considered for each lift.

Lifting and rigging equipment used to lift, install or remove a desuperheater assembly or component must be properly selected and sized for the weight and configuration of the desuperheater assembly or component being lifted. The weight of the complete desuperheater assembly, including attached accessories, must be taken in consideration for this purpose. The lifting and rigging equipment must be properly maintained and inspected for damage before each use.

Lifting lugs or other lifting equipment attached to the desuperheater must never be used to lift or support the weight of attached piping.

If the ATST is equipped with butt weld ends, the desuperheater body must be supported using a lifting sling or other method that does not place a load or force onto the finished surface of the butt weld ends. The ATST does not have a stable resting condition. The desuperheater inlet and outlet must be fully supported until fully welded (butt weld end connections) or bolted (flanged end connections) into the piping.

2. Arrange lifting slings, or other lifting and rigging equipment appropriate for the desuperheater weight and configuration, around the main steam pipe to safely lift the ATST to the pipe opening.

⚠ WARNING

Do not expose the ATST to undue stresses by installing it in bent pipes or flanges. Personal injury and equipment damage could result from flange sealing failure due to improper installation.

3. Flanged Connections—Lubricate the flange connection bolts with a high temperature thread lubricant. Install flange gaskets and connection bolts per accepted practices and tighten securely.
4. Welded Connections—Welding procedures should be in accordance with the applicable codes and the base materials. For preheat, welding electrodes, and post weld heat treatment, refer to the applicable codes and practices applicable for the specific facility. Materials are specified on the customer specification sheet.

NOTICE

Depending on desuperheater body materials used, post weld heat treating may be required. If so, damage to internal parts is possible. In general, if post weld heat treating is to be performed, all nozzles should be removed. Contact your [Emerson sales office](#) for additional information.

5. Remove the spraywater control valve and flush the cooling water line until all debris is removed from the line prior to connecting it to the ATST desuperheater. Use only clean sources of cooling water to reduce the possibility of nozzle clogging. A strainer should be installed in the water line as close to the ATST desuperheater as possible. To determine appropriate mesh size, refer to desuperheater sizing and specification document, or contact your Emerson sales office. Review strainer manufacturer's pressure drop curves to determine appropriate strainer body size. You may need to use a strainer that is larger than the water line size.
6. Remove the atomizing steam valve and flush the steam line until all debris is removed from the line prior to connecting it to the ATST desuperheater.

⚠ WARNING

Failure to use a strainer could result in nozzle clogging and subsequent property damage or loss. Uncontrolled temperatures resulting from clogged nozzles may result in equipment or process temperature limits being exceeded. Exceeding system temperature limits could result in property damage or personal injury.

7. A length of straight pipe is required downstream of the ATST desuperheater to ensure complete vaporization of cooling water. An example of a typical installation appears in figure 2. Consult the ATST cooler sizing sheet for the required distance of straight pipe. This is unique for each application and is supplied by Emerson.
8. Typically, a temperature sensor will be mounted downstream of the ATST desuperheater. This distance will vary depending on a number of factors including steam velocity and percentage of spraywater. Consult the ATST cooler sizing sheet provided with the unit for this temperature sensor distance. The steam line should not have any branch lines dividing the steam flow between the ATST desuperheater and the temperature sensor. If you have any questions, contact your [Emerson sales office](#).
9. A typical installation is illustrated in figure 2. A temperature sensor (TE) measures changes in temperature and a temperature transmitter (TT) transmits the signal to the temperature control device. The output signal from the controller is sent to the positioner on the cooling water (spraywater) control valve (SWCV). The positioner's output signal strokes the SWCV open, increasing water pressure on the nozzles. Increasing water pressure upstream of the nozzles increases water flow through the nozzles.

The atomizing steam valve operates either as on/off or control depending on application, and the type of operation will be listed in the ATST sizing. In on/off operation, the atomizing steam valve is normally controlled so it fully opens just prior to the spraywater control valve opening. In control operation, the valve signal is modulated based on a downstream pressure target, as noted in the ATST sizing.

Maintenance

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- **Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.**
- **Use bypass valves or completely shut off the process to isolate the desuperheater from process pressure. Relieve process pressure and drain process media from the desuperheater.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

Servicing

Table 2. Inspection Summary

Key	Part Description	Inspection Tips and Diagnostics	Repair	Replacement
1	Steam Pipe (not replacement part)	Inspect for erosion, thermal fatigue, and other damage	Consult your local Emerson Service Center or Emerson Accredited Service Provider for a recommendation on necessary weld repair or replacement	
2	Nozzle Body (not replacement part)	Inspect for erosion, thermal fatigue, and other damage	Consult your local Emerson Service Center or Emerson Accredited Service Provider for a recommendation on necessary weld repair or replacement	
3	Nozzle Alignment Pin	Refer to Nozzle Maintenance Section		As needed
7	Nozzle Body Flange	Inspect gasket surfaces for damage that could indicate gasket leakage when spray nozzles are replaced	Replacement Only	As needed
10	Nozzle	Refer to Nozzle Maintenance Section		Replacement every 30-42 months for optimal performance
12	Steam Pipe Liner (not replacement part)	Inspect for erosion, thermal fatigue, and other damage	Consult your local Emerson Service Center or Emerson Accredited Service Provider for a recommendation on necessary weld repair or replacement	

Nozzle Maintenance and Replacement

When subjected to normal operating conditions, it is possible that wear, blockage, and/or fatigue will occur to the nozzle assembly. During regularly scheduled maintenance, visually inspect the nozzles for wear and blockage. Your local Emerson Service Center or Emerson Accredited Service Provider can help to determine the extent of fatigue and the correct course of action. Poor performing nozzles or nozzle failure is typically caused by wear, corrosion, erosion, and/or blockage. The following instructions will help to determine if any of these problems are present and provide a recommended course of action for each.

Note

For optimal performance, nozzles should be inspected every 18-24 months and replaced every 30-42 months.

1. Loosen and remove the nozzle body flange stud nuts (key 6) and washers (key 4). Then, remove the nozzle body flange assembly (key 7). Inspect the nozzle body flange gasket surfaces for damage. If damage is present, replacement is necessary.

Figure 3. Fisher ATST Nozzle


X1886

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

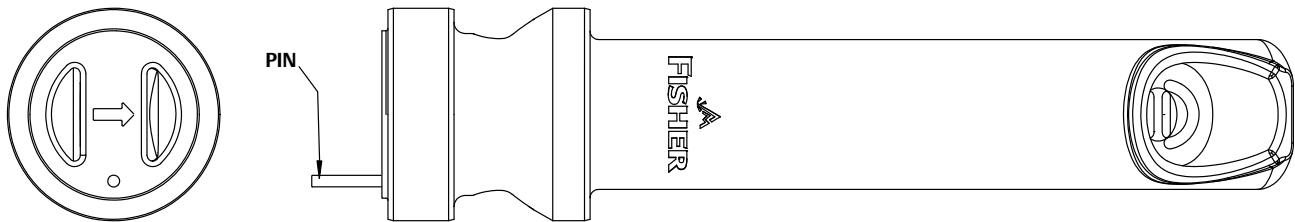
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ATST Desuperheater

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2. Remove the nozzle (key 10), nozzle gaskets (key 9), and nozzle body flange gasket (key 8).
3. Inspect the water and atomizing steam injection orifices for excessive wear, erosion/corrosion, or blockage due to particulate. Wear is defined as any cuts, gouges, or widening of the openings at the point of water and steam injection. Erosion/corrosion is defined as any form of rust or erosion of the nozzle. Blockages are defined as small particulate becoming trapped within the flow channels of the nozzle, impeding flow. Replacement of the nozzle is recommended if any of the preceding problems are present.
4. Rinse the nozzle (key 10) to remove any loose particulate that may be present.

Figure 4. Spray Nozzle Alignment Pin Location



GH01927

5. Reassemble in the following order: nozzle gasket (key 9), nozzle body flange gasket (key 8), spray nozzle (key 10), second nozzle gasket (key 9), nozzle alignment pin (key 3), nozzle body flange assembly (key 7), washers (key 4), and stud nuts (key 6). Ensure the nozzle is installed such that the flow arrow is aligned with the direction of process steam flow. It is recommended that any used gaskets be discarded and replaced with new ones.
6. Torque nozzle body flange nuts as indicated in table 3.

Table 3. Recommended Nozzle Body Flange Bolting Torque with Nickel Anti-Seize Lubricant⁽¹⁾

BOLT SIZE, INCH	THREADS PER INCH	LUBRICATION	RECOMMENDED BOLT TORQUE ⁽²⁾	
			N•m	Lbf•ft
5/8	11	Nickel Anti-Seize	163	120
3/4	10		258	190
7/8	9		373	275
1	8		522	385
1-1/8			712	525
1-1/4			942	695
1-3/8			1268	935
1-1/2			1654	1220
1. For other lubricants, contact your Emerson sales office for recommended bolt torque. 2. Torques for lubricated studs with heavy hex nuts.				

Parts Ordering

Each ATST desuperheater is assigned a serial number. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and key numbers for each part required. The key numbers in the Parts List and the assembly drawing in figure 5 can be used to help in part identification.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher desuperheater, because they may void your warranty, might adversely affect the performance of the desuperheater, and could cause personal injury and property damage.

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description
-----	-------------

1	Steam Pipe
2	Nozzle Body
3	Nozzle Alignment Pin
4	Nozzle Body Flange Washer
5	Nozzle Body Flange Stud
6	Nozzle Body Flange Stud Nut
7	Nozzle Body Flange Assembly

Key	Description
-----	-------------

8*	Nozzle Body Flange Gasket
9*	Nozzle Gasket
10*	Spray Nozzle
11	Steam Pipe Liner Guide Ring
12	Steam Pipe Liner
13	Steam Pipe Liner Retention Pin
14	Nameplate (not shown)

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Figure 5. Fisher ATST Desuperheater

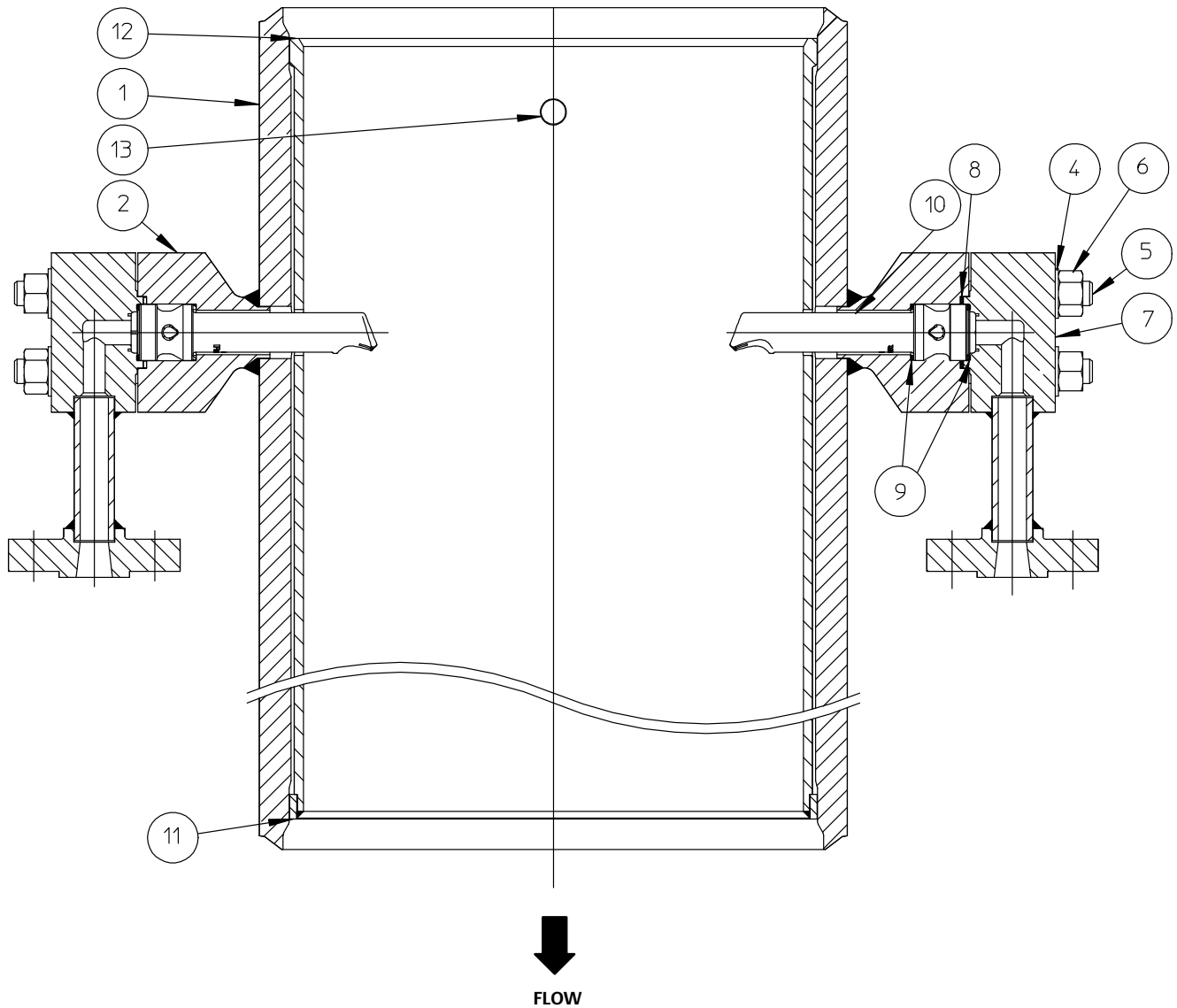
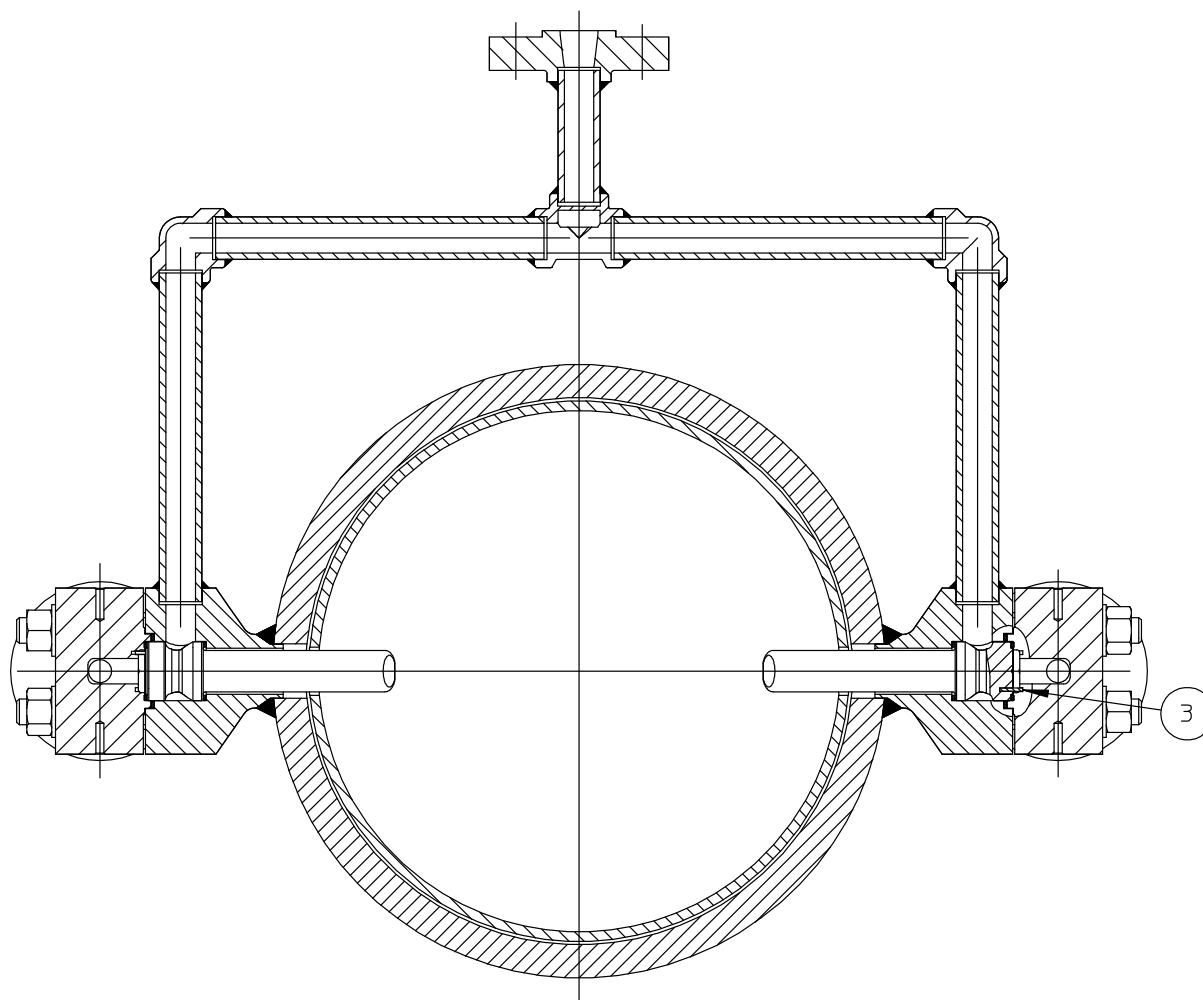


Figure 6. Fisher ATST Desuperheater Alternate View



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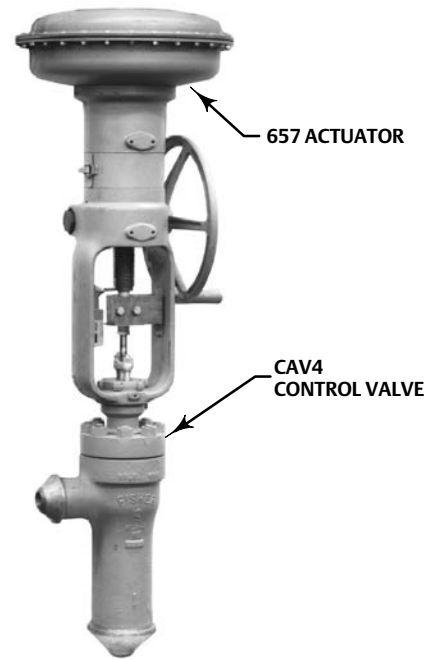


Fisher™ CAV4 Control Valve

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Figure 1. Fisher CAV4 Control Valve with 657 Actuator



W2700-1

Introduction

Scope of Manual

This manual includes installation, maintenance, and parts ordering information for the Fisher CAV4 control valve and Cavitrol™ IV trim. Information on the flushing trim is also provided. Refer to separate manuals for information concerning the actuator, positioner, and other accessories used with this control valve.



Do not install, operate, or maintain a CAV4 control valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications
Available Configurations and Valve Sizes

Common Characteristics: Four-stage Cavitrol IV trim with soft metal-to-metal seats in CAV4 angle valve. Valve plug action is push-down-to-close

Seal Ring Construction: NPS 2, 3, 4, or 6 angle NPS 6 valve with pressure-balanced valve plug and spring-loaded PTFE seal ring. For use in low-temperature applications

Stem-Balanced Construction: NPS 2 angle or 4 valve body with stem-balanced valve plug (valve stem diameter--for that portion of the stem that passes through the bonnet--is equal to the nominal port diameter). For use in high-temperature applications

Piston Ring Construction: NPS 6 valve with pressure-balanced valve plug and five graphite piston rings. For use in high temperature applications

Unbalanced Construction: NPS 2 globe valve

Maximum Inlet Pressure, Temperature, and Pressure Drops⁽¹⁾

Consistent with ASME B16.34 CL1500 and CL2500 pressure/temperature ratings; but do not exceed the pressure, temperature, and pressure drop conditions specified when the valve was ordered. Also, see the Installation section in this manual

End Connection Style

Butt welding Ends: All butt welding end schedules per ASME B16.25 that are compatible with ASME B16.34 valve body rating.

Raised-Face or Ring-Type Joint Flanged Ends: Inlet connection is CL1500 or CL2500 flange per B16.5. Outlet connection mates with CL2500 flange and has tapped bolt holes

Shutoff Classification

TSO (Tight Shutoff) Trim: Valves with TSO trim are factory tested to a more stringent Emerson

Automation Solutions test requirement of no leakage at time of shipment using ANSI/FCI 70-2 and IEC 60534-4 Class V procedures.

Piston Ring Construction: Class IV per ANSI/FCI 70-2 and IEC 60534-4

Angle Body: Class VI per ANSI/FCI 70-2 and IEC 60534-4

Globe Body: Class V per ANSI/FCI 70-2 and IEC 60534-4

Flow Direction

Angle Bodies: In through the side connection and out the bottom connection

Globe Bodies: Flow down

Flow Characteristic

Linear

Port Diameters and Unbalance Area

See table 2, or table 3 for TSO trim

Minimum Seating Force

First refer to figure 2 to determine minimum seat load in lbf per inch of port circumference, then multiply that value by the port circumference from table 2, or table 3 for TSO trim

Valve Plug Travel

See table 2

Yoke Boss and Valve Stem Diameters

See table 2

Approximate Weights

See table 4

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for the valve should not be exceeded.

Description

The CAV4 control valve, shown in figure 1, is an angle or globe (NPS 2 only) valve with soft metal-to-metal seats, Cavitrol IV trim, cage guiding, and push-down-to-close valve plug action. Figures 6 and 8 show a typical balanced TSO (tight shutoff) trim construction. Figure 13 shows three additional valve plug constructions that are available: one with a pressure-assisted spring-loaded PTFE seal ring with PEEK (poly ether ether ketone) anti-extrusion rings, another with five graphite piston rings, and a third with stem-balancing.

Cavitrol IV trim is most often used to help eliminate cavitation damage on liquid service where the differential pressure drop is greater than 207 bar, differential (3000 psi). It may also be used in applications with lower pressure drops where its anti-cavitation performance is required. Figure 15 shows the valve with flushing trim. Flushing trim consists of two plates installed prior to system flushing in order to protect Cavitrol IV trim and valve body gasket surfaces.

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Earlier CAV4 control valves used hard metal-to-metal seats. The soft metal-to-metal seated version can be identified by the letters SMS stamped on the seat ring (key 35, figure 13) or lower cage assembly (key 2, figure 13).

Educational Services

For information on available courses for the Fisher CAV4 valve, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Specifications

Specifications for the CAV4 control valve are shown in tables 1, 2, and 4.

Table 2. Additional Valve Specifications

VALVE SIZE, NPS	BODY TYPE	VALVE STEM DIAMETER		YOKE BOSS DIAMETER		TRAVEL		PORT DIAMETER		PORT CIRCUMFERENCE		UNBALANCE AREA ⁽¹⁾		APPROX. WEIGHT	
		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm ²	Inch ²	kg	lb
2	Globe	---	---	91	3-9/16	19	3/4	25.4	1	---	---	5.10	0.79	---	---
	Angle	19.0 38.1	3/4 1-1/2 ⁽²⁾	91 127	3-9/16 5	38	1.5	38.1	1.5	119.6	4.71	1.10	0.17	167 182	369 401
3	Angle	19.0	3/4	91	3-9/16	51	2	55.6	2.1875	174.5	6.87	1.68	0.26	301	664
4	Angle	19.0	3/4	91	3-9/16	64	2.5	69.9	2.75	219.4	8.64	2.06	0.32	532	1172
		25.4 69.8	1 2-3/4 ⁽³⁾	127 178	5 7									532 554	1172 1222
6	Angle	31.7	1-1/4	127	5 and 5H	102	4	111.1	4.375	349.2	13.75	3.29	0.51	1512	3334

1. For seal ring and piston ring constructions. For stem-balanced construction, use port area of 11.4 cm² (1.77 inch²) for NPS 2 valve and 38.3 cm² (5.94 inch²) for NPS 4 valve.
2. Stem-balanced construction has 31.8 mm (1-1/4 inch) valve stem connection.
3. Stem-balanced construction has 50.8 mm (2 inch) valve stem connection.

Table 3. Additional Valve Specifications for TSO (Tight Shutoff) Trim

VALVE SIZE, NPS	MAXIMUM TRAVEL		YOKE BOSS SIZE ⁽¹⁾		PORT DIAMETER				PORT CIRCUMFERENCE		C _v REDUCTION AT 100% TRAVEL ⁽²⁾
					Nominal		Actual TSO				
	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	
2 ⁽³⁾	38	1.5	91 127	3-9/16 5	38.1	1.5	38.1	1.5	119.6	4.71	0%
3	50.8	2	91	3-9/16	55.6	2.1875	55.6	2.1875	174.5	6.87	0%
4	64	2.5	91 127	3-9/16 5	69.9	2.75	69.9	2.75	219.4	8.64	0%

1. Consult the factory for larger yoke boss sizes.

2. This column lists the percent reduction of published maximum C_v of the trim listed in the TRIM column.

3. Angle valve only.

Table 4. Approximate Weights

VALVE SIZE, NPS	BODY TYPE	YOKE BOSS DIAMETER		TOTAL		BONNET ONLY		VALVE PLUG AND STEM ASSEMBLY		LOWER CAGE ASSEMBLY		UPPER CAGE	
		mm	Inch	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb
2	Globe	91	3-9/16	---	---	---	---	---	---	---	---	---	---
	Angle	91 127	3-9/16 5	167 182	369 401	44 59	98 130	3 3	7 7	12 12	27 27	4 4	9 9
3	Angle	91	3-9/16	301	664	47	103	5	12	14	30	7	16
4	Angle	91 or 127	3-9/16 or 5	532	1172	127	280	12	27	37	82	12	27
		178	7	554	1222	150	330	12	27	37	82	12	27
6	Angle	127	5 and 5H	1512	3334	240	530	44	98	84	186	54	120

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or system damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 and on the appropriate nameplates. To avoid such injury or damage, use pressure-relieving devices as required by applicable industry codes to prevent the service conditions from exceeding these limits.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

The valve configuration and construction materials were selected to meet particular pressure, pressure drop, temperature, and controlled fluid conditions indicated when the valve was ordered. Do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

Trim parts, seals, and gaskets may be damaged if post-weld butt-weld heat treatment is applied to valve areas other than the end connections. If heat treatment will be performed over the entire valve body, seals and gaskets must be removed. Valve plug seals may be reused; gaskets that are removed must not be reused. Use new gaskets upon assembly.

If hoisting the valve, be sure the hoist used is capable of handling the weight of the valve and actuator. Also, be sure the sling does not damage the painted surfaces, is positioned securely to prevent swinging or slipping, and is positioned so as to cause no damage to tubing or any accessories.

1. The valve must be installed so that the actuator is positioned vertically above the valve body. This position reduces the possibility of uneven wear on the valve plug. Also, this position facilitates easier maintenance and prevents stem binding due to actuator weight.
2. Be certain the valve body and adjacent pipelines are free of foreign materials that may damage valve seating surfaces.
3. If continuous operation of the system will be required during valve inspection and maintenance, install a conventional three-valve bypass around the point of valve installation.

CAUTION

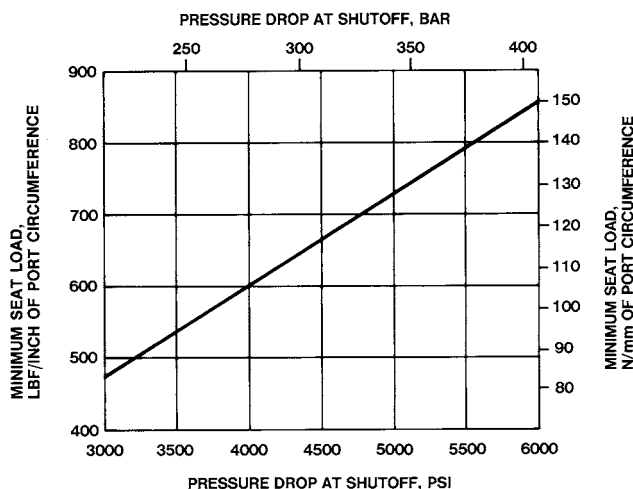
For long service life and more effective operation, the process liquid must be clean. Impurities or entrained solids in the process liquid may cause irreparable erosion damage to the seating surfaces and may plug cage holes, causing cavitation damage. During valve installation or the plant cleaning cycle, install a strainer upstream from the valve to help free pipelines of foreign material.

4. Flow through the valve must be as indicated by the flow direction arrow on the valve body.
5. Use accepted piping practices when installing the valve in the pipeline. For flanged valves, remove the protective covering from the outlet flange studs, and use a suitable gasket between the valve and the pipeline flanges.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however, the packing might require some readjustment to meet specific service conditions.

Figure 2. Recommended Minimum Seat Load for All Constructions



A2922-1

Flushing the Pipeline

Before flushing the piping system, install the CAV4 flushing trim (figure 15), if available, as described in the Use of Optional Flushing Trim procedure in the Maintenance section.

Principle of Operation

With Cavitrol IV trim, liquid flow enters the valve through the side connection and enters the cage through the top set of holes as shown in figure 3. No significant pressure drop occurs across the set of holes because the flow area is relatively large. As the liquid flows down through the cage, it undergoes four staged pressure drops by flowing through four additional sets of holes. All significant throttling action occurs in the four sets of holes down-stream of the seating surfaces. Flow leaves the valve through the bottom connection.

When the valve is partially open, the valve plug blocks some of the holes above the seating surfaces. A small amount of flow enters the blocked holes and flows out through the clearance between the cage and plug. Because all significant pressure drop is taken downstream of the seating surfaces, the clearance flow does not cavitate or cause erosion of the seating surfaces. Each of the four stages has a successively larger flow area, resulting in higher pressure drops across the first stages where there is no danger of the liquid pressure falling low enough to allow the formation of vapor bubbles that can cause cavitation.

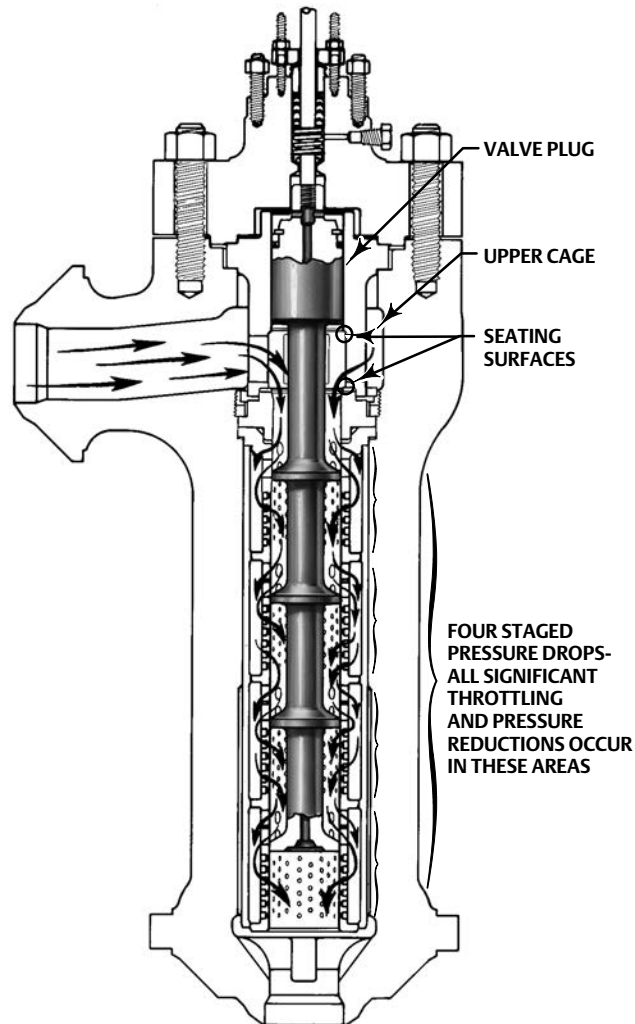
Because more than 90 percent of the total valve pressure drop is across the first three stages, both the inlet pressure to the final stage and the pressure drop across the final stage are relatively low. A low inlet pressure and pressure drop at the final stage result in a pressure at the vena contracta (the lowest pressure reached in the flow stream) that is above the liquid vapor pressure. Maintaining this higher pressure at the vena contracta ensures that the liquid pressure does not fall below the vapor pressure, and thus cavitation does not occur.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing replacement, trim removal, trim replacement, and use of flushing trim.

Key numbers used in these procedures are shown in figure 13, except where indicated.

Figure 3. Schematic of CAV4 Angle Valve with Cavitrol IV Trim



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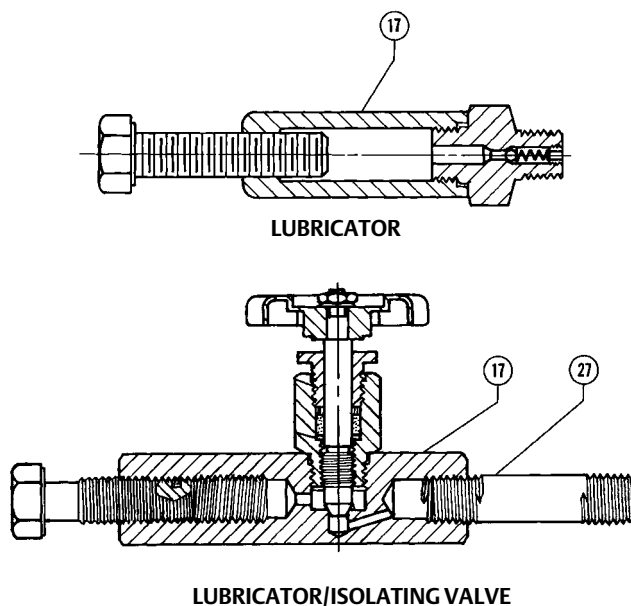
⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure, and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Figure 4. Optional Lubricator and Lubricator/Isolating Valve



Packing Lubrication

CAUTION

Do not lubricate graphite packing. Graphite packing is self-lubricated. Additional lubrication may result in slip-stick movement of the valve.

Note

To avoid lubricants breaking down at elevated temperatures, do not lubricate packing used in processes with temperatures over 260°C (500°F).

A lubricator or lubricator/isolating valve (figure 4) is available for use with PTFE-composition packing or other packings that require lubrication. If a lubricator or lubricator/isolating valve is used, it will be installed in place of the pipe plug (key 17) in the bonnet (key 12).

Use a good quality silicon-base lubricant. Packing used in processes with temperatures over 260°C (500°F) should not be lubricated. Be certain the lubricant is compatible with the process liquid. The frequency of lubrication depends upon the severity of the service conditions.

To operate the lubricator, simply turn the cap screw clockwise to force lubricant into the packing box. The lubricator/isolating valve operates the same way except the isolating valve must first be opened and then closed after lubrication is completed.

Table 5. Recommended Torque for Packing Flange Nuts

STEM DIAMETER		MINIMUM		MAXIMUM	
mm	Inch	N•m	Lbf•ft	N•m	Lbf•ft
19.1	3/4	41	30	61	45
25.4	1	61	45	91	67
31.8	1-1/4	81	60	122	90
38.1	1-1/2	61	45	91	67
69.9	2-3/4	81	60	122	90

Packing Maintenance

For spring-loaded single PTFE V-ring packing (figure 5), the spring (key 23) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 22), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 15) until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, replace the packing as described in the Packing Replacement procedure.

For PTFE-composition or graphite ribbon/filament packing (figure 5), leakage around the packing follower may be stopped by tightening the packing flange nuts (key 15). If leakage cannot be stopped by tightening the nuts, replace packing as described in the Packing Replacement procedure.

Packing Replacement

WARNING

Refer to the **WARNING** at the beginning of the Maintenance section.

For spring-loaded PTFE V-ring packing (shown in figure 5), tighten the packing flange nuts (key 15) until the shoulder on the packing follower (key 22, figure 5) contacts the bonnet (key 12). If packing leakage still exists, replace the packing according to the numbered steps below.

If packing leakage exists with PTFE-composition or graphite ribbon/filament packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts (key 15) to at least the minimum recommended torque in table 5. However, do not exceed the maximum recommended torque in table 5, or excessive friction may result.

If the packing is relatively new and tight on the stem, and if tightening the packing flange nuts does not stop the leakage, the valve stem may be worn or nicked so that a seal cannot be made. The surface finish of a new valve stem is 0.1 micro-meter (4 micro-inches) rms. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches around the packing box wall. While replacing the packing according to the numbered steps below, inspect the valve stem and packing box wall for nicks or scratches. If the nicks or scratches cannot be removed by refinishing, replace the parts with new parts.

1. Remove the cap screws in the valve/actuator stem connector (not shown), and separate the two halves of the stem connector. Then exhaust all actuator pressure, if any was applied, and disconnect the actuator supply and any leakoff piping.
2. Unscrew the hex nuts (key 26) or the yoke locknut (not shown), and lift the actuator from the bonnet (key 12).
3. Loosen the packing flange nuts (key 15) so that the packing (key 19 or keys 29 and 13, figure 5) is not tight on the valve stem (key 4). Remove any travel indicator disc and stem locknuts from the valve stem threads.

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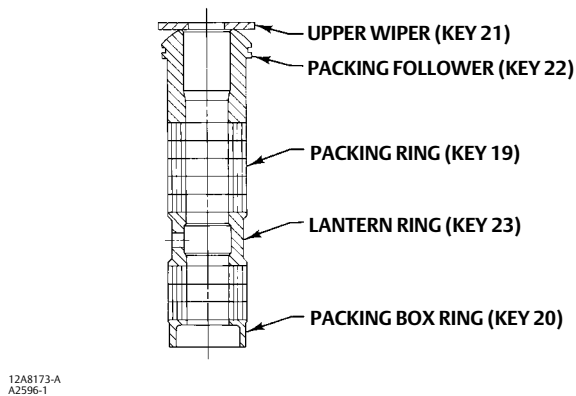
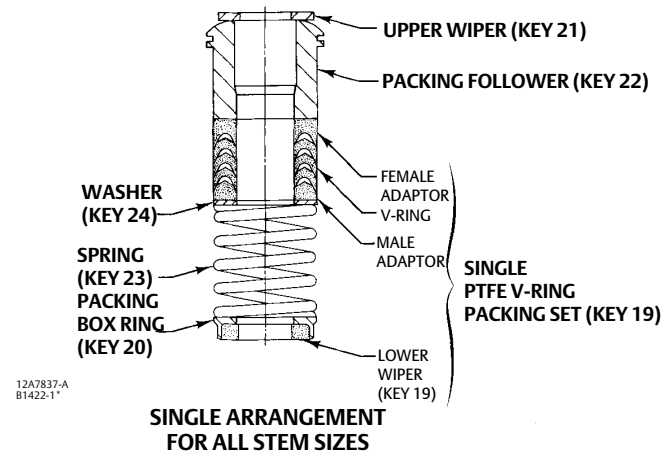
CAV4 Valve

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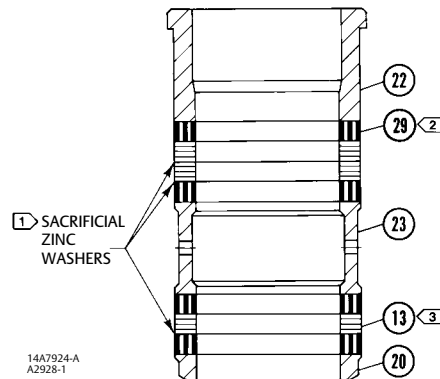
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Figure 5. Packing Arrangements



**19.1 mm (3/4-INCH)
25.4 mm (1-INCH) OR
31.8 mm (1-1/4-INCH) STEM**



- NOTES:
- ① ONLY 0.102mm (0.004 INCH) THICK; USE ONLY ONE BELOW EACH GRAPHITE RING.
 - ② HAS THE APPEARANCE OF A WOVEN OR BRAIDED RING.
 - ③ HAS THE APPEARANCE OF FLAT WASHERS PRESSED TOGETHER.

**GRAPHITE PACKING FOR 31.8, 38.1, & 69.9 mm
(1-1/4, 1-1/2, & 2-3/4 INCH) STEM DIA**

Table 6. Valve Body-to-Bonnet Bolting Torque

VALVE SIZE, NPS	BODY STYLE	TORQUE	
		N•m	Lbf•ft
2	Angle	974	717
	Globe CL1500	258	190
	Globe CL2500	380	280
3	Angle	1058	780
4		1776	1310
6		2712	2000

CAUTION

When lifting the bonnet (key 12), be sure that the valve plug and stem assembly (key 4) remains on the seat. This will avoid damage to the seating surfaces as a result of the assembly dropping from the bonnet after being lifted part way out. The bonnet is easier to handle separately.

When removing packing, use care to avoid scratching the packing box wall.

4. Unscrew the large hex nuts (key 27) that secure the bonnet (key 12) to the valve body. Carefully lift the bonnet off the valve stem. If the valve plug and stem assembly (key 4) starts to lift with the bonnet, tap the end of the stem down with a brass or similar hammer that will not deform the valve stem threads. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.
5. Remove the upper bonnet gasket (key 6).
6. Cover the opening in the valve body to protect the gasket surface and to prevent foreign material from falling into the valve body cavity.
7. Remove the packing flange nuts (key 15), packing flange (key 16), upper wiper (key 21, figures 5 and 13, not used with graphite ribbon/filament packing), and packing follower (key 22). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall.
8. Clean the packing box and these metal packing parts: packing follower (key 22), packing box ring (key 20), spring and special washer (keys 23 and 24, used with PTFE V-ring packing, figure 5) or lantern ring (key 23, used with other packing as shown in the figure 5 arrangements).
9. Inspect the valve stem threads for any sharp edges that might cut the packing. A whetstone or emery cloth may be used to smooth the threads if necessary.
10. Remove the protective covering from the valve body cavity, and install a new upper bonnet gasket (key 6). Then slide the bonnet (key 12) over the stem and onto the stud bolts (key 28).

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) immediately if a discrepancy between actual parts and approved parts is suspected.

11. Lubricate the stud bolt (key 28) threads and the faces of the hex nuts (key 27) with anti-seize lubricant (key 18) (not necessary if new factory prelubricated hex nuts are used). Replace the washers and hex nuts, but do not tighten them. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 6. When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.
12. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 5. Slip a smooth-edged pipe over the valve stem, and gently tamp each soft packing part into the packing box.

13. Slide the packing follower (key 22), wiper (key 21, not used with graphite ribbon/filament packing), and packing flange (key 16) into position. Lubricate the packing flange studs (key 14) and the faces of the packing flange nuts (key 15). Replace the packing flange nuts.

For spring-loaded PTFE V-ring packing, tighten packing flange nuts (key 15) until the shoulder on the packing follower (key 22) contacts the bonnet (key 12).

For other packing types, tighten the packing flange nuts (key 15) to the maximum recommended torque shown in table 5. Then loosen the packing flange nuts, and retighten them to the recommended minimum torque in the table.

14. Mount the actuator on the valve body assembly, and reconnect the actuator and valve stem according to the procedures in the appropriate actuator instruction manual. After the valve is returned to service, retighten the hex nuts (key 27) to the torques listed in table 6.

Trim Removal

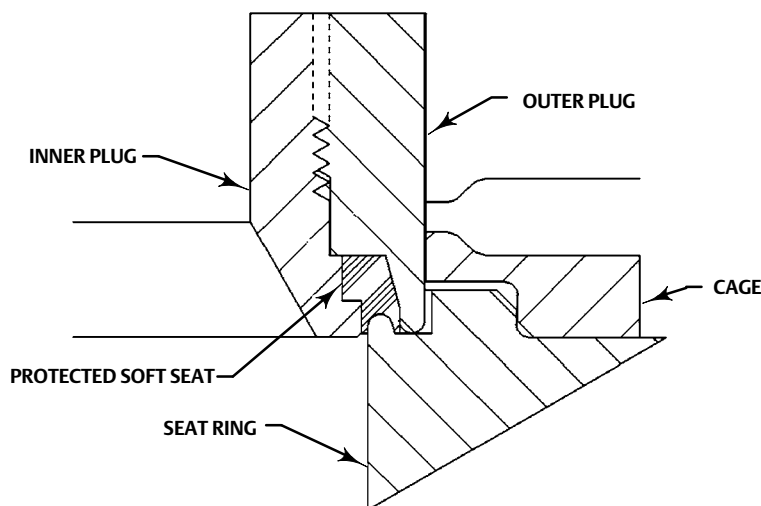
Angle Valves

Note

The NPS 3 CAV4 valve is a clamped-in trim design. No cage retainer is used. See figure 13. Therefore, if you are using these instructions for an NPS 3 valve, disregard references to a cage retainer.

The valve trim consists of the valve plug and stem assembly (key 4), the valve plug rings, if used, (keys 8, 9, 10, 11, and 37), the upper cage (key 3), the cage retainer (key 5), the lower cage assembly (key 2), the separable seat ring (key 35, seal ring construction only), the upper and lower bonnet gaskets (key 6), and the cage gasket (key 7).

Figure 6. TSO (Tight Shutoff) Trim, Detail of Protected Soft Seat



A7088

During trim removal, inspect the seating surface of the plug and lower cage or seat ring. Also inspect the inside diameter of the lower cage. If the seating surfaces need to be refinished, or if the inside diameter of the lower cage has plugged holes, deep scratches, or other signs of wear, the cage retainer and lower cage assembly must be removed. A seat ring or lower cage assembly and cage retainer in good condition may both remain in the valve body.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D100384X012

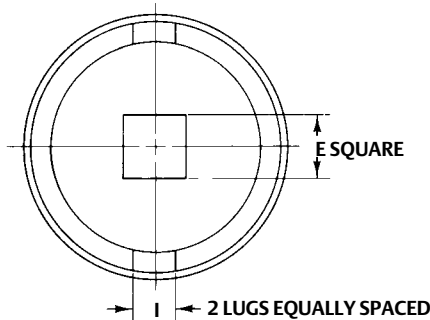
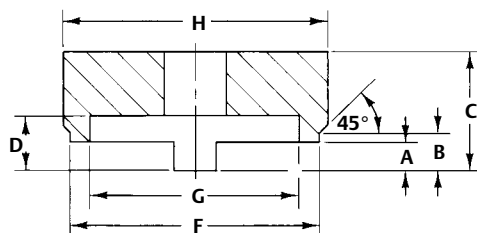
CAV4 Valve

April 2022

Figure 7. Information for Machining and Use of Cage Retainer Tool

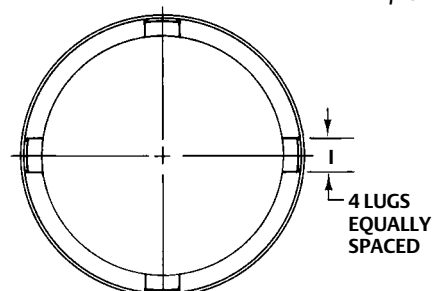
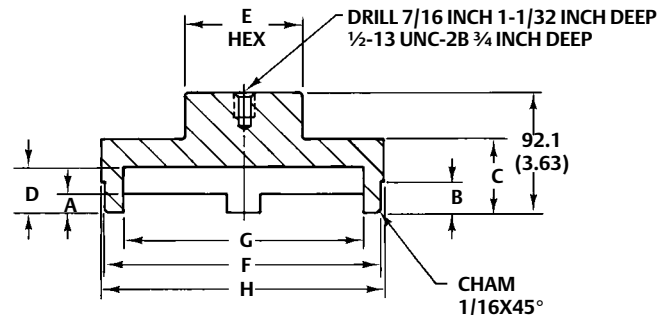
VALVE SIZE, NPS	TOOL DIMENSIONS																	
	A ⁽¹⁾		B		C		D		E		F ⁽¹⁾ Dia		G Dia		H Dia		I ⁽¹⁾	
	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
2	9.7	.38	12.7	.50	38.1	1.50	12.7	.50	25.4	1.00	86.1 85.6	3.390 3.370	74.7	2.94	88.9	3.50	18.8 18.5	.740 .730
3	Not Applicable																	
4	11.2	.44	14.2	.56	36.6	1.44	15.8	.62	38.1	1.50	143.3 142.8	5.640 5.620	127.0	5.00	145.8	5.74	25.2 24.9	.990 .980
6	17.7 17.4	.695 .685	19.1	.75	54.0	2.12	31.8	1.25	88.9	3.50	201.7 201.5	7.942 7.932	182.6	7.19	205.7 205.5	8.100 8.090	25.2 24.9	.990 .980

1. Double dimensions indicate maximum and minimum values.



A5495

TOOL FOR NPS 2 AND 4 VALVE BODIES

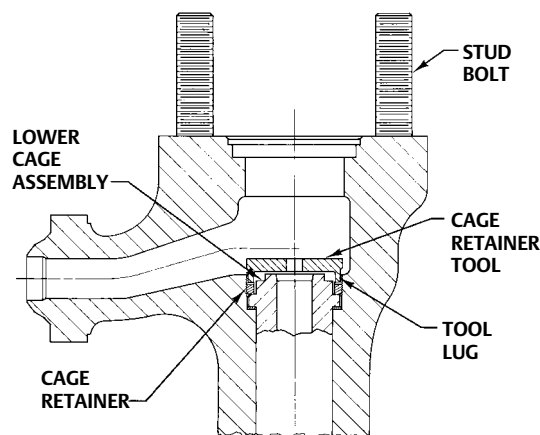


25A4066-D
A2930-1

TOOL FOR NPS 6 VALVE BODY

mm
(INCH)

VALVE SIZE, NPS	TORQUE	
	N•m	Lbf•ft
2	1356	1000
3	N.A.	N.A.
4	6100	4500
6	13,560	10,000

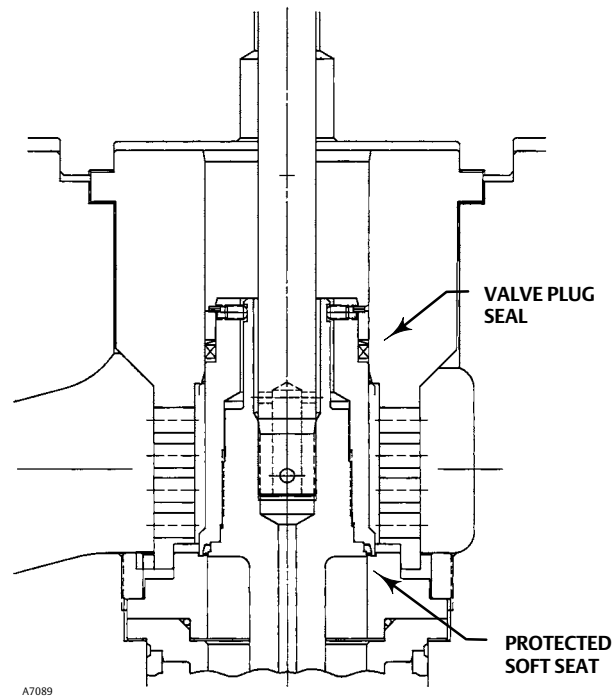


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A2929-1

TOOL INSTALLATION

Recommended Materials	Minimum Rockwell Hardness
S41600	28
S17400	36
S41000	31

Figure 8. Typical Balanced TSO Trim



A cage retainer tool is required to remove the cage retainer and lower cage assembly. If specifically ordered, a tool is supplied with the valve. It can also be ordered individually by referencing the tool part number included in the Parts List of this manual. A tool can also be machined for a specific valve using the dimensions shown in figure 7.

Note

Machine the tool from a material listed in figure 7, or from a material with a yield strength of at least 827 MPa (120,000 psi). Using a tool of lower strength may result in damage to the valve body threads.

CAUTION

Careful handling and installation of trim parts is extremely critical on all CAV4 valves. Any damage to gasket and seal surfaces of the cage or valve body, or valve plug and cage seating surfaces can result in leakage that can cause eventual damage to the cage and valve body due to erosion and cavitation.

1. Remove the actuator (not shown), bonnet (key 12) and packing by following steps 1 through 7 of the Packing Replacement section.

CAUTION

When lifting the valve plug and stem assembly out of the valve body, be certain the upper cage (key 3) remains in the valve (key 1). This will prevent damage that might be caused by the upper cage dropping back into the valve after being lifted

part way out. Use care to avoid damaging gasket sealing surfaces. Lay the valve plug and stem assembly on a protective surface in a safe location.

The NPS 6 CAV4 graphite piston rings (key 11) are brittle and in two halves. Use care to avoid damage to the piston rings caused by dropping or rough handling.

2. Pull the valve plug and stem assembly (key 4) out of the cages. Lay it on a protective surface in a safe location.
3. For stem-balanced valve plugs, proceed to step 4.

For seal ring valve plugs, work the retaining ring (key 10) off the valve plug with a screwdriver. Carefully slide the backup ring (key 9), two-piece anti-extrusion ring (key 37), and seal ring (key 8) off the valve plug (key 4).

For piston-ring valve plugs, the graphite piston rings (key 11) are each in two halves. If the rings are worn and need to be replaced, remove the sections from the grooves in the valve plug (key 4).

For TSO (tight shutoff) trim, perform the following steps (refer to figures 6 and 8):

CAUTION

In the following steps, use care to avoid damaging the outer plug guide surfaces.

- Remove the piston ring, anti-extrusion rings, backup ring, and retainer.
 - Remove the set screws that lock the outer plug to the inner plug.
 - Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
 - Remove the protected soft seat seal.
 - Inspect the parts for damage and replace if needed.
4. The upper cage (key 3) has two tapped holes to aid in removal. Refer to table 7 for the hole diameter and thread type. Install eyebolts or similar devices into those holes, then carefully lift the upper cage out of the valve body.
 5. Remove the lower bonnet gasket (key 6).

If removal of the lower cage assembly is necessary, use a cage retainer tool (figure 7) to remove the cage retainer (key 5) as follows:

- a. Insert the tool into the valve body. Be certain the tool lugs are engaged in the corresponding recesses in the retainer.

CAUTION

Do not use an impact wrench to remove or install the seat ring retainer. Damage to cage retainer, valve body threads, and lower cage could result.

- b. Use a power torque wrench having torque capabilities equal to or greater than those shown in figure 7. Connect the power torque wrench to a standard socket wrench extension or other suitable tool. This extension or tool must fit snugly into the square hole or hex head of the cage retainer tool. Refer to figure 7 for square hole and hex head sizes.

- c. Insert the extension into the cage retainer tool.
- d. Use the stud bolts (key 28) to prevent the power torque wrench from rotating.

Table 7. Hole Diameter and Thread Type for Cage Removal

Valve Size, NPS	Upper Cage	Lower Cage Assembly
2	2 holes, 1/4-20 UNC	---
3	2 holes, 3/8-16 UNC	4 holes, 1/4-20 UNC
4	2 holes, 3/8-16 UNC	4 holes, 1/4-20 UNC
6	2 holes, 1/2-13 UNC	4 holes, 3/8-16 UNC

CAUTION

Hold the power torque wrench and attached socket wrench extension at right angles to the cage retainer when applying torque. Tilting the wrench and extension while applying torque causes the lugs on the cage retainer tool to suddenly disengage from the recesses in the retainer, damaging the retainer and the lower cage assembly (key 2).

- e. Remove the cage retainer (key 5).
- f. Remove the seat ring (key 35) and O-ring (key 36), if used.
6. The NPS 4 and 6 lower cage assemblies (key 2) have tapped holes to aid in removal. Refer to table 7 for hole diameter and thread type. Install eyebolts or similar devices into these holes. Carefully lift the lower cage assembly (key 2) straight out of the valve body.
7. Remove the cage gasket (key 7).

CAUTION

The seat ring (key 35) or integral seat cage assembly (key 2) has a soft metal seat. To avoid damage to the seating surfaces, DO NOT lap this surface. If this area needs repair, contact your [Emerson sales office](#) for assistance.

NPS 2 Globe Valve**CAUTION**

Careful handling and installation of trim parts is extremely critical on all CAV4 valves. Any damage to gasket and seal surfaces of the cage or valve body, bonnet spacer, or valve plug and cage seating surface can result in leakage that can cause eventual damage to the cage and valve body due to erosion and cavitation.

1. Remove the actuator (not shown), bonnet (key 12) and packing by following steps 1 through 7 of the packing replacement section (shown in figure 14).

CAUTION

When lifting the valve plug and stem assembly out of the valve body, be certain the upper cage (key 3), seat ring (key 35) and lower cage assembly (key 2) remain the valve (key 1). This will prevent damage that might be caused by dropping these parts back into the valve after being lifted.

2. Pull the valve plug and stem assembly (key 4) out of the cages. Lay it on a protective surface in a safe location.
3. Remove the upper bonnet gasket (key 6) followed by bonnet spacer (key 40) and lower bonnet gasket (key 6.)
4. Remove the two spiral wound gaskets (key 39).
5. Carefully lift the upper cage (key 3) out of the valve body.
6. Carefully remove the seat ring (key 35) and O-ring (key 36).
7. Carefully lift the lower cage assembly (key 2) straight out of the valve body and remove the cage gasket or O-ring (key 7).

Trim Replacement

Angle Valves

Note

The NPS 3 CAV4 valve is a clamped-in trim design. No cage retainer is used. See figure 13. Therefore, if you are using these instructions for an NPS 3 valve, disregard references to a cage retainer.

After all trim maintenance has been completed, reassemble the trim by following the steps below.

Be certain that all gasketed surfaces are clean. Use new gaskets (keys 6 and 7) during assembly.

1. If the lower cage assembly (key 2) and cage retainer (key 5) remained in the valve body (key 1), proceed to step 4.

If these parts were removed, read the following caution and proceed to step 2:

CAUTION

To avoid galling or improper gasket loading that may result in leakage, thoroughly clean the threads and the gasket surfaces in the valve body (key 1), the valve body bore, and the cage retainer (key 5). Lubricate the surfaces indicated in figure 9 with the appropriate lubricant. Be certain to lubricate all of the following mating surfaces:

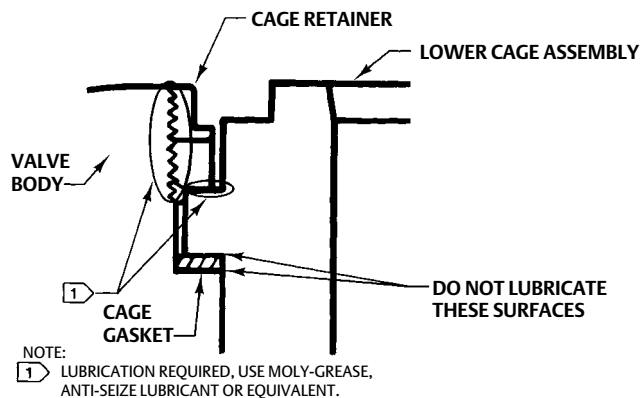
- cage retainer and valve body threads,
- bottom of the cage retainer and top of the flange on the lower cage assembly.

Do not lubricate the gasket surfaces.

Position the valve vertically and carefully lower the lower cage assembly into the valve body. When inserting the assembly, use an even motion; do not rock the lower cage assembly while installing it. Use care to avoid damaging the cage gasket (key 7).

2. Install a new cage gasket (key 7), and insert the lower cage assembly (key 2) into the valve body. If installing the separable seat ring (key 35), first install the O-ring (key 36) around the bottom diameter of the seat ring.
3. Thread the cage retainer (key 5) into the valve body. Use the cage retainer tool (figure 7) to tighten the cage retainer as follows:
 - a. Insert the tool into the valve body. Be certain the tool lugs are engaged in the corresponding recesses in the retainer.

Figure 9. Trim Surfaces Requiring Lubrication and Recommended Lubricants



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A2935-1

CAUTION

Do not use an impact wrench to remove or install the seat ring retainer. Damage to cage retainer, valve body threads, and lower cage could result.

- b. Use a power torque wrench having torque capabilities equal to or greater than those shown in figure 7. Connect the power torque wrench to a standard socket wrench extension or other suitable tool. The extension or tool must fit snugly into the square hole or the hex head of the cage retainer tool. Refer to figure 7 for square hole or hex head sizes.
- c. Insert the extension into the cage retainer tool.
- d. Use the stud bolts (key 28) to prevent the power torque wrench from rotating.

CAUTION

Hold the power torque wrench and attached socket wrench extension at right angles to the cage retainer when applying torque. Tilting the wrench and extension while applying torque causes the lugs on the cage retainer tool to suddenly disengage from the recesses in the retainer, damaging the retainer and lower cage assembly.

- e. Tighten the cage retainer (key 5) to the torque shown in figure 7.
4. Install a new lower bonnet gasket (key 6), and insert the upper cage (key 3). Be sure the lugs on the bottom of the cage engage the corresponding slots in the cage retainer (key 5).

Note

Rotate the upper cage (key 3) clockwise by hand as much as possible once the cage lugs engage the slots in the cage retainer (key 5). Failure to do so may result in slight seat leakage.

5. For stem-balanced valve plug, proceed to step 6.

For piston ring valve plug, if installing new graphite piston rings (key 11), each replacement ring will arrive in one piece. Use a vise with smooth jaws to break this replacement ring into halves. Place the new ring in the vise so that the jaws will compress the ring into an oval. Slowly compress the ring until the ring snaps on both sides. If one side snaps first, do not try to tear or cut the other side. Instead, keep compressing the ring until the other side snaps.

With the valve plug and stem assembly (key 4) on a protective surface, place the piston rings in the piston ring grooves with the fractured ends matched. Rotate the rings in the grooves so that all the matched ends are at different points around the plug circumference.

For seal ring valve plug, install the seal ring (key 8) with the open side facing the four flutes on the valve plug. Slide the 2-piece anti-extrusion ring (key 37) and the backup ring (key 9) onto the valve plug. Secure with the retaining ring (key 10).

For TSO (tight shutoff) trim, perform the following steps (refer to figures 6 and 8).

CAUTION

In the following steps, use care to avoid damaging the outer plug guide surfaces.

- Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
 - Mark the top of the inner plug and outer plug with alignment marks in the assembled position.
 - Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
 - Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is compressed properly. Do not damage the outer plug guide surfaces.
 - Install set screws centering the inner plug in the outer plug and torque to 11 N•m (8 lbf•ft).
 - Assemble the piston ring, anti-extrusion rings, backup ring, and retainer.
6. Slide the valve plug and stem assembly (key 4) into the cages.
7. Place a new upper bonnet gasket (key 6) onto the upper cage (key 3) as shown in figure 13.
8. Install the bonnet (key 12) over the valve stem and onto the valve body (key 1).

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

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9. Lubricate the threads of the studs (key 28) and the faces of the hex nuts (key 27) with anti-seize lubricant (key 18) (not necessary if new factory prelubricated hex nuts are used). Replace the washers and hex nuts but do not tighten them. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 6. When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.
10. Install new packing and packing box parts per steps 12 and 13 of the Packing Replacement section.
11. Mount the actuator by following the procedures in the appropriate actuator instruction manual. Check for packing leakage as the valve is being put into service. Retighten packing flange nuts as required. After the valve is returned to service, retighten the hex nuts (key 27) to the torque listed in table 6.

CAUTION

The soft metal seat life can be seriously shortened if the following step is not carefully completed.

12. Isolate the valve from the process and stroke the plug at least three times with maximum actuator force to seat the plug surface against the soft metal seat.

NPS 2 Globe Valve

After all trim maintenance has been completed, reassemble the trim by following the steps below.

Be certain all gasketed surfaces are clean. Use new gaskets (keys 6 and 39) along with new O-rings (keys 36 and 7) during assembly.

1. Install a new cage gasket or O-ring (key 7) in the bottom groove in the lower cage assembly (key 2). Position the valve vertically and carefully lower the lower cage assembly into the valve body (key 1.) When inserting the assembly, use an even motion; do not rock the lower cage assembly while installing it.
2. Install a new gasket or O-ring (key 36) in the bottom groove of the seat ring (key 35). Carefully lower the seat ring onto the lower cage assembly. Acceptable to lubricate O-ring, do not lubricate if gasket.
3. Carefully lower the upper cage (key 3) onto the seat ring.
4. Place two new spiral wound gaskets (key 39) onto the upper cage. Place a new lower bonnet gasket (key 6) on the valve body.
5. Carefully lower the bonnet spacer (key 40) onto the valve body.
6. Slide the valve plug and stem assembly (key 4) into the cages.
7. Place a new upper bonnet gasket (key 6) onto the upper cage.

8. Install the bonnet (key 12) over the valve stem and onto the bonnet spacer.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

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9. Lubricate the threads of the studs (key 28) and faces of the hex nuts (key 27) with anti-seize lubricant (key 18) (not necessary if new factory prelubricated hex nuts are used). Replace the hex nuts but do not tighten them. Torque the nuts in a crisscross pattern to no more than $\frac{1}{4}$ of the nominal torque value specified in table 6. When all nuts are tightened to that torque value, increase the torque by $\frac{1}{4}$ of the specified nominal torque and repeat the crisscross pattern. Stroke the valve plug a few times as the bonnet studs are tightened to be sure the valve action is smooth. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again, if any nut still turns, tighten every nut again.
10. Install new packing and packing box parts per steps 12 and 13 of the packing replacement section.
11. Mount the actuator by following the procedure in the appropriate actuator instruction manual. Check for packing leakage as the valve is being put into service. Retighten packing flange nuts as required. After the valve is returned to service, retighten the hex nuts (key 27) to the torque listed in table 6.

Use of Optional Flushing Trim for Angle Valve

Install the optional flushing trim (figure 15) prior to system flushing in order to protect the Cavitrol IV trim and the valve body gasket surfaces.

Gaskets (keys 6 and 7) that have not been in service (i.e., original gaskets in a CAV4 valve being installed or new gaskets for a valve already installed) may be used with the flushing trim.

Key numbers referenced in this section are shown in figure 15, unless otherwise indicated.

1. Remove the actuator, and disassemble the valve body by completing steps 1 and 2, and 4 through 7 of the Trim Removal procedure.
2. Install the lower flushing plate (key 31).
3. Thread the cage retainer (key 5) into the valve body hand-tight.
4. Install the lower bonnet gasket (key 6), the upper flushing plate (key 30), and the upper bonnet gasket (key 6).

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

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5. Place the bonnet (key 12, figure 13) on the valve body. Lubricate the threads of the studs (key 28) and the faces of the hex nuts (key 27) with anti-seize lubricant (key 18) (not necessary if new factory prelubricated hex nuts are used). Replace the washers and hex nuts but do not tighten them. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 6. When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.
6. After system flushing is completed, remove the bonnet (key 12) and bonnet gaskets (key 6), upper flushing plate (key 30), cage retainer (key 5), lower flushing plate (key 31), and cage gasket (key 7).
7. Assemble the valve as described in the Trim Replacement procedure.

Parts Ordering

Each valve body-bonnet assembly is assigned a serial number, which can be found on the valve body. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the number when contacting your [Emerson sales office](#) for technical assistance or when ordering replacement parts.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

When ordering replacement parts, also be sure to include the 11-character part number from the following parts kits or parts list information.

Parts Kits

Standard Packing Repair Kits (Non Live-Loaded)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
PTFE (Contains keys 22, 24, 25, 26, 27)	RPACKX00032	RPACKX00342	RPACKX00352
Double PTFE (Contains keys 22, 24, 26, 27)	RPACKX00062	RPACKX00362	RPACKX00372
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring], 24, and 26)	RPACKX00122	---	---
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring], and 26)	---	RPACKX00532	RPACKX00542
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring])	RPACKX00152	---	---

ENVIRO-SEAL™ Packing Retrofit Kits

Retrofit kits include parts to convert valves with existing standard bonnets to the ENVIRO-SEAL packing box construction.

Refer to figure 10 for key numbers for PTFE packing, to figure 11 for key numbers for Graphite ULF packing, and to figure 12 for key numbers for duplex packing.

PTFE kits include keys 200, 201, 211, 212, 214, 215, 217, 218, tag, and cable tie. Graphite ULF kits include keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 216, 217, tag, and cable tie. Duplex kits include keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, and cable tie.

Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances, and design specifications may adversely alter the performance of this packing kit.

For part numbers of individual components in the ENVIRO-SEAL packing kits, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#).

ENVIRO-SEAL Packing Retrofit Kits

PACKING MATERIAL	STEM DIAMETER AND YOKE BOSS DIAMETER, mm (INCH)		
	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
Double PTFE	RPACKXRT032	RPACKXRT042	RPACKXRT052
Graphite ULF	RPACKXRT282	RPACKXRT292	RPACKXRT302
Duplex	RPACKXRT232	RPACKXRT242	RPACKXRT252

ENVIRO-SEAL Packing Repair Kits

Repair kits include parts to replace the “soft” packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits.

Refer to figure 10 for key numbers for PTFE packing, to figure 11 for key numbers for Graphite ULF packing, and to figure 12 for key numbers for duplex packing.

PTFE repair kits include keys 214, 215, and 218. Graphite ULF repair kits include keys 207, 208, 209, 210, and 214. Duplex repair kits include keys 207, 209, 214, and 215.

Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances, and design specifications may adversely alter the performance of this packing kit.

For part numbers of individual components in the ENVIRO-SEAL packing kits, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#).

ENVIRO-SEAL Packing Repair Kits

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
Double PTFE (Contains keys 214, 215, & 218)	RPACKX00212	RPACKX00222	RPACKX00232
Graphite ULF (Contains keys 207, 208, 209, 210, and 214)	RPACKX00612	RPACKX00622	RPACKX00632
Duplex (Contains keys 207, 209, 214, and 215)	RPACKX00312	RPACKX00322	RPACKX00332

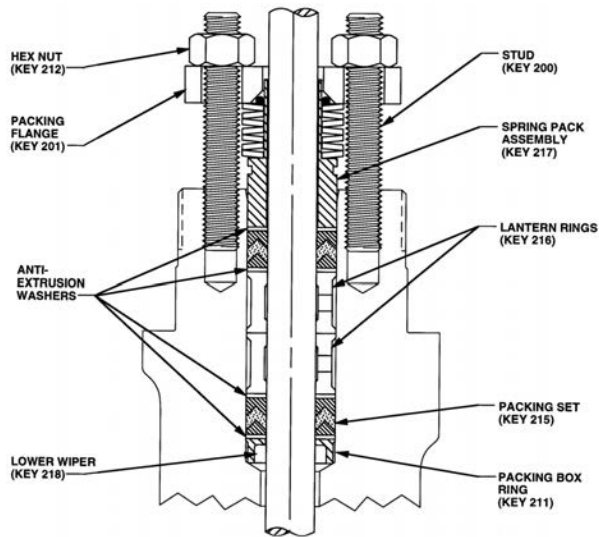
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CAV4 Valve

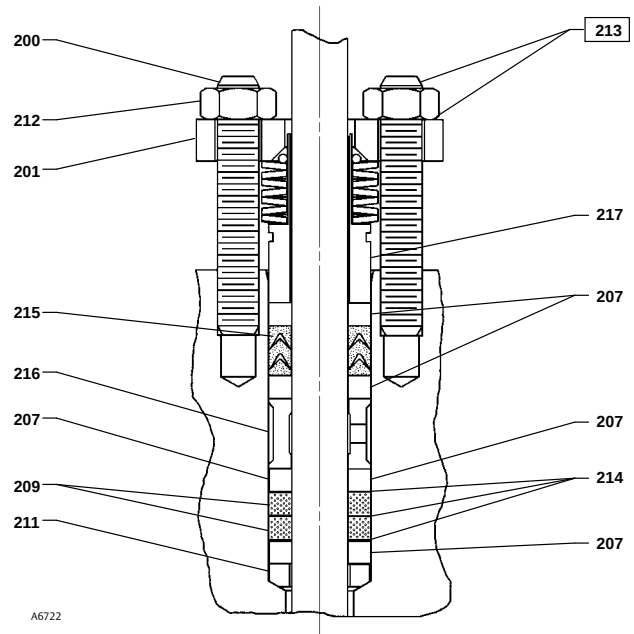
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Figure 10. Typical ENVIRO-SEAL Packing System with PTFE Packing



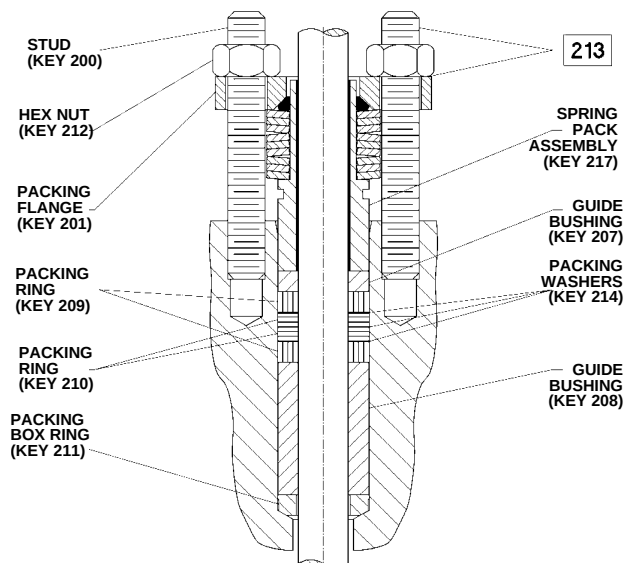
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Figure 12. Typical ENVIRO-SEAL Packing System with Duplex Packing



A6722

Figure 11. Typical ENVIRO-SEAL Packing System with Graphite ULF Packing



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Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your [Emerson sales office](#).

Key	Description
1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number, and desired material.
2*	Lower Cage Assembly
3*	Upper Cage
4*	Valve Plug and Stem Assembly
5*	Cage Retainer
6*	Bonnet Gasket (2 req'd)
7*	Cage Gasket or O-ring
8*	Valve Plug Seal Ring (for seal ring construction)
9	Valve Plug Back Up Ring
10*	Retaining Ring (for seal ring construction)
11*	Piston Ring (5 req'd)

See following table

Key	Description
12	Bonnet If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.
13*	Packing Ring
14	Packing Flange Stud Bolt (2 req'd)
15	Packing Flange Hex Nut [2 req'd, 4 req'd on 178 mm (7 in) yoke boss]
16	Packing Flange
17	Pipe Plug
18	Anti-Seize Lubricant (not furnished with the valve)
19*	Packing Set
20*	Packing Box Ring
21*	Upper Wiper
22	Packing Follower
23	Packing Spring
23	Lantern Ring
24	Special Washer
25	Stud Bolt (8 req'd)
26	Yoke Locknut (not shown)
26	Hex Nut (8 req'd)
27	Hex Nut NPS 2 through 4 (8 req'd) NPS 6 (12 req'd)
28	Stud Bolt NPS 2 through 4 (8 req'd) NPS 6 (12 req'd)
29*	Packing Rings
30	Upper Flushing Plate
31	Lower Flushing Plate
32	Line Flange Studs (8 req'd)
33	Yoke Locknut [for 19.1 mm (3/4 in) stem only] (not shown)
35*	Seat Ring
36*	O-Ring
37*	Anti-Extrusion Ring
39	Spiral Wound Gasket(s)
40	Bonnet Spacer

See following table

Figure 13. Fisher CAV4 Control Valve Angle Body with Cavitrol IV Trim

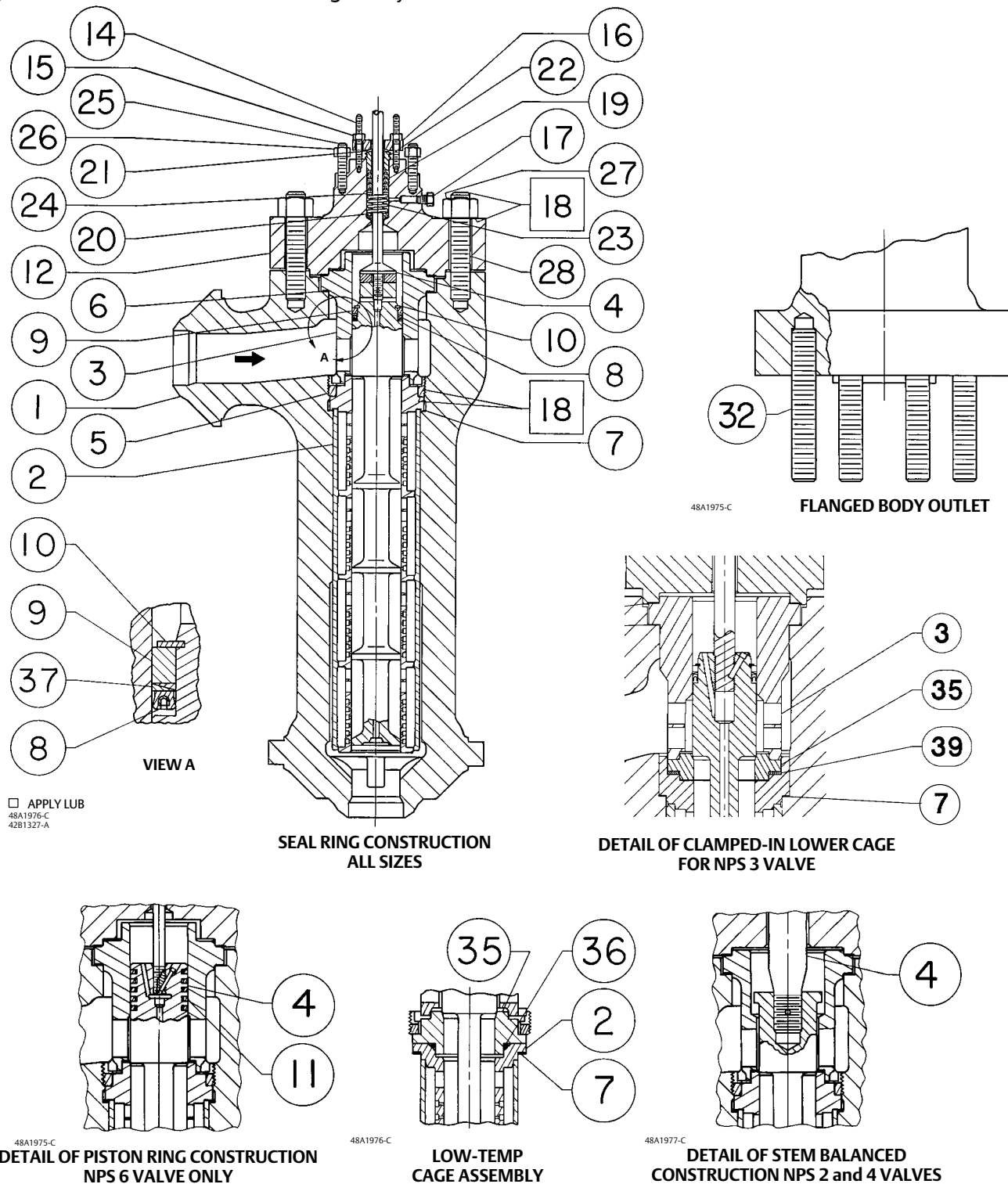


Figure 14. Fisher CAV4 Control Valve Globe Body NPS 2

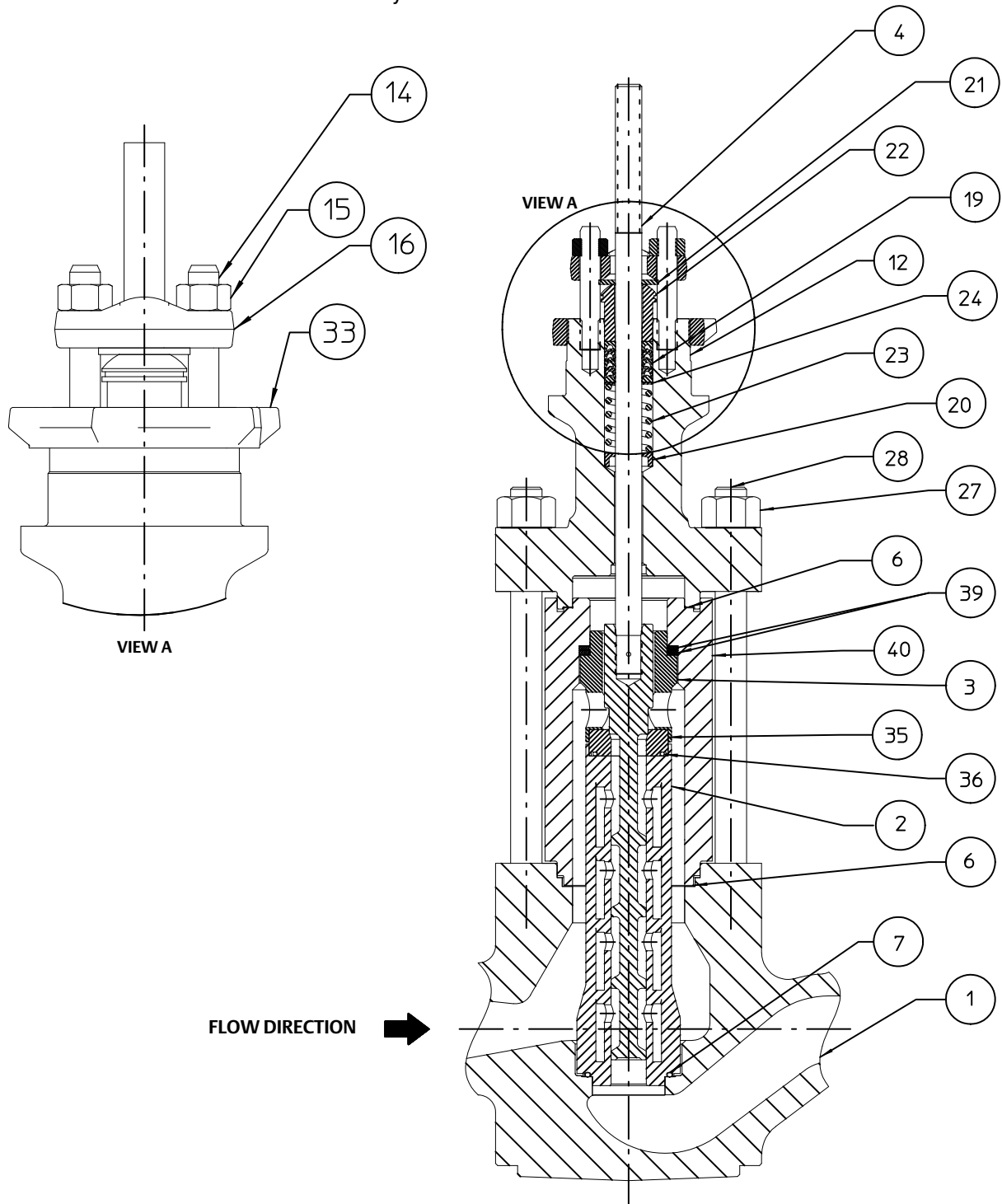
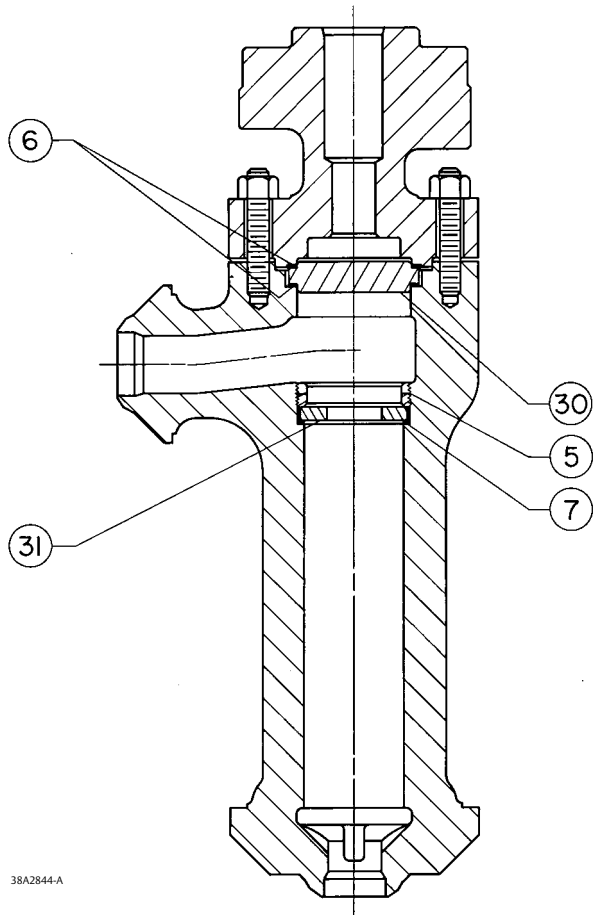


Figure 15. Optional Flushing Trim



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Key Description

TSO (Tight Shutoff) Trim Parts

2*	Cage Assembly	See following table
3*	Upper Cage	
4*	Plug/Stem Assembly	See following table
5*	Cage Retainer	
8*	Seal Ring	
9*	Back Up Ring	
10*	Retaining Ring	
35*	Seat Ring	
37*	Anti-Extrusion Ring	

*Recommended spare parts

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Key 4* Valve Plug and Stem Assembly for Angle Valves

VALVE SIZE, NPS	VALVE STEM DIAMETER		VALVE PLUG TRAVEL		ACTUATORS ⁽¹⁾	VALVE PLUG MATERIAL ⁽²⁾
	mm	Inch	mm	Inch		Heat Treated S44004
Seal Ring Construction						
2	19.1	3/4	38	1.5	Group 1	42B0593X022
3	19.1	3/4	51	2	Group 1	47B9380X022
4	19.1	3/4	64	2.5	Groups 1, 402, and 403 Group 100 Groups 101 and 405 Group 406	41B8678X022
	25.4	1	64	2.5		42B0595X022
	25.4	1	64	2.5		42B0595X032
	25.4	1	64	2.5		42B0595X042
6	31.8	1-1/4	102	4	Group 407 Groups 408 and 409	42B0600X022
			102	4		42B0600X032
Stem-Balanced Construction						
2	38.1	1-1/2	38	1.5	Group 100	38A2821X022
					Group 101	38A2821X032
4	69.9	2-3/4	64	2.5	657 Size 80	38A1967X022
			64	2.5	470 Series Size 130 and Group 408	38A1967X032
Piston Ring Construction						
6	31.8	1-1/4	102	4	Group 407 Groups 408 and 409	42B0602X022 42B0602X032
1. See Actuator Groups (by Type Number) table for appropriate actuator group. 2. Valve stem material is S31600, except for S17400 19.1 mm (3/4 in) stem in the NPS 4 valve body.						

Keys 2* and 4* TSO Trim 810 Parts for Fisher CAV4 Angle Valves

VALVE SIZE, NPS	PORT, INCH	TRAVEL, INCH	STEM DIAMETER		ACTUATOR GROUP	CHARACTERISTIC	KEY 2	KEY 4
			mm	Inch			Cage Assembly	Plug/Stem Assembly
2	1.5	1.5	19.1	3/4	1	Std Characterized	31B9642X012 31B9642X032	38B0289X012
3	2.1875	2	19.1	3/4	1	Std Characterized	37B9440X012 37B9440X022	38B0296X012
4	2.6875	2.5	19.1	3/4	1, 402, 403	Std Characterized	31B9649X012 31B9649X022	38B1301X012
			25.4	1	100	Std Characterized	31B9649X012 31B9649X022	38B0288X012
					101, 405	Std Characterized	31B9649X012 31B9649X022	38B0288X022
					406	Std Characterized	31B9649X012 31B9649X022	38B0288X032

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Key 19* Packing Set

DESCRIPTION	STEM DIAMETER, mm (INCH)				
	19.1 (3/4)	25.4 (1)	31.8 (1-1/4)	38.1 (1-1/2)	69.9 (2-3/4)
Single PTFE V-Ring Packing set	1R290401012	1R290601012	1R290801012	---	---

Actuator Groups (by Type Number)

Group 1 90.5 mm (3-9/16 In) Yoke Boss	Group 405 127 mm (5 In) Yoke Boss
472 and 473 585C—50.8 mm (2 in) maximum travel 657 and 667—76.2 mm (3 in) maximum travel 1008—Except with 50.8 mm (2 in) travel	657 MO 657-4 MO
Group 100 127 mm (5 In) Yoke Boss	Group 406 127 mm (5 In) Yoke Boss
472 473 474 476 585C 657 1008	667 MO 667-4 MO
Group 101 127 mm (5 In) Yoke Boss	Group 407 127 mm (5 In) Yoke Boss
667	474 585C 657
Group 401 90.5 mm (3-9/16 In) Yoke Boss	Group 408 127 mm (5H) and 178 mm (7 In) Yoke Boss
657 657 MO 657-4 657-4 MO 667 667 MO	657 Size 100 685 1008
	Group 409 127 mm (5H) and 178 mm (7 In) Yoke Boss
	667 Size 100

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Fisher™ CHP Control Valve

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Figure 1. Fisher CHP NPS 12 Control Valve



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher CHP control valve. Refer to separate manuals for instructions covering the actuator, positioner, and accessories.

Do not install, operate, or maintain CHP valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The CHP globe valve (figure 1) has a metal seat, cage guiding, quick change trim, and push-down-to-close valve plug action. The valve uses a balanced valve plug. To provide a seal between the cage and a balanced valve plug, the balanced valve plug uses a PEEK (Poly Ether Ether Ketone) anti-extrusion ring with a pressure-assisted spring-loaded seal ring.

Specifications

Specifications for the CHP valves are shown in table 1.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

CHP Valve

June 2017

Instruction Manual

D103463X012

Table 1. Specifications

Size/Pressure Class/Body Materials NPS 12 / CL2500 / WCC, WC9 Maximum Inlet Pressure and Temperature⁽¹⁾ Consistent with ASME B16.34 except CHPT PEEK anti-extrusion seal ring construction. Maximum temperature limit is 316°C (600°F). For temperature exceeding 316°C (600°F), please consult Singapore SD&S End Connection Style Buttweld Ends : All butt welding end schedules per ASME B16.25 Bonnet and Body-to-Bonnet Bolting Plain Bonnet: 5 inch H Yoke Boss Studs: Steel A 193-B7 Nuts: Steel A 194-2H	Flow Coefficient Maximum Cv: 1040 Km: 0.65 Fl: 0.81 Modified Equal Percentage Flow Direction Flow down (in through the cage windows and out through the seat ring) except for service with pressure drop exceeding 69 bar (1000psi) when a diverter cone plug is used Stem Diameter 1-1/4 inch with 2-inch VSC (Valve Stem Connection) Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4 CHPT: Class IV (standard), Class V (optional) CHPD: Class III ⁽²⁾ Weight Estimated 2000 kg Please consult Singapore SD&S for any queries
--	--

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

2. For Boiler feedwater application, proper use of a block valve during closing of the control valve is recommended to minimize control valve trim damage.

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

A bonnet flange has a tapped hole that was used to handle the bonnet during manufacture. Since this tapped hole was not designed or intended to support the weight of the valve/bonnet assembly, do not use this tapped hole to lift the valve assembly or personal injury may result from the assembly falling.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first checking with your [Emerson sales office](#) or Local Business Partner.

1. Before installing the valve, inspect it to ensure that the valve body cavity is free of foreign material.
2. Clean out all pipelines to remove scale, welding slag, and other foreign materials before installing the valve.
3. Flow through the valve must be in the direction indicated by the flow arrow, which is attached to the valve body.
4. Use accepted piping practices when installing the valve in the pipeline.
5. Install a three-valve bypass around the valve if continuous operation is required during maintenance.
6. If the actuator and valve body are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.
7. If the valve body was shipped without packing installed in the packing box, install the packing before putting the valve body into service. Refer to instructions given in the Packing Maintenance procedure.

WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Maintenance

Refer to figure 4.

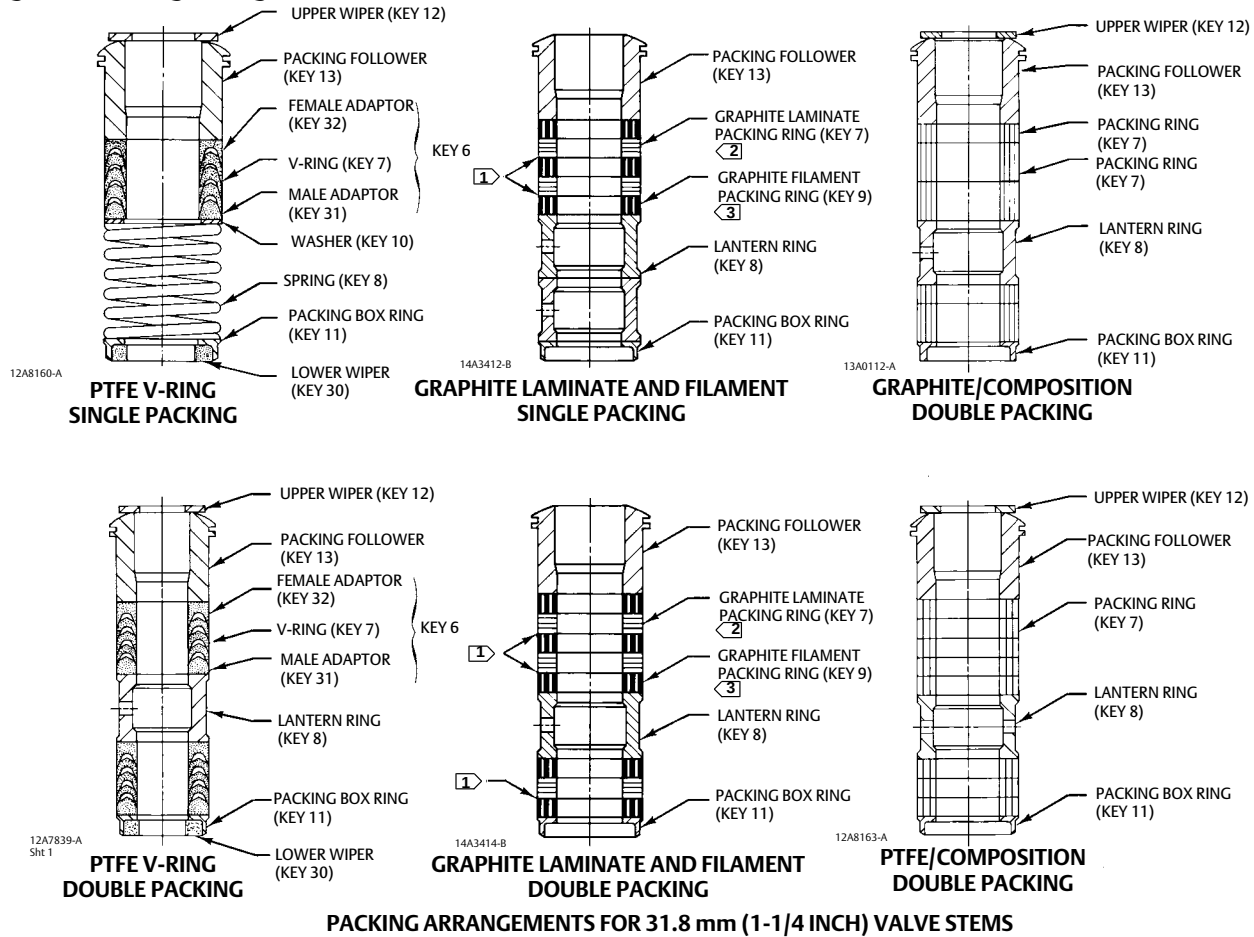
Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing maintenance and trim maintenance. All maintenance operations may be performed with the valve in the line.

WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

- Do not remove the actuator from the valve while the valve is still pressurized.
 - Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
 - Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
 - Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
 - Vent the power actuator loading pressure and relieve any actuator spring precompression.
 - Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
 - The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
 - Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
-

Figure 2. Packing Arrangements



NOTES:
 1 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS.
 USE ONLY ONE BELOW EACH GRAPHITE LAMINATE RING.

2 HAS THE APPEARANCE OF FLAT WASHERS PRESSED TOGETHER.
 3 HAS THE APPEARANCE OF A WOVEN OR BRAIDED RING.

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Table 2. CL2500 Recommended Torque for Packing Flange Nuts (non live-loaded)

VALVE STEM DIAMETER		PRESSURE RATING	TORQUE			
			N•m		lbf•ft	
mm	Inches		Min	Max	Min	Max
31.8	1-1/4	CL2500	81	122	60	90

Table 3. Torque for Body-to-Bonnet Bolting Using Anti-Seize Lubricant

VALVE RATING	BOLT TORQUES	
	SA193-B7, B16	
	N•m	lbf•ft
CL2500	5760	4260

Table 4. Valve Stem Connection Torque and Hole Size for Pin

VALVE STEM DIAMETER		TORQUE, MINIMUM TO MAXIMUM		HOLE SIZE ⁽¹⁾	
mm	Inches	N•m	Lbf•ft	mm	Inch
31.8	1-1/4	827-908	610-670	9.53 - 9.65	0.375 - 0.380

1. VSC (Valve Stem Connection) size is 2-inch.

CAUTION

The CHP valve uses spiral-wound gaskets which are crushed to provide their seal. A spiral-wound gasket should never be reused. Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket must be installed upon reassembly. This is necessary to ensure a good gasket seal, since the used gasket will not seal properly.

The spiral-wound gaskets are of special design. Failure to use genuine Fisher replacement parts may result in valve damage and/or failure.

Packing Maintenance

Key numbers refer to figure 2 for PTFE V-ring packing and graphite ribbon/filament, unless otherwise indicated.

⚠ WARNING

To avoid personal injury or equipment damage resulting from packing leakage, inspect the valve plug stem and packing box wall for nicks or scratches while performing the following procedures.

Use care to avoid damaging these surfaces.

For spring-loaded single PTFE V-ring packing, the spring (key 8) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 21, figure 4) until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the Replacing Packing procedure.

If there is undesirable packing leakage with other than spring-loaded PTFE V-ring packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts (key 21, figure 4) to at least the minimum recommended torque in table 2. However, do not exceed the maximum recommended torque in table 2 or excessive friction may result. If leakage continues, replace the packing by following the numbered steps presented in the Replacing Packing procedure.

If the packing is relatively new and tight on the valve plug stem, and if tightening the packing flange nuts does not stop the leakage, it is possible that the stem is worn or nicked so that a seal cannot be made. The surface finish of a new

stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. While replacing the packing according to the Replacing Packing procedure, inspect the valve plug stem and packing box wall for nicks or scratches.

Adding Packing Rings

⚠ WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

To avoid personal injury or equipment damage resulting from packing leakage, inspect the valve plug stem and packing box wall for nicks or scratches while performing the following procedures.

Use care to avoid damaging these surfaces.

Key numbers referred to in this procedure are shown in figure 4, unless otherwise indicated.

When using packing with a lantern ring it may be possible to add packing rings above the lantern ring as a temporary measure without removing the actuator from the valve body.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the packing flange nuts (key 21) and lift the packing flange, upper wiper, and packing follower (keys 19, 27, and 28) away from the valve body.
3. It may be possible to dig out the old packing rings on top of the lantern ring, but use care to avoid scratching the valve plug stem or packing box wall. Clean all metal parts to remove particles that would prevent the packing from sealing.
4. Remove the stem connector and slip the packing rings over the end of the valve plug stem.
5. Reassemble the packing follower, upper wiper, packing flange, and packing flange nuts (keys 28, 27, 19, and 21).
6. Reconnect the body-actuator stem connection according to the appropriate actuator instruction manual.
7. Tighten the packing flange nuts only far enough to stop leakage under operating conditions. Check for leakage around the packing follower when the valve is being put into service. Retighten the packing flange nuts as required (see table 2).

Replacing Packing

⚠ WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

To avoid personal injury or equipment damage resulting from packing leakage, inspect the valve plug stem and packing box wall for nicks or scratches while performing the following procedures.

Use care to avoid damaging these surfaces.

Key numbers referred to in this procedure are shown in figure 4, unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power

actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

2. Remove the cap screws in the stem connector, and separate the two halves of the stem connector. Then exhaust all actuator pressure, if any was applied, and disconnect the actuator supply and any leakoff piping.
3. Remove the hex nuts (key 30), and remove the actuator from the bonnet (key 18).
4. Loosen the packing flange nuts (key 21) so that the packing (keys 7, 9, 31, or 32, figure 2) is not tight on the valve plug stem (key 6). Remove the stem locknuts from the valve plug stem threads.

CAUTION

When lifting the bonnet (key 18), be sure that the valve plug and stem assembly (keys 5 and 6) remains on the seat ring (key 4). This avoids damage to the seating surfaces as a result of the assembly dropping from the bonnet after being lifted part way out. The parts are also easier to handle separately.

Use care to avoid damaging gasket sealing surfaces.

⚠ WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. If the cage sticks to the bonnet, proceed carefully with bonnet removal and support the cage so that it will not fall unexpectedly from the bonnet.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

5. Hex nuts (key 14) attach the bonnet to the valve body. Loosen these nuts approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed to the next step. If fluid leaks from the joint, the process pressure was not relieved from the valve as noted in the Warning at the beginning of the Maintenance section in this manual.
6. Unscrew the hex nuts (key 14) and carefully lift the bonnet off the valve stem. If the valve plug and stem assembly starts to lift with the bonnet, use a brass or lead hammer on the end of the stem and tap it back down. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.
7. Remove the valve plug (key 5), bonnet gasket (key 11), cage (key 2), seat ring (key 4), and the seat ring gasket (key 12).

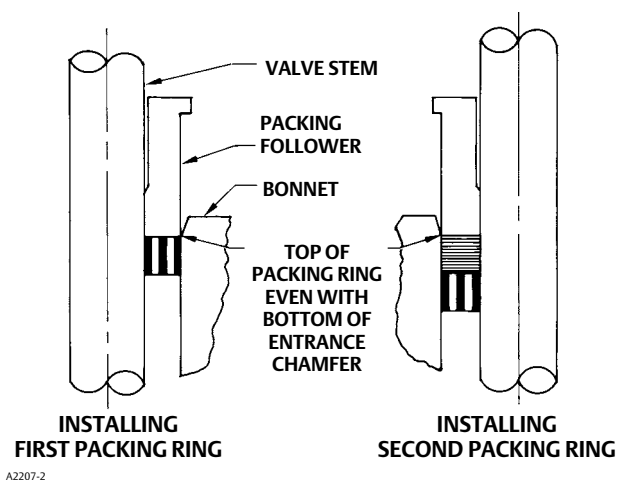
CAUTION

Inspect the seat ring, cage, bonnet, and body gasket surfaces. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm (0.003 inch) in height (the thickness of a human hair) can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, since they will prevent the gaskets from sealing properly.

8. Clean all gasket surfaces with a good wire brush. Clean in the same direction as the surface serrations, not across them.

9. Cover the opening in the valve body to protect the gasket surface and to prevent foreign material from getting into the valve body cavity.
10. Remove the packing flange nuts (key 21), packing flange (key 19), upper wiper (key 27), and packing follower (key 28). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall.
11. Clean the packing box and the following metal packing parts: packing follower, packing box ring (key 11, figure 2), spring or lantern ring (key 8, figure 2), and, for single arrangements of PTFE V-ring packing only, special washer (key 10, figure 2).
12. Inspect the valve stem threads for any sharp edges that might cut the packing. A whetstone or emery cloth may be used to smooth the threads if necessary.
13. Remove the protective covering from the valve body cavity, and install the seat ring and cage using a new seat ring gasket (key 12), bonnet gasket (key 11). Install the plug, then slide the bonnet over the stem and onto the studs (key 13).

Figure 3. Installing Graphite Ribbon/Filament Packing Rings One at a Time



Note

The prelubricated hex nuts (key 14) referred to in step 14 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 14 include--but are not limited to--ensuring that the bonnet stud threads are clean, and that the hex nuts are evenly tightened to the specified torque values.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 3 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended.

14. Lubricate the stud threads and the faces of the hex nuts (key 14) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Install the hex nuts and tighten them finger-tight. Stroke the valve several times to center the trim. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 3.

When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

Note

When installing packing rings, prevent entrapping air between the rings. Add the rings one at a time without forcing them below the chamfer of the packing box entrance chamber. As each successive ring is added, the stack should not be pushed down more than the thickness of the added ring (figure 3).

15. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 2. If desired, packing parts may be pre-lubricated with a silicon base grease for easier installation. Slip a smooth-edged pipe over the valve stem, and gently tap each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.
16. Slide the packing follower, wiper, and packing flange into position. Lubricate the packing flange studs (key 20) and the faces of the packing flange nuts (key 21). Install the packing flange nuts.

For the spring-loaded PTFE V-ring packing shown in figure 2, tighten the packing flange nuts until the shoulder on the packing follower (key 28) contacts the bonnet.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 2. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 2.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 2. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

17. Mount the actuator on the valve body assembly, and reconnect the actuator and valve plug stems according to the procedures in the appropriate actuator instruction manual.

Trim Removal

Key numbers referenced in this procedure are shown in figure 4, except where indicated.

1. Remove the actuator and bonnet by following steps 1 through 6 of the replacing packing procedure. Observe all warnings and cautions in that procedure.
2. Lift the valve stem and attached valve plug out of the valve body. If the valve plug is to be reused, tape or otherwise protect the valve plug stem and the valve plug seating surface to prevent scratches.
3. Lift out the cage (key 2) and the bonnet gasket (key 11).
4. Remove the seat ring (key 4) and the seat ring gasket (key 12).
5. Inspect the parts for wear or damage and replace if needed.
6. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

Valve Plug Maintenance

Key numbers used in this procedure are shown in figure 4, except where indicated.

1. With the valve plug (key 5) removed according to the trim removal procedure, proceed as appropriate:

For the CHPT valve, work the retaining ring (key 10) off the valve plug with a screwdriver. Carefully slide the backup ring, anti-extrusion rings (keys 9, 63, and 8), and seal ring off the valve plug.

2. To replace the valve plug stem (key 6), drive out the pin (key 7), and unscrew the stem from the valve plug.

CAUTION

Never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem. This weakens the stem and may cause the stem to fail in service. If a new valve plug is required, always order a valve plug, stem, and pin as an assembly. Specify the correct part number of each of the three parts, but state that the parts are being ordered as an assembly.

A used valve plug may be reused with a new stem.

3. Thread the new stem into the valve plug and tighten it to the appropriate torque value given in table 4. Using the valve plug pin hole as a guide, drill the pin hole through the stem. Refer to table 4 for drill sizes.
4. Drive in the pin to lock the assembly.
5. If it is necessary to lap the seating surfaces, complete the lapping seats procedure before installing the seal ring. The Trim Replacement procedure provides seal ring installation instructions and valve reassembly instructions.

Lapping Seats

Key numbers referenced in this procedure are shown in figure 4, except where indicated.

With metal-seat constructions, lapping seating surfaces of the valve plug and seat ring (keys 5 and 4) can improve shutoff. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Note

The CHP valve uses spiral-wound gaskets. These gaskets provide their seal by being crushed and therefore should never be reused. This includes reusing a gasket after the lapping procedure has been performed.

An “old” gasket can be used to lap the seat, however the gasket must be replaced with a new gasket.

To preserve the effects of lapping, do not change either the position of the seat ring in the valve body cavity or the position of the cage on the seat ring after lapping the seating surfaces. When the parts are removed for cleaning and replacement of the “old” gaskets, return them to the original positions.

Use the following procedure to lap the seating surfaces.

1. Install the following parts according to the instructions presented in the trim replacement procedure: “old” seat ring gasket (key 12), seat ring (key 4), cage (key 2) and “old” bonnet gasket (key 11).
2. Install the valve plug and stem assembly (keys 5 and 6) into the cage.
3. Install the bonnet (key 18) over the valve stem, and secure the bonnet with four of the hex nuts (key 14).
4. Attach a handle, such as a piece of strap iron secured by stem locknuts, to the valve stem. Rotate the handle alternately in each direction to lap the seats.
5. After lapping, disassemble as necessary (you may mark the position of the seat ring and cage with a soft tip marker). Clean the seating surfaces, replace the gaskets, reassemble (taking care to return the seat ring and cage to their original positions), and test for shutoff. Repeat the lapping procedure if necessary.

Trim Replacement

⚠ WARNING

Observe the warning at the start of the Maintenance section.

After all trim maintenance has been completed, reassemble the valve body by following the numbered steps below. Be certain that all gasketed surfaces have been well cleaned. Key numbers referenced in this procedure are shown in figure 4, except where indicated.

CAUTION

Inspect the seat ring, cage, bonnet, and body gasket surfaces. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm (0.003 inches) in height (the thickness of a human hair) can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, since they will prevent the gaskets from sealing properly.

1. Install the seat ring gasket (key 12) into the valve body. Install the seat ring (key 4).
2. Install the cage (key 2).
3. Install the seal ring (key 8) onto the valve plug (key 5). Install the anti-extrusion rings (key 63) onto the valve plug (key 5). Install the ring with the open side facing the seat end of the valve plug for flow-down applications (view A of figure 4). Slide the backup ring (key 9) onto the valve plug. Secure with the retaining ring (key 10).
4. Install the valve plug into the cage.
5. Install the bonnet gasket (key 11).
6. Install the bonnet over the valve stem and onto the valve body.

Note

The prelubricated hex nuts (key 14) referred to in step 7 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 7 include--but are not limited to--ensuring that the bonnet stud threads are clean, and that the hex nuts are evenly tightened to the specified torque values.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 3 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended.

7. Lubricate the stud threads and the faces of the hex nuts (key 14) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Install the hex nuts, but do not tighten them. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 3. When all nuts are tightened

to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

8. Install new packing and packing box parts per steps 15 and 16 of the Replacing Packing procedure. Be certain to observe the note given prior to step 15 of that procedure.
9. Mount the actuator by following the procedures in the actuator instruction manual. Check for packing leakage as the valve is being put into service. Retorque the packing flange nuts as required. See table 2.

Parts Ordering

Each valve body-bonnet assembly is assigned a serial number which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) or Local Business Partner for technical assistance. When ordering replacement parts, reference the valve serial number to obtain the correct eleven-character part number for each part; the following Parts Kit and Parts List is for information only.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Packing Kits (non live-loaded)

Single PTFE (Contains keys 22, 24, 25, 26, 27)
Single Graphite Ribbon/Filament (Contains keys 23, 23, 24, 26)

Parts List

Numerous available combinations of valve parts make selection of some parts difficult; when ordering valve parts for which a part number is not listed, provide the valve serial number with the order, permitting proper selection of replacement parts to be made at the factory.

Note

For part numbers not shown, contact your [Emerson sales office](#) or Local Business Partner.

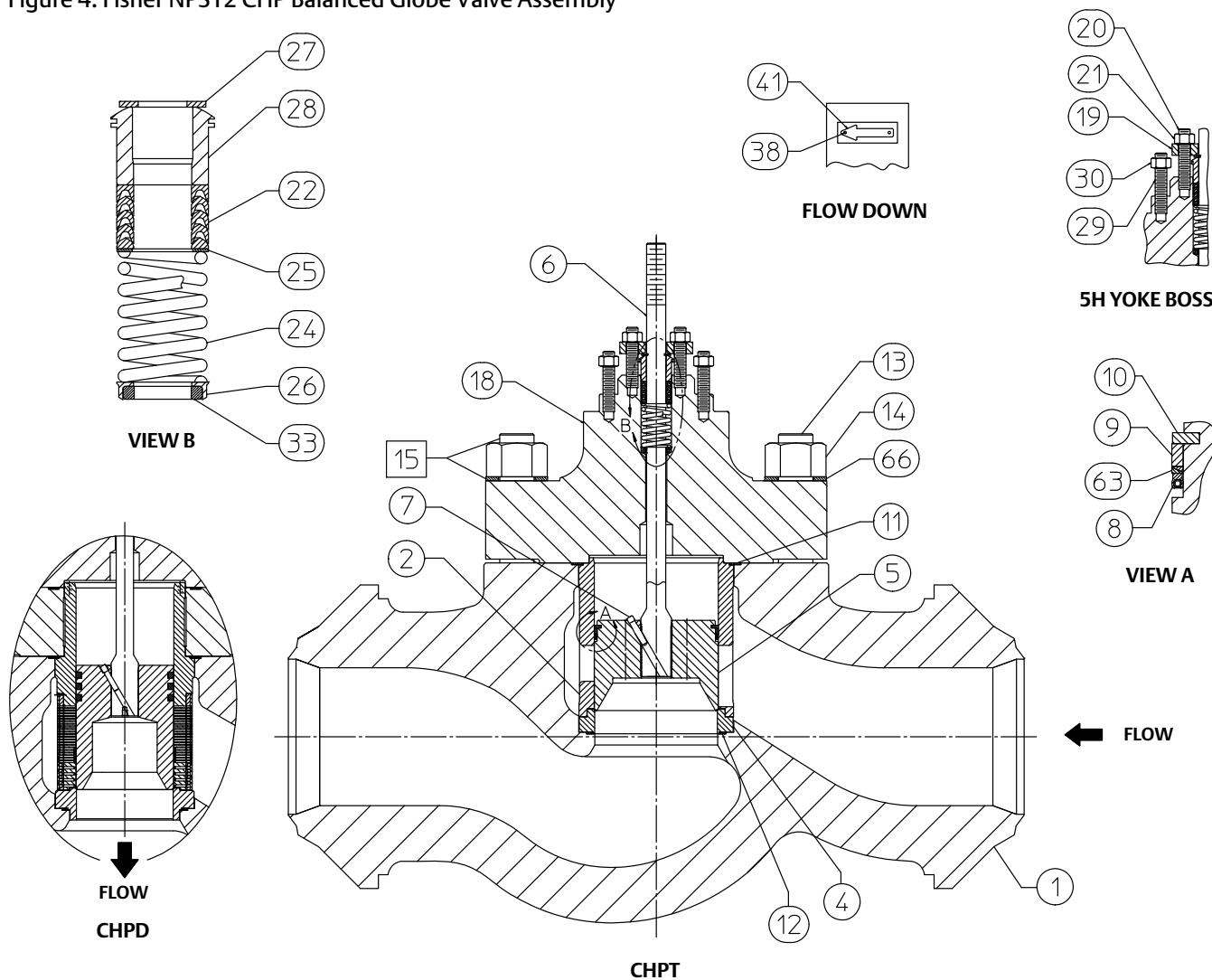
Key Description

1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number, and desired material.
2 *	Cage
4 *	Seat Ring
5 *	Valve Plug
6 *	Valve Stem
7 *	Pin
8 *	Seal Ring
9 *	Back Up Ring
10 *	Retaining Ring
11 *	Bonnet Gasket
12 *	Seat Ring Gasket
13	Stud, Cont Thd

Key Description

14	Hex Nut
15	Anti-Seize Lubricant
16	Nameplate (not shown)
17	Wire (not shown)
18	Bonnet---
	If you need a bonnet as a replacement part, order by serial number, and desired material.
19	Packing Flange
20	Stud Bolt
21	Hex Nut
22 *	Packing Set
23 *	Packing Ring
24	Spring or Lantern Ring
25	Washer, Special
26 *	Packing Box Ring
27 *	Upper Wiper
28	Packing Follower
29	Stud Bolt
30	Hex Nut
33	Lower Wiper
38	Drive Screw
41	Flow Arrow
63 *	Anti-Extrusion Ring
66 *	Carbon Steel Washer

Figure 4. Fisher NPS12 CHP Balanced Globe Valve Assembly



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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

CHP Valve

June 2017

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Fisher™ CL600 Control-Disk™ Rotary Valve

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Figure 1. Fisher CL600 Control-Disk Valve with 2052 Actuator and DVC6200 Digital Valve Controller



X0955-1

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher CL600 Control-Disk valve, NPS 3 through NPS 24 (figure 1). Refer to separate instruction manuals for information covering the power actuator and accessories.

Do not install, operate, or maintain a CL600 Control-Disk valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The Fisher CL600 Control-Disk valve maintains tight shutoff, and can be specified for a wide range of pressure and temperature conditions.

The CL600 Control-Disk valve is available in a lugged or double flanged body design. A splined shaft can combine with a variety of spring-and-diaphragm or pneumatic piston actuators. A keyed shaft option is available for larger sizes and can combine with a variety of pneumatic piston actuators. These combinations help make the CL600 Control-Disk valve a reliable rotary control valve for control applications in the process industries.

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Table 1. Fisher CL600 Control-Disk Valve Specifications

Specifications	ASME
Valve Body Size	NPS 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24
Pressure Rating	CL600 per ASME B16.34
Valve Body Materials	WCC or CF8M (std)
	LCC, CD3MN, M35-2, and CW2M
Disk Materials	CF8M (std), CD3MN, M35-2, and CW2M
Disk Edge Coating	Chrome Plate (std)
	Chrome Coat
	Chromium Carbide Coating
End Connections	Mates with RF Flanges per ASME B16.5 Optional construction mates with RTJ Flanges per ASME B16.5
Valve Body Style	Lugged (Single Flange), Lugged with drilled through flange holes, or Double Flange
Shaft Connection Style	NPS 3-24: Splined (std) NPS 14-24: Keyed
Face-to-Face Dimensions	Meets MSS SP68, API 609, ASME B16.10, EN 558 standards; Double Flange upon request
Shutoff	Soft Seal: Class VI
	Metal Seal: Class IV, reverse direction only
	Phoenix III Seal: Class VI; reverse direction preferred, forward direction optional
	High Pressure Seal: Class VI, reverse direction only
Flow Direction	Standard (reverse flow) is with the flow into the shaft side of the disk
Flow Characteristic	Linear
Disk Rotation	Clockwise (CW) to close

Educational Services

For information on available courses for Fisher CL600 Control-Disk valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Table 2. Valve Size, Shaft Diameter, and Approximate Weight

VALVE SIZE, NPS	SHAFT DIAMETER AT PACKING		SHAFT DIAMETER AT ACTUATOR ⁽¹⁾		SINGLE FLANGE APPROXIMATE WEIGHT		DOUBLE FLANGE APPROXIMATE WEIGHT	
	mm	Inches	mm	Inches	kg	Pounds	kg	Pounds
3	15.9	5/8	15.9	5/8	10.8	24	25.9	57
4	19.1	3/4	19.1	3/4	21.6	48	48.1	106
6	31.8	1-1/4	31.8	1-1/4	45.5	101	97.1	214
8	38.1	1-1/2	38.1	1-1/2	80.2	178	145.6	321
10	50.8	2	44.5	1-3/4	157	348	247.7	546
12	57.2	2-1/4	50.8	2	213	473	316.6	698
14	63.5	2-1/2	63.5	2-1/2	281	624	410	904
16	76.2	3	63.5	2-1/2	395	876	571.5	1260
18	88.9	3-1/2	76.2	3	563	1250	817.4	1802
20	101.6	4	76.2	3	721	1600	989.3	2181
24	114.3	4-1/2	76.2	3	1000	2220	1422	3135

1. Fisher actuator

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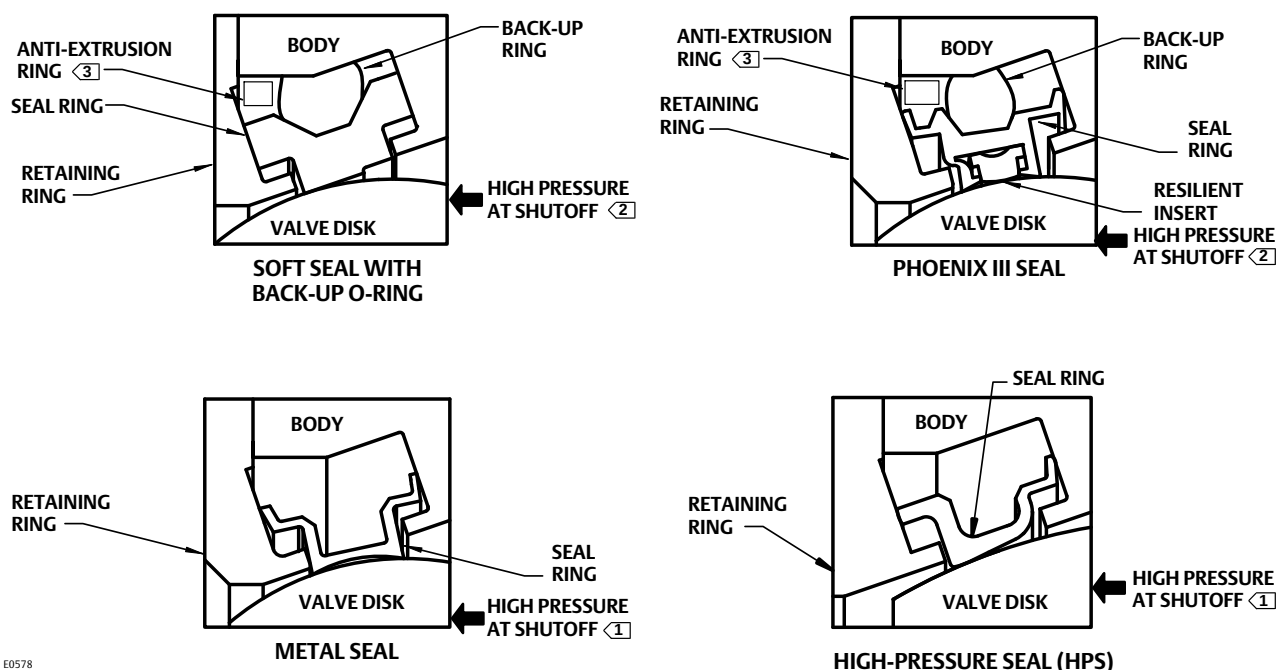
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Figure 2. Available Seal Configurations



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Notes:

1. This unidirectional seal must be installed so that the retaining ring is downstream from the high pressure side of the valve at shutoff, as shown.
2. For this bidirectional seal, the "preferred" valve orientation places the retaining ring downstream from the high pressure side of the valve at shutoff.
3. NPS 3 only.

Table 3. Maximum Allowable Inlet Pressure for CW2M Valves

TEMPERATURE	CW2M ⁽¹⁾
	600 ⁽²⁾
°C	Bar
-29 to 38	103.4
93	103.4
149	100.3
204	96.2
260	91.7
316	83.4
371	78.3
427	70.0
482	62.1
538	50.0
°F	Psig
-20 to 100	1500
200	1500
300	1455
400	1395
500	1330
600	1210
700	1135
800	1015
900	900
1000	725

1. This material is not listed in ASME B16.34. Also see the Installation section.

2. The designation 600 is used only to indicate relative pressure-retaining capabilities and is not an ASME pressure-temperature rating class designation.

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Table 4. Material Temperature Ranges

PART NAME	MATERIAL	TEMP °C	TEMP °F
Valve Body	WCC Steel	-29 to 427	-20 to 800
	CF8M ⁽¹⁾	-254 to 538	-425 to 1000
	LCC	-45 to 343	-50 to 650
	CD3MN	-51 to 316	-60 to 600
	M35-2	-198 to 482	-325 to 900
	CW2M ⁽¹⁾	-198 to 538	-325 to 1000
Disk	CF8M with Chrome Plated Disk Edge	-254 to 427	-425 to 800
	CF8M with Chrome Coated Disk Edge ⁽¹⁾	-254 to 538	-425 to 1000
	CF8M with Chromium Carbide Disk Edge ⁽¹⁾	-254 to 538	-425 to 1000
	CD3MN (no plating) ⁽²⁾	-51 to 316	-60 to 600
	M35-2 (no plating) ⁽²⁾	-198 to 482	-325 to 900
	CW2M (no plating) ⁽¹⁾⁽²⁾	-198 to 538	-325 to 1000
Shaft	S17400 (H1025)	-46 to 427	-50 to 800
	S20910 ⁽¹⁾	-198 to 538	-325 to 1000
	S31803	-51 to 316	-60 to 600
	N05500	-198 to 482	-325 to 900
	N10276	-198 to 538	-325 to 1000
	N07718 ⁽¹⁾	-254 to 538	-425 to 1000
Bearings	PEEK ⁽¹⁾	-73 to 149	-100 to 300
	S31600 Nitrided ⁽¹⁾	-254 to 538	-425 to 1000
	R30006 (Alloy 6) ⁽¹⁾	-198 to 538	-325 to 1000
Seal	ETFE Soft Seal Ring		
	ETFE Soft Seal Ring with FKM Backup Ring	-29 to 149	-20 to 300
	ETFE Soft Seal Ring with EPR Backup Ring	-54 to 149	-65 to 300
	S20910/ETFE Phoenix III Seal Ring		
	S20910/ETFE Phoenix III Seal Ring with FKM Backup Ring	-40 to 149	-40 to 300
	S20910/ETFE Phoenix III Seal Ring with EPR Backup Ring	-62 to 149	-80 to 300
	Metal Seal		
	S21800 ⁽¹⁾	-198 to 538	-325 to 1000
	S20910 ⁽¹⁾	-198 to 538	-325 to 1000
	High Pressure Seal		
	S21800 Nitrided	-198 to 538	-325 to 1000
	S20910 Nitrided	-198 to 538	-325 to 1000
Packing	PTFE /Carbon-filled PTFE (standard)	-45 to 232	-50 to 450
	ENVIRO-SEAL™ PTFE	-45 to 232	-50 to 450
	Graphite Die-molded Ribbon	-198 to 538	-325 to 1000
	ENVIRO-SEAL Graphite	-198 to 371	-325 to 700

1. The maximum temperature for a standard of the CL600 Control-Disk valve is 538°C (1000°F). Contact your [Emerson sales office](#) for use in higher temperature applications
2. For use with soft seal only.

Installation

Key numbers in this procedure are shown in figures 13, 14, and 15 unless otherwise indicated.

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the bursting of pressure retaining parts, be certain the service conditions do not exceed either the valve body rating or the flange joint rating, or other limits given in table 4 or on the nameplate. Use pressure-relieving or pressure-limiting devices to prevent the service conditions from exceeding these limits.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section on page 10 in this manual.

CAUTION

The valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions specified in the customer's order. Because some valve body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

The maximum allowable inlet pressures for steel and stainless steel valve bodies are consistent with the pressure-temperature ratings shown in table 1, except where further limited by the trim and packing material temperature capabilities given in table 4. Valves are also available in CW2M valve body materials. The CW2M valve body material is not listed in ASME B16.34. Valve bodies constructed of this material mates with ASME flanges, but must not be installed in systems requiring conformance to ASME standards if not included in ASME pressure/temperature ratings. Maximum allowable inlet pressures for CL600 Control-Disk valve bodies made of CW2M construction materials are shown in table 3.

1. Install a three-valve bypass around the control valve assembly if continuous operation is necessary during inspection and maintenance of the valve body.
2. Inspect the valve body to be certain it is free of foreign material.
3. The valve is normally shipped as part of a control valve assembly, with an actuator mounted on the valve body.

If the valve body and actuator have been purchased separately or if the actuator has been removed for maintenance, mount the actuator, and adjust actuator travel to close the valve before inserting the valve body into the line. This is necessary due to the measurements that must be made during the actuator adjustment process. Refer to the Actuator Mounting section on page 22 of this manual and to the separate actuator instruction manual for mounting and adjusting instructions before proceeding.

4. Inspect adjacent pipelines to be certain they are free of any foreign material, such as pipe scale or welding slag, that could damage the valve body seating surfaces.

CAUTION

Damage to the disk (key 6) will occur if any pipe flanges or piping connected to the valve body interfere with the disk rotation path. However, the disk can be rotated without interference when the valve body is installed between adjacent pipe flanges or piping that has an inside diameter equal to or greater than either schedule 80 pipe or compatible EN pipe sizes. If piping with a smaller inner diameter than specified above is connected to the valve, measure carefully to be certain the disk rotates without interference before putting the valve into operation.

5. Flow is in the standard direction when the seal retainer (key 16) is facing downstream. Standard flow direction is also indicated by the flow direction arrow cast into the valve body. Flow in the forward direction is permissible within allowable pressure drop limits with the proper seal.

CAUTION

CL600 Control-Disk disk rotation is counterclockwise to open (when viewed from the actuator side of the valve body, see figure 12) through 90 degrees of disk rotation.

6. With the disk in the closed position, install line flange gaskets, and insert the valve between the pipeline flanges. Use either flat sheet gaskets or spiral-wound gaskets with compression-controlling centering rings. Spiral-wound gaskets without compression-controlling centering rings are not recommended for this purpose.

Lifting Guidelines

Threaded holes for lifting are standard on the NPS 6 - 24 valve bodies. It is required that swivel hoists rings be used to lift the valve or valve and actuator assembly. An eyebolt cannot accommodate all lifting angles required to install or maintain the valve. The load carrying capability of an eyebolt decreases dramatically if used in any other orientation than axially. Therefore, the use of eyebolts is not permitted.

CAUTION

Care must be taken when lifting the valve/actuator assembly to ensure the accessories and tubing are not damaged in the process. The valve weight is listed in table 2. For the actuator weight, refer to the appropriate instruction manual. Make sure to use appropriate lifting straps/hoists capable of lifting this combined weight.

⚠ WARNING

Avoid personal injury or property damage caused by uncontrolled movement or dropping of the valve assembly.

Ensure the disk is secure from rotating during lifting process. Failure to do so could result in personal injury if the disk rotates uncontrolled during lifting.

Swivel Hoist rings are sized to lift only the valve and actuator. Do not attach piping or other structures to the valve and actuator assembly when lifting with swivel hoists rings.

Take appropriate precautions to avoid unbalanced loading which may result in sudden swinging or movement of the assembled unit, including additional lifting and/or support methods when necessary.

Do not use eyebolts when lifting the valve or valve and actuator assembly due to variable loading angles inherent to valve maintenance and installation.

Failure to utilize safe lifting practices may result in equipment damage and/or personal injury.

Lifting Valve/Actuator Assembly

To lift the assembly, install swivel hoist rings into one or two of the threaded holes on the valve body (see figure 3). Thread sizes are listed in table 5. When lifting the valve and actuator assembly, a strap around the actuator may be required to ensure lifting stability. If straps are used on the actuator, ensure the lifting location is above the center of gravity (CG) for the actuator to prevent load shifting during lifting. Refer to the appropriate assembly drawings for the CG for your assembly.

Lifting Valve Only

To lift the valve, insert two swivel hoist rings into the body. Thread sizes are listed in table 5. Ensure the valve is closed and that the packing is tightened to prevent shaft rotation during lifting. Without an actuator, the valve disk is free to rotate if enough momentum is generated during the lifting process by a sudden stop. The packing and seal friction should prevent the disk from rotating; however take proper precaution when lifting the valve.

7. Insert the valve between the flanges and install two or more line flange studs into the line flanges to help hold the valve in position while centering the valve. Carefully center the valve on the flanges to ensure disk clearance.

Note

Lubricate line flange studs before inserting them into flanges. If necessary, provide additional support for the control valve assembly because of its combined weight.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

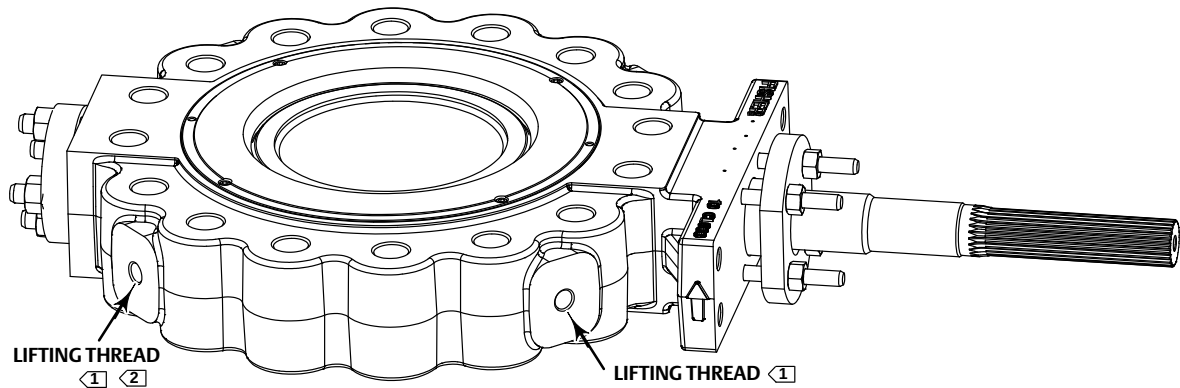
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Figure 3. Lugged Valve Body Lifting Thread Locations (NPS 10 shown)



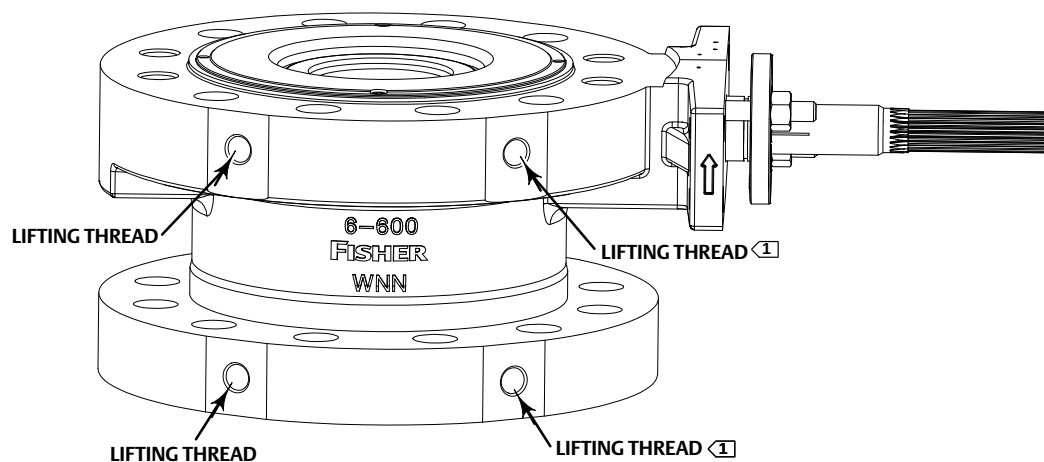
Notes:

- ① Holes on opposite side are identical.
- ② NPS 10-24 only.

Table 5. Lugged Valve Body Lifting Thread Information

NPS	NUMBER OF THREADED HOLES	THREAD SIZE	THREAD DEPTH	
		Inches	mm	Inches
6	2	3/4 - 10	41.9	1.65
8	2			
10	4			
12	4	1 - 8	55.9	2.20
14	4			
16	4			
18	4	1-1/4 - 7	68.8	2.71
20	4			
24	4			
		1-1/2 - 6	82.8	3.26

Figure 4. Double Flange Lifting Thread Locations



Note:

- ① Holes on opposite side are identical.

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Table 6. Double Flange Valve Body Lifting Thread Information

VALVE SIZE, NPS	NUMBER OF THREADED HOLES	THREAD SIZE	THREAD DEPTH	
		Inches	mm	Inches
3	8	3/8-16	14.2	0.56
4		1/2-13	19.1	0.75
6		3/4-10	41.9	1.65
8				
10		1-8	61	2.4
12			44.5	1.75
14		1-1/4-7	69	2.72
16				
18		1-1/2-6	72.6	2.86
20				
24				

Table 7. Lugged Valve Body Recommended Line Bolting Lengths

VALVE SIZE NPS	LUGGED BODY WITH THROUGH HOLES					LUGGED BODY WITH THREADED HOLES					
	Size Dia & Thread, Inch	No. of Stud Bolts	A Dimension, Inch	Next to Shaft Bore		No. of Stud Bolts	C Dimension, Inch	No. of Stud Bolts	B Dimension ⁽¹⁾ , Inch	Next to Shaft Bore	
				No. of Stud Bolts	B Dimension ⁽¹⁾ , Inch					No. of Stud Bolts	B Dimension ⁽¹⁾ , Inch
3	3/4 - 10	8	7.5	---	---	8	7.5	---	---	---	---
4	7/8 - 9	8	9	---	---	8	9	---	---	---	---
6	1 - 8	12	10.5	---	---	12	10.5	---	---	---	---
8	1-1/8 - 8	12	12.5	---	---	12	12.5	---	---	---	---
10	1-1/4 - 8	12	13.5	8	6	---	---	24	7.5	8	6
12	1-1/4 - 8	16	14.5	8	6	---	---	32	7.5	8	6
14	1-3/8 - 8	16	15.75	8	6.5	---	---	32	8	8	6.5
16	1-1/2 - 8	16	17.25	8	7	---	---	32	8.5	8	7
18	1-5/8 - 8	16	19	8	7.5	---	---	32	9	8	7.5
20	1-5/8 - 8	20	20	8	8	---	---	40	9.5	8	8
24	1-7/8 - 8	20	22.25	8	9	---	---	40	11	8	9

1. Full stud thread engagement as shown in figure 5.

Table 8. Double Flange Recommended Line Bolting Lengths

VALVE SIZE, NPS	Size Dia & Thread, Inch	DOUBLE FLANGE WITH THROUGH HOLES		DOUBLE FLANGE WITH THREADED HOLES	
		No. of Stud Bolts	D Dimension, Inch	No. of Stud Bolts	E Dimension, Inch
3	3/4-10	12	5.25	4	4
4	7/8-9	12	6	4	4.5
6	1-8	20	7.25	4	5.5
8	1 1/8-8	20	8.25	4	5.75
10	1 1/4-8	28	8.75	4	6
12	1 1/4-8	36	9.25	4	6
14	1 3/8-8	32	9.75	8	6.75
16	1-1/2-8	32	10.25	8	7
18	1-5/8-8	24	11.25	16	7.75
20	1-5/8-8	32	11.75	16	8
24	1-7/8-8	32	13.5	16	9

Figure 5. Stud Bolts for Installation (also see table 7)

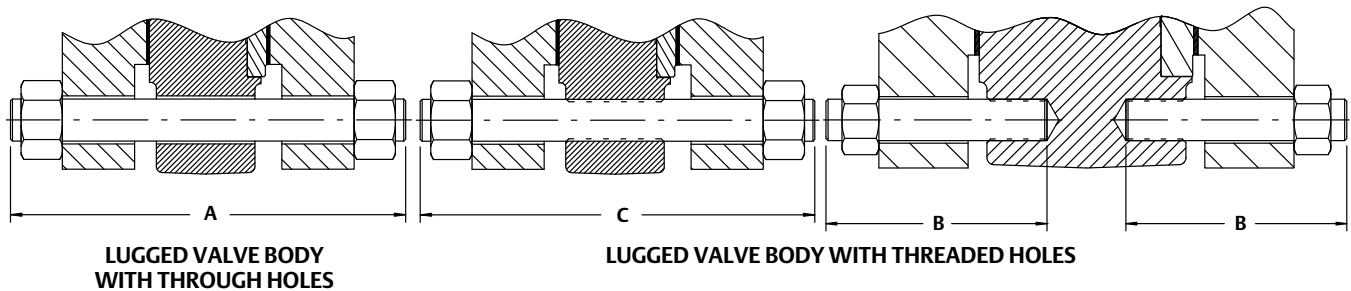
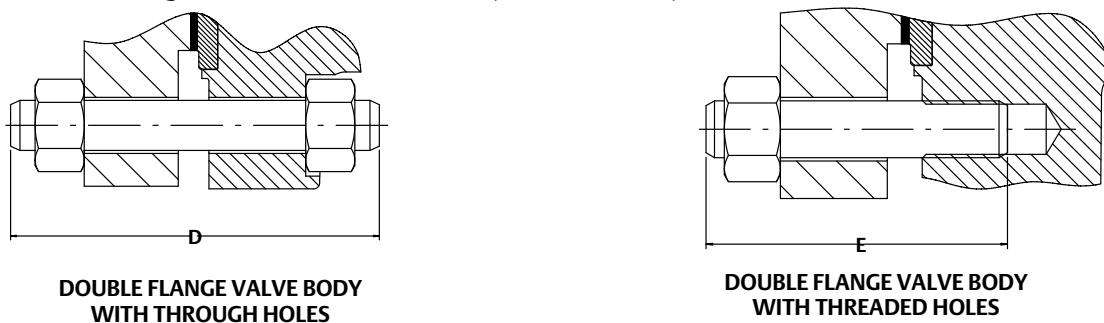


Figure 6. Double Flange Stud Bolts for Installation (also see table 8)



⚠ WARNING

For lugged valve bodies with threaded line bolt holes, personal injury and property damage could result from sudden release of process pressure if line bolts are not properly installed. To ensure proper line bolt thread engagement, line studs must be centered in the threaded section of the valve body so that each stud has equal thread engagement in the body. See figure 5.

8. After centering the valve body, first lubricate and then install the remaining line flange bolting to secure the valve in the pipeline. Tighten the nuts to the line flange studs in a crisscross pattern to ensure proper alignment of valve, gaskets, and flanges.

⚠ WARNING

A CL600 Control-Disk valve body is not necessarily grounded when installed in a pipeline. If the valve is used in a flammable or hazardous atmosphere or for oxygen service, an explosion could result due to a discharge of static electricity from the valve components. To avoid personal injury or property damage, always make sure the valve body is grounded to the pipeline before putting the control valve assembly into operation in a flammable or hazardous atmosphere.

Note

Standard packings for the CL600 Control-Disk valve are composed of all conductive packing rings (graphite ribbon packing) or partially conductive packing rings (such as a carbon-filled PTFE female adaptor with PTFE V-ring packing) to electrically bond the

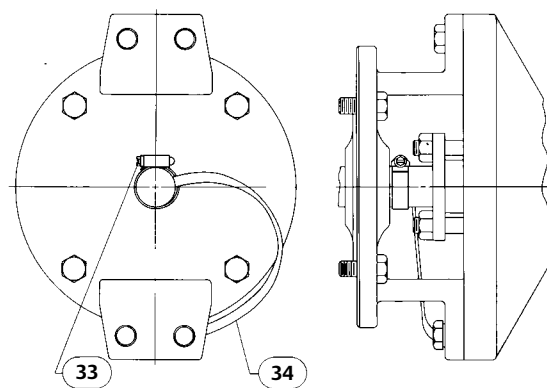
shaft to the valve body for hazardous area service. For oxygen service applications, provide alternate shaft-to-valve body bonding according to the following step.

9. For oxygen service applications, attach the bonding strap assembly (key 34, figure 7) to the shaft with the clamp (key 33, figure 7), and connect the other end of the bonding strap assembly to the valve body with the cap screw (key 31).

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however, the packing might require some readjustment to meet specific service conditions.

Figure 7. Optional Shaft-to-Valve Body Bonding Strap Assembly



Valves with ENVIRO-SEAL packing systems will not require this initial re-adjustment. See ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section on page 23 of this manual.

Maintenance

Valve body parts are subject to normal wear and must be inspected regularly and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given in this section for: replacing trim components, changing disk rotation or valve action, and mounting and adjusting the actuator.

As used in these instructions, actuator refers to power actuators (such as pneumatic diaphragm, piston actuators, and rack and pinion actuators).

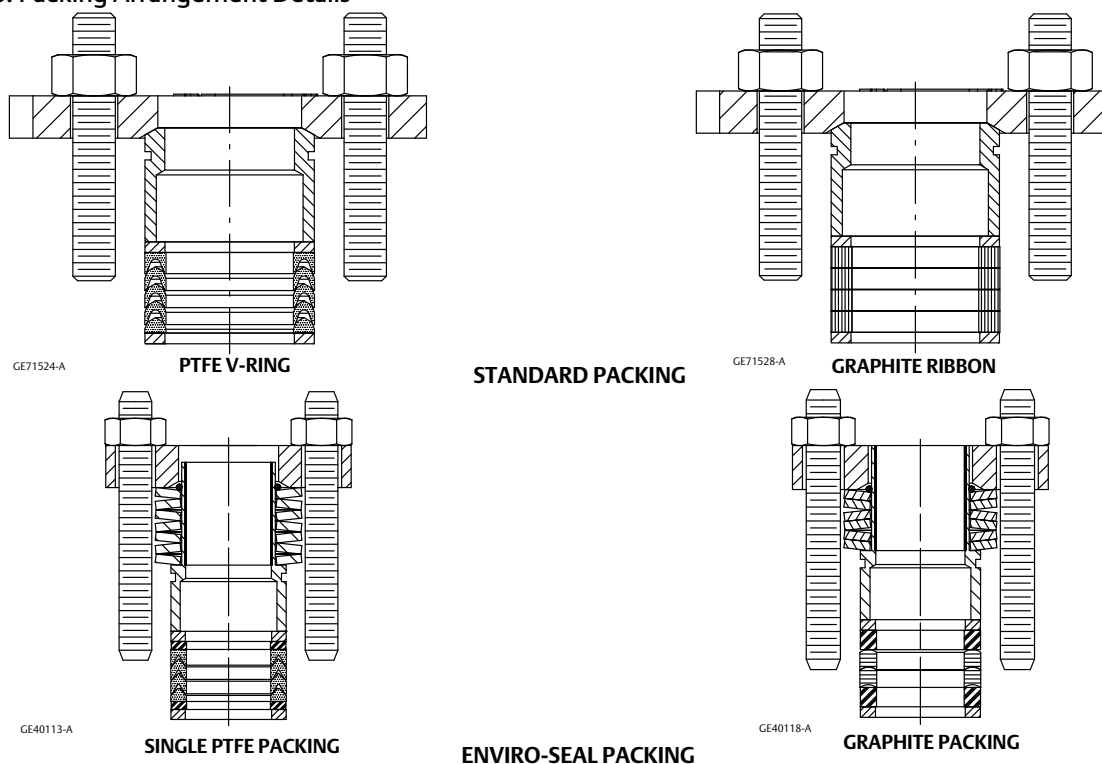
⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.

- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any spring precompression.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Figure 8. Packing Arrangement Details



NOTES:

1. WITH CONDUCTIVE PACKING, THE FEMALE ADAPTOR IN PTFE V-RING PACKING IS CARBON-FILLED PTFE.

Packing Maintenance

Refer to figure 8 for available packing configurations. All maintenance operations in this section may be performed with the valve in the line. Packing may be PTFE V-ring or graphite.

An ENVIRO-SEAL packing system is also available with the CL600 Control-Disk valve. To install the ENVIRO-SEAL packing system in an existing valve, follow the instructions in the instruction manual included with the packing system ([D101643X012](#)). To remove packing parts in a valve with the ENVIRO-SEAL packing system, follow the procedures for valves with the ENVIRO-SEAL packing system in this section. Install the replacement packing following the instructions in the packing system instruction manual (D101643X012).

Stopping Leakage

For valves with PTFE or graphite packing:

CAUTION

Tighten the packing flange only enough to prevent shaft leakage. Excessive tightening will only accelerate wear of the packing and could produce higher torques on the valve.

Leakage around the packing followers can be stopped by tightening the packing flange nuts (key 27).

If the packing is relatively new and tight on the shaft, and if tightening the packing flange nuts does not stop leakage, the shaft may be worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches around the packing box wall. Inspect the shaft and packing box wall for nicks and scratches when performing the packing replacement procedures.

For valves with the ENVIRO-SEAL packing system:

Optimum performance of the ENVIRO-SEAL packing system is obtained when the Belleville springs are tightened to their "target load." The target load is the point where the springs are compressed to 85% of their maximum deflection, or nearly flat. Maximum deflection is when the springs are 100% compressed, or completely flat.

Under normal conditions, the packing nuts should not require re-tightening. However, when servicing, if the springs do not remain at the target load of 85% compression, retighten the packing box nuts according to the following procedure:

1. Tighten the packing flange nuts alternately and evenly, keeping the packing flange parallel with the valve flange (see figure 8), until the Belleville springs are compressed 100% (or completely flat).

- For PTFE packing, loosen each packing flange nut one half turn (180° of rotation).
- For Graphite packing, loosen each packing flange nut one quarter turn (90° of rotation).

The target load of 85% compression has now been reached. If leakage continues, replace the packing components as described in the following procedures.

Replacing the Packing

To replace the packing, the actuator must be removed. Also, the valve should be removed from the pipeline to allow proper readjustment of the disk position.

⚠ WARNING

The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 6).

CAUTION

Damage to the disk (key 6) may occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, apply operating pressure to the actuator temporarily to retain the disk in the closed position while removing the valve from the pipeline.

For valves with PTFE or graphite packing:

Key numbers in this procedure are shown in figures 13, 14, and 15 unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shutoff all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.

CAUTION

When removing the actuator in the following step, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws (key 31). Remove the clamp (key 33, figure 7) if the strap (key 34, figure 7) is used.
3. Remove the packing flange nuts (key 27) and the packing flange (key 25) and pull out the packing follower (key 24).
4. Remove the anti-blowout ring, if used (NPS 3-8) (key 23) from the drive shaft (key 7).
5. Remove the old packing rings (key 22) and the packing box ring (key 21). Carefully avoid scratching the shaft or packing box wall to avoid damage that could cause leakage around the shaft. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing.

⚠ WARNING

Do not lubricate parts when used in oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

6. Use the appropriate procedures below for installing packing.
 - Install the packing as shown in figure 8. For NPS 3-8, two packing box rings (key 21) are used on the top and bottom of the packing set (see figures 8, 13, and 14 for details). For NPS 10-24, only one packing box ring (key 21) is used on the bottom of the packing set, at the end closest to the disk (see figure 15 for details).
 - With graphite ribbon packing, stack the packing rings and packing washers together, and slide the stack into the packing box as far as it will go while carefully avoiding trapping air between the rings.
 - Install the anti-blowout ring, if used (NPS 3-8) (key 23) in the groove on the drive shaft (key 7).
 - Install the packing follower and the packing flange.
 - Install the packing flange nuts, and tighten them only far enough to stop leakage under normal operating conditions.
 - For oxygen service applications, attach the bonding strap assembly (key 34, figure 7) to the shaft with the clamp (key 33, figure 7), and connect the other end of the bonding strap assembly to the valve body with a cap screw (key 31).
7. Mount the actuator and adjust the closed position of the valve, per the Actuator Mounting section on page 22 of this manual, before returning the valve to service.
8. When placing the control valve into operation, check around the packing follower for leakage; retighten the packing flange nuts as required according to accepted bolting procedures.

For valves with ENVIRO-SEAL packing systems:

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shutoff all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

CAUTION

When removing the actuator, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws (key 31). Remove the clamp (key 33, figure 7) if the strap (key 34, figure 7) is used.
3. Loosen the two packing hex nuts evenly to remove spring tension, then remove the nuts.
4. Remove the packing flange and spring pack assembly. The spring pack assembly consists of the spring stack and packing follower. The spring stack is retained on the packing follower by an O-ring. Remove the anti-blowout ring, if used (NPS 3-8) (key 23) from the drive shaft (key 7). Remove the anti-extrusion washer, the packing set, and the packing ring.

CAUTION

The valve shaft surface condition is critical in making and maintaining a good seal. If the valve shaft surface is scratched, nicked, dented, or worn, replace the valve shaft before replacing the packing system.

5. Inspect the existing valve shaft. If necessary, replace the valve shaft as described in the Replacing the Disk, Shafts, or Bearings section.
6. Install the new packing system components as described in the ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)). For NPS 3-8, two packing box rings (key 21) are used on the top and bottom of the packing set (see figures 8, 13, and 14 for details). For NPS 10-24, only one packing box ring (key 21) is used on the bottom of the packing set, at the end closest to the disk (see figure 15 for details).
7. Install the anti-blowout ring, if used (NPS 3-8) (key 23) onto the drive shaft (key 7) before installing the packing follower.
8. Mount the actuator and adjust the closed position of the valve, per the Actuator Mounting section on page 22 of this manual, before returning the valve to service.

Replacing the Seal Ring Assembly

Perform this procedure only if the control valve is not shutting off properly (that is, leaking downstream). This procedure does not require removing the actuator from the valve body.

Key numbers in this procedure are shown in figures 13, 14, and 15 unless otherwise indicated.

1. Isolate the control valve from line pressure, and relieve pressure from the valve body. Shut off and disconnect all lines from the power actuator.

⚠ WARNING

The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 6).

CAUTION

Damage to the disk (key 6) may occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, apply operating pressure to the actuator temporarily to retain the disk in the closed position while removing the valve from the pipeline.

2. Unscrew the flange bolts, and remove the valve from the pipeline.
3. Rotate the disk 180° from the closed position per figure 10.
4. Unscrew the retainer screws (key 17) and remove the seal retainer (key 16).
5. Thread the retainer screws into the jack screw retainer holes to unseat the retainer. These threaded holes may be used to lift the retainer. The thread size is listed in table 9.
6. Remove the retainer gasket and clean the body gasket groove and retainer surface.
7. Remove the seal ring assembly (key 19).

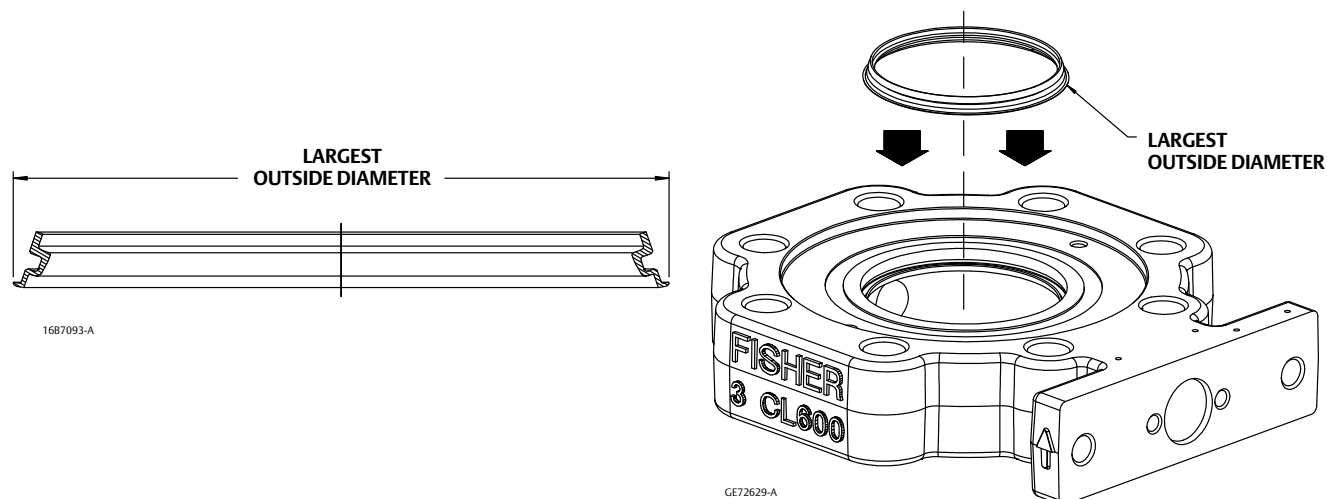
Soft Seal Installation

1. Locate the replacement seal ring (key 19) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 9. Around the outside circumference is one wide groove.

Before installing the seal ring into the valve body, the backup ring (key 20) must first be placed onto the wide, outer groove of the seal ring.

2. The seal ring and backup ring assembly must be installed in the valve. The wider outside diameter of the seal ring goes into the T-slot area of the valve body, shown in figure 9. Start the wider diameter edge of the seal ring into the T-slot of the valve body using a blunt end screwdriver.

Figure 9. Seal Installation Orientation



3. Carefully tuck the backup ring downward into the valve body T-slot until the seal ring and backup ring are completely entrapped in the valve body T-slot. Install the anti-extrusion ring per figure 2 (for NPS 3 only).
4. Place the retainer gasket (key 18) in the groove in the valve body.

CAUTION

The retainer gasket (key 18) is a thin graphite material. Take care to avoid damaging the gasket during handling.

- When the seal and gasket are seated, re-install the seal retainer (key 16) and screws (key 17). Tighten the retainer screws just enough to eliminate vertical movement of the seal retainer. With the use of the blunt end tool, carefully tuck the lip of the seal ring under the seal retainer.
- When the seal is under the lip of the seal retainer, tighten the screws according to table 9. Manually rotate the valve shaft clockwise 180° to return the disk to its closed position. Ensure these screws are tightened prior to installation.
- Be certain the disk is closed before installing the valve according to the Actuator Mounting section of this manual.

Metal Seal Installation

- With the disk in the closed position, place the seal ring (key 19) onto the disk (key 6). Set the retainer onto the seal, making sure proper alignment between the seal and retainer has been achieved. Install the anti-extrusion ring per figure 2 (for NPS 3 Phoenix III seal only).
- Place the retainer gasket (key 18) in the groove in the valve body.

CAUTION

The retainer gasket (key 18) is a thin graphite material. Take care to avoid damaging the gasket during handling.

- Attach the seal retainer (key 16) to the valve body and tighten the retainer screws (key 17). Tighten just enough to eliminate vertical movement of the retainer.
- Rotate the valve shaft 90° open/closed 3 times.
- With the disk in the closed position, tighten the retainer screws per table 9.
- Be certain the disk is closed before installing the valve according to the Actuator Mounting section of this manual.

Replacing the Disk, Shafts, or Bearings

Key numbers in this procedure are shown in figures 13, 14, and 15 unless otherwise indicated.

Table 9. Recommended Retainer Screw Torque

RAISED FACE FLANGE					RTJ FLANGE				
Valve Size, NPS	Number of Screws	Screw Size	Torque		Valve Size, NPS	Number of Screws	Screw Size	Torque	
			CL 12.9 / NCF1 Screws					B8M CL2 and B7M Screws	
		Inch	N • m	Lbf • ft			Inch	N • m	Lbf • ft
3	2	1/4 - 20	14	10.5	3	10	1/4 - 20	9	6.75
4					4	8	1/4 - 20	9	6.75
6					6	12	1/4 - 20	9	6.75
8					8	16	5/16 - 18	19	14
10					4	10			
12	2	1/2 - 13	88	65	12	12	1/2 - 13	80	59
14					14	20			
16					16	24			
18	4				18	22	5/8 - 11	161	119
20					20	24			
24					24	12	1 - 8	651	480

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104143X012

CL600 Control-Disk Valve

January 2019

Table 10. Follower Shaft Internal Threads

VALVE SIZE, NPS	THREAD SIZE
3	10 - 24
4	1/4 - 20
6	3/8 - 16
8	
10	1/2 - 13
12	
14	5/8 - 11
16	
18	
20	
24	

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shutoff all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

CAUTION

When removing the actuator in the following step, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws (key 31). Remove the clamp (key 33, figure 7) if the strap (key 34, figure 7) is used.
3. Remove the packing flange nuts (key 27) and the packing flange (key 25) and pull out the packing follower (key 24 or 29).

Disassembly

1. Remove the seal ring assembly according to steps 3 through 7 of the Replacing Seal Ring Assembly section of this manual.
2. Remove hex nuts, blind flange, gasket, when used (keys 5, 2, and 3).
3. Clean the gasket surfaces on the blind flange (key 2) and on the end of the valve body (key 1).
4. Rotate the disk (key 6) 180 ° from the closed position, as shown in figure 10.
5. Remove shaft pins (key 9) from the disk. Pins can be removed by their internal thread tapping in table 11.

Table 11. Pin Removal Thread

VALVE SIZE	THREAD SIZE
NPS	Inch
3	6 - 32
4	10 - 24
6	
8	3/8 - 16
10	
12	
14	
16	
18	
20	
24	

⚠ WARNING

Once the shafts have been removed in the following step, the disk may fall from the valve body. To avoid personal injury and disk damage, support the disk to prevent it from falling as the shafts are being removed.

6. Pull the follower shaft (key 8), when used, out through the outboard end of the valve body. If the follower shaft cannot be pulled free, the end of the follower shaft is internally threaded (see table 10) for screwing in a bolt or stud to aid in pulling the follower shaft.
7. Pull the drive shaft (key 7) out through the actuator end of the valve body and remove the anti-blowout ring, when used (key 23), from the drive shaft. The end of the shaft is internally threaded (shown in table 10) for screwing in a bolt or stud to aid in pulling the drive shaft.
8. Remove the disk (key 6) from the valve body through the side opposite the seal.
9. Remove the packing (key 22, figure 8) and the packing box ring (key 21, figure 8).
10. If any of the bearings (keys 14 and 15) require replacement, remove them.
11. Clean the packing box.

Assembly

⚠ WARNING

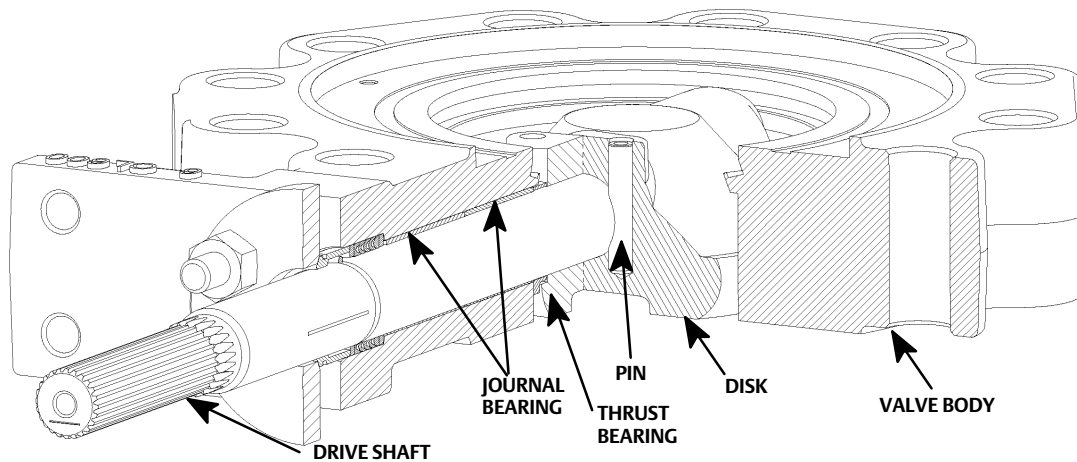
Do not lubricate bearings that will be used for oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

Table 12. Required Blind Flange Bolt Torque

VALVE SIZE	STUD SIZE	STUD MATERIAL ⁽¹⁾			
		SA193 B8M CL2, SA193 B7M/NCF2, SA453 660, & SB164 N05500 Studs		N07718 Studs	
NPS	Inch	N•m	lbf•ft	N•m	lbf•ft
8	1/2 - 13	95	70	149	110
10	5/8 - 11	190	140	298	220
12	3/4 - 10	325	240	508	375
14	7/8 - 9	481	355	827	610
16					
18	1 - 8	719	530	1261	930
20	1-1/8 - 8	1044	770	1627	1200
24					

1. Stud and nut threads must be lubricated to achieve proper preload.

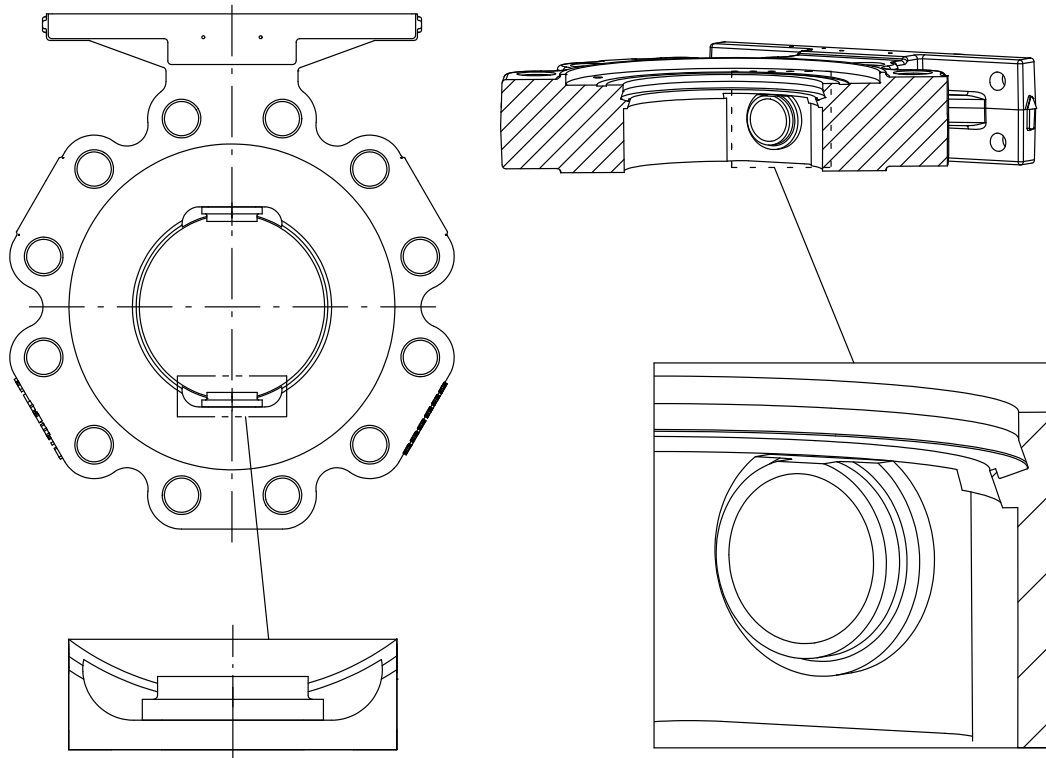
Figure 10. Disk Orientation for Pin Removal and Soft Seal Installation



CAUTION

To avoid possible product damage, ensure the NPS 3, 4, and 6 thrust bearings are oriented correctly when installing in the following procedure. See figure 11 for proper orientation of the thrust bearings.

Figure 11. Orientation of NPS 3, 4, and 6 Thrust Bearings



1. If new bearings (keys 14 and 15) are required, install them in the valve body. Install the journal bearings (key 14) before installing the thrust bearing (key 15). If installing a thrust bearing into NPS 3-6 valves, ensure the thrust bearing flat is oriented under the seal cavity, as shown in figure 9. If installing a NPS 8-24 thrust bearing, ensure the circular thrust bearing is fully seated in the body thrust bearing counterbore. For NPS 3-6 valves, three journal bearings (key 14 in figure 11) and two thrust bearings (key 15 in figure 11) are required per assembly. For NPS 8-24 valves, four journal bearings (key 14 in figures 12 and 13) and two thrust bearings (key 15 in figures 12 and 13) are required per assembly.
2. Insert the disk (key 6) into the valve body as shown in figure 10, ensuring the “T” stamped on the disk hub is oriented toward the actuator end of the valve body.
3. Install the drive shaft (key 7) and the follower shaft (key 8, when used) through the valve body and into the disk.
4. Align the holes in the shafts with the pin holes in the disk and drive the disk pins (key 9) into the disk. Once the pins are fully seated in the disk, use a punch or small chisel to stake the pins at three points.

CAUTION

To prevent the disk pin from sliding out during operation, ensure the staking operation deforms the disk pin hole diameter sufficiently.

5. Install the blind flange gasket, blind flange, and hex nuts (keys 2, 3, and 5). Ensure the blind flange is oriented so the serrations face the gasket and valve body. Tighten the hex nuts (key 5) per table 12.

CAUTION

Once the final preload torque is applied, do not loosen or remove the blind flange nuts (key 5). If nut removal is necessary, a new gasket is required.

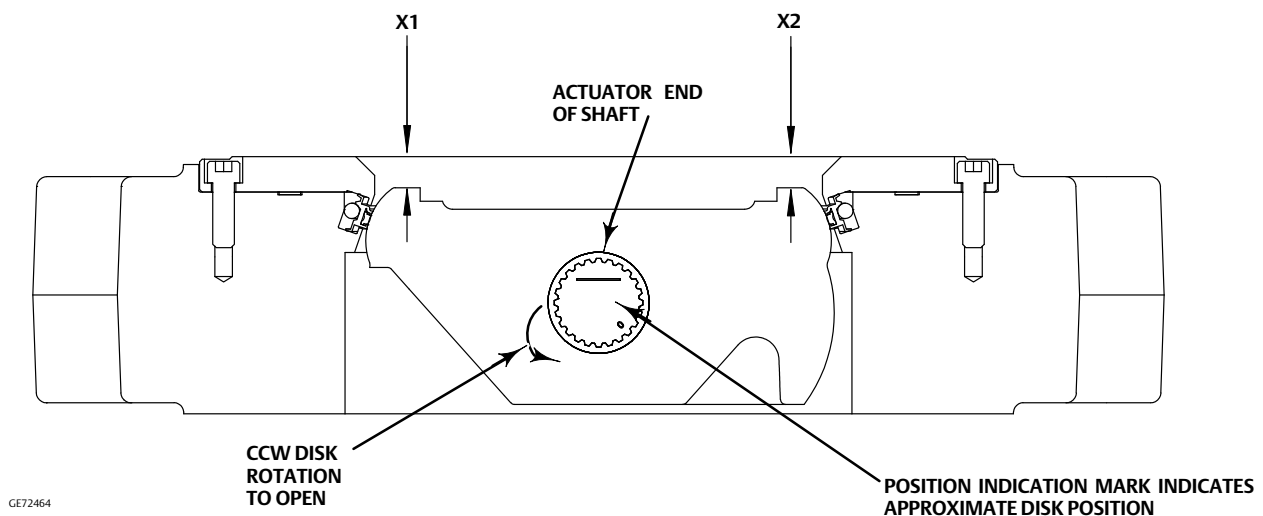
Soft Seal Installation

1. Locate the replacement seal ring (key 19) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 9. Around the outside circumference is one wide groove, as shown in figure 2.

Before installing the seal ring into the valve body, the backup ring (key 20) must first be placed onto the wide, outer groove of the seal ring. Rotate the disk 180° from closed before installing the seal ring (shown in figure 10).

2. The seal ring and backup ring assembly must be installed in the valve. The wider outside diameter of the seal ring goes into the T-slot area of the valve body, shown in figure 9. Start the wider diameter edge of the seal ring into the T-slot of the valve body using a blunt end screwdriver.
3. Carefully tuck the backup ring downward into the valve body T-slot until the seal ring and backup ring are completely entrapped in the valve body T-slot. If installing for NPS 3, install the anti-extrusion ring per figure 2.
4. Place the retainer gasket (key 18) in the groove in the valve body.
5. When the seal and gasket are seated, install the seal retainer (key 16) and screws (key 17). Tighten the retainer screws just enough to eliminate vertical movement of the seal retainer. With the use of the blunt end tool, carefully tuck the lip of the seal ring under the seal retainer.
6. When the seal is under the lip of the seal retainer, tighten the screws according to table 9. Manually rotate the valve shaft clockwise 180° to return the disk to its closed position.

Figure 12. Sectional of Typical Valve Body



Metal Seal Installation

1. With the disk in the closed position, place the seal ring (key 19) onto the disk (key 6). Set the retainer (key 16) onto the seal, making sure proper alignment between the seal and retainer has been achieved.

2. Place the retainer gasket (key 18) in the groove in the valve body.
3. Attach the seal retainer (key 16) to the valve body and tighten the retainer screws (key 17) just enough to eliminate the vertical movement of the retainer.
4. Rotate the valve shaft 90° open/closed 3 times.
5. Tighten the retainer screws per table 9.
6. Be certain the disk is closed before installing the valve according to the Actuator Installation section of this manual.

General Valve Assembly

7. For **standard packing**, install the packing according to the appropriate instructions presented in step 5 of the Replacing Packing section of this manual.
For **ENVIRO-SEAL packing**, install the new packing system components as described in the ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)).
8. Install the anti-blowout ring (key 23) when used, in the groove in the drive shaft.

Actuator Mounting

With the valve body out of the line, mount the actuator on the valve body in accordance with the instructions in the actuator instruction manual. Mount the actuator yoke to the valve body, and tighten the actuator-mounting cap screws (key 31) to the appropriate torque from table 13.

Table 13. Required Actuator-Mounting Bolt Torque

VALVE SIZE NPS	SCREW SIZE Inch	SAE J429 GRADE 5/NCF3 ⁽¹⁾	
		N•m	lbf•ft.
3	1/2 - 13	102	75
4			
6	5/8 - 11	190	140
8			
10	3/4 - 10	339	250
12			
14	7/8 - 9	508	375
16			
18	1-1/4 - 8	1491	1100
20			
24			

1. Screws must be lubricated to achieve proper preload.

CAUTION

CL600 Control-Disk valve disk rotation is counterclockwise to open (when viewed from the actuator side of the valve body, see figure 12). Rotating the disk (key 6) past the fully closed position will damage the seal ring (key 18).

Adjusting the Valve Closed Position

Adjust the actuator to bring the disk to the fully closed position at the end of the actuator stroke. To determine the fully closed disk position, measure the distances between the disk face and the seal retainer face at the top and bottom of the valve (X1 and X2) as shown in figure 12. Adjust the travel stops or turnbuckle to rotate the disk slightly until the two measurements are equal, but are allowed to be within 0.25 mm (0.010 inch) of each other. Refer to the appropriate actuator instruction manual for assistance.

Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number. When ordering replacement parts, also specify the key number, part name, desired material, using the Parts List.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Retrofit Kits for ENVIRO-SEAL Packing

Retrofit kits are available for replacing the packing in an existing valve with an ENVIRO-SEAL packing system. These kits are available for single PTFE or graphite packing. All parts required for installation of the ENVIRO-SEAL packing system into an existing CL600 Control-Disk valve are included in the kits.

Worn shafts, packing box damage, or other components that do not meet Emerson finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of the retrofit kit.

ENVIRO-SEAL Packing System Retrofit Kits

SHAFT DIAMETER		SINGLE PTFE PACKING	GRAPHITE PACKING
mm	Inches		
15.9	5/8	RPACKXRT752	RPACKXRT862
19.1	3/4	RPACKXRT762	RPACKXRT872
31.8	1-1/4	RPACKXRT772	RPACKXRT882
38.1	1-1/2	RPACKXRT782	RPACKXRT892
50.8	2	RPACKXRT792	RPACKXRT902
57.2	2-1/4	RPACKXRT802	RPACKXRT912
63.5	2-1/2	RPACKXRT812	RPACKXRT922
76.2	3	RPACKXRT822	RPACKXRT932
88.9	3-1/2	RPACKXRT832	RPACKXRT942
101.6	4	RPACKXRT842	RPACKXRT952
114.3	4-1/2	RPACKXRT852	RPACKXRT962

Parts List

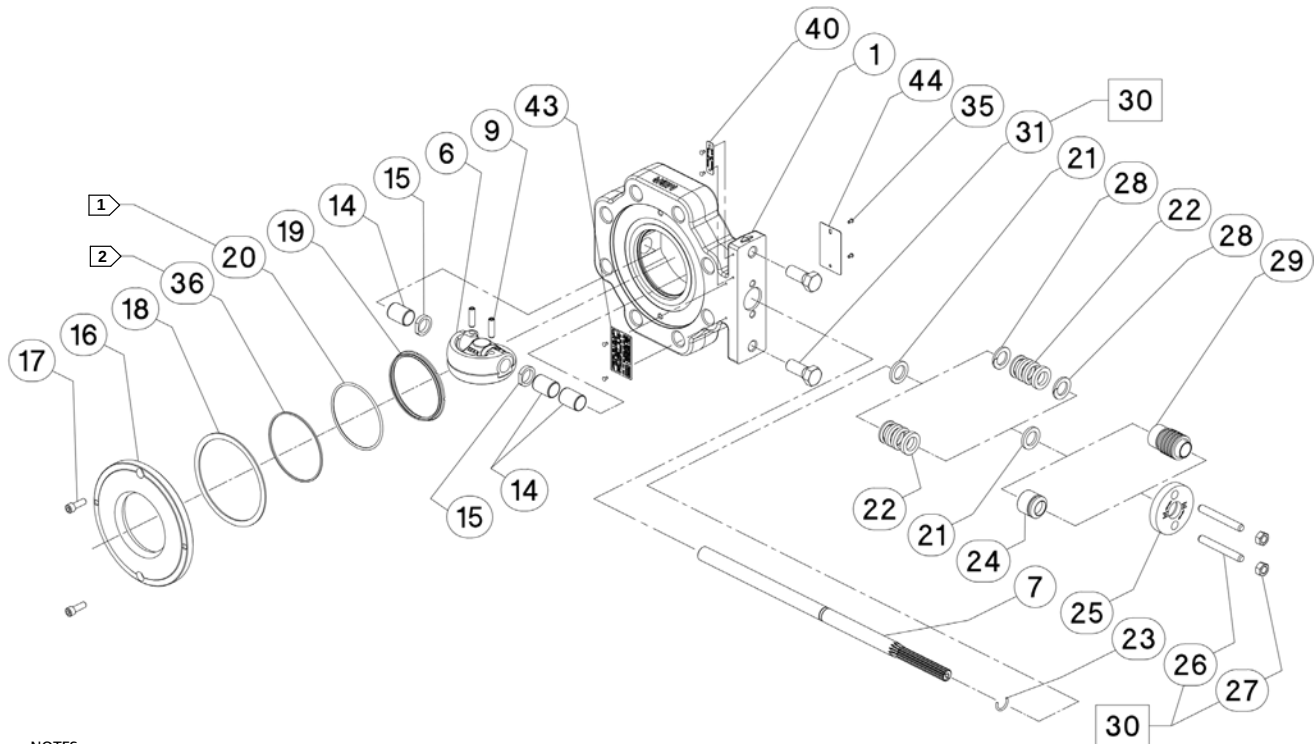
Note

Contact your [Emerson sales office](#) for part ordering information.

Key	Description
1	Valve Body
2	Blind Flange
3*	Gasket, Blind Flange
4	Stud, Blind Flange (4 req'd)
5	Nut, Blind Flange (4 req'd)
10*	Disk/Shaft Assy
6	Disk
7	Drive Shaft
8	Follower Shaft
9	Pin, Disk/Shaft (NPS 3-8, 2 req'd, NPS 10-24, 3 req'd)
11*	Key
12	Washer
13	Cap Screw
14*	Journal Bearing (NPS 3-6, 3 req'd, NPS 8-24, 4 req'd)
15*	Thrust Bearing (2 req'd)
16	Seal Retainer
17	Retainer Screw (NPS 3-8, 2 req'd, NPS 10-24, 3 req'd)
18*	Gasket, Retainer
19*	Seal

Key	Description
20*	O-ring, PTFE Seal
21*	Packing Box Ring
22*	Packing Set
23	Anti Blowout Ring
24	Packing Follower
25	Packing Flange
26	Packing Stud (NPS 3-8, 2 req'd, NPS 10-24, 4 req'd)
27	Packing Nut (NPS 3-8, 2 req'd, NPS 10-24, 4 req'd)
28*	Anti-Extrusion Ring
29	Spring Pack (PTFE ENVIRO-SEAL)
30	Lubricant
31	Mounting Cap Screw (NPS 3, 2 req'd, NPS 4-24, 4 req'd)
32*	Packing Washer (3 req'd)
33	Clamp
34	Ground Strap
35	Drive Screw
36*	Anti-Extrusion Ring (NPS 3 soft seal only)
37	Cable Tie (ENVIRO-SEAL Tag)
38	Tag, Warning (Packing)
39	Tag, ENVIRO-SEAL
40	Tag, Not Dead End
41	Tag, Phoenix III
42	Tag, Notice
43	Nameplate, Fisher
44	Nameplate, Mfr, CD
45	Mounting Bracket

Figure 13. Fisher CL600 Control-Disk, NPS 3-6, CL600 Valve Assembly

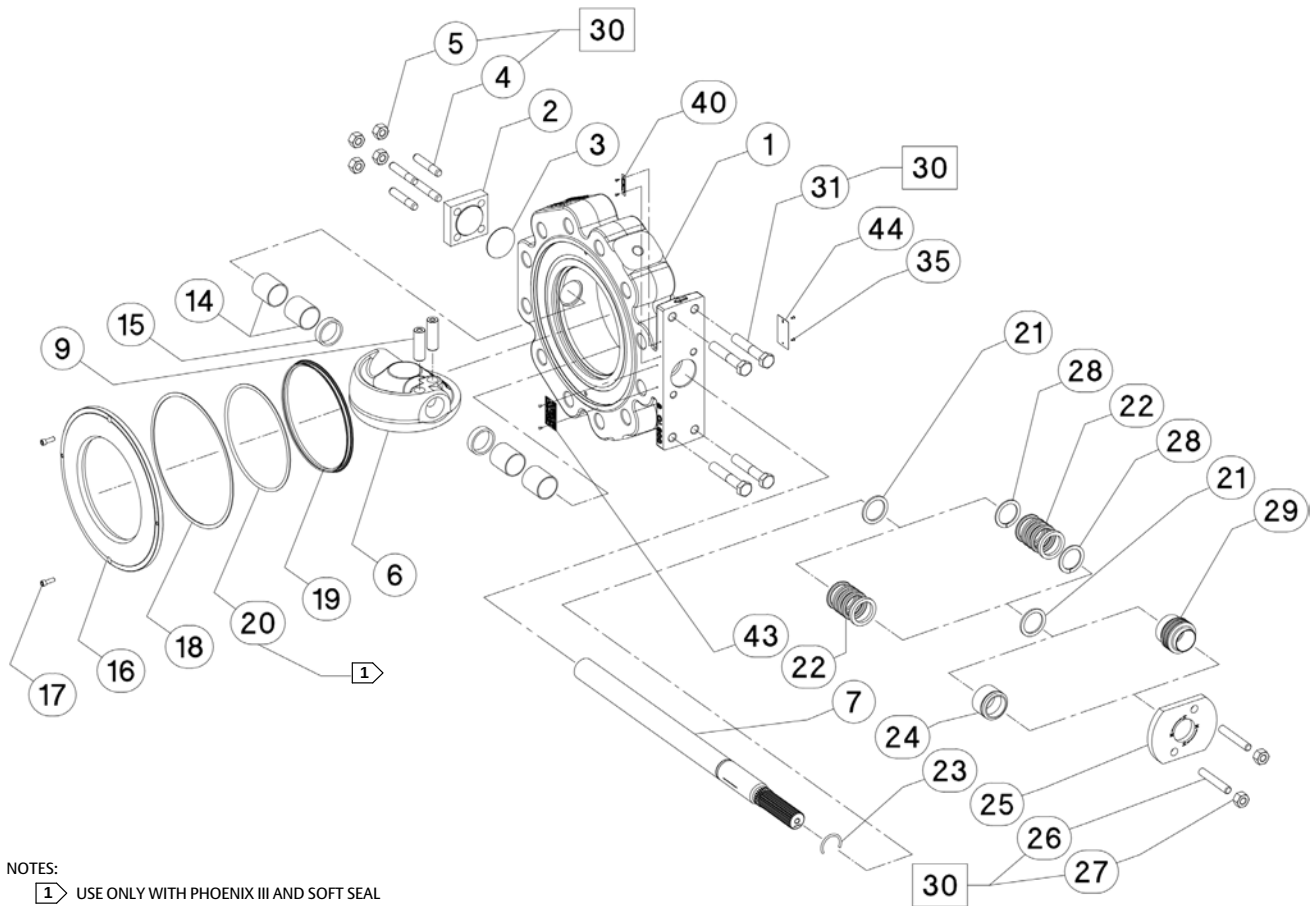


NOTES:

- 1 > USE ONLY WITH PHOENIX III AND SOFT SEAL
- 2 > USE ONLY WITH NPS 3 SOFT SEAL AND PHOENIX III SEAL

PARTS NOT SHOWN: 32, 33, 34, 37, 38, 39, 41, 42

Figure 14. Fisher CL600 Control-Disk, NPS 8, CL600 Valve Assembly



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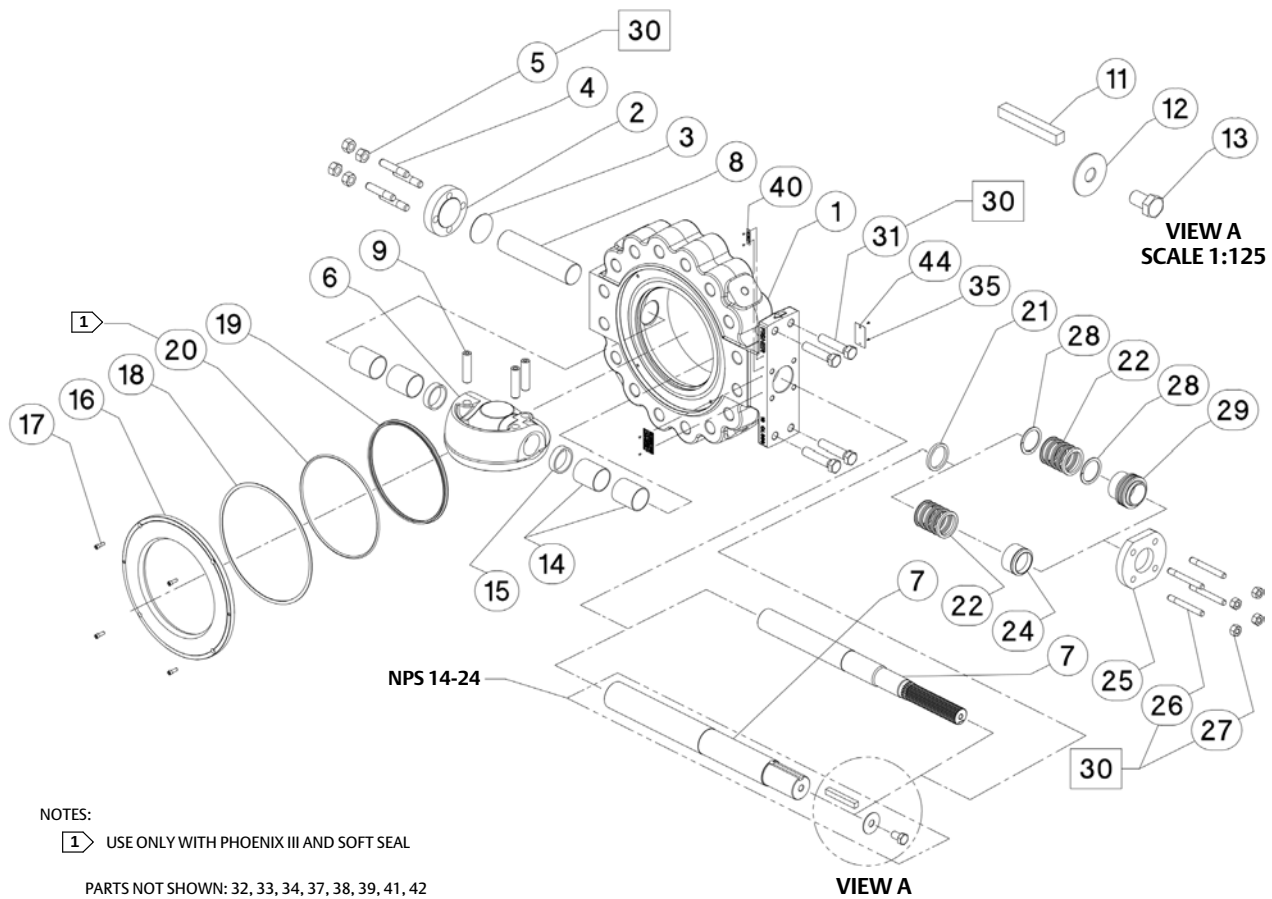
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Figure 15. Fisher CL600 Control-Disk, NPS 10-24, CL600 Valve Assembly



GE72089-A

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Fisher™ Control-Disk™ NPS 14-36 CL150-300 High-Performance Butterfly Valve

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Figure 1. Fisher Control-Disk Valve with 1061 Actuator and FIELDVUE™ DVC6020 Digital Valve Controller



W9138-1

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts ordering information for NPS 14 through 36, CL150-300 Control-Disk High-Performance Butterfly Valves (see figure 1). Refer to separate instruction manuals for information covering the actuator and accessories.



Do not install, operate, or maintain A31A valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Unless otherwise noted, all NACE references are to NACE MR0175-2002.

Table 1. Specifications

Valve Size and End Connection Styles ■ NPS 14, ■ 16, ■ 18, ■ 20, ■ 24, ■ 30, or ■ 36 valves, in ■ wafer-style (flangeless) or ■ single-flange (lugged) with raised-face flanges, CL150 or CL300 Maximum Pressure Drop⁽¹⁾ Consistent with CL150 and CL300 pressure/temperature ratings per ASME B16.34. Contact your Emerson sales office for additional information Shutoff Classification Per ANSI/FCI 70-2 and IEC 60534-4 Standard Soft Seal: Bidirectional shutoff Class VI (bubble-tight) NOVEX Seal: Unidirectional shutoff Class V (reverse flow direction only) Phoenix III Seal: Bidirectional shutoff Class VI (bubble-tight) Phoenix III Seal for Fire-Tested Applications: Unidirectional shutoff Class VI (reverse flow direction only) (bubble-tight). Fire Tested per API 607 Rev. 4. For cryogenic seal applications, consult your Emerson sales office. Available Seal Configurations Standard Constructions See figure 2 and table 2 Standard Construction Materials See table 2 Flow Characteristic Equal percentage Flow Coefficients Contact your Emerson sales office	Flow Coefficient Ratio⁽²⁾ 100 to 1 Noise Levels See Catalog 12 for sound/pressure level prediction Valve In-Line Position Shaft horizontal. See figure 4 Valve/Actuator Action With diaphragm or piston rotary actuator, field-reversible between: ■ push-down-to-close (extending actuator rod closes valve) and ■ push-down-to-open (extending actuator rod opens valve) Valve Body Classification NPS 14 to 24: Face-to-face dimensions are in compliance with MSS SP68 and API 609 standards. Valve bodies are designed for installation between ASME B16.5 CL150 and CL300 raised-face flanges NPS 30 to 36: Valve bodies are designed for installation between ASME B16.47 CL150 and CL300 raised-face flanges Disk Rotation Clockwise to close (when viewing from the drive shaft end) through 90 degrees rotation Shaft Diameter and Approximate Weight See tables 3 and 4 ENVIRO-SEAL™ Packing This optional packing system provides improved sealing, guiding, and transmission of loading force to control liquid and gas emissions. Contact your Emerson sales office for availability of ENVIRO-SEAL packing
--	--

1. The pressure/temperature limits in this manual, and any applicable code or standard limitation should not be exceeded.

2. Ratio of maximum flow coefficient to minimum usable flow coefficient may also be called rangeability.

Description

The valve is available in either a flangeless wafer body or a single-flange (lugged) body design, with a variety of seals and internal components. The pressure-assisted seal provides tight shutoff. The upper (splined) shaft combines with a variety of pneumatic piston or spring-and-diaphragm actuators. Maximum inlet pressure/temperature ratings are consistent with CL150 and CL300.

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Table 2. Material Temperature Ratings

COMPONENT AND MATERIAL OF CONSTRUCTION ⁽¹⁾		TEMPERATURE RANGE	
		°C	°F
Body Carbon Steel (WCC or SA 516-70) ⁽⁵⁾ CF8M (316 SST) CL150 CF8M FMS 20B16 (0.04% min carbon) CL300		-29 to 427 -198 to 538 -198 to 816	-20 to 800 -325 to 1000 -325 to 1500
Disk CF8M (316 SST) w/ or w/o Hard coating CF8M with CoCr-A edge (Alloy 6)		-198 to 538 -198 to 538	-325 to 1000 -325 to 1000
Shaft S20910 S17400 (17-4 PH H1025) S17400 (17-4 PH H1150M)		-198 to 538 -73 to 427 -196 to 427	-325 to 1000 -100 to 800 -320 to 800
Bearings PEEK ⁽²⁾ (standard) S31600 ⁽³⁾		-73 to 260 -198 to 816	-100 to 500 -325 to 1500
Packing PTFE Packing and PTFE ENVIRO-SEAL Packing Graphite packing Graphite packing with oxidizing media Graphite ENVIRO-SEAL packing		-54 to 232 -198 to 916 -198 to 538 -7 to 316	-65 to 450 -325 to 1500 -325 to 1000 20 to 600
Seal Ring and Backup Ring	PTFE Seal Ring		
	NBR (Nitrile) Backup O-Ring	-29 to 93	-20 to 200
	CR (chloroprene) Backup O-Ring	-43 to 149	-45 to 300
	EPR Backup O-Ring	-54 to 182	-65 to 360
	Fluorocarbon Backup O-Ring	-29 to 204	-20 to 400
	PTFE Backup O-Ring	-73 to 204	-100 to 400
Seal Ring and Backup Ring	UHMWPE ⁽⁴⁾ Seal Ring (CL150 Only)		
	NBR Backup O-Ring	-29 to 93	-20 to 200
	CR Backup O-Ring	-43 to 93	-45 to 200
	EPR Backup O-Ring	-54 to 93	-65 to 200
	Fluorocarbon Backup O-Ring	-29 to 93	-20 to 200
	PTFE Backup O-Ring	-73 to 93	-100 to 200
Seal Ring and Backup Ring	Phoenix III and/or Fire Tested Construction		
	S31600 and PTFE Seal Ring with NBR Backup O-Ring	-40 to 149	-40 to 300
	CR Backup O-Ring	-54 to 149	-65 to 300
	EPR Backup O-Ring	-62 to 204	-80 to 400
	Fluorocarbon Backup O-Ring	-40 to 232	-40 to 450
Seal Ring	NOVEX S31600 Seal ⁽³⁾ Ring (CL150)	-29 to 538	-20 to 1000
	NOVEX S31600 Seal ^(3, 6) Ring (CL300)	-29 to 816	-20 to 1500
	NOVEX S21800 Seal Ring (CL300)	-29 to 816	-20 to 1500
	Cryogenic Seal Ring	Contact your Emerson sales office	

1. NACE trim constructions are available; consult your [Emerson sales office](#).

2. PEEK stands for poly-ether-ether-ketone.

3. For a complete material description, contact your Emerson sales office.

4. UHMWPE stands for ultra high molecular weight polyethylene.

5. Cast or wrought /plate grades used interchangeably, depending upon availability - unless specified by customer.

6. Seal rated for CL150 pressures. For fully rated CL300 seal rating, use NOVEX S21800 seal ring.

1. NACE trim constructions are available; consult your [Emerson sales office](#).

2. PEEK stands for poly-ether-ether-ketone.

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4. UHMWPE stands for ultra high molecular weight polyethylene.

5. Cast or wrought / plate grades used interchangeably, depending upon availability - unless specified by customer.

6. Seal rated for CL150 pressures. For fully rated CL300 seal rating, use NOVEX S21800 seal ring.

Installation

The valve is normally shipped as part of a control valve assembly, with the power actuator mounted on the valve. If the valve or actuator has been purchased separately, or if the actuator has been removed for maintenance, mount the actuator on the valve, and adjust actuator travel before installing the valve into the line. This is necessary due to the measurements that must be made during the actuator calibration adjustment process. Refer to the Actuator Mounting section of this manual and to the separate actuator instruction manual for mounting and adjusting instructions before proceeding.

⚠ WARNING

To avoid personal injury or property damage resulting from the sudden release of pressure:

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operation.
- Do not install the valve assembly where service conditions could exceed the limits given in this manual or on the nameplates.
- Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices to protect from over-pressurizing the system.
- Check with your process or safety engineer for any other hazards that may be present from exposure to process media.
- If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions indicated when the valve was ordered. Because some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines to the power actuator, release pressure from the actuator, and disconnect the pressure lines from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you are working on the equipment.

See the WARNING at the beginning of the Maintenance section for more information before removing the valve from the pipeline.

2. Install a three-valve bypass around the control valve assembly if continuous operation is necessary during inspection and maintenance of the valve.
3. Inspect the valve to be certain that it is free of foreign material.
4. Be certain that adjacent pipelines are free of any foreign material, such as pipe scale or welding slag, that could damage the valve sealing surfaces.

NOTICE

Damage to the disk will occur if any pipe flanges or piping connected to the valve interfere with the disk rotation path. If the piping flange has a smaller inner diameter than specified for schedule 80 piping, measure carefully to be certain the disk rotates without interference before placing the valve into operation. Minimum inside diameters for flanges or pipe mating with valves are shown in tables 3 and 4.

Valve Orientation

The valve can be installed in any orientation, however it is recommended that the valve drive shaft be horizontal and the actuator vertical as shown in figure 4.

Install the valve with the high-pressure shutoff side in the direction noted by the flow arrow for proper installation, and see figure 4 for more information.

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Before Installing the Valve

⚠ WARNING

The edges of a rotating valve disk (key 2, figure 9) close with a shearing, cutting motion. To avoid personal injury, keep hands, tools, and other objects away from the disk while stroking the valve.

If the Control-Disk valve is equipped with a fail-open actuator, cycle the valve into the fully closed position. Ensure the valve cannot open during installation by using a manual actuator, a constant supply pressure to the pneumatic actuator, or other steps as necessary.

Table 3. Valve Body Data, CL150

VALVE SIZE, NPS	SHAFT DIAMETER AT ACTUATOR YOKE	FACE-TO-FACE DIMENSION ⁽¹⁾	MINIMUM I.D. ⁽²⁾	APPROXIMATE WEIGHT, KILOGRAMS	
				Wafer	Single-Flange
		mm			
14	31.8	92.1	331.2	79.8	103
16	31.8	102	375.2	106	150
18	39.7	114	418.8	152	191
20	44.5	127	464.1	191	248
24	57.2	154	580.9	286	381
30	(3)	159	723.9	625	824
36	(3)	178	876.3	934	1250
VALVE SIZE, NPS	SHAFT DIAMETER AT ACTUATOR YOKE	FACE-TO-FACE DIMENSION ⁽¹⁾	MINIMUM I.D. ⁽²⁾	APPROXIMATE WEIGHT, POUNDS	
				Wafer	Single-Flange
		Inches			
14	1.25	3.63	13.04	176	227
16	1.25	4.00	14.77	233	330
18	1.56	4.50	16.49	336	422
20	1.75	5.00	18.27	421	546
24	2.25	6.06	22.87	630	840
30	(3)	6.25	28.5	1380	1820
36	(3)	7.00	34.5	2060	2750

1. NPS 14 to 24 face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications.
2. Minimum I.D. is the minimum pipe or flange I.D. required for disk swing clearance.
3. Contact your [Emerson sales office](#) for information.

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Table 4. Valve Body Data, CL300

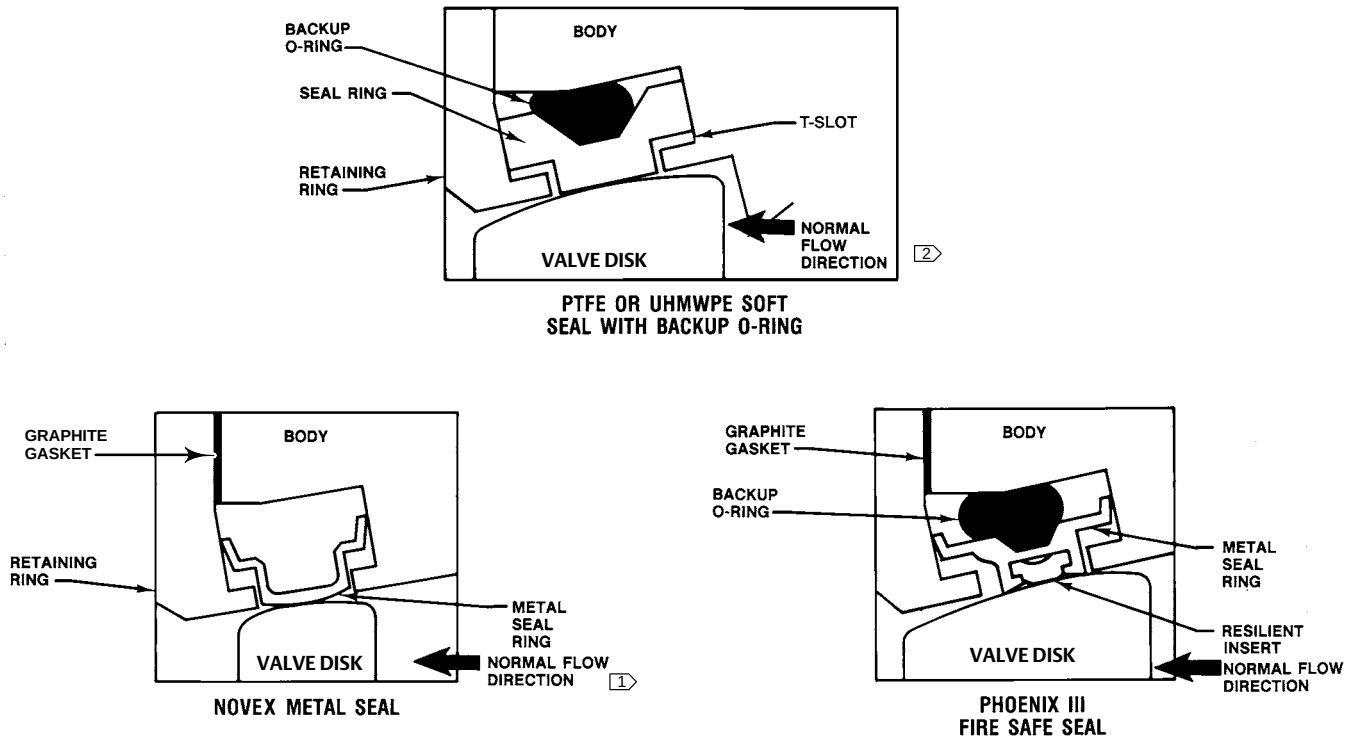
VALVE SIZE, NPS	SHAFT DIAMETER AT ACTUATOR YOKE	FACE-TO-FACE DIMENSION ⁽¹⁾	MINIMUM I.D. ⁽²⁾	APPROXIMATE WEIGHT, KILOGRAMS	
				Wafer	Single-Flange
		mm			
14	44.5	118	304.3	143	249
16	44.5	133	346.2	203	314
18	57.2	149	389.4	253	427
20	76.2	156	442.0	388	568
24	88.9	181	523.2	501	853
30	(3)	241	670.6	1070	1520
36	(3)	273	828.0	1470	2150
VALVE SIZE, NPS	SHAFT DIAMETER AT ACTUATOR YOKE	FACE-TO-FACE DIMENSION ⁽¹⁾	MINIMUM I.D. ⁽²⁾	APPROXIMATE WEIGHT, POUNDS	
				Wafer	Single-Flange
		Inches			
14	1.75	4.63	11.98	315	549
16	1.75	5.25	13.63	447	693
18	2.25	5.88	15.32	558	941
20	3.00	6.13	17.40	855	1250
24	3.50	7.13	20.59	1110	1880
30	(3)	9.50	26.4	2360	3360
36	(3)	10.8	32.6	3240	4730
1. Face-to-face dimensions are in compliance with MSS SP68 and API 609 specifications. 2. Minimum I.D. is the minimum pipe or flange I.D. required for disk swing clearance. 3. Contact your Emerson sales office for information.					

A Control-Disk valve is normally shipped as part of an assembly with an actuator and other accessories such as a valve positioner. If the valve and actuator have been purchased separately or if the actuator has been removed for maintenance, properly mount the actuator and adjust valve/actuator travel before inserting the valve into the line.

NOTICE

Damage to the disk will occur if any pipe flanges or piping connected to the valve interfere with the disk rotation path. Be certain to align the valve accurately to avoid contact between the disk (key 2) and the flanges.

Figure 2. Available Seal Configurations



B2313-3

NOTES:

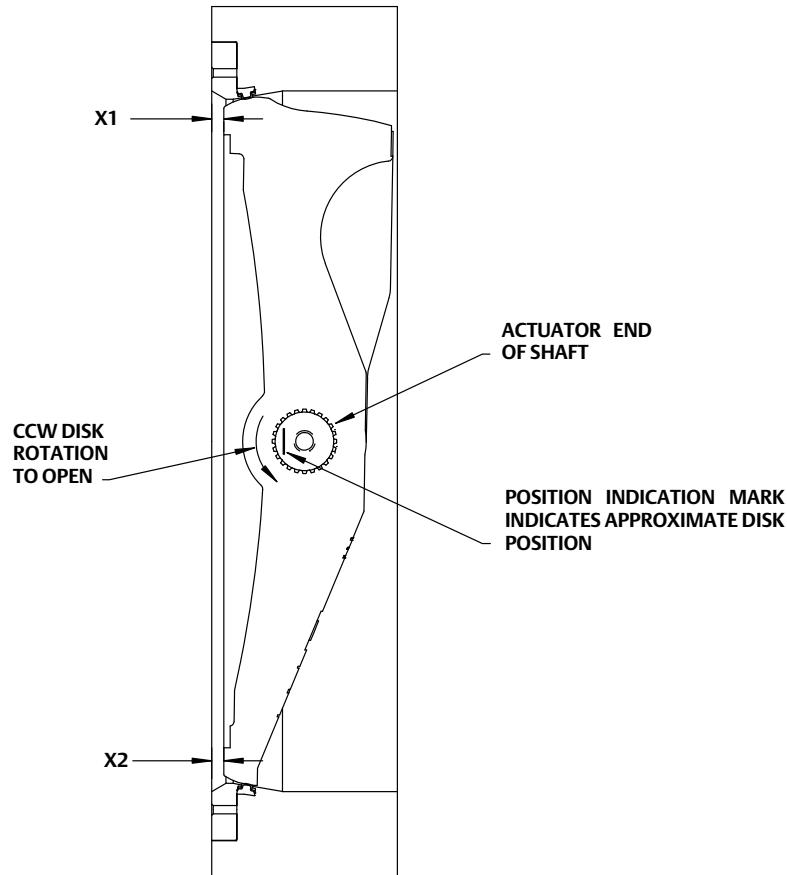
- 1 THIS UNIDIRECTIONAL SEAL MUST BE INSTALLED SO THAT THE RETAINING RING IS DOWNSTREAM FROM THE HIGH PRESSURE SIDE OF THE VALVE AT SHUTOFF, AS SHOWN.
- 2 FOR THIS BIDIRECTIONAL SEAL, THE "PREFERRED" VALVE ORIENTATION PLACES THE RETAINING RING DOWNSTREAM FROM THE HIGH PRESSURE SIDE OF THE VALVE AT SHUTOFF.

Adjusting the Actuator Travel

Key number locations are shown in figure 9, unless otherwise noted.

1. Adjust the actuator to bring the disk to the fully closed position at the end of the actuator stroke. To determine the fully closed disk position, measure the distances between the disk face and the seal retainer face at the top and bottom of the valve (X1 and X2) as shown in figure 3. Adjust the actuator to rotate the disk slightly until the two measurements are within 0.8 mm (0.032 inch) of each other. Refer to the appropriate actuator instruction manual for assistance.
2. Before installing the valve/actuator assembly in the process line, cycle the valve several times to be sure the valve disk returns to the proper position.

Figure 3. Sectional of Typical Valve Body



GES3027-A

Installing the Valve

The maximum allowable inlet pressures for Control-Disk valves are consistent with the applicable ASME pressure/temperature ratings except where limited by the material capabilities as shown in table 2 or figure 2.

Refer to table 5 for the quantity and size of line bolting required to install the valve in the pipeline.

NOTICE

To avoid damage to the valve disk during installation, the valve must be in the fully closed position. If the Control-Disk valve is equipped with a fail-open actuator, remove the actuator before installing the valve/actuator assembly or cycle the valve into the fully closed position. Then, take appropriate steps to be sure that the actuator does not cause the valve to open during installation.

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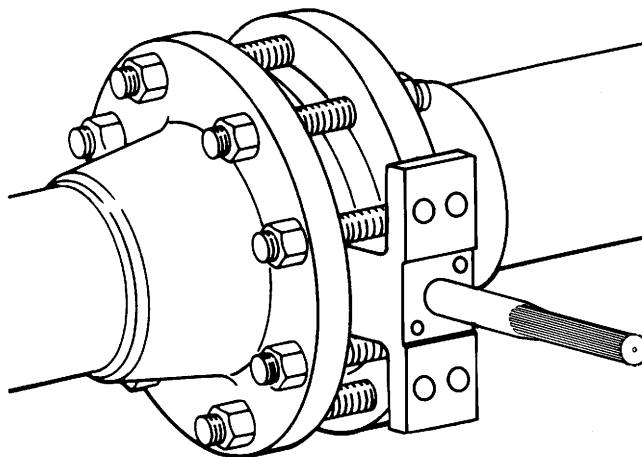
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Table 5. Hex Head Screw, Stud Bolt and Cap Screw Data⁽¹⁾

VALVE SIZE, NPS	NO. OF CAP SCREWS		NO. OF STUD BOLTS		SIZE-DIA. INCH & THREAD		LENGTH OF CAP SCREWS, INCH		LENGTH OF STUD BOLTS, INCH	
	CL150	CL300	CL150	CL300	CL150	CL300	CL150	CL300	CL150	CL300
Single-Flange Style ⁽²⁾										
14	24	40	---	---	1-8	1-1/8-8	2.75	3.5	---	---
16	32	40	---	---	1-8	1-1/4-8	3	3.75	---	---
18	32	48	---	---	1-1/8-8	1-1/4-8	3.25	4	---	---
20	40	48	---	---	1-1/8-8	1-1/4-8	3.5	4	---	---
24	40	48	---	---	1-1/4-8	1-1/2-8	3.5	4.5	---	---
30	8	8	24	24	1-1/4-8	1-3/4-8	4.5	5.75	15.5	21.5
36	8	8	28	28	1-1/2-8	2-8	5.25	6.5	18	24.25
Wafer-Style										
14	---	8	12	16	1-8	1-1/8-8	---	3.5	9.5	12
16	---	8	16	16	1-8	1-1/8-8	---	3.75	10	13.5
18	---	8	16	16	1-1/8-8	1-1/4-8	---	4	11	13.75
20	---	8	20	20	1-1/8-8	1-1/4-8	---	4	12	14.5
24	---	8	20	20	1-1/4-8	1-1/2-8	---	4.5	14	16.5
30	56	56	---	---	1-1/4-8	1-3/4-8	4.5	5.75	---	---
36	64	64	---	---	1-1/2-8	2-8	5.25	6.5	---	---
1. Thread engagement in accordance with ASME B31.3 "Chemical Plant and Petroleum Refinery Piping". 2. Bolting lengths are based on installation of valve between standard raised face flanges and utilizing flange gaskets with a final compression thickness of 0.125 inch. When gaskets used have a final compression thickness of less than 0.125 inch, reduce bolting lengths shown by 0.25 inch.										

Figure 4. Installation of Wafer-Style Valves

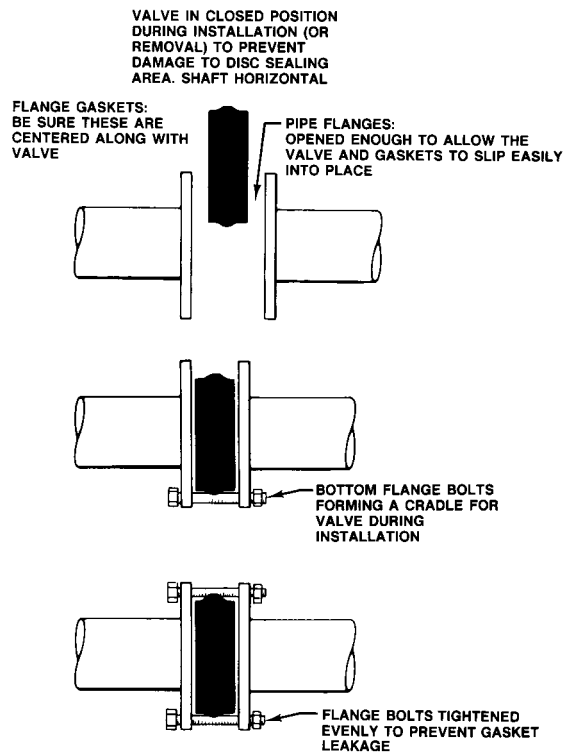


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1. See figure 4 for recommended valve orientation.

- For Wafer-Style Valves: Install the lower flange bolts first to form a cradle for the valve (see figure 5). See table 5 for flange bolt specifications.
 - For Single-Flange Valves: Position the valve between the flanges. Be sure to leave enough room for the flange gaskets. Install the lower flange bolts.
2. For all Valves: Select the appropriate gaskets for the application. Flat sheet, spiral wound, or other gasket types, made to the ASME B16.5 standard or user's standard, can be used on Control-Disk valves depending on the service conditions of the application.

Figure 5. Proper Installation Steps



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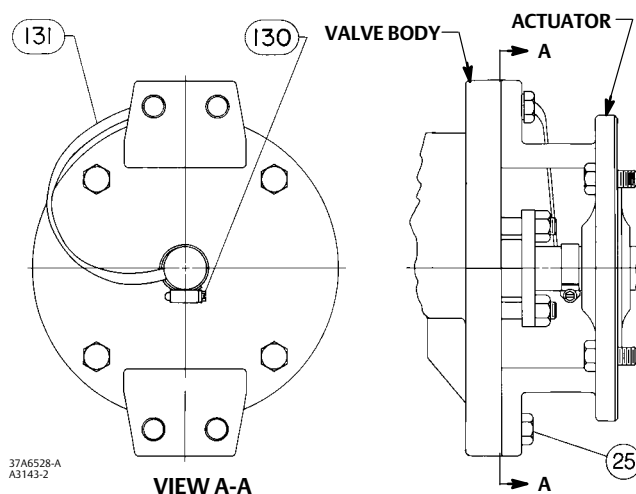
3. For Wafer-Style Valves: Properly orient the valve according to the specific application. Place the valve in the line so the flow properly enters the valve as indicated by the flow tag. Then, install the valve and the gaskets between the flanges into the cradle formed by the flange bolts.
4. Install the remaining flange bolts.
 - For Wafer-Style Valves: Make sure the gaskets are centered on the gasket sealing surfaces of the flange and body.
5. For all Valves: Tighten the flange bolts in an alternating criss-cross fashion to a torque value of one-fourth of the final bolting torque. Repeat this procedure several times, increasing the torque value each time by a fourth of the final desired torque. After applying the final torque value, tighten each flange bolt again to allow for gasket compression.

Packing Adjustment and Shaft Bonding

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

Figure 6. Optional Shaft-to-Valve Body Bonding Strap Assembly



NOTICE

For non-ENVIRO-SEAL packing: Tighten the packing follower nuts only enough to prevent shaft leakage. Excessive tightening will accelerate wear of the packing and could produce higher friction loads on the valve stem.

1. For PTFE or graphite packing: Tighten standard packing follower nuts only enough to prevent shaft leakage. Excessive tightening of packing will accelerate wear and could produce higher rotating friction loads on the valve stem. If necessary, refer to the Packing Maintenance section.
2. The ENVIRO-SEAL Packing Systems will not require this initial re-adjustment. Refer to the separate instruction manual ENVIRO-SEAL Packing System for Rotary Valves, [D101643X012](#), for repair and adjustment procedures.
3. For hazardous atmosphere or oxygen service valves, read the following Warning, and provide the bonding strap assembly mentioned below if the valve is used in an explosive atmosphere.

⚠ WARNING

The valve shaft is not necessarily grounded when installed in a pipeline unless the shaft is electrically bonded to the valve.

To avoid personal injury or property damage resulting from the effects of a static electricity discharge from valve components in a hazardous atmosphere or where the process fluid is combustible, electrically bond the drive shaft (key 3) to the valve according to the following step.

Note

Standard PTFE packing is composed of a partially conductive carbon-filled PTFE female adaptor with PTFE V-ring packing. Standard graphite packing is composed of all conductive graphite ribbon packing. Alternate shaft-to-valve body bonding is available for hazardous service areas where the standard packing is not sufficient to bond the shaft to the valve (see the following step).

For oxygen service applications, provide alternate shaft-to-valve body bonding according to the following step.

4. Attach the bonding strap assembly (key 131, figure 6) to the shaft with the clamp (key 130, figure 6).

5. Connect the other end of the bonding strap assembly to the valve flange cap screws.
6. For more information, refer to the Packing Maintenance section below.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

Key numbers in this procedure are shown in figure 9 unless otherwise indicated.

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure.
- Use lockout procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

Removing and Replacing the Actuator

Refer to the appropriate actuator instruction manual for actuator removal and replacement procedures.

Packing Maintenance

The Control-Disk valve is designed so the packing can be replaced without removing the valve from the process pipeline.

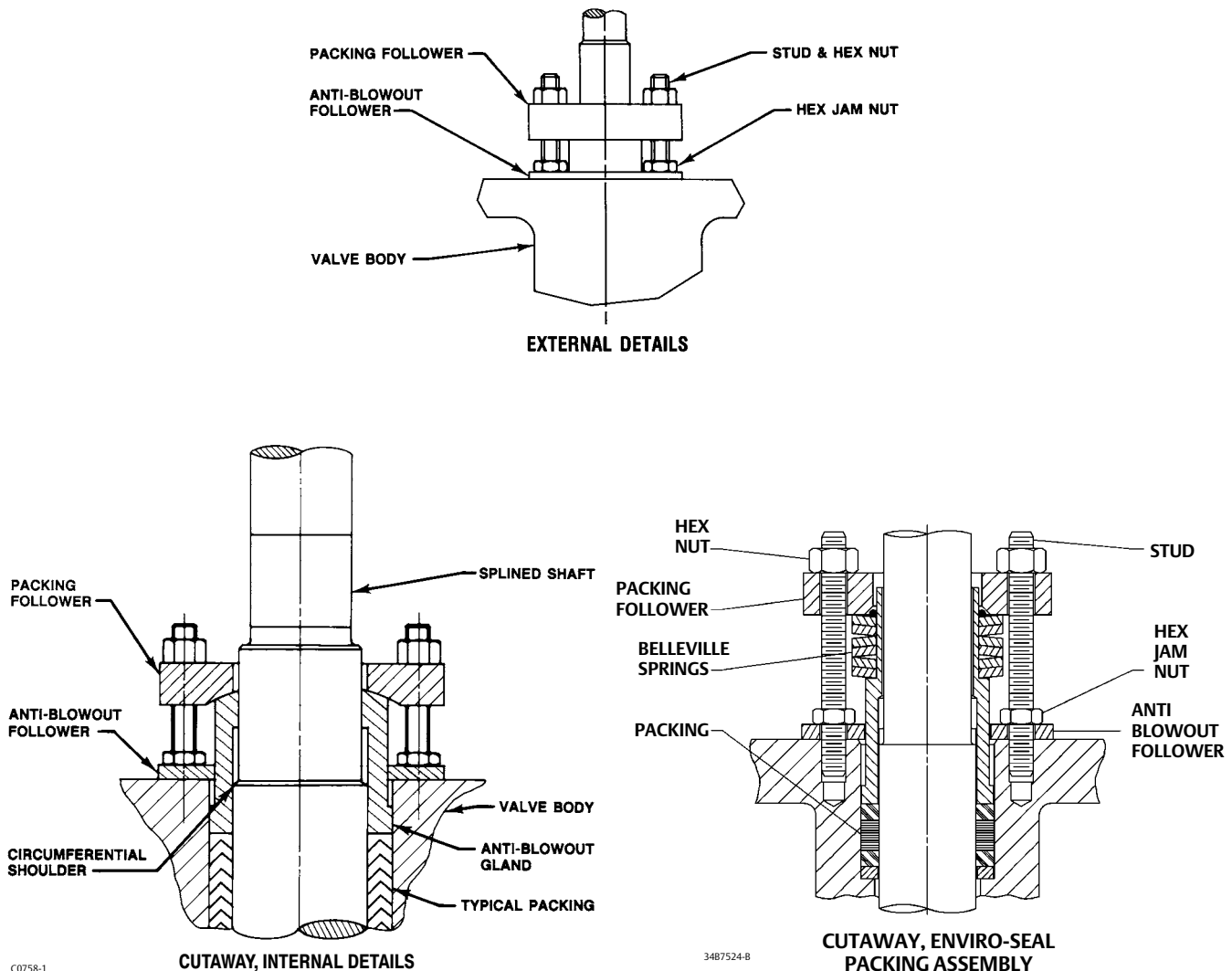
NOTICE

For non-ENVIRO-SEAL packing: Tighten the packing follower nuts only enough to prevent shaft leakage. Excessive tightening will accelerate wear of the packing and could produce higher friction loads on the valve stem.

Usually, packing leakage can be eliminated by merely tightening the hex nuts (key 15) located above the packing follower (key 11) while the valve is in the pipeline. However, if leakage continues, the packing must be replaced.

For PTFE ENVIRO-SEAL packing systems, refer to the separate instruction manual, ENVIRO-SEAL Packing System for Rotary Valves, [D101643X012](#), (see figure 10).

Figure 7. Anti-Blowout Design Details



⚠ WARNING

Never use a wrench or pliers on the splined (upper) shaft (key 3). A damaged shaft could cut the packing and allow leakage.

1. Before loosening any parts on the valve, release the pressure from the pipeline. Then, remove the hex nuts (key 15) and lift off the packing follower (key 11).
2. Remove the hex jam nuts (key 17) and the anti-blowout flange (key 10). Remove the packing follower (key 12). Refer to figure 7 for details of the anti-blowout design parts.

The packing is now accessible.

3. Use a packing extractor to remove packing. Insert the corkscrew-like end of the tool into the first piece of packing and pull firmly to remove the packing. Repeat this process until all packing parts have been removed.

⚠ WARNING

Be careful when cleaning the packing box. Scratches to the upper shaft (key 3) or inside diameter of the packing bore might cause leakage.

4. Before installing new packing, clean the packing box.
5. Install new packing one ring at a time, using the packing follower as a driver. If using split-ring packing, stagger the splits in the rings to avoid creating a leak path.
6. Reinstall packing parts. Refer to figure 9 for sequence of packing parts.

Removing the Valve

1. Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open the valve. Vent the power actuator loading pressure.
2. Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from either side of the valve.

NOTICE

Damage to the valve disk can occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, stroke the actuator to place the disk in the closed position while removing the valve from the pipeline.

3. Loosen the flange bolting that holds the valve. Make sure the valve cannot slip or twist while loosening and removing the bolting.
4. Before removing the valve from the pipeline, make sure the valve disk is closed. Removing the valve with the disk open could cause damage to the disk, piping, or pipe flanges.
5. After removing the valve from the pipeline, move the valve to an appropriate work area. Always support the valve properly.
6. When valve maintenance is complete, refer to the Installation procedures in this manual.

Seal Maintenance

Note

For larger valves, it is possible to replace the seal (key 5) while the actuator is mounted to the valve and can be accomplished by cycling the valve to 90 degrees open.

Key numbers in this procedure are shown in figure 9 unless otherwise indicated.

1. After removing the valve from the pipeline, remove the manual or power actuator. Manually rotate the upper shaft (key 3) counterclockwise until the disk has moved a full 180 degrees away from the closed position.

⚠ WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping of a large valve. Support large valves during maintenance.

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2. Lay the valve flat on a work bench in a secure position with the retaining ring (key 18) and retaining ring screws (key 19) facing up. Properly secure the valve on a suitable worktable so it cannot slip, twist, or fall during maintenance. Remove all retaining ring screws.
3. Remove the retaining ring by placing a socket head cap screw from the retaining ring in each of the two retaining ring jacking screw holes. Slowly turn the screws until the retaining ring has been lifted from the valve body. Remove the retaining ring to expose the seal in the T-slot area of the valve body.

Note

The Control-Disk valve is available with different seal designs and components. See figure 2 to identify the specific seal design.

NOTICE

In the following procedure, take care not to damage the seal or T-slot area of the valve body during removal of the seal.

4. Insert a regular screwdriver or other similar tool under the top edge of the seal and gently pry the seal out of the T-slot area in the valve body. Take care not to damage the seal or T-slot area of the valve body. After the seal has been removed, clean the T-slot area, retaining ring and, if required, polish the disk (key 2) thoroughly with fine steel wool or other appropriate material.

To install a new seal, O-ring (key 6), and retaining ring gasket, follow the appropriate instructions given below.

Table 6. Torque Values for Fasteners

FASTENER NOMINAL SIZE	RETAINING RING SCREWS		GASKET RETAINING BOLTS	
	N•m	lbf•ft	N•m	lbf•ft
#10	4.6	41	4.0	35
1/4	11	100	9.2	81
5/16	25	220	19	167
3/8	45	400	33	295
	N•m	ft•lbf	N•m	ft•lbf
7/16	72	53	53	39
1/2	112	83	80	59
9/16	161	119	117	86
5/8	225	166	161	119
3/4	401	296	286	210
7/8	651	480	447	330
1	976	720	651	480
1-1/8	1356	1000	837	617

Note: These values are based upon standard materials, S66286/N07718 screws and ASTM A193GRB6 bolts. For other special fastener materials, please contact your Emerson sales office.

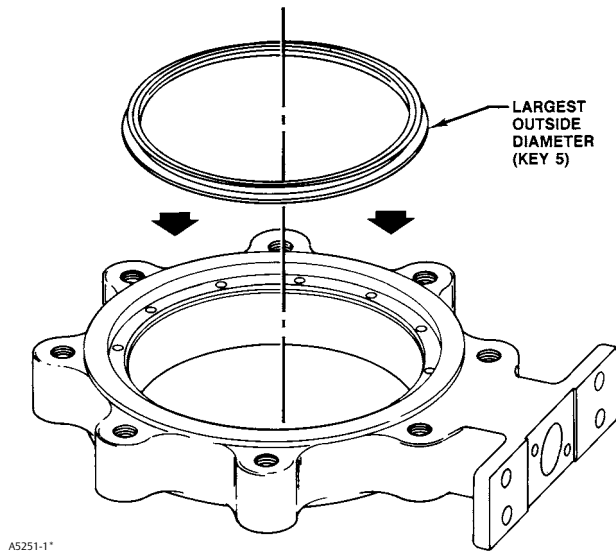
PTFE Seals

1. Locate the replacement seal ring (key 5) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter. Around the outside circumference is one wide groove.

Before installing the seal ring into the valve body, place the O-ring (key 6) into the wide, outer groove of the seal ring. Refer to figure 8.

2. Install the seal ring and O-ring assembly in the valve body. The wider outside diameter of the seal ring goes into the T-slot area of the body (see figure 5). Start the edge with the wider diameter into the T-slot of the valve body using a blunt-end screwdriver.

Figure 8. Typical Seal Installation



3. Carefully tuck the O-ring downward into the body T-slot until the seal ring is completely entrapped in the body T-slot, and it completely covers the backup O-ring.
4. Re-install the retaining ring and the socket head cap screws. Tighten the cap screws just enough to eliminate any movement of the retaining ring. Do not over-tighten the retaining ring screws. Using a blunt-end tool, carefully tuck the lip of the seal ring under the retaining ring.
5. When the seal is under the lip of the retaining ring, continue to tighten the cap screws according to standard procedures. Do not fully torque the screws at this time. Final tightening of the screws is accomplished in step 7 of this procedure.
6. Manually rotate the upper shaft clockwise 180 degrees to return the disk (key 2) to its closed position.
7. The final seating of the retaining ring cap screws can now be done. For the screw torque values, refer to table 6. The seal is now fully installed. Refer to the Installation procedures in this manual.

NOVEX, Phoenix III and/or Phoenix III Fire-Tested Seals

1. Locate the replacement seal ring (key 5) and note the shape of the ring. The ring is wider across one edge diameter and narrower across the other edge diameter as shown in figure 8. Around the outside circumference is one wide groove.

Install the seal ring (key 5) in the valve body by first placing the wider outside diameter of the seal ring into the T-slot area of the valve body which is shown in figure 2.

The backup O-ring (key 6) for the Phoenix III seal will have to be installed after placement of the seal ring in the valve body using a blunt-end screwdriver. Do not use the screwdriver directly on the metal seat. Use tools on the O-ring only.

2. With the seal ring inserted all the way around the body T-slot now lay the O-ring into the opening between the valve body and the seal ring. Use the screwdriver to apply pressure to the O-ring and carefully tuck the O-ring down into the T-slot between the valve body and the seal ring.

Note

On larger valves, it may be more efficient to have someone hold down the seal ring while you push the O-ring into the T-slot.

3. Once the seal ring and backup O-ring have been fully installed into the body T-slot, the retaining ring gasket can be installed. This gasket is a thin graphite material. Punch one initial screw hole through the gasket for alignment, being careful not to cause additional damage to the gasket.
4. Install the retaining ring and align the screw holes in the retaining ring with the holes in the valve body. Install the first retaining ring screw through the punched hole in the ring gasket. Install the other ring screws by pushing the screws through the graphite gasket and threading them into the valve body.
5. Tighten the retaining ring socket head cap screws just enough to eliminate any movement of the retaining ring. Do not over-tighten the retaining ring screws.

WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping of a large valve. Support large valves during maintenance.

6. To complete this step, stand the valve up. Support the valve securely using methods appropriate for the valve size. If a vise or other clamps are being used, be sure to not damage the flange gasket sealing area of the valve body.
7. Manually rotate the upper shaft (key 3) to turn the disk clockwise to meet the seal.
8. Adjust the actuator to bring the disk to the fully closed position at the end of the actuator stroke. To determine the fully closed disk position, measure the distances between the disk face and the seal retainer face at the top and bottom of the valve (X1 and X2) as shown in figure 3. Adjust the actuator to rotate the disk slightly until the two measurements are within 0.8 mm (0.032 inch) of each other. Refer to the appropriate actuator instruction manual for assistance.
9. The final seating of the retaining ring screws can now be done. For the screw torque values, refer to table 6.

Anti-Blowout Design, Packing, Valve Shaft, Disk, and Bearing Maintenance

Note

The Control-Disk valve has a two-piece shaft. In these procedures, the shaft (with the splined end) is called the upper shaft (key 3). The shaft opposite the upper shaft is called the lower (follower) shaft (key 4).

NOTICE

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever off the valve shaft. Driving the lever or actuator off the valve shaft could damage the valve internal parts.

If necessary, use a wheel puller to remove the lever or actuator from the valve shaft. It is okay to tap the wheel puller screw lightly to loosen the lever or actuator, but hitting the screw with excessive force could also damage internal valve parts.

Key numbers in this procedure are shown in figure 9 unless otherwise indicated.

1. Remove the valve from the pipeline. Remove the actuator from the valve.

⚠ WARNING

Never use a wrench, pliers, or similar tool to turn the upper shaft. A damaged shaft can cut the packing and allow leakage.

Note

It is not necessary to remove the retaining ring and valve seal when removing the shaft(s) and disk.

⚠ WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping of a large valve. Support large valves during maintenance.

2. Properly secure the valve on a suitable worktable so it cannot slip, twist, or fall during maintenance.
3. Removing the Anti-Blowout Design:
 - a. **For PTFE or Graphite Packing:** Remove the hex nuts (key 15) and pull off the packing follower (key 11). Remove the hex jam nuts (key 17) and the anti-blowout flange (key 10). Remove the anti-blowout gland (key 12). See figure 7.
 - b. **For ENVIRO-SEAL Packing System:** Remove the hex nuts (key 101), the packing follower (key 102), jam nuts (key 17), anti-blowout flange (key 10), and the spring pack assembly (key 103). See figure 10.
4. Remove the packing from around the upper shaft.
5. Remove the tangential pins or disk pins. Locate the pins (key 9) in the upper shaft (key 3) and the pin in the lower shaft (key 4), if the valve has a two-piece shaft.
 - a. If a maintenance kit is available, use the pin extractor to remove the disk pins. Select the correct size pin extractor tip with screws of proper thread size to match the thread size in the disk pins. If you do not have a kit, see steps c and d below.
 - b. Screw the pin extractor tip into the pin as far as possible. With an upward, straight sliding motion, pull out the pin. Repeat the same procedure for the other pins.
 - c. You can use a threaded rod with an appropriate spacer (tube) and nut as an extractor tool. If you use a threaded rod, choose a rod with threads that fit the inside thread of the pins. The rod should extend several inches above the disk when it is screwed into a pin.

- d. After screwing the rod into the pin, slide the spacer over the rod and pin. Thread a nut onto the rod and tighten it. As you tighten the nut, the nut will drive the spacer against the disk. The increasing force will draw the pin from the disk.
6. The gasket retainer (key 20) on the side of the valve opposite the upper shaft must be removed before removing the lower shaft.

Remove the hex head bolts (key 23) and lockwashers (key 22) from the gasket retainer and remove the gasket retainer and gasket (key 21) to expose the end of the lower shaft.

7. Before removing the lower shaft (key 4), be sure the valve disk is properly supported. Pull the lower shaft from the valve body. Use a shaft extractor screwed into the puller hole in the end of the lower shaft.
8. Before removing the upper shaft (key 3), be sure the valve disk is properly supported. Pull out the upper shaft (key 3) by hand-pulling or by using a shaft extractor screwed into the end of the shaft.

NOTICE

To avoid damage to the disk, seal, and T-slot area, do not force the disk past the seal or T-slot area. Remove the disk from the opposite side of the valve body.

Note

Both the upper shaft and the lower shaft have a thrust bearing (key 24) between the disk and the bearings (key 7). The thrust bearing is located outside of the bearing bore which holds the bearings. Use care when removing the valve disk to avoid loss of or damage to the thrust bearings.

9. After removing the shaft(s), remove the disk. Do not force the disk past the seal or T-slot area. Collect the thrust bearings.
10. Remove the bearings (key 7). Using a suitable punch or puller, drive or pull the bearings into the valve body bore from the upper shaft bearing bore. Remove the bearing from the lower shaft bearing bore.
11. Inspect the valve body bore, bearings, bearing bores, and packing box for damage.

Note

In these instructions, the drive shaft (with splined end) is called the upper shaft (key 3). The shaft opposite the upper shaft is called the lower (follower) shaft (key 4).

Installing the Two-Piece Shaft

Key numbers in this procedure are shown in figure 9 unless otherwise indicated.

⚠ WARNING

Avoid personal injury or property damage caused by the impact of a falling or tipping of a large valve. Support large valves during maintenance.

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1. Properly secure the valve on a suitable worktable so it cannot slip, twist, or fall during maintenance. Be prepared to support the valve disk.

Note

Replacement disk and shafts are provided as a matched set and both should be replaced at the same time.

2. Inspect all parts removed from the valve for wear or damage. Replace any worn or damaged parts. Clean the valve body and all parts to be installed with an appropriate solvent or degreaser.

Note

When installing the bearings, apply lubricant to the outside diameter of the bearing for ease of installation.

NOTICE

Premature valve failure and loss of process control may result if bearings are improperly installed or are damaged during installation.

3. When installing the lower bearings (key 4), insert one or more bearings into the lower shaft bearing bore so it is flush with the body bore.

The number of bearings required changes with valve size and construction. Two bearings are required in the upper shaft and two bearings in the lower shaft. If using an NPS 14 CL150 valve with metal bearings, four bearings in the upper and four in the lower shaft will be required.

4. Hold the lower shaft thrust bearing (key 24) in the valve body bore against the counterbore of the lower shaft bearing bore. Push the lower shaft into the bearing bore just enough to hold the thrust bearing.
5. When installing the upper bearing (key 7), insert one or more bearings into the upper shaft from the body bore into the bearing bore below the packing box. Use caution to prevent damage to the bearing.
6. Hold the upper shaft thrust bearing (key 24) in the valve body bore against the counterbore of the upper shaft bearing bore. Push the upper shaft through the packing box side into the bearing bore just enough to hold the thrust bearing.
7. When installing the lower bearing (key 4), insert one or more bearings into the lower shaft bearing bore so it is flush with the body bore.
8. Insert the lower shaft through the bore in the valve body uncovered by removal of the gasket retainer. Hold the lower shaft thrust bearing (key 24) in the valve body bore against the counterbore of the lower shaft bearing bore. Push the lower shaft into the bearing bore just enough to hold the thrust bearing.

NOTICE

To avoid damage to the disk, seal, and T-slot area, do not force the disk past the seal or T-slot area. Install the disk from the opposite side of the valve body.

9. Place the flat side of the disk on a flat surface and insert wooden blocks to raise the disk approximately 51 mm (2 inches) from the worktable surface. Then, suspend the valve body over the disk so the seal/T-slot area is facing up. Align the shaft bores through the disk with the upper shaft and lower shaft bores. Lower the valve body over the disk using caution not to dislodge or damage the thrust bearings placed on the ends of the shafts.
10. With the disk (key 2) properly positioned in the valve body (key 1), push the upper shaft and lower shaft the rest of the way through the thrust bearings and into the shaft bores in the valve disk.
11. Align the holes in the shafts with the holes in the disk.

NOTICE

To avoid damage to the tangential pins, disk pins, valve disk, or shaft(s) resulting from the application of excessive force, use appropriate care when driving the pins into the disk hub and shaft(s). Use the right tool. Do not use excessive force.

12. Install the appropriate tangential pins, and disk pins. Use 2 tangential pins that will go through the upper shaft and 1 disk pin that will go through the lower shaft.
13. Refer to the Anti-Blowout Design, Packing, Valve Shaft, Disk and Bearing Maintenance procedures in this manual to re-install the packing and anti-blowout design.

Gasket Retainer

Valves with a two-piece shaft use a gasket retainer and gasket (keys 20 and 21) to cover the lower shaft opening in the valve body. The gasket is held in place by the gasket retainer and four hex head bolts and lockwashers (keys 23 and 22). When re-assembling the valve, use a new gasket.

Be sure to center the gasket over the lower shaft bore before retightening bolts. Tighten down bolts evenly in a crossover or star pattern.

Refer to table 6 for proper torque values.

Parts Ordering

Typical parts are shown in figure 9.

When corresponding with your [Emerson sales office](#) about a Control-Disk valve, identify the valve as a Control-Disk and provide the valve serial number. For valve/actuator combinations assembled at the factory, the valve serial number is stamped on the nameplate attached to the actuator.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Retrofit Kits

Retrofit kits include all parts required for installation of the ENVIRO-SEAL packing system into existing high-performance butterfly valves. Retrofit kits are available for single PTFE packing.

See table 7 for retrofit kit part numbers.

Retrofit Kit Included Parts		
Key	Description	Quantity
10	Anti-blowout follower	1
17	Jam nut	1
100	Packing stud	2
101	Packing nut	2
102	Packing flange	1
103	Spring pack assembly	1
105	Packing Set	1
106	Anti-extrusion washer	2 ⁽¹⁾
107	Packing box ring	2 ⁽²⁾
111	Tag	1
112	Cable	1

1. Not included in graphite packing kit.
2. Only 1 req'd for NPS 18 CL300, NPS 20 CL150 and NPS 24 CL150.

Note: Key 103, the spring pack assembly, is made up of the packing spring stack held in place by an O-ring on the packing follower.

Repair Kits

PTFE Repair kits include a single PTFE packing set and anti-extrusion washers. Graphite packing sets include graphite packing rings and carbon anti-extrusion rings. See table 7 for PTFE repair kit part numbers.

Table 7. Retrofit and Repair Kit Part Numbers

VALVE SIZE, NPS	PRESSURE RATING	SHAFT DIAMETER ⁽¹⁾⁽²⁾ , mm (Inch)	RETROFIT KITS	REPAIR KITS
			PTFE	PTFE
14	CL150	34.9 (1-3/8)	RRTYXRT0592	RRTYX000172
	CL300	50.8 (2)	RRTYXRT0602	RRTYX000182
16	CL150	38.1 (1-1/2)	RRTYXRT0612	RRTYX000192
	CL300	57.2 (2-1/4)	RRTYXRT0622	RRTYX000202
18	CL150	44.5 (1-3/4)	RRTYXRT0632	RRTYX000212
	CL300	63.5 (2-1/2)	RRTYXRT0642	RRTYX000222
20	CL150	50.8 (2)	RRTYXRT0652	RRTYX000182
24	CL150	63.5 (2-1/2)	RRTYXRT0662	RRTYX000222
30, 36	No kit available			

1. Shaft diameter; Diameter through the packing box.
2. For larger shaft sizes, consult your [Emerson sales office](#).

Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your [Emerson sales office](#).

Key Description

1	Valve Body If you need a valve body as a replacement part, order the valve size, Class and desired material. Contact your Emerson sales office.
2	Disk
3	Drive Shaft
4	Follower Shaft
5*	Seal Ring
6*	Backup Ring
7*	Bearing
9	Tangential Pin / Disk Pin
10	Anti-Blowout Flange
11	Packing Flange
12	Packing Follower
13*	Packing Set
14	Stud (2 req'd)
15	Hex nut (2 req'd)
17	Hex Jam Nut (2 req'd)
18	Retaining Ring
19	Retaining Ring Screw

Key Description

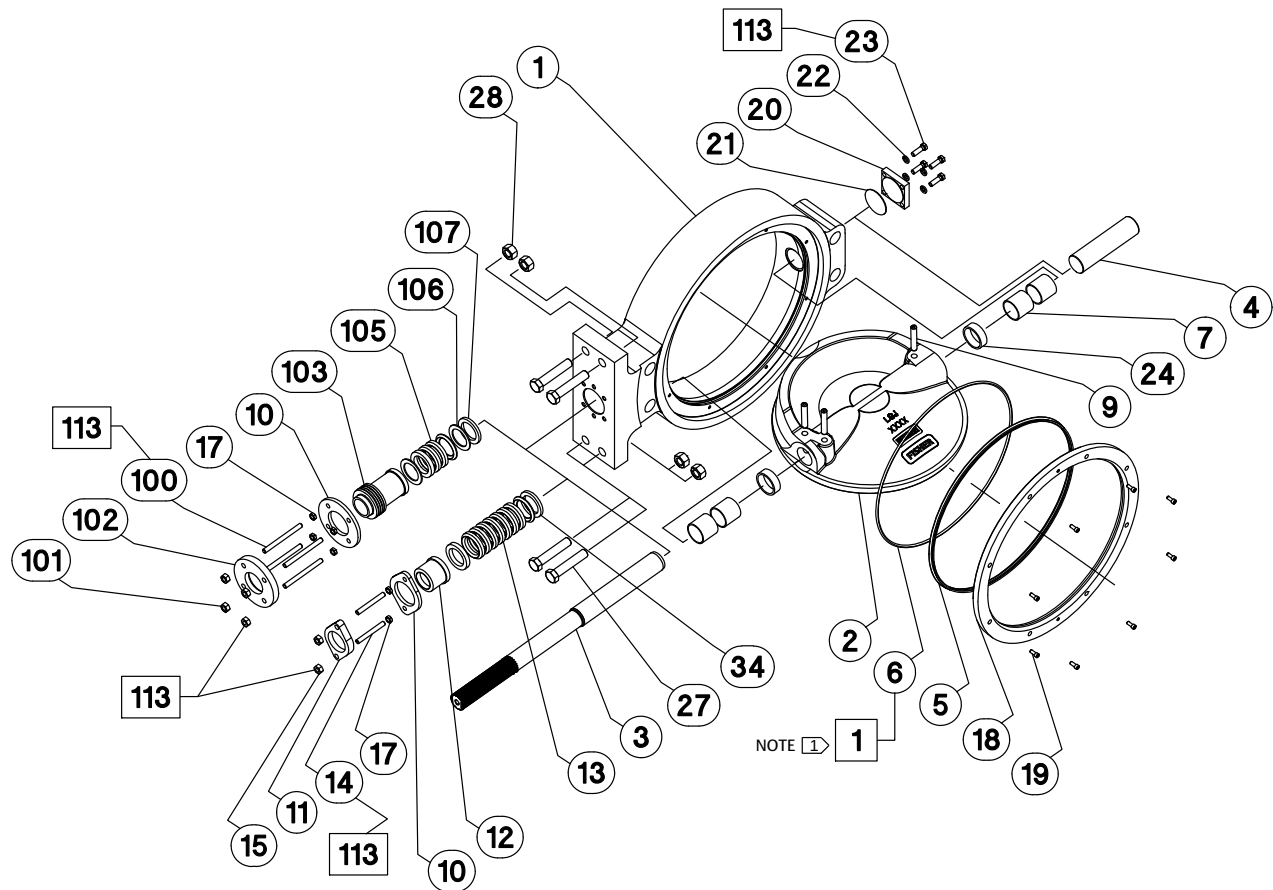
20	Gasket Retainer
21*	Gasket
22	Lockwasher (4 req'd)
23	Cap Screw (4 req'd)
24*	Thrust Bearing
26*	Retaining Ring Gasket
27	Cap Screw - Actuator (4 req'd)
28	Hex Nut - Actuator (4 req'd)
29	Nameplate (not shown)
32	Drive Screw (2 req'd) (not shown)
33	Flow Direction Arrow (not shown)
34	Packing Box Ring
35	Disk/Shaft/Pin Assembly

ENVIRO-SEAL Packing System (See figure 10)

Key Description

10	Anti-Blow Flange
17	Hex Jam Nut (4 req'd)
100	Packing Flange Stud (4 req'd)
101	Packing Flange Nut (4 req'd)
102	Packing Flange
103	Spring Pack Assembly
105*	Packing Set
106*	Anti-Extrusion Ring (2 req'd)
107	Packing Box Ring
111	Tag (not shown)
112	Cable Tie (not shown)
113	Lubricant

Figure 9. Fisher Control-Disk Wafer Style Valve Assembly



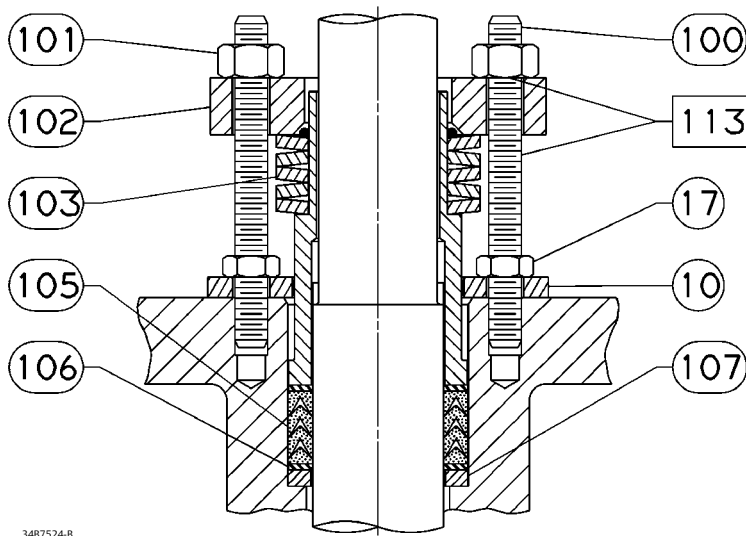
GES3130-A

PARTS NOT SHOWN: 29, 32, 33, 26, 111, 112

NOTE:

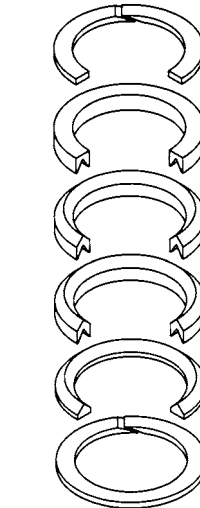
1 USE ONLY WITH SOFT SEAL AND PHOENIX III SEAL

Figure 10. ENVIRO-SEAL Packing Systems



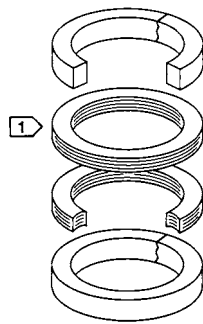
3487524-B

PTFE PACKING SYSTEM



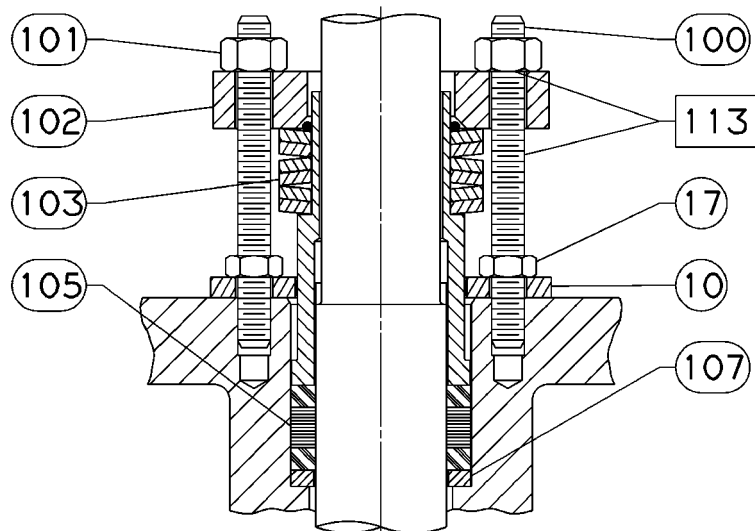
1480095-A

STACKING ORDER OF
PTFE PACKING RINGS



1480086-A

STACKING ORDER OF
GRAPHITE PACKING RINGS



3487524-B

GRAPHITE PACKING SYSTEM

NOTES:

1 VALVES WITH SHAFTS LARGER THAN 38.1 mm (1-1/2 INCH) USE GRAPHITE RINGS

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Control-Disk NPS 14-36

April 2023

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Fisher™ Control-Disk™ Rotary Valve NPS 2 through 12

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Figure 1. Fisher Control-Disk Valve with 2052 Actuator and DVC6200 Digital Valve Controller



WS418-2

LUGGED STYLE

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher Control-Disk valve, DN50 through DN300 or NPS 2 through NPS 12 (figure 1). Refer to separate instruction manuals for information covering the power on-off actuator and accessories. Do not install, operate, or maintain a Control-Disk valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The Control-Disk rotary valve offers excellent throttling performance. An equal percentage flow characteristic provides an improved throttling range comparable to that of a segmented ball valve. This improved capability allows you to control closer to the target set point, regardless of process disturbances, which results in a reduction in process variability.

Retainer clips provide for versatility to mount and align the same wafer style valve body in different piping configurations (ASME and EN ratings). The valve body is compatible with PN 10 through PN 40, CL150, and CL300 ratings. Face-to-face dimensions meet EN 558, API 609, and MSS-SP68 standards. The Control-Disk rotary valve features an eccentrically-mounted disk with either soft or metal seal, providing capability for enhanced shutoff. The interchangeable sealing technology allows for the same valve body to accept both soft and metal seals.

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Educational Services

For information on available courses for Fisher Control-Disk valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Table 1. Fisher Control-Disk Valve Specifications

Specifications		EN	ASME
Valve Body Size		DN 50, 80, 100, 150, 200, 250, and 300	NPS 2, 3, 4, 6, 8, 10, and 12
Pressure Rating		PN 10 to 40 per EN 12516-1	CL150 and 300 per ASME B16.34 (CL600 for NPS 2)
Valve Body Materials		EN 1.0619 steel	WCC steel
		EN 1.4409 stainless steel	CF3M (316L) stainless steel
		CW2M ⁽¹⁾	CW2M ⁽¹⁾
		M35-2 ⁽⁴⁾	M35-2
Disk Materials	PTFE or RPTFE Seal ⁽³⁾	EN 1.4409 stainless steel	CF3M stainless steel
		CW2M	CW2M
		M35-2	M35-2
		Metal or UHMWPE ⁽²⁾ Seal	Chrome-plated EN 1.4409 Stainless Steel
End Connections		Mates with raised-face flanges per EN 1092-1	Mates with raised-face flanges per ASME B16.5
Valve Body Style		Lugged with threaded or through holes, Double-Flange with through holes, and Wafer (for select sizes)	
Face-to-Face Dimensions		Meets MSS SP68, API 609, and EN 558 standards	
Shutoff		PTFE, RPTFE, or UHMWPE seal ring - Class VI per ANSI/FCI 70-2 and IEC 60534-4	
		S31600 (316 SST) seal ring - Class IV per ANSI/FCI 70-2 and IEC 60534-4	
Flow Direction		Standard (forward flow) is with the seal retainer facing upstream; reverse flow is permissible within specified pressure drop limitations for soft seal only. Metal seal is unidirectional.	
Flow Characteristic		Equal percentage	
Disk Rotation		Counterclockwise to open (when viewed from actuator side of valve body) through 90 degrees of disk rotation	
1. This material is not listed in EN 12516-1 or ASME B16.34. See table 4 for pressure/temperature ratings. 2. UHMWPE stands for ultra high molecular weight polyethylene. 3. RPTFE is a reinforced PTFE seal. 4. This material is not listed in EN 12516-1. See table 4 for pressure/temperature ratings.			

Table 2. Valve Size, Shaft Diameter, and Approximate Weight

VALVE SIZE		PRESSURE RATING		SHAFT DIAMETER		APPROXIMATE WEIGHT					
DN	NPS	EN	ASME	mm	Inches	Wafer-Style		Lugged		Double-Flanged	
						kg	Pounds	kg	Pounds	kg	Pounds
50	2	PN10-40	CL150/300/600	12.7	1/2	4.7	10	6.7	15	---	---
80	3	PN10-40	CL150	15.9	5/8	---	---	11.2	25	17.6	39
		PN25-40	CL300							29.0	64
100	4	PN10-40	CL150	19.1	3/4	---	---	17.6	39	28.9	64
		PN25-40	CL300							47.8	105
150	6	PN10-40	CL150	25.4	1	15.7	35	26.5	58	40.2	89
		PN25-40	CL300							76.4	168
200	8	PN10-16	CL150	31.8	1-1/4	---	---	40.9	90	71.3	157
		PN25-40	CL300	31.8	1-1/4	34.6	76	46.7	103	124	273
250	10	PN10-16	CL150	31.8	1-1/4	---	---	50.7	112	80.0	176
		PN25-40	CL300	31.8	1-1/4	52	115	79.4	175	203	448
300	12	PN10-16	CL150	38.1	1-1/2	---	---	98.6	217	144	317
		PN25-40	CL300	38.1	1-1/2	---	---	104.9	231	275	606

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Table 3. Material Temperature Capabilities

MATERIAL					TEMPERATURE LIMITS ⁽¹⁾	
EN Materials						
Valve Body	Shaft	Bearing Lining and Jacket	Seal	Packing	°C	°F
1.0619 Steel	S17400 or S20910	PEEK / PTFE	PTFE or RPTFE	PTFE or Graphite	-10 to 232	14 to 450
			UHMWPE	PTFE or Graphite	-10 to 93	14 to 200
			Metal	PTFE or Graphite	-10 to 232	14 to 450
		R30006 (Alloy 6) or S31600 Nitride	Metal	Graphite	-10 to 400	14 to 752
1.4409 Stainless Steel	S20910	PEEK / PTFE	PTFE or RPTFE	PTFE or Graphite	-10 to 232	14 to 450
			UHMWPE	PTFE or Graphite	-10 to 93	14 to 200
			Metal	PTFE or Graphite	-10 to 232	14 to 450
		R30006 (Alloy 6) or S31600 Nitride	Metal	Graphite	-10 to 500 ⁽²⁾	14 to 932 ⁽²⁾
CW2M	N10276	PEEK / PTFE	PTFE or RPTFE	PTFE	-10 to 232	14 to 450
M35-2	N05500	PEEK / PTFE	PTFE or RPTFE	PTFE	-10 to 232	14 to 450
ASME Materials						
Valve Body	Shaft	Bearing Lining and Jacket	Seal	Packing	°C	°F
WCC steel	S17400 or S20910	PEEK / PTFE	PTFE or RPTFE	PTFE or Graphite	-29 to 232	-20 to 450
			UHMWPE	PTFE or Graphite	-18 to 93	0 to 200
			Metal	PTFE or Graphite	-29 to 232	-20 to 450
		R30006 (Alloy 6) or S31600 Nitride	Metal	Graphite	-29 to 427	-20 to 800
CF3M Stainless Steel	S20910	PEEK / PTFE	PTFE or RPTFE	PTFE or Graphite	-46 to 232	-50 to 450
			UHMWPE	PTFE or Graphite	-18 to 93	0 to 200
			Metal	PTFE or Graphite	-46 to 232	-50 to 450
		R30006 (Alloy 6) or S31600 Nitride	Metal	Graphite	-46 to 454 ⁽²⁾	-50 to 850 ⁽²⁾
CW2M	N10276	PEEK / PTFE	PTFE or RPTFE	PTFE	-46 to 232	-50 to 450
M35-2	N05500	PEEK / PTFE	PTFE or RPTFE	PTFE	-46 to 232	-50 to 450

1. Minimum allowable temperature for PN series flanges is -10°C (14°F). See requirements of EN 13445-2 Annex B for applications below -10°C (14°F) with PN series flanges.

2. For applications exceeding 427°C (800°F), consult your [Emerson sales office](#) or Local Business Partner for appropriate high temperature disk edge coating selection.

Table 4. Maximum Allowable Inlet Pressure for CW2M and M35-2 Valves

TEMPERATURE	CW2M ⁽¹⁾						M35-2 ⁽³⁾			
	150 ⁽²⁾	300 ⁽²⁾	PN 10 ⁽²⁾	PN 16 ⁽²⁾	PN 25 ⁽²⁾	PN 40 ⁽²⁾	PN 10 ⁽²⁾	PN 16 ⁽²⁾	PN 25 ⁽²⁾	PN 40 ⁽²⁾
°C	Bar						Bar			
-46 to 38	20.0	51.7	10.0	16.0	25.0	40.0	9.3	15.2	23.8	37.9
50	19.5	51.7	9.9	15.9	24.8	39.6	9.3	15.2	23.8	37.9
100	17.7	51.5	9.4	15.1	23.6	37.8	9.3	15.1	23.7	37.8
150	15.8	50.3	9.4	15.1	23.6	37.8	9.3	14.8	23.4	37.2
200	13.8	48.3	9.1	14.6	22.9	36.6	9.0	14.5	22.5	36.3
232	12.7	47.0	9.1	14.6	22.9	36.6	9.0	14.5	22.4	36.2
°F	Psig						Psig			
-50 to 100	290	750	145	232	362	580	135	220	345	550
200	260	750	144	230	359	575	135	220	345	540
300	230	730	137	219	342	548	135	215	340	525
400	200	700	133	212	331	530	130	210	325	525
450	185	680	133	212	331	530	130	210	325	525

1. This material is not listed in EN 12516-1 or ASME B16.34. Also see the Installation section.
2. The designations PN or 150 and 300 are used only to indicate relative pressure-retaining capabilities and are not EN or ASME pressure-temperature rating class designations.
3. This material is not listed in EN 12516-1. Also see the Installation section.

Installation

Key numbers in this procedure are shown in figure 11 unless otherwise indicated.

⚠ WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the bursting of pressure retaining parts, be certain the service conditions do not exceed either the valve body rating or the flange joint rating, or other limits given in table 1 or on the nameplate. Use pressure-relieving or pressure-limiting devices to prevent the service conditions from exceeding these limits.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section on page 8 in this manual.

CAUTION

The valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions specified in the customer's order. Because some valve body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#) or Local Business Partner.

The maximum allowable inlet pressures for steel and stainless steel valve bodies are consistent with the pressure-temperature ratings shown in table 1, except where further limited by the trim and packing material temperature capabilities given in table 3. Valves are also available in CW2M and M35-2 valve body materials. The CW2M valve body material is not listed in EN 12516-1 or in ASME B16.34. The M35-2 valve body material is listed in ASME B16.34, but is not listed in EN 12516-1. Valve bodies constructed of these materials mate with EN and ASME flanges, but must not be installed in systems requiring conformance to EN or ASME standards if not included in EN or ASME pressure/temperature ratings. Maximum allowable inlet pressures for Control-Disk valve bodies made of CW2M or M35-2 construction materials are shown in table 4.

1. Install a three-valve bypass around the control valve assembly if continuous operation is necessary during inspection and maintenance of the valve.
2. Inspect the valve body to be certain it is free of foreign material.
3. The valve is normally shipped as part of a control valve assembly, with an actuator mounted on the valve body.

If the valve body and actuator have been purchased separately or if the actuator has been removed for maintenance, mount the actuator, and adjust actuator travel before inserting the valve body into the line. This is necessary due to the measurements that must be made during the actuator adjustment process. Refer to the Actuator Mounting section on page 19 of this manual and to the separate actuator instruction manual for mounting and adjusting instructions before proceeding.

4. Inspect adjacent pipelines to be certain they are free of any foreign material, such as pipe scale or welding slag, that could damage the valve body seating surfaces.

CAUTION

Damage to the disk (key 3) will occur if any pipe flanges or piping connected to the valve body interfere with the disk rotation path. However, the disk can be rotated without interference when the valve body is installed between adjacent

pipe flanges or piping that has an inside diameter equal to or greater than either schedule 80 pipe or compatible EN pipe sizes. If piping with a smaller inner diameter than specified above is connected to the valve, measure carefully to be certain the disk rotates without interference before putting the valve into operation.

5. Flow is in the standard direction when the seal retainer (key 2) is facing upstream. Standard flow direction is also indicated by the flow direction arrow cast into the valve body. Flow in the reverse direction is permissible within allowable pressure drop limits for the soft seal. The metal seal is forward flow only.

CAUTION

Control-Disk valve disk rotation is counterclockwise to open (when viewed from the actuator side of the valve body, see figure 8) through 90 degrees of disk rotation. Rotating the disk (key 3) past either the open or closed position could damage the seal and disk sealing surfaces and could cause the disk to jam in the seal retainer.

6. With the disk in the closed position, install line flange gaskets, and insert the valve between the pipeline flanges. Use either flat sheet gaskets or spiral-wound gaskets with compression-controlling centering rings. Spiral-wound gaskets without compression-controlling centering rings are not recommended for this purpose.
7. Depending on valve size and pressure rating, the wafer style valve is centered in the pipeline using either retainer clips or the flange bolt holes. (For valves that have four flange bolt holes in the valve body (key 1), each hole engages one corresponding line flange stud.) Insert the valve between the flanges and use either the retainer clips or install two or more line flange studs into the line flanges to help hold the valve in position while centering the valve. Carefully center the valve on the flanges to ensure disk clearance.
 - Select and install two pipeline gaskets.

Note

Lubricate line flange studs before inserting them into flanges. If necessary, provide additional support for the control valve assembly because of its combined weight.

⚠ WARNING

For lugged valve bodies with threaded line bolt holes, personal injury and property damage could result from sudden release of process pressure if line bolts are not properly installed. To ensure proper line bolt thread engagement, line studs must be centered in the threaded section of the valve body so that each stud has equal thread engagement in the body. See figure 2.

8. After centering the valve body, first lubricate and then install the remaining line flange bolting to secure the valve in the pipeline. Tighten the nuts to the line flange studs in a crisscross pattern to ensure proper alignment of valve, gaskets, and flanges.

⚠ WARNING

A Control-Disk valve body is not necessarily grounded when installed in a pipeline. If the valve is used in a flammable or hazardous atmosphere or for oxygen service, an explosion could result due to a discharge of static electricity from the valve components. To avoid personal injury or property damage, always make sure the valve body is grounded to the pipeline before putting the control valve assembly into operation in a flammable or hazardous atmosphere.

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Control-Disk Valve

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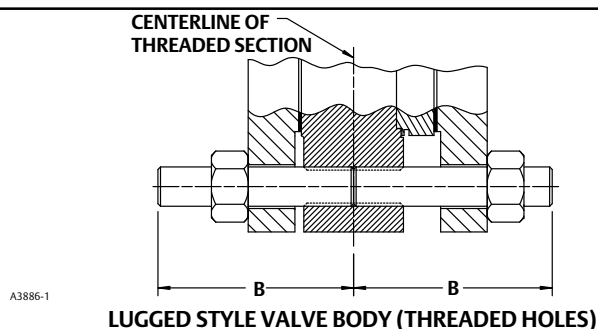
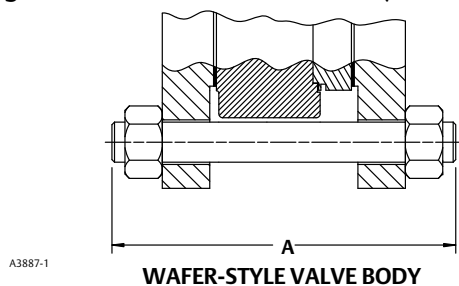
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Table 5. Stud Bolt Data

VALVE SIZE	WAFER STYLE AND LUGGED STYLE WITH THROUGH DRILLED HOLES											
	PN 10			PN 16			PN 25			PN 40		
DN	No. of Stud Bolts	Size Dia & Thread, mm	A Dimension, mm	No. of Stud Bolts	Size Dia & Thread, mm	A Dimension, mm	No. of Stud Bolts	Size Dia & Thread, mm	A Dimension, mm	No. of Stud Bolts	Size Dia & Thread, mm	A Dimension, mm
50	4	M16X2	125	4	M16X2	125	4	M16X2	130	4	M16X2	130
80	8	M16X2	140	8	M16X2	140	8	M16X2	150	8	M16X2	150
100	8	M16X2	150	8	M16X2	150	8	M20X2.5	160	8	M20X2.5	160
150	8	M20X2.5	160	8	M20X2.5	160	8	M24X3	180	8	M24X3	170
200	8	M20X2.5	170	12	M20X2.5	170	12	M24X3	190	12	M27X3	210
250	12	M20X2.5	180	12	M24X3	190	12	M27X3	210	12	M30X3.5	230
300	12	M20X2.5	190	12	M24X3	200	16	M27X3	230	16	M30X3.5	250
VALVE SIZE	LUGGED STYLE (THREADED HOLES)											
	PN 10			PN 16			PN 25			PN 40		
DN	No. of Stud Bolts	Size Dia & Thread, mm	B Dimension, mm	No. of Stud Bolts	Size Dia & Thread, mm	B Dimension, mm	No. of Stud Bolts	Size Dia & Thread, mm	B Dimension, mm	No. of Stud Bolts	Size Dia & Thread, mm	B Dimension, mm
50	---	---	---	---	---	---	---	---	---	---	---	---
80	16	M16X2	85	16	M16X2	85	16	M16X2	90	16	M16X2	90
100	16	M16X2	90	16	M16X2	90	16	M20X2.5	100	16	M20X2.5	100
150	16	M20X2.5	110	16	M20X2.5	110	---	---	---	---	---	---
200	16	M20X2.5	110	24	M20X2.5	110	24	M24X3	120	---	---	---
250	24	M20X2.5	120	24	M24X3	120	24	M27X3	130	---	---	---
300	24	M20X2.5	120	24	M24X3	130	24	M27X3	140	24	M30X3.5	150
VALVE SIZE	WAFER STYLE AND LUGGED STYLE WITH THROUGH DRILLED HOLES						LUGGED STYLE (THREADED HOLES)					
	CL150			CL300			CL150			CL300		
NPS	No. of Stud Bolts	Size Dia & Thread, Inch	A Dimension, Inch	No. of Stud Bolts	Size Dia & Thread, Inch	A Dimension, Inch	No. of Stud Bolts	Size Dia & Thread, Inch	B Dimension, Inch	No. of Stud Bolts	Size Dia & Thread, Inch	B Dimension, Inch
2	4	5/8-11	5	8	5/8-11	5.25	---	---	---	---	---	---
3	4	5/8-11	5.75	8	3/4-10	6.5	8	5/8-11	4.00	16	3/4-10	4.25
4	8	5/8-11	6	8	3/4-10	7	16	5/8-11	4.00	16	3/4-10	4.50
6	8	3/4-10	6.5	12	3/4-10	7.5	16	3/4-10	4.25	24	3/4-10	4.75
8	8	3/4-10	7	12	7/8-9	9	16	3/4-10	4.50	24	7/8-9	5.50
10	12	7/8-9	8	16	1-8	10	24	7/8-9	5.00	32	1-8	6.50
12	12	7/8-9	8.5	16	1-1/8-8	11	24	7/8-9	5.25	32	1-1/8-8	7.00

Figure 2. Stud Bolts for Installation (also see table 5)



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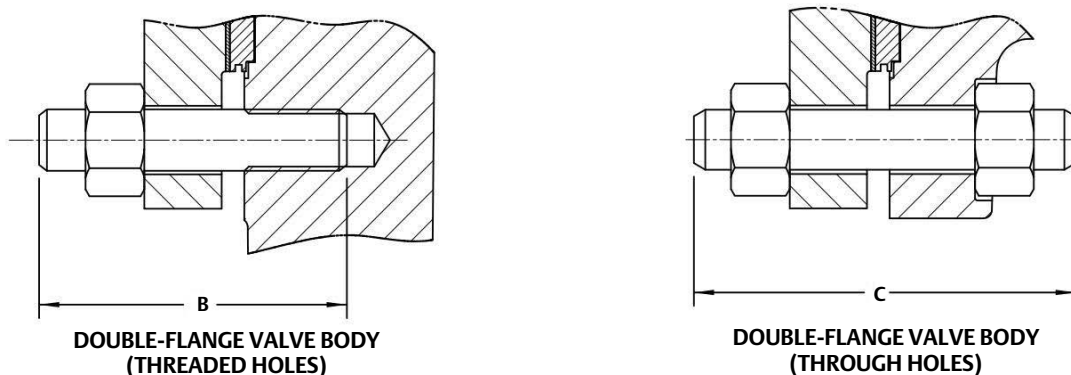
Control-Disk Valve

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Table 6. Stud Bolt Data

VALVE SIZE	DOUBLE FLANGE STYLE									
	CL150					CL300				
	Size Dia & Thread, Inch	Through Holes		Threaded Holes		Size Dia & Thread, Inch	Through Holes		Threaded Holes	
NPS		No. of Stud Bolts	C Dimension, Inch	No. of Stud Bolts	B Dimension, Inch		No. of Stud Bolts	C Dimension, Inch	No. of Stud Bolts	B Dimension, Inch
3	5/8-11	8	3.75	---	---	5/8-11	12	4.25	4	3.25
4	5/8-11	12	4.00	4	3.00	3/4-10	12	4.75	4	3.75
6	3/4-10	12	4.50	4	3.50	3/4-10	12	5.25	4	4.00
8	3/4-10	12	4.50	4	3.75	7/8-9	20	6.00	4	4.5
10	7/8-9	20	5.00	4	4.00	1-8	28	6.50	4	5.25
12	7/8-9	20	5.25	4	4.00	1 1/8-8	28	7.00	4	5.25

Figure 3. Stud Bolts for Installation (also see table 6)



Note

Standard packings for the Control-Disk valve are composed of all conductive packing rings (graphite ribbon packing) or partially conductive packing rings (such as a carbon-filled PTFE female adaptor with PTFE V-ring packing) to electrically bond the shaft to the valve body for hazardous area service. For oxygen service applications, provide alternate shaft-to-valve body bonding according to the following step.

- For oxygen service applications, attach the bonding strap assembly (key 131, figure 4) to the shaft with the clamp (key 130, figure 4), and connect the other end of the bonding strap assembly to the valve body with the cap screw (key 35). Secure each cap screw with a hex nut (key 36).

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however, the packing might require some re-adjustment to meet specific service conditions.

Valves with ENVIRO-SEAL™ packing systems will not require this initial re-adjustment. See ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section on page 21 of this manual.

Maintenance

Valve body parts are subject to normal wear and must be inspected regularly and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are given in this section for: replacing trim components, changing disk rotation or valve action, and mounting and adjusting the actuator.

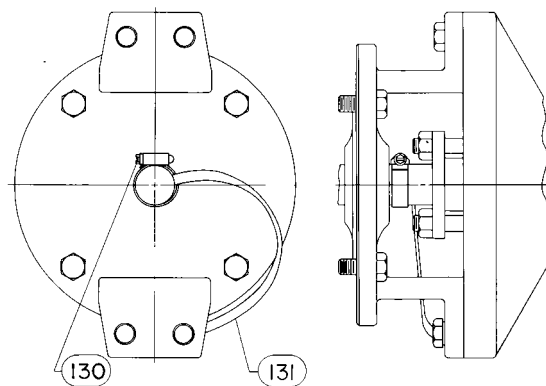
As used in these instructions, actuator refers to power actuators (such as pneumatic diaphragm, piston actuators, and rack and pinion actuators).

⚠ WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any spring precompression.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Figure 4. Optional Shaft-to-Valve Body Bonding Strap Assembly



Packing Maintenance

Refer to figure 5 for available packing configurations. All maintenance operations in this section may be performed with the valve in the line. Packing may be PTFE V-ring or graphite.

An ENVIRO-SEAL packing system is also available with the Control-Disk valve. To install the ENVIRO-SEAL packing system in an existing valve, follow the instructions in the instruction manual included with the packing system ([D101643X012](#)). To remove packing parts in a valve with the ENVIRO-SEAL packing system, follow the procedures for valves with the ENVIRO-SEAL packing system in this section. Install the replacement packing following the instructions in the packing system instruction manual (D101643X012).

Stopping Leakage

For valves with PTFE or graphite packing:

CAUTION

Tighten the packing flange only enough to prevent shaft leakage. Excessive tightening will only accelerate wear of the packing and could produce higher torques on the valve.

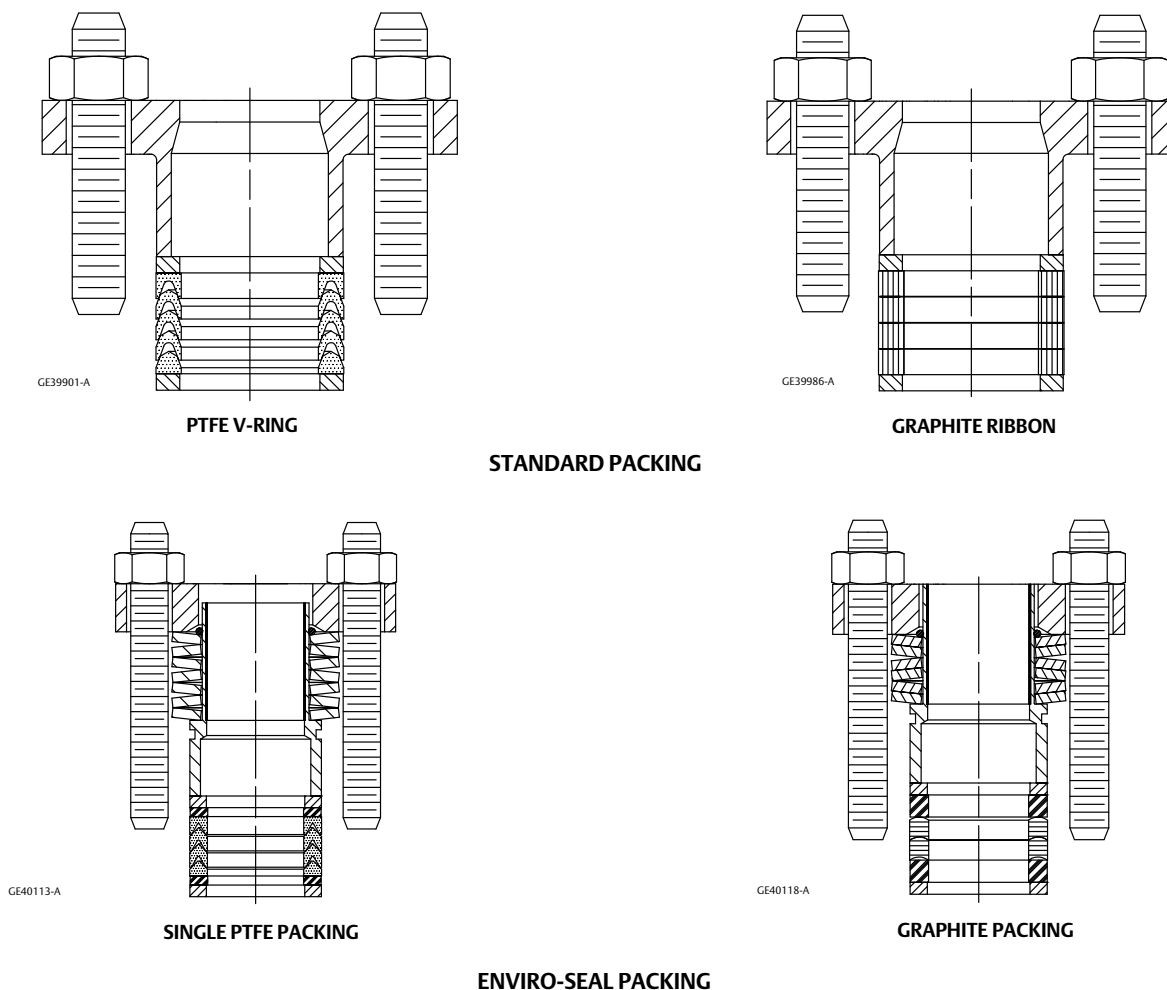
Leakage around the packing followers can be stopped by tightening the packing flange nuts (key 28, figure 11).

If the packing is relatively new and tight on the shaft, and if tightening the packing flange nuts does not stop leakage, the shaft may be worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches around the packing box wall. Inspect the shaft and packing box wall for nicks and scratches when performing the packing replacement procedures.

For valves with the ENVIRO-SEAL packing system:

Optimum performance of the ENVIRO-SEAL packing system is obtained when the Belleville springs are tightened to their “target load.” The target load is the point where the springs are compressed to 85% of their maximum deflection, or nearly flat. Maximum deflection is when the springs are 100% compressed, or completely flat.

Figure 5. Packing Arrangement Details



NOTES:

1. WITH CONDUCTIVE PACKING, THE FEMALE ADAPTOR IN PTFE V-RING PACKING IS CARBON-FILLED PTFE.
2. APPLY LUBRICANT.
3. THESE TWO SURFACES SHOULD REMAIN PARALLEL AS YOU ALTERNATELY AND EVENLY TIGHTEN THE PACKING NUTS (KEY 28).

Under normal conditions, the packing nuts should not require re-tightening. However, when servicing, if the springs do not remain at the target load of 85% compression, retighten the packing box nuts according to the following procedure:

1. Tighten the packing flange nuts alternately and evenly, keeping the packing flange parallel with the valve flange (see figure 5), until the Belleville springs are compressed 100% (or completely flat).
 - For PTFE packing, loosen each packing flange nut one half turn (180° of rotation).
 - For Graphite packing, loosen each packing flange nut one quarter turn (90° of rotation).

The target load of 85% compression has now been reached. If leakage continues, replace the packing components as described in the following procedures.

Replacing the Packing

To replace the packing, the actuator must be removed. Also, the valve should be removed from the pipeline to allow proper readjustment of the disk position.

⚠ WARNING

The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 3).

CAUTION

Damage to the disk (key 3) may occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, apply operating pressure to the actuator temporarily to retain the disk in the closed position while removing the valve from the pipeline.

For valves with PTFE or graphite packing:

Key numbers in this procedure are shown in figure 11 unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shutoff all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.

CAUTION

When removing the actuator in the following step, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws and nuts (keys 35 and 36). Remove the clamp (key 130, figure 4) if the strap (key 131, figure 4) is used.
3. Remove the packing flange nuts and the packing flange (key 26) if used and pull out the packing follower (key 25).
4. Remove the anti-blowout ring (key 40) from the drive shaft (key 10).
5. Remove the old packing rings (key 24) and, if used, the packing washers (key 31). Carefully avoid scratching the shaft or packing box wall to avoid damage that could cause leakage around the shaft. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing.

⚠ WARNING

Do not lubricate parts when used in oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

6. Use the appropriate procedures below for installing packing.

- Install the packing as shown in figure 5.
 - With graphite ribbon packing, stack the packing rings and packing washers together, and slide the stack into the packing box as far as it will go while carefully avoiding trapping air between the rings.
 - Install the anti-blowout ring (key 40) in the groove on the drive shaft (key 10).
 - Install the packing follower and, if used, the packing flange.
 - Install the packing flange nuts, and tighten them only far enough to stop leakage under normal operating conditions.
 - For oxygen service applications, attach the bonding strap assembly (key 131, figure 4) to the shaft with the clamp (key 130, figure 4), and connect the other end of the bonding strap assembly to the valve body with a cap screw (key 35). Secure each cap screw with a hex nut (key 36).
7. Mount the actuator and adjust the closed position of the valve, per the Actuator Mounting section on page 19 of this manual, before returning the valve to service.
 8. When placing the control valve into operation, check around the packing follower for leakage; retighten the packing flange nuts as required according to accepted bolting procedures.

For valves with ENVIRO-SEAL packing systems:

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shutoff all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

CAUTION

When removing the actuator, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws and nuts (keys 35 and 36). Remove the clamp (key 130, figure 4) if the strap (key 131, figure 4) is used.
3. Loosen the two packing hex nuts evenly to remove spring tension, then remove the nuts.
4. Remove the packing flange and spring pack assembly. The spring pack assembly consists of the spring stack and packing follower. The spring stack is retained on the packing follower by an O-ring. Remove the anti-blowout ring (key 40) from the driveshaft (key 10). Remove the anti-extrusion washer, the packing set, and the packing ring.

CAUTION

The valve shaft surface condition is critical in making and maintaining a good seal. If the valve shaft surface is scratched, nicked, dented, or worn, replace the valve shaft before replacing the packing system.

5. Inspect the existing valve shaft. If necessary, replace the valve shaft as described in the Replacing the Disk, Shafts, or Bearings section.
6. Install the new packing system components as described in the ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)).

7. Install the anti-blowout ring (key 40) onto the drive shaft (key 10) before installing the packing follower.
8. Mount the actuator and adjust the closed position of the valve, per the Actuator Mounting section on page 19 of this manual, before returning the valve to service.

Replacing the Seal Ring Assembly

Perform this procedure only if the control valve is not shutting off properly (that is, leaking downstream). This procedure does not require removing the actuator from the valve body.

Key numbers in this procedure are shown in figure 11 unless otherwise indicated.

1. Isolate the control valve from line pressure, and relieve pressure from the valve body. Shut off and disconnect all lines from the power actuator.

⚠ WARNING

The edges of a rotating disk have a shearing effect that may result in personal injury. To help prevent such injury, stay clear of the disk edges when rotating the disk (key 3).

CAUTION

Damage to the disk (key 3) may occur if the disk is not closed when the valve is being removed from the pipeline. If necessary, apply operating pressure to the actuator temporarily to retain the disk in the closed position while removing the valve from the pipeline.

2. Unscrew the flange bolts, and remove the valve from the pipeline.
3. Unscrew the machine screws (key 14), remove the retainer clip (key 13), and remove the seal retainer (key 2).
4. Remove the seal ring assembly (key 4).
5. The valve must be closed during seal ring installation to permit accurate centering of the seal. To install the new seal ring assembly:
 - For a soft seal, if the spring (key 5) was disassembled, hook the spring ends together. Work the spring into the recess in the seal ring (key 4). Place the seal ring assembly onto the disk. Set the retainer onto the seal, making sure proper alignment between the seal and retainer has been achieved.
 - For the metal seal ring assembly, place the seal ring assembly onto the disk. Set the retainer onto the seal, making sure proper alignment between the seal and retainer has been achieved.
6. Attach the seal retainer (key 2) and the retainer clips (key 13) to the valve body and secure with the machine screws (key 14).
7. Be certain the disk is closed before installing the valve according to the Installation section on page 4 of this manual.

Replacing the Disk, Shafts, or Bearings

Key numbers in this procedure are shown in figure 11 unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shutoff all pressure lines to the power

actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

CAUTION

When removing the actuator in the following step, use a wheel puller to separate the actuator parts from the valve shaft. Do not drive the actuator parts off the valve shaft because this could damage valve trim components.

2. Remove the actuator per instructions in separate actuator instruction manuals, then remove the cap screws and nuts (keys 35 and 36). Remove the clamp (key 130, figure 4) if the strap (key 131, figure 4) is used.
3. Remove the packing flange nuts and the packing flange (key 26) if used and pull out the packing follower (key 25).

Disassembly

1. Remove the seal ring assembly according to steps 3 and 4 of the Replacing Seal Ring section on page 13 of this manual.
2. Remove hex nuts, blind flange, gasket, spacer (if present), follower spring seats, and follower spring (keys 19, 17, 16, 15, 9, and 12).

Figure 6. Orientation of Bearing Tabs

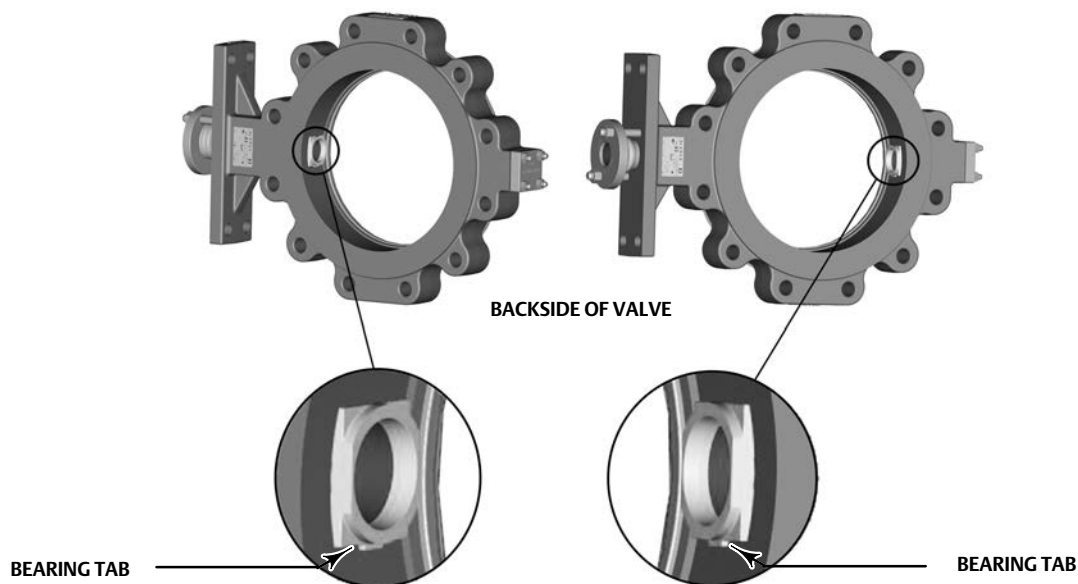


Table 6. Follower Shaft Internal Threads

VALVE SIZE		THREAD SIZE
DN	NPS	
50	2	M8 X 1.25
80	3	M10 X 1.50
100	4	M12 X 1.75
180	6	M16 X 2.00
200	8	M20 X 2.50 ⁽¹⁾
250	10	M20 X 2.50 ⁽¹⁾
300	12	M24 X 3.00 ⁽¹⁾

1. For valves with a two-piece, split-shaft design only. DN 200 - 300 (NPS 8-12) valves changed to a one-piece, through-shaft design in 2015.

Table 7. Recommended Blind Flange Bolt Torque

VALVE SIZE		TORQUE	
DN	NPS	N•m	lbf•ft
50 to 150	2 to 6	9.5	7.0
200, 250	8, 10	23	17
300	12	45	33

- Clean the gasket surfaces on the blind flange (key 17) and on the end of the valve body (key 1).
- Rotate the disk (key 3) to the fully open position.
- Refer to figure 7 and determine the location of the smaller end of the taper pins (key 8). Drive out the taper pins and expansion pins (key 7) towards the larger end.

WARNING

Once the shafts have been removed in the following step, the disk may fall from the valve body. To avoid personal injury and disk damage, support the disk to prevent it from falling as the shafts are being removed.

- For valves with a two-piece, split-shaft, pull the follower shaft (key 11) out through the outboard end of the valve body. If the follower shaft cannot be pulled free, the end of the follower shaft is internally threaded (see table 6) for screwing in a bolt or stud to aid in pulling the follower shaft.
- Pull the drive shaft (key 10) out through the actuator end of the valve body and remove the anti-blowout ring (key 40) from the drive shaft.
- Remove the disk (key 3) from the valve body.
- Remove the packing (key 24, figure 5) and the packing box ring (key 23, figure 5).
- If either of the bearings (key 6) require replacement, remove them.
- Clean the packing box and [metal packing box parts].

Assembly

WARNING

Do not lubricate bearings that will be used for oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

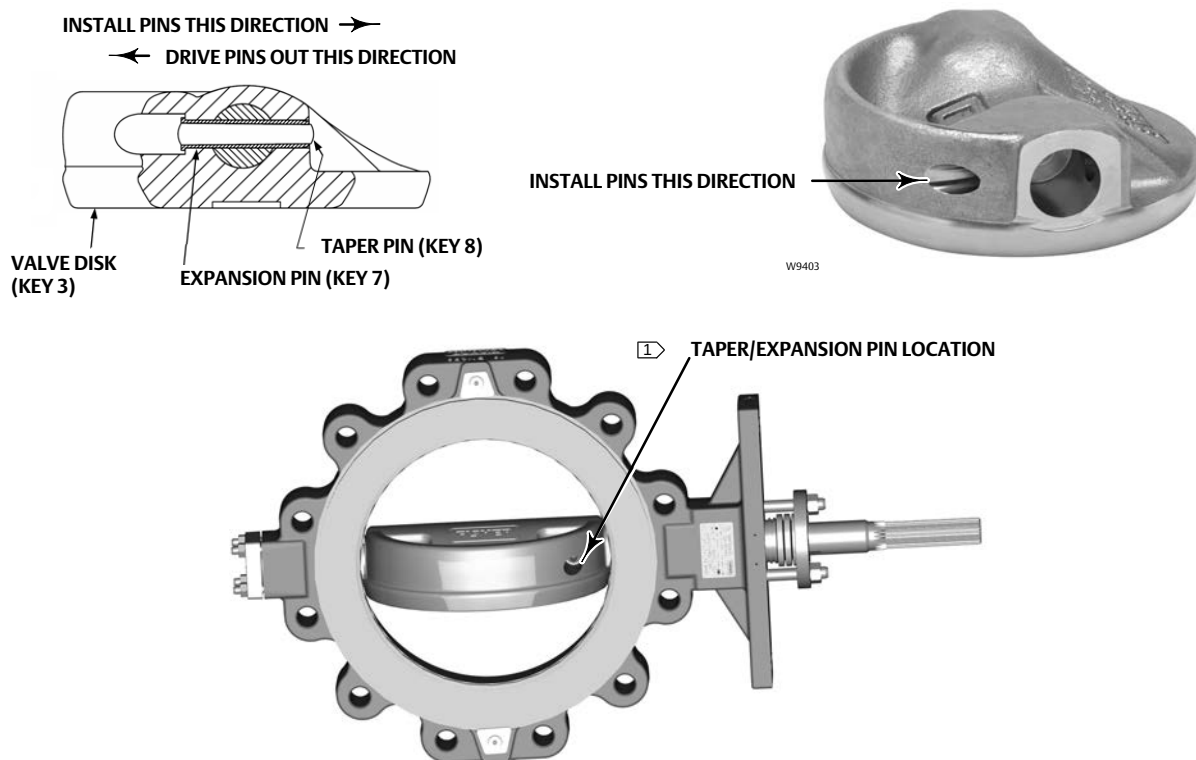
CAUTION

To avoid possible product damage, ensure the bearing tabs are oriented correctly when installing in the following procedure. See figure 6 for proper orientation of the bearings.

1. If new bearings (key 6) are required, install and orient them in the valve body, as shown in figure 6. Ensure the bearings are fully seated, contacting the inside diameter of the valve body.
2. Insert the disk into the valve body as shown in figure 7, ensuring the “T” stamped on the disk hub is oriented toward the actuator end of the valve body.
3. Install the drive shaft (key 10) through the valve body into the disk. The disk/shaft connection utilizes taper and expansion pins. The hole for the drive shaft connection is slightly off-center to prevent the drive shaft from being installed in the wrong orientation. Orient the position indication mark on the end of the shaft with the face of the disk as shown in figure 8. For valves using a two-piece, split-shaft, the hole for the follower shaft connection is on-center. Insert the expansion pins into the disk until they are seated, as shown in figure 7. Once in place, insert the taper pins. The taper pins must be driven into the disk/shaft/expansion pin assemblies until “solid contact” is felt. “Solid contact” can be identified by the sound of the hammer blow and the bounce felt in the hammer. NPS 8-12 valves changed to a one-piece, through-shaft design in 2015 and utilize only one pin connection. NPS 8-12 valves shipped prior to 2015 used a two-piece, split-shaft design with two pin connections - same as the NPS 2-6 valves.
4. Reinstall the follower spring/spring seat assembly (keys 9, 12, and 9, figure 9) inside the follower shaft or follower side of the drive shaft for valves with a one-piece, through-shaft design.
5. Install the spacer (key 15) if used, and the gasket, blind flange, and hex nuts (keys 16, 17, and 19). Ensure the blind flange is oriented so the serrations face the gasket and valve body. Tighten the hex nuts (key 19) per table 7.
6. The valve must be closed during seal ring installation to permit accurate centering of the seal. To install the new seal ring assembly or flow ring:
 - For a soft seal, if the spring (key 5) was disassembled, hook the spring ends together. Work the spring into the recess in the seal ring (key 4). Place the seal ring assembly onto the disk. Set the retainer onto the seal, making sure proper alignment between the seal and retainer has been achieved.
 - For the metal seal ring assembly, place the seal ring assembly onto the disk. Set the retainer onto the seal.
 - For the flow ring construction, place the gasket (key 41) onto the valve body. Set the retainer onto the gasket.
7. Attach the seal retainer (key 2) and the retainer clips (key 13) to the valve body and secure with the machine screws (key 14).
8. Insert a packing box ring (key 23) into the packing box.
9. For standard packing, install the packing according to the appropriate instructions presented in step 5 of the Replacing Packing section on page 11 of this manual.

For ENVIRO-SEAL packing, install the new packing system components as described in the ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)).
10. Install the anti-blowout ring (key 40) in the groove in the drive shaft.
11. Rotate the disk to the approximate closed position.
12. Mount and adjust the actuator per the following Actuator Mounting section on page 19 of this manual.

Figure 7. Taper / Expansion Pin Installation



NOTES:
1 INSTALL THE PINS FROM THIS SIDE OF THE DISK.

Table 8. Recommended Actuator-Mounting Bolt Torque

VALVE SIZE		TORQUE	
DN	NPS	N•m	lbf•ft.
50, 80, 100, and 150	2, 3, 4, and 6	120	88
200, 250, and 300	8, 10, and 12	250	185

Figure 8. Sectional of Typical Valve Body

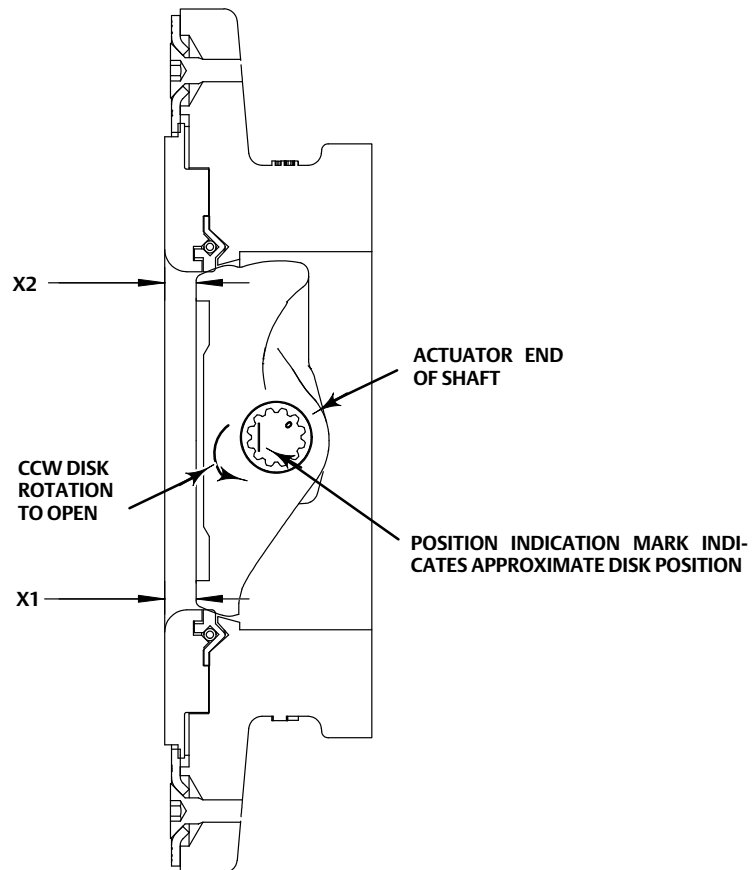
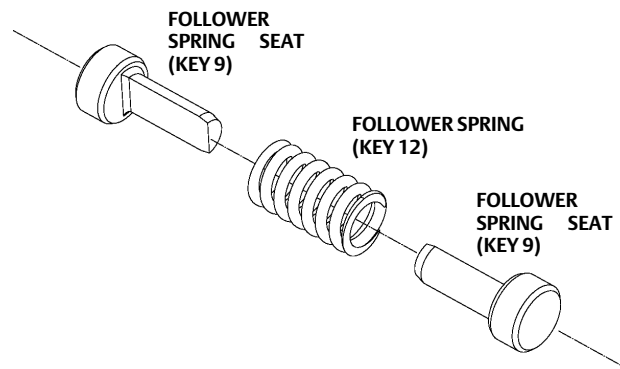


Figure 9. Follower Spring/Spring Seat Assembly



Actuator Mounting

With the valve body out of the line, mount the actuator on the valve body in accordance with the instructions in the actuator instruction manual. Mount the actuator yoke to the valve body, and tighten the actuator-mounting cap screws and nuts (keys 35 and 36) to the appropriate torque from table 8.

Key numbers in this procedure are shown in figure 11 unless otherwise indicated.

1. Determine the actuator mounting style and position from figure 10.

CAUTION

Control-Disk valve disk rotation is counterclockwise to open (when viewed from the actuator side of the valve body, see figure 8). Rotating the disk (key 3) past the fully closed position will damage the seal ring (key 4). To prevent this damage, use the following procedures:

- For actuators with adjustable travel stops, such as a Fisher 2052, 1051/1052 size 33, 1066 or 1066SR actuator, make certain the actuator travel stop prevents the disk from rotating past the fully closed position.
- For actuators with an adjustable turnbuckle, such as the Fisher 1051/1052 size 40, 60, and 70, or 1061 actuator, the turnbuckle must be adjusted so that the valve is closed when the diaphragm plate or piston is against the actuator travel stop.

2. Adjust the actuator to bring the disk to the fully closed position at the end of the actuator stroke. To determine the fully closed disk position, measure the distances between the disk face and the seal retainer face at the top and bottom of the valve (X1 and X2) as shown in figure 8. Adjust the travel stops or turnbuckle to rotate the disk slightly until the two measurements are within 0.8 mm (0.032 inch) of each other. Refer to the appropriate actuator instruction manual for assistance.

Parts Ordering

When corresponding with your [Emerson sales](#) office or Local Business Partner about this equipment, always mention the valve serial number.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

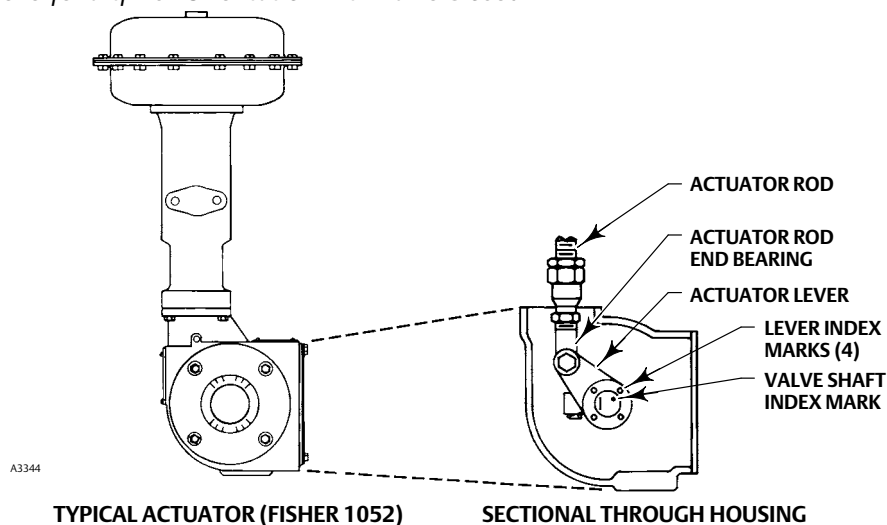
Control-Disk Valve

July 2018

Instruction Manual

D103298X012

Figure 10. Lever/Shaft/Disk Orientation with Valve Closed



ACTUATOR		VALVE CLOSED 4	MOUNTING POSITION 1 5	MOUNTING POSITION 2 5	MOUNTING POSITION 3 5	MOUNTING POSITION 4 5
MOUNTING	STYLE					
RIGHT-HAND 1	STYLE A (PDTO)	FORWARD FLOW				
	STYLE B (PDTC) 3	FORWARD FLOW				
LEFT-HAND 2	STYLE C (PDTC) 3	FORWARD FLOW				
	STYLE D (PDTO)	FORWARD FLOW				

NOTES:

- 1 WHEN ONE IS FACING THE INLET, THE ACTUATOR IS TO THE RIGHT OF THE VALVE BODY.
- 2 WHEN ONE IS FACING THE INLET, THE ACTUATOR IS TO THE LEFT OF THE VALVE BODY.
- 3 FOR 60-DEGREE OPERATION WITH PUSH-DOWN-TO-CLOSE ACTION (EXTENDING ACTUATOR ROD CLOSSES VALVE), ROTATE ACTUATOR LEVER COUNTERCLOCKWISE SO THAT LEVER INDEX MARK IS OFFSET 1 SPLINE TOOTH FROM VALVE SHAFT INDEX MARK FOR NPS 2 THROUGH 4 VALVES AND 2 SPLINE TEETH FROM VALVE SHAFT INDEX MARK FOR NPS 6 THROUGH 12 VALVES.
- 4 CURVED ARROWS IN "VALVE CLOSED" COLUMN INDICATE ROTATION REQUIRED TO OPEN VALVE (COUNTERCLOCKWISE WHEN VIEWED FROM ACTUATOR SIDE OF VALVE).
- 5 ARROWS IN "MOUNTING POSITION" COLUMNS INDICATE DIRECTION OF ACTUATOR ROD TRAVEL REQUIRED TO OPEN VALVE.
6. PDTC—PUSH DOWN TO CLOSE; PDTO—PUSH DOWN TO OPEN.

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B1125-1

Parts Kits

Retrofit Kits for ENVIRO-SEAL Packing

Retrofit kits are available for replacing the packing in an existing valve with an ENVIRO-SEAL packing system. These kits are available for single PTFE or graphite packing. All parts required for installation of the ENVIRO-SEAL packing system into an existing Control-Disk valve are included in the kits.

Worn shafts, packing box damage, or other components that do not meet Emerson finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of the retrofit kit.

ENVIRO-SEAL Packing System Retrofit Kits

SHAFT DIAMETER		SINGLE PTFE PACKING	GRAPHITE PACKING
mm	Inches		
12.7	1/2	RPACKXRT482	RPACKXRT422
15.9	5/8	RPACKXRT492	RPACKXRT432
19.1	3/4	RPACKXRT502	RPACKXRT442
25.4	1	RPACKXRT512	RPACKXRT452
31.8	1-1/4	RPACKXRT522	RPACKXRT462
38.1	1-1/2	RPACKXRT532	RPACKXRT472

Repair Kits for ENVIRO-SEAL Packing

Repair kits for ENVIRO-SEAL PTFE packing include one packing set and two anti-extrusion washers. Repair kits for ENVIRO-SEAL graphite packing include two packing rings and two anti-extrusion rings.

Worn shafts, packing box damage, or other components that do not meet Emerson finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of the repair kit.

ENVIRO-SEAL Packing System Repair Kits

SHAFT DIAMETER		FOR PTFE PACKING	FOR GRAPHITE PACKING
mm	Inches		
12.7	1/2	RRTYX000012	13B8816X012
15.9	5/8	RRTYX000022	13B8816X032
19.1	3/4	RRTYX000032	13B8816X052
25.4	1	RRTYX000052	13B8816X092
31.8	1-1/4	RRTYX000062	13B8816X112
38.1	1-1/2	RRTYX000072	13B8816X142

Parts List

Note

Contact your [Emerson sales office](#) or Local Business Partner for Part Ordering information.

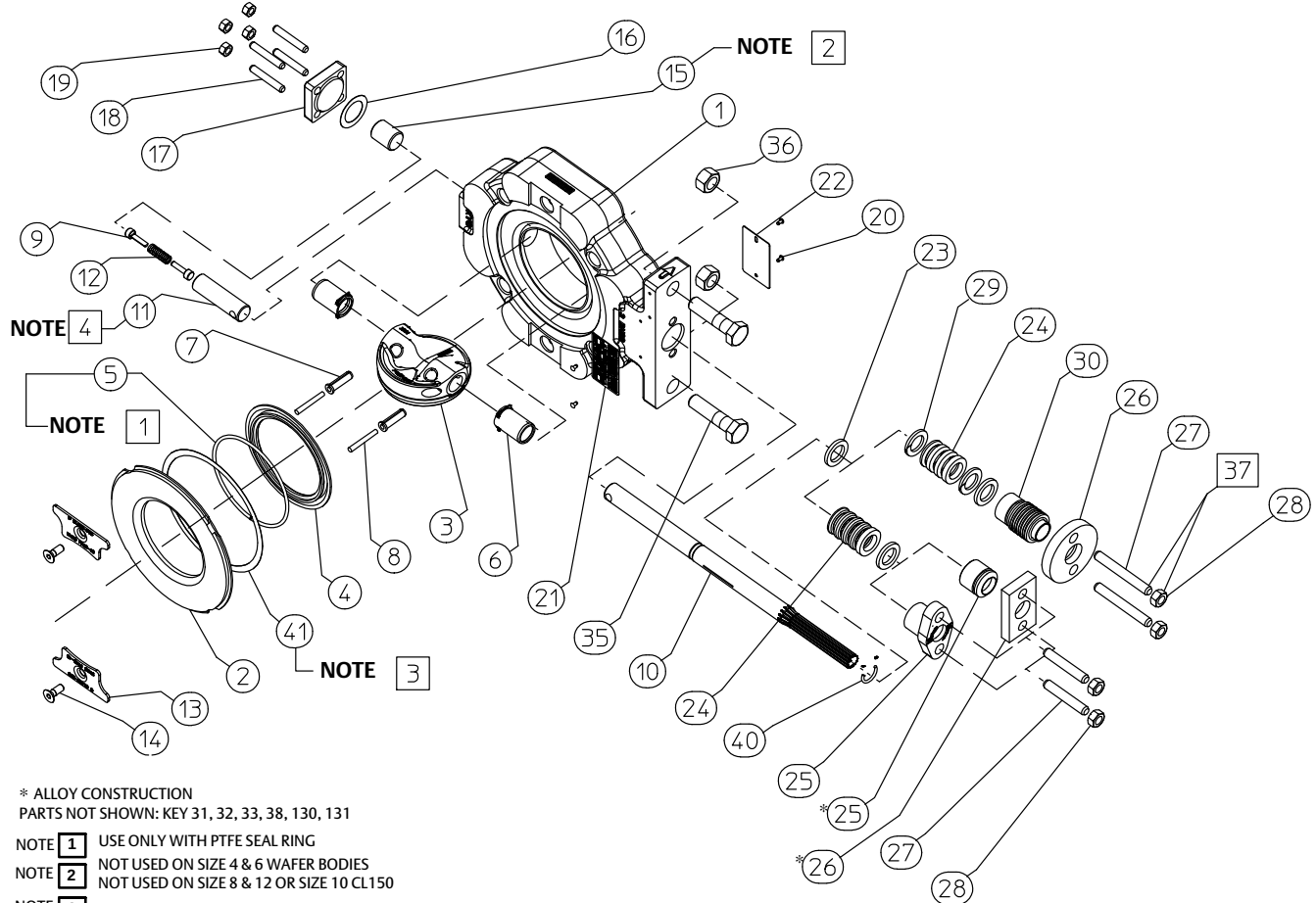
Key Description

1	Valve Body If you need a new valve body, please order by valve size, serial number and desired material.
2	Seal Retainer / Flow Ring
3*	Disk
4*	Seal Ring
5*	Spring
6*	Bearing (2 req'd)
7*	Expansion Pin (NPS 2-6, 2 req'd) (NPS 8-12, 1 req'd ⁽¹⁾)
8*	Taper Pin (NPS 2-6, 2 req'd) (NPS 8-12, 1 req'd ⁽¹⁾)
9	Follower Spring Seats
10*	Drive Shaft
11*	Follower Shaft (when used)
12	Follower Spring
13	Retainer Clip
14	Machine Screw, Flat Head, Hex Socket

Key Description

15	Spacer
16*	Gasket
17	Blind Flange
18	Stud
19	Hex Nut
20	Drive Screw
21	Nameplate
22	Mfg Label
23*	Packing Box Ring
24*	Packing Set
24*	Packing Ring (4 req'd)
24*	Packing Set, ENVIRO-SEAL
25	Packing Follower
26	Packing Flange
27	Packing Stud
28	Packing Nut
29*	Anti-extrusion Ring, ENVIRO-SEAL, use w/ PTFE packing
30	Spring Pack Assy
31*	Packing Washer
32	Tag
33	Cable Tie
34	Mounting Bracket
35	Cap Screw
36	Hex Nut
37	Lubricant
39	Machine Screw, Flat Head, Hex Socket
40	Anti-blowout Ring
41*	Gasket, Flow Ring
130	Clamp
131	Bonding Strap Assy

Figure 11. Fisher Control-Disk Valve Assembly



* ALLOY CONSTRUCTION

PARTS NOT SHOWN: KEY 31, 32, 33, 38, 130, 131

NOTE 1 USE ONLY WITH PTFE SEAL RING

NOTE 2 NOT USED ON SIZE 4 & 6 WAFER BODIES

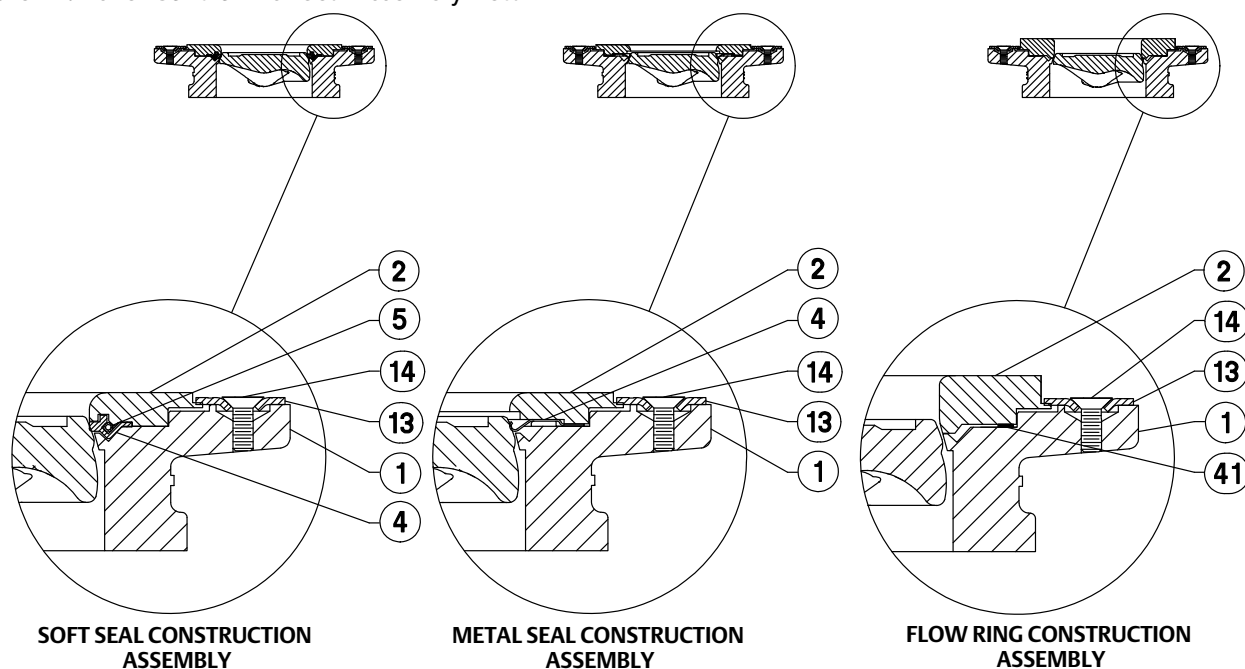
NOTE 2 NOT USED ON SIZE 8 & 12 OR SIZE 10 CL150

NOTE 3 USE ONLY WITH FLOW RING CONSTRUCTION

NOTE 4 NOT USED ON SIZE 8, 10, AND 12 THRU SHAFT CONSTRUCTION

GE36633_D

Figure 12. Fisher Control-Disk Seal Assembly Detail



GE36633_C_2

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Fisher™ CV500 Rotary Globe Control Valve

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Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts ordering information for NPS 3 through 20 Fisher CV500 Cam Vee-Ball™ rotary control valves. Refer to separate manuals for information concerning the actuator and accessories.

Description

The CV500 Cam-Vee-Ball rotary control valve, has a Vee-Ball style segmented ball in a valve body similar to the V500 valve. The CV500 is a flanged valve (figure 1) with a self-centering seat, eccentrically rotating V-notch ball, and splined valve shaft. Suitable for forward or reverse flow use, this valve mates with a variety of actuators to provide throttling or on-off service. The flanged valve mates with ASME flanges or EN flanges.



Do not install, operate, or maintain a CV500 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. Fisher CV500 Valve



X0189

**Fisher CV500 VALVE WITH 2052 ACTUATOR AND
FIELDVUE™ DVC6200 DIGITAL VALVE CONTROLLER**

Table 1. Specifications

Valve Sizes ■ NPS 3, ■ 4, ■ 6, ■ 8, ■ 10, ■ 12, ■ 14, ■ 16, and ■ 20 End Connection Style ■ Raised-face flanges or ■ ring-type joint flanges (ASME B16.5). Valve bodies with EN flanges also available. Consult your Emerson sales office. Maximum Inlet Pressure⁽¹⁾ Consistent with applicable ASME B16.34 or EN 12516-1 ratings Shutoff Classification Class IV per ANSI/FCI 70-2 and IEC 60534-4, (0.01% of valve capacity at full travel), for either flow direction Flow Characteristic Approximately equal percentage Flow Direction ■ Forward (normal) flow is into the convex side of the V-notch ball	■ Bidirectional flow is into either side of the V-notch ball Actuator Mounting ■ Right-hand or ■ left-hand as viewed from the upstream side of the valve Mounting position depends on the desired open valve position and flow direction required by operating conditions Valve Ball Rotation Counterclockwise to close (when viewed from actuator side of valve body) through 90 degrees of ball rotation Valve Body/Actuator Action With diaphragm or piston rotary actuator, field-reversible between ■ push-down-to-close (extending actuator rod closes valve body) and ■ push-down-to-open (extending actuator rod opens valve body) Shaft Diameters⁽²⁾ and Approximate Weights See table 2
---	--

1. The pressure/temperature limits in this manual and any applicable standard limitations should not be exceeded.

2. Shaft diameter and spline end must match available shaft diameter of actuator.

Specifications

Specifications for the CV500 rotary control valve are listed in table 1.

Educational Services

Emerson Automation Solutions
 Educational Services - Registration
 Phone: 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/mytraining

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed either the valve body rating or the mating pipe flange joint rating. To avoid such injury or property damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions indicated when the valve was ordered. Because some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

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Table 2. Shaft Diameters and Approximate Weights

VALVE SIZE, NPS	SHAFT DIAMETERS		APPROXIMATE WEIGHTS		
			Flanged		
	Through Valve Body	At Spline End ⁽¹⁾	CL150	CL300	CL600
	mm		kg		
3	25.4	25.4	19	24	26
	25.4	19.1			
4	31.8	31.8	36	42	50
6	38.1	38.1	54	69	93
	38.1	31.8			
8	38.1	38.1	79	98	135
10	44.5	44.5	181	208	312
12	53.8	53.8	215	253	367
	53.8	50.8			
14	53.8	53.8	247	345	454
16	76.2	76.2	322	426	610
20	76.2	76.2	388	558	801
	Inches		lbs		
3	1	1	42	52	57
	1	3/4			
4	1-1/4	1-1/4	79	93	111
6	1-1/2	1-1/2	120	152	204
	1-1/2	1-1/4			
8	1-1/2	1-1/2	175	217	298
10	1-3/4	1-3/4	398	458	687
12	2-1/8	2-1/8	473	558	810
	2-1/8	2			
14	2-1/8	2-1/8	545	760	1000
16	3	3	710	940	1345
20	3	3	855	1230	1765

1. Spline diameter that connects to actuator versus shaft diameter.

Key numbers are shown in figure 10 for NPS 3 through 8, figure 11 for NPS 10 and 12, and figure 12 for NPS 14 through 20, unless otherwise indicated.

1. If the valve body (key 1) is to be stored before installation, protect the flange mating surfaces and keep the valve body cavity dry and clear of foreign material.
2. Install a three-valve bypass around the control valve assembly if continuous operation will be necessary during inspection and maintenance of the valve.
3. A CV500 valve is normally shipped as part of a control valve assembly, with a power or manual actuator mounted on the valve. If the valve and actuator have been purchased separately or if the actuator has been removed from the valve, mount the actuator according to the actuator instruction manual. Also, adjust the actuator travel using the Adjusting Actuator Travel procedure in this manual before installing the valve; the required measurements cannot be made with the valve installed.
4. Before starting the actual installation of the valve, determine the proper installation orientation of the V-notch ball (key 2) and actuator. Determine the flow direction of the process fluid through the valve. See figure 2.

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Figure 2. Index Marks for Actuator Lever Orientation

ACTUATOR		VALVE OPEN	ACTUATOR POSITION			
MOUNTING	STYLE		1	2	3	4
RIGHT-HAND	STYLE A (PDTC)					
	STYLE B (PDTO)					
LEFT-HAND	STYLE C (PDTO)					
	STYLE D (PDTC)					

NOTES:
 1. ARROW ON LEVER INDICATES DIRECTION OF ACTUATOR THRUST TO CLOSE VALVE.
 2. PDTC=PUSH DOWN TO CLOSE; PDTO=PUSH DOWN TO OPEN.
 3. F=FORWARD FLOW; R=REVERSE FLOW.

C0741

Note

For control valves used in slurry service, mount the actuator and install the control valve so that the V-notch ball rotates above the valve drive shaft (refer to figure 2), if possible.

5. Before installing the valve, make sure the flow direction arrow (key 32) on the valve (key 1) matches the actual process fluid flow direction through the valve for the application where the valve will be installed.
-

Note

For best shutoff performance, install the valve with the drive shaft horizontal and the Vee-Ball closing in the downward direction for standard right hand mounting.

6. Install the flange gaskets and insert the valve between the mating pipeline flanges. Use flat sheet gaskets compatible with the process media, or spiral wound gaskets with compression-controlling center rings.
7. Install the line bolts and nuts; then, tighten them using accepted bolting procedures. These procedures include, but are not limited to, lubricating the line bolts and hex nuts and tightening the nuts in a crisscross sequence to ensure proper gasket load.
8. If a purge is desired for the purged bearing construction, remove the pipe plugs (keys 29 and 24) and install the purge lines. Purge pressure should be greater than the pressure within the valve and the purge fluid should be as clean as possible.

⚠ WARNING

A CV500 drive shaft is not necessarily grounded when installed in a pipeline unless the shaft is electrically bonded to the valve.

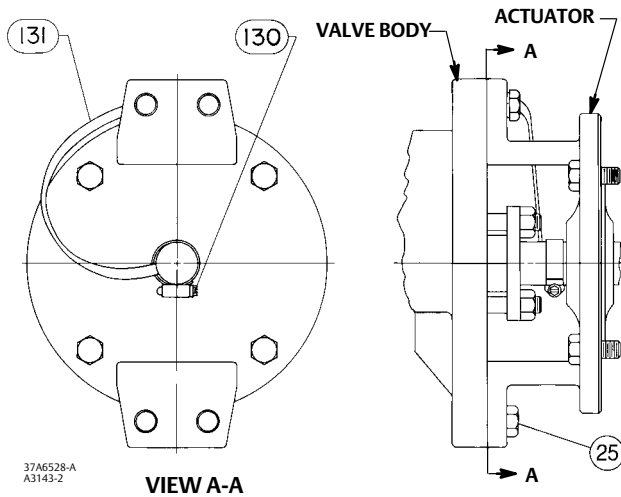
To avoid personal injury or property damage resulting from the effects of a static electricity discharge from valve components in a hazardous atmosphere or where the process fluid is combustible, electrically bond the drive shaft (key 3) to the valve according to the following step.

Note

Standard CV500 packings (key 13) are composed either entirely of conductive packing rings (graphite ribbon packing) or partially of conductive packing rings (a carbon-filled PTFE female adaptor with PTFE V-ring packing or a graphited-composition packing ring with PTFE/composition packing) in order to electrically bond the shaft to the valve body. Alternate shaft-to-valve body bonding is available for hazardous service areas where the standard packing is not sufficient to bond the shaft to the valve (see the following step).

9. For hazardous applications, attach the bonding strap assembly (key 131, figure 3) to the shaft with the clamp (key 130, figure 3) and connect the other end of bonding strap assembly to the valve body with the cap screw (key 25, figure 3).
10. Connect pressure lines to the actuator as indicated in the actuator instruction manual. When a manual actuator (handwheel) is used with a power actuator, install a bypass valve on the power actuator (if not already supplied) for use during manual operation.

Figure 3. Optional Shaft-to-Body Bonding Strap Assembly



⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If the valve has ENVIRO-SEAL™ live-loaded packing installed, readjustment will probably not be required. See the instruction manual titled Fisher ENVIRO-SEAL Packing System for Rotary Valves ([D101643X012](#)) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section near the end of this manual.

Maintenance

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- The valve packing area may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

Packing Maintenance

Key numbers refer to figure 10 for NPS 3 through 8, figure 11 for NPS 10 and 12, and figure 12 for NPS 14 through 20, unless otherwise indicated.

Note

For the ENVIRO-SEAL packing system, refer to the Parts List section for retrofit kits, parts kits, and individual parts (see figures 13 and 14). Refer to separate ENVIRO-SEAL instruction manual ([D101643X012](#)) for maintenance instructions.

Standard ENVIRO-SEAL packing systems can be used in vacuum service with packing rings in the standard orientation. It is not necessary to reverse the ENVIRO-SEAL PTFE packing rings.

Stopping Leakage

All maintenance procedures in this section may be performed with the valve body (key 1) in the line.

For packings other than spring-loaded packing, leakage around the packing follower (key 14) may be stopped by tightening the packing flange nuts (key 16). If leakage cannot be stopped in this manner, replace the packing according to the Replacing Packing procedure in this manual.

If the packing is relatively new and tight on the drive shaft (key 3), and if tightening the packing nuts does not stop leakage, it is possible that the shaft is worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches on the packing box wall. Inspect the shaft and packing box wall for nicks or scratches when performing the following procedures.

Replacing Packing

Note

If the valve has ENVIRO-SEAL live-loaded packing installed, see the manual entitled Fisher ENVIRO-SEAL Packing System for Rotary Valves ([D101643X012](#)).

This procedure may be performed without removing the actuator from the valve if adding PTFE/composition packing rings as a temporary measure. However, the actuator must be removed if replacing any other kind of packing or if the metal packing parts (keys 14, 17, and, if used, 18) need to be replaced.

WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

NOTICE

To avoid increased leakage, increased valve component wear or possible damage to the valve body, ball, shaft, and bearings resulting from a sharp blow to the shaft, use a wheel puller to separate the actuator parts from the drive shaft.

Do not drive the actuator parts off the drive shaft since this could move the valve bearings, shaft, and ball away from proper alignment, causing improper seating of the ball. Such misalignment may result in damage to valve components if the valve is returned to service without disassembly and inspection of the valve ball alignment.

2. If necessary, remove the cap screws (key 25) and hex nuts (key 26). Then remove the actuator while referring to the actuator instruction manual for assistance.
3. Remove the packing nuts (key 16). For NPS 3 through 8, remove the packing follower (key 14). For NPS 10 through 20, remove the packing flange (key 45) and then remove the packing follower (key 14).

⚠ WARNING

In the following step, take care not to scratch the valve shaft or packing box wall, as this may cause leakage.

4. Remove the old packing rings (key 13), packing box ring (key 17), and, if used, the lantern ring (key 18). Do not scratch the valve shaft or packing box wall; scratching these surfaces could cause leakage. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing.
5. Whenever you are installing new packing, be sure the ball (key 2) is closed while you install and tighten the new packing. Install the new packing rings and packing box ring by stacking the parts as shown in figure 4. Make sure split rings are arranged so that the splits do not line up to form a leak path. Then slide the stack into the packing box as far as they will go while being careful to avoid trapping air among the rings.
6. Install the packing follower (key 14), and, for NPS 10 through 20, also install the packing flange (key 45). Install the nuts (key 16), and tighten them far enough to stop leakage under normal conditions.
7. Mount the actuator while referring to the actuator mounting procedures in the actuator instruction manual. Complete the Adjusting Actuator Travel procedure in this manual before installing the valve in the pipeline. This is necessary due to the measurements that must be made during the actuator adjustment process.
8. When the control valve is being put back into operation, check the packing follower for leakage, and retighten the packing nuts as necessary.

Replacing Retainer, Seat Ring, and Face Seals

This procedure is to be performed if the control valve is not shutting off properly, if installing a different seat ring, or if seat ring inspection is necessary. The actuator and valve must be removed from the pipeline; however, the actuator may remain mounted during this procedure. Key numbers refer to figure 10 for NPS 3 through 8, figure 11 for NPS 10 and 12, and figure 12 for NPS 14 through 20, unless otherwise indicated.

A retainer tool is required to remove the retainer (key 5) on sizes NPS 3 through 12. If specifically ordered, a tool is supplied with the valve; a tool can also be ordered individually by referencing key 33 of the Parts List. If desired, a tool can be machined using the dimensions shown in figure 5.

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NOTICE

During assembly, handle the retainer, seat ring, and face seals carefully. Critical areas that must be protected are the threads and inner surface of the retainer (key 5), the sealing surfaces of the face seals (key 8), the face seal grooves in the seat ring (key 4), the shutoff surface of the seat ring, and the face seal surface in the valve body.

A new retainer gasket (key 11) is required whenever the retainer (key 5) is removed. Other parts that are in good condition can be reused.

Disassembly

⚠ WARNING

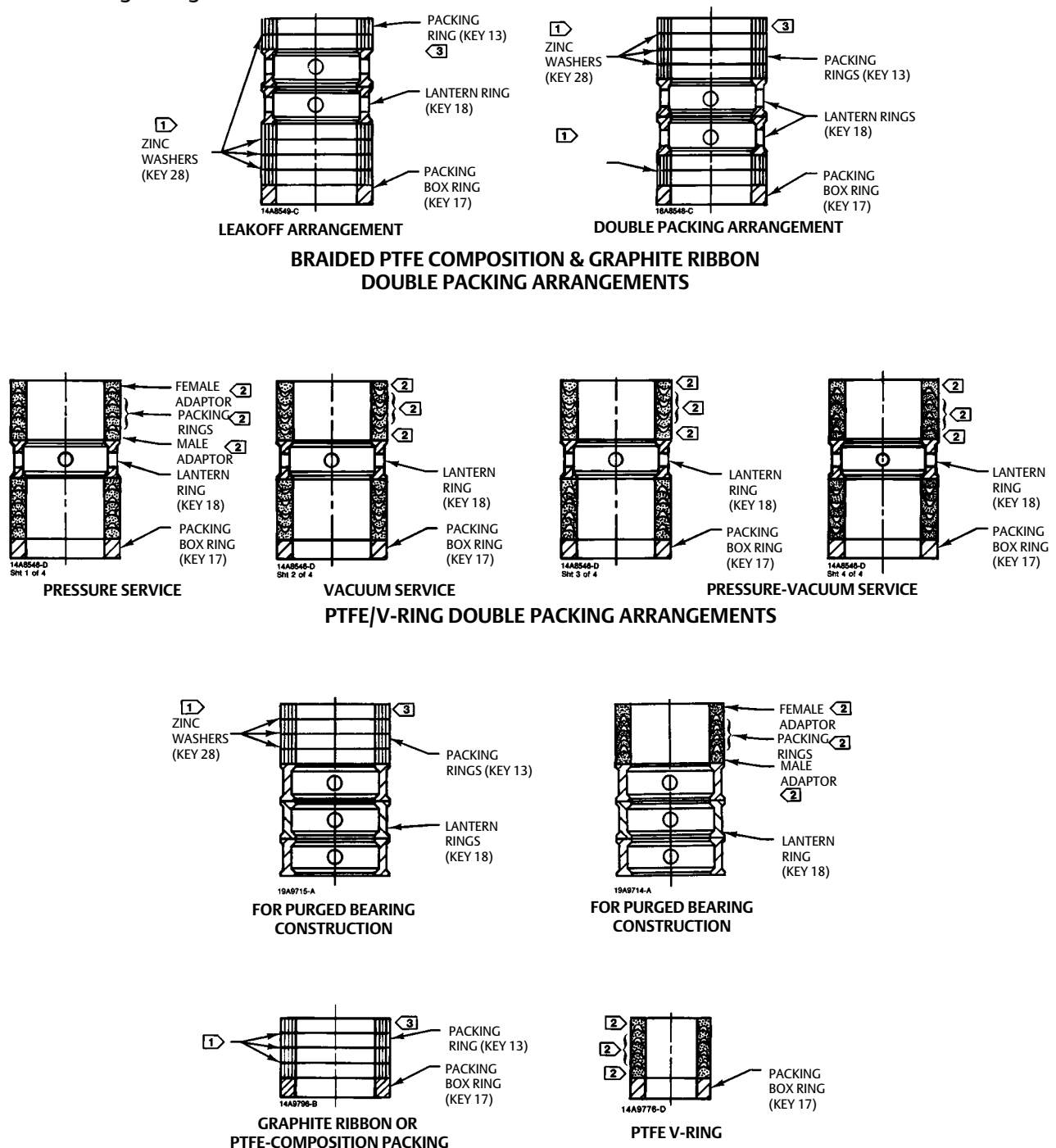
Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

The ball closes with a shearing, cutting motion, which could result in personal injury. To avoid personal injury or damage to tools, valve parts, or other items resulting from the ball closing, prevent against ball travel by using travel stops, manual actuators, constant supply pressure to a pneumatic actuator, or other steps as appropriate. When installing the seat ring, keep hands, tools, and other objects out of the valve.

Table 3. Assembly Clearance

PROCESS TEMPERATURE	SEAT RING AND RETAINER CLEARANCE			
	mm		Inches	
	Minimum	Maximum	Minimum	Maximum
To 260°C (500°F) ⁽¹⁾	0.08	0.30	0.003	0.012
Over 260°C (500°F) ⁽²⁾	0.20	0.43	0.008	0.017
1. Standard Trim 2. Special High Temperature Trim				

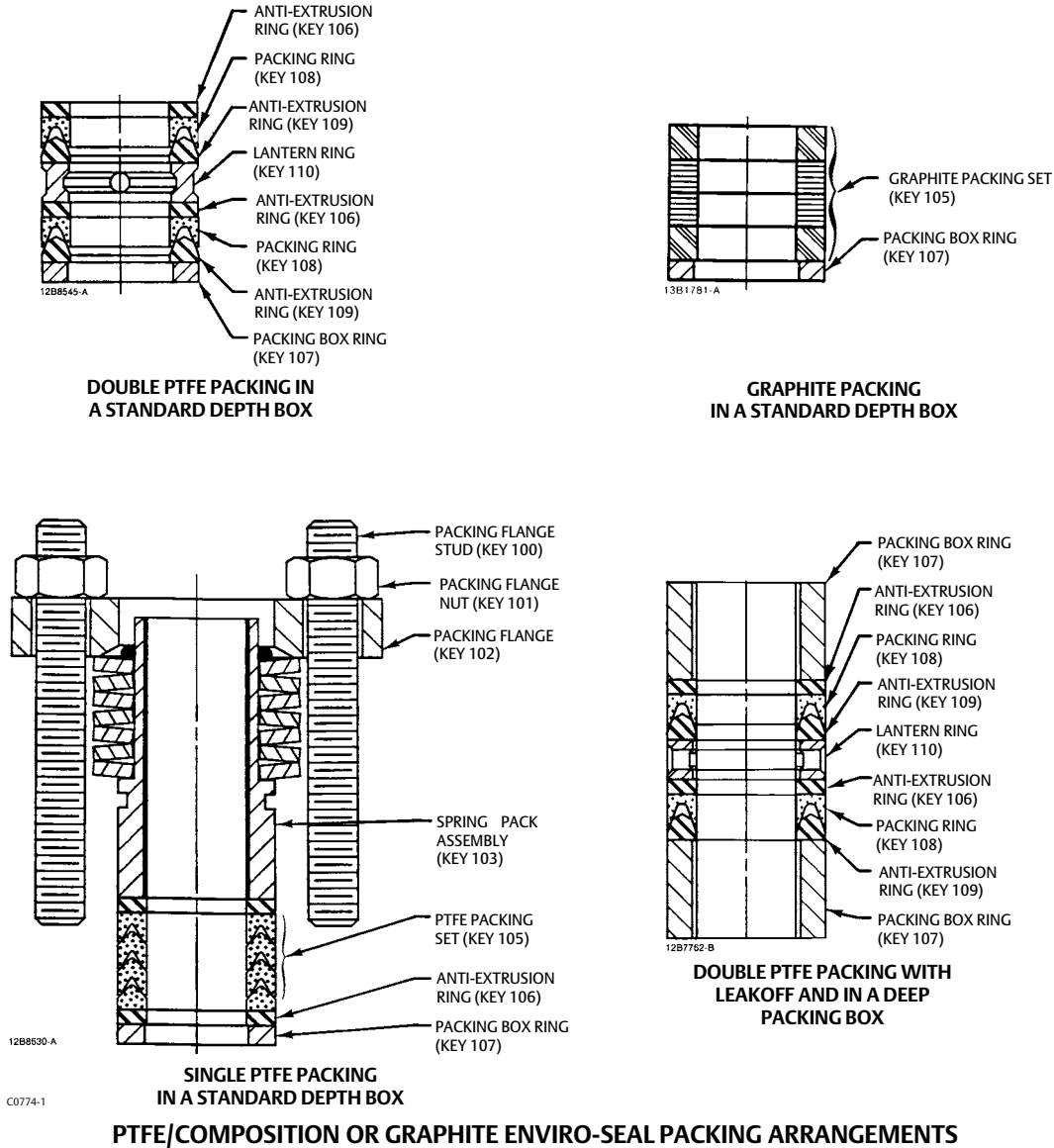
Figure 4. Packing Arrangements



NOTES:

- 1 INCLUDES ZINC WASHERS (KEY 28) FOR GRAPHITE RIBBON PACKING ONLY
- 2 INCLUDED IN PTFE/V-RING PACKING SET (KEY 13).
- 3 FOR ONLY PTFE/BOUND-COMPOSITION PACKING, TOP RING IS CONDUCTIVE GRAPHITE FILAMENT RING.

Figure 4. Packing Arrangements (continued)



1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove line bolting. Then, remove the control valve from the pipeline and place the valve on a flat surface with the retainer (key 5) facing up.

3. Rotate the drive shaft (key 3) to move the ball (key 2) into the open position.

Note

For sizes NPS 3 through 12 the retainer (key 5) was installed at the factory using the torque listed in figure 5.

NOTICE

After performing the following procedures, place the retainer, the seat ring, and both face seals on a protected, flat surface where the threads and sealing surfaces will not be contaminated or damaged.

4. For sizes NPS 3 through 12, remove the retainer (key 5) by engaging the retainer tool, attaching an impact wrench or other suitable tool, and unscrewing the retainer. Inspect the retainer. Place it on a protected, flat surface where the threads and sealing surfaces will not be contaminated or damaged.
5. For sizes NPS 14 through 20, remove the retainer (key 5) by removing each of the four retainer bolts (key 48) and gently lifting it out of the valve body. Inspect the retainer. Place it on a protected, flat surface where the sealing surfaces will not be contaminated or damaged.
6. Remove the retainer gasket (key 11). Inspect the gasket surface in the valve body.
7. Lift out the seat ring (key 4) and both face seals (key 8). Inspect the parts and place them on a flat, protected surface.
8. Inspect the shutoff surface of the V-notch ball. If it is worn, nicked, or scratched, proceed to the Replacing Ball, Shaft, and Bearings procedure in this manual. If the parts are in good condition and do not require replacement, continue to the Assembly procedure in this manual.

Assembly

⚠ WARNING

Seat ring installation requires that the ball (key 2) remain in the open position.

The ball closes with a shearing, cutting motion, which could result in personal injury. To avoid personal injury or damage to tools, valve parts, or other items resulting from the ball closing, prevent against ball travel by using travel stops, manual actuators, constant supply pressure to a pneumatic actuator, or other steps as appropriate. When installing the seat ring, keep hands, tools, and other objects out of the valve.

1. Apply enough supply pressure to the actuator to open the ball, or take other steps to hold the ball open.
2. Clean the valve body, the retainer threads, the retainer gasket surface, and the seat ring sealing surfaces.
3. Using either face seals (key 8) in good condition or new face seals, place one seal in the seat ring cavity of the valve body.

Note

The seat ring (key 4) may have one or two shutoff surfaces. The shutoff surfaces are the narrow, rounded edges of the seat ring bore. Inspect the seat ring and locate the shutoff surfaces before proceeding.

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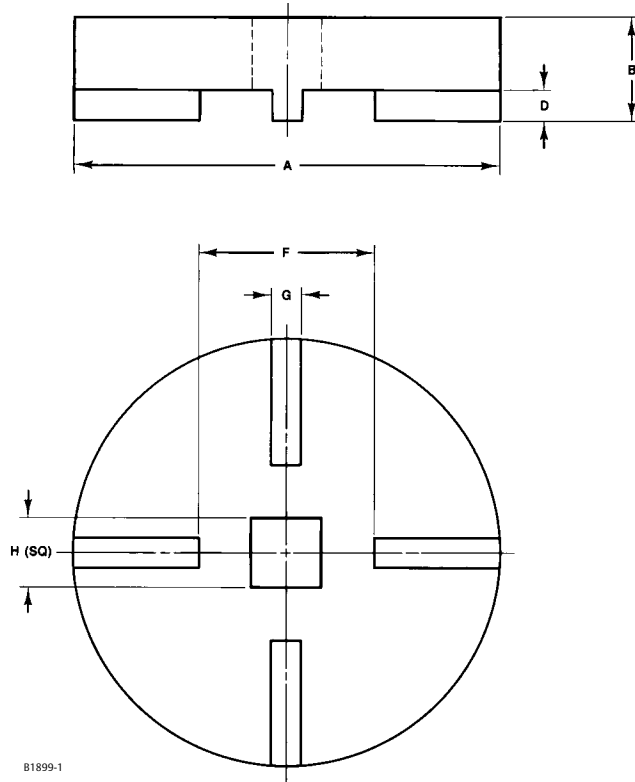
Table 4. Data for Making and Using the Retainer Tool

VALVE SIZE, NPS	A	B	D	F	G	H (SQUARE)	A	B	D	F	G	H (SQUARE)
	mm						Inches					
3	79.2	33.3	7.9	41.4	7.9	19.0	3.12	1.31	.31	1.62	.31	.75
4	104.6	33.3	7.9	41.4	7.9	25.4	4.12	1.31	.31	1.62	.31	1.00
6	155.4	38.1	11.2	63.5	11.2	25.4	6.12	1.50	.44	2.50	.44	1.00
8	203.2	50.8	11.2	101.6	11.2	38.1	8.00	2.00	.44	4.00	.44	1.50
10	241.3	50.8	11.2	127.0	19.1	38.1	9.5	2.00	.44	5.00	.75	1.50
12	273.0	50.8	11.2	127.0	25.4	38.1	10.75	2.00	.44	5.00	1.00	1.50

Table 5. Data for Making and Using the Retainer Tool

VALVE SIZE, NPS	RETAINER TORQUE	
	N•m	Lbf•ft
3	515	380
4	1170	860
6	2305	1700
8	3120	2300
10	4750	3500
12	6100	4500

Figure 5. Data for Making and Using the Retainer Tool



B1899-1

RETAINER TOOL FOR NPS 3 THROUGH 12 VALVES

4. Insert the seat ring into the seat ring cavity with the correct shutoff surface facing the V-notch ball and shaft. The seat ring will cover the face seal installed in step 3.
5. Place the second face seal (key 8) on the seat ring (key 4).
6. Apply anti-seize lubricant to the gasket surface in the valve body. Install the gasket (key 11), while making certain that the concave surface of the gasket is up (hump surface of gasket down).
7. For valve sizes NPS 3 through 12
 - a. Apply anti-seize lubricant to the gasket surface in the valve body. Install the gasket (key 11), while making certain that the concave surface of the gasket is up (hump surface of gasket down).
 - b. Apply anti-seize lubricant to the threads and bottom of the retainer (key 5) only in the area that contacts the gasket. Thread the retainer into the valve body till it begins to compress the face seals.
 - c. Insert a screwdriver, pry bar, or similar tool between the lower ear of the ball and the valve body. Use the pry to move the ball tightly against the thrust washer and bearing stop (key 7) on the actuator side of the valve.
 - d. Rotate the drive shaft to move the ball till it contacts and centers the seat ring. Once the seat ring is centered return ball to the open position.
 - e. Refer to table 5. Find the correct retainer torque for the valve size. With the appropriate tool, tighten the retainer to the torque listed in table 5.
 - f. A gap between the seat ring (key 4) and retainer (key 5) allows the seat ring to self-center. Applying the proper amount of torque during installation should position the retainer and seat ring properly. Use a feeler gage to measure between the parts as shown in figures 9 and 10, making certain the necessary clearance exists. Compare the measured gap to the clearance in table 4.
 - g. If the measured clearance is within the values specified in table 4, proceed to the next step.
 - If the measured gap is larger than the maximum, tighten the retainer--apply more torque than that listed in figure 5, if necessary, until the clearance is within the maximum and minimum values.
 - If the measured clearance is smaller than the minimum, remove the retainer, seat ring, and face seals, clean the parts, and reassemble so as to obtain the necessary minimum clearance.
 - h. Perform the Adjusting Actuator Travel procedure in this manual (pg. 22) and then install the control valve in the pipeline.
8. For valve sizes NPS 14 through 20
 - a. Prior to Actuator Travel Adjustment procedure:

Note

For valve sizes NPS 14, 16, and 20 the retainer gasket (key 11) should not be installed for the Actuator Travel Adjustment procedure.

- Gently lower the retainer (key 5) into the valve body, while making certain that the countersunk bolt holes line up with threaded holes in the body.
- Lubricate and install the retainer bolts (key 48) and torque them to 32 in • lbf (3.6 N • m).
- Perform the Actuator Travel Adjustment procedure in this manual.

b. Post Actuator Travel Adjustment procedure:

- Remove the retainer bolts (key 48) and retainer (key 5) from the valve body.

⚠ WARNING

To avoid personal injury from process fluid leakage, the retainer gasket must be installed prior to installation of the valve in the pipeline.

- Install the retainer gasket (key 11) into the groove in the valve body.
- Gently lower the retainer (key 5) into the valve body, while making certain that the countersunk bolt holes line up with threaded holes in the body.
- Lubricate and install the retainer bolts (key 48) and torque them to 32 in • lbf (3.6 N • m).

Replacing Ball, Shaft, and Bearings

Perform this procedure to replace the ball (key 2), expansion pin (key 9), taper pin (key 10), drive shaft (key 3), follower shaft (key 38), groove pins (key 39), or bearings (keys 6 and 42). These parts are independently replaceable; for example, installing a new ball does not require replacing a reusable valve shaft or expansion pin assembly. For key numbers refer to figure 10 for NPS 3 through 8, figure 11 for NPS 10 and 12, and figure 12 for NPS 14 through 20, unless otherwise indicated.

Disassembly

⚠ WARNING

To avoid personal injury resulting from contact with edges of the V-notch ball (key 2) and seat ring (key 4) during ball rotation, stay clear of its edges when rotating the ball. To avoid damage to tools, valve parts, or other items resulting from V-notch ball rotation, keep tools and other property away from the edges of the ball.

The ball closes with a shearing, cutting motion, which could result in personal injury. When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, resulting in personal injury or property damage. To avoid injury or damage, carefully rotate the ball/shaft assembly to a stable position in the valve body after the actuator is disconnected.

NOTICE

To avoid increased leakage, increased valve component wear or possible damage to the valve body (key 1), ball (key 2), drive shaft (key 3), follower shaft (key 38), and bearings (keys 6 and 42) resulting from a sharp blow to the actuator or valve parts, use a wheel puller to separate the actuator parts from the valve drive shaft.

Do not drive the actuator parts off the valve drive shaft since this could move the valve bearings, shafts, and ball away from proper alignment, causing improper seating of the ball. Such misalignment may result in damage to valve components if the valve is returned to service without disassembly and inspection of the ball alignment.

⚠ WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

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1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the actuator cover. Note the actuator orientation with respect to the valve body and the lever orientation with respect to the valve drive shaft (see figure 2). Remove the lever but do not loosen the actuator turnbuckle adjustment. Remove the actuator mounting screws and nuts, and remove the actuator. If necessary, refer to the actuator instruction manual for assistance.
3. With the valve body (key 1) out of the pipeline, loosen the packing nuts (key 16). If the packing is to be reused, do not remove it. However, Emerson recommends that the packing be replaced whenever the drive shaft is removed.

Table 6. Data for Tapped Holes on Valve Shaft

VALVE SIZE, NPS	SHAFT DIAMETER				THREAD SIZE, UNC
	Through Valve	At Spline End	Through Valve	At Spline End	
	mm		Inches		
3	25.4	25.4	1.00	1.00	3/8-16
	25.4	19.1	1.00	0.75	5/16-18
4	31.8	31.8	1.25	1.25	3/8-16
6	38.1	38.1	1.50	1.50	1/2-13
	38.1	31.8	1.50	1.25	3/8-16
8	38.1	38.1	1.50	1.50	1/2-13
10	44.5	44.5	1.75	1.75	1/2-13
12	53.8	53.8	2.12	2.12	3/4-10
	53.8	50.8	2.12	2.00	
14	53.8	52.3	2.12	2.06	3/4-10
16	76.2	73	3	2.87	3/4-10
20	76.2	73	3	2.87	3/4-10

4. Rotate the V-notch ball (key 2) to the fully open position.
5. Drive out the groove pin (key 39) that secures the ball (key 2) to the follower shaft (key 38). Remove the groove pin from the ball ear in the direction shown in figure 6.
6. For NPS 3 through 8, refer to figure 6. The expansion pin (key 9) and the taper pin (key 10) inside of it are holding the ball in position on the drive shaft. Find the larger hole in the ball ear where these pins enter the ear. On the opposite side of the ear is a smaller hole where the chamfered end of the expansion pin rests on the inner lip of the hole.
7. For NPS 10 through 20, drive out the groove pin from the drive shaft (key 3) in the direction shown in figure 6.
8. For NPS 3 through 8, remove the pipe plug (key 29). Using a punch, drive the follower shaft (key 38) into the center of the ball (key 2). Use care to avoid dropping the follower shaft.
9. For NPS 10 through 20, remove the hex nuts (key 44), and then remove the bottom flange (key 40). Thread a bolt into the end of the follower shaft and pull the follower shaft out of the valve. Refer to table 6 for thread sizes. The bearing (key 6) may come out with the follower shaft. For NPS 14 through 20 the follower shaft can alternatively be pushed out into the center of the ball.

Note

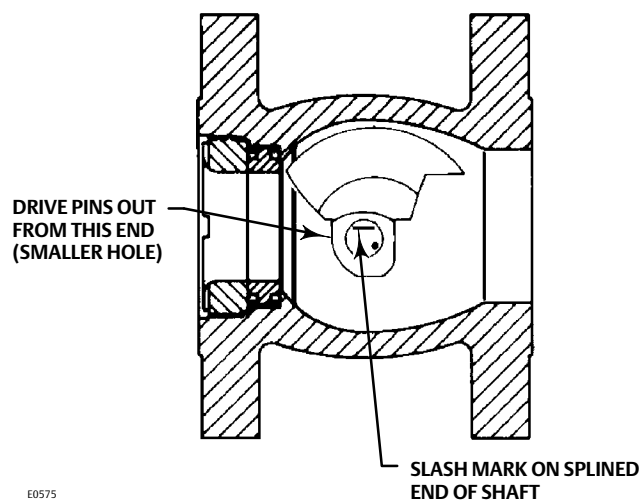
For the NPS 14 through 20 if the valve is mounted with the shaft vertical relative to the ground a spring (key 54), two spring seats (key 53), and a thrust washer (key 55) will also be removed with the follower shaft ones the bottom flange has been unbolted.

⚠ WARNING

To avoid personal injury or damage to tools, valve parts, or other items resulting from the ball (key 2) falling from the valve body, support the ball to prevent it from falling as the drive shaft (key 3) is being removed.

10. Pull the drive shaft (key 3) from the valve body. If the shaft cannot be removed by hand, attach a slide hammer or similar tool to the spline end of the shaft that was attached to the actuator. If the shaft has a tapped hole at the spline end of the shaft, refer to table 6 for thread sizes.
11. Remove the ball (key 2), and thrust washers (key 12) from the valve body. For sizes NPS 3 through 12, if using 17-7PH thrust washers there will be two, if using alloy 6 there will only be one thrust washer.

Figure 6. Taper and Expansion Pin Removal from Ball and Drive Shaft



Note

For NPS 3 through 8, two shaft bearings (key 6) are located inside the valve body on either side of the ball. Only one of these two bearings is identified by key 6. The other bearing is located along the drive shaft on the other side of the V-notch ball.

For NPS 10 through 20, there are two shaft bearings. One is identified as key 6, and the other is identified as key 42.

12. If the shaft bearings are to be replaced, remove the packing (key 13).
13. If the bearing closest to the packing (key 6 on NPS 3 through 8 and key 42 on NPS 10 and 12) requires replacement and cannot be removed by hand, press it out using a ram with dimensions as given in figure 7.

For valve sizes NPS 3 through 12, the ram has a smaller diameter than the bearing stop (key 7) so the bearing stop need not be removed when pressing out the bearing on the drive shaft. Insert the ram through the packing box and press the bearing into the valve body cavity. Take care not to move the bearing stop when pressing out the bearing.

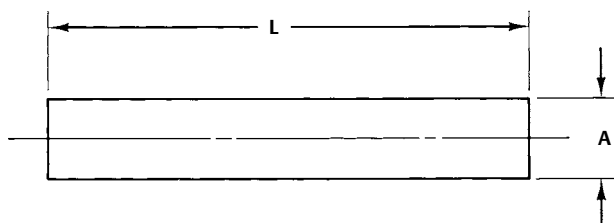
14. For valve sizes NPS 3 through 8, if the second bearing (key 6) requires replacement and cannot be removed by hand, use one of the following methods:
 - a. Knock or pry the bearing out, or

- b. Use the valve drive shaft as a piston to drive the bearing from the valve body. To accomplish this, install the pipe plug (key 29). Fill the bearing bore with a heavy grease and then insert the end of the shaft back through the valve body and into the grease-filled bearing. Protect the splined end of the shaft with, for example, a block of wood; then strike the protected end. When the shaft is struck, it will act as a piston, pushing the grease into the bearing bore. The grease will then force the bearing out of the bore and farther along the shaft. Soon, the bearing will be positioned for easy removal.
15. For NPS 10 through 20, if the bearing (key 6) on the follower shaft requires replacement and cannot be removed by hand, press it out using a ram with dimensions as given in figure 7. Press the bearing into the valve body cavity. Alternatively, for sizes NPS 14 through 20 the follower shaft (key 38) can be used to pull the bearing out by attaching a slide hammer or similar tool to the threaded hole in the bottom. Refer to table 6 for thread size.
16. If used, remove the O-rings (keys 19 and 20) from the bearings.

Table 7. Ram Dimension for Bearing Removal

VALVE SIZE, NPS	A		L	
	mm	Inches	mm	Inches
3	<u>27.8</u> 27.4	<u>1.094</u> 1.078	165	6.50
4	<u>34.1</u> 33.7	<u>1.344</u> 1.328	165	6.50
6	<u>42.1</u> 41.7	<u>1.656</u> 1.641	197	7.75
8	<u>42.1</u> 41.7	<u>1.656</u> 1.641	229	9.00
10	<u>48.4</u> 48.0	<u>1.905</u> 1.890	229	9.00
12	<u>57.8</u> 57.4	<u>2.275</u> 2.260	260	10.25
14	<u>62.5</u> 57.4	<u>2.46</u> 2.26	228.6	9
16	<u>84.5</u> 79.6	<u>3.325</u> 3.135	279.4	11
20	<u>84.5</u> 79.6	<u>3.325</u> 3.135	279.4	11

Figure 7. Ram Dimension for Bearing Removal



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Assembly

Note

Before starting to assemble the valve components, place the valve body (key 1) on a flat surface with the retainer (key 5) facing down as shown in figure 8. This orientation of the valve allows easier installation of the V-notch ball.

1. Thoroughly clean the parts before assembly.
2. If O-rings (keys 19 and 20) are used on the bearings, apply a small amount of lubricant to the O-rings so the bearings will easily slide into the valve body. Insert the smaller O-ring (key 20) inside the bearing and the larger O-ring (key 19) around the outside of the bearing.

NOTICE

To avoid damage to O-rings resulting from contact with sharp edges within the bearing holes, use appropriate care when installing the O-rings.

3. Slide the bearing (key 6) and, if used, O-rings (keys 19 and 20) into the follower shaft bore located on the valve body (key 1) opposite the packing box. For NPS 10 and 12, make certain the groove located on the outside diameter of the bearing is positioned towards the bottom flange side of the valve body.
4. Slide the bearing located on the packing box side (key 6 for NPS 3 through 8 and key 42 for NPS 10 through 20) into the valve body and against the bearing stop.
5. For NPS 3 through 8, inspect the drive shaft (key 3). Insert the shaft end with the expansion or groove pin hole into the packing box and through the bearing that was previously installed in the packing box in step 4. Stop before the drive shaft enters the main valve body cavity. Support the splined or keyed end of the shaft.

For NPS 10 and 12, inspect the drive shaft (key 3). Insert the splined shaft end with the groove pin hole into the packing box and through the bearing that was previously installed in step 4. Stop before the drive shaft enters the main valve body cavity. Support the end of the drive shaft that extends out from the valve body.

6. For NPS 3 and 4, insert the follower shaft through the outside of the ear of the V-notch ball that has the smaller diameter (non-stepped) hole. Push the follower shaft through the ear until the end of the follower shaft with the groove pin hole is between the ears and the other end of the follower shaft is flush with the outside edge of the ear. Place the ball in the valve body cavity with the ear containing the follower shaft adjacent to the follower shaft bore. Slide the follower shaft through the ear of the ball and into the bearing (key 6) which was previously installed in step 3.

For NPS 6 and 8, locate the smaller diameter hole in the V-notch ball ear. Place the ball in the valve body cavity with the ear containing the smaller diameter hole adjacent to the follower shaft bore. Place the follower shaft between the ears of the ball. Slide the follower shaft through the ear of ball and into the bearing (key 6) that was previously installed in step 3.

For NPS 10 and 12, place the ball in the valve body cavity. Slide the follower shaft, splined end first, through the bearing (key 6) that was previously installed in step 3, and into the ear of the ball. Align the groove pin hole in the follower shaft with the hole in the ball ear.

For NPS 14 through 20, place the thrust washer (key 12) in the groove on the drive ear of the V-notch ball using anti seize lubricant to hold in place if needed. Place the ball in the valve body cavity with the splined V-notch ball ear on the packing box side of the body. Slide the follower shaft through the ear of the ball and into the follower bearing (key 6) installed in step 3. Align the groove pin hole in the follower shaft with the hole in the V-notch ball ear.

7. For NPS 3 through 8, position the ball so that the larger of the two expansion pin holes is facing up, away from the seat ring and retainer. Determine the correct orientation of the V-notch ball (key 2) required by the specific installation orientation of the valve and the flow direction of the process fluid. See figure 2.

For NPS 10 through 20, determine the correct orientation of the V-notch ball (key 2) required by the specific installation orientation of the valve and the flow direction of the process fluid. See figure 2. The groove pin hole in both the drive shaft (key 3) and the ear of the ball are offset from center. Make certain the holes will align.

Note

Before proceeding, inspect the V-notch ball position once again to ensure the correct orientation. If the ball is not properly installed, it will not rotate properly and will not shutoff in service.

8. For NPS 3 through 12, Hold the thrust washer (key 12) between the ball (key 2) and the bearing installed next to the packing (key 6 for NPS 3 through 8 and key 42 for NPS 10 and 12).

Note

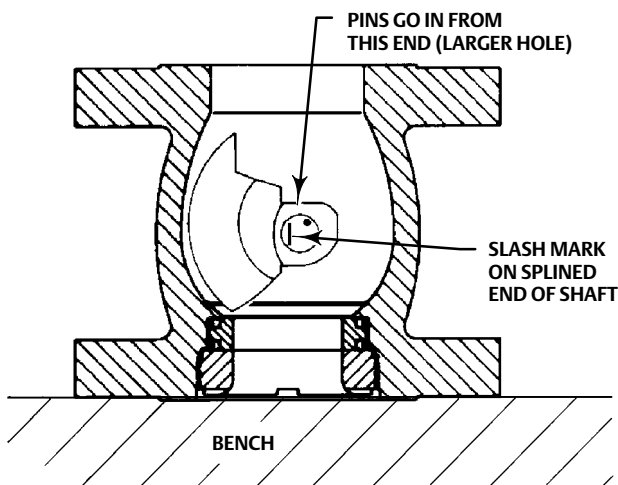
To obtain the correct thickness, two thrust washers (key 12) are needed when using 17-7PH or a single 17-4PH for the NPS 14 through 20. When using alloy 6, only one thrust washer is needed to get the correct thickness.

For NPS 10 through 20, align the zero mark located on the end of the drive shaft with the zero mark located on the ball ear.

Slide the valve drive shaft (key 3) from the packing box into the valve body through the thrust washer and into the ear of the ball. The expansion or groove pin hole in both the drive shaft (key 3) and the ear of the vee-ball are offset from center. Make certain the holes will align.

9. For NPS 3 through 8, secure the ball in the correct open position. Locate the slash mark on the actuator end of the valve drive shaft. Rotate the drive shaft until the slash mark is vertical and facing out from the center of the shaft in the same direction as the ball seating surface. See figure 8.

Figure 8. Taper and Expansion Pin Insertion into Ball and Drive Shaft



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Note

When the valve drive shaft is correctly positioned for NPS 3 through 8, the slash mark on the splined end will be parallel with the ball shutoff surface. See figure 8. If the ball is not properly aligned with the slash mark, the valve will not function correctly.

Step 9 is not required for NPS 10 through 20 because the drive shaft and the ear of the ball are both splined and were aligned in step 8.

10. Secure the ball to the follower shaft by aligning the groove pin hole in the ball ear and the hole on the opposite side of this ear with the groove pin hole through the follower shaft (key 38).
11. Use pin punches to drive in the groove pin until it is flush with the surface of the ball ear. Stake both ends of the pin hole in the ball ear to retain the pin during this step.
12. Secure the ball to the drive shaft (key 3) as follows:

For NPS 3 through 8:

- c. The holes in both the drive shaft (key 3) and the ear of the ball are offset from center. Make certain the holes in the ear of the ball will align with the hole in the drive shaft.

Note

If the holes in the ball ear do not line up with the hole in the drive shaft, check the slash mark on the splined end of the shaft. Make sure the shaft and ball are properly oriented.

- d. Place the chamfered end of the expansion pin (key 9) into the larger hole in the ball ear (see figure 8).

NOTICE

To avoid damage to the expansion pin, ball, or drive shaft resulting from the application of excessive force on the expansion pin, use appropriate care when driving the expansion pin through the ball and drive shaft. Use the correct tool. Do not use excessive force.

- e. Drive the expansion pin into the larger hole until the chamfered end of the pin reaches the inner lip of the smaller hole on the opposite side of the ball. Closely observe the progress of the pin to avoid striking it after it has reached the lip of the smaller hole.
- f. Place the taper pin (key 10) into the open end of the expansion pin. Drive the taper pin into the expansion pin until the pins, ball, and drive shaft are snug. Do not attempt to drive either pin flush with the ear.

For NPS 10 through 20, the groove pin holes in both the drive shaft (key 3) and the ear of the ball are offset from center and have spline ridges. Make certain the holes in the ear of the ball will align with the hole in the drive shaft. Secure the ball to the drive shaft by using pin punches and driving in the groove pin until it is flush with the surface of the ball ear. Make certain that the groove pin goes completely through the drive shaft and into the opposite side of the ball ear.

13. Rotate the ball by hand to check that it rotates properly. If rotation interferes with the valve body, drive out the taper and expansion pins (keys 9 and 10) for NPS 3 through 8 and the groove pin (key 39) that fastens the drive shaft to the ball for NPS 10 and 12. Remove the drive shaft (key 3), and repeat this procedure starting with step 5.
14. For NPS 3 through 8, install the pipe plug (key 29).
15. For NPS 14 through 20, if the valve has a vertical mounting spring (key 54) then install a spring seat (key 53) into the follower shaft as shown in figure 13 followed by the spring (key 54) and another spring seat (key 53) and finally the thrust washer (key 55) can sit in the bottom flange (key 40) groove.

16. For NPS 10 through 20, lubricate the bottom flange studs (key 43) and hex nuts (key 43) with appropriate anti-seize lubricant. Install the bottom flange studs (key 43), gasket (key 41), bottom flange (key 40), and then install and tighten the hex nuts (key 44) using accepted bolting procedures. See table 8 for torque values. Make sure the pipe plug (key 29) is installed in the bottom flange if applicable.

Table 8. NPS 10 through 20 Torque Levels

VALVE SIZE, NPS	TORQUE		STUD SIZE
	N•m	Lbf•ft	
10	141	104	9/16-12
12	176	130	5/8-11
14	442	325	7/8-9
16			
20			

17. If the seat ring (key 4), face seals (key 8), and retainer (key 5) need to be installed, complete the Assembly portion of the Replacing Retainer, Seat Ring, and Face Seals procedure in this manual. If the seat ring has previously been installed, proceed to Adjusting Actuator Travel in this manual. If the packing has been removed, be sure to refer to the Packing Maintenance procedures in this manual to replace the packing before installing the actuator on the valve.

Cavitrol Hex Replacement

Disassembly

WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

1. Isolate the control valve from line pressure, drain the process media from both sides of the valve, and remove the control valve/actuator assembly from the pipeline as described in the replacing retainer, seat ring, and face seals section.
2. Place the valve on a protected flat surface with the body outlet flange facing up.
3. Refer to figures 15 and 16. Remove the two fasteners (key 48) securing the Cavitrol Hex trim to the valve body.

WARNING

To avoid personal injury or property damage, do not use the two threaded lifting holes provided in the NPS 8 through NPS 12 Cavitrol Hex trim to lift the complete valve assembly. The two threaded holes are sized for lifting the Cavitrol Hex trim only.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations, and applicable lifting and rigging equipment standards. Lifting and rigging equipment used to lift, install, or remove the Cavitrol Hex trim must be properly selected and sized for the weight of the component. The weights of the Cavitrol Hex trim are provided in table 9.

4. For sizes NPS 8 through NPS 12, install hoist rings or other appropriate lifting equipment into the two 3/8"-16 threaded holes in the Cavitrol Hex flange.
5. Remove the Cavitrol Hex trim (key 49) and place on a protected flat surface.
6. Remove gasket (key 50) from the valve body outlet flange.

Assembly

The Cavitrol Hex anti-cavitation trim (key 49) is available for the NPS 4 through NPS 12 CV500 with raised-face flanged body constructions. To retrofit the Cavitrol Hex to an existing valve assembly, special body machining is required. Two threaded holes must be added to the valve body outlet flange. Contact your [Emerson sales office](#) for retrofit information.

Note

The Cavitrol Hex anti-cavitation trim will add 12.7 mm (1/2-inch) to the face to face dimension of the valve.

1. The Cavitrol Hex anti-cavitation trim (key 49) is to be installed last, after the CV500 valve body assembly is complete. The recommended valve orientation for assembly is with the body outlet flange facing up. Refer to figures 15 and 16.
2. Ensure the ball is in the open position.
3. Place the gasket (key 50) over the body outlet flange serrated surface as illustrated in figure 15.
4. For sizes NPS 8 through NPS 12, install hoist rings or other appropriate lifting equipment into the two 3/8"-16 threaded holes in the Cavitrol Hex flange.

Table 9. Fisher Cavitrol Hex Dimensions and Weight

VALVE SIZE	FLANGE THICKNESS C (ADD TO OVERALL FACE-TO-FACE DIMENSION)		WEIGHT	
NPS	mm	Inch	kg	lbs
4	12.7	0.5	3.3	7.3
6	12.7	0.5	7.8	17.3
8	12.7	0.5	12.8	28.3
10	12.7	0.5	24.0	53.1
12	12.7	0.5	35.7	78.8

5. Insert the Cavitrol Hex anti-cavitation trim into the valve, ensuring the holes in the body outlet flange align with the holes in the trim flange. If applicable, remove the lifting equipment used to install Cavitrol Hex trim.
6. Install two fasteners (key 48) and adequately tighten to secure the trim to the valve assembly.

Adjusting Actuator Travel

Note

For valve sizes NPS 14 through 20 this procedure should be done without the retainer gasket installed.

For valve sizes NPS 14 through 20 ordered without an actuator a temporary zero mark will exist on the shaft (key 3) and packing flange (key 102). The closed position of the valve is achieved when the two marks are aligned, and the actuator travel stops can be adjusted accordingly.

The temporary marks indicating the closed position on sizes NPS 14 through 20 ordered without an actuator are only to be used when setting the travel stops on the actuator for the first time. The marks should be removed after.

Perform this procedure whenever the actuator is removed or disconnected from the valve and whenever the seat ring and retainer (keys 4 and 5) are removed. Too little actuator travel will increase shutoff leakage; too much travel will cause excessive ball and seat ring torque and wear.

Any of the Fisher pneumatic, electric, electrohydraulic, or manual actuators--or any other actuator--must be adjusted for use with a CV500 valve so that the ball is rotated to the fully closed position. For sizes NPS 3 through 12, a gap of approximately 0.0254 mm (0.001 inch) for temperatures to 260°C (500°F) or 0.1524 mm (0.006 inch) for higher temperatures measured between the seat ring (key 5) and retainer (key 4) indicates the fully closed position. For sizes 14 through 20, a gap of approximately 0.0254 mm (0.001 inch) is applicable for the entire temperature range of the product.

Note that this gap is also measured when assembling the seat ring, retainer, and face seals to ensure correct assembly. Measure the gap according to this procedure to ensure proper actuator adjustment. Merely completing the assembly measurement is not sufficient.

Travel adjustments vary with the type of actuator (some use turnbuckle assemblies; some use externally adjusted travel stops; others use internal limit switches). Refer to the actuator instruction manual for adjustment instructions.

Note

When mounting the actuator, be sure the ball (key 2) is closed. Do not use a hammer or other tool to drive the actuator lever onto the valve shaft. Clean the valve shaft and actuator lever splines to be sure the actuator lever will slide on easily.

If the lever does not slide on easily, carefully wedge the ball solidly against the actuator-side thrust washer using a screw driver or similar tool in the same location as the pry bar in the installation. Keep the wedge in place while installing the lever, but again, do not drive on the lever.

Remove the wedge after you have clamped the actuator lever on the valve shaft and connected the lever to the actuator piston rod or diaphragm rod.

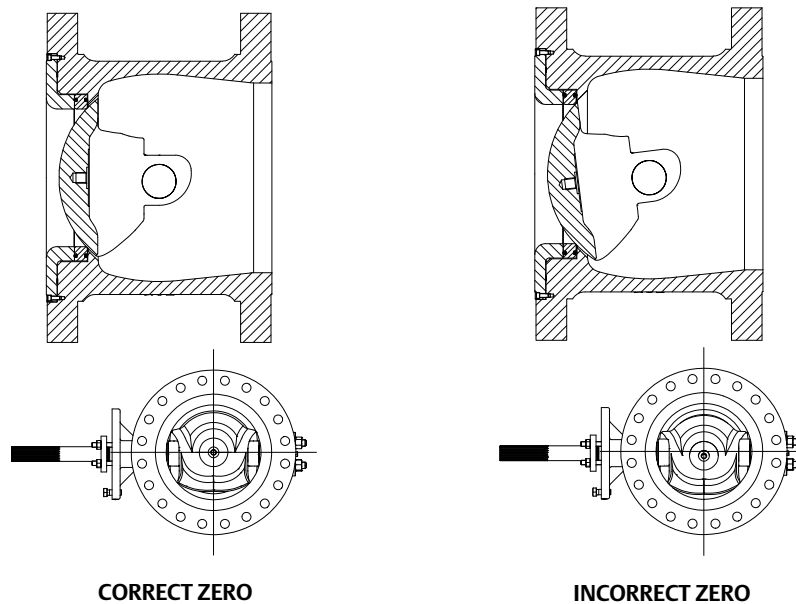
1. Mount the actuator following the instructions in the actuator instruction manual. Refer to figure 2 to select actuator mounting style and position and to orient the actuator lever with the valve drive shaft (key 3).
2. For actuators with clamped levers, pull the drive shaft (key 3) by hand toward the packing (key 13) so that the ball (key 2) and thrust washer (key 12) are tight against the bearing closest to the packing (key 6 for NPS 3 through 8 and key 42 for NPS 10 and 12). Clamp the lever to the valve drive shaft.

NOTICE

Do not apply full actuator signal (pressure or power) to the actuator in the next step. A full signal may wedge the ball into the seat ring. Use a regulated signal source and gradually increase the signal to slowly stroke the actuator.

3. Adjust the actuator travel and stroke the actuator so that the ball is close to but not contacting the seat ring at full actuator travel. If available on electric actuators, use the manual handwheel to position the plug.
4. Adjust the travel, using a full actuator signal, until the ball contacts the seat ring around its full circumference. This contact self-centers the seat ring on the V-notch ball.
5. Continue to adjust the travel until a gap of approximately 0.0254 mm (0.001 inch) exists between the seat ring and retainer, as shown in figure 11, at full actuator travel.
6. Refer to the actuator instruction manual to lock the actuator travel adjustment.
7. For valve sizes NPS 14 through 20, refer to the Assembly procedure of the Replacing Retainer, Seat Ring, and Face Seals section in this manual prior to installing the valve in line.
8. After Zeroing the actuator verify that the seat is not visible when looking at the back face of the vee ball. If it is visible remove the retainer cap screws and retainer and repeat the zeroing procedure and ensure that the retainer cap screws are torqued to 32 in • lbf (3.6 N • m). See figure 9 showing a correctly zeroed valve vs an incorrectly zeroed valve with the seat ring visible.

Figure 9. Zeroing the Actuator



Changing Valve Flow Direction

The CV500 valve may be installed in either forward or reverse flow service. Standard flow direction is forward flow enters the seat ring first, then flows past the V-notch ball. If Cavitrol Hex trim is installed, the valve should be used in the forward flow direction for the anti-cavitation trim to be most effective. If changing flow direction is necessary, release all pressure from the valve and actuator. Remove the control valve assembly from the pipeline and rotate the assembly about the valve drive shaft to put the retainer end of the valve where the other end was. Refer to the procedure for changing actuator mounting style if the actuator must be repositioned, and refer to the installation section to install the control valve assembly. Be sure to reposition the flow direction arrow on the valve.

Changing Actuator Mounting Style

Refer to figure 2 of this manual and the actuator instruction manual when changing mounting styles or positions. Right-hand mounting places the actuator on the right side of the valve as viewed from the upstream side of the valve; left-hand mounting places the actuator on the left side of the valve. Remember that the upstream side of the valve inlet is the retainer end of the valve body for forward flow and the other end of the valve body is the upstream side for reverse flow.

Complete the Adjusting Actuator Travel procedure in this manual whenever the actuator is removed.

Parts Ordering

A serial number is assigned to each valve body and stamped on the nameplate. Always refer to this serial number when corresponding with your [Emerson sales office](#) regarding spare parts or technical information.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Repair Kits

Repair kits include recommended spares for standard and sealed bearing constructions.

VALVE SIZE, NPS		REPAIR KIT NUMBER
3		RV500X00042
4		RV500X00052
6		RV500X00062
8		RV500X00072
Parts Included in Kits		Quantity in Kit
Key Number	Description	
9	Expansion pin	1
10	Taper pin	1
11	Retainer gasket	1
19	O-ring (sealed bearing only)	2
20	O-ring (sealed bearing only)	2

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

CV500 Valve

March 2023

Instruction Manual

D101640X012

Retrofit Kits for ENVIRO-SEAL Packing

Retrofit kits include parts to convert existing CV500 valves with single depth packing box to the ENVIRO-SEAL packing box construction. Retrofit kits include single PTFE or graphite packing box construction (see the following table).

VALVE SIZE, NPS	SHAFT DIAMETER		PART NUMBER	
	mm	Inches	Single PTFE	Graphite
3	25.4	1	RRTYXRT0052	RRTYXRT0352
4	31.8	1-1/4	RRTYXRT0062	RRTYXRT0362
6 & 8	38.1	1-1/2	RRTYXRT0072	RRTYXRT0372
10	44.5	1-3/4	RRTYXRT0682	RRTYXRT0822
12 & 14	53.8	2-1/8	RRTYXRT0722	RRTYXRT0862
16 & 20	76.2	3	RRTYX000272	13B8816X212

Parts Included in Kits			Quantity in Kit	
Key	Description		Single PTFE	Graphite
100	Packing Stud	Packing Stud	2	2
101	Packing Nut	Packing Nut	2	2
102	Packing Flange	Packing Flange	1	1
103	Spring Pack Assembly	Spring Pack Assembly	1	1
105	Packing Set	Packing Set	1	1
106	Anti-Extrusion Washer	Anti-Extrusion Washer	2	---
107	Packing Box Ring	Packing Box Ring	1	1

Repair Kits for ENVIRO-SEAL Packing

Packing boxes in these valves may be deep drilled. If the valve body being repaired has a deep packing box, additional parts are required. Refer to the Packing Maintenance section in this manual.

VALVE SIZE, NPS	SHAFT DIAMETER		PART NUMBER	
	mm	Inches	PTFE	Graphite
3	25.4	1	RRTYX000052	13B8816X092
4	31.8	1-1/4	RRTYX000062	13B8816X112
6 & 8	38.1	1-1/2	RRTYX000072	13B8816X142
10 ⁽¹⁾	44.5	1-3/4	RRTYX000232	13B8816X152
12 & 14 ⁽¹⁾	53.8	2-1/8	RRTYX000252	13B8816X182
16 & 20	76.2	3	---	---
Parts Included in Kits			Quantity in Kit	
Key Number	Description			
105	Packing Set	Packing Set	1	1
106	Anti-Extrusion Washer	Anti-Extrusion Washer	2	--- (2)

1. Order individual parts from the Parts List.
2. Included in packing set key 105.

Cavitrol Hex Retrofit Kit

Kit includes the Cavitrol Hex (key 47), gasket (key 48), and fasteners (key 46). Kits are available for the NPS 4 through 12 CV500 flanged, raised-face body constructions. To retrofit the Cavitrol Hex anti-cavitation trim to an existing valve assembly, special body machining is required. Two threaded holes must be added to the valve body outlet flange. Contact your [Emerson sales office](#) for retrofit information.

VALVE SIZE, NPS	MATERIAL	
	S31603 (316L)	R31233 (Cobalt Alloy)
	KIT PART NUMBER	
4	RCAVHEX0242	RCAVHEX0252
6	RCAVHEX0162	RCAVHEX0172
8	RCAVHEX0182	RCAVHEX0192
10	RCAVHEX0202	RCAVHEX0212
12	RCAVHEX0222	RCAVHEX0232

Figure 10. Fisher CV500 Valve, NPS 3 Through 8

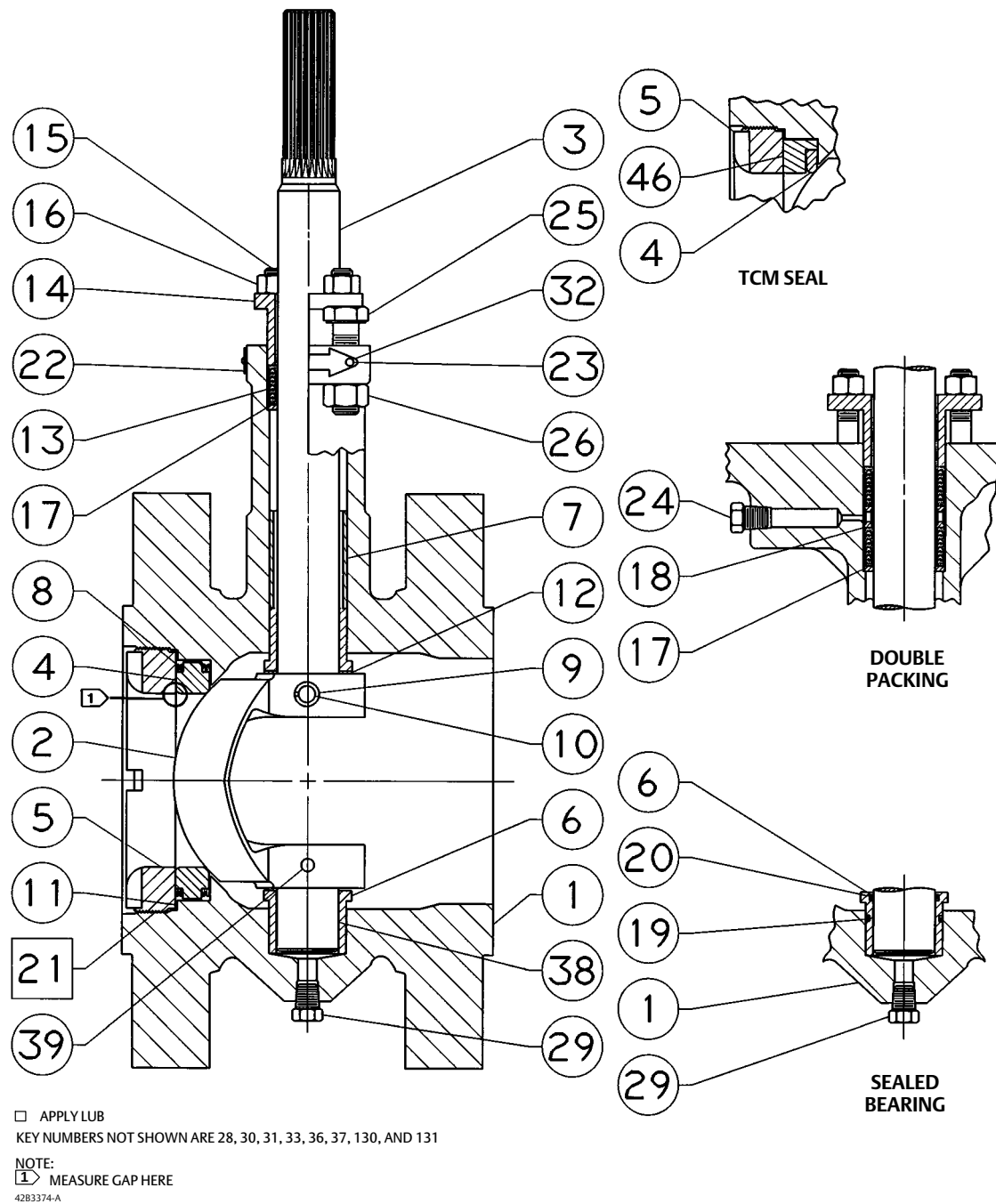
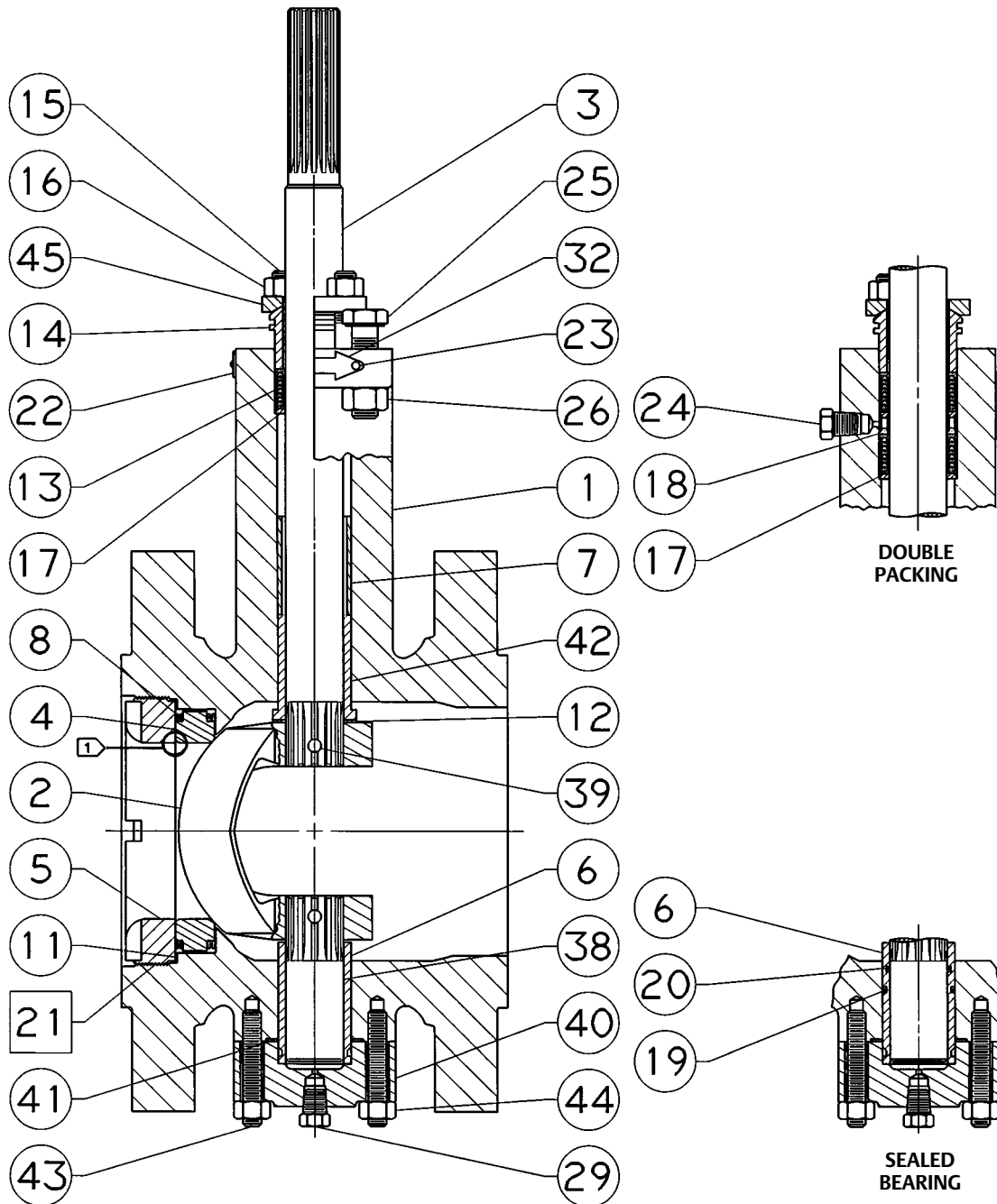


Figure 11. Fisher CV500 Valve, NPS 10 and 12



□ APPLY LUB

KEY NUMBERS NOT SHOWN ARE 28, 30, 31, 33, 36, 37, 130, AND 131

NOTE:

1 MEASURE GAP HERE

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

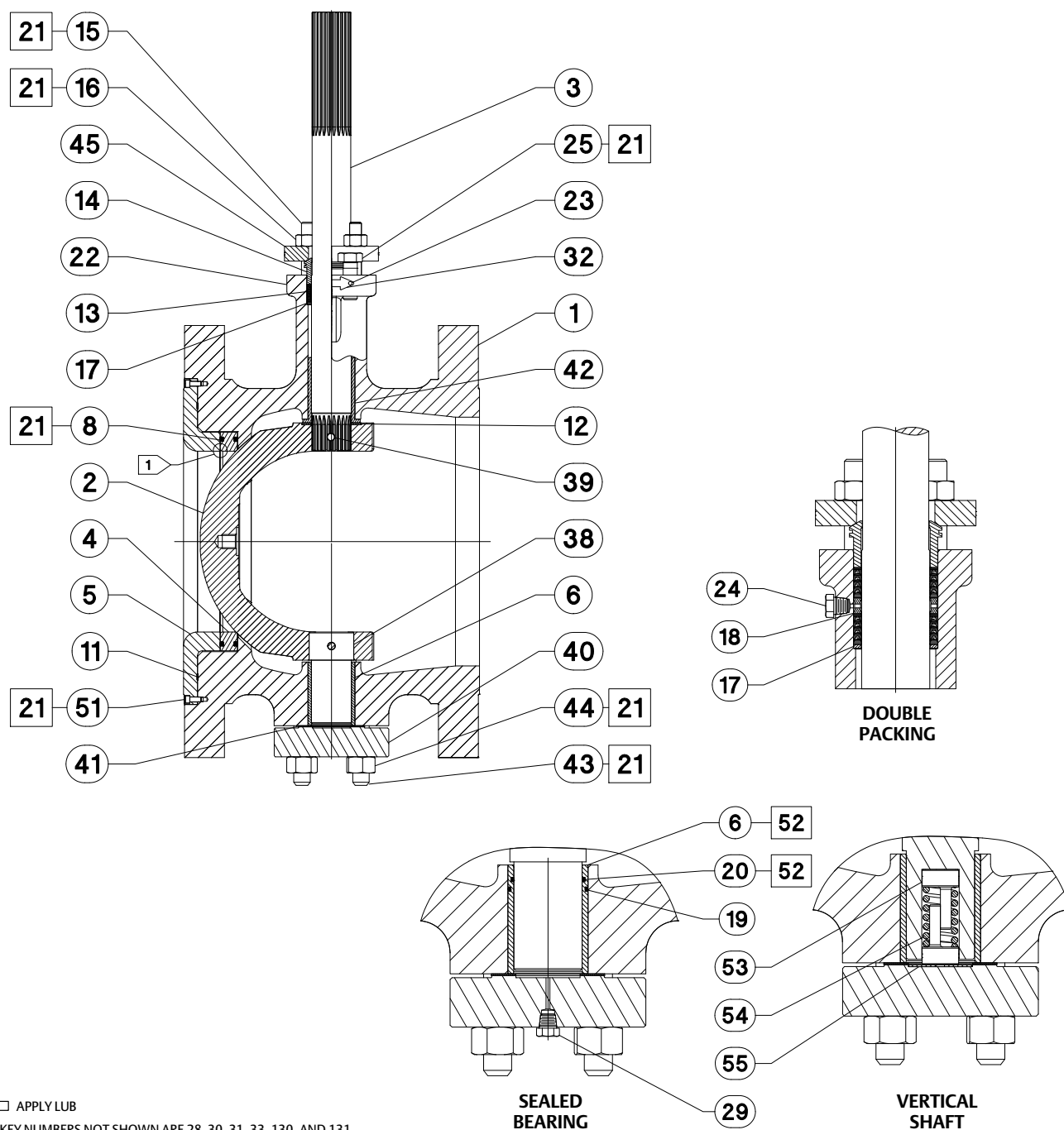
CV500 Valve

March 2023

Instruction Manual

D101640X012

Figure 12. Fisher CV500 Valve, NPS 14 through 20



□ APPLY LUB

KEY NUMBERS NOT SHOWN ARE 28, 30, 31, 33, 130, AND 131

NOTE:

1 MEASURE GAP HERE

198A0414300

Figure 13. Typical ENVIRO-SEAL Rotary Packing Arrangements with PTFE Packing

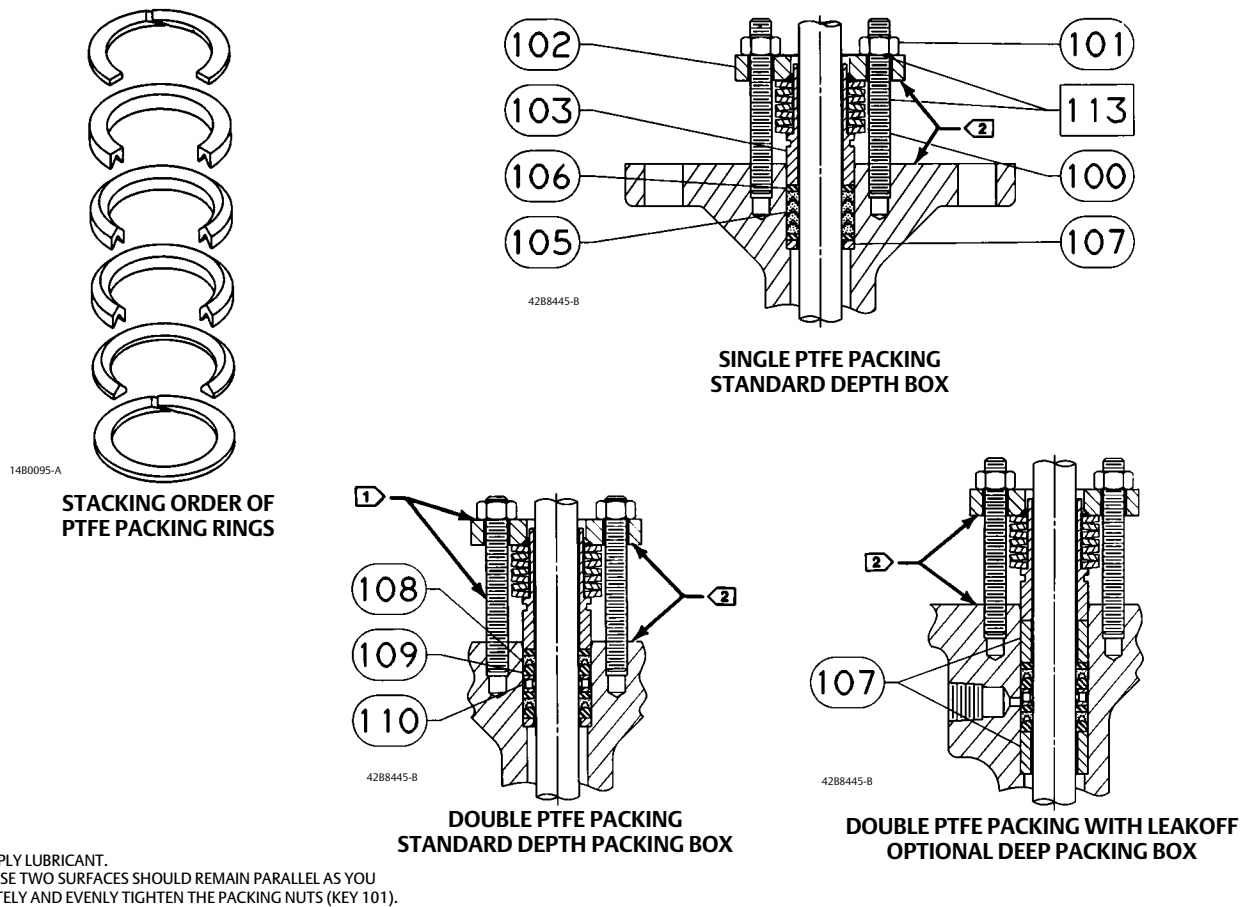


Figure 14. Typical ENVIRO-SEAL Rotary Packing Arrangements with Graphite Packing

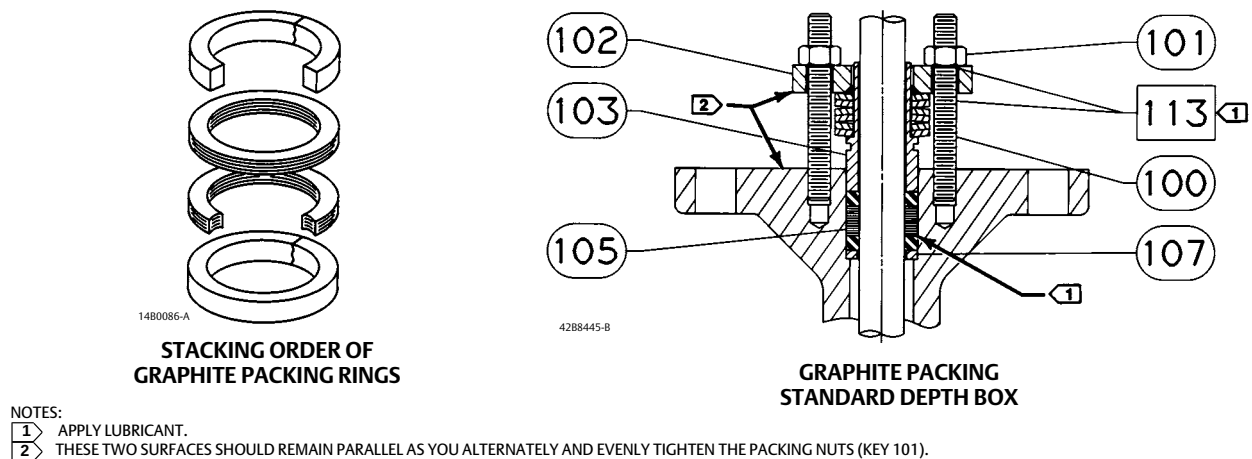
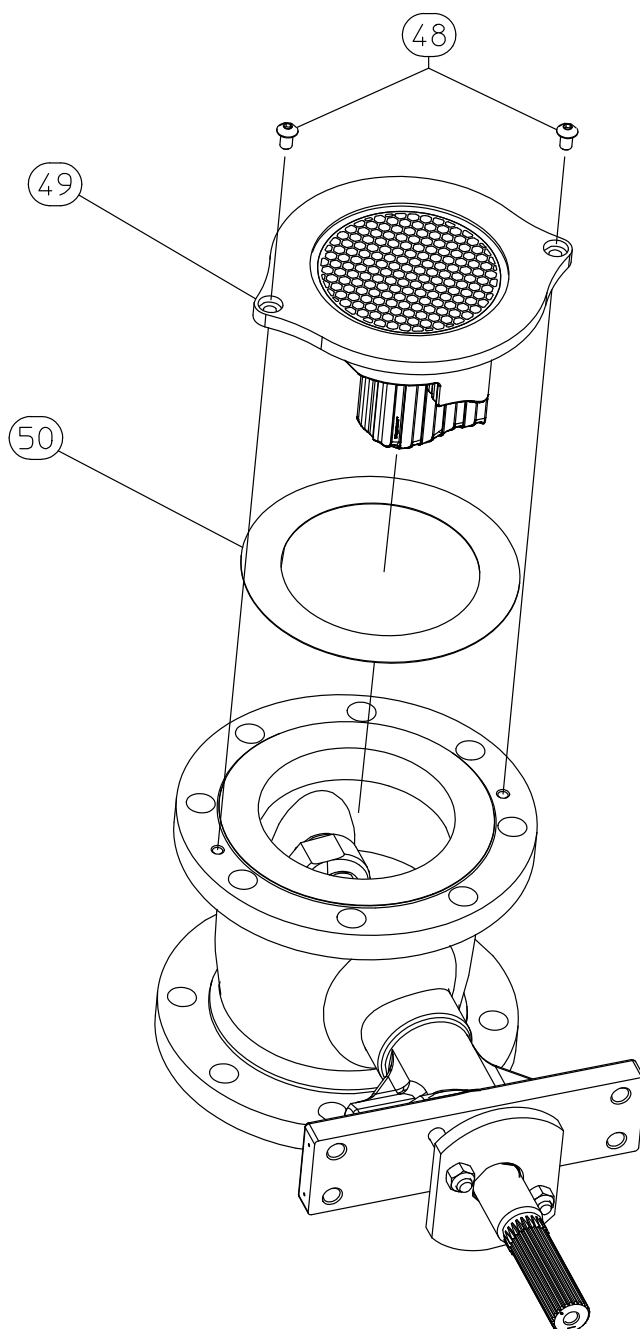
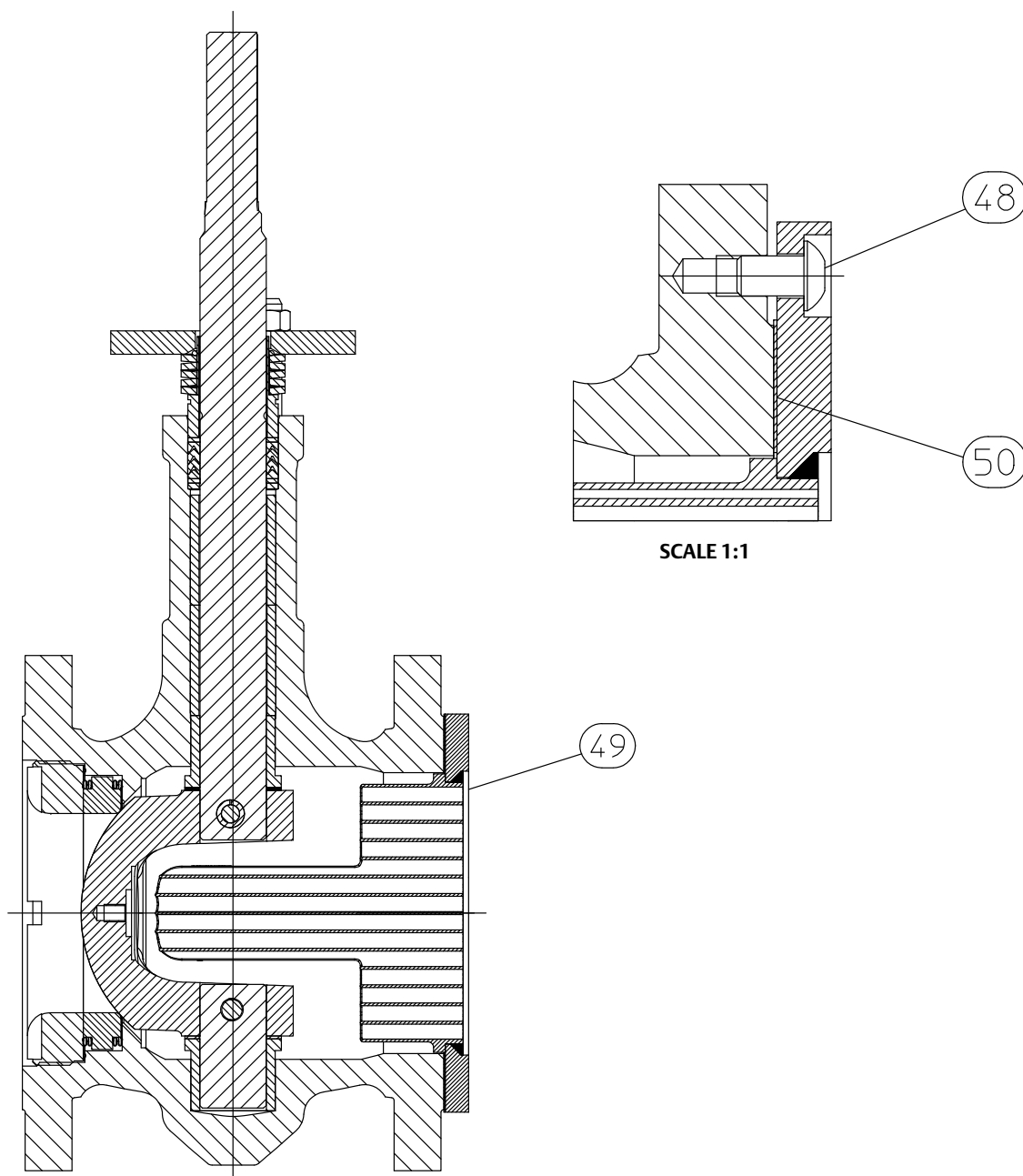


Figure 15. Fisher CV500 Valve with Cavitrol Hex



GH12213

Figure 16. Fisher CV500 Valve Assembly with Cavitrol Hex



Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Valve Body (figures 10 and 11)

Key	Description
1	Body/Bearing Assembly Keys 1 and 7 are included in the valve body/bearing assembly. If a part number is required, contact your Emerson sales office for assistance
2 *	Ball
3 *	Drive Shaft
4 *	Seat Ring
5	Retainer Ring
6 *	Bearing (2 req'd for NPS 3 through 8) (1 req'd for NPS 10 through 20)
7	Bearing Stop
8 *	Face Seal (2 req'd)
9 *	Expansion Pin
10 *	Taper Pin
11 *	Retainer Gasket
12	Thrust Washer (2 req'd for 17-7PH) ⁽¹⁾ (1 req'd for alloy 6)
13 *	Packing Set
14	Packing Follower
15	Packing Flange Stud
16	Packing Flange Nut
17 *	Packing Box Ring
18	Lantern Ring
19 *	O-Ring (for sealed bearings, 2 req'd)
20 *	O-Ring (for sealed bearings, 2 req'd)
21	Anti-seize lubricant
22	Identification Nameplate
23	Drive Screw
24	Pipe plug
25	Cap Screw
26	Hex Nut
28 *	Packing Washer (not shown)
29	Pipe Plug
30	Nameplate

Key	Description
32	Flow Arrow
33	Retainer Tool (Not Shown)
36	Stud
37	Cap Screw
38 *	Follower Shaft
39	Groove Pin
40	Bottom Flange
41 *	Gasket
42 *	Drive Bearing
43	Stud (for bottom flange bolting)
44	Hex Nut (for bottom flange bolting)
45	Packing Flange
48	Screw
49	Cavitrol Hex
50	Gasket
51	Socketed Cap Screw
52	O-ring Lubricant
53	Follower Spring Seat
54	Follower Spring
55	Washer
130	Clamp (Req'd w/non-conductive packing)
131	Bonding Strap Assembly (Req'd w/non-conductive packing)

ENVIRO-SEAL Packing System (figures 13 and 14)

Key	Description
100	Packing Flange Stud
101	Packing Flange Nut
102	Packing Flange
103	Spring Pack Assembly
105 *	Packing Set
106 *	Anti-Extrusion Ring
107 *	Packing Box Ring
108 *	Packing Ring
109 *	Anti-Extrusion Ring
110	Lantern Ring
111	Tag
112	Cable Tie
113	Lubricant

*Recommended spare parts

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www.Fisher.com



Fisher™ CVX Blowdown Fixture

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Introduction

Scope of Manual

This instruction manual includes installation and operation information for the Fisher CVX Blowdown Fixture. Piping blowdown is very important to successful plant startup and trouble free operation. The plan for piping blowdown should be undertaken by professionals familiar with all aspects of blowdown operation. This manual is not intended to cover all details required for successful piping system cleaning.

The CVX Blowdown Fixture is only available for constructions including replaceable diffusers.

Key numbers identified for valve disassembly are shown in the specific valve instruction manual. Refer to separate instruction manuals for instructions covering the exact valve, actuator, and accessories associated with the blowdown fixture.

Do not install, operate, or maintain a CVX Blowdown Fixture without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The CVX Blowdown Fixture provides a convenient way to clean piping upstream of the valve while taking care not to damage internal valve parts.

Educational Services

For information on available courses for the Fisher CVX Blowdown Fixture, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Principle of Operation

The Blowdown Fixture replaces the valve plug and cage and allows steam flow from the upstream piping to be directed through the valve body and out the valve outlet and downstream piping.

Maintenance

WARNING

To avoid personal injury or property damage from release of pressurized process media, ensure that the system is completely depressurized and appropriate safety measures have been taken prior to carrying out any of the following maintenance procedures. Only trained competent individuals with the proper equipment should attempt to disassemble and install a Blowdown Fixture, and reassemble a CVX valve.

- Do not remove the actuator from the desuperheater while the valve is still pressurized.
 - Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
 - Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
 - Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
 - Vent the power actuator loading pressure and relieve any actuator spring precompression.
 - Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
 - The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
 - Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
-

Valve Disassembly

The following valve disassembly steps are intended as a quick reference only. Refer to the CVX instruction manual, D103606X012, for key numbers and further detail regarding valve disassembly.

Actuator Removal

The following actuator disassembly steps are intended as a quick reference only. Refer to the appropriate actuator instruction manual for further detail on actuator removal.

1. Release the actuator seat load by either manually stroking the valve or applying the appropriate instrument signal. The stem connector may be removed once the plug is off of the valve seat.
2. If an instrument signal has been used to stroke the plug off the seat, remove the signal only after removing the stem connector.
3. Isolate and disconnect the operating lines from the actuator.
4. Loosen the yoke fasteners and remove the actuator from the valve.

Packing Box

Unbolt the packing stud nuts, (key 68), and remove the packing flange (key 66) and packing follower, (key 65) (reference the appropriate instruction manual for key numbers). Remove as much packing as possible from the packing box.

CAUTION

Extreme care should be taken to avoid scratching the stem or the packing box.

Bonnet and Trim

1. Loosen the bonnet stud nuts, (key 55) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the bonnet studs, which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

2. Remove the bonnet (key 6) from the valve with uni-axial pull. If the bonnet seems to bind in the valve body, check the alignment of the hoist or pulling mechanism. Deviation from an axial pull of the parts may result in galling or bending of the stem (key 23). The bonnet may be lightly tapped back into alignment with a soft face mallet. The stem and plug should be pushed back into the valve body while the bonnet is being removed. Once the bonnet is removed, dislodge any remaining packing rings from the packing box.

CAUTION

Do not attempt to overpower any binding, as damage to the guide surfaces may result.

3. Remove the packing ring (key 63) from the bottom of the packing box. Lightly sand the inside of the packing box with 60 or 80 grit paper to remove any adherent packing material. Final cleanup should be made with 160 grit or finer paper.

4. Inspect the bonnet guiding surfaces and gasket mating surfaces. Light damage on the guiding surface may be repaired with an emery cloth or other suitable material. Damage to the gasket mating surface may require bonnet replacement to avoid leakage.
5. Remove the plug assembly (key 22, 23, and 53) as a single unit by grasping the valve stem (key 23) and pulling the assembly from the body cavity. The plug assembly contains sensitive guiding and sealing surfaces on its outside diameter and care must be taken in its handling. The plug should be temporarily stored on a clean wooden or cloth surface.
6. Remove the cage (key 21) from the valve body. Remove and discard the upper and lower cage gaskets (key 43). Reference the CVX valve instruction manual for guidance in performing this disassembly. The cage contains sensitive guiding surfaces on its outside diameter and care must be taken during handling. The cage should be temporarily stored on a clean wooden or cloth surface.
7. Clean and inspect the guiding and sealing surfaces of the plug assembly. For balanced plug designs, inspect the piston ring (key 45) and Bore Seal ring (key 46) for signs of excess wear or damage and replace if necessary. The piston ring is a two piece design with an outer seal ring and an inner expander ring. The outer ring diameter should be expanded beyond the diameter of the plug in its free state. It can be shifted within its groove to inspect for uneven wear around its circumference. The piston ring should require some compression when installing the plug into the cage. Lack of required compression indicates that the piston ring has worn or relaxed and should be replaced. Vertical marks in the axial orientation also indicates wear that requires replacement of the ring. The Bore Seal ring has a C-shaped cross section with the open portion of the C-shape facing the stem side of the plug for flow-up designs and the open portion of the C-shape facing the seating surface of the plug for flow-down designs. Any uneven marks around the circumference of the ring or any flattening of the ring shape at its outside diameter are indications of wear and require replacement. Contact your [Emerson sales office](#) or Local Business Partner for Bore Seal ring replacement.
8. Clean and inspect the inside diameter surfaces of the cage. The entire length of the cage inside diameter is either a sealing and/or guiding surface and any measurable wear requires that the cage be replaced.
9. **Bolted Seat Ring Removable Diffuser Only:** The bolted seat ring and seat diffuser must be removed. Loosen the seat ring bolts, (key 76) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the seat ring studs, which may cause binding. Individual bolts should not be completely loosened while the remaining bolts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs. Reference the CVX instruction manual for guiding on removing the bolted seat ring and seat diffuser (key 77). Discard lower diffuser gaskets (key 75). The bolted seat ring and seat diffuser contain sensitive guiding and gasket surfaces on its outside diameter and care must be taken in their handling. The seat ring and seat diffuser should be temporarily stored on a clean wooden or cloth surface.
10. Remove all used gaskets and foreign matter from the interior of the valve and from the inlet and outlet openings. Remove any foreign matter that may be in the valve trim. Inspect all valve body guiding and sealing surfaces for any signs of wear.

Visual Inspection

Visually inspect the interior of the valve for abnormal wear, signs of erosion, or scoring if the valve has been in service. All scores and scratches should be removed by grinding or filing to remove any interference of the clearance zones between the internal bores and the mating parts. The affected area should be sanded with 100 grit or finer paper. Do not attempt to completely remove the score, only the interference should be removed and sanded.

The gasket surfaces of the valve body and bonnet should be inspected to verify that they are not damaged and are free of imbedded gasket material.

Installation of the Blowdown Plug

Inspect the valve to ensure that all parts and gaskets have been removed and the valve body is free from foreign debris. Lubricate the lower body bore where the bolted seat and seat diffuser guide are located and the upper valve body bore and counterbore. Install the trim as noted below and illustrated in the Blowdown Fixture drawings, figure 1.

1. Place the lower cage gasket (key 43) into the valve body.
2. Insert the Blowdown Plug (key 3) into the valve body, making sure that the gasket remains properly placed.

Table 1. Recommended Bonnet Stud Torque⁽¹⁾

Bolt Size, Inch	Threads Per Inch	Recommended Bolt Torque, lbf•ft ⁽²⁾
1	8	405
1-1/8	8	550
1-1/4	8	730
1-3/8	8	980
1-1/2	8	1290
1-5/8	8	1650
1-3/4	8	2070
1-7/8	8	2560
2	8	3130
2-1/4	8	4490

1. Torque values for lubricated threads.
2. Torques for studs with heavy hex nuts.

3. Place the upper cage gasket (key 43) on top of the flange of the Blowdown Plug.
4. Lubricate the bonnet studs (key 54) and lower the bonnet (key 6) onto the valve body, making sure that the upper cage gasket remains in the gasket containment groove.
5. Lubricate and tighten the bonnet fasteners as recommended in the TBX valve instruction manual. Torque values are also shown in table 1 of this document.

CAUTION

Failure to comply with good body-to-bonnet bolting practices and the torque values shown in table 1 or in the appropriate valve instruction manual may result in damage to the valve.

Piping Blowdown with the Blowdown Fixture Installed

⚠ WARNING

To avoid personal injury or property damage from blown out debris, take appropriate measures to stay clear of the outlet of the blowdown piping during the following procedure.

Note

The following steps are not intended to be complete instructions for performing a proper system blowdown. They are intended only to address the basic issues required for proper piping blowdown.

1. Perform piping blowdown according to plant startup procedures. Normal blowdown procedures should incorporate piping velocities in excess of those anticipated during maximum system operation. Piping should be blown down until two subsequent checks of a target placed at the outlet of the blowdown piping indicate that all debris has been removed from the piping.
2. At the completion of the blowdown procedure, secure and depressurize the system.

Disassembly of the Blowdown Fixture

1. Loosen the bonnet nuts, (key 55) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the bonnet flange studs which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

2. Remove the bonnet (key 6) from the valve with uni-axial pull. If the bonnet seems to bind in the valve body, check the alignment of the hoist or pulling mechanism. Deviation from an axial pull of the parts may result in galling or bending of the stem.

CAUTION

Do not attempt to over-power any binding, as damage to the guide surfaces may result.

3. Remove and discard the upper cage gasket (key 43).
4. Remove the Blowdown Plug (key 3) from the valve body cavity using the integral eyebolt holes in the blowdown plug.
5. Remove and discard the lower cage gasket (key 43).

CAUTION

To avoid compromising the service life of the TBX valve body and/or trim, do not reuse the Blowdown Fixture gaskets for valve reassembly.

Cleaning

After removal of the Blowdown Plug, the interior of the valve body should be rinsed with clean water or repeatedly wiped with clean towels until the surfaces are clean to the touch. All internal parts should be cleaned prior to reassembly.

Reassembly

Refer to the CVX valve instruction manual for guidance in reassembling the valve.

Ordering Information

Information required to order a CVX Blowdown Fixture.

- Valve Serial Number
- Valve Tag Number
- Customer Order Number
- Valve Model Number

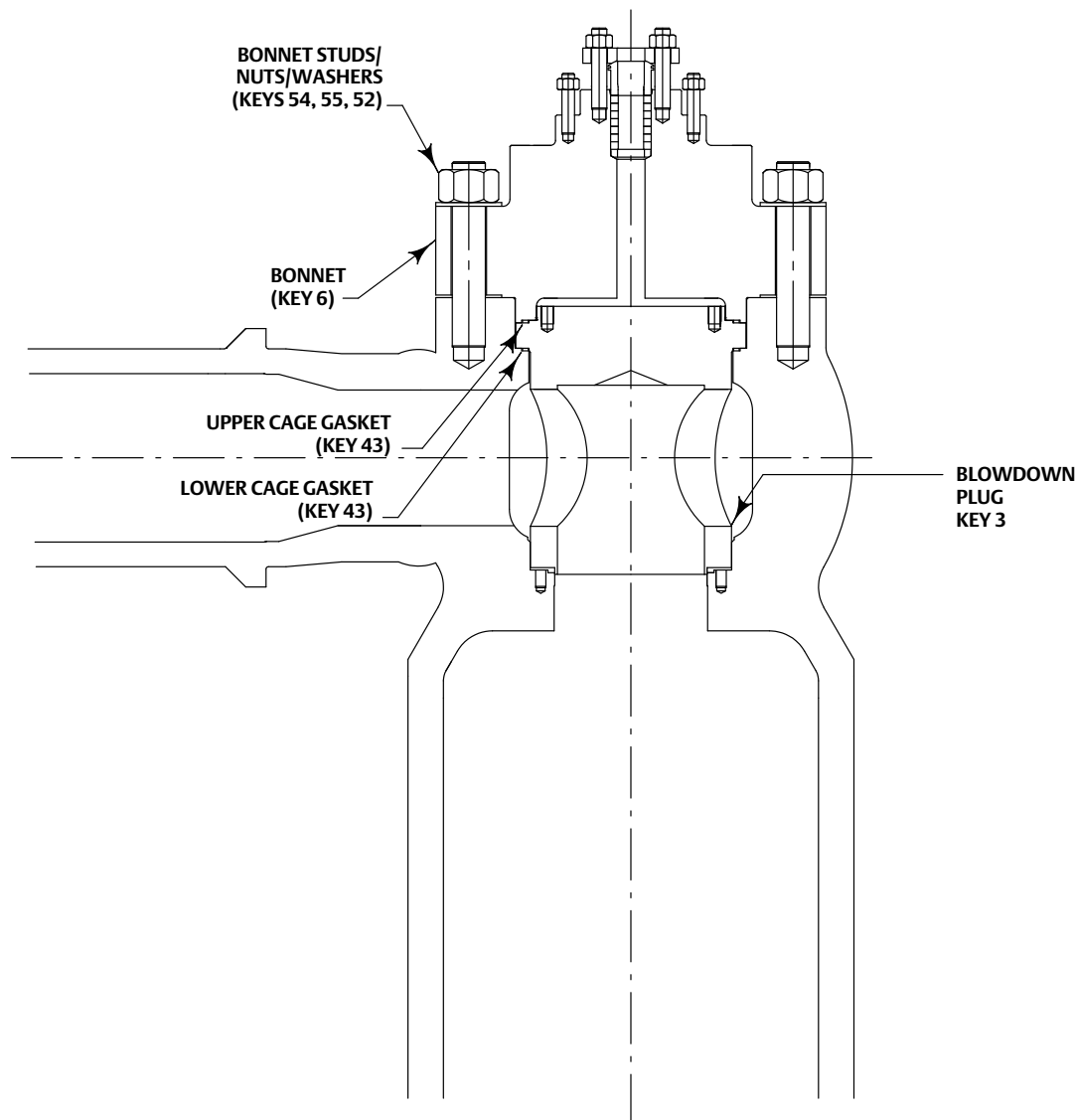
Blowdown Fixture Design Conditions

- Flushing Fluid
- Flushing Fluid Pressure
- Flushing Fluid Temperature
- Material (carbon steel unless otherwise specified)

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 1. Fisher CVX Removable Diffuser Blowdown Fixture



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Fisher® CVX Blowout Fixture

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Introduction

Scope of Manual

This instruction manual includes installation and operation information for the Fisher CVX Blowout Fixture. Piping blowdown is very important to successful plant startup and trouble free operation. The plan for piping blowdown should be undertaken by professionals familiar with all aspects of blowdown operation. This manual is not intended to cover all details required for successful piping system cleaning.

CVX valves are available with either integral welded diffusers or bolted removable diffusers. Some instructions are different between both constructions. See table 1 or consult your Emerson Process Management sales office to determine which blowout fixtures are available for use.

Key numbers identified for valve disassembly are shown in the specific valve instruction manual. Refer to separate instruction manuals for instructions covering the exact valve, actuator, and accessories associated with the blowout fixture.

Do not install, operate, or maintain a CVX Blowout Fixture without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.

Description

The CVX Blowout Fixture provides a convenient way to clean piping upstream of the valve while taking care not to damage internal valve parts.



Educational Services

For information on available courses for the Fisher CVX Blowout Fixture, as well as a variety of other products, contact:

Emerson Process Management
Educational Services, Registration
P.O. Box 190; 301 S. 1st Ave.
Marshalltown, IA 50158-2823
Phone: 800-338-8158 or
Phone: 641-754-3771
FAX: 641-754-3431
e-mail: education@emerson.com

Table 1. Fisher CVX Blowout Fixture Availability

	Flanged Outlet - Bonnet Blowout	Flange Inlet - Bonnet Blowout	BWE Outlet - Bonnet Blowout	BWE Inlet - Bonnet Blowout
CVX welded seat ring & welded integral diffuser	NA	Available	NA	Available
CVX bolted seat ring & welded integral diffuser	NA	Available	NA	Available
CVX bolted seat ring & bolted removable diffuser	Available	Available	Available	Available

Principle of Operation

The Blowout Fixture replaces the valve cage and plug, as well as the valve bonnet. The fixture allows steam flow from the inlet or outlet piping to be directed through the valve, out the blowout fixture, and through temporary piping.

Maintenance

⚠ WARNING

To avoid personal injury or property damage from the release of pressurized process media, ensure that the system is completely depressurized and appropriate safety measures have been taken prior to carrying out any of the following procedures. Only trained competent individuals with the proper equipment should attempt to disassemble and install a Blowout Fixture, and reassemble a CVX valve.

- Do not remove the actuator from the desuperheater while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valve Disassembly

The following valve disassembly steps are intended as a quick reference only. Refer to the CVX instruction manual, D103606X012, for key numbers and further detail regarding valve disassembly.

Actuator Removal

The following actuator disassembly steps are intended as a quick reference only. Refer to the appropriate actuator instruction manual for further detail regarding actuator removal.

1. Release the actuator seat load by either manually stroking the valve or applying the appropriate instrument signal. The stem connector may be removed once the plug is off of the valve seat.
2. If an instrument signal has been used to stroke the plug off the seat, remove the signal only after removing the stem connector.
3. Isolate and disconnect the operating lines from the actuator.
4. Loosen the yoke fasteners, as appropriate, and remove the actuator from the valve.

Packing Box

Unbolt the packing stud nuts, (key 68), and remove the packing flange (key 66) and packing follower, (key 65) (reference the appropriate instruction manual for key numbers). Remove as much packing as possible from the packing box.

CAUTION

Extreme care should be taken to avoid scratching the stem or the packing box.

Bonnet and Trim

1. Loosen the bonnet stud nuts, (key 55) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the bonnet studs which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

2. Remove the bonnet (key 6) from the valve with uni-axial pull. If the bonnet seems to bind in the valve body, check the alignment of the hoist or pulling mechanism. Deviation from an axial pull of the parts may result in galling or bending of the stem (key 23).

CAUTION

Do not attempt to over-power any binding, as damage to the guide surfaces may result.

The bonnet may be lightly tapped back into alignment with a soft face mallet. The stem and plug should be pushed back into the valve body while the bonnet is being removed. Once the bonnet is removed, dislodge any remaining packing rings from the packing box.

3. Remove the packing ring (key 63) from the bottom of the packing box. Lightly sand the inside of the packing box with 60 or 80 grit paper to remove any adherent packing material. Final cleanup should be made with 160 grit or higher paper.
4. Inspect the bonnet guiding surfaces and gasket mating surfaces. Light damage on the guiding surface may be repaired with an emery cloth or other suitable material. Damage to the gasket mating surface may require bonnet replacement to avoid leakage.
5. Remove the plug assembly (key 22, 23, and 53) as a single unit by grasping the valve stem (key 23) and pulling the assembly from the body cavity. The plug assembly contains sensitive guiding and sealing surfaces on its outside diameter and care must be taken in its handling. The plug should be temporarily stored on a clean wooden or cloth surface.
6. Remove the cage (key 21) from the valve body. Remove and discard the upper and lower cage gaskets (key 43). Reference the CVX valve instruction manual for guidance in performing this disassembly. The cage contains sensitive guiding surfaces on its outside diameter and care must be taken during handling. The cage should be temporarily stored on a clean wooden or cloth surface.
7. Clean and inspect the guiding and sealing surfaces of the plug assembly. For balanced plug designs, inspect the piston ring (key 45) and Bore Seal ring (key 46) for signs of excess wear or damage and replace if necessary. The piston ring is a two piece design with an outer seal ring and an inner expander ring. The outer ring diameter should be expanded beyond the diameter of the plug in its free state. It can be shifted within its groove to inspect for uneven wear around its circumference. The piston ring should require some compression when installing the plug into the cage. Lack of required compression indicates that the piston ring has worn or relaxed and should be replaced. Vertical marks in the axial orientation also indicates wear that requires replacement of the ring. The Bore Seal ring has a C-shaped cross section with the open portion of the C-shape facing the stem side of the plug for flow-up designs and the open portion of the C-shape facing the seating surface of the plug for flow-down designs. Any uneven marks around the circumference of the ring or any flattening of the ring shape at its outside diameter are indications of wear and require replacement. Contact your Emerson Process Management sales office for Bore Seal ring replacement.
8. Clean and inspect the inside diameter surfaces of the cage. The entire length of the cage inside diameter is either a sealing and/or guiding surface and any measurable wear requires that the cage be replaced.
9. **Integral welded diffuser only:** The seat ring remains retained inside the valve body regardless if it is bolted or welded. Clean and inspect the angled seating surface. Any detectable damage around the circumference of the seating surface is an indication of wear and requires reconditioning to ensure seating performance. Contact your Emerson Process Management sales office for specific instructions on reconditioning the seating surface.
10. **Removable bolted diffuser only:** The bolted seat ring and removable diffuser must be removed. Loosen the seat ring bolts, (key 76) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the seat ring studs, which may cause binding. Individual bolts should not be completely loosened while the remaining bolts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs. Reference the CVX instruction manual for guiding on removing the bolted seat ring and removable diffuser (key 77). Discard lower cage gaskets (key 75). The bolted seat ring and removable diffuser contain sensitive guiding and gasket surfaces on its outside diameter and care must be taken in their handling. The seat ring and removable diffuser should be temporarily stored on a clean wooden or cloth surface.
11. Remove all used gaskets and foreign matter from the interior of the valve and from the inlet and outlet openings. Remove any foreign matter that may be in the valve body or trim. Inspect all valve body guiding and sealing surfaces for any signs of wear.

Visual Inspection

Visually inspect the interior of the valve for abnormal wear, signs of erosion, or scoring if the valve has been in service. All scores and scratches should be removed by grinding or filing to remove any interference of the clearance zones between the internal bores and the mating parts. The affected area should be sanded with 100 grit or finer paper. Do not attempt to completely remove the score, only the interference should be removed and sanded.

The gasket surfaces of the valve body and bonnet should be inspected to verify that they are not damaged and are free of imbedded gasket material.

Installation of the Blowout Fixture

Inspect the valve to ensure that all parts and gaskets have been removed and the valve body is free from foreign debris. For CVX constructions with welded integral diffusers, lubricate the inside and outside of the seat lip and the upper valve body bore and counterbore. For CVX constructions with bolted removable diffusers, lubricate the lower body bore where the bolted seat and removable diffuser guide are located and the upper valve body bore and counterbore. Install the trim as noted below and illustrated in the Blowout Fixture drawings, figures 1-8.

1. Place the lower cage gasket (key 43) in the valve body.
2. **Integral welded diffuser only:** Insert the blowout plug (key 4 or 5) in the valve body making sure that the gasket remains properly placed. Note that the Blowout Plug must extend to and engage with the seat ring. If there is any question regarding the proper seating of the Blowout Plug inside the valve body, the following measurements can be taken for confirmation. Measure the thickness of the Blowout Plug flange at its largest diameter. Measure the depth of the mating counterbore where the Blowout Plug flange engages into the valve body. When assembled with a new cage gasket, the resulting depth from the top of the valve body to the top of the Blowout Plug flange should be the difference in these two measured values, minus an additional 0.045 inch to allow for the uncompressed gasket.
3. **Removable bolted diffuser only:** Insert the Blowout Plug (key 4 or 5) into the valve body, making sure that the gasket remains properly placed.
4. Place the upper cage gasket (key 43) on top of the Blowout Plug flange.
5. Lubricate the bonnet studs (key 54) and lower the blowout bonnet (key 10) onto the valve body, making sure that the upper cage gasket remains located in the gasket containment groove.
6. Lubricate and tighten the bonnet fasteners as recommended in the CVX valve instruction manual. Torque values are also shown in table 2 of this document.

CAUTION

Failure to comply with good body-to-bonnet bolting practices and the torque values shown in table 2 or in the appropriate valve instruction manual may result in damage to the valve.

Piping Blowdown with the Blowout Fixture Installed

⚠ WARNING

To avoid personal injury or property damage from sudden release of process pressure or bursting of parts, do not exceed the pressure class rating of the blowout fixture when performing the piping blowdown.

Note

The following steps are not intended to be complete instructions for performing a proper system blowdown. They are intended only to address the basic issues required for proper piping blowdown.

1. Connect temporary piping to the Blowout Bonnet connection taking care not to impose excessive piping loads on the valve-to-bonnet connection.
2. Perform piping blowdown according to plant startup procedures. Normal blowdown procedures should incorporate piping velocities in excess of those anticipated during maximum system operation. Piping should be blown down until two subsequent checks of a target placed at the outlet of the blowdown piping indicate that all debris has been removed from the piping.
3. At the completion of the blowdown procedure, secure and depressurize the system.

Table 2. Recommended Bonnet Bolt Torque

Bolt Size, Inch	Threads per Inch	Recommended Bolt Torque, lbf•ft ⁽¹⁾
1	8	405
1-1/8	8	550
1-1/4	8	730
1-3/8	8	980
1-1/2	8	1290
1-5/8	8	1650
1-3/4	8	2070
1-7/8	8	2560
2	8	3130
2-1/4	8	4490

1. Torques for studs with heavy hex nuts.

Disassembly of the Blowout Fixture

1. Disconnect the temporary piping connection from the Blowout Bonnet.
2. Loosen the Blowout Bonnet nuts, (key 55) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the bonnet flange studs which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

3. Remove the Blowout Bonnet (key 10) from the valve with uni-axial pull. If the Blowout Bonnet seems to bind in the valve body, check the alignment of the hoist or pulling mechanism. Deviation from an axial pull of the parts may result in galling or bending of the stem.

CAUTION

Do not attempt to over-power any binding, as damage to the guide surfaces may result.

4. Remove and discard the upper cage gasket (key 43).
5. Remove the Blowout Plug (key 5) from the valve body cavity using the integral eyebolt holes in the Blowout Plug.
6. Remove and discard the lower cage gasket (key 43).

CAUTION

To avoid compromising the service life of the CVX valve body and/or trim, do not reuse the Blowout Fixture gaskets for valve reassembly.

Cleaning

After removal of the blowout trim, the interior of the valve body should be rinsed with clean water or repeatedly wiped with clean towels until the surfaces are clean to the touch. All internal parts should be thoroughly cleaned prior to reassembly of the valve.

Reassembly

Refer to the CVX valve instruction manual for guidance in reassembling the valve.

Ordering Information for Flanged Fixture

Information required for specifying and ordering the CVX Blowout Fixture. See figures 1 to 4.

Valve Information

- Valve Serial Number
- Valve Tag Number
- Customer Order Number
- Valve Model Number

Blow Fixture Design Conditions

- Flushing Fluid
- Flushing Fluid Pressure
- Flushing Fluid Temperature
- Material (carbon steel unless otherwise noted)
- Blow Fixture Pressure Class: CL300 (this is the default class if not otherwise specified)

Ordering Information for BWE Fixture

Information required for specifying and ordering the CVX Blowout Fixture. See figures 5 to 8.

Valve Information

- Valve Serial Number
- Valve Tag Number
- Customer Order Number
- Valve Model Number

Blow Fixture Design Conditions

- Flushing Fluid
- Flushing Fluid Pressure
- Flushing Fluid Temperature
- Material (carbon steel unless otherwise noted)
- Blow Fixture Pressure Class: CL300 (this is the default class if not otherwise specified)
- Blow Fixture Outlet Pipe Schedule (Schedule XS unless otherwise noted)

Figure 1. Fisher CVX Welded Seat Ring Integral Diffuser Flanged Inlet-to-Bonnet Blowout Fixture (Blows Debris from the Inlet)

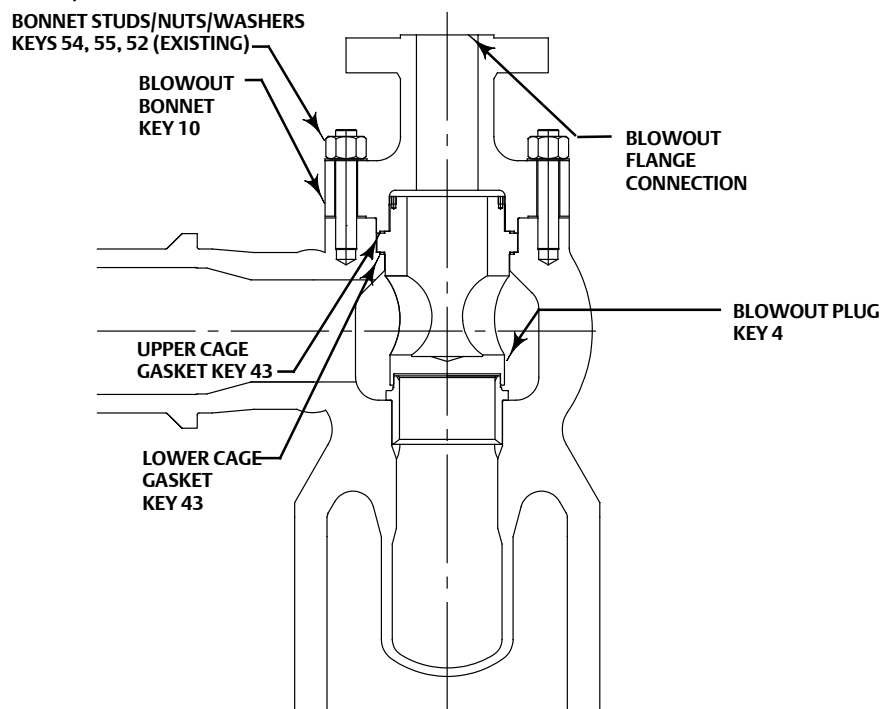


Figure 2. Fisher CVX Bolted Seat Ring Integral Diffuser Flanged Inlet-to-Bonnet Blowout Fixture (Blows Debris from the Inlet)

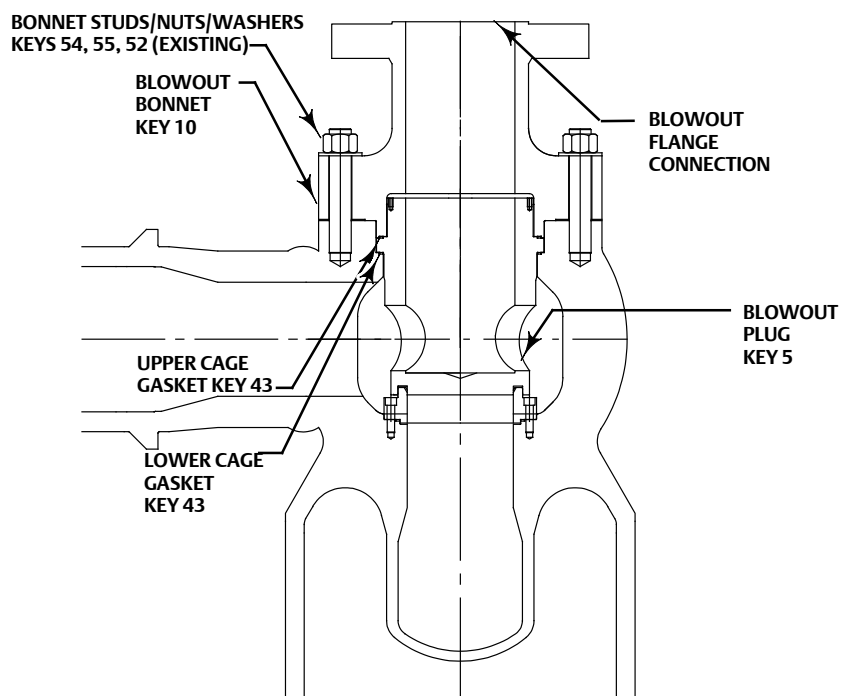


Figure 3. Fisher CVX Bolted Seat Ring Removable Diffuser Flanged Inlet-to-Bonnet Fixture (Blows Debris from the Inlet)

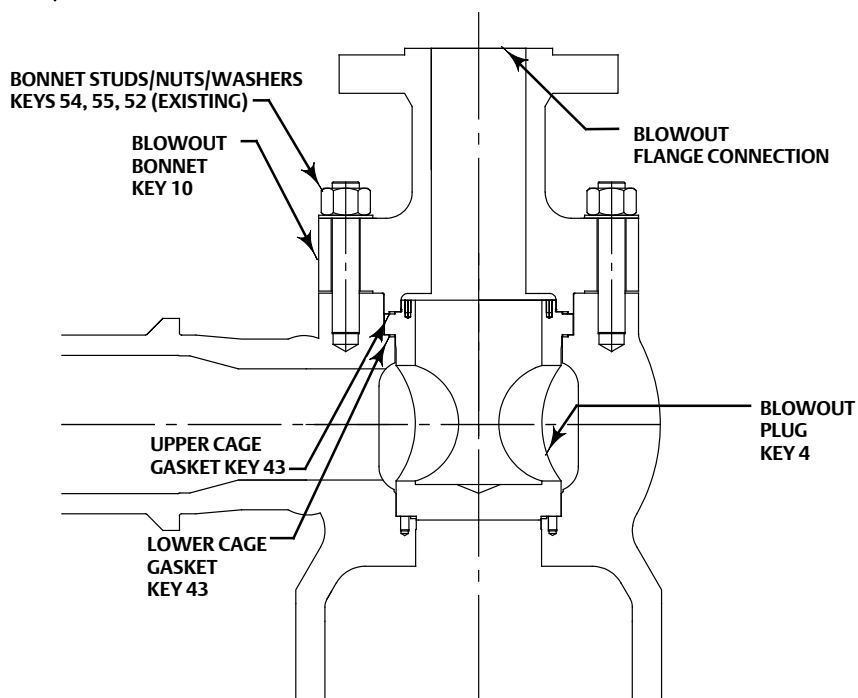


Figure 4. Fisher CVX Bolted Seat Ring Removable Diffuser Flanged Outlet-to-Bonnet Fixture (Blows Debris from the Outlet)

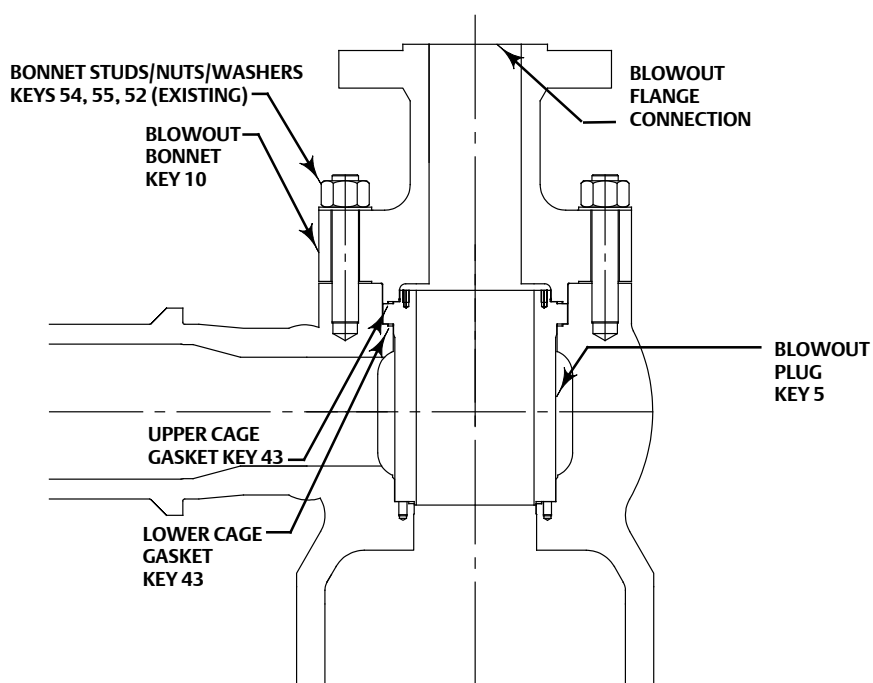


Figure 5. Fisher CVX Welded Seat Ring Integral Diffuser BWE Inlet-to-Bonnet Blowout Fixture (Blows Debris from the Inlet)

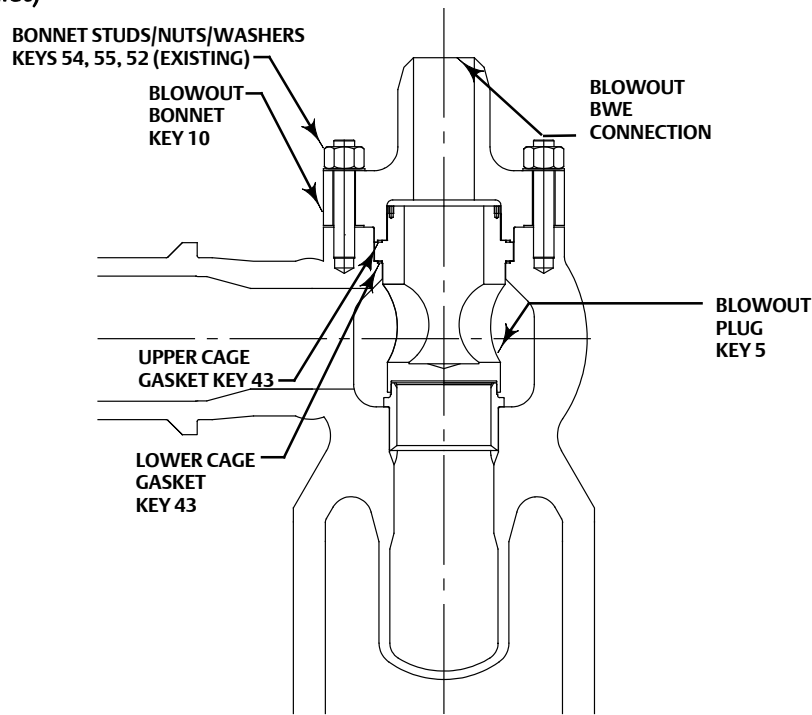


Figure 6. Fisher CVX Bolted Seat Ring Integral Diffuser BWE Inlet-to-Bonnet Blowout Fixture (Blows Debris from the Inlet)

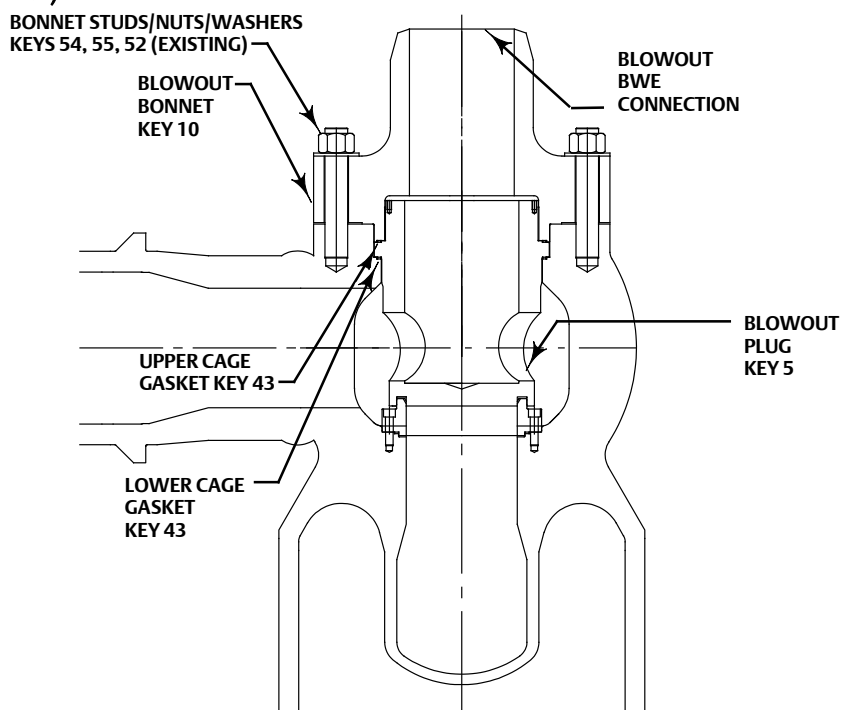


Figure 7. Fisher CVX Bolted Seat Ring Removable Diffuser BWE Inlet-to-Bonnet Fixture (Blows Debris from the Inlet)

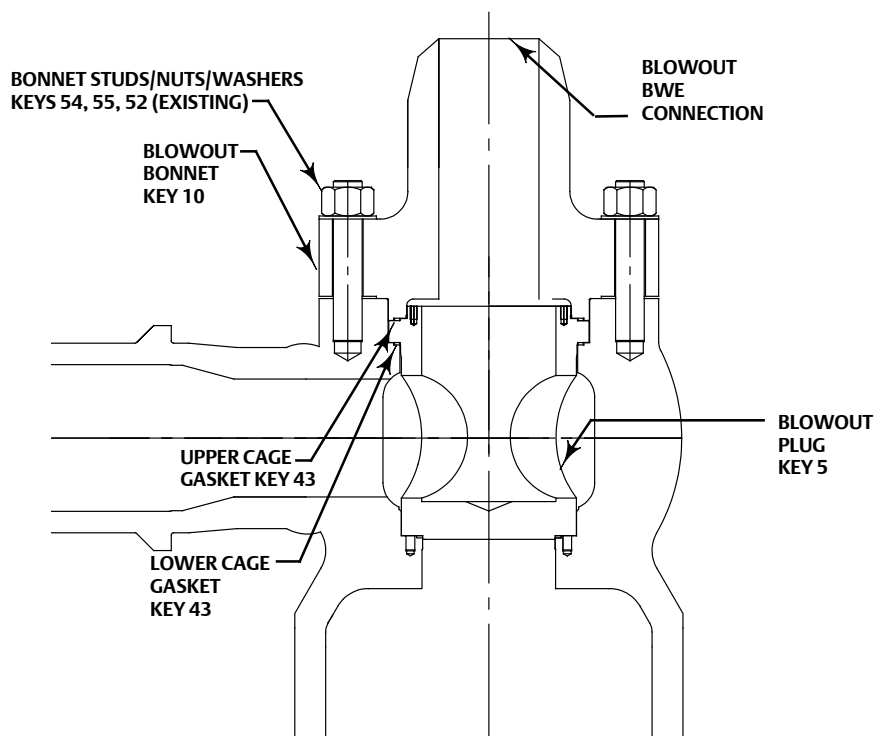
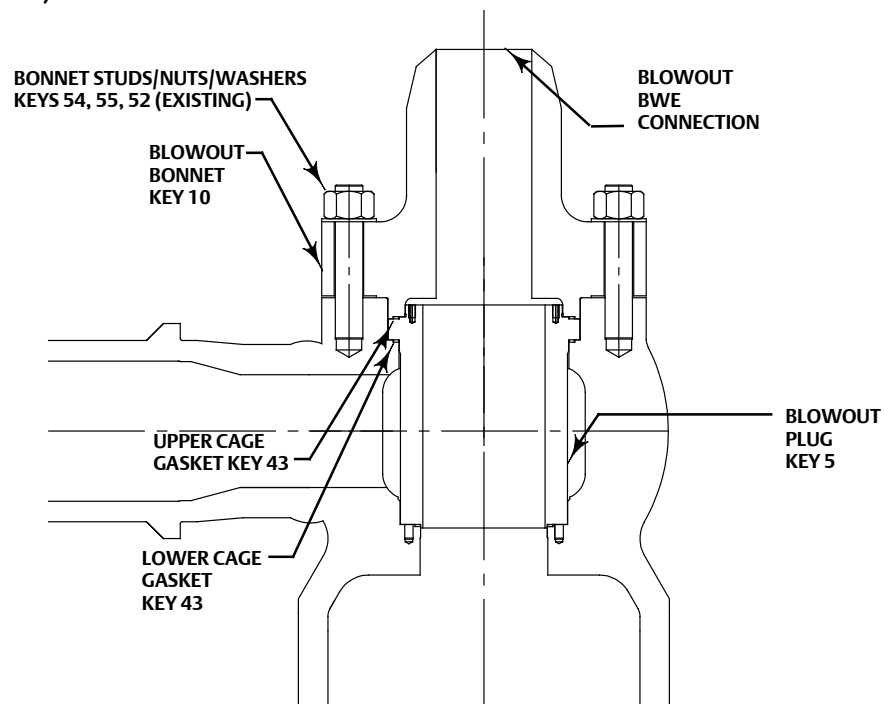


Figure 8. Fisher CVX Bolted Seat Ring Removable Diffuser BWE Outlet-to-Bonnet Fixture (Blows Debris from the Outlet)



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

CVX Blowout Fixture

October 2012

Instruction Manual

D103629X012

⚠ WARNING

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Fisher™ CVX Hydro-Plug Fixture

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Introduction

Scope of Manual

This instruction manual includes installation and operation information for the Fisher CVX Hydro-Plug Fixture. The CVX Hydro-Plug Fixture can be very useful in establishing hydro test boundaries since most CVX valves are split class valves. This manual is not intended to cover all details required for successful hydro testing.

Key numbers identified for valve disassembly are shown in the specific valve instruction manual. Refer to separate instruction manuals for instructions covering the exact valve, actuator, and accessories associated with the Hydro-Plug.

Do not install, operate, or maintain a CVX Hydro-Plug Fixture without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The CVX Hydro-Plug fixture provides a convenient way to establish hydrotest boundaries associated with using a split class valve typical of the CVX. The Hydro-Plug fixture is intended to be used so that the upstream piping can be tested at the required pressure for body and inlet piping pressure class without overpressurizing the lower pressure class outlet and outlet piping.

Educational Services

For information on available courses for the Fisher CVX Hydro-Plug Fixture, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Principle of Operation

The Hydro-Plug replaces the valve plug and cage and allows pressurization of the valve inlet, valve body, and inlet piping to the appropriate hydro pressure without overpressurizing the lower pressure class valve outlet and outlet piping.

CAUTION

The Hydro-Plug Fixture employs a rubber O-ring to create a positive seal at the valve seat. The sealing integrity of this O-ring will be compromised if the Hydro-Plug is installed when welding the valve body inline, or during welding preheat or post weld heat treatment.

Maintenance

⚠ WARNING

To avoid personal injury or property damage from pressurized escape of process media, ensure that the system is completely depressurized and appropriate safety measures have been taken prior to carrying out any of the following procedures. Only trained competent individuals with the proper equipment should attempt to disassemble and install a Hydro-Plug Fixture, and reassemble a CVX valve.

- Do not remove the actuator from the desuperheater while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.

-
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
-

Valve Disassembly

The following valve disassembly steps are intended as a quick reference only. Refer to the CVX instruction manual, D103606X012, for further detail regarding valve disassembly.

Actuator Removal

The following actuator disassembly steps are intended as a quick reference only. Refer to the appropriate actuator instruction manual for further detail regarding actuator removal.

1. Release the actuator seat load by either manually stroking the valve or applying the appropriate instrument signal. The stem connector may be removed once the plug is off the valve seat.
2. If an instrument signal has been used to stroke the plug off the seat, remove the signal only after removing the stem connector.
3. Isolate and disconnect the operating lines from the actuator.
4. Loosen the yoke locknut or the fasteners and remove the actuator from the valve.

Packing Box

Unbolt the packing stud nuts, (key 68), and remove the packing flange (key 66) and packing follower, (key 65) (reference appropriate instruction manual for key numbers). Remove as much packing as possible from the packing box.

CAUTION

Extreme care should be taken to avoid scratching the stem or the packing box.

Bonnet and Trim

1. Loosen the bonnet stud nuts (key 55), using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the bonnet studs which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

2. Remove the bonnet (key 6) from the valve with uni-axial pull. If the bonnet seems to bind in the valve body, check the alignment of the hoist or pulling mechanism. Deviation from an axial pull of the parts may result in galling or bending of the stem (key 23).

CAUTION

Do not attempt to over-power any binding, as damage to the guide surfaces may result.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

CVX Hydro-Plug Fixture

June 2017

Instruction Manual

D103630X012

The bonnet may be lightly tapped back into alignment with a soft face mallet. The stem and plug should be pushed back into the valve body while the bonnet is being removed. Once the bonnet is removed, dislodge any remaining packing rings from the packing box.

3. Remove the packing ring (key 63) from the bottom of the packing box. Lightly sand the inside of the packing box with 60 or 80 grit paper to remove any adherent packing material. Final cleanup should be made with 160 grit or higher paper.
4. Inspect the bonnet guiding surfaces and gasket mating surfaces. Light damage on the guiding surface may be repaired with an emery cloth or other suitable material. Damage to the gasket mating surface may require bonnet replacement to avoid leakage.
5. Remove the plug assembly (key 22, 23, and 53) as a single unit by grasping the valve stem (key 23) and pulling the assembly from the body cavity. The plug assembly contains sensitive guiding and sealing surfaces on its outside diameter and care must be taken in its handling. The plug should be temporarily stored on a clean wooden or cloth surface.
6. Remove the cage (key 21) from the valve body. Remove and discard the upper and lower cage gaskets (key 43). Reference the CVX valve instruction manual for guidance in performing this disassembly. The cage contains sensitive guiding surfaces on its outside diameter and care must be taken during handling. The cage should be temporarily stored on a clean wooden or cloth surface.
7. Clean and inspect the guiding and sealing surfaces of the plug assembly. For balanced plug designs, inspect the piston ring (key 45) and Bore Seal ring (key 46) for signs of excess wear or damage and replace if necessary. The piston ring is a two piece design with an outer seal ring and an inner expander ring. The outer ring diameter should be expanded beyond the diameter of the plug in its free state. It can be shifted within its groove to inspect for uneven wear around its circumference. The piston ring should require some compression when installing the plug into the cage. Lack of required compression indicates that the piston ring has worn or relaxed and should be replaced. Vertical marks in the axial orientation also indicates wear that requires replacement of the ring. The Bore Seal ring has a C-shaped cross section with the open portion of the C-shape facing the seating surface of the plug for flow-up designs and the open portion of the C-shape facing the seating surface of the plug for flow-down designs. Any uneven marks around the circumference of the ring or any flattening of the ring shape at its outside diameter are indications of wear and require replacement. Contact your [Emerson sales office](#) or Local Business Partner for Bore Seal ring replacement.

Table 1. Recommended Bonnet Bolt Torque

Bolt Size, Inch	Threads per Inch	Recommended Bolt Torque, lbf•ft ⁽¹⁾
1	8	405
1-1/8	8	550
1-1/4	8	730
1-3/8	8	980
1-1/2	8	1290
1-5/8	8	1650
1-3/4	8	2070
1-7/8	8	2560
2	8	3130
2-1/4	8	4490

1. Torques for studs with heavy hex nuts.

8. Clean and inspect the inside diameter surfaces of the cage. The entire length of the cage inside diameter is either a sealing and/or guiding surface and any measurable wear requires that the cage be replaced.
9. **Integral Diffuser Constructions Only:** The seat ring remains retained inside the valve body regardless if it is bolted or welded. Clean and inspect the angled seating surface. Any detectable damage around the circumference of the seating surface is an indication of wear and requires reconditioning to ensure seating performance. Contact your Emerson sales office or Local Business Partner for specific instructions on reconditioning the seating surface.
10. **Bolted Seat Ring Removable Diffuser Only:** The bolted seat ring and seat diffuser must be removed. Loosen the seat ring bolts, (key 76) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the

seat ring studs, which may cause binding. Individual bolts should not be completely loosened while the remaining bolts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs. Reference the CVX instruction manual for guiding on removing the bolted seat ring and seat diffuser (key 77). Discard lower diffuser gaskets (key 75). The bolted seat ring and seat diffuser contain sensitive guiding and gasket surfaces on its outside diameter and care must be taken in their handling. The seat ring and seat diffuser should be temporarily stored on a clean wooden or cloth surface.

11. Remove all used gaskets and foreign matter from the interior of the valve and from the inlet and outlet openings. Remove any foreign matter that may be in the valve trim. Inspect all valve body guiding and sealing surfaces for any signs of wear.

Visual Inspection

Visually inspect the interior of the valve for abnormal wear, signs of erosion, or scoring if the valve has been in service. All scores and scratches should be removed by grinding or filing to remove any interference of the clearance zones between the internal bores and the mating parts. The affected area should be sanded with 100 grit or finer paper. Do not attempt to completely remove the score, only the interference should be removed and sanded.

The gasket surfaces of the valve body and bonnet should be inspected to verify that they are not damaged and are free of imbedded gasket material.

Installation of the Hydro-Plug

Inspect the valve to ensure that all parts and gaskets have been removed and the valve body is free from foreign debris. For CVX constructions containing integral diffusers, lubricate the inside and outside of the seat lip and the upper valve body bore and counterbore. For CVX constructions with removable diffusers, lubricate the lower body bore where the bolted seat and removable diffuser guide and the upper valve body bore and counterbore. Install the trim as noted below and illustrated in the Hydro-Plug Fixture drawings, figures 1 to 3).

1. Place the lower cage gasket (key 43) in the valve body.
2. **Integral Diffuser Constructions only:** Insert the Hydro-Plug (key 2) in the valve body, making sure that the gasket remains properly placed. Note that the Hydro-Plug must extend to and engage with the seat ring. If there is any question regarding the proper seating of the Hydro-Plug inside the valve body, the following measurements can be taken for confirmation. Measure the thickness of the Hydro-Plug flange at its largest diameter. Measure the depth of the mating counterbore where the Hydro-Plug flange engages into the valve body. When assembled with a new cage gasket, the resulting depth from the top of the valve body to the top of the Hydro-Plug flange should be the difference in these two measured values, minus an additional 0.045 inch to allow for the uncompressed gasket.
3. **Bolted Seat Ring Removable Diffuser Only:** Insert the Hydro-Plug (key 2) into the valve body, making sure that the gasket remains properly placed.
4. Place the upper cage gasket (key 43) on the Hydro-Plug.
5. Lubricate the bonnet studs (key 54) and lower the bonnet (key 6) onto the valve body, making sure that the upper cage gasket remains in the gasket containment groove.
6. Lubricate and tighten the bonnet fasteners as recommended in the appropriate valve instruction manual. Torque values are also shown in table 1 of this document.

CAUTION

Failure to comply with good body-to-bonnet bolting practices and the torque values shown in table 1 or in the appropriate valve instruction manual may result in damage to the valve.

Piping Hydro Test with Hydro-Plug Fixture Installed

⚠ WARNING

To avoid personal injury or property damage from pressurized escape of process media, ensure that the system is completely depressurized and appropriate safety measures have been taken prior to carrying out any of the following procedures. Only trained competent individuals with the proper equipment should attempt to perform the following procedure.

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

The following steps are not intended to be complete instructions for performing a safe and complete hydrotest. They are intended only to address the basic issues required for hydrotesting.

1. Establish hydrotest boundaries to ensure that all required components are tested without overpressurizing the lower pressure class piping and components. After following all safety precautions and venting the system of air, raise the system to the required hydrotest pressure.
2. At the completion of the hydrotest procedure, secure and depressurize the system.

Disassembly of the Hydro-Plug Fixture

1. Loosen the bonnet nuts, (key 55) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the bonnet flange studs which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

2. Remove the bonnet (key 6) from the valve with uni-axial pull. If the bonnet seems to bind in the valve body, check the alignment of the hoist or pulling mechanism. Deviation from an axial pull of the parts may result in galling or bending of the stem.

CAUTION

Do not attempt to over-power any binding, as damage to the guide surfaces may result.

3. Remove and discard the upper cage gasket (key 43).
4. Remove the Hydro-Plug (key 2) from the valve body cavity using the integral eyebolt holes in the Hydro-Plug.
5. Remove and discard the lower cage gasket (key 43).

CAUTION

To avoid compromising the service life of the CVX valve body and/or trim, do not reuse the blowout gaskets for valve reassembly.

Cleaning

After removal of the hydro-plug, the interior of the valve body should be rinsed with clean water or repeatedly wiped with clean towels until the surfaces are clean to the touch. All internal parts should be cleaned prior to reassembly.

Reassembly

Refer to the appropriate valve instruction manual for guidance in reassembling the valve.

Ordering Information for Hydro-Plug Fixture

Information required for specifying and ordering the CVX Hydro-Plug Fixture.

Valve Information

- Valve Serial Number
- Valve Tag Number
- Customer Order Number
- Valve Model Number
- Material (carbon steel unless otherwise specified)

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 1. Fisher CVX Welded Seat Ring Integral Diffuser Hydro-Plug

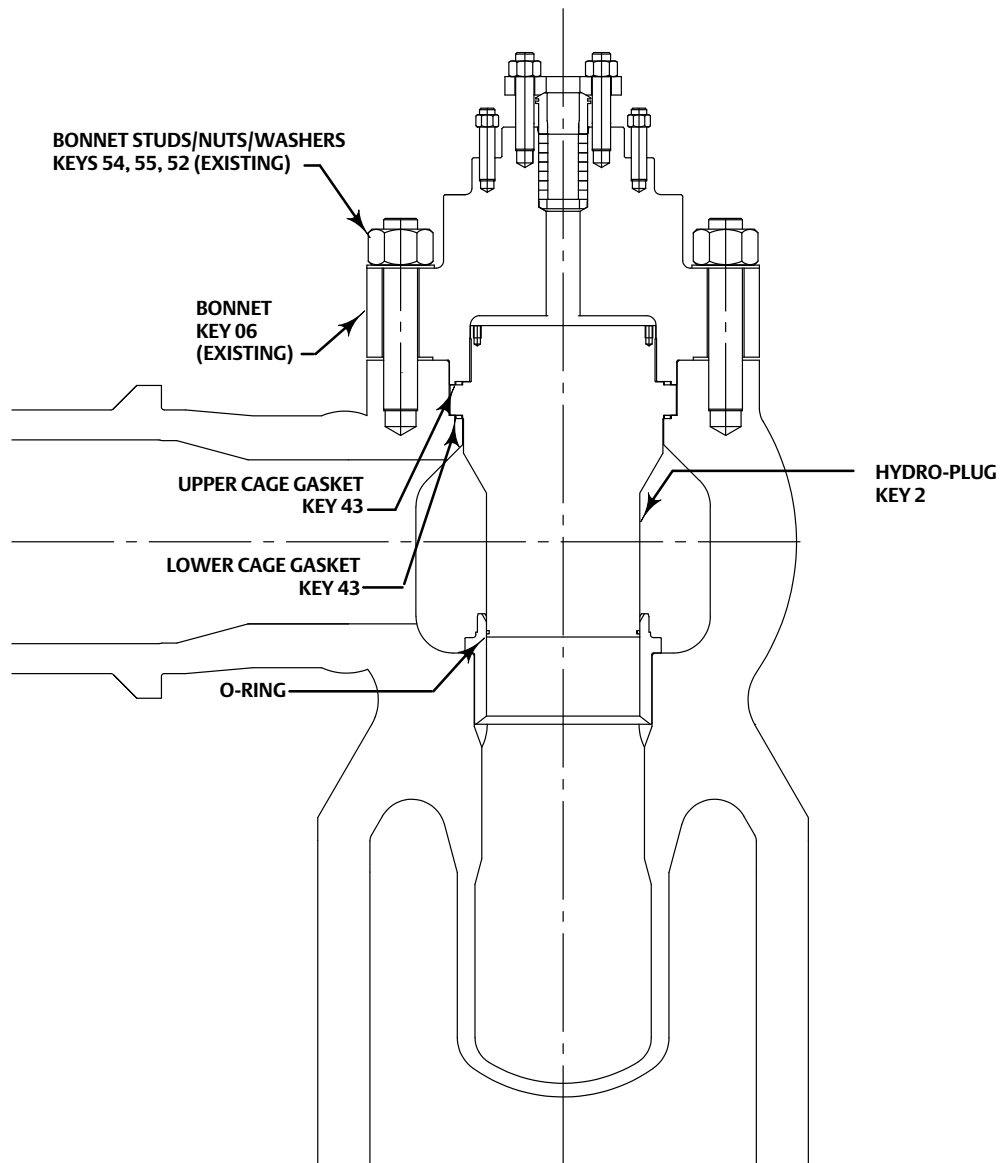


Figure 2. Fisher CVX Bolted Seat Ring Integral Diffuser Hydro-Plug

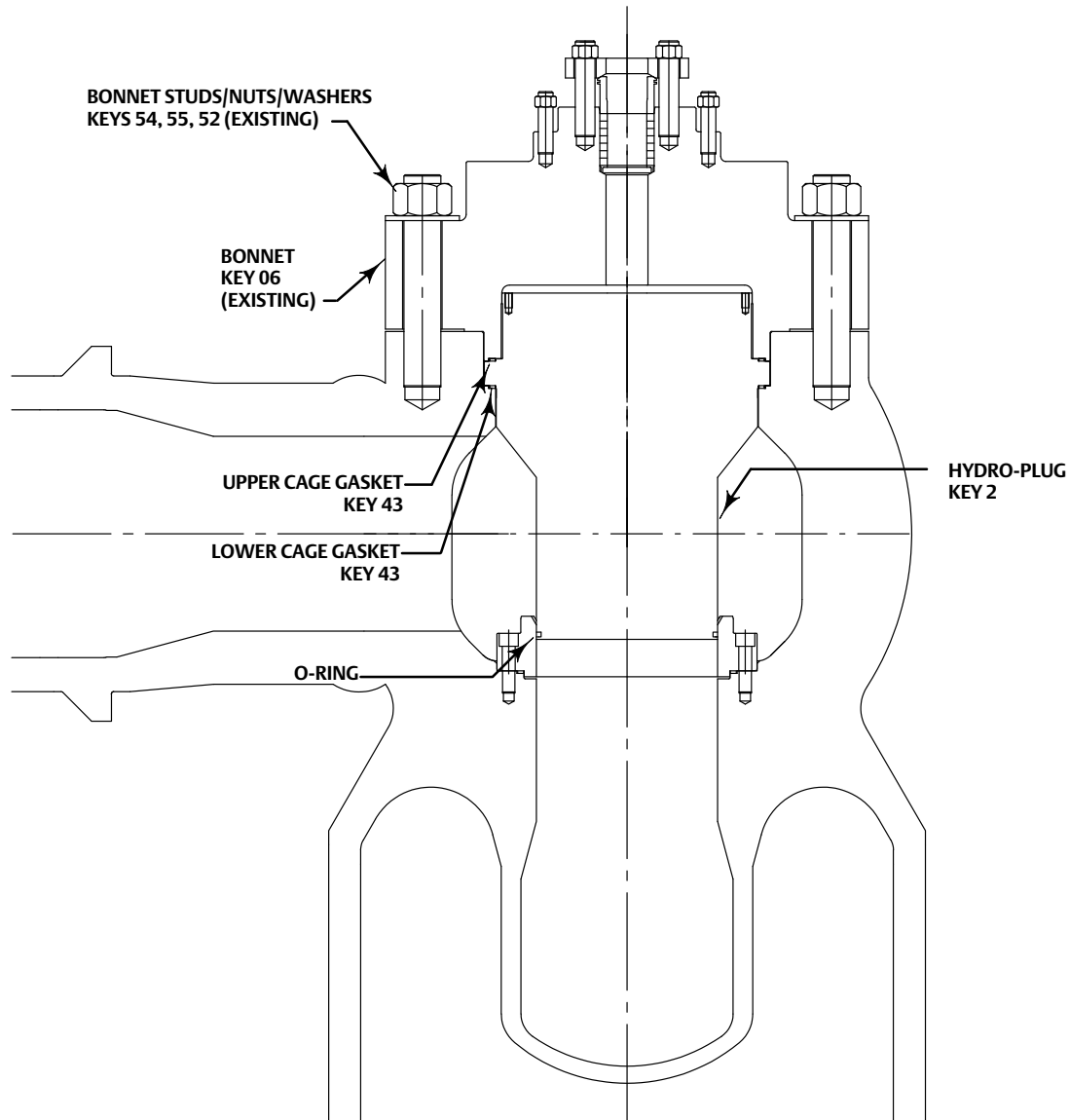
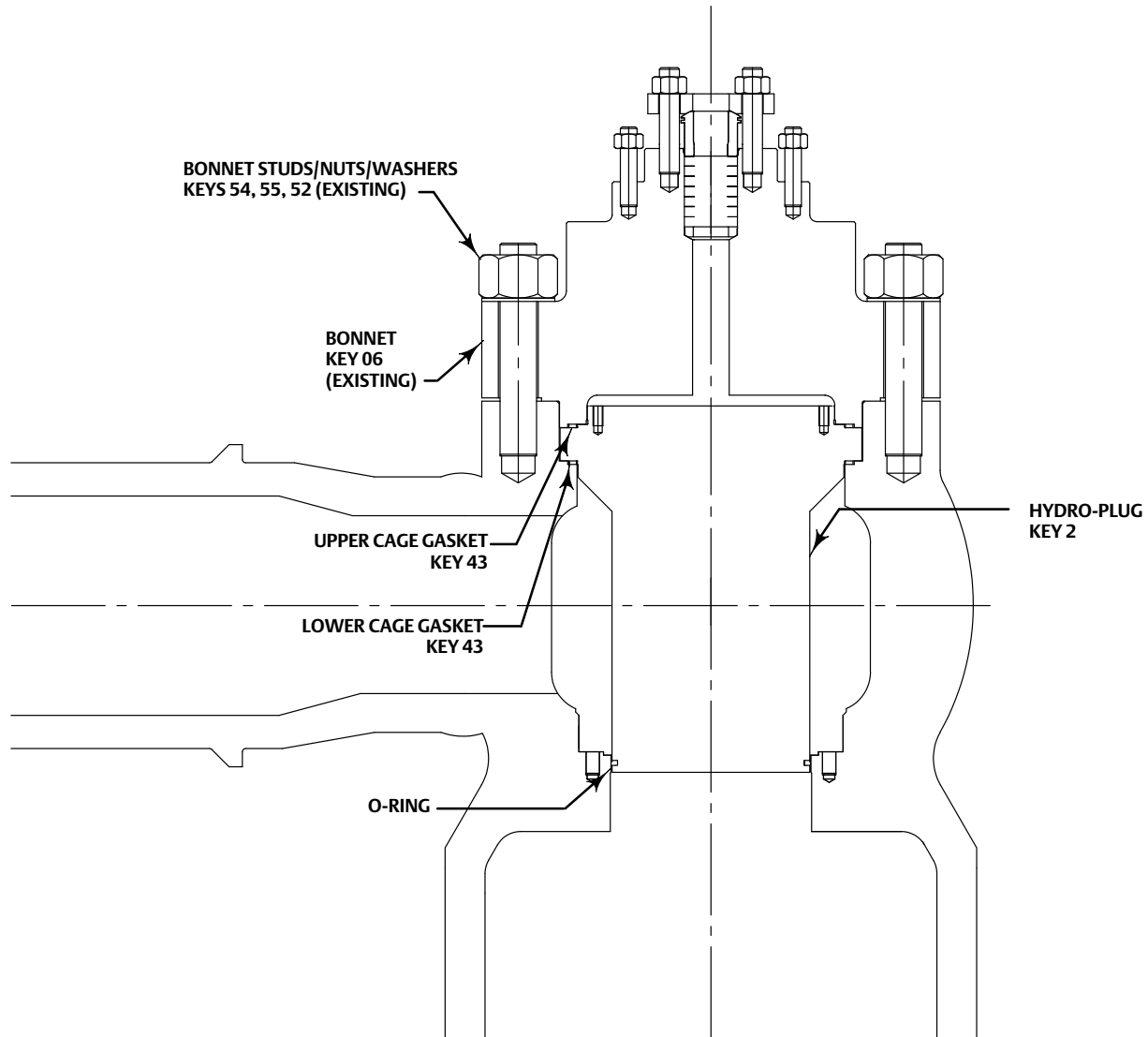


Figure 3. Fisher CVX Bolted Seat Ring Removable Diffuser Hydro-Plug



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Fisher™ CVX Steam Conditioning Valve



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and operation information for the Fisher CVX control valve. Refer to separate instruction manuals for instructions covering the actuator and accessories.

WARNING



Do not install, operate or maintain a CVX valve without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

1.2 Description

The CVX Steam Conditioning Valve (see Figure 1) provides a convenient and efficient way to reduce steam pressure and temperature within a single device. Typical installations include steam backpressure control, turbine bypass, boiler start-up service, auxiliary steam letdown for drying rolls, kettles, equipment drives, plant heating and other loads requiring dependable and accurate control of steam pressure and temperature.

Figure 1. Fisher CVX Steam Conditioning Valve

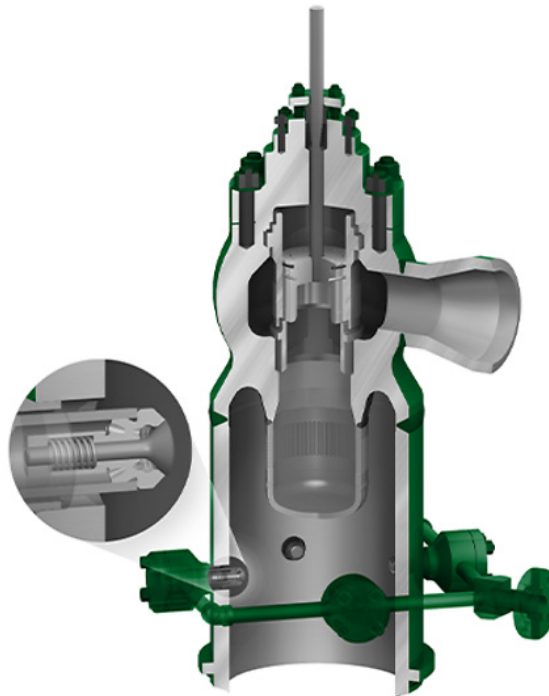


Table 1. Specifications

End Connection Sizes ⁽¹⁾	Construction Materials (continued)
Valve Inlet: NPS 4 through 24 Valve Outlet: NPS 8 through 60	Diffuser Welded (permanent) ■ Carbon Steel ■ 2-1/4 Cr-1 Mo ■ 9 Cr-1 Mo-V ■ 9 Cr-2 W-V Bolted (removable) ■ 2-1/4 Cr-1 Mo with N07718 or B16 Bolting ■ 9 Cr-1 Mo-V with N07718 Bolting Clamped Seat/Clamped Seat and Diffuser (removable) ■ 2-1/4 Cr-1 Mo with Alloy 6 Seating Surfaces ⁽¹⁾ ■ 9 Cr-1 Mo-V with Alloy 6 Seating Surfaces ⁽²⁾
End Connection Types	
■ ASME Buttweld (all sizes) ■ ASME Raised Face Flanges (all sizes) ■ ASME Ring Type Joint Flanges (all sizes)	Seat Ring Welded Seat Ring ■ Carbon Steel with Alloy 6 ■ 2-1/4 Cr-1 Mo with Alloy 6 ■ 9 Cr-1 Mo-V with Alloy 6 ■ 9 Cr-2 W-V with Alloy 6 Bolted Seat Ring ■ 2-1/4 Cr-1 Mo with N07718 or B16 Bolting ■ N06625 with N07718 Bolting ■ N07718 with N07718 Bolting
Valve Configuration	
Angle Pattern (flow down)	
Valve Body Ratings ⁽²⁾⁽⁴⁾	
ASME: CL150 to CL2500	
Bonnet Type	
Bolted	
Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4	
Class V: Standard Class IV: Optional	Control Plug: ■ 2-1/4 Cr-1 Mo with Alloy 6 Guiding Surfaces ■ 9 Cr-1 Mo-V with Alloy 6 Guiding Surfaces
Flow Characteristics ⁽³⁾	
Linear	
Diffusers	
Clamped Seat Ring (removable): Standard Welded (permanent): Optional Bolted (removable): Optional	Stem ■ SA479 Type S20910 ■ N07718 Control Cage: ■ 2-1/4 Cr-1 Mo Nitrided ■ 9 Cr-1 Mo-V Nitrided
Construction Materials	
Body/Bonnet ■ SA105 Carbon Steel ■ SA182 Grade F22 (2-1/4 Cr-1 Mo) ■ SA182 Grade F91 (9 Cr-1 Mo-V) ■ SA182 Grade F92 (9 Cr-2 W-V) Bonnet Bolting ■ SA193 Grade B7 ■ SA193 Grade B16 ■ N07718	Piston Rings ■ Alloy 6 with N07750 Expander Bore Seal ■ N07718 Gaskets ■ N06600/Graphite or N07750/Graphite Packing ■ Graphite/Flexible Graphite Nozzles ■ S41000 SST ■ N07718
1. Standard end connection sizes. Alternate inlet and outlet sizes available for each valve body size to match piping requirements. 2. Not all valve sizes are available in all valve body ratings. 3. Contact your Emerson sales office for other flow characteristics. 4. Intermediate classes above CL2500 available upon request. PN pressure ratings available per pressure requirements of EN12516-1. Consult your Emerson sales office for additional options.	

The CVX Steam Conditioning Valve (Figure 1) is designed to handle moderate to severe applications in today's cycling power plants as well as provide precise pressure and temperature control for process applications. The CVX incorporates over 30 years of steam conditioning experience and product development. The valve body is designed with the latest finite element analysis (FEA) and computational fluid dynamics (CFD) tools to optimize performance and reliability for demanding steam systems.

The CVX valve design provides an exceptional combination of performance and maintainability. The simplified trim configuration is thermally compensated to handle rapid changes in temperatures, as expected during a turbine trip, without any sticking or binding.

Water atomization and vaporization are key elements in any steam conditioning application. The CVX incorporates a spraywater manifold of variable geometry Type AF nozzles producing a spray pattern suitable for high rangeability applications. These nozzles are strategically placed to achieve complete mixing and quick vaporization at all flowing conditions. Years of research in spray atomization and vaporization were key to optimizing the water injection system. Extensive use of CFD analysis, in addition to field performance feedback, was used to validate spray system enhancements.

1.3 Education Services

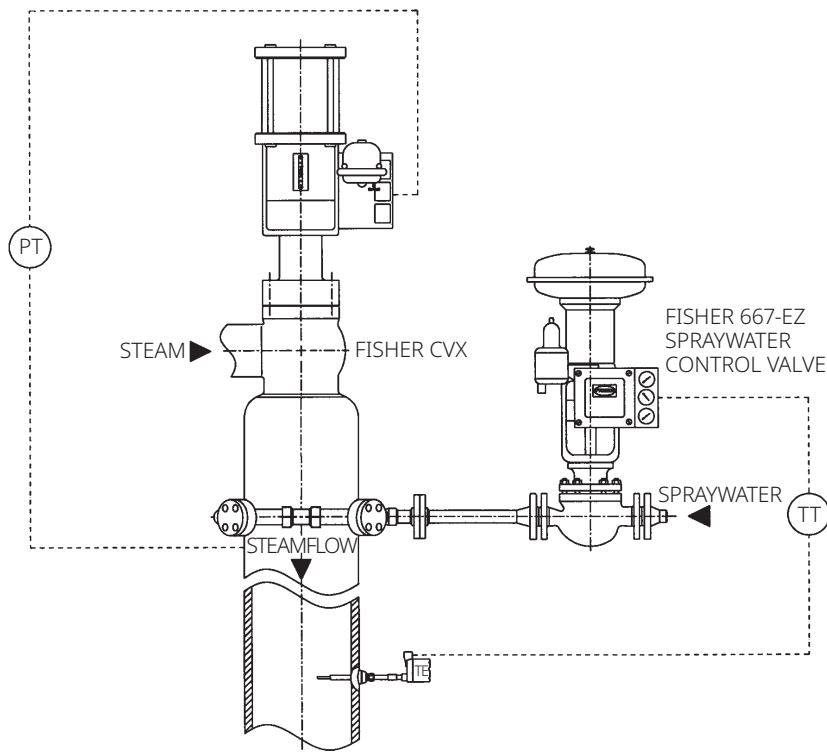
Emerson Education Services
Phone: 800-338-8158
Email: education@emerson.com
emerson.com/mytraining

Section 2: Principle of Operation

The positioning of the valve plug within the control cage controls the steam flow (see Figure 1). The control cage has an array of orifices to provide the control characteristic specified. As the plug is lifted from the seat, steam is permitted to pass into the center of the control cage and out through the seat orifice. A signal from the pressure control loop to the valve actuator moves the valve plug within the control cage, which increases or decreases the amount of free flow area. Retracting the plug increases steam flow.

The outlet section of the valve is comprised of a combination acoustical diffuser/cooler section. As the steam exits the seat orifice, it enters a diffuser section designed to further decrease steam pressure. Flow is directed radially, through the multiple orifice diffuser to the outlet pipe. The outlet section is fitted with cooling nozzles connected to a water manifold. This manifold provides cooling water flow to individual cooling nozzles installed in the pipe wall of the outlet section. The result is the creation of a fine spray mist injected into the highly turbulent outlet steam flow.

Figure 2. Typical Fisher CVX Installation



E1463

Section 3: Installation

⚠ WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the CVX valve is installed where service conditions could exceed the limits of the pressure rating noted on the nameplate. To avoid such injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

This valve is intended for a specific range of service conditions (see Table 1). Applying different conditions to the valve could result in parts damage, malfunction of the valve or loss of control of the process. Do not expose this valve to service conditions or variables other than those for which this valve is intended. If you are not sure what these conditions are, you should contact **Emerson** for more complete specifications. Provide the product serial number (shown on the nameplate) and all other pertinent information.

NOTICE

Check that the CVX valve is properly orientated with respect to the flow direction of the valve (flow down). Incorrect installation can result in damage to the valve and poor performance.

NOTICE

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also, remove any pipe scale, welding slag or other foreign material from the pipeline.

1. Before installation, all piping upstream of the valve must be blown clean so that no loose materials such as welding slag, dirt or other foreign matter, are left in the pipe. Use care to keep foreign matter out of the line openings while preparing the valve installation.
2. If possible, before fitting in the line, connect the actuator to a temporary air supply and operate to verify positioning. Disconnect the instrument lines (if applicable).

**WARNING**

Do not lift the valve by its actuator yoke or cooler manifold piping. Lifting lugs attached to the actuator must not be used to lift the complete valve assembly unless clearly marked as being rated to support the complete valve assembly weight. Personal injury or damage to equipment could occur if the valve is improperly lifted into place.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Only personnel trained in proper lifting and rigging practices shall perform valve/actuator assembly lifting, rigging and installation. Because each lift will be unique, the method of lifting the valve assembly, the correct location for attaching and lifting the valve assembly and what the valve assembly will do when lifted shall be considered for each lift.

Lifting and rigging equipment used to lift, install or remove a valve assembly or component must be properly selected and sized for the weight and configuration of the valve assembly or component being lifted. The weight of the complete valve assembly, including attached accessories, must be taken in consideration for this purpose. The lifting and rigging equipment must be properly maintained and inspected for damage before each use.

Lifting lugs or other lifting equipment attached to the valve or actuator must never be used to lift or support the weight of attached piping.

If the CVX is equipped with buttweld ends, the valve body must be supported using a lifting sling or other method that does not place a load or force onto the finished surface of the buttweld ends. The CVX does not have a stable resting position. The valve inlet and outlet must be fully supported until fully welded (buttweld end connections) or bolted (flanged end connections) into the piping.

NOTICE

Care must be taken when lifting the valve/actuator assembly to ensure all accessories and tubing are not damaged in the process. Accessories and tubing may need to be removed prior to lifting to prevent damage and properly reinstalled before use. Protect valve flange faces, buttweld ends and other connection surfaces from damage during lifting.

3. Arrange lifting slings or other lifting and rigging equipment appropriate for the valve weight and configuration around the main valve body to safely lift the valve to the pipe opening.

**WARNING**

Do not expose the valve to undue stresses by installing it in bent pipes or flanges. Personal injury and equipment damage could result from flange sealing failure due to improper installation.

4. Flanged Connections – Lubricate the flange connection bolts with a high temperature thread lubricant. Install flange gaskets and connection bolts per accepted practices and tighten securely.
5. Welded Connections – Welding procedures should be in accordance with the applicable codes and the base materials. For preheat, welding electrodes and postweld heat treatment, refer to the applicable codes and practices applicable for the specific facility. Materials are specified on the customer specification sheet. Emerson recommends the valve be disassembled for welding, however if the valve inlet and outlet connections are to be welded with the valve assembled, the valve plug should be maintained off the valve seat during all associated operations. If the valve is to be welded by SMAW process, the valve must be disassembled for welding to ensure that any weld slag is removed from the valve.

NOTICE

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal parts is possible. In general, if post weld heat treating is to be performed, all trim parts and nozzles should be removed. Contact your Emerson sales office for additional information.

6. Remove the spraywater control valve and flush the cooling water line until all debris is removed from the line prior to connecting it to the CVX valve. Use only clean sources of cooling water to reduce the possibility of nozzle clogging. A strainer should be installed in the water line as close to the CVX valve as possible. To determine appropriate mesh size, refer to valve sizing and specification document or contact your Emerson sales office. Review strainer manufacturer's pressure drop curves to determine appropriate strainer body size. You may need to use a strainer that is larger than the water line size.

⚠ WARNING

Failure to use a strainer could result in nozzle clogging and subsequent property damage or loss. Uncontrolled temperatures resulting from clogged nozzles may result in equipment or process temperature limits being exceeded. Exceeding system temperature limits could result in property damage or personal injury.

7. A length of straight pipe is required downstream of the CVX valve to ensure complete vaporization of cooling water. An example of a typical installation appears in Figure 2. Consult the CVX cooler sizing sheet for the required distance of straight pipe. This is unique for each application and is supplied by Emerson.
8. Typically, a temperature sensor should be mounted downstream of the CVX valve. This distance will vary depending on a number of factors including steam velocity and percentage of spraywater. Consult the cooler sizing sheet provided with the unit for this temperature sensor distance. The steam line should not have any branch lines dividing the steam flow between the CVX valve and the temperature sensor. If you have any questions, contact your [Emerson sales office](#).
9. A typical installation is illustrated in Figure 2. A pressure transmitter senses the pressure downstream (or upstream in backpressure control applications). The pressure controller sends a signal to the actuator positioner opening or closing the CVX valve as required to maintain pressure. A rising stem opens the CVX valve to allow additional steam flow. A temperature sensor (TE) measures changes in temperature and a temperature transmitter (TT) transmits the signal to the temperature control device. The output signal from the controller is sent to the positioner on the cooling water (spraywater) control valve (SWCV). The positioner's output signal strokes the SWCV open, increasing water pressure on the nozzles. Increasing water pressure upstream of the nozzles increases water flow through the nozzles.

NOTICE

Pneumatic lines (where applicable) should be thoroughly blown clean with dry air before connection. Check to make sure wiring connections are made per the equipment manufacturer's instructions and in accordance with local, regional and national codes.

10. If foreign debris has been introduced into the valve or upstream piping during installation, it must be removed prior to using the valve for the first time. A Blowout or Blow-through tool can be purchased to match the CVX valve and facilitate piping blowdown without removal of the valve from the line. Contact your [Emerson sales office](#) for pricing and availability of fixtures.
11. After cleanliness of the piping system has been assured, connect instrumentation and power supply to the CVX valve actuator and associated equipment.
12. Monitor the CVX valve as the system is brought on line. Some visible vapors may be seen as the lubricants are heated. If you see any steam leaks after startup, follow isolation and disassembly procedures and disassemble the valve and replace the gaskets (key 43). If the packing box leaks, tighten hex nuts (key 68). If leakage continues, replace the packing (key 64). Be sure to properly isolate the CVX valve prior to disassembly of valve or packing.

13. Valves with HIGH-SEAL live-loaded packing will not require this initial re-adjustment. See the Fisher Instruction Manual for HIGH-SEAL Live-Loaded Packing System (as appropriate), for packing instructions.

WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however, the packing might require some re-adjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Section 4: Maintenance

It is recommended that diagnostic tests be performed on the valve 3 to 6 months prior to scheduled maintenance shutdowns. Complete valve disassembly is recommended if tests performed on the valve indicate leakage, sticking or substandard operation. If diagnostics indicate normal valve operation, complete disassembly and inspection of the CVX is recommended during every other regularly scheduled outage or after 24 to 36 months, whichever comes first. Table 2 identifies the recommended inspection tips and diagnostics that can be performed with corresponding repair and replacement information.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D103606X012

CVX Valve

September 2025

NOTE

For valves with HIGH-SEAL packing, see the Fisher instruction manual, HIGH-SEAL Live-Loaded Packing System, [D101453X012](#), for packing instructions.

Table 2. Inspection Summary

Key	Part Description	Inspection Tips and Diagnostics	Repair	Replacement
1	Valve Body	Inspect for erosion, thermal fatigue and other damage.	Consult your local Emerson Service Center for a recommendation on necessary weld repair or replacement if damage exists.	
6	Bonnet	Inspect gasket surfaces for damage that could indicate gasket leakage. Inspect packing box to ensure no galling, scoring or particulate is present.	If damage exists consult your local Emerson Service Center for a recommendation on necessary weld repair or replacement.	
20	Nozzle Body Flange	Inspect gasket surfaces for damage that could indicate gasket leakage when spray nozzles are replaced.	Replacement Only	As needed
21	Cage	Inspect cage bore for excessive wear, galling damage, particulate damage and flow passage damage or clogging.	Consult your local Emerson Service Center for a recommendation on necessary repair or replacement if damage exists.	As needed for optimal performance
22	Plug	Inspect for seat erosion, excessive wear, galling damage and particulate damage, paying close attention to the seating and guiding surfaces.	Re-cutting/machining of seating surfaces can be performed by your local Emerson Service Center .	As needed for optimal performance
23, 53	Stem and Stem Pin	Inspect stem for dings, scoring and galling. Inspect valve stem connection for tightness.	Valve stem connection can be repaired by your local Emerson Service Center .	As needed
24	Seat	Inspect for seat erosion, particulate damage, galling and proper bolt torque (if applicable, refer to Table 5).	Re-cutting/machining of seating surfaces can be performed by your local Emerson Service Center .	As needed to maintain proper shutoff
25	Plug Retainer	Inspect for excessive wear, galling and other damage.	Repair can be performed by your local Emerson Service Center .	As needed
30	Spray Nozzle	Refer to Nozzle Maintenance Section.		Replacement every 24 to 36 months for optimal performance
37	Nozzle Sleeve	Inspect for particulate or magnetite buildup when spray nozzles are replaced.	Clean if necessary	As needed
43, 47, 48, 75	All Gaskets	Every valve disassembly requires replacement of gaskets.	Replacement Only	Every valve disassembly
45	Piston Ring	Inspect for particulate buildup, scoring and excessive wear. Ensure piston ring is free to expand and contract in the groove.	Replacement Only	As needed

- continued -

Table 2. Inspection Summary (continued)

Key	Part Description	Inspection Tips and Diagnostics	Repair	Replacement
46	Bore Seal Ring	Inspect for excessive wear, galling, signs of leakage and other damage.	Replacement Only	Every 36 months for optimal performance
63	Packing Box Ring	Inspect for scoring, galling and other damage.	Replacement Only	As needed
64	Packing Set	Every valve disassembly requires replacement of the packing set.	Replacement Only	Every valve disassembly
65	Packing Follower	Inspect for scoring, galling and other damage.	Replacement Only	As needed
66	Packing Flange	Inspect for scoring, galling and other damage.	Replacement Only	As needed
77	Bolted Diffuser	Inspect for thermal fatigue, erosion, particulate damage and flow passage damage or clogging.	Clean if necessary	As needed
N/A	Diffuser	Inspect for thermal fatigue, erosion, particulate damage and flow passage damage or clogging.	Clean if necessary	Consult your local Emerson Service Center if replacement is necessary.

4.1 Servicing

Shut off water and steam flow and vent all system pressure before breaking any pressure boundaries.

WARNING

Residual system pressure may be released during the following steps if the system was improperly isolated or vented.

Use extreme care to prevent personal injury while loosening any fasteners in the pressure boundary.

4.2 Removal of Valve Bonnet and Trim

1. If the valve is Class V leakage construction and has a bore seal, use the actuator to unseat the bore seal from the landing.
2. Disconnect all external connections to the positioner and actuator and remove the actuator from the valve. Consult the actuator manufacturer's documentation for assistance in actuator removal.
3. Loosen and remove the hex nuts (key 68) along with the packing follower (key 65). If possible, remove packing set (key 64) from the packing box.
4. Loosen bonnet stud nuts (key 55) using an even pattern to avoid uneven expansion of the gaskets. Remove the entire bonnet assembly (key 6), pulling evenly in line with the valve stem (key 23) centerline. Uneven bonnet removal can result in galling or bending of the valve stem. If difficulty is encountered in removing the bonnet, check the bonnet for alignment and straighten the bonnet before making further attempts to remove it from the valve body.

**WARNING**

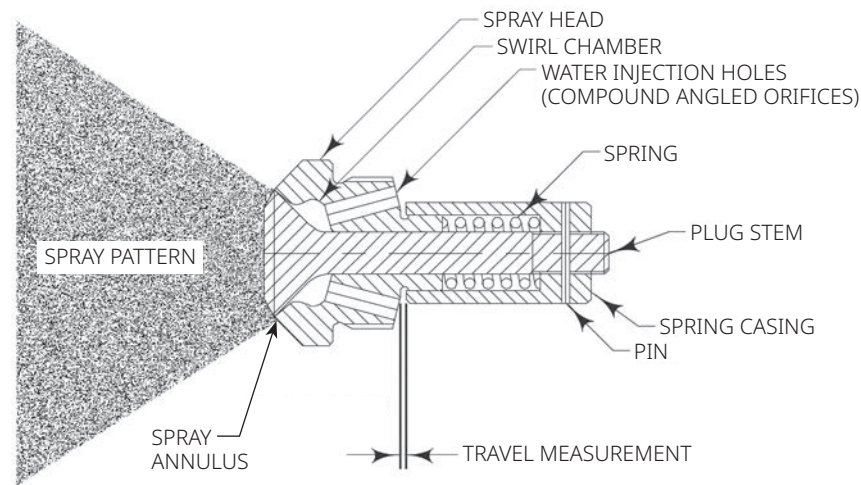
The bonnet must be handled with care while being removed from the body. Damage to the bonnet can result in gasket leakage while the valve is in service.

Protect the bonnet by placing it on clean cloth or wood while the valve is disassembled.

5. Dislodge any remaining packing (key 64) from the packing box and discard. Remove the packing box ring (key 63) from the bottom of the packing box. Inspect all parts: packing box, packing box ring (key 63), packing follower (key 65), valve stem (key 23), hex nuts (key 68) and studs (key 69) for signs of wear. Replace parts that are damaged or show excessive wear.
6. Inspect the bonnet guiding surfaces and gasket mating surfaces. Light damage on the guiding surface may be repaired with an emery cloth or other suitable material. Damage to the gasket mating surface may require bonnet replacement to avoid leakage.
7. Remove the plug assembly (keys 22, 23 and 53) as a single unit by lifting the valve stem (key 23) with appropriate rigging and lifting equipment and pulling the assembly from the body cavity. The plug assembly contains sensitive guiding and sealing surfaces on its outside diameter and care must be taken in its handling. Protect the plug by placing it on clean cloth or wood while the valve is disassembled.
8. Remove the cage (key 21) from the valve body. Remove and discard cage gaskets (keys 43 and 44). Reference Figures 13, 15, 16, 17 and 18 for guidance in performing this disassembly. The cage contains sensitive guiding surfaces on its inside and outside diameter and care must be taken during handling. Protect the cage by placing it on clean cloth or wood while the valve is disassembled.
9. ANSI/FCI 70-2 Class V constructions only: Clean and inspect the guiding and sealing surfaces of the plug assembly. Inspect the piston ring (key 45) and Bore Seal ring (key 46) for signs of excess wear or damage and replace if necessary. The piston ring is a two-piece design with an outer seal ring and an inner expander ring. The outer ring diameter should be expanded beyond the diameter of the plug in its free state. It can be shifted within its groove to inspect for uneven wear around its circumference. The piston ring should require some compression when installing the plug into the cage. Lack of required compression indicates that the piston ring has worn or relaxed and should be replaced. Vertical marks in the axial orientation also indicate wear that requires replacement of the ring. The Bore Seal ring has a C-shaped cross section with the open portion of the C-shape facing the seat ring side of the plug. Any uneven marks around the circumference of the ring or any flattening of the ring shape at its outside diameter are indications of wear and require replacement. Contact your [Emerson sales office](#) for Bore Seal ring replacement.

ANSI/FCI 70-2 Class IV constructions only: Clean and inspect the guiding and sealing surfaces of the plug assembly. Inspect the two piston rings (key 45) for signs of excess wear or damage and replace if necessary. The piston ring is a two piece design with an outer seal ring and an inner expander ring. The outer ring diameter should be expanded beyond the diameter of the plug in its free state. It can be shifted within its groove to inspect for uneven wear around its circumference. The piston ring should require some compression when installing the plug into the cage. Lack of required compression indicates that the piston ring has worn or relaxed and should be replaced. Vertical marks in the axial orientation also indicate wear that requires replacement of the ring.

10. Clean and inspect the cage bore for excessive wear. The entire length of the cage bore is either a sealing and/or guiding surface and any measurable wear requires that the cage be replaced.
11. Welded seat rings remain retained inside the valve body. Clean and inspect the seating surface. Any detectable damage around the circumference of the seating surface is an indication of wear and requires reconditioning to ensure seating performance. Contact your [Emerson sales office](#) for specific instructions on reconditioning the seating surface. If the CVX has a bolted seat ring, remove the cap screws (key 76) and discard the gasket (key 75) that sits between the seat ring and diffuser (key 77) or valve body, depending on construction. Inspect cap screws for damage and excessive wear; replace as necessary.
12. Removable (bolted/camped) diffuser constructions only. Remove the diffuser (key 77 or 24) and gasket (key 75) that sits between the diffuser and valve body. Inspect the diffuser for thermal fatigue and flow passage damage or clogging and clean if necessary. Diffuser replacement will be necessary if damage is present. The bolted diffuser contains sensitive guiding surfaces on its outside diameter and care must be taken during handling. Protect the seat diffuser by placing it on a clean cloth or wood while the valve is disassembled.
13. Welded diffuser constructions only. Inspect the diffuser for thermal fatigue and flow passage damage or clogging and clean if necessary. If damage or clogging remains after cleaning, then diffuser replacement will be required; contact your local [Emerson Service Center](#) for this process.
14. Remove all used gaskets and foreign material from the interior of the valve and from the inlet and outlet openings. Remove any foreign material that may be in the valve body or trim. Inspect all valve body guiding and sealing surfaces for any signs of wear.
15. If the valve has been in service, visually inspect the interior of the valve for abnormal wear, erosion or thermal fatigue. The gasket surfaces of the valve body and bonnet should be inspected to verify they are not damaged and are free of imbedded gasket material. All scratches should be removed by grinding or filing to remove any interference of the clearance zones between the internal bores and the mating parts. All signs of thermal fatigue should be carefully evaluated to determine if repair or replacement is necessary. Your local [Emerson Service Center](#) can help determine the severity of damage, if present and recommend a course of action.

Figure 3. Fisher AF Nozzle Cross Section

A7191-2D

4.3 Nozzle Maintenance and Replacement

When subjected to normal operating conditions, it is possible that wear, blockage and/or weld fatigue will occur to the valve body or nozzle assembly. During regularly scheduled maintenance, visually inspect the nozzles for wear and blockage. Your local [Emerson Service Center](#) can help to determine the extent of weld fatigue and the correct course of action. Poor performing nozzles or nozzle failure is typically caused by wear, corrosion, erosion and/or blockage. The following instruction will help to determine if any of these problems are present and provide a recommended course of action for each.

NOTE

For optimal performance, nozzles should be inspected every 18 to 24 months and replaced every 24 to 36 months.

1. OPTIONAL: Figure 3 shows the spray pattern that will need to be present during operation of the AF nozzles. Testing can be performed by attaching the existing or an alternate, similar pressure, water line to the spray water input connection. If this spray pattern is not present, replacement is recommended.
2. Loosen and remove the nozzle body flange stud nuts (key 58) and washers (key 59). Then, remove the nozzle body flange (key 20). Inspect the nozzle body flange gasket surfaces for damage. If damage is present replacement is necessary.

3. Remove the nozzle sleeve (key 37) with attached spray nozzle (key 30), nozzle sleeve gasket (key 47) and nozzle body flange gasket (key 48). Inspect the nozzle sleeve for particulate or magnetite buildup and clean if necessary.
4. Inspect the spray annulus surface, the area between the plug stem and spray head, for excessive wear, erosion/corrosion or blockage due to particulate. Wear is defined as any nicks, cuts or gouges on or immediately around the spray annulus. Erosion/corrosion is defined as any form of rust or erosion of the metal on the plug stem or spray head. Blockages are typically caused by small particulate trapped between the plug stem and spray head or spring casing and spray head. Replacement of the nozzle is recommended if any of the preceding problems are present.
5. Grind off the tack welds holding the nozzle (key 30) in place. Apply a penetrant type thread lubricant and allow to soak prior to unscrewing the nozzle. Using the provided flats on the side of the spray head, unscrew the nozzle from the nozzle sleeve (key 37).
6. Grind excess tack weld material off both the nozzle (key 30) and nozzle sleeve (key 37).
7. In the absence of external forces, the nozzle must be fully closed. If the nozzle is not fully closed, it will need to be replaced.
8. Inspect the water injection holes for reduced or non-circular shape due to erosion. Every hole must be the same size and shape. If any are oversized or non-circular in shape, the nozzle will need to be replaced.
9. Inspect the interior of the water injection holes for buildup of particulate or magnetite. Nozzle replacement will be needed if any buildup is present.

NOTE

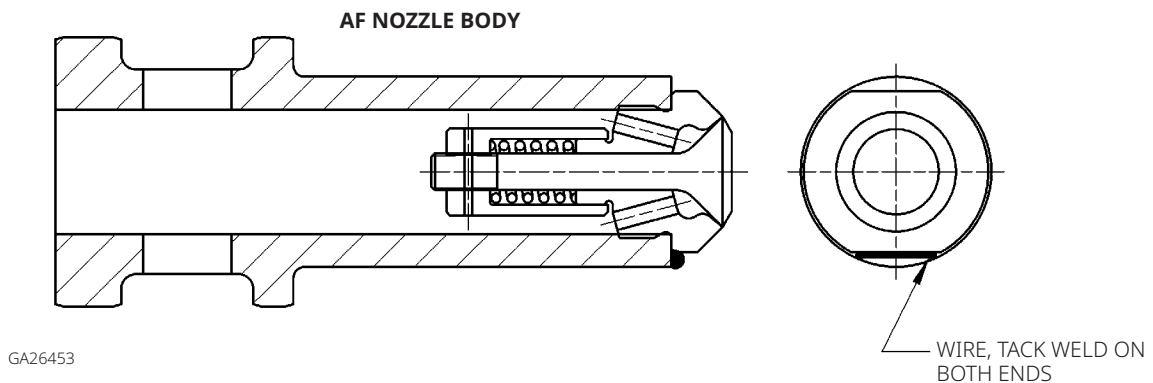
Complete disassembly of the nozzle is strongly discouraged, due to individual spare parts not being available.

10. **OPTIONAL:** To further check the nozzle for buildup of particulate or magnetite, the nozzle can be disassembled. If disassembled, take great care not to damage the sharp edges of the spray annulus on the plug stem and the sprayhead, as this will greatly affect the spray pattern. Do not compress a removed spring by hand or with a tool, as compression beyond its normal operating range will damage the spring.
To disassemble the nozzle, first remove the pin using a small punch and unscrew the spring casing from the plug stem. The nozzle can be reassembled by following a reverse order of disassembly, taking care to line the hole in the plug stem up with the hole in the spring casing, then pressing the pin back into place through the two parts.
11. The internal spring may relax over time and not provide the tensile force required to shut off and control flow. If the nozzle spring is suspected of being too relaxed, then the nozzle should be replaced.
12. The travel can be determined by using a feeler gauge to measure the distance between the spray head near the water injection ports to the side of the spring casing, as outlined in Figure 3. This measurement must match the factory set plug stem travel for the corresponding nozzle type as shown in Table 3.

Table 3. AF Nozzle Specifications

Nozzle Type	Plug Travel, In.
AF7	0.014
AF10	0.028
AF14	0.029
AF17	0.034
AF20	0.036
AF24	0.042
AF28	0.048
AF32	0.056
AF35	0.065
AF40	0.063
AF44	0.069

13. Inspect nozzle threads for damage and clean if needed. If damage is present, nozzle replacement will be necessary.
14. Rinse both the nozzle (key 30) and nozzle sleeve (key 37) to remove particulate.
15. Screw nozzle into the nozzle sleeve (key 37) and tighten just until the spray head is flat and tight against the nozzle sleeve.
16. Tack-weld a small piece of welding wire onto the nozzle sleeve (key 37) next to either of the spray head flats to prevent rotation during service; refer to Figure 4. Maintain low heat to prevent distortion of the nozzle.

Figure 4. Spray Nozzle Tack Weld Location

17. Reassemble in the following order: nozzle sleeve gasket (key 47), nozzle body flange gasket (key 48), spray nozzle/sleeve assembly (keys 30 and 37), nozzle body flange (key 20), washers (key 59) and stud nuts (key 58). It is required to replace the nozzle sleeve gasket (key 47) and nozzle body flange gasket (key 48) with new gaskets each time the nozzle body flange (key 20) is removed.

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

**WARNING**

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson sales office immediately if a discrepancy between actual parts and approved parts is suspected.

18. Lubricate the nozzle body studs (key 57) and all surfaces the studs and nuts come into contact with. Tighten the nozzle body flange nuts (key 58) in a uniform, multistage cross pattern. You may need to torque multiple times at each torque to ensure that the nozzle body flange is torqued evenly. Required nozzle body flange bolting torque can be found in Table 4.

Table 4. Recommended Nozzle Body Flange Bolting Torque with Nickel Anti-Seize Lubricant⁽¹⁾

BOLT SIZE in.	THREADS PER INCH	LUBRICATION	RECOMMENDED BOLT TORQUE ⁽²⁾	
			N•m	Lbf•ft
5/8	11	Nickel Anti-Seize	163	120
3/4	10		258	190
7/8	9		373	275
1	8		522	385
1-1/8	8		712	525
1-1/4	8		942	695
1-3/8	8		1268	935
1-1/2	8		1654	1220

1. For other lubricants, contact your Emerson sales office for recommended bolt torque.

2. Torques for lubricated studs with heavy hex nuts.

4.4 Valve Assembly

1. Cleaning – Make certain that all interior surfaces of the valve body and bonnet (including the packing box) are clean and free of dirt, including the inlet and outlet openings. All surfaces of the valve interior that receive mating parts should be given special attention when cleaning. All sliding fit surfaces should be coated with a copper-based high temperature anti-seize lubricant prior to reassembly. Refer to Figures 16, 17 and 18 for reference.

If the CVX has a removable seat ring, proceed with steps 2 through 4; otherwise proceed directly to step 5.

2. Place one gasket (key 75) into the valve body. If the CVX has a welded-in diffuser: Install the seat ring (key 24) onto this gasket surface. If the CVX has a removable diffuser: install the diffuser (key 77 or 24) onto this gasket surface. If trim is bolted, ensure the bolt holes in the diffuser are positioned with the bolt holes in the valve body. Then place another gasket (key 75) onto the diameter of the diffuser and install the seat ring onto this second gasket surface. Clamped trim constructions will only have one gasket (key 75). Proceed to step 6 if using clamped trim.

NOTE

Horizontal actuator only: CVX valves positioned in the process pipeline with a horizontal actuator/trim may require special attention to ensure that the spiral wound gaskets are maintained in the proper location during the valve assembly procedures without falling out of the gasket groove. A gasket manufacturer recommends spray adhesive 3M #77 Super Spray Adhesive to temporarily hold gaskets in place until they are fully contained by the CVX valve body and trim components. Please note special spiral wound gasket-positioning techniques may be recommended. To use the adhesive, lightly spray the gasket groove that the gasket will be installed in. Also lightly spray one side of the spiral wound gasket that will be contacting the previously coated gasket groove. Let the spray adhesive set for one minute and then lightly press the spiral wound gasket into the gasket groove.

Other Considerations: Ensure the spiral wound gasket is located in the correct location when contact is made. Trying to remove the gasket after contact will damage the gasket by pulling out or removing the soft filler/facing material. If the gasket is incorrectly positioned after applying the spray adhesive, it must be removed and discarded. The gasket groove will then need to be cleaned and a new gasket will need to be installed.

3. Lubricate the seat ring cap screws (key 76) and all surfaces that contact the screws, including the valve body and seat ring.
4. Torque the cap screws in a crisscross pattern, using no more than 1/4 of the specified torque as indicated in Table 5. Repeat the crisscross pattern, working up to the specified torque in 1/4 increments until the final torque is achieved. Wait a minimum of one minute to allow for gasket/screw relaxation and recheck the torque, adjusting as necessary.

Table 5. CVX (Flow Down) Bolted Seat Ring Torque with Nickel Anti-Seize Lubricant⁽¹⁾

CAP SCREW SIZE in.	THREADS PER INCH	LUBRICATION	RECOMMENDED BOLT TORQUE	
			N•m	Lbf•ft
3/8	16	Nickel Anti-Seize	41	30
1/2	13		91	67
5/8	11		163	120

1. For other lubricants, contact your [Emerson sales office](#) for recommended bolt torque.

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

**WARNING**

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) immediately if a discrepancy between actual parts and approved parts is suspected.

5. Install one cage gasket (key 43) into the groove in the valve body. If the valve has a horizontal stem orientation, ensure the gasket remains in the groove and does not get pinched during cage installation.

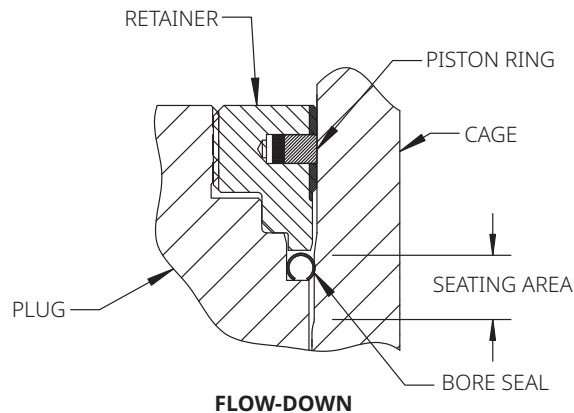
NOTE

Horizontal actuator only: Follow the note in Step 2 above to ensure the gasket are in the proper location during valve assembly.

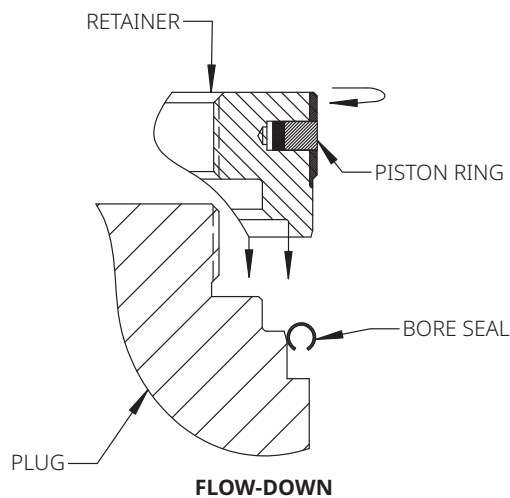
6. Lubricate the inside of the cage as completely as possible. Insert the lubricated cage (key 21) into the valve body. Ensure the lower cage diameter slides over the outside diameter of the seat ring. If there is any question regarding the proper seating of the cage inside the valve body, the following measurements can be taken for confirmation. For welded or bolted seat rings: Measure the thickness of the cage flange at its largest diameter. Measure the depth of the mating counterbore where the cage flange engages into the valve body. When assembled with a new cage gasket, the resulting depth from the top of the valve body to the top of the cage flange should be the difference in these two measured values, minus an additional 0.045 to allow for the uncompressed gasket. If the CVX is an ANSI/FCI 70-2 Class V construction, proceed with steps 712; otherwise proceed directly to step 13 for Class IV constructions.

7. The plug assembly includes a plug (key 22), stem (key 23), stem pin (key 53), retainer (key 25), piston ring (key 45) and Bore Seal ring (key 46). Lubricate the plug assembly at all raised outside diameter surfaces and lubricate the piston ring and Bore Seal ring.
8. Orient the Bore Seal for correct sealing action according to Figure 5.
9. Place the Bore Seal plug seal over the top of the valve plug. The retainer will help guide the Bore Seal down onto the plug. Do not force the Bore Seal over the plug (Figure 6).

Figure 5. Fisher Bore Seal Construction



-
10. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the Bore Seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
 11. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place to secure the Bore Seal retainer.
 12. Install the lubricated plug assembly into the cage. The piston ring should require some radial compression to collapse into the cage diameter. Do not use a metallic tool to create this piston ring compression as this could damage the outer sealing diameter of the ring. The plug should slide into the cage smoothly with little effort until the Bore Seal ring reaches its mating cage diameter. The extra load required to seat the Bore Seal trim seal will be applied during actuator set up.
 13. ANSI/FCI 70-2 Class IV constructions only: The plug assembly includes a plug (key 22), stem (key 23) and two piston rings (key 45). Lubricate the plug assembly at all raised outside diameter surfaces and lubricate the piston rings. Install the lubricated plug assembly into the cage. The piston ring should require some radial compression to collapse into the cage diameter. Do not use a metallic tool to create this piston ring compression, as this could damage the outer sealing diameter of the ring. The plug should slide into the cage smoothly with little effort. Refer to Figure 8.

Figure 6. Retainer Guiding Fisher Bore Seal Onto the Plug

14. Install the second cage gasket (key 43) over the cage boss where it will be self-centering for the mating bonnet groove. For clamped trims, install the bonnet gasket (key 44) in the body groove.

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

**WARNING**

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) immediately if a discrepancy between actual parts and approved parts is suspected.

15. Apply appropriate high-temperature anti-seize lubricant to the bonnet studs (key 54) and screw them into the valve body. Back the studs out 1/2 to 1 turns after bottoming the stud in the valve body.
16. Lubricate the bonnet locating surfaces and carefully install the bonnet (key 6). Use care to avoid bending the stem.

17. Install bonnet stud washers (key 52) and nuts (key 55) and hand tighten.
18. Tighten the bonnet nuts (key 55) in a uniform, multistage cross pattern. Monitor the distance between the bonnet and body and keep it even to ensure that the bonnet is being torqued evenly. It is recommended that torquing be performed in a minimum of four torque levels until the final torque level is achieved. You may need to torque multiple times at each torque level to ensure that the bonnet is torqued evenly. Required torque can be found in Table 6. After final torquing, ensure there is an even gap and that the metal-to-metal contact between the valve body and bonnet is achieved around the entire circumference of the body-bonnet joint.
19. After the bonnet has been torqued to the required level, check the plug movement to ensure that the plug still moves freely.
20. Recheck cleanliness of the packing box. Insert the packing box ring (key 63) over the stem and into the packing box. Measure the depth of the packing box before and after ring insertion to be certain that it has traveled to the bottom of the packing box. Insert packing rings (key 64), after lubricating with high temperature grease, into the packing box and staggering the gaps on adjacent rings. The packing follower (key 65) can be used to ensure that each packing ring is pushed down before installing the next packing ring.
21. After all packing rings are installed, thoroughly lubricate the studs (key 69) and insert the packing follower (key 65) and the packing flange (key 66). Tighten the hex nuts (key 68) tight enough to block leakage but not so tight that stem travel is hindered. Consult Table 7, Recommended Packing Nut Torque for recommended torque levels. Evenly tighten the nuts to the maximum level, then loosen and retighten to the minimum torque level. After operating, further tightening may be required to prevent leakage.
22. Install the actuator on the valve in accordance with manufacturer's standard procedure. If this is an ANSI/FCI 70-2 Class V construction, the plug assembly will require an additional load and travel to seat the Bore Seal ring (refer to Figure 9 for details). After calibration of the actuator, the valve should be ready to return to service.

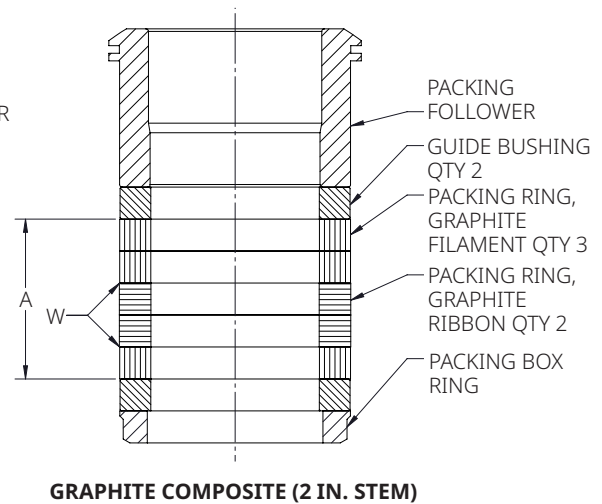
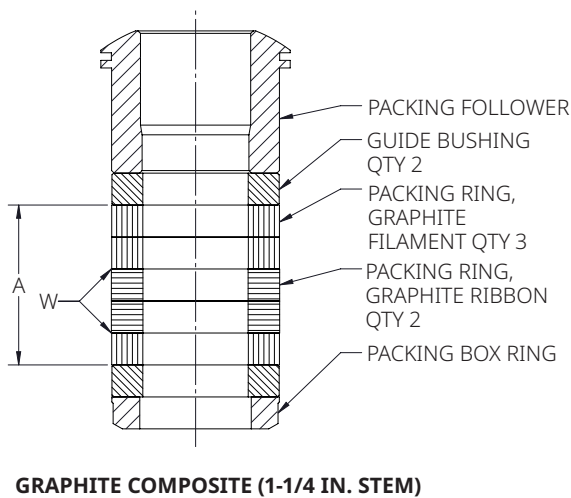
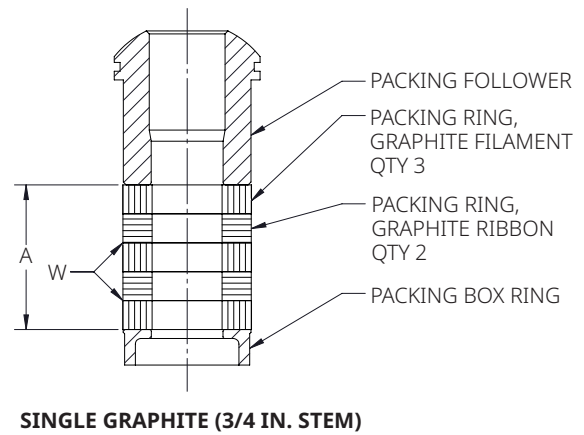
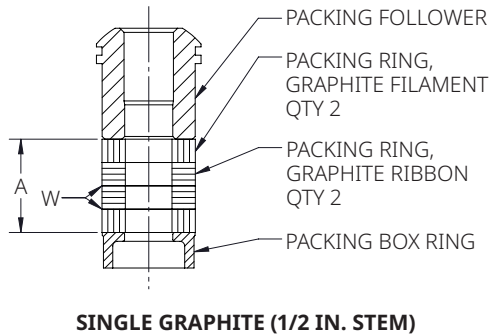
Table 6. Recommended Body/Bonnet Bolting Torque with Nickel Anti-Seize Lubricant⁽¹⁾

BOLT SIZE in.	THREADS PER INCH	LUBRICATION	RECOMMENDED BOLT TORQUE ⁽²⁾	
			N•m	Lbf•ft
3/4	10	Nickel Anti-Seize	258	190
7/8	9		373	275
1	8		522	385
1-1/8	8		712	525
1-1/4	8		942	695
1-3/8	8		1268	935
1-1/2	8		1654	1220
1-5/8	8		2129	1570
1-3/4	8		2671	1970
1-7/8	8		3308	2440
2	8		4027	2970
2-1/4	8		5776	4260
2-1/2	8		7986	5890

1. For other lubricants, contact your [Emerson sales office](#) for recommended bolt torque.

2. Torques for lubricated studs with heavy hex nuts.

Figure 7. Packing Arrangements



GK19146

NOTES:

WHEN SACRIFICIAL WASHER COMES WITH PACKING, INSTALL AT PLACES MARKED W.
FOR HIGH-SEAL PACKING, REFER TO [D101453X012](#) FOR PACKING ARRANGEMENT.

Table 7. Recommended Packing Nut Torque with Anti-Seize Lubricant

STEM DIAMETER In.	ASME PRESSURE RATING	MAXIMUM TORQUE		MINIMUM TORQUE	
		N•m	Lbf•ft	N•m	Lbf•ft
1/2	CL300	10	7	7	5
	CL600	14	10	9	7
	CL900	18	13	12	9
	CL1500	22	16	15	11
	CL2500	24	18	18	13
3/4	CL300	23	15	15	10
	CL600	31	22	21	15
	CL900	41	30	27	20
	CL1500	50	37	34	25
	CL2500	61	45	41	30
1-1/4	CL300	49	36	33	24
	CL600	67	49	45	33
	CL900	83	61	56	41
	CL1500	102	75	68	50
	CL2500	122	90	82	60
2	CL300	65	48	59	43
	CL600	91	67	83	61
	CL900	120	88	109	80
	CL1500	147	108	133	98
	CL2500	170	125	156	115

Figure 8. Fisher CVX Class IV Construction

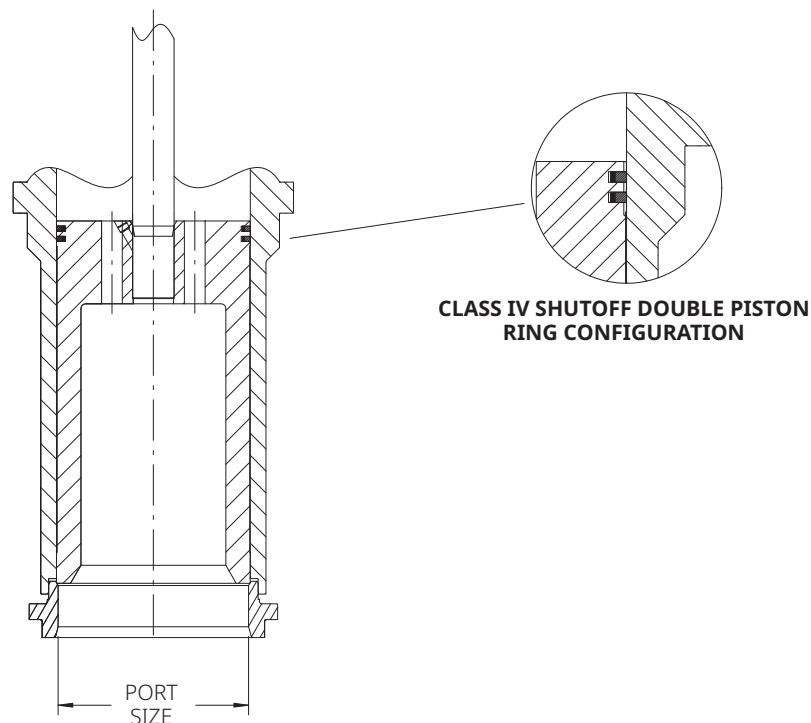


Figure 9. Fisher CVX Class V Construction

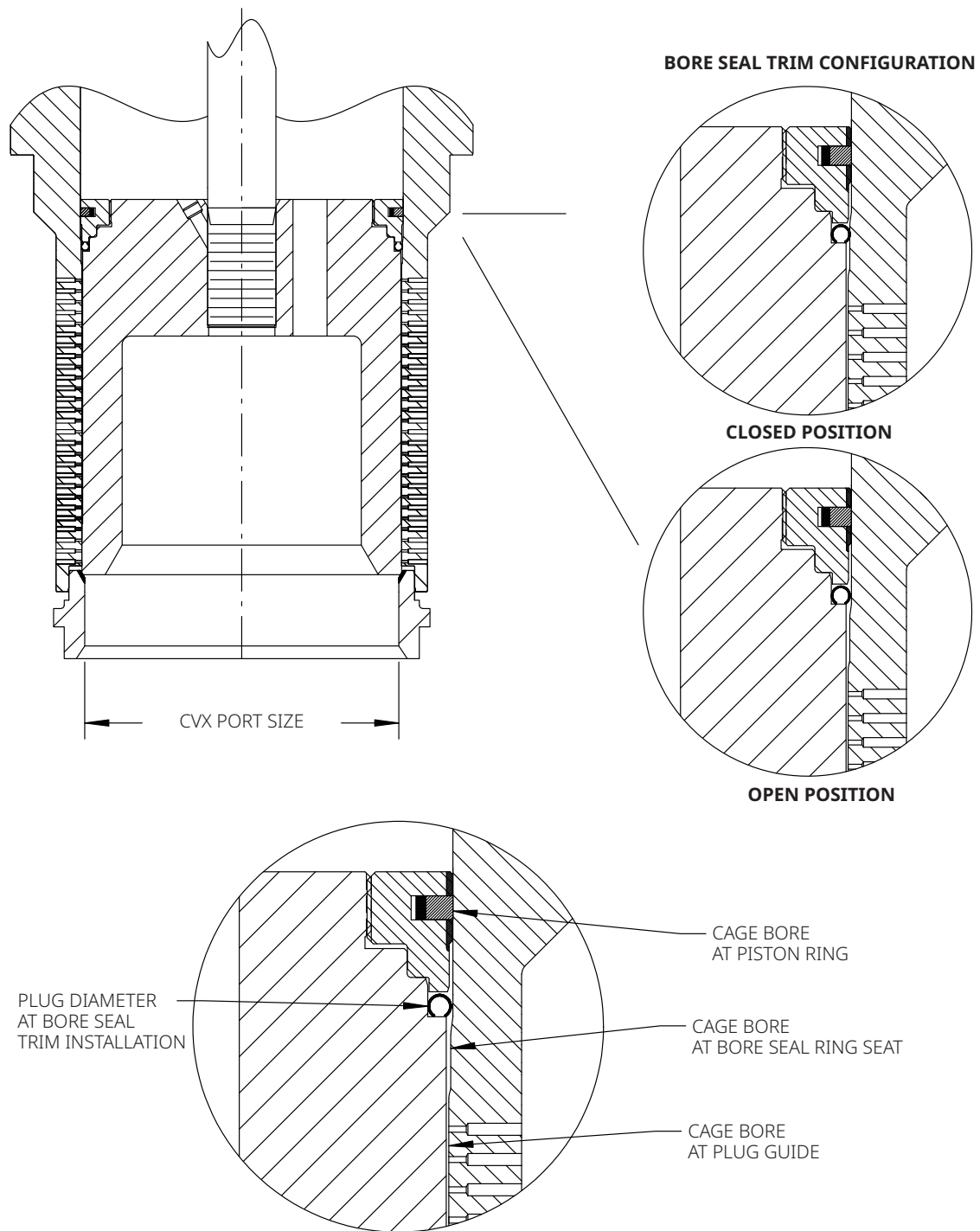
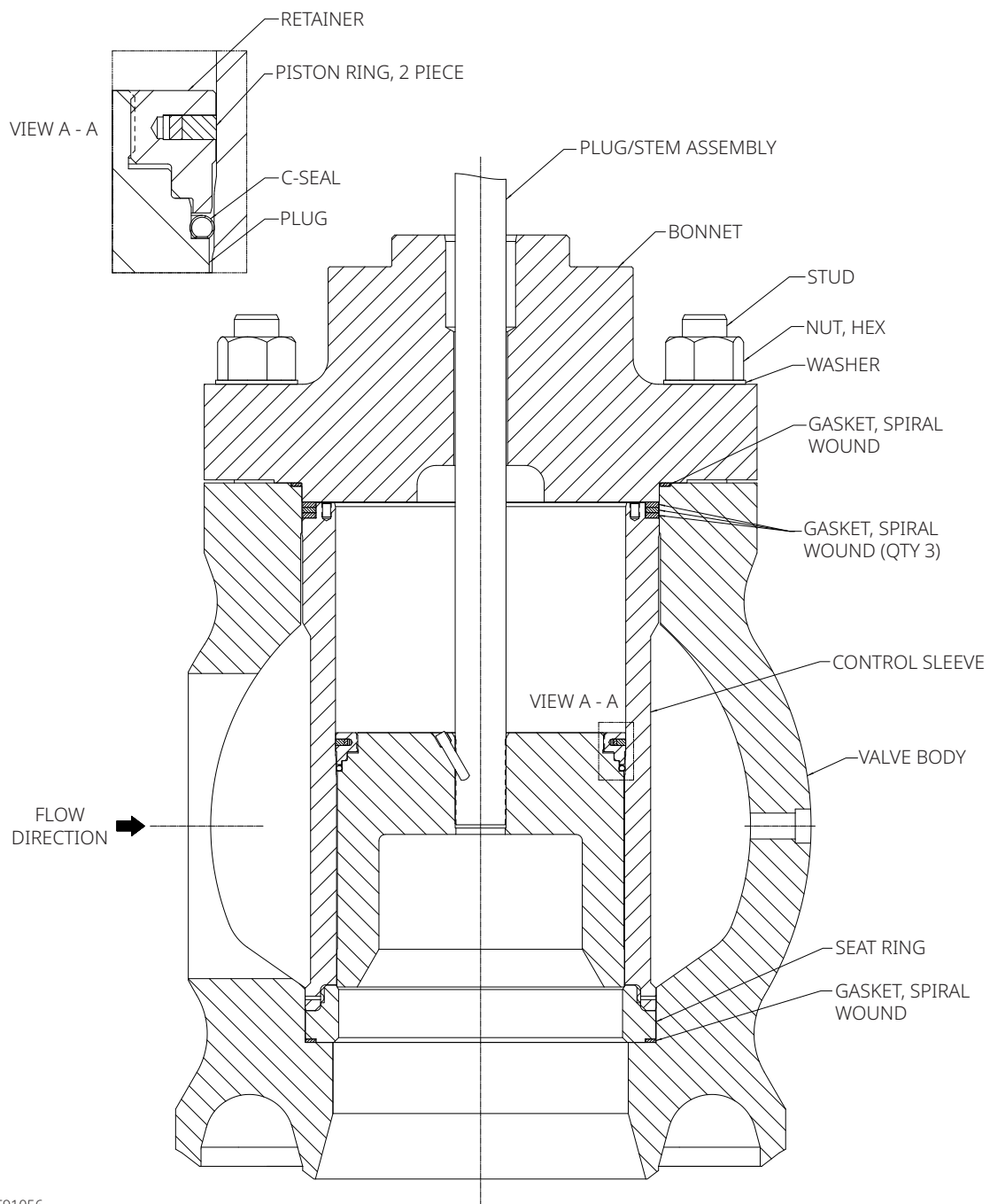
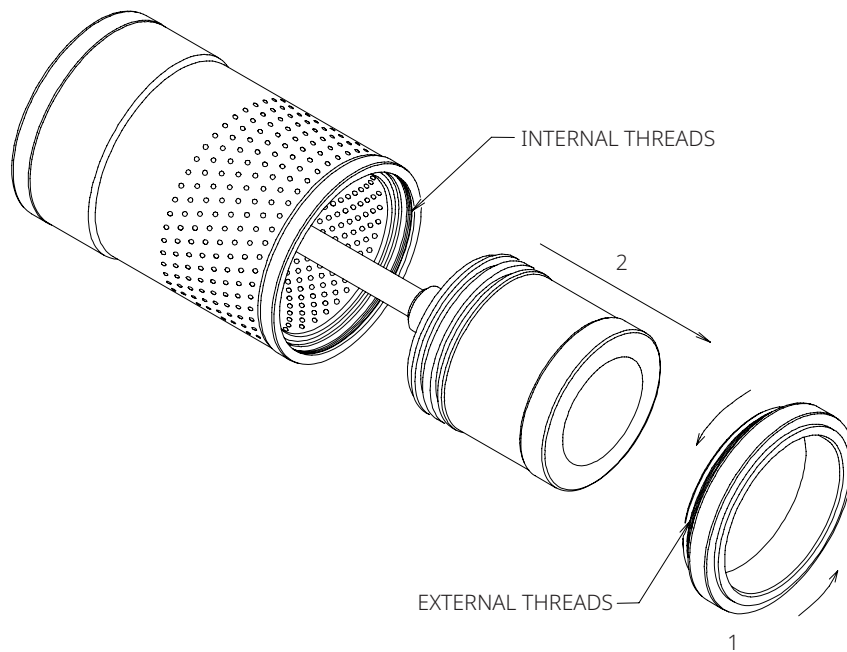


Figure 10. CVX Bore Seal Trim Size 260 to 425 MM PT



GE91056

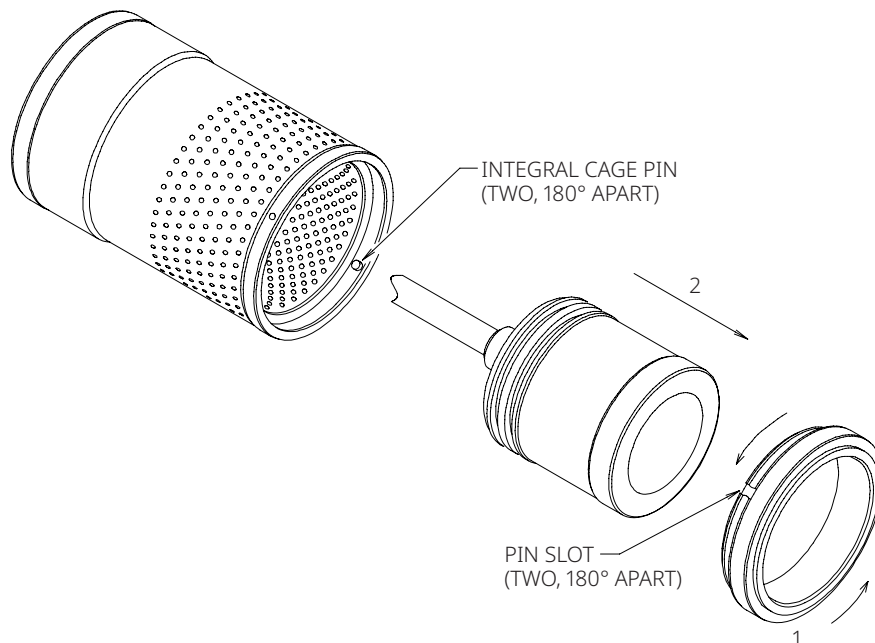
Figure 11. Design CVX Trim Assembly (Sizes 160 and Smaller)

B2640 / IL

NOTE: IF THE TRIM IS BORE SEAL DESIGN, THE PLUG WOULD BE INSERTED FROM THE TOP OF THE CAGE, NOT THE BOTTOM.

1. UNSCREW SEAT FROM CAGE.

2. REMOVE PLUG FROM LOWER END OF CAGE.

Figure 12. Design CVX Trim Assembly (Sizes 175 and Larger)

B2641 / IL

NOTE: IF THE TRIM IS BORE SEAL DESIGN, THE PLUG WOULD BE INSERTED FROM THE TOP OF THE CAGE, NOT THE BOTTOM.

1. ROTATE SEAT UNTIL CAGE PIN ALIGNS WITH SEAT SLOT. SEPARATE SEAT FROM CAGE.

2. REMOVE PLUG FROM LOWER END OF CAGE.

Section 5: Parts

5.1 Parts Ordering

Each CVX valve is assigned a serial number that can be found on the bonnet flange. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and key numbers for each part required. The key numbers in the Parts List and the assembly drawing in Figures 16, 17 and 18 can be used to help in part identification.



WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

5.2 Parts List

NOTE

Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description	Key	Description
1	Body	53*	Stem pin
6	Bonnet	54	Bonnet stud
20	Nozzle body flange	55	Bonnet stud nut
21*	Control cage	57	Nozzle body flange stud
22*	Control plug	58	Nozzle body flange stud nut
23*	Stem	59	Nozzle body flange washer
24*	Seat ⁽¹⁾ /Seat diffuser	60	Actuator stud
25	Plug retainer	61	Actuator stud nut
30*	Spray nozzle	62	Yoke lock nut
37	Nozzle sleeve	63*	Packing box ring
41	Clamped seat ring gasket	64*	Packing set
43*	Cage gasket ⁽²⁾	65*	Packing follower
44	Bonnet gasket	66*	Packing flange
45*	Piston ring	68*	Hex nut
46*	Bore seal ring	69*	Stud
47*	Nozzle sleeve gasket	75*	Bolted seat ring gasket
48*	Nozzle body flange gasket	76*	Seat ring cap screws
52	Bonnet stud washer	77	Diffuser

*Recommended spare parts.

1. If seat is a welded seat, it is not a recommended spare.

2. 1, 2 or 3 gaskets required depending on actual construction.

Figure 13. Fisher CVX Assembly with Clamped Seat Ring and Diffuser

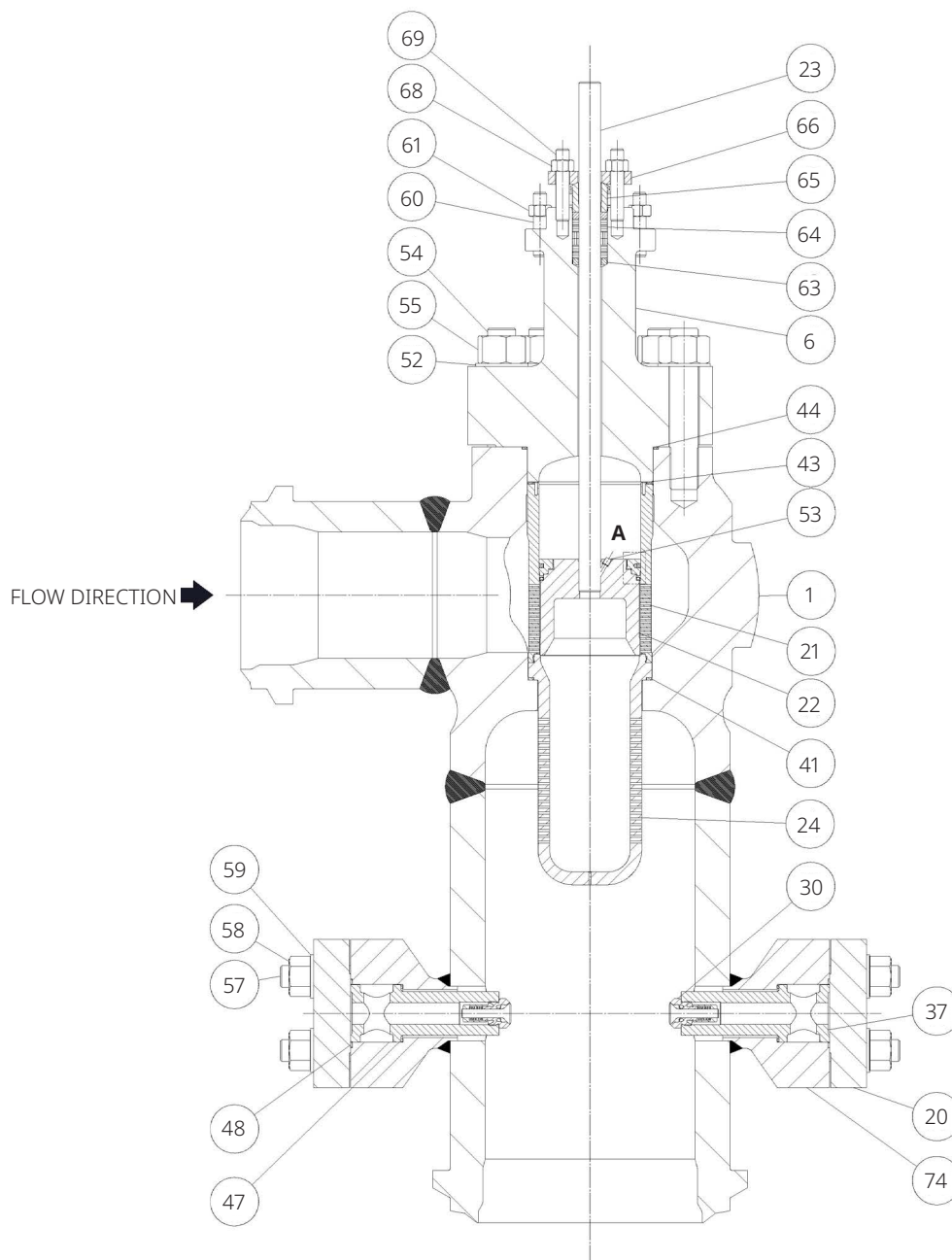
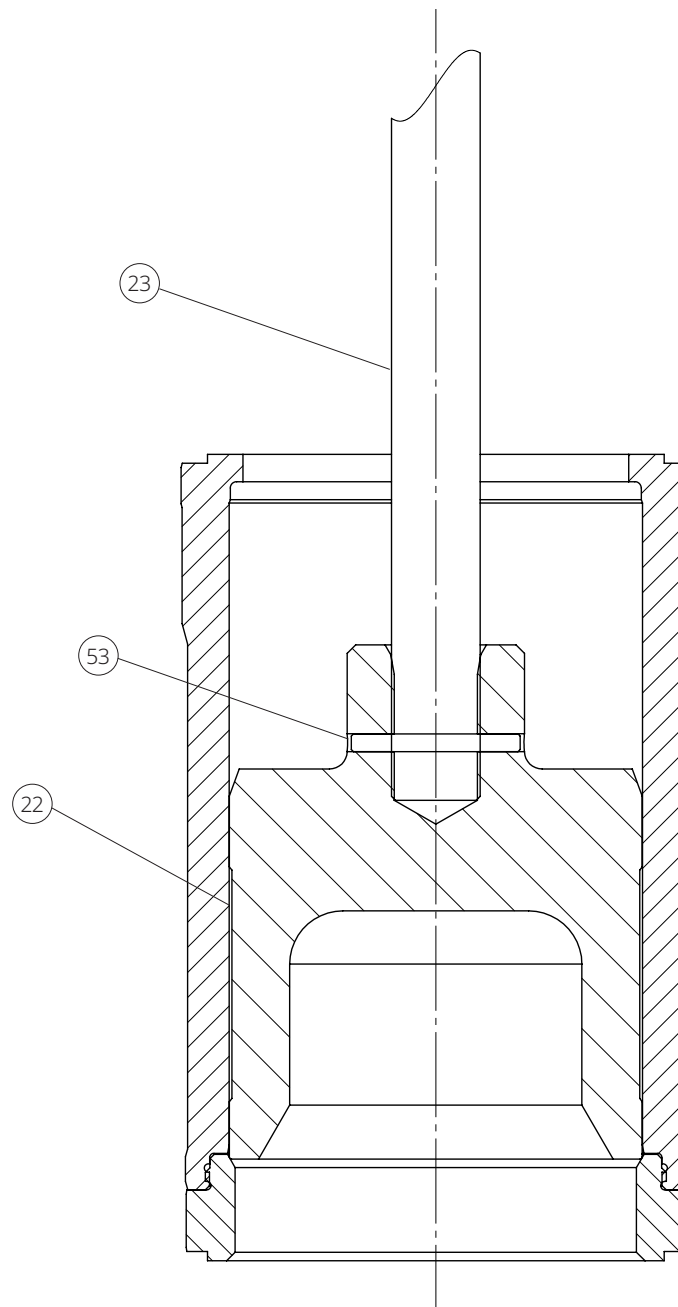


Figure 14. Unbalanced Plug/Stem Assembly



GK19147

Figure 15. Fisher CVX Assembly with Clamped Seat Ring and Welded Diffuser

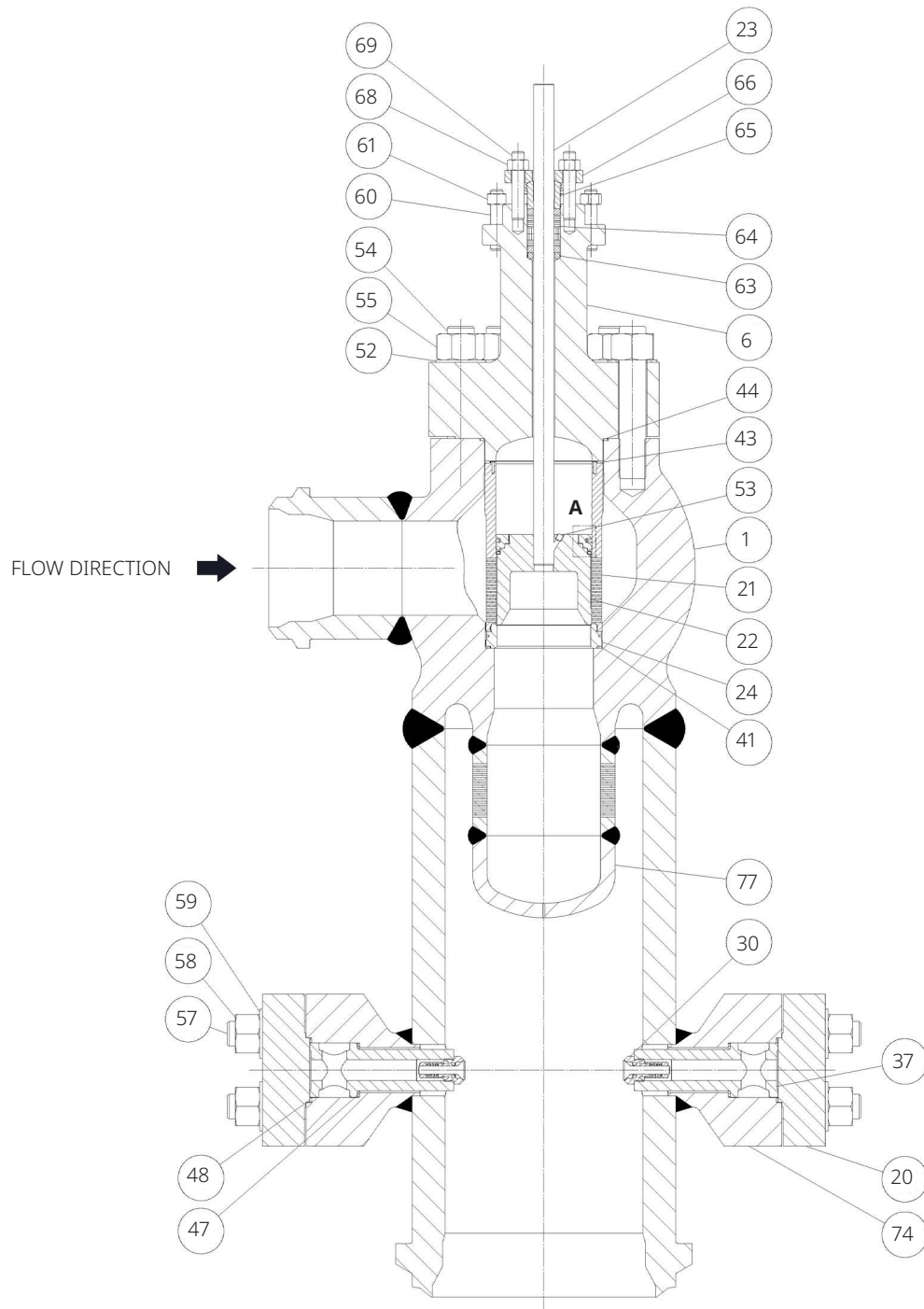


Figure 16. Fisher CVX Assembly with Welded Seat Ring and Welded Diffuser

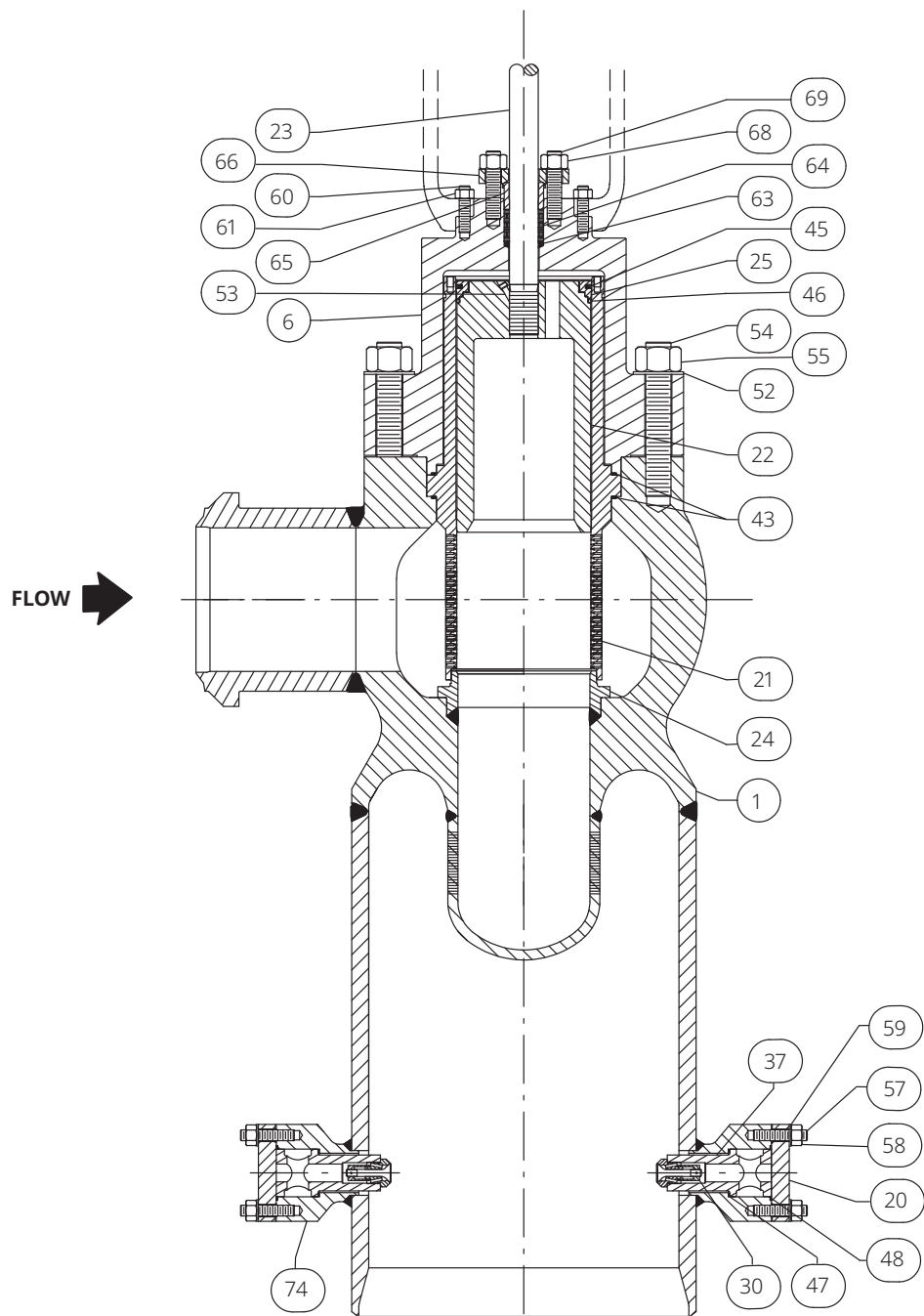


Figure 17. Fisher CVX Assembly with Bolted Seat Ring and Welded Diffuser

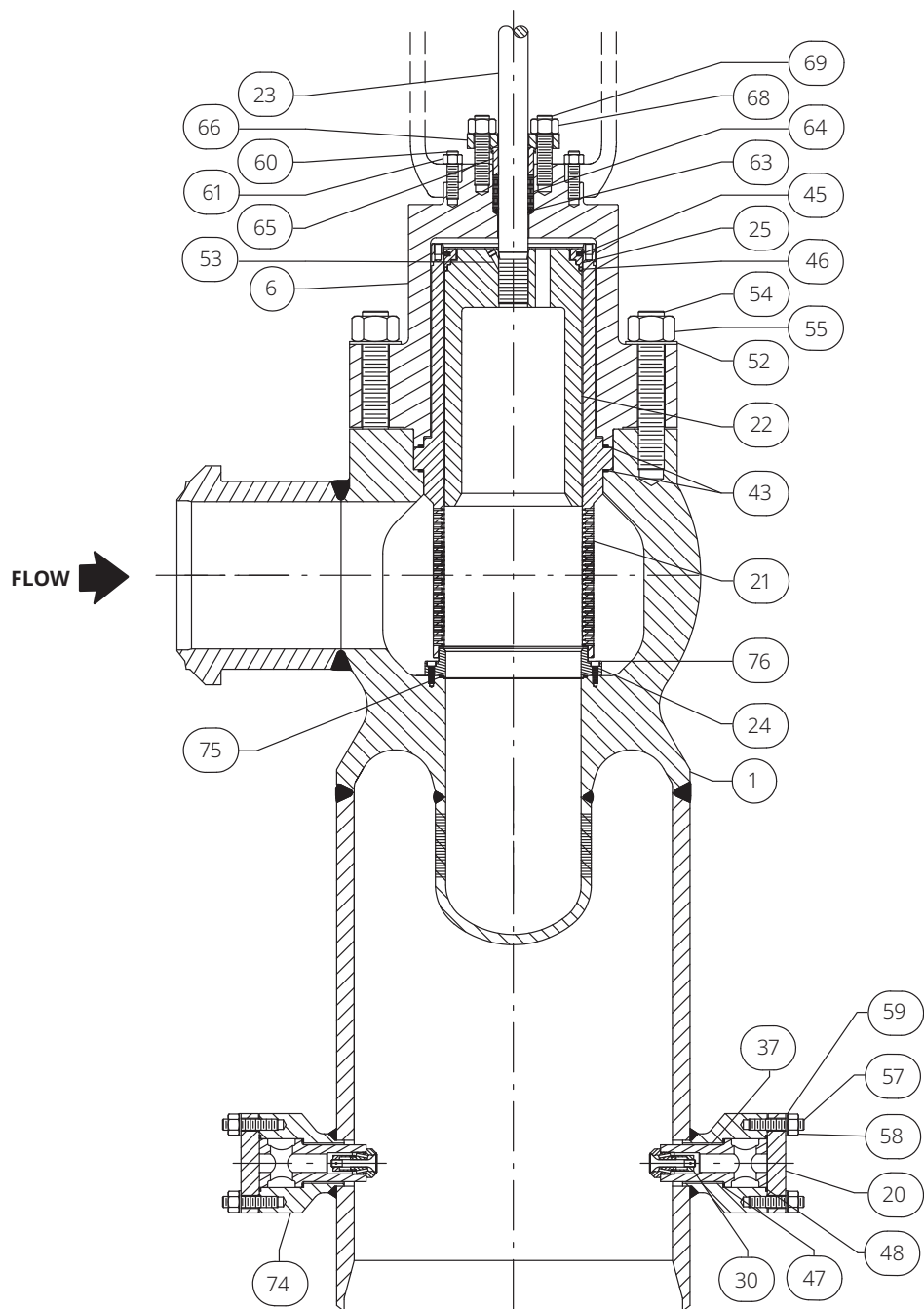
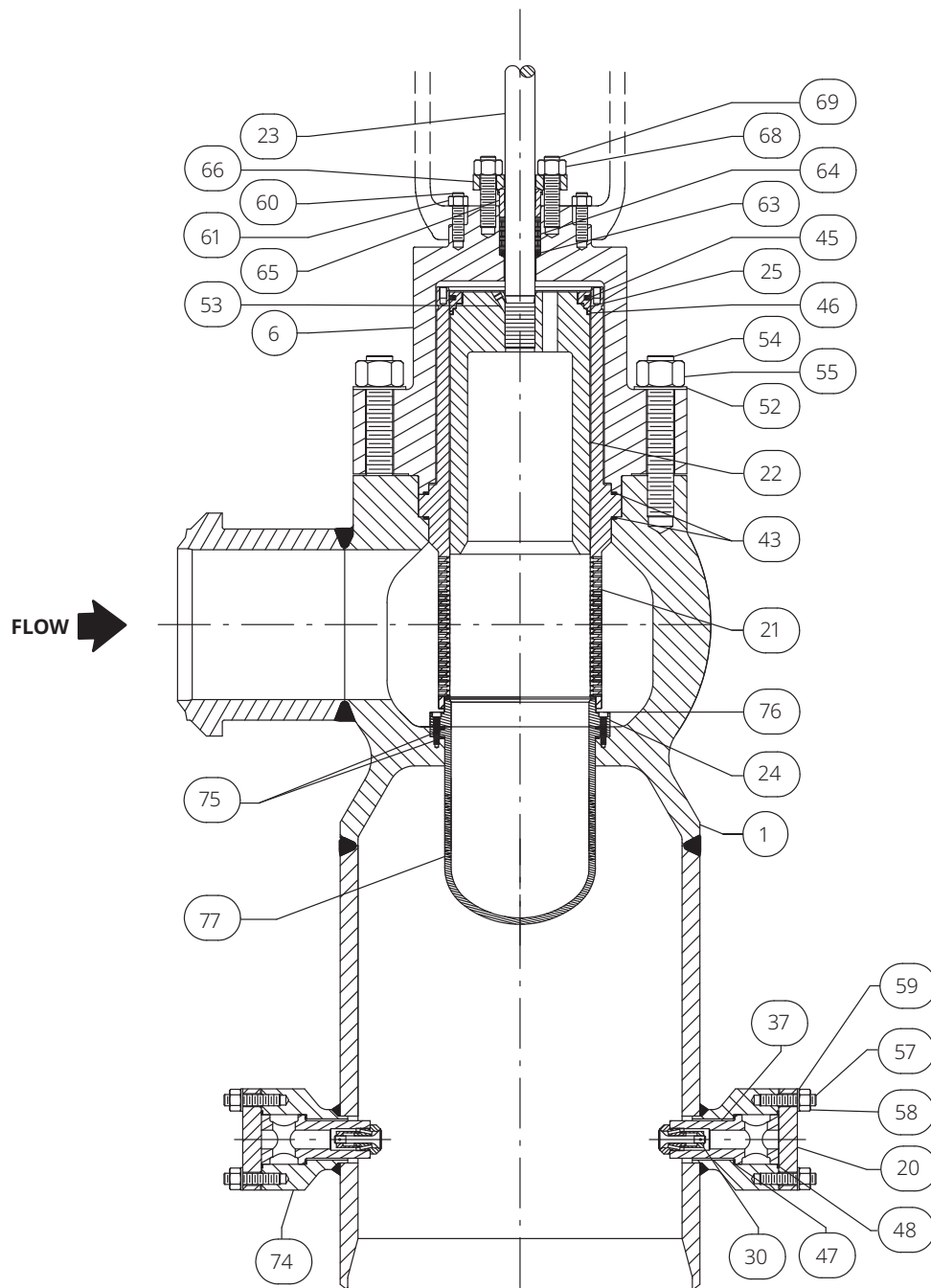
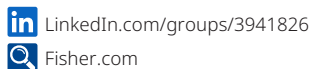


Figure 18. Fisher CVX Assembly with Bolted Seat Ring and Bolted Diffuser



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS



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Fisher™ D and DA Valves



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for Fisher D and DA valves. Refer to separate manuals for instructions covering the actuator, positioner and accessories.



WARNING



Do not install, operate or maintain a D or DA valve without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Unless otherwise noted, all NACE references are to NACE MR0175-2002.

1.2 Description

The Fisher D globe-style (Figure 1) and DA angle-style (Figure 5) valves are single-port, metal-seated valves for high-pressure applications.

Figure 1. Fisher D Valve with 657 Actuator



W0232

Table 1. Specifications

Maximum Inlet Pressures and Temperatures ⁽¹⁾	Maximum Service Temperature
If the valve nameplate shows an ASME pressure-temperature class, maximum inlet pressure and temperature is consistent with applicable ASME class per ASME B16.34. If the nameplate does not show an ASME class, it will show a maximum cold working pressure at 38°C / 100°F (for example, 3600, 6000, 9000 or 10,000 psi)	232°C / 450°F
	Flow Characteristic
	Equal Percentage
Maximum Allowable Pressure Drops ⁽¹⁾	Flow Direction
Flow up: Capable of full rated pressure drops. Flow down: See Table 2 for pressure drop limits for ceramic trim.	Fisher D Valve: Flow up through the seat ring and out past the valve plug Fisher DA Valve: Flow in either direction
Shutoff Classification Per ANSI/FCI 70-2 and IEC 60534-4	Approximate Weight
Standard: Class IV Optional: Class V	Fisher D Valve: 34 kg / 75 lbs Fisher DA Valve: 46 kg / 100 lbs
1. Do not exceed the pressure or temperature limits in this manual and any applicable standard limitations.	

1.3 Specifications

Specifications for these valves are in Table 1. Some of the specifications for a given valve appear on a nameplate, which is attached to the valve actuator or wired to the valve assembly if the valve was purchased without an actuator.

1.4 Education Services

Emerson Education Services
 Phone: 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/mytraining

Table 2. Flow Down Pressure Drop Limits - Ceramic Trim Only

VALVE SIZE, NPS	SEAT RING DIAMETER, mm / in.					
	6.4 / 0.25	9.5 / 0.375	12.7 / 0.5	19.1 / 0.75	25.4 / 1	31.8 / 1.25
	Pressure Drop, bar					
1	414	414	414	193	---	---
2	689	689	689	462	262	165
	Pressure Drop, psi					
	6.4 / 0.25	9.5 / 0.375	12.7 / 0.5	19.1 / 0.75	25.4 / 1	31.8 / 1.25
	Pressure Drop, bar					
1	6000	6000	6000	2800	---	---
2	10,000	10,000	10,000	6700	3800	2400

Section 2: Ceramic Trim

Some types of ceramic trim, including the VTC (very tough ceramic) variety, can create a spark under certain circumstances. When the edge of a ceramic part is struck against a second ceramic part with enough force, a spark can be created.



WARNING

Avoid personal injury and property damage from ignition of process fluid caused by sparks from ceramic trim.

Do not use ceramic trim where the process fluid is unstable or if it is an explosive mixture (such as ether and air).

Section 3: Installation



WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the sudden release of process pressure or bursting of parts, do not install the valve assembly where service conditions could exceed the limits given in this manual or on the appropriate nameplates. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some valve body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

NOTICE

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag or other foreign material from the pipeline.

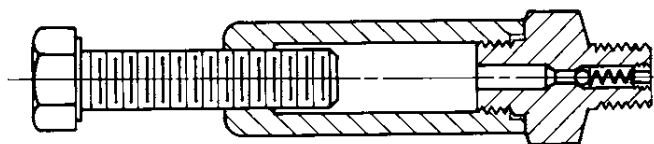
1. Before installing the valve, inspect it to be certain that the valve body cavity is free of foreign material. Clean out all pipelines to remove scale, welding slag and other foreign materials.
2. Install the valve so that flow through the valve is in the direction shown by the arrow cast on the valve body. The control valve assembly may be installed in any position unless limited by seismic considerations. However, the normal method is with the actuator vertical above the valve. With some valves, the actuator may need support when it is not vertical. For more information, consult your [Emerson sales office](#).
3. Use accepted piping and welding practices when installing the valve in the line. For flanged valve bodies, use suitable gaskets between the body flanges and pipeline flanges.

NOTICE

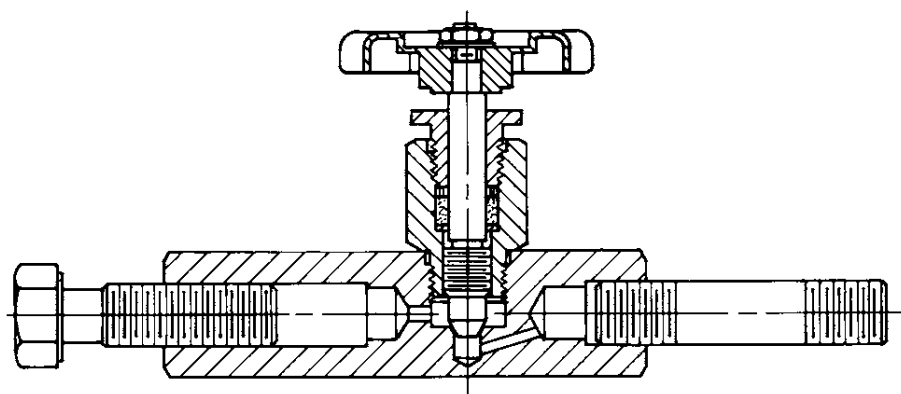
Depending on valve body materials used, post-weld heat treating might be needed. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Shrink-fit pieces and threaded connections may also loosen. In general, if post-weld heat treating is needed, remove all trim parts. Contact your [Emerson sales office](#) for additional information.

For screwed end connections, apply pipe compound to pipeline threads.

4. To allow continuous operation during inspection or maintenance, install a three-valve bypass around the control valve assembly.
5. If you received the actuator and valve body shipped separately, refer to the appropriate actuator instruction manual for the actuator mounting procedure.

Figure 2. Lubricator and Lubricator/Isolating Valve (Optional)

LUBRICATOR



LUBRICATOR/ISOLATING VALVE

10A9421-A
AJ5428-D
A0832-2

**WARNING**

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however the packing might require some readjustment to meet specific service conditions.

Section 4: Maintenance

WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shutoff the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Table 3. Bolting Torque for Packing Box Nuts (key 15)

VALVE RATING	STEM DIAMETER		MINIMUM RECOMMENDED TORQUE		MAXIMUM RECOMMENDED TORQUE	
	mm	in.	N•m	lbf•in	N•m	lbf•in
3600 psi or to CL1500	9.5	3/8	4	36	5	48
	12.7	1/2	7	66	11	96
	19.1	3/4	16	144	24	216
6000 psi or CL2500	9.5	3/8	5	42	7	60
	12.7	1/2	9	78	12	108
	19.1	3/4	20	180	30	264
9000 psi	12.7	1/2	6	54	8	72
	19.1	3/4	20	180	30	264
10,000 psi	12.7	1/2	6	54	8	72
	19.1	3/4	20	180	30	264

Valve body parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions.

This section includes instructions for packing lubrication, packing maintenance, trim maintenance and lapping seating surfaces. All maintenance operations can be performed with the valve in the line.

NOTE:

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket upon reassembly. This is necessary to ensure a good gasket seal because the used gasket might not seal properly.

4.1 Packing Lubrication

The valve might have an optional lubricator or lubricator/isolating valve (Figure 2) in the tapped bonnet. Use the lubricator or lubricator/isolating valve for PTFE/composition or other packings that need lubrication. Use a silicon-base lubricant. Do not lubricate packing used in oxygen service. To operate the lubricator, turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except open the isolating valve before turning the cap screw. Close the isolating valve after lubrication is completed.

4.2 Packing Maintenance

Refer to Figures 3, 4 and 5 for key number locations. For spring-loaded single PTFE V-ring packing, the packing spring (key 9) maintains a sealing force on the packing. If you find leakage around the packing follower (key 10), check to be sure the packing follower is touching the bonnet (key 5). If the packing follower is not touching the bonnet, tighten the packing flange nuts (key 15) until the packing follower touches the bonnet. If you cannot stop leakage in this way, proceed to the Replacing Packing procedure.

If there is unwanted packing leakage with other than spring-loaded packing, first try to limit the leakage and seal the stem. To limit the leakage, tighten the packing flange nuts (key 15) to at least the minimum recommended torque in Table 3. However, do not exceed the maximum recommended torque in Table 3 or excessive friction might result. If the packing (key 8) is relatively new and tight on the stem and tightening the packing flange nuts does not stop the leakage, a worn or nicked valve stem might prevent a seal. If the leakage comes from the outside diameter of the packing, nicks or scratches around the packing box wall might cause the leakage. While replacing the packing per the numbered steps below, inspect the valve stem and packing box wall for nicks and scratches.

4.3 Replacing Packing

Except where indicated, refer to Figures 3, 4 and 5 for key number locations.



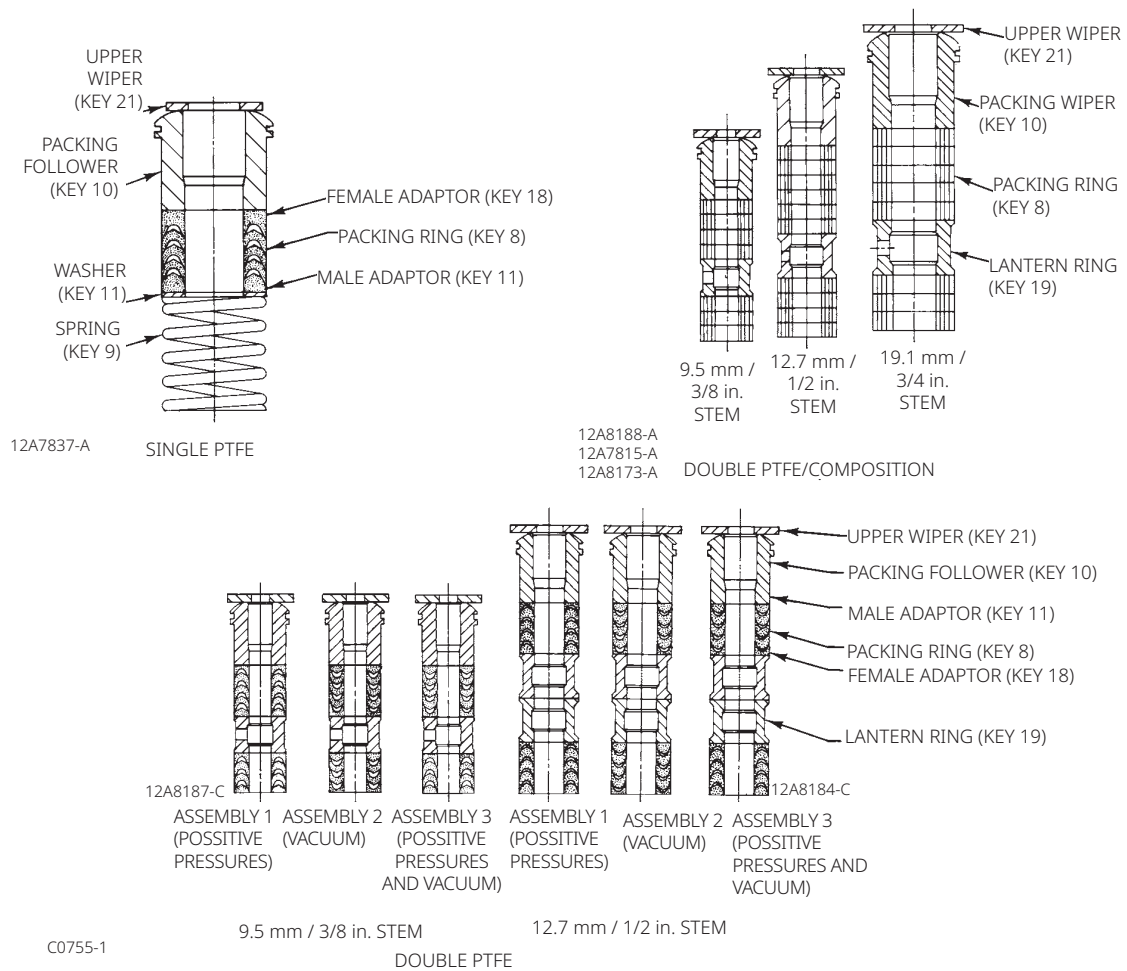
WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator and any leak-off piping from the bonnet. Release all pressure from the actuator and relieve spring precompression. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

Disconnect the stem connector and then remove the actuator from the valve body by unscrewing the actuator yoke locknut (key 14).
2. Loosen the packing flange nuts (key 15) so the packing is not tight on the valve stem. Remove any travel indicator parts and stem locknuts from the valve stem threads.
3. Unscrew the bonnet (key 5) from the valve body (key 1). Carefully lift off the bonnet and valve plug/stem assembly (key 4) as a unit. Set the bonnet on a protective surface to prevent damage to the bonnet threads and gasket surface.
4. Remove the valve plug/stem assembly from the bonnet. If you plan to re-use the valve plug, tape or otherwise protect the valve plug seating surface and the stem threads to prevent damage.
5. Remove the bonnet gasket (key 7). Cover the opening in the valve body to protect the gasket surface and prevent foreign material from getting into the body cavity.
6. Remove the packing flange nuts, packing flange, upper wiper and follower (keys 15, 12, 21 and 10). Carefully push out all the remaining packing box parts from the bonnet using a rounded rod or other tool that will not scratch the packing box wall or bottom guide bushing. Clean the packing box and the metal packing box parts.
7. Inspect the valve stem threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If you cannot improve the surface condition by light sanding, replace the damaged parts.

Figure 3. Packing Arrangements



8. Install a new bonnet gasket (key 7), making sure the gasket seating surfaces are clean and smooth. Carefully install the valve plug/stem assembly into the valve body. Then slide the bonnet over the stem and thread it tightly into the valve body, per the torque values in Table 4.
9. Install new packing and the metal packing box parts according to the correct arrangement in Figure 3. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box.

Table 4. Torque for Body-to-Bonnet Joint

VALVE SIZE	RECOMMENDED TORQUE	
	N•m	lbf•ft
NPS 1	1060	780
NPS 2 - Up to 6000 psi valve rating	2030	1500
NPS 2 to 9000 ⁽¹⁾ and 10,000 psi valve rating	2710	2000
1. 9000 psi valve rating is available for Fisher DA only.		

Table 5. Torque for Seat Ring (Key 2)

VALVE SIZE, NPS	RECOMMENDED TORQUE	
	N•m	lbf•ft
1	407	300
2	698	515

10. Slide the packing follower, upper wiper and packing flange (keys 10, 21 and 12) into position. Lubricate the packing flange studs (key 13) and the faces of the packing flange nuts (key 15). Install the packing flange nuts.
11. For spring-loaded PTFE V-ring packing, tighten the packing flange nuts (key 15) until the packing follower (key 10) contacts the bonnet. For other packing arrangements, tighten the packing flange nuts (key 15) alternately in small equal increments. Continue until one of the nuts reaches the minimum recommended torque shown in Table 3. Then tighten the remaining packing flange nut until the packing flange is level and at a 90° angle to the valve stem.
12. Mount the actuator on the bonnet (key 5) and connect the actuator and valve plug stem according to the procedure in the appropriate actuator instruction manual. Check for leakage around the packing follower when you put the control valve assembly into service. Retighten the packing flange nuts as required.

4.4 Trim Maintenance

Refer to Figures 4 and 5 for key number locations.

Disassembly

1. Remove the actuator and the bonnet as described in steps 1 through 3 of the Replacing Packing procedure.

NOTICE

Use care to avoid damaging the gasket sealing surfaces.

The stem surface finish of the valve plug/stem assembly (key 4) is critical for making a good packing seal. The seating surfaces of the seat ring (key 2) and the plug of the valve plug/stem assembly (key 4) are critical for tight shutoff. Protect these parts from damage if you plan to re-use them in the valve.

2. If you wish, remove the valve plug/stem assembly (key 4) and the packing parts from the bonnet. If you plan to re-use the valve plug, tape or otherwise protect the valve plug seating surface and the stem threads to prevent damage. Remove the packing parts as described in the Packing Maintenance procedure.
3. Use a socket wrench to remove the seat ring (key 2).
4. Remove the seat ring (key 2) and seat ring gasket (key 3) from the valve body.
5. Inspect parts for wear or damage that would prevent proper operation of the valve body. Clean the gasket surfaces.
6. Replace trim parts as necessary or use the Lapping Metal Seats procedure.

Lapping Metal Seats

A certain amount of leakage should be expected with metal-to-metal seating in any valve body. If the leakage becomes excessive, however, the condition of the seating surfaces of the valve plug and seat ring (keys 4 and 2, Figures 4 and 5) can be improved by lapping. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Partially assemble the valve so the seat ring and valve plug are in place and the bonnet (with bushing installed) is screwed hand-tight into the body. Make a simple handle from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction with light downward pressure to lap the seats. If you think there is not enough lubrication (for example, if you hear a squeaking noise or feel vibration), stop the procedure and apply more lapping compound before continuing. After lapping, remove the bonnet and valve plug/stem assembly as a unit and clean the seating surfaces. Completely assemble as described in the Assembly portion of the Trim Maintenance procedure.

Test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

Assembly

1. Thoroughly clean the seat ring and bonnet threads in the valve body (key 1). Also clean the valve body seat ring gasket surfaces.
2. Apply anti-seize lubricant to the threads of the seat ring (key 2), bonnet (key 5) and their mating threads in the body.
3. Put the seat ring gasket (key 3) into the body.
4. Screw the seat ring into the body. Use a socket wrench to tighten the seat ring to the torque values shown in Table 4. Remove all excess lubricant after tightening.
5. Clean the bonnet gasket seating surfaces and install a new bonnet gasket (key 7).
6. If you had not removed the valve plug/stem assembly and packing from the bonnet, then install the bonnet (key 5) and valve plug/stem assembly (key 4) as a unit, into the valve body. Keeping the valve plug/stem assembly in an "up" position, thread the bonnet tightly into the valve body, per torque values in Table 4.
7. If you had previously chosen to remove the valve plug/stem assembly and packing from the bonnet, then remove any protective tape or covering from the valve plug/stem assembly (key 4) and carefully install it into the valve body. Slide the bonnet (key 5) over the stem and thread it tightly into the valve body. Install new packing and the metal packing box parts according to the correct arrangement in Figure 3. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box.
8. Slide the packing follower, upper wiper and packing flange (keys 10, 21 and 12) into position. Lubricate the packing flange studs (key 13) and the washer surfaces of the packing flange nuts (key 15). Install the packing flange nuts.
9. For spring-loaded PTFE V-ring packing, tighten the packing flange nuts (key 15) until the packing follower (key 10) contacts the bonnet. For other packing arrangements, tighten the packing flange nuts (key 15) alternately in small equal increments. Continue until one of the nuts reaches the minimum recommended torque shown in Table 3. Then tighten the remaining packing flange nut until the packing flange is level and at a 90° angle to the valve stem.
10. Mount the actuator on the bonnet (key 5) and connect the actuator and valve plug stem according to the procedure in the appropriate actuator instruction manual. Check for leakage around the packing follower (key 10) when you put the control valve assembly into service. Retighten the packing flange nuts as required.

Section 5: Parts

5.1 Parts Ordering

Each body-bonnet assembly is assigned a serial number, which is on the body or nameplate. The serial number also appears on the actuator nameplate if you bought a valve and actuator assembly. Refer to this serial number when contacting your [Emerson sales office](#) for technical advice. When ordering replacement parts, mention the serial number. Also specify key number, part description, material and part number from the following lists of Parts Kits and part numbers.



WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

5.2 Parts Kits

Description	Part Number
Packing box parts for double PTFE V-Ring Packing (Includes keys 3, 7, 8, 11, 18, 19 and 21) 9.5 mm / 3/8 in. Stem 12.7 mm / 1/2 in. Stem	RDX0000CN12 RDX0000CN22
Trim package (S31600) [Includes Equal Percentage S31600 (316 SST) with R30006 (alloy 6) tip valve plug/stem (key 4), S316000 with alloy 6 seat ring (key 2), stainless steel gaskets (keys 3 and 7) and single PTFE packing parts (keys 8, 9, 11, 17, 18 and 21) or double PTFE packing parts (keys 8, 11, 18, 19 and 21)]	
Double PTFE V-ring packing NPS 1 Valve with 9.5 mm / 3/8 in. Stem Dia. 6.4 mm / 0.25 in. port dia. 9.5 mm / 0.375 in. port dia. 12.7 mm / 0.5 in. port dia. 19.1 mm / 0.75 in. port dia. NPS 2 Valve with 12.7 mm / 1/2 in. Stem Dia. 6.4 mm / 0.25 in. port dia. 9.5 mm / 0.375 in. port dia. 12.7 mm / 0.5 in. port dia. 19.1 mm / 0.75 in. port dia. 25.4 mm / 1 in. port dia. 31.8 mm / 1.25 in. port dia.	RDXCNTRM112 RDXCNTRM122 RDXCNTRM132 RDXCNTRM142 RDXCNTRM212 RDXCNTRM222 RDXCNTRM232 RDXCNTRM242 RDXCNTRM252 RDXCNTRM262

Description	Part Number
Trim package (Ceramic)	
Includes seat ring and valve plug/stem assy (keys 2 and 4)	
NPS 1 Valve with 9.5 mm / 3/8 in. Stem Dia.	
6.4 mm / 0.25 in. port dia.	RDXVTC00012
9.5 mm / 0.375 in. port dia.	RDXVTC00022
12.7 mm / 0.5 in. port dia.	RDXVTC00032
19.1 mm / 0.75 in. port dia.	RDXVTC00042
NPS 2 Valve with 12.7 mm / 1/2 in. Stem Dia.	
6.4 mm / 0.25 in. port dia.	RDXVTC00052
9.5 mm / 0.375 in. port dia.	RDXVTC00062
12.7 mm / 0.5 in. port dia.	RDXVTC00072
19.1 mm / 0.75 in. port dia.	RDXVTC00082
25.4 mm / 1 in. port dia.	RDXVTC00092
31.8 mm / 1.25 in. port dia.	RDXVTC00102

5.3 Parts List

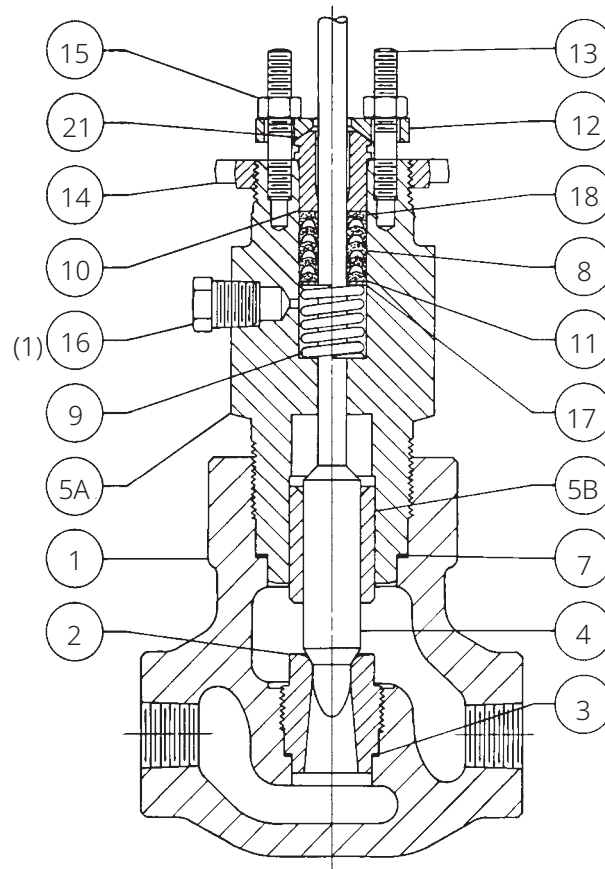
NOTE:

Part numbers are shown for recommended spares only. For part numbers not shown, contact your [Emerson sales office](#).

NOTE:

Abbreviations used in this parts list are: SST (stainless steel), RTJ (ring-type joint), RF (raised face), SCH (schedule), BWE (butt welding end), dia. (diameter), in. (inches), mm (millimeters), psi (pounds per square inch) and zn pl (zinc plated). Sizes shown in inches are valve sizes unless otherwise stated. Select parts titled 3600 psi if your valve has a CL1500 or lower rating and select parts titled 6000 psi if your valve has a CL2500 rating.

Key	Description	Key	Description
001	Valve body	011*	Packing adaptor, male
002*	Seat ring	012	Packing flange
003*	Gasket	013	Packing box stud
004*	Micro-Flute valve plug/stem assembly	014	Yoke locknut, steel
004*	Equal percentage valve plug/stem assembly	015	Hex nut
005	Bonnet/Bushing assy	016	Pipe plug
005	Bonnet/Bushing assy	016	Stem lubricator/Isolating valve
007*	Gasket	016	Pipe Nipple for lubricator/Isolating valve
008*	Packing ring	016	Stem lubricator
010	Packing follower		
*Recommended spare parts			

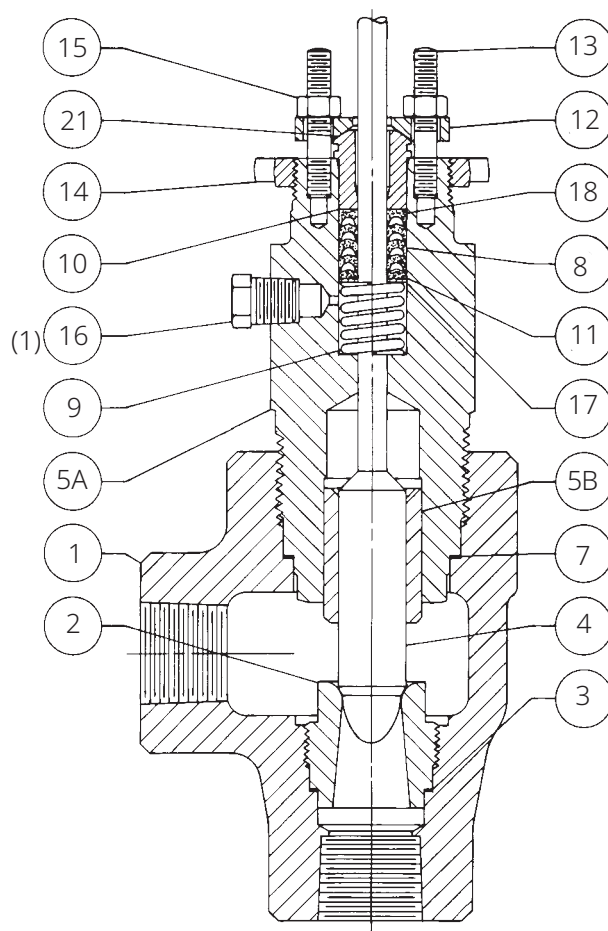
Figure 4. Fisher D Globe-Style Valve

BF2007-F
A5862-1



NOTE:

1. PIPE PLUG (KEY 16) INCLUDED ONLY IF BONNET IS DRILLED AND TAPPED FOR PACKING LUBRICATOR AND LUBRICATOR IS NOT INSTALLED.

Figure 5. Fisher DA Angle-Style Valve

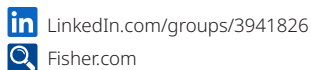
BF2035-D
A5861-1

NOTE:

1. PIPE PLUG (KEY 16) INCLUDED ONLY IF BONNET IS DRILLED AND TAPPED FOR PACKING LUBRICATOR AND LUBRICATOR IS NOT INSTALLED.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS



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FISHER™



Fisher™ D2T FloPro and D2 Angle Control Valves



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual provides installation, maintenance and parts information for the Fisher D2T and D2 Angle control valves and actuators.

WARNING



Do not install, operate or maintain a D2T or D2 Angle control valve without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

1.2 Description

The D2T and D2 Angle control valves (Figure 1) are compact, rugged valves designed for on/off control of a variety of fluids at pressures up to 155 bar / 2250 psig. This valve is ideal for use as a dump valve on gas separators and scrubbers. It is also well suited for other high pressure applications in natural gas production, compression and processing. The valve has threaded end connections and is available in an NPS 1 globe style or angle style valve body.

Figure 1. Fisher D2T FloPro Control Valve and D2 Angle Control Valve



Table 1. Specifications

Valve Assembly Pressure Class	Port Diameter
ASME B16.34 CL900	13 mm / 0.5 in.
Maximum Inlet Pressure and Temperature ⁽¹⁾	Maximum Travel
155 bar from -46 to +93°C and 150 bar at 149°C / 2250 psig from -50 to +200°F and 2185 psig at 300°F	13 mm / 0.5 in.
Maximum Allowable Pressure Drop ⁽¹⁾	Approximate Weight
Flow Down⁽²⁾ Maximum Inlet Pressure: 155 bar / 2250 psig Maximum Outlet Pressure: 103 bar / 1500 psig Flow Up Maximum Inlet Pressure: 103 bar / 1500 psig Maximum Outlet Pressure: 103 bar / 1500 psig	7.7 kg / 17 lb
Shutoff Classification	Material Temperature Capabilities
	Valve Body Assembly: -46 to +149°C / -50 to +300°F Actuator Assembly: -46 to +93°C / -50 to +200°F
End Connections	Bonnet/Body Connection
Class IV ANSI/FCI 70-2 and IEC 60534-4	Threaded with leakoff bleed
Construction Materials	Standard Actuator Configuration
Valve Body and Bonnet: ASME SA 352 LCC Valve Plug and Seat: ■ R30006 (Alloy 6) or ■ S17400 double H1150 Valve Stem: S31600 O-rings: HNBR (Hydrogenated Nitrile) Packing: PTFE/Carbon PTFE Packing Springs: N07718 Stem Bushing: PPS (polyphenylene sulfide) Actuator Diaphragm: Nitrile/Polyester Actuator Springs: Zinc-plated steel	The actuator is an on/off spring-and-diaphragm. Globe or Angle Valve Body: Supplied as either Air-to-Open or Air-to-Close.
Flow Characteristic	Maximum Actuator Casing Pressure
	2.8 bar / 40 psig
Flow Characteristic	Minimum Required Actuator Casing Pressure
	2.1 to 2.4 bar / 30 to 35 psig
Flow Characteristic	Actuator Diaphragm Effective Area
	194 cm ² / 30 in ²
Flow Characteristic	Actuator Pressure Connections
	1/4 NPT internal
1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded. 2. Standard flow direction.	

1.3 Education Services

Emerson's Education Services
Phone: 800-338-8158
Email: education@emerson.com
emerson.com/en/final-control/services/valve-training

1.4 Specifications

Table 1 lists specifications for the D2T and D2 Angle control valves. Some of the specifications for a given control valve as it originally comes from the factory are stamped on a nameplate located on the upper diaphragm casing flange.

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in Table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for overpressure protection as required by accepted industry or local, state and Federal codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

NOTICE

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also, remove any pipe scale, welding slag or other foreign material from the pipeline.

1. Before installing the valve, inspect it to be certain that the valve body cavity is free of foreign material. Clean out all pipelines to remove scale, welding slag and other foreign materials.
2. The control valve assembly may be installed in any orientation unless limited by seismic criteria.
The standard flow direction is indicated by the arrow on the valve body.
3. Use accepted piping practices when installing the valve in the pipeline.
4. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.

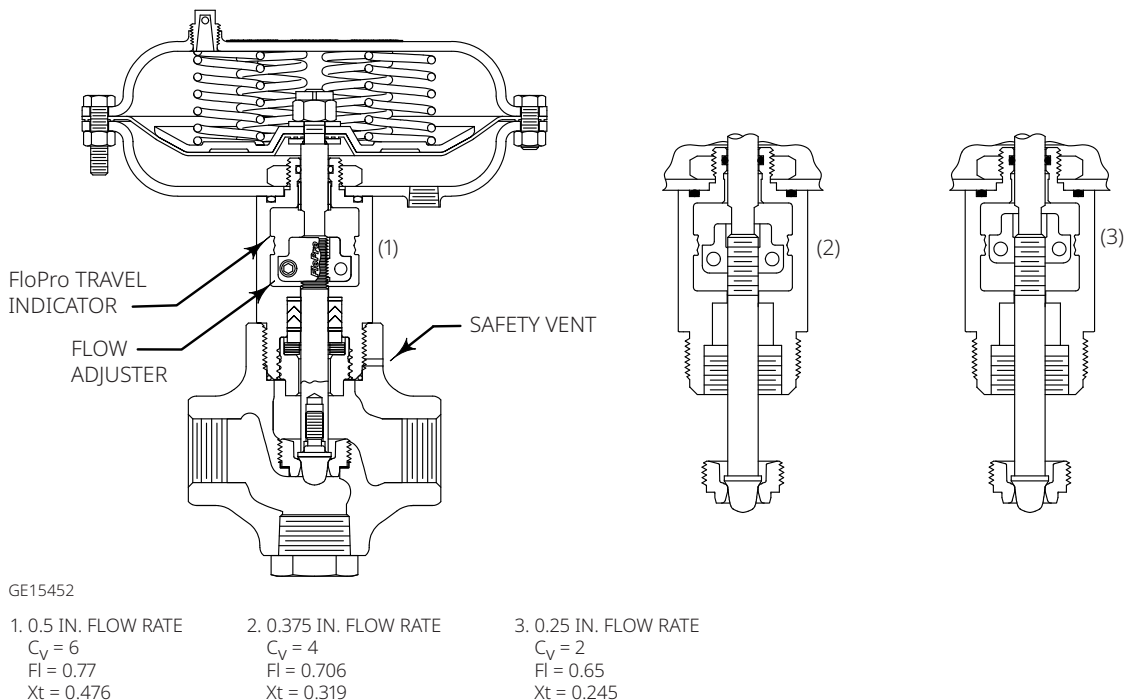
NOTE

The D2T and D2 Angle valves are equipped with Fisher ENVIRO-SEAL™ packing.

The actuator is available from the factory as either air-to-open or air-to-close.

Additionally, the actuator as shipped from the factory, has the FloPro flow adjuster set at a 0.375 in. port flow rate position. If some other flow rate is desired, see the Setting Valve FloPro Flow Adjuster section in this manual.

Figure 2. Flow Rate Adjustments



2.1 Setting Valve FloPro Flow Adjuster

Air-to-Open Actuator Action

1. To change the valve flow rate, loosen the flow adjuster socket head cap screws (key 29) and reposition the flow adjuster halves (keys 14 and 15) to the desired flow rate position. See Figure 2 for flow rate settings.

Air-to-Close Actuator Action

1. Attach a pressure line to the actuator. Supply pressure to the actuator to seat the plug in the seat ring.
2. To change the valve flow rate, loosen the flow adjuster socket head cap screws (key 29) and reposition the flow adjuster halves (keys 14 and 15) to the desired flow rate position. See Figure 2 for flow rate settings.

2.2 Changing Actuator Action from (Air-to-Open) to (Air-to-Close)

Key numbers are referenced in Figures 6 and 7.



WARNING

To prevent possible personal injury or property damage from removing the casing cap screws in the wrong sequence, follow the procedure as outlined below for removing the upper casing.

1. Remove the six short actuator casing cap screws (key 22) first. Once these have been removed from the actuator assembly, remove the two long actuator cap screws (key 30) by alternating between them as you loosen them, to keep the upper casing (key 21) level during this procedure.

NOTE

Be aware as you loosen and remove the actuator cap screws that the actuator springs are under compression.

2. Remove the upper casing (key 21) and the springs (key 27).
3. Do not turn the valve stem (key 4) while removing the diaphragm hex nut (key 26). Keep the stem from turning by using an open end wrench on the machined flats located on the valve stem above the flow adjuster for this procedure. Continue the actuator disassembly by removing the washer (key 24) diaphragm plate (key 25), diaphragm (key 19), washer (key 36) and O-ring (key 37). Inspect the diaphragm for any wear or damage. Replace with a new one if necessary.

4. Unscrew the socket head cap screws (key 29) and remove the flow adjuster halves (keys 14 and 15). Position the stem (key 4) to its most upward position.
5. Place 2 of the springs (key 27) from the actuator into the bottom casing (key 20), equally spaced, 180 degrees apart. Place the washer (key 36) over the valve stem, as shown in view A of Figure 7. Then place the O-ring (key 37) over the valve stem. Next install the diaphragm plate (key 25) and, using the diaphragm plate, correctly position the actuator springs.
6. Place the diaphragm (key 19) over the stem, along with washer (key 24). Position the diaphragm so the holes in the diaphragm align with the holes in the bottom casing.
7. Insert a 1/8 in. diameter drift punch or other suitable device through the 5/32 in. diameter hole in the valve stem located below the bottom of the previously removed flow adjuster. Install hex nut (key 26) and tighten to 10 N•m / 90 lbf•in. Use the 1/8 in. drift punch or other holding device to turn the stem to align the holes of the diaphragm (key 19) to the lower casing (key 20).
8. Position the upper casing and install the two long cap screws (key 30) opposite one another. Install the six shorter cap screws (key 22) and the hex nuts, tightening the actuator casing cap screws evenly using a cross-tightening procedure. Torque to 10 N•m / 8 lbf•ft.
9. Connect a pressure line to the top actuator pressure connection and apply pressure to the actuator. Stroke the actuator until the valve plug is seated on the seat ring. Install the flow adjuster, positioning it to the desired travel. Tighten the flow adjuster socket head cap screws to 3 N•m / 26 lbf•in.
10. Release the actuator pressure and install the vent plug (key 28) into the bottom casing pressure connection.

Section 3: Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing and trim maintenance and replacing actuator parts.

All maintenance operations can be performed with the valve in the line.

NOTE

Whenever a gasket seal or O-ring is disturbed by removing or shifting gasketed parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal, since the used gasket or O-ring will not seal properly.

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

3.1 Valve Trim Maintenance

NOTE

The following maintenance procedures apply to both air-to-open and air-to-close actuator configurations, except for steps 2 and 8 as noted.

Key numbers are referenced in Figures 6 and 7.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve.
2. For air-to-open actuator action only, apply pressure to the actuator to fully stroke it open. This will raise the plug off its seat so that the valve stem serrations are visible inside the flow adjuster window (see Figure 3). Loosen the socket head screws (key 29) and lower the flow adjuster (key 14 and 15) to its lowest position on the valve stem. Retighten the socket head screws (key 29) to 3 N•m / 26 lbf•in. Relieve pressure to the actuator, shut off all pressure lines to the actuator and disconnect. Use lockout procedures to be sure that the above measures stay in effect while you work on the equipment.

NOTICE

The preceding step is intended to prevent damage to the valve plug (key 3) and seat ring (key 5) during the removal of the bonnet and actuator.

3. Unscrew the bonnet from the valve body.

**WARNING**

Avoid personal injury from sudden release of process pressure. If the process media starts to escape from the safety vent (see Figure 2) located in the bonnet neck of the valve body,

STOP DISASSEMBLY IMMEDIATELY!

The escape of process media indicates that the valve has NOT been isolated from the process media or process pressure is trapped in the valve body.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

4. Once the bonnet has been removed from the valve body, inspect the seat ring (key 5) for wear or damage. If the seating surface has been damaged, remove it from the valve body. Also remove the seat ring gasket (key 6). Clean and inspect the valve body gasket surface for damage. Visually inspect the valve body interior below the seat ring for erosion. Replace the valve body if necessary.

To replace the seat ring, first install a new seat ring gasket. Install the new seat ring and tighten to 230 N•m / 170 lbf•ft.

Cover the opening in the valve body to prevent foreign material from getting into the valve body cavity.
5. Inspect the valve stem for scratches or wear and valve plug for wear or damage. Replace if necessary.
6. If the valve plug requires replacement, use an open end wrench on the machined flats located on the valve stem above the flow adjuster and unscrew the valve plug from the valve stem. Replace it with a new valve plug. Screw the valve plug into the valve stem, being careful not to damage the plug seat or plug contour. Tighten to 18 N•m / 13 lbf•ft.

**WARNING**

Upon reassembly, ensure that no foreign material blocks the safety vent hole as shown in Figure 2. If the safety vent hole is blocked or plugged, possible personal injury from the sudden release of process pressure during maintenance disassembly may occur.

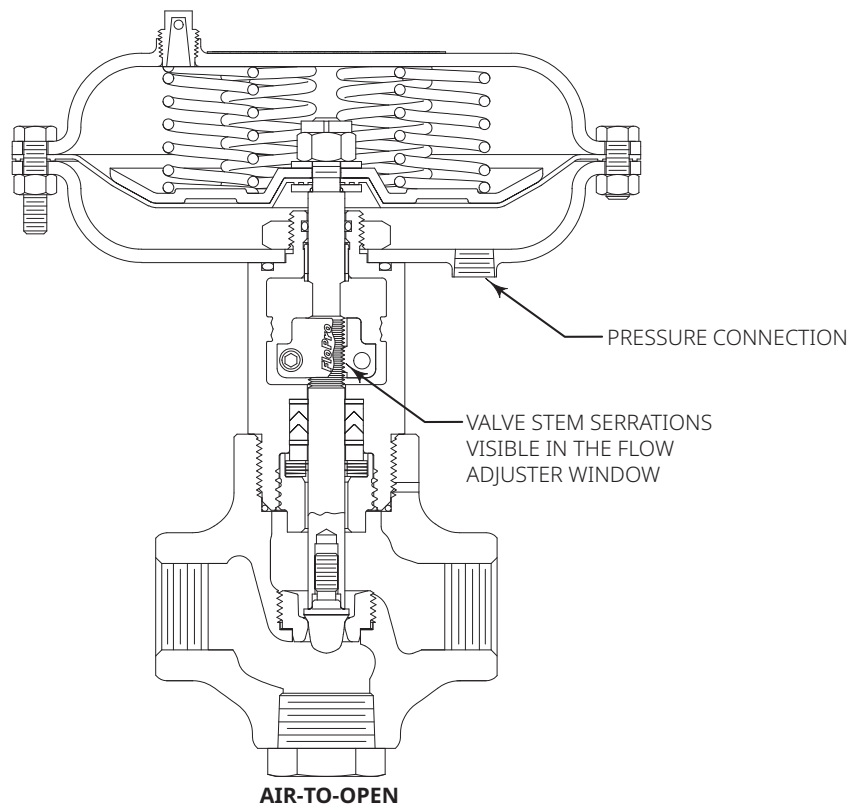
7. Lubricate a new O-ring (key 13) with lithium grease and place it into the valve body as shown in Figure 6 or 7. Ensure that no foreign material blocks the safety vent hole. Screw the bonnet into the valve body and torque to a range of 542 to 678 N•m / 400 to 500 lbf•ft.
8. For air-to-open actuator action only, attach the pressure line to the actuator and supply pressure to the actuator. Loosen the socket head screws (key 29) and remove the flow adjuster (keys 14 and 15). Release the pressure to the actuator. This allows the plug to find its seated position.
9. Set the flow adjuster to the desired travel position (see Figure 2) and tighten the flow adjuster socket head cap screws to 3 N•m / 26 lbf•in.

3.2 Packing, Valve Trim and Actuator Maintenance

NOTE

The following maintenance procedures apply to both air-to-open and air-to-close actuator configurations, except as noted.

Figure 3. Fisher D2T FloPro Construction



Key numbers are referenced in Figures 6 and 7.

Disassembly

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve.
2. For air-to-open actuator action only, apply pressure to the actuator to fully stroke it open. This will raise the plug off its seat so that the valve stem serrations are visible inside the flow adjuster window (see Figure 3). Loosen the socket head screws (key 29) and lower the flow adjuster (keys 14 and 15) to its lowest position on the valve stem. Retighten the socket head screws (key 29) to 3 N•m / 26 lbf•in. Relieve pressure to the actuator, shut off all pressure lines to actuator and disconnect. Use lockout procedures to be sure that the above measures stay in effect while you work on the equipment.

NOTICE

The preceding step is intended to prevent damage to the valve plug (key 3) and seat ring (key 5) during the removal of the bonnet and actuator.

3. Unscrew the bonnet from the valve body.



WARNING

Avoid personal injury from sudden release of process pressure. If the process media starts to escape from the safety vent (see Figure 2) located in the bonnet neck of the valve body,

STOP DISASSEMBLY IMMEDIATELY!

The escape of process media indicates that the valve has NOT been isolated from the process media or process pressure is trapped in the valve body.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

4. Once the bonnet has been removed from the valve body, inspect the valve seat (key 5) for wear or damage. If the seating surface has been damaged, remove it from the valve body. Also remove the seat ring gasket (key 6). Clean and inspect the valve body gasket surface for damage. Visually inspect the valve body interior below the seat ring for erosion. Replace the valve body if necessary.

To replace the seat ring, first install a new seat ring gasket. Install the new seat ring and tighten to 230 N•m / 170 lbf•ft.

Cover the opening in the valve body to prevent foreign material from getting into the valve body cavity.



WARNING

To prevent possible personal injury or property damage from removing the casing cap screws in the wrong sequence, follow the procedure as outlined below for removing the upper casing.

5. Remove the six short actuator casing cap screws (key 22) first. Once these have been removed from the actuator assembly, remove the two long actuator cap screws (key 30) by alternating between them as you loosen them, to keep the upper casing (key 21) level during this procedure.

NOTE

Be aware as you loosen and remove the actuator cap screws that the actuator springs are under compression for the air-to-open configuration.

6. Remove the upper casing (key 21) and the springs (key 27).
7. Do not turn the valve stem (key 4) while removing the diaphragm hex nut (key 26). Keep the stem from turning by using an open end wrench on the machined flats located on the valve stem above the flow adjuster for this procedure. Continue the actuator disassembly by removing these parts: washer (key 24) diaphragm plate (key 25), diaphragm (key 19), washer (key 36) and O-ring (key 37). Inspect the diaphragm for any wear or damage. Replace with a new one if necessary.

If you wish to inspect/replace the bonnet to actuator casing O-ring (key 16), mark the orientation of the actuator pressure connection to the bonnet for later reference (see Figure 3). Unscrew the hex nut (key 18) from the bonnet. Remove the bottom casing (key 20).
8. Unscrew the flow adjuster socket head cap screws (key 29) and remove the flow adjuster halves.
9. Unscrew the packing retainer (key 7) from the bonnet (key 2). After the packing retainer has been unscrewed from the bonnet, pull the valve stem and plug out of the bonnet.
10. Remove the five Belleville springs (key 9), packing spacer (key 10), packing (key 11) and two anti-extrusion rings (key 12) from the bonnet. See Figure 4.
11. Clean and inspect the packing box wall to ensure that the packing surfaces are not damaged. If the surface condition is damaged and cannot be improved by light sanding, replace the bonnet by contacting your [Emerson sales office](#).
12. Inspect the valve stem for scratches or wear and valve plug for wear or damage. Replace if necessary.
13. If the valve plug requires replacement, use an appropriate tool on the machined flats located on the valve stem above the flow adjuster and unscrew the valve plug from the valve stem. Replace it with a new valve plug. Screw the valve plug into the valve stem, being careful not to damage the plug seat or plug contour. Tighten to 18 N•m / 13 lbf•ft.
14. Inspect the valve stem bushing (key 8) located in the upper end of the bonnet. If damaged, remove and replace it with new bushing (key 8). Replace the valve stem bushing by inserting the bushing, flange end first, into the bore located at the top of the bonnet flow adjuster window. Insert until the flange snaps into the groove provided for it.
15. Remove the O-ring (key 17) from the upper end of the bonnet. Replace it with a new one and lubricate it with lithium grease.

Assembly

1. Use the packing spacer (key 10) and a tube to push the upper anti-extrusion washer (key 12) into place. Using the packing spacer in this manner will ensure the upper anti-extrusion washer is fully seated and flat when installed in the packing bore.
2. Remove the packing spacer from the packing bore.

NOTE

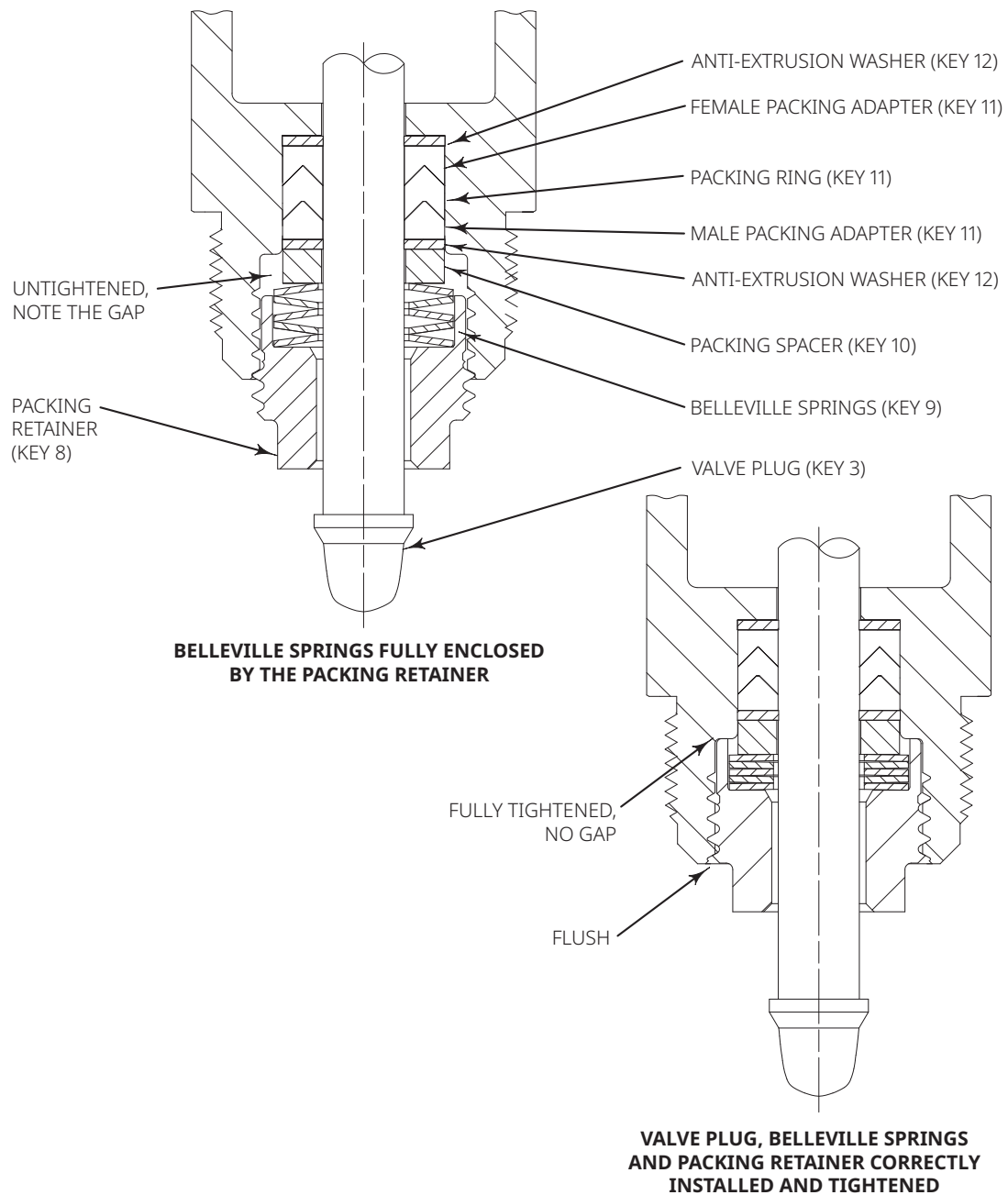
All D2T and D2 Angle packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D2T or D2 Angle packing lubricant.

NOTE

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-in. length of 1/2 in. PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

3. Apply a 3 mm / 1/8 in. bead of the supplied high performance fluorinated grease (key 38) around the groove of the female packing adaptor as shown in Figure 5 and install over the valve stem.
4. Apply a 3 mm / 1/8 in. bead of the supplied high performance fluorinated grease (key 38) around the groove of the packing ring as shown in Figure 5 and install over the valve stem.
5. Install the male packing adaptor, lower anti-extrusion washer (key 12) and packing spacer over the valve stem as shown in Figure 4.
6. Firmly press all packing parts into the packing bore with a tube.
7. Install the five Belleville springs (key 9) over the valve stem as shown in Figure 4.
8. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 in. wrench. Make sure the Belleville springs are completely enclosed by the packing retainer as shown in Figure 4.
9. Torque the packing retainer to 81 N•m / 60 lbf•ft. The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet (key 2). The packing retainer threads should be flush with the bottom of the bonnet as shown in Figure 4.

Figure 4. Packing and Belleville Spring Stacking Order



13. Position the upper casing and install the two long cap screws (key 30) opposite one another. Install the six shorter cap screws (key 22) and the hex nuts, tightening the actuator casing cap screws evenly using a cross-tightening procedure. Torque to 10 N•m / 8 lbf•ft.



WARNING

Upon reassembly, ensure that no foreign material blocks the safety vent hole as shown in Figure 2. If the safety vent hole is blocked or plugged, possible personal injury from the sudden release of process pressure during maintenance disassembly may occur.

14. Lubricate a new O-ring (key 13) with lithium grease and place it into the valve body as shown in Figure 6 or 7. Ensure that no foreign material blocks the safety vent hole. Screw the bonnet into the valve body and torque to a range of 542 to 678 N•m / 400 to 500 lbf•ft.
15. For air-to-open actuator action only, attach the pressure line to the actuator and supply pressure to the actuator. Loosen the socket head screws (key 29) and remove the flow adjuster (keys 14 and 15). Release the pressure to the actuator. This allows the plug to find its seated position.
16. Set the flow adjuster to the desired travel position (see Figure 2) and tighten the flow adjuster socket head cap screws to 3 N•m / 26 lbf•in.
17. For air-to-close actuator action only, attach a pressure line to the actuator. Supply pressure to the actuator to seat the plug in the seat ring.
18. Set the flow adjuster to the desired travel position (see Figure 2) and tighten the flow adjuster socket head cap screws to 3 N•m / 26 lbf•in.

Section 4: NPT Port Location

WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

NOTE

The NPT plug may be located in any port depending on customer installation requirements. The valve is shipped with the NPT plug installed in the bottom port.

1. The NPT plug shall be inserted into the desired port using NPT pipe sealant and/or pipe tape.
2. Tighten the NPT fitting until hand tight, then add 1 to 2-1/2 turns 149 to 163 N•m / 110 to 120 lbf•ft.

Figure 6. Fisher D2T FloPro Assembly—Air-to-Open

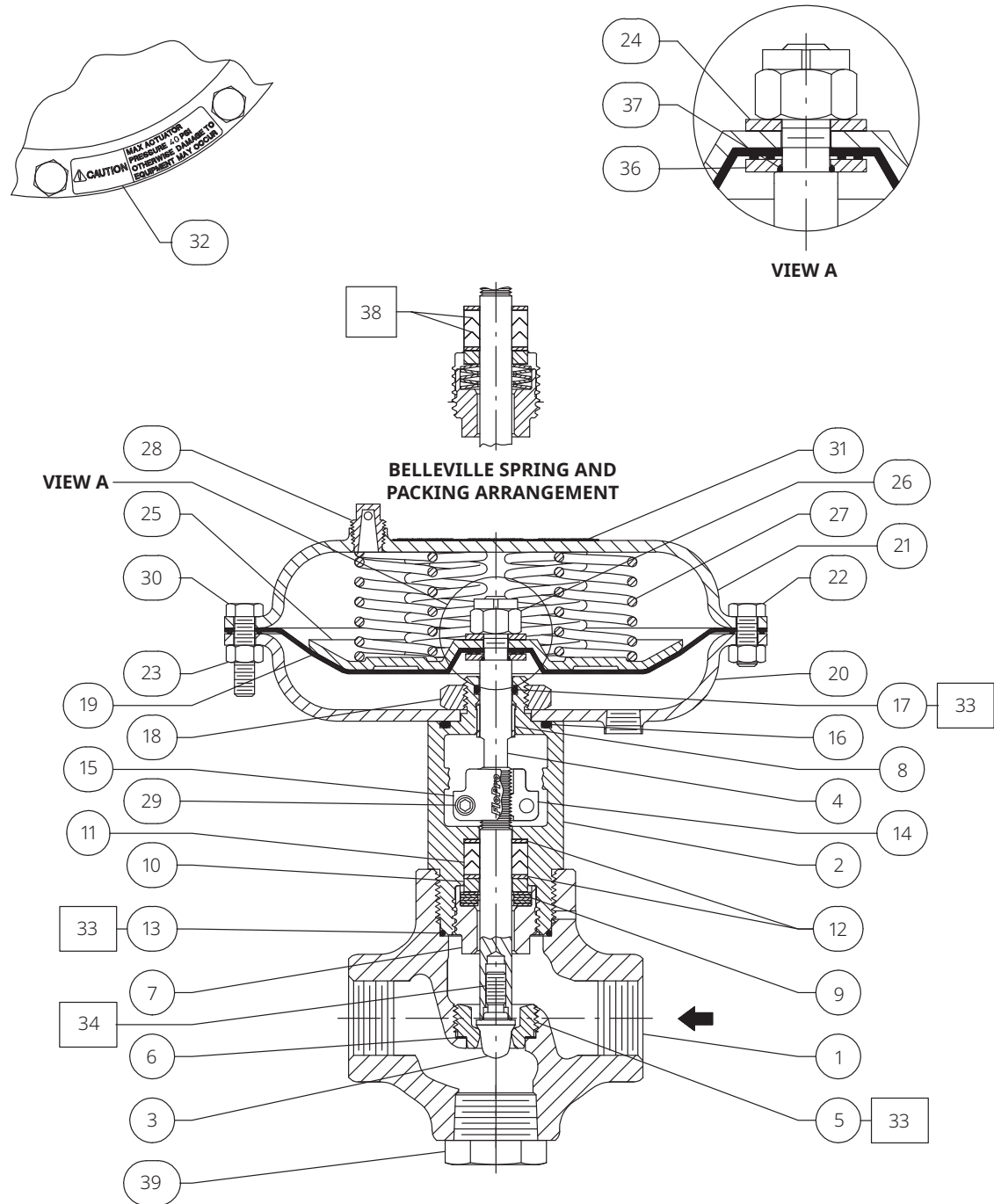


Figure 7. Fisher D2T FloPro Assembly—Air-to-Close

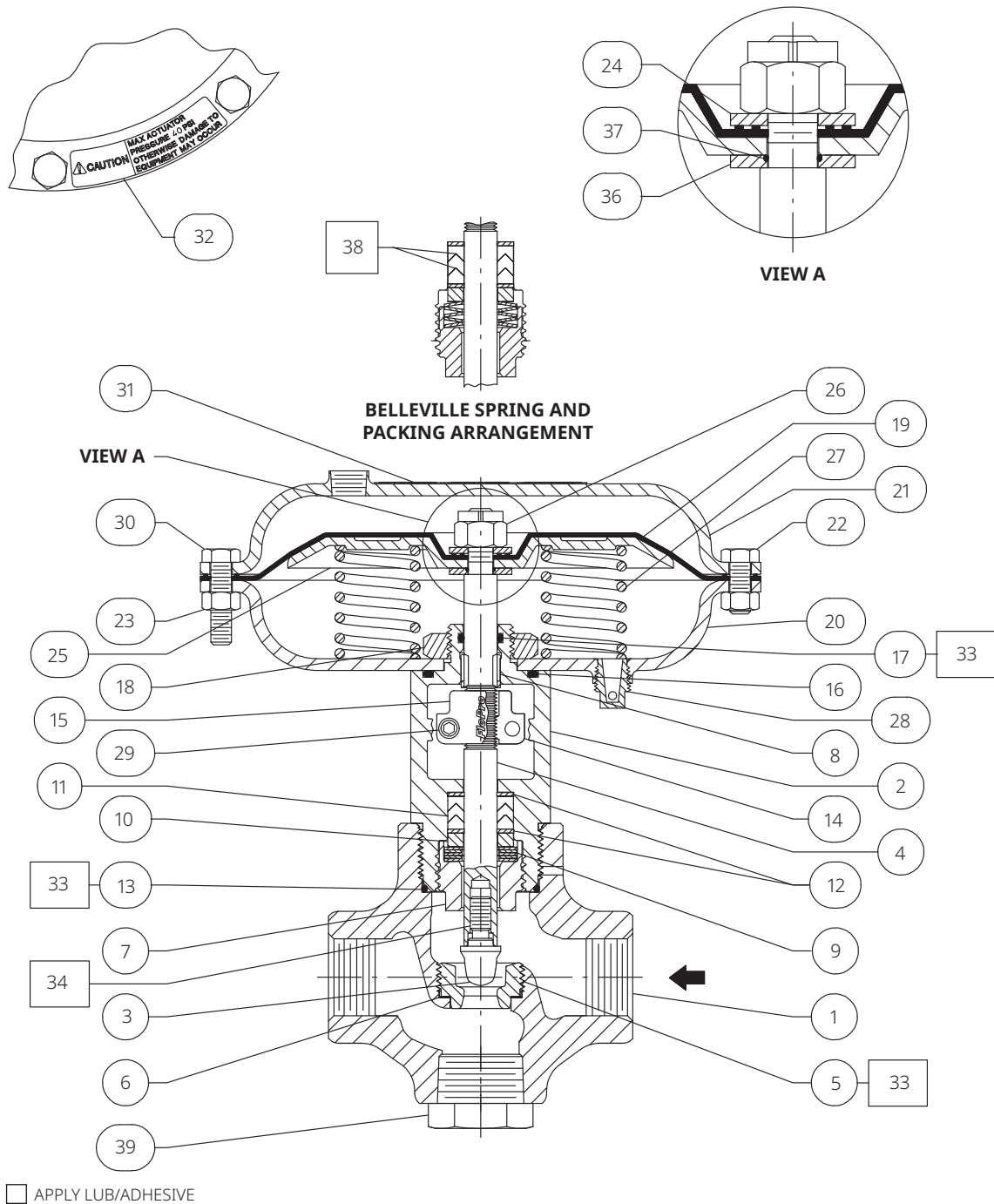
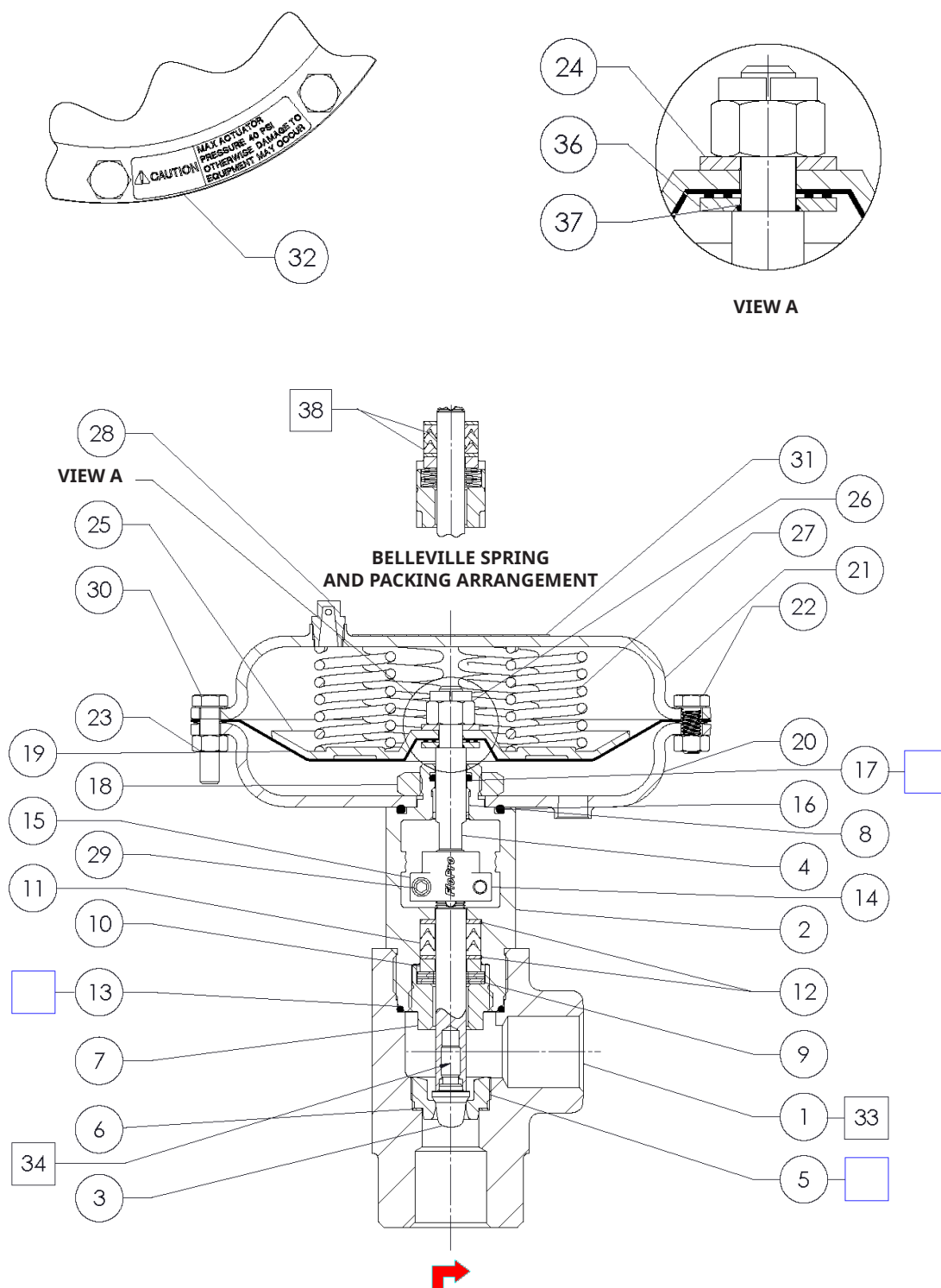


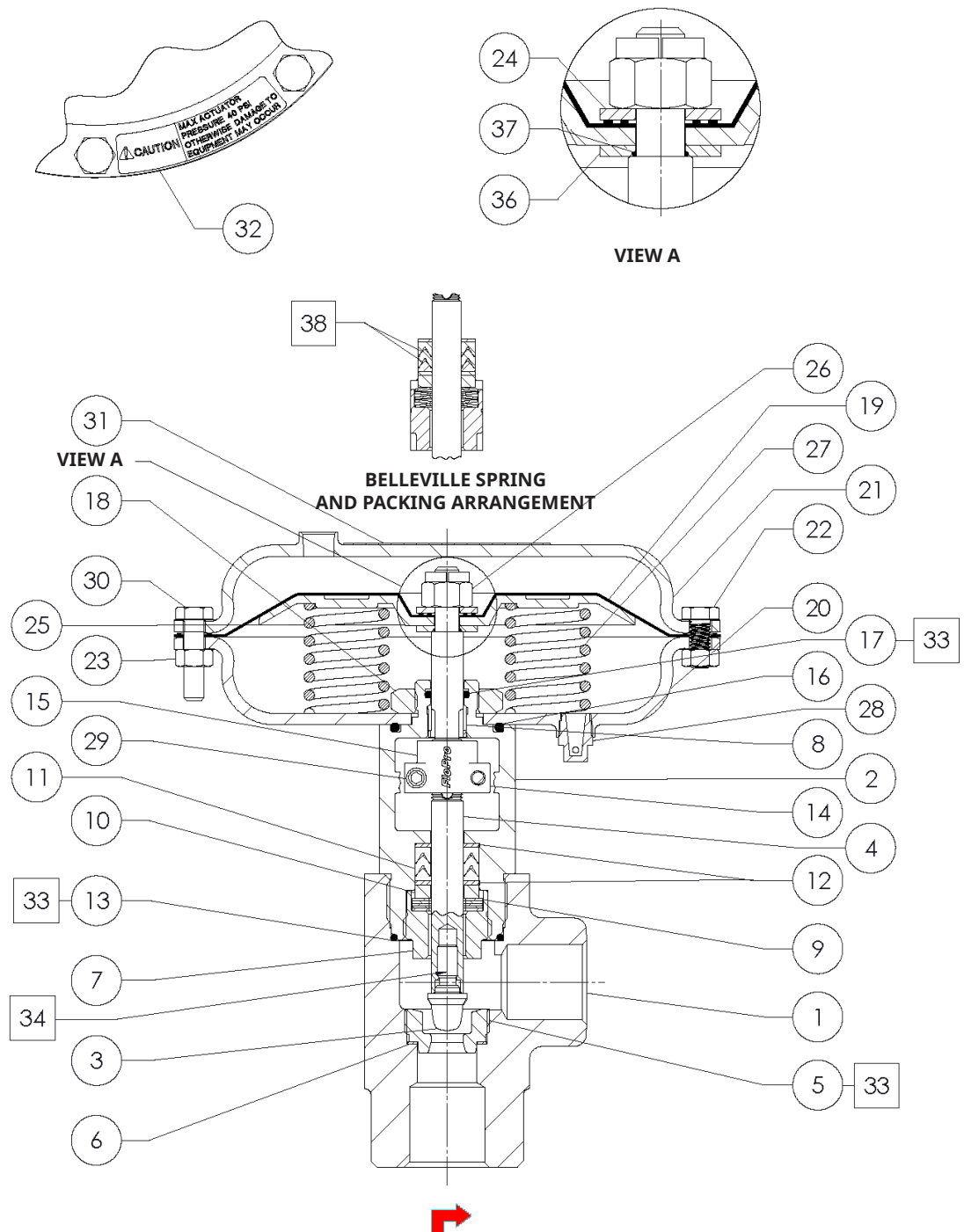
Figure 8. Fisher D2 Angle Body Assembly—Air to Open



GK26234

☐ . APPLY LUB/ADHESIVE

Figure 9. Fisher D2 Angle Body Assembly—Air to Close



GK26236

Section 5: Parts

5.1 Parts Ordering

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

5.2 Parts Kits

Table 2. Parts Kits

Description	Part Number
Valve Trim Kit*	
R30006 Valve Plug and Seat Includes key numbers 3, 5, 6 and 13	19B8485X012
S17400 double H1150 Valve Plug and Seat Includes key numbers 3, 5, 6 and 13	19B8485X022
Valve Packing Kit*	
Includes key numbers 8, 11, 12 (2 req'd), 13, 16, 17 and 38	19B8486X012
*Recommended spare parts.	

5.3 Parts List

NOTE

Contact your [Emerson sales office](#) for Part Ordering information.

Table 3. Parts List

Key	Description	Key	Description
1	Valve body	21	Upper casing
2	Bonnet	22	Short actuator casing cap screws (6 req'd)
3*	Valve plug	23	Nut
4*	Valve stem	24	Washer
5*	Seat ring	25	Diaphragm plate
6*	Seat ring gasket	26	Diaphragm hex nut

- continued -

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

D2T and D2 Angle Valves

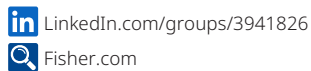
June 2026

Instruction Manual

D104138X012

Table 3. Parts List (continued)

Key	Description	Key	Description
7	Packing retainer	27	Springs Air-to-open (use 6 springs) Air-to-close (use 2 springs)
8*	Valve stem bushing		
9	Belleville springs (3 req'd)		
10	Packing spacer	28	Vent plug
11*	ENVIRO-SEAL Packing set	29	Flow adjuster socket head cap screws (2 req'd)
12*	Anti-extrusion ring (2 req'd)	30	Long actuator casing cap screws (2 req'd)
13*	Valve body O-ring	31	Nameplate
14	Flow adjuster half	32	Caution label
15	Flow adjuster half	33	Lubricant, lithium grease
16*	Casing O-ring	36	Washer
17*	Valve stem O-ring	37*	O-ring
18	Hex nut	38*	High performance fluorinated grease packing lubricant
19*	Diaphragm		
20	Bottom casing	39	NPT plug
*Recommended spare parts.			



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FISHER™



Fisher™ D3 Control Valve with easy-Drive™ Electric Actuator

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Figure 1. Fisher D3 Control Valve with easy-Drive Electric Actuator



W9795-4

Introduction

Scope of Manual

This instruction manual provides installation, maintenance, and parts information for the Fisher D3 control valve with easy-Drive electric actuator.

Do not install, operate, or maintain a D3 valve with easy-Drive electric actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Table 1. Specifications

Valve Body Sizes, End Connection Styles, and Port Diameters⁽¹⁾

VALVE SIZE, NPS	PORT DIAMETER, (INCHES)	THREADED	RAISED FACE (RF) FLANGED
		CL900	CL600
1	0.375, 0.75, 1	X	X
2	0.375, 0.75, 1	X	X

X = Available construction.

Maximum Inlet Pressures and Temperatures⁽¹⁾

VALVE BODY SIZE	MAXIMUM INLET PRESSURE	TEMPERATURE RANGE
	bar (psig)	°C (°F)
NPS 1 NPT CL900	155 (2250)	-46 to 93 (-50 to 200)
	150 (2185)	93 to 149 (200 to 300)
NPS 2 NPT CL900	155 (2250)	-46 to 93 (-50 to 200)
	150 (2185)	93 to 149 (200 to 300)
NPS 1 RF CL600	103 (1500)	-46 to 93 (-50 to 200)
	100 (1455)	93 to 149 (200 to 300)
NPS 2 RF CL600	103 (1500)	-46 to 93 (-50 to 200)
	100 (1455)	93 to 149 (200 to 300)

Maximum Shutoff Pressure Drops⁽¹⁾

MAXIMUM ΔP BAR (PSI) PER PORT SIZE			
Port Size, mm (inch)	9.5 (0.375)	19.1 (0.75)	25.4 (1.00)
Flow Up	155 (2250)	105 (1518)	75 (1089)
Flow Down	155 (2250)	155 (2250)	130 (1889)

Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4

Class IV

Flow Characteristic / Valve Plug Style

Equal percentage / Micro-Form Valve Plug

Maximum Travel

15 mm (0.6 inch)

Material Temperature Capabilities⁽¹⁾

Valve Body Assembly:

Standard Bonnet O-Ring: -40 to 135°C (-40 to 275°F)

Electric Actuator Assembly: -20 to 70°C

(-4 to 158°F), < 90% non-condensing humidity

Flow Direction

Flow up (standard), Flow down (optional)

Available Actuator Configurations

On/off (snap acting)

Positioning (flow or pressure control)

Power Requirements

12 or 24VDC, minimum 4 amp power supply required (fuse to 5 amps)

Maximum Current Draw

4 amps

Idle Current Draw

38 mA

Conduit Connections

Two 3/4 NPT connections

Stroke Length

FloPro controlled between 10mm (0.4 inch) and 15mm (0.6 inch)

Nominal Stroke Speed⁽²⁾

3.9 mm/s (0.15 inch/s) at 24 VDC

2.2 mm/s (0.09 inch/s) at 12 VDC

Hazardous Area Approvals

CSA (C/US): Explosion-Proof Class I, Division 1, Groups C and D, T6, Ex d IIA T6, Class I, Zone 1, AEx d IIA T6

ATEX Flameproof - Gas:

Ex II 2 G, Ex d IIA T6

IECEx Flameproof - Gas: Ex d IIA T6

Enclosure Rating

Type 4X and IP66

Duty Cycle

50% maximum

Enclosure Material

Cast aluminum alloy with powder coat paint

Approximate Weight:

18 - 27 kg (39 - 60 lbs), depending upon construction

1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded.

2. 10% variation can be expected, based on temperature and pressure of application.

Description

The Fisher D3 with easy-Drive electric actuator technology (figure 1) is a globe valve with electric actuator specifically designed for upstream, low power applications. The easy-Drive operates with 12 or 24VDC in either on/off or Positioning configurations.

The on/off configuration has 2 different states; opened or closed, which are ideal for dump or snap acting applications. The Positioning configuration extends the functionality to intermediate positions for flow and pressure control applications.

Specifications

Table 1 lists specifications for the D3 control valve. Some of the specifications for a given control valve as it originally comes from the factory are stamped on a nameplate located on the lower actuator housing.

Educational Services

For information on available courses for the Fisher D3 control valve with easy-Drive electric actuator, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts or by uncontrolled process fluid, be certain the service conditions do not exceed the limits shown on the valve nameplate and in table 1. Use pressure-relieving devices required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

For explosion-proof applications, ensure the actuator cover is properly bolted before applying power to the actuator. Personal injury or property damage may result from fire or explosion if power is applied to the actuator with the cover removed in a hazardous area.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 457 mm (18 inches) from the actuator. Personal injury or property damage may result from explosion if the seal is not installed.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection, and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#) or Local Business Partner.

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag, or other foreign material from the pipeline.

1. Before installing the control valve assembly, inspect it for any damage and for any foreign material that may have collected in the valve body.
2. Clean out all pipelines to remove scale, welding slag, and other foreign materials.
3. The control valve assembly may be installed in any orientation, but normally the actuator is vertical above the valve. Install the valve so the flow direction arrow on the side of the valve indicates the direction of the process flow.
4. Install the valve following local and national piping codes when they apply to the application. For screwed connections, treat the external pipe threads with a good grade pipe compound. For flanged connections, use suitable gaskets between valve and pipeline flanges.
5. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.

Special Instructions for “Safe Use” and Installations in Hazardous Locations

ATEX/IECEX

WARNING

To avoid static discharge from the enclosure, do not rub or clean the enclosure with solvents. To do so could result in an explosion. Clean with a mild detergent and water only.

The enclosure is non-conducting and may generate an ignition-capable level of electrostatic charges under certain extreme conditions. The user should ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a build-up of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment shall only be done with a damp cloth.

To avoid damage to the enclosure, when screws are fully tightened into blind holes in enclosure walls, with no washer fitted, at least one full thread shall remain free at the base of the hole.

Startup Overview

Figure 2. Flowchart

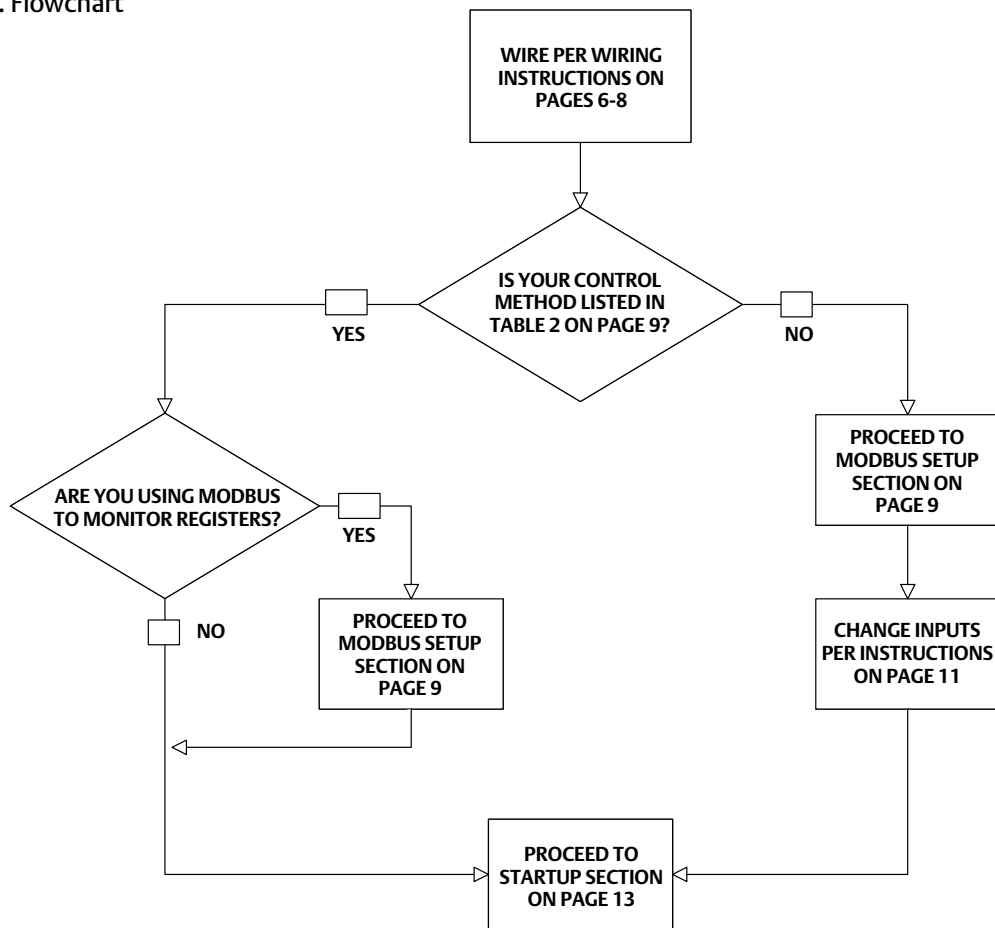
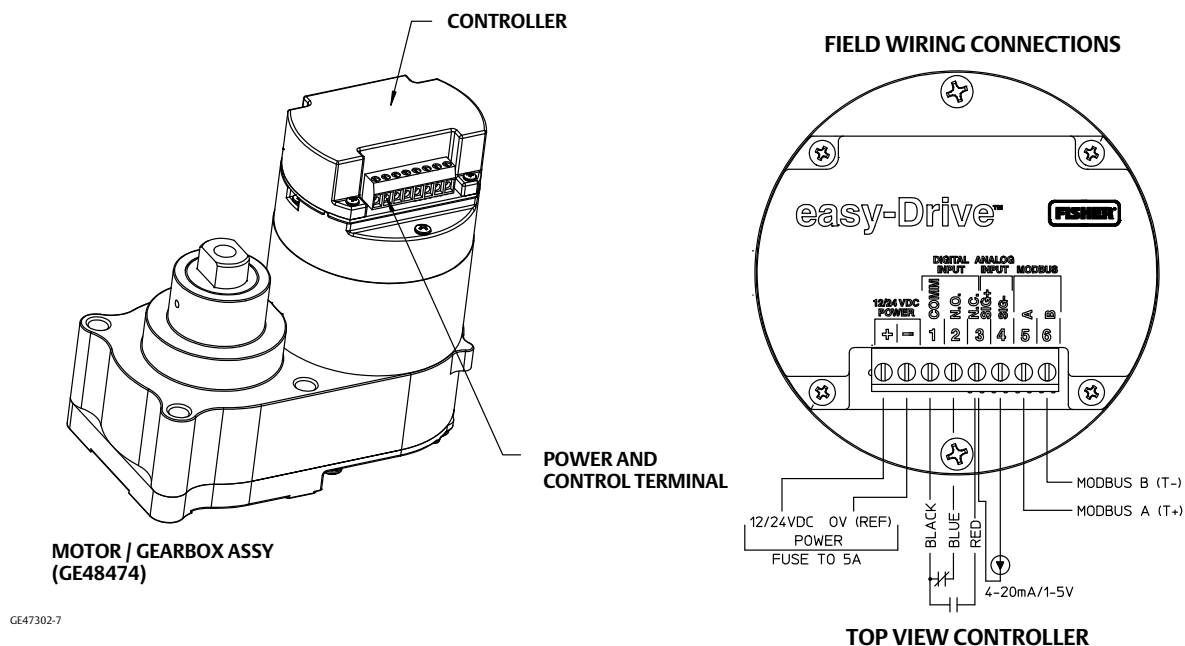


Figure 3. Fisher D3 Valve with easy-Drive Actuator Wiring Diagram



Power Requirements

Ensure a stable DC power source is available, maintaining less than 5% ripple and sufficiently surge protected for the application. A 4 amp (minimum) power supply is required. Use of a 36 volt transient voltage suppressor is highly recommended.

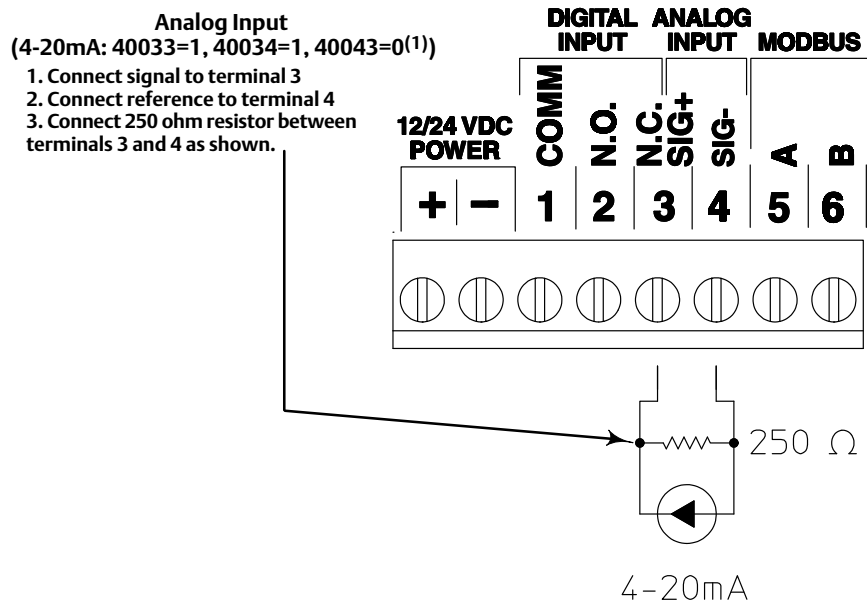
Wiring Instructions

1. Observe local wiring requirements for hazardous location usage.
2. Conduit seals within 450 mm (18 inches) of the enclosure port are required for explosion-proof installation.
3. 22AWG (0.33mm²) to 12AWG (3.31mm²) wire size required.
4. Fuse system to 5A.
5. Connect enclosure and analog signal shields.
6. Ensure power is turned off before connecting the wires.

Power

1. Connect 12 or 24 VDC reference to: –
2. Connect 12 or 24 VDC positive to: +
3. Be sure to tighten terminals sufficiently to ensure solid mechanical connection.

Figure 4. Wiring - Analog Input



NOTE:
1. 40043=0 SETS ANALOG INPUT TO 1-5V AND ASSUMES USE OF RECOMMENDED EXTERNAL 250 OHM RESISTOR.
IF NO EXTERNAL RESISTOR IS USED, SET 40043=1.

Figure 5. Wiring - L2e

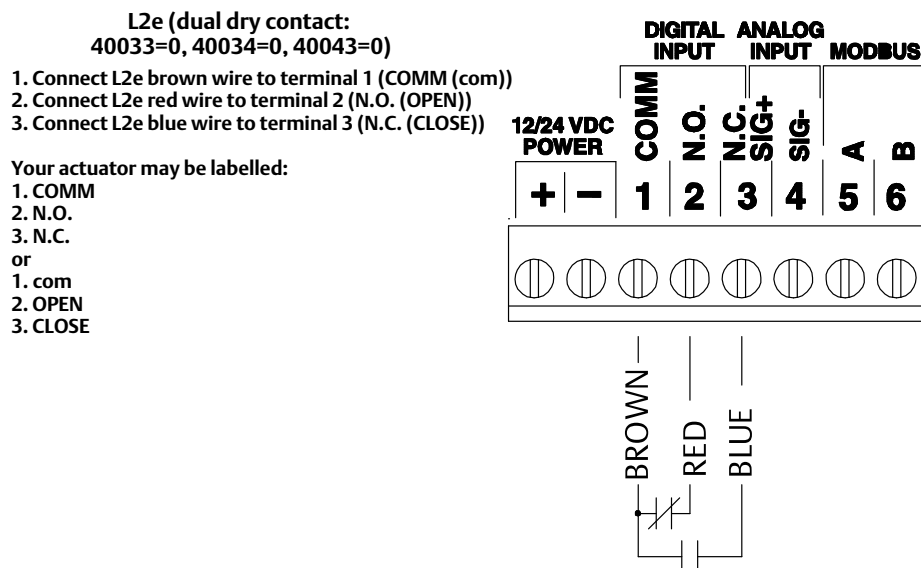


Figure 6. Wiring - Single Dry Contact

**Dry Contact (single dry contact:
40033=0, 40034=0, 40043=1)**

1. Connect one side of contact switch to terminal 1 (COMM)
2. Connect other side of contact switch to terminal 2 (N.O.)

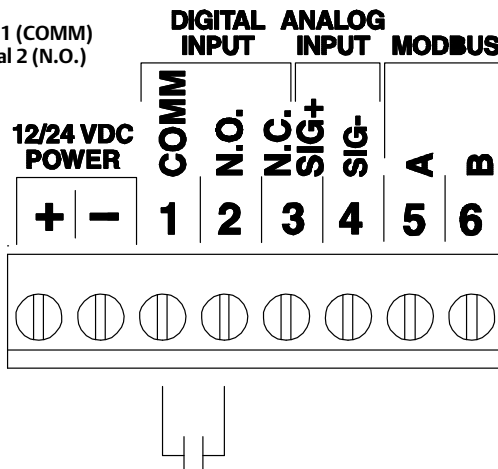


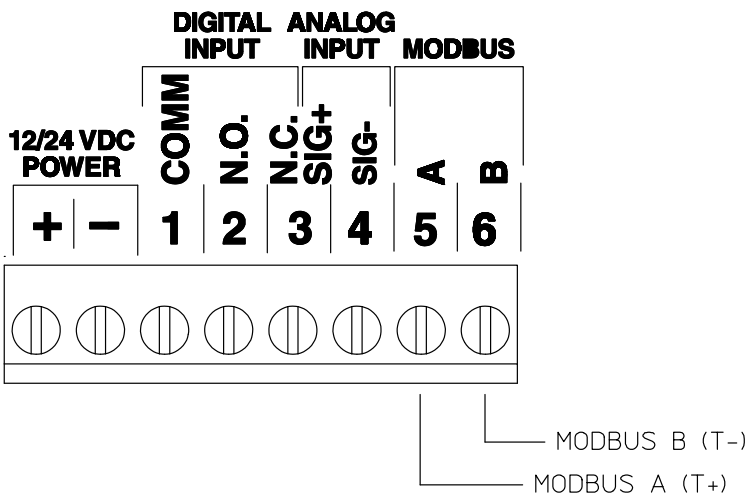
Figure 7. Wiring - Modbus Input

Modbus Input: 40033=1

1. Connect Channel A (T+) to terminal 5
2. Connect Channel B (T-) to terminal 6

Modbus Defaults

Address 1
9600 Baud
Even parity
1 Stop Bit



Important Technical Notice for easy-Drive Electric Actuator

When using the easy-Drive electric actuator with a 4-20mA control signal, the unit should always have 12/24VDC power present on the power input terminals prior to applying the 4-20mA signal, unless an external 250 ohm resistor is installed per figure 4. Failure to do so could result in damage to the analog input circuitry.

It is strongly recommended to place an external 250 ohm resistor between terminals 3 and 4 when using a 4-20mA signal to control the actuator. When the actuator is configured to 1-5V input with an external 250 ohm resistor in place, a 4-20mA signal may be safely used without danger to input circuitry.

This order of operation must always be maintained when powering the unit on if no external 250 ohm resistor is used:

1. 12/24VDC power on
2. 4-20mA control signal engaged

This order of operation must always be maintained when powering the unit off:

1. 4-20mA control signal disengaged
2. 12/24VDC power off

The result of not following this order of operation could result in permanent damage to the analog input circuitry. This damage can result in the inability of the controller to see the control signal, resulting in the actuator moving the valve plug to the loss of signal position.

Default Input Signals

The D3 with easy-Drive comes from the factory calibrated and ready for use with the following default input signals shown in table 2.

Table 2. D3 easy-Drive Default Input Signals

CONFIGURATION	ON/OFF	POSITIONING
Input Signal	L2e (dual dry contact)	4-20 mA

If the input signal of the application matches table 2, proceed to the Wiring Instructions section. If the input signal of the application does not match table 2, proceed to the Configuration section.

Configuration

Input Configuration

There are 2 functional configurations available for the easy-Drive electric actuator: On/Off and Positioning. It is not possible to change an actuator from On/Off to Positioning after it has been delivered from the factory. Version 4.21 and higher firmware will allow a positioning unit to be changed to on/off.

All available input signals are shown in table 3.

Table 3. All Available Input Signals

CONFIGURATION	ON/OFF			POSITIONING		
Control Source	Modbus	Local		Modbus	Local	
Input Signal	Modbus	L2e Dual Dry Contact (default)	Single Dry Contact	Modbus	4-20 mA (default)	1-5 V

If you are using the default inputs signals, and the valve has not been disassembled or adjusted in any way, there is no need to recalibrate the assembly. You can proceed directly to Startup (page 12).

Changing the Inputs from Default Settings

All configuration within the valve is done by setting values in Modbus registers. This can be done using any Modbus master (flow computer, PLC, PC). Configuration software, providing a visual interface to the registers, is available through your [Emerson sales office](#) or Local Business Partner.

Modbus setup

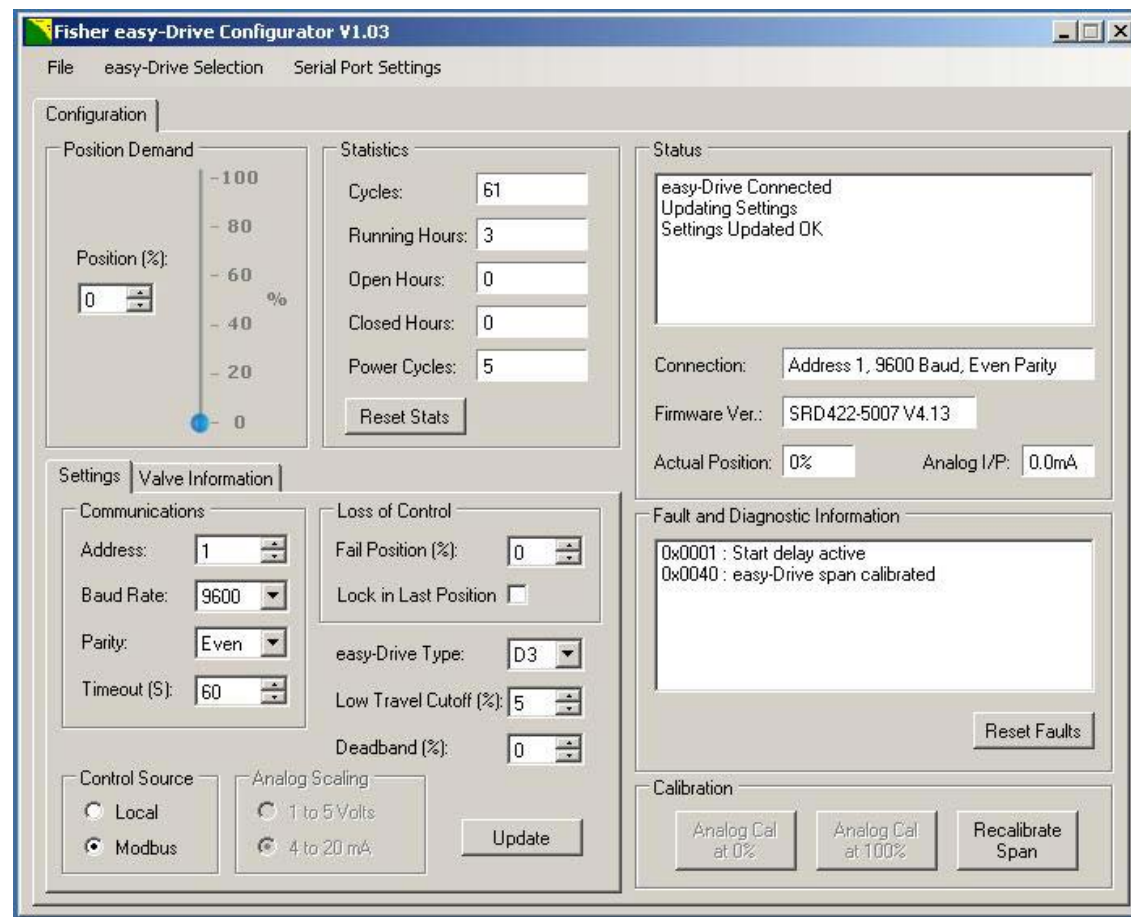
Use the instructions in the instruction manual for the Modbus master to initiate the connection. The D3 with easy-Drive electric actuator Modbus factory defaults are Address 1, 9600 baud, even parity, 1 stop bit.

When a connection has been achieved, the actuator may be configured to accept the input signal over the Modbus link (ignoring the physical inputs) and the Modbus settings may be changed to accommodate the network to which it is attached. Other changes to functionality are possible, such as:

- Low level cutoff: 40037 (default is 5%)
- Position upon loss of signal: 40035 (default is 0%)

See Appendix A for a full map of Modbus registers and their functions.

Figure 8. Fisher easy-Drive Configuration Software



Connecting using the Fisher easy-Drive configuration software

The Fisher easy-Drive configuration software allows configuration and diagnosing of the Fisher easy-Drive electric actuator with a graphical interface. Connect a PC to the actuator using a USB or serial device to Modbus RTU converter using the wiring instructions above. The USB or serial device will be visible in the drop menu under Serial Port Settings. Baud rate and parity should be set to the Modbus settings of the actuator. Default actuator settings are 9600 baud and Even parity.

Use the Fisher easy-Drive configuration software (figure 8) to make the desired changes, or register values may be changed to allow different functionality. Modbus register 40034 dictates whether the unit will respond to a physical

signal or to the value in Modbus register 40001. A value of 0 in register 40034 will result in the actuator responding to the value in 40001 and a value of 1 will result in the actuator responding to physical control signals.

Note

If an actuator is on/off, a Modbus command of 0-49 in register 40001 will cause the valve to close fully, while a value of 50-100 will cause the valve to open fully.

Local to Modbus Control

Modbus

- Set register 40034 (Control Source)
 - 1 = Local Control
 - 0 = Modbus control

Configuration Software

- Use radio button to select Local Control or Modbus Control.

4-20mA to 1-5V Control

Modbus

- Set register 40043 (Analog I/P mode)
 - 0 = 1-5V
 - 1 = 4-20mA

Configuration Software

- Use radio button to select 4-20mA or 1-5V local analog control when Control Source is set to Local.

L2e (Dual dry contact) to Single Dry Contact Control

Modbus

- Set register 40043 (Analog I/P mode)
 - 0 = L2e (Dual dry contact)
 - 1 = Single dry contact

Configuration Software

- Use radio button to select L2e or Single pole local digital control when Control Source is set to Local.

Calibration Instructions

WARNING

To avoid personal injury or property damage, be aware that the valve will open fully and then close fully during the calibration cycle.

It is not necessary to calibrate your easy-Drive electric actuator prior to use from a factory shipment.

If any of the following are true, recalibration will be required (see next section)

- A change in the Flo-Pro setting
- The actuator has been re-mounted on a different valve since shipment
- Disassembly of the valve for trim or packing changes
- A new version of firmware has been loaded on the controller

The following scenarios do not require recalibrations

- New unit from the box
- Power dips or interruptions
- Changing of control method (i.e. from 4-20mA to Modbus control)
- Extended periods of storage

Calibration with the use of Modbus

1. After the unit has been properly wired and fused per instructions in the Wiring section of this instruction manual, turn power to the unit on.
2. Calibrate using Modbus:
 - a. Send position command of 0% to actuator to prevent unexpected motion. Valve will move to commanded position following the calibration procedure.
 - b. Send a value of 1 to register 40003. Valve plug will move to fully open position and then to fully closed. The valve plug will then return to the commanded position.

If a Modbus connection is not available, and recalibration is desired, use the appropriate calibration method as determined by the control method of your valve.

Calibration without the use of Modbus

1. Turn power to the actuator off.
2. Wait for 10 seconds to ensure all circuits have discharged.
3. Return power to the actuator and use the appropriate calibration method for your control signal. Calibration sequence must be done within 15 seconds of power being switched on.
4. For On/Off operation using L2e dual-input dry contact:
 - a. Close the contact to create a short between pins 1 and 2 – valve plug will not move at this time.
 - b. Close the contact to create a short between pins 1 and 3 – valve plug will move to the upper, open position and then to the lower, closed position.
5. For On/Off operation using single dry contact:
 - a. Close the contact to create a short between pins 1 and 2 – valve plug will not move at this time.
 - b. Open the contact to create an open circuit between pins 1 and 2 – valve plug will move to the upper, open position and then to the lower, closed position.

6. For positioning operation using 4-20mA:
 - a. Apply a 20mA signal between pins 3 and 4 – valve plug will not move at this time.
 - b. Apply a 4mA signal between pins 3 and 4 – valve plug will move to the upper stop, immediately followed by moving to the lower, closed position.
 - c. If calibration of the analog input is desired to improve positional accuracy, an optional operation is listed in the next section titled Analog Input Calibration.
7. For positioning operation using 1-5V:
 - a. Apply a 5V signal between pins 3 and 4 – valve plug will not move at this time.
 - b. Apply a 1V signal between pins 3 and 4 – valve plug will move to the upper stop, immediately followed by moving to the lower, closed position.
 - c. If calibration of the analog input is desired to improve positional accuracy, an optional operation is listed in the next section titled Analog Input Calibration.

8. The unit is now calibrated.

Analog Input Calibration

Improved positional accuracy may be obtained by calibrating the actuator to the analog signal input. The position of the valve plug is linearly proportional to the analog control signal end points, with 4 mA/1V equating to fully closed and 20 mA/5V equating to fully open.

1. Apply a 4 mA or 1V signal between pins 3 and 4 - valve plug will move to the fully open position.
2. Send a value of 1 to register 40004 or click Analog Cal at 0% in the configuration software.
3. Apply a 20 mA or 5V signal between pins 3 and 4 - valve plug will move to the fully closed position.
4. Send a value of 1 to register 40005 or click Analog Cal at 100% in the configuration software.
5. The unit is calibrated to your analog signal.

Start Up

WARNING

To avoid personal injury or property damage, be aware that the valve will move and respond to an input signal during start up.

1. Before turning on power to the unit, be sure that a closed signal is being commanded to the unit.
 - Dry-Contact: contact is open.
 - L2e (Dual Dry Contact): Contact closed across pins 1 & 3.
 - Analog Input: signal < 4mA or 1V.
 - Modbus: position demand = 0.
2. Turn on power to the unit.
3. Apply a change in position demand to ensure unit responds properly.

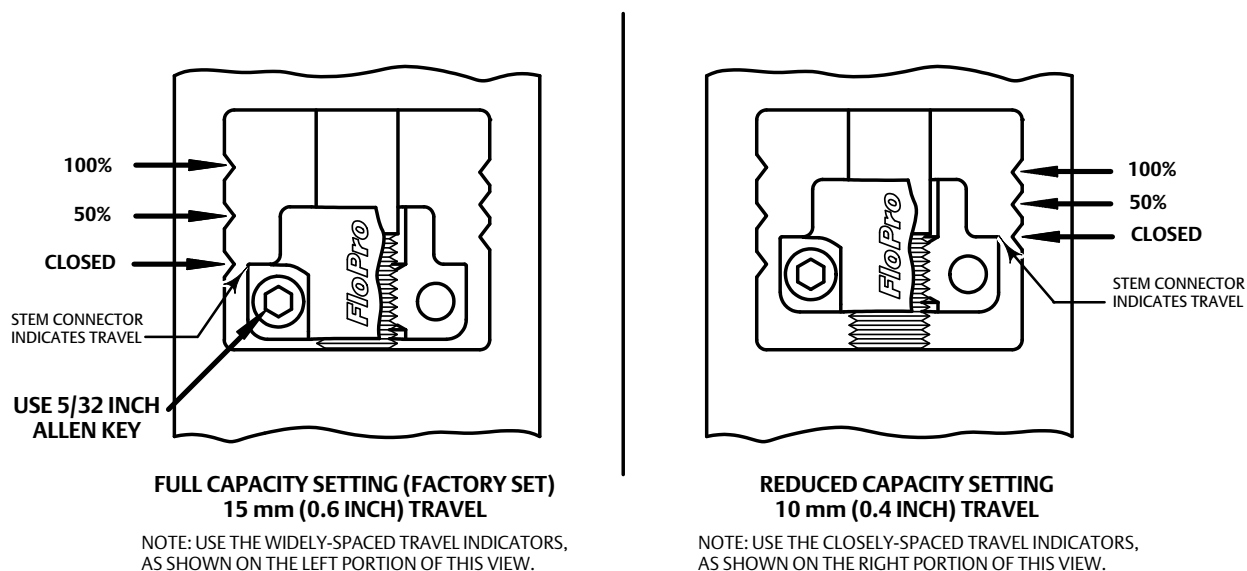
- Dry-Contact:
 - Closed contact between pins 1 & 2 will open the valve.
 - Dual contact / L2e only (40043=0) : Closed contact between pins 1 & 2 will open the valve. Closed contact between pins 1 & 3 will close the valve.
 - Analog Input: valve will respond to proportional demand.
 - Modbus: valve will respond to positional demand in register 40001. 0 = fully closed and 100 = fully open.
4. If the valve does not respond as expected, proceed to Troubleshooting guide on page 14.
 5. Check conduit ports.
 - Conduit seal must be in place within 450mm (18 inches) of the enclosure.
 - Unused conduit ports must be sealed with an explosion-proof port plug.
 6. Replace the cover and tighten all 8 bolts to 20 N-m (15 ft-lbs).

Troubleshooting

1. Unit does not move.
 - a. Verify that 12VDC to 24VDC is present on the power terminals as shown on the cover.
 - b. Verify that all wires are firmly attached on both ends.
 - c. Verify that wires are connected to the correct terminals - see Wiring in the manual.
 - d. Verify mode of operation (on/off or positioning) matches control signal.
 - e. Verify mode of control (local or Modbus) matches control signal.
2. Unit does not respond to 4-20mA signal
 - a. Verify that 12VDC to 24VDC is present on the power terminals as shown on the cover.
 - b. Verify that the 4-20mA signal is wired correctly and that the terminals are firmly on the wires.
 - c. Verify mode of operation matches control signal (local control: 40033=0, positioning: 40034=1).
 - d. Check the value of the analog input in register 40025 (middle right of configuration software screen) to determine if it is 0 or greater.
 - i. If register 40025 shows 0 and the circuit board is green (not blue), it is possible a 4-20mA signal was applied without power to the power terminals and damage to the input circuitry has occurred. Contact your [Emerson sales office](#) or Local Business Partner for further information.
3. Unit moves to fully open when 1V signal is applied and closed when 5V signal is applied.
 - a. Unit is likely configured as an on/off unit with local control; on/off units can not be controlled as an analog device.
 - i. If on/off control is desired, use a dry contact switch to control in local mode or change to Modbus mode to control the unit.

- ii. If positioning control is desired, contact your [Emerson sales office](#) or Local Business Partner to upgrade your actuator to positioning control.
4. Diagnostics show a Motor Stall Fault.
 - a. The easy-Drive electric actuator is designed to operate in a manner consistent with a pneumatic actuator. This means that if the valve plug can not move to its commanded position, the actuator will stop, without damage, and issue a Motor Stall Fault warning. When the command signal changes outside of the deadband (Modbus register 40036), it will attempt to move again. Recalibrate the actuator span per instructions in the Startup section of this manual.
5. Position on D3 is not accurate (proportional positioning units only).
 - a. If the position of a D3 is too high (i.e. 50% is much higher than 50% on the bonnet), check the valve type. If valve type is D4, change to D3, cycle power, and recalibrate.
 - b. If the local analog input is being used (4-20mA or 1-5V), the analog inputs of the actuator may be calibrated to match the input signal.
 - i. Command 0% (4mA or 1V).
 - ii. Using a Modbus link, send a 1 to register 40004 or use the Fisher easy-Drive configuration software by clicking the button “Analog Cal at 0%”.
 - iii. Command 100% (20mA or 5V).
 - iv. Using a Modbus link, send a 1 to register 40005 or use the Fisher easy-Drive configuration software by clicking the button “Analog Cal at 100%”.

Figure 9. Adjusts to Vary Flow Capacity (Shown with Valve Plug in Seated Position)



Setting the Valve Flow Adjuster

The flow setting may only be adjusted if the 0.375 and 0.75 inch port sizes are installed and only when using the on/off version.

When shipped from the factory, the actuator has the flow adjuster set at the maximum flow rate position for the given port size.

1. Ensure the valve plug is in the seated position.
2. To change the valve flow rate, loosen the flow adjuster socket head cap screws (key 15) with a 5/32 inch Allen key, and reposition the flow adjuster halves (key 13 and 14) to the desired flow rate position. See figure 9 for flow rate settings.
3. Retighten the socket head screws (key 15) to 3 N•m (26 lbf•in).
4. Follow instructions for recalibration on page 10.

Maintenance

Refer to figure 12.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and maintenance depends on the severity of the service conditions.

WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

WARNING

For explosion-proof applications, ensure the actuator cover is properly bolted before applying power to the actuator. Personal injury or property damage may result from fire or explosion if power is applied to the actuator with the cover removed in a hazardous area.

Do not remove the actuator cover for 10 minutes after power is disconnected if the UPS option is installed.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 457 mm (18 inches) from the transducer. Personal injury or property damage may result from explosion if the seal is not installed.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection, and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion.

Figure 10. Packing and Belleville Spring Stacking Order

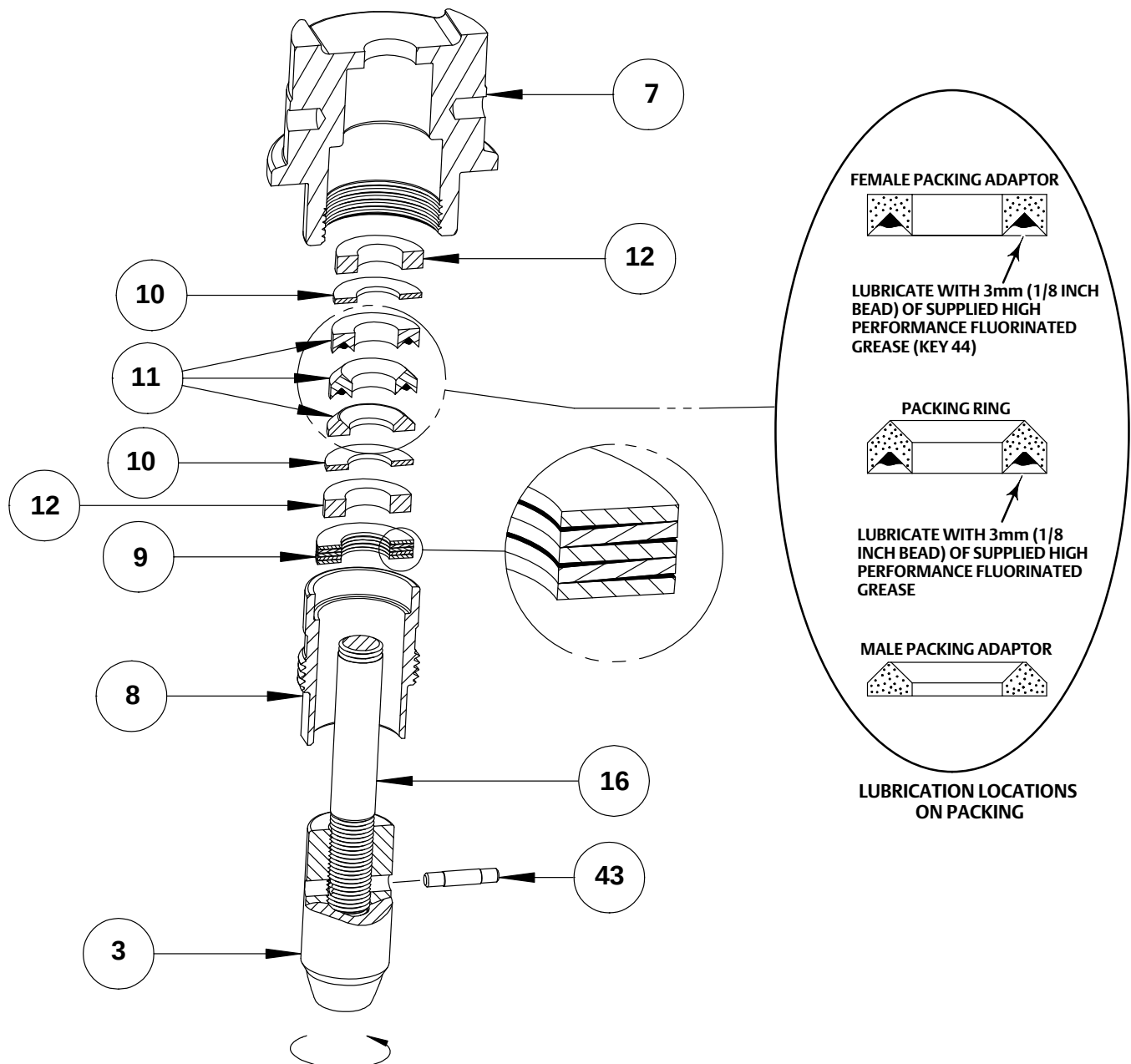
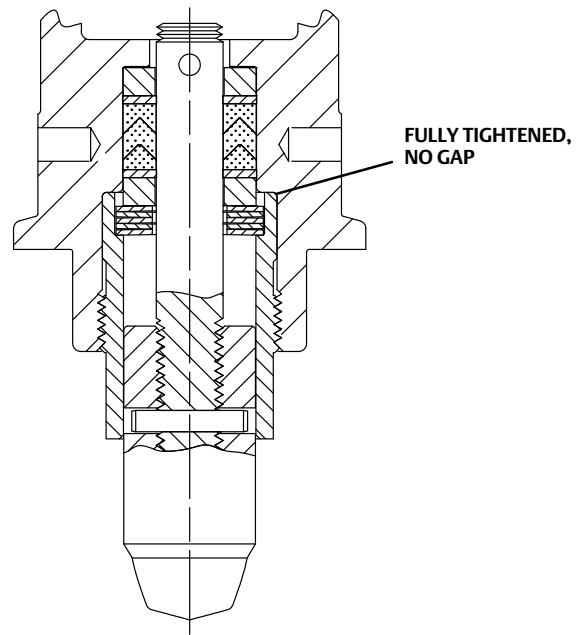
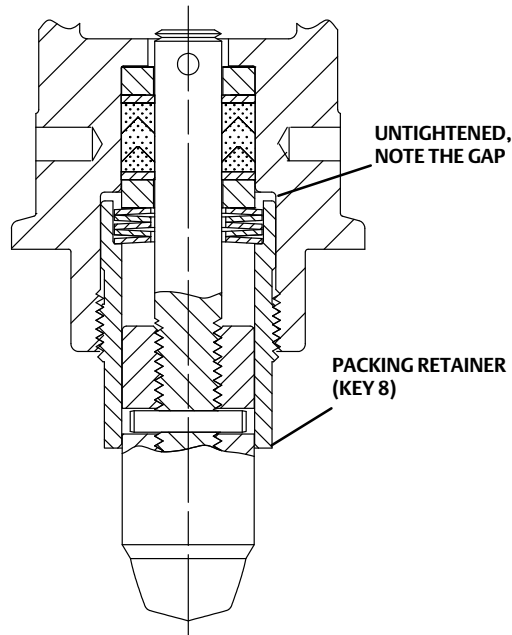


Figure 11. Packing and Belleville Spring Stacking Order



Valve Plug and Seat Ring Maintenance Trim Disassembly

Key numbers are referenced in figures 10, 12, and 13.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body (key 1), and drain the process media from both sides of the valve.

CAUTION

The following steps are intended to prevent damage to the valve plug (key 3) and seat ring (key 2) during the removal of the bonnet and actuator.

For ON/OFF Actuators

2. Command the valve open.
3. Place an open end wrench or a similar obstruction about 6 mm (1/4 inch) thick under the FloPro.
4. Command the valve closed.

For Positioning Actuators

5. Command the valve to anywhere between 10% and 20% travel.
6. Isolate power and signal.

7. Break the bonnet nut (key 5) loose with a hammer. Continue turning the bonnet nut by using a hammer or a large adjustable wrench, tightened around one ear of the bonnet nut. If the bonnet (key 7) is stuck in the valve, continue to unscrew the bonnet nut. The bonnet nut will contact the spring pins (or pipe plugs) (key 6, figure 12) and jack the bonnet out of the valve. Carefully lift the actuator assembly from the valve body.

⚠ WARNING

The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

8. Completely remove the packing retainer (key 8) using a 1-1/8 inch wrench.
9. Remove the valve plug by driving out the pin (key 43) and unscrewing the valve plug from the stem. Do not remove the Belleville springs (key 9) from the stem, in order to retain the Belleville stacking orientation as shown in figure 10.
10. Use a 1-3/16 inch socket wrench to loosen and remove the seat ring (key 2).

CAUTION

Inspect the seat ring and valve body interior for wear, erosion, or damage in the following steps.

11. Inspect the seat ring for wear or damage. If the seating surface has been damaged, discard the seat ring.
12. Visually inspect the valve body interior below the seat ring for erosion or damage. Replace the valve body if necessary.

⚠ WARNING

Be careful to avoid damaging the seating surface on the valve plug or seat ring as damage in these areas will allow excessive leakage at shutoff. Avoid damaging the highly polished valve stem surface. A damaged valve stem could cut the packing and allow process fluid to leak to the atmosphere.

Cover the opening in the valve body to prevent foreign material from getting into the valve body cavity.

Trim Assembly

1. Ensure the threads of the valve stem (key 16) and valve plug (key 3) are clean and free of debris.
2. Make sure the Belleville springs (key 9) are properly installed on the valve stem, as shown in figure 11.
3. Install the valve plug on the stem and insert a new pin (key 43).
4. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs (key 9) are completely enclosed by the packing retainer as shown in figure 11.
5. Torque the packing retainer to 81 N•m (60 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet (key 7). The packing retainer threads should be completely enclosed by the bonnet (see figure 11).
6. Thoroughly clean the seat ring (key 2) threads and the mating threads in the valve body (key 1).
7. Apply anti-seize lubricant to the threads of the seat ring and its mating threads in the valve body.
8. Screw the seat ring into the valve body. Use a 1-3/16 inch socket wrench to tighten the seat ring to 170 N•m (125 lbf•ft). Remove all excess lubricant after tightening.
9. Lubricate the bonnet O-ring (key 4) with lithium grease and install on the bonnet.

10. Apply anti-seize lubricant to the threads on the valve body and bonnet nut (key 5) and the contact surfaces of the bonnet and bonnet nut flange. Install the bonnet and actuator assembly onto the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.

Packing Maintenance

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Key numbers are referenced in figure 10.

The valve stem packing can only be serviced by removing the bonnet from the valve body.

Packing Disassembly

1. Disassemble the valve per steps 1 - 9 in the Trim Disassembly section of the Valve Plug and Seat Ring Maintenance section of this manual.
2. Remove the five Belleville springs (key 9), lower packing spacer (key 12), packing set (key 11), and two anti-extrusion washers (key 10) from the bonnet (key 7) using a formed wire hook.
3. Clean and inspect the packing box wall to ensure that the packing surfaces are not damaged. If the surface condition is damaged and cannot be improved by light sanding, replace the bonnet.
4. Inspect the valve stem (key 16) and valve plug (key 3) for scratches or wear and replace if necessary.

Packing Assembly

The following steps define the proper procedure for installing the packing in a D3 valve. Improper packing assembly can lead to poor valve performance. The proper packing arrangement is shown in figures 10 and 11.

1. Ensure the upper packing spacer (key 12) is installed.
2. Use the lower packing spacer (key 12) and a tube to push the upper anti-extrusion washer (key 10) into place. Using the lower packing spacer in this manner will ensure the upper anti-extrusion washer is fully seated and flat when installed in the packing bore.
3. Remove the lower packing spacer from the packing bore.

CAUTION

All D3 packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D3 packing lubricant.

Note

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-inch length of 1/2 inch PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

4. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the female packing adaptor as shown in figure 10 and install over the valve stem (key 16).
5. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the packing ring as shown in figure 10 and install over the valve stem.

6. Install the male packing adaptor, lower anti-extrusion washer (key 10), and lower packing spacer over the valve stem as shown in figure 10.
7. Firmly press all packing parts into the packing bore with a tube.
8. Install the five Belleville springs (key 9) over the valve stem as shown in figure 10.
9. Install the valve plug (key 3) on the stem and insert a new groove pin (key 43).
10. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs are completely enclosed by the packing retainer as shown in figure 11.
11. Torque the packing retainer to 81 N•m (60 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet (key 7). The packing retainer threads should be completely enclosed by the bonnet.
12. Apply anti-seize lubricant to the threads on the valve body and bonnet nut (key 5) and the contact surfaces of the bonnet and bonnet nut flange. Install the bonnet and actuator assembly onto the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.

Stem Replacement

CAUTION

If the valve stem is replaced, the packing will also need to be replaced, since the threads on the valve stem may damage the packing when the valve stem is removed.

1. Follow the Trim Disassembly procedures, steps 1-8 on page 18 of this manual.
2. Ensure power and signal have been isolated from the actuator. Open the explosion-proof enclosure (keys 60 and 61), using a 13mm wrench.
3. Remove the FloPro (keys 13, 14, and 15), using a 5/32 inch hex head wrench.
4. Remove the stem nut (key 27), using an 11/16 inch wrench, noting the position of the FloPro relative to the bonnet markings.
5. Use a rubber mallet to gently drive the stem downward through the bottom of the actuator housing and remove the stem.
6. Ensure the packing has been removed, using procedures in the Packing Disassembly on page 20 of this manual.
7. Replace the stem by gently pushing the stem up through the actuator.
8. Replace the packing and plug, using the procedures in the Packing Assembly on page 20 of this manual.
9. Install the FloPro at the same position it was removed from in step 4. Tighten the hex socket head cap screws to 3 N•m (26 lbf•in).
10. Tighten the stem nut (key 27) to 39 N•m (29 lbf•ft) using an 11/16 inch wrench. Be sure the FloPro is not allowed to rotate when tightening the stem nut.
11. Apply anti-seize lubricant to the threads on the valve body and bonnet nut (key 5) and the contact surfaces of the bonnet and bonnet nut flange. Install the bonnet and actuator assembly onto the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.

Parts Ordering

Each D3 control valve is assigned a serial number, which can be found on the nameplate. Refer to the number when contacting your [Emerson sales office](#) or Local Business Partner for assistance or when ordering replacement parts.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

TRIM KITS	Port Diameter (inches)	0.375	0.75	1
	Standard trim kit (Contains keys 2, 3, 4, and 43)	RD3STD0012	RD3STD0022	RD3STD0032
	Carbide trim kit (Contains keys 2, 3, 4, and 43)	RD3CARB0042	RD3CARB0052	RD3CARB0062

PACKING KIT	Contains keys 4, 10, 11, 43, and 44	RD3PACK0012
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VALVE STEM	Key 16	GE48049X012
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Parts List

Note

Recommended spare parts are included in the Parts Kits shown at the top of this page. For additional information or for part numbers not shown, contact your [Emerson sales office](#) or Local Business Partner.

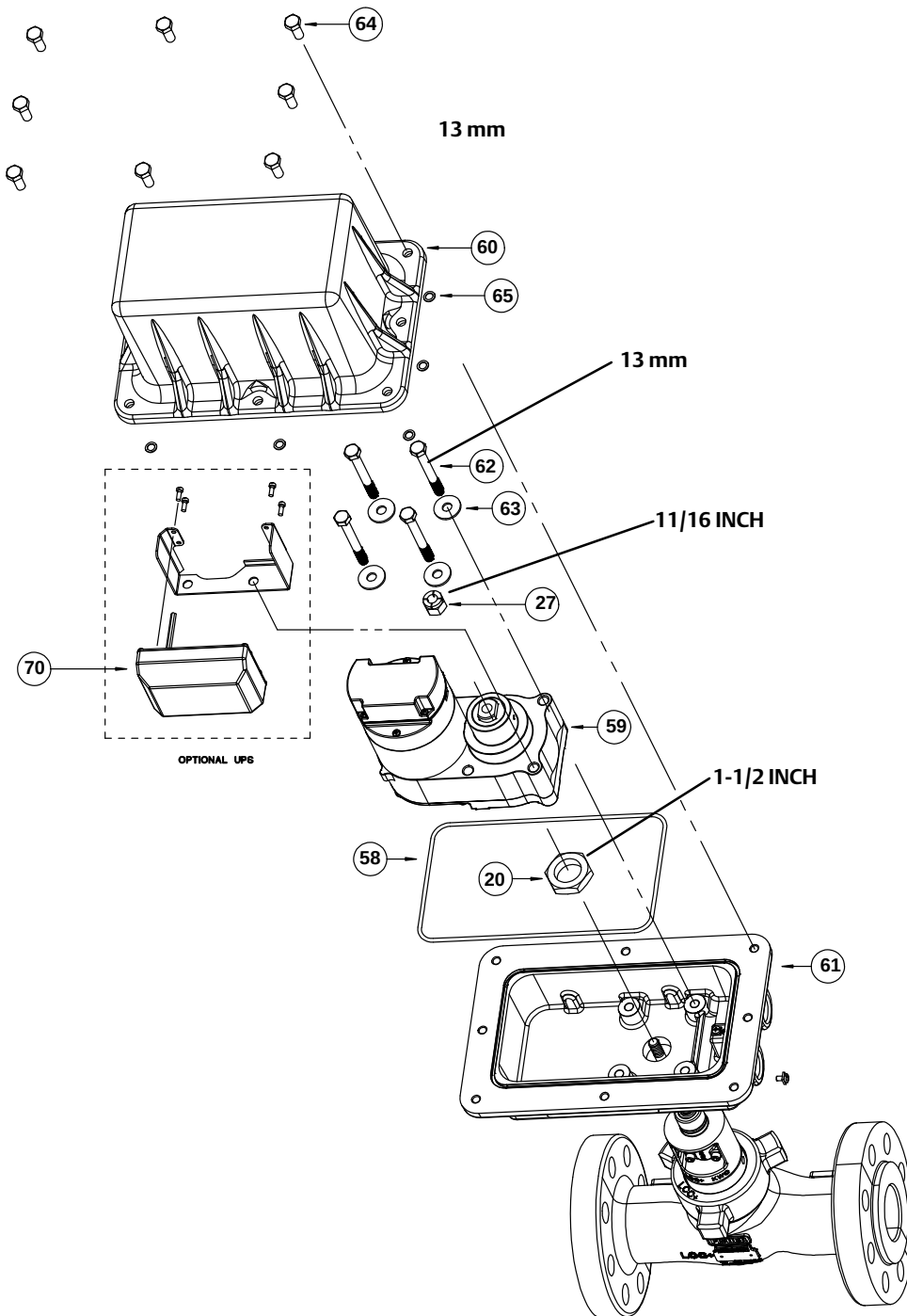
Key Description

1	Valve Body
2*	Seat Ring
3*	Valve Plug
4*	Bonnet O-ring
5	Bonnet Nut
6	Spring Pin (or alternate pipe plug) (2 req'd)
7	Bonnet
8	Packing Retainer
9	Belleville Springs (5 req'd)
10*	Anti-Extrusion Washer (2 req'd)
11*	Packing Set

Key Description

12	Packing Spacer
13	FloPro Half
14	FloPro Half
15	Hex Socket Head Cap Screw (2 req'd)
16*	Stem
18	O-ring
20	Locknut
25	Stem O-ring
27	Stem Nut
34	Valve Nameplate
41	Drive Screw (2 req'd)
43*	Groove Pin
44*	High Performance Fluorinated Grease Packing Lubricant
58	Enclosure O-ring
59	Motor/gearbox/controller assembly
60	Upper Enclosure
61	Lower Enclosure
62	Motor Cap Screws (4 req'd)
63	Motor Cap Screw Washers (4 req'd)
64	Enclosure Cap Screws (8 req'd)
65	Enclosure Cap Screw Retaining Washers (8 req'd)
66	Ground Screw
68	Certification Nameplate
69	easy-Drive Label
70	Uninterruptable Power Supply

Figure 12. D3 Valve Assembly



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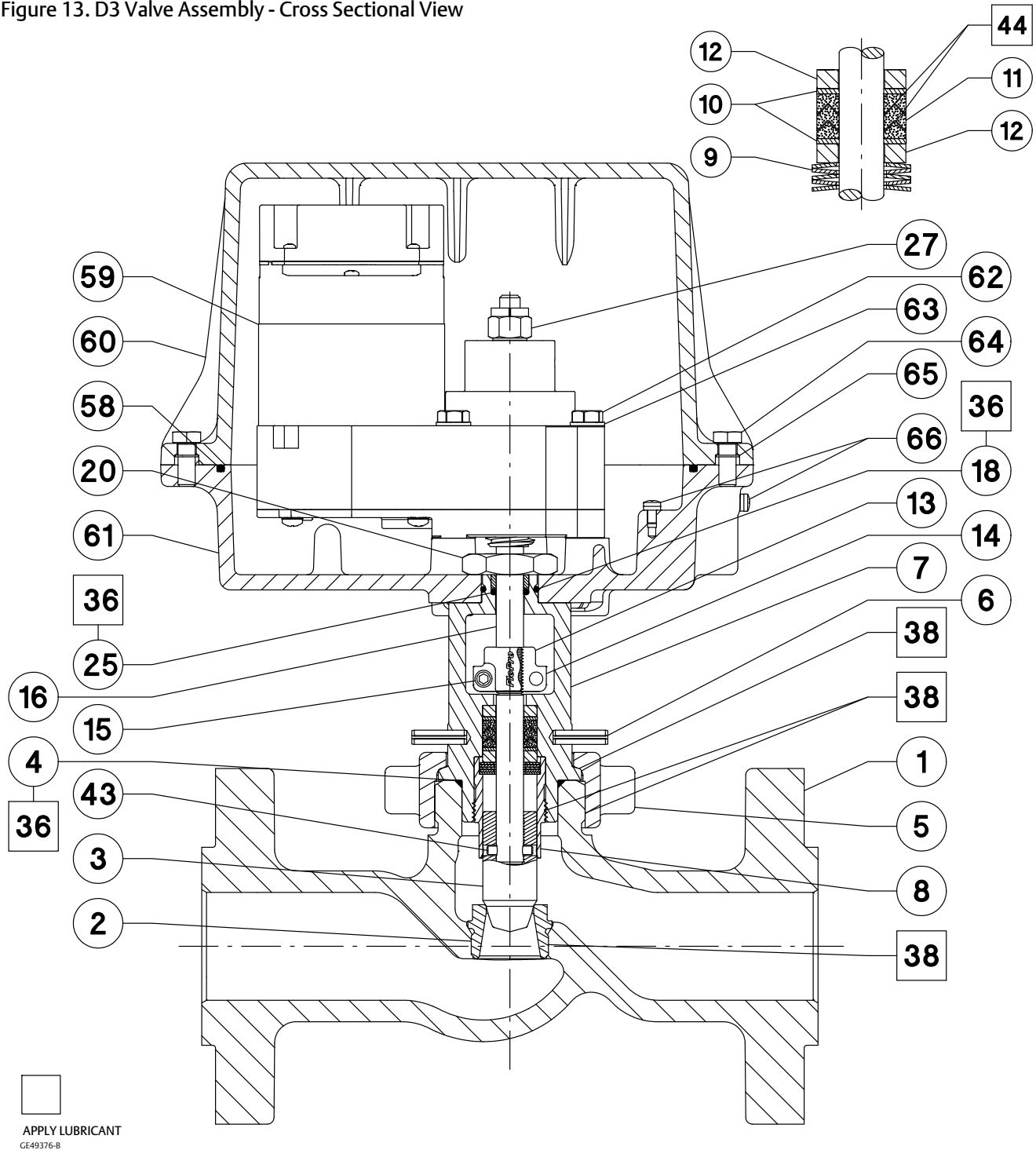
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Figure 13. D3 Valve Assembly - Cross Sectional View



Appendix A - Modbus

A.1 Register Summary

Table 4. Register Summary

DATA	LEGAL FUNCTION CODES	REGISTER (PHYSICAL)	TYPE	R/W	DESCRIPTION
Position Demand – Proportional	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40001 (0x0000)	UINT16	R/W	Value 0-100 = 0-100% Position
Reset Diagnostics	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40002 (0x0001)	UINT16 (BOOL)	R/W	0 = Reset Idle, 1 = Reset Active
Recalibrate Demand	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40003 (0x0002)	UINT16	R/W	0 = Idle, 1 = Reset calibration request – unit will reset to non calibrated state and await calibration sequence
Analog Cal at 0%	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40004 (0x0003)	UINT16	R/W	0 = Idle, 1 = Calibrate at 0%
Analog Cal at 100%	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40005 (0x0004)	UINT16	R/W	0 = Idle, 1 = Calibrate at 100%
Reserved	03 – Read Holding Reg	40006 (0x0005)	UINT16	R	Read will return power up default of 0
Reserved	03 – Read Holding Reg	40007 (0x0006)	UINT16	R	Read will return power up default of 0
Reserved	03 – Read Holding Reg	40008 (0x0007)	UINT16	R	Read will return power up default of 0
Test Register	03 – Read Holding Reg	40009 (0x0008)	UINT16	R	Read will return power up default of 45964 decimal (Binary/Hex -0b10110001110001100 / 0xB38C)
Actual Position	03 – Read Holding Reg	40010 (0x0009)	UINT16	R	Value 0-100 = 0-100% Position
Actual Demand	03 – Read Holding Reg	40011 (0x000A)	UINT16	R	Value 0-100 = 0-100% is demand to position loop from active control source
Diagnostic Flags	03 – Read Holding Reg	40012 (0x000B)	UINT16	R	Bit Flags – see Description in section A.2 and table 5
Number of cycles	03 – Read Holding Reg	40013 (LSW) (0x000C) 40014 (MSW) (0x000D)	UINT32†	R	Number of movements
Hours Running	03 – Read Holding Reg	40015 (LSW) (0x000E) 40016 (MSW) (0x000F)	UINT32†	R	Total hours powered - version 4.13 Total minutes powered - version 4.21
Hours Open	03 – Read Holding Reg	40017 (LSW) (0x0010) 40018 (MSW) (0x0011)	UINT32†	R	Total hours in open position (at 100%) - version 4.13 Total minutes in open position (at 100%) - version 4.21
Hours Closed	03 – Read Holding Reg	40019 (LSW) (0x0012) 40020 (MSW) (0x0013)	UINT32†	R	Total hours in closed position (at 0%) - version 4.13 Total minutes in closed position (at 0%) - version 4.21
Number of power up cycles	03 – Read Holding Reg	40021 (LSW) (0x0014) 40022 (MSW) (0x0015)	UINT32†	R	Number of times power is cycled successfully
Serial Number	03 – Read Holding Reg	40023 (LSW) (0x0016) 40024 (MSW) (0x0017)	UINT32†	R	Product Unique Identifier 0-4294967295
Analog I/P Value	03 – Read Holding Reg	40025 (0x0018)	UINT16	R	0-50 = 0-5V (Voltage mode I/P) 0-200 = 0-20mA (Current Loop I/P)
Firmware Project Code	03 – Read Holding Reg	40026 (0x0019)	UINT16	R	Project code
Firmware Document Reference	03 – Read Holding Reg	40027 (0x001A)	UINT16	R	Document reference
Firmware Version	03 – Read Holding Reg	40028 (0x001B)	UINT16	R	Version, MSB 8bits = major, LSB 8bits = minor
Diagnostic Flags History	03 – Read Holding Reg	40029 (0x001C)	UINT16	R	Bit Flags – see Description in section A.2. – This is a history of any faults that have occurred and is stored in memory
Reserved	03 – Read Holding Reg	40030 (0x001D)	UINT16	R	Read will return power up default of 0

-continued-

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Table 4. Register Summary (continued)

DATA	LEGAL FUNCTION CODES	REGISTER (PHYSICAL)	TYPE	R/W	DESCRIPTION
Reserved	03 – Read Holding Reg	40031 (0x001E)	UINT16	R	Read will return power up default of 0
Valve type	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40032 (0x001F)	UINT16	R/W	1 = D3, 2 = D4
Control Type	03 – Read Holding Reg	40033 (0x0020)	UINT16	R	0 = On/Off, 1 = Proportional
Control Source	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40034 (0x0021)	UINT16	R/W	0 = Modbus RTU Register Commands, 1 = Local Control
Loss of control input/comms default position	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40035 (0x0022)	UINT16	R/W	Value 0-100 = 0-100% Position Valve 101 - Last Position
Deadband	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40036 (0x0023)	UINT16	R/W	Value 0-100 = 0-100% Level of hysteretic dead band applied to position control demand
Low travel cutoff	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40037 (0x0024)	UINT16	R/W	Blanking from zero position in percent
Communications Timeout	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40038 (0x0025)	UINT16	R/W	Timeout in seconds before loss of communications state is asserted
Communications Address	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40039 (0x0026)	UINT16	R/W	Modbus address in the range 1-247 (Default = 1)
Communications Baudrate	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40040 (0x0027)	UINT16	R/W	0 = 300 Baud, 1 = 600 Baud, 2 = 1200 Baud, 3 = 2400 Baud, 4 = 4800 Baud, 5 = 9600 Baud, (Default) 6 = 19200 Baud, 7 = 38400 Baud
Parity	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40041 (0x0028)	UINT16 (BOOL)	R/W	0 = Odd, 1 = Even, 2 = None ("None" available in version 4.21 only)
Reset Statistics	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40042 (0x0029)	UINT16 (BOOL)	R/W	0 = Reset Idle, 1 = Reset Active
Local Control Mode	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40043 (0x002A)	UINT16	R/W	On/Off 0 = L2e dual dry contact 1 = Single dry contact Proportional 0 = 1-5V 1 = 4-20 mA

UINT16 – unsigned 16 bit variable, can take value 0-65535.

UINT32 – unsigned 32 bit variable, can take value 0-4294967295.

(Reserved) – registers used for development use only.

† - 32bit register contains data that spans two registers – reads and write of data needs to be performed within the same Modbus command function to ensure coherency of data.

Table 5. Fault Register – Fault Flags Summary Table

Diagnostic Flags – Bit Mask Value	Diagnostic Flags – Binary Mask Value	Description
0x8001	1000 0000 0000 0000	Fault in N.V. Memory – system has restored default settings
0x4000	0100 0000 0000 0000	Motor assembly stall
0x2000	0010 0000 0000 0000	Speed measurement fault
0x1000	0001 0000 0000 0000	System or Watchdog fault
0x0800	0000 1000 0000 0000	Overspeed condition
0x0400	0000 0100 0000 0000	Calibration span not in legal range
0x0200	0000 0010 0000 0000	Fault in N.V. Memory – system has recovered settings
0x0100	0000 0001 0000 0000	Communications Timeout
0x0080	0000 0000 1000 0000	Valve was shutdown while moving
0x0040	0000 0000 0100 0000	Valve span calibrated (informational)
0x0020	0000 0000 0010 0000	Valve position controller active (informational)
0x0010	0000 0000 0001 0000	Analog input – below 3mA/0.75V (informational)
0x0008	0000 0000 0000 1000	Motor Overspeed coast condition
0x0004	0000 0000 0000 0100	Modbus command has been sent (starts a calibrated system)
0x0002	0000 0000 0000 0010	Analog input initialized (system has seen input >3mA/1V)
0x0001	0000 0000 0000 0001	Start delay active (within 10 second calibration window)

A.2 Diagnostic Flags

The diagnostic register holds a 16 bit value that represents 16 individual flags, when set (value '1'), this indicates the following conditions have occurred or are still present, the highest 7 bits are latching and will be present in the register even if the initial cause for the flag being set is removed. If these flags are set, a reset needs to be performed to clear the fault.

A.2.1 Fault in NV Memory

This is a severe fault and is usually seen when the firmware is upgraded with a program that uses a different EEPROM/Non-volatile memory map. If this is not the case then the probable cause is a fault in the memory hardware.

A.2.2 Motor Assembly Stall

The valve plug was unable to move to the commanded position. The drive has attempted to move the motor by applying a non-zero PWM signal, and the speed has not been detected as greater than 0 with a 400ms period. This fault latches and needs to be reset.

A.2.3 Speed Measurement Fault

The controller detected pulses that correspond to the motor going much faster than the speed the speed measurement system is designed for – the integrity of the measurement cannot be relied upon. This fault latches and needs to be reset.

A.2.4 System or Watchdog Fault

The software system has been reset and this flag is set at power up if the case of the reset was the onboard watchdog either timing out OR being forced by program function call. This flag is used as an indication that this type of reset has occurred.

A.2.5 Overspeed Condition

The drive speed was detected as being over the speed 3300RPM. This fault latches and needs to be reset.

A.2.6 Calibration Span Not in Legal Range

Following a calibration the detected mechanical travel was detected as being too short for the valve type. This fault latches and needs to be reset.

A.2.7 Fault in NV Memory – recovered settings

This fault is similar to Fault in NV Memory but is different in that the settings were recovered, however it is possible the fault was due to a setting being changed during a power cycle. The settings need to be validated before valve operation.

A.2.8 Communications Timeout

This flag is set after a timeout or loss of valid communications, it will be cleared if communications is reestablished with the valve controller. If this flag is set and the control demand is set to be taken from the Modbus then the valve will be commanded to the 'Loss of communications position' in setting accessed at Modbus register 40034.

A.2.9 Valve was Shutdown while Moving

The valve was actuating while power was removed, the position information may be unreliable. Command valve to 0% to assure position information is accurate.

A.2.10 Valve Span Calibrated

The valve is calibrated.

A.2.11 Valve Position Controller Active

The valve is being actively controlled to go to a demanded position. The speed and position control loop logic is setting the pwm and direction demands to the ValuDrive motor.

A.2.12 Analog Input Below 3mA/0.75V

The analog input is below a set threshold of 3mA. If since being powered up this level has been met the flag 'Analog input initialized' will be set. If the control source is the analog input and this flag is set then the valve will be commanded to actuate to the 'Loss of control input' position.

A.2.13 Motor Overspeed Coast Condition

The drive speed was detected as being over the speed 2500RPM. The flag is cleared if the speed falls below the coast threshold level. This flag is used purely as a diagnostic.

A.2.14 Modbus Command Initialized

The system has received a command to the Position demand register since being powered up. If Modbus is the selected control mode the valve will be commanded to this position after the startup period.

A.2.15 Analog Input Initialized

The analog input has been detected as having a control signal within the expected range of 3-20mA. If the analog input is the selected control signal then this will activate the valve after the startup period.

A.2.16 Start Delay Active

This is a flag set during the startup phase of operation, if this is set then the valve may be recalibrated by sending the calibration signal sequence (100% demand followed by 0%). It is cleared to indicate normal operation (recalibration will then require a command to Modbus register 40003).

A.3 Register Description

A.3.1 40001 Position Demand – Proportional [Read & Write]

Register: 40001, Address 0x0000 (0).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a value between 0 and 100% to demand a valve position. This register will only be used by the system if the control source (set by register 40035) is set for Modbus RTU control. If the control type (set by register 40034) is On/Off then value will be resolved with a boolean set operation for a Open/Closed position demand variable output (e.g. Values 0-49 = '0' and 50-100 = '100'). This variable needs to be set to 100% then 0% after a power-up to calibrate an un-calibrated system.

A.3.2 40002 Reset Diagnostics [Read & Write]

Register: 40002, Address 0x0001 (1).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a modbus request to reset the system from a fault state (indicated if the Diagnostics flags register has any set faults). Writing a decimal 1 to the register will start a reset process only if the system has a fault, otherwise the write will be ignored. Once the fault reset request has been acknowledged the register will be set to decimal 0. Bit assignments are shown in table 5.

A.3.3 40003 Recalibrate Demand [Read & Write]

Register: 40003, Address 0x0002 (2).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: Writing a value of 1 to this register will force the system to clear any calibration information and go through a cycle of calibration.

A.3.4 40004 Analog Cal at 0% [Read & Write]

Register: 40004, Address 0x0003 (3).
Function code: 0x10 – Write Multiple registers,

Description: 0x06 – Write Single register, or
0x03 – Read Holding registers.
This is a register is used to initiate a calibration of the analog to digital circuit in the system. A write of a '1' will cause the system to store the value at the analog input. This action should be performed with a calibrated 1V or 4mA present at the analog input. If this is not performed the system uses defaults. Values outside the range 0-1 will return an exception code.

A.3.5 40005 Analog Cal at 100% [Read & Write]

Register: 40005, Address 0x0004 (4).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a register is used to initiate a calibration of the analog to digital circuit in the system. A write of a '1' will cause the system to store the value at the analog input. This action should be performed with a calibrated 5V or 20mA present at the analog input. If this is not performed the system uses defaults. Values outside the range 0-1 will return an exception code.

A.3.6 40004-40008 Reserved [Read Only]

Register: 40004-40008 Address 0x0003 (3) - 0x0007 (7).
Function code: 0x03 – Read Holding registers.
Description: Not used – reads will return a value of 0.

A.3.7 40009 Test Register [Read Only]

Register: 40009, Address 0x0008 (8).
Function code: 0x03 – Read Holding registers.
Description: A test register – can be used to confirm communications. Holds a power up default of 45964 (0xB38C Hex).

A.3.8 40010 Actual Position [Read Only]

Register: 40010, Address 0x0009 (9).
Function code: 0x03 – Read Holding registers.
Description: This is a value between 0 and 100% that indicates the physical position of a calibrated valve system. If the valve is un-calibrated (indicated if the Diagnostics flags register has a cleared calibration informational flag), then this register will read 0.

A.3.9 40011 Actual Demand [Read Only]

Register: 40011, Address 0x000A (10).
Function code: 0x03 – Read Holding registers.
Description: This is a value between 0 and 100% that indicates the demand to the position control loop from the active control source.

A.3.10 40012 Diagnostic Flags [Read Only]

Register: 40012, Address 0x000B (11).
Function code: 0x03 – Read Holding registers.
Description: This is a set of 16 bit flags that indicate the state of the system. The lower order byte contains flags that cause the system to go to a fault state – actuation of the valve will not be possible

until the cause of the fault condition has been removed and the fault condition reset by writing a reset request to register 40001. The upper order byte contains flags used to indicate the operational status of the valve actuator. See table 5 - Fault Register for details.

A.3.11 40013-40014 Number of Open/Close Cycles [Read Only]

Register: 40013-40014, Address 0x000C (12) – 0x000D (13).
Function code: 0x03 – Read Holding registers.
Description: This is a pair of registers that hold a 32bit number indicating the number of actuations of the valve. A cycle of moving the valve from closed to open and back closed will count as 2 cycles. The register needs to be read using a single read function command to ensure coherency of the data in the two registers.

A.3.12 40015-40016 Hours/Minutes Running [Read Only]

Register: 40015-40016, Address 0x000E (14) – 0x000F (15).
Function code: 0x03 – Read Holding registers.
Description: This is a pair of registers that hold a 32bit number indicating the number of hours the valve has been powered. The register needs to be read using a single read function command to ensure coherency of the data in the two registers. If version 4.13 firmware is installed, hours are displayed. If version 4.21 firmware is installed, minutes are displayed.

A.3.13 40017-40018 Hours/Minutes Open [Read Only]

Register: 40017-40018, Address 0x0010 (16) – 0x0011 (17).
Function code: 0x03 – Read Holding registers.
Description: This is a pair of registers that hold a 32bit number indicating the number of hours the valve has been in the open (100%) position. The register needs to be read using a single read function command to ensure coherency of the data in the two registers. If version 4.13 firmware is installed, hours are displayed. If version 4.21 firmware is installed, minutes are displayed.

A.3.14 40019-40020 Hours/Minutes Closed [Read Only]

Register: 40019-40020, Address 0x0012 (18) – 0x0013 (19).
Function code: 0x03 – Read Holding registers.
Description: This is a pair of registers that hold a 32bit number indicating the number of hours the valve has been in the closed (0%) position. The register needs to be read using a single read function command to ensure coherency of the data in the two registers. If version 4.13 firmware is installed, hours are displayed. If version 4.21 firmware is installed, minutes are displayed.

A.3.15 40021-40022 Number of Power up cycles [Read Only]

Register: 40021-40022, Address 0x0014 (20) – 0x0015 (21).
Function code: 0x03 – Read Holding registers.
Description: This is a pair of registers that hold a 32bit number of times the system has been successfully powered up. The register needs to be read using a single read function command to ensure coherency of the data in the two registers.

A.3.16 40023-40024 Serial Number [Read Only]

Register: 40023-40024, Address 0x0016-0x0017 (22-23).
Function code: 0x03 – Read Holding registers.

Description: This is a pair of registers that hold a 32 bit number that can be used to hold a unique serial number. The register needs to be read using a single read Modbus function transaction command to ensure coherency of the data in the two registers.

A.3.17 40025 Analog I/P value [Read Only]

Register: 40025, Address 0x0018 (24).
Function code: 0x03 – Read Holding registers.
Description: This is a register that holds a 16 bit scaled representation of the analog input. It is scaled according to input i.e. 0-200 for 0-20.0mA and 0-50 for 1-5 V.

A.3.18 40026 Firmware Project Code [Read Only]

Register: 40026, Address 0x0019 (25).
Function code: 0x03 – Read Holding registers.
Description: This is a register that holds the SRD project code (SRD422) – 422. This is the code used in version control of SRD documents and source code.

A.3.19 40027 Firmware Document Reference [Read Only]

Register: 40027, Address 0x001A (26).
Function code: 0x03 – Read Holding registers.
Description: This is a register that holds the SRD document code (SRD422-5007) – 5007. This code along with the project code is used in version control of SRD documents and source code.

A.3.20 40028 Firmware Version [Read Only]

Register: 40028, Address 0x001B (27).
Function code: 0x03 – Read Holding registers.
Description: This is a register that holds the hex encoded equivalent of a four digit decimal version number of the firmware, the high order 8bits encode the whole number of the version and the low order 8 bits the fraction, e.g. v1.16 would be encoded 0x0110, v2.66 would be 0x0242. Together with the data from registers 40026- 40028 it is possible to determine the unique identity of the code being run in the processor.

A.3.21 40029 Diagnostic Flags [Read Only]

Register: 40029, Address 0x001C (28).
Function code: 0x03 – Read Holding registers.
Description: This is a set of 16 bit flags that show the accumulation of fault flags that have occurred – as faults are self resetting. The register is stored in non-volatile memory. The mapping is the same as the diagnostic register at 40012. See table 5 - Fault Register for guide to values.

A.3.22 40030-40031 Reserved [Read Only]

Register: 40030-40031, Address 0x001D-0x001E (29-30).
Function code: 0x03 – Read Holding registers.
Description: Not used – reads will return a value of 0.

A.3.23 40032 Valve Type [Read & Write]

Register: 40032, Address 0x001F (31).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a register that holds an enumeration of the three types of valve. This is used to set up several internal variables and constants. Writes outside of the legal range 0-2 will be rejected with an exception code.

A.3.24 40033 Control Type [Read Only]

Register: 40033, Address 0x0020 (32).
Function code: 0x03 – Read Holding registers.
Description: This is a register that holds an enumeration of the control type – either 0 for On/Off, or 1 for proportional control.

A.3.25 40034 Control Source [Read & Write]

Register: 40034, Address 0x0021 (33).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a register that holds an enumeration of the control source – either 0 for Modbus RTU control, or 1 for signals local to the system – decided by the contents of register 40032. Note that if the Modbus serial link is not the active mode then the faults associated with serial communications will be disabled, although serial communications for such activities as test and debug monitoring of the analog input will all still function. Writes outside of the legal range 0-1 will be rejected with an exception code.

A.3.26 40035 Loss of Control Default Position [Read & Write]

Register: 40035, Address 0x0022 (34).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a register that holds a position demand 0-100% that will be applied to the position control loop if the active control source is determined to be corrupt or out of normal operating specification, this applies to modbus communications messages being absent or the analog input being un-calibrated or below 3mA/0.75V(open control loop). Writes outside of the legal range 0-100 will be rejected with an exception code.

A.3.27 40036 Deadband [Read & Write]

Register: 40036, Address 0x0023 (35).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a register that holds an integer value of percentage hysteresis used to discriminate against noise entering the control system from the selected control source, this can take a value of 0-100%, e.g. a value of 100 would make the system only respond to 0 or 100% demands. Writes outside of the legal range 0-100 will be rejected with an exception code.

A.3.28 40037 Low travel Cutoff [Read & Write]

Register: 40037, Address 0x0024 (36).
 Function code: 0x10 – Write Multiple registers,
 0x06 – Write Single register, or
 0x03 – Read Holding registers.
 Description: This is a register that holds an integer value of percentage used as a clamp – any position demand less than this value will be clamped to zero before being passed to the position control system.

A.3.29 40038 Communications Timeout [Read & Write]

Register: 40038, Address 0x0025 (37).
 Function code: 0x10 – Write Multiple registers,
 0x06 – Write Single register, or
 0x03 – Read Holding registers.
 Description: This is a register that holds a value 0-65535 that is the number of seconds for a timeout before the modbus serial communications channel is determined to be uncommunicative (0 - ~18Hrs). A valid addressed message must be received by the system within this time limit if the active control source is Modbus RTU communications. If the time without communications is exceeded the system will fault and the valve commanded to the default loss of communications position. A value of 0 can be used to disable this feature. If communications is resumed then the flag will be cleared and the valve will take the refreshed position as a demand. The use of this register is shown in table 5 - Fault Register.

A.3.30 40039 Communications Address [Read & Write]

Register: 40039, Address 0x0026 (38).
 Function code: 0x10 – Write Multiple registers,
 0x06 – Write Single register, or
 0x03 – Read Holding registers.
 Description: This is a register that holds a value 1-247 that is the Modbus address used by the system on power up. Values outside the range 1-247 will return an exception code

A.3.31 40040 Communications Baudrate [Read & Write]

Register: 40040, Address 0x0027 (39).
 Function code: 0x10 – Write Multiple registers,
 0x06 – Write Single register, or
 0x03 – Read Holding registers.
 Description: This is a register that holds a value 4-6 that is an enumeration of the baudrate used by the system on power up.

A.3.32 40041 Parity [Read & Write]

Register: 40041, Address 0x0028 (40).
 Function code: 0x10 – Write Multiple registers,
 0x06 – Write Single register, or
 0x03 – Read Holding registers.
 Description: This is a register that holds an enumeration of the parity type used by the Modbus serial interface – either 0 for Odd, or 1 for Even in version 4.13 firmware (version 4.21 firmware defines 0=Odd, 1=Even, 2=None). Writes outside of the legal range will be rejected with an exception code.

A.3.33 40042 Reset Statistics [Read & Write]

Register: 40042, Address 0x0029 (41).

Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.

Description: This is a register used to reset the non volatile system statistics (such as number of hours run). Writing a value of 1 to these registers will reset the values that accessed in registers 40013-40022 to 0.

A.3.34 40043 Analog Input Mode [Read & Write]

Register: 40043, Address 0x002A (42).

Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.

Description: This is a register that holds an enumeration 0-1 that sets the mode of operation for on/off and proportional control. When in proportional mode (40033 = 1), a value of 0 sets the unit for using a 1-5V voltage input. 1 sets up the unit for using a 4-20 mA current command input. The scaling of the different modes is reflected in the scaling of the value reported in register at 40023 – ‘Analog I/P value’. When in on/off mode (40033 = 0), a value of 0 sets the unit for using both digital inputs, optimized for using the L2e level controller. 1 sets up the unit for using a single digital input. See Operation for further details.

A.4 Example Modbus Protocol Transactions

A.4.1 Write to Position Demand Register (40002/0x0001/1)

Write of a position demand value of 100% to device at address 1 on the Modbus network – 8 characters.

FIELD	SLAVE ADDRESS	FUNCTION CODE	REGISTER ADDRESS HI	REGISTER ADDRESS LO	REGISTER DATA HI	REGISTER DATA LO	CRC LO	CRC HI
Index	0	1	2	3	4	5	6	7
Hex (Dec)	0x01 (1)	0x06 (6)	0x00 (0)	0x01 (1)	0x00 (0)	0x64 (100)	0xD9 (217)	0xE1 (225)

Normal response, 8 characters:

FIELD	SLAVE ADDRESS	FUNCTION CODE	REGISTER ADDRESS HI	REGISTER ADDRESS LO	REGISTER DATA HI	REGISTER DATA LO	CRC LO	CRC HI
Index	0	1	2	3	4	5	6	7
Hex (Dec)	0x01 (1)	0x06 (6)	0x00 (0)	0x01 (1)	0x00 (0)	0x64 (100)	0xD9 (217)	0xE1 (225)

Write of a position demand value of 101% to device at address 1 on the Modbus network, note that this value (101% is outside the legal range of values permitted to be written to this address, so an exception frame is generated – 8 characters.

FIELD	SLAVE ADDRESS	FUNCTION CODE	REGISTER ADDRESS HI	REGISTER ADDRESS LO	REGISTER DATA HI	REGISTER DATA LO	CRC LO	CRC HI
Index	0	1	2	3	4	5	6	7
Hex (Dec)	0x01 (1)	0x06 (6)	0x00 (0)	0x01 (1)	0x00 (0)	0x65 (101)	0x18 (24)	0x21 (33)

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

D3 Valve with easy-Drive Actuator

October 2017

Instruction Manual

D103460X012

Exception response, write not OK – slave device failure (Code 4), error code is function code with 0x80 added, 5 characters returned:-

FIELD	SLAVE ADDRESS	ERROR CODE	EXCEPTION CODE	CRC LO	CRC HI
Index	0	1	2	3	4
Hex (Dec)	0x01 (1)	0x06 (6)	0x00 (0)	0x18 (24)	0x21 (33)

A.4.2 Read of Actual Position (40010/0x0009/9)

Read of actual position from device at address 1 on the Modbus network using read holding register function – 8 characters.

FIELD	SLAVE ADDRESS	FUNCTION CODE	REGISTER ADDRESS HI	REGISTER ADDRESS LO	QUANTITY OF REGS HI	QUANTITY OF REGS LO	CRC LO	CRC HI
Index	0	1	2	3	4	5	6	7
Hex (Dec)	0x01 (1)	0x03 (3)	0x00 (0)	0x09 (9)	0x00 (0)	0x01 (1)	0x54 (84)	0x08 (8)

Normal response (returning a value of 0%), 7 characters returned:-

FIELD	SLAVE ADDRESS	FUNCTION CODE	BYTE COUNT	REGISTER ADDRESS HI	REGISTER ADDRESS LO	CRC LO	CRC HI
Index	0	1	2	4	5	6	7
Hex (Dec)	0x01 (1)	0x03 (3)	0x02 (2)	0x00 (0)	0x00 (0)	0xB8 (184)	0x44 (68)

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Fisher™ D3 Control Valve with Gen 2 easy-Drive™ Electric Actuator



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual provides installation, maintenance and parts information for the Fisher D3 control valve with Gen 2 easy-Drive electric actuator. For Gen 1 electric actuators, use Fisher D3 with easy-Drive Instruction Manual, (D103460X012). If the actuator has a RPU-100 installed refer to easy-Drive RPU-100 Instruction Manual, (D104551X012).



WARNING



Do not install, operate or maintain a D3 valve with Gen 2 easy-Drive electric actuator without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. Fisher D3 Control Valve with Gen 2 easy-Drive Electric Actuator



W9797-7

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

D3 Valve with Gen 2 easy-Drive Actuator

Instruction Manual

June 2026

D104161X012

Table 1. Specifications

Valve Body Sizes, End Connection Styles and Port Diameters ⁽¹⁾				Available Actuator Configurations																
VALVE SIZE, NPS	PORT DIAMETER, IN.	THREADED	RAISED FACE (RF) FLANGED	On/off (snap-acting) Positioning (flow or pressure control)																
		CL900	CL600																	
1	0.375, 0.75, 1	X	X	Power Requirements 11 to 30 V DC, minimum 4 A power supply required (fuse to 5 A)																
2	0.375, 0.75, 1	X	X																	
X = Available construction.																				
Maximum Inlet Pressures and Temperatures ⁽¹⁾				Maximum Current Draw																
VALVE BODY SIZE	MAXIMUM INLET PRESSURE	TEMPERATURE RANGE		4 A																
	bar / psig	°C / °F																		
NPS 1 NPT CL900	155 / 2250	-46 to +93 / -50 to +200		Idle Current Draw 15 mA at 24 V DC, 25 mA at 12 V DC																
	150 / 2185	93 to 149 / 200 to 300																		
NPS 2 NPT CL900	155 / 2250	-46 to +93 / -50 to +200		Conduit Connections Two 3/4 NPT connections																
	150 / 2185	93 to 149 / 200 to 300																		
NPS 1 RF CL600	103 / 1500	-46 to +93 / -50 to +200		Stroke Length FloPro controlled between 10 mm / 0.4 in. and 15 mm / 0.6 in.																
	100 / 1455	93 to 149 / 200 to 300																		
NPS 2 RF CL600	103 / 1500	-46 to +93 / -50 to +200																		
	100 / 1455	93 to 149 / 200 to 300																		
Maximum Shutoff Pressure Drops ⁽¹⁾				Nominal Stroke Speed ⁽²⁾																
<table><tr><th colspan="4">MAXIMUM ΔP BAR / PSI PER PORT SIZE</th></tr><tr><th>Port Size, mm / in.</th><th>9.5 / 0.375</th><th>19.1 / 0.75</th><th>25.4 / 1.00</th></tr><tr><td>Flow Up</td><td>155 / 2250</td><td>105 / 1518</td><td>75 / 1089</td></tr><tr><td>Flow Down</td><td>155 / 2250</td><td>155 / 2250</td><td>130 / 1889</td></tr></table>				MAXIMUM ΔP BAR / PSI PER PORT SIZE				Port Size, mm / in.	9.5 / 0.375	19.1 / 0.75	25.4 / 1.00	Flow Up	155 / 2250	105 / 1518	75 / 1089	Flow Down	155 / 2250	155 / 2250	130 / 1889	3.9 mm/s / 0.15 in./s at 24 V DC 2.2 mm/s / 0.09 in./s at 12 V DC
MAXIMUM ΔP BAR / PSI PER PORT SIZE																				
Port Size, mm / in.	9.5 / 0.375	19.1 / 0.75	25.4 / 1.00																	
Flow Up	155 / 2250	105 / 1518	75 / 1089																	
Flow Down	155 / 2250	155 / 2250	130 / 1889																	
Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4				Hazardous Area Approvals																
Class IV				CSA (C/US): Explosion-Proof Class I, Division 1, Groups C and D, T6, Ex db IIA T6, Class I, Zone 1, AEx db IIA T6 ATEX Flameproof - Gas: Ⓔ II 2 G, Ex db IIA T6 Gb IECEX Flameproof - Gas: Ex db IIA T6 Gb																
Flow Characteristic / Valve Plug Style				Enclosure Rating																
Equal percentage / Micro-Form Valve Plug				Type 4X and IP66																
Maximum Travel				Duty Cycle																
15 mm / 0.6 in.				50% maximum																
Material Temperature Capabilities ⁽¹⁾				Enclosure Material																
Valve Body Assembly: Standard Bonnet O-ring: -40 to +135°C / -40 to +275°F Electric Actuator Assembly: -20 to +70°C / -4 to +158°F, < 90% non-condensing humidity				Cast aluminum alloy with powder coat paint																
Flow Direction				Approximate Weight																
Flow up (standard), Flow down (optional)				18 to 27 kg / 39 to 60 lbs, depending upon construction																
1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded. 2. 10% variation can be expected, based on temperature and pressure of application.																				

1.2 Description

The Fisher D3 with easy-Drive electric actuator technology (Figure 1) is a globe valve with electric actuator specifically designed for upstream, low power applications. The easy-Drive operates with 12 or 24 V DC in either on/off or Positioning configurations.

The on/off configuration has 2 different states; opened or closed, which are ideal for dump or snap-acting applications. The Positioning configuration extends the functionality to intermediate positions for flow and pressure control applications.

1.3 Specifications

Table 1 lists specifications for the D3 control valve. Some of the specifications for a given control valve as it originally comes from the factory are stamped on a nameplate located on the lower actuator housing.

1.4 Education Services

Emerson Education Services

Phone: 800-338-8158

Email: education@emerson.com

emerson.com/en/final-control/services/valve-training

Section 2: Installation



WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts or by uncontrolled process fluid, be certain the service conditions do not exceed the limits shown on the valve nameplate and in Table 1.

Use pressure-relieving devices required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

For explosion-proof applications, ensure the actuator cover is properly bolted before applying power to the actuator. Personal injury or property damage may result from fire or explosion if power is applied to the actuator with the cover removed in a hazardous area.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 457 mm / 18 in. from the actuator. Personal injury or property damage may result from explosion if the seal is not installed.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional and national codes for any given hazardous area approval. Failure to follow the local, regional and national codes could result in personal injury or property damage from fire or explosion.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

NOTICE

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag or other foreign material from the pipeline.

1. Before installing the control valve assembly, inspect it for any damage and for any foreign material that may have collected in the valve body.
2. Clean out all pipelines to remove scale, welding slag and other foreign materials.
3. The control valve assembly may be installed in any orientation, but normally the actuator is vertical above the valve. Install the valve so the flow direction arrow on the side of the valve indicates the direction of the process flow.
4. Install the valve following local and national piping codes when they apply to the application. For screwed connections, treat the external pipe threads with a good grade pipe compound. For flanged connections, use suitable gaskets between valve and pipeline flanges.
5. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.

2.1 Special Instructions for “Safe Use” and Installations in Hazardous Locations

ATEX/IECEX

WARNING

To avoid static discharge from the enclosure, do not rub or clean the enclosure with solvents. To do so could result in an explosion. Clean with a mild detergent and water only.

The enclosure is non-conducting and may generate an ignition-capable level of electrostatic charges under certain extreme conditions. The user should ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a buildup of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment shall only be done with a damp cloth.

NOTICE

To avoid damage to the enclosure, when screws are fully tightened into blind holes in enclosure walls, with no washer fitted, at least one full thread shall remain free at the base of the hole.

2.2 Startup Overview

Figure 2. Flowchart

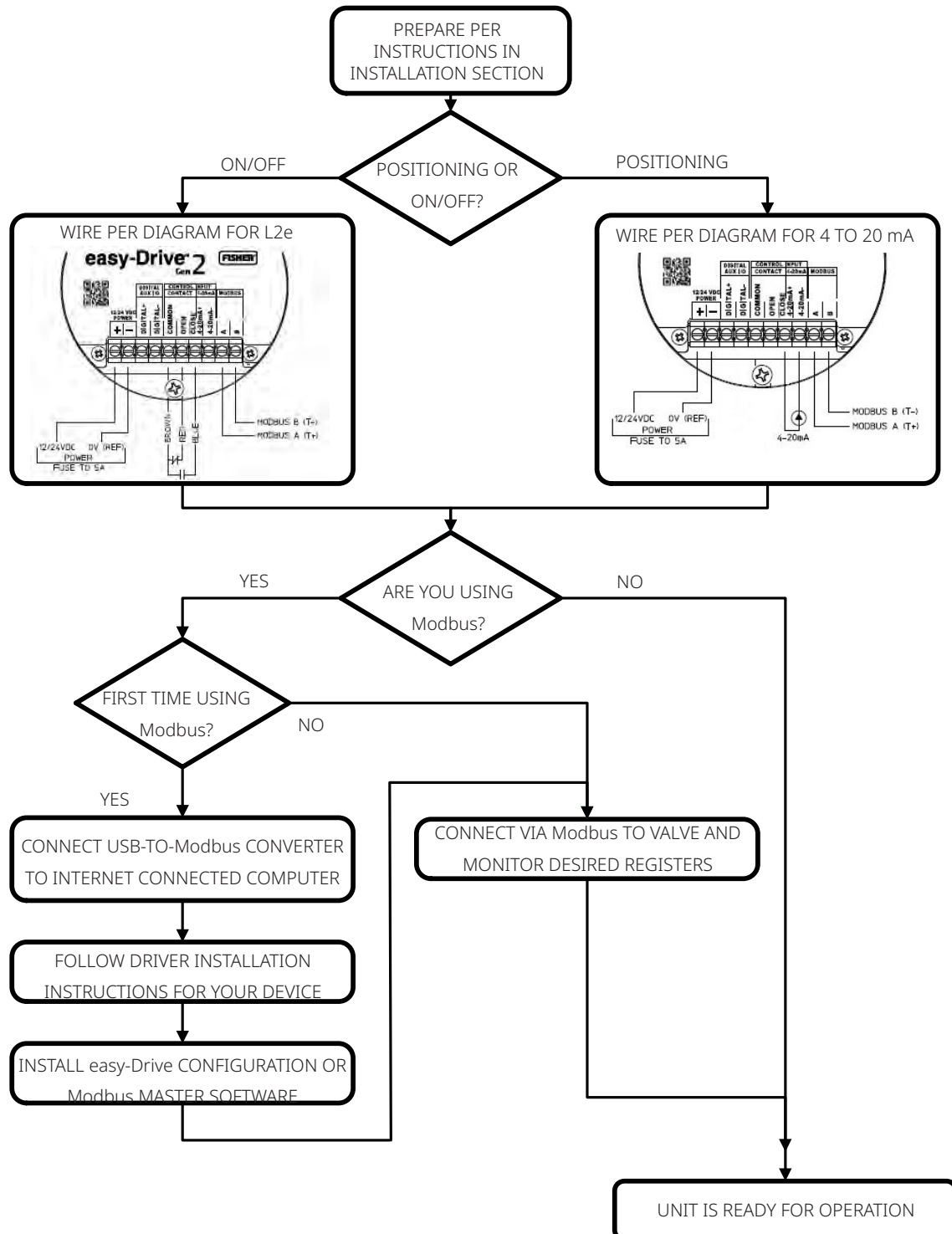
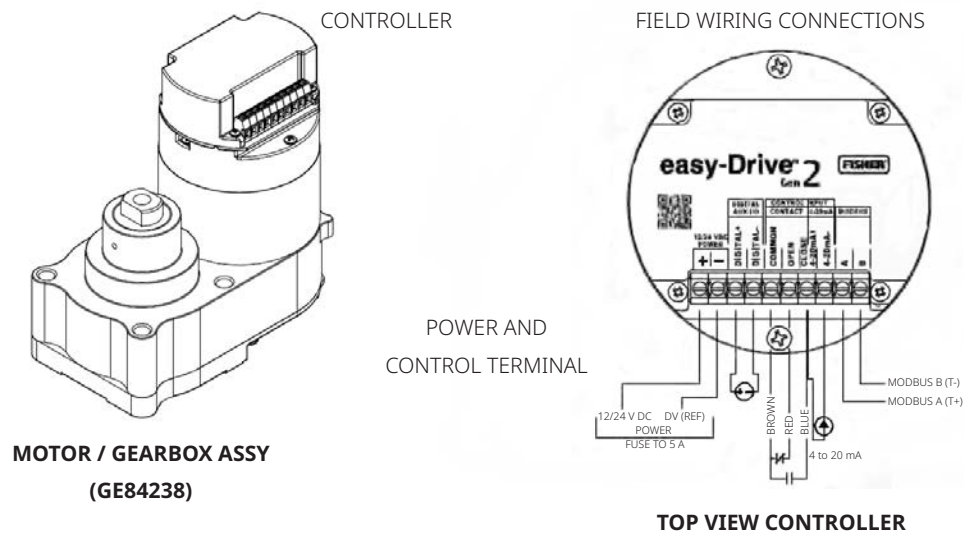


Figure 3. Fisher D3 Valve with Gen 2 easy-Drive Actuator Wiring Diagram



GE47302-7

Power Requirements

Ensure a stable DC power source is available, maintaining less than 5% ripple and sufficiently surge protected for the application. A 4 amp (minimum) power supply is required.

Wiring Instructions

1. Observe local wiring requirements for hazardous location usage.
2. Conduit seals within 450 mm / 18 in. of the enclosure port are required for explosion-proof installation.
3. 18 AWG / 0.52 mm² to 12 AWG / 3.31 mm² wire size required.
4. Fuse system to 5 A.
5. Connect enclosure and analog signal shields.
6. Ensure power is turned off before connecting the wires.

Power

1. Connect 12 or 24 V DC reference to: –
2. Connect 12 or 24 V DC positive to: +
3. Be sure to tighten terminals sufficiently to ensure solid mechanical connection.

Figure 4. Wiring - Analog Input

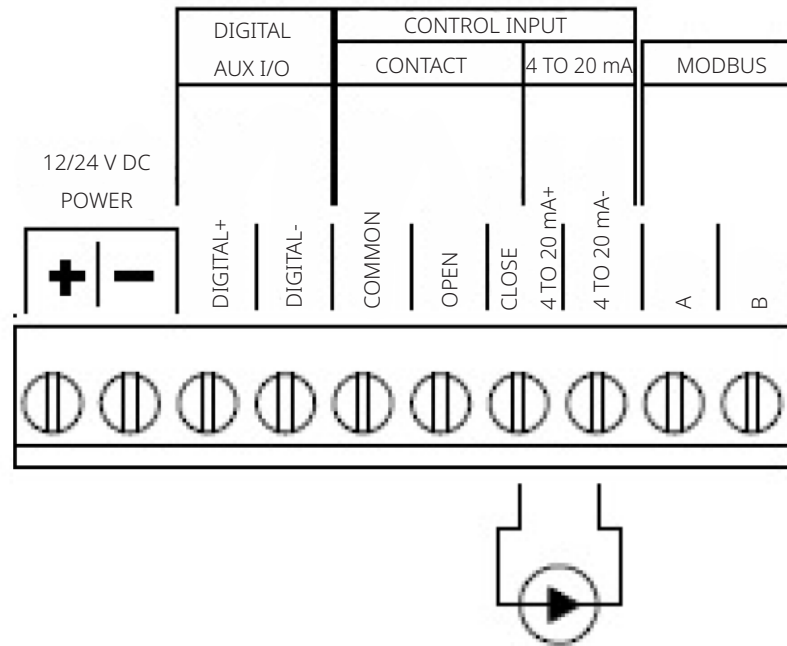


Figure 5. Wiring - L2e

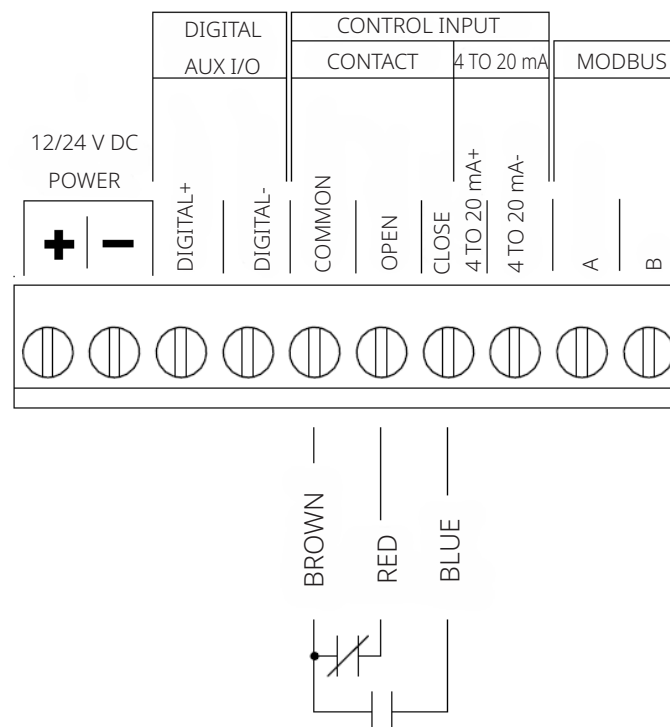


Figure 6. Wiring - Single Dry Contact

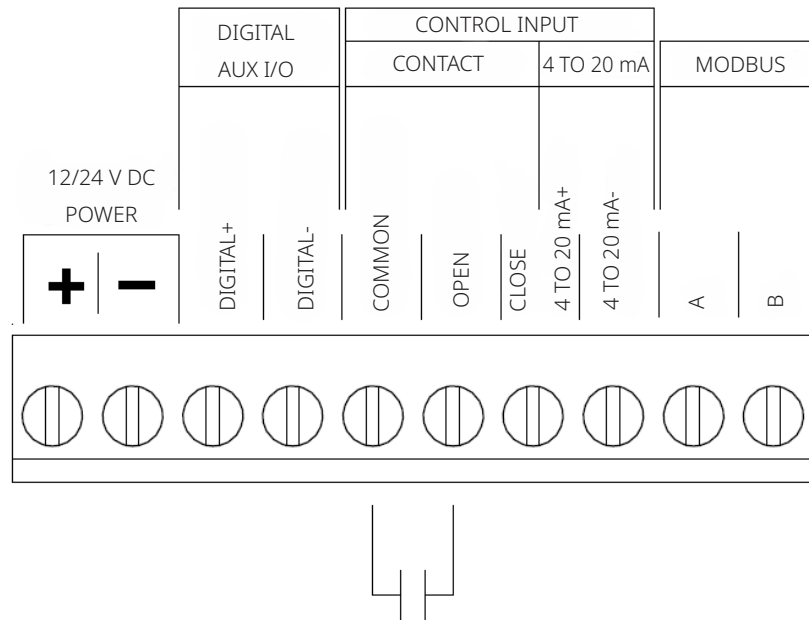


Figure 7. Wiring - Modbus Input

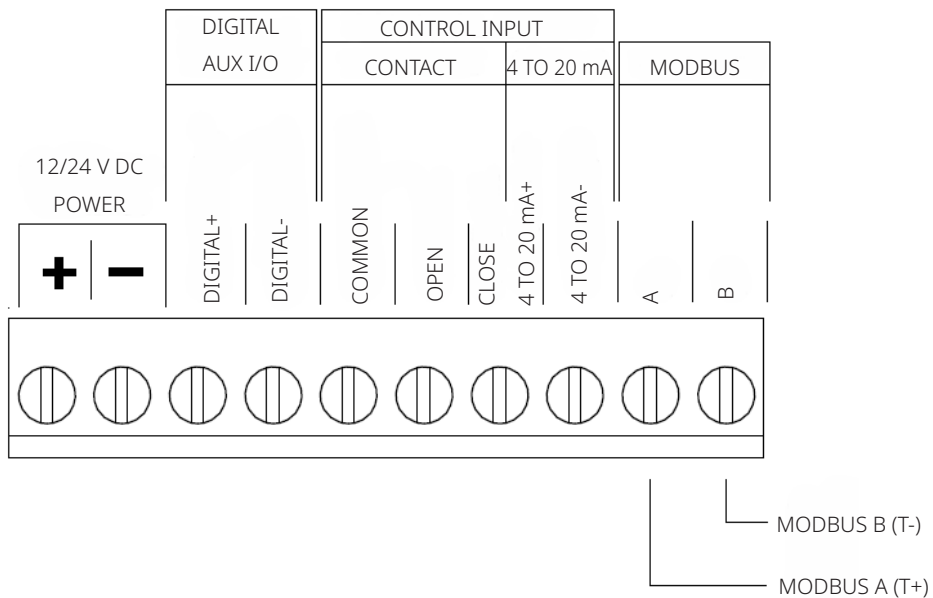


Figure 8. Wiring - Auxiliary Digital I/O Set to Input (40080=0)

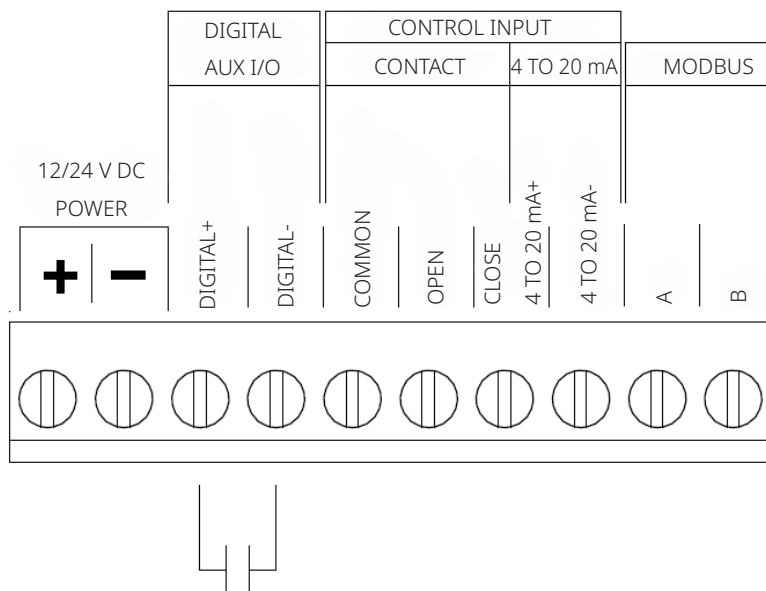
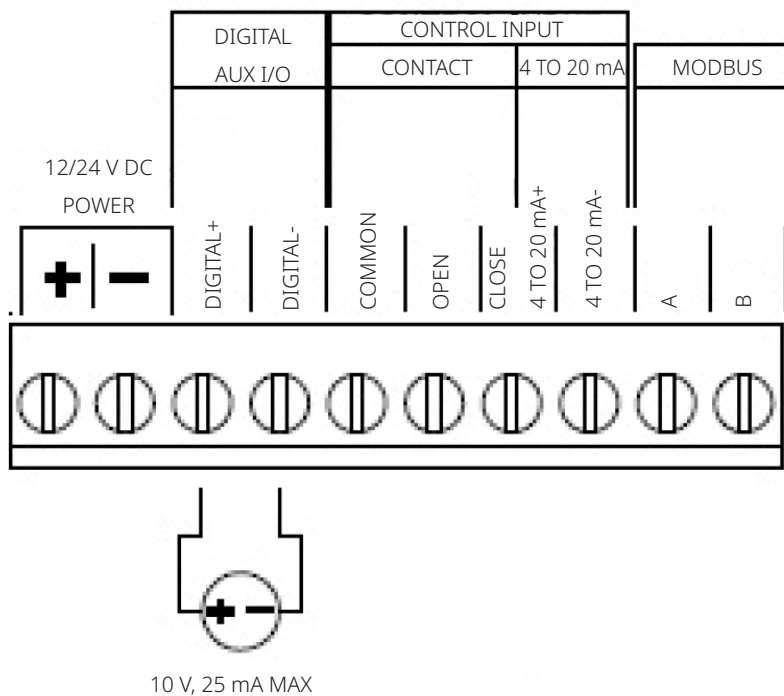


Figure 9. Wiring - Auxiliary Digital I/O Set to Output (40080=1)



2.3 Default Input Signals

The D3 with easy-Drive comes from the factory calibrated and ready for use with the following default input signals shown in Table 2.

Table 2. D3 easy-Drive Default Input Signals

CONFIGURATION	ON/OFF	POSITIONING
Input Signal	L2e (dual dry contact)	4 to 20 mA

If the input signal of the application matches Table 2, proceed to the Wiring Instructions section. If the input signal of the application does not match Table 2, proceed to the Configuration section.

2.4 Configuration

Input Configuration

There are two functional configurations available for the easy-Drive electric actuator: On/Off and Positioning. It is possible to change an actuator from On/Off to Positioning after it has been delivered from the factory using a positioning license key. See Licensing section.

All available input signals are shown in Table 3.

Table 3. All Available Input Signals

CONFIGURATION	ON/OFF			POSITIONING	
Control Source	Modbus	Local		Modbus	Local
Input Signal	Modbus	L2e Dual Dry Contact (default)	Single Dry Contact	Modbus	4 to 20 mA (default)

If you are using the default inputs signals and the valve has not been disassembled or adjusted in any way, there is no need to recalibrate the assembly. You can proceed directly to Startup (page 19).

Changing the Inputs from Default Settings

All configuration within the valve is done by setting values in Modbus registers. This can be done using any Modbus master (flow computer, PLC, PC). Configuration software, providing a visual interface to the registers, is available through your [Emerson sales office](#).

2.5 Modbus Setup

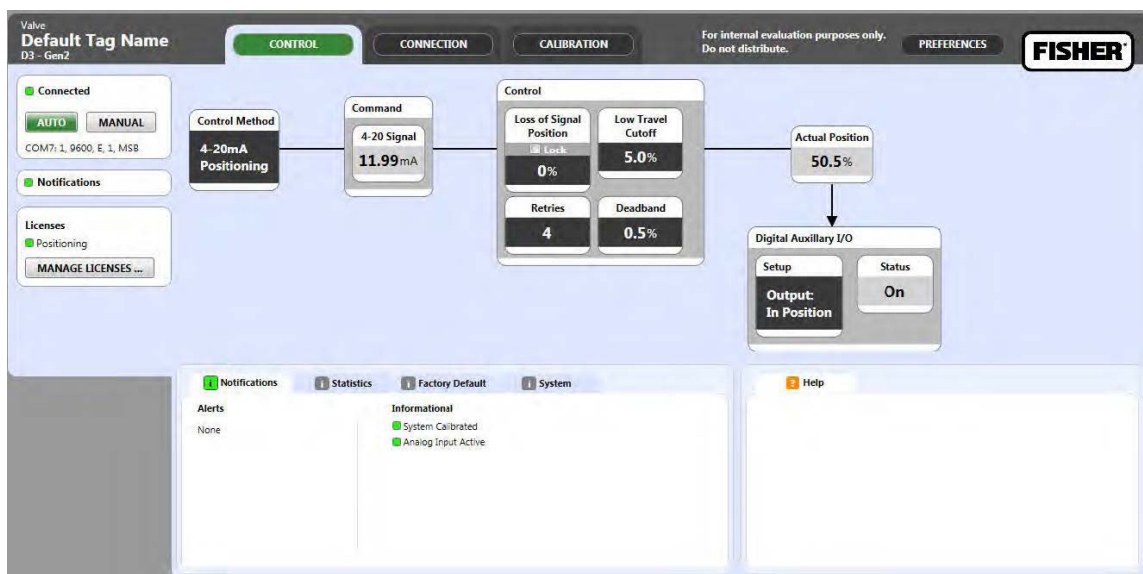
Use of a serial or USB to RS-485 device is required to connect to the actuator. Refer to manufacturer's requirements for installation. The D3 with easy-Drive electric actuator Modbus factory defaults are Address 1, 9600 baud, even parity, 1 stop bit, MSB.

When a connection has been achieved, the actuator may be configured to accept the input signal over the Modbus link (ignoring the physical inputs) and the Modbus settings may be changed to accommodate the network to which it is attached. Other changes to functionality are possible, such as:

- Low level cutoff: 40054 (default is 5%)
- Position upon loss of signal: 40053 (default is 0%)

See Appendix A for a full map of Modbus registers and their functions.

Figure 10. Fisher easy-Drive Configuration Software



Connecting Using the Fisher easy-Drive Configuration Software

The Fisher easy-Drive configuration software allows configuration and diagnosing of the Fisher easy-Drive electric actuator with a graphical interface. Connect a PC to the actuator using a USB or serial device to Modbus RTU converter using the wiring instructions. The USB or serial device will be visible in the drop menu under Serial Port Settings. Baud rate and parity should be set to the Modbus settings of the actuator. Default actuator settings are address 1, 9600 baud, even parity, 1 stop bit, MSB. Press the AUTO button in the upper left corner to connect to the valve.

Use the Fisher easy-Drive configuration software (Figure 10) to make the desired changes or register values may be changed to allow different functionality.

NOTE

If an actuator is on/off, a Modbus command of 0 to 499 in register 40001 will cause the valve to close fully, while a value of 500 to 1000 will cause the valve to open fully. The command register has one implied decimal point.

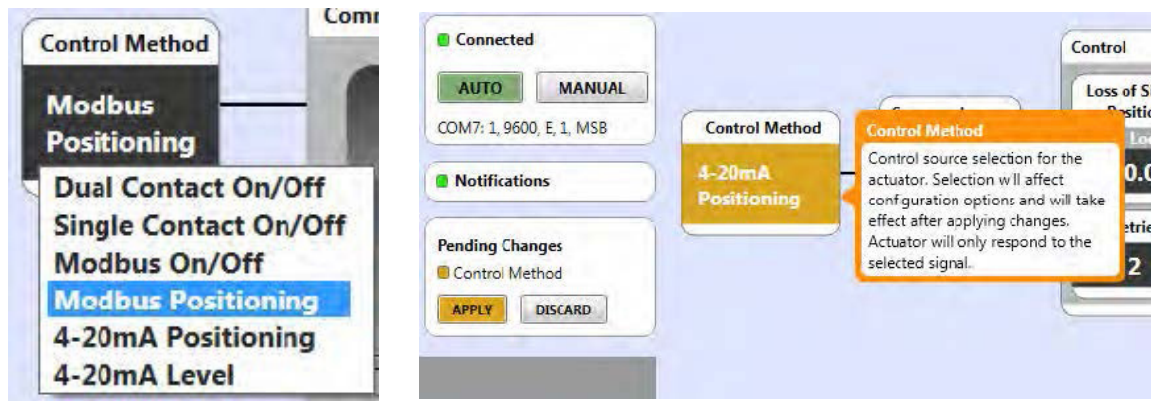
Initial Setup

The control method selection determines what control signal to which the valve will respond. Only the control signal selected will result in movement of the valve; all others will be ignored. The control methods available are dependent upon the licensing tier purchased with the valve. The functions for each tier are shown below.

- On/Off Tier
 - Dual Contact On/Off
 - Single Contact On/Off
 - Modbus On/Off
- Positioning Tier - License required (see Licensing section)
 - Dual Contact On/Off
 - Single Contact On/Off
 - Modbus On/Off
 - Modbus Positioning
 - 4 to 20 mA Positioning
 - 4 to 20 mA Level

When using the easy-Drive Configuration Tool, clicking on the “Control Method” box will create a drop menu as shown. Select the desired control source; the selection will turn yellow. A box with Pending Changes will appear showing all changes. Press “APPLY” and the valve will immediately respond to that signal only.

Figure 11. Fisher easy-Drive Configuration Software



Calibration Instructions

⚠ WARNING

To avoid personal injury or property damage, be aware that the valve will open fully and then close fully during the calibration cycle.

If an easy-Drive valve has been shipped from the Fisher factory, it is not necessary to perform a span calibration. If, however, the valve has a new controller board or maintenance has been performed on the valve, such as trim replacement, it will be necessary to perform a span calibration. A span calibration is accomplished by the following method:

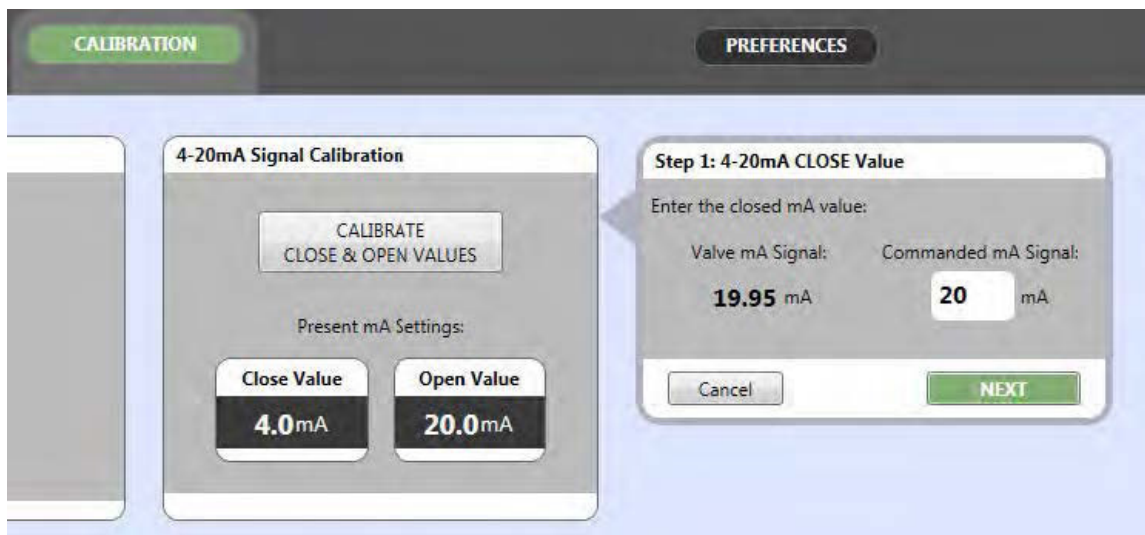
1. Ensure the process and valve are in a safe state – the valve may move during this operation.
2. Press the CALIBRATE SPAN button to initiate the span calibration. The software will show a progress bar during the calibration and display Valve Span Calibrated when complete.

Analog Input Calibration

For valves using 4 to 20 mA as a control source, several options are available to customize control of the actuator. Use a 4 to 20 mA signal generator to provide the desired signal. It is possible to calibrate the 4 to 20 mA signal in reverse acting or split-ranging with the method below with at least 4 mA of signal difference between the close and open values. The example shows a valve being changed from normal to reverse acting during the calibration process.

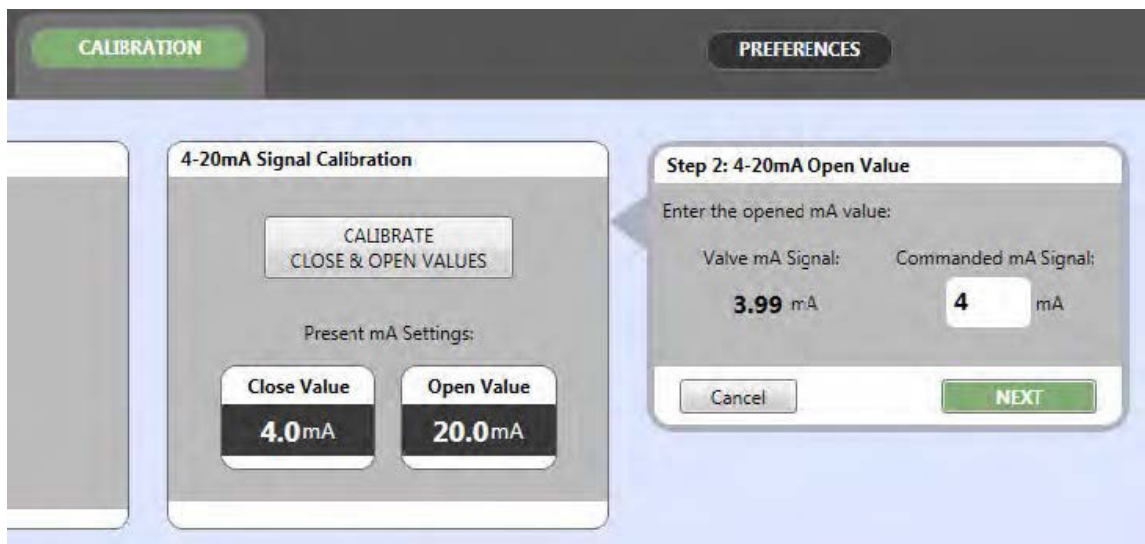
1. With the Control Method set to 4 to 20 mA Positioning or 4 to 20 mA Level, enter the Calibration screen and the 4 to 20 mA Signal Calibration window will be visible.
2. Click the CALIBRATE CLOSE and OPEN VALUES button. A separate window will open to guide through the process.
3. Set the 4 to 20 mA signal to the desired value for when the valve is to be closed.
4. Enter this value into the Calibrated mA Signal text box and press Next.

Figure 12. Fisher easy-Drive Configuration Software



5. Set the 4 to 20 mA signal to the desired value for when the valve is to be open.
6. Enter this value into the Calibrated mA Signal text box and press Next.

Figure 13. Fisher easy-Drive Configuration Software



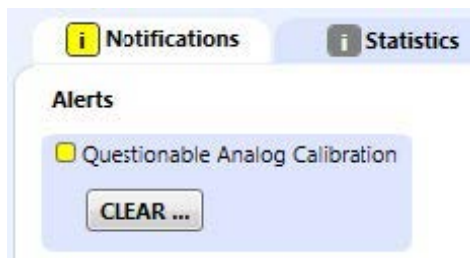
7. If the Close and Open values are as expected, press Confirm to accept these values. If not, press Cancel to restart the process.

NOTE

Note 1: The value of the 4 to 20 mA signal must have at least 4 mA difference between the close and open signals. A differential less than that amount will cause the actuator to reject the calibration and use the previous values.

Note 2: Should the entered values vary more than 10% from the expected 4 to 20 mA values; the actuator will accept the calibration and a Notification displaying "Questionable Analog Calibration" will result.

Figure 14. Fisher easy-Drive Configuration Software



Calibration with the Use of Modbus

1. After the unit has been properly wired and fused per instructions in the Wiring section of this instruction manual, turn power to the unit on.
2. Calibrate using Modbus:
 - a. Send position command of 0% to actuator to prevent unexpected motion. Valve will move to commanded position following the calibration procedure.
 - b. Send a value of 1 to register 40043. Valve plug will move to fully open position and then to fully closed. The valve plug will then return to the commanded position.

If a Modbus connection is not available and recalibration is desired, use the appropriate calibration method as determined by the control method of your valve.

Calibration Without the Use of Modbus

1. Turn power to the actuator off.
2. Wait for 10 seconds to ensure all circuits have discharged.
3. Return power to the actuator and use the appropriate calibration method for your control signal. Calibration sequence must be done within 15 seconds of power being switched on.
4. For positioning operation using 4 to 20 mA:
 - a. Apply a 4 mA signal between pins 4 to 20 mA - and 4 to 20 mA +. If Span is currently uncalibrated, valve plug will not move at this time.
 - b. Apply a 20 mA signal between pins 4 to 20 mA - and 4 to 20 mA +. If Span is currently uncalibrated, valve plug will not move at this time.
 - c. Apply a 4 mA signal between pins 4 to 20 mA - and 4 to 20 mA +; valve plug will move to the upper stop, immediately followed by moving to the lower, closed position.
 - d. If calibration of the analog input is desired to improve positional accuracy, an optional operation is listed on page 14 titled Analog Input Calibration.

5. For On/Off operation using dual-input dry contact:
 - a. Close the contact to create a short between pins COMMON and CLOSE. If Span is currently uncalibrated, valve plug will not move at this time.
 - b. Close the contact to create a short between pins COMMON and OPEN. If Span is currently uncalibrated, valve plug will not move at this time.
 - c. Close the contact to create a short between pins COMMON and CLOSE; valve plug will move to the upper, open position and then to the lower, closed position.
6. For On/Off operation using single dry contact:
 - a. Open the contact to create an open circuit between pins COMMON and OPEN. If Span is currently uncalibrated, valve plug will not move at this time.
 - b. Close the contact to create a short between pins COMMON and OPEN. If Span is currently uncalibrated, valve plug will not move at this time.
 - c. Open the contact to create an open circuit between pins COMMON and OPEN; valve plug will move to the upper, open position and then to the lower, closed position.
7. The unit is now calibrated.

Licensing

The Gen 2 easy-Drive actuator has two differing modes of operation: On/Off and Positioning. The On/Off mode is intended for snap-acting applications where the valve is either fully open or fully closed. In this mode, the valve plug cannot remain at any intermediate position; it will move to a fully closed or fully open position only. For applications that require the actuator to control over the full range of motion, it is necessary to have a Positioning license installed. A positioning license will allow access to 4 to 20 mA positioning, 4 to 20 mA level control and Modbus positioning.

Positioning licenses can be purchased with the actuator and installed at the factory or can be installed at a later date by use of a license key on a USB license dongle. Installation of the license can be completed using the configuration software.

1. Insert the USB license dongle into the computer connected to the Gen 2 easy-Drive actuator.

Figure 15. Fisher easy-Drive Configuration Software



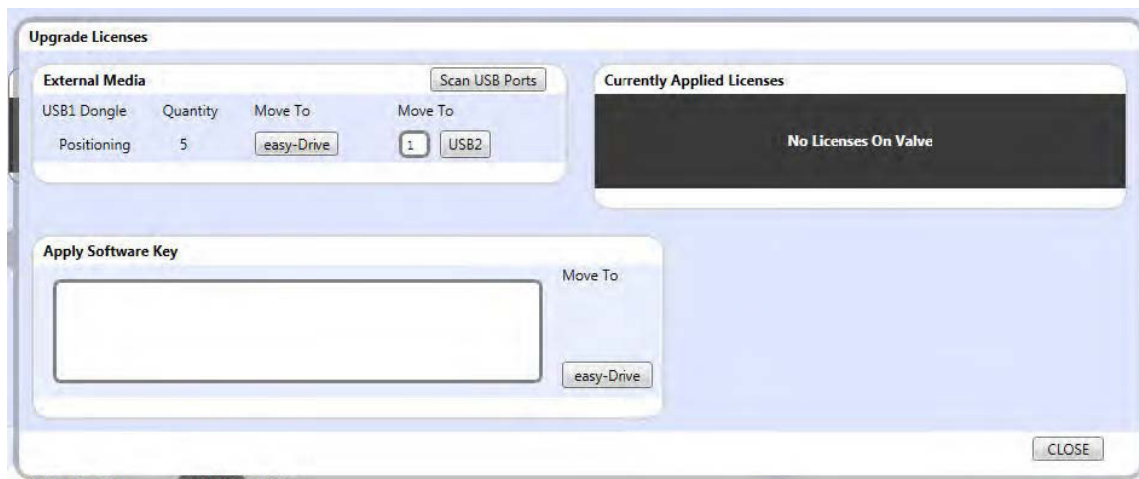
- Click the button labelled **MANAGE LICENSES** on the left side of the configuration software screen.

Figure 16. Fisher easy-Drive Configuration Software



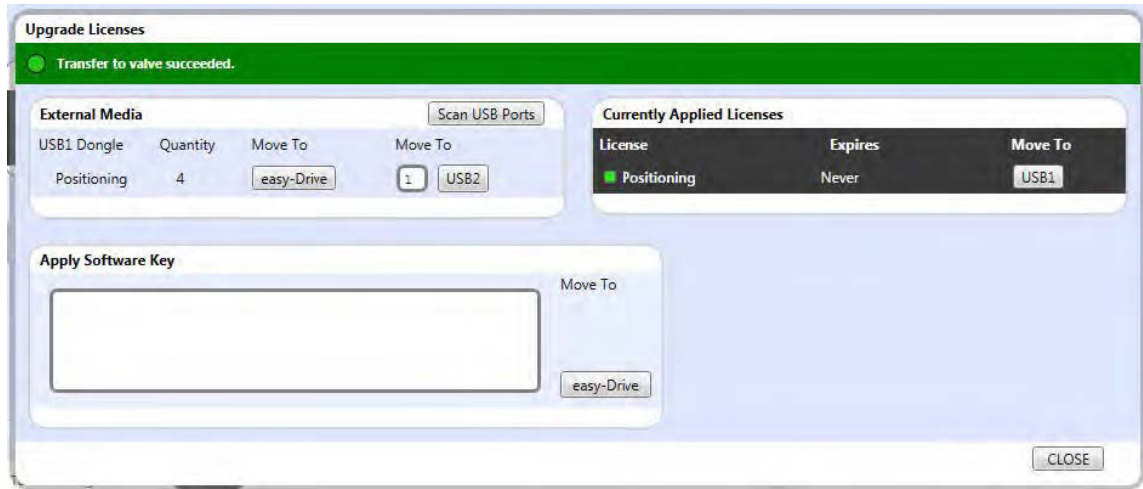
- The license control screen will open, showing all licenses installed on the USB and the actuator.

Figure 17. Fisher easy-Drive Configuration Software



4. After verifying the presence of the desired license on the USB license dongle, click the button labelled 'easy-Drive' under Move To and the license will be transferred to the valve as shown below.

Figure 18. Fisher easy-Drive Configuration Software



5. It is also possible to transfer licenses from one USB license dongle to another. Place two dongles into the computer with the configuration software. Type in the number of licenses to move and click USB 2 to move the licenses.

Startup

⚠ WARNING

To avoid personal injury or property damage, be aware that the valve will move and respond to an input signal during startup.

1. Before turning on power to the unit, be sure that a closed signal is being commanded to the unit.
 - Dry Contact: Contact is open.
 - L2e (Dual Dry Contact): Contact closed across pins COMMON and CLOSE.
 - Analog Input: signal = 4 mA.
 - Modbus: position demand = 0.
2. Turn on power to the unit.

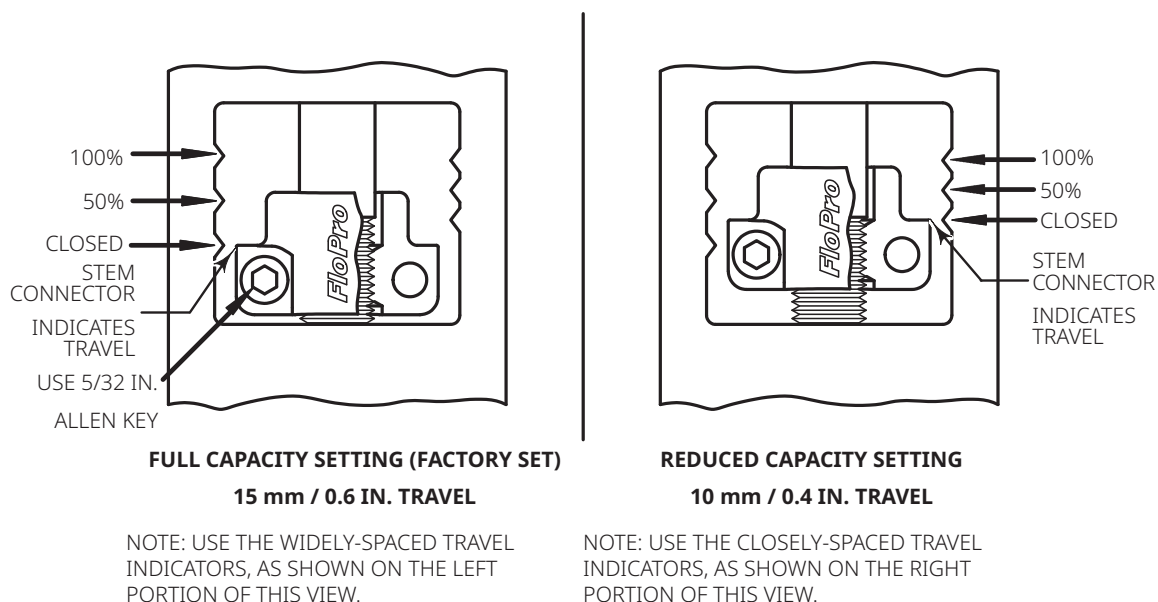
3. Apply a change in position demand to ensure unit responds properly.
 - Dry Contact: Closed contact between pins COMMON and OPEN will open the valve.
 - Dual contact/L2e only: Closed contact between pins COMMON and OPEN will open the valve. Closed contact between pins COMMON and CLOSE will close the valve.
 - Analog Input: valve will respond to proportional demand.
 - Modbus: valve will respond to positional demand in register 40001. 0 = fully closed and 1000 = fully open.
4. If the valve does not respond as expected, proceed to Troubleshooting guide on page 20.
5. Check conduit ports.
 - Conduit seal must be in place within 450 mm / 18 in. of the enclosure.
 - Unused conduit ports must be sealed with an explosionproof port plug.
6. Replace the cover and tighten all 8 bolts to 20 N•m / 15 ft•lbs.

Section 3: Troubleshooting

1. Unit does not move.
 - a. Verify that 12 V DC to 24 V DC is present on the power terminals as shown on the cover. Green heartbeat LED will pulse near Modbus terminals when power is present.
 - b. Verify that all wires are firmly attached on both ends.
 - c. Verify that wires are connected to the correct terminals - see Wiring in the manual.
 - d. Verify mode of operation (on/off or positioning) matches control signal.
 - e. Verify mode of control (local or Modbus) matches control signal.
2. Unit does not respond to 4 to 20 mA signal.
 - a. Verify that 12 V DC to 24 V DC is present on the power terminals as shown on the cover.
 - b. Verify that the 4 to 20 mA signal is wired correctly and that the terminals are firmly on the wires.
 - c. Verify mode of operation matches control signal (local control: 40067=0, positioning: 40065=1).
 - d. Check the value of the analog input in register 40026 to determine if it is 0 or greater.
 - i. If register 40026 shows 0, the 4 to 20 mA may be wired backwards. Swap wire and attempt again.

3. Diagnostics show a Motor Stall - Travel Deviation Fault.
 - a. The easy-Drive electric actuator is designed to operate in a manner consistent with a pneumatic actuator. This means that if the valve plug can not move to its commanded position, the actuator will stop, without damage and issue a Motor Stall - Travel Deviation Fault warning. When the command signal changes outside of the deadband (Modbus register 40036), it will attempt to move again. Recalibrate the actuator span per instructions in the Startup section of this manual.
4. Position on D3 is not accurate (proportional positioning units only).
 - a. If the position of a D3 is too high (i.e., 50% is much higher than 50% on the bonnet), check the valve type. If valve type is D4, change to D3, cycle power and recalibrate.
 - b. If the local analog input is being used (4 to 20 mA or 1 to 5 V), the analog inputs of the actuator may be calibrated to match the input signal.
 - i. Command 0% (4 mA or 1 V).
 - ii. Using a Modbus link, send a 1 to register 40004 or use the Fisher easy-Drive configuration software by clicking the button "Analog Cal at 0%".
 - iii. Command 100% (20 mA or 5 V).
 - iv. Using a Modbus link, send a 1 to register 40005 or use the Fisher easy-Drive configuration software by clicking the button "Analog Cal at 100%".

Figure 19. Adjusts to Vary Flow Capacity (Shown with Valve Plug in Seated Position)



Section 4: Setting the Valve Flow Adjuster

The flow setting may only be adjusted if the 0.375 and 0.75 in. port sizes are installed and only when using the on/off version.

When shipped from the factory, the actuator has the flow adjuster set at the maximum flow rate position for the given port size.

1. Ensure the valve plug is in the seated position.
2. To change the valve flow rate, loosen the flow adjuster socket head cap screws (key 15) with a 5/32 in. Allen key and reposition the flow adjuster halves (keys 13 and 14) to the desired flow rate position. See Figure 19 for flow rate settings.
3. Retighten the socket head screws (key 15) to 3 N·m / 26 lbf·in.
4. Follow instructions for recalibration as outlined earlier in this manual.

Section 5: Maintenance

Refer to Figure 22.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and maintenance depends on the severity of the service conditions.

WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.



WARNING

For explosion-proof applications, ensure the actuator cover is properly bolted before applying power to the actuator. Personal injury or property damage may result from fire or explosion if power is applied to the actuator with the cover removed in a hazardous area.

Do not remove the actuator cover for 10 minutes after power is disconnected if the UPS option is installed.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 457 mm / 18 in. from the transducer. Personal injury or property damage may result from explosion if the seal is not installed.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional and national codes for any given hazardous area approval. Failure to follow the local, regional and national codes could result in personal injury or property damage from fire or explosion.

Figure 20. Packing and Belleville Spring Stacking Order

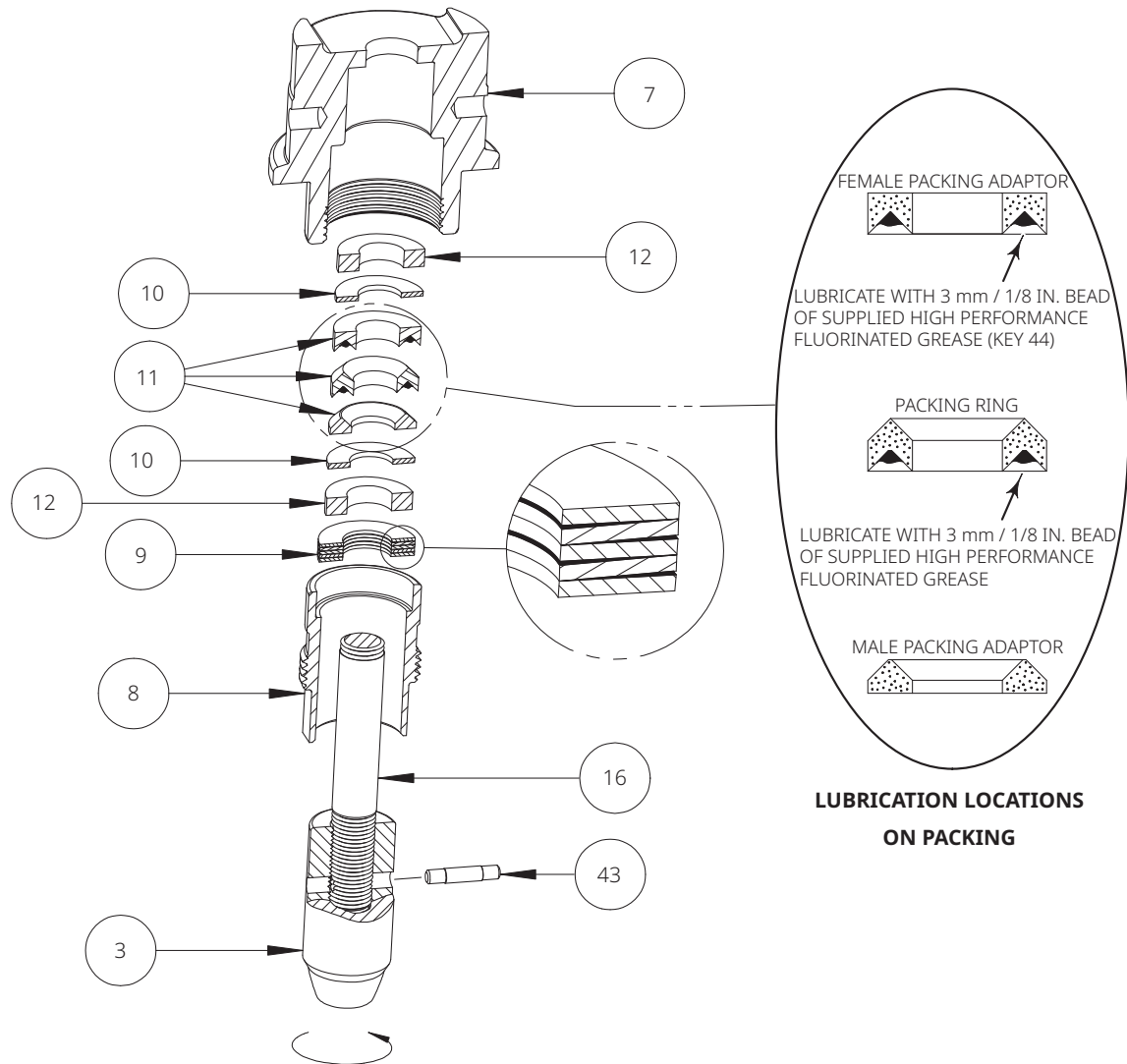
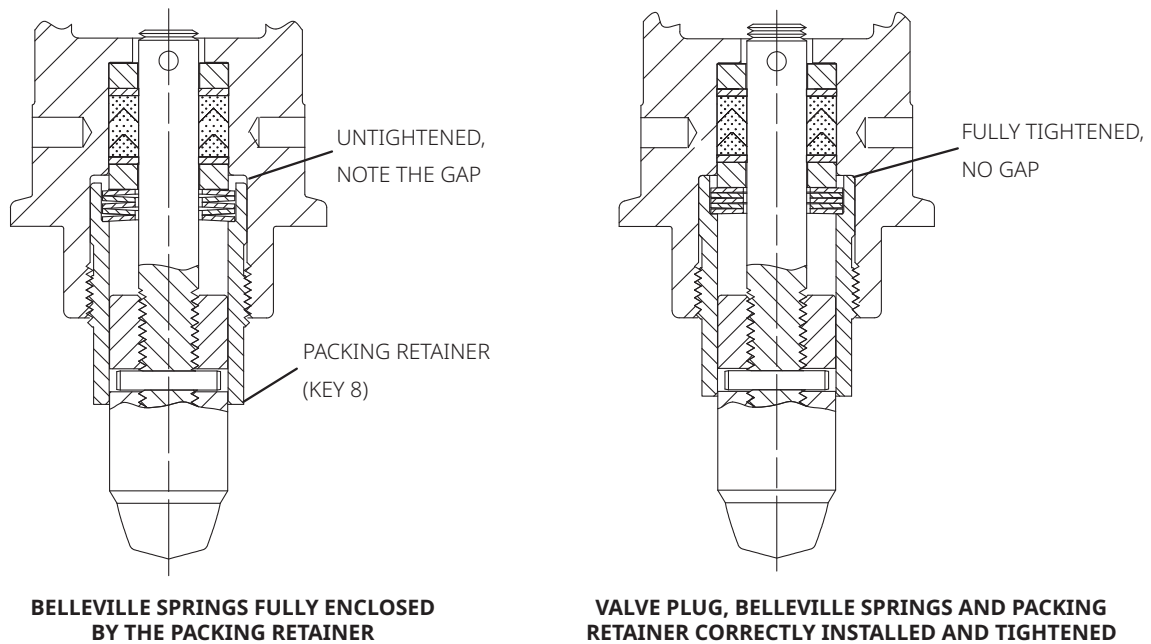


Figure 21. Packing and Belleville Spring Stacking Order

5.1 Valve Plug and Seat Ring Maintenance

Trim Disassembly

Key numbers are referenced in Figures 20, 22 and 23.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body (key 1) and drain the process media from both sides of the valve.

NOTICE

The following steps are intended to prevent damage to the valve plug (key 3) and seat ring (key 2) during the removal of the bonnet and actuator.

For ON/OFF Actuators

2. Command the valve open.
3. Place an open end wrench or a similar obstruction about 6 mm / 1/4 in. thick under the FloPro.
4. Command the valve closed.

For Positioning Actuators

5. Command the valve to anywhere between 10% and 20% travel.
6. Isolate power and signal.

7. Break the bonnet nut (key 5) loose with a hammer. Continue turning the bonnet nut by using a hammer or a large adjustable wrench, tightened around one ear of the bonnet nut. If the bonnet (key 7) is stuck in the valve, continue to unscrew the bonnet nut. The bonnet nut will contact the spring pins (or pipe plugs) (key 6, Figure 22) and jack the bonnet out of the valve. Carefully lift the actuator assembly from the valve body.

WARNING

The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

8. Completely remove the packing retainer (key 8) using a 1-1/8 in. wrench.
9. Remove the valve plug by driving out the pin (key 43) and unscrewing the valve plug from the stem. Do not remove the Belleville springs (key 9) from the stem, in order to retain the Belleville stacking orientation as shown in Figure 20.
10. Use a 1-3/16 in. socket wrench to loosen and remove the seat ring (key 2).

NOTE

Inspect the seat ring and valve body interior for wear, erosion or damage in the following steps.

11. Inspect the seat ring for wear or damage. If the seating surface has been damaged, discard the seat ring.
12. Visually inspect the valve body interior below the seat ring for erosion or damage. Replace the valve body if necessary.

WARNING

Be careful to avoid damaging the seating surface on the valve plug or seat ring as damage in these areas will allow excessive leakage at shutoff. Avoid damaging the highly polished valve stem surface. A damaged valve stem could cut the packing and allow process fluid to leak to the atmosphere.

NOTE

Cover the opening in the valve body to prevent foreign material from getting into the valve body cavity.

Trim Assembly

1. Ensure the threads of the valve stem (key 16) and valve plug (key 3) are clean and free of debris.
2. Make sure the Belleville springs (key 9) are properly installed on the valve stem, as shown in Figure 21.
3. Install the valve plug on the stem and insert a new pin (key 43).
4. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 in. wrench. Make sure the Belleville springs (key 9) are completely enclosed by the packing retainer as shown in Figure 21.
5. Torque the packing retainer to 81 N•m / 60 lbf•ft. The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet (key 7). The packing retainer threads should be completely enclosed by the bonnet (see Figure 21).
6. Thoroughly clean the seat ring (key 2) threads and the mating threads in the valve body (key 1).
7. Apply anti-seize lubricant to the threads of the seat ring and its mating threads in the valve body.
8. Screw the seat ring into the valve body. Use a 1-3/16 in. socket wrench to tighten the seat ring to 170 N•m / 125 lbf•ft. Remove all excess lubricant after tightening.
9. Lubricate the bonnet O-ring (key 4) with lithium grease and install on the bonnet.
10. Apply anti-seize lubricant to the threads on the valve body and bonnet nut (key 5) and the contact surfaces of the bonnet and bonnet nut flange. Install the bonnet and actuator assembly onto the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.

5.2 Packing Maintenance

WARNING

Observe the warning at the start of the Maintenance section.

Key numbers are referenced in Figure 20.

The valve stem packing can only be serviced by removing the bonnet from the valve body.

Packing Disassembly

1. Disassemble the valve per steps 1 to 9 in the Trim Disassembly section of the Valve Plug and Seat Ring Maintenance section of this manual.
2. Remove the five Belleville springs (key 9), lower packing spacer (key 12), packing set (key 11) and two anti-extrusion washers (key 10) from the bonnet (key 7) using a formed wire hook.
3. Clean and inspect the packing box wall to ensure that the packing surfaces are not damaged. If the surface condition is damaged and cannot be improved by light sanding, replace the bonnet.
4. Inspect the valve stem (key 16) and valve plug (key 3) for scratches or wear and replace if necessary.

Packing Assembly

The following steps define the proper procedure for installing the packing in a D3 valve. Improper packing assembly can lead to poor valve performance. The proper packing arrangement is shown in Figures 20 and 21.

1. Ensure the upper packing spacer (key 12) is installed.
2. Use the lower packing spacer (key 12) and a tube to push the upper anti-extrusion washer (key 10) into place. Using the lower packing spacer in this manner will ensure the upper anti-extrusion washer is fully seated and flat when installed in the packing bore.
3. Remove the lower packing spacer from the packing bore.

NOTE

All D3 packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D3 packing lubricant.

NOTE

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-in. length of 1/2 in. PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

4. Apply a 3 mm / 1/8 in. bead of the supplied high performance fluorinated grease (key 44) around the groove of the female packing adaptor as shown in Figure 20 and install over the valve stem (key 16).
5. Apply a 3 mm / 1/8 in. bead of the supplied high performance fluorinated grease (key 44) around the groove of the packing ring as shown in Figure 20 and install over the valve stem.
6. Install the male packing adaptor, lower anti-extrusion washer (key 10) and lower packing spacer over the valve stem as shown in Figure 20.
7. Firmly press all packing parts into the packing bore with a tube.
8. Install the five Belleville springs (key 9) over the valve stem as shown in Figure 20.
9. Install the valve plug (key 3) on the stem and insert a new groove pin (key 43).
10. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 in. wrench. Make sure the Belleville springs are completely enclosed by the packing retainer as shown in Figure 21.
11. Torque the packing retainer to 68 N•m / 50 lbf•ft. The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet (key 7). The packing retainer threads should be completely enclosed by the bonnet.
12. Apply anti-seize lubricant to the threads on the valve body and bonnet nut (key 5) and the contact surfaces of the bonnet and bonnet nut flange. Install the bonnet and actuator assembly onto the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.

Stem Replacement

NOTICE

If the valve stem is replaced, the packing will also need to be replaced, since the threads on the valve stem may damage the packing when the valve stem is removed.

1. Follow the Trim Disassembly procedures, steps 1 to 8 on page 25 of this manual.
2. Ensure power and signal have been isolated from the actuator. Open the explosion-proof enclosure (keys 60 and 61), using a 13 mm wrench.
3. Remove the FloPro (keys 13, 14 and 15), using a 5/32 in. hex head wrench.
4. Remove the stem nut (key 27), using an 11/16 in. wrench, noting the position of the FloPro relative to the bonnet markings.
5. Use a rubber mallet to gently drive the stem downward through the bottom of the actuator housing and remove the stem.
6. Ensure the packing has been removed, using procedures in the Packing Disassembly on page 27 of this manual.
7. Replace the stem by gently pushing the stem up through the actuator.
8. Replace the packing and plug, using the procedures in the Packing Assembly on page 28 of this manual.
9. Install the FloPro at the same position it was removed from in step 4. Tighten the hex socket head cap screws to 3 N•m / 26 lbf•in.
10. Tighten the stem nut (key 27) to 39 N•m / 29 lbf•ft using an 11/16 in. wrench. Be sure the FloPro is not allowed to rotate when tightening the stem nut.
11. Apply anti-seize lubricant to the threads on the valve body and bonnet nut (key 5) and the contact surfaces of the bonnet and bonnet nut flange. Install the bonnet and actuator assembly onto the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.

Section 6: Parts

6.1 Parts Ordering

Each D3 control valve is assigned a serial number, which can be found on the nameplate. Refer to the number when contacting your [Emerson sales office](#) for assistance or when ordering replacement parts.



WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

6.2 Parts Kits

Table 4. Trim Kits

Port Diameter, in.	0.375	0.75	1
Standard trim kit (Contains keys 2, 3, 4 and 43)	RD3STD0012	RD3STD0022	RD3STD0032
Carbide trim kit (Contains keys 2, 3, 4 and 43)	RD3CARB042	RD3CARB052	RD3CARB062

Table 5. Actuator Parts Kits

Kit	Part Number
Packing Kit (Contains keys 4, 10, 11, 43 and 44)	RD3PACK012
Valve Stem (Key 16)	GE48049X012
Board Replacement Kit (On/Off is default)	GE83055X012
Board Replacement Kit + Positioning License Dongle	GE83126X012
Motor/Gearbox Assembly	GK10613X012
Motor/Gearbox/Board Assembly (On/Off is default)	GK16046X012
Motor/Gearbox/Board Assembly + Positioning License Dongle	GK16047X012
Replacement Kit - Belleville Springs	GK15266X012
Replacement Kit - Drivetrain	GK15328X012
Positioning License Dongle (1 License)	GE83574X012
Positioning License Dongle (5 License)	GE83574X022

6.3 Parts List

NOTE

Recommended spare parts are included in the Parts Kits. Contact your [Emerson sales office](#) for Part Ordering information.

Table 6. Parts List

Key	Description	Key	Description
1	Valve body	25*	Stem O-ring
2*	Seat ring	27	Stem nut
3*	Valve plug	34	Valve nameplate
4*	Bonnet O-ring	41	Drive screw (2 req'd)
5	Bonnet nut	43*	Groove pin
6	Spring pin (or alternate pipe plug) (2 req'd)	44*	High performance fluorinated grease packing lubricant
7	Bonnet	58	Enclosure O-ring
8	Packing retainer	59	Motor/gearbox/controller assembly
9	Belleville springs (5 req'd)	60	Upper enclosure
10*	Anti-extrusion washer (2 req'd)	61	Lower enclosure
11*	Packing set	62	Motor cap screws (4 req'd)
12	Packing spacer	63	Motor cap screw washers (4 req'd)
13	FloPro half	64	Enclosure cap screws (8 req'd)
14	FloPro half	65	Enclosure cap screw retaining washers (8 req'd)
15	Hex socket head cap screw (2 req'd)	66	Ground screw
16*	Stem	68	Certification nameplate
18*	O-ring	69	easy-Drive label
20	Locknut	- - -	- - -
1. *Recommended spare parts			

Figure 22. D3 Valve Assembly

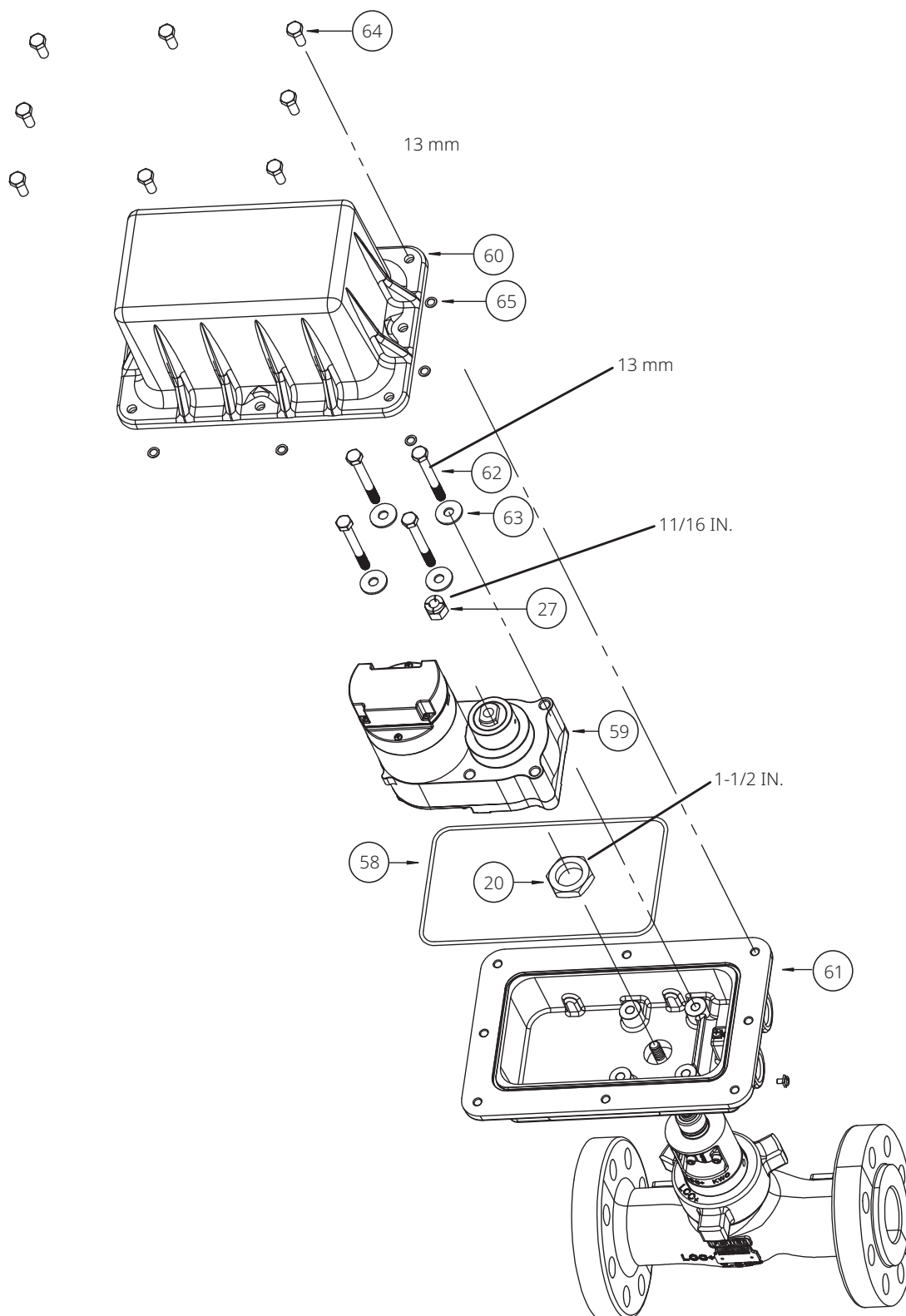
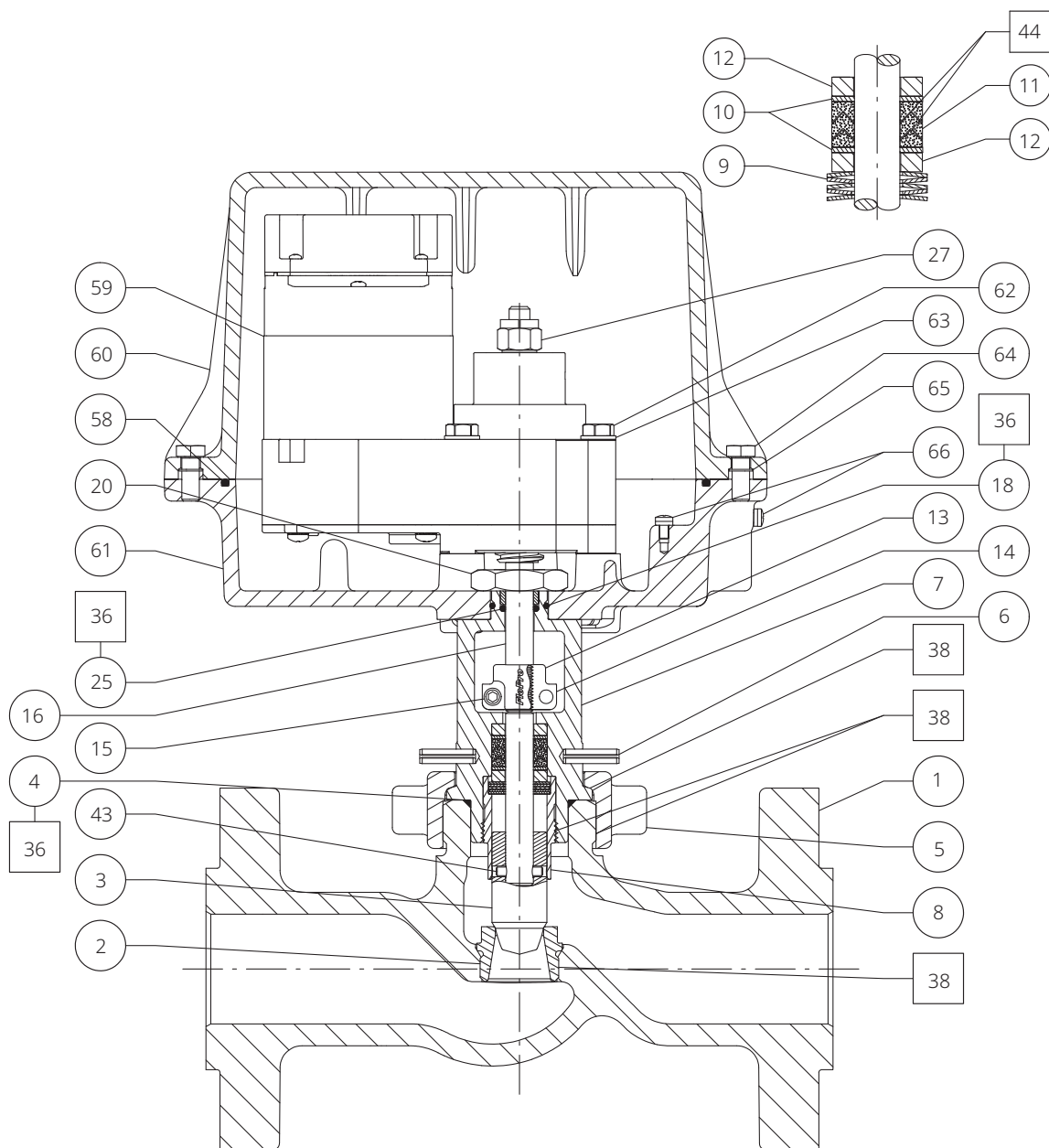


Figure 23. D3 Valve Assembly - Cross Sectional View



 APPLY LUBRICANT

GE49376-B

Appendix A: Modbus

A.1 Register Summary

Table A-1. Gen 2 easy-Drive Actuator Modbus Map

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint16	Modbus position command (100=10.0%)	40001	0	R/W	0 to 1000	Modbus command value with one implied decimal place (1000=100.0%). R/W at all times but only used in Modbus control mode. In on/off mode 0 to 499 will result in a move to 0% and 500 to 1000 will result in a move to 100%.
uint16	Digital output	40002	0	R/W	0, 1	0=no voltage supplied to terminals, 1=voltage supplied to terminals (Only used when output setup is set for Remote controlled)
uint16	Reset error codes	40003	0	R/W	0, 1	Value of 1 will clear faults. Will automatically set back to 0.
uint16	RESERVED	40004	---	---	---	---
uint16	RESERVED	40005	---	---	---	---
uint16	RESERVED	40006	---	---	---	---
uint16	RESERVED	40007	---	---	---	---
uint16	RESERVED	40008	---	---	---	---
uint16	RESERVED	40009	---	---	---	---
uint16	Actual position (100=10.0%)	40010	0	R	0 to 1000	Present position of the actuator relative to span with 1 implied decimal place (1000=100.0%). Valid for all control modes.
uint16	Commanded position (100=10.0%)	40011	0	R	0 to 1000	Present position command of the actuator relative to span (1000=100.0%). Valid for all control modes.
uint16	Diagnostic Flags	40012	0	R	0 to 65535	Bit flags - see chart
uint16	Digital status	40013	0	R	0 to 1	0=no connection between terminals, 1=connection between terminals (Status of digital input or output)
uint32	Total Running Time (min)	40014, 40015	0	R	4294967296	Total number of minutes the actuator has been powered on since time has been reset
uint32	Total Open Time (min)	40016, 40017	0	R	4294967296	Total number of minutes the actuator has been at 100% of travel since time has been reset
uint32	Total Closed Time (min)	40018, 40019	0	R	4294967296	Total number of minutes the actuator has been at 0% of travel since time has been reset
uint32	Number of Closed (Cycle count)	40020, 40021	0	R	4294967296	Total number of close cycles the actuator has performed since reset. One open/close cycle counts as 1.

- continued -

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D3 Valve with Gen 2 easy-Drive Actuator

D104161X012

June 2026

Table A-1. Gen 2 easy-Drive Actuator Modbus Map (continued)

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint32	Number of Power Cycles	40022, 40023	0	R	4294967296	Total number of times the actuator has been powered on.
uint32	Number of Movements	40024, 40025	0	R	4294967296	Total number of movements the actuator has performed. Move must be at least 5% of rated travel for cycle to increment.
uint16	Analog input control value	40026	0	R	0 to 2400	Value of the analog signal in mA with 2 implied decimals. In analog control mode, this is the command value and is subject to the analog settings in registers 40046 to 40059. Always active but a slower refresh rate when unit is not in analog control mode.
uint16	Incoming voltage	40027	0	R	0 to 350	Diagnostic register - value of incoming voltage with 1 implied decimal.
uint16	Latch Open State	40028	0	R	0 to 1	Normally open latch state
uint16	Latch Close State	40029	0	R	0 to 1	Normally closed latch state
uint16	RESERVED	40030	---	---	---	---
uint16	RESERVED	40031	---	---	---	---
uint16	RESERVED	40032	---	---	---	---
uint16	RESERVED	40033	---	---	---	---
uint16	RESERVED	40034	---	---	---	---
uint16	RESERVED	40035	---	---	---	---
uint16	RESERVED	40036	---	---	---	---
uint16	RESERVED	40037	---	---	---	---
uint16	RESERVED	40038	---	---	---	---
uint16	RESERVED	40039	---	---	---	---
uint16	Test Register - 16 bit	40040	45964	R	45964	Fixed register to test correct reading of 16 bit registers - Hex=B38C, Binary=1011001110001100
uint32	Test Register - 32 bit	40041, 40042	3,012,341,331	R	3,012,341,331	Fixed register to test correct reading of 32 bit registers - Hex=B38C AE53, Binary=1011001110001100 1010111001010011
uint16	Span calibration	40043	0	R/W	0, 1	Value of 1 will initiate span calibration. Will automatically set back to 0.
uint16	RESERVED	40044	---	---	---	---
uint16	RESERVED	40045	---	---	---	---
uint16	RESERVED	40046	---	---	---	---
uint16	RESERVED	40047	---	---	---	---
uint16	RESERVED	40048	---	---	---	---
uint16	RESERVED	40049	---	---	---	---

- continued -

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

D3 Valve with Gen 2 easy-Drive Actuator

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D104161X012

Table A-1. Gen 2 easy-Drive Actuator Modbus Map (continued)

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint16	Loss of signal position (100=10.0%)	40050	0	R/W	0 to 1001	Position to which valve plug will be driven upon loss of signal. Loss of signal is based upon the active control mode. 0 to 1000=0 to 100.0% with 1 implied decimal point. In on/off mode 0 to 499 will result in movement to 0% while 500 to 1000 will result in movement to 100%. A value of 1001 in any control mode is the setting for "lock-in-last".
uint16	Modbus timeout (s)	40051	60	R/W	0 to 65535	Time without a valid Modbus message is seen (to any address) before "loss of signal" motion is engaged when in Modbus control mode. Only active in Modbus control mode. 0=disabled
uint16	Dual contact timeout (s)	40052	60	R/W	0 to 3600	Time without a digital signal being low (contact made) from either digital input as viewed by voltage level on the digital input terminals. If neither contact has been made (pulled input low) within the timeout period, the valve plug will be moved to the loss-of-signal position. Only active in the local, on-off, dual contact mode. 0=disabled.
uint16	Deadband (10=1.0%)	40053	5	R/W	0 to 250	Minimum percentage signal change to elicit a movement response based upon end position of last movement. For example, if the previous command resulted in the actuator moving to 31.2% of travel and deadband is set to 100 (10.0%), setpoint must command valve to 21.2% or 41.2% before valve will move to new position. Default is set to minimize signal dithering.
uint16	Low travel cutoff position (100=10.0%)	40054	50	R/W	0 to 999	Analog input command, in percent with one implied decimal (50=5.0%), below this value will result in the valve plug moving to the closed position. Active in both local and Modbus control modes.
uint16	Analog on/off close position (100=10.0%)	40055	400	R/W	0 to 999	When the valve is in 4 to 20 mA on/off mode, this value is the point at which the valve will close. It must be set to a smaller value than the analog on/off open position. Percentage position value with one implied decimal (400=40.0%).
uint16	Analog on/off open position (100=10.0%)	40056	500	R/W	1 to 1000	When the valve is in 4 to 20 mA on/off mode, this value is the point at which the valve will open. It must be set to a larger value than the analog on/off close position. Percentage position value with one implied decimal (500=50.0%).
uint16	Analog Close Value	40057	40	R	31 to 220	The analog value, in mA with one implied decimal (40=4.0 mA), that defines the closed position
uint16	Analog Open Value	40058	200	R	31 to 220	The analog value, in mA with one implied decimal (200=20.0 mA), that defines the open position

- continued -

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D3 Valve with Gen 2 easy-Drive Actuator

D104161X012

June 2026

Table A-1. Gen 2 easy-Drive Actuator Modbus Map (continued)

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint16	Number of retries	40059	2	R/W	0 to 4	When the valve plug encounters an obstruction, how many attempts will it make to move past that point, assuming no change in the command signal within the deadband range.
uint16	RESERVED	40060	---	---	---	---
uint16	RESERVED	40061	---	---	---	---
uint16	RESERVED	40062	---	---	---	---
uint16	RESERVED	40063	---	---	---	---
uint16	RESERVED	40064	---	---	---	---
uint16	RESERVED	40065	---	---	---	---
uint16	RESERVED	40066	---	---	---	---
uint16	Control Source	40067	0	R/W	0 to 5	0=Dual Contact On/Off 1=Single Contact On/Off 2=Modbus On/Off 3=Modbus Positioning 4=4 to 20 Positioning 5=4 to 20 Level
uint16	Valve Type	40068	1	R/W	1 to 10	1=D3, 2=D4
uint16	RESERVED	40069	---	---	---	---
uint16	RESERVED	40070	---	---	---	---
uint16	RESERVED	40071	---	---	---	---
uint16	RESERVED	40072	---	---	---	---
uint16	RESERVED	40073	---	---	---	---
uint16	Modbus address	40074	1	R/W	1 to 247	Slave Address of the actuator
uint16	Baud Rate	40075	5	R/W	4, 5, 6, 7	4=4800 baud, 5=9600 baud (default), 6=19200 baud, 7=38400 baud
uint16	Parity	40076	0	R/W	0, 1, 2	0=Even, 1=Odd, 2=None
uint16	Modbus stop bits	40077	1	R/W	0, 1, 2	1 stop bit is the standard with even and odd parity while 2 stop bits is the standard for none.
uint16	MSB/LSB	40078	0	R/W	0, 1	0=MSB (Big Endian), 1=LSB (Little Endian)
uint16	RESERVED	40079	---	---	---	---
uint16	Digital I/O selection	40080	1	R/W	0, 1	0=9 V sinking digital input, 1=25 mA at 10 V digital output
uint16	Digital I/O output setup	40081	0	R/W	0, 1, 2, 3	Valid only when Digital I/O selection is set to Output (1) - 0=In position, 1=Fully closed, 2=Fully open, 3 = Remote controlled (driven by Digital Output register)
uint16	Digital I/O input setup	40082	0	R/W	0, 1	Valid only when Digital I/O selection is set to Input (0) - 0=Reference only (status appears in 40013 and does nothing else), 1=Override (status appears in 40013 and valve plug is moved to safe position noted in register 40050)

- continued -

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

D3 Valve with Gen 2 easy-Drive Actuator

Instruction Manual

June 2026

D104161X012

Table A-1. Gen 2 easy-Drive Actuator Modbus Map (continued)

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint16	RESERVED	40083	---	---	---	---
uint16	RESERVED	40084	---	---	---	---
uint16	RESERVED	40085	---	---	---	---
uint16	RESERVED	40086	---	---	---	---
uint16	RESERVED	40087	---	---	---	---
uint16	RESERVED	40088	---	---	---	---
uint16	RESERVED	40089	---	---	---	---
uint16	RESERVED	40090	---	---	---	---
uint16	RESERVED	40091	---	---	---	---
uint16	RESERVED	40092	---	---	---	---
uint16	RESERVED	40093	---	---	---	---
uint32	Device Tag	40094 to 40113	"easyDrive2"	R/W	0 to 255 per character	Device Tag (20 character UTF8 string)
uint32	Valve serial number	40114, 40115	0	R/W*	0 to 4,294,967,296	Valve assembly serial number assigned at Fisher assembly plant
uint32	Motor serial number	40116, 40117	0	R/W*	0 to 4,294,967,296	Motor/gearbox serial number
uint32	Motor revision	40118, 40119	0	R/W*	0 to 4,294,967,296	Motor/gearbox revision
uint32	PCB serial number	40120, 40121	0	R/W*	0 to 4,294,967,296	PCB serial number
uint16	PCB revision	40122, 40123	0	R/W*	0 to 4,294,967,296	PCB revision
uint16	Flash Firmware major revision	40124	0	R	0 to 65535	From flash firmware when compiled
uint16	Flash Firmware minor revision	40125	0	R	0 to 65535	From flash firmware when compiled
uint16	Flash Firmware mod revision	40126	0	R	0 to 65535	From flash firmware when compiled
uint16	Flash Firmware build revision	40127	0	R	0 to 65535	From flash firmware when compiled
uint16	Boot Firmware major revision	40128	0	R	0 to 65535	From boot firmware when compiled
uint16	Boot Firmware minor revision	40129	0	R	0 to 65535	From boot firmware when compiled
uint16	Boot Firmware mod revision	40130	0	R	0 to 65535	From boot firmware when compiled
uint16	Boot Firmware build revision	40131	0	R	0 to 65535	From boot firmware when compiled
uint32	PCB test date	40132, 40133	0	R/W*	0 to 4,294,967,296	Seconds since January 1, 2000, Board Supplier Functional Test Date
uint32	Motor test date	40134, 40135	0	R/W*	0 to 4,294,967,296	Seconds since January 1, 2000, Motor Supplier Test Date
uint32	System completion date	40136, 40137	0	R/W*	0 to 4,294,967,296	Seconds since January 1, 2000, Final Assembly Test Date
1. uint is defined as unsigned integer 2. uint16 – unsigned 16-bit variable, can take value 0 to 65535. 3. uint32 – unsigned 32-bit variable, can take value 0 to 4294967295. 4. (Reserved) – registers used for development use only. 5. † - 32-bit register contains data that spans two registers – reads and write of data needs to be performed within the same Modbus command function to ensure coherency of data.						

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D3 Valve with Gen 2 easy-Drive Actuator

D104161X012

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Table A-2. Diagnostic Fault Flags

Hex Value	Bit Mask	Description	Value	Bit	Definition
0x8000	1000 0000 0000 0000	Fault in N.V. Memory – system has restored default settings	32768	15	A memory fault has occurred and the actuator has been restored to factory defaults. Contact your Emerson sales office .
0x8000	1000 0000 0000 0000	Fault in N.V. Memory – system has restored default settings	32768	15	A memory fault has occurred and the actuator has been restored to factory defaults. Contact your Emerson sales office .
0x4000	0100 0000 0000 0000	Motor Assembly Stall - Travel Deviation	16384	14	The actuator is unable to move to the commanded position and has stopped. Follow troubleshooting guide in Help section to remedy.
0x2000	0010 0000 0000 0000	Discrete Input override mode active	8192	13	The digital input has detected a closed contact and the actuator has moved to its safe position. Check switch input device status.
0x1000	0001 0000 0000 0000	System or Watchdog fault	4096	12	The actuator has experienced a fatal error and shut down. Contact your Emerson sales office .
0x0800	0000 1000 0000 0000	Analog Input calibration value not in expected range	2048	11	The analog values entered do not match the analog signal level. Check analog signal value and value entered.
0x0400	0000 0100 0000 0000	Valve travel distance calibration not in legal range	1024	10	The valve travel distance is outside the acceptable range. Confirm valve type and that no obstructions are present.
0x0200	0000 0010 0000 0000	Analog Input span calibration not in legal range	512	9	The analog values for open and close are less than 4 mA and previous values have been maintained. Calibrate analog input with differential >4 mA.
0x0100	0000 0001 0000 0000		256	8	- - -
0x0080	0000 0000 1000 0000	Valve was shutdown while moving	128	7	Actuator was powered down during a move and actual position may vary from commanded. Recalibrate the valve span.
0x0040	0000 0000 0100 0000	Valve span calibrated (informational)	64	6	Span has been calibrated and actuator is ready.
0x0020	0000 0000 0010 0000	Valve position controller active (informational)	32	5	Actuator is active and ready.
0x0010	0000 0000 0001 0000	Loss of signal active	16	4	Control signal not present. Signal is <3 mA, timeout period exceeded (40051 or 40052).
0x0008	0000 0000 0000 1000		8	3	- - -
0x0004	0000 0000 0000 0100	Modbus command has been sent (starts a calibrated system)	4	2	The actuator is successfully moving the valve.
0x0002	0000 0000 0000 0010	Analog input initialized (system has seen input >3 mA / 1 V)	2	1	4 to 20 mA analog input has a valid signal present.
0x0001	0000 0000 0000 0001	Start delay active (within 15-second calibration window)	1	0	Span calibration using physical inputs allowed during startup

Appendix B: Certificate of Conformance



EU Declaration of Conformity

We, the manufacturer,

Emerson
Fisher Controls International LLC
205 South Center Street
Marshalltown, Iowa 50158 USA

declare under our sole responsibility that the following product(s);

Electric Actuator
easy-Drive

to which this declaration relates, is in conformity with the provisions of the following European Community Directives, including the latest amendments, as shown in the attached schedule.

Assumption of conformity is based on the application of the harmonized standards and, when applicable or required, a European Community Notified Body certification, as shown in the attached schedule.

Chad Engle
Director – Product Design Compliance
Marshalltown, Iowa 50158

20-Oct-2025

Date

European Contact

Emerson | Group Services SAS | Rue Paul-Baudry | B.P. 10150 | 68701 Cernay Cedex France

EMC Directive – 2014/30/EU

Models: All
EN 61326-1:2013

RoHS Directive – 2011/65/EU as amended by 2015/863/EU

Declaration of Exclusion

Models: All

The above equipment is excluded from the scope of this directive per Article 2, Paragraph 4, part C of 2011/65/EU, therefore the equipment cannot bear the CE mark related to RoHS compliance. However, the equipment may bear the CE mark to indicate compliance with other applicable EU directives.

ATEX Directive – 2014/34/EU (Applicable only if this mark appears on the product)

Certificate – **SIRA12ATEX1168X – Group II Category 2 G – Flameproof**
easy-Drive
Ex db IIA T6(Ta ≤ 70°C) Gb
Standards used: EN IEC 60079-0:2018/AC:2020, EN60079-1:2014

ATEX Notified Body for EC-Type Examination Certificate(s)
CSA Group Netherlands B.V. – Notified Body Number: 2813
Utrechtseweg 310, Building B42
6812AR Arnhem
The Netherlands

ATEX Notified Body for Quality Assurance

SGS Fimko Oy – Notified Body Number: 0598
P.O. Box 30 (Särkiniementie 3)
Helsinki, 00211
Finland

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Fisher™ D3 FloPro Control Valve

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Figure 1. Fisher D3 FloPro Control Valve
NPS 2 RF Flanged End Connection



W9249

Introduction

Scope of Manual

This instruction manual provides installation, maintenance, and parts information for the Fisher D3 FloPro control valve and actuator.



Do not install, operate, or maintain D3 FloPro valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The D3 FloPro control valve (figure 1) is a compact, rugged valve designed for on-off control of a variety of fluids at pressures up to 155 bar (2250 psig). This valve is ideal for use as a dump valve on gas separators and scrubbers. It is also well suited for other high pressure applications in natural gas production, compression, and processing. NPS 1 and NPS 2 D3 FloPro control valves are available in CL900 NPT end connections and CL600 raised face flanged end connections.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

D3 FloPro Valve

April 2022

Instruction Manual

D103221X012

Table 1. Specifications

Valve Body Sizes and End Connection Styles⁽¹⁾

See table 3

Maximum Inlet Pressures and Temperatures⁽¹⁾

VALVE BODY SIZE	MAXIMUM INLET PRESSURE	TEMPERATURE RANGE
	bar (psig)	°C (°F)
NPS 1 and NPS 2 NPT CL900	155 (2250)	-46 to 93 (-50 to 200)
	150 (2185)	93 to 149 (200 to 300)
NPS 1 and NPS 2 RF CL600	103 (1500)	-46 to 93 (-50 to 200)
	100 (1455)	93 to 149 (200 to 300)

Maximum Shutoff Pressure Drops⁽¹⁾

See table 2

Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4

Class IV

Flow Characteristic / Valve Plug Style

Equal percentage / Micro-Form Valve Plug

Port Diameters

See table 3

Maximum Travel

15 mm (0.6 inch)

Material Temperature Capabilities⁽¹⁾

Valve Body Assembly:

Standard O-Ring: -40 to 135°C (-40 to 275°F)

Actuator Assembly: -34 to 82°C (-30 to 180°F)

Flow Direction

Flow Up or Flow Down

Available Actuator Configurations

Spring-to-Open

Spring-to-Close

Maximum Actuator Casing Pressure⁽¹⁾

3.4 bar (50 psig)

Actuator Diaphragm Effective Area

329 cm² (51 square inches)

Actuator Pressure Connections

1/4 NPT internal

1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded.

Specifications

Table 1 lists specifications for the D3 FloPro control valve. Some of the specifications for a given control valve as it originally comes from the factory are stamped on a nameplate located on the upper diaphragm casing.

Table 2. Fisher D3 Maximum Shutoff Pressure Drops

FLOW DIRECTION	ACTUATOR ACTION	INPUT SIGNAL	NUMBER OF SPRINGS	MAXIMUM ΔP (PSI) PER PORT SIZE (INCH)		
		psi		0.375	0.75	1.00
Up	Spring-to-Close	0-20	3	2250	544	341
		0-35	6	2250	1504	999
	Spring-to-Open	0-20	2	2250	935	608
		0-35	2	2250	2250	2094
Down	Spring-to-Close	0-20	2	1558	1800	950
		0-35	3	2250	2250	2250
	Spring-to-Open	0-20	2	2250	1700	939
		0-35	3	2250	2250	1575

Table 3. Valve Sizes and Connection Styles

VALVE SIZE, NPS	PORT DIAMETER, (INCHES)	THREADED	RAISED FACE (RF) FLANGED
		CL900	CL600
1	0.375, 0.75, 1	X	X
2	0.375, 0.75, 1	X	X

X = Available construction.

Educational Services

For information on available courses for Fisher D3 valves, as well as a variety of other products, contact:

Emerson Automation Solutions
 Educational Services - Registration
 Phone: 1-641-754-3771 or 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts or by uncontrolled process fluid, be certain the service conditions do not exceed the limits shown on the valve nameplate and in table 1. Use pressure-relieving devices required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

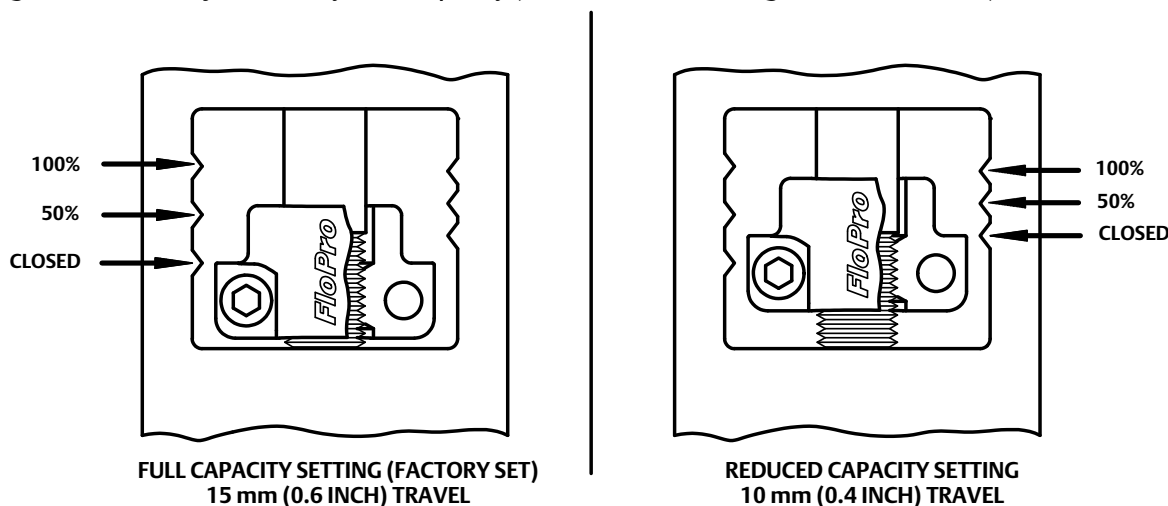
When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag, or other foreign material from the pipeline.

1. Before installing the control valve assembly, inspect it for any damage and for any foreign material that may have collected in the valve body.
2. Clean out all pipelines to remove scale, welding slag, and other foreign materials.
3. The control valve assembly may be installed in any orientation, but normally the actuator is vertical above the valve. Install the valve so the flow direction arrow on the side of the valve indicates the direction of the process flow.

4. Install the valve following local and national piping codes when they apply to the application. For screwed connections, treat the external pipe threads with a good grade pipe compound. For flanged connections, use suitable gaskets between valve and pipeline flanges.
5. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
6. Connect loading pressure for the Spring-to-Close configuration to the lower casing assembly (key 21) as shown in figure 7. The Spring-to-Open configuration loading pressure connection is in the upper casing assembly (key 32) as shown in figure 8.

Figure 2. FloPro Adjusts to Vary Flow Capacity (Shown with Valve Plug in Seated Position)



Setting the Valve FloPro Flow Adjuster

The flow setting may only be adjusted if the 0.375 and 0.75 inch port sizes are installed.

When shipped from the factory, the actuator has the FloPro flow adjuster set at the maximum flow rate position for the given port size.

Spring-to-Close Actuator Action

1. Ensure the valve plug is in the seated position.
2. To change the valve flow rate, loosen the flow adjuster socket head cap screws (key 15), and reposition the flow adjuster halves (key 13 and 14) to the desired flow rate position. See figure 2 for flow rate settings.
3. Retighten the socket head screws (key 15) to 3 N•m (26 lbf•in).

Spring-to-Open Actuator Action

1. Attach a pressure line to the actuator. Pressurize the actuator to a maximum of 2.41 bar (35 psi) to seat the plug in the seat ring.
2. To change the valve flow rate, loosen the flow adjuster socket head cap screws (key 15), and reposition the flow adjuster halves (key 13 and 14) to the desired flow rate position. See figure 2 for flow rate settings.
3. Retighten the socket head screws (key 15) to 3 N•m (26 lbf•in).

Maintenance

Refer to figures 7 and 8.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and maintenance depends on the severity of the service conditions.

⚠ WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valve Plug and Seat Ring Maintenance

Trim Disassembly

Spring-to-Close (Air-to-Open)

Key numbers are referenced in figure 7.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body (key 1), and drain the process media from both sides of the valve.

CAUTION

The following steps are intended to prevent damage to the valve plug (key 3) and seat ring (key 2) during the removal of the bonnet and actuator.

2. Pressurize the actuator to a maximum of 2.41 bar (35 psi) to stroke the valve to mid travel. This will raise the valve plug (key 3) off its seat and expose all of the serrations on the valve stem (key 16).
3. Loosen the hex socket head cap screws (key 15) and lower the flow adjuster (keys 13 and 14) to its lowest position on the valve stem.
4. Tighten the hex socket head cap screws to 3 N•m (26 lbf•in).
5. Relieve pressure to the actuator, shut off all pressure lines to the actuator, and disconnect. Use lockout procedures to ensure the above measures stay in effect while you work on the equipment.
6. Break the bonnet nut (key 5) loose with a hammer. Continue turning the bonnet nut by using a hammer or a large adjustable wrench, tightened around one ear of the bonnet nut. If the bonnet (key 7) is stuck in the valve, continue

to unscrew the bonnet nut. The bonnet nut will contact the spring pins (or pipe plugs) (key 6, figures 7 or 8) and jack the bonnet out of the valve. Carefully lift the actuator assembly from the valve body.

⚠ WARNING

The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

7. Completely remove the packing retainer (key 8) using a 1-1/8 inch wrench.
8. Remove the valve plug by driving out the pin (key 43) and unscrewing the valve plug from the stem. Utilize a 1/8 inch drift punch in the holes provided on the stem to keep the stem from turning as the plug is removed. Do not remove the Belleville springs (key 9) from the stem, in order to retain the Belleville stacking orientation as shown in figure 3.
9. Use a 1-3/16 inch socket wrench to loosen and remove the seat ring (key 2).

CAUTION

Inspect the seat ring and valve body interior for wear, erosion, or damage in the following steps.

10. Inspect the seat ring for wear or damage. If the seating surface has been damaged, discard the seat ring.
11. Visually inspect the valve body interior below the seat ring for erosion or damage. Replace the valve body if necessary.

⚠ WARNING

Be careful to avoid damaging the seating surface on the valve plug or seat ring as damage in these areas will allow excessive leakage at shutoff. Avoid damaging the highly polished valve stem surface. A damaged valve stem could cut the packing and allow process fluid to leak to the atmosphere.

Cover the opening in the valve body to prevent foreign material from getting into the valve body cavity.

Spring-to-Open (Air-to-Close)

Key numbers are referenced in figure 8.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body (key 1), and drain the process media from both sides of the valve.

Note

The following steps are intended to ensure the groove pin is fully exposed below the bonnet to allow you to remove the pin before removing the valve plug.

2. Pressurize the actuator to a maximum of 2.41 bar (35 psi) to stroke the valve fully closed. This will seat the valve plug (key 3) and expose the top of the serrations on the valve stem (key 16).
3. Loosen the hex socket head cap screws (key 15) and raise the flow adjustor (keys 13 and 14) to its highest position on the valve stem.
4. Tighten the hex socket head cap screws to 3 N•m (26 lbf•in).
5. Relieve pressure to the actuator and disconnect the air lines. Ensure the flow adjustor is touching the top of the bonnet window. Use lockout procedures to ensure the above measures stay in effect while you work on the equipment.

6. Break the bonnet nut (key 5) loose with a hammer. Continue turning the bonnet nut by using a hammer or a large adjustable wrench, tightened around one ear of the bonnet nut. If the bonnet (key 7) is stuck in the valve, continue to unscrew the bonnet nut. The bonnet nut will contact the spring pins (or pipe plugs) (key 6, figures 7 or 8) and jack the bonnet out of the valve. Carefully lift the actuator assembly from the valve body.

⚠ WARNING

The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

7. Completely remove the packing retainer (key 8) using a 1-1/8 inch wrench.
8. Remove the valve plug by driving out the pin (key 43) and unscrewing the valve plug from the stem. Utilize a 1/8 inch drift punch in the holes provided on the stem to keep the stem from turning as the plug is removed. Do not remove the Belleville springs (key 9) from the stem, in order to retain the Belleville stacking orientation as shown in figure 3.
9. Use a 1-3/16 inch socket wrench to loosen and remove the seat ring (key 2).

CAUTION

Inspect the seat ring and valve body interior for wear, erosion, or damage in the following steps.

10. Inspect the seat ring for wear or damage. If the seating surface has been damaged, discard the seat ring.
11. Visually inspect the valve body interior below the seat ring for erosion or damage. Replace the valve body if necessary.

⚠ WARNING

Be careful to avoid damaging the seating surface on the valve plug or seat ring as damage in these areas will allow excessive leakage at shutoff. Avoid damaging the highly polished valve stem surface. A damaged valve stem could cut the packing and allow process fluid to leak to the atmosphere.

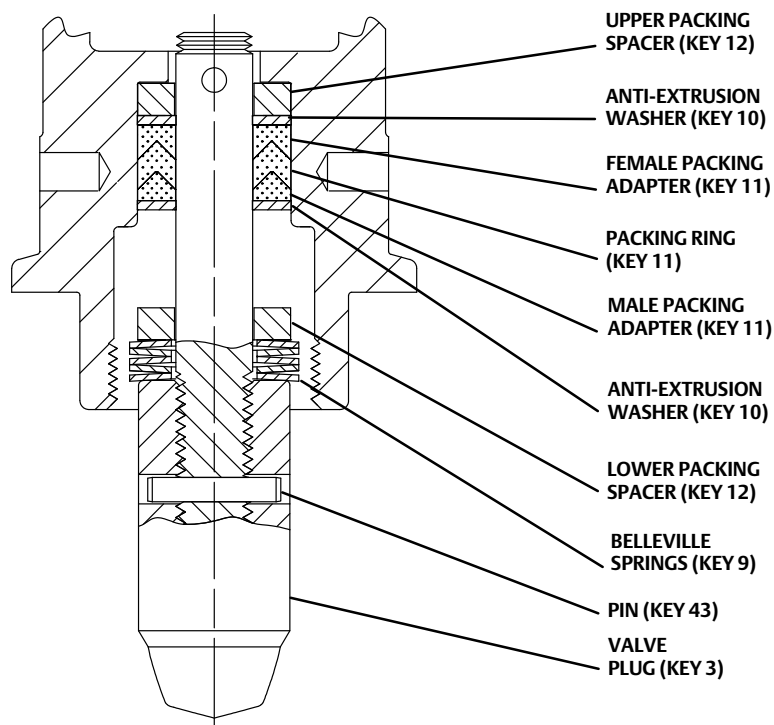
Cover the opening in the valve body to prevent foreign material from getting into the valve body cavity.

Trim Assembly

Spring-to-Close (Air-to-Open)

1. Ensure the threads of the valve stem (key 16) and valve plug (key 3) are clean and free of debris.
2. Make sure the Belleville springs (key 9) are properly installed on the valve stem, as shown in figure 3.
3. Install the valve plug on the stem and insert a new pin (key 43).
4. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs (key 9) are completely enclosed by the packing retainer as shown in figure 4.
5. Torque the packing retainer to 81 N•m (60 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet (key 7). The packing retainer threads should be completely enclosed by the bonnet.

Figure 3. Packing and Belleville Spring Stacking Order



VALVE PLUG INSTALLED WITHOUT PACKING RETAINER

Figure 4. Packing and Belleville Spring Stacking Order

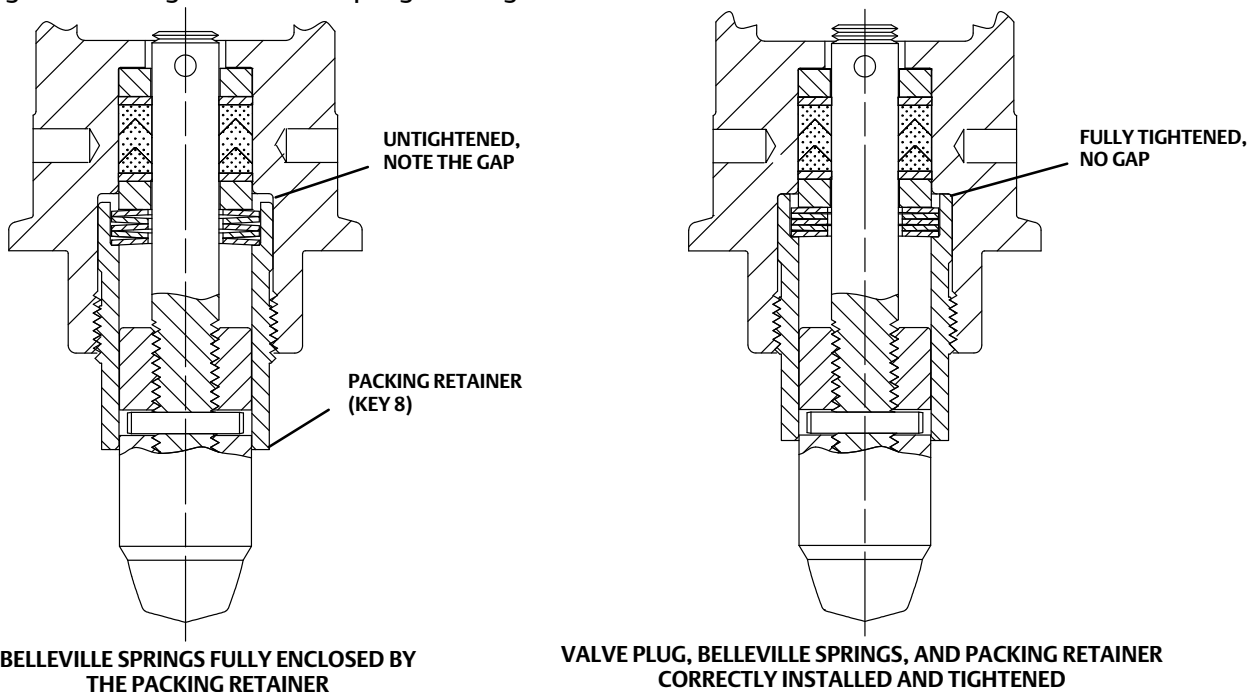
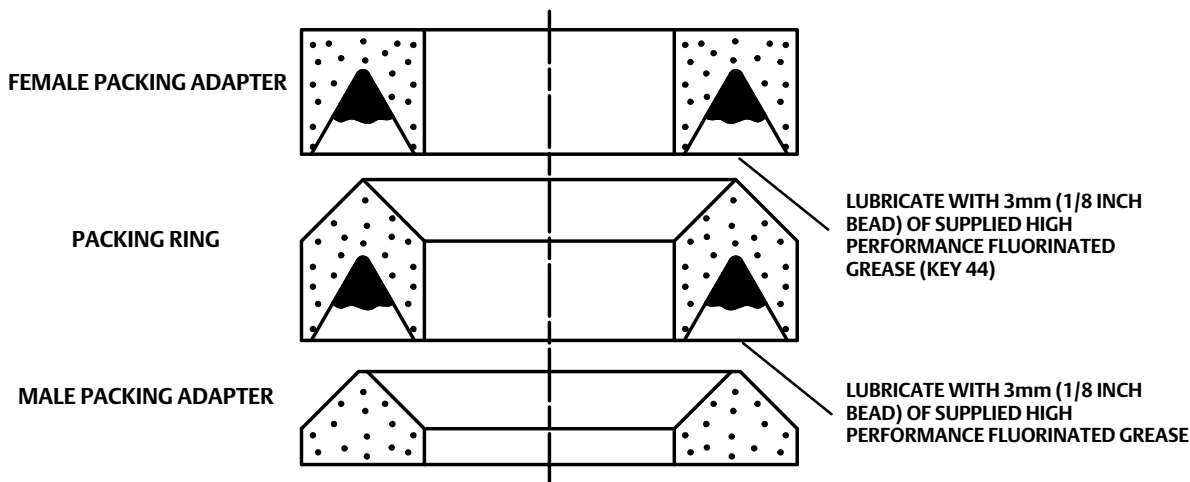


Figure 5. Lubrication Locations on Packing



6. Thoroughly clean the seat ring (key 2) threads and the mating threads in the valve body (key 1).
7. Apply anti-seize lubricant to the threads of the seat ring and its mating threads in the valve body.
8. Screw the seat ring into the valve body. Use a 1-3/16 inch socket wrench to tighten the seat ring to 170 N•m (125 lbf•ft). Remove all excess lubricant after tightening.
9. Lubricate the bonnet O-ring (key 4) with lithium grease and install on the bonnet.
10. Apply anti-seize lubricant to the threads on the valve body and bonnet nut (key 5) and the contact surfaces of the bonnet and bonnet nut flange. Install the bonnet and actuator assembly onto the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.
11. Pressurize the actuator to a maximum of 2.41 bar (35 psi) to stroke the valve to mid travel.
12. Loosen the hex socket head cap screws (key 15) and remove the flow adjuster (keys 13 and 14).
13. Relieve pressure to the actuator to fully close the valve.
14. Make sure the valve is fully seated and install the flow adjuster (keys 13 and 14) and hex socket head cap screws (key 15).
15. Set the desired flow rate position according to figure 2.
16. Tighten the hex socket head cap screws to 3 N•m (26 lbf•in).

Spring-to-Open (Air-to-Close)

1. Ensure the threads of the valve stem (key 16) and valve plug (key 3) are clean and free of debris.
2. Make sure the Belleville springs (key 9) are properly installed on the valve stem, as shown in figure 3.
3. Install the valve plug on the stem and insert a new pin (key 43).
4. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs (key 9) are completely enclosed by the packing retainer as shown in figure 4.
5. Torque the packing retainer to 68 N•m (50 lbf•ft). The packing retainer has been installed correctly when a metal to metal contact has been made between the packing retainer end and the bonnet (key 7). The packing retainer threads should be completely enclosed by the bonnet.
6. Thoroughly clean the seat ring (key 2) threads and the mating threads in the valve body (key 1).
7. Apply anti-seize lubricant to the threads of the seat ring and its mating threads in the valve body.
8. Screw the seat ring into the valve body. Use a 1-3/16 inch socket wrench to tighten the seat ring to 170 N•m (125 lbf•ft). Remove all excess lubricant after tightening.

9. Lubricate the bonnet O-ring (key 4) with lithium grease and install on the bonnet.
10. Apply anti-seize lubricant to the threads on the valve body and bonnet nut (key 5) and the contact surfaces of the bonnet and bonnet nut flange. Install the bonnet and actuator assembly onto the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.
11. Pressurize the actuator to a maximum of 2.41 bar (35 psi) to stroke the valve fully closed.
12. Loosen the hex socket head cap screws (key 15) and set the desired flow rate position according to figure 2.
13. Tighten the hex socket head cap screws to 3 N•m (26 lbf•in).
14. Relieve pressure to the actuator.

Packing Maintenance

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Key numbers are referenced in figure 3.

The valve stem packing can only be serviced by removing the bonnet from the valve body.

Packing Disassembly

Spring-to-Close (Air-to-Open)

1. Disassemble the valve per steps 1 - 8 in the Spring-to-Close Trim Disassembly section of the Valve Plug and Seat Ring Maintenance section of this manual.
2. Remove the five Belleville springs (key 9), lower packing spacer (key 12), packing set (key 11), and two anti-extrusion washers (key 10) from the bonnet (key 7) using a formed wire hook.
3. Clean and inspect the packing box wall to ensure that the packing surfaces are not damaged. If the surface condition is damaged and cannot be improved by light sanding, replace the bonnet.
4. Inspect the valve stem (key 16) and valve plug (key 3) for scratches or wear and replace if necessary.

Spring-to-Open (Air-to-Close)

1. Disassemble the valve per steps 1 - 8 in the Spring-to-Open Trim Disassembly section of the Valve Plug and Seat Ring Maintenance section of this manual.
2. Remove the five Belleville springs (key 9), lower packing spacer (key 12), packing set (key 11), and two anti-extrusion washers (key 10) from the bonnet (key 7) using a formed wire hook.
3. Clean and inspect the packing box wall to ensure that the packing surfaces are not damaged. If the surface condition is damaged and cannot be improved by light sanding, replace the bonnet.
4. Inspect the valve stem (key 16) and valve plug (key 3) for scratches or wear and replace if necessary.

Packing Assembly

The following steps define the proper procedure for installing the packing in a D3 FloPro Control Valve. Improper packing assembly can lead to poor valve performance. The proper packing arrangement is shown in figure 3.

Spring-to-Close (Air-to-Open)

1. Ensure the upper packing spacer (key 12) is installed.

2. Use the lower packing spacer (key 12) and a tube to push the upper anti-extrusion washer (key 10) into place. Using the lower packing spacer in this manner will ensure the upper anti-extrusion washer is fully seated and flat when installed in the packing bore.
3. Remove the lower packing spacer from the packing bore.

CAUTION

All D3 FloPro packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D3 packing lubricant.

Note

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-inch length of 1/2 inch PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

4. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the female packing adaptor as shown in figure 5 and install over the valve stem (key 16).
5. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the packing ring as shown in figure 5 and install over the valve stem.
6. Install the male packing adaptor, lower anti-extrusion washer (key 10), and lower packing spacer over the valve stem as shown in figure 3.
7. Firmly press all packing parts into the packing bore with a tube.
8. Install the five Belleville springs (key 9) over the valve stem as shown in figure 3.
9. Install the valve plug (key 3) on the stem and insert a new groove pin (key 43).
10. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs are completely enclosed by the packing retainer as shown in figure 4.
11. Torque the packing retainer to 81 N•m (60 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet (key 7). The packing retainer threads should be completely enclosed by the bonnet.
12. Assemble the valve per steps 9 - 16 in the Spring-to-Close Trim Assembly section of the Valve Plug and Seat Ring Maintenance section of this manual.

Spring-to-Open (Air-to-Close)

1. Ensure the upper packing spacer (key 12) is installed.
2. Use the lower packing spacer (key 12) and a tube to push the upper anti-extrusion washer (key 10) into place. Using the lower packing spacer in this manner will ensure the upper anti-extrusion washer is fully seated and flat when installed in the packing bore.
3. Remove the lower packing spacer from the packing bore.

CAUTION

All D3 FloPro packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D3 packing lubricant.

Note

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-inch length of 1/2 inch PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

4. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the female packing adaptor as shown in figure 5 and install over the valve stem (key 16).
5. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the packing ring as shown in figure 5 and install over the valve stem.
6. Install the male packing adaptor, lower anti-extrusion washer (key 10), and lower packing spacer over the valve stem as shown in figure 3.
7. Firmly press all packing parts into the packing bore with a tube.
8. Install the five Belleville springs (key 9) over the valve stem as shown in figure 3.
9. Install the valve plug (key 3) on the stem and insert a new groove pin (key 43).
10. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs are completely enclosed by the packing retainer as shown in figure 4.
11. Torque the packing retainer to 81 N•m (60 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet (key 7). The packing retainer threads should be completely enclosed by the bonnet.
12. Assemble the valve per steps 9 - 14 in the Spring-to-Open Trim Assembly section of the Valve Plug and Seat Ring Maintenance section of this manual.

Servicing the Actuator

The D3 FloPro valve is equipped with a spring and diaphragm actuator. The actuator action may be reversed without the need for additional parts. The number of springs contained in the actuator may have to be adjusted according to actuator action and/or supply pressure. Refer to table 2 for the proper number of springs for your actuator action and valve service conditions.

Actuator Disassembly

Spring-to-Close (Air-to-Open)

Key numbers are referenced in figure 7.

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Inspect all parts for wear or damage during disassembly. Replace any worn or damaged parts with genuine Fisher replacement parts. If the diaphragm is replaced, a new diaphragm O-ring should also be installed.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body (key 1), and drain the process media from both sides of the valve.

⚠ WARNING

To prevent possible personal injury or property damage from removing the casing cap screws in the wrong sequence, follow the procedure as outlined below for removing the upper casing.

Be aware as you loosen and remove the actuator casing cap screws that the actuator springs are under compression.

2. Remove the ten short actuator casing cap screws (key 29).
3. Remove the two long actuator casing cap screws (key 31) by alternating between them as you loosen them. Keep the upper casing (key 32) level during this procedure.
4. Remove the upper casing and the springs (key 28).
5. Remove the stem nut (key 27) taking care not turn the valve stem (key 16). Keep the valve stem from turning by inserting a 1/8 inch drift punch in the holes provided on the valve stem.
6. Remove the actuator spacer (key 26), diaphragm O-ring (key 19), diaphragm plate (key 24), diaphragm (key 23), and the diaphragm washer (key 22).
7. Remove the bonnet locknut (key 20) with a 1-1/2 inch socket wrench and lift off the lower casing (key 21).
8. Remove the casing O-ring (key 17).
9. Break the bonnet nut (key 5) loose with a hammer. Continue turning the bonnet nut by using a hammer or a large adjustable wrench, tightened around one ear of the bonnet nut. If the bonnet (key 7) is stuck in the valve, continue to unscrew the bonnet nut. The bonnet nut will contact the spring pins (or pipe plugs) (key 6, figures 7 or 8) and jack the bonnet out of the valve. Carefully lift the actuator assembly from the valve body.

⚠ WARNING

The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

10. Completely remove the packing retainer (key 8) using a 1-1/8 inch wrench.
11. Remove the valve plug (key 3) by driving out the pin (key 43) and unscrewing the valve plug from the stem. Utilize a 1/8 inch drift punch in the holes provided on the stem to keep the stem from turning as the plug is removed.
12. Remove the five Belleville springs (key 9), lower packing spacer (key 12), packing set (key 11), and two anti-extrusion washers (key 10) from the bonnet using a formed wire hook.
13. Completely remove the flow adjuster (keys 13, 14, and 15) from the valve stem.
14. Remove the valve stem from the top of the bonnet.

CAUTION

The valve stem must be removed to replace the stem O-ring and the bonnet bushing. If the valve stem is removed, the valve packing must be replaced since the threads on the valve stem may damage the packing when the valve stem is removed.

15. Remove the stem O-ring (key 25) and the bonnet bushing (key 18).
16. If the hammer nut needs to be removed from the bonnet, the spring pins (or pipe plugs) (key 6, figures 7 or 8) can be removed with locking pliers.

Spring-to-Open (Air-to-Close)

Key numbers are referenced in figure 8.

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Inspect all parts for wear or damage during disassembly. Replace any worn or damaged parts with genuine Fisher replacement parts. If the diaphragm is replaced, a new diaphragm O-ring should also be installed.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body (key 1), and drain the process media from both sides of the valve.
2. Remove the ten short actuator casing cap screws (key 29) and the two long actuator casing cap screws (key 31).
3. Remove the upper casing (key 32).
4. Lubricate the threads above the stem nut (key 27) with anti-seize lubricant to prevent galling of the threads.

⚠ WARNING

To prevent possible personal injury or property damage, be aware as you loosen and remove the stem nut that the actuator springs are under compression.

5. Relieve spring tension by slowly removing the stem nut. Do not allow the valve stem (key 16) to turn while removing the stem nut. Keep the valve stem from turning by inserting a 1/8 inch drift punch in the holes provided on the valve stem.
6. Remove the diaphragm washer (key 22), diaphragm (key 23), diaphragm plate (key 24), diaphragm O-ring (key 19), and actuator spacer (key 26).
7. Remove the bonnet locknut (key 20) with a 1-1/2 inch socket wrench and lift off the lower casing (key 21).
8. Remove the casing O-ring (key 17).
9. Break the bonnet nut (key 5) loose with a hammer. Continue turning the bonnet nut by using a hammer or a large adjustable wrench, tightened around one ear of the bonnet nut. If the bonnet (key 7) is stuck in the valve, continue to unscrew the bonnet nut. The bonnet nut will contact the spring pins (or pipe plugs) (key 6, figures 7 or 8) and jack the bonnet out of the valve. Carefully lift the actuator assembly from the valve body.

⚠ WARNING

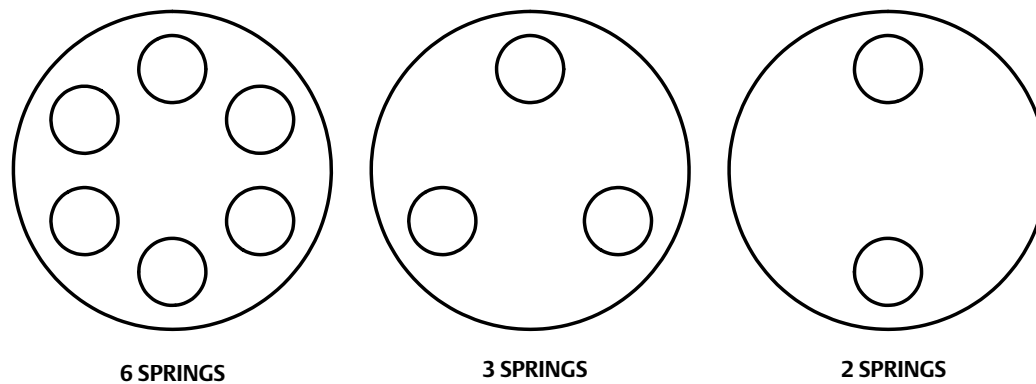
The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

10. Completely remove the packing retainer (key 8) using a 1-1/8 inch wrench.
11. Remove the valve plug (key 3) by driving out the pin (key 43) and unscrewing the valve plug from the stem. Utilize a 1/8 inch drift punch in the holes provided on the stem to keep the stem from turning as the plug is removed.
12. Remove the five Belleville springs (key 9), lower packing spacer (key 12), packing set (key 11), and two anti-extrusion washers (key 10) from the bonnet using a formed wire hook.
13. Completely remove the flow adjuster (keys 13, 14, and 15) from the valve stem.
14. Remove the valve stem from the bottom of the bonnet (key 16).

CAUTION

The valve stem must be removed to replace the stem O-ring and the bonnet bushing. If the valve stem is removed, the valve packing must be replaced since the threads on the valve stem may damage the packing when the valve stem is removed.

Figure 6. Spring Locations As Seen From Above Lower Actuator Casing



15. Remove the stem O-ring (key 25) and the bonnet bushing (key 18).
16. If the hammer nut needs to be removed from the bonnet, the spring pins (or pipe plugs) (key 6, figures 7 or 8) can be removed with locking pliers.

Actuator Assembly

Spring-to-Close (Air-to-Open)

Key numbers are referenced in figure 7. The proper packing arrangement is shown in figure 3.

CAUTION

Avoid possible product damage in the following procedure by ensuring there are no burrs or sharp edges on any threads or surfaces which may damage internal valve components during assembly.

Make sure all parts are clean and in good condition before starting assembly. There should be no burrs or sharp edges on any threads or surfaces that might cut or damage soft parts in the valve assembly.

CAUTION

The threads on factory-produced valve stems have been specially machined to avoid O-ring, bushing, or packing damage during trim maintenance. Use of other than a factory-produced valve stem may result in early stem O-ring, bushing, and packing failure.

⚠ WARNING

The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

1. Install the bonnet nut (key 5) and spring pins (or pipe plugs) (key 6, figures 7 or 8) if previously removed.

2. Lubricate the stem O-ring (key 25) with lithium grease and install in the bonnet (key 7).
3. Press the bonnet bushing (key 18) with the slots upward into the upper hole in the bonnet. The bonnet bushing is installed correctly when it snaps into place.
4. Install the casing O-ring (key 17) in the provided groove at the top of the bonnet.
5. Position the lower casing (key 21) on the bonnet.
6. Install the casing locknut (key 20) on the bonnet and torque to 203 N•m (150 lbf•ft).
7. Install the valve stem (key 16) from the bottom of the bonnet. Inserting the valve stem in this manner will prevent damage to the bonnet bushing and stem O-ring.
8. Ensure the upper packing spacer (key 12) is installed.
9. Use the lower packing spacer (key 12) and a tube to push the upper anti-extrusion washer (key 10) into place. Using the lower packing spacer in this manner will ensure the upper anti-extrusion washer is fully seated and flat when installed in the packing bore.
10. Remove the lower packing spacer from the packing bore.

CAUTION

All D3 FloPro packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D3 packing lubricant.

Note

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-inch length of 1/2 inch PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

11. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the female packing adaptor as shown in figure 5 and install over the valve stem (key 16).
12. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the packing ring as shown in figure 5 and install over the valve stem.
13. Install the male packing adaptor, lower anti-extrusion washer (key 10), and lower packing spacer over the valve stem as shown in figure 3.
14. Firmly press all packing parts into the packing bore with a tube.
15. Install the five Belleville springs (key 9) over the valve stem as shown in figure 3.
16. Install the valve plug on the stem and insert a new pin (key 43).
17. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs (key 9) are completely enclosed by the packing retainer as shown in figure 4.
18. Torque the packing retainer to 81 N•m (60 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet. The packing retainer threads should be completely enclosed by the bonnet.
19. Lubricate the bonnet O-ring (key 4) with lithium grease and install onto the bonnet.
20. Ensure the seat ring is installed in the valve body.
21. Apply anti-seize lubricant on the threads of the valve body (key 1), the threads of the bonnet nut (key 5), and the contact surfaces of the bonnet and bonnet nut flange.
22. Install the bonnet and actuator assembly into the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.

CAUTION

Avoid possible product damage which may affect proper operation of the diaphragm. Ensure the washer is aligned with the hole in the diaphragm so the washer does not cut the diaphragm.

23. Install the diaphragm washer (key 22) over the valve stem threads with the lip facing upward. If you are unsure of the correct orientation for the diaphragm washer, see figure 7 view A for the correct orientation.
24. Install the diaphragm (key 23), diaphragm plate (key 24), diaphragm O-ring (key 19), and actuator spacer (key 26) on the valve stem. Position the diaphragm so the holes in the diaphragm align with the holes in the lower casing.
25. Lubricate the threads above the stem nut (key 27) with anti-seize lubricant to prevent galling of the threads.
26. Install the stem nut (key 27) and torque to 20 N•m (15 lbf•ft). Use a 1/8 inch drift punch to keep the valve stem from turning as the hex nut is installed.

CAUTION

Non-symmetrical spring arrangement could cause actuator failure, resulting in possible product damage.

27. Install the correct number of springs (key 28) in a symmetrical pattern on the spring locators on the diaphragm plate. See figure 6 for the proper arrangement of the springs. The correct number of springs is dependent on your application and supply pressure. See table 2 for the correct number of springs.
28. Place the upper casing (key 32) on the diaphragm and lower casing. Position the upper casing so the holes in the upper casing align with the holes in the diaphragm and lower casing.

CAUTION

Do not lubricate cap screws (key 29 and 31). The following torque specifications are for unlubricated bolting.

29. Install the two long cap screws (key 31) opposite each other. Install the hex nuts (key 30) onto the long cap screws and tighten, alternating until the upper casing contacts the diaphragm. Keep the upper casing level during this process.
30. Install the ten short cap screws (key 29) into the remaining holes and install hex nuts on the remaining cap screws.
31. Torque the hex nuts in a crossing pattern to 16 N•m (12 lbf•ft).
32. Make sure valve is fully seated and install the flow adjustor (keys 13 and 14) and hex socket head cap screws (key 15).
33. Set the desired flow rate position according to figure 2.
34. Tighten the hex socket head cap screws to 3 N•m (26 lbf•in).

Spring-to-Open (Air-to-Close)

Key numbers are referenced in figure 8. The proper packing arrangement is shown in figure 3.

CAUTION

Avoid possible product damage in the following procedure by ensuring there are no burrs or sharp edges on any threads or surfaces which may damage internal valve components during assembly.

Make sure all parts are clean and in good condition before starting assembly. There should be no burrs or sharp edges on any threads or surfaces that might cut or damage soft parts in the valve assembly.

CAUTION

The threads on factory-produced valve stems have been specially machined to avoid O-ring, bushing, or packing damage during trim maintenance. Use of other than a factory-produced valve stem may result in early stem O-ring, bushing, and packing failure.

⚠ WARNING

The spring pins/pipe plugs (key 6) must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

1. Install the bonnet nut (key 5) and spring pins (or pipe plugs) (key 6, figures 7 or 8) if previously removed.
2. Lubricate the stem O-ring (key 25) with lithium grease and install in the bonnet (key 7).
3. Press the bonnet bushing (key 18) with the slots upward into the upper hole in the bonnet. The bonnet bushing is installed correctly when it snaps into place.
4. Install the casing O-ring (key 17) in the provided groove at the top of the bonnet.
5. Position the lower casing (key 21) on the bonnet.
6. Install the casing locknut (key 20) on the bonnet and torque to 203 N•m (150 lbf•ft).
7. Install the valve stem (key 16) from the bottom of the bonnet. Inserting the valve stem in this manner will prevent damage to the bonnet bushing and stem O-ring.
8. Ensure the upper packing spacer (key 12) is installed.
9. Use the lower packing spacer (key 12) and a tube to push the upper anti-extrusion washer (key 10) into place. Using the lower packing spacer in this manner will ensure the upper anti-extrusion washer is fully seated and flat when installed in the packing bore.
10. Remove the lower packing spacer from the packing bore.

CAUTION

All D3 FloPro packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D3 packing lubricant.

Note

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-inch length of 1/2 inch PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

11. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the female packing adaptor as shown in figure 5 and install over the valve stem (key 16).
12. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the packing ring as shown in figure 5 and install over the valve stem.

13. Install the male packing adaptor, lower anti-extrusion washer (key 10), and lower packing spacer over the valve stem as shown in figure 3.
14. Firmly press all packing parts into the packing bore with a tube.
15. Install the five Belleville springs (key 9) over the valve stem as shown in figure 3.
16. Install the valve plug on the stem and insert a new pin (key 43).
17. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-1/8 inch wrench. Make sure the Belleville springs (key 9) are completely enclosed by the packing retainer as shown in figure 4.
18. Torque the packing retainer to 81 N•m (60 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet. The packing retainer threads should be completely enclosed by the bonnet.
19. Lubricate the bonnet O-ring (key 4) with lithium grease and install onto the bonnet.
20. Ensure the seat ring is installed in the valve body.
21. Apply anti-seize lubricant on the threads of the valve body (key 1), the threads of the bonnet nut (key 5), and the contact surfaces of the bonnet and bonnet nut flange.
22. Install the bonnet and actuator assembly into the valve body. Tighten the bonnet nut until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.

CAUTION

Non-symmetrical spring arrangement could cause actuator failure, resulting in possible product damage.

23. Install the correct number of springs (key 28) in a symmetrical pattern on the lower casing. See figure 6 for the proper arrangement of the springs. The correct number of springs is dependent on your application and supply pressure. See table 2 for the correct number of springs.
24. Install the actuator spacer (key 26), diaphragm O-ring (key 19), diaphragm plate (key 24), and diaphragm (key 23) on the valve stem. Position the diaphragm so the holes in the diaphragm align with the holes in the bottom casing.

CAUTION

Avoid possible product damage which may affect proper operation of the diaphragm. Ensure the washer is aligned with the hole in the diaphragm so the washer does not cut the diaphragm.

25. Install the diaphragm washer (key 22) over the valve stem threads with the lip facing downward. If you are unsure of the correct orientation for the diaphragm washer, see figure 8 view A for the correct orientation. Make sure the lip fits inside the diaphragm hole.
26. Lubricate the threads above the stem nut (key 27) with anti-seize lubricant to prevent galling of the threads.
27. Install the stem nut and torque to 20 N•m (15 lbf•ft). Use a 1/8 inch drift punch to keep the valve stem from turning as the hex nut is installed. The springs will be compressed when the stem nut is fully tightened.
28. Place the upper casing (key 32) on the diaphragm and lower casing. Position the upper casing so the holes in the upper casing align with the holes in the diaphragm and lower casing.

CAUTION

Do not lubricate cap screws (key 29 and 31). The following torque specifications are for unlubricated bolting.

29. Install the two long cap screws (key 31) opposite each other. Install the ten short cap screws (key 29) into the remaining holes and install hex nuts (key 30) on all cap screws.
30. Torque the hex nuts in a crossing pattern to 16 N•m (12 lbf•ft).
31. Pressurize the actuator to a maximum of 2.41 bar (35 psi) to stroke the valve fully closed.
32. Make sure valve is fully seated and install the flow adjustor (keys 13 and 14) and hex socket head cap screws (key 15).
33. Set the desired flow rate position according to figure 2.
34. Tighten the hex head screws to 3 N•m (26 lbf•in).
35. Relieve pressure to the actuator.

Changing Actuator Action

From Spring-to-Close to Spring-to-Open

1. Follow steps 1 to 6 in the Disassembly instructions for the Spring-to-Close actuator on page 12 of this manual.
2. Follow steps 23 to 34 in the Assembly instructions for the Spring-to-Open actuator on page 17 of this manual.

From Spring-to-Open to Spring-to-Close

1. Follow steps 1 to 6 in the Disassembly instructions for the Spring-to-Open actuator on page 13 of this manual.
2. Follow steps 23 to 34 in the Assembly instructions for the Spring-to-Close actuator on page 17 of this manual.

Parts Ordering

Each D3 FloPro control valve is assigned a serial number, which can be found on the nameplate. Refer to the number when contacting your [Emerson sales office](#) for assistance or when ordering replacement parts.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 7. Fisher D3 FloPro Valve Assembly (Spring-to-Close)

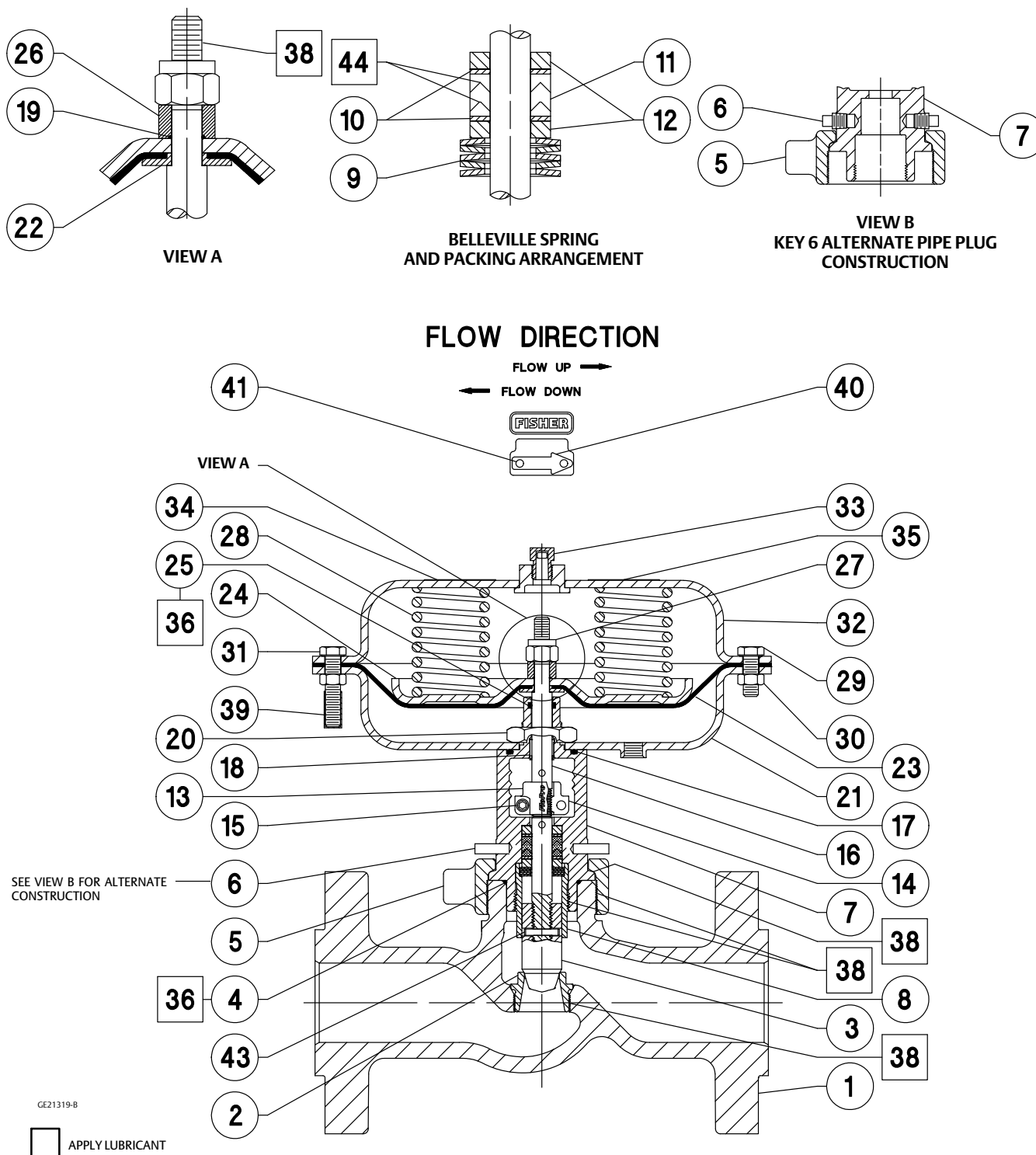
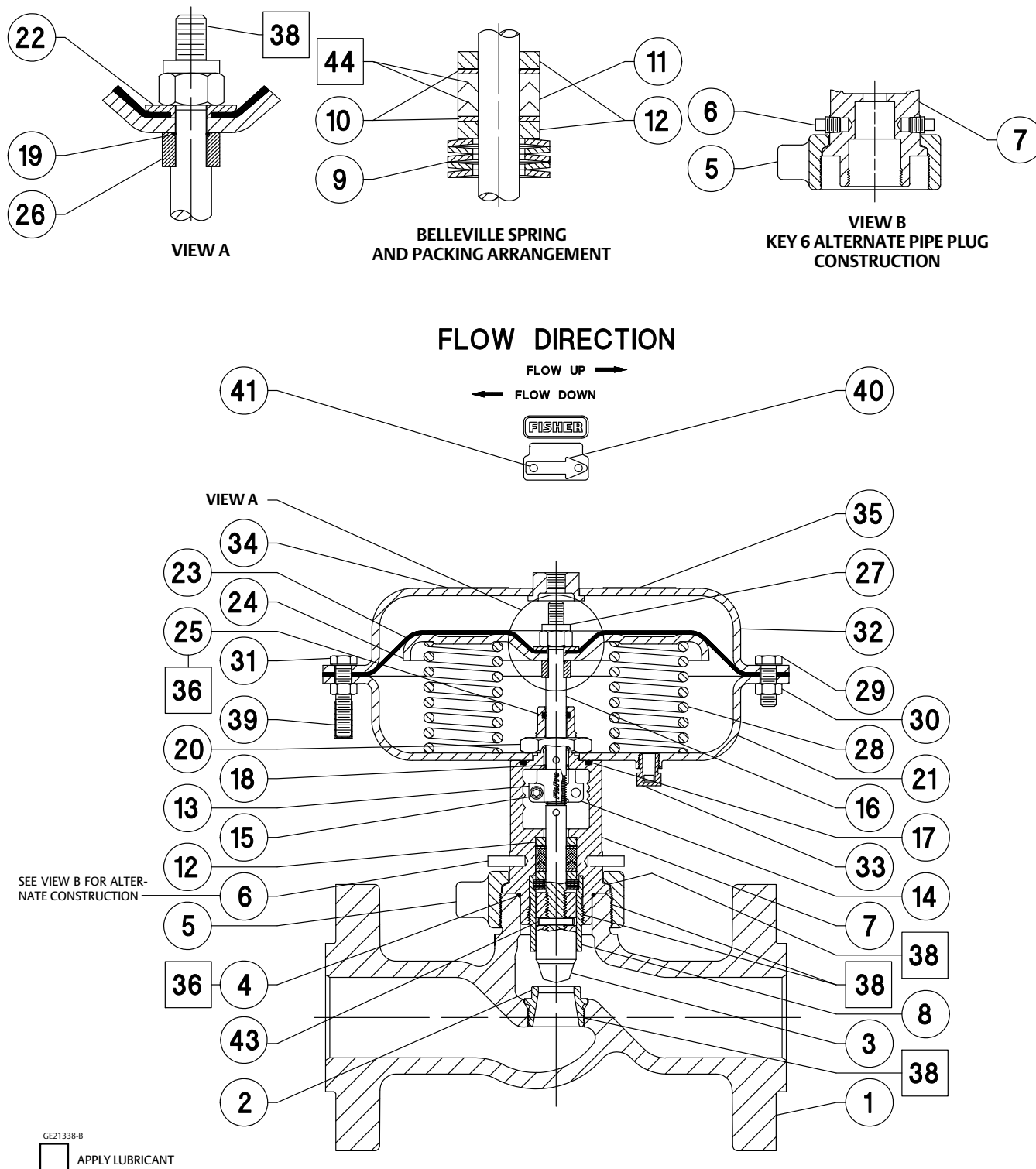


Figure 8. Fisher D3 FloPro Valve Assembly (Spring-to-Open)



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Parts Kits

TRIM KITS	Port Diameter (inches)	0.375	0.75	1
	Standard trim kit (Contains keys 2, 3, 4, and 43)	RD3STD0012	RD3STD0022	RD3STD0032
	Carbide trim kit (Contains keys 2, 3, 4, and 43)	RD3CARBX042	RD3CARBX052	RD3CARBX062

ACTUATOR KIT	Contains keys 17, 18, 19, 23, and 25	RD3X0000012
-----------------	--------------------------------------	-------------

PACKING KIT	Contains keys 4, 10, 11, 43, and 44	RD3PACKX012
----------------	-------------------------------------	-------------

SPRING	Key 28	GE18774X012
BONNET O-RING	Key 4	1P1676X0062
VALVE STEM	Key 16	GE20615X012

Parts List

Note

Recommended spare parts are included in the Parts Kits shown at the top of this page. For additional information or for part numbers not shown, contact your [Emerson sales office](#).

Key Description

1	Valve Body
2*	Seat Ring
3*	Valve Plug
4*	Bonnet O-ring
5	Bonnet Nut
6	Spring Pin (or alternate pipe plug) (2 req'd)
7	Bonnet
8	Packing Retainer
9	Belleville Springs (5 req'd)
10*	Anti-Extrusion Washer (2 req'd)
11*	Packing Set
12	Packing Spacer
13	FloPro Half
14	FloPro Half
15	Hex Socket Head Cap Screw (2 req'd)

Key Description

16*	Stem
17*	Casing O-ring
18*	Bonnet Bushing
19*	Diaphragm O-ring
20	Locknut
21	Lower Casing
22	Diaphragm Washer
23*	Diaphragm
24	Diaphragm Plate
25*	Stem O-ring
26	Actuator Spacer
27	Stem Nut
28*	Spring (quantity varies with application)
29	Short Hex Head Cap Screw (10 req'd)
30	Hex Nut (12 req'd)
31	Long Hex Head Cap Screw (2 req'd)
32	Upper Casing
33	Vent
34	Nameplate
35	Spring Label
36	Lubricant, lithium grease
38	Lubricant, Anti-Seize
39	Protector Cap (2 req'd)
40	Flow Arrow
41	Drive Screw (2 req'd)
43*	Groove Pin
44*	High Performance Fluorinated Grease Packing Lubricant

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Fisher™ D4 Control Valve Assembly

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Figure 1. Fisher D4 Control Valve



W8531

Introduction

Scope of Manual

This instruction manual provides installation, maintenance, and parts information for the Fisher D4 control valve.



Do not install, operate, or maintain a D4 control valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The D4 control valve is a compact, rugged valve designed primarily for high-pressure throttling applications. This valve is ideal for use on pressure and flow control applications within the oil and gas production industry. The D4 valve also makes an excellent dump valve for high-pressure separators and scrubbers.

The D4 control valve meets the metallurgical requirements of NACE MR0175/ISO 15156 without environmental limits for temperatures below 135°C (275°F). If the temperature is above 135°C (275°F), the N07718 Belleville washers will impose some limits, as shown in table 3.

Table 1. Specifications

Available Configurations Spring-to-Close Spring-to-Open Valve Body Sizes and End Connection Styles⁽¹⁾ See table 2 Maximum Inlet Pressures and Temperatures⁽¹⁾ If the valve nameplate shows an ASME pressure-temperature class, maximum inlet pressure and temperature is consistent with the applicable class per ASME B16.34. If the nameplate does not show an ASME class, it will show a maximum cold working pressure at 38°C (100°F) (for example, 293 bar [4250 psi]) Maximum Pressure Drops⁽¹⁾ See tables 4, 5, 6, and 7 Input Signal to Actuator See tables 4, 5, 6, and 7 Actuator Maximum Casing Pressure⁽¹⁾ 3.4 bar (50 psig) Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4 Class IV	Material Temperature Capabilities⁽¹⁾ Actuator Assembly: -40 to 93°C (-40 to 200°F) Valve Body Assembly: <i>Standard Bonnet O-Ring:</i> -40 to 135°C (-40 to 275°F) <i>Optional Fluorocarbon Bonnet O-Ring:</i> -23 to 204°C (-10 to 400°F) Flow Characteristic Equal percentage Flow Direction Flow up only Port Diameters See table 2 Valve Plug Travel 19 mm (0.75 inch) Valve Plug Style Micro-Form valve plug Actuator Diaphragm Effective Area 452 cm ² (69 inches ²) Actuator Pressure Connection Size 1/4 NPT internal
---	---

1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded.

Specifications

Table 1 lists specifications for the D4 control valve. Some of the specifications for a given control valve as it originally comes from the factory are stamped on a nameplate located on the actuator spring barrel.

Educational Services

Emerson
 Educational Services - Registration
 Phone: 1-641-754-3771 or 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/fishervalvetraining

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Table 2. Valve Sizes and Connection Styles

VALVE SIZE, NPS	PORT DIAMETER, (INCHES)	SCREWED	RAISED FACE (RF) FLANGED				RING TYPE JOINT (RTJ) FLANGED	
		4250 psi	CL150	CL300	CL600	CL900 and CL1500	CL600	CL900 and CL1500
1	0.25, 0.375, 0.5, 0.75	X	X	X	X	X	X	X
2	0.25, 0.375, 0.5, 0.75, 1, 1.25	X	X	X	X	X	X	X

X = Available construction.

Table 3. D4 Environmental Limits for NACE MR0175/ISO 15156 with Sour Trim

MAXIMUM TEMPERATURE		MAXIMUM H ₂ S PARTIAL PRESSURE		COMPATIBLE WITH ELEMENTAL SULFUR?
°C	°F	MPa	psia	
232	450	0.2	30	No
204	400	1.4	200	No
199	390	2.3	330	No
191	375	2.5	360	No
149	300	2.8	400	No
135	275	No Limit		Yes

Table 4. Maximum Shutoff Pressure Drops⁽¹⁾ for Fisher D4 Control Valves (Spring-to-Close) When Used with Typical Control Instrumentation⁽²⁾

INPUT SIGNAL TO ACTUATOR		0 to 1.2 Bar (0 to 18 Psig)		0 to 1.4 Bar (0 to 20 Psig)		0 to 2.0 Bar (0 to 30 Psig)		0 to 2.3 Bar (0 to 33 Psig)		0 to 2.4 Bar (0 to 35 Psig)		0 to 3.4 Bar (0 to 50 Psig)	
SPRING		Light Rate						Heavy Rate					
INITIAL SPRING SETTING		0.77 Bar (9 Psig)		0.77 Bar (9 Psig)		0.85 Bar (12.4 Psig)		1.05 Bar (15.3 Psig)		1.18 Bar (17.1 Psig)		1.18 Bar (17.1 Psig)	
PORT DIAMETER		Maximum Pressure Drop											
mm	Inches	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi
6.4	0.25	276 ⁽³⁾	4000 ⁽³⁾	276 ⁽³⁾	4000 ⁽³⁾	293	4250	293	4250	293	4250	293	4250
9.5	0.375	276 ⁽³⁾	4000 ⁽³⁾	276 ⁽³⁾	4000 ⁽³⁾	293	4250	293	4250	293	4250	293	4250
12.7	0.5	181	2630	181	2630	219	3180	288	4180	293	4250	293	4250
19.1	0.75	76	1100	76	1100	92	1340	123	1785	143	2080	143	2080
25.4	1	39	570	39	570	49	715	67	965	78	1130	78	1130
31.8	1.25	15	220	15	220	30	430	41	590	48	700	48	700

1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded.

2. For example, use the column marked 0-1.4 bar (0-20 psig) for a 0.21-1.0 bar (3-15 psig) pneumatic controller with 1.4 bar (20 psig) supply pressure.

3. For applications with downstream pressure in excess of 196 bar (2845 psig), use 196 bar (2845 psig) for Maximum Shutoff Pressure.

Table 5. Maximum Shutoff Pressure Drops⁽¹⁾ for Fisher D4 Control Valves (Spring-to-Close) When Used with Instrumentation with Restricted Output Range⁽²⁾

INPUT SIGNAL TO ACTUATOR		0.4 to 2.0 Bar (6 to 30 Psig)		0.14 to 2.3 Bar (2 to 33 Psig)	
SPRING		Heavy Rate		Heavy Rate	
INITIAL SPRING SETTING		0.97 Bar (14.0 Psig)		1.17 Bar (17.0 Psig)	
PORT DIAMETER		Maximum Pressure Drop			
mm	Inches	Bar	Psi	Bar	Psi
6.4	0.25	293 ⁽³⁾	4250 ⁽³⁾	293	4250
9.5	0.375	210 ⁽³⁾	3045 ⁽³⁾	293	4250
12.7	0.5	113	1635	282	4095
19.1	0.75	45	655	120	1750
25.4	1	23	330	65	945
31.8	1.25	13	185	39	580
1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded. 2. For example, an Electro-Pneumatic Transducer calibrated for 0.4-2.0 bar (6-30 psig) output pressure. 3. For applications with downstream pressure in excess of 118 bar (1715 psia), use 118 bar (1715 psia) for Maximum Shutoff Pressure.					

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Table 6. Maximum Shutoff Pressure Drops⁽¹⁾ for Fisher D4 Control Valves (Spring-to-Open)
When Used with Typical Control Instrumentation⁽²⁾

INPUT SIGNAL TO ACTUATOR		0 to 1.2 Bar (0 to 18 Psig)		0 to 1.4 Bar (0 to 20 Psig)		0 to 2.0 Bar (0 to 30 Psig)		0 to 2.3 Bar (0 to 33 Psig)		0 to 2.4 Bar (0 to 35 Psig)		0 to 3.4 Bar (0 to 50 Psig)	
SPRING		Light Rate				Heavy Rate							
INITIAL SPRING SETTING		0.23 Bar (3.4 Psig)		0.23 Bar (3.4 Psig)		0.28 Bar (4.0 Psig)		0.28 Bar (4.0 Psig)		0.28 Bar (4.0 Psig)		0.28 Bar (4.0 Psig)	
PORT DIAMETER		Maximum Pressure Drop											
mm	Inches	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi
6.4	0.25	293 ⁽³⁾	4250 ⁽³⁾	293 ⁽³⁾	4250 ⁽³⁾	293	4250	293	4250	293	4250	293	4250
9.5	0.375	293 ⁽³⁾	4250 ⁽³⁾	293 ⁽³⁾	4250 ⁽³⁾	293	4250	293	4250	293	4250	293	4250
12.7	0.5	187	2715	233	3380	293	4250	293	4250	293	4250	293	4250
19.1	0.75	78	1135	99	1430	147	2130	178	2575	198	2875	293	4250
25.4	1	41	600	53	765	80	1160	97	1410	109	1575	195	2830
31.8	1.25	24	355	32	465	49	715	60	875	68	985	123	1785
1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded. 2. For example, use the column marked 0-1.4 bar (0-20 psig) for a 0.21-1.0 bar (3-15 psig) pneumatic controller with 1.4 bar (20 psig) supply pressure. 3. For applications with downstream pressure in excess of 190 bar (2760 psig), use 190 bar (2760 psig) for Maximum Shutoff Pressure.													

Table 7. Maximum Shutoff Pressure Drops⁽¹⁾ for Fisher D4 Control Valves (Spring-to-Open)
When Used with Instrumentation with Restricted Output Range⁽²⁾

INPUT SIGNAL TO ACTUATOR		0.4 to 2.0 Bar (6 to 30 Psig)		0.14 to 2.3 Bar (2 to 33 Psig)	
SPRING		Heavy Rate		Heavy Rate	
INITIAL SPRING SETTING		0.69 Bar (10.0 Psig)		0.42 Bar (6.1 Psig)	
PORT DIAMETER		Maximum Pressure Drop			
mm	Inches	Bar	Psi	Bar	Psi
6.4	0.25	293 ⁽³⁾	4250 ⁽³⁾	293	4250
9.5	0.375	293 ⁽³⁾	4250 ⁽³⁾	293	4250
12.7	0.5	196	2845	293	4250
19.1	0.75	82	1195	156	2265
25.4	1	43	630	85	1235
31.8	1.25	26	380	52	765
1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded. 2. For example, an Electro-Pneumatic Transducer calibrated for 0.4-2.0 bar (6-30 psig) output pressure. 3. For applications with downstream pressure in excess of 202 bar (2925 psig), use 202 bar (2925 psig) for Maximum Shutoff Pressure.					

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts or by uncontrolled process fluid, be certain the service conditions do not exceed the limits shown on the valve nameplate and in tables 1, 4, 5, 6, and 7. Use pressure-relieving devices required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

⚠ WARNING

Avoid personal injury or property damage caused by possible actuator failure. The use of a rigidly-mounted support on the actuator casing may cause additional stress on the actuator leading to premature wear and/or failure of the actuator components.

NOTICE

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag, or other foreign material from the pipeline.

1. Before installing the control valve assembly, inspect it for any damage and for any foreign material that may have collected in the valve body.
2. Remove any pipe scale, welding slag, and other foreign material from the pipeline.
3. The control valve can be installed in any position, but normally the actuator is vertical above the valve. Install the valve so the flow direction arrow on the side of the valve indicates the direction of the process flow.
4. Install the valve following local and national piping codes when they apply to the application. For screwed connections, treat the external pipe threads with a good grade pipe compound. For flanged valves, use suitable gaskets between valve and pipeline flanges.
5. If continuous operation is required during maintenance and inspection, install a conventional three-valve bypass around the valve.
6. Connect loading pressure for the Spring-to-Open configuration to the 1/4-18 NPT connection in the upper casing assembly (key 23) as shown in figure 5. The Spring-to-Close configuration loading pressure connection is in the lower casing assembly (key 39) as shown in figure 4.

Spring Adjustment

The spring has a fixed pressure span over which loading pressure will stroke the valve. Adjustment of the spring compression shifts the span so that more or less loading pressure is required to start travel. Since the span does not change, there will be a corresponding increase or decrease in the pressure requirements at the end of the valve stroke.

In order to maximize shutoff pressure drop values, the actuator spring must be accurately adjusted for each Input Signal Pressure Range. If the actuator has been disassembled or pressure conditions have changed, the spring may require adjustment. Refer to tables 2 and 4 to determine the Initial Spring Set values based on the Input Signal range that is available to the actuator. These values include packing friction.

Spring-to-Close

Refer to figure 4.

1. Loosen the adjusting screw nut (key 44).
2. Turn the adjusting screw (key 31) clockwise to compress the spring or counterclockwise to decrease spring compression.
3. After adjustment, tighten the adjusting screw nut (key 44).

Spring-to-Open

Refer to figure 5.

1. Unscrew the spring case assembly (key 27).
2. Turn the adjusting stem nut (key 44) clockwise to compress the spring or counterclockwise to decrease spring compression.
3. After adjustment, replace the spring case assembly (key 27).

Maintenance

Refer to figure 4.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and maintenance depends on the severity of the service conditions.

WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valve Plug and Seat Ring

The D4 control valve is designed to allow easy access to the valve plug and seat ring without disturbing the packing. Refer to other sections of this instruction manual if additional maintenance is required.

Disassembly

1. Remove the loading pressure tubing and any accessories that may hamper disassembly.
2. Break the hammer nut (key 6) loose with a hammer. Continue turning the hammer nut by using a hammer or a large adjustable wrench, tightened around one ear of the hammer nut. If the bonnet is stuck on the valve, continue to unscrew the hammer nut. The hammer nut will contact the spring pins (key 7) and will force the bonnet out of the valve. Carefully lift the actuator, bonnet, and valve plug assembly from the valve body.

⚠ WARNING

The spring pins must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

3. Use a socket wrench to loosen the seat ring (key 3).
4. Remove the seat ring (key 3) and seat ring gasket (key 9) from the valve body.
5. Inspect parts for wear or damage that would prevent proper operation of the valve body. Carefully clean the seat ring gasket surfaces and seat ring threads.

⚠ WARNING

Be careful to avoid damaging the seating surface on the valve plug or seat ring as damage in these areas will allow excessive leakage at shutoff. Avoid damaging the highly polished valve stem surface. A damaged valve stem could cut the packing and allow process fluid to leak to the atmosphere.

Table 8. Torque for Seat Ring (Key 3)

VALVE SIZE	RECOMMENDED TORQUE	
	N•m	Lbf•ft
NPS		
1	407	300
2	698	515

6. For spring-to-close only: To remove the valve plug (key 2), drive out the groove pin (key 4) and unscrew the valve plug from the stem (key 47). If the groove pin (key 4) is not exposed, verify that downward movement of the stem is not restricted by instrument linkages attached to the stem (key 47).

If the valve plug cannot be easily unscrewed from the stem, use a punch to keep the stem from turning as the plug is removed.

7. For spring-to-open only: To remove the valve plug (key 2), first remove the spring case assembly (key 27). Remove the adjustment screw nut (key 44), the upper spring seat (key 29), and the spring (key 30). Push the adjustment stem (key 31) fully downward until the diaphragm plate (key 40) contacts the cap screws (key 38), exposing the groove pin (key 4) in the plug. If the groove pin (key 4) is not exposed, verify that downward movement of the stem is not restricted by instrument linkages attached to the stem (key 47). Drive out the groove pin (key 4) and unscrew the valve plug from the stem (key 47).

If the valve plug cannot be easily unscrewed from the stem, use a punch to keep the stem from turning as the plug is removed.

Assembly

1. Make sure the bonnet O-ring (key 8) is on the bonnet and lubricated with lithium grease (key 49).
2. Install the plug (key 2) on the stem (key 47) and insert a new groove pin (key 4).

3. Thoroughly clean the seat ring and bonnet threads in the valve body (key 1). Also clean the valve body seat ring gasket surfaces.
4. Apply anti-seize lubricant (key 54) to the threads of the seat ring (key 3), and its mating threads in the valve body.
5. Apply anti-seize lubricant (key 54) to the seat ring gasket (key 9) and install into the valve body.
6. Screw the seat ring into the valve body. Use a socket wrench to tighten the seat ring to the torque values shown in table 8. Remove all excess lubricant after tightening.
7. Lubricate (key 54) the threads on the valve body and hammer nut and the contact surfaces of the bonnet and hammer nut flange. Install the bonnet and actuator assembly with pinned valve plug onto the valve body. Tighten the hammer nut using an adjustable wrench until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.
8. See the actuator assembly and spring adjustment sections of this manual.

Valve Packing

WARNING

Observe the warning at the start of the Maintenance section.

The valve stem packing can only be accessed from within the valve body. If packing maintenance is required, first disassemble per steps 1, 2, and 6 or 7 in the Valve Plug and Seat Ring Disassembly section of this document.

Note

Packing installation and adjustment is critical to the long-term packing performance. Absolutely no deviations from this procedure are allowed.

To minimize friction and maximize sealing performance, a small amount of fluorinated grease (key 56) is placed between the packing rings.

Single Packing Arrangement

The packing components are to be installed as shown in the assembly drawing per the following procedure:

1. Install packing spacer (key 48) in the packing box.
2. Using a non-marring installation tool, such as a 12 inch length of 1/2 inch PVC pipe, push the first anti-extrusion washer (key 12) fully into the packing box by hand. Then, use the packing spacer (key 14) to fully seat the anti-extrusion washer by firmly tapping the packing spacer against the anti-extrusion washer with a hammer and the PVC pipe.
3. Using a needle point syringe filled with fluorinated grease, apply a continuous bead of approximately 3/16 inch diameter inside the V-groove of the female adaptor ring. See figure 2. Take care to keep the lubricant confined to only the V-groove. Do not lubricate the other surfaces of the packing ring, the stem, or the packing box.

Note

All D4 packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D4 packing lubricant.

4. Install the female adaptor ring using the packing spacer and PVC pipe to push the ring against the anti-extrusion washer. Apply only enough force to cause the female adaptor to make contact.
5. Using a needle point syringe filled with fluorinated grease, apply a continuous bead of approximately 3/16 inch diameter inside the V-groove of the white V-ring. See figure 2. Take care to keep the lubricant confined to only the V-groove. Do not lubricate the other surfaces of the packing ring, the stem, or the packing box.
6. Install the V-ring using the packing spacer and PVC pipe to push the V-ring against the female adaptor. Apply only enough force to cause the female adaptor to make contact.
7. Install the male adaptor.
8. Using the PVC pipe, push the second anti-extrusion washer (key 12) fully into the packing box by hand. Then, use the packing spacer (key 14) to fully seat the anti-extrusion washer by firmly tapping the packing spacer against the anti-extrusion washer with a hammer and the PVC pipe.
9. Install the packing spacer (key 14) and five Belleville springs (key 11). The Belleville springs (key 11) should be single stacked with the ID of the inner spring contacting the packing spacer (key 14) and the OD of the outer spring contacting the packing retainer (key 10). The final Belleville spring should be within the 1.26 inch-diameter bore of the bonnet.
10. Adjust the packing retainer by hand until it contacts the Belleville springs. Do not tighten by hand, simply install the packing retainer until it contacts the Belleville springs. Torque the packing retainer to 68 N•m (50 lbf•ft).

Figure 2. Fisher D4 Packing Installation

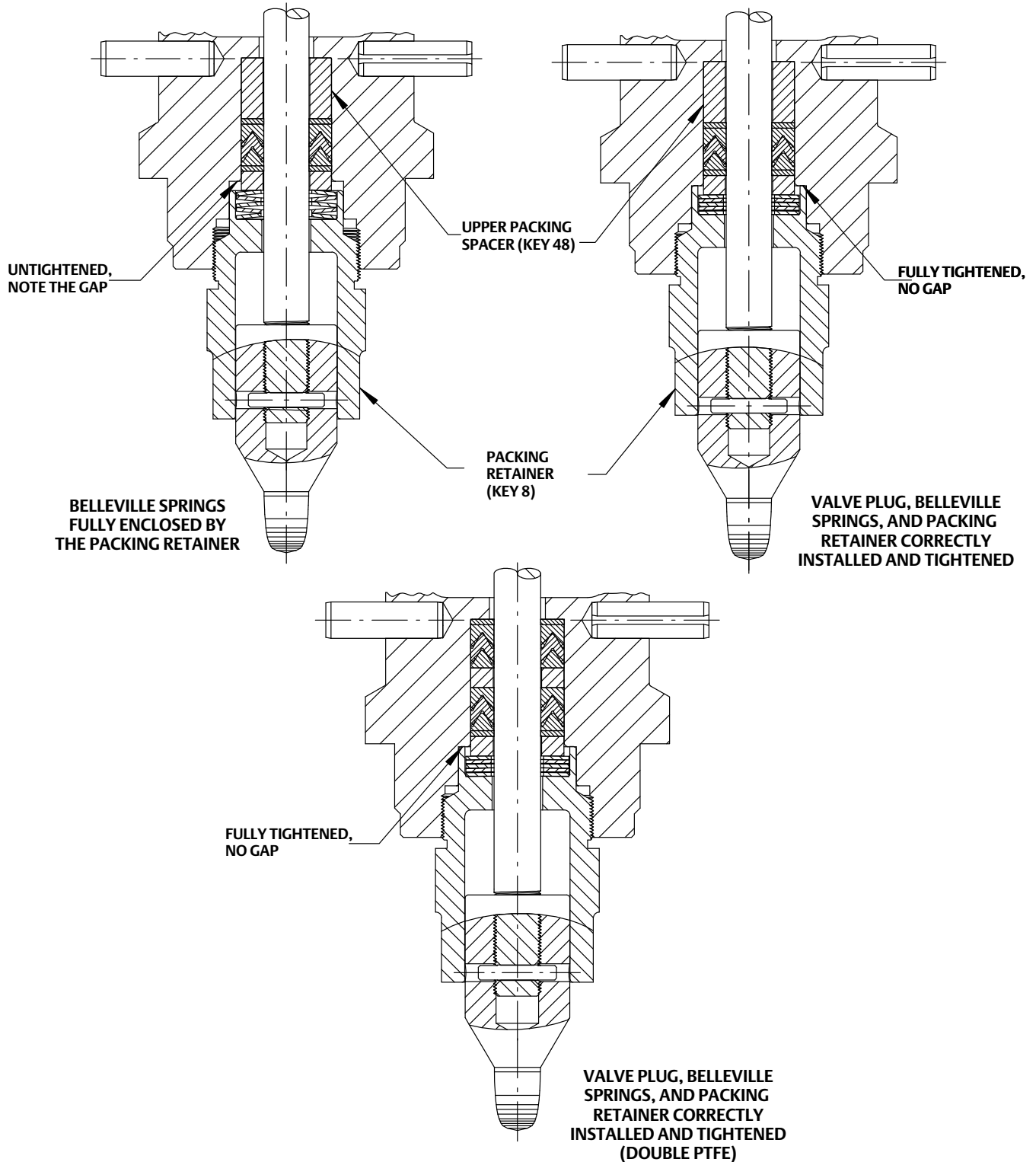
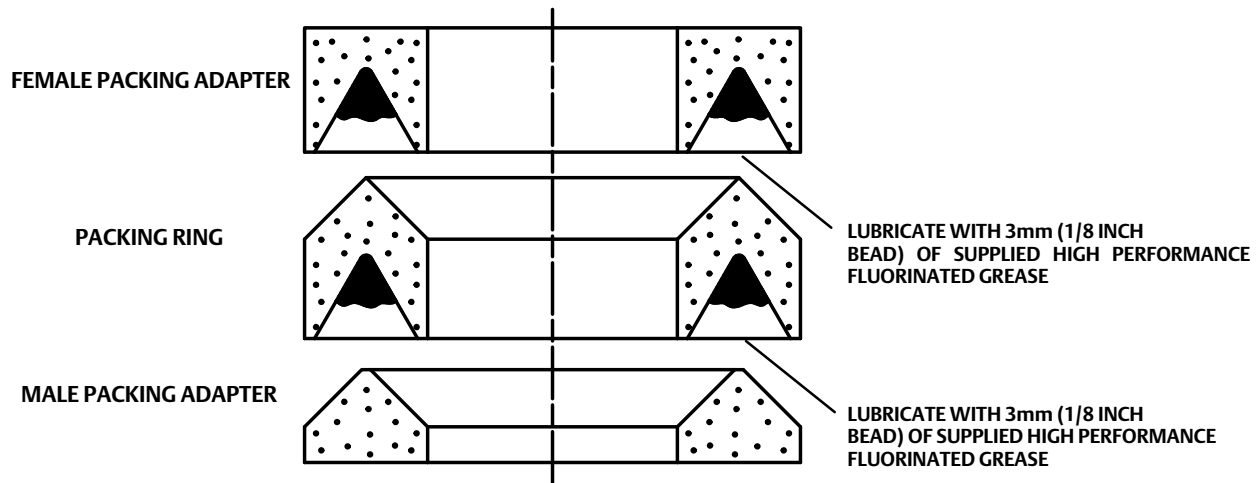


Figure 3. Lubrication Locations on Packing



Double Packing Arrangement

The packing components are to be installed as shown in the assembly drawing per the following procedure:

1. Using a non-marring installation tool, such as a 12 inch length of 1/2 inch PVC pipe, push the first anti-extrusion washer (key 12) fully into the packing box by hand. Then, use the packing spacer (key 14) to fully seat the anti-extrusion washer by firmly tapping the packing spacer against the anti-extrusion washer with a hammer and the PVC pipe.
2. Using a needle point syringe filled with fluorinated grease, apply a continuous bead of approximately 3/16 inch diameter inside the V-groove of the female adaptor ring. See figure 2. Take care to keep the lubricant confined to only the V-groove. Do not lubricate the other surfaces of the packing ring, the stem, or the packing box.

Note

All D4 packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D4 packing lubricant.

3. Install the female adaptor ring using the packing spacer and PVC pipe to push the ring against the anti-extrusion washer. Apply only enough force to cause the female adaptor to make contact.
4. Using a needle point syringe filled with fluorinated grease, apply a continuous bead of approximately 3/16 inch diameter inside the V-groove of the white V-ring. See figure 2. Take care to keep the lubricant confined to only the V-groove. Do not lubricate the other surfaces of the packing ring, the stem, or the packing box.
5. Install the V-ring using the packing spacer and PVC pipe to push the V-ring against the female adaptor. Apply only enough force to cause the female adaptor to make contact.
6. Install the male adaptor.
7. Install the packing spacer (key 14).
8. Using a needle point syringe filled with fluorinated grease, apply a continuous bead of approximately 3/16 inch diameter inside the V-groove of the female adaptor ring. See figure 2. Take care to keep the lubricant confined to only the V-groove. Do not lubricate the other surfaces of the packing ring, the stem, or the packing box.
9. Install the female adaptor ring using the packing spacer and PVC pipe to push the ring against the anti-extrusion washer. Apply only enough force to cause the female adaptor to make contact.

10. Using a needle point syringe filled with fluorinated grease, apply a continuous bead of approximately 3/16 inch diameter inside the V-groove of the white V-ring. See figure 2. Take care to keep the lubricant confined to only the V-groove. Do not lubricate the other surfaces of the packing ring, the stem, or the packing box.
11. Install the V-ring using the packing spacer and PVC pipe to push the V-ring against the female adaptor. Apply only enough force to cause the female adaptor to make contact.
12. Install the male adaptor.
13. Using the PVC pipe, push the second anti-extrusion washer (key 12) fully into the packing box by hand. Then, use the packing spacer (key 14) to fully seat the anti-extrusion washer by firmly tapping the packing spacer against the anti-extrusion washer with a hammer and the PVC pipe.
14. Install the packing spacer (key 14) and six Belleville springs (key 11). The Belleville springs (key 11) should be double stacked with the ID of the inner spring contacting the packing spacer (key 14) and the OD of the outer spring contacting the packing retainer (key 10). The final Belleville spring should be within the 1.26 inch-diameter bore of the bonnet.
15. Adjust the packing retainer by hand until it contacts the Belleville springs. Torque the packing retainer to 54 N•m (40 lbf•ft).

Actuator (Spring-to-Close)

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Refer to figure 4.

Before disassembling the actuator, disassemble the valve plug, seat ring, and packing according to instructions in this manual.

Disassembly

1. Loosen the adjusting screw nut (key 44) and turn the adjusting screw (key 31) counterclockwise to remove all spring compression.
2. Unscrew the casing cap screws and hex nuts (keys 45 and 46), and remove the upper casing assembly (key 23) from the lower casing (key 39).
3. Remove the spring seat (key 29) and actuator spring (key 30).
4. Lift out the diaphragm, diaphragm plate, and stem assembly. Remove the travel indicator (key 32) when the bottom of the stem enters the yoke window.
5. To replace the diaphragm (key 15), separate the diaphragm assembly by using a wrench on the hex nuts (key 42) to unscrew the assembly.
6. Separate the parts--diaphragm washer, actuator O-ring (keys 41 and 25), diaphragm, and diaphragm plate, (keys 15 and 40).
7. Inspect the diaphragm and the actuator O-ring for damage or deterioration, and replace if necessary. If the diaphragm is replaced, a new O-ring should also be installed.
8. Inspect the stem O-ring (key 19) and bonnet bushing (key 20); replace if necessary. To inspect the casing O-ring (key 18), remove the cap screws (key 38) and lift off the lower casing (key 39). Replace the O-ring if necessary.
9. If the hammer nut needs to be removed from the bonnet, the spring pins (key 7) can be removed with locking pliers.

Assembly

1. Before starting assembly, make sure all parts are clean and in good condition. There should be no burrs or sharp edges on any threads or surfaces that might cut or damage an O-ring, bushing, the packing, or the diaphragm.

When replacing O-rings and bushings, be sure the O-ring or bushing groove is clean and undamaged. Using a general purpose lubricant (key 49), lubricate all bushings and O-rings and the threads of parts that have to pass through the bushings and O-rings.

NOTICE

The threads on factory-produced valve stems have been specially machined to avoid O-ring, bushing, or packing damage during trim maintenance. Use of other than a factory-produced valve stem may result in early stem O-ring, bushing, and packing failure.

Note

Do not lubricate cap screws (key 38) before inserting them in the following procedure.

2. Place the hammer nut and spring pins on the bonnet, if removed. Install the casing O-ring (key 18), the stem O-ring (key 19), and the bonnet bushing (key 20). Position the lower casing (key 39) on the bonnet. Insert the nonlubricated cap screws (key 38), and torque to 49 N•m (36 lbf•ft).

⚠ WARNING

The spring pins must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

3. Assemble the diaphragm plate assembly. Place the patterned side of the diaphragm (key 15) against the diaphragm plate (key 40). Be sure to turn the diaphragm washer (key 41) so that the side that is beveled on the inside diameter is against the O-ring (key 25). Also, make sure that it is assembled for installation with the diaphragm on the loading pressure side and the lockwasher (key 43) and lower spring seat (key 28) are on the spring side.
4. Fasten the diaphragm and diaphragm plate assembly on the stem with hex nuts (key 42). Place the diaphragm and diaphragm plate, and stem assembly into the lower casing and bonnet. Install the travel indicator (key 32) on the stem as the bottom of the stem enters the yoke window.

NOTICE

Over-tightening the diaphragm casing cap screws and nuts (keys 45 and 46) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

5. Replace the spring (key 30) on the diaphragm plate (key 40). Replace the upper spring seat (key 29). Position the upper casing (key 23) on the lower casing (key 39). Insert the cap screws (key 45) and tighten the hex nuts (key 46). Torque the casing cap screws evenly to 27 N•m (20 lbf•ft) using a crisscross pattern.
6. Adjust the initial spring set per the Spring Adjustment section in this manual.

Actuator (Spring-to-Open)

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Refer to figure 5.

Before disassembling the actuator, disassemble the valve plug, seat ring, and packing according to instructions in this manual.

Disassembly

1. Unscrew the spring case assembly (key 27). Turn the adjusting screw nut (key 44) counterclockwise to remove all spring compression. Remove the adjusting screw nut, upper spring seat, and spring (keys 44, 29, and 30)
2. Unscrew the casing cap screws and hex nuts (keys 45 and 46), and remove the upper casing assembly (key 23) from the lower casing (key 39). Remove the cotter pin (key 36) and unscrew the adjusting stem (key 31).
3. Lift out the diaphragm (key 15), diaphragm plate (key 40), and stem assembly. Remove the travel indicator (key 32) when the bottom of the stem enters the yoke window.
4. To replace the diaphragm (key 15), separate the diaphragm assembly by using a wrench on the hex nuts (key 42) to unscrew the assembly.
5. Separate the parts--diaphragm washer, actuator O-ring (keys 41 and 25), diaphragm, and diaphragm plate, (keys 15 and 40).
6. Inspect the diaphragm and the actuator O-ring for damage or deterioration, and replace if necessary. If the diaphragm is replaced, a new O-ring should also be installed.
7. Inspect the stem O-ring (key 19) and bonnet bushing (key 20); replace if necessary. To inspect the casing O-ring (key 18), remove the cap screws (key 38) and lift off the lower casing (key 39). Replace the O-ring if necessary. Inspect the adjusting stem bushing (key 26) and actuator stem O-ring (key 53). Replace if necessary.
8. If the hammer nut needs to be removed from the bonnet, the spring pins (key 7) can be removed with locking pliers.

Assembly

1. Before starting assembly, make sure all parts are clean and in good condition. There should be no burrs or sharp edges on any threads or surfaces that might cut or damage an O-ring, bushing, the packing, or the diaphragm. When replacing O-rings and bushings, be sure the O-ring or bushing groove is clean and undamaged. Using a general purpose lubricant (key 49), lubricate all bushings and O-rings and the threads of parts that have to pass through the bushings and O-rings.

NOTICE

The threads on factory-produced valve stems have been specially machined to avoid O-ring, bushing, or packing damage during trim maintenance. Use of other than a factory-produced valve stem may result in early stem O-ring, bushing, and packing failure.

Note

Do not lubricate cap screws (key 38) before inserting them in the following procedure.

2. Place the hammer nut and spring pins on the bonnet, if removed. Install the casing O-ring (key 18), the stem O-ring (key 19), and the bonnet bushing (key 20). Position the lower casing (key 39) on the bonnet. Insert the nonlubricated cap screws (key 38), and torque to 49 N•m (36 lbf•ft).
3. Assemble the diaphragm plate assembly. Place the patterned side of the diaphragm (key 15) against the diaphragm plate (key 40). Be sure to turn the diaphragm washer (key 41) so that the side that is beveled on the inside diameter is against the O-ring (key 25). Also, make sure that it is assembled for installation with the diaphragm on the loading pressure side and the lockwasher (key 43) and diaphragm washer (key 41) are on the upper side.

⚠ WARNING

The spring pins must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

4. Fasten the diaphragm and diaphragm plate assembly on the stem with hex nuts (key 42). Place the diaphragm and diaphragm plate, and stem assembly into the lower casing and bonnet. Install the travel indicator (key 32) on the stem as the bottom of the stem enters the yoke window.
5. Screw the adjusting stem (key 31) onto the stem (key 47) and secure the cotter pin (key 36). Make sure the bushing and O-ring are in place in the upper casing.

NOTICE

Over-tightening the diaphragm casing cap screws and nuts (keys 45 and 46) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

6. Position the upper casing (key 23) on the lower casing (key 39). Insert the cap screws (key 45) and tighten the hex nuts (key 46). Torque the casing cap screws evenly to 27 N•m (20 lbf•ft) using a crisscross pattern.
7. Replace the spring (key 30), spring seat (key 29), and adjusting stem nut (key 44) over the adjusting stem. Replace the spring case assembly (key 27).
8. Adjust the initial spring set per the Spring Adjustment section in this manual.

Parts Ordering

Each D4 control valve is assigned a serial number, which can be found on the nameplate. Refer to the number when contacting your [Emerson sales office](#) for assistance or when ordering replacement parts.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Repair Kits

Note

All repair kits are supplied with hydrogenated nitrile bonnet O-ring. FKM (fluorocarbon) bonnet O-ring must be ordered separately when required.

	Description	Part Number
*	Packing Repair Kit Includes key numbers 4, 8, 12 (2 req'd), 13, and high performance fluorinated grease	RD4X0000012
*	Actuator Repair Kit Includes key numbers 4, 8, 12 (2 req'd), 13, 15, 18, 19, 20, 25, 26, 36, 53, and high performance fluorinated grease	RD4X0000022

Parts List

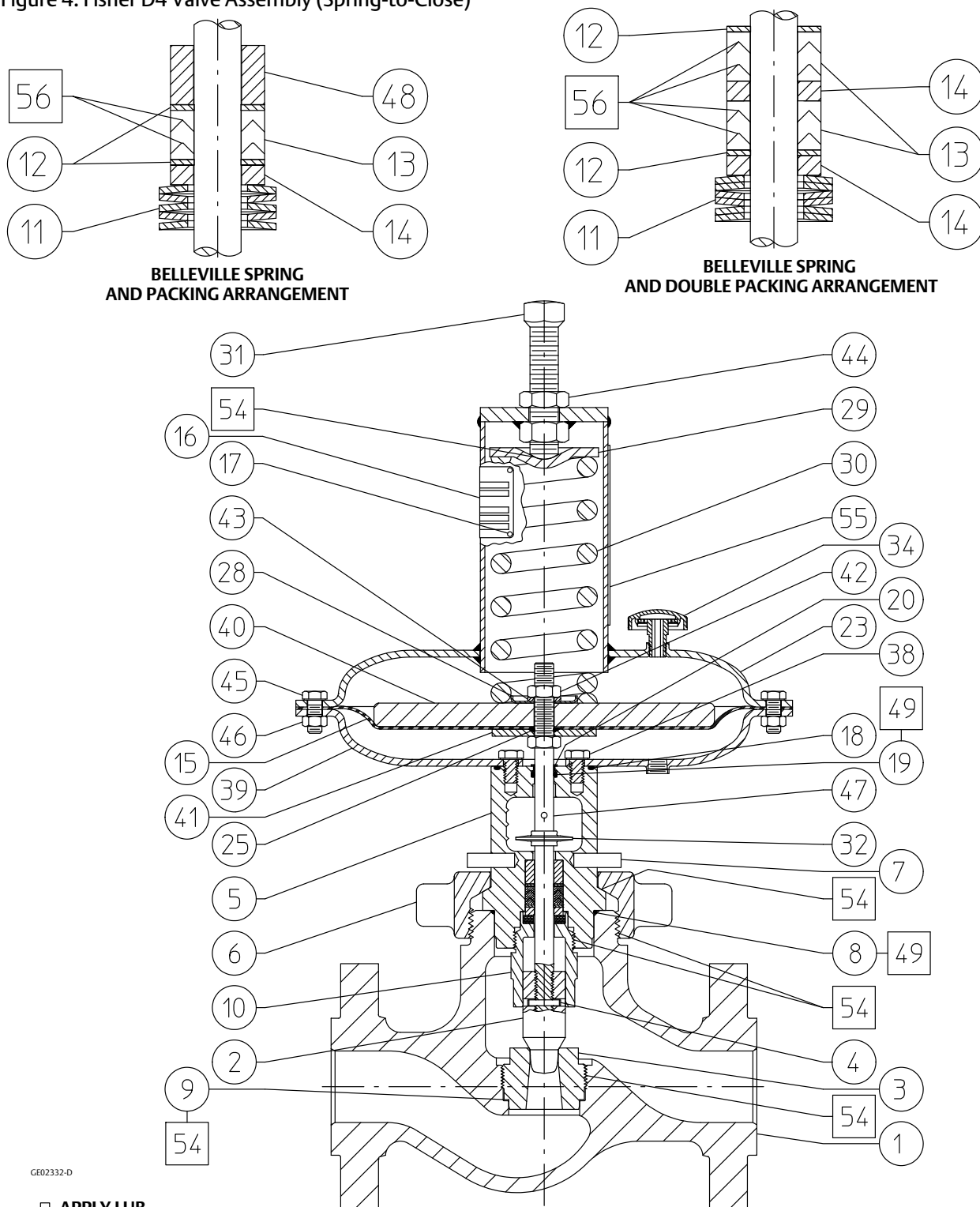
Note

Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description
1	Valve Body
2*	Valve Plug
3*	Seat Ring
4*	Groove Pin
5	Bonnet
6	Hammer Nut
7	Spring Pin
8*	Bonnet O-ring

Key	Description
9*	Seat Ring Gasket
10	Packing Retainer
11	Belleville Springs, (5 req'd)
12*	Anti-Extrusion Washer, (2 req'd)
13*	Packing Set
14	Packing Spacer
15*	Diaphragm
16	Nameplate
17	Drive Screw
18*	Casing O-ring
19*	Stem O-ring
20*	Bonnet Bushing
23	Upper Casing Assembly
25*	Actuator O-ring
26*	Adjusting Stem Bushing (spring-to-open only)
27	Spring Case Assembly
28	Lower Spring Seat
29	Upper Spring Seat
30	Spring
31	Adjustment Screw or Stem
32	Travel Indicator
34	Vent Assembly
36*	Cotter Pin (spring-to-open only)
37	Pipe Plug
38	Cap Screw
39	Lower Casing
40	Diaphragm Plate
41	Diaphragm Washer
42	Hex Nut
43	Lockwasher
44	Adjustment Screw Nut
45	Cap Screw
46	Hex Nut
47*	Valve Stem
48	Upper packing spacer
49	Lubricant (lithium grease)
51	Drive Screw
53*	Actuator Stem O-ring (spring-to-open only)
54	Lubricant (anti-seize)
55	Spring Setting Label (not shown)
56	High Performance Fluorinated Grease Packing Lubricant

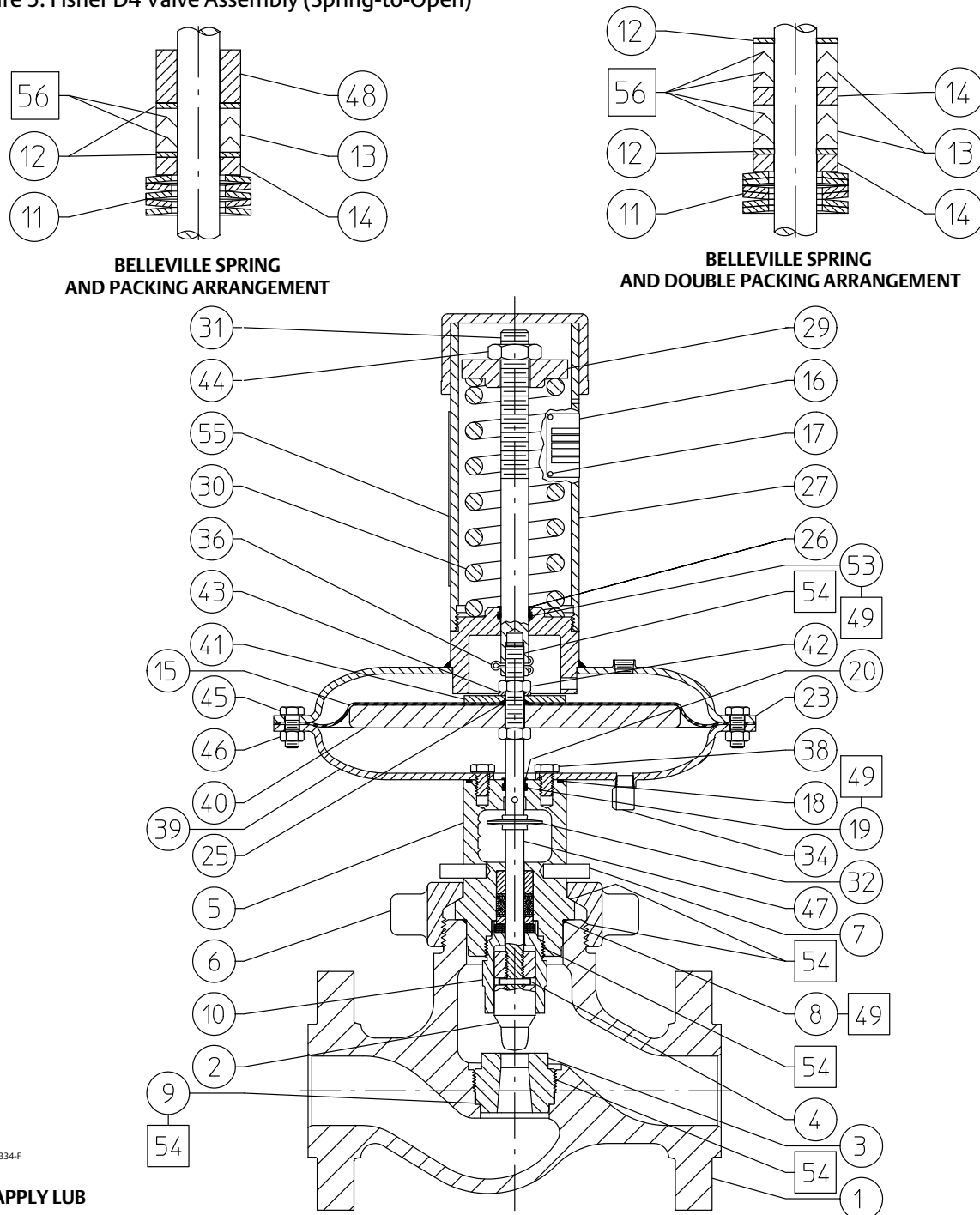
Figure 4. Fisher D4 Valve Assembly (Spring-to-Close)



GE02332-D

□ APPLY LUB

Figure 5. Fisher D4 Valve Assembly (Spring-to-Open)



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D103042X012

D4 Valve

April 2023

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

D4 Valve

April 2023

Instruction Manual

D103042X012

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Fisher™ D4 Control Valve with easy-Drive™ Electric Actuator

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Figure 1. Fisher D4 Control Valve with easy-Drive Electric Actuator



W9933-1

Introduction

Scope of Manual

This instruction manual provides installation, maintenance, and parts information for the Fisher D4 control valve with easy-Drive electric actuator.

Do not install, operate, or maintain a D4 control valve with easy-Drive electric actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Table 1. Specifications

Valve Body Sizes and End Connection Styles⁽¹⁾ See table 2 Maximum Inlet Pressures and Temperatures⁽¹⁾ If the valve nameplate shows an ASME pressure-temperature class, maximum inlet pressure and temperature is consistent with the applicable class per ASME B16.34. If the nameplate does not show an ASME class, it will show a maximum cold working pressure at 38°C (100°F) (for example, 293 bar [4250 psi]) Maximum Pressure Drops⁽¹⁾ See table 4 Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4 Class IV Material Temperature Capabilities⁽¹⁾ Valve Body Assembly: <i>Standard Bonnet O-Ring:</i> -40 to 135°C (-40 to 275°F) <i>Optional Fluorocarbon Bonnet O-Ring:</i> -23 to 204°C (-10 to 400°F) Flow Characteristic Equal percentage Flow Direction Flow up only Port Diameters See table 2 Valve Plug Travel 19 mm (0.75 inch) Valve Plug Style Micro-Form valve plug Available Actuator Configurations On/off (snap acting) Positioning (flow or pressure control)	Power Requirements 12 or 24VDC, minimum 4 amp power supply required (fuse to 5 amps) Maximum Current Draw 4 amps Idle Current Draw 38 mA Conduit Connections Two 3/4 NPT connections Stroke Length 19mm (0.75 inch) Nominal Stroke Speed⁽²⁾ 3.9 mm/s (0.15 inch/s) at 24 VDC 2.2 mm/s (0.09 inch/s) at 12 VDC Hazardous Area Approvals CSA (C/US): Explosion-Proof Class I, Division 1, Groups C and D, T6, Ex d IIA T6, Class I, Zone 1, AEx d IIA T6 ATEX Flameproof - Gas: Ex II 2 G ,Ex d IIA T6 IECEx Flameproof - Gas: Ex d IIA T6 Enclosure Rating Type 4X and IP66 Duty Cycle 50% maximum Enclosure Material Cast aluminum alloy with powder coat paint Approximate Weight: 22 - 51 kg (49 - 113 lbs), depending upon construction
--	---

1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded.

2. 10% variation can be expected, based on temperature and pressure of application.

Description

The D4 control valve with easy-Drive electric actuator is a compact, rugged valve designed primarily for high-pressure throttling applications. This valve is ideal for use on pressure and flow control applications within the oil and gas production industry. The D4 valve also makes an excellent dump valve for high-pressure separators and scrubbers.

The D4 control valve meets the metallurgical requirements of NACE MR0175/ISO 15156 without environmental limits for temperatures below 135°C (275°F). If the temperature is above 135°C (275°F), the N07718 Belleville washers will impose some limits, as shown in table 3.

Specifications

Table 1 lists specifications for the D4 control valve with easy-Drive electric actuator. Some of the specifications for a given control valve as it originally comes from the factory are stamped on a nameplate located on the lower actuator enclosure.

Educational Services

For information on available courses for the Fisher D4 control valve with easy-Drive electric actuator, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Table 2. Valve Sizes and Connection Styles

VALVE SIZE, NPS	PORT DIAMETER, (INCHES)	SCREWED	RAISED FACE (RF) FLANGED				RING TYPE JOINT (RTJ) FLANGED	
		4250 psi	CL150	CL300	CL600	CL900 and CL1500	CL600	CL900 and CL1500
1	0.25, 0.375, 0.5, 0.75	X	X	X	X	X	X	X
2	0.25, 0.375, 0.5, 0.75, 1, 1.25	X	X	X	X	X	X	X

X = Available construction.

Table 3. D4 Environmental Limits for NACE MR0175/ISO 15156 with Sour Trim

MAXIMUM TEMPERATURE		MAXIMUM H ₂ S PARTIAL PRESSURE		COMPATIBLE WITH ELEMENTAL SULFUR?
°C	°F	MPa	psia	
232	450	0.2	30	No
204	400	1.4	200	No
199	390	2.3	330	No
191	375	2.5	360	No
149	300	2.8	400	No
135	275	No Limit		Yes

Table 4. Fisher D4 easy-Drive Maximum Pressure Drop

PORT DIAMETER		MAXIMUM PRESSURE DROP ⁽¹⁾	
mm	Inch	Bar	psi
6.4	0.25	293	4250 ⁽¹⁾
9.5	0.375	293	4250 ⁽¹⁾
12.7	0.5	247	3576 ⁽¹⁾
19.1	0.75	105	1518
25.4	1	56	814
31.8	1.25	34	495

1. Downstream pressure, P2, is limited to 2250 psig.

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts or by uncontrolled process fluid, be certain the service conditions do not exceed the limits shown on the valve nameplate and in table 1. Use pressure-relieving devices required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

For explosion-proof applications, ensure the actuator cover is properly bolted before applying power to the actuator. Personal injury or property damage may result from fire or explosion if power is applied to the actuator with the cover removed in a hazardous area.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 457 mm (18 inches) from the actuator. Personal injury or property damage may result from explosion if the seal is not installed.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection, and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#) or Local Business Partner.

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag, or other foreign material from the pipeline.

WARNING

Avoid personal injury or property damage caused by possible actuator failure. The use of a rigidly-mounted support on the actuator casing may cause additional stress on the actuator leading to premature wear and/or failure of the actuator components.

CAUTION

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag, or other foreign material from the pipeline.

1. Before installing the control valve assembly, inspect it for any damage and for any foreign material that may have collected in the valve body.
2. Remove any pipe scale, welding slag, and other foreign material from the pipeline.
3. The control valve can be installed in any position, but normally the actuator is vertical above the valve. Install the valve so the flow direction arrow on the side of the valve indicates the direction of the process flow.
4. Install the valve following local and national piping codes when they apply to the application. For screwed connections, treat the external pipe threads with a good grade pipe compound. For flanged valves, use suitable gaskets between valve and pipeline flanges.
5. If continuous operation is required during maintenance and inspection, install a conventional three-valve bypass around the valve.

Special Instructions for “Safe Use” and Installations in Hazardous Locations

ATEX/IECEX

⚠ WARNING

To avoid static discharge from the enclosure, do not rub or clean the enclosure with solvents. To do so could result in an explosion. Clean with a mild detergent and water only.

The enclosure is non-conducting and may generate an ignition-capable level of electrostatic charges under certain extreme conditions. The user should ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a build-up of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment shall only be done with a damp cloth.

To avoid damage to the enclosure, when screws are fully tightened into blind holes in enclosure walls, with no washer fitted, at least one full thread shall remain free at the base of the hole.

Startup Overview

Figure 2. Flowchart

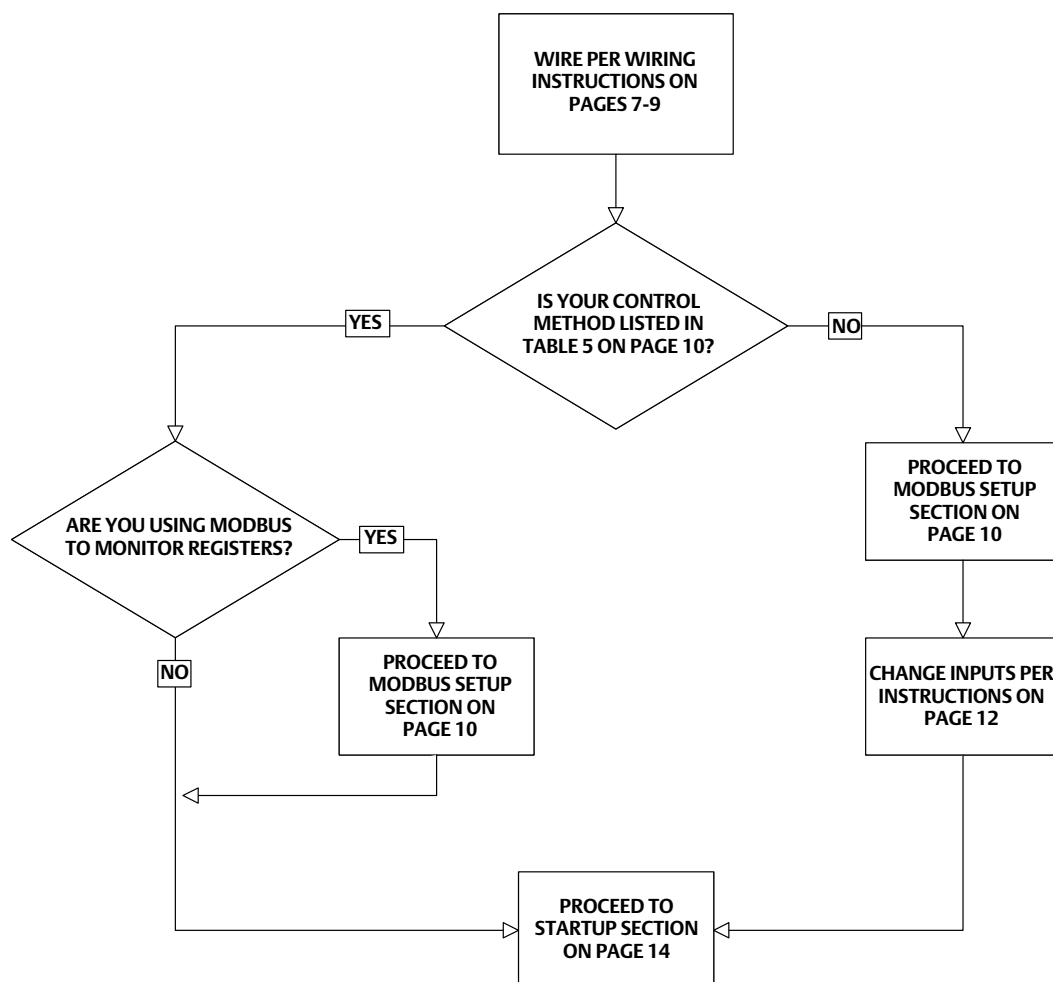
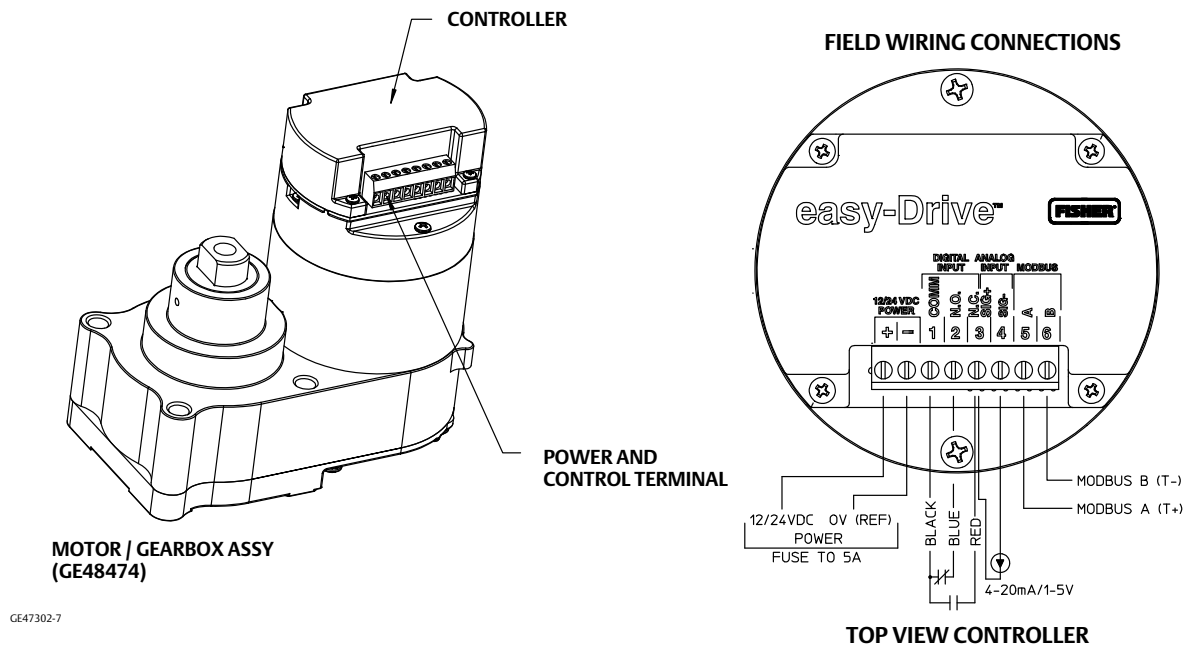


Figure 3. Fisher D4 Valve with easy-Drive Actuator Wiring Diagram



Power Requirements

Ensure a stable DC power source is available, maintaining less than 5% ripple and sufficiently surge protected for the application. A 4 amp (minimum) power supply is required. Use of a 36 volt transient voltage suppressor is highly recommended.

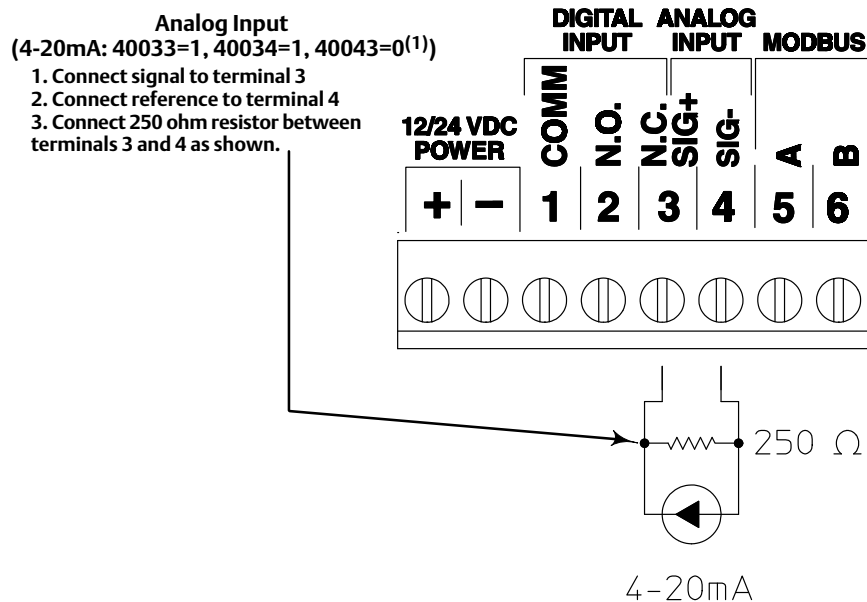
Wiring Instructions

1. Observe local wiring requirements for hazardous location usage.
2. Conduit seals within 457 mm (18 inches) of the enclosure port are required for explosion-proof installation.
3. 22AWG (0.33mm²) to 12AWG (3.31mm²) wire size required.
4. Fuse system to 5A.
5. Connect enclosure and analog signal shields.
6. Ensure power is turned off before connecting the wires.

Power

1. Connect 12 or 24 VDC reference to: –
2. Connect 12 or 24 VDC positive to: +
3. Be sure to tighten terminals sufficiently to ensure solid mechanical connection.

Figure 4. Wiring - Analog Input



NOTE:
1. 40043=0 SETS ANALOG INPUT TO 1-5V AND ASSUMES USE OF RECOMMENDED EXTERNAL 250 OHM RESISTOR.
IF NO EXTERNAL RESISTOR IS USED, SET 40043=1.

Figure 5. Wiring - L2e

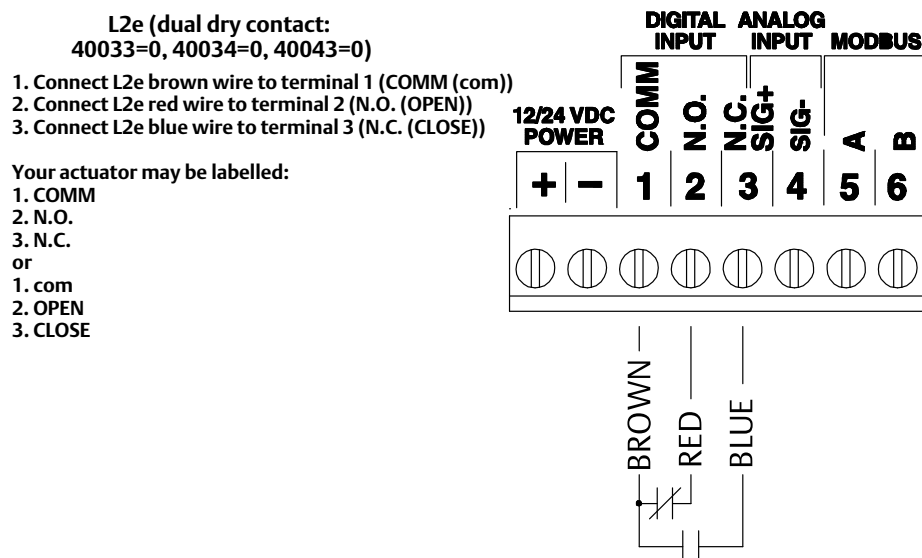


Figure 6. Wiring - Single Dry Contact

Dry Contact (single dry contact:
40033=0, 40034=0, 40043=1)

1. Connect one side of contact switch to terminal 1 (COMM)
2. Connect other side of contact switch to terminal 2 (N.O.)

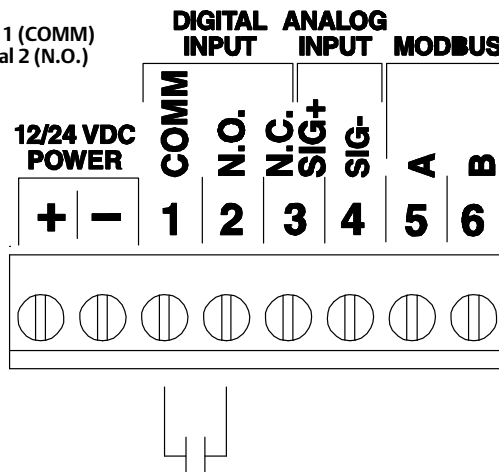


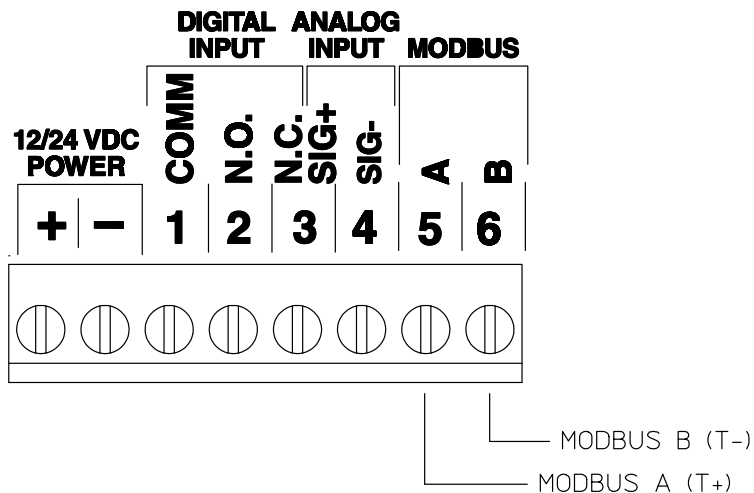
Figure 7. Wiring - Modbus Input

Modbus Input: 40033=1

1. Connect Channel A (T+) to terminal 5
2. Connect Channel B (T-) to terminal 6

Modbus Defaults

Address 1
9600 Baud
Even parity
1 Stop Bit



Important Technical Notice for easy-Drive Electric Actuator

When using the easy-Drive electric actuator with a 4-20mA control signal, the unit should always have 12/24VDC power present on the power input terminals prior to applying the 4-20mA signal, unless an external 250 ohm resistor is installed per figure 4. Failure to do so could result in damage to the analog input circuitry.

It is strongly recommended to place an external 250 ohm resistor between terminals 3 and 4 when using a 4-20mA signal to control the actuator. When the actuator is configured to 1-5V input with an external 250 ohm resistor in place, a 4-20mA signal may be safely used without danger to input circuitry.

This order of operation must always be maintained when powering the unit on if no external 250 ohm resistor is used:

1. 12/24VDC power on
2. 4-20mA control signal engaged

This order of operation must always be maintained when powering the unit off:

1. 4-20mA control signal disengaged
2. 12/24VDC power off

The result of not following this order of operation could result in permanent damage to the analog input circuitry. This damage can result in the inability of the controller to see the control signal, resulting in the actuator moving the valve plug to the loss of signal position.

Default Input Signals

The D4 with easy-Drive comes from the factory calibrated and ready for use with the following default input signals shown in table 5.

Table 5. D4 easy-Drive Default Input Signals

CONFIGURATION	ON/OFF	POSITIONING
Input Signal	L2e (dual dry contact)	4-20 mA

If the input signal of the application matches table 5, proceed to the Wiring Instructions section. If the input signal of the application does not match table 5, proceed to the Configuration section.

Configuration

Input Configuration

There are 2 functional configurations available for the easy-Drive electric actuator: On/Off and Positioning. It is not possible to change an actuator from On/Off to Positioning after it has been delivered from the factory. Version 4.21 and higher firmware will allow a positioning unit to be changed to on/off.

All available input signals are shown in table 6.

Table 6. All Available Input Signals

CONFIGURATION	ON/OFF			POSITIONING		
Control Source	Modbus	Local		Modbus	Local	
Input Signal	Modbus	L2e Dual Dry Contact (default)	Single Dry Contact	Modbus	4-20 mA (default)	1-5 V

If you are using the default inputs signals, and the valve has not been disassembled or adjusted in any way, there is no need to recalibrate the assembly. You can proceed directly to Startup (page 12).

Changing the Inputs from Default Settings

All configuration within the valve is done by setting values in Modbus registers. This can be done using any Modbus master (flow computer, PLC, PC). Configuration software, providing a visual interface to the registers, is available through your Emerson local business partner or the Fisher website.

Modbus setup

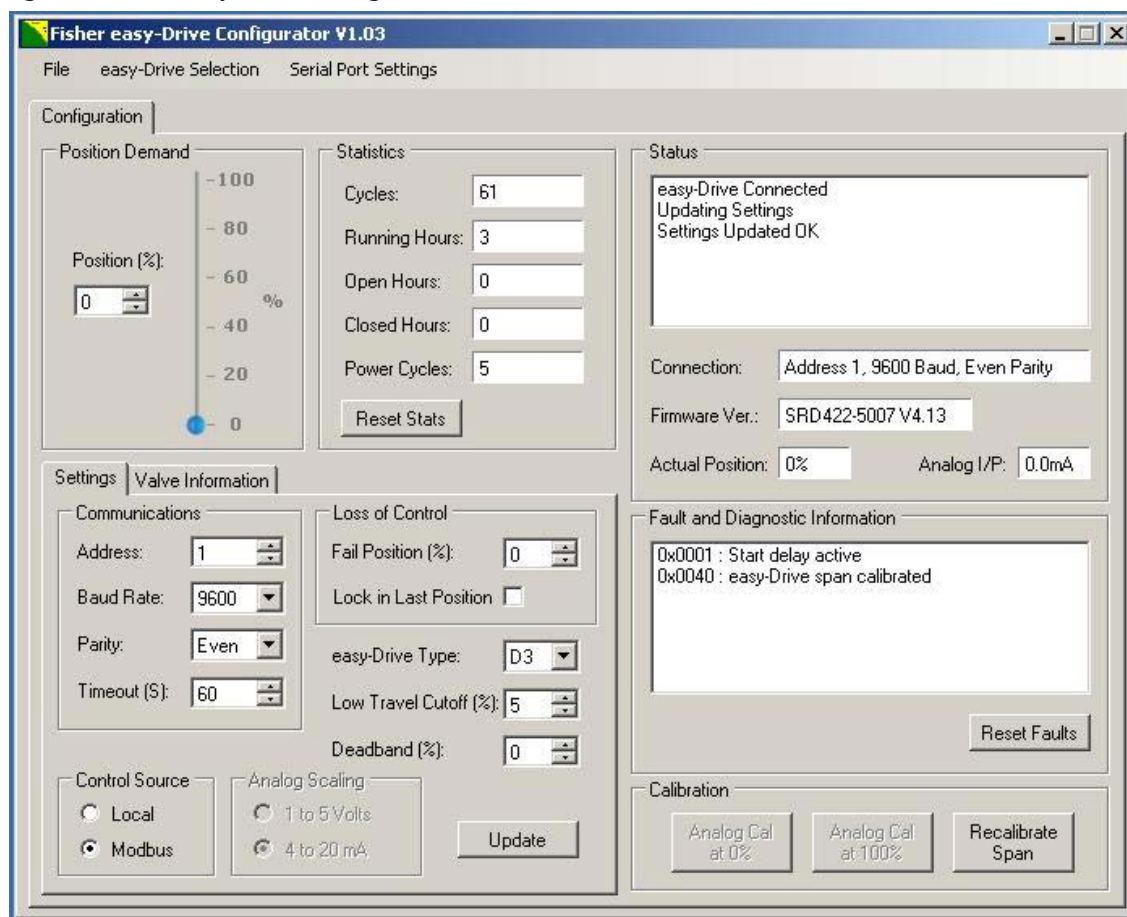
Use the instructions in the instruction manual for the Modbus master to initiate the connection. The D4 with easy-Drive electric actuator Modbus factory defaults are Address 1, 9600 baud, even parity, 1 stop bit.

When a connection has been achieved, the actuator may be configured to accept the input signal over the Modbus link (ignoring the physical inputs) and the Modbus settings may be changed to accommodate the network to which it is attached. Other changes to functionality are possible, such as:

- Low level cutoff: 40037 (default is 5%)
- Position upon loss of signal: 40035 (default is 0%)

See Appendix A for a full map of Modbus registers and their functions.

Figure 8. Fisher easy-Drive Configuration Software



Connecting using the Fisher easy-Drive configuration software

The Fisher easy-Drive configuration software allows configuration and diagnosing of the Fisher easy-Drive electric actuator with a graphical interface. Connect a PC to the actuator using a USB or serial to Modbus RTU converter using the wiring instructions above. The USB or serial device will be visible in the drop menu under Serial Port Settings. Baud rate and parity should be set to the Modbus settings of the actuator. Default actuator settings are 9600 baud and Even parity.

Use the Fisher easy-Drive configuration software (figure 8) to make the desired changes, or register values may be changed to allow different functionality. Modbus register 40034 dictates whether the unit will respond to a physical signal or to the value in Modbus register 40001. A value of 0 in register 40034 will result in the actuator responding to the value in 40001 and a value of 1 will result in the actuator responding to physical control signals.

Note

If an actuator is on/off, a Modbus command of 0-49 in register 40001 will cause the valve to close fully, while a value of 50-100 will cause the valve to open fully.

Local to Modbus Control

Modbus

- Set register 40034 (Control Source)
 - 1 = Local Control
 - 0 = Modbus control

Configuration Software

- Use radio button to select Local Control or Modbus Control.

4-20mA to 1-5V Control

Modbus

- Set register 40043 (Analog I/P mode)
 - 0 = 1-5V
 - 1 = 4-20mA

Configuration Software

- Use radio button to select 4-20mA or 1-5V local analog control when Control Source is set to Local.

L2e (Dual dry contact) to Single Dry Contact Control

Modbus

- Set register 40043 (Analog I/P mode)

- 0 = L2e (Dual dry contact)
- 1 = Single dry contact

Configuration Software

- Use radio button to select L2e or Single pole local digital control when Control Source is set to Local.

Calibration Instructions

WARNING

To avoid personal injury or property damage, be aware that the valve will open fully and then close fully during the calibration cycle.

It is not necessary to calibrate your easy-Drive electric actuator prior to use from a factory shipment.

If any of the following are true, recalibration will be required (see next section)

- The actuator has been re-mounted on a different valve since shipment
- Disassembly of the valve for trim or packing changes
- A new version of firmware has been loaded on the controller

The following scenarios do not require recalibrations

- New unit from the box
- Power dips or interruptions
- Changing of control method (i.e. from 4-20mA to Modbus control)
- Extended periods of storage

Calibration with the use of Modbus

1. After the unit has been properly wired and fused per instructions in the Wiring section of this instruction manual, turn power to the unit on.
2. Calibrate using Modbus:
 - a. Send position command of 0% to actuator to prevent unexpected motion. Valve will move to commanded position following the calibration procedure.
 - b. Send a value of 1 to register 40003. Valve plug will move to fully closed. The valve plug will then return to the commanded position.

If a Modbus connection is not available, and recalibration is desired, use the appropriate calibration method as determined by the control method of your valve.

Calibration without the use of Modbus

1. Turn power to the actuator off

2. Wait for 10 seconds to ensure all circuits have discharged.
3. Return power to the actuator and use the appropriate calibration method for your control signal. Calibration sequence must be done within 15 seconds of power being switched on.
4. For On/Off operation using L2e dual-input dry contact:
 - a. Close the contact to create a short between pins 1 and 2 – valve plug will not move at this time.
 - b. Close the contact to create a short between pins 1 and 3 – valve plug will move to the lower, closed position.
5. For On/Off operation using single dry contact:
 - a. Close the contact to create a short between pins 1 and 2 – valve plug will not move at this time.
 - b. Open the contact to create an open circuit between pins 1 and 2 – valve plug will move to the lower, closed position.
6. For positioning operation using 4-20mA:
 - a. Apply a 20mA signal between pins 3 and 4 – valve plug will not move at this time.
 - b. Apply a 4mA signal between pins 3 and 4 – valve plug will move to the lower, closed position.
 - c. If calibration of the analog input is desired to improve positional accuracy, an optional operation is listed in the next section titled Analog Input Calibration.
7. For positioning operation using 1-5V:
 - a. Apply a 5V signal between pins 3 and 4 – valve plug will not move at this time.
 - b. Apply a 1V signal between pins 3 and 4 – valve plug will move to the lower, closed position.
 - c. If calibration of the analog input is desired to improve positional accuracy, an optional operation is listed in the next section titled Analog Input Calibration.
8. The unit is now calibrated.

Analog Input Calibration

Improved positional accuracy may be obtained by calibrating the actuator to the analog signal input. The position of the valve plug is linearly proportional to the analog control signal end points, with 4 mA/1V equating to fully closed and 20 mA/5V equating to fully open.

1. Apply a 4 mA or 1V signal between pins 3 and 4 - valve plug will move to the fully open position.
2. Send a value of 1 to register 40004 or click Analog Cal at 0% in the configuration software.
3. Apply a 20 mA or 5V signal between pins 3 and 4 - valve plug will move to the fully closed position.
4. Send a value of 1 to register 40005 or click Analog Cal at 100% in the configuration software.
5. The unit is calibrated to your analog signal.

Start Up

WARNING

To avoid personal injury or property damage, be aware that the valve will move and respond to an input signal during start up.

1. Before turning on power to the unit, be sure that a closed signal is being commanded to the unit
 - Dry-Contact: contact is open
 - L2e (Dual Dry Contact): Contact closed across pins 1 & 3
 - Analog Input: signal < 4mA or 1V
 - Modbus: position demand = 0
2. Turn on power to the unit
3. Apply a change in position demand to ensure unit responds properly
 - Dry-Contact:
 - Closed contact between pins 1 & 2 will open the valve
 - Dual contact / L2e only (40043=0) : Closed contact between pins 1 & 2 will open the valve. Closed contact between pins 1 & 3 will close the valve
 - Analog Input: valve will respond to proportional demand
 - Modbus: valve will respond to positional demand in register 40001. 0 = fully closed and 100 = fully open.
4. If the valve does not respond as expected, proceed to Troubleshooting guide on page 15.
5. Check conduit ports
 - Conduit seal must be in place within 450mm (18 inches) of the enclosure
 - Unused conduit ports must be sealed with an explosion-proof port plug
6. Replace the cover and tighten all 8 bolts to 20 N-m (15 ft-lbs)

Troubleshooting

1. Unit does not move
 - a. Verify that 12VDC to 24VDC is present on the power terminals as shown on the cover
 - b. Verify that all wires are firmly attached on both ends
 - c. Verify that wires are connected to the correct terminals - see Wiring in the manual
 - d. Verify mode of operation (on/off or positioning) matches control signal
 - e. Verify mode of control (local or Modbus) matches control signal
2. Unit does not respond to 4-20mA signal
 - a. Verify that 12VDC to 24VDC is present on the power terminals as shown on the cover.
 - b. Verify that the 4-20mA signal is wired correctly and that the terminals are firmly on the wires.
 - c. Verify mode of operation matches control signal (local control: 40033=0, positioning: 40034=1).

- d. Check the value of the analog input in register 40025 (middle right of configuration software screen) to determine if it is 0 or greater.
 - i. If register 40025 shows 0 and the circuit board is green (not blue), it is possible a 4-20mA signal was applied without power to the power terminals and damage to the input circuitry has occurred. Contact your [Emerson sales office](#) or Local Business Partner for further information.
3. Unit moves to fully open when 1V signal is applied and closed when 5V signal is applied
 - a. Unit is likely configured as an on/off unit with local control; on/off units can not be controlled as an analog device.
 - i. If on/off control is desired, use a dry contact switch to control in local mode or change to Modbus mode to control the unit
 - ii. If positioning control is desired, contact your Emerson sales office or Local Business Partner to upgrade your actuator to positioning control.
4. Diagnostics show a Motor Stall Fault
 - a. The easy-Drive electric actuator is designed to operate in a manner consistent with a pneumatic actuator. This means that if the valve plug can not move to its commanded position, the actuator will stop, without damage, and issue a Motor Stall Fault warning. When the command signal changes outside of the deadband (Modbus register 40036), it will attempt to move again. Recalibrate the actuator span per instructions in the Startup section of this manual.
5. Position on D4 is not accurate (proportional positioning units only)
 - a. If the valve plug opened during calibration, it is set to a D3. Change valve type to D4 and recalibrate.
 - b. If the local analog input is being used (4-20mA or 1-5V), the analog inputs of the actuator may be calibrated to match the input signal. Follow instructions in Analog Input Calibration, found in the Calibration section of this instruction manual.

Maintenance

Refer to figure 12.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and maintenance depends on the severity of the service conditions.

WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.

- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

⚠ WARNING

For explosion-proof applications, ensure the actuator cover is properly bolted before applying power to the actuator. Personal injury or property damage may result from fire or explosion if power is applied to the actuator with the cover removed in a hazardous area.

Do not remove the actuator cover for 10 minutes after power is disconnected if the UPS option is installed.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 457 mm (18 inches) from the actuator. Personal injury or property damage may result from explosion if the seal is not installed.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection, and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion.

Valve Plug and Seat Ring

Disassembly

Key Numbers are referenced in figures 11 and 12.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body (key 1), and drain the process media from both sides of the valve.

CAUTION

The following steps are intended to prevent damage to the valve plug (key 3) and seat ring (key 2) during the removal of the bonnet and actuator.

2. For Positioning Actuators

- Command the valve to anywhere between 10% and 20% travel.
- Isolate power and signal.
- Proceed to step 3.

For ON/OFF Actuators

- Command the valve to open or close, and cut the power when the valve is at mid-stroke.
- Isolate power and signal.
- Proceed to step 3.

3. Break the hammer nut (key 6) loose with a hammer. Continue turning the hammer nut by using a hammer or a large adjustable wrench, tightened around one ear of the hammer nut. If the bonnet is stuck on the valve, continue to unscrew the hammer nut. The hammer nut will contact the spring pins (key 7) and will force the bonnet out of the valve. Carefully lift the actuator, bonnet, and valve plug assembly from the valve body.

⚠ WARNING

The spring pins must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

4. Use a socket wrench to loosen the seat ring (key 3).
5. Remove the seat ring (key 3) and seat ring gasket (key 9) from the valve body.
6. To replace the plug, the stem nut (key 42) must be removed to expose the groove pin (key 4). Open the explosion-proof enclosure (key 60), using a 13mm wrench.
7. Remove the stem nut (key 42) using a 11/16 inch wrench; insert a punch in the hole in the stem to restrict rotation of the stem while removing the stem nut. The travel indicator (key 32) may need to be moved to expose the hole.
8. Push the stem downward just far enough to expose the groove pin (key 4) on the plug.
9. Remove the plug by driving out the groove pin and unscrewing the valve plug from the stem.

⚠ WARNING

Be careful to avoid damaging the seating surface on the valve plug or seat ring as damage in these areas will allow excessive leakage at shutoff. Avoid damaging the highly polished valve stem surface. A damaged valve stem could cut the packing and allow process fluid to leak to the atmosphere.

Table 7. Torque for Seat Ring (Key 3)

VALVE SIZE	RECOMMENDED TORQUE	
	N•m	Lbf•ft
NPS 1	407	300
NPS 2	698	515

Assembly

1. Make sure the bonnet O-ring (key 8) is on the bonnet and lubricated with lithium grease (key 49).
2. Install the plug (key 2) on the stem (key 47) and insert a new groove pin (key 4).
3. Push the plug and stem upward to ensure the threads on the top of the stem are exposed. Thread the stem nut (key 42) onto the top of the stem and tighten the stem nut (key 42) to 39 N•m (29lbf•ft). Insert a punch in the hole in the stem to restrict rotation while tightening the stem nut.
4. Replace the top of the explosion proof enclosure (key 60) and tighten cap screws (key 64) to 20 N•m (15 lbf•ft).
5. Thoroughly clean the seat ring and bonnet threads in the valve body (key 1). Also clean the valve body seat ring gasket surfaces.
6. Apply anti-seize lubricant (key 54) to the threads of the seat ring (key 3), and its mating threads in the valve body.
7. Apply anti-seize lubricant (key 54) to the seat ring gasket (key 9) and install into the valve body.
8. Screw the seat ring into the valve body. Use a socket wrench to tighten the seat ring to the torque values shown in table 7. Remove all excess lubricant after tightening.
9. Lubricate (key 54) the threads on the valve body and hammer nut and the contact surfaces of the bonnet and hammer nut flange. Install the bonnet and actuator assembly with pinned valve plug onto the valve body. Tighten the hammer nut using an adjustable wrench until the nut stops turning. A few hammer blows will be required to ensure that the assembly is tight.

Valve Packing

⚠ WARNING

Observe the warning at the start of the Maintenance section.

The valve stem packing can only be accessed from within the valve body.

Disassembly

1. Disassemble the valve per steps 1 through 12 of the Valve Plug and Seat Ring Disassembly section in this instruction manual.
2. Unscrew the packing retainer (key 10) from the bonnet (key 5).
3. Remove the five Belleville springs (key 11), packing spacer (key 14), packing (key 13), and two anti-extrusion rings (key 12) from the bonnet, using a formed wire hook. To aid in packing removal, the stem may be removed.
4. Clean and inspect the packing box wall to ensure that the packing surfaces are not damaged. If the surface condition is damaged, and cannot be improved by light sanding, replace the bonnet by contacting your [Emerson sales office](#) or Local Business Partner.
5. Inspect the valve stem for scratches or wear, and valve plug for wear or damage. Replace if necessary.

Figure 9. Fisher D4 Packing Installation

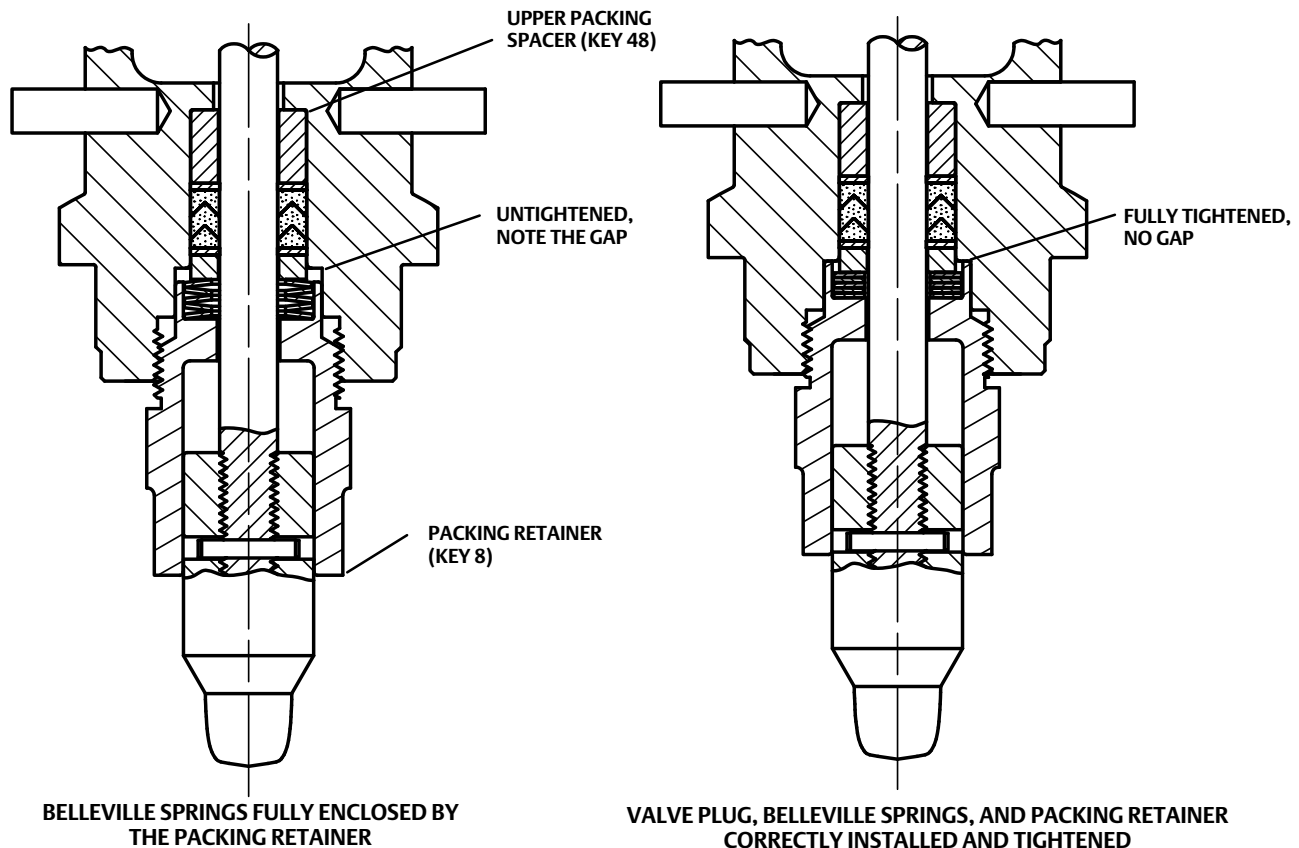
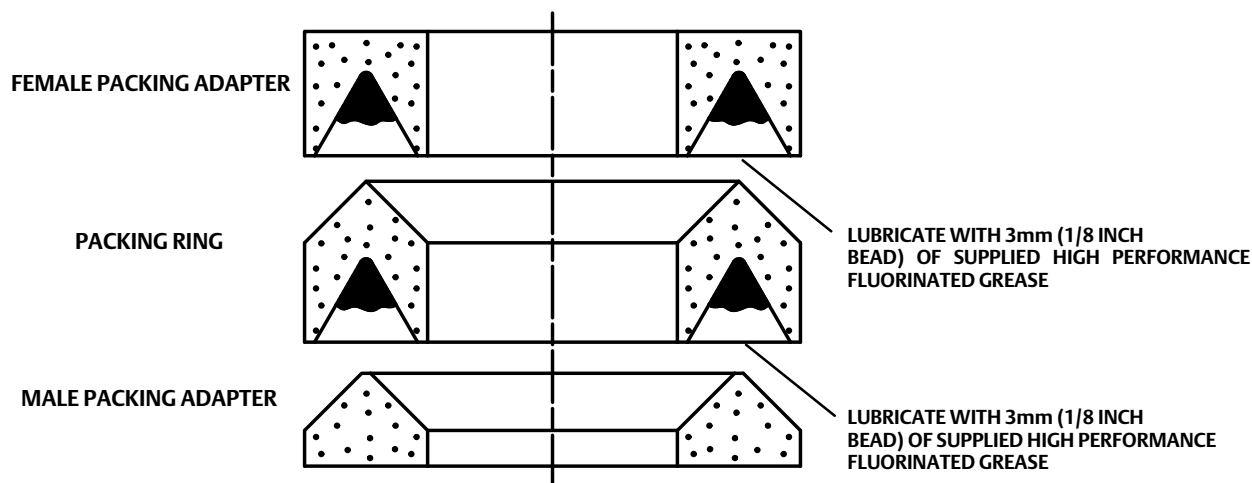


Figure 10. Lubrication Locations on Packing



Assembly

Refer to figures 9, 10, 11, and 12.

1. If the stem was removed during packing disassembly, insert the stem back into the valve/actuator assembly.
2. Ensure the upper packing spacer (key 48) is installed, as shown in figure 9.
3. Using a non-marring installation tool, such as a 12-inch length of 1/2 inch PVC pipe, push the first anti-extrusion washer (key 12) fully into the packing box by hand. Then, use the packing spacer (key 14) to fully seat the anti-extrusion washer by firmly tapping the packing spacer against the anti-extrusion washer with a hammer and the PVC pipe.
4. Remove the packing spacer from the packing bore.

CAUTION

All D4 packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D4 packing lubricant.

Note

In the following procedure, carefully install each packing ring individually over the valve stem and push completely into the packing box with a non-marring tube. A 12-inch length of 1/2 inch PVC pipe works well for this. It is recommended that the lubricated packing rings be installed individually rather than pushed in as a set.

5. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the female packing adaptor as shown in figure 10 and install over the valve stem (key 16).
6. Apply a 3mm (1/8 inch) bead of the supplied high performance fluorinated grease (key 44) around the groove of the packing ring as shown in figure 10 and install over the valve stem.
7. Install the male packing adaptor, lower anti-extrusion washer (key 10), and lower packing spacer over the valve stem as shown in figure 9.

8. Firmly press all packing parts into the packing bore with a tube.
9. Install the five Belleville springs (key 11) over the valve stem. The Belleville springs should be single-stacked with the inside diameter of the inner spring contacting the packing spacer (key 14), and the outside diameter of the outer spring contacting the packing retainer (key 10).
10. Lubricate the threads of the packing retainer with anti-seize and install into the bonnet using a 1-5/8 inch wrench. Make sure the Belleville springs are completely enclosed by the packing retainer as shown in figure 9.
11. Torque the packing retainer to 136 N•m (100 lbf•ft). The packing retainer has been installed correctly when a metal-to-metal contact has been made between the packing retainer end and the bonnet (key 5). The packing retainer threads should be completely enclosed by the bonnet.
12. Follow steps 1 through 9 of the Valve Plug and Seat Ring Assembly section in this instruction manual.

Parts Ordering

Each D4 control valve is assigned a serial number, which can be found on the nameplate. Refer to the number when contacting your [Emerson sales office](#) or Local Business Partner for assistance or when ordering replacement parts.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Repair Kits

Note

All repair kits are supplied with hydrogenated nitrile bonnet O-ring. FKM (fluorocarbon) bonnet O-ring must be ordered separately when required.

Description	Part Number
* Packing Repair Kit Includes key numbers 4, 8, 12 (2 req'd), 13, and high performance fluorinated grease	RD4X0000012

Parts List

Note

For part numbers not shown, contact your [Emerson sales office](#) or Local Business Partner.

Key	Description	Part Number
1	Valve Body	
2*	Valve Plug	
	S41000 / S41600 HT	
	NPS 1 valve	
	0.25 inch port diameter	20C3692X012
	0.375 inch port diameter	20C3693X012
	0.5 inch port diameter	20C3694X012
	0.75 inch port diameter	GE01557X012
	NPS 2 valve	
	0.25 inch port diameter	GE00992X012
	0.375 inch port diameter	GE00993X012
	0.5 inch port diameter	GE00994X012
	0.75 inch port diameter	GE01558X012
	1-inch port diameter	GE01561X012
	1.25 inch port diameter	GE01555X012
	S17400 H1150 Dbl	
	NPS 1 valve	
	0.25 inch port diameter	20C3692X032
	0.375 inch port diameter	20C3693X032
	0.5 inch port diameter	20C3694X032
	0.75 inch port diameter	GE01557X032
	NPS 2 valve	
	0.25 inch port diameter	GE00992X032
	0.375 inch port diameter	GE00993X032
	0.5 inch port diameter	GE00994X032
	0.75 inch port diameter	GE01558X032
	1-inch port diameter	GE01561X032
	1.25 inch port diameter	GE01555X032
	Tungsten Carbide	
	NPS 1 valve	

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

D4 Valve with easy-Drive Actuator

October 2017

Instruction Manual

D103597X012

Key	Description	Part Number	Key	Description	Part Number
	0.25 inch port diameter	20C3696X012	4*	Groove Pin	GE01163X012
	0.375 inch port diameter	20C3697X012	5	Bonnet	
	0.5 inch port diameter	20C3698X012	6	Hammer Nut	
	0.75 inch port diameter	20C3699X012	7	Spring Pin	
	NPS 2 valve		8*	Bonnet O-ring	
	0.25 inch port diameter	20C3682X012		Hydrogenated Nitrile	
	0.375 inch port diameter	20C3683X012		-46 to 149°C (-50 to 300°F)	10C3680X012
	0.5 inch port diameter	20C3685X012		FKM, -23 to 204°C (-10 to 400°F)	10C3680X022
	0.75 inch port diameter	20C3686X012	9*	Seat Ring Gasket	
	1-inch port diameter	20C3687X012		For NPS 1 valve	1B198636042
	1.25 inch port diameter	20C3688X012		For NPS 2 valve	1B198836042
3*	Seat Ring		10	Packing Retainer	
	S17400 H1150 Dbl		11	Belleville Springs, 5 req'd	
	NPS 1 valve		12*	Anti-Extrusion Washer, 2 req'd	12B6335X022
	0.25 inch port diameter	GE00982X032	13*	Packing Set	12B6667X012
	0.375 inch port diameter	GE00983X032	14	Packing Spacer	
	0.5 inch port diameter	GE00984X032	16	Valve Nameplate	
	0.75 inch port diameter	GE00985X032	17	Drive Screw	
	NPS 2 valve		18	O-ring	13A9576X052
	0.25 inch port diameter	GE00986X032	19	Stem O-ring	1K7561X0072
	0.375 inch port diameter	GE00987X032	32	Travel Indicator	
	0.5 inch port diameter	GE00988X032	42	Stem Nut	
	0.75 inch port diameter	GE00989X032	47*	Valve Stem	GE48549X012
	1-inch port diameter	GE00990X032	48	Upper packing spacer	
	1.25 inch port diameter	GE00991X032	49	Lubricant (lithium grease)	
	Tungsten Carbide		54	Lubricant (anti-seize)	
	NPS 1 valve		56	High Performance Fluorinated Grease	
	0.25 inch port diameter	GE07347X012		Packing Lubricant	
	0.375 inch port diameter	GE07363X012	58	Enclosure O-ring	
	0.5 inch port diameter	GE07364X012	59	Motor/gearbox/controller assembly	
	0.75 inch port diameter	GE07365X012	60	Upper Enclosure	
	NPS 2 valve		61	Lower Enclosure	
	0.25 inch port diameter	GE07389X012	62	Motor Cap Screws (4 req'd)	
	0.375 inch port diameter	GE07394X012	63	Motor Cap Screw Washers (4 req'd)	
	0.5 inch port diameter	GE07397X012	64	Enclosure Cap Screws (8 req'd)	
	0.75 inch port diameter	GE07398X012	65	Enclosure Cap Screw Retaining Washers (8 req'd)	
	1-inch port diameter	GE07399X012	66	Ground Screw	
	1.25 inch port diameter	GE07406X012	68	Certification Nameplate	
			69	easy-Drive Label	

Figure 11. D4 Valve Assembly

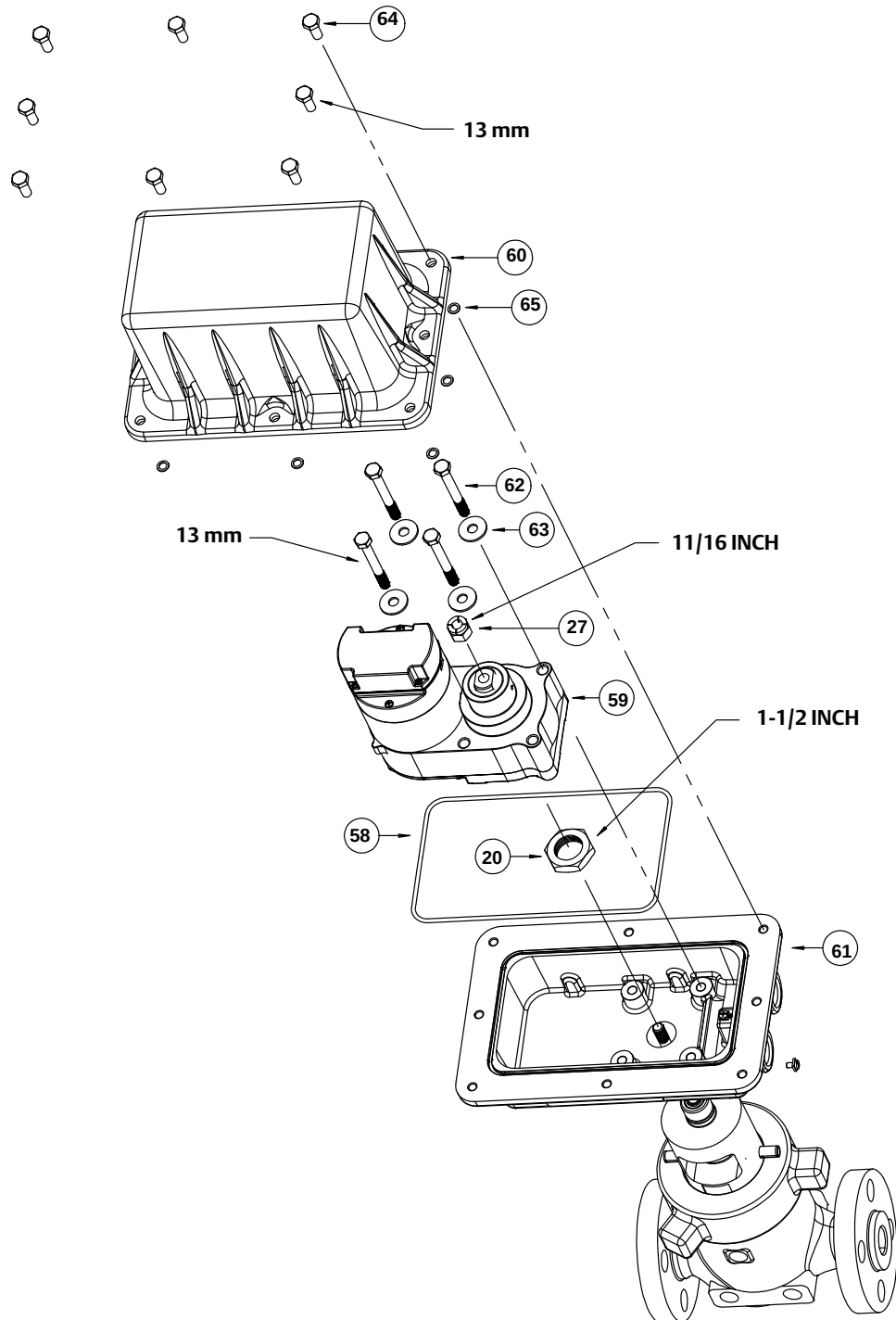
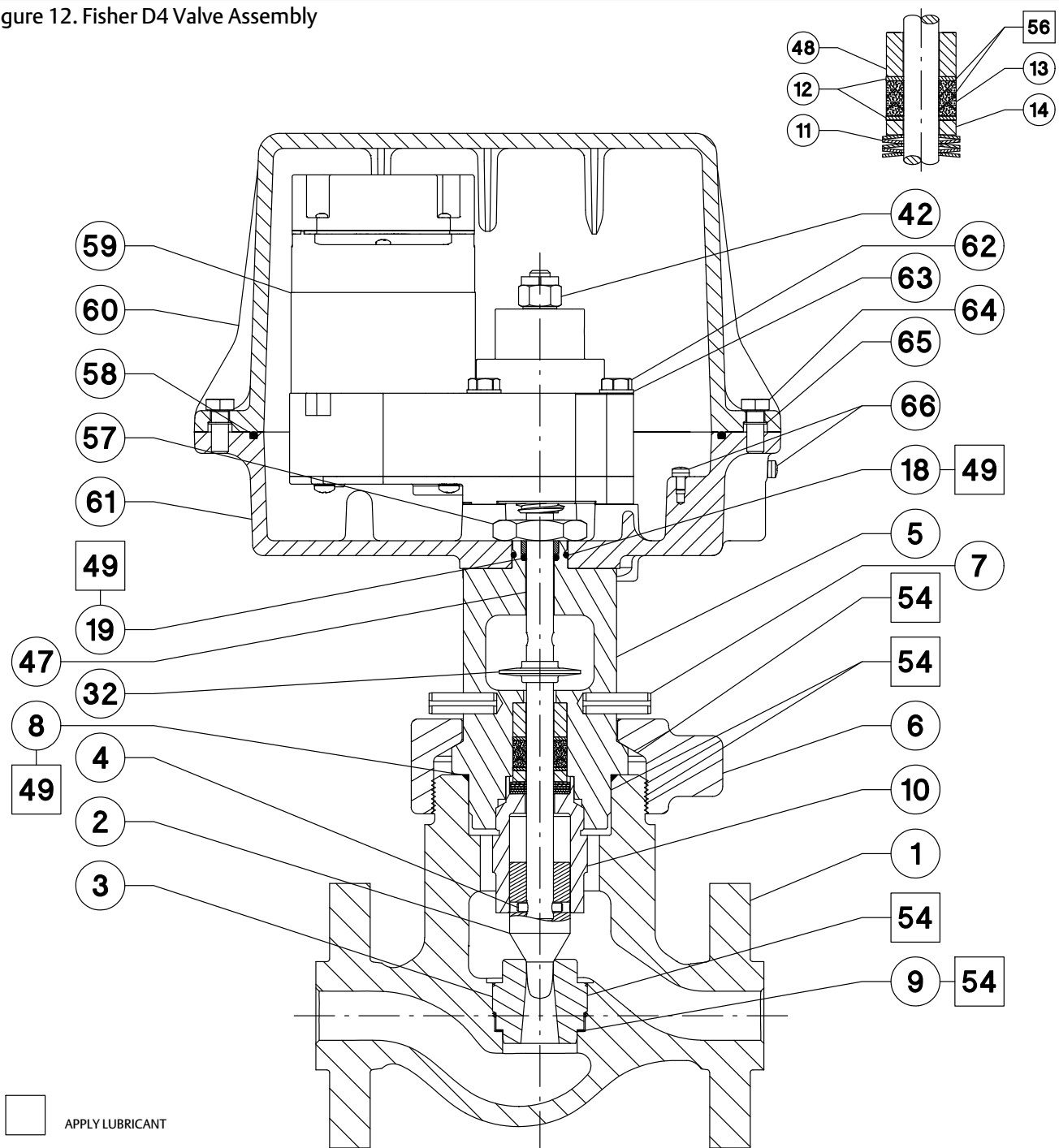


Figure 12. Fisher D4 Valve Assembly



Appendix A - Modbus

A.1 Register Summary

Table 8. Register Summary

DATA	LEGAL FUNCTION CODES	REGISTER (PHYSICAL)	TYPE	R/W	DESCRIPTION
Position Demand – Proportional	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40001 (0x0000)	UINT16	R/W	Value 0-100 = 0-100% Position
Reset Diagnostics	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40002 (0x0001)	UINT16 (BOOL)	R/W	0 = Reset Idle, 1 = Reset Active
Recalibrate Demand	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40003 (0x0002)	UINT16	R/W	0 = Idle, 1 = Reset calibration request – unit will reset to non calibrated state and await calibration sequence
Analog Cal at 0%	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40004 (0x0003)	UINT16	R/W	0 = Idle, 1 = Calibrate at 0%
Analog Cal at 100%	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40005 (0x0004)	UINT16	R/W	0 = Idle, 1 = Calibrate at 100%
Reserved	03 – Read Holding Reg	40006 (0x0005)	UINT16	R	Read will return power up default of 0
Reserved	03 – Read Holding Reg	40007 (0x0006)	UINT16	R	Read will return power up default of 0
Reserved	03 – Read Holding Reg	40008 (0x0007)	UINT16	R	Read will return power up default of 0
Test Register	03 – Read Holding Reg	40009 (0x0008)	UINT16	R	Read will return power up default of 45964 decimal (Binary/Hex -0b10110001110001100 / 0xB38C)
Actual Position	03 – Read Holding Reg	40010 (0x0009)	UINT16	R	Value 0-100 = 0-100% Position
Actual Demand	03 – Read Holding Reg	40011 (0x000A)	UINT16	R	Value 0-100 = 0-100% is demand to position loop from active control source
Diagnostic Flags	03 – Read Holding Reg	40012 (0x000B)	UINT16	R	Bit Flags – see Description in section 5.2 and table 9
Number of cycles	03 – Read Holding Reg	40013 (LSW) (0x000C) 40014 (MSW) (0x000D)	UINT32†	R	Number of movements
Hours Running	03 – Read Holding Reg	40015 (LSW) (0x000E) 40016 (MSW) (0x000F)	UINT32†	R	Total hours powered - version 4.13 Total minutes powered - version 4.21
Hours Open	03 – Read Holding Reg	40017 (LSW) (0x0010) 40018 (MSW) (0x0011)	UINT32†	R	Total hours in open position (at 100%) - version 4.13 Total minutes in open position (at 100%) - version 4.21
Hours Closed	03 – Read Holding Reg	40019 (LSW) (0x0012) 40020 (MSW) (0x0013)	UINT32†	R	Total hours in closed position (at 0%) - version 4.13 Total minutes in closed position (at 0%) - version 4.21
Number of power up cycles	03 – Read Holding Reg	40021 (LSW) (0x0014) 40022 (MSW) (0x0015)	UINT32†	R	Number of times power is cycled successfully
Serial Number	03 – Read Holding Reg	40023 (LSW) (0x0016) 40024 (MSW) (0x0017)	UINT32†	R	Product Unique Identifier 0-4294967295
Analog I/P Value	03 – Read Holding Reg	40025 (0x0018)	UINT16	R	0-50 = 0-5V (Voltage mode I/P) 0-200 = 0-20mA (Current Loop I/P)
Firmware Project Code	03 – Read Holding Reg	40026 (0x0019)	UINT16	R	Project code
Firmware Document Reference	03 – Read Holding Reg	40027 (0x001A)	UINT16	R	Document reference
Firmware Version	03 – Read Holding Reg	40028 (0x001B)	UINT16	R	Version, MSB 8bits = major, LSB 8bits = minor
Diagnostic Flags History	03 – Read Holding Reg	40029 (0x001C)	UINT16	R	Bit Flags – see Description in section 5.2. – This is a history of any faults that have occurred and is stored in memory
Reserved	03 – Read Holding Reg	40030 (0x001D)	UINT16	R	Read will return power up default of 0

-continued-

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

D4 Valve with easy-Drive Actuator

October 2017

Instruction Manual

D103597X012

Table 8. Register Summary (continued)

DATA	LEGAL FUNCTION CODES	REGISTER (PHYSICAL)	TYPE	R/W	DESCRIPTION
Reserved	03 – Read Holding Reg	40031 (0x001E)	UINT16	R	Read will return power up default of 0
Valve type	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40032 (0x001F)	UINT16	R/W	1 = D3, 2 = D4
Control Type	03 – Read Holding Reg	40033 (0x0020)	UINT16	R	0 = On/Off, 1 = Proportional
Control Source	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40034 (0x0021)	UINT16	R/W	0 = Modbus RTU Register Commands, 1 = Local Control
Loss of control input/comms default position	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40035 (0x0022)	UINT16	R/W	Value 0-100 = 0-100% Position Valve 101 - Last Position
Deadband	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40036 (0x0023)	UINT16	R/W	Value 0-100 = 0-100% Level of hysteretic dead band applied to position control demand
Low travel cutoff	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40037 (0x0024)	UINT16	R/W	Blanking from zero position in percent
Communications Timeout	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40038 (0x0025)	UINT16	R/W	Timeout in seconds before loss of communications state is asserted
Communications Address	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40039 (0x0026)	UINT16	R/W	Modbus address in the range 1-247 (Default = 1)
Communications Baudrate	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40040 (0x0027)	UINT16	R/W	0 = 300 Baud, 1 = 600 Baud, 2 = 1200 Baud, 3 = 2400 Baud, 4 = 4800 Baud, 5 = 9600 Baud, (Default) 6 = 19200 Baud, 7 = 38400 Baud
Parity	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40041 (0x0028)	UINT16 (BOOL)	R/W	0 = Odd, 1 = Even, 2 = None ("None" available in version 4.21 only)
Reset Statistics	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40042 (0x0029)	UINT16 (BOOL)	R/W	0 = Reset Idle, 1 = Reset Active
Local Control Mode	03 – Read Holding Reg 06 – Write Single Reg 16 – Write Multiple Reg	40043 (0x002A)	UINT16	R/W	On/Off 0 = L2e dual dry contact 1 = Single dry contact Proportional 0 = 1-5V 1 = 4-20 mA

UINT16 – unsigned 16 bit variable, can take value 0-65535.

UINT32 – unsigned 32 bit variable, can take value 0-4294967295.

(Reserved) – registers used for development use only.

† - 32bit register contains data that spans two registers – reads and write of data needs to be performed within the same Modbus command function to ensure coherency of data.

Table 9. Fault Register – Fault Flags Summary Table

Diagnostic Flags – Bit Mask Value	Diagnostic Flags – Binary Mask Value	Description
0x8001	1000 0000 0000 0000	Fault in N.V. Memory – system has restored default settings
0x4000	0100 0000 0000 0000	Motor assembly stall
0x2000	0010 0000 0000 0000	Speed measurement fault
0x1000	0001 0000 0000 0000	System or Watchdog fault
0x0800	0000 1000 0000 0000	Overspeed condition
0x0400	0000 0100 0000 0000	Calibration span not in legal range
0x0200	0000 0010 0000 0000	Fault in N.V. Memory – system has recovered settings
0x0100	0000 0001 0000 0000	Communications Timeout
0x0080	0000 0000 1000 0000	Valve was shutdown while moving
0x0040	0000 0000 0100 0000	Valve span calibrated (informational)
0x0020	0000 0000 0010 0000	Valve position controller active (informational)
0x0010	0000 0000 0001 0000	Analog input – below 3mA/0.75V (informational)
0x0008	0000 0000 0000 1000	Motor Overspeed coast condition
0x0004	0000 0000 0000 0100	Modbus command has been sent (starts a calibrated system)
0x0002	0000 0000 0000 0010	Analog input initialized (system has seen input >3mA/1V)
0x0001	0000 0000 0000 0001	Start delay active (within 10 second calibration window)

A.2 Diagnostic Flags

The diagnostic register holds a 16 bit value that represents 16 individual flags, when set (value '1'), this indicates the following conditions have occurred or are still present, the highest 7 bits are latching and will be present in the register even if the initial cause for the flag being set is removed. If these flags are set, a reset needs to be performed to clear the fault.

A.2.1 Fault in NV Memory

This is a severe fault and is usually seen when the firmware is upgraded with a program that uses a different EEPROM/Non-volatile memory map. If this is not the case then the probable cause is a fault in the memory hardware.

A.2.2 Motor Assembly Stall

The valve plug was unable to move to the commanded position. The drive has attempted to move the motor by applying a non-zero PWM signal, and the speed has not been detected as greater than 0 with a 400ms period. This fault latches and needs to be reset.

A.2.3 Speed Measurement Fault

The controller detected pulses that correspond to the motor going much faster than the speed the speed measurement system is designed for – the integrity of the measurement cannot be relied upon. This fault latches and needs to be reset.

A.2.4 System or Watchdog Fault

The software system has been reset and this flag is set at power up if the case of the reset was the onboard watchdog either timing out OR being forced by program function call. This flag is used as an indication that this type of reset has occurred.

A.2.5 Overspeed Condition

The drive speed was detected as being over the speed 3300RPM. This fault latches and needs to be reset.

A.2.6 Calibration Span Not in Legal Range

Following a calibration the detected mechanical travel was detected as being too short for the valve type. This fault latches and needs to be reset.

A.2.7 Fault in NV Memory – recovered settings

This fault is similar to Fault in NV Memory but is different in that the settings were recovered, however it is possible the fault was due to a setting being changed during a power cycle. The settings need to be validated before valve operation.

A.2.8 Communications Timeout

This flag is set after a timeout or loss of valid communications, it will be cleared if communications is reestablished with the valve controller. If this flag is set and the control demand is set to be taken from the Modbus then the valve will be commanded to the 'Loss of communications position' in setting accessed at Modbus register 40034.

A.2.9 Valve was Shutdown while Moving

The valve was actuating while power was removed, the position information may be unreliable. Command valve to 0% to assure position information is accurate.

A.2.10 Valve Span Calibrated

The valve is calibrated.

A.2.11 Valve Position Controller Active

The valve is being actively controlled to go to a demanded position. The speed and position control loop logic is setting the pwm and direction demands to the ValuDrive motor.

A.2.12 Analog Input Below 3mA/0.75V

The analog input is below a set threshold of 3mA. If since being powered up this level has been met the flag 'Analog input initialized' will be set. If the control source is the analog input and this flag is set then the valve will be commanded to actuate to the 'Loss of control input' position.

A.2.13 Motor Overspeed Coast Condition

The drive speed was detected as being over the speed 2500RPM. The flag is cleared if the speed falls below the coast threshold level. This flag is used purely as a diagnostic.

A.2.14 Modbus Command Initialized

The system has received a command to the Position demand register since being powered up. If Modbus is the selected control mode the valve will be commanded to this position after the startup period.

A.2.15 Analog Input Initialized

The analog input has been detected as having a control signal within the expected range of 3-20mA. If the analog input is the selected control signal then this will activate the valve after the startup period.

A.2.16 Start Delay Active

This is a flag set during the startup phase of operation, if this is set then the valve may be recalibrated by sending the calibration signal sequence (100% demand followed by 0%). It is cleared to indicate normal operation (recalibration will then require a command to Modbus register 40003).

A.3 Register Description

A.3.1 40001 Position Demand – Proportional [Read & Write]

Register: 40001, Address 0x0000 (0).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a value between 0 and 100% to demand a valve position. This register will only be used by the system if the control source (set by register 40035) is set for Modbus RTU control. If the control type (set by register 40034) is On/Off then value will be resolved with a boolean set operation for a Open/Closed position demand variable output (e.g. Values 0-49 = '0' and 50-100 = '100'). This variable needs to be set to 100% then 0% after a power-up to calibrate an un-calibrated system.

A.3.2 40002 Reset Diagnostics [Read & Write]

Register: 40002, Address 0x0001 (1).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a modbus request to reset the system from a fault state (indicated if the Diagnostics flags register has any set faults). Writing a decimal 1 to the register will start a reset process only if the system has a fault, otherwise the write will be ignored. Once the fault reset request has been acknowledged the register will be set to decimal 0. Bit assignments are shown in table 9.

A.3.3 40003 Recalibrate Demand [Read & Write]

Register: 40003, Address 0x0002 (2).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: Writing a value of 1 to this register will force the system to clear any calibration information and go through a cycle of calibration.

A.3.4 40004 Analog Cal at 0% [Read & Write]

Register: 40004, Address 0x0003 (3).
Function code: 0x10 – Write Multiple registers,

Description: 0x06 – Write Single register, or
0x03 – Read Holding registers.
This is a register is used to initiate a calibration of the analog to digital circuit in the system. A write of a '1' will cause the system to store the value at the analog input. This action should be performed with a calibrated 1V or 4mA present at the analog input. If this is not performed the system uses defaults. Values outside the range 0-1 will return an exception code.

A.3.5 40005 Analog Cal at 100% [Read & Write]

Register: 40005, Address 0x0004 (4).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a register is used to initiate a calibration of the analog to digital circuit in the system. A write of a '1' will cause the system to store the value at the analog input. This action should be performed with a calibrated 5V or 20mA present at the analog input. If this is not performed the system uses defaults. Values outside the range 0-1 will return an exception code.

A.3.6 40004-40008 Reserved [Read Only]

Register: 40004-40008 Address 0x0003 (3) - 0x0007 (7).
Function code: 0x03 – Read Holding registers.
Description: Not used – reads will return a value of 0.

A.3.7 40009 Test Register [Read Only]

Register: 40009, Address 0x0008 (8).
Function code: 0x03 – Read Holding registers.
Description: A test register – can be used to confirm communications. Holds a power up default of 45964 (0xB38C Hex).

A.3.8 40010 Actual Position [Read Only]

Register: 40010, Address 0x0009 (9).
Function code: 0x03 – Read Holding registers.
Description: This is a value between 0 and 100% that indicates the physical position of a calibrated valve system. If the valve is un-calibrated (indicated if the Diagnostics flags register has a cleared calibration informational flag), then this register will read 0.

A.3.9 40011 Actual Demand [Read Only]

Register: 40011, Address 0x000A (10).
Function code: 0x03 – Read Holding registers.
Description: This is a value between 0 and 100% that indicates the demand to the position control loop from the active control source.

A.3.10 40012 Diagnostic Flags [Read Only]

Register: 40012, Address 0x000B (11).
Function code: 0x03 – Read Holding registers.
Description: This is a set of 16 bit flags that indicate the state of the system. The lower order byte contains flags that cause the system to go to a fault state – actuation of the valve will not be possible

until the cause of the fault condition has been removed and the fault condition reset by writing a reset request to register 40001. The upper order byte contains flags used to indicate the operational status of the valve actuator. See table 9 - Fault Register for details.

A.3.11 40013-40014 Number of Open/Close Cycles [Read Only]

Register: 40013-40014, Address 0x000C (12) – 0x000D (13).
Function code: 0x03 – Read Holding registers.
Description: This is a pair of registers that hold a 32bit number indicating the number of actuations of the valve. A cycle of moving the valve from closed to open and back closed will count as 2 cycles. The register needs to be read using a single read function command to ensure coherency of the data in the two registers.

A.3.12 40015-40016 Hours/Minutes Running [Read Only]

Register: 40015-40016, Address 0x000E (14) – 0x000F (15).
Function code: 0x03 – Read Holding registers.
Description: This is a pair of registers that hold a 32bit number indicating the number of hours the valve has been powered. The register needs to be read using a single read function command to ensure coherency of the data in the two registers. If version 4.13 firmware is installed, hours are displayed. If version 4.21 firmware is installed, minutes are displayed.

A.3.13 40017-40018 Hours/Minutes Open [Read Only]

Register: 40017-40018, Address 0x0010 (16) – 0x0011 (17).
Function code: 0x03 – Read Holding registers.
Description: This is a pair of registers that hold a 32bit number indicating the number of hours the valve has been in the open (100%) position. The register needs to be read using a single read function command to ensure coherency of the data in the two registers. If version 4.13 firmware is installed, hours are displayed. If version 4.21 firmware is installed, minutes are displayed.

A.3.14 40019-40020 Hours/Minutes Closed [Read Only]

Register: 40019-40020, Address 0x0012 (18) – 0x0013 (19).
Function code: 0x03 – Read Holding registers.
Description: This is a pair of registers that hold a 32bit number indicating the number of hours the valve has been in the closed (0%) position. The register needs to be read using a single read function command to ensure coherency of the data in the two registers. If version 4.13 firmware is installed, hours are displayed. If version 4.21 firmware is installed, minutes are displayed.

A.3.15 40021-40022 Number of Power up cycles [Read Only]

Register: 40021-40022, Address 0x0014 (20) – 0x0015 (21).
Function code: 0x03 – Read Holding registers.
Description: This is a pair of registers that hold a 32bit number of times the system has been successfully powered up. The register needs to be read using a single read function command to ensure coherency of the data in the two registers.

A.3.16 40023-40024 Serial Number [Read Only]

Register: 40023-40024, Address 0x0016-0x0017 (22-23).
Function code: 0x03 – Read Holding registers.

Description: This is a pair of registers that hold a 32 bit number that can be used to hold a unique serial number. The register needs to be read using a single read Modbus function transaction command to ensure coherency of the data in the two registers.

A.3.17 40025 Analog I/P value [Read Only]

Register: 40025, Address 0x0018 (24).
Function code: 0x03 – Read Holding registers.
Description: This is a register that holds a 16 bit scaled representation of the analog input. It is scaled according to input i.e. 0-200 for 0-20.0mA and 0-50 for 1-5 V.

A.3.18 40026 Firmware Project Code [Read Only]

Register: 40026, Address 0x0019 (25).
Function code: 0x03 – Read Holding registers.
Description: This is a register that holds the SRD project code (SRD422) – 422. This is the code used in version control of SRD documents and source code.

A.3.19 40027 Firmware Document Reference [Read Only]

Register: 40027, Address 0x001A (26).
Function code: 0x03 – Read Holding registers.
Description: This is a register that holds the SRD document code (SRD422-5007) – 5007. This code along with the project code is used in version control of SRD documents and source code.

A.3.20 40028 Firmware Version [Read Only]

Register: 40028, Address 0x001B (27).
Function code: 0x03 – Read Holding registers.
Description: This is a register that holds the hex encoded equivalent of a four digit decimal version number of the firmware, the high order 8bits encode the whole number of the version and the low order 8 bits the fraction, e.g. v1.16 would be encoded 0x0110, v2.66 would be 0x0242. Together with the data from registers 40026- 40028 it is possible to determine the unique identity of the code being run in the processor.

A.3.21 40029 Diagnostic Flags [Read Only]

Register: 40029, Address 0x001C (28).
Function code: 0x03 – Read Holding registers.
Description: This is a set of 16 bit flags that show the accumulation of fault flags that have occurred – as faults are self resetting. The register is stored in non-volatile memory. The mapping is the same as the diagnostic register at 40012. See table 9 - Fault Register for guide to values.

A.3.22 40030-40031 Reserved [Read Only]

Register: 40030-40031, Address 0x001D-0x001E (29-30).
Function code: 0x03 – Read Holding registers.
Description: Not used – reads will return a value of 0.

A.3.23 40032 Valve Type [Read & Write]

Register: 40032, Address 0x001F (31).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a register that holds an enumeration of the three types of valve. This is used to set up several internal variables and constants. Writes outside of the legal range 0-2 will be rejected with an exception code.

A.3.24 40033 Control Type [Read Only]

Register: 40033, Address 0x0020 (32).
Function code: 0x03 – Read Holding registers.
Description: This is a register that holds an enumeration of the control type – either 0 for On/Off, or 1 for proportional control.

A.3.25 40034 Control Source [Read & Write]

Register: 40034, Address 0x0021 (33).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a register that holds an enumeration of the control source – either 0 for Modbus RTU control, or 1 for signals local to the system – decided by the contents of register 40032. Note that if the Modbus serial link is not the active mode then the faults associated with serial communications will be disabled, although serial communications for such activities as test and debug monitoring of the analog input will all still function. Writes outside of the legal range 0-1 will be rejected with an exception code.

A.3.26 40035 Loss of Control Default Position [Read & Write]

Register: 40035, Address 0x0022 (34).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a register that holds a position demand 0-100% that will be applied to the position control loop if the active control source is determined to be corrupt or out of normal operating specification, this applies to modbus communications messages being absent or the analog input being un-calibrated or below 3mA/0.75V(open control loop). Writes outside of the legal range 0-100 will be rejected with an exception code.

A.3.27 40036 Deadband [Read & Write]

Register: 40036, Address 0x0023 (35).
Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.
Description: This is a register that holds an integer value of percentage hysteresis used to discriminate against noise entering the control system from the selected control source, this can take a value of 0-100%, e.g. a value of 100 would make the system only respond to 0 or 100% demands. Writes outside of the legal range 0-100 will be rejected with an exception code.

A.3.28 40037 Low travel Cutoff [Read & Write]

Register: 40037, Address 0x0024 (36).
 Function code: 0x10 – Write Multiple registers, 0x06 – Write Single register, or 0x03 – Read Holding registers.
 Description: This is a register that holds an integer value of percentage used as a clamp – any position demand less than this value will be clamped to zero before being passed to the position control system.

A.3.29 40038 Communications Timeout [Read & Write]

Register: 40038, Address 0x0025 (37).
 Function code: 0x10 – Write Multiple registers, 0x06 – Write Single register, or 0x03 – Read Holding registers.
 Description: This is a register that holds a value 0-65535 that is the number of seconds for a timeout before the modbus serial communications channel is determined to be uncommunicative (0 - ~18Hrs). A valid addressed message must be received by the system within this time limit if the active control source is Modbus RTU communications. If the time without communications is exceeded the system will fault and the valve commanded to the default loss of communications position. A value of 0 can be used to disable this feature. If communications is resumed then the flag will be cleared and the valve will take the refreshed position as a demand. The use of this register is shown in table 9 - Fault Register.

A.3.30 40039 Communications Address [Read & Write]

Register: 40039, Address 0x0026 (38).
 Function code: 0x10 – Write Multiple registers, 0x06 – Write Single register, or 0x03 – Read Holding registers.
 Description: This is a register that holds a value 1-247 that is the Modbus address used by the system on power up. Values outside the range 1-247 will return an exception code

A.3.31 40040 Communications Baudrate [Read & Write]

Register: 40040, Address 0x0027 (39).
 Function code: 0x10 – Write Multiple registers, 0x06 – Write Single register, or 0x03 – Read Holding registers.
 Description: This is a register that holds a value 4-6 that is an enumeration of the baudrate used by the system on power up.

A.3.32 40041 Parity [Read & Write]

Register: 40041, Address 0x0028 (40).
 Function code: 0x10 – Write Multiple registers, 0x06 – Write Single register, or 0x03 – Read Holding registers.
 Description: This is a register that holds an enumeration of the parity type used by the Modbus serial interface – either 0 for Odd, or 1 for Even in version 4.13 firmware (version 4.21 firmware defines 0=Odd, 1=Even, 2=None). Writes outside of the legal range will be rejected with an exception code.

A.3.33 40042 Reset Statistics [Read & Write]

Register: 40042, Address 0x0029 (41).

Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.

Description: This is a register used to reset the non volatile system statistics (such as number of hours run). Writing a value of 1 to these registers will reset the values that accessed in registers 40013-40022 to 0.

A.3.34 40043 Analog Input Mode [Read & Write]

Register: 40043, Address 0x002A (42).

Function code: 0x10 – Write Multiple registers,
0x06 – Write Single register, or
0x03 – Read Holding registers.

Description: This is a register that holds an enumeration 0-1 that sets the mode of operation for on/off and proportional control. When in proportional mode (40033 = 1), a value of 0 sets the unit for using a 1-5V voltage input. 1 sets up the unit for using a 4-20 mA current command input. The scaling of the different modes is reflected in the scaling of the value reported in register at 40023 – ‘Analog I/P value’. When in on/off mode (40033 = 0), a value of 0 sets the unit for using both digital inputs, optimized for using the L2e level controller. 1 sets up the unit for using a single digital input. See Operation for further details.

A.4 Example Modbus Protocol Transactions

A.4.1 Write to Position Demand Register (40002/0x0001/1)

Write of a position demand value of 100% to device at address 1 on the Modbus network – 8 characters.

FIELD	SLAVE ADDRESS	FUNCTION CODE	REGISTER ADDRESS HI	REGISTER ADDRESS LO	REGISTER DATA HI	REGISTER DATA LO	CRC LO	CRC HI
Index	0	1	2	3	4	5	6	7
Hex (Dec)	0x01 (1)	0x06 (6)	0x00 (0)	0x01 (1)	0x00 (0)	0x64 (100)	0xD9 (217)	0xE1 (225)

Normal response, 8 characters:

FIELD	SLAVE ADDRESS	FUNCTION CODE	REGISTER ADDRESS HI	REGISTER ADDRESS LO	REGISTER DATA HI	REGISTER DATA LO	CRC LO	CRC HI
Index	0	1	2	3	4	5	6	7
Hex (Dec)	0x01 (1)	0x06 (6)	0x00 (0)	0x01 (1)	0x00 (0)	0x64 (100)	0xD9 (217)	0xE1 (225)

Write of a position demand value of 101% to device at address 1 on the Modbus network, note that this value (101% is outside the legal range of values permitted to be written to this address, so an exception frame is generated – 8 characters.

FIELD	SLAVE ADDRESS	FUNCTION CODE	REGISTER ADDRESS HI	REGISTER ADDRESS LO	REGISTER DATA HI	REGISTER DATA LO	CRC LO	CRC HI
Index	0	1	2	3	4	5	6	7
Hex (Dec)	0x01 (1)	0x06 (6)	0x00 (0)	0x01 (1)	0x00 (0)	0x65 (101)	0x18 (24)	0x21 (33)

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

D4 Valve with easy-Drive Actuator

October 2017

Instruction Manual

D103597X012

Exception response, write not OK – slave device failure (Code 4), error code is function code with 0x80 added, 5 characters returned:-

FIELD	SLAVE ADDRESS	ERROR CODE	EXCEPTION CODE	CRC LO	CRC HI
Index	0	1	2	3	4
Hex (Dec)	0x01 (1)	0x06 (6)	0x00 (0)	0x18 (24)	0x21 (33)

A.4.2 Read of Actual Position (40010/0x0009/9)

Read of actual position from device at address 1 on the Modbus network using read holding register function – 8 characters.

FIELD	SLAVE ADDRESS	FUNCTION CODE	REGISTER ADDRESS HI	REGISTER ADDRESS LO	QUANTITY OF REGS HI	QUANTITY OF REGS LO	CRC LO	CRC HI
Index	0	1	2	3	4	5	6	7
Hex (Dec)	0x01 (1)	0x03 (3)	0x00 (0)	0x09 (9)	0x00 (0)	0x01 (1)	0x54 (84)	0x08 (8)

Normal response (returning a value of 0%), 7 characters returned:-

FIELD	SLAVE ADDRESS	FUNCTION CODE	BYTE COUNT	REGISTER ADDRESS HI	REGISTER ADDRESS LO	CRC LO	CRC HI
Index	0	1	2	4	5	6	7
Hex (Dec)	0x01 (1)	0x03 (3)	0x02 (2)	0x00 (0)	0x00 (0)	0xB8 (184)	0x44 (68)

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Fisher™ D4 Control Valve with Gen 2 easy-Drive™ Electric Actuator



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Appendix B: Certificate of Conformance

Section 1: Introduction

1.1 Scope of the Manual

This instruction manual provides installation, maintenance and parts information for the Fisher D4 control valve with Gen 2 easy-Drive electric actuator. For Gen 1 electric actuators, use Fisher D4 with easy-Drive Instruction Manual, (D103597X012). If the actuator has a RPU-100 installed, refer to easy-Drive RPU-100 Instruction Manual, (D104551X012).



WARNING



Do not install, operate, or maintain a D4 control valve with Gen 2 easy-Drive electric actuator without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. Fisher D4 Control Valve with Gen 2 easy-Drive Electric Actuator



W9933-5

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

D4 Valve with Gen 2 easy-Drive Actuator

June 2026

Instruction Manual

D104188X012

Table 1. Specifications

Valve Body Sizes and End Connection Styles ⁽¹⁾	Power Requirements
See Table 2.	11 to 30 V DC, minimum 4 A power supply required (fuse to 5 A)
Maximum Inlet Pressures and Temperatures ⁽¹⁾	Maximum Current Draw
If the valve nameplate shows an ASME pressure-temperature class, maximum inlet pressure and temperature is consistent with the applicable class per ASME B16.34. If the nameplate does not show an ASME class, it will show a maximum cold working pressure at 38°C / 100°F (for example, 293 bar / 4250 psi).	4 A
Maximum Pressure Drops ⁽¹⁾	Idle Current Draw
See Table 4.	15 mA at 24 V DC, 25 mA at 12 V DC
Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4	Conduit Connections
Class IV	Two 3/4 NPT connections
Material Temperature Capabilities ⁽¹⁾	Stroke Length
Valve Body Assembly: Standard Bonnet O-ring: -40 to +135°C / -40 to +275°F Optional Fluorocarbon Bonnet O-ring: -23 to +204°C / -10 to +400°F	19 mm / 0.75 in.
Flow Characteristic	Nominal Stroke Speed ⁽²⁾
Equal percentage	3.9 mm/s / 0.15 in./s at 24 V DC 2.2 mm/s / 0.09 in./s at 12 V DC
Flow Direction	Hazardous Area Approvals
Flow up only	CSA (C/US): Explosion-Proof Class I, Division 1, Groups C and D, T6, Ex db IIA T6, Class I, Zone 1, AEx db IIA T6 ATEX Flameproof - Gas:  II 2 G, Ex db IIA T6 Gb IECEx Flameproof - Gas: Ex db IIA T6 Gb
Port Diameters	Enclosure Rating
See Table 2.	Type 4X and IP66
Valve Plug Travel	Duty Cycle
19 mm / 0.75 in.	50% maximum
Valve Plug Style	Enclosure Material
Micro-Form valve plug	Cast aluminum alloy with powder coat paint
Available Actuator Configurations	Approximate Weight:
On/off (snap acting) Positioning (flow or pressure control)	22 to 51 kg / 49 to 113 lbs, depending upon construction
1. The pressure or temperature limits in the referenced tables and any applicable ASME code limitations should not be exceeded. 2. 10% variation can be expected, based on temperature and pressure of application.	

1.2 Description

The D4 control valve with easy-Drive electric actuator is a compact, rugged valve designed primarily for high-pressure throttling applications. This valve is ideal for use on pressure and flow control applications within the oil and gas production industry. The D4 valve also makes an excellent dump valve for high-pressure separators and scrubbers.

The D4 control valve meets the metallurgical requirements of NACE MR0175/ISO 15156 without environmental limits for temperatures below 135°C / 275°F. If the temperature is above 135°C / 275°F, the N07718 Belleville washers will impose some limits, as shown in Table 3.

1.3 Specifications

Table 1 lists specifications for the D4 control valve with easy-Drive electric actuator. Some of the specifications for a given control valve as it originally comes from the factory are stamped on a nameplate located on the lower actuator enclosure.

1.4 Education Services

For information on available courses for the Fisher D4 control valve with easy-Drive electric actuator, as well as a variety of other products, contact:

Emerson Educational Services

Phone: 800-338-8158

Email: education@emerson.com

emerson.com/en/final-control/services/valve-training

Table 2. Valve Sizes and Connection Styles

VALVE SIZE, NPS	PORT DIAMETER, IN.	SCREWED	RAISED FACE (RF) FLANGED				RING TYPE JOINT (RTJ) FLANGED	
		4250 psi	CL150	CL300	CL600	CL900 and CL1500	CL600	CL900 and CL1500
1	0.25, 0.375, 0.5, 0.75	X	X	X	X	X	X	X
2	0.25, 0.375, 0.5, 0.75, 1, 1.25	X	X	X	X	X	X	X

X = Available construction.

Table 3. D4 Environmental Limits for NACE MR0175/ISO 15156 with Sour Trim

MAXIMUM TEMPERATURE		MAXIMUM H ₂ S PARTIAL PRESSURE		COMPATIBLE WITH ELEMENTAL SULFUR
°C	°F	MPa	psia	
232	450	0.2	30	No
204	400	1.4	200	No
199	390	2.3	330	No
191	375	2.5	360	No
149	300	2.8	400	No
135	275	No Limit		Yes

Table 4. Fisher D4 easy-Drive Maximum Pressure Drop

PORT DIAMETER		MAXIMUM PRESSURE DROP ⁽¹⁾	
mm	in.	bar	psi
6.4	0.25	293	4250 ⁽¹⁾
9.5	0.375	293	4250 ⁽¹⁾
12.7	0.5	247	3576 ⁽¹⁾
19.1	0.75	105	1518
25.4	1	56	814
31.8	1.25	34	495

1. Downstream pressure, P₂, is limited to 2250 psig.

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts or by uncontrolled process fluid, be certain the service conditions do not exceed the limits shown on the valve nameplate and in Table 1. Use pressure-relieving devices required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

For explosion-proof applications, ensure the actuator cover is properly bolted before applying power to the actuator. Personal injury or property damage may result from fire or explosion if power is applied to the actuator with the cover removed in a hazardous area.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 457 mm / 18 in. from the actuator. Personal injury or property damage may result from explosion if the seal is not installed.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional and national codes for any given hazardous area approval. Failure to follow the local, regional and national codes could result in personal injury or property damage from fire or explosion.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

NOTICE

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag or other foreign material from the pipeline.

⚠ WARNING

Avoid personal injury or property damage caused by possible actuator failure. The use of a rigidly-mounted support on the actuator casing may cause additional stress on the actuator leading to premature wear and/or failure of the actuator components.

1. Before installing the control valve assembly, inspect it for any damage and for any foreign material that may have collected in the valve body.
2. Remove any pipe scale, welding slag and other foreign material from the pipeline.
3. The control valve can be installed in any position, but normally the actuator is vertical above the valve. Install the valve so the flow direction arrow on the side of the valve indicates the direction of the process flow.
4. Install the valve following local and national piping codes when they apply to the application. For screwed connections, treat the external pipe threads with a good grade pipe compound. For flanged valves, use suitable gaskets between valve and pipeline flanges.
5. If continuous operation is required during maintenance and inspection, install a conventional three-valve bypass around the valve.

2.1 Special Instructions for “Safe Use” and Installations in Hazardous Locations

ATEX/IECEx



WARNING

To avoid static discharge from the enclosure, do not rub or clean the enclosure with solvents. To do so could result in an explosion. Clean with a mild detergent and water only.

The enclosure is non-conducting and may generate an ignition-capable level of electrostatic charges under certain extreme conditions. The user should ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as highpressure steam) which might cause a build-up of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment shall only be done with a damp cloth.

NOTICE

To avoid damage to the enclosure, when screws are fully tightened into blind holes in enclosure walls, with no washer fitted, at least one full thread shall remain free at the base of the hole.

2.2 Startup Overview

Figure 2. Flowchart

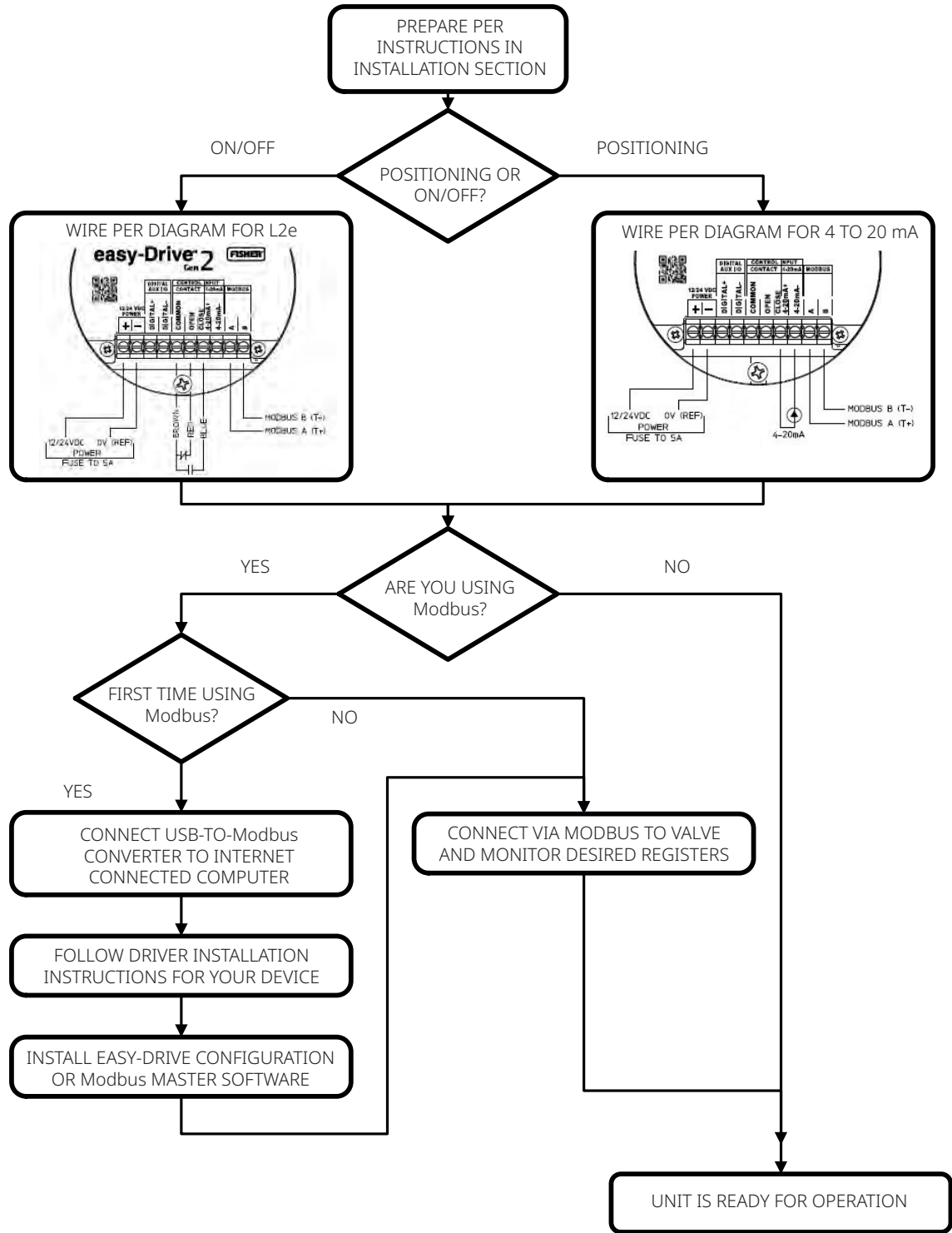
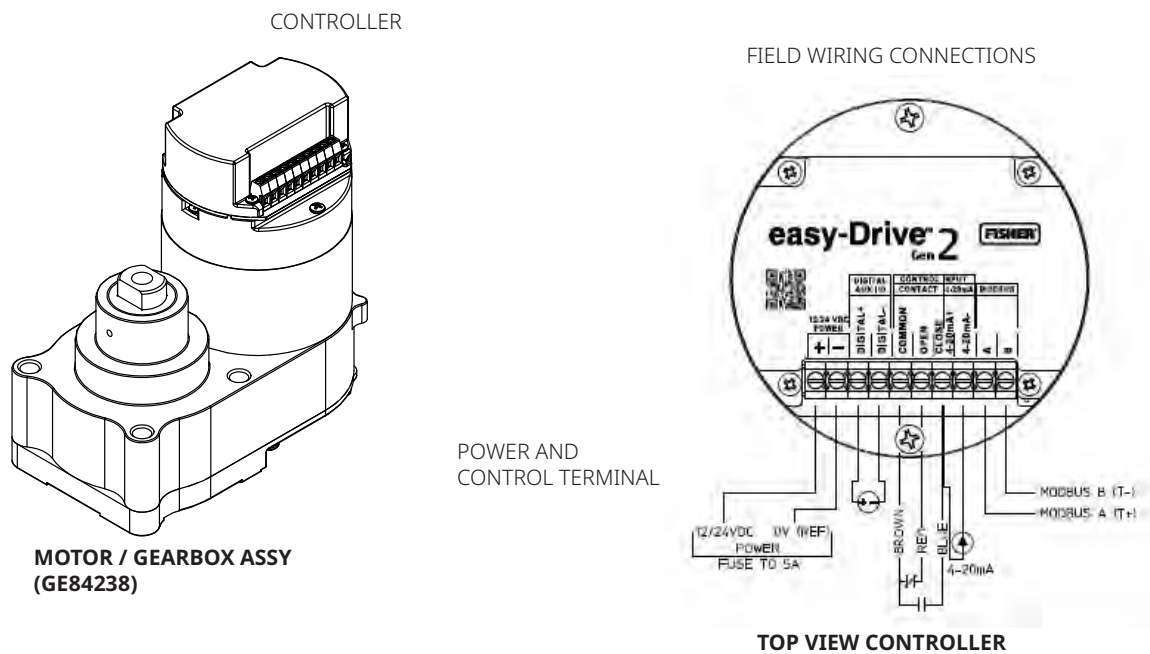


Figure 3. Fisher D4 Valve with Gen 2 easy-Drive Actuator Wiring Diagram



GE47302-7

Power Requirements

Ensure a stable DC power source is available, maintaining less than 5% ripple and sufficiently surge protected for the application. A 4 amp (minimum) power supply is required.

Wiring Instructions

1. Observe local wiring requirements for hazardous location usage.
2. Conduit seals within 450 mm / 18 in. of the enclosure port are required for explosion-proof installation.
3. 18 AWG / 0.52 mm² to 12 AWG / 3.31 mm² wire size required.
4. Fuse system to 5 A.
5. Connect enclosure and analog signal shields.
6. Ensure power is turned off before connecting the wires.

Power

1. Connect 12 or 24 V DC reference to: –
2. Connect 12 or 24 V DC positive to: +
3. Be sure to tighten terminals sufficiently to ensure solid mechanical connection.

Figure 4. Wiring - Analog Input

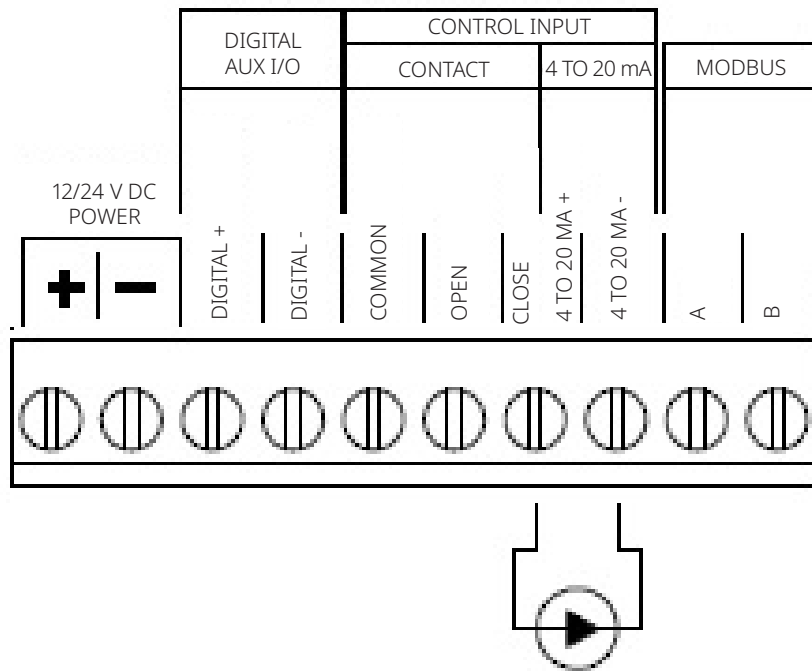


Figure 5. Wiring - L2e

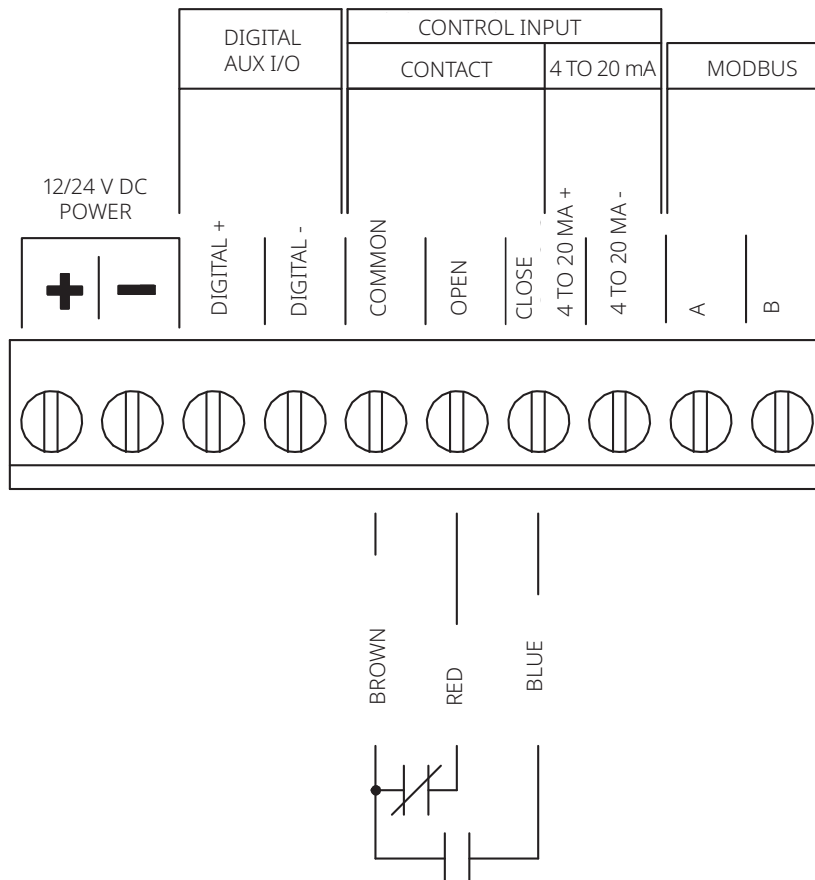


Figure 6. Wiring - Single Dry Contact

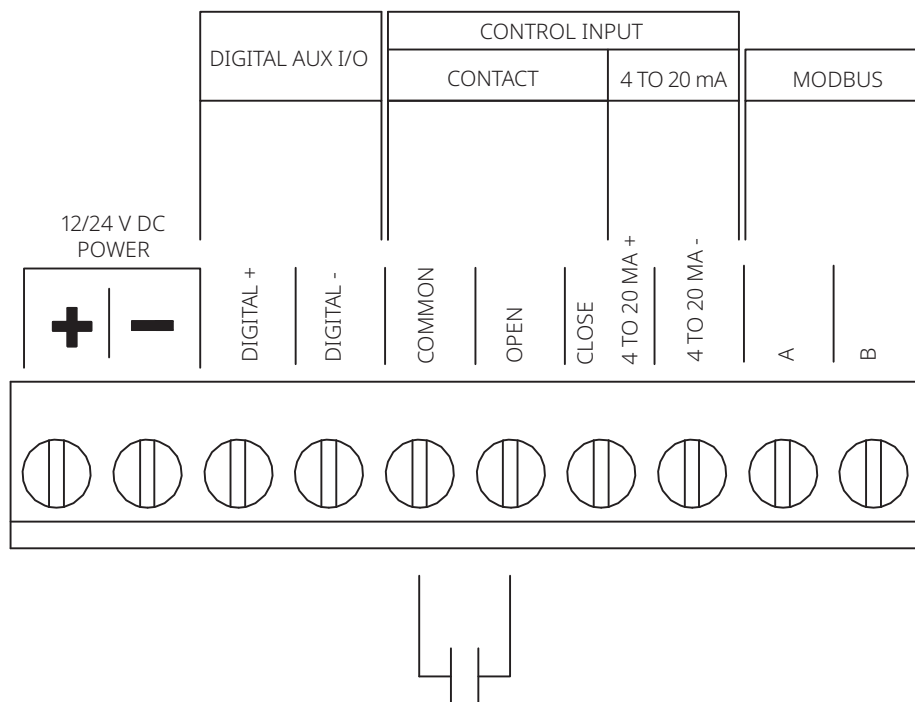


Figure 7. Wiring - Modbus Input

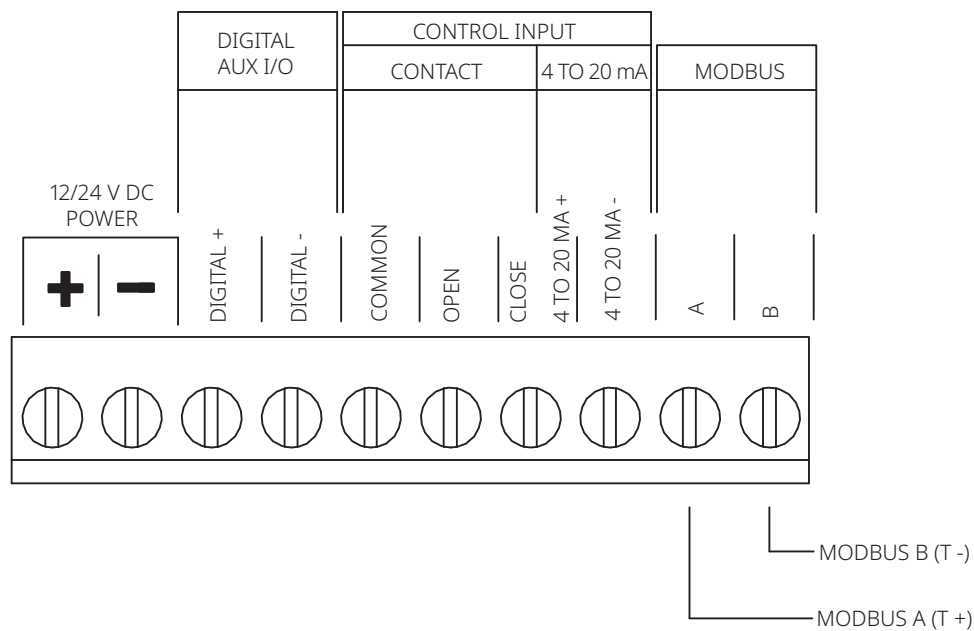


Figure 8. Wiring - Auxiliary Digital I/O Set to Input (40080=0)

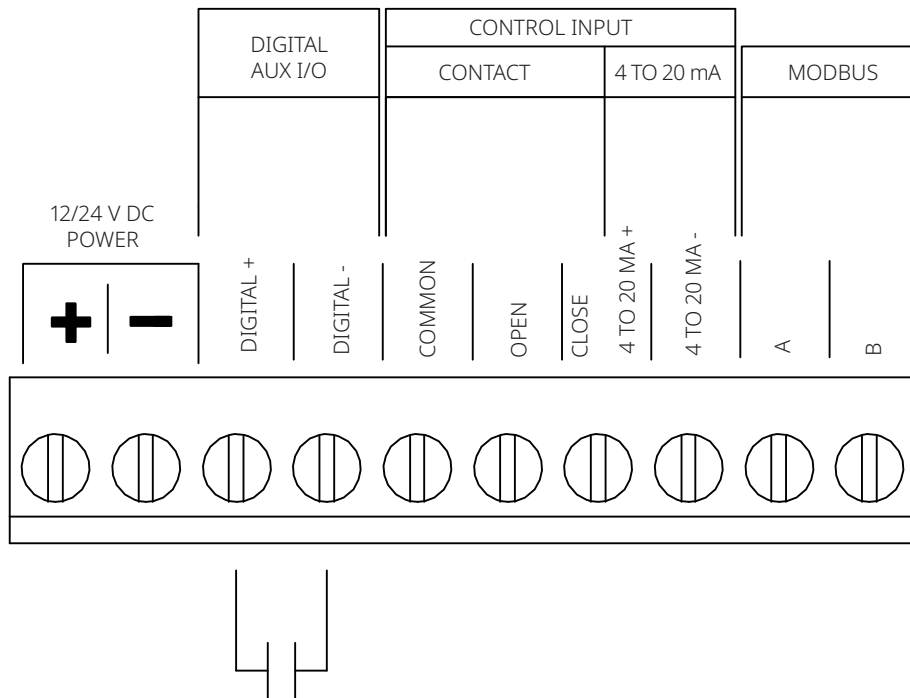
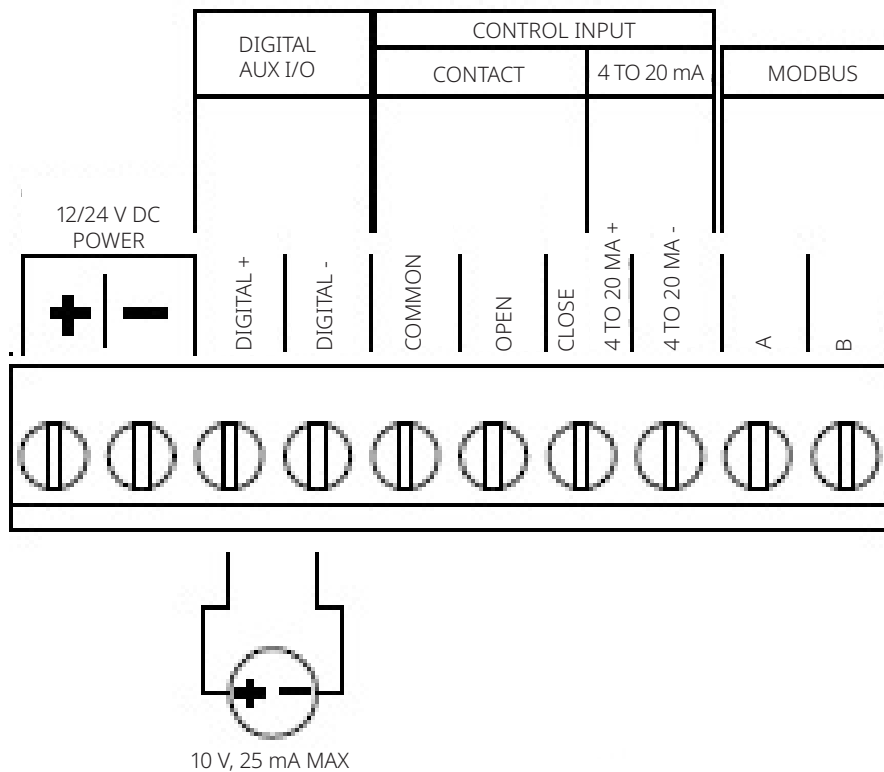


Figure 9. Wiring - Auxiliary Digital I/O Set to Output (40080=1)



2.3 Default Input Signals

The D4 with easy-Drive comes from the factory calibrated and ready for use with the following default input signals shown in Table 5.

Table 5. D4 easy-Drive Default Input Signals

CONFIGURATION	ON/OFF	POSITIONING
Input Signal	L2e (dual dry contact)	4 to 20 mA

If the input signal of the application matches Table 5, proceed to the Wiring Instructions section. If the input signal of the application does not match Table 5, proceed to the Configuration section.

2.4 Configuration

Input Configuration

There are two functional configurations available for the easy-Drive electric actuator: On/Off and Positioning. It is possible to change an actuator from On/Off to Positioning after it has been delivered from the factory using a positioning license key. See Licensing section.

All available input signals are shown in Table 6.

Table 6. All Available Input Signals

CONFIGURATION	ON/OFF			POSITIONING	
Control Source	Modbus	Local		Modbus	Local
Input Signal	Modbus	L2e Dual Dry Contact (default)	Single Dry Contact	Modbus	4 to 20 mA (default)

If you are using the default inputs signals and the valve has not been disassembled or adjusted in any way, there is no need to recalibrate the assembly. You can proceed directly to Startup (page 21).

Changing the Inputs from Default Settings

All configuration within the valve is done by setting values in Modbus registers. This can be done using any Modbus master (flow computer, PLC, PC). Configuration software, providing a visual interface to the registers, is available through your [Emerson sales office](#) or the Fisher website, at www.emerson.com/en-us/catalog/fisher-easy-drive.

2.5 Modbus setup

Use of a serial or USB to RS-485 device is required to connect to the actuator. Refer to manufacturer's requirements for installation. The D4 with easy-Drive electric actuator Modbus factory defaults are Address 1, 9600 baud, even parity, 1 stop bit, MSB.

When a connection has been achieved, the actuator may be configured to accept the input signal over the Modbus link (ignoring the physical inputs) and the Modbus settings may be changed to accommodate the network to which it is attached. Other changes to functionality are possible, such as:

- Low level cutoff: 40054 (default is 5%)
- Position upon loss of signal: 40053 (default is 0%)

See Appendix A for a full map of Modbus registers and their functions.

Figure 10. Fisher easy-Drive Configuration Software



Connecting Using the Fisher easy-Drive Configuration Software

The Fisher easy-Drive configuration software allows configuration and diagnosing of the Fisher easy-Drive electric actuator with a graphical interface. Connect a PC to the actuator using a USB or serial device to Modbus RTU converter using the wiring instructions. The USB or serial device will be visible in the drop menu under Serial Port Settings. Baud rate and parity should be set to the Modbus settings of the actuator. Default actuator settings are address 1, 9600 baud, even parity, 1 stop bit, MSB. Press the AUTO button in the upper left corner to connect to the valve.

Use the Fisher easy-Drive configuration software (Figure 10) to make the desired changes or register values may be changed to allow different functionality.

NOTE

If an actuator is on/off, a Modbus command of 0 to 499 in register 40001 will cause the valve to close fully, while a value of 500 to 1000 will cause the valve to open fully. The command register has one implied decimal point.

Initial Setup

The control method selection determines what control signal to which the valve will respond. Only the control signal selected will result in movement of the valve; all others will be ignored. The control methods available are dependent upon the licensing tier purchased with the valve. The functions for each tier are shown below.

- On/Off Tier
 - Dual Contact On/Off
 - Single Contact On/Off
 - Modbus On/Off
- Positioning Tier - License required (see Licensing section)
 - Dual Contact On/Off
 - Single Contact On/Off
 - Modbus On/Off
 - Modbus Positioning
 - 4 to 20 mA Positioning
 - 4 to 20 mA Level

When using the easy-Drive Configuration Tool, clicking on the "Control Method" box will create a drop menu as shown. Select the desired control source; the selection will turn yellow. A box with Pending Changes will appear showing all changers. Press "APPLY" and the valve will immediately respond to that signal only.

Figure 11. Initial Setup



Calibration Instructions

WARNING

To avoid personal injury or property damage, be aware that the valve will open fully and then close fully during the calibration cycle.

If an easy-Drive valve has been shipped from the Fisher factory, it is not necessary to perform a span calibration. If, however, the valve has a new controller board or maintenance has been performed on the valve, such as trim replacement, it will be necessary to perform a span calibration. A span calibration is accomplished by the following method:

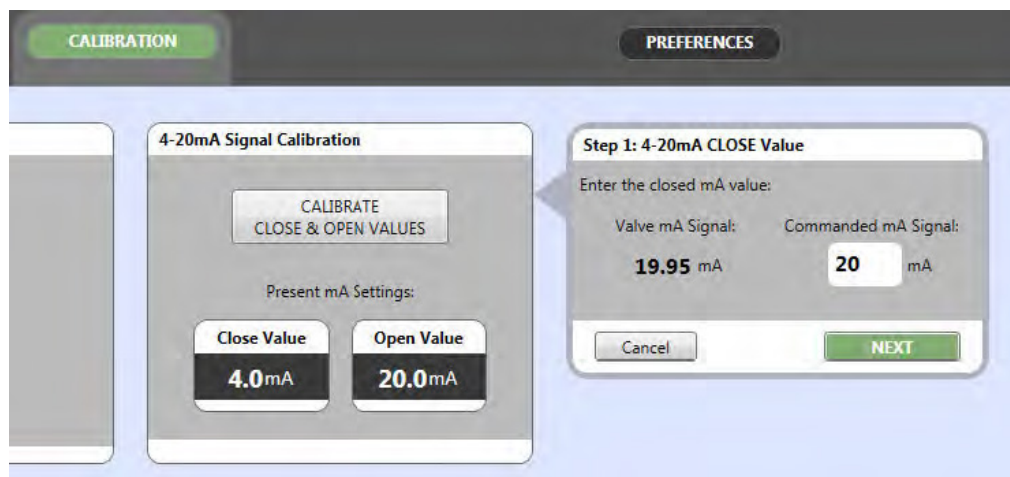
1. Ensure the process and valve are in a safe state – the valve may move during this operation.
2. Press the CALIBRATE SPAN button to initiate the span calibration. The software will show a progress bar during the calibration and display Valve Span Calibrated when complete.

Analog Input Calibration

For valves using 4 to 20 mA as a control source, several options are available to customize control of the actuator. Use a 4 to 20 mA signal generator to provide the desired signal. It is possible to calibrate the 4 to 20 mA signal in reverse acting or split-ranging with the method below with at least 4 mA of signal difference between the close and open values. The example shows a valve being changed from normal to reverse acting during the calibration process.

1. With the Control Method set to 4 to 20mA Positioning or 4 to 20mA Level, enter the Calibration screen and the 4 to 20mA Signal Calibration window will be visible.
2. Click the CALIBRATE CLOSE & OPEN VALUES button. A separate window will open to guide through the process.
3. Set the 4 to 20 mA signal to the desired value for when the valve is to be closed.
4. Enter this value into the Calibrated mA Signal text box and press Next.

Figure 12. Analog Input Calibration



5. Set the 4 to 20 mA signal to the desired value for when the valve is to be open.
6. Enter this value into the Calibrated mA Signal text box and press Next.

Figure 13. Analog Input Calibration

The screenshot displays the 'CALIBRATION' tab with a 'PREFERENCES' button. The main area is titled '4-20mA Signal Calibration' and contains a 'CALIBRATE CLOSE & OPEN VALUES' button. Below this, 'Present mA Settings' are shown: 'Close Value' at 4.0mA and 'Open Value' at 20.0mA. A modal window titled 'Step 2: 4-20mA Open Value' is open, prompting the user to 'Enter the opened mA value:'. It shows 'Valve mA Signal' as 3.99 mA and 'Commanded mA Signal' as 4 mA. The modal has 'Cancel' and 'NEXT' buttons.

7. If the Close and Open values are as expected, press Confirm to accept these values. If not, press Cancel to restart the process.

NOTE

The value of the 4 to 20 mA signal must have at least 4 mA difference between the close and open signals. A differential less than that amount will cause the actuator to reject the calibration and use the previous values.

Should the entered values vary more than 10% from the expected 4 to 20 mA values; the actuator will accept the calibration and a Notification displaying "Questionable Analog Calibration" will result.

Figure 14. Analog Input Calibration

The screenshot shows the 'Notifications' tab with a 'Statistics' button. Under the 'Alerts' section, there is a notification titled 'Questionable Analog Calibration' with a yellow warning icon. Below the notification is a 'CLEAR ...' button.

Calibration with the use of Modbus

1. After the unit has been properly wired and fused per instructions in the Wiring section of this instruction manual, turn power to the unit on.
2. Calibrate using Modbus:
 - a. Send position command of 0% to actuator to prevent unexpected motion. Valve will move to commanded position following the calibration procedure.
 - b. Send a value of 1 to register 40043. Valve plug will move to fully open position and then to fully closed. The valve plug will then return to the commanded position.

If a Modbus connection is not available and recalibration is desired, use the appropriate calibration method as determined by the control method of your valve.

Calibration without the use of Modbus

3. Turn power to the actuator off.
4. Wait for 10 seconds to ensure all circuits have discharged.
5. Return power to the actuator and use the appropriate calibration method for your control signal. Calibration sequence must be done within 15 seconds of power being switched on.
6. For positioning operation using 4 to 20 mA:
 - a. Apply a 4 mA signal between pins 4 to 20 mA - and 4 to 20 mA +. If Span is currently uncalibrated, valve plug will not move at this time.
 - b. Apply a 20 mA signal between pins 4 to 20 mA - and 4 to 20 mA +. If Span is currently uncalibrated, valve plug will not move at this time.
 - c. Apply a 4 mA signal between pins 4 to 20 mA - and 4 to 20 mA +; valve plug will move to the upper stop, immediately followed by moving to the lower, closed position.
 - d. If calibration of the analog input is desired to improve positional accuracy, an optional operation is listed on page 16 titled Analog Input Calibration.
7. For On/Off operation using dual-input dry contact:
 - a. Close the contact to create a short between pins COMMON and CLOSE. If Span is currently uncalibrated, valve plug will not move at this time.
 - b. Close the contact to create a short between pins COMMON and OPEN. If Span is currently uncalibrated, valve plug will not move at this time.
 - c. Close the contact to create a short between pins COMMON and CLOSE; valve plug will move to the upper, open position and then to the lower, closed position.
6. For On/Off operation using single dry contact:
 - a. Open the contact to create an open circuit between pins COMMON and OPEN. If Span is currently uncalibrated, valve plug will not move at this time.
 - b. Close the contact to create a short between pins COMMON and OPEN. If Span is currently uncalibrated, valve plug will not move at this time.

- c. Open the contact to create an open circuit between pins COMMON and OPEN; valve plug will move to the upper, open position and then to the lower, closed position.
7. The unit is now calibrated.

Licensing

The Gen 2 easy-Drive actuator has two differing modes of operation: On/Off and Positioning. The On/Off mode is intended for snap-acting applications where the valve is either fully open or fully closed. In this mode, the valve plug cannot remain at any intermediate position; it will move to a fully closed or fully open position only. For applications that require the actuator to control over the full range of motion, it is necessary to have a Positioning license installed. A positioning license will allow access to 4 to 20 mA positioning, 4 to 20 mA level control and Modbus positioning.

Positioning licenses can be purchased with the actuator and installed at the factory or can be installed at a later date by use of a license key on a USB license dongle. Installation of the license can be completed using the configuration software.

1. Insert the USB license dongle into the computer connected to the Gen 2 easy-Drive actuator.

Figure 15. USB License Dongle



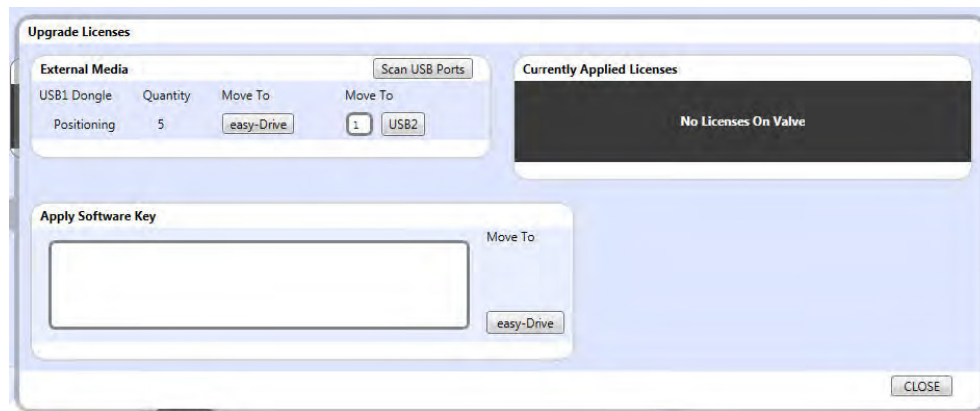
2. Click the button labelled MANAGE LICENSES on the left side of the configuration software screen.

Figure 16. Configuration Software Screen



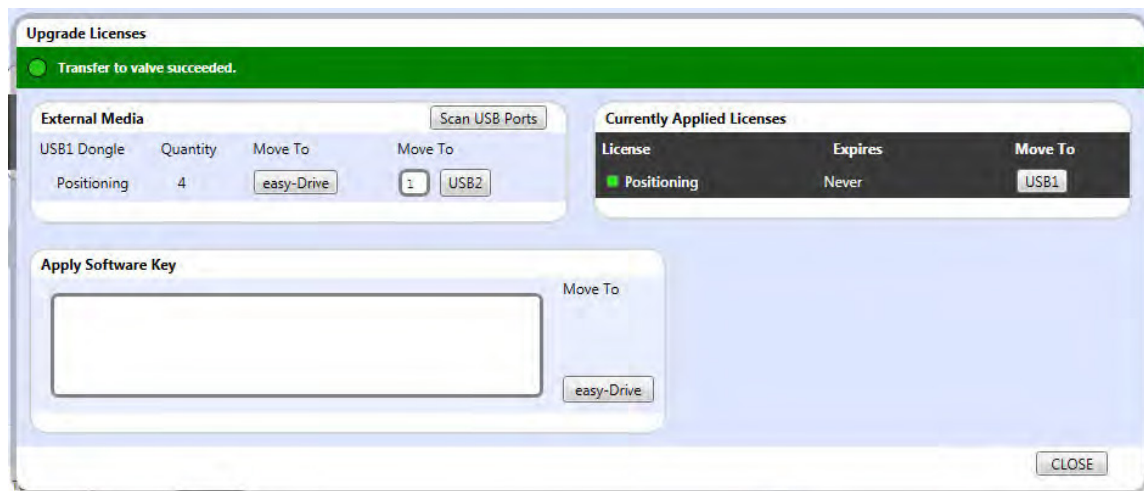
- The license control screen will open, showing all licenses installed on the USB and the actuator.

Figure 17. License Control Screen



- After verifying the presence of the desired license on the USB license dongle, click the button labelled 'easy-Drive' under Move To and the license will be transferred to the valve as shown below.

Figure 18. Licensing



- It is also possible to transfer licenses from one USB license dongle to another. Place two dongles into the computer with the configuration software. Type in the number of licenses to move and click USB 2 to move the licenses.

Startup

WARNING

To avoid personal injury or property damage, be aware that the valve will move and respond to an input signal during startup.

1. Before turning on power to the unit, be sure that a closed signal is being commanded to the unit.
 - DryContact: contact is open.
 - L2e (Dual Dry Contact): Contact closed across pins COMMON and CLOSE.
 - Analog Input: signal = 4 mA.
 - Modbus: position demand = 0.
2. Turn on power to the unit.
3. Apply a change in position demand to ensure unit responds properly.
 - DryContact:
 - Closed contact between pins COMMON and OPEN will open the valve.
 - Dual contact / L2e only: Closed contact between pins COMMON and OPEN will open the valve. Closed contact between pins COMMON and CLOSE will close the valve.
 - Analog Input: valve will respond to proportional demand.
 - Modbus: valve will respond to positional demand in register 40001. 0 = fully closed and 1000 = fully open.
4. If the valve does not respond as expected, proceed to Troubleshooting guide on page 22.
5. Check conduit ports.
 - Conduit seal must be in place within 450 mm / 18 in. of the enclosure.
 - Unused conduit ports must be sealed with an explosion-proof port plug.
6. Replace the cover and tighten all 8 bolts to 20 N•m / 15 ft•lbs.

Section 3: Troubleshooting

1. Unit does not move.
 - a. Verify that 12 V DC to 24 V DC is present on the power terminals as shown on the cover. Green heartbeat LED will pulse near Modbus terminals when power is present.
 - b. Verify that all wires are firmly attached on both ends.
 - c. Verify that wires are connected to the correct terminals - see Wiring in the manual.
 - d. Verify mode of operation (on/off or positioning) matches control signal.
 - e. Verify mode of control (local or Modbus) matches control signal.
2. Unit does not respond to 4 to 20 mA signal
 - a. Verify that 12 V DC to 24 V DC is present on the power terminals as shown on the cover.
 - b. Verify that the 4 to 20 mA signal is wired correctly and that the terminals are firmly on the wires.
 - c. Verify mode of operation matches control signal (local control: 40067=0, positioning: 40065=1).
 - d. Check the value of the analog input in register 40026 to determine if it is 0 or greater.
 - i. If register 40026 shows 0, the 4 to 20 mA may be wired backwards. Swap wire and attempt again.
3. Diagnostics show a Motor Stall - Travel Deviation Fault.
 - a. The easy-Drive electric actuator is designed to operate in a manner consistent with a pneumatic actuator. This means that if the valve plug cannot move to its commanded position, the actuator will stop, without damage and issue a Motor Stall - Travel Deviation Fault warning. When the command signal changes outside of the deadband (Modbus register 40036), it will attempt to move again. Recalibrate the actuator span per instructions in the Startup section of this manual.

Section 4: Maintenance

Refer to Figure 22.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and maintenance depends on the severity of the service conditions.

WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

WARNING

For explosion-proof applications, ensure the actuator cover is properly bolted before applying power to the actuator. Personal injury or property damage may result from fire or explosion if power is applied to the actuator with the cover removed in a hazardous area.

Do not remove the actuator cover for 10 minutes after power is disconnected if the UPS option is installed.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 457 mm / 18 in. from the actuator. Personal injury or property damage may result from explosion if the seal is not installed.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional and national codes for any given hazardous area approval. Failure to follow the local, regional and national codes could result in personal injury or property damage from fire or explosion.

4.1 Valve Plug and Seat Ring

Disassembly

Key Numbers are referenced in Figures 21 and 22.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body (key 1) and drain the process media from both sides of the valve.

NOTICE

The following steps are intended to prevent damage to the valve plug (key 3) and seat ring (key 2) during the removal of the bonnet and actuator.

2. For Positioning Actuators

- Command the valve to anywhere between 10% and 20% travel.
- Isolate power and signal.
- Proceed to step 3.

For ON/OFF Actuators

- Command the valve to open or close and cut the power when the valve is at mid-stroke.
- Isolate power and signal.
- Proceed to step 3.

3. Break the hammer nut (key 6) loose with a hammer. Continue turning the hammer nut by using a hammer or a large adjustable wrench, tightened around one ear of the hammer nut. If the bonnet is stuck on the valve, continue to unscrew the hammer nut. The hammer nut will contact the spring pins (key 7) and will force the bonnet out of the valve. Carefully lift the actuator, bonnet and valve plug assembly from the valve body.



WARNING

The spring pins must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.

4. Use a socket wrench to loosen the seat ring (key 3).
5. Remove the seat ring (key 3) and seat ring gasket (key 9) from the valve body.
6. To replace the plug, the stem nut (key 42) must be removed to expose the groove pin (key 4). Open the explosion-proof enclosure (key 60), using a 13 mm wrench.
7. Remove the stem nut (key 42) using a 11/16 in. wrench; insert a punch in the hole in the stem to restrict rotation of the stem while removing the stem nut. The travel indicator (key 32) may need to be moved to expose the hole.

8. Push the stem downward just far enough to expose the groove pin (key 4) on the plug.
9. Remove the plug by driving out the groove pin and unscrewing the valve plug from the stem.

**WARNING**

Be careful to avoid damaging the seating surface on the valve plug or seat ring as damage in these areas will allow excessive leakage at shutoff. Avoid damaging the highly polished valve stem surface. A damaged valve stem could cut the packing and allow process fluid to leak to the atmosphere.

Table 7. Torque for Seat Ring (Key 3)

VALVE SIZE, NPS	RECOMMENDED TORQUE	
	N•m	Lbf•ft
1	407	300
2	698	515

Assembly

1. Make sure the bonnet O-ring (key 8) is on the bonnet and lubricated with lithium grease (key 49).
2. Install the plug (key 2) on the stem (key 47) and insert a new groove pin (key 4).
3. Push the plug and stem upward to ensure the threads on the top of the stem are exposed. Thread the stem nut (key 42) onto the top of the stem and tighten the stem nut (key 42) to 39 N•m / 29lbf•ft. Insert a punch in the hole in the stem to restrict rotation while tightening the stem nut.
4. Replace the top of the explosion-proof enclosure (key 60) and tighten cap screws (key 64) to 20 N•m / 15 lbf•ft.
5. Thoroughly clean the seat ring and bonnet threads in the valve body (key 1). Also clean the valve body seat ring gasket surfaces.
6. Apply anti-seize lubricant (key 54) to the threads of the seat ring (key 3) and its mating threads in the valve body.
7. Apply anti-seize lubricant (key 54) to the seat ring gasket (key 9) and install into the valve body.
8. Screw the seat ring into the valve body. Use a socket wrench to tighten the seat ring to the torque values shown in Table 7. Remove all excess lubricant after tightening.
9. Lubricate (key 54) the threads on the valve body and hammer nut and the contact surfaces of the bonnet and hammer nut flange. Install the bonnet and actuator assembly with pinned valve plug onto the valve body. Tighten the hammer nut using an adjustable wrench until the nut stops turning. A few hammer blows will be required to ensure the assembly is tight.

4.2 Valve Packing

WARNING

Observe the warning at the start of the Maintenance section.

The valve stem packing can only be accessed from within the valve body. If packing maintenance is required, first disassemble per steps 1, 2 and 6 or 7 in the Valve Plug and Seat Ring Disassembly section of this document.

NOTE

Packing installation and adjustment is critical to the long-term packing performance. Absolutely no deviations from this procedure are allowed.

To minimize friction and maximize sealing performance, a small amount of fluorinated grease (key 56) is placed between the packing rings.

Single Packing Arrangement

The packing components are to be installed as shown in the assembly drawing per the following procedure:

1. Install packing spacer (key 48) in the packing box.
2. Using a non-marring installation tool, such as a 12 in. length of 1/2 in. PVC pipe, push the first anti-extrusion washer (key 12) fully into the packing box by hand. Then, use the packing spacer (key 14) to fully seat the anti-extrusion washer by firmly tapping the packing spacer against the anti-extrusion washer with a hammer and the PVC pipe.
3. Using a needle point syringe filled with fluorinated grease, apply a continuous bead of approximately 3/16 in. diameter inside the V-groove of the female adaptor ring. See Figure 2. Take care to keep the lubricant confined to only the V-groove. Do not lubricate the other surfaces of the packing ring, the stem or the packing box.

NOTE

All D4 packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D4 packing lubricant.

4. Install the female adaptor ring using the packing spacer and PVC pipe to push the ring against the anti-extrusion washer. Apply only enough force to cause the female adaptor to make contact.
5. Using a needle point syringe filled with fluorinated grease, apply a continuous bead of approximately 3/16 in. diameter inside the V-groove of the white V-ring. See Figure 2. Take care to keep the lubricant confined to only the V-groove. Do not lubricate the other surfaces of the packing ring, the stem or the packing box.
6. Install the V-ring using the packing spacer and PVC pipe to push the V-ring against the female adaptor. Apply only enough force to cause the female adaptor to make contact.
7. Install the male adaptor.
8. Using the PVC pipe, push the second anti-extrusion washer (key 12) fully into the packing box by hand. Then, use the packing spacer (key 14) to fully seat the anti-extrusion washer by firmly tapping the packing spacer against the anti-extrusion washer with a hammer and the PVC pipe.
9. Install the packing spacer (key 14) and five Belleville springs (key 11). The Belleville springs (key 11) should be single stacked with the ID of the inner spring contacting the packing spacer (key 14) and the OD of the outer spring contacting the packing retainer (key 10). The final Belleville spring should be within the 1.26 in.-diameter bore of the bonnet.
10. Adjust the packing retainer by hand until it contacts the Belleville springs. Do not tighten by hand, simply install the packing retainer until it contacts the Belleville springs. Torque the packing retainer to 68 N•m / 50 lbf•ft.

Figure 19. Fisher D4 Packing Installation

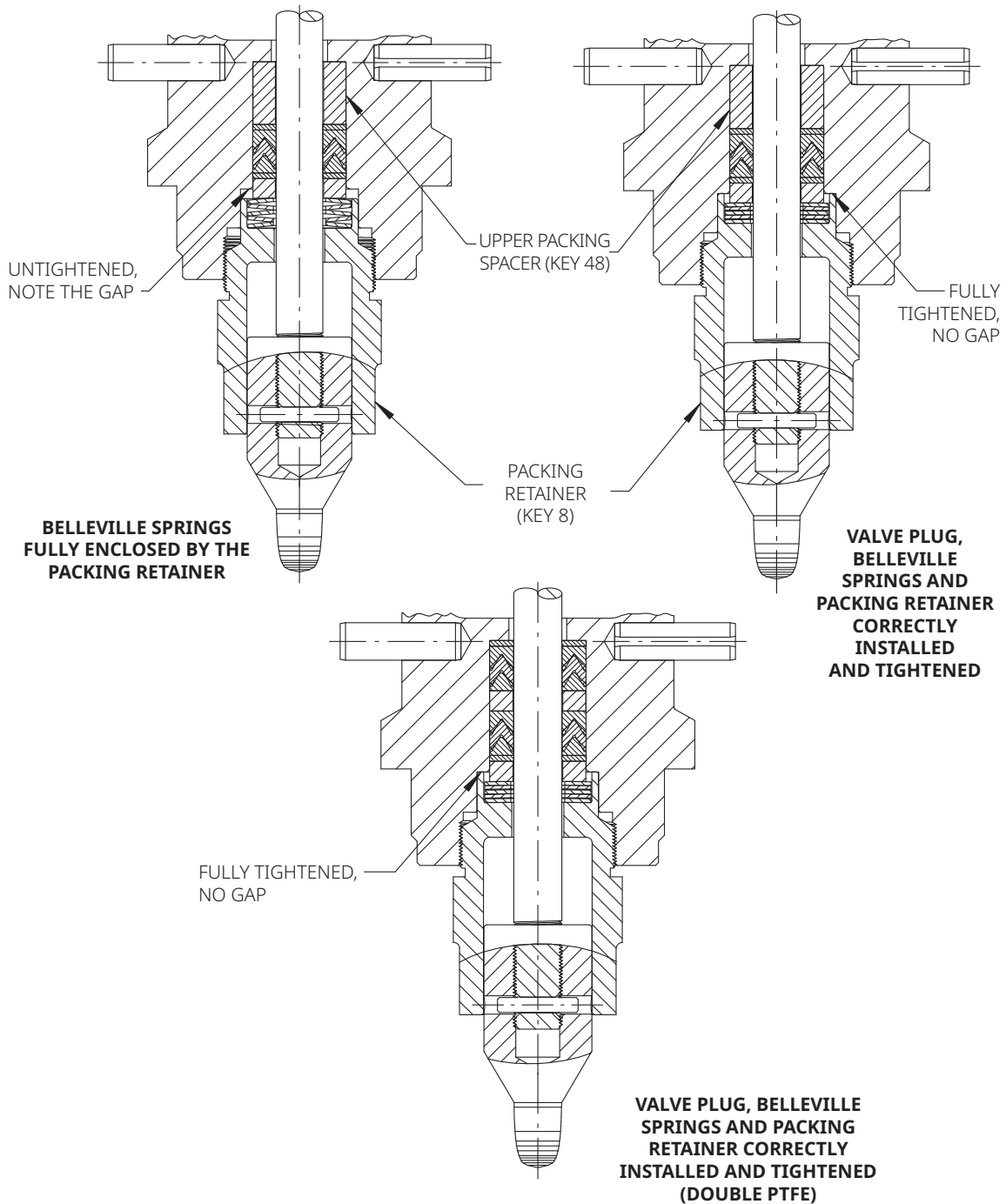
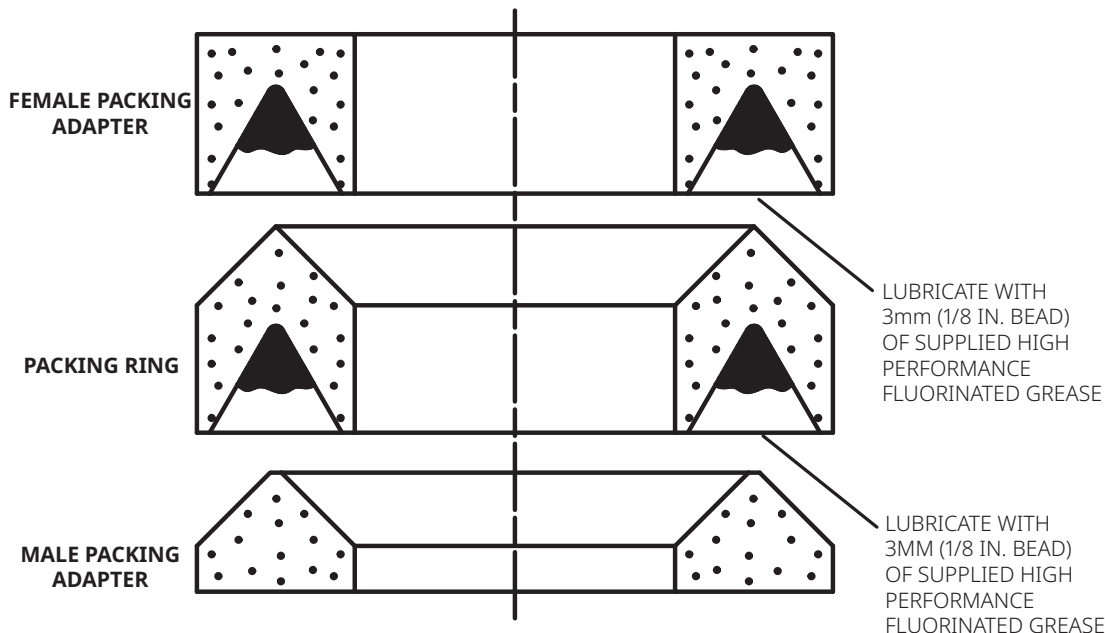


Figure 20. Lubrication Locations on Packing

Double Packing Arrangement

The packing components are to be installed as shown in the assembly drawing per the following procedure:

1. Using a non-marring installation tool, such as a 12 in. length of 1/2 in. PVC pipe, push the first anti-extrusion washer (key 12) fully into the packing box by hand. Then, use the packing spacer (key 14) to fully seat the anti-extrusion washer by firmly tapping the packing spacer against the anti-extrusion washer with a hammer and the PVC pipe.
2. Using a needle point syringe filled with fluorinated grease, apply a continuous bead of approximately 3/16 in. diameter inside the V-groove of the female adaptor ring. See Figure 2. Take care to keep the lubricant confined to only the V-groove. Do not lubricate the other surfaces of the packing ring, the stem or the packing box.

NOTE

All D4 packing kits include a single use packet of high performance fluorinated grease. This is the only acceptable D4 packing lubricant.

3. Install the female adaptor ring using the packing spacer and PVC pipe to push the ring against the anti-extrusion washer. Apply only enough force to cause the female adaptor to make contact.

4. Using a needle point syringe filled with fluorinated grease, apply a continuous bead of approximately 3/16 in. diameter inside the V-groove of the white V-ring. See Figure 2. Take care to keep the lubricant confined to only the V-groove. Do not lubricate the other surfaces of the packing ring, the stem or the packing box.
5. Install the V-ring using the packing spacer and PVC pipe to push the V-ring against the female adaptor. Apply only enough force to cause the female adaptor to make contact.
6. Install the male adaptor.
7. Install the packing spacer (key 14).
8. Using a needle point syringe filled with fluorinated grease, apply a continuous bead of approximately 3/16 in. diameter inside the V-groove of the female adaptor ring. See Figure 2. Take care to keep the lubricant confined to only the V-groove. Do not lubricate the other surfaces of the packing ring, the stem or the packing box.
9. Install the female adaptor ring using the packing spacer and PVC pipe to push the ring against the anti-extrusion washer. Apply only enough force to cause the female adaptor to make contact.
10. Using a needle point syringe filled with fluorinated grease, apply a continuous bead of approximately 3/16 in. diameter inside the V-groove of the white V-ring. See Figure 2. Take care to keep the lubricant confined to only the V-groove. Do not lubricate the other surfaces of the packing ring, the stem or the packing box.
11. Install the V-ring using the packing spacer and PVC pipe to push the V-ring against the female adaptor. Apply only enough force to cause the female adaptor to make contact.
12. Install the male adaptor.
13. Using the PVC pipe, push the second anti-extrusion washer (key 12) fully into the packing box by hand. Then, use the packing spacer (key 14) to fully seat the anti-extrusion washer by firmly tapping the packing spacer against the anti-extrusion washer with a hammer and the PVC pipe.
14. Install the packing spacer (key 14) and six Belleville springs (key 11). The Belleville springs (key 11) should be double stacked with the ID of the inner spring contacting the packing spacer (key 14) and the OD of the outer spring contacting the packing retainer (key 10). The final Belleville spring should be within the 1.26 in.-diameter bore of the bonnet.
15. Adjust the packing retainer by hand until it contacts the Belleville springs. Torque the packing retainer to 54 N•m / 40 lbf•ft.

Section 5: Parts

5.1 Parts Ordering

Each D4 control valve is assigned a serial number, which can be found on the nameplate. Refer to the number when contacting your [Emerson sales office](#) for assistance or when ordering replacement parts.



WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

5.2 Parts Kits

Table 8. Actuator Parts Kits

Kit	Part Number
Board Replacement Kit (On/Off is default)	GE83055X012
Board Replacement Kit + Positioning License Dongle	GE83126X012
Motor/Gearbox Assembly	GK10613X012
Motor/Gearbox/Board Assembly (On/Off is default)	GK16046X012
Motor/Gearbox/Board Assembly + Positioning License Dongle	GK16047X012
Replacement Kit - Belleville Springs	GK15266X012
Replacement Kit - Drivetrain	GK15328X012
Positioning License Dongle (1 License)	GE83574X012
Positioning License Dongle (5 License)	GE83574X022

5.3 Repair Kits

NOTE

All repair kits are supplied with hydrogenated nitrile bonnet O-ring. FKM (fluorocarbon) bonnet O-ring must be ordered separately when required.

Table 9. Repair Kits

Description	Part Number
Packing Repair Kit Includes key numbers 4, 8, 12 (qty. 2), 13 and high performance fluorinated grease	RD4X0000012

5.4 Parts List

NOTE

Contact your [Emerson sales office](#) for Part Ordering Information.

Table 10. Parts List

Key	Description	Key	Description
1	Valve body	42	Stem nut
2*	Valve plug	47*	Valve stem
3*	Seat ring	48	Upper packing spacer
4 *	Groove pin	49	Lubricant (lithium grease)
5	Bonnet	54	Lubricant (anti-seize)
6	Hammer nut	56*	High performance fluorinated grease Packing lubricant
7	Spring pin		
8*	Bonnet O-ring	58	Enclosure O-ring
9*	Seat ring gasket	59	Motor/gearbox/controller assembly
10	Packing retainer	60	Upper enclosure
11	Belleville springs (5 req'd)	61	Lower enclosure
12*	Anti-extrusion washer (2 req'd)	62	Motor cap screws (4 req'd)
13*	Packing set	63	Motor cap screw washers (4 req'd)
14	Packing spacer	64	Enclosure cap screws (8 req'd)
16	Valve nameplate	65	Enclosure cap screw retaining washers (8 req'd)
17	Drive screw	66	Ground screw
18*	O-ring	68	Certification nameplate
19	Stem O-ring	69	easy-Drive Label
32	Travel indicator	---	---
*Recommended spare parts.			

Figure 21. D4 Valve Assembly

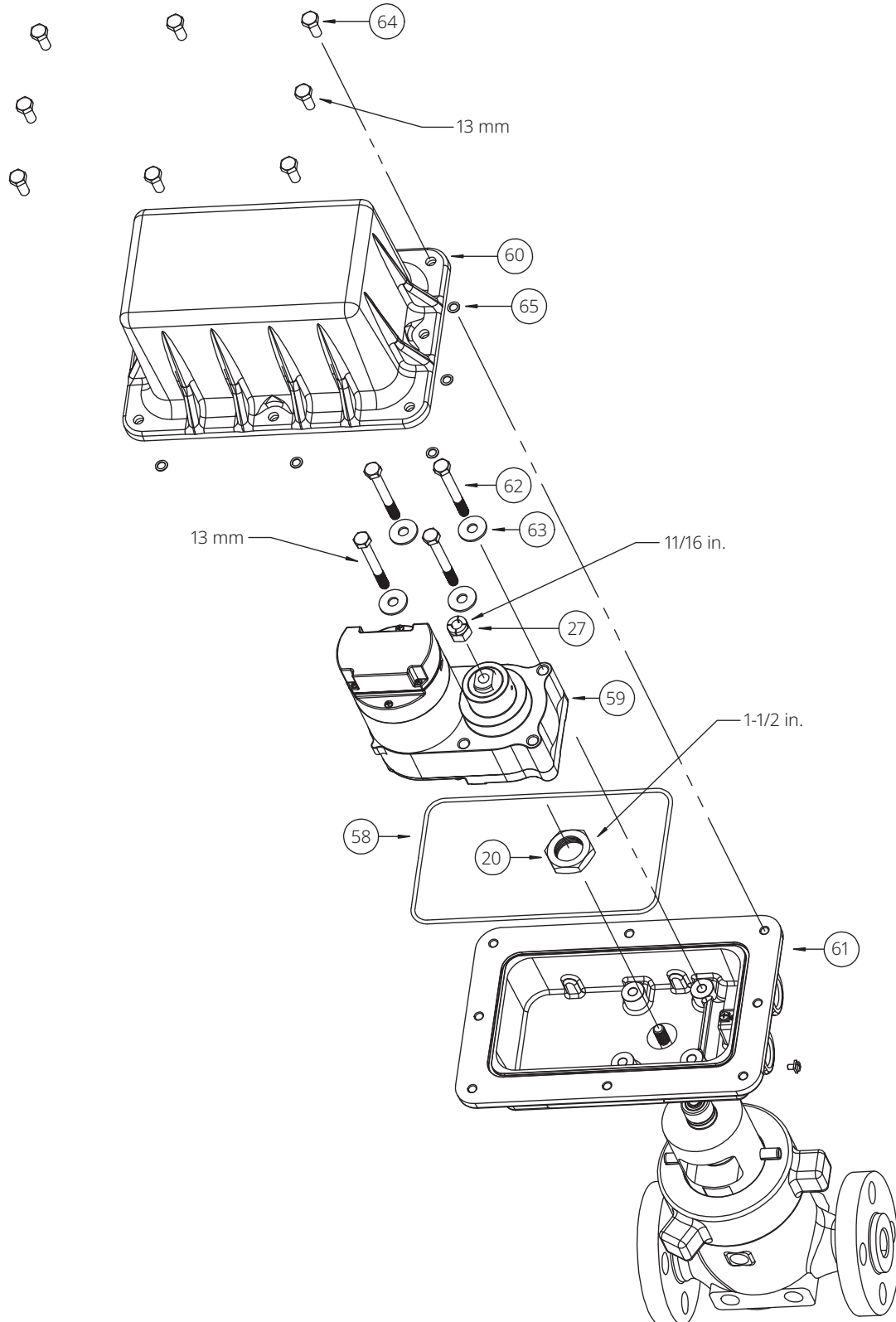
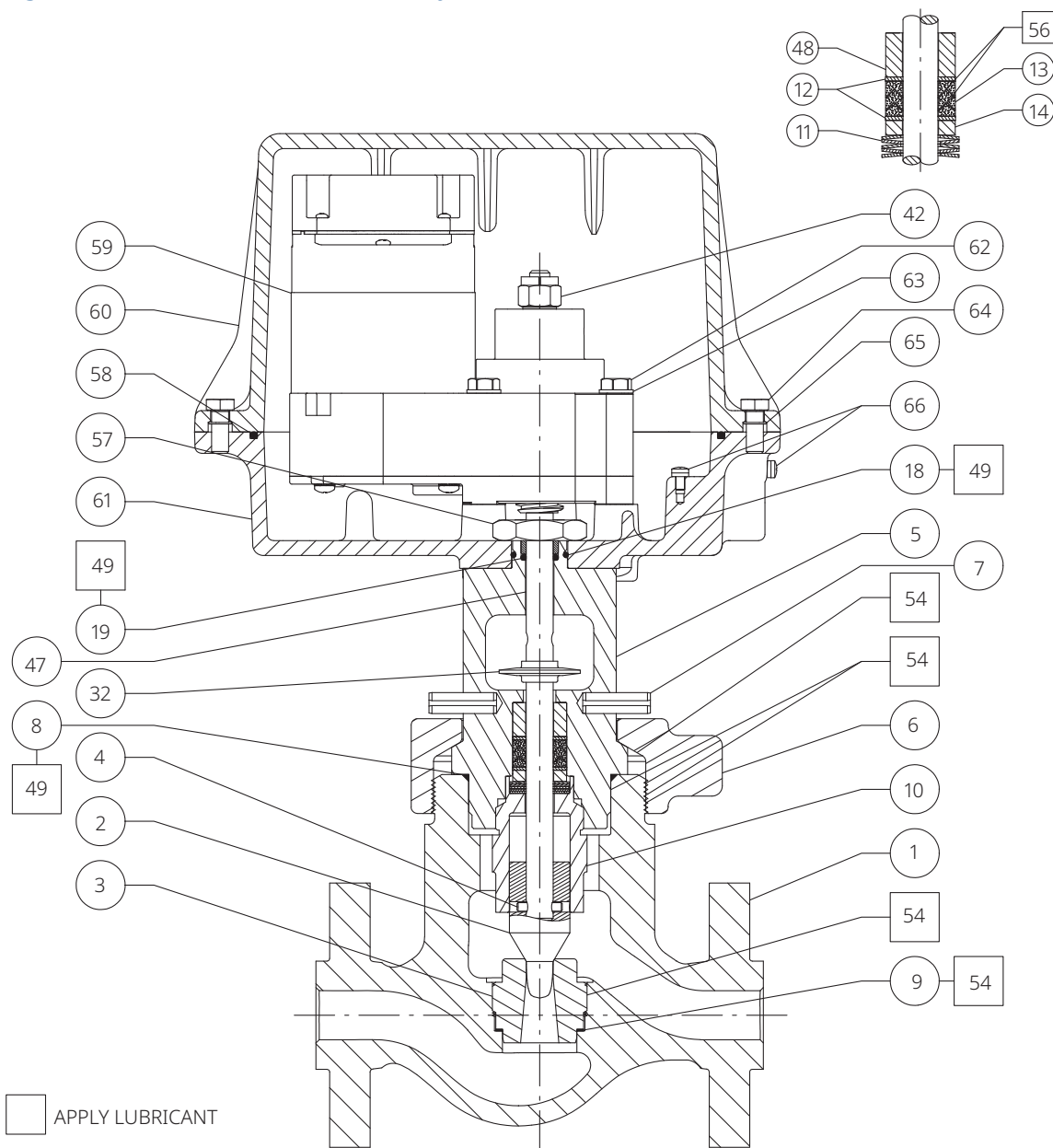


Figure 22. Fisher D4 Valve Assembly



GE49375-B

Appendix A: Modbus

A.1 Register Summary

Table A-1. Gen 2 easy-Drive Actuator Modbus Map

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint16	Modbus position command (100=10.0%)	40001	0	R/W	0 to 1000	Modbus command value with one implied decimal place (1000=100.0%). R/W at all times but only used in Modbus control mode. In on/off mode 0 to 499 will result in a move to 0% and 500 to 1000 will result in a move to 100%.
uint16	Digital output	40002	0	R/W	0, 1	0=no voltage supplied to terminals, 1=voltage supplied to terminals (Only used when output setup is set for Remote controlled)
uint16	Reset error codes	40003	0	R/W	0, 1	Value of 1 will clear faults. Will automatically set back to 0.
uint16	RESERVED	40004	---	---	---	---
uint16	RESERVED	40005	---	---	---	---
uint16	RESERVED	40006	---	---	---	---
uint16	RESERVED	40007	---	---	---	---
uint16	RESERVED	40008	---	---	---	---
uint16	RESERVED	40009	---	---	---	---
uint16	Actual position (100=10.0%)	40010	0	R	0 to 1000	Present position of the actuator relative to span with 1 implied decimal place (1000=100.0%). Valid for all control modes.
uint16	Commanded position (100=10.0%)	40011	0	R	0 to 1000	Present position command of the actuator relative to span (1000=100.0%). Valid for all control modes.
uint16	Diagnostic Flags	40012	0	R	0 to 65535	Bit flags - see chart
uint16	Digital status	40013	0	R	0 to 1	0=no connection between terminals, 1=connection between terminals (Status of digital input or output)
uint32	Total Running Time (min)	40014, 40015	0	R	4294967296	Total number of minutes the actuator has been powered on since time has been reset
uint32	Total Open Time (min)	40016, 40017	0	R	4294967296	Total number of minutes the actuator has been at 100% of travel since time has been reset
uint32	Total Closed Time (min)	40018, 40019	0	R	4294967296	Total number of minutes the actuator has been at 0% of travel since time has been reset

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Table A-1. Gen 2 easy-Drive Actuator Modbus Map (continued)

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint32	Number of Closed (Cycle count)	40020, 40021	0	R	4294967296	Total number of close cycles the actuator has performed since reset. One open/close cycle counts as 1.
uint32	Number of Power Cycles	40022, 40023	0	R	4294967296	Total number of times the actuator has been powered on.
uint32	Number of Movements	40024, 40025	0	R	4294967296	Total number of movements the actuator has performed. Move must be at least 5% of rated travel for cycle to increment.
uint16	Analog input control value	40026	0	R	0 to 2400	Value of the analog signal in mA with 2 implied decimals. In analog control mode, this is the command value and is subject to the analog settings in registers 40046 to 40059. Always active but a slower refresh rate when unit is not in analog control mode.
uint16	Incoming voltage	40027	0	R	0 to 350	Diagnostic register - value of incoming voltage with 1 implied decimal.
uint16	Latch Open State	40028	0	R	0 to 1	Normally open latch state
uint16	Latch Close State	40029	0	R	0 to 1	Normally closed latch state
uint16	RESERVED	40030	---	---	---	---
uint16	RESERVED	40031	---	---	---	---
uint16	RESERVED	40032	---	---	---	---
uint16	RESERVED	40033	---	---	---	---
uint16	RESERVED	40034	---	---	---	---
uint16	RESERVED	40035	---	---	---	---
uint16	RESERVED	40036	---	---	---	---
uint16	RESERVED	40037	---	---	---	---
uint16	RESERVED	40038	---	---	---	---
uint16	RESERVED	40039	---	---	---	---
uint16	Test Register - 16 bit	40040	45964	R	45964	Fixed register to test correct reading of 16 bit registers - Hex=B38C, Binary=1011001110001100
uint32	Test Register - 32 bit	40041, 40042	3,012,341,331	R	3,012,341,331	Fixed register to test correct reading of 32 bit registers - Hex=B38C AE53, Binary=1011001110001100 101011001010011
uint16	Span calibration	40043	0	R/W	0, 1	Value of 1 will initiate span calibration. Will automatically set back to 0.
uint16	RESERVED	40044	---	---	---	---
uint16	RESERVED	40045	---	---	---	---

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Table A-1. Gen 2 easy-Drive Actuator Modbus Map (continued)

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint16	RESERVED	40046	---	---	---	---
uint16	RESERVED	40047	---	---	---	---
uint16	RESERVED	40048	---	---	---	---
uint16	RESERVED	40049	---	---	---	---
uint16	Loss of signal position (100=10.0%)	40050	0	R/W	0 to 1001	Position to which valve plug will be driven upon loss of signal. Loss of signal is based upon the active control mode. 0 to 1000=0-100.0% with 1 implied decimal point. In on/off mode 0 to 499 will result in movement to 0% while 500 to 1000 will result in movement to 100%. A value of 1001 in any control mode is the setting for "lock-in-last".
uint16	Modbus timeout (s)	40051	60	R/W	0 to 65535	Time without a valid Modbus message is seen (to any address) before "loss of signal" motion is engaged when in Modbus control mode. Only active in Modbus control mode. 0=disabled
uint16	Dual contact timeout (s)	40052	60	R/W	0 to 3600	Time without a digital signal being low (contact made) from either digital input as viewed by voltage level on the digital input terminals. If neither contact has been made (pulled input low) within the timeout period, the valve plug will be moved to the loss-of-signal position. Only active in the local, on-off, dual contact mode. 0=disabled.
uint16	Deadband (10=1.0%)	40053	5	R/W	0 to 250	Minimum percentage signal change to elicit a movement response based upon end position of last movement. For example, if the previous command resulted in the actuator moving to 31.2% of travel and deadband is set to 100 (10.0%), setpoint must command valve to 21.2% or 41.2% before valve will move to new position. Default is set to minimize signal dithering.
uint16	Low travel cutoff position (100=10.0%)	40054	50	R/W	0 to 999	Analog input command, in percent with one implied decimal (50=5.0%), below this value will result in the valve plug moving to the closed position. Active in both local and Modbus control modes.

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Table A-1. Gen 2 easy-Drive Actuator Modbus Map (continued)

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint16	Analog on/off close position (100=10.0%)	40055	400	R/W	0 to 999	When the valve is in 4 to 20 mA on/off mode, this value is the point at which the valve will close. It must be set to a smaller value than the analog on/off open position. Percentage position value with one implied decimal (400=40.0%).
uint16	Analog on/off open position (100=10.0%)	40056	500	R/W	1 to 1000	When the valve is in 4 to 20 mA on/off mode, this value is the point at which the valve will open. It must be set to a larger value than the analog on/off close position. Percentage position value with one implied decimal (500=50.0%).
uint16	Analog Close Value	40057	40	R	31 to 220	The analog value, in mA with one implied decimal (40=4.0 mA), that defines the closed position.
uint16	Analog Open Value	40058	200	R	31 to 220	The analog value, in mA with one implied decimal (200=20.0 mA), that defines the open position.
uint16	Number of retries	40059	2	R/W	0 to 4	When the valve plug encounters an obstruction, how many attempts will it make to move past that point, assuming no change in the command signal within the deadband range.
uint16	RESERVED	40060	---	---	---	---
uint16	RESERVED	40061	---	---	---	---
uint16	RESERVED	40062	---	---	---	---
uint16	RESERVED	40063	---	---	---	---
uint16	RESERVED	40064	---	---	---	---
uint16	RESERVED	40065	---	---	---	---
uint16	RESERVED	40066	---	---	---	---
uint16	Control Source	40067	0	R/W	0 to 5	0=Dual Contact On/Off 1=Single Contact On/Off, 2=Modbus On/Off, 3=Modbus Positioning, 4=4 to 20 Positioning, 5=4 to 20 Level
uint16	Valve Type	40068	1	R/W	1 to 10	1=D3, 2=D4
uint16	RESERVED	40069	---	---	---	---
uint16	RESERVED	40070	---	---	---	---
uint16	RESERVED	40071	---	---	---	---
uint16	RESERVED	40072	---	---	---	---
uint32	RESERVED	40073	---	---	---	---
uint16	Modbus address	40074	1	R/W	1 to 247	Slave Address of the actuator

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Table A-1. Gen 2 easy-Drive Actuator Modbus Map (continued)

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint16	Baud Rate	40075	5	R/W	4, 5, 6, 7	4=4800 baud, 5=9600 baud (default), 6=19200 baud, 7=38400 baud
uint16	Parity	40076	0	R/W	0, 1, 2	0=Even, 1=Odd, 2=None
uint16	Modbus stop bits	40077	1	R/W	0, 1, 2	1 stop bit is the standard with even and odd parity while 2 stop bits is the standard for none.
uint16	MSB/LSB	40078	0	R/W	0, 1	0=MSB (Big Endian), 1=LSB (Little Endian)
uint16	RESERVED	40079	---	---	---	---
uint16	Digital I/O selection	40080	1	R/W	0, 1	0=9 V sinking digital input, 1=25 mA at 10 V digital output
uint16	Digital I/O output setup	40081	0	R/W	0, 1, 2, 3	Valid only when Digital I/O selection is set to Output (1) - 0=In position, 1=Fully closed, 2=Fully open, 3=Remote controlled (driven by Digital Output register)
uint16	Digital I/O input setup	40082	0	R/W	0, 1	Valid only when Digital I/O selection is set to Input (0) - 0=Reference only (status appears in 40013 and does nothing else), 1=Override (status appears in 40013 and valve plug is moved to safe position noted in register 40050)
uint16	RESERVED	40083	---	---	---	---
uint16	RESERVED	40084	---	---	---	---
uint16	RESERVED	40085	---	---	---	---
uint16	RESERVED	40086	---	---	---	---
uint16	RESERVED	40087	---	---	---	---
uint16	RESERVED	40088	---	---	---	---
uint16	RESERVED	40089	---	---	---	---
uint16	RESERVED	40090	---	---	---	---
uint16	RESERVED	40091	---	---	---	---
uint16	RESERVED	40092	---	---	---	---
uint16	RESERVED	40093	---	---	---	---
uint32	Device Tag	40094 to 40113	"easyDrive2"	R/W	0 to 255 per character	Device Tag (20 character UTF8 string)
uint32	Valve serial number	40114, 40115	0	R/W*	0 to 4,294,967,296	Valve assembly serial number assigned at Fisher assembly plant
uint32	Motor serial number	40116, 40117	0	R/W*	0 to 4,294,967,296	Motor/gearbox serial number

- continued -

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

D4 Valve with Gen 2 easy-Drive Actuator

June 2026

Instruction Manual

D104188X012

Table A-1. Gen 2 easy-Drive Actuator Modbus Map (continued)

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint32	Motor revision	40118, 40119	0	R/W*	0 to 4,294,967,296	Motor/gearbox revision
uint32	PCB serial number	40120, 40121	0	R/W*	0 to 4,294,967,296	PCB serial number
uint16	PCB revision	40122, 40123	0	R/W*	0 to 4,294,967,296	PCB revision
uint16	Flash Firmware major revision	40124	0	R	0 to 65535	From flash firmware when compiled
uint16	Flash Firmware minor revision	40125	0	R	0 to 65535	From flash firmware when compiled
uint16	Flash Firmware mod revision	40126	0	R	0 to 65535	From flash firmware when compiled
uint16	Flash Firmware build revision	40127	0	R	0 to 65535	From flash firmware when compiled
uint16	Boot Firmware major revision	40128	0	R	0 to 65535	From boot firmware when compiled
uint16	Boot Firmware minor revision	40129	0	R	0 to 65535	From boot firmware when compiled
uint16	Boot Firmware mod revision	40130	0	R	0 to 65535	From boot firmware when compiled
uint16	Boot Firmware build revision	40131	0	R	0 to 65535	From boot firmware when compiled
uint32	PCB test date	40132, 40133	0	R/W*	0 to 4,294,967,296	Seconds since January 1, 2000, Board Supplier Functional Test Date
uint32	Motor test date	40134, 40135	0	R/W*	0 to 4,294,967,296	Seconds since January 1, 2000, Motor Supplier Test Date
uint32	System completion date	40136, 40137	0	R/W*	0 to 4,294,967,296	Seconds since January 1, 2000, Final Assembly Test Date
1. uint is defined as unsigned integer uint16 – unsigned 16 bit variable, can take value 0 to 65535. uint32 – unsigned 32 bit variable, can take value 0 to 4294967295. (Reserved) – registers used for development use only. † - 32bit register contains data that spans two registers – reads and write of data needs to be performed within the same Modbus command function to ensure coherency of data.						

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104188X012

D4 Valve with Gen 2 easy-Drive Actuator

June 2026

Table A-2. Diagnostic Fault Flags

Hex Value	Bit Mask	Description	Value	Bit	Definition
0x8000	1000 0000 0000 0000	Fault in N.V. Memory – system has restored default settings	32768	15	A memory fault has occurred and the actuator has been restored to factory defaults. Contact your Emerson sales office .
0x8000	1000 0000 0000 0000	Fault in N.V. Memory – system has restored default settings	32768	15	A memory fault has occurred and the actuator has been restored to factory defaults. Contact your Emerson sales office .
0x4000	0100 0000 0000 0000	Motor Assembly Stall - Travel Deviation	16384	14	The actuator is unable to move to the commanded position and has stopped. Follow troubleshooting guide in Help section to remedy.
0x2000	0010 0000 0000 0000	Discrete Input override mode active	8192	13	The digital input has detected a closed contact and the actuator has moved to its safe position. Check switch input device status.
0x1000	0001 0000 0000 0000	System or Watchdog fault	4096	12	The actuator has experienced a fatal error and shut down. Contact your Emerson sales office .
0x0800	0000 1000 0000 0000	Analog Input calibration value not in expected range	2048	11	The analog values entered do not match the analog signal level. Check analog signal value and value entered.
0x0400	0000 0100 0000 0000	Valve travel distance calibration not in legal range	1024	10	The valve travel distance is outside the acceptable range. Confirm valve type and that no obstructions are present.
0x0200	0000 0010 0000 0000	Analog Input span calibration not in legal range	512	9	The analog values for open and close are less than 4 mA and previous values have been maintained. Calibrate analog input with differential >4 mA.
0x0100	0000 0001 0000 0000		256	8	- - -
0x0080	0000 0000 1000 0000	Valve was shutdown while moving	128	7	Actuator was powered down during a move and actual position may vary from commanded. Recalibrate the valve span.
0x0040	0000 0000 0100 0000	Valve span calibrated (informational)	64	6	Span has been calibrated and actuator is ready.
0x0020	0000 0000 0010 0000	Valve position controller active (informational)	32	5	Actuator is active and ready.
0x0010	0000 0000 0001 0000	Loss of signal active	16	4	Control signal not present. Signal is <3 mA, timeout period exceeded (40051 or 40052).
0x0008	0000 0000 0000 1000		8	3	- - -
0x0004	0000 0000 0000 0100	Modbus command has been sent (starts a calibrated system)	4	2	The actuator is successfully moving the valve.
0x0002	0000 0000 0000 0010	Analog input initialized (system has seen input >3 mA/1 V)	2	1	4 to 20 mA analog input has a valid signal present
0x0001	0000 0000 0000 0001	Start delay active (within 15 second calibration window)	1	0	Span calibration using physical inputs allowed during startup

EMC Directive – 2014/30/EU

Models: All
EN 61326-1:2013

RoHS Directive – 2011/65/EU as amended by 2015/863/EU

Declaration of Exclusion

Models: All

The above equipment is excluded from the scope of this directive per Article 2, Paragraph 4, part C of 2011/65/EU, therefore the equipment cannot bear the CE mark related to RoHS compliance. However, the equipment may bear the CE mark to indicate compliance with other applicable EU directives.

ATEX Directive – 2014/34/EU (Applicable only if this mark appears on the product)

Certificate – **SIRA12ATEX1168X – Group II Category 2 G** – Flameproof
easy-Drive
Ex db IIA T6(Ta ≤ 70°C) Gb
Standards used: EN IEC 60079-0:2018/AC:2020, EN60079-1:2014

ATEX Notified Body for EC-Type Examination Certificate(s)

CSA Group Netherlands B.V. – Notified Body Number: 2813
Utrechtseweg 310, Building B42
6812AR Arnhem
The Netherlands

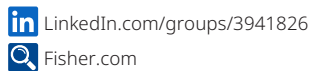
ATEX Notified Body for Quality Assurance

SGS Fimko Oy – Notified Body Number: 0598
P.O. Box 30 (Särkiniementie 3)
Helsinki, 00211
Finland

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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FISHER™



Fisher™ DFA Variable Geometry Desuperheater

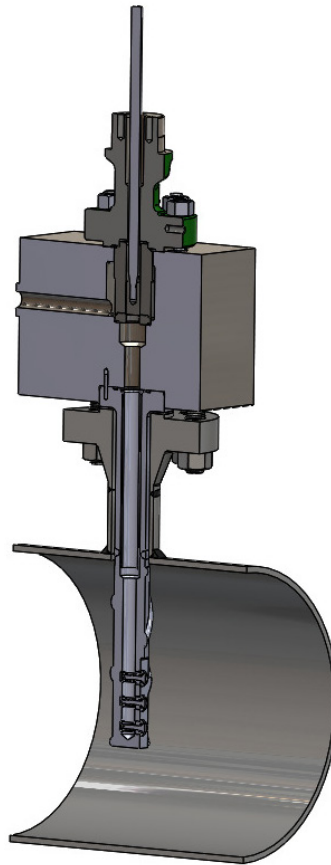


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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and operation information for the DFA variable orifice desuperheater. Refer to separate instruction manuals for information on the actuator and accessories.



WARNING



Do not install, operate or maintain a DFA desuperheater without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson sales office before proceeding.

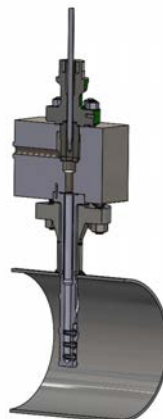
1.2 Description

The Fisher DFA desuperheater flexible architecture (Figure 1) incorporates both a water control element and a variable geometry mechanically atomized, self-contained desuperheater for moderate to high flow variation. It is installed through a flanged connection on the side of an NPS 8 or larger pipeline.

The desuperheater design incorporates an integral thermal liner inside the desuperheater body pipe. This minimizes the potential for thermal shock when cool water is introduced to the unit which has been heated to the operating steam temperature.

The nozzle mount for the DFA is engineered to minimize the potential for excitation due to vortex shedding and flow induced vibration. The DFA desuperheater is installed through a flanged connection on a DN 200 / NPS 8 or larger pipeline. Maximum nozzle C_V is 15.0.

Figure 1. Fisher DFA Variable Geometry Desuperheater



X0838

Table 1. Specifications

Available Configurations ⁽¹⁾ and Valve Sizes	Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4
■ DFA valve body style: Angle Common Characteristics: Designed according to ASME B16.34 Valve-Flanges, Threaded and Welding End	Class V only
End Connections Styles ⁽¹⁾	Material Temperature Capabilities ⁽¹⁾
See Tables 2 and 3	Up to 593°C / 1100°F depending on construction
Maximum Inlet Pressure and Temperature ^(1,2)	Flow Characteristics ⁽⁴⁾
Flanged, Socketwelding or Buttwelding: Consistent with CL150, 300, 600, 900, 1500 and 2500 according to ASME B16.34, unless limited by maximum pressure drop or material temperature capabilities.	Standard Cages: ■ Linear, ■ equal percentage, ■ modified equal percentage ⁽⁵⁾ Cavitrol III: Linear Micro-Flat (with or without liner): Linear
Maximum Pressure Drop ⁽¹⁾	Flow Direction
Valve with Cavitrol™ III Cage: 149 bar / 2160 psi for two-stage and 207 bar / 3000 psi for three-stage cage. Consult Fisher Bulletin 80.2:030, Cavitrol III One-, Two- and Three-Stage trims, for more information. Anti-cavitation MicroFlat: <51.7 bard / <750 psid	All: Flow down
Up to 50:1. The ratio of maximum to minimum controllable C_V is dependent upon the available water pressure differential.	Bonnet Style and Mounting ⁽¹⁾
	Standard Bonnet Yoke Temperature Limit: Standard bonnet with cast iron yoke is limited to 537°C / 1000°F
Inherent Rangeability	Packing Arrangements
Up to 50:1. The ratio of maximum to minimum controllable C_V is dependent upon the available water pressure differential.	■ Single, ■ Double and ■ Leakoff standard graphite packing or optional ENVIRO-SEAL™ and ■ HIGH-SEAL packing systems. See Bulletin 59.1:061, ENVIRO-SEAL and HIGH-SEAL Packing System for Sliding-Stem Valves
Spray Water Pressure Required ⁽³⁾	Approximate Weight
6.9 bar / 100 psi above steam pressure	See Table 12
1. Do not exceed the pressure or temperature limits in this bulletin, nor any applicable code or standard limitations. 2. EN (or other valve body material) ratings and end connections can usually be supplied; consult your Emerson sales office . 3. A function of required turndown and equipment selection. 4. Special characterized cages are available. Contact your Emerson sales office . 5. Modified equal percentage characteristic is equal percentage for the first 75% of travel, then opens quickly for additional capacity.	

The DFA Features

1. Fine atomization over a wide range of operating conditions helping to assure rapid and complete vaporization of injected water.
2. Available with a wide range of standard and anti-cavitation trim styles.
3. Design minimizes affects of thermal cycling.
4. High turndown capability.
5. Flexible architecture with multiple valve trim combinations and face-to-face dimensions available.

1.3 Education Services

Emerson Education Services
Phone: 800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Section 2: Principle of Operation

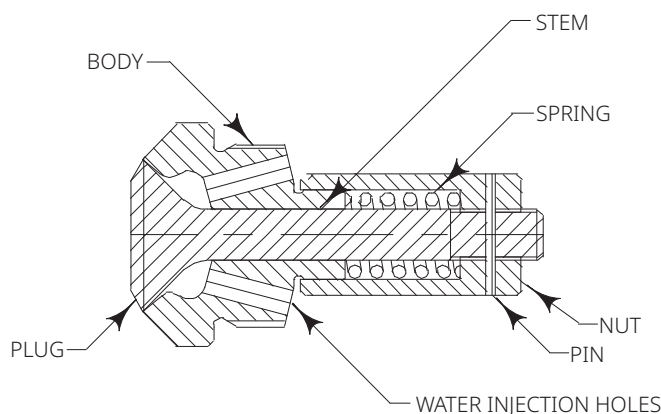
The DFA desuperheater reduces steam temperatures through the introduction of cooling water directly into the hot steam flow stream. By regulating the quantity of water that is injected, accurate downstream steam temperature can be both controlled and maintained.

The rate of vaporization and/or cooling, is a function of droplet size, distribution, mass flow and temperature. Steam velocity is critical and should be maintained at 6.1 to 9.1 meters per second / 20 to 30 feet per second as the minimum. Actual minimum steam velocity requirements will vary by application. As steam velocity increases, a longer distance is required to achieve homogeneous mixing and to complete vaporization.

In DFA desuperheater nozzle styles, the spraywater quantity is controlled by internal control valve which responds to signals received from the temperature control system. The water enters the main tube of the desuperheater, passes through the spray nozzle and discharges into the steam line as a fine, atomized spray (see Figure 4).

Each particular nozzle or set of nozzles, in the sprayhead is tailored to meet a specific set of operating conditions. The nozzle design optimizes the spraywater droplet size promoting rapid atomization and complete vaporization of water in the steam flow stream to obtain precise temperature control. The DFA desuperheater uses a variable geometry AF nozzle. In the AF nozzle design (see Figure 4), water enters the swirl chamber via compound angled orifices, thus creating a rotational flow stream. This flow stream is further accelerated as it is forced up and out through the spray annulus. The cone-shaped plug varies the geometry of the spray annulus using a force balance principle between water pressure and the preload exerted by a helical spring. This variable geometry design sprays a thin hollow cone over a wide range of flow rates, resulting in excellent temperature control over a wide range of operating conditions.

Figure 2. AF Nozzle Cross Section



A7191

Section 3: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the desuperheater is installed where service conditions could exceed the limits of the pressure class noted on the nameplate. To avoid such injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Table 2. Available Spray Inlet Connections

Inlet Size, NPS	ASME Pressure Rating ^(2,4)	Spraywater Connection Styles ^(1,2,3)
1, 1-1/2 and 2	CL150 to 2500	RF, RTJ, BW and SW
1. End connection style abbreviations: RF-Raised Face, RTJ-Ring Type Joint, BW-Butt weld, SW-Socket Weld. 2. EN (or other valve body material) ratings and end connections can usually be supplied; consult your Emerson sales office. 3. Socket weld available on NPS 1, 1-1/2 and 2 only. 4. Inlet and outlet of DFA must have the same pressure class rating.		

Table 3. Available Desuperheater Body Connections

DESIGN	STEAM LINE SIZE, NPS	STEAM LINE CONNECTION		
		Size, NPS	ASME Pressure Rating ^(1,2)	CONNECTION STYLES
DFA	8 to 60	3 or 4	CL150 to 2500	RF and RTJ
1. Steam line connection pressure rating must match the valve inlet connection pressure rating. 2. Inlet and outlet of DFA must have the same pressure class rating.				

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D103643X012

DFA Desuperheater

November 2025

Table 4. Fisher DFA Dimensions

DESUPERHEATER BODY FLANGE ⁽¹⁾		E INLET CENTERLINE TO OUTLET FLANGE FACE ⁽²⁾		F INLET FLANGE FACE TO OUTLET CENTERLINE ⁽²⁾	
Size, NPS	Pressure Rating	mm	in.	mm	in.
3 and 4	CL150 to 1500	152	6	229	9
	CL2500	178	7	241	9.5
1. The NPS 4 DFA requires a 4.00 inch minimum mounting I.D. Contact your Emerson sales office for NPS 3 DFA minimum mounting I.D. 2. For different centerline to flange face distances Contact your Emerson sales office .					

Table 5. Fisher DFA Installation Dimensions

DESUPERHEATER BODY FLANGE SIZE, NPS	("D" DIMENSION) PIPE LINE	("B" DIMENSION) INSERTION LENGTH		("T" DIMENSION) T-HEIGHT	
	Size, NPS	mm	in.	mm	in.
3 and 4	8	332	13.00	222	8.75
	10	358	14.25	222	8.75
	12	384	15.25	222	8.75
	14	400	15.75	222	8.75
	16	425.4	16.75	222	8.75
	18	451	17.50	216	8.50
	20	477	17.75	222	8.75
	22	502	17.75	222	8.75
	24	527	17.75	222	8.75
	30	600	17.63	219	8.63

Table 6. Fisher DFA Minimum Mounting I.D.

MINIMUM BODY FLANGE SIZE	NOZZLE MODEL	MINIMUM MOUNTING I.D.	
NPS		mm	in.
3	DFA- A, B, C	66.65	2.624
3	DFA- D, E	73.66	2.9
4	DFA- A through H	101.6	4

⚠ WARNING

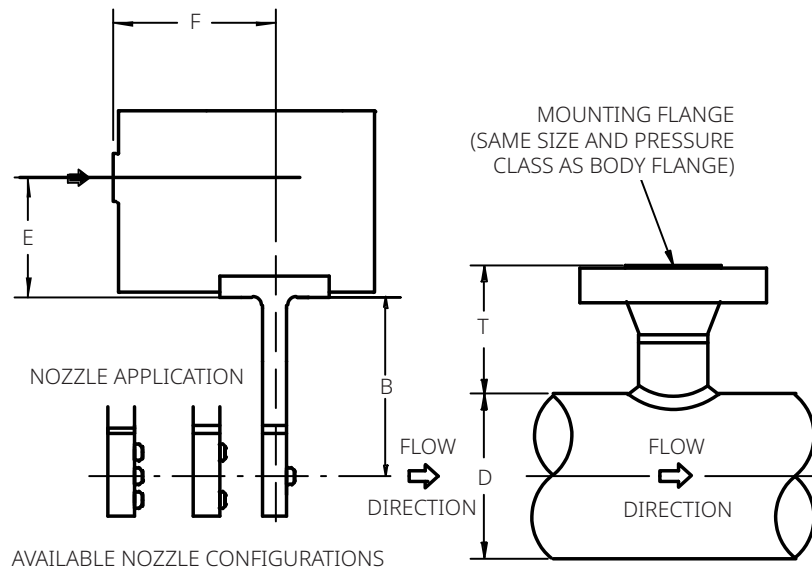
When ordered, the desuperheater configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and fluid conditions. Do not apply any other conditions to the desuperheater without first contacting your Emerson sales office.

1. Mount the DFA desuperheater in a "Tee" piece at the desired location in the pipe, in accordance with standard piping practice. The nozzle should be positioned in the top quadrant of the pipe (see Figure 3 for the proper "T" length dimension).
2. Clean and flush out the cooling water line before connecting to the desuperheater. Use only clean sources of cooling water. Use of clean water decreases wear and prevents clogging of the nozzle by solid particles.

⚠ WARNING

Personal injury or property damage could result from clogging of the desuperheater. Installation of a strainer and an isolating valve on the water line between the desuperheater and the water control valve is recommended. Failure to do so may result in clogging of the desuperheater by solid particles, thus hampering temperature control of the steam.

3. A minimum straight run of pipe is required downstream of the desuperheater before any elbows or reducer to ensure complete vaporization of cooling water. Consult the desuperheater certified drawing for the required distance of straight pipe.
4. The temperature sensor should be mounted according to the manufacturer's instructions. Typical distance to the sensor is at least 9.1 meters / 30 feet downstream of the desuperheater. This distance changes with higher velocity steam flow before any elbows or reducer and the percentage of spraywater required. Consult the desuperheater certified drawing for this distance.
5. There should be no branching out from or into the steam line to divide the steam flow between the temperature sensor and the desuperheater.
6. A typical installation is illustrated in Figure 6. A temperature sensor element (TE) measures changes in temperature and transmits a signal to a remote temperature-indicating controller (TC) or distributed control system (DCS). The output signal from the controller is sent to the positioner on the spraywater control valve. The positioner output signal is piped to the actuator. The actuator strokes the stem/plug of the spraywater control valve, as required, to supply the required cooling water to the desuperheater to maintain temperature setpoint.

Figure 3. Fisher DFA Dimensions (Also See Tables 4 and 5)

Section 4: Nozzle Maintenance and Replacement

If it is necessary to remove the DFA desuperheater from service, take note of the following warning.

⚠ WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

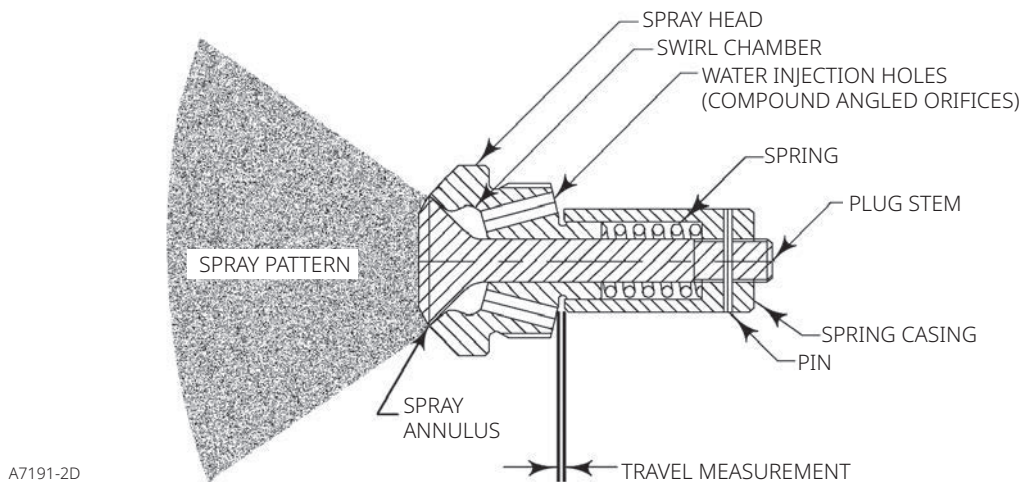
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- Isolate the desuperheater from process pressure. Relieve process pressure on both sides of the desuperheater. Drain the process media from both sides of the desuperheater.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

When subjected to normal operating conditions, it is possible that wear, blockage and/or weld fatigue will occur to the desuperheater body or nozzle assembly. During regularly scheduled maintenance, visually inspect the desuperheater welds for cracks and inspect nozzles for wear and blockage. Your local [Emerson sales office](#) can help to determine the extent of weld fatigue and the correct course of action. Poor performing nozzles or nozzle failure is typically caused by wear, corrosion, erosion and/or blockage. The following instruction will help to determine if any of these problems are present and provide a recommended course of action for each.

NOTE

For optimal performance, nozzles should be inspected every 18 to 24 months and replaced every 24 to 36 months.

Figure 4. Fisher AF Nozzle (DFA)



4.1 DFA Desuperheater Variable Geometry Nozzles

1. Inspect the spray annulus surface, the area between the plug stem and spray head, for excessive wear, erosion/corrosion and/or blockage due to particulate. Wear is defined as any nicks, cuts or gouges on or immediately around the spray annulus. Erosion/corrosion is defined as any form of rust or erosion of the metal on the plug stem or spray head. Blockages are defined when small particulate becomes trapped between the plug stem and spray head or spring casing and spray head. Replacement of the nozzle is recommended if any of the preceding problems are present.
2. **OPTIONAL:** Figure 4 shows the spray pattern that will need to be present during operation of the AF nozzles. Testing can be performed by attaching the existing or an alternate, similar pressure, water line to the unit. If this spray pattern is not present, replacement is recommended.

3. Grind off the tack welds holding the nozzle in place. Apply a penetrant type thread lubricant and allow to soak prior to unscrewing the nozzle. Using the provided flats on the side of the spray head, unscrew the nozzle.
4. Grind excess tack weld material off of both the nozzle and desuperheater body.
5. In the absence of external forces, the nozzle must be fully closed. If the nozzle is not fully closed, it will need to be replaced.
6. Inspect the water injection holes for reduced or non-circular shape due to erosion. Every hole must be the same size and shape. If any are oversized or non-circular in shape, the nozzle will need to be replaced.
7. Inspect the interior of the water injection holes for buildup of particulate and/or magnetite. Nozzle replacement will be needed if any buildup is present.

NOTE

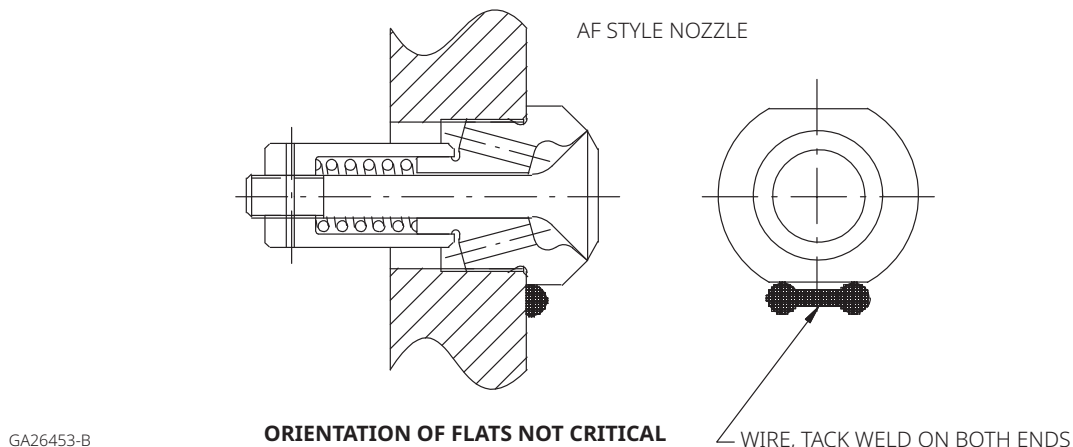
Complete disassembly of the nozzle is strongly discouraged, due to individual spare parts not being available.

8. OPTIONAL: To further check the nozzle for buildup of particulate or magnetite, the nozzle can be disassembled. If disassembled, take great care not to damage the sharp edges of the spray annulus on the plug stem and the sprayhead, as this will greatly affect the spray pattern. Do not compress a removed spring by hand or with a tool, as compression beyond its normal operating range will damage the spring.

To disassemble the nozzle, first remove the pin using a small drill bit as a punch and unscrew the spring casing from the plug stem. The nozzle can be reassembled by following a reverse order of disassembly, taking care to line the hole in the plug stem up with the hole in the spring casing, then pressing the pin back into place through the two parts.

Table 7. AF Nozzle Specifications

NOZZLE TYPE	PLUG TRAVEL	
	mm	in.
AF7	0.356	0.014
AF10	0.711	0.028
AF14	0.737	0.029
AF17	0.864	0.034
AF20	0.914	0.036
AF24	1.067	0.042
AF28	1.122	0.048
AF32	1.422	0.056
AF35	1.651	0.065
AF40	1.600	0.063
AF44	1.753	0.069

Figure 5. Spray Nozzle Tack Weld Locations

9. The travel can be determined by using a feeler gauge to measure the distance between the nozzle body near the water injection ports to the side of the spring casing as outlined in Figure 4. This measurement must match the factory set plug travel for the corresponding nozzle type as shown in Table 7.
10. Inspect nozzle threads for damage and clean if needed; if damage is present, nozzle replacement will be necessary.
11. Rinse both the desuperheater body and nozzle to remove particulate.
12. Screw nozzle into the desuperheater body and tighten just until the spray head is flat and tight against the desuperheater body.
13. Tackweld a small piece of welding wire onto the nozzle mount next to either of the spray head flats to prevent rotation during service (refer to Figure 5). Maintain low heat to prevent distortion of the nozzle.
14. Reinstall the desuperheater into the line, using a reverse order of assembly; refer to the installation instructions to complete this step. Make sure the mounting flange gasket (customer supplied) is replaced with a new one.

4.2 DFA Installation

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) immediately if a discrepancy between actual parts and approved parts is suspected.

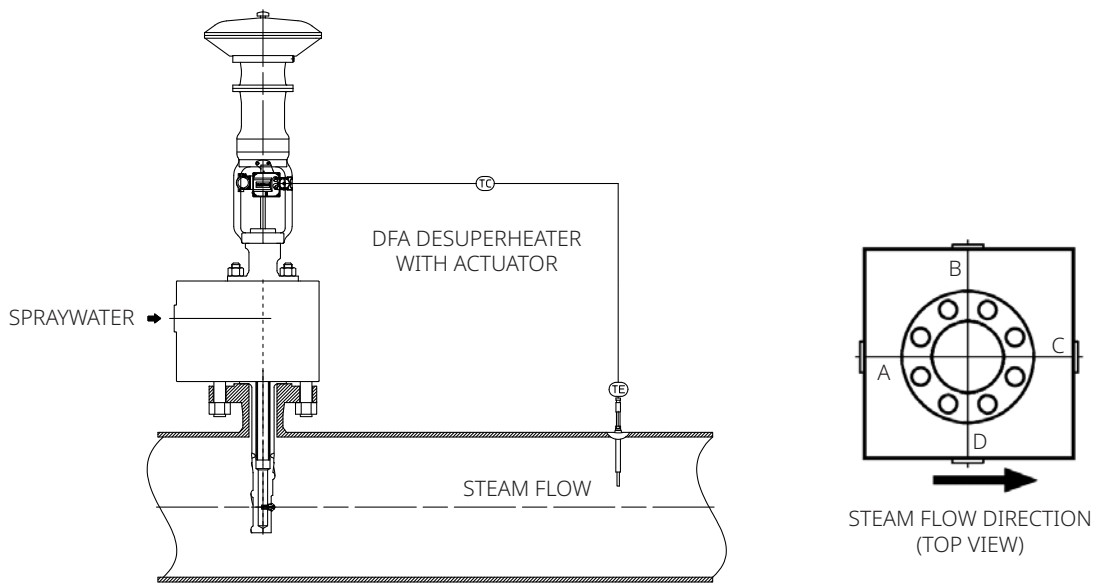
1. Place the desuperheater portion of the DFA into the line and align with the pin. Nozzles should face downstream.
2. Insert the gasket into the lower portion of the DFA.
3. Slowly lower the valve body onto the desuperheater portion and ensure that the alignment pin from the lower portion slides into the corresponding hole in the valve body.
4. Completely lower the valve body onto the lower portion and bolt into place using the recommended line gasket bolting torques.

4.3 Troubleshooting

Table 8 is intended as a basic first line troubleshooting guide. Contact your local [Emerson sales office](#) for assistance if you are unable to resolve your field operation problem.

Table 8. Troubleshooting Guide

Problem	Corrective Action
Temperature setpoint is not reached	Check water source availability and pressure
Temperature setpoint is not reached	Check nozzle(s) for plugging
Temperature setpoint is not reached	Make sure that steam saturation pressure is not above setpoint
Temperature setpoint is not reached	Check to ensure full actuator stroke is reached on the spraywater control valve
Temperature setpoint is not reached	Check for proper orientation of nozzle in steam flow
Temperature is below setpoint	Check temperature control loop - reset
Temperature is below setpoint	Check nozzle for fouling/poor spray pattern - clean/replace
Temperature is below setpoint	Check temperature sensor location - relocate per guidelines
Temperature is below setpoint	Check for proper orientation of nozzle in steam flow
Water in steam line	Check that steam traps are functioning properly
Water in steam line when steam line isolated	Check for proper spraywater control valve actuator installation
Water in steam line when steam line isolated	Replace spraywater control valve seat and plug assembly

Figure 6. Typical DFA Installation

Section 5: Parts

5.1 Parts Ordering

Each desuperheater assembly is assigned a serial number which can be found on the mounting flange of the desuperheater. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering numbers for each part required, the key numbers on Figure 7 can be used to help in part identification.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

5.2 Parts List

Key	Description	Key	Description
1	Nozzle Mount	12	Bonnet Stud
2*	Spray Nozzle	13	Bonnet Stud Nut
3	Body Flange	14	Bonnet
4*	Desuperheater Gasket	15*	Packing Box Ring
5	Alignment Pin	16*	Lantern Ring
6*	Seat Gasket	17*	Packing Rings
7*	Seat	18	Packing Follower
8*	Plug Stem Assembly	19	Packing Flange
9*	Cage	20	Packing Flange Nut
10	Valve Body	21	Packing Flange Stud
11*	Bonnet Gasket	---	---
*Recommended spare parts			

Table 9. Desuperheater Gasket

VALVE SIZE, NPS	CLASS	PART NUMBER
3 and 4	CL150 to CL1500	12B4275X042

Table 10. Bonnet Parts

VALVE SIZE, NPS	CLASS	BULLETIN/INSTRUCTION MANUAL
1, 1-1/2 and 2	CL150 to CL600	EA
1, 1-1/2 and 2	CL900 to CL2500	HPA

Table 11. Trim Parts

VALVE SIZE, NPS	CLASS	BULLETIN/INSTRUCTION MANUAL
1, 1-1/2 and 2	CL150 to CL600	EA
1, 1-1/2 and 2	CL900 to CL2500	HPA

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

DFA Desuperheater

November 2025

Instruction Manual

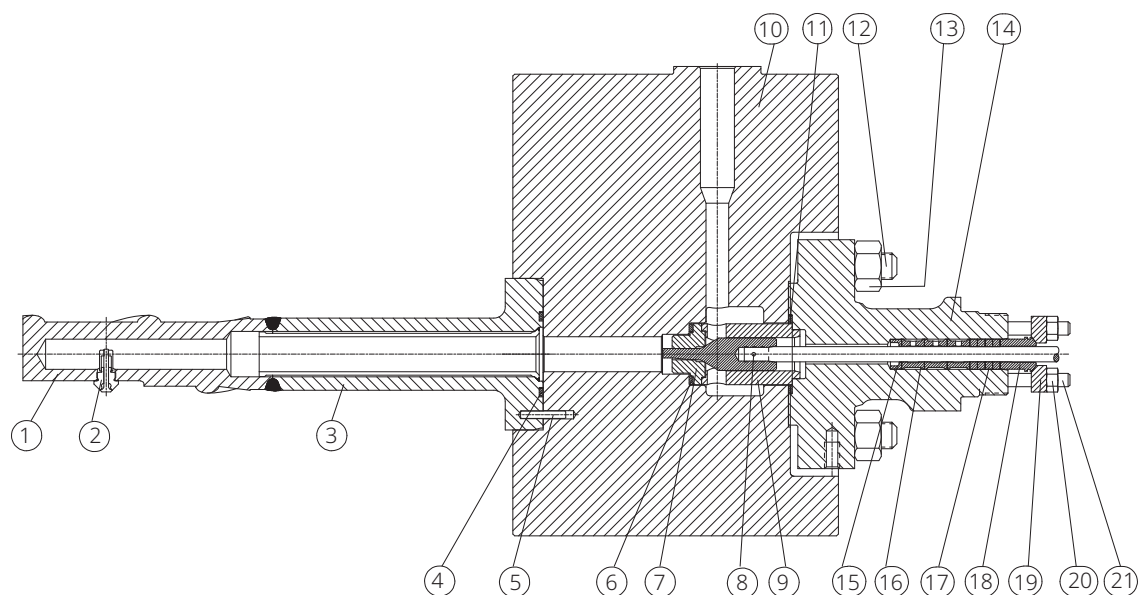
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Table 12. Fisher DFA Weights⁽¹⁾

OUTLET CONNECTION, NPS	INLET CONNECTION, NPS	CLASS	APPROXIMATE WEIGHT	
			kg	lbs
3	1	600	128	283
		1500	183	403
		2500	253	558
	1-1/2	600	137	301
		1500	193	426
		2500	273	602
	2	600	138	304
		1500	206	454
		2500	287	633
4	1	600	179	394
		1500	224	494
		2500	312	688
	1-1/2	600	191	420
		1500	237	522
		2500	337	743
	2	600	193	425
		1500	253	558
		2500	354	781

1. Desuperheater section weighs about 11.4 kg / 25 lbs.

Figure 7. DFA Assembly



NOTE: IMAGE SHOWN WITH ANTICAV MICROFLAT. OTHER OPTIONS ARE AVAILABLE.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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FISHER™



Fisher™ DMA, DMA/AF, and DMA/AF-HTC Mechanically Atomized Desuperheaters

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Figure 1. Fisher DMA, DMA/AF, and DMA/AF-HTC Desuperheaters



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and operation information for the Fisher DMA, DMA/AF, and DMA/AF-HTC mechanically atomized desuperheaters.

Do not install, operate, or maintain these desuperheaters without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your local [Emerson sales office](#) or Local Business Partner before proceeding.

Description

DMA, DMA/AF, and DMA/AF-HTC desuperheaters (figure 1) can be used in many applications to effectively reduce the temperature of superheated steam to the desired set point. Available variations are mechanically atomized (both fixed geometry and variable geometry styles). Desuperheaters are available for installation in steam lines from DN 150 through DN 1500 (NPS 6 through 60) in diameter and are capable of maintaining steam temperatures to within 6°C (10°F) of saturation temperatures.

- **DMA**—A simple mechanically atomized desuperheater with single or multiple, fixed-geometry spray nozzles is intended for applications with nearly constant load. The DMA is installed through a flanged connection on the side of a DN 150 (NPS 6) or larger pipeline. Maximum unit C_v is 3.8.
- **DMA/AF**—A variable-geometry, mechanically atomized, back-pressure-activated desuperheater with one, two, or three spray nozzles is designed for applications requiring control over moderate load fluctuations. The DMA/AF desuperheater (figure 2) is installed through a flanged connection on the side of a DN 200 (NPS 8) or larger pipeline. Maximum unit C_v is 15.0.
- **DMA/AF-HTC**—The DMA/AF-HTC is functionally equivalent to the DMA/AF, however it is structurally suited for more severe applications. The most common applications include boiler interstage attemperation, where the desuperheater is exposed to high thermal cycling and stress, high steam velocities and flow induced vibration. In addition to this specific application, the DMA/AF-HTC is suitable for other severe desuperheating application environments. The DMA/AF-HTC uses a construction optimized to move weld joints away from high stress regions.

The desuperheater design incorporates an integral thermal liner inside the desuperheater body pipe. This minimizes the potential for thermal shock when cool water is introduced to the unit which has been heated to the operating steam temperature.

The nozzle mount for the DMA/AF-HTC is engineered to minimize the potential for excitation due to vortex shedding and flow induced vibration. The DMA/AF-HTC desuperheater (figure 3) is installed through a flanged connection on a DN 200 (NPS 8) or larger pipeline. Maximum unit C_v is 15.0.

Specifications

Specifications for the DMA, DMA/AF, and DMA/AF-HTC desuperheaters are shown in table 1 and table 2.

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DMA Desuperheater

July 2017

Table 1. Specifications

Steam Line Sizes See table 2 Steam Line Connection Sizes See table 2 Spraywater Connection Sizes See table 2 Maximum Inlet Pressures⁽¹⁾ Consistent with applicable CL150, 300, 600, 900, 1500, or 2500 pressure-temperature ratings per ASME B16.34 Inherent Rangeability⁽²⁾ DMA: Up to 3:1 DMA/AF: Up to 10:1 DMA/AF-HTC: Up to 10:1 Spraywater Pressure Required 3.5 to 35 bar (50 to 500 psi) greater than steam line pressure	Minimum Steam Velocity DMA: 9.1 m/s (30 feet per second) DMA/AF: 7.6 m/s (25 feet per second) DMA/AF-HTC: 7.6 m/s (25 feet per second) Maximum Unit C_v (for Spraywater Flow) DMA: 3.8 DMA/AF: 15.0 DMA/AF-HTC: 15.0 Construction Materials Desuperheater Body (all designs except DMA/AF-HTC): ■ Carbon steel, ■ Chrome-moly alloy steel (F22), or ■ 300 series stainless steel Desuperheater Body (DMA/AF-HTC): ■ Carbon Steel (SA105) or ■ Chrome-moly alloy steel (F22, F91) Note: NPS 3 will have body-matched cast equivalent material for nozzle mount Nozzle Material DMA: ■ 303 or ■ 316, stainless steel DMA/AF, DMA/AF-HTC: ■ 410 stainless steel
--	--

1. Do not exceed the pressure or temperature limits in this instruction manual, nor any applicable code or standard limitations.

2. Ratio of maximum to minimum controllable C_v.

Table 2. Connection Sizes

DESIGN	STEAM LINE SIZE	STEAM LINE CONNECTION		SPRAYWATER CONNECTION	
		Size, NPS	Raised-Face Flange ⁽¹⁾ Rating	Size	Raised-Face Flange ⁽¹⁾ Rating
	metric				
DMA	DN 150 - DN 1500	DN 80, 100, or 150	PN 20, 50, 100	DN 25, 40, or 50	PN 20, 50, 100, 150, 250, or 420
DMA/AF	DN 200 - DN 1500	DN 80 ⁽²⁾ , 100, 150, or 200		DN 25, 40, 50, 65, or 80	
DMA/AF-HTC	DN 200 - DN 1500	DN 80 or 100	PN 20, 50, 100, 150, 250, or 420	DN 40 ⁽³⁾ , or 50	PN 20, 50, 100, 150, 250, or 420
	ASME				
DMA	NPS 6 - NPS 60	NPS 3, 4, or 6	CL150, 300, 600	NPS 1, 1-1/2, or 2	CL150, 300, 600, 900, 1500, or 2500
DMA/AF	NPS 8 - NPS 60	NPS 3 ⁽²⁾ , 4, 6, or 8		NPS 1, 1-1/2, 2, 2-1/2, or 3	
DMA/AF-HTC	NPS 8 - NPS 60	NPS 3 or 4	CL150, 300, 600, 900, 1500, or 2500	NPS 1-1/2 ⁽³⁾ , or 2	CL150, 300, 600, 900, 1500, or 2500

1. Other standard flanges and connections are also available.⁷

2. Consult your local [Emerson sales office](#) or Local Business Partner for acceptability of NPS 3 mounting connection for size and pressure class specified.

3. NPS 1-1/2 spraywater connection is only available for CL150 - 900.

Principle of Operation

The DMA, DMA/AF, and DMA/AF-HTC desuperheaters reduce steam temperatures through the introduction of cooling water directly into the hot steam flow stream. By regulating the quantity of water that is injected, accurate downstream steam temperature can be both controlled and maintained.

The rate of vaporization, and/or cooling, is a function of droplet size, distribution, mass flow, and temperature. Steam velocity is critical and should be maintained at 6.1 to 9.1 meters per second (20 to 30 feet per second) as the minimum. Actual minimum steam velocity requirements will vary by application. As steam velocity increases, a longer distance is required to achieve homogeneous mixing and to complete vaporization.

In both DMA desuperheater nozzle styles, the spraywater quantity is controlled by an external control valve which responds to signals received from the temperature control system. The water enters the main tube of the desuperheater, passes through the spray nozzle, and discharges into the steam line as a fine, atomized spray (see figure 2).

Each particular nozzle, or set of nozzles, in the sprayhead is tailored to meet a specific set of operating conditions. The nozzle design optimizes the spraywater droplet size promoting rapid atomization and complete vaporization of water in the steam flow stream to obtain precise temperature control. The DMA desuperheater uses a fixed geometry nozzle, while the DMA/AF desuperheater uses a variable geometry AF nozzle. In the AF nozzle design (see figure 5), water enters the swirl chamber via compound angled orifices, thus creating a rotational flow stream. This flow stream is further accelerated as it is forced up and out through the spray annulus. The cone-shaped plug varies the geometry of the spray annulus using a force balance principle between water pressure and the preload exerted by a helical spring. This variable geometry design sprays a thin hollow cone over a wide range of flow rates, resulting in excellent temperature control over a wide range of operating conditions.

Figure 2. Detail of Fisher DMA/AF Desuperheater

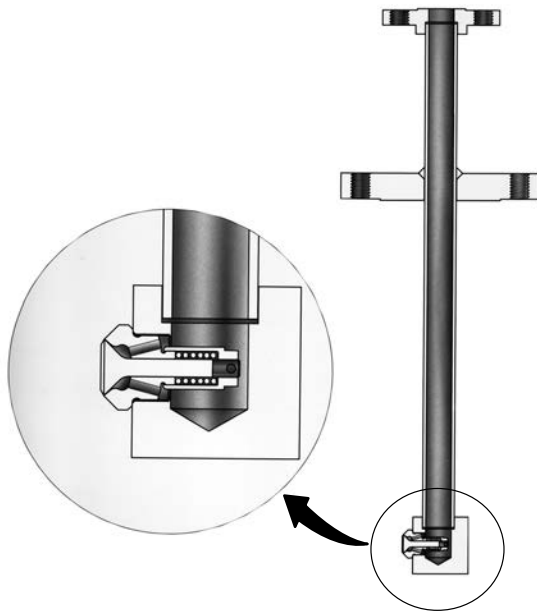


Figure 3. Detail of Fisher DMA/AF-HTC Desuperheater

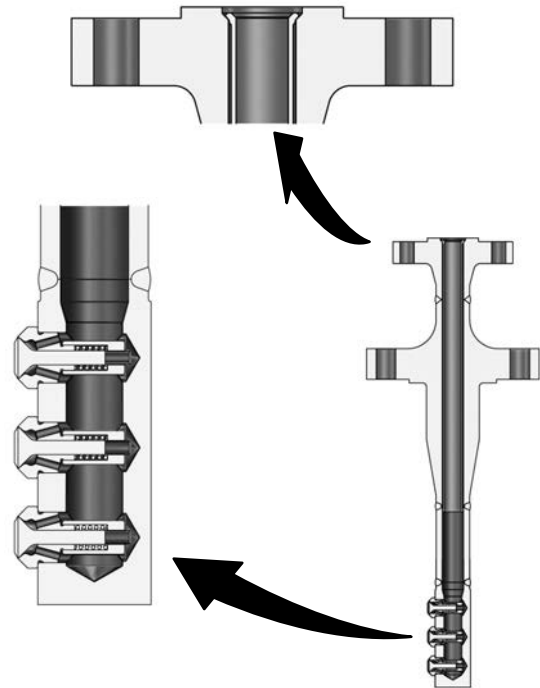
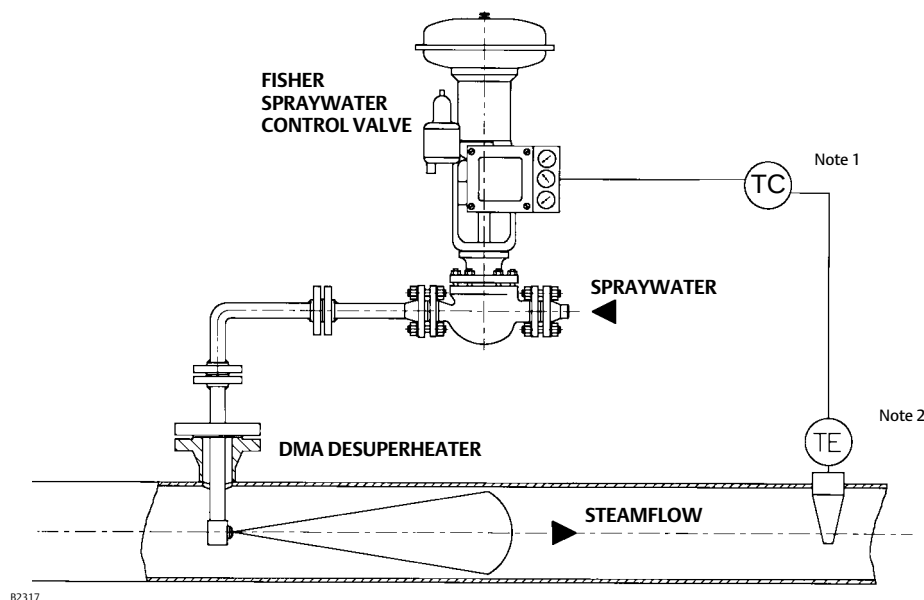


Figure 4. Typical Fisher DMA, DMA/AF, or DMA/AF-HTC Desuperheater Installation



Notes:

1. TC - Temperature-Indicating Controller
2. TE - Temperature Sensor Element

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the desuperheater is installed where service conditions could exceed the limits given in table 1 or on the nameplate. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the desuperheater configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and fluid conditions. Do not apply any other conditions to the desuperheater without first contacting your local Emerson Automation Solutions sales office representative.

1. Mount the DMA, DMA/AF, or DMA/AF-HTC desuperheater in a "Tee" piece at the desired location in the pipe, in accordance with standard piping practice. The nozzle should be positioned in the top quadrant of the pipe (see figure 6 or 7 for the proper "T" length dimension).

2. Clean and flush out the cooling water line before connecting to the desuperheater. Use only clean sources of cooling water. Use of clean water decreases wear and prevents clogging of the nozzle by solid particles.

⚠ WARNING

Personal injury or property damage could result from clogging of the desuperheater. Installation of a strainer and an isolating valve on the water line between the desuperheater and the water control valve is recommended. Failure to do so may result in clogging of the desuperheater by solid particles, thus hampering temperature control of the steam.

3. A minimum straight run of pipe is required downstream of the desuperheater to ensure complete vaporization of cooling water. Consult the desuperheater certified drawing for the required distance of straight pipe.
4. The temperature sensor should be mounted according to the manufacturer's instructions. Typical distance to the sensor is at least 9.1 meters (30 feet) downstream of the desuperheater. This distance changes with higher velocity steam flow and the percentage of spraywater required. Consult the desuperheater certified drawing for this distance.
5. There should be no branching out from or into the steam line to divide the steam flow between the temperature sensor and the desuperheater.
6. A typical installation is illustrated in figure 4. A temperature sensor element (TE) measures changes in temperature and transmits a signal to a remote temperature-indicating controller (TC) or distributed control system (DCS). The output signal from the controller is sent to the positioner on the spraywater control valve. The positioner output signal is piped to the actuator. The actuator strokes the stem/plug of the spraywater control valve, as required, to supply the required cooling water to the desuperheater to maintain temperature setpoint.

Nozzle Maintenance and Replacement

If it is necessary to remove the DMA, DMA/AF, or DMA/AF-HTC desuperheater from service, take note of the following warning.

⚠ WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

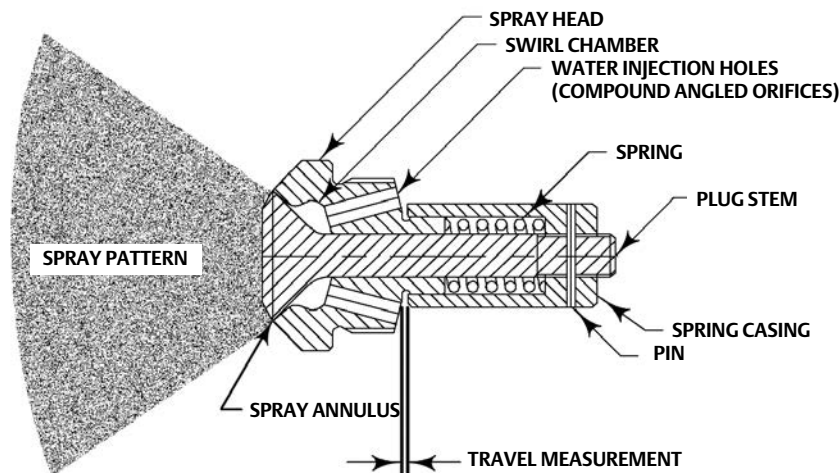
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Isolate the desuperheater from process pressure. Relieve process pressure on both sides of the desuperheater. Drain the process media from both sides of the desuperheater.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

When subjected to normal operating conditions, it is possible that wear, blockage, and/or weld fatigue will occur to the desuperheater body or nozzle assembly. During regularly scheduled maintenance, visually inspect the desuperheater welds for cracks and inspect nozzles for wear and blockage. Your local [Emerson sales office](#) or Local Business Partner can help to determine the extent of weld fatigue and the correct course of action. Poor performing nozzles or nozzle failure is typically caused by wear, corrosion, erosion, and/or blockage. The following instruction will help to determine if any of these problems are present and provide a recommended course of action for each.

Note

For optimal performance, nozzles should be inspected every 18-24 months and replaced every 24-36 months.

Figure 5. Fisher AF Nozzle (DMA/AF and DMA/AF-HTC)



A7191-2D

DMA/AF and DMA/AF-HTC Desuperheater Variable Geometry Nozzles

1. Inspect the spray annulus surface, the area between the plug stem and spray head, for excessive wear, erosion/corrosion, and/or blockage due to particulate. Wear is defined as any nicks, cuts, or gouges on or immediately around the spray annulus. Erosion/corrosion is defined as any form of rust or erosion of the metal on the plug stem or spray head. Blockages are defined when small particulate becomes trapped between the plug stem and spray head or spring casing and spray head. Replacement of the nozzle is recommended if any of the preceding problems are present.
2. **OPTIONAL:** Figure 5 shows the spray pattern that will need to be present during operation of the AF nozzles. Testing can be performed by attaching the existing or an alternate, similar pressure, water line to the unit. If this spray pattern is not present, replacement is recommended.
3. Grind off the tack welds holding the nozzle in place. Apply a penetrant type thread lubricant and allow to soak prior to unscrewing the nozzle. Using the provided flats on the side of the spray head, unscrew the nozzle.
4. Grind excess tack weld material off of both the nozzle and desuperheater body.
5. In the absence of external forces, the nozzle must be fully closed. If the nozzle is not fully closed, it will need to be replaced.
6. Inspect the water injection holes for reduced or non-circular shape due to erosion. Every hole must be the same size and shape. If any are over-sized or non-circular in shape, the nozzle will need to be replaced.
7. Inspect the interior of the water injection holes for buildup of particulate and/or magnetite. Nozzle replacement will be needed if any buildup is present.

Note

Complete disassembly of the nozzle is strongly discouraged, due to individual spare parts not being available.

8. **OPTIONAL:** The internal spring may relax over time and not provide the tensile force required to shut off and control flow. If the nozzle spring is suspected of being too relaxed, then the nozzle should be replaced.

Table 3. AF Nozzle Specifications

NOZZLE TYPE	PLUG TRAVEL, INCHES
AF7	0.014
AF10	0.028
AF14	0.029
AF17	0.034
AF20	0.036
AF24	0.042
AF28	0.048
AF32	0.056
AF35	0.065
AF40	0.063
AF44	0.069

To further check the spring, the spring can be removed by first removing the pin, using a small drill bit as a punch and unscrewing the spring casing from the plug stem. The nozzle can be reassembled by following a reverse order of disassembly, taking care to line the hole in the plug stem up with the hole in the spring casing, then pressing the pin back into place through the two parts.

9. The travel can be determined by using a feeler gauge to measure the distance between the nozzle body near the water injection ports to the side of the spring casing as outlined in figure 5. This measurement must match the factory set plug travel for the corresponding nozzle type as shown in table 3.
10. Inspect nozzle threads for damage and clean if needed; if damage is present, nozzle replacement will be necessary.
11. Rinse both the desuperheater body and nozzle to remove particulate.
12. Screw nozzle into the desuperheater body and tighten just until the spray head is flat and tight against the desuperheater body.
13. Tack-weld a small piece of welding wire onto the nozzle mount next to either of the spray head flats to prevent rotation during service (refer to figure 8). Maintain low heat to prevent distortion of the nozzle.
14. Reinstall the desuperheater into the line, using a reverse order of assembly; refer to the installation instructions to complete this step. Make sure the mounting flange gasket (customer supplied) is replaced with a new one.

DMA Desuperheater Fixed Geometry Nozzles

1. Inspect the nozzle orifice for excessive wear, erosion/corrosion, and/or blockage due to particulate. Wear is defined as any nicks, cuts, or gouges on or immediately around the orifice. Erosion/corrosion is defined as any form of rust or erosion of the metal on the nozzle. Blockages are defined when small particulate becomes trapped between the plug stem and spray head. Replacement of the nozzle is recommended if any of the preceding problems are present.

Proceed to steps 2-5 only if nozzle replacement is required.

2. Grind off the tack welds holding the nozzle in place. Apply a penetrant type thread lubricant and allow to soak prior to unscrewing the nozzle. Using the provided flats on the side of the spray head, unscrew the nozzle.
3. Rinse both the desuperheater body and new nozzle to remove particulate.
4. Screw the new nozzle into place just until it is tight in the nozzle mount.
5. Tack-weld the nozzle in place to prevent rotation during service (refer to figure 8). Maintain low heat to prevent distortion of the nozzle.
6. Reinstall the desuperheater into the line, using a reverse order of assembly; refer to the installation instructions to complete this step. Make sure the mounting flange gasket (customer supplied) is replaced with a new one.

Troubleshooting

Table 4 is intended as a basic first line troubleshooting guide. Contact your [Emerson sales office](#) or Local Business Partner for assistance if you are unable to resolve your field operation problem.

Table 4. Troubleshooting Guide

Problem	Corrective Action
Temperature setpoint is not reached	Check water source availability and pressure
Temperature setpoint is not reached	Check nozzle(s) for plugging
Temperature setpoint is not reached	Make sure that steam saturation pressure is not above setpoint
Temperature setpoint is not reached	Check to ensure full actuator stroke is reached on the spraywater control valve
Temperature setpoint is not reached	Check for proper orientation of nozzle in steam flow
Temperature is below setpoint	Check temperature control loop - reset
Temperature is below setpoint	Check nozzle for fouling/poor spray pattern - clean/replace
Temperature is below setpoint	Check temperature sensor location - relocate per guidelines
Temperature is below setpoint	Check for proper orientation of nozzle in steam flow
Water in steam line	Check that steam traps are functioning properly
Water in steam line when steam line isolated	Check for proper spraywater control valve actuator installation
Water in steam line when steam line isolated	Replace spraywater control valve seat and plug assembly

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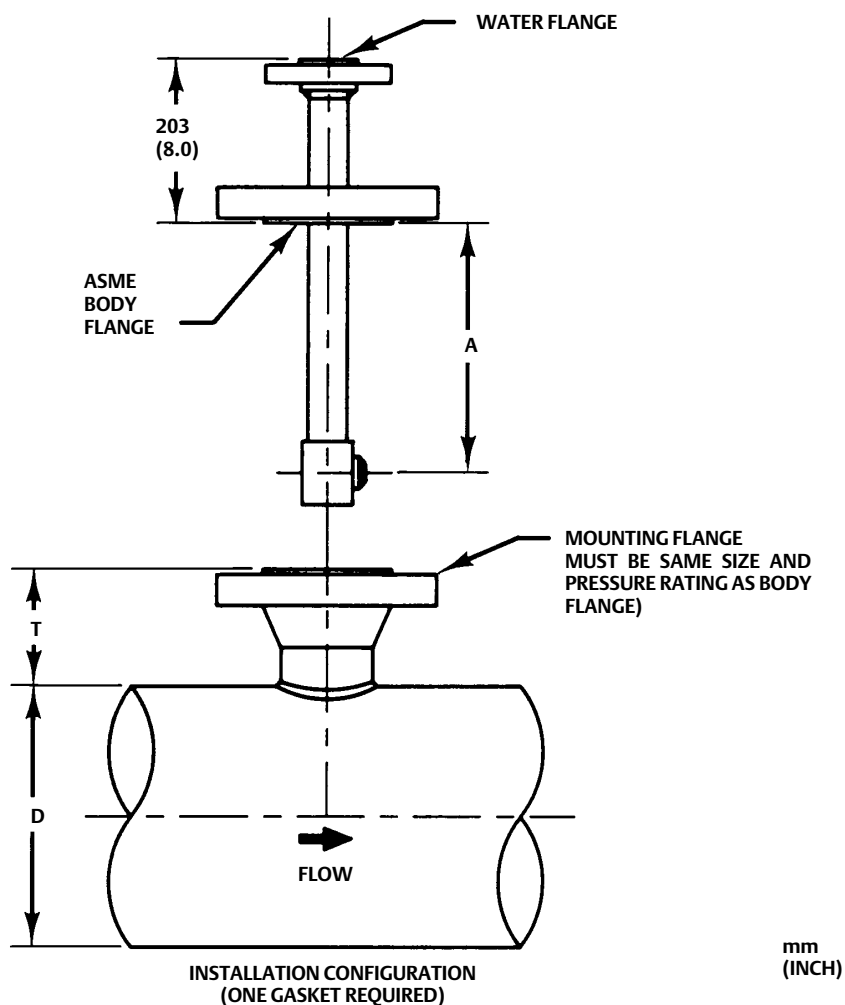
DMA Desuperheater

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Figure 6. Fisher DMA and DMA/AF Dimensions (also see table 5)



A5094-1 NOTE: ALL FLANGE BOLT HOLES STRADDLE STEAM PIPE CENTERLINE

Table 5. Fisher DMA and DMA/AF Dimensions

DIMENSION				
A		D	T	
mm	Inches	NPS	mm	Inches
360	14.19	6 ⁽¹⁾	273	10.75
360	14.19	8	248	9.75
360	14.19	10	216	8.50
448	17.63	12	279	11.00
448	17.63	14	267	10.50
448	17.63	16	241	9.50
448	17.63	18	216	8.50
524	20.63	20	267	10.50
524	20.63	22	241	9.50
524	20.63	24	216	8.50
524	20.63	>24	216	8.50

1. DMA only.
Note: For DN 150 and 200 (NPS 6 and 8) (DMA/AF only) mounting flange, add 69.6 mm (2.75 inches) to the A and T dimensions. For CL2500 mounting, consult your local Emerson Automation Solutions sales office representative. Refer to the certified drawing to verify the inside-diameter requirements of mounting for DMA/AF.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

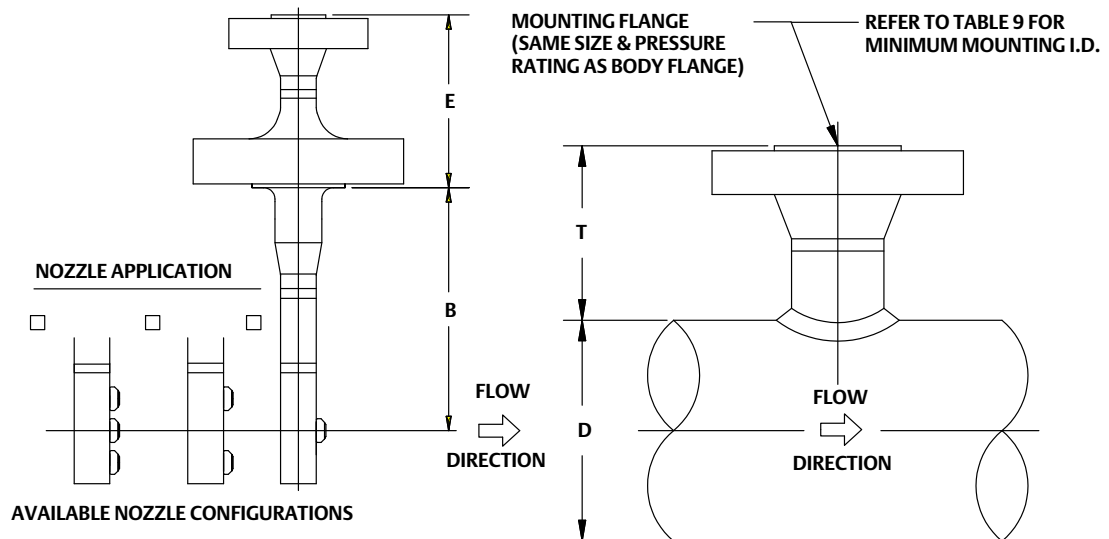
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DMA Desuperheater

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Figure 7. Fisher DMA/AF-HTC Dimensions



GA32864-C

Table 6. Fisher DMA/AF-HTC Dimensions

WATER FLANGE		DESUPERHEATER BODY FLANGE ⁽¹⁾		DIMENSION	
Size, NPS	Pressure Rating	Size, NPS	Pressure Rating	E (Standard)	
				mm	Inches
1-1/2	CL150	3 or 4	CL150	203	8
	CL300	3 or 4	CL300	203	8
	CL600	3 or 4	CL600	203	8
	CL900	3 or 4	CL900	203	8
2	CL150	3 or 4	CL150	203	8
	CL300	3 or 4	CL300	203	8
	CL600	3 or 4	CL600	203	8
	CL900	3 or 4	CL900	254	10
	CL1500	3 or 4	CL1500	254	10
	CL2500	3 or 4	CL2500	292	11.5

1. The NPS 4 DMA/AF-HTC requires a 4.00 inch minimum mounting I.D. Contact your [Emerson sales office](#) or Local Business Partner for NPS 3 DMA/AF-HTC minimum mounting I.D. '

Table 7. Fisher DMA/AF-HTC Dimensions

DIMENSION						
D (Nominal Pipe Size)		Desuperheater Body Flange Size, NPS	B (Insertion Length)		T (Height)	
mm	NPS		mm	Inches	mm	Inches
200	8	3 or 4	356	14.00	248	9.75
250	10	3 or 4	356	14.00	216	8.5
300	12	3 or 4	444	17.50	279	11.0
350	14	3 or 4	444	17.50	267	10.5
400	16	3 or 4	444	17.50	241	9.5
450	18	3 or 4	444	17.50	216	8.5
500	20	3 or 4	444	17.50	216	8.5
550	22	3 or 4	444	17.50	216	8.5
600-900	24-36	3 or 4	444	17.50	216	8.5

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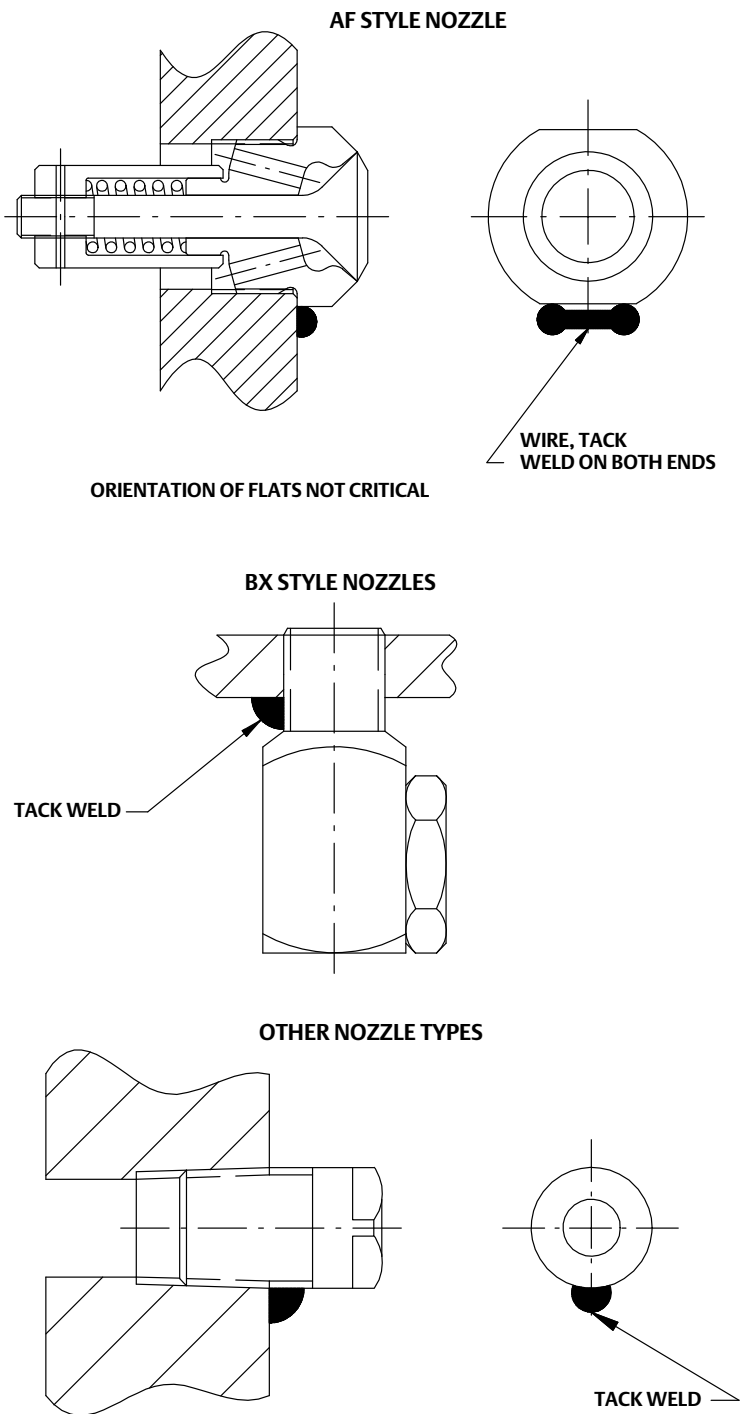
Table 8. Fisher DMA/AF Minimum Mounting I.D.

NOZZLE MODEL	VALVE BODY PIPE	MINIMUM VALVE BODY FLANGE	WATER FLANGE	MINIMUM MOUNTING I.D.	
	Size, NPS	Size, NPS	Size, NPS	mm	Inches
DMA - M Spray Nozzle	1	3	1, 1-1/2, or 2	73.66	2.9
DMA - A through DMA - U Spray Nozzle				58.42	2.3
DMA/AF-A, B, C			1	66.65	2.624
DMA/AF-D, E				73.66	2.9
DMA/AF-A, B, C, D	1-1/2	4	1, 1-1/2, or 2	77.98	3.07
DMA/AF-E				80.06	3.152
DMA/AF-F				87.33	3.438
DMA/AF-G				92.05	3.624
DMA/AF-H				97.18	3.826
DMA/AF-J		6	1, 1-1/2, or 2	129.5	5.1

Table 9. Fisher DMA/AF-HTC Minimum Mounting I.D.

NOZZLE MODEL	MINIMUM VALVE BODY FLANGE	WATER FLANGE	MINIMUM MOUNTING I.D.	
	Size, NPS	Size, NPS	mm	Inches
DMA/AF-A, B, C	3	1-1/2 or 2	66.65	2.624
DMA/AF-D, E			72.66	2.9
DMA/AF-A through H	4	1-1/2 or 2	101.6	4

Figure 8. Spray Nozzle Tack Weld Locations



Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, mention the serial number of the desuperheater. Each DMA, DMA/AF, and DMA/AF-HTC desuperheater assembly is assigned a serial number which can be found on the mounting flange. The only available replacement part for this desuperheater is the complete nozzle assembly. Whenever ordering replacement nozzles, state the complete eleven-digit part number of each nozzle required as found in the following parts list.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher equipment, because they may void your warranty, might adversely affect the performance of the equipment, and could cause personal injury and property damage.

Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your [Emerson sales office](#) or Local Business Partner.

NOZZLE TYPE	PART NUMBER
AF7	GA07205X012
AF10	GA12476X012
AF14	GA03907X012
AF17	GA11805X012
AF20	GA03901X012
AF24	GA11435X012
AF28	GA03877X012
AF32	GA12196X012
AF35	GA11788X032
AF40	GA05300X012
AF44	GA11944X012

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D101617X012

DMA Desuperheater

July 2017

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

DMA Desuperheater

July 2017

Instruction Manual

D101617X012

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Fisher™ DSA Steam-Atomized Desuperheater

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Figure 1. Fisher DSA Steam-Atomized Desuperheater



W5366-1

Introduction

Scope of Manual

This instruction manual includes installation and operation information for the Fisher DSA steam-atomized desuperheater.

Do not install, operate, or maintain a DSA desuperheater without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The DSA steam-atomized desuperheater (figure 1) serves a wide range of desuperheating applications. It is best suited for those installations requiring high rangeability in low steam velocity pipelines. With adequate controls, this unit provides an efficient means of atomizing spraywater over wide fluctuations in flow rate while maintaining downstream steam temperature to within 6 to 8°C (10 to 15°F) of saturation. The DSA desuperheater is easily installed directly into the steam line. The standard mounting is with the desuperheater perpendicular to the steam line. However, the DSA desuperheater can be made to fit angle or elbow installations.

Table 1. Specifications

Steam Line Sizes ■ NPS 6 to 60	Inherent Rangeability⁽²⁾ Up to 50:1
Steam Line Connection Sizes NPS ■ 3, ■ 4, and ■ 6 ■ CL150, ■ CL300, ■ CL600, ■ CL900, ■ CL1500, and ■ CL2500 raised-face flange	Spraywater Pressure Required 3.5 to 35 bar (50 to 500 psi) greater than steam line pressure
Spraywater and Atomizing Steam Connection Sizes NPS ■ 1, ■ 1-1/2, and ■ 2 ■ CL150, ■ CL300, ■ CL600, ■ CL900, ■ CL1500, and ■ CL2500 raised-face flange	Minimum Steam Velocity 1.5 m/s (5 feet per second) depending on actual operating conditions
Maximum Inlet Pressures⁽¹⁾ Consistent with applicable CL150, 300, 600, 900, 1500, or 2500 pressure-temperature ratings per ASME B16.34	Atomizing Steam Atomizing steam should be at least 2.0 times the pressure of the steam to be desuperheated. Total atomizing steam flow (lb/hr) will be 10 to 15 percent of the maximum spraywater flow (lb/hr).

1. Do not exceed the pressure or temperature limits in this instruction manual, nor any applicable code or standard limitations.

2. Ratio of maximum to minimum controllable Cv.

Principle of Operation

The DSA desuperheater utilizes the energy of atomizing steam to produce a fine spray of cooling water for injection into the steam line. An external spraywater control valve controls the quantity of cooling water. The water flows into the desuperheater and fills the main body of the unit just ahead of the atomizing head. Here the water is directed into a number of flow channels where it is mixed and atomized by the high velocity atomizing steam (see figure 3).

The atomizing steam is controlled via an automatic or manual shutoff valve. The steam flows down the center of the desuperheater body toward the atomizing head. Here too, the steam is directed into a number of flow channels. These channels are sized to produce a critical pressure drop. This assures very high steam velocities and maximum kinetic energy for spraywater atomization.

The atomizing steam mixes with the cooling water and produces a spraywater cloud with almost infinite surface area. This spray cloud is almost instantaneously vaporized when injected into the main steam line, resulting in steam at a reduced temperature.

The atomizing steam tube inside the desuperheater is only secured at the atomizing head. The packing box on top allows for the free movement of the unit due to thermal expansion from steam/water temperature differentials.

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the desuperheater is installed where service conditions could exceed the limits given in table 1 or on the nameplate. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the desuperheater configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and fluid conditions. Do not apply any other conditions to the desuperheater without first contacting your Emerson Automation Solutions sales office.

1. Insert the DSA desuperheater into the flanged pipe stud on the steam line (see figure 2 for the proper “T” length dimension). Bolt the unit to the pipe in accordance with standard piping practice.
2. Clean and flush out the cooling water line before connecting to the desuperheater. Use only clean sources of cooling water. Use of clean water decreases wear to the valve trim and prevents clogging of the desuperheater by solid particles.

⚠ WARNING

Personal injury or property damage could result from clogging of the desuperheater. Emerson Automation Solutions recommends installation of a strainer and isolating valve on the water line leading to the desuperheater. Failure to do so may result in clogging of the desuperheater by solid particles, thus hampering temperature control of the steam.

3. A straight run of pipe is required downstream of the desuperheater to assure complete vaporization of cooling water. Consult the desuperheater certified drawing for the required distance of straight pipe.
4. The temperature sensor should be mounted according to manufacturer's instructions. Minimum distance to the sensor is approximately 9.1 m (30 feet) downstream of the desuperheater. This distance changes with higher velocity steam flow and percentage of spraywater required. Consult the desuperheater certified drawing for the exact distance.
5. Allow no branching out from the steam line, to divide the steam flow, between the temperature sensor and the desuperheater.

A typical control loop is illustrated in figure 4. A temperature sensor generates a pneumatic instrument air signal through a transmitter. This signal is transmitted to a remote mounted temperature indicating control station. The output signal from the control station is sent to the positioner on the spraywater control valve. The positioner output signal is piped to the actuator, which strokes the valve and controls the flow of cooling water to the desuperheater. The atomizing steam valve is normally controlled so that it fully opens as soon as the spraywater control valve starts to open.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however some readjustment will be required to meet specific service conditions.

Operating Instructions

Verification of Control Instrumentation

Note

The following steps assume that a local controller is used. If all controls are through a DCS, adjust verification steps accordingly.

1. Connect the instrument air supply lines to the temperature transmitter, indicating control station, and valve positioner in accordance with instrumentation manufacturer's instructions.
2. Switch the controller to manual control.

Note

If 0.4 to 2.0 bar (6 to 30 psig) or another range is used, adjust the instrument air signal referenced in the following steps accordingly.

3. This instruction manual assumes an instrument air signal of 0.2 to 1.0 bar (3 to 15 psig). Adjust the instrument air signal to 0.2 bar (3 psig). Check that the water valve is completely closed. Adjust the positioner, if necessary.
4. Now adjust the instrument air signal to 1.0 bar (15 psig). Check that the water valve opens to its full travel. Adjust the positioner to correct the range and re-zero if needed, by referring to step 3. Check to ensure the atomizing steam valve opens as soon as the spraywater control valve begins to open.
5. Thereafter, check that the controller is responding so that rising steam temperature gives an increasing instrument air signal.
6. Adjust the instrument air signal to 0.6 bar (9 psig).
7. Verify that the atomizing steam valve has opened.
8. Open the water supply.
9. Observe the downstream steam temperature.
10. Increase the instrument air signal to 0.8 bar (11 psig). Check that the steam temperature decreases.
11. Adjust the instrument air signal to 0.5 bar (7 psig) and check that the steam temperature rises.

Note

If the temperature does not fall when the instrument air signal is increased, the cause may be that either the water isolation valve has not been opened or that the steam temperature is close to saturation. If the latter is the case, set the instrument air signal to 0.3 bar (4 psig) [spraywater valve slightly open] and increase to 0.4 bar (6 psig). Check if the temperature decreases.

12. When satisfactory coordination between the instrument air signal and steam temperature is reached, adjust the controller according to directions of the manufacturer.
13. Switch the controller to "automatic" for automatic positioning.

Note

For more detailed calibration information, refer to the instrument manufacturer's operating instructions.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D101618X012

DSA Desuperheater

July 2017

Figure 2. "T" Dimension

D NPS	T	
	mm	Inches
6 Nominal	273.1	10.75
8 Nominal	247.7	9.75
10 Nominal	215.9	8.5
12 Nominal	279.4	11
14 Nominal	266.7	10.5
16 Nominal	241.3	9.5
18 Nominal	215.9	8.5
20 Nominal	266.7	10.5
22 Nominal	241.3	9.5
24 Nominal	215.9	8.5
> 24 Nominal	215.9	8.5

For the NPS 6 mounting flange, add 69.9 mm (2.75 inches) to the "T" dimension.

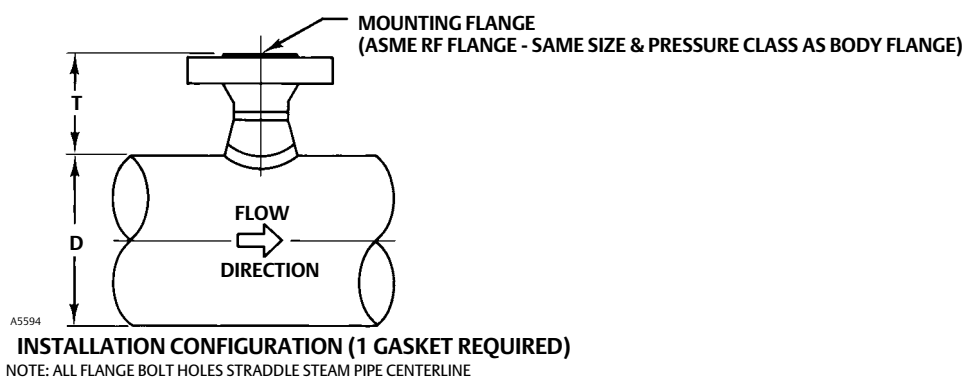


Figure 3. Detail of Fisher DSA Desuperheater

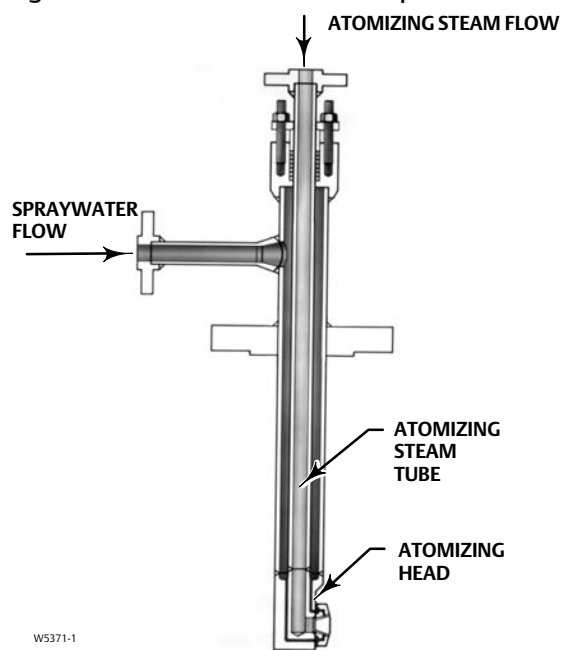


Figure 4. Control Loop with Fisher DSA Desuperheater

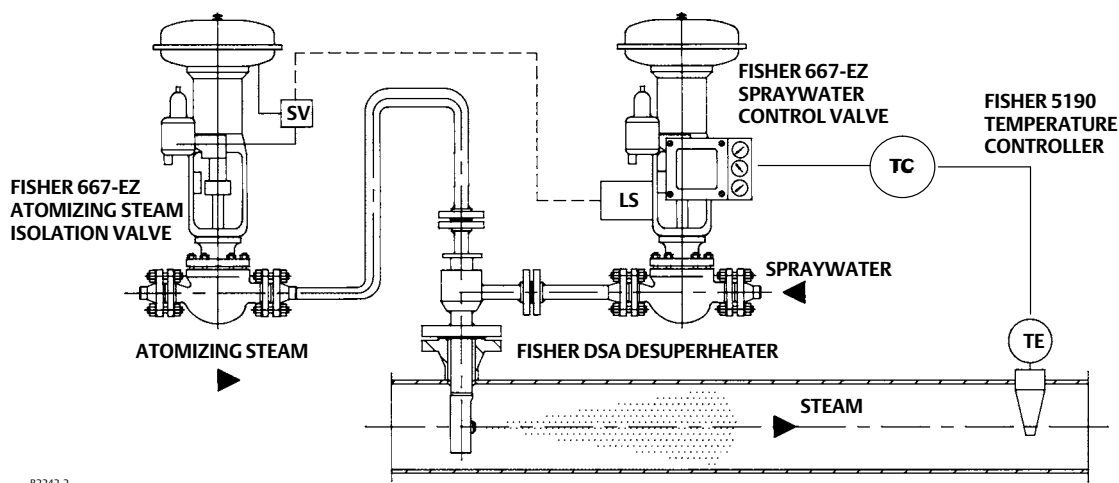
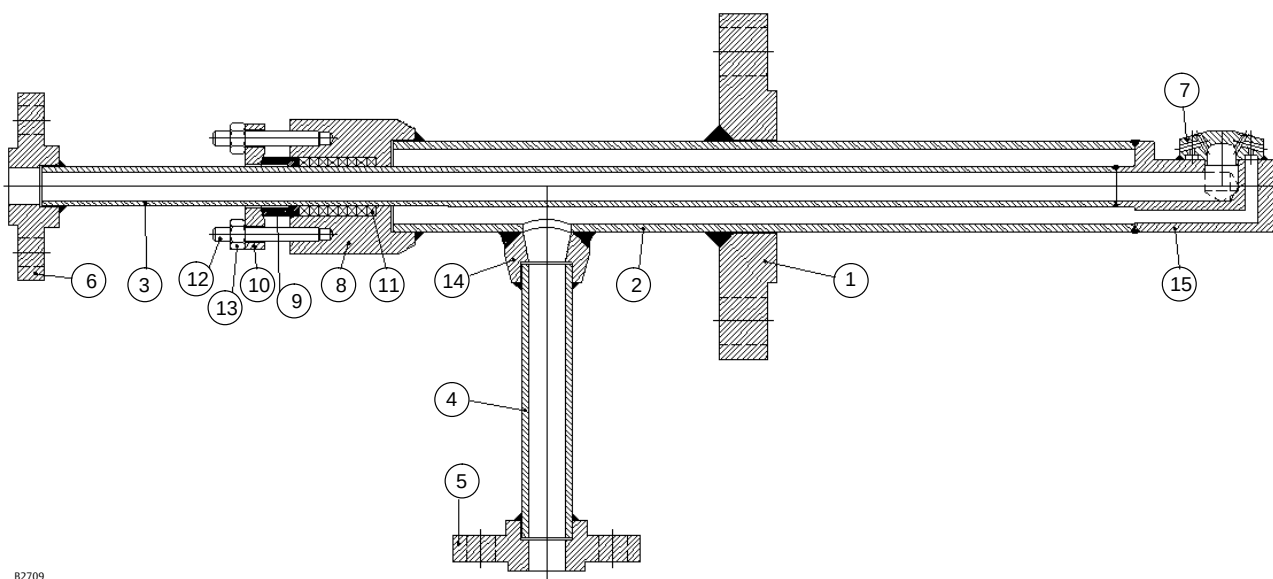


Figure 5. Fisher DSA Assembly



Maintenance Instructions

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the desuperheater while the valve is still pressurized.

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuators. Be sure the actuators cannot suddenly open or close the atomizing steam or spraywater control valves.
- Completely shut off the process to isolate the DSA desuperheater from process pressure. Relieve process pressure and drain the process media before servicing the unit.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The desuperheater packing box may contain process fluids that are pressurized, *even when the desuperheater has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Servicing

Although the DSA desuperheater is a simple design requiring almost no maintenance, it may be necessary to repack the unit if a steam packing leak should develop.

⚠ WARNING

Residual system pressure may be released during the following steps if the system was improperly isolated or vented. Use extreme care to prevent personal injury while loosening any fasteners in the pressure boundary.

1. Slowly and evenly loosen the gland nuts (key 13, figure 5) and remove them from the gland studs (key 12, figure 5).
2. Pull back the gland flange (key 10, figure 5) and gland follower (key 9, figure 5) from the stuffing box.
3. Using a suitable packing pick, remove the packing (key 11, figure 5) from the stuffing box.
4. Reinstall packing (key 11, figure 5), making sure to push down each ring as far as possible with the gland follower (key 9, figure 5) prior to installing the next ring. This process can be made somewhat easier by lubricating each ring with grease similar to copper-based anti-seize or heavy duty anti-seize.
5. After installation of the new packing set, gland follower and gland flange, tighten the gland nuts (key 13, figure 5) to seal the packing on the steam pipe from leakage.
6. After ensuring that the DSA desuperheater is properly reinstalled in the pipeline, the unit may be returned to service. The DSA desuperheater should be monitored as the unit is brought on line to ensure that there are no leaks in the connections.

Table 1. Troubleshooting Guide

Problem	Possible Solution
Temperature setpoint is not reached	Check water source availability and pressure
Temperature setpoint is not reached	Check nozzle(s) for plugging
Temperature setpoint is not reached	Make sure that steam saturation pressure is not above setpoint
Temperature setpoint is not reached	Check to ensure full actuator stroke is reached
Temperature is below setpoint	Check temperature control loop - reset
Temperature is below setpoint	Check nozzle for fouling/poor spray pattern - clean/replace
Temperature is below setpoint	Check temperature sensor location - relocate per guidelines
Temperature oscillates around setpoint	Tune control system parameters
Temperature oscillates around setpoint	Temperature setpoint may be too close to saturation
Water in steam line	Check atomizing steam supply pressure and valve opening
Water in steam line	Check that steam traps are functioning properly
Water in steam line when steam line isolated	Check for leakage of spraywater control valve
Water in steam line	Review piping configuration for downstream tees and elbows

Troubleshooting

Table 1 is a basic first line troubleshooting guide. Contact your [Emerson sales office](#) or Local Business Partner for assistance if you are unable to resolve your field operation problem.

Parts Ordering

Each DSA desuperheater is assigned a serial number that can be found on the DSA desuperheater body or on a tag attached to the mounting flange. Refer to the serial number when contacting your Emerson sales office or Local Business Partner for technical assistance. When ordering a replacement part, refer to the serial number and key number. The key numbers in figure 5 can be used to help in part identification.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Key	Description	Key	Description
1	Body Flange	8	Stuffing Box
2	Body Pipe	9	Gland Follower
3	Steam Pipe	10	Gland Flange
4	Water Pipe	11*	Packing
5	Water Flange	12	Gland Stud
6	Steam Flange	13	Gland Nut
7	Sprat Head	14	Water Sockolet
		15	Sprayhead Block

*Recommended spare parts

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Fisher™ DSV1000 Full-Bore Ball Valve

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Figure 1. Fisher DSV1000 Valve



X1492

Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for the Fisher DSV1000 Full-Bore Ball valve (see figure 1). Refer to separate manuals for information concerning the actuator, positioner, and accessories.



Do not install, operate, or maintain a DSV1000 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The Fisher DSV1000 is a three piece, trunnion mounted, full-bore ball valve designed with features for isolation shutoff. The DSV1000 comes standard with dual seal construction allowing unidirectional or bidirectional flow and double block-and-bleed operation. The full-bore ball design presents little or no restriction to flow at full travel. The DSV1000 construction meets ANSI / NACE MR0175 / ISO 15156 as standard.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

DSV1000 Valve

June 2022

Instruction Manual

D104727X012

Table 1. Specifications

Valve Body Size ■ NPS 6, ■ 8, ■ 10, ■ 12, ■ 14, ■ 16, ■ 20, and ■ 24	Face-to-Face Dimensions Long Pattern per B16.10
Body/Shell Pressure Rating⁽¹⁾ ■ CL150, ■ CL300, and ■ CL600 pressure-temperature ratings per ASME B16.34	Shutoff Classification API 598
Standard Materials of Construction See table 2	Flow Direction Unidirectional or Bidirectional flow
Valve Temperature Capability -40 to 82°C (-40 to 180°F)	Flow Characteristic Modified equal percentage
End Connections Raised Face per B16.5	Maximum Ball Rotation 90 degrees
Shaft Connection Style Keyed	Approximate Weight See table 3

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

Educational Services

For information on available courses contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104727X012

DSV1000 Valve

June 2022

Table 2. Standard Materials of Construction

Part	Material
Valve Body	LF2 Carbon Steel
Ball	LF2 Carbon Steel / ENP
Seal	Devlon with S31600 SST Seal Carrier
Drive Shaft	S17400 H1150D
Spring	N07750
Tailpiece	LF2 Carbon Steel
Tailpiece Mounting and Packing Box Bolting	L7M Steel
Bearing Plate	LF2 Carbon Steel
Trunnion Bushings	Carbon Steel, Bronze, PTFE
Thrust Washer	Glass filled PTFE
Shaft Bushing	N04400 / Comp
Packing Box Housing	Carbon Steel
Packing	Live-Loaded PTFE
Packing Bolting	B7M Steel
Packing Follower, Packing Box Ring	S31600 SST
Straight Pins	S17400 H1150D
O Ring , Backup Rings	Nitrile
Actuator Mounting Bolting	Steel Grade 5

Table 3. Face-to-Face Dimensions and Approximate Weights

VALVE SIZE, NPS	CLASS	FACE-TO-FACE DIMENSIONS		APPROXIMATE WEIGHT	
		mm	Inches	kg	lbs
6	150	394	15.50	170	370
	300	403	15.88	190	415
	600	559	22.00	280	620
8	150	457	18.00	305	670
	300	502	19.75	350	775
	600	660	26.00	465	1020
10	150	533	21.00	430	950
	300	568	22.38	495	1095
	600	787	31.00	745	1640
12	150	610	24.00	645	1425
	300	648	25.50	770	1695
	600	838	33.00	1050	2320
14	150	686	27.00	1045	2305
	300	762	30.00	1065	2350
	600	889	35.00	1365	3015
16	150	762	30.00	1275	2810
	300	838	33.00	1455	3210
	600	991	39.00	1925	4250
20	150	914	36.00	2245	4945
	300	991	39.00	2580	5685
	600	1194	47.00	3450	7610
24	150	1067	42.00	3380	7450
	300	1143	45.00	4280	9435
	600	1397	55.00	5775	12740

Installation

⚠ WARNING

- To avoid personal injury, always wear protective gloves, clothing, and eyewear when performing any installation operations.
- To avoid personal injury or property damage resulting from the bursting of pressure retaining parts, be certain the service conditions do not exceed the limits given in this manual.
- To avoid personal injury or property damage that can result from the sudden release of process pressure if valve or mating pipe flange pressure ratings are exceeded, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.
- Personal injury could result from packing leakage. See the Packing Maintenance section for adjustment information.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.
- Use proper lifting and rigging practices while moving the valve or valve/actuator assembly.

Key number locations are shown in figures 4, 5, and 6, unless otherwise noted. Throughout this manual, the component key number will be identified for clarity.

1. Install a three-valve bypass around the valve assembly if continuous operation will be necessary during inspection and maintenance of the valve.
2. The valve is normally shipped as part of a valve assembly, with a factory adjusted actuator mounted on the valve. If the valve or actuator has been purchased separately, or if the actuator has been removed, refer to the Actuator Mounting section and the appropriate actuator instruction manual for installation and adjustment procedures.
3. The standard valve construction allows uni-directional or bi-directional flow. If possible, install the valve in a horizontal pipeline with the drive shaft vertical, however, the orientation of the valve does not affect the performance.

NOTICE

Be certain the valve and adjacent pipelines are free of any foreign material that could damage the valve sealing surfaces.

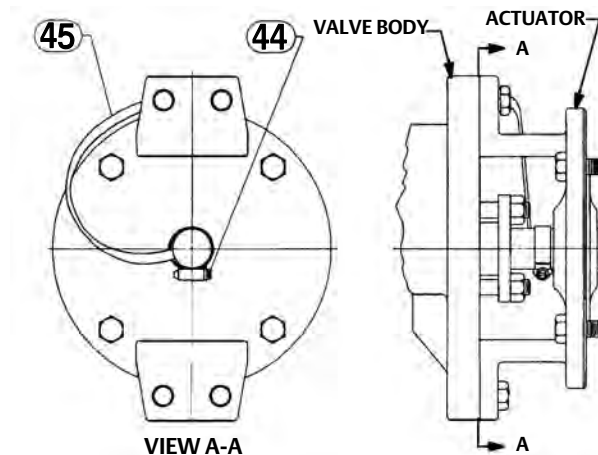
4. Provide appropriate flange gaskets, and place the valve in the pipeline. Tighten flange bolting in a star pattern to ensure the flange gaskets are compressed evenly.

Note

Standard Fisher DSV1000 live-loaded PTFE packing is composed of partially conductive packing rings (carbon-filled PTFE male and female adaptors) to electrically bond the drive shaft to the valve body. For hazardous area service, an alternate shaft-to-body bonding strap is also available by using the following step (see figure 2).

5. For hazardous area applications where redundant shaft-to-body grounding is preferred, attach the optional bonding strap assembly (key 45) to the valve drive shaft (key 4) with the clamp (key 44) and connect the other end of the bonding strap assembly to the valve body with the mounting cap screw as shown in figure 2.

Figure 2. Optional Shaft-to-Body Bonding Strap Assembly



A3143-2

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

⚠ WARNING

Avoid personal injury or equipment damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Do not loosen any pressure retaining bolting while the valve is still pressurized. This includes the body to tailpiece nuts (key 21), packing box housing screws (key 10), packing nuts (key 36) or pipe plugs (keys 23 and 28).
- Avoid injury by keeping hands, tools, and other objects away from the ball while stroking the valve.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Check the actuator cannot suddenly open or close the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure, relieve any process pressure from both sides of the valve body, and drain the process media from both sides of the valve.
- Dual-seal constructions can retain pressure and process fluid even after process pressure has been removed from both sides of the valve. The ball should be partially opened to relieve this pressure before disassembling or removing the valve from the line. Take additional care if the process fluid is hot, flammable, caustic, or hazardous.
- A tip over hazard exists for the valve/actuator assembly. Ensure the valve/actuator assembly is properly secured and always supported to prevent falling or rolling which may cause injury or property damage.
- Use lock-out/tag-out best practices and procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box housing may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Packing Maintenance

Refer to figure 3 for details of the standard live-loaded PTFE packing. All maintenance operations in this section may be performed on an unpressurized valve that is still installed inline.

Note

For additional information on the live-loaded packing system refer to the ENVIRO-SEAL Packing System Instruction Manual ([D101643X012](#)).

Stopping Leakage

Optimum performance of the PTFE live-loaded packing system is obtained when the Belleville springs are compressed to the required “target load”. The target load is the point where the springs are compressed to 85% of their maximum deflection.

Under normal conditions, the packing nuts should not require re-tightening. However, when servicing, if the springs do not remain at the target load of 85% compression, retighten the packing box nuts per the following:

1. Tighten the packing flange nuts alternately and evenly, keeping the packing flange parallel with the valve flange (see figure 3), until the Belleville springs are compressed 100% (or completely flat).
 - a. For PTFE packing, loosen each packing flange nut one half turn (180° of rotation).
2. The target load of 85% compression has now been reached. If leakage continues, replace the packing components and inspect the packing box housing bore and valve drive shaft for damage as described in the following procedures.

Replacing Packing

Replacing the packing requires bleeding off the system and removing the actuator from the valve. Valve/actuator adjustments cannot be made correctly without observing the fully open or closed position of the ball (key 3). It is not necessary to remove the valve from the pipeline to make adjustments, if care is taken to note the position and alignment of the shaft and coupler.

Refer to figure 3 which identifies the DSV1000 packing components by key number.

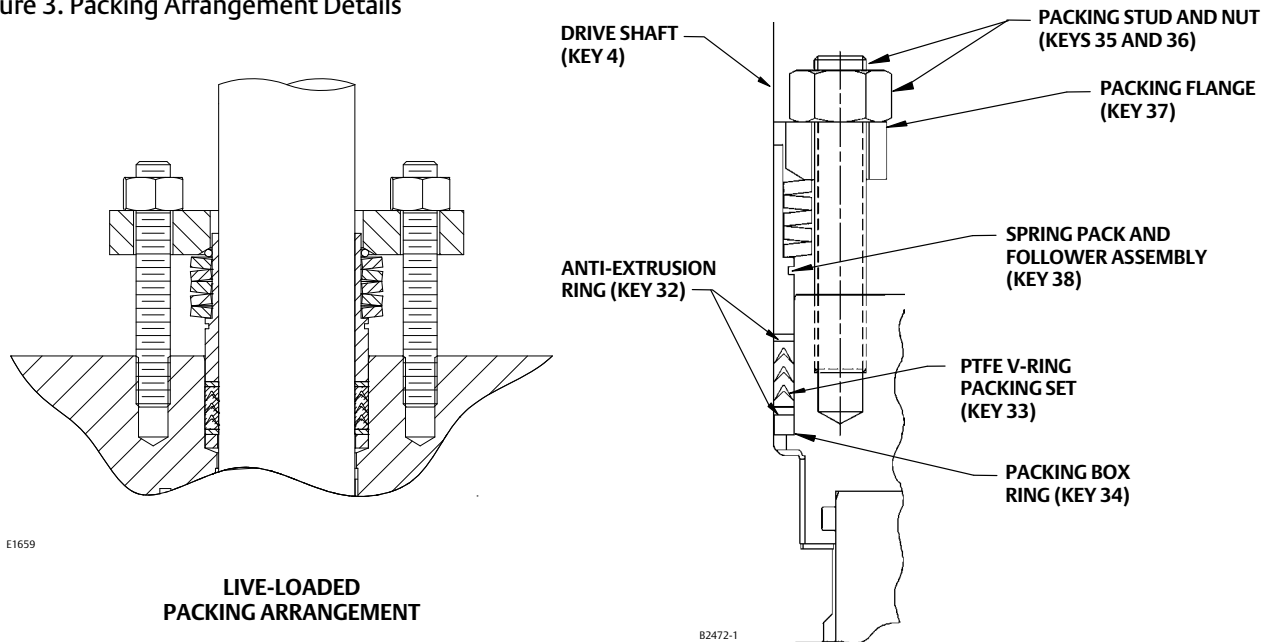
Packing Disassembly

1. Isolate the valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines (or other power source) to the power actuator, release pressure from the actuator, and disconnect the pressure lines from the actuator. Use lockout/tagout procedures to be sure that the above measures stay in effect while disassembling the equipment.

WARNING

- See the **WARNING** at the beginning of the Maintenance section for more information before removing the valve from the pipeline.
 - Use proper lifting and rigging practices while moving the valve or valve/actuator assembly.
-

Figure 3. Packing Arrangement Details



2. To assist with future reassembly, note and mark the orientation of the actuator with respect to the valve body and the coupler orientation with respect to the valve drive shaft.
3. Refer to the appropriate actuator instruction manual for information on removal.
4. Remove the actuator mounting screws, bolts, or nuts while properly supporting the actuator then separate the actuator and mounting bracket from the valve.
5. If necessary, remove the bonding strap assembly, shown in figure 2, from the valve before removing the packing parts.
6. Remove the packing follower nuts, packing flange, and spring pack and packing follower (keys 36, 37, and 38).
7. Remove the packing parts:
 - a. If the packing box housing (key 6) is mounted on the valve: Use a formed wire hook with a sharp end to pierce the packing rings, and pull the rings out of the packing box housing. Do not scratch the drive shaft or packing gland bore. Scratching these surfaces could cause leakage. Clean, inspect, and obtain replacement parts as necessary for reassembly. Examine the drive shaft and packing gland bore for any signs of damage that may prevent proper sealing.
 - b. If the packing box housing is separated from the valve (refer to Seal Ring Maintenance section of this manual for disassembly instructions): Remove the drive shaft (key 4) from the packing box housing. With the drive shaft removed, remove all internal packing parts. Clean, inspect, and obtain replacement parts as necessary for reassembly. Examine the drive shaft and packing gland bore for any signs of damage that may prevent proper sealing.

Packing Assembly

For additional information on the live-loaded packing system refer to the ENVIRO-SEAL Packing System Instruction Manual ([D101643X012](#)).

1. If the packing housing box (key 6) is removed from the valve, use the valve assembly steps to reinstall the drive shaft (key 4) and packing box housing assembly on the valve. (Refer to Seal Ring Maintenance section of this manual for additional assembly instructions).
2. Place the new packing components over the drive shaft and slide each into the packing box housing until properly seated at the bottom of the packing gland. Use the parts sequence shown in figure 3 and verify the Belleville springs are in the correct configuration.
3. Secure the spring pack and packing follower assembly and packing flange with the packing nuts (keys 38, 37, and 36).
4. Tighten the packing flange nuts alternately and evenly, keeping the packing flange parallel with the valve flange (see figure 3), until the Belleville springs are compressed 100% (or completely flat).
 - a. For PTFE packing, loosen each packing flange nut one half turn (180° of rotation).
5. If necessary, install the bonding strap assembly shown in figure 2.
6. Use the steps provided in the Actuator Mounting section to install the actuator on the valve. For actuator travel adjustments, refer to the appropriate actuator instruction manual.
7. When the valve is in operation, carefully examine the packing follower region for any signs of leakage.

Seal Ring Maintenance

⚠ WARNING

- See the **WARNING** at the beginning of the Maintenance section for more information before removing the valve from the pipeline.
- Use proper lifting and rigging practices while moving the valve or valve/actuator assembly.

Valve Disassembly

Refer to figures 4, 5, and 6 to identify the DSV1000 valve components by key number.

Disassemble the valve only to the extent necessary to accomplish the needed inspection and repairs. For some repairs complete disassembly of the valve is not necessary. Follow the disassembly procedures to the point necessary to accomplish the repair, then skip to the appropriate assembly steps to complete the reassembly of the valve. Always clean and protect sealing surfaces from damage.

Mark parts as necessary to allow them to be returned to the same position and orientation as removed. The tailpiece, for instance, shall be returned to the same end of the valve from which it was removed. The seal assembly shall also be returned to the same tailpiece and in the same orientation from which it was removed.

1. Isolate the valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines to the power actuator, release pressure from the actuator, and disconnect the pressure lines from the actuator. Use lockout/tagout procedures to be sure that the above measures stay in effect while working on the equipment.
2. Remove line bolting, remove the valve from the pipeline, and clean all valve surfaces. Place the actuator/valve assembly on a flat working surface.

3. Mark parts as necessary to allow them to be returned to the same position during re-assembly.
4. Refer to the appropriate actuator instruction manual for information on removal. Loosen the actuator mounting screws, bolts, or nuts while properly supporting the actuator then separate the actuator and mounting bracket from the valve. When valve maintenance is complete, refer to the Mounting Actuator procedure in this manual to reinstall the actuator on the valve.
5. Provide a clean soft working surface to protect the tailpiece-flange serrated surface. Lift the valve and place it on either tailpiece flange face. Be sure the valve is in a stable, upright position before releasing the hoist connection.

Note

If the packing is in good condition, it is possible to remove and replace the seal assembly without removing the packing box assembly. However, the packing box assembly must be removed to remove the ball (key 3) from the valve body.

6. Remove the packing box housing socket head cap screws (key 10).
 - a. If necessary, two packing box housing cap screws can be used as jack bolts to assist with separating the packing box housing assembly from the valve.
 - b. Remove the two plastic plugs (key 39) from the packing box housing and install two packing box housing cap screws until contact with the body occurs. Alternately and evenly, turn each fastener clockwise until the packing box housing assembly is adequately separated from the valve body. Remove the packing box housing assembly from the valve body. The packing box housing assembly includes all packing parts, drive shaft (key 4), O-ring seal (key 14), drive shaft bushing (key 8), and thrust washer (key 9). The two straight pins (key 7) may stay attached to the packing box.
 - c. If necessary, use a punch and drive each straight pin towards the valve side of the packing box to remove.
7. If it is desired to separate the packing box assembly parts, loosen or remove the packing components and slide the shaft down and out the valve side of the packing box. Inspect the drive shaft bushing (key 8) and the thrust washer (key 9). If necessary, replace worn components.
8. Remove the heavy hex nuts (key 21) from the studs, if applicable, remove base brackets (key 25), and lift the upper tailpiece from the body. If studs (key 19 and 20) are removed from the valve body, mark installed locations of long studs (key 20) in valve body.

NOTICE

While lifting the tailpiece (key 2) from the valve body, check to see if the seal (key 5) is lifting with the tailpiece. If so, use caution in case the seal falls out and protect the ball's spherical surface. An additional strap can be employed to ensure the seal stays in place.

9. Turn the tailpiece assembly over so the seal is facing up, and place it on a clean soft surface to protect the flange serrated surface. Note the tailpiece O-ring (key 13).
10. Lift the seal out of the tailpiece. Note the seal O-ring and back up ring (keys 15 and 16) and the multitude of springs (key 18). Ensure all springs and the bearing plate dowel pins (key 22) are accounted for. Clean and protect all sealing surfaces.

⚠ WARNING

When lifting the ball, ensure the bearing plates (key 11) are secure on the ball trunnions to prevent parts from falling which may cause personal injury or property damage.

Note

Refer to figure 6 and note the NPS6 CL150 construction is different than the balance of the DSV1000 product line in that it lacks bearing plates and the ball design does not have male trunnions. Specific to the NPS6 CL150, ball removal also requires removal of the follower trunnion (key 42) and fasteners (key 43).

11. Turn the ball (key 3) to the closed position. Use an approved lifting sling through the ball bore to lift the ball out of the valve body. Lift the ball and set it on a clean soft surface.
12. Remove the two bearing plates (key 11) and thrust washers (key 17) from the ball. Inspect the lined bushing (key 12) in each bearing plate and the thrust washers. If necessary, replace worn components.
13. Evenly loosen the heavy hex nuts (key 21) from the studs, if applicable, remove base brackets (key 25), and lift the body (key 1) from the lower tailpiece (key 2).
14. Lift the seal out of the lower tailpiece. Note the seal O-ring and back up ring (keys 15 and 16) and the multitude of springs (key 18). Ensure all springs and the lower bearing plate dowel pins (key 22) are accounted for. Clean and protect all sealing surfaces.

Valve Assembly

Be sure to replace valve parts in the same position and orientation from which they were removed. Use the following steps to reassemble the valve.

Note

Clean and protect all sealing surfaces from damage while installing parts. Lubricate components when necessary as an aid for installation and to help protect sealing surfaces.

Refer to figures 4, 5, and 6 to identify the DSV1000 valve components by key number.

During assembly, visually inspect component surfaces that interface with an O-ring or seal for any damage that may prevent proper sealing.

1. Place both tailpieces (key 2), flange end down on a clean soft surface with the seal assembly cavity facing up. Use caution to protect the flange end serrated surfaces.
2. Lubricate the tailpiece counterbores where the seal will insert and inject lubricant into each of the spring holes. Install the seal springs (key 18).
3. On both seals (key 5), install the O-ring (key 15) and backup ring (key 16) in the correct orientation (see figure 5 and 6).
4. Lubricate the seal O-rings and insert the seal assembly into the tailpiece counterbores. Maintain axial alignment of the two components as the seal assembly is pushed into place.

5. Lubricate and install the O-rings (key 13) in both tailpieces.
 - a. For NPS 6 through NPS 12 constructions, one O-ring per tailpiece is required.
 - b. For NPS 14 through NPS 24 constructions, two O-rings per tailpiece are required.
6. Place the body (key 1) on an appropriate work surface.
7. If studs (keys 19 and 20) were removed from valve body during disassembly, apply anti-seize lubricant (key 47) to threaded stud holes. Apply anti-seize lubricant to the long studs (key 20), which are used to attach the base brackets (key 25). Install the long studs first in the stud hole locations marked during disassembly. (Note: Base brackets are not available for the NPS6 CL150 and NPS6 CL300 valve constructions.) Apply anti-seize compound to the balance of studs (key 19) and install in the body.
8. Lubricate the tailpiece O-ring gland of the body and lower the tailpiece into place, guiding the male O-ring gland of the tailpiece within the female gland of the body. Take special care to prevent pinching of the O-ring. The tailpiece must be oriented such that the bearing plate dowel pin holes are in alignment and parallel with the body shaft bore axis. Refer to figure 4 and note the tailpiece (key 2) orientation in relation to the body (key 1), bearing plates (key 11), and dowel pins (key 22).
9. Apply anti-seize lubricant compound to the face and threads of the heavy hex nuts (key 21). If applicable, place the base bracket (key 25) over the long studs. Install the heavy hex nuts on the studs by hand with the material identifier facing outwards. Use an appropriate torque device to apply the final torque specification (see table 3).
10. Lift and orient the assembly so the raised face of the tailpiece end connection flange is sitting on a clean, soft surface. Take special care to prevent damage to the raised face serrated surface. Install the bearing plate dowel pins (key 22) in the tailpiece. (Note: The dowel pins are not applicable to the NPS6 CL150, as this construction does not incorporate bearing plates.)
11. If necessary, install new bushings (key 12) in the bearing plates (key 11) by driving out the old and pressing in the new.

WARNING

When lifting the ball, ensure the bearing plates (key 11) are secure on the ball trunnions to prevent parts from falling which may cause personal injury or property damage.

12. Use an approved lifting sling through the ball bore to lift the ball (key 3).
 - a. Lubricate and install the thrust washers (key 17) and bearing plates on both ball trunnions.
 - b. Install the ball and bearing plate assembly into the body.
 - c. Guarantee the dowel pins (key 22) in the lower tailpiece have engaged the holes in the bearing plates and that the ball shaft interface geometry is aligned with the body shaft bore.
 - d. Note: Specific to the NPS 6 CL150 construction, lubricate and place the follower end thrust washer (key 17) in the follower end bore of the ball then lubricate and press in the follower end bushing (key 12) prior to installing the ball assembly into the body. See figure 6.
13. Insert the upper bearing plate dowel pins (key 22) into the intended holes and install the upper studs, tailpiece, base bracket, and heavy hex nuts per steps 7 through 10.
14. Insert the drive shaft (key 4) into the body shaft bore and engage the ball interface geometry. Slide the shaft thrust washer (key 9) into place.
15. Install the drive shaft bushing (key 8) in the packing box from the end that engages the body. Lubricate and install the O-ring (key 14) in the packing box housing.
16. After lubricating the body shaft bore and thrust washer (key 9), position the packing box housing assembly over the drive shaft and slide into place ensuring the O-ring (key 14) properly engages the body shaft bore. For DSV1000 constructions other than the NPS6 CL150, skip to step 18.

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17. Specific to the DSV1000 NPS 6 CL150 construction, inject lubricant into the spring hole of the follower trunnion (key 42) and install the grounding spring (key 40) by pressing firmly into place (see figure 6).
 - a. Lubricate and install the O-ring (key 41) in the gland of the follower trunnion.
 - b. Lubricate the body follower bore and install the follower trunnion assembly.
 - c. Apply anti-seize lubricant to the socket head cap screws (key 43) and tighten in a star pattern to 81 N•m (60 ft•lbf).
18. Apply anti-seize lubricant to the packing box housing socket head cap screws (key 10). Thread in all fasteners, but do not tighten.
19. The packing box holes for the straight pins (key 7) were originally staked at the factory. Use a file to remove the deformed material at the top of each pin hole to allow the pin to slide by with minimal interference. Lubricate the straight pins (key 7) and drive each through the packing box housing and into the valve body. When properly installed and bottomed out, the pin top surface will be slightly below the packing box top surface. Stake all pins in place making sure the packing box housing material has been deformed within the bore to prevent the pins from disengaging.
20. Tighten the socket head cap screws (key 10) in a star pattern to the appropriate torque specification (see table 4). Reinstall the two plastic packing box plugs (key 39) into their respective jack bolt counterbores to prevent environmental ingress.
21. Install the packing components as detailed in the Packing Maintenance section of this manual.
22. Install the valve shaft key (key 29), flat washer (key 30) and hex head bolt (key 31). The purpose of the washer and hex bolt is to prevent the key from migrating axially out of the keyway in-service.

Table 4. Torque Values

VALVE SIZE, NPS	CLASS	VALVE BODY HEAVY HEX NUT TORQUE ⁽¹⁾		PACKING BOX HOUSING SOCKET HEAD CAP SCREW TORQUE ⁽¹⁾	
		N • m	ft • lbf	N • m	ft • lbf
6	150	255	188	81	60
	300	255	188	81	60
	600	525	387	81	60
8	150	376	277	81	60
	300	525	387	81	60
	600	711	524	81	60
10	150	376	277	81	60
	300	376	277	81	60
	600	941	694	81	60
12	150	376	277	81	60
	300	711	524	81	60
	600	1267	934	81	60
14	150	525	387	81	60
	300	525	387	81	60
	600	1660	1224	81	60
16	150	525	387	81	60
	300	711	524	81	60
	600	2126	1568	81	60
20	150	711	524	81	60
	300	1267	934	81	60
	600	3305	2437	153	113
24	150	941	694	153	113
	300	2777	2048	153	113
	600	5782	4264	247	182

1. Fasteners must be lubricated to achieve proper preload.

Actuator Mounting

Use the appropriate actuator instruction manual for mounting the actuator or changing the actuator position. Attach the actuator mounting bracket to the valve packing box and tighten the mounting bracket fasteners as detailed in table 5.

Table 5. Required Actuator Mounting Bracket-to-Valve Bolt Torque

VALVE SIZE, NPS	FASTENER SIZE INCH	GRADE 5/NCF3 ⁽¹⁾	
		N • m	ft • lbf
6	3/4-10	339	250
8			
10	7/8-9	508	375
12			
14	1-1/4-8	1491	1100
16			
20			
24			

1. Fasteners must be lubricated to achieve proper preload

Determining Closed Position

1. To confirm proper actuator adjustment visually check the position of the ball.
2. Adjust the actuator linkage or travel stops as described in the actuator instruction manual so that at the end of stroke, the valve ball bore diameter in the full open (100%) position is in alignment and centered within the upstream and downstream valve seal inside diameters. The actuator linkage or travel stops should be adjusted so that the full closed (0%) valve position is precisely 90 degrees from the visually verified 100% open position.
3. For reference, two parallel lines are machined on the actuator mounting end of the valve drive shaft (key 4). The lines represent the orientation of the valve ball bore. The ball is in the closed position when the two lines are perpendicular to the pipeline bore.

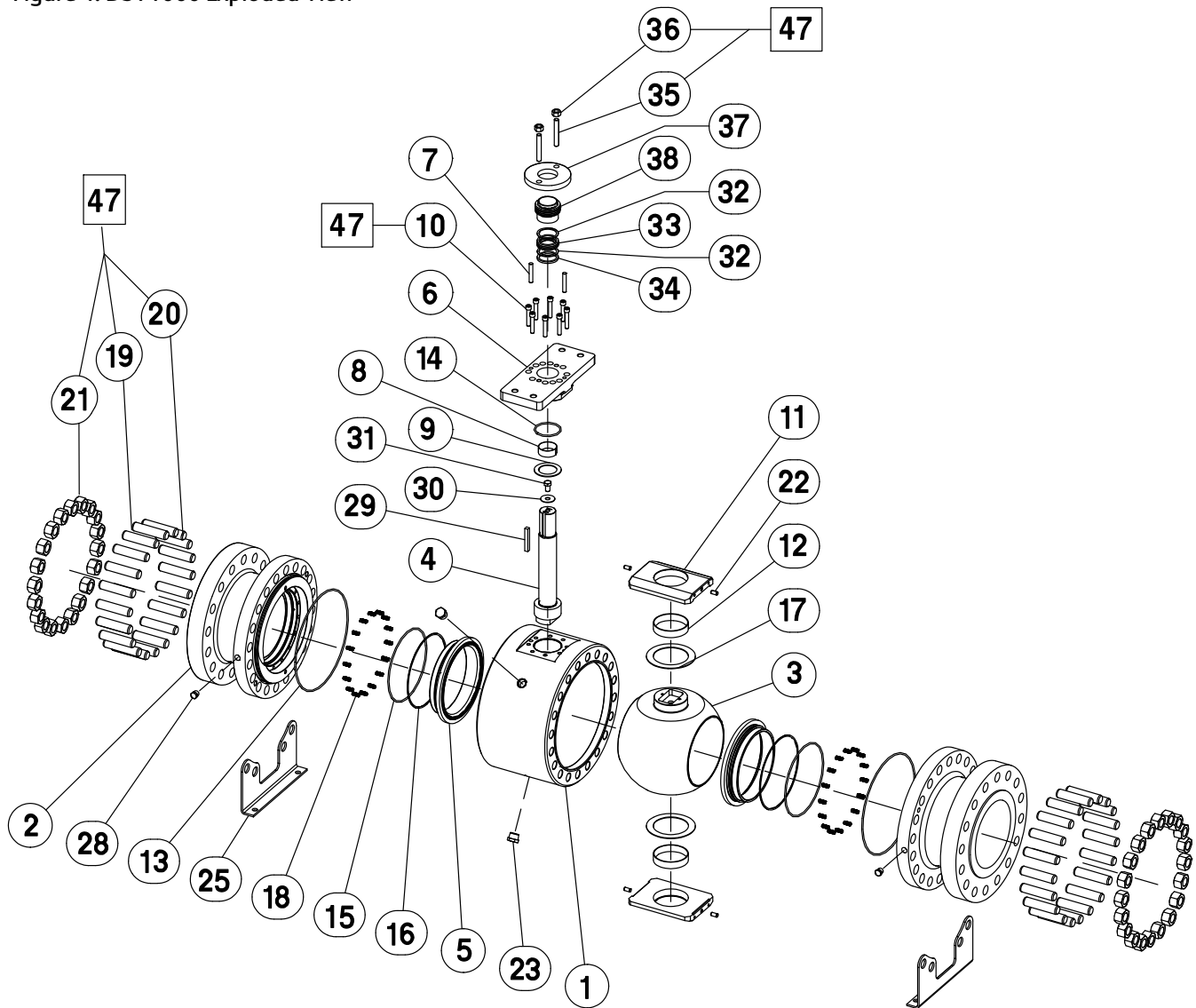
Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your [Emerson sales office](#) regarding spare parts or technical information. When ordering replacement parts, also specify the part name and desired material.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 4. DSV1000 Exploded View



NOTE:

1. KEY NUMBERS 24, 26, 27, 39, 44, 45 AND 46 ARE NOT SHOWN

□ APPLY LUBRICANT

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Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Key Description

1	Valve Body If you need a valve body as a replacement part, order the valve size, pressure rating, serial number, and desired material
2	Tailpiece
3	Ball
4	Drive Shaft Assembly
5*	Seal (2 req'd)
6	Packing Box Housing
7	Pin, Straight
8*	Drive Shaft Bushing (1 req'd)
9*	Thrust Washer (1 req'd)
10	Hex Socket Screw Cap
11	Bearing Plate
12*	Lined Bushing (2 req'd)
13*	O-Ring (2 req'd NPS 6-NPS 12; 4 req'd NPS 14-NPS 24)
14*	O-Ring (1 req'd)
15*	O-Ring (2 req'd)
16*	Back up Ring (2 req'd)

Key Description

17*	Thrust Washer (2 req'd)
18	Spring
19	Continuous Thread Stud - short
20	Continuous Thread Stud - long
21	Heavy Hex Nut
22	Dowel Pin
23	Hex Head Pipe Plug
24	NACE Label (not shown)
25	Base Bracket
26	Nameplate (not shown)
27	Drive Screw, for nameplate (not shown)
28	Hex Head Pipe Plug
29	Square Key
30	Flat Washer
31	Hex Head Screw Cap
32*	Anti-Extrusion Ring (2 req'd)
33*	Packing Set (1 req'd)
34	Packing Box Ring
35	Bolt Stud
36	Heavy Hex Nut
37	Packing Flange
38	Spring Pack Assembly
39*	Packing Box Plug (not shown) (2 req'd)
40	Spring
41*	O-Ring (1 req'd)
42	Follower Trunnion
43	Hex Socket Screw Cap
44	Clamp (see figure 2)
45	Ground Strap (see figure 2)
46	Round Head Screw Machine (not shown)
47	Lub Anti-seize/Lub-3

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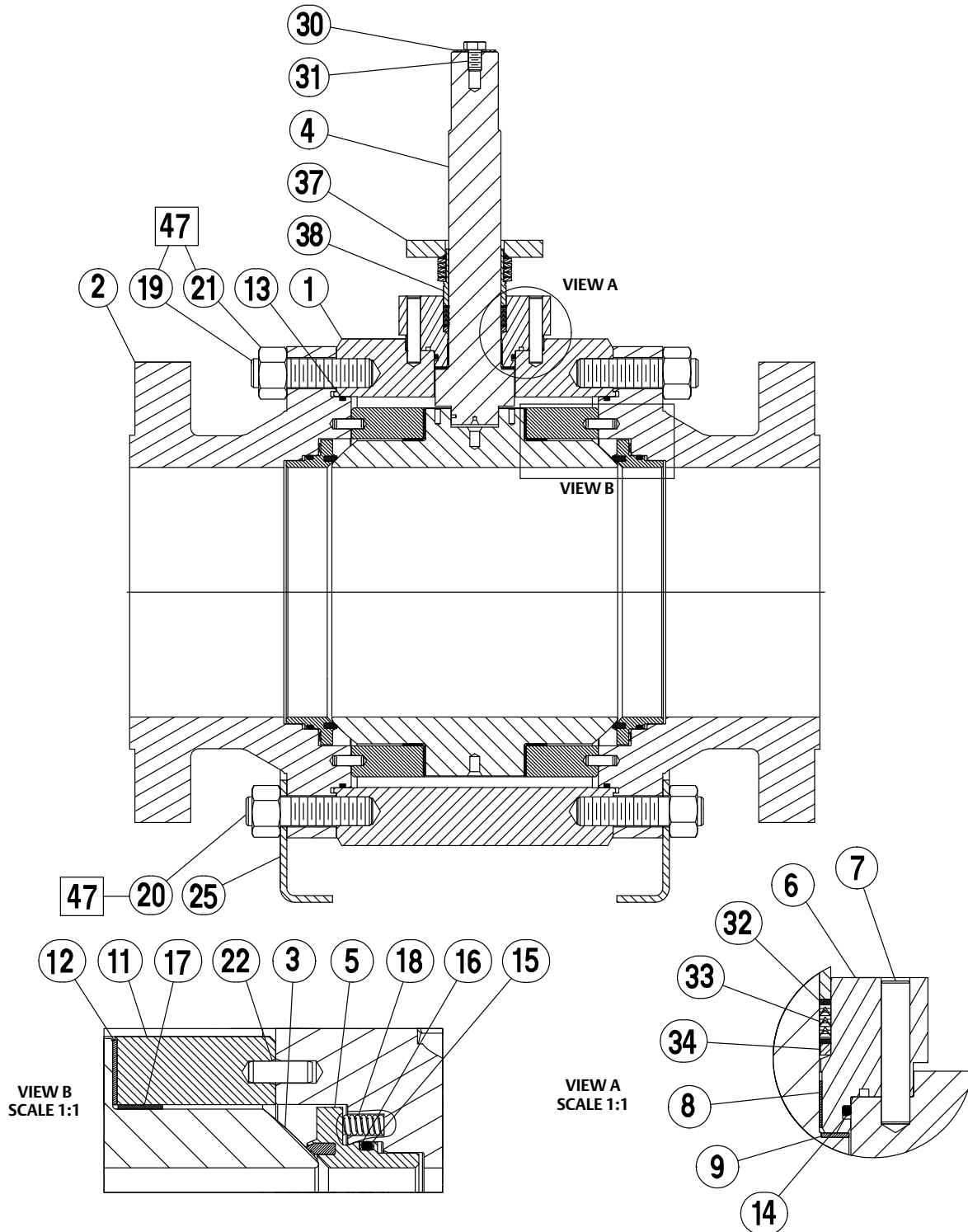
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Figure 5. Fisher NPS 6 CL300 through NPS 24 CL600 DSV1000 Valve Assembly

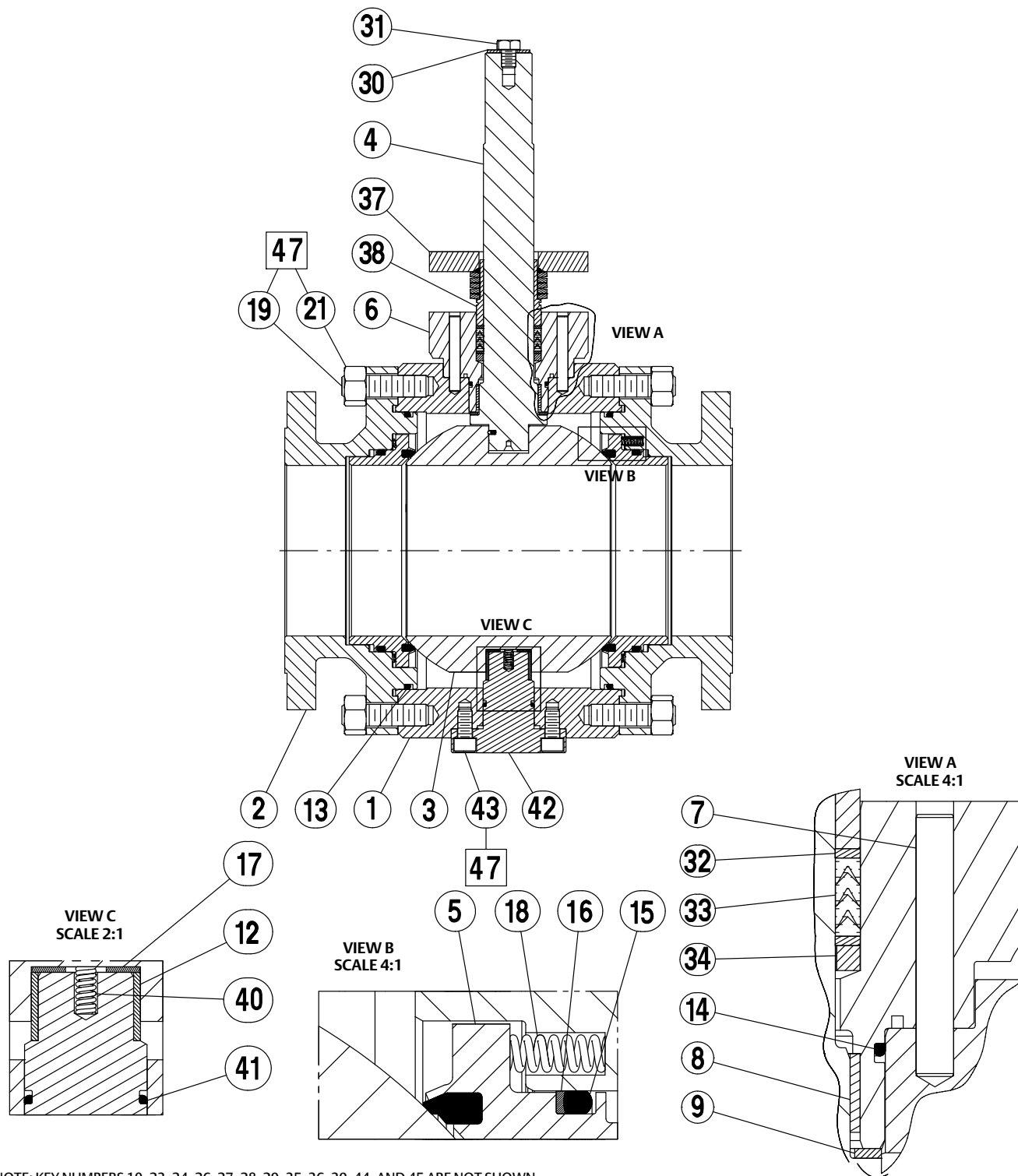


NOTE: KEY NUMBERS 10, 23, 24, 26, 27, 28, 29, 35, 36, 39, 44, AND 45 ARE NOT SHOWN

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Figure 6. Fisher NPS 6 CL150 DSV1000 Valve Assembly



NOTE: KEY NUMBERS 10, 23, 24, 26, 27, 28, 29, 35, 36, 39, 44, AND 45 ARE NOT SHOWN

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Fisher™ DVI Desuperheater Venturi Inline

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Figure 1. Fisher DVI Desuperheater Venturi Inline



W5365-1

Introduction

Scope of Manual

This instruction manual includes installation and operation information for the Fisher DVI desuperheater venturi inline.

Do not install, operate, or maintain a DVI desuperheater without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The DVI desuperheater venturi inline (figure 1) offers efficient desuperheating in steam pipelines of NPS 24 and less. It is particularly designed for rugged service conditions and can maintain final temperatures to within 6 to 8°C (10 to 15°F) of saturation. By utilizing a compact design and unique flow path, the desuperheater provides even distribution of spraywater with good turndown for a fixed orifice desuperheater. It is easily installed between any two ASME flanges up to CL1500 and NPS 24. The simple design of the desuperheater allows for virtually maintenance-free operation.

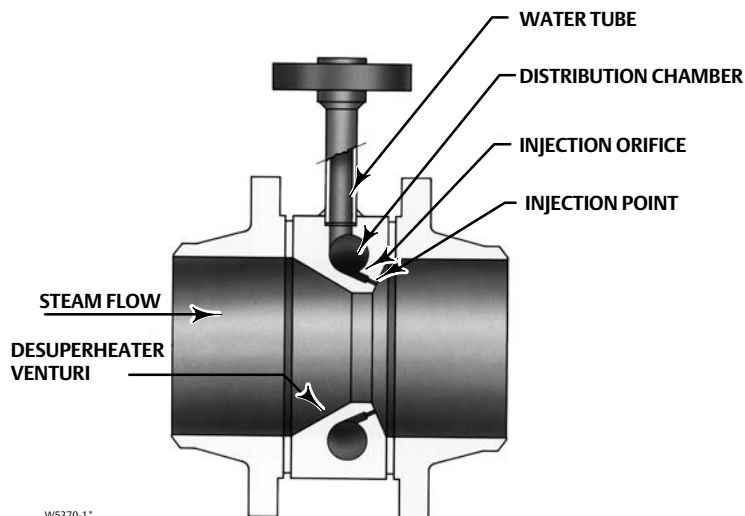
Table 1. Specifications

Steam Line Sizes NPS 1 through 24 Steam Line Connection Sizes Designed for water connection with NPS 1 through 24 ■ CL150, ■ 300, ■ 600, ■ 900, and ■ 1500 raised-face and ring type joint flanges Spraywater Connection Sizes ■ NPS 1/2, ■ 3/4, ■ 1, and ■ 2 ■ CL150, ■ 300, ■ 600, ■ 900, and ■ 1500 raised-face and ring type joint flanges	Maximum Inlet Pressures⁽¹⁾ Consistent with applicable CL150, 300, 600, 900, or 1500 pressure-temperature ratings per ASME B16.34 Inherent Rangeability⁽²⁾ Up to 10:1 Spraywater Pressure Required 3.5 to 35 bar (50 to 500 psi) greater than steam line pressure -- depending on nozzle design Minimum Steam Velocity 6.1 m/s (20 feet per second) -- depending on conditions
---	---

1. Do not exceed the pressure or temperature limits in this instruction manual, nor any applicable code or standard limitations.

2. Ratio of maximum to minimum controllable C_v .

Figure 2. Detail of Fisher DVI Desuperheater



Principle of Operation

The operation of the DVI desuperheater is quite simple. Spraywater flow is throttled by a control valve that responds to the signal generated by the temperature control loop. The spraywater enters the desuperheater water tube and then continues into the distribution chamber (see figure 2). As the chamber fills, the spraywater is forced into the injection orifices. As the flow area is reduced, the spraywater accelerates to the injection point. The accelerated flow results in a fine spray for efficient and rapid vaporization.

At the same time, the steam flow is entering the desuperheater venturi. The reduction in flow area continues until the point of water injection. This results in a higher velocity and turbulent steam flow, thus improving the mixing of the spraywater with the steam and increasing overall system turndown.

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Use bypass valves or completely shut off the process to isolate the line from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

Personal injury or equipment damage caused by sudden release of pressure may result if the desuperheater is installed where service conditions could exceed the limits given in table 1 or on the nameplate. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

CAUTION

When ordered, the desuperheater configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and fluid conditions. Do not apply any other conditions to the desuperheater without first contacting your [Emerson sales office](#) or Local Business Partner.

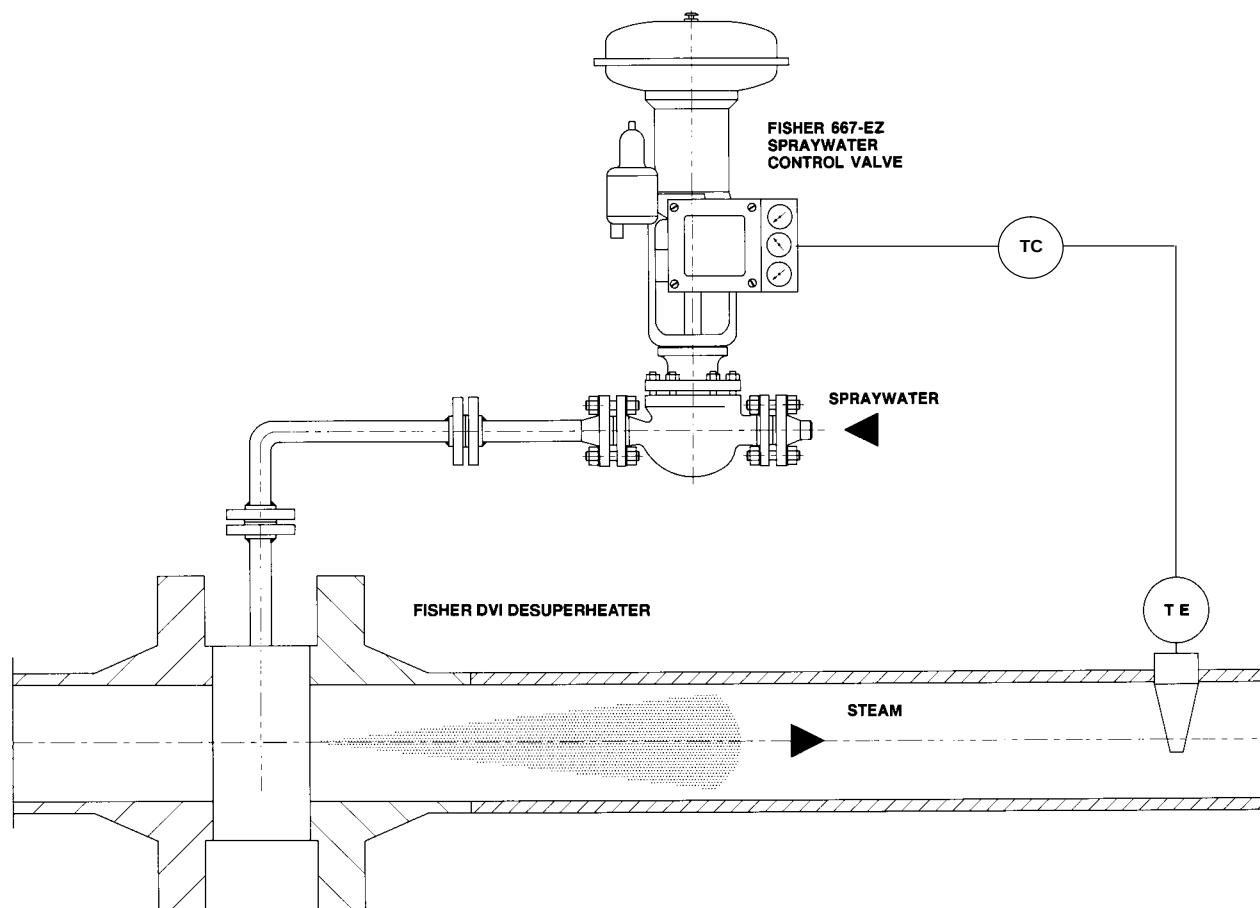
1. Mount the DVI desuperheater between two flanges with gaskets and bolt the desuperheater to the pipe in accordance with standard piping practice.
2. Clean and flush out the cooling water line before connection to the desuperheater. Use only clean sources of cooling water. Use of clean water decreases wear and prevents clogging of the desuperheater by solid particles.

Note

Installation of a strainer and isolating valve on the water line leading to the desuperheater is recommended. Failure to do so may result in clogging of the desuperheater by solid particles, thus hampering temperature control of the steam. Please consult the factory for the minimum diameter of the nozzles and recommended strainer size to assure debris will not disrupt the flow by blocking the nozzles.

3. A straight run of pipe is required downstream of the desuperheater to ensure complete vaporization of the cooling water. Consult the desuperheater sizing sheet for installation recommendations including the exact straight pipe distance required.

Figure 3. Typical Control Loop with Fisher DVI Desuperheater



B2318-1

4. A temperature sensor should be mounted in accordance with the manufacturer's instructions. The recommended distance from the desuperheater to the temperature sensor changes with the velocity and percentage of spraywater required. Consult the desuperheater sizing sheet for installation recommendations including the exact distance required before the temperature sensor.
5. Allow no branching out from the steam line, to divide the steam flow, between the temperature sensor and the desuperheater.

A typical control loop is illustrated in figure 3. A temperature sensor generates a signal (pneumatic or digital) through a transmitter. This signal is transmitted to the positioner on the spraywater control valve. The positioner output signal is piped to the actuator, which strokes the spraywater control valve governing the amount of spraywater flow.

Operating Instructions

Verification of Control Instrumentation

1. Connect the appropriate signal lines to the temperature transmitter, indicating control station, and valve positioner in accordance with the instrumentation manufacturer's instructions.

2. Switch the controller to manual control.
3. This instruction manual assumes a pneumatic signal of 0.2 to 1.0 bar (3 to 15 psig). If 0.4 to 2.0 bar (6 to 30 psig) or another range is used, adjust the instrument signal referenced in the following steps accordingly. Adjust the instrument signal to 0.2 bar (3 psig). Check that the water valve is completely closed. Adjust the positioner, if necessary.
4. Now adjust the instrument signal to 1.0 bar (15 psig). Check that the control valve opens to its full travel. Adjust the positioner to correct the range and re-zero if needed, by referring to step 3.
5. Thereafter, check that the controller is responding so that rising steam temperature gives an increasing instrument signal.
6. Adjust the instrument signal to 0.6 bar (9 psig).
7. Open the water supply.
8. Observe the downstream steam temperature.
9. Increase the instrument signal to 0.8 bar (11 psig). Check that the steam temperature decreases.
10. Adjust the instrument signal to 0.5 bar (7 psig) and check that the steam temperature rises.

Note

If the temperature does not fall when the instrument signal is increased, the cause may be that either the water valve has not been opened or that the steam temperature is close to saturation. If the latter is the case, set the instrument signal to 0.3 bar (4 psig) [water valve slightly open] and increase the signal to 0.4 bar (6 psig). Check if the temperature decreases.

11. When satisfactory coordination between the instrument signal and steam temperature is reached, adjust the controller in accordance with the manufacturer's instructions.
12. Switch the controller to "automatic" for automatic positioning.

Note

For more detailed calibration information, refer to the instrument manufacturer's operating instructions.

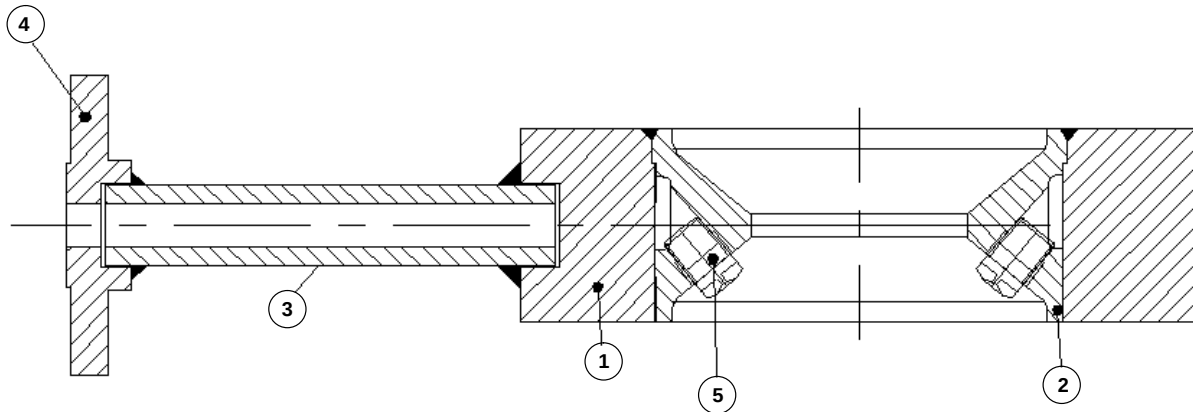
Maintenance Instructions

WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
 - Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
 - Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator for the spraywater control valve. Be sure the actuator cannot suddenly open the valve.
 - Completely shut off the process to isolate the DVI desuperheater from process pressure. Relieve process pressure on both sides of the desuperheater. Drain the process media from the desuperheater.
 - Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
 - Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
-

Figure 4. Fisher DVI Desuperheater with Nozzle Cross Section



B2710

Servicing

Although the DVI desuperheater is a simple design requiring very little maintenance, in the event that the spray nozzles become clogged by debris, it may be necessary to service the unit. Prior to removal of the unit from the line, ensure that the necessary gaskets and spare nozzles (if applicable) are available for rebuild if turnaround time for the repair is critical. Review the drawing and specification sheet for clarification. If in doubt as to the construction, advise your [Emerson sales office](#) or Local Business Partner of the serial number and model number and ask for further clarification.

⚠ WARNING

Residual system pressure may be released during the following steps if the system was improperly isolated or vented. Use extreme care to prevent personal injury while loosening any fasteners in the pressure boundary.

Ensure that the weight of the unit is sufficiently supported to avoid personal injury.

1. Slowly loosen the flange stud bolts retaining the DVI desuperheater in line taking care to ensure that there is no residual pressure and that the weight of the unit is sufficiently supported to avoid personal injury. Normally the lower flange bolts will be left loosely in place during removal of the desuperheater from the line unless the location or design requires their complete removal.
2. Remove the DVI desuperheater from the line.
3. Inspect the desuperheater for cuts on the flange mating facing and repair if needed. If there is damage on the gasket surfaces that is too large for field repair, the unit may require replacement.
4. Inspect the nozzles or spray orifices. If the desuperheater has drilled holes for water injection, ream out the holes with a small drill bit or welding rod to clear all obstructions. If the desuperheater has a screwed in nozzle(s) (key 5, figure 4), cut the tack weld(s) and unscrew the nozzle(s).
5. Thoroughly flush the DVI desuperheater after cleaning. For desuperheaters using screwed in nozzles, it is recommended that the nozzles be replaced if the unit has required cleaning.
6. After cleaning the unit including all gasket surfaces, screw in the new nozzles (key 5), if applicable, and tack weld the new nozzles in place with ER309 or similar weld rod taking care not to damage any gasket surface or other nozzles.

7. When reinstalling the unit in line, take care to center the desuperheater between the steam line flanges as evenly as possible. This will help avoid leakage as well as making sure that the steam flow is not disrupted by not having the desuperheater installed evenly in the piping. Tighten the steam line flanges in accordance with good piping practice.
8. After installing the DVI desuperheater in the steam line, reconnect the water line flange connection.
9. After ensuring that the desuperheater is properly reinstalled in the pipeline, the unit may be returned to service. The desuperheater should be monitored as the unit is brought on line to ensure that there are no leaks in the connections.

Troubleshooting

The following guide (table 2) is a basic first line troubleshooting guide. Contact your [Emerson sales office](#) or Local Business Partner for assistance if you are unable to resolve your field operation problem.

Table 2. Troubleshooting Guide

Problem	Possible Solution
Temperature setpoint is not reached	Check water source availability and pressure
Temperature setpoint is not reached	Check nozzle(s) for plugging
Temperature setpoint is not reached	Make sure that steam saturation pressure is not above setpoint
Temperature setpoint is not reached	Check to ensure full actuator stroke is reached
Temperature is below setpoint	Check temperature control loop - reset
Temperature is below setpoint	Check nozzle for fouling/poor spray pattern - clean/replace
Temperature is below setpoint	Check temperature sensor location - relocate per guidelines
Temperature oscillates around setpoint	Tune control system parameters
Temperature oscillates around setpoint	Temperature setpoint may be too close to saturation
Water in steam line	Check that steam traps are functioning properly
Water in steam line when steam line isolated	Check for leakage of spraywater control valve
Water in steam line	Review piping configuration for downstream tees and elbows

Parts Ordering

Each DVI desuperheater is assigned a serial number that can be found on the DVI desuperheater body or on a tag attached to the water pipe. Refer to the serial number when contacting your [Emerson sales office](#) or Local Business Partner for technical assistance. When ordering a replacement nozzle, refer to the serial number and key number. The key numbers in figure 4 can be used to help in part identification.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

For part numbers not shown, contact your [Emerson sales office](#) or Local Business Partner.

Key	Description
-----	-------------

- | | |
|----|--------------|
| 1 | Body |
| 2 | Venturi |
| 3 | Water Pipe |
| 4 | Water Flange |
| 5* | Spray Nozzle |

*Recommended spare parts

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Fisher™ easy-Drive™ 200L



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Section 1: Introduction

1.1 Scope of the Manual

If the actuator has a RPU-100 installed refer to easy-Drive RPU-100 Instruction Manual (D104551X012).

WARNING



This instruction manual provides installation, maintenance and parts information for the easy-Drive 200L. Do not install, operate or maintain an easy-Drive 200L without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

1.2 Description

The easy-Drive 200L is a compact, rugged electric actuator designed primarily for high-pressure throttling applications. This actuator is ideal for use on pressure and flow control applications.

Figure 1. Fisher easy-Drive 200L



X1520-1

Table 1. Specifications

Available Actuator Configurations	Average Thrust
Positioning	2446 N / 550 lbf
Power Requirements	Nominal Stroke Speed ⁽¹⁾
11 to 30 V DC, minimum 4 A power supply required (fuse to 5 A)	3.9 mm/s / 0.15 in./s at 24 V DC 2.2 mm/s / 0.09 in./s at 12 V DC
Material Temperature Capabilities	Hazardous Area Approvals
Electric Actuator Assembly: -20°C / -4°F to 70°C / 158°F	CSA (C/US): Explosion-Proof Class I, Division 1, Groups C and D, T6, Ex db IIA T6, Class I, Zone 1, AEx db IIA T6 ATEX Flameproof - Gas: II 2 G, Ex db IIA T6 Gb IECEx Flameproof - Gas: Ex db IIA T6 Gb
Maximum Current Draw	Enclosure Rating
4 A	Type 4X and IP66
Idle Current Draw	Duty Cycle
15 mA at 24 V DC, 25 mA at 12 V DC	50% maximum
Conduit Connections	Enclosure Material
Two 3/4 NPT connections	Cast aluminum alloy with powder coat paint
Maximum Stroke Length	Approximate Weight
19 mm / 0.75 in.	9.5 kg / 21 lbs
Maximum Thrust	
3336 N / 750 lbf	
1. 10% variation can be expected, based on temperature and pressure of application.	

1.3 Specifications

Table 1 lists specifications for the easy-Drive 200L. Some of the specifications for a given actuator as it originally comes from the factory are stamped on a nameplate located on the lower actuator enclosure.

1.4 Education Services

Emerson Education Services
 Phone: 800-338-8158
 Email: education@emerson.com
emerson.com/en/final-control/services/valve-training

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts or by uncontrolled process fluid, be certain the service conditions do not exceed the limits shown on the valve nameplate and in Table 1. Use pressure-relieving devices required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

For explosion-proof applications, ensure the actuator cover is properly bolted before applying power to the actuator. Personal injury or property damage may result from fire or explosion if power is applied to the actuator with the cover removed in a hazardous area.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 457 mm / 18 in. from the actuator. Personal injury or property damage may result from explosion if the seal is not installed.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional and national codes for any given hazardous area approval. Failure to follow the local, regional and national codes could result in personal injury or property damage from fire or explosion.

WARNING

Avoid personal injury or property damage caused by possible actuator failure. The use of a rigidly-mounted support on the actuator casing may cause additional stress on the actuator leading to premature wear and/or failure of the actuator components.

1. The easy-Drive 200L can be installed in any position, but normally the actuator is vertical above the valve. Install the valve per the manufacturer's guidelines and per any applicable local, regional and national piping codes.
2. For explosion-proof applications, install rigid metal conduit and seal no more than 457 mm / 18 in. from the actuator.
3. Unused conduit ports must be sealed with an explosion-proof port plug.

NOTE

Plastic conduit ports provided by factory are to be removed prior to operation and replaced with an explosion-proof port plug.

2.1 Special Instructions for “Safe Use” and Installations in Hazardous Locations



WARNING

To avoid static discharge from the enclosure, do not rub or clean the enclosure with solvents. To do so could result in an explosion. Clean with a mild detergent and water only.

The enclosure is non-conducting and may generate an ignition-capable level of electrostatic charges under certain extreme conditions. The user should ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a buildup of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment shall only be done with a damp cloth.

To avoid damage to the enclosure, when screws are fully tightened into blind holes in enclosure walls, with no washer fitted, at least one full thread shall remain free at the base of the hole.

2.2 Actuator Mounting

The following procedure describes how to mount an easy-Drive 200L actuator.

The actuator is shipped with the stem in the ideal coupling position; 6% off the lower actuator stop.

NOTE

Do not stroke the actuator prior to coupling the unit to the valve.

To reposition the actuator to the ideal coupling position calibrate the actuator as valve type “Stop-to-Stop”. Ensure the actuator is able to travel making contact with its internal stops. Once calibration is complete command the valve to 6% open.

User designed and manufactured Mounting Kit and Stem Coupler will be needed to complete this procedure.



WARNING

To avoid personal injury or property damage, keep hands and tools out of the actuator stem travel path when moving the actuator stem in the following steps.

1. Supply a method of supporting the weight of the valve and actuator during assembly.
2. Push the valve stem down away from the actuator to the closed position for push-down-to-close valves.
3. Mount the easy-Drive 200L to the mounting kit designed and supplied by the user.
 - a. Utilizing the wrench flats on the actuator yoke tighten the actuator yoke locknut to 205 N•m / 151 lb•ft.
4. Lift or hoist the actuator and mounting assembly onto the valve and mate the mounting kit securely to the valve following the valve manufacturer's guidelines.

NOTE

The valve stem must be fully in the down position.

5. Make the stem connection between the actuator and valve stems.
 - a. When installing the user-supplied stem connector the actuator stem's threads should engage the threads of the stem connector by a distance equal to or greater than the diameter of the actuator stem.

NOTICE

Incomplete engagement of the actuator stem in the stem connector can result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than one diameter of that stem. Damage to threads on either stem or in the stem connector can cause the parts to be replaced prematurely. Do not attempt to remove the stem connector when force is applied to the stem.

6. Configure the actuator to the appropriate mode using the easy-Drive configurator tool. See Valve Type Configuration section of this manual.
7. Calibrate the actuator. See Calibration Instructions section of this manual.

2.3 Startup Overview

Figure 2. Flowchart

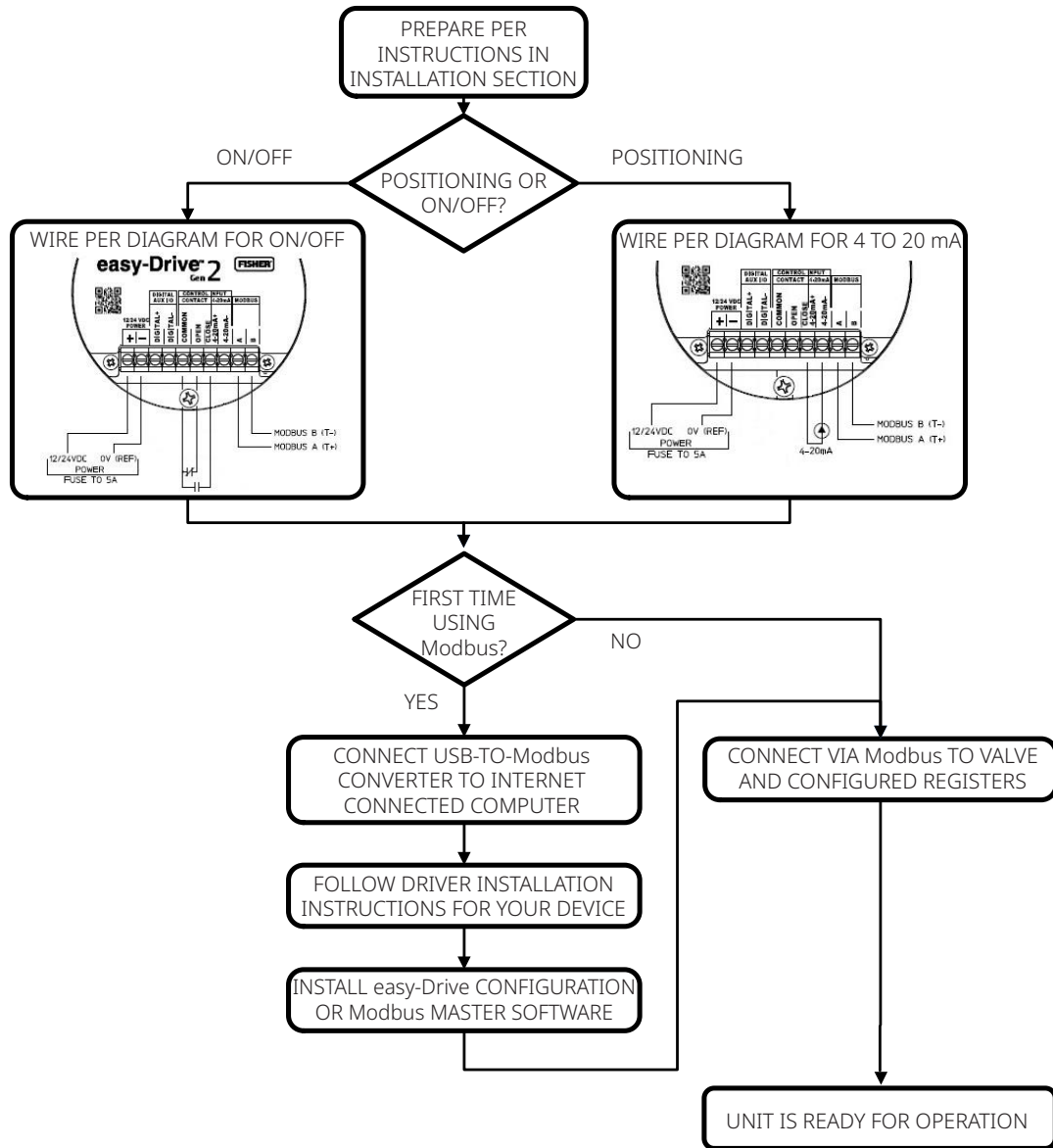
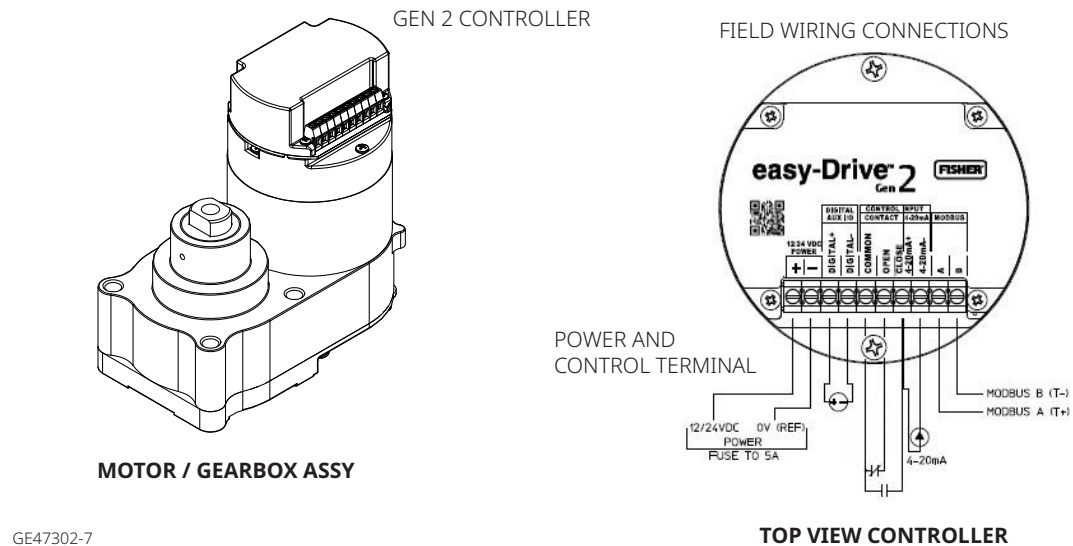


Figure 3. Fisher easy-Drive 200L Wiring Diagram



Power Requirements

Ensure a stable DC power source is available, maintaining less than 5% ripple and sufficiently surge protected for the application. A 4 amp (minimum) power supply is required.

Wiring Instructions

1. Observe local wiring requirements for hazardous location usage.
2. Conduit seals within 450 mm / 18 in. of the enclosure port are required for explosion-proof installation.
3. 18 AWG / 0.52 mm² to 12 AWG / 3.31 mm² wire size required.
4. Fuse system to 5 A.
5. Connect enclosure and analog signal shields.
6. Ensure power is turned off before connecting the wires.

Power

1. Connect 12 or 24 V DC reference to: –
2. Connect 12 or 24 V DC positive to: +
3. Be sure to tighten terminals sufficiently to ensure solid mechanical connection.

Figure 4. Wiring - Analog Input

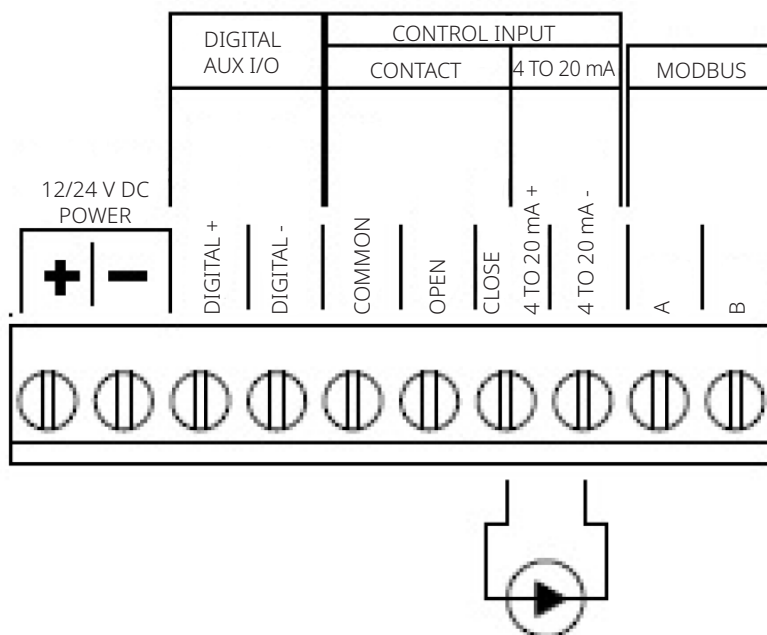


Figure 5. Wiring - Dual Dry Contact

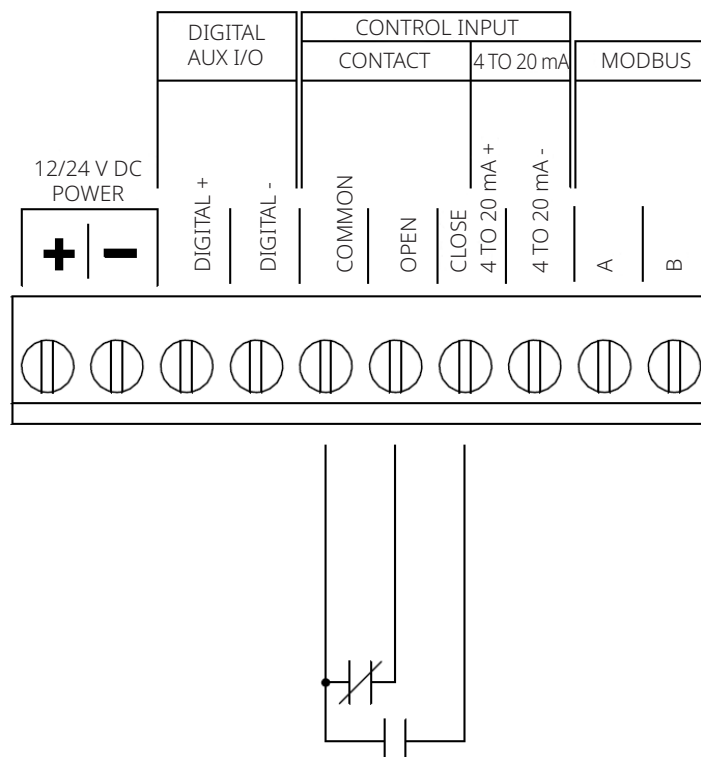


Figure 6. Wiring - Single Dry Contact

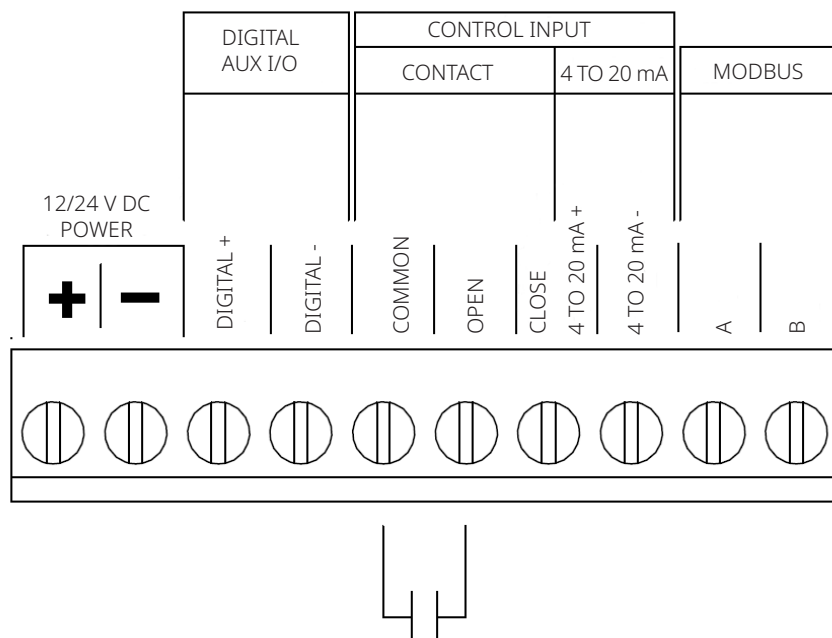


Figure 7. Wiring - Modbus Input

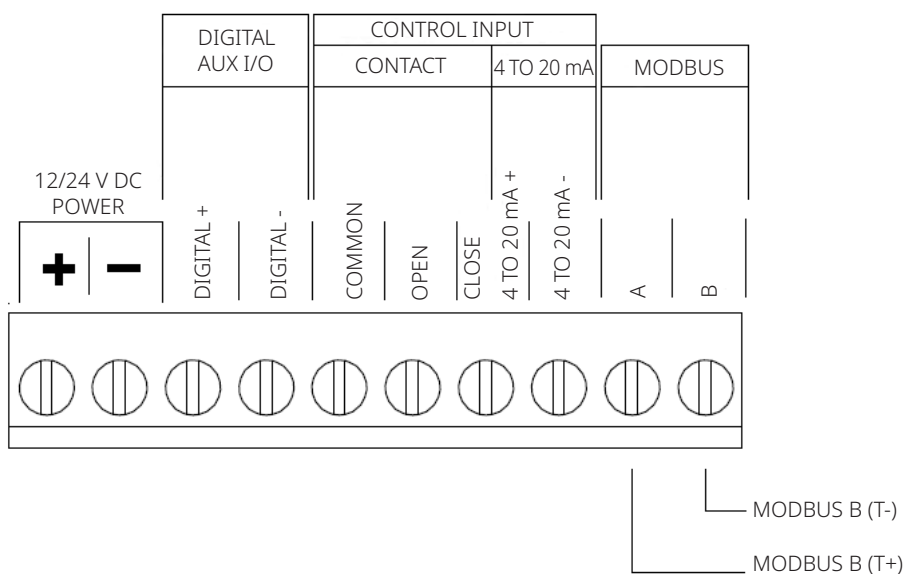


Figure 8. Wiring - Auxiliary Digital I/O Set to Input (40080=0)

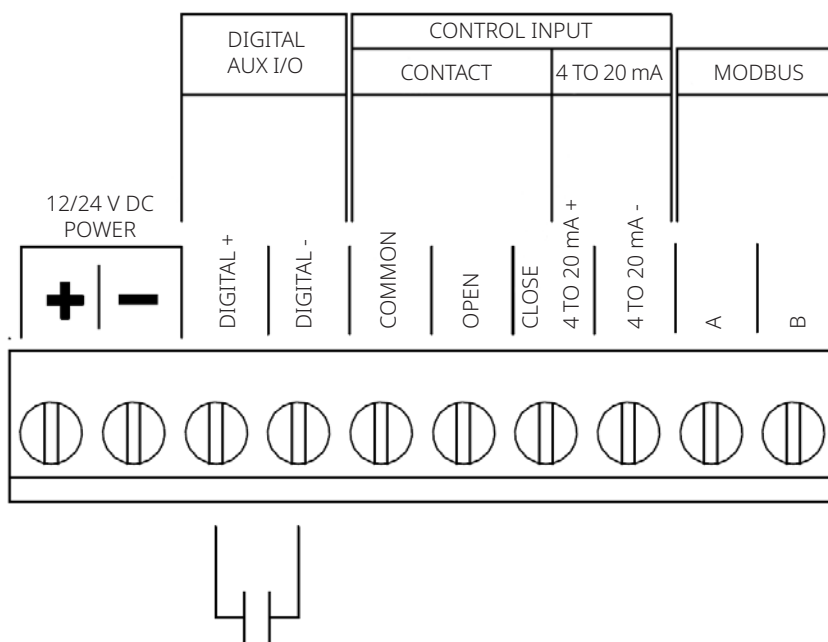
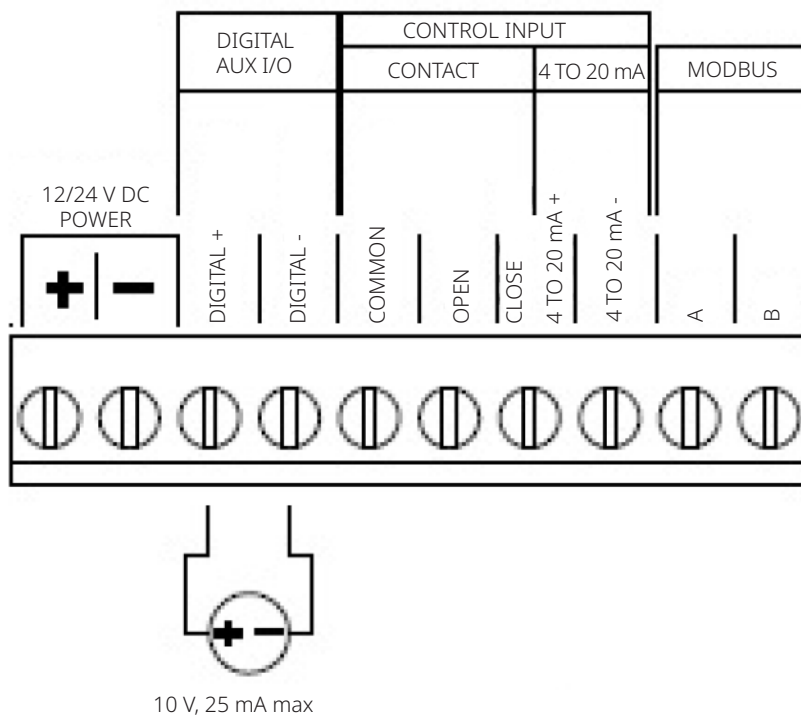


Figure 9. Wiring - Auxiliary Digital I/O Set to Output (40080=1)



2.4 Configuration

The easy-Drive 200L must be configured prior to operation.

All configuration within the actuator is done by setting values in Modbus registers. Configuration software, providing a visual interface to the registers, is available through your Emerson sales office or at www.fisher.com/easydrive. Control and monitoring can be done using any Modbus master (flow computer, PLC, PC).

See Appendix A for a full map of Modbus registers and their functions.

Control Method Configuration

There are two functional configurations available for the easy-Drive electric actuator: On/Off and Positioning.

All available input signals are shown in Table 2.

Table 2. All Available Input Signals

CONFIGURATION	ON/OFF			POSITIONING	
	Control Source	Modbus	Local		Modbus
	Input Signal	Modbus	Dual Dry Contact	Single Dry Contact	Modbus
					4 to 20 mA (default)

2.5 Modbus Setup

Use of a serial or USB to RS-485 device is required to connect to the actuator. Refer to manufacturer's requirements for installation. The easy-Drive 200L Modbus factory defaults are Address 1, 9600 baud, even parity, 1 stop bit, MSB.

When a connection has been achieved, the actuator may be configured as required for the application.

Figure 10. Fisher easy-Drive Configuration Software



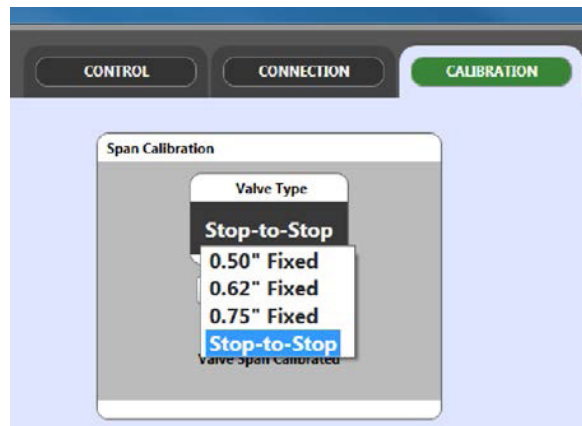
Connecting Using the Fisher easy-Drive Configuration Software

The Fisher easy-Drive configuration software allows configuration and diagnosing of the Fisher easy-Drive electric actuator with a graphical interface. Connect a PC to the actuator using a USB or serial device to RS-485 converter using the wiring instructions above. The USB or serial device will be visible in the drop menu under Serial Port Settings. Baud rate and parity should be set to the Modbus settings of the actuator. Default actuator settings are address 1, 9600 baud, even parity, 1 stop bit, MSB. Press the AUTO button in the upper left corner to connect to the valve.

Use the Fisher easy-Drive configuration software (Figure 10) to make the desired changes or register values may be changed to allow different functionality.

Valve Type Configuration

- Valve Type
 - 0.5" Fixed
 - 0.62" Fixed
 - 0.75" Fixed
 - Stop-to-Stop

Figure 11. Fisher easy-Drive Configuration Software

Fixed travel settings will set the fixed travel from the valve seat (push down to close) up, i.e., 0.50" Fixed, will set the full range of travel at 0.5 in. from the seat.

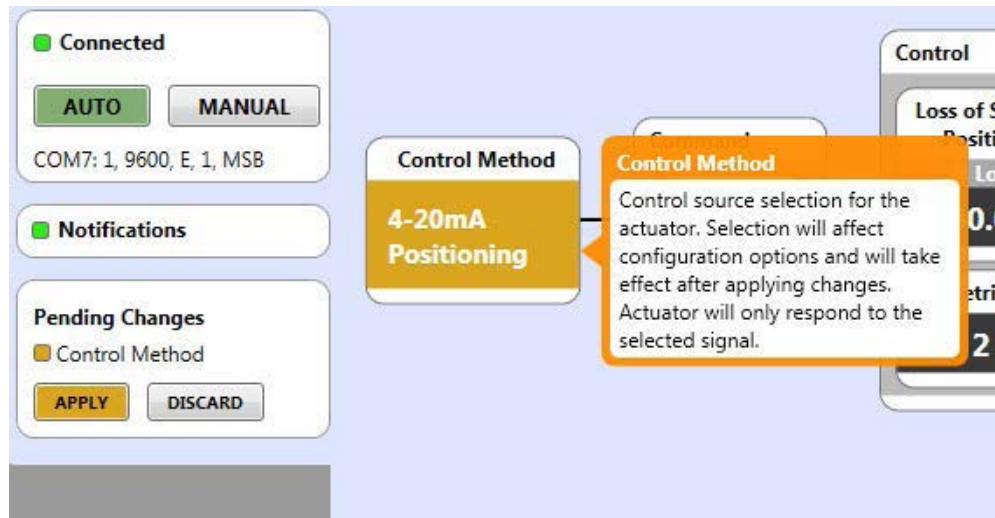
Stop-to-stop setting will set the travel using hard stops that define the full range (max 0.75 in.).

Initial Setup

The control method selection determines the control signal to which the valve will respond. Only the control signal selected will result in movement of the valve; all others will be ignored.

- Control Methods
 - Dual Contact On/Off
 - Single Contact On/Off
 - Modbus On/Off
 - Modbus Positioning
 - 4 to 20 mA Positioning
 - 4 to 20 mA Level

When using the easy-Drive Configuration Tool, clicking on the "Control Method" box will create a drop down menu as shown. Select the desired control source; the selection will turn yellow. A box with Pending Changes will appear showing all changes. Press "APPLY" to confirm the change(s).

Figure 12. Fisher easy-Drive Configuration Software

Calibration Instructions

⚠ WARNING

To avoid personal injury or property damage, be aware that the valve will move during the calibration cycle.

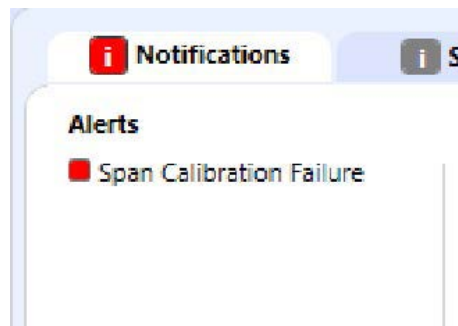
Span Calibration

It will be necessary to perform a span calibration. A span calibration is accomplished by the following method:

1. Ensure the process and valve are in a safe state – the valve may move during this operation.
2. Press the “CALIBRATE SPAN” button to initiate the span calibration. The software will show a progress bar during the calibration and display “Valve Span Calibrated” when complete.

NOTE

Should actual travel not equal the expected travel you will receive a span calibration failure alert. See Figure 13. Ensure valve type is selected correctly. It may be necessary to re-couple the valve actuator assembly.

Figure 13. Fisher easy-Drive Configuration Software

Span Calibration without the Use of Modbus

1. Turn power to the actuator off.
2. Wait for 10 seconds to ensure all circuits have discharged.
3. Return power to the actuator and use the appropriate calibration method for your control signal. Calibration sequence must be done within 15 seconds of power being switched on.
4. For positioning operation using 4 to 20 mA:
 - a. Apply a 4 mA signal between pins 4 to 20 mA - and 4 to 20 mA +. If Span is currently uncalibrated, valve plug will not move at this time.
 - b. Apply a 20 mA signal between pins 4 to 20 mA - and 4 to 20 mA +. If Span is currently uncalibrated, valve plug will not move at this time.
 - c. Apply a 4 mA signal between pins 4 to 20 mA - and 4 to 20 mA + – valve plug will move to the upper stop, immediately followed by moving to the lower, closed position.
 - d. If calibration of the analog input is desired to improve positional accuracy, an optional operation is listed in the next section titled Analog Input Calibration.
5. For On/Off operation using dual input dry contact:
 - a. Close the contact to create a short between pins COMMON and CLOSE. If Span is currently uncalibrated, valve plug will not move at this time.
 - b. Close the contact to create a short between pins COMMON and OPEN. If Span is currently uncalibrated, valve plug will not move at this time.
 - c. Close the contact to create a short between pins COMMON and CLOSE – valve plug will move to the upper, open position and then to the lower, closed position.

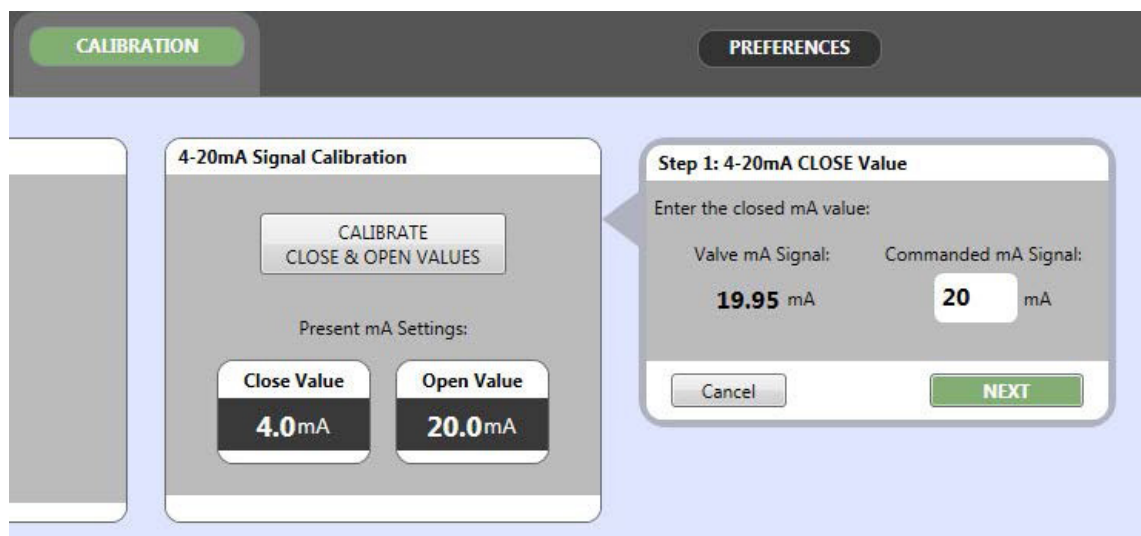
6. For On/Off operation using single dry contact:
 - a. Open the contact to create an open circuit between pins COMMON and OPEN. If Span is currently uncalibrated, valve plug will not move at this time.
 - b. Close the contact to create a short between pins COMMON and OPEN. If Span is currently uncalibrated, valve plug will not move at this time.
 - c. Open the contact to create an open circuit between pins COMMON and OPEN – valve plug will move to the upper, open position and then to the lower, closed position.
7. The unit is now calibrated.

Analog Input Calibration

For valves using 4 to 20 mA as a control source, several options are available to customize control of the actuator. Use a 4 to 20 mA signal generator to provide the desired signal. It is possible to calibrate the 4 to 20 mA signal in reverse acting or split-ranging with the method below with at least 4 mA of signal difference between the close and open values. The example shows a valve being changed from normal to reverse acting during the calibration process.

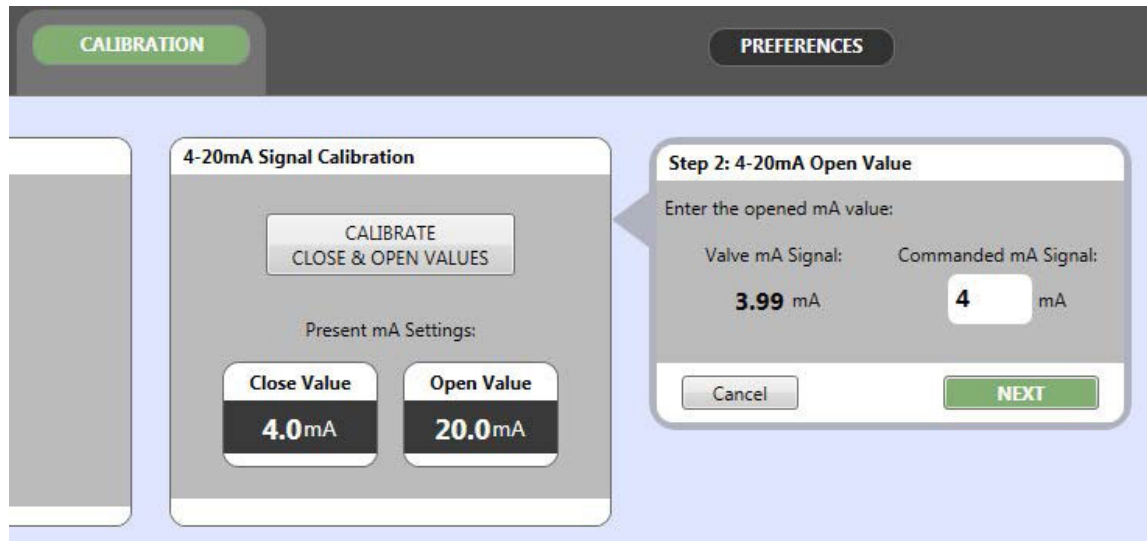
1. With the Control Method set to 4 to 20 Positioning or 4 to 20 mA Level, enter the Calibration screen and the 4 to 20 mA Signal Calibration window will be visible.
2. Click the CALIBRATE CLOSE & OPEN VALUES button. A separate window will open to guide through the process.
3. Set the 4 to 20 mA signal to the desired value for when the valve is to be closed.
4. Enter this value into the Calibrated mA Signal text box and press Next.

Figure 14. Fisher easy-Drive Configuration Software



5. Set the 4 to 20 mA signal to the desired value for when the valve is to be open.
6. Enter this value into the Commanded mA Signal text box and press Next.

Figure 15. Fisher easy-Drive Configuration Software



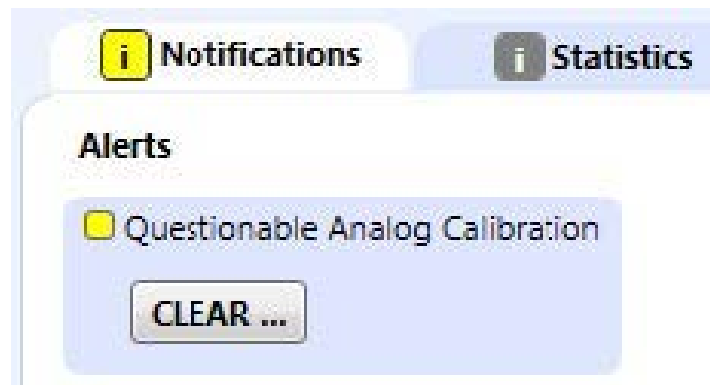
7. If the Close and Open values are as expected, press Confirm to accept these values. If not, press Cancel to restart the process.

NOTE

The value of the 4 to 20 mA signal must have at least 4 mA difference between the close and open signals. A differential less than that amount will cause the actuator to reject the calibration and use the previous values.

Should the entered values vary more than 10% from the expected 4 to 20 mA values, the actuator will accept the calibration and a notification displaying "Questionable Analog Calibration" will result.

Figure 16. Fisher easy-Drive Configuration Software



Operational Verification



WARNING

To avoid personal injury or property damage, be aware that the valve will move and respond to an input signal during start up.

1. Before turning on power to the unit, be sure that a closed signal is being commanded to the unit.
 - Single Dry Contact: contact is open.
 - Dual Dry Contact: contact closed across pins COMMON and CLOSE.
 - Analog Input: signal = 4 mA.
 - Modbus: position demand = 0.
2. Turn on power to the unit.
3. Apply a change in position demand to ensure unit responds properly.
 - Single Dry Contact:
 - Closed contact between pins COMMON and OPEN will open the valve.
 - Dual dry contact: Closed contact between pins COMMON and OPEN will open the valve. Closed contact between pins COMMON and CLOSE will close the valve.
 - Analog Input: valve will respond to proportional demand.
 - Modbus: valve will respond to positional demand in register 40001. 0 = fully closed and 1000 = fully open.
4. If the valve does not respond as expected, proceed to Troubleshooting guide.
5. Check conduit ports.
 - Conduit seal must be in place within 450 mm / 18 in. of the enclosure.
 - Unused conduit ports must be sealed with an explosion-proof port plug.
6. Replace the cover and tighten all 8 bolts to 20 N•m / 15 ft•lbs.

Section 3: Troubleshooting

1. Unit does not move.
 - a. Green heartbeat LED will pulse near Modbus terminals when power is present. Verify the 12 V DC to 24 V DC is present on the power terminals as shown on the cover.
 - b. Verify all wires are firmly attached on both ends.
 - c. Verify the wires are connected to the correct terminals - see Wiring in the manual.
 - d. Verify the configured control method matches control signal.
2. Unit does not respond to 4 to 20 mA signal.
 - a. Green heartbeat LED will pulse near Modbus terminals when power is present. Verify the 12 V DC to 24 V DC is present on the power terminals as shown on the cover.
 - b. Verify all wires are firmly attached on both ends.
 - c. Verify the wires are connected to the correct terminals - see Wiring in the manual.
 - d. Verify the configured control method matches control signal.
 - e. Check the value of the analog input in register 40026. If this register shows 0, the 4 to 20 mA may be wired backwards. Swap wire and attempt again.
3. Diagnostics show a Motor Stall - Travel Deviation Fault.
 - a. If the actuator can not move to its commanded position, the actuator will stop, without damage and issue a Motor Stall - Travel Deviation Fault warning. When the command signal changes outside of the deadband (Modbus register 40053), it will attempt to move again.

Section 4: Maintenance

The frequency of inspection and maintenance depends on the severity of the service conditions.



WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Back plug away from seat to relieve spring compression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.



WARNING

For explosion-proof applications, ensure the actuator cover is properly bolted before applying power to the actuator. Personal injury or property damage may result from fire or explosion if power is applied to the actuator with the cover removed in a hazardous area.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 457 mm / 18 in. from the actuator. Personal injury or property damage may result from explosion if the seal is not installed.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional and national codes for any given hazardous area approval. Failure to follow the local, regional and national codes could result in personal injury or property damage from fire or explosion.

4.1 Disassembly

1. Follow valve manufacturer's warnings and instructions for isolating and releasing line pressure prior to disassembling the valve.
2. Move the actuator off the seat before disassembling the valve and actuator.

NOTICE

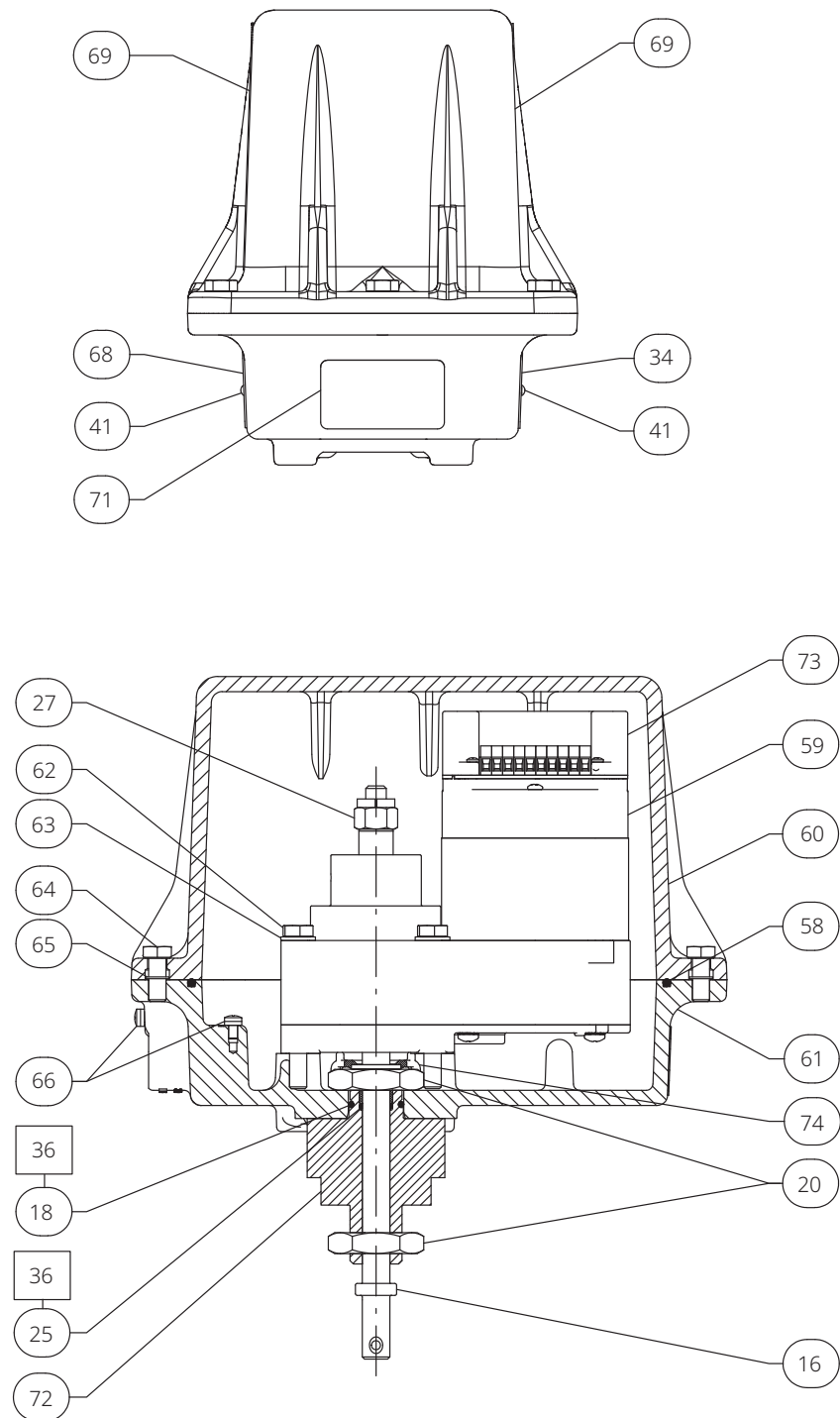
The following steps are intended to prevent damage to the valve during the removal of the yoke and actuator.

3. For Positioning Actuators:
 - Command the valve to anywhere between 10% and 20% travel.
 - Disconnect power and signal.
 - Proceed to step 4.For On/Off Actuators:
 - Command the valve to open or close and cut the power when the valve is at midstroke.
 - Disconnect power and signal.
 - Proceed to step 4.
4. Remove actuator and mounting kit from the valve body.

Assembly

1. Connect actuator and mounting kit to valve body.
2. Replace the top of the explosion proof enclosure (key 60) and tighten cap screws (key 64) to 20 N•m / 15 lbf•ft.

Figure 17. Fisher easy-Drive 200L Actuator Exploded View



GE94736-A

Section 5: Parts

5.1 Parts Ordering

Each easy-Drive 200L actuator is assigned a serial number, which can be found on the nameplate. Refer to the number when contacting your [Emerson sales office](#) for assistance or when ordering replacement parts.



WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher actuator, because they may void your warranty, might adversely affect the performance of the actuator and could cause personal injury and property damage.

NOTE

Previous generation gearboxes may not be compatible with the easy-Drive 200L. For additional information please consult your [Emerson sales office](#).

5.2 Parts Kits

Table 3. Kit and Part Number

Kit	Part Number
Board Replacement Kit (On/Off is default)	GE83055X012
Board Replacement Kit + Positioning License Dongle	GE83126X012
Motor/Gearbox Assembly	GK10613X012
Motor/Gearbox/Board Assembly (On/Off is default)	GK16046X012
Motor/Gearbox/Board Assembly + Positioning License Dongle	GK16047X012
Replacement Kit - Belleville Springs	GK15266X012
Replacement Kit - Drivetrain	GK15328X012
Positioning License Dongle (1 License)	GE83574X012
Positioning License Dongle (5 License)	GE83574X022

5.3 Parts List

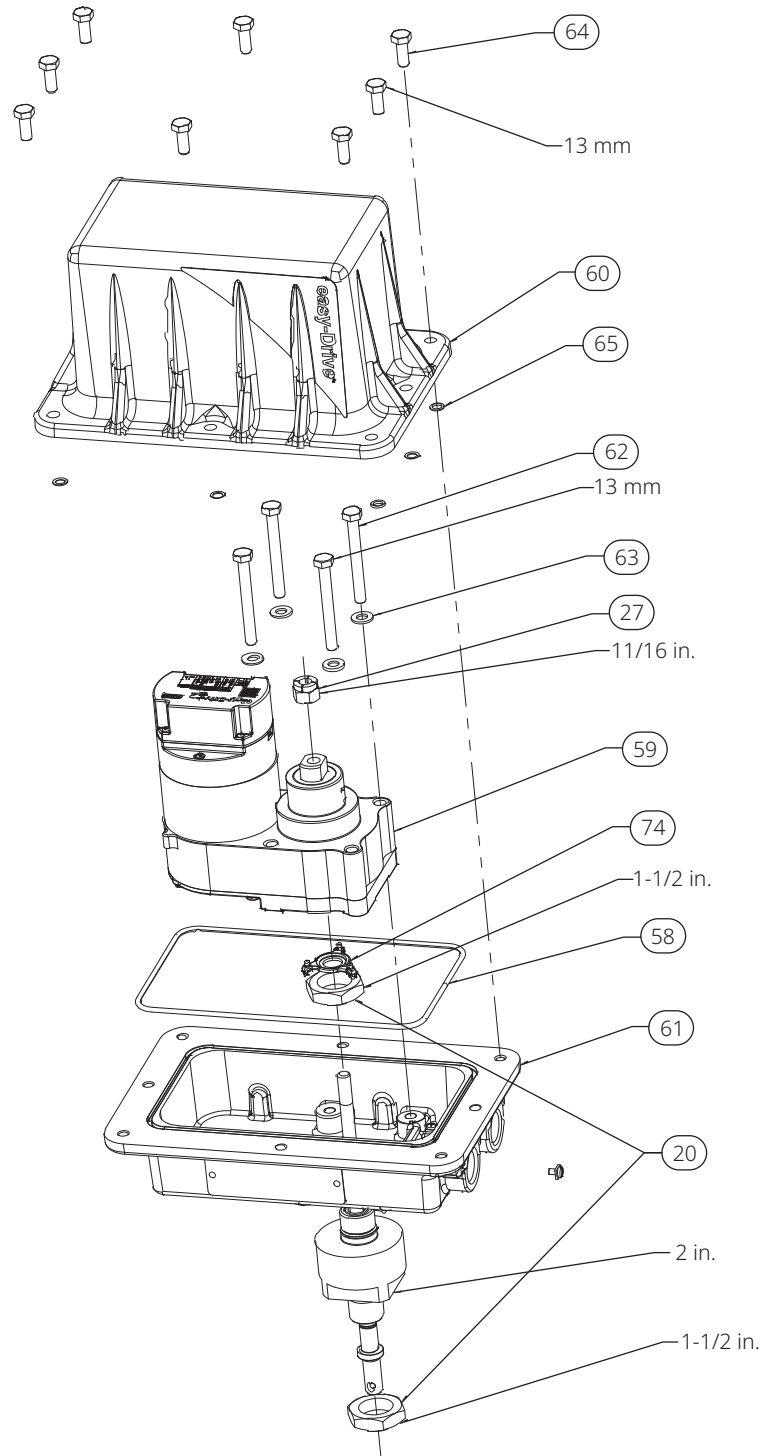
NOTE

For part numbers not shown, contact your [Emerson sales office](#).

Table 4. Parts List

Key	Description	Key	Description
16	Stem	62	Screw cap, Hex Hd
18	O-ring	63	Washer, plain
20	Nut, Hex, Locking	64	Screw cap, Hex Hd
25	O-ring	65	Retaining washer
27	Nut, Hex Nylon insert	66	Retainer, Wire (Sem)
34	Nameplate, easy-Drive 200L	68	Certification nameplate
36	Lubricant, Grease	69	Label, Cover
41	Screw, Drive	71	Label, HiPot
58	O-ring	72	Yoke assembly
59	Motor/Gearbox	73	Cover/Controller board
60	Upper enclosure	74	Stop assembly
61	Lower enclosure	---	---

Figure 18. Fisher easy-Drive 200L Actuator Assembly



GE94736_ex

Appendix A: Modbus

A.1 Register Summary

Table A-1. easy-Drive 200L Modbus Map

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint16	Modbus position command (100=10.0%)	40001	0	R/W	0 to 1000	Modbus command value with one implied decimal place (1000=100.0%). R/W at all times but only used in Modbus control mode. In on/off mode 0 to 499 will result in a move to 0% and 500 to 1000 will result in a move to 100%.
uint16	Digital output	40002	0	R/W	0, 1	0=no voltage supplied to terminals, 1=voltage supplied to terminals (Only used when output setup is set for Remote controlled)
uint16	Reset error codes	40003	0	R/W	0, 1	Value of 1 will clear faults. Will automatically set back to 0.
uint16	RESERVED	40004	---	---	---	---
uint16	RESERVED	40005	---	---	---	---
uint16	RESERVED	40006	---	---	---	---
uint16	RESERVED	40007	---	---	---	---
uint16	RESERVED	40008	---	---	---	---
uint16	RESERVED	40009	---	---	---	---
uint16	Actual position (100=10.0%)	40010	0	R	0 to 1000	Present position of the actuator relative to span with 1 implied decimal place (1000=100.0%). Valid for all control modes.
uint16	Commanded position (100=10.0%)	40011	0	R	0 to 1000	Present position command of the actuator relative to span (1000=100.0%). Valid for all control modes.
uint16	Diagnostic Flags	40012	0	R	0 to 65535	Bit flags - see chart
uint6	Digital status	40013	0	R	0 to 1	0=no connection between terminals, 1=connection between terminals (Status of digital input or output)
uint32	Total Running Time (min)	40014, 40015	0	R	4294967296	Total number of minutes the actuator has been powered on since time has been reset
uint32	Total Open Time (min)	40016, 40017	0	R	4294967296	Total number of minutes the actuator has been at 100% of travel since time has been reset
uint32	Total Closed Time (min)	40018, 40019	0	R	4294967296	Total number of minutes the actuator has been at 0% of travel since time has been reset
uint32	Number of Closed (cycle count)	40020, 40021	0	R	4294967296	Total number of close cycles the actuator has performed since reset. One open/close cycle counts as 1.

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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Table A-1. easy-Drive 200L Modbus Map (continued)

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint32	Number of Power Cycles	40022, 40023	0	R	4294967296	Total number of times the actuator has been powered on.
uint32	Number of Movements	40024, 40025	0	R	4294967296	Total number of movements the actuator has performed. Move must be at least 5% of rated travel for cycle to increment.
uint16	Analog input control value	40026	0	R	0 to 2400	Value of the analog signal in mA with 2 implied decimals. In analog control mode, this is the command value and is subject to the analog settings in registers 40046 to 40059. Always active but a slower refresh rate when unit is not in analog control mode.
uint16	Incoming voltage	40027	0	R	0 to 350	Diagnostic register - value of incoming voltage with 1 implied decimal.
uint16	Latch Open State	40028	0	R	0 to 1	Normally open latch state
uint16	Latch Close State	40029	0	R	0 to 1	Normally closed latch state
uint16	RESERVED	40030	---	---	---	---
uint16	RESERVED	40031	---	---	---	---
uint16	RESERVED	40032	---	---	---	---
uint16	RESERVED	40033	---	---	---	---
uint16	RESERVED	40034	---	---	---	---
uint16	RESERVED	40035	---	---	---	---
uint16	RESERVED	40036	---	---	---	---
uint16	RESERVED	40037	---	---	---	---
uint16	RESERVED	40038	---	---	---	---
uint16	RESERVED	40039	---	---	---	---
uint16	Test Register - 16 bit	40040	45964	R	45964	Fixed register to test correct reading of 16 bit registers - Hex=B38C, Binary=1011001110001100
uint32	Test Register - 32 bit	40041, 40042	3,012,341,331	R	3,012,341,331	Fixed register to test correct reading of 32 bit registers - Hex=B38C AE53, Binary=1011001110001100 1010111001010011
uint16	Span calibration	40043	0	R/W	0, 1	Value of 1 will initiate span calibration. Will automatically set back to 0.
uint16	RESERVED	40044	---	---	---	---
uint16	RESERVED	40045	---	---	---	---
uint16	RESERVED	40046	---	---	---	---
uint16	RESERVED	40047	---	---	---	---
uint16	RESERVED	40048	---	---	---	---
uint16	RESERVED	40049	---	---	---	---

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Table A-1. easy-Drive 200L Modbus Map (continued)

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint16	Loss of signal position (100=10.0%)	40050	0	R/W	0 to 1001	Position to which valve plug will be driven upon loss of signal. Loss of signal is based upon the active control mode. 0 to 1000=0-100.0% with 1 implied decimal point. In on/off mode 0 to 499 will result in movement to 0% while 500 to 1000 will result in movement to 100%. A value of 1001 in any control mode is the setting for "lock-in-last."
uint16	Modbus timeout(s)	40051	60	R/W	0 to 65535	Time without a valid Modbus message is seen (to any address) before "loss of signal" motion is engaged when in Modbus control mode. Only active in Modbus control mode. 0=disabled
uint16	Dual contact timeout(s)	40052	60	R/W	0 to 3600	Time without a digital signal being low (contact made) from either digital input as viewed by voltage level on the digital input terminals. If neither contact has been made (pulled input low) within the timeout period, the valve plug will be moved to the loss-of-signal position. Only active in the local, on-off, dual contact mode. 0=disabled
uint16	Deadband (10=1.0%)	40053	5	R/W	0 to 250	Minimum percentage signal change to elicit a movement response based upon end position of last movement. For example, if the previous command resulted in the actuator moving to 31.2% of travel and deadband is set to 100 (10.0%), setpoint must command valve to 21.2% or 41.2% before valve will move to new position. Default is set to minimize signal dithering.
uint16	Low travel cutoff position (100=10.0%)	40054	50	R/W	0 to 999	Analog input command, in percent with one implied decimal (50=5.0%), below this value will result in the valve plug moving to the closed position. Active in both local and Modbus control modes.
uint16	Analog on/off close position (100=10.0%)	40055	400	R/W	0 to 999	When the valve is in 4 to 20 mA on/off mode, this value is the point at which the valve will close. It must be set to a smaller value than the analog on/off open position. Percentage position value with one implied decimal (400=40.0%).
uint16	Analog on/off open position (100=10.0%)	40056	500	R/W	1 to 1000	When the valve is in 4 to 20 mA on/off mode, this value is the point at which the valve will open. It must be set to a larger value than the analog on/off close position. Percentage position value with one implied decimal (500=50.0%).
uint16	Analog Close Value	40057	40	R	31 to 220	The analog value, in mA with one implied decimal (40=4.0 mA), that defines the closed position.

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Table A-1. easy-Drive 200L Modbus Map (continued)

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint16	Analog Open Value	40058	200	R	31 to 220	The analog value, in mA with one implied decimal (200=20.0 mA), that defines the open position.
uint16	Number of retries	40059	2	R/W	0 to 4	When the valve plug encounters an obstruction, how many attempts will it make to move past that point, assuming no change in the command signal within the deadband range.
uint16	RESERVED	40060	---	---	---	---
uint16	RESERVED	40061	---	---	---	---
uint16	RESERVED	40062	---	---	---	---
uint16	RESERVED	40063	---	---	---	---
uint16	RESERVED	40064	---	---	---	---
uint16	RESERVED	40065	---	---	---	---
uint16	RESERVED	40066	---	---	---	---
uint16	Control Source	40067	0	R/W	0 to 5	0=Dual Contact On/Off 1=Single Contact On/Off 2=Modbus On/Off 3=Modbus Positioning 4=4 to 20 Positioning 5=4 to 20 Level
uint16	Valve Type	40068	1	R/W	1 to 10	1=D3 2=D4 3=easy-Drive Actuator 0.62" 4=easy-Drive Actuator 0.75" 5=easy-Drive Actuator Stop-to-Stop, 6=easy-Drive Actuator 0.50"
uint16	RESERVED	40069	---	---	---	---
uint16	RESERVED	40070	---	---	---	---
uint16	RESERVED	40071	---	---	---	---
uint16	RESERVED	40072	---	---	---	---
uint16	RESERVED	40073	---	---	---	---
uint16	Modbus address	40074	1	R/W	1 to 247	Slave Address of the actuator
uint16	Baud Rate	40075	5	R/W	4, 5, 6, 7	4=4800 baud, 5=9600 baud (default), 6=19200 baud, 7=38400 baud
uint16	Parity	40076	0	R/W	0, 1, 2	0=Even, 1=Odd, 2=None
uint16	Modbus stop bits	40077	1	R/W	0, 1, 2	1 stop bit is the standard with even and odd parity while 2 stop bits is the standard for none.
uint16	MSB/LSB	40078	0	R/W	0, 1	0=MSB (Big Endian) 1=LSB (Little Endian)
uint16	RESERVED	40079	---	---	---	---
uint16	Digital I/O selection	40080	1	R/W	0, 1	0=9 V sinking digital input, 1=25 mA at 10 V digital output

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Table A-1. easy-Drive 200L Modbus Map (continued)

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint16	Digital I/O output setup	40081	0	R/W	0, 1, 2, 3	Valid only when Digital I/O selection is set to Output (1) - 0=In position, 1=Fully closed, 2=Fully open, 3=Remote controlled (driven by Digital Output register)
uint16	Digital I/O input setup	40082	0	R/W	0, 1	Valid only when Digital I/O selection is set to Input (0) - 0=Reference only (status appears in 40013 and does nothing else), 1=Override (status appears in 40013 and valve plug is moved to safe position noted in register 40050)
uint16	RESERVED	40083	---	---	---	---
uint16	RESERVED	40084	---	---	---	---
uint16	RESERVED	40085	---	---	---	---
uint16	RESERVED	40086	---	---	---	---
uint16	RESERVED	40087	---	---	---	---
uint16	RESERVED	40088	---	---	---	---
uint16	RESERVED	40089	---	---	---	---
uint16	RESERVED	40090	---	---	---	---
uint16	RESERVED	40091	---	---	---	---
uint16	RESERVED	40092	---	---	---	---
uint16	RESERVED	40093	---	---	---	---
uint32	Device Tag	40094 to 40113	Default tag name	R/W	0 to 255 per character	Device Tag (20 character UTF8 string)
uint32	Valve serial number	40114, 40115	0	R/W*	0 to 4,294,967,296	Valve assembly serial number assigned at Fisher assembly plant
uint32	Motor serial number	40116, 40117	0	R/W*	0 to 4,294,967,296	Motor/gearbox serial number
uint32	Motor revision	40118, 40119	0	R/W*	0 to 4,294,967,296	Motor/gearbox revision
uint32	PCB serial number	40120, 40121	0	R/W*	0 to 4,294,967,296	PCB serial number
uint16	PCB revision	40122, 40123	0	R/W*	0 to 4,294,967,296	PCB revision
uint16	Flash Firmware major revision	40124	0	R	0 to 65535	From flash firmware when compiled
uint16	Flash Firmware minor revision	40125	0	R	0 to 65535	From flash firmware when compiled
uint16	Flash Firmware mod revision	40126	0	R	0 to 65535	From flash firmware when compiled
uint16	Flash Firmware build revision	40127	0	R	0 to 65535	From flash firmware when compiled
uint16	Boot Firmware major revision	40128	0	R	0 to 65535	From boot firmware when compiled
uint16	Boot Firmware minor revision	40129	0	R	0 to 65535	From boot firmware when compiled
uint16	Boot Firmware mod revision	40130	0	R	0 to 65535	From boot firmware when compiled
uint16	Boot Firmware build revision	40131	0	R	0 to 65535	From boot firmware when compiled
uint32	PCB test date	40132, 40133	0	R/W*	0 to 4,294,967,296	Seconds since January 1, 2000, Board Supplier Functional Test Date
uint32	Motor test date	40134, 40135	0	R/W*	0 to 4,294,967,296	Seconds since January 1, 2000, Motor Supplier Test Date
uint32	System completion date	40136, 40137	0	R/W*	0 to 4,294,967,296	Seconds since January 1, 2000, Final Assembly Test Date
1. uint is defined as unsigned integer uint16 – unsigned 16-bit variable, can take value 0 to 65535. uint32 – unsigned 32-bit variable, can take value 0 to 4294967295. (Reserved) – registers used for development use only. † - 32-bit register contains data that spans two registers – reads and write of data needs to be performed within the same Modbus command function to ensure coherency of data.						

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Table A-2. Diagnostic Fault Flags

Hex Value	Bit Mask	Description	Value	Bit	Definition
0x8000	1000 0000 0000 0000	Fault in N.V. Memory – system has restored default settings	32768	15	A memory fault has occurred and the actuator has been restored to factory defaults. Contact your Emerson sales office .
0x8000	1000 0000 0000 0000	Fault in N.V. Memory – system has restored default settings	32768	15	A memory fault has occurred and the actuator has been restored to factory defaults. Contact your Emerson sales office .
0x4000	0100 0000 0000 0000	Motor Assembly Stall - Travel Deviation	16384	14	The actuator is unable to move to the commanded position and has stopped. Follow troubleshooting guide in Help section to remedy.
0x2000	0010 0000 0000 0000	Discrete Input override mode active	8192	13	The digital input has detected a closed contact and the actuator has moved to its safe position. Check switch input device status.
0x1000	0001 0000 0000 0000	System or Watchdog fault	4096	12	The actuator has experienced a fatal error and shut down. Contact your Emerson sales office .
0x0800	0000 1000 0000 0000	Analog Input calibration value not in expected range	2048	11	The analog values entered do not match the analog signal level. Check analog signal value and value entered.
0x0400	0000 0100 0000 0000	Valve travel distance calibration not in legal range	1024	10	The valve travel distance is outside the acceptable range. Confirm valve type and that no obstructions are present.
0x0200	0000 0010 0000 0000	Analog Input span calibration not in legal range	512	9	The analog values for open and close are less than 4 mA and previous values have been maintained. Calibrate analog input with differential >4 mA.
0x0100	0000 0001 0000 0000		256	8	- - -
0x0080	0000 0000 1000 0000	Valve was shutdown while moving	128	7	Actuator was powered down during a move and actual position may vary from commanded. Recalibrate the valve span.
0x0040	0000 0000 0100 0000	Valve span calibrated (informational)	64	6	Span has been calibrated and actuator is ready.
0x0020	0000 0000 0010 0000	Valve position controller active (informational)	32	5	Actuator is active and ready.
0x0010	0000 0000 0001 0000	Loss of signal active	16	4	Control signal not present. Signal is <3 mA, timeout period exceeded (40051 or 40052).
0x0008	0000 0000 0000 1000		8	3	- - -
0x0004	0000 0000 0000 0100	Modbus command has been sent (starts a calibrated system)	4	2	The actuator is successfully moving the valve.
0x0002	0000 0000 0000 0010	Analog input initialized (system has seen input >3 mA / 1 V)	2	1	4 to 20 mA analog input has a valid signal present.
0x0001	0000 0000 0000 0001	Start delay active (within 15-second calibration window)	1	0	Span calibration using physical inputs allowed during startup.

Appendix B: Certificate of Conformance

	
EU Declaration of Conformity	
We, the manufacturer,	
Emerson	
Fisher Controls International LLC	
205 South Center Street	
Marshalltown, Iowa 50158 USA	
declare under our sole responsibility that the following product(s);	
Electric Actuator	
easy-Drive	
to which this declaration relates, is in conformity with the provisions of the following European Community Directives, including the latest amendments, as shown in the attached schedule.	
Assumption of conformity is based on the application of the harmonized standards and, when applicable or required, a European Community Notified Body certification, as shown in the attached schedule.	
	
Chad Engle	
Director – Product Design Compliance	
Marshalltown, Iowa 50158	
20-Oct-2025	
Date	
European Contact	
Emerson Group Services SAS Rue Paul-Baudry B.P. 10150 68701 Cernay Cedex France	
EDOCS ID: FCS_55	Page 1 of 2

- continued -

EMC Directive – 2014/30/EU

Models: All
EN 61326-1:2013

RoHS Directive – 2011/65/EU as amended by 2015/863/EU

Declaration of Exclusion

Models: All

The above equipment is excluded from the scope of this directive per Article 2, Paragraph 4, part C of 2011/65/EU, therefore the equipment cannot bear the CE mark related to RoHS compliance. However, the equipment may bear the CE mark to indicate compliance with other applicable EU directives.

ATEX Directive – 2014/34/EU (Applicable only if this mark appears on the product)

Certificate – **SIRA12ATEX1168X – Group II Category 2 G – Flameproof**
easy-Drive
Ex db IIA T6(Ta ≤ 70°C) Gb
Standards used: EN IEC 60079-0:2018/AC:2020, EN60079-1:2014

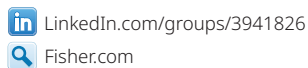
ATEX Notified Body for EC-Type Examination Certificate(s)

CSA Group Netherlands B.V. – Notified Body Number: 2813
Utrechtseweg 310, Building B42
6812AR Arnhem
The Netherlands

ATEX Notified Body for Quality Assurance

SGS Fimko Oy – Notified Body Number: 0598
P.O. Box 30 (Särkiniementie 3)
Helsinki, 00211
Finland

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS



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FISHER™



Fisher™ easy-Drive™ 200L Quick Start Guide

Mounting and travel configuration for your Fisher easy-Drive 200L actuator.

Before You Begin



Do not install, operate, or maintain a 200L actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this quick start guide, including all safety cautions and warnings. Refer to the Fisher easy-Drive 200L Instruction Manual ([D104331X012](#)) for product specifications, custom setup information, maintenance procedures, and installation in hazardous locations. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

WARNING

To avoid personal injury or property damage, keep hands and tools out of the actuator stem travel path. The actuator stem will move during calibration and positioning steps.

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Note

Refer to easy-Drive 200L Instruction Manual ([D104331X012](#)) for wiring, Modbus setup and connecting the Configurator to an easy-Drive actuator as this will be needed to configure and calibrate the 200L.

Ensure Actuator Stem is in the Proper Position Prior to Mounting and Coupling

Your 200L actuator has internal hard stops to limit maximum travel within the actuator. A new actuator will be shipped from the factory at 6% off the lower internal hard stop, which is the recommended mounting position.

Note

If you are mounting a new actuator that has never been positioned and is still in its recommended mounting position of 6% of maximum travel, you can begin at step 5.

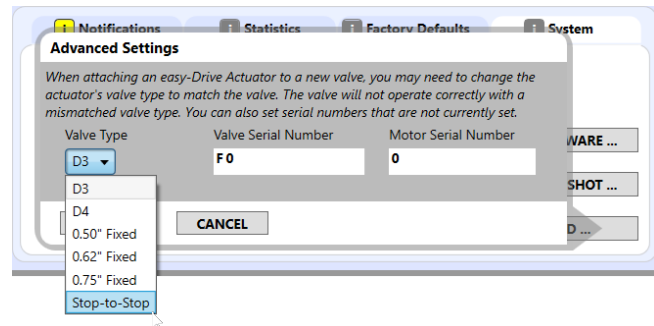
To set the stand-alone 200L actuator to the recommended mounting position of 6% of maximum travel, follow steps 1-4:

Step 1. Ensure use of a stand-alone 200L (must be actuator only, no valve body).

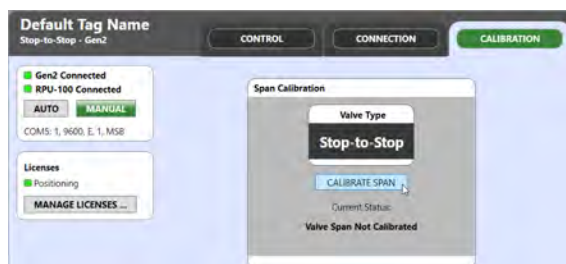


X1520-1

Step 2. Using the Fisher easy-Drive Configurator, select the "System" tab and then "Advanced Settings." Select the valve type "Stop-to-Stop" from the drop-down options and click "Apply."



Step 3. Perform Span Calibration from Calibration tab.



Step 4. Position actuator to 6% travel.



Note

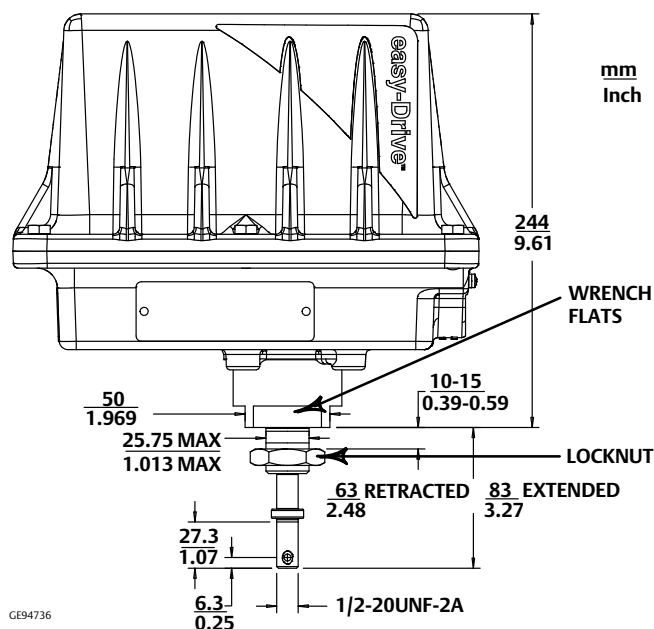
Stop-to-Stop is used for positioning the actuator to 6% off the lower travel stop. Select proper valve type and travel after mounting the 200L to the valve body.

Mount the Actuator to the Valve Body and Couple the Stems

Note

User supplied mounting bracket and stem coupler will be needed to complete this procedure.

- Step 5. Supply a method of supporting the weight of the valve and actuator during assembly.
- Step 6. Push the valve stem down away from the actuator to the valves closed position for push down to close valves.
- Step 7. Mount the to the mounting bracket supplied by the user. Tighten the actuator locknut to 205 N•m (151lb•ft).
- Step 8. Lift or hoist the actuator and mounting bracket onto the valve and mate the mounting bracket securely to the valve following the valve manufacturer's instructions.
- Step 9. Make the stem connection between the actuator and valve stems. When installing the user-supplied stem connector, be sure the actuator stem threads engage the threads of the stem connector by a distance equal to or greater than the diameter of the actuator stem.

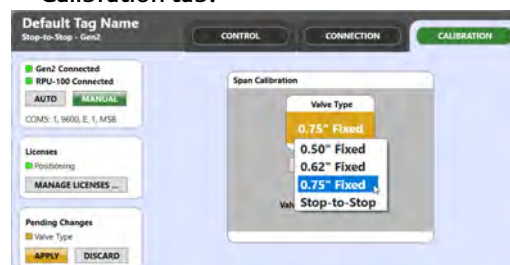


Refer to the easy-Drive 200L bulletin ([D104361X012](#)) for complete mounting specifications.

Select Proper Valve Type

- Step 10. Refer to valve manufacturer documentation to determine maximum valve travel. (Manufacturer specifications may vary.)

- Step 11. In the Configurator, navigate to the Calibration tab.



- Step 12. Click on the "Valve Type" and select the appropriate value that matches desired travel of the valve body for your application and is within manufacturer valve travel limits. Then click "Apply" to save the selection.

Note

Stop-to-Stop valve type selection should be avoided unless the valve is specifically designed with its own internal up and down hard stops within the valve body. Fixed travel settings are recommended and will set the travel from the valve seat (push down to close) up to a pre-defined amount of travel, e.g. '0.75" Fixed' setting, will set the full range of travel at 19 mm (0.75 inches) from the seat.

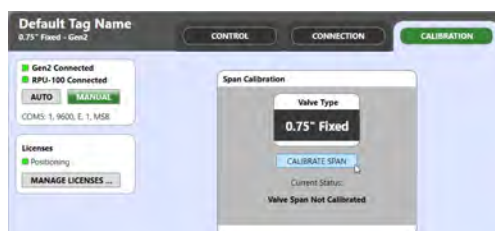
Calibrate Travel of the Actuator to the Valve Assembly

Step 13. Ensure the process and valve are in a safe state – the valve will move during the calibration steps.

Step 14. Navigate to the Calibration tab of the Configurator

Step 15. Press the “Calibrate Span” button to initiate the span calibration. The software will show a progress bar during the calibration and display “Valve Span Calibrated” when complete.

Step 16. Verify valve is closed when commanded to 0%.



Step 17. Verify full desired travel is achieved when commanded to 100% by confirming “Actual Position” in the Configurator is 100%.



Note

If actuator cannot achieve desired travel, review steps 5-12 to ensure all steps were followed, validate proper Configurator selections were made, and confirm the stems were properly coupled.

The valve/actuator assembly is now ready to be put into operation. If the 200L is not operating properly contact your [Emerson sales office](#).

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Fisher™ easy-Drive™ 200R

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Figure 1. Fisher easy-Drive 200R



Introduction

Scope of Manual



This instruction manual provides installation, maintenance, and parts information for the easy-Drive 200R. Do not install, operate, or maintain an easy-Drive 200R without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The easy-Drive 200R electric rotary actuators are used on rotary-shaft valve bodies for throttling or on-off applications. The 200R has an ISO 5211 mating interface that allows installation to non-Fisher valves. Style F mounting is available for coupling with Fisher rotary valves. This actuator is ideal for use on pressure and flow control applications for Fisher Vee-Ball NPS 1-6, HPBV NPS 2-4 and non-Fisher 90° rotary valves with 9 mm, 11 mm, 14 mm, or 19 mm square shaft connections, and 5/8-inch or 3/4-inch splined shaft connections. In applications that require a known loss of power position, an RPU-100 can be used to drive the easy-Drive actuator open or closed. Consult the easy-Drive RPU-100 Instruction Manual ([D104551X012](#)).

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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

easy-Drive 200R

April 2024

Instruction Manual

D104742X012

Table 1. Specifications

Material Temperature Capabilities⁽¹⁾ Electric Actuator Assembly: -40 to 70°C (-40 to 158°F)	Torque⁽⁵⁾ Rated: 124 N • m (1100 in • lbf)
Available Actuator Configurations⁽⁴⁾ Positioning	Nominal Stroke Speed⁽²⁾ 9° per second at 24 VDC
Compatible Fisher Valve Types and Sizes See tables 2 and 3	Hazardous Area Approvals CSA (C/US): Explosion-Proof Class I, Division 1, Groups C and D, T6, Ex db IIB T6, Class I, Zone 1, AEx db IIB T6 ATEX Flameproof - Gas: ⚠ II 2 G, Ex db IIB T6 Gb IECEx Flameproof - Gas: Ex db IIB T6 Gb
Power Requirements 11-30 VDC, minimum 2.7 amp power supply required (fuse to 5 amps)	Enclosure Rating Type 4X and IP66
Maximum Current Draw ■ 2.3 amps	Duty Cycle 50% maximum
Idle Current Draw ■ 15 mA at 24 VDC ■ 25 mA at 12 VDC	Enclosure Material Cast aluminum alloy with powder coat paint
Conduit Connections Two 3/4 NPT connections	Approximate Weight: 17.7 kg (39 lbs)
Travel⁽³⁾ Rated: 1/4 turn, 90°	

1. The temperature limits in the referenced tables and any applicable code or standard limitations should not be exceeded.

2. Variation can be expected, based on temperature and pressure of application.

3. Actuator is capable of 14° of over-travel (104° of total travel) for travel stop adjustment and valve zeroing.

4. Not compatible for use with valve assemblies that include a handwheel or manual actuator.

5. Not intended for applications where process conditions could produce torque beyond the rated torque.

Table 2. Compatible Fisher Valve Types and Sizes for Square Shaft Connection

VALVE TYPE	VALVE SIZE, NPS	SQUARE SHAFT CONNECTION SIZE (mm)
V150, V150E, V200, and V300	1	9
	1-1/2 and 2	11
	3 and 4	14
	6	19
8580	2	9
	6	19
8580 and 8590	3	11
	4	14

Table 3. Compatible Fisher Valve Types and Sizes for Splined Shaft Connection (Retro-fit Only)⁽¹⁾

VALVE TYPE	VALVE SIZE, NPS	SPLINE SHAFT CONNECTION SIZE (Inch)
V150, V150E, V200, and V300	1-1/2 and 2	5/8
	3 and 4	3/4
8580 and 8590	3	5/8
	4	3/4

1. Mounting bracket not supplied with splined shaft adaptor.

Specifications

Table 1 lists specifications for the easy-Drive 200R. Some of the specifications for a given actuator as it originally comes from the factory are stamped on a nameplate located on the lower actuator enclosure.

Educational Services

Emerson Educational Services
Phone: 1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Security

NOTICE

Physical security is an important part of any security program and is fundamental to protecting your system.

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and must be protected against by restricting access to unauthorized personnel in your facility.

- If unsecured, any device in the field is vulnerable to a physical attack; safety and security procedures must include mitigation by physical security controls.
- The easy-Drive actuator has optional Configurator software for configuration and data viewing. When the Configurator software is used, it must run on devices that are configured according to local security policies.
- Ensure that operation personnel are trained both on local security policies and the secure operation of the easy-Drive actuator.
- Operate the device within a controlled and secured physical environment.
- Operate the easy-Drive actuator and Configurator software within a controlled and secured network environment.
- Apply security patches and updates as they are released.
- Report security incidents and potential product vulnerabilities.
(https://go.emersonautomation.com/reportvulnerability_en)
- Follow local disposal policy for securely disposing of an unneeded device.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage caused by bursting of pressure-retaining parts or by uncontrolled process fluid, be certain the service conditions do not exceed the limits shown on the valve nameplate and in table 1. Use pressure-relieving devices required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

For explosion-proof applications, ensure the actuator cover is properly bolted before applying power to the actuator. Personal injury or property damage may result from fire or explosion if power is applied to the actuator with the cover removed in a hazardous area. Do not remove cover(s) or make live connections unless the area is known to be non-hazardous.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 457 mm (18 in) from the actuator. Personal injury or property damage may result from explosion if the seal is not installed.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection, and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion.

⚠ WARNING

Avoid personal injury or property damage caused by possible actuator failure. The use of a rigidly-mounted support on the actuator casing may cause additional stress on the actuator leading to premature wear and/or failure of the actuator components.

1. The easy-Drive 200R can be installed in any position. Install the valve per the manufacturer's guidelines and per any applicable local, regional, and national piping codes.
2. For explosion-proof applications, install rigid metal conduit and seal no more than 457 mm (18 in) from the actuator.
3. Plastic conduit ports provided by factory are to be removed prior to operation and replaced with an explosion-proof port plug.

Special Instructions for “Safe Use” and Installations in Hazardous Locations

⚠ WARNING

To avoid static discharge from the enclosure, do not rub or clean the enclosure with solvents. To do so could result in an explosion. Clean with a mild detergent and water only.

The enclosure is non-conducting and may generate an ignition-capable level of electrostatic charges under certain extreme conditions. The user should ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a build-up of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment shall only be done with a damp cloth.

To avoid damage to the enclosure, when screws are fully tightened into blind holes in enclosure walls, with no washer fitted, at least one full thread shall remain free at the base of the hole.

Flame proof joints are not intended to be repaired. To ensure safe use in hazardous locations, do not attempt to repair the upper enclosure (key 3), lower enclosure (key 2) or output shaft assembly (key 5). Contact your [Emerson sales office](#) for more information.

Actuator Mounting

The following procedure describes how to mount an easy-Drive 200R actuator.

Standalone actuators will be shipped with the shaft adaptor at the configured loss of signal position.

User designed and manufactured Mounting Kit and Stem Coupler will be needed to complete this procedure.

⚠ WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

⚠ WARNING

To avoid personal injury and equipment damage from moving parts, keep fingers and tools clear while stroking the actuator in the following steps.

NOTICE

To avoid damage to the 200R actuator, do not install on a valve assembly that includes a handwheel or manual actuator.

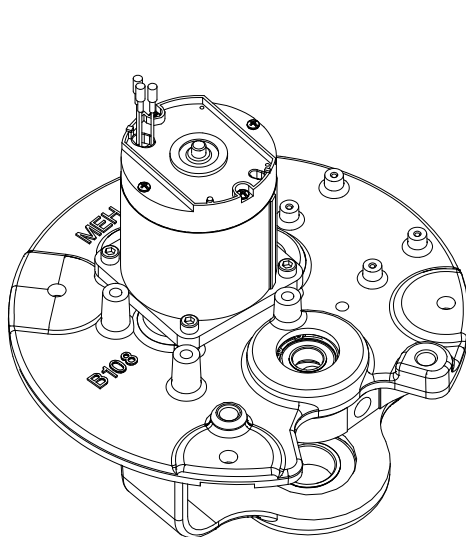
1. Supply a method of supporting the weight of the valve and actuator during assembly.
2. Manually rotate the valve shaft to the loss of signal position.
3. Mount the easy-Drive 200R to the mounting kit designed and supplied by the user.
4. Lift or hoist the actuator and mounting assembly onto the valve and mate the mounting kit securely to the valve following the valve manufacturer's guidelines.
5. Make the shaft connection between the actuator coupler and valve shaft.
 - a. When installing the user-supplied shaft connector the actuator shaft coupler should fully engage the valve shaft by a distance equal to or greater than the diameter of the actuator stem.

NOTICE

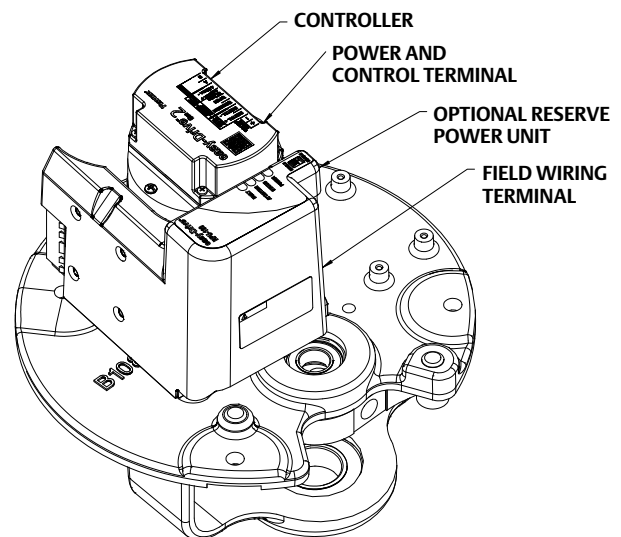
Be sure that the output shaft adaptor on the actuator and valve shaft are completely engaged. Do not attempt to remove the shaft adaptor when force is applied to the shaft.

6. Configure the actuator to the appropriate mode using the easy-Drive configurator tool. See Valve Type Configuration section of this manual.
7. Externally adjustable travel stops are used to limit the degree of rotation at both ends of the actuator stroke to calibrate valve to the actuator.
8. Calibrate the actuator. See Calibration Instructions section of this manual.

Figure 2. Fisher easy-Drive 200R

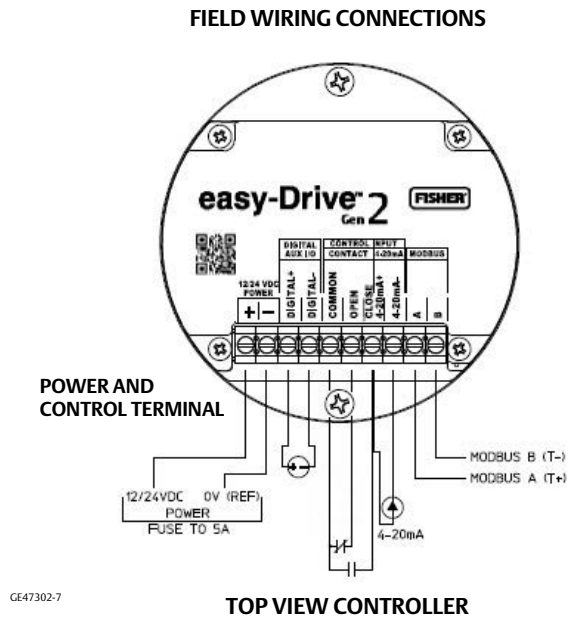


MOTOR AND GEAR CASE ASSEMBLY



**MOTOR AND GEAR CASE ASSEMBLY
INCLUDING GEN2 CONTROL BOARD
AND RPU-100**

Figure 3. Fisher easy-Drive 200R Wiring Diagram



Power Requirements

Ensure a stable DC power source is available, maintaining less than 5% ripple and sufficiently surge protected for the application. A 2.7A (minimum) power supply is required, fused to 5A. 12 VDC or 24 VDC is typical.

NOTICE

Misconfiguration of the valve type when powering the control board could result in damage to the valve or actuator. Ensure proper configuration and decommissioning are performed when installing, removing, or configuring a control board.

Wiring Instructions

1. Observe local wiring requirements for hazardous location usage.
2. Ensure power is turned off before connecting the wires.
3. Conduit seals within 450 mm (18 inches) of the enclosure port are required for explosion-proof installation.
4. 18 AWG (0.52 mm²) to 12 AWG (3.31 mm²) wire size required.
5. Fuse system to 5A.
6. Connect enclosure and analog signal shields.

Power

1. Connect 12 or 24 VDC reference to: –
2. Connect 12 or 24 VDC positive to: +
3. Be sure to tighten terminals sufficiently to ensure solid mechanical connection.

Figure 4. Wiring - Analog Input

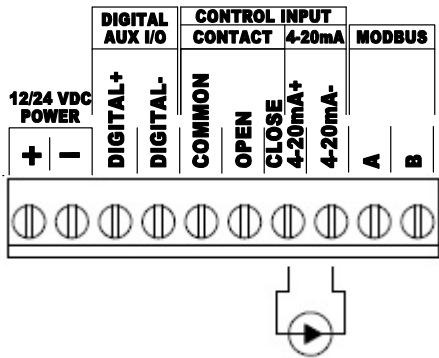


Figure 5. Wiring - Dual Dry Contact

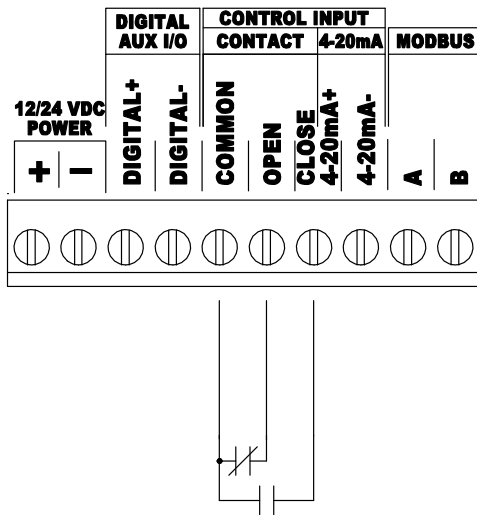


Figure 6. Wiring - Single Dry Contact

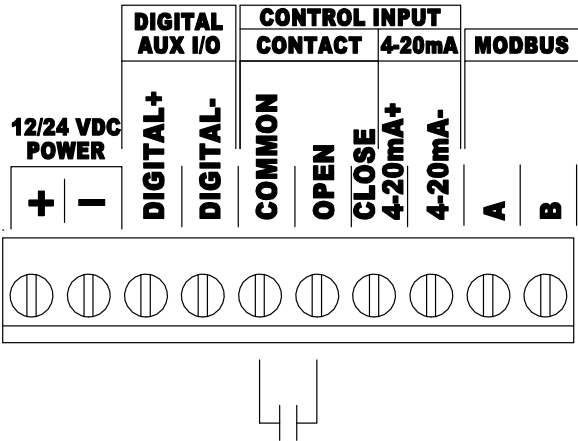


Figure 7. Wiring - Modbus Input

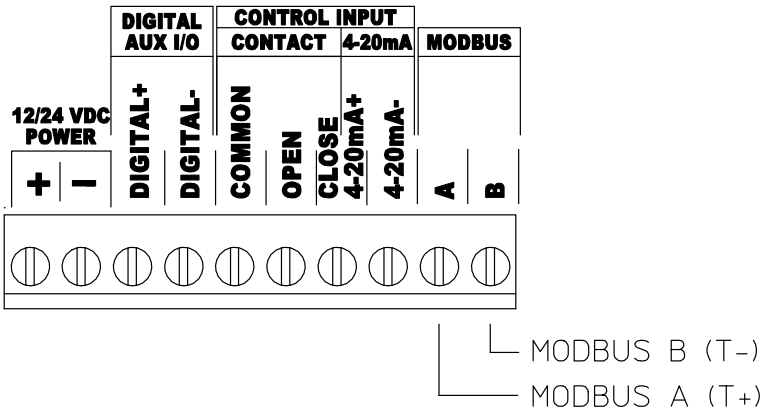


Figure 8. Wiring - Auxiliary Digital I/O set to input (40080=0)

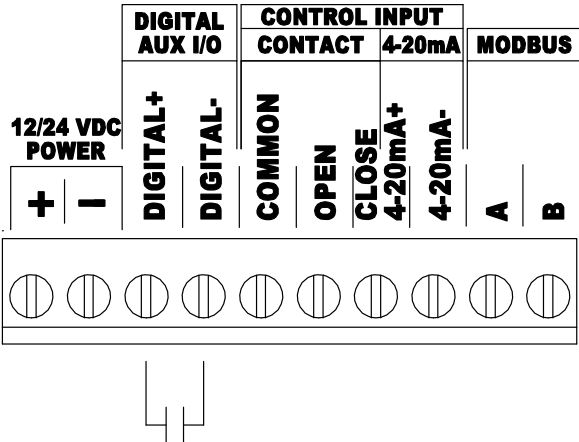
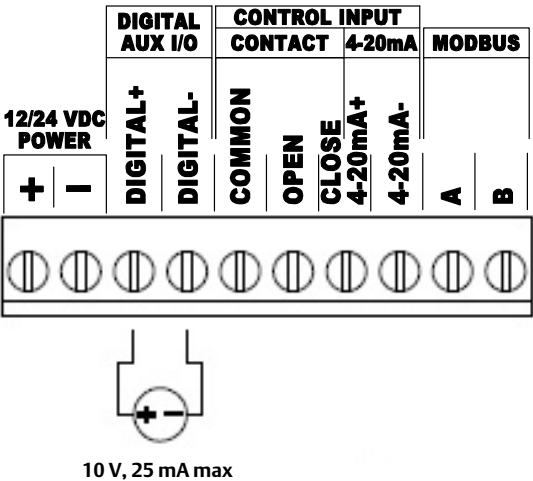


Figure 9. Wiring - Auxiliary Digital I/O set to output



Configuration

The easy-Drive 200R must be configured prior to operation.

All configuration within the actuator is done by setting values in Modbus registers. Configuration software, providing a visual interface to the registers, is available through your Emerson sales office or at www.emerson.com/en-us/catalog/fisher-200R. Control and monitoring can be done using any Modbus master (flow computer, PLC, PC).

See Appendix A for a full map of Modbus registers and their functions.

Control Method Configuration

There are two functional configurations available for the easy-Drive electric actuator: On/Off and Positioning.

All available input signals are shown in table 4.

Table 4. All Available Input Signals

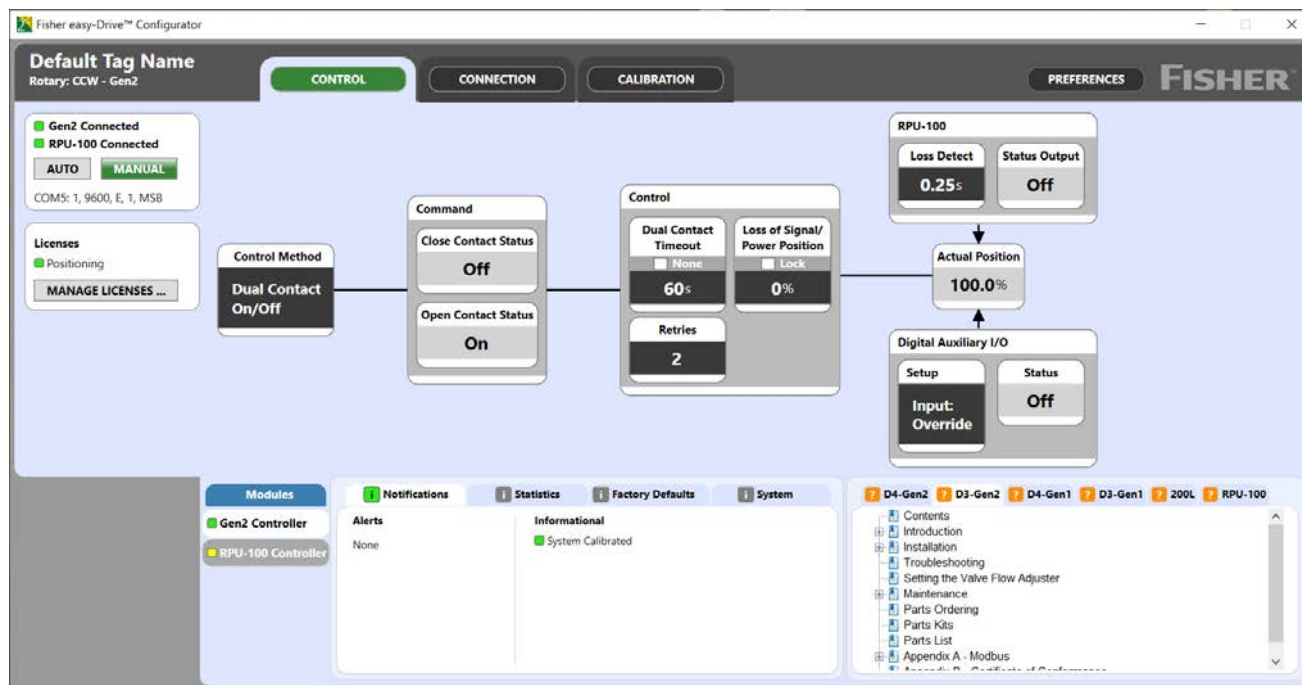
CONFIGURATION	ON/OFF			POSITIONING	
Control Source	Modbus	Local		Modbus	Local
Input Signal	Modbus	Dual Dry Contact (default)	Single Dry Contact	Modbus	4-20 mA (default)

Modbus Setup

Use of a serial or USB to RS-485 device is required to connect to the actuator. Refer to manufacturer's requirements for installation. The easy-Drive 200R Modbus factory defaults are Address 1, 9600 baud, even parity, 1 stop bit, MSB.

When a connection has been achieved, the actuator may be configured as required for the application.

Figure 10. Fisher easy-Drive Configuration Software



Connecting Using the Fisher easy-Drive Configuration Software

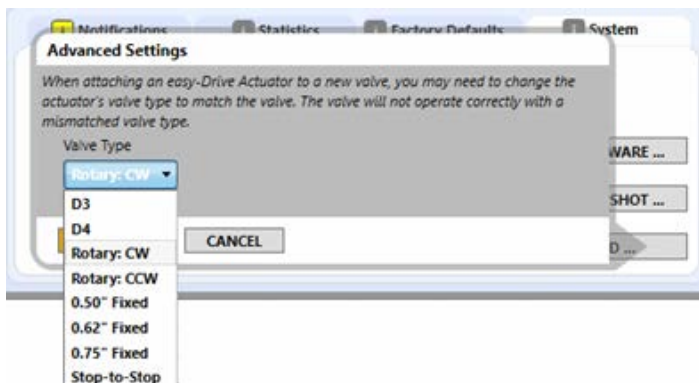
The Fisher easy-Drive Configurator software allows configuration and diagnosing of the Fisher easy-Drive electric actuator with a graphical interface. Connect a PC to the actuator using a serial or USB to RS-485 device using the wiring instructions above. The USB or serial device will be visible in the drop menu under Serial Port in the Manual Computer Connection settings. Address baud rate, parity, stop bits, and byte order should be set to the Modbus settings of the actuator. See Modbus Setup above for default actuator settings. Press the AUTO button in the upper left corner to attempt to scan for and enable from the Preferences in the upper right.

Use the Fisher easy-Drive configuration software (figure 10) to make the desired changes, or register values may be changed to allow different functionality.

Valve Type Configuration

- Valve Type
 - Rotary: CW (clockwise to close)
 - Rotary: CCW (counterclockwise to close)

Figure 11. Fisher easy-Drive Configuration Software



The easy-Drive 200R limits travel using hard stops that define the full range (max 104° rotation). Adjustable Travel Stops are provided to allow for adjustments to travel to meet the application requirements, and for valve alignment/calibration. See Actuator Mounting Section for more information on configuring the adjustable travel stops.

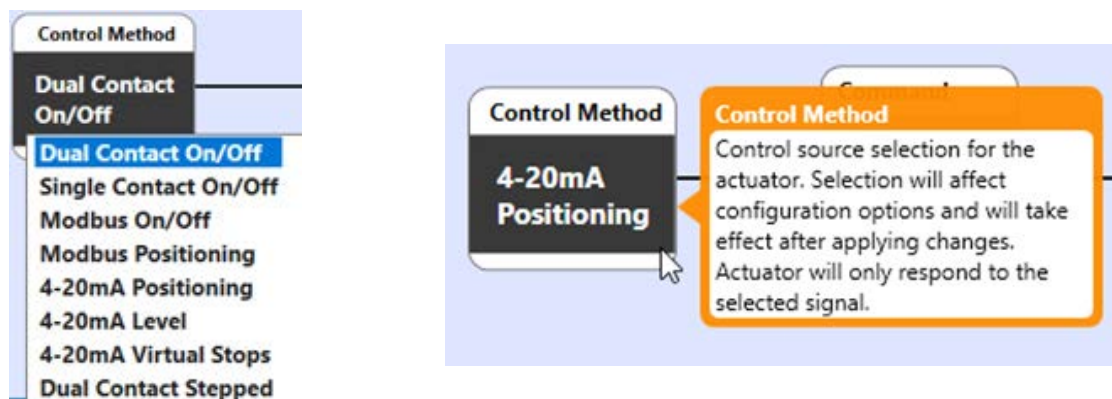
Initial Setup

The control method selection determines the control signal to which the valve will respond. Only the control signal selected will result in movement of the valve; all others will be ignored.

- Control Methods
 - Dual Contact On/Off
 - Dual Contact Stepped Control
 - Single Contact On/Off
 - Modbus On/Off
 - Modbus Positioning
 - 4-20mA Positioning
 - 4-20mA Level
 - 4-20mA Virtual Stops

When using the easy-Drive Configuration Tool, clicking on the “Control Method” box will create a drop down menu as shown. Select the desired control source; the selection will turn yellow. A box with Pending Changes will appear showing all changes. Press “APPLY” to confirm the change(s).

Figure 12. Fisher easy-Drive Configuration Software



Calibration Instructions

⚠ WARNING

To avoid personal injury or property damage, be aware that the valve will move during the calibration cycle.

NOTICE

A mismatch between the Configurator and valve type may cause damage to the actuator.

Span Calibration

It will be necessary to perform a span calibration. A span calibration is accomplished by the following method:

Note

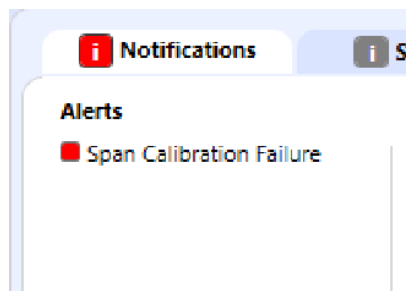
If the actuator is equipped with a RPU-100, the RPU-100 must be disabled via the Disable switch prior to powering off the actuator.

1. Ensure the process and valve are in a safe state – the valve may move during this operation.
2. Press the “CALIBRATE SPAN” button to initiate the span calibration. The software will show a progress bar during the calibration and display “Valve Span Calibrated” when complete.

Note

Should actual travel not equal the expected travel you will receive a span calibration failure alert. See figure 13. Ensure valve type is selected correctly. It may be necessary to re-couple the valve actuator assembly.

Figure 13. Fisher easy-Drive Configuration Software



Span Calibration without the use of Modbus

1. Turn power to the actuator off.
2. Wait for 10 seconds to ensure all circuits have discharged.
3. Return power to the actuator and use the appropriate calibration method for your control signal. Calibration sequence must be done within 15 seconds of power being switched on.
4. For positioning operation using direct acting 4-20 mA:
 - a. Apply a fully closed signal between pins 4-20 mA - and 4-20 mA +. If Span is currently uncalibrated, valve ball/disk will not move at this time.
 - b. Apply a fully open signal between pins 4-20 mA - and 4-20 mA +. If Span is currently uncalibrated, valve ball/disk will not move at this time.
 - c. Apply a fully closed signal between pins 4-20 mA - and 4-20 mA + – valve ball/disk will move its fully opened position, followed by moving to its closed position.
 - d. If calibration of the analog input is desired to improve positional accuracy, an optional operation is listed in the next section titled Analog Input Calibration.

5. For On/Off operation using dual-input dry contact:

- Close the contact to create a short between pins COMMON and CLOSE. If Span is currently uncalibrated, valve ball/disk will not move at this time.
- Close the contact to create a short between pins COMMON and OPEN. If Span is currently uncalibrated, valve ball/disk will not move at this time.
- Close the contact to create a short between pins COMMON and CLOSE – valve ball/disk will move to its fully opened position, followed after a delay by moving to its closed position.

6. For On/Off operation using single dry contact:

- Open the contact to create an open circuit between pins COMMON and OPEN. If Span is currently uncalibrated, valve ball/disk will not move at this time.
- Close the contact to create a short between pins COMMON and OPEN. If Span is currently uncalibrated, valve ball/disk will not move at this time.
- Open the contact to create an open circuit between pins COMMON and OPEN – valve plug will move to its fully opened position, followed after a delay by moving to its closed position.

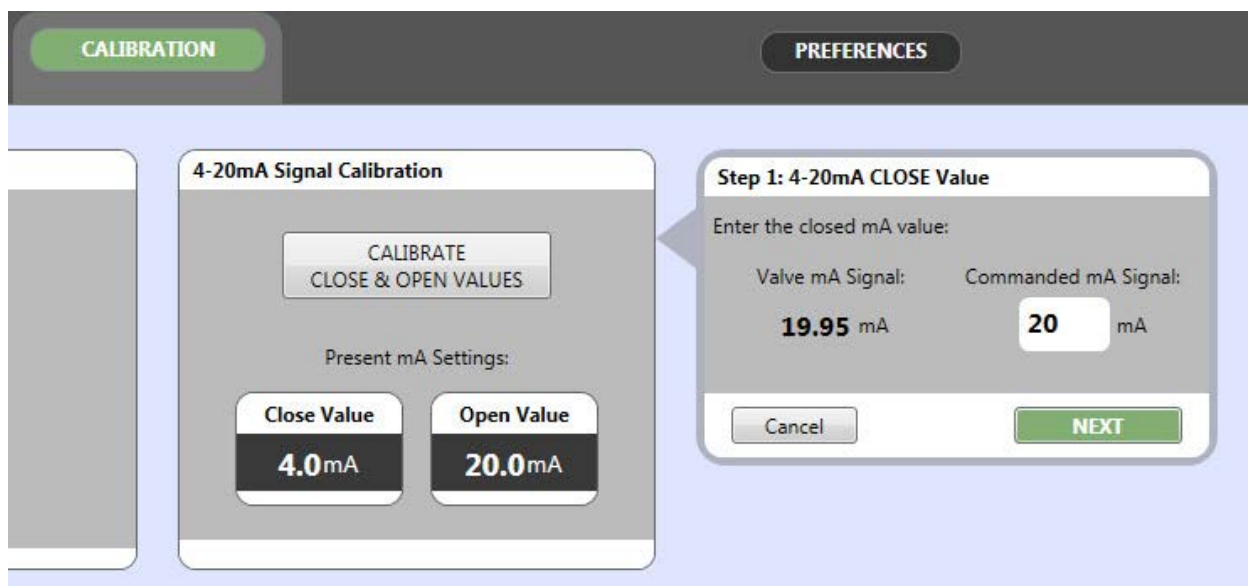
7. The unit is now calibrated.

Analog Input Calibration

For valves using 4-20 mA as a control source, several options are available to customize control of the actuator. Use a 4-20 mA signal generator to provide the desired signal. It is possible to calibrate the 4-20 mA signal in reverse acting or split-ranging with the method below with at least 4 mA of signal difference between the close and open values. The example shows a valve being changed from normal to reverse acting during the calibration process.

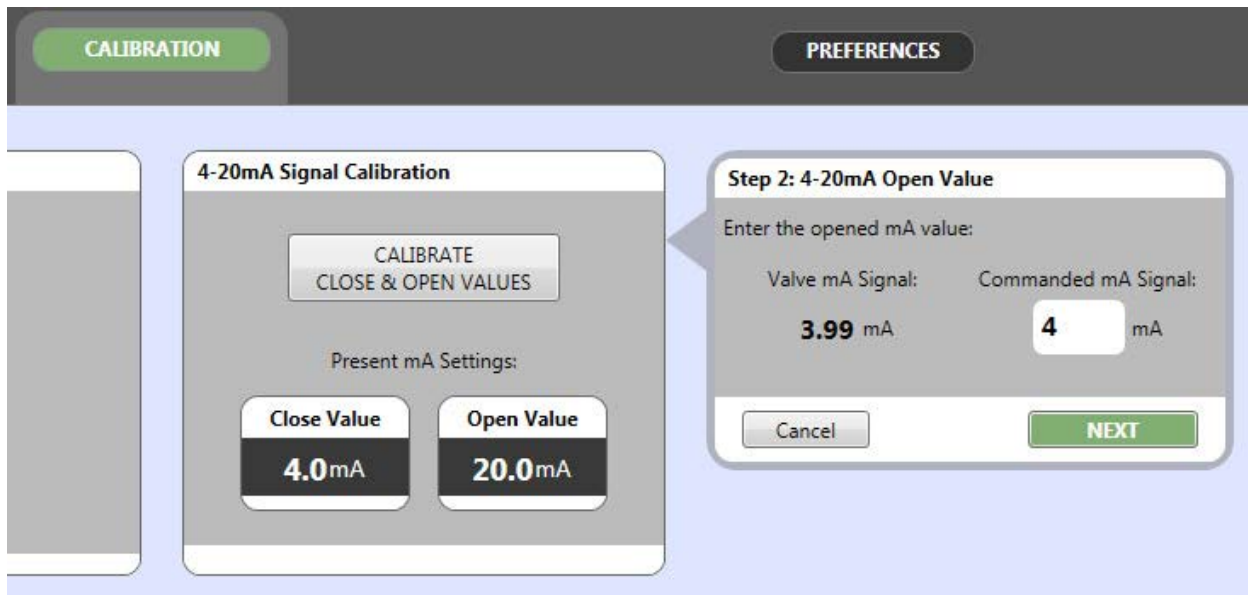
- With the Control Method set to 4-20 Positioning or 4-20 mA Level, enter the Calibration screen and the 4-20 mA Signal Calibration window will be visible.
- Click the CALIBRATE CLOSE & OPEN VALUES button. A separate window will open to guide through the process.
- Set the 4-20 mA signal to the desired value for when the valve is to be closed.
- Enter this value into the Calibrated mA Signal text box and press Next.

Figure 14. Fisher easy-Drive Configuration Software



5. Set the 4-20 mA signal to the desired value for when the valve is to be open.
6. Enter this value into the Commanded mA Signal text box and press Next.

Figure 15. Fisher easy-Drive Configuration Software



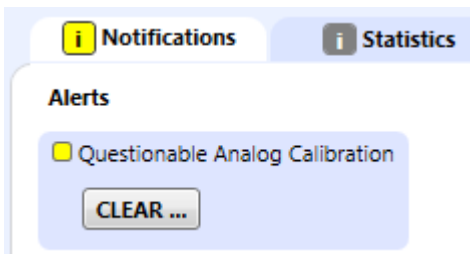
7. If the Close and Open values are as expected, press Confirm to accept these values. If not, press Cancel to restart the process.

Note

The value of the 4-20 mA signal must have at least 4 mA difference between the close and open signals. A differential less than that amount will cause the actuator to reject the calibration and use the previous values.

Should the entered values vary more than 10% from the expected 4-20 mA values; the actuator will accept the calibration and a Notification displaying "Questionable Analog Calibration" will result.

Figure 16. Fisher easy-Drive Configuration Software



Operational Verification

⚠ WARNING

To avoid personal injury or property damage, be aware that the valve will move and respond to an input signal during start up.

1. Before turning on power to the unit, be sure that a closed signal is being commanded to the unit.
 - Single Dry-Contact: contact is open.
 - Dual Dry Contact: Contact closed across pins COMMON and CLOSE.
 - Analog Input: signal = 4 mA.
 - Modbus: position demand = 0.
2. Turn on power to the unit.
3. Apply a change in position demand to ensure unit responds properly.
 - Single Dry-Contact:
 - Closed contact between pins COMMON and OPEN will open the valve.
 - Dual dry contact: Closed contact between pins COMMON and OPEN will open the valve. Closed contact between pins COMMON and CLOSE will close the valve.
 - Analog Input: valve will respond to proportional demand.
 - Modbus: valve will respond to positional demand in register 40001. 0 = fully closed and 1000 = fully open.
4. If the valve does not respond as expected, proceed to Troubleshooting guide of this instruction manual.
5. Check conduit ports
 - Conduit seal must be in place within 450 mm (18 in) of the enclosure.
 - Unused conduit ports must be sealed with an explosion-proof port plug.
6. Replace the cover and tighten all 10 bolts to 40.7 N•m (30 ft•lbs).

Troubleshooting

1. Unit does not move.
 - a. Green heartbeat LED will pulse near Modbus terminals when power is present. Verify the 12VDC to 24VDC is present on the power terminals as shown on the cover.
 - b. Verify all wires are firmly attached on both ends, screw terminals are fully screwed down and wire gauge is sufficient for length of wiring.
 - c. Verify the wires are connected to the correct terminals - see Wiring in the manual.
 - d. Verify the configured control method matches control signal.
 - e. Verify the configured valve type matches the mounted valve.

2. Unit does not respond to 4-20 mA signal
 - a. Green heartbeat LED will pulse near Modbus terminals when power is present. Verify the 12VDC to 24VDC is present on the power terminals as shown on the cover.
 - b. Verify all wires are firmly attached on both ends.
 - c. Verify the wires are connected to the correct terminals - see Wiring in the manual.
 - d. Verify the configured control method matches control signal.
 - e. Check the analog input control value. If the value is 0, the 4-20 mA may be wired backwards. Swap wire and attempt again.
3. Unit does not respond to Modbus signal.
 - a. Green heartbeat LED will pulse near Modbus terminals when power is present. Verify the 12VDC to 24VDC is present on the power terminals as shown on the cover.
 - b. Verify all wires are firmly attached on both ends.
 - c. Verify the wires are connected to the correct terminals. See Wiring section of this instruction manual.
 - d. Verify the configured control method matches control signal.
 - e. Verify multiple Modbus devices are not using the same Modbus address.
4. Unit does not communicate with easy-Drive Configurator software.
 - a. Ensure appropriate drivers are installed for RS-485 modem.
 - b. Verify multiple Modbus devices are not using the same Modbus address.
 - c. Ensure RS-45 modem is functional and compatible.
5. Diagnostics show a Motor Stall - Travel Deviation Fault.
 - a. If the actuator can not move to its commanded position, the actuator will stop, without damage, and issue a Motor Stall - Travel Deviation Fault warning. When the command signal changes outside of the deadband (Modbus register 40053), it will attempt to move again.

Maintenance

The frequency of inspection and maintenance depends on the severity of the service conditions.

⚠ WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Back plug away from seat to relieve spring compression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

⚠ WARNING

For explosion-proof applications, ensure the actuator cover is properly bolted before applying power to the actuator. Personal injury or property damage may result from fire or explosion if power is applied to the actuator with the cover removed in a hazardous area.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 457 mm (18 in) from the actuator. Personal injury or property damage may result from explosion if the seal is not installed.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection, and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion.

Disassembly

1. Follow valve manufacturer's warnings and instructions for isolating and releasing line pressure prior to disassembling the valve.

NOTICE

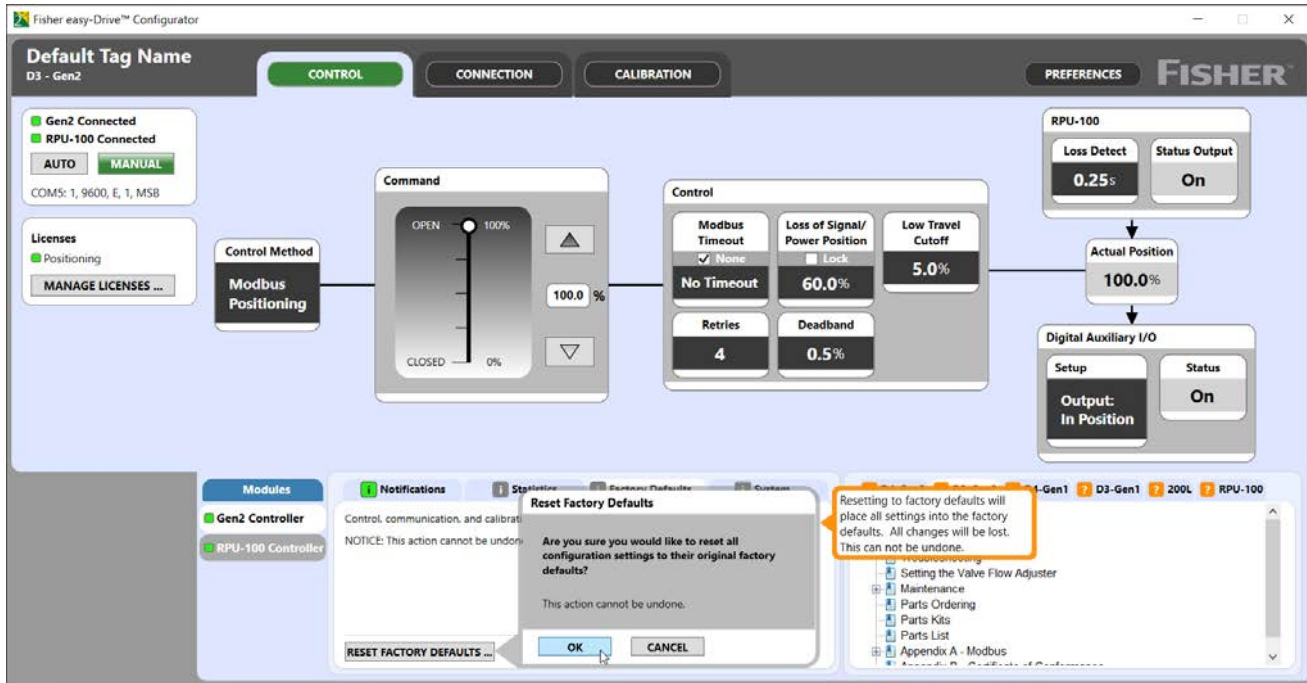
The following steps are intended to prevent damage to the valve during the removal of the yoke and actuator.

Note

If the actuator is equipped with a RPU-100, the RPU-100 must be disabled via the Disable switch prior to powering off the actuator.

2. Remove any positioning licenses to a license dongle if you wish to use them on a different device.
3. Perform a Restore to Defaults operation on the control board if the control board is to be used on a different actuator.

Figure 17. Fisher easy-Drive Configuration Defaults



4. Remove actuator and mounting kit from the valve body.

Assembly

1. Connect actuator and mounting bracket to valve body.
2. Replace the top of the explosion proof enclosure (key 3) and tighten cap screws (key 32) to 40.7 N • m (30 lbf • ft).

Parts Ordering

Each easy-Drive 200R actuator is assigned a serial number, which can be found on the nameplate. Refer to the number when contacting your [Emerson sales office](#) for assistance or when ordering replacement parts.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher actuator, because they may void your warranty, might adversely affect the performance of the actuator, and could cause personal injury and property damage.

Parts Kits

KIT NAME	PART NUMBER
Board Replacement Kit (On/Off is default)	GE83055X012
Board Replacement Kit + Positioning License Dongle	GE83126X012
Motor/Gearbox Assembly	GE84237X012
Positioning License Dongle (1 License)	GE83574X012
Positioning License Dongle (5 License)	GE83574X022

Parts List

Note

Contact your Emerson sales office for part ordering information.

Key Description

1	Motor Gear Box Assembly
2	Lower Enclosure
3	Upper Enclosure
4	Output Shaft O-ring
5	Output Shaft Assembly
6	Output Shaft Adapter
7	Output Shaft Bearing
8	Output Shaft Upper Snap Ring
11	Taper Key

Key Description

12	Taper Key Washer
13	Taper Key Bolt
14	Ground Screw
15	Internal Travel Stop
16	Dowel Pin
21	Enclosure O-ring
22	Bolt Retainer
23	Adjustable Travel Stop
24	Travel Stop Jam Nut
25	Nameplate
31	Drive Screw
32	Bolt Enclosure
33	Travel Scale and Cover Screw
34	Travel Scale Cover
35	Travel Scale
36	easy-Drive Label
37	Output Shaft Adapter Bolt
71	HiPot Label
72	Gen2 Board

Figure 19. Fisher easy-Drive 200R Exploded View

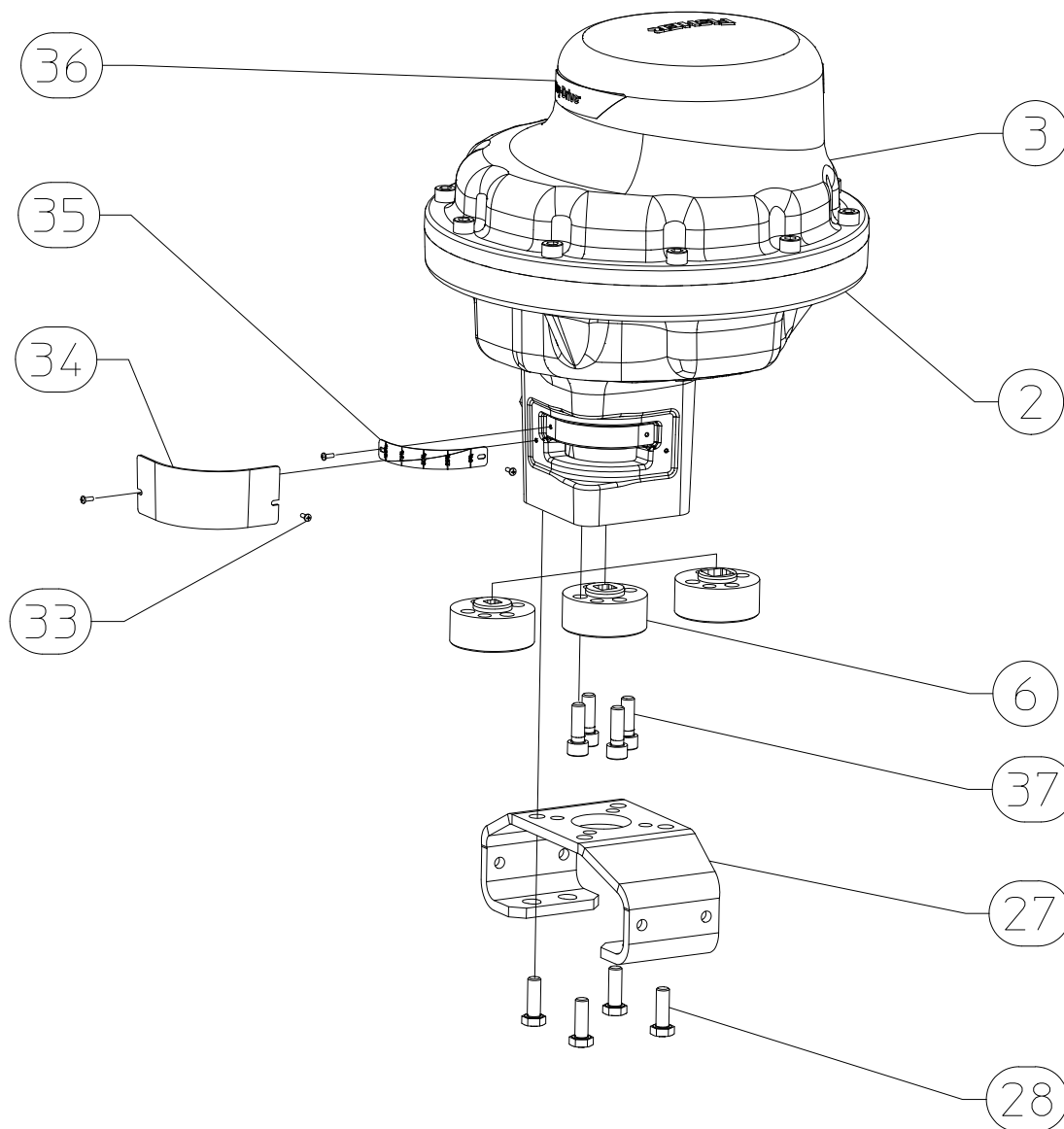
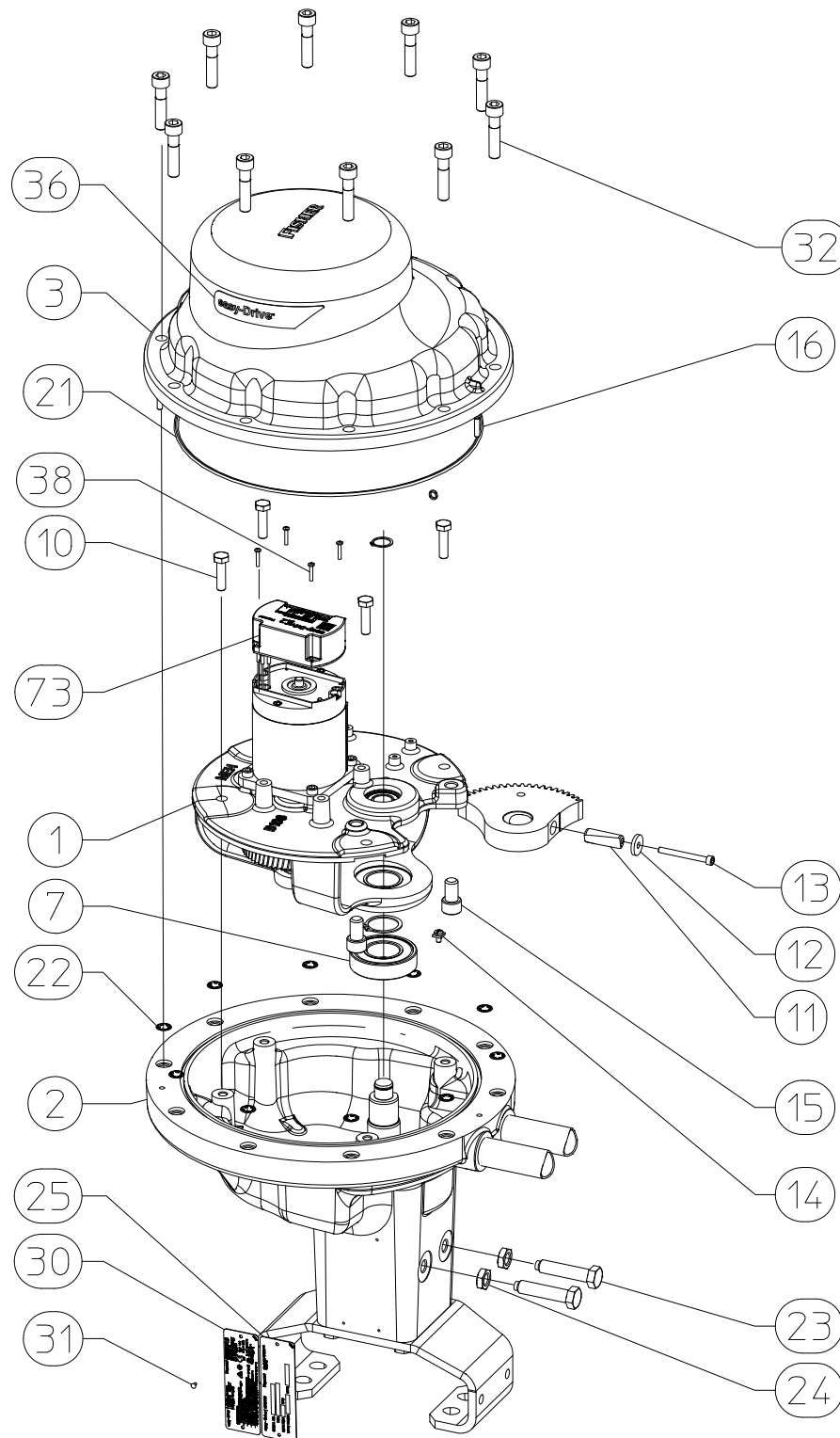
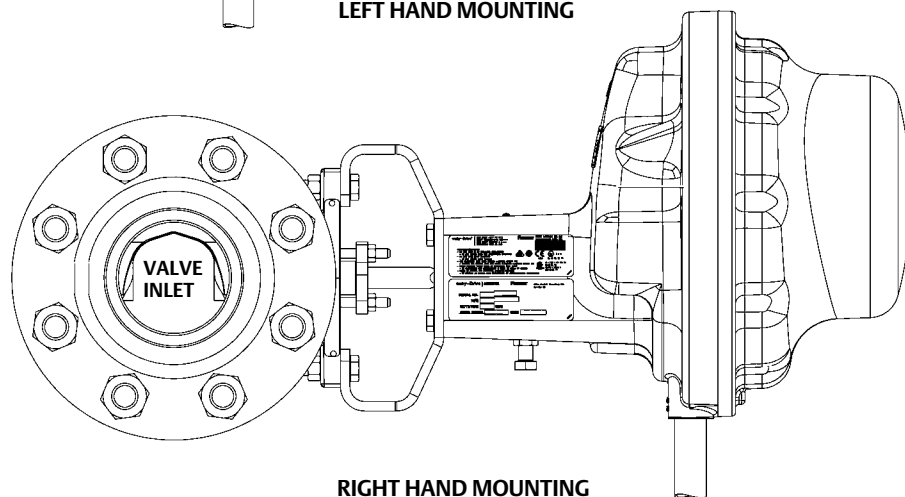
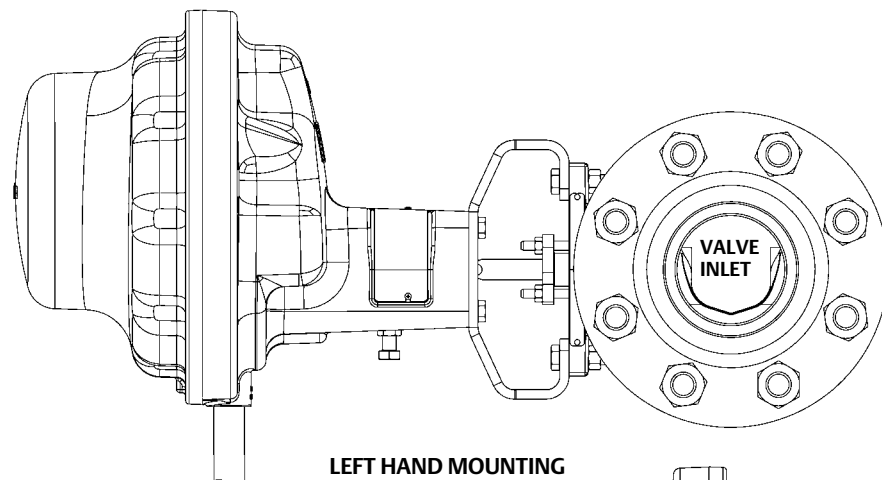


Figure 20. Fisher easy-Drive 200R Actuator Exploded View

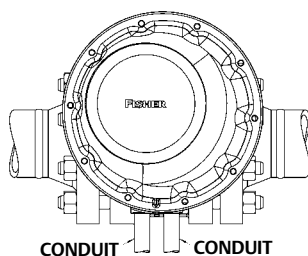


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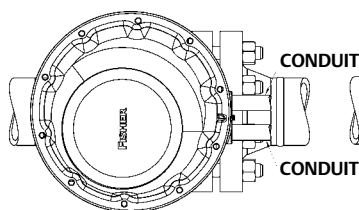
Figure 21. Fisher easy-Drive 200R Mounting Positions



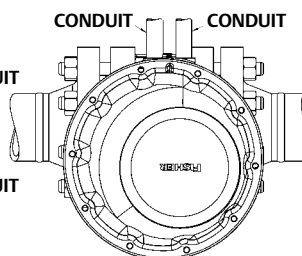
**POSITION 1
(PREFERRED)**



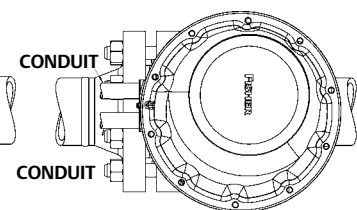
POSITION 2



POSITION 3



POSITION 4



Actuator Mounting Configuration (Figure 21)

Position 1 is preferred for both right or left hand mounted options. This has the conduit ports facing down below the centerline of the valve body, and the 210.1 mm (8.72 in) dimension of the actuator above the centerline of the valve, in either configuration. A vertical mounted orientation may be used if desired but may not be recommended for the trim wear of the intended valve assembly.

Note

Refer to the Instruction manual of the valve body to determine which position the valve can be oriented for optimal performance and life of trim parts.

Appendix A - Modbus

A.1 Register Summary

Table 5. easy-Drive 200R Modbus Map

Type ⁽¹⁾	Name	MB Register	Default	R/W	Values	Notes
uint16	Modbus position command (100=10.0%)	40001	0	R/W	0-1000	Modbus command value with one implied decimal place (1000=100.0%). R/W at all times but only used in Modbus control mode. In on/off mode 0-499 will result in a move to 0% and 500-1000 will result in a move to 100%.
uint16	Digital output	40002	0	R/W	0,1	0=no voltage supplied to terminals, 1=voltage supplied to terminals (Only used when output setup is set for Remote controlled)
uint16	Reset error codes	40003	0	R/W	0,1	Value of 1 will clear faults. Will automatically set back to 0.
uint16	RESERVED	40004				
uint16	RESERVED	40005				
uint16	RESERVED	40006				
uint16	RESERVED	40007				
uint16	RESERVED	40008				
uint16	RESERVED	40009				
uint16	Actual position (100=10.0%)	40010	0	R	0-1000	Present position of the actuator relative to span with 1 implied decimal place (1000=100.0%). Valid for all control modes.
uint16	Commanded position (100=10.0%)	40011	0	R	0-1000	Present position command of the actuator relative to span (1000=100.0%). Valid for all control modes.
uint16	Diagnostic Flags	40012	0	R	0-65535	Bit flags - see Table 6
uint16	Digital status	40013	0	R	0 - 1	0=no connection between terminals, 1=connection between terminals (Status of digital input or output)
uint32	Total Running Time (min)	40014, 40015	0	R	4,294,967,296	Total number of minutes the actuator has been powered on since time has been reset
uint32	Total Open Time (min)	40016, 40017	0	R	4,294,967,296	Total number of minutes the actuator has been at 100% of travel since time has been reset
uint32	Total Closed Time (min)	40018, 40019	0	R	4,294,967,296	Total number of minutes the actuator has been at 0% of travel since time has been reset
uint32	Number of Closed (Cycle count)	40020, 40021	0	R	4,294,967,296	Total number of close cycles the actuator has performed. One open/close cycle counts as 1.
uint32	Number of Power Cycles	40022, 40023	0	R	4,294,967,296	Total number of times the actuator has been powered on.
uint32	Number of Movements	40024, 40025	0	R	4,294,967,296	Total number of movements the actuator has performed. Move must be at least 5% of rated travel for cycle to increment.
uint16	Analog input control value	40026	0	R	0-2400	Value of the analog signal in mA with 2 implied decimals. In analog control mode, this is the command value and is subject to the analog settings in registers 40046 to 40059. Always active but a slower refresh rate when unit is not in analog control mode.
uint16	Incoming voltage	40027	0	R	0-350	Diagnostic register - value of incoming voltage with 1 implied decimal. Future plans are to have this available in a historian type register.
uint16	Latch Open State	40028	0	R	0 - 1	Normally open latch state
uint16	Latch Close State	40029	0	R	0 - 1	Normally closed latch state
uint16	Dual Contact Stepped Status	40030		R	0-10	Current status of Dual Contact Stepped Control. 0=Closed, 1=At first position, 2=At second position, 3=At third position, 4-7=RESERVED, 8=Override close, 9=Override open, 10=At Loss of Signal/Power Position

-continued-

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Table 5. easy-Drive 200R Modbus Map (cont.)

Type	Name	MB Register	Default	R/W	Values	Notes
uint16	Dual Contact Stepped Remaining Time	40031	0	R	0-60001	The time remaining in seconds at the current Dual Contact Stepped Position. If time is 60001, this position will be held until dual contact is closed.
uint16	RESERVED	40032	0			
uint16	RESERVED	40033				
uint16	RESERVED	40034				
uint16	RESERVED	40035				
uint16	RESERVED	40036				
uint16	RESERVED	40037				
uint16	RESERVED	40038				
uint16	RESERVED	40039				
uint16	Test Register - 16 bit	40040	45964	R	45964	Fixed register to test correct reading of 16 bit registers - Hex=B38C, Binary=1011001110001100
uint32	Test Register - 32 bit	40041, 40042	3,012,341,331	R	3,012,341,331	Fixed register to test correct reading of 32 bit registers - Hex=B38C AE53, Binary=1011001110001100 1010111001010011
uint16	Span calibration	40043	0	R/W	0,1	Value of 1 will initiate span calibration. Will automatically set back to 0.
uint16	RESERVED	40044				
uint16	RESERVED	40045				
uint16	RESERVED	40046				
uint16	RESERVED	40047				
uint16	RESERVED	40048				
uint16	RESERVED	40049				
uint16	Loss of signal position (100=10.0%)	40050	0	R/W	0-1001	Position to which valve plug will be driven upon loss of signal. Loss of signal is based upon the active control mode. 0-1000=0-100.0% with 1 implied decimal point. In on/off mode 0-499 will result in movement to 0% while 500-1000 will result in movement to 100%. A value of 1001 in any control mode is the setting for "lock-in-last".
uint16	Modbus timeout (s)	40051	60	R/W	0-65535	Time without a valid Modbus message is seen (to any address) before "loss of signal" motion is engaged when in Modbus control mode. Only active in Modbus control mode. 0=disabled
uint16	Dual contact timeout (s)	40052	60	R/W	0-3600	Time without a digital signal being low (contact made) from either digital input as viewed by voltage level on the digital input terminals. If neither contact has been made (pulled input low) within the timeout period, the valve plug will be moved to the loss-of-signal position. Only active in the local, on-off, dual contact mode. 0=disabled.
uint16	Deadband (10=1.0%)	40053	5	R/W	0-250	Minimum percentage signal change to elicit a movement response based upon end position of last movement. For example, if the previous command resulted in the actuator moving to 31.2% of travel and deadband is set to 100 (10.0%), setpoint must command valve to 21.2% or 41.2% before valve will move to new position. Default is set to minimize signal dithering.
uint16	Low travel cutoff position (100=10.0%)	40054	50	R/W	0-999	Analog input command below this value will result in the valve plug moving to the closed position. Always active in Modbus and 4-20mA Positioning control modes, active in 4-20mA Virtual Stop Positioning if Lower Virtual Hard Stop is disabled (0).

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Table 5. easy-Drive 200R Modbus Map (cont.)

Type	Name	MB Register	Default	R/W	Values	Notes
uint16	4-20mA level close position	40055	400	R/W	0-999	When the valve is in 4-20mA level mode, this value is the point at which the valve will close. It must be set to a smaller value than the 4-20mA level open position.
uint16	4-20mA level open position	40056	500	R/W	1-1000	When the valve is in 4-20mA level mode, this value is the point at which the valve will open. It must be set to a larger value than the 4-20mA level close position.
uint16	Analog Close Value	40057	40	R	31 - 220	The analog value that defines the closed position
uint16	Analog Open Value	40058	200	R	31 - 220	The analog value that defines the open position
uint16	Number of retries	40059	4	R/W	0-4	When the valve plug encounters an obstruction, how many attempts will it make to move past that point, assuming no change in the command signal within the deadband range
uint16	Upper Virtual Hard Stop (100=10.0%)	40060	1000	R/W	1-1000	When the valve is in 4-20mA Virtual Stop control mode, it will not travel above this point.
uint16	Lower Virtual Hard Stop (100=10.0%)	40061	0	R/W	0-999	When the valve is in 4-20mA Virtual Stop control mode, it will not travel below this point.
uint16	4-20mA level max position	40062	1000	R/W	1-1000	When the valve is in 4-20mA level mode, it will not travel above this point. Must be greater than or equal to 4-20mA level open value.
uint16	RESERVED	40063				
uint16	RESERVED	40064				
uint16	RESERVED	40065				
uint16	RESERVED	40066				
uint16	Control Method	40067	2	R/W	0 - 7	0=Dual Contact On/Off 1=Single Contact On/Off, 2=Modbus On/Off, 3=Modbus Positioning, 4=4-20 Positioning, 5=4-20 Level, 6=4-20 Virtual Stop Positioning, 7=Dual Contact Stepped Positioning
uint16	Valve Type	40068	1	R/W	1 - 10	0=Dual Contact On/Off 1=Single Contact On/Off, 2=Modbus On/Off, 3=Modbus Positioning, 4=4-20mA Positioning, 5=4-20mA Level, 6=4-20 Virtual Stop Positioning, 7=Dual Contact Stepped Positioning
uint16	CW or CCW Close	40069	1	R/W	0,1	Only used on rotary valves. 0=Rotate clockwise to close. 1=Rotate Counter-clockwise to close
uint16	RESERVED	40070				
uint16	RESERVED	40071				
uint16	RESERVED	40072				
uint16	RESERVED	40073				
uint16	Modbus address	40074	1	R/W	1-247	Slave address of the actuator
uint16	Baud Rate	40075	5	R/W	4,5,6,7	4=4800 baud, 5=9600 baud (default), 6=19200 baud, 7=38400 baud
uint16	Parity	40076	0	R/W	0,1,2	0=Even, 1=Odd, 2=None
uint16	Modbus stop bits	40077	1	R/W	1,2	1 will be the standard with even and odd parity while 2 is the standard for none.
uint16	MSB/LSB	40078	0	R/W	0,1	0=MSB, 1=LSB
uint16	RESERVED	40079				
uint16	Digital I/O selection	40080	1	R/W	0,1	0=9V sinking digital input, 1=200mA digital output
uint16	Digital I/O output setup	40081	0	R/W	0,1,2,3	Valid only when Digital I/O selection is set to Output (1) - 0=In position, 1=Fully closed, 2=Fully open, 3 = Remote controlled (driven by Digital Output register)

-continued-

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Table 5. easy-Drive 200R Modbus Map (cont.)

Type	Name	MB Register	Default	R/W	Values	Notes
uint16	Digital I/O input setup	40082	0	R/W	0,1	Valid only when Digital I/O selection is set to Input (0) - 0=Reference only (status appears in 40013 and does nothing else), 1=Override (status appears in 40013 and valve plug is moved to safe position noted in register 40050)
uint16	Dual Contact Stepped Position 1	40083	1000	R/W	0-1001	When dual contact is Open, the actuator will first move to this position. It will remain at this position for the number of seconds specified in Dual Contact Stepped Time at Position 1, or until dual contact is closed. If Position is 1001, this position is disabled and the next position will be considered.
uint16	Dual Contact Stepped Position 2	40084	1001	R/W	0-1001	When dual contact is Open, the actuator will move to this position following position 1. It will remain at this position for the number of seconds specified in Dual Contact Stepped Time at Position 2, or until dual contact is closed. If Position is 1001, this position is disabled and the next position will be considered.
uint16	Dual Contact Stepped Position 3	40085	1001	R/W	0-1001	When dual contact is Open, the actuator will move to this position following position 2. It will remain at this position until dual contact is closed. If Position is 1001, this position is disabled and the actuator will close upon reaching this position.
uint16	Dual Contact Stepped Time at Position 1	40086	6001	R/W	1-60001	The time in seconds to remain at Dual Contact Stepped Position 1 before moving to Dual Contact Stepped Position 2. If time is 60001, this position will be held until dual contact is closed.
uint16	Dual Contact Stepped Time at Position 2	40087	6001	R/W	1-60001	The time in seconds to remain at Dual Contact Stepped Position 2 before moving to Dual Contact Stepped Position 3. If time is 60001, this position will be held until dual contact is closed.
uint16	Dual Contact Stepped Override	40088	0	R/W	0-2	If configured to a non-zero value (Off), the actuator will move to the position specified regardless of the Dual Contact Stepped Control Status. Options are 0=Off, 1=Close, 2=Open. This does not take precedence over loss of signal/power positioning.
uint16	RESERVED	40089				
uint16	RESERVED	40090				
uint16	RESERVED	40091				
uint16	RESERVED	40092				
uint16	RESERVED	40093				
uc10	Device Tag	40094 - 40113	"Default Tag Name"	R/W	0 - 255 per character	Device Tag (10 character UTF8 string)
uint32	Valve serial number	40114, 40115	0	R/W*	0-4,294,967,296	Valve assembly serial number assigned at Fisher assembly plant
uint32	Motor serial number	40116, 40117	0	R/W*	0-4,294,967,296	Motor/gearbox serial number assigned by Nidec
uint32	Motor revision	40118, 40119	0	R/W*	0-4,294,967,296	Motor/gearbox revision assigned by Nidec
uint32	PCB serial number	40120, 40121	0	R/W*	0-4,294,967,296	PCB serial number
uint32	PCB revision	40122, 40123	0	R/W*	0-4,294,967,296	PCB revision
uint16	Flash Firmware major revision	40124	0	R	0-65535	From flash firmware when compiled
uint16	Flash Firmware minor revision	40125	0	R	0-65535	From flash firmware when compiled
uint16	Flash Firmware mod revision	40126	0	R	0-65535	From flash firmware when compiled
uint16	Flash Firmware build revision	40127	0	R	0-65535	From flash firmware when compiled
uint16	Boot Firmware major revision	40128	0	R	0-65535	From boot firmware when compiled
uint16	Boot Firmware minor revision	40129	0	R	0-65535	From boot firmware when compiled
uint16	Boot Firmware mod revision	40130	0	R	0-65535	From boot firmware when compiled
uint16	Boot Firmware build revision	40131	0	R	0-65535	From boot firmware when compiled
uint32	PCB test date	40132, 40133	0	R/W*	0-4,294,967,296	Seconds since January 1, 2000, Board Supplier Functional Test Date

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Table 5. easy-Drive 200R Modbus Map (cont.)

Type	Name	MB Register	Default	R/W	Values	Notes
uint32	Motor test date	40134, 40135	0	R/W*	0-4,294,967,296	Seconds since January 1, 2000, Motor Supplier Test Date
uint32	System completion date	40136, 40137	0	R/W*	0-4,294,967,296	Seconds since January 1, 2000, Final Assembly Test Date

1. uint is defined as unsigned integer
 uint16 – unsigned 16 bit variable, can take value 0-65535.
 uint32 – unsigned 32 bit variable, can take value 0-4294967295.
 (Reserved) – registers used for development use only.

† - 32bit register contains data that spans two registers – reads and write of data needs to be performed within the same Modbus command function to ensure coherency of data.

Table 6. Diagnostic Fault Flags

Hex Value	Bit Mask	Description	Value	Bit	Definition
0x8000	1000 0000 0000 0000	Fault in N.V. Memory – system has restored default settings	32768	15	A memory fault has occurred and the actuator has been restored to factory defaults. Contact your Emerson sales office .
0x4000	0100 0000 0000 0000	Motor Assembly Stall - Travel Deviation	16384	14	The actuator is unable to move to the commanded position and has stopped. Follow troubleshooting guide in Help section to remedy.
0x2000	0010 0000 0000 0000	Discrete Input override mode active	8192	13	The digital input has detected a closed contact and the actuator has moved to its safe position. Check switch input device status.
0x1000	0001 0000 0000 0000	System or Watchdog fault	4096	12	The actuator has experienced a fatal error and shut down. Contact your Emerson sales office.
0x0800	0000 1000 0000 0000	Analog Input calibration value not in expected range	2048	11	The analog values entered do not match the analog signal level. Check analog signal value and value entered.
0x0400	0000 0100 0000 0000	Valve travel distance calibration not in legal range	1024	10	The valve travel distance is outside the acceptable range. Confirm valve type and that no obstructions are present.
0x0200	0000 0010 0000 0000	Analog Input span calibration not in legal range	512	9	The analog values for open and close are less than 4 mA and previous values have been maintained. Calibrate analog input with differential >4 mA.
0x0100	0000 0001 0000 0000		256	8	
0x0080	0000 0000 1000 0000	Valve was shutdown while moving	128	7	Actuator was powered down during a move and actual position may vary from commanded. Recalibrate the valve span.
0x0040	0000 0000 0100 0000	Valve span calibrated (informational)	64	6	Span has been calibrated and actuator is ready.
0x0020	0000 0000 0010 0000	Valve position controller active (informational)	32	5	Actuator is active and ready.
0x0010	0000 0000 0001 0000	Loss of signal active	16	4	Control signal not present. Signal is <3 mA, timeout period exceeded (40051 or 40052).
0x0008	0000 0000 0000 1000		8	3	
0x0004	0000 0000 0000 0100	Modbus command has been sent (starts a calibrated system)	4	2	The actuator is successfully moving the valve.
0x0002	0000 0000 0000 0010	Analog input initialized (system has seen input >3 mA/1 V)	2	1	4-20 mA analog input has a valid signal present.
0x0001	0000 0000 0000 0001	Start delay active (within 15 second calibration window)	1	0	Span calibration using physical inputs allowed during startup.

Appendix B - Certificate of Conformance

		
EU Declaration of Conformity		
We, the manufacturer, Emerson Fisher Controls International LLC 205 South Center Street Marshalltown, Iowa 50158 USA		
declare under our sole responsibility that the following product(s); Electric Actuator easy-Drive 200R		
to which this declaration relates, is in conformity with the provisions of the following European Community Directives, including the latest amendments, as shown in the attached schedule.		
Assumption of conformity is based on the application of the harmonized standards and, when applicable or required, a European Community Notified Body certification, as shown in the attached schedule.		
 Michael Gotlieb Vice President-Sliding Stem Valve Business Unit Marshalltown, Iowa 50158		
10/23/2023 Date		
European Contact Emerson Group Services SAS Rue Paul-Baudry B.P. 10150 68701 Cernay Cedex France		
EDOCs ID: FCS_91 Page 1 of 2		

-continued-

Appendix B - Certificate of Conformance (cont.)

EMC Directive – 2014/30/EU

Models: All
EN 61326-1:2013

RoHS Directive – 2011/65/EU

Declaration of Exclusion

Models: All

The above equipment is excluded from the scope of this directive per Article 2, Paragraph 4, part C. Therefore the equipment cannot bear the CE mark related to RoHS compliance. However, the equipment may bear the CE mark to indicate compliance with other applicable EU directives.

ATEX Directive – 2014/34/EU (Applicable only if this mark appears on the product)

Certificate – **CSANe 21ATEX1000X – Group II Category 2 G** – Flameproof
easy-Drive 200R
Ex db IIB T6(Ta ≤ 70°C) Gb
Standards used: EN60079-0:2018, EN60079-1:2014

ATEX Notified Body for EC-Type Examination Certificate(s)

CSA Group Netherlands B.V. – Notified Body Number: 2813
Utrechtseweg 310, Building B42
6812AR Arnhem
The Netherlands

ATEX Notified Body for Quality Assurance

SGS Fimko Oy – Notified Body Number: 0598
P.O. Box 30 (Särkiniementie 3)
Helsinki, 00211
Finland

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

easy-Drive 200R

April 2024

Instruction Manual

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Singapore 128461 Singapore

www.Fisher.com



Fisher™ easy-Drive™ RPU-100

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Figure 1. Fisher easy-Drive RPU-100



X1718

Introduction

Scope of Manual



This instruction manual provides product information including installation for the Fisher easy-Drive RPU-100. For Fisher easy-Drive actuators refer to the appropriate easy-Drive actuator instruction manual. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The easy-Drive RPU-100 is a reserve power unit designed to provide backup power to the easy-Drive actuator upon loss of incoming power. The RPU-100 provides enough power to the actuator to allow the actuator to drive the valve to the pre-defined loss of power or loss of signal position. The RPU-100 can be ordered with a new easy-Drive assembly or be retrofit into existing easy-Drive units that have the Gen2 control board.

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easy-Drive RPU-100

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Table 1. Specifications

Material Temperature Capabilities -40°C (40°F) to 70°C (158°F) Power Requirements 11-30 VDC, minimum 4 amp power supply required (fuse to 5 amps) Maximum Current Draw 4 amps Idle Current Draw 30 mA at 24 VDC, 50 mA at 12 VDC	Hazardous Area Approvals CSA (C/US): Explosion-Proof Class I, Division 1, Groups C and D, T6, Ex db IIB T6, Class I, Zone 1, AEx db IIB T6 ATEX Flameproof - Gas: Ⓔ II 2 G, Ex db IIB T6 Gb IECEx Flameproof - Gas: Ex db IIB T6 Gb Approximate Weight: 0.5 kg (1 lb)
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Educational Services

Emerson Educational Services
Phone: 1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Related Documents

This section lists other documents containing information related to the easy-Drive RPU-100. These documents include:

- Fisher easy-Drive 200L Instruction Manual ([D104331X012](#))
- Fisher easy-Drive 200R Instruction Manual ([D104742X012](#))
- Fisher D3 Valve with Gen 2 easy-Drive Actuator Instruction Manual ([D104161X012](#))
- Fisher D4 Valve with Gen 2 easy-Drive Actuator Instruction Manual ([D104188X012](#))

Product Operation

The easy-Drive RPU-100 will begin charging once valid power ($\geq 11\text{VDC}$) is received. Once the RPU-100 is charged, it will pass power through to the easy-Drive actuator. Upon loss of power the RPU-100 will interrupt the control signals commanding the actuator to move to the defined loss of power/signal position. The RPU-100 will provide power to the actuator for 120 seconds to ensure enough time to complete move and then power down.

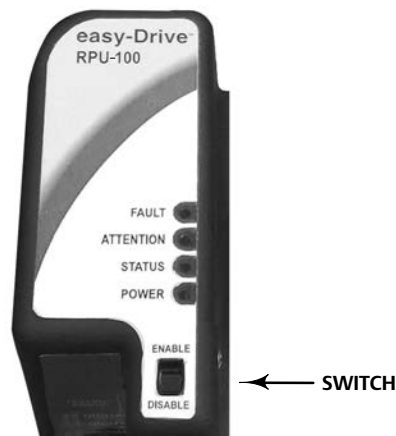
The easy-Drive RPU-100 will determine when it is sufficiently charged. Charge time will depend on the application and/or power used to perform a back up. A minimum charge time is enforced.

Product Interfaces

Enable / Disable Switch

The switch enables or disables the functionality of the RPU. When the switch is in the “disable” position the RPU-100 will continue to pass line power through to the actuator and charge but will not provide backup capability upon loss of power.

Figure 2. Fisher easy-Drive RPU-100 Switch



LED Key

Figure 3. States of the Fisher easy-Drive RPU-100

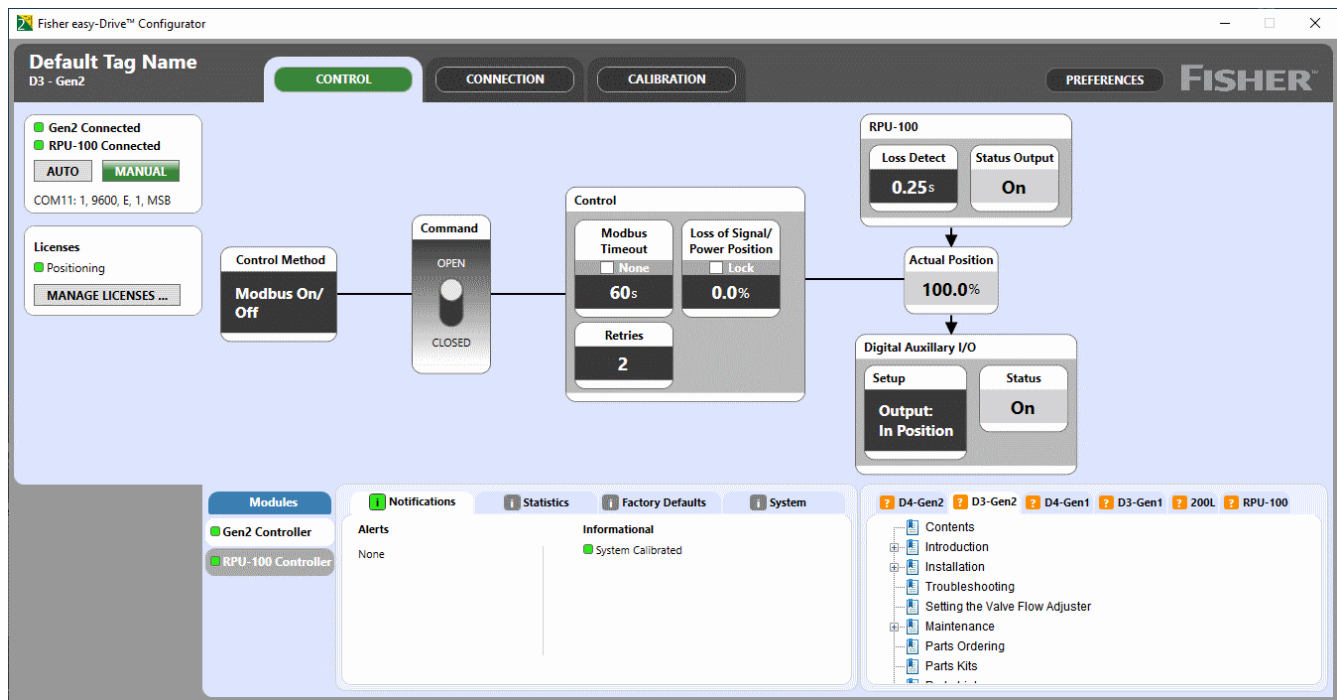
	Power (Green)	Status (Blue)	Attention (Yellow)	Fault (Red)
Normal Operation				
Charging				
Providing Power				
Disabled				
Recoverable Fault				
Non-Recoverable Fault				

 INDICATES FLASHING LIGHT  INDICATES SOLID LIGHT

easy-Drive User Interface

The easy-Drive configurator is available on the Emerson [easy-Drive](#) product website or [Fisher.com](#).

Figure 4. Fisher easy-Drive Configuration Software



Loss Detect

The loss detect is a user defined time the RPU-100 will wait to verify loss of power before performing a backup operation. This time is configurable between 0.05 and 3.00 seconds. The default is 0.250 seconds.

Status Output

The status output is a discrete output that indicates the overall status of the RPU-100. If the output is on, (connection made) this indicates the RPU-100 is operational. If the output is off, additional information can be found in the Modbus diagnostic fault flags register.

See the Mounting section of this manual for wiring details.

Installation

⚠ WARNING

Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- For linear actuator, back plug away from seat to relieve spring compression.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve. If an RPU-100 is already installed, move the switch to the disable position to prevent movement of the valve by the RPU-100.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

⚠ WARNING

- For explosion-proof applications, ensure the actuator cover is properly bolted before applying power to the actuator. Personal injury or property damage may result from fire or explosion if power is applied to the actuator with the cover removed in a hazardous area.
- For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 457 mm (18 in) from the actuator. Personal injury or property damage may result from explosion if the seal is not installed.
- Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection, and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.
- Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion.
- To avoid exposure hazard or release of toxic gases, DO NOT disassemble, subject to heat above 100°C (212°F), or incinerate the RPU-100.

Note

End user must ensure a power supply voltage of 11-30VDC after retrofitting an easy-Drive electric actuator with the RPU-100 to maintain the actuator's CSA hazardous area approval.

Product Security

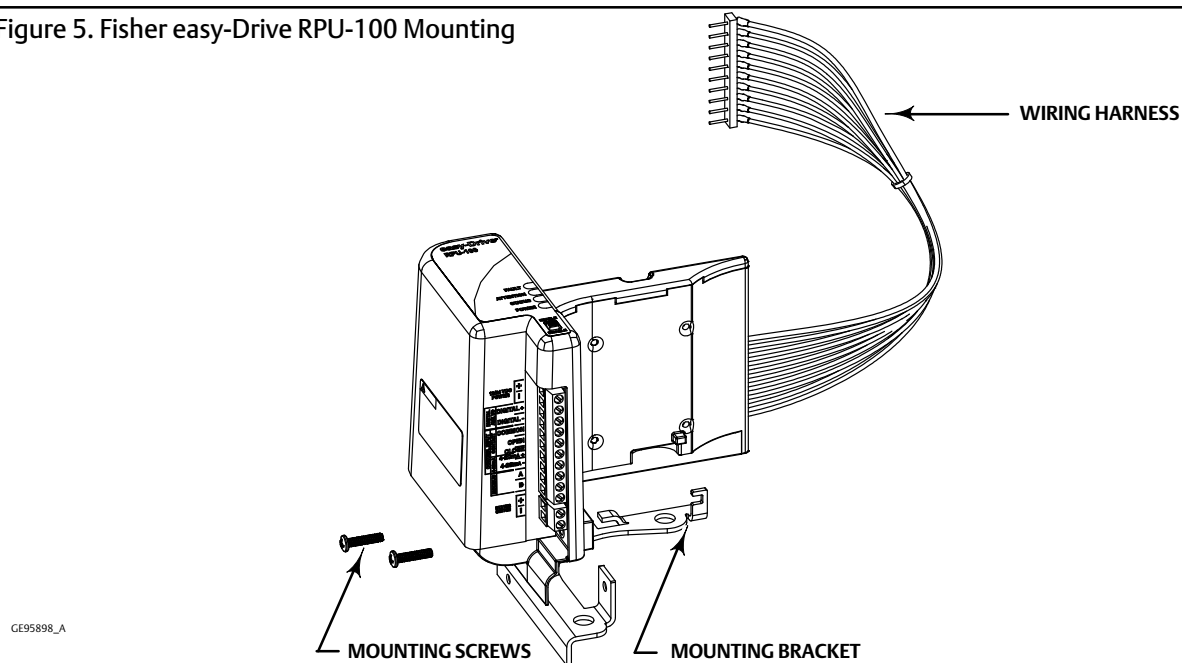
It is the end-user's responsibility to provide a secure facility with limits to operating equipment.

Facility cyber security practices should include keeping the Fisher easy-Drive Configurator up to date.

Mounting

The RPU-100 is mounted using the motor/gearbox bolts and the provided mounting bracket.

Figure 5. Fisher easy-Drive RPU-100 Mounting



1. For linear easy-Drive — Loosen all four motor housing bolts, removing the three bolts as shown below.
 - For rotary easy-Drive — 3 mounting bolts are provided with the RPU-100 when ordered for the 200R.
2. Position the bracket on the motor/gearbox.

Figure 6.



LINEAR

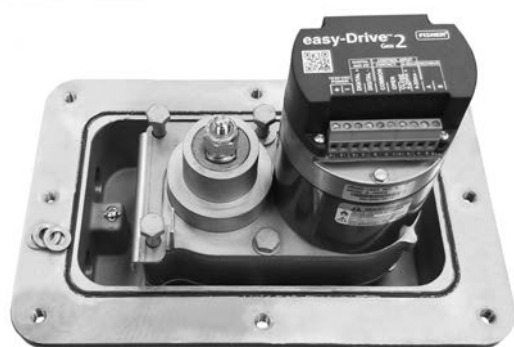


ROTARY

3. For linear easy-Drive — Use the motor housing bolts removed in step one to secure the mounting bracket in place. Note the washers will not be used with the bolts with the mounting bracket.

- For rotary easy-Drive — Use the 3 mounting bolts provided to secure the mounting bracket in place.

Figure 7.



LINEAR



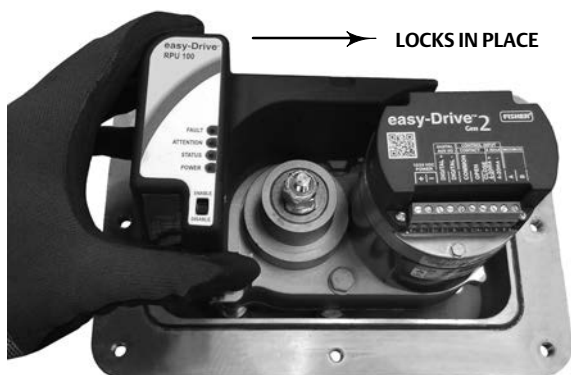
ROTARY

4. For linear easy-Drive — Tighten all 4 motor bolts to 15 ft•lbs (20 N•m) using a criss-cross pattern while tightening the bolts.

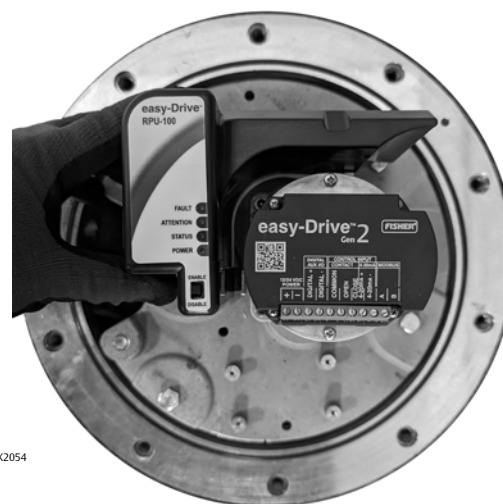
- For rotary easy-Drive — Tighten all 3 bolts to 15 ft•lbs (20 N•m).

5. The RPU-100 will sit down on the mounting bracket then slide toward the motor to lock into place.

Figure 8.



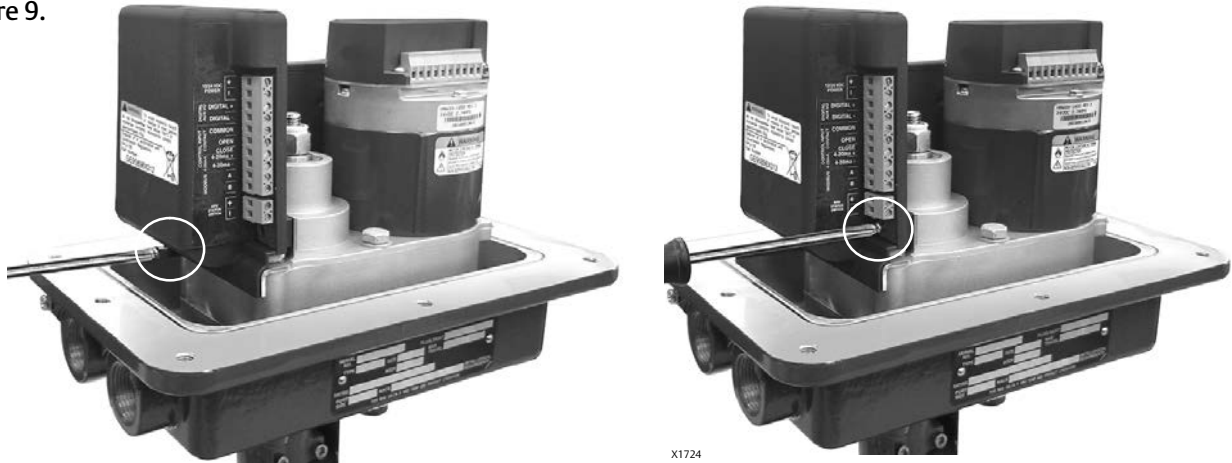
LINEAR



ROTARY

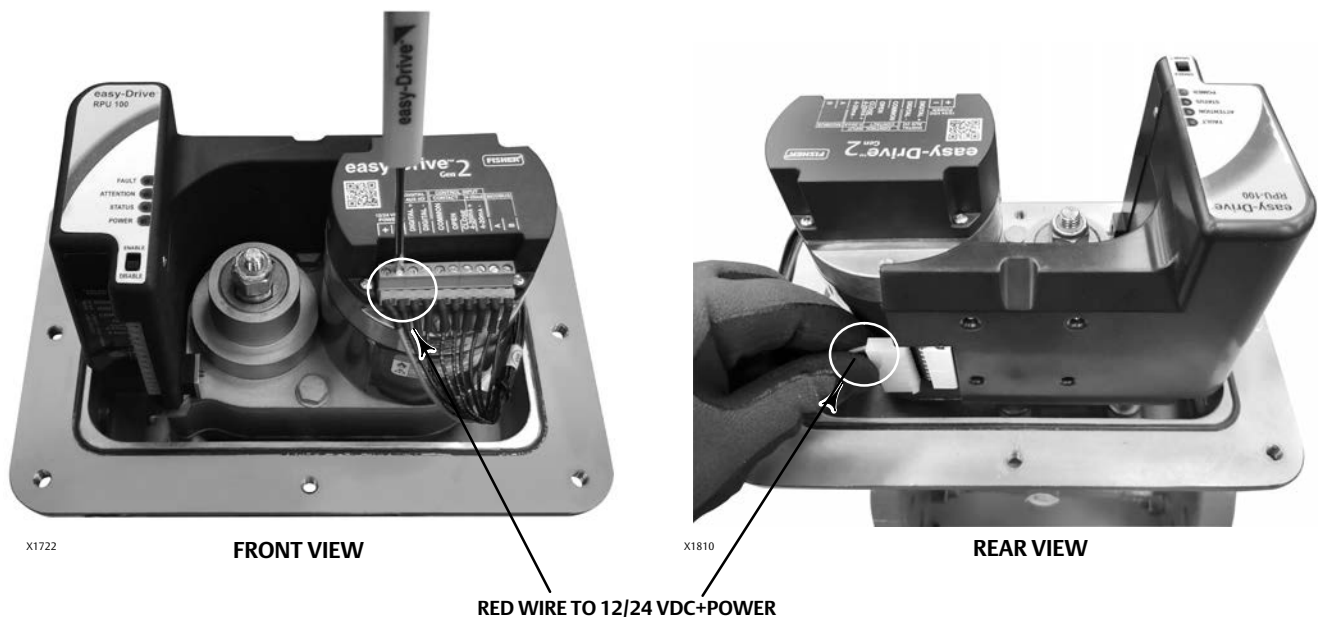
6. For linear and rotary easy -Drive — Once the RPU-100 is locked in place install the two mounting screws to finish securing the unit.

Figure 9.



7. Use the provided wiring harness to connect the RPU-100 to the easy-Drive control board. Tighten all terminals to ensure solid mechanical connection. Ensure the red wire is connected to the 12/24 VDC + Power.
8. After wiring connections have been completed, install easy-Drive actuator upper enclosure per the applicable actuator instruction manual.
9. Use the easy-Drive configurator to configure the RPU-100 after installation.

Figure 10.



Wiring

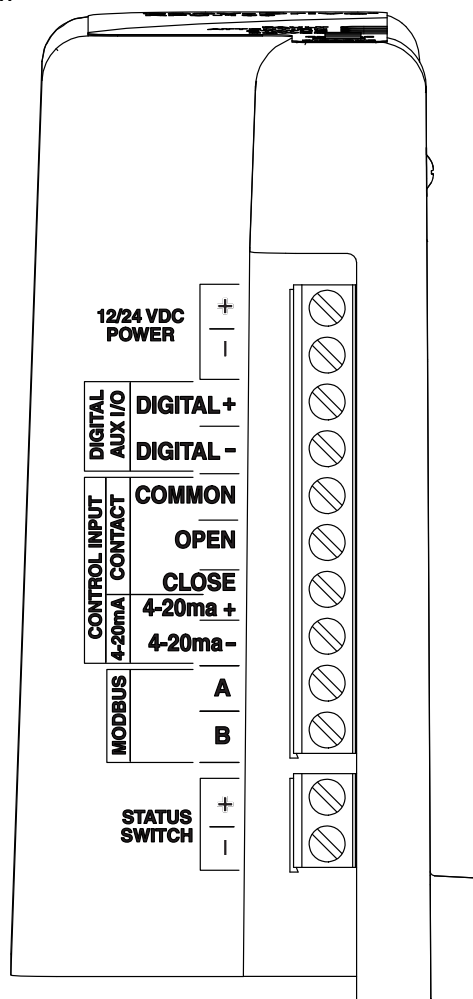
Power Requirements

Ensure a stable DC power source is available, maintaining less than 5% ripple and sufficiently surge protected for the application. A 4 amp (minimum) power supply is required.

Wiring Instructions

1. Ensure power is turned off before connecting the wires.
2. Observe local wiring requirements for hazardous location usage.
3. Conduit seals within 450 mm (18 inches) of the enclosure port are required.
4. 18 AWG (0.52mm²) to 12 AWG (3.31mm²) wire size required.
5. Fuse system to 5A.
6. Connect enclosure and analog signal shields.
7. Be sure to tighten terminals sufficiently to ensure solid mechanical connection.

Figure 11. Wiring - RPU-100 Front View



Power

- 1. Connect 12 or 24 VDC reference to: –
- 2. Connect 12 or 24 VDC positive to: +

Figure 12. Wiring - RPU-100 Input

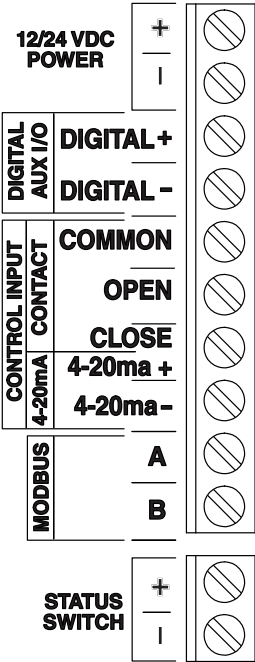


Figure 13. Wiring - Analog Input

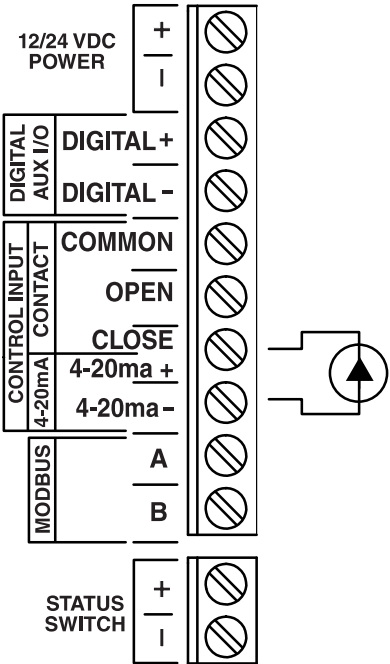


Figure 14. Wiring - Dual Dry Contact

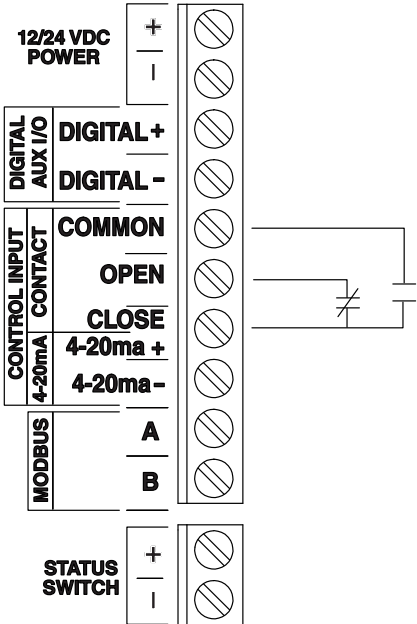


Figure 15. Wiring - Modbus Input

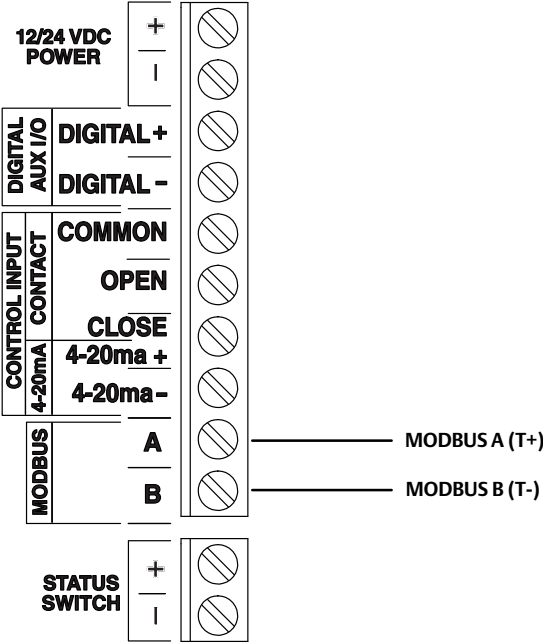


Figure 16. Wiring - Auxiliary Digital I/O

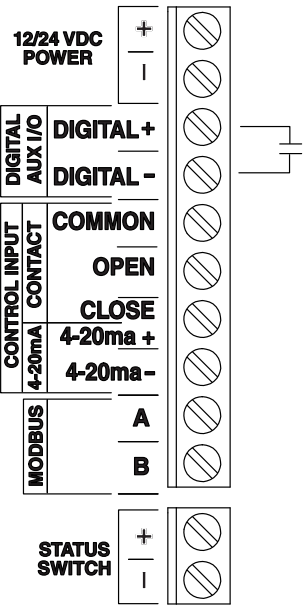


Figure 17. Wiring - Auxiliary Digital I/O

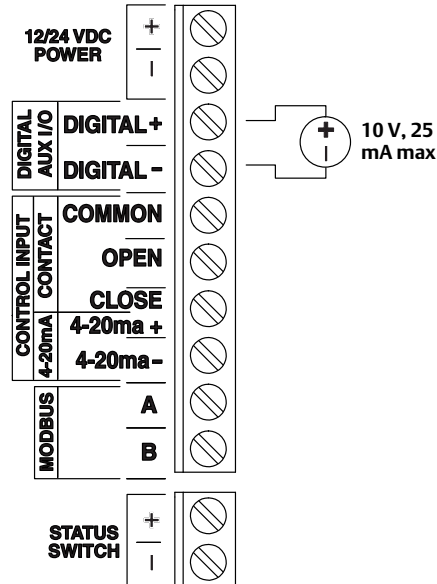
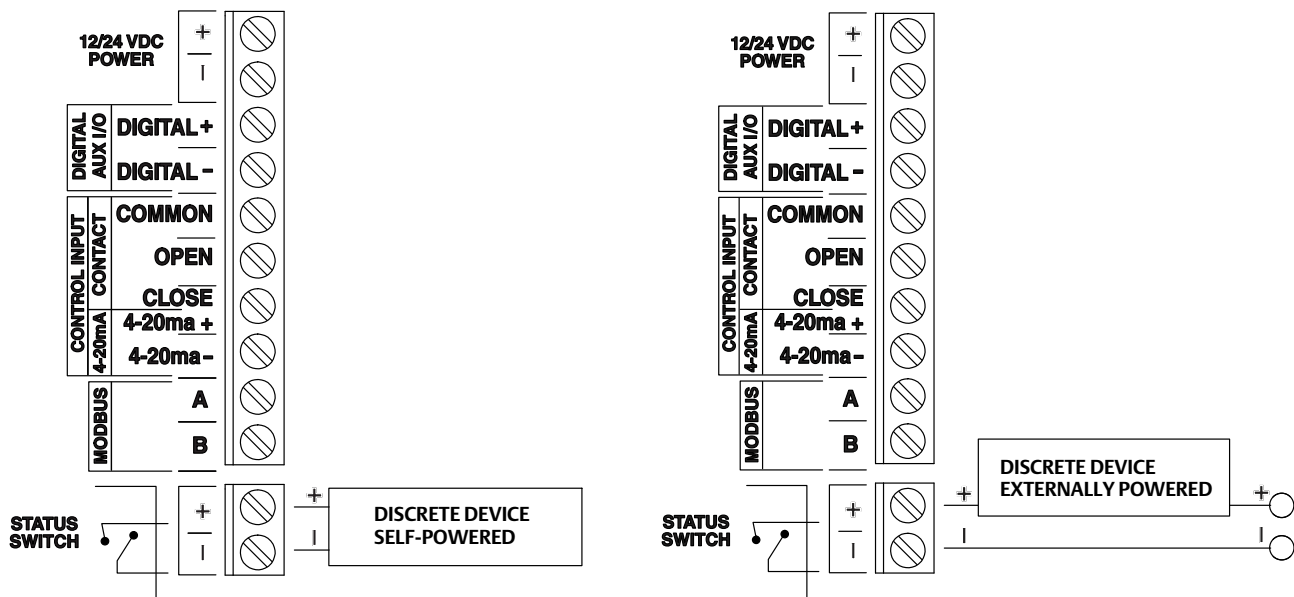


Figure 18. Wiring - RPU-100 Status Switch



Replacement

⚠ WARNING

- Refer to the **WARNINGS** at the beginning of the **Installation** section in this instruction manual.
- To avoid exposure hazard or release of toxic gases, do not disassemble, subject to heat above 100°C (212°F), or incinerate the RPU-100.

Note

Proper disposal of used reserve power unit, which contains acetonitrile, is required. Disposal should be done in accordance with applicable federal, state, and local rules and regulations.

Removal

Refer to figures 5 through 10.

1. Remove the easy-Drive actuator upper enclosure per the applicable actuator instruction manual.
2. Disable RPU-100 by moving switch on reserve power unit to 'disable' position.
3. Disconnect power from the RPU-100.
4. Disconnect wiring harness from the RPU-100.
5. Remove the two mounting screws securing the RPU-100 to the actuator.
6. Slide RPU-100 to remove from mounting bracket.

Installation

Refer to Mounting section, steps 5 through 9, for installation of new RPU-100 reserve power unit. The existing wiring harness can be used to connect to the new RPU-100.

Parts Ordering

The RPU-100 can be ordered as a part to be installed into existing easy-Drive electric actuators. Contact your [Emerson sales office](#) for assistance or when ordering replacement parts.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher actuator, because they may void your warranty, might adversely affect the performance of the actuator, and could cause personal injury and property damage.

Appendix A - Modbus

A.1 Register Summary

Table 2. easy-Drive RPU-100 Modbus Map

Type	Name	MB Register	Default	R/W	Values	Notes
uint16	RESERVED	44001				
uint16	RESERVED	44002				
uint16	RESERVED	44003				
uint16	RESERVED	44004				
uint16	RESERVED	44005				
uint16	RESERVED	44006				
uint16	RESERVED	44007				
uint16	RESERVED	44008				
uint16	Clear Diagnostic Flags	44009	0	R/W	0 - 1	Value of 1 will clear diagnostic flags register. This register will automatically return to 0 after flags are cleared.
uint16	Diagnostic Flags	44010	0	R	0 - 65535	Bit flags - see chart
uint16	Digital Output Status	44011	0	R	0 - 1	0=no connection between terminals, 1=connection between terminals (Status of digital input or output)
uint32	Total Running Time	44012, 44013	0	R	0 - 4,294,967,295	Total number of minutes the RPU has been powered on since time has been reset.
uint32	Number of Power Cycles	44014, 44015	0	R	0 - 4,294,967,295	Total number of times since reset the RPU has dropped below the power loss threshold and recovered.
uint32	Number of Backup Operations	44016, 44017	0	R	0 - 4,294,967,295	Total number of backup operations the RPU has performed since reset.
uint16	Line Voltage	44018	0	R	0-3500	Value of incoming voltage with 2 implied decimal. (0.00 - 35.00 V)
uint16	RESERVED	44019				
uint16	RESERVED	44020				
uint16	RESERVED	44021				
uint16	RESERVED	44022				
uint16	RESERVED	44023				
uint16	RESERVED	44024				
uint16	RESERVED	44025				
uint16	RESERVED	44026				
uint16	RESERVED	44027				
uint16	RESERVED	44028				
uint16	RESERVED	44029				
uint16	RESERVED	44030				
uint16	RESERVED	44031				
uint16	RESERVED	44032				
uint16	RESERVED	44033				
uint16	RESERVED	44034				
uint16	RESERVED	44035				
uint16	RESERVED	44036				
uint16	Test Register - 16 bit	44037	45964	R	45964	Fixed register to test correct reading of 16 bit registers - Hex=B38C, Binary=1011001110001100
uint32	Test Register - 32 bit	44038, 44039	3,012,341,331	R	3,012,341,331	Fixed register to test correct reading of 32 bit registers - Hex=B38C AE53, Binary=1011001110001100 1010111001010011
uint16	RESERVED	44040				

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Table 2. easy-Drive RPU-100 Modbus Map (cont.)

Type	Name	MB Register	Default	R/W	Values	Notes
uint16	Loss of Power Detection Timeout	44041	250	R/W	50 - 3000	The amount of time that power is lost before the RPU makes the decision power is truly lost and takes action. Time is in milliseconds.
uint16	RESERVED	44042				
uint16	RESERVED	44043				
uint16	RESERVED	44044				
uint16	RESERVED	44045				
uint16	RESERVED	44046				
uint16	RESERVED	44047				
uint16	RESERVED	44048				
uint16	RESERVED	44049				
uint16	RESERVED	44050				
uint16	RESERVED	44051				
uint16	RESERVED	44052				
uint16	RESERVED	44053				
uint16	RESERVED	44054				
uint16	RESERVED	44055				
uint16	RESERVED	44056				
uint16	RESERVED	44057				
uint16	RESERVED	44058				
uint16	RESERVED	44059				
uint16	RESERVED	44060				
uint16	RESERVED	44061				
uint16	RESERVED	44062				
uint16	RESERVED	44063				
uint16	RESERVED	44064				
uint16	RESERVED	44065				
uint16	RESERVED	44066				
uint16	RESERVED	44067				
uint16	RESERVED	44068				
uint16	RESERVED	44069				
uint16	RESERVED	44070				
uint16	Modbus address	44071	1	R/W	1-247	Slave address of the actuator
uint16	Baud Rate	44072	5	R/W	4 - 7	4=4800 baud, 5=9600 baud, 6=19200 baud, 7=38400 baud
uint16	Parity	44073	0	R/W	0 - 2	0=Even, 1=Odd, 2=None
uint16	Modbus stop bits	44074	1	R/W	1 - 2	1 will be the standard with even and odd parity while 2 is the standard for none.
uint16	MSB/LSB	44075	0	R/W	0 - 1	0=MSB, 1=LSB
uint16	RESERVED	44076				
uc10	Device Tag	44077 - 44096	"Default Tag Name"	R/W	0 - 255 per character	Device Tag (40 byte UTF8 string)
uint16	RESERVED	44097				
uint16	RESERVED	44098				
uint16	RESERVED	44099				
uint16	RESERVED	44100				
uint16	RESERVED	44101				
uint16	RESERVED	44102				
uint16	RESERVED	44103				
uint16	RESERVED	44104				
uint16	RESERVED	44105				

-continued-

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Table 2. easy-Drive RPU-100 Modbus Map (cont.)

Type	Name	MB Register	Default	R/W	Values	Notes
uint16	RESERVED	44106				
uint16	RESERVED	44107				
uint16	RESERVED	44108				
uint16	RESERVED	44109				
uint16	RESERVED	44110				
uint32	PCB serial number	44111, 44112	0	R/W*	0 - 4,294,967,295	PCB serial number
uint32	PCB revision	44113, 44114	0	R/W*	0 - 4,294,967,295	PCB revision
uint16	Flash Firmware major revision	44115	0	R	0 - 65535	From flash firmware when compiled
uint16	Flash Firmware minor revision	44116	0	R	0 - 65535	From flash firmware when compiled
uint16	Flash Firmware mod revision	44117	0	R	0 - 65535	From flash firmware when compiled
uint16	Flash Firmware build revision	44118	0	R	0 - 65535	From flash firmware when compiled
uint16	Boot Firmware major revision	44119	0	R	0 - 65535	From boot firmware when compiled
uint16	Boot Firmware minor revision	44120	0	R	0 - 65535	From boot firmware when compiled
uint16	Boot Firmware mod revision	44121	0	R	0 - 65535	From boot firmware when compiled
uint16	Boot Firmware build revision	44122	0	R	0 - 65535	From boot firmware when compiled
uint32	PCB test date	44123, 44124	0	R/W*	0 - 4,294,967,295	Seconds since January 1, 2000, Board Supplier Functional Test Date
uint32	System completion date	44125, 44126	0	R/W*	0 - 4,294,967,295	Seconds since January 1, 2000, Final Assembly Test Date
uint16	RESERVED	44127				
uint16	RESERVED	44128				
uint16	RESERVED	44129				
uint16	RESERVED	44130				
uint16	RESERVED	44131				
uint16	RESERVED	44132				
uint16	RESERVED	44133				
uint16	RESERVED	44134				
uint16	RESERVED	44135				
uint16	RESERVED	44136				
uint16	RESERVED	44137				
uint16	RESERVED	44138				
uint16	RESERVED	44139				
uint16	RESERVED	44140				
uint16	RESERVED	44141				
uint16	RESERVED	44142				
uint16	RESERVED	44143				
uint16	RESERVED	44144				
uint16	RESERVED	44145				
uint16	RESERVED	44146				
uint16	RESERVED	44147				
uint16	Reset to factory defaults	44148	0	R/W	0 - 1	Value of 1 will reset all setup registers to factory defaults. Will automatically set back to 0.
uint16	Reset statistics	44149	0	R/W	0 - 1	Value of 1 will clear all statistic registers (44011 - 44017). Will automatically set back to 0.

1. uint is defined as Unsigned Integer
uint16 – unsigned 16 bit variable, can take value 0-65535.
uint32 – unsigned 32 bit variable, can take value 0-4294967295.
(Reserved) – registers used for development use only.

R/W* - writable in manufacturing.
† - 32bit register contains data that spans two registers – reads and write of data needs to be performed within the same Modbus command function to ensure coherency of data.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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easy-Drive RPU-100

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Table 3. Diagnostic Fault Flags

Hex Value	Bit Mask	Description	Value	Bit	Definition
0x8000	1000 0000 0000 0000	Fault in N.V. Memory – system has restored default settings	32768	15	A memory fault has occurred and the actuator has been restored to factory defaults. Contact your Emerson sales office .
0x1000	0001 0000 0000 0000	System or Watchdog fault	4096	12	The RPU-100 has experienced a fatal error and restarted. Contact your Emerson sales office.
0x0100	0000 0001 0000 0000	Fault in N.V. Memory – system unable to restore system settings	256	8	A memory fault has occurred and the actuator cannot be restored to factory defaults. Contact your Emerson sales office.
0x0800	0000 0000 1000 0000	Operating Normal	128	7	The RPU-100 is operating normally and monitoring for power loss events.
0x0040	0000 0000 0100 0000	Charging	64	6	The RPU-100 is charging.
0x0020	0000 0000 0010 0000	Providing Backup Power	32	5	Backup power is being provided to the actuator.
0x0010	0000 0000 0001 0000	Reduced Capacitance	16	4	Reduced capacitance has been detected. Contact your Emerson sales office.
0x0008	0000 0000 0000 1000	Non-functional	8	3	The RPU-100 is currently non-functional. If over current protection is also active, correct over current situation and recheck. Contact your Emerson sales office.
0x0004	0000 0000 0000 0100	Disabled	4	2	Normal operation of the RPU-100 has been disabled via the Disable Switch. Backup power will not be provided on event of power loss.
0x0001	0000 0000 0000 0001	Overcurrent Protection Active	1	0	An over current has been detected and the output of the RPU-100 has been temporarily disabled.

Appendix B - Certificate of Conformance Linear easy-Drive

		
EU Declaration of Conformity		
We, the manufacturer, Emerson Fisher Controls International LLC 205 South Center Street Marshalltown, Iowa 50158 USA		
declare under our sole responsibility that the following product(s); Electric Actuator easy-Drive		
to which this declaration relates, is in conformity with the provisions of the following European Community Directives, including the latest amendments, as shown in the attached schedule.		
Assumption of conformity is based on the application of the harmonized standards and, when applicable or required, a European Community Notified Body certification, as shown in the attached schedule.		
		
Bob Stahlin Vice President-Sliding Stem Valve Business Unit Marshalltown, Iowa 50158		
3-August-2020 Date		
European Contact Emerson Group Services SAS Rue Paul-Baudry B.P. 10150 68701 Cernay Cedex France		
EDOCS ID: FCS_55	Page 1 of 2	

-continued-

Appendix B - Certificate of Conformance (cont.)

EMC Directive – 2014/30/EU

Models: All
EN 61326-1:2013

RoHS Directive – 2011/65/EU

Declaration of Exclusion

Models: All

The above equipment is excluded from the scope of this directive per Article 2, Paragraph 4, part C. Therefore the equipment cannot bear the CE mark related to RoHS compliance. However, the equipment may bear the CE mark to indicate compliance with other applicable EU directives.

ATEX Directive – 2014/34/EU (Applicable only if this mark appears on the product)

Certificate – SIRA12ATEX1168X – Group II Category 2 G – Flameproof
easy-Drive
Ex db IIA T6(Ta ≤ 70°C) Gb
Standards used: EN60079-0:2012/A11:2013, EN60079-1:2014

ATEX Notified Body for EC-Type Examination Certificate(s)

CSA Group Netherlands B.V. – Notified Body Number: 2813
Utrechtseweg 310, Building B42
6812AR Arnhem
The Netherlands

ATEX Notified Body for Quality Assurance

SGS Fimko Oy – Notified Body Number: 0598
P.O. Box 30 (Särkiniementie 3)
Helsinki, 00211
Finland

Appendix B - Certificate of Conformance Rotary easy-Drive

		
EU Declaration of Conformity		
We, the manufacturer, Emerson Fisher Controls International LLC 205 South Center Street Marshalltown, Iowa 50158 USA		
declare under our sole responsibility that the following product(s); Electric Actuator easy-Drive 200R		
to which this declaration relates, is in conformity with the provisions of the following European Community Directives, including the latest amendments, as shown in the attached schedule.		
Assumption of conformity is based on the application of the harmonized standards and, when applicable or required, a European Community Notified Body certification, as shown in the attached schedule.		
		
Michael Gotlieb Vice President-Sliding Stem Valve Business Unit Marshalltown, Iowa 50158		
10/23/2023 Date		
European Contact Emerson Group Services SAS Rue Paul-Baudry B.P. 10150 68701 Cernay Cedex France		
EDOCS ID: FCS_91	Page 1 of 2	

-continued-

Appendix B - Certificate of Conformance (cont.)

EMC Directive – 2014/30/EU

Models: All
EN 61326-1:2013

RoHS Directive – 2011/65/EU

Declaration of Exclusion

Models: All

The above equipment is excluded from the scope of this directive per Article 2, Paragraph 4, part C. Therefore the equipment cannot bear the CE mark related to RoHS compliance. However, the equipment may bear the CE mark to indicate compliance with other applicable EU directives.

ATEX Directive – 2014/34/EU (Applicable only if this mark appears on the product)

Certificate – **CSANe 21ATEX1000X – Group II Category 2 G** – Flameproof
easy-Drive 200R
Ex db IIB T6(Ta ≤ 70°C) Gb
Standards used: EN60079-0:2018, EN60079-1:2014

ATEX Notified Body for EC-Type Examination Certificate(s)

CSA Group Netherlands B.V. – Notified Body Number: 2813
Utrechtseweg 310, Building B42
6812AR Arnhem
The Netherlands

ATEX Notified Body for Quality Assurance

SGS Fimko Oy – Notified Body Number: 0598
P.O. Box 30 (Särkiniementie 3)
Helsinki, 00211
Finland

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easy-Drive RPU-100

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Instruction Manual

D104551X012

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Fisher™ ED and EAD easy-e™ Valves CL125 through CL600

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Figure 1. Fisher ED Valve with 667 Actuator



W1916-2

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Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 1 through 8 Fisher ED valves, and NPS 1 through 6 EAD valves, through CL600 ratings. Refer to separate manuals for instructions covering the actuator and accessories.

Do not install, operate, or maintain ED or EAD valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications
End Connection Styles
Cast Iron Valves

Flanged: CL125 flat-face or 250 raised-face flanges per ASME B16.1

Steel and Stainless Steel Valves

Flanged: CL150, 300, and 600 raised-face or ring-type joint flanges per ASME B16.5

Screwed or Socket Welding: All available ASME B16.11 schedules that are consistent with CL600 per ASME B16.34

Butt welding: NPS 1 through 8

Schedules 40 or 80 consistent with ASME B16.25

Maximum Inlet Pressure⁽¹⁾
Cast Iron Valves

Flanged: Consistent with CL125B or 250B pressure-temperature ratings per ASME B16.1

Steel and Stainless Steel Valves

Flanged: Consistent with CL150, 300, and 600⁽²⁾ pressure-temperature ratings per ASME B16.34

Screwed or Welding: Consistent with CL600 pressure-temperature ratings per ASME B16.34

Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4

Standard: Class II

Optional: Class III--For valves with graphite piston ring and 3.4375 inch or larger port diameter; Class IV--For valves with multiple graphite piston rings and 4.375 inch or larger port diameter

C-seal trim: High-temperature, Class V.
See table 2

Flow Characteristics

Standard Cages: ■ Linear, ■ quick opening, or ■ equal percentage

Whisper Trim™ and WhisperFlo™ Cages: Linear

Flow Directions

Linear, Quick Opening, or Equal Percentage Cage:
Normally down

Whisper Trim and WhisperFlo Cages: Always up

Approximate Weights

NPS 1 & 1-1/4 valves: 14 kg (30 lb)

NPS 1-1/2 valves: 20 kg (45 lb)

NPS 2 valves: 30 kg (67 lb)

NPS 2-1/2 valves: 45 kg (100 lb)

NPS 3 valves: 57 kg (125 lb)

NPS 4 valves: 77 kg (170 lb)

NPS 6 valves: 159 kg (350 lb)

NPS 8 valves: 408 kg (900 lb)

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

2. Certain bonnet bolting material selections may require a CL600 easy-e valve assembly to be derated. Contact your [Emerson sales office](#).

Description

These single-port valves have cage guiding, quick-change trim, and balanced push-down-to-close valve plug action. Valve configurations are as follows:

ED--Globe-style valve (figure 1) with metal-to-metal seating for all general applications over a wide variety of pressure drops and temperatures.

EAD--Angle version of ED, used to facilitate piping or in applications where a self-draining valve is required.

C-seal trim is available for ED valves, CL150, 300, and 600, in NPS 2-1/2, 3, 4, 6, and 8. C-seal trim is available for EAD valves, CL150, 300, and 600, in NPS 3, 4, and 6.

With C-seal trim, a balanced valve can achieve high-temperature, Class V shutoff. Because the C-seal plug seal is formed from metal (N07718 nickel alloy) rather than an elastomer, a valve equipped with the C-seal trim can be applied in processes with a fluid temperature of up to 593°C (1100°F), provided other material limits are not exceeded.

Specifications

Typical specifications for these valves are shown in table 1.

Educational Services

For information on available courses for Fisher ED and EAD valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

1. Before installing the valve, inspect the valve and associated equipment for any damage and any foreign material.
2. Make certain the valve body interior is clean, that pipelines are free of foreign material, and that the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.
3. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven valve plug and cage wear, and improper operation. With some valves, the actuator may also need to be supported when it is not vertical. For more information, consult your Emerson sales office.
4. Use accepted piping and welding practices when installing the valve in the line. For flanged valves, use a suitable gasket between the valve and pipeline flanges.

CAUTION

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Shrink-fit pieces and threaded connections may also loosen. In

general, if post weld heat treating is to be performed, all trim parts should be removed. Contact your [Emerson sales office](#) for additional information.

5. With a leak-off bonnet construction, remove the pipe plugs (keys 14 and 16, figure 18) to hook up the leak-off piping. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
6. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.

Table 2. Additional Shutoff Classification

Valve	Valve Size, NPS	Port Diameter, Inches	Cage Style	Leakage Class
ED (CL150-600)	2-1/2	2.875	Equal Percentage, Linear, Whisper I, Cavitrol™ III, 1 stage	V (for port diameters from 2.875 through 8-inch with optional C-seal trim)
	3	3.4375		
	3	2.875	Cavitrol III, 2 stage	
	4	2.875		
	4	4.375	Equal Percentage, Linear, Whisper I, Cavitrol III, 1 stage	
	6	5.375	Whisper III (A3, B3, D3, D3), Cavitrol III, 2 stage	
		7	Equal Percentage, Linear, Whisper I, Cavitrol III, 1 stage	
	8	7	Cavitrol III, 2 stage	
		8	Equal Percentage, Linear, Whisper I, Cavitrol III, 1 stage	

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valves with ENVIRO-SEAL live-loaded packing or HIGH-SEAL live-loaded packing will not require this initial re-adjustment. See the Fisher instruction manuals, ENVIRO-SEAL Packing System for Sliding-Stem Valves or HIGH-SEAL Live-Loaded Packing System (as appropriate), for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the Parts Kit sub-section near the end of this manual.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance, trim maintenance, and ENVIRO-SEAL bellows seal bonnet replacement. All maintenance operations may be performed with the valve in the line.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.

- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This ensures a good gasket seal because the used gasket may not seal properly.

Packing Lubrication

Note

ENVIRO-SEAL or HIGH-SEAL packing does not require lubrication.

WARNING

To avoid personal injury or property damage resulting from fire or explosion, do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F).

If a lubricator or lubricator/isolating valve (figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the pipe plug (key 14, figure 18). Use a good quality silicon-based lubricant. Do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F). To operate the lubricator, simply turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except open the isolating valve before turning the cap screw and then close the isolating valve after lubrication is completed.

Packing Maintenance

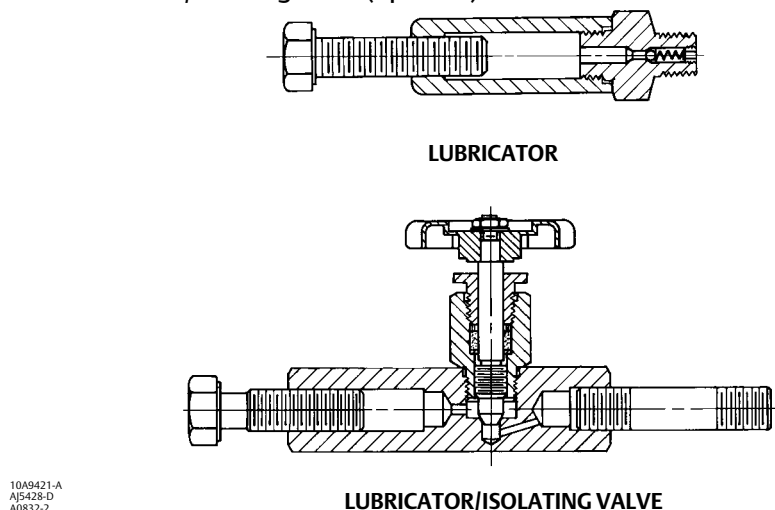
Note

For valves with ENVIRO-SEAL packing, see the Fisher instruction manual, ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#), for packing instructions.

For valves with HIGH-SEAL packing, see the Fisher instruction manual, HIGH-SEAL Live-Loaded Packing System, [D101453X012](#), for packing instructions.

Key numbers refer to figure 3 for PTFE V-ring packing and to figure 4 for PTFE/composition packing, unless otherwise indicated.

Figure 2. Lubricator and Lubricator/Isolating Valve (optional)



For spring-loaded single PTFE V-ring packing, the spring (key 8, figure 3) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13, figure 3), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5, figure 18) until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the Replacing Packing procedure.

If there is undesirable packing leakage with other than spring-loaded packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

If the packing is relatively new and tight on the stem, and if tightening the packing flange nuts does not stop the leakage, the valve stem may be worn or nicked so that a seal cannot be made. The surface finish of a new valve stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

Replacing Packing

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet. Disconnect the stem connector, then remove the actuator from the valve by unscrewing the yoke locknut (key 15, figure 18) or the hex nuts (key 26, figure 18).

Figure 3. PTFE V-Ring Packing Arrangements for Plain or Extension Bonnets

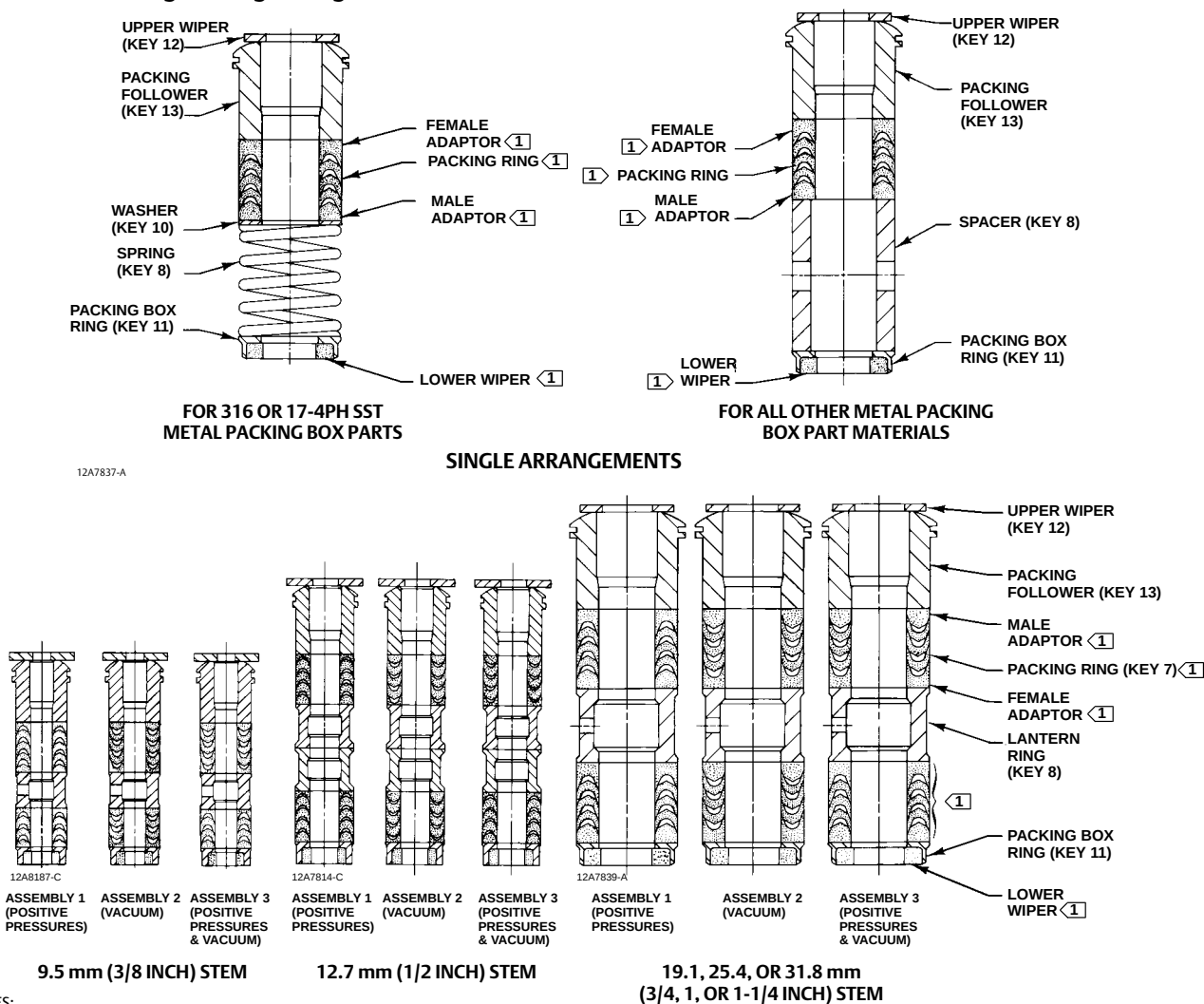


Table 3. Body-to-Bonnet Bolt Torque Guidelines

Valve Size, NPS		Bolt Torques ^(1, 3)			
ED	EAD	SA193-B7		SA193-B8M ⁽²⁾	
		N•m	Lbf•ft	N•m	Lbf•ft
1-1/4 or less	1	129	95	64	47
1-1/2, 1-1/2 x 1, 2, or 2 x 1	2 or 2 x 1	96	71	45	33
2-1/2 or 2-1/2 x 1-1/2	3 or 3 x 1-1/2	129	95	64	47
3, 3 x 2, or 3 x 2-1/2	4 or 4 x 2	169	125	88	65
4, 4 x 2-1/2, or 4 x 3	6 or 6 x 2-1/2	271	200	156	115
6	---	549	405	366	270
8	---	746	550	529	390

1. Determined from laboratory tests.
2. SA193-B8M annealed.
3. For other materials, contact your [Emerson sales office](#) for torque values.

3. Loosen the packing flange nuts (key 5, figure 18) so that the packing is not tight on the valve stem. Remove any travel indicator parts and stem locknuts from the valve stem threads.

⚠ WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

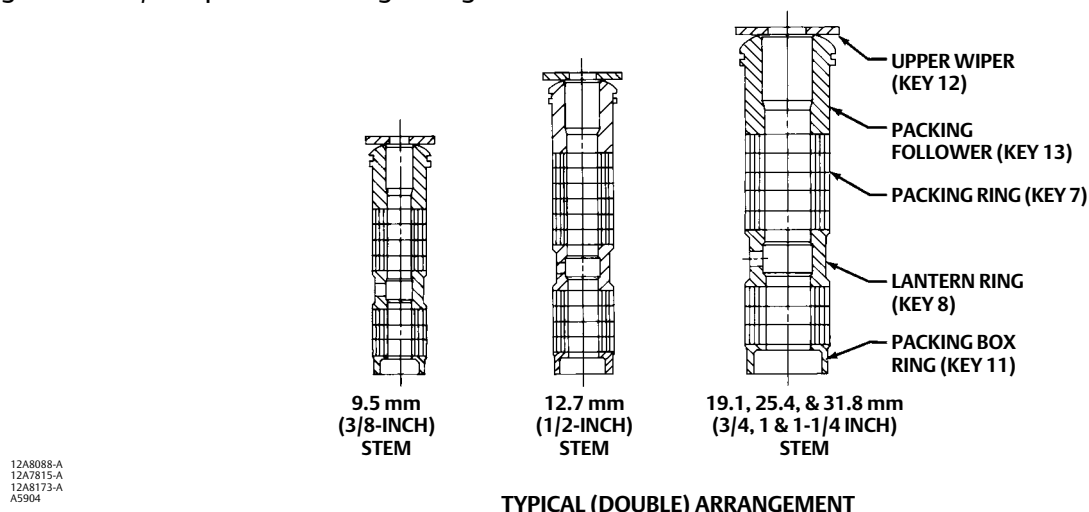
CAUTION

Avoid damaging the seating surface caused by the valve plug and stem assembly dropping from the bonnet (key 1, figure 18) after being lifted part way out. When lifting the bonnet, temporarily install a valve stem locknut on the valve stem. This locknut will prevent the valve plug and stem assembly from dropping out of the bonnet.

If the cage starts to lift with the bonnet, tap it with a plastic mallet, or other soft material, to be sure it stays in the valve.

4. Hex nuts (key 16, figure 19, 20, or 21) or cap screws (not shown) attach the bonnet (key 1, figure 18) to the valve body (key 1, figure 19, 20, or 21). Loosen these nuts or cap screws approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, remove the nuts or cap screws completely and carefully lift the bonnet off the valve.
5. Remove the locknut and separate the valve plug and stem from the bonnet. Set the parts on a protective surface to prevent damage to gasket or seating surfaces.
6. Remove the bonnet gasket (key 10, figure 19, 20, or 21) and cover the opening in the valve to protect the gasket surface and prevent foreign material from getting into the valve body cavity.
7. Remove the packing flange nuts, packing flange, upper wiper, and packing follower (keys 5, 3, 12, and 13, figure 18). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
8. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts by following the appropriate steps in the Trim Maintenance procedure.
9. Remove the cover protecting the valve body cavity and install a new bonnet gasket (key 10, figure 19 through 21), making sure the gasket seating surfaces are clean and smooth. Place the valve plug and stem into the valve body, making sure it is properly centered on the seat ring. Then slide the bonnet over the stem and onto the stud bolts (key 16, figure 19, 20, or 21) or onto the valve body cavity if cap screws (not shown) will be used instead.

Figure 4. PTFE/Composition Packing Arrangements for Plain or Extension Bonnets



Note

Proper performance of the bolting procedures in step 10 compresses the spiral wound gasket (key 12, figure 19 or 20) or load ring (key 26, figure 21) enough to both load and seal the seat ring gasket (key 13, figure 19, 20, or 21). It also compresses the outer edge of the bonnet gasket (key 10, figure 19 through 21) enough to seal the body-to-bonnet joint.

The bolting procedures in step 10 include--but are not limited to--ensuring that bolting threads are clean, and evenly tightening the cap screws, or the nuts onto the studs, in a crisscross pattern. Tightening one cap screw or nut may loosen an adjacent cap screw or nut. Repeat the crisscross tightening pattern several times until each cap screw or nut is tight and the body-to-bonnet seal is made.

10. Install bolting, using accepted bolting procedures during tightening, so that the body-to-bonnet joint will withstand test pressures and application service conditions. Use the bolt torques in table 3 as guidelines.
11. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 3, 4, or 5. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box.
12. Slide the packing follower, upper wiper, and packing flange (keys 13, 12, and 3, figure 18) into position. Lubricate the packing flange studs (key 4, figure 18) and the faces of the packing flange nuts (key 5, figure 18). Install the packing flange nuts.
13. For spring-loaded PTFE V-ring packing, tighten the packing flange nuts until the shoulder on the packing follower (key 13, figure 18) contacts the bonnet.

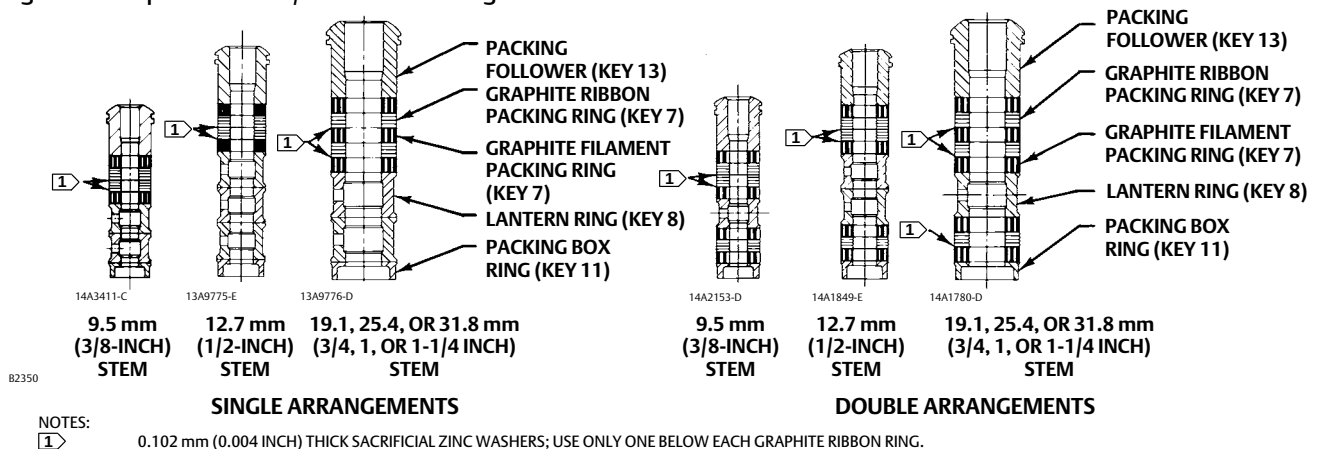
For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 4. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 4.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 4. Then, tighten the remaining flange nut until the packing flange is level and at a 90-degree angle to the valve stem.

For ENVIRO-SEAL or HIGH-SEAL live-loaded packing, refer to the note at the beginning of Packing Maintenance.

14. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

Figure 5. Graphite Ribbon/Filament Packing for Plain or Extension Bonnets



Trim Maintenance

⚠ WARNING

Observe the warning at the start of the Maintenance section.

For C-seal construction, see the appropriate C-seal sections in this instruction manual.

Except where indicated, key numbers in this section are referenced in figure 19 for standard NPS 1 through 6 constructions, figure 20 for Whisper Trim III cage detail, figure 21 for the NPS 8 ED valve, and figures 22 and 23 for WhisperFlo trim. Some valve plug constructions require three piston rings (key 6).

Disassembly

1. Remove the actuator and the bonnet according to steps 1 through 5 of the Replacing Packing procedure in the Maintenance section.

⚠ WARNING

Avoid personal injury or property damage from valve or packing leakage.

The graphite piston rings in an ED or EAD valve are brittle and in two pieces. Use care to avoid damage to the piston rings caused by dropping or rough handling.

Any damage to the gasket sealing surfaces could cause the valve to leak. The surface finish of the valve stem (key 7) is critical for making a good packing seal. The inside surface of the cage or cage/baffle assembly (key 3), or cage retainer (key 31), is critical for smooth operation of the valve plug and for making a seal with the piston rings (key 6). The seating surfaces of the valve plug (key 2) and seat ring (key 9) are critical for proper shutoff. Protect these parts accordingly while disassembling the trim.

2. Remove the packing flange nuts, packing flange, upper wiper, and packing follower (keys 5, 3, 12, and 13, figure 18). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
3. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.

Table 4. Recommended Torque for Packing Flange Nuts

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE TYPE PACKING				PTFE TYPE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
mm	Inches		N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in
9.5	3/8	CL125, 150	3	27	5	40	1	13	2	19
		CL250, 300	4	36	6	53	2	17	3	26
		CL600	6	49	8	73	3	23	4	35
12.7	1/2	CL125, 150	5	44	8	66	2	21	4	31
		CL250, 300	7	59	10	88	3	28	5	42
		CL600	9	81	14	122	4	39	7	58
19.1	3/4	CL125, 150	11	99	17	149	5	47	8	70
		CL250, 300	15	133	23	199	7	64	11	95
		CL600	21	182	31	274	10	87	15	131
25.4	1	CL300	26	226	38	339	12	108	18	162
		CL600	35	310	53	466	17	149	25	223
31.8	1-1/4	CL300	36	318	54	477	17	152	26	228
		CL600	49	437	74	655	24	209	36	314

- Remove the load ring (key 26) from an NPS 8 ED valve, or the cage adaptor (key 4) from any restricted-trim valve through NPS 4, and wrap it for protection.
- On an NPS 6 ED valve with a Whisper Trim III cage or WhisperFlo trim, remove the bonnet spacer (key 32) and bonnet gasket (key 10) on top of the spacer. Then on any construction with a cage retainer (key 31), remove the cage retainer and its associated gaskets. A Whisper Trim III and WhisperFlo cage retainer has two 3/8 inch-16 UNC tappings in which screws or bolts can be installed for lifting.
- Remove the cage or cage/baffle assembly (key 3) and the associated gaskets (keys 10, 11, and 12), and shim (key 51 for the ED valve, key 27 for the EAD valve). If the cage is stuck in the valve, use a rubber mallet to strike the exposed portion of the cage at several points around its circumference.
- Remove the seat ring or liner (key 9), seat ring gasket (key 13), and the seat ring adaptor (key 5) and adaptor gasket (key 14) where used in a restricted-trim seat ring construction.
- Inspect parts for wear or damage which would prevent proper operation of the valve. Replace or repair trim parts according to the following procedure for Lapping Metal Seats or other valve plug maintenance procedures as appropriate.

Lapping Metal Seats

CAUTION

To avoid damaging the ENVIRO-SEAL bellows seal bonnet assembly, do not attempt to lap the metal seating surfaces. The design of the assembly prevents rotation of the stem and any forced lapping rotation will damage internal components of the ENVIRO-SEAL Bellows Seal bonnet.

With metal-seat constructions, seating surfaces of the valve plug and seat ring or liner (keys 2 and 9, figure 19, 20, or 21) can be lapped for improved shutoff. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply compound to the bottom of the valve plug.

Assemble the valve to the extent that the cage and the cage retainer and bonnet spacer (if used) are in place and the bonnet is bolted to the valve. A simple handle can be made from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction to lap the seats. After lapping, remove the bonnet and clean the seat surfaces. Completely assemble as described in the Assembly portion of the Trim Maintenance procedure and test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

Valve Plug Maintenance

Except where indicated, key numbers in this section are referenced in figure 19 for standard NPS 1 through 6 constructions, figure 20 for Whisper Trim III detail, figure 21 for the NPS 8 ED valve, and figures 22 and 23 for WhisperFlo trim. Some valve plug constructions require three piston rings (key 6).

CAUTION

To avoid the piston ring (key 6) not sealing properly, be careful not to scratch the surfaces of the ring groove in the valve plug or any of the surfaces of the replacement ring.

1. With the valve plug (key 2) removed according to the Disassembly portion of the Trim Maintenance procedure, proceed as appropriate:

For the carbon-filled PTFE piston ring, The ring is split in one place. If there is visible damage, spread the ring slightly and remove it from the groove in the valve plug.

To install a carbon-filled PTFE piston ring, Spread the ring apart slightly at the split and install it over the stem and into the groove in the valve plug. The open side must face along the stem, depending on flow directions, as shown in view A of figure 19.

For the graphite piston ring, The ring can be easily removed since it is in two pieces. A new graphite piston ring is furnished as a complete ring. Use a vise with smooth or taped jaws to break this replacement ring into halves. Place the new ring in the vise so that the jaws will compress the ring into an oval. Slowly compress the ring until it snaps on both sides. If one side snaps first, do not try to tear or cut the other side. Instead, keep compressing the ring until the other side snaps. Be sure to match the broken ends when installing the ring in the valve plug groove.

CAUTION

Never reuse an old stem or adaptor with a new valve plug. Using an old stem or adaptor with a new plug requires drilling a new pin hole in the stem (or adaptor in case an ENVIRO-SEAL bellows seal bonnet is being used). This drilling weakens the stem or adaptor and may cause failure in service. However, a used valve plug may be reused with a new stem or adaptor.

Note

For plain bonnets and style 1 extension bonnets, the valve plug (key 2), valve stem (key 7), and pin (key 8) are available completely assembled. Refer to the Key 2, 7, and 8 Valve Plug and Stem Assembly tables in the Parts List.

2. To replace the valve stem (key 7), drive out the pin (key 8). Unscrew the valve plug from the stem or adaptor.
3. To replace the adaptor (key 24, figure 18) on ENVIRO-SEAL bellows seal bonnets, place the plug stem assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out the pin (key 36, figure 18). Reverse the plug stem assembly and valve plug in the soft-jaw chuck or vise. Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the valve plug/adaptor assembly (key 24, figure 18) from the valve stem assembly (key 20, figure 18).
4. Screw the new stem or adaptor into the valve plug. Tighten to the torque value given in table 5. Refer to table 5 to select the proper drill size. Drill through the stem or adaptor, using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin to lock the assembly.
5. For ENVIRO-SEAL bellows seal bonnets, grip the flats of the stem extending out of the top of the bellows shroud with a soft-jaw chuck or other type of vise. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as

necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.

Assembly

Except where indicated, key numbers are referenced in figure 19 for standard NPS 1 through 6 constructions, figure 20 for Whisper Trim III detail, figure 21 for the NPS 8 ED valve, and figures 22 and 23 for WhisperFlo trim.

Table 5. Valve Stem Connection Torque and Pin Replacement

VALVE STEM CONNECTION (VSC)		TORQUE, MINIMUM TO MAXIMUM		DRILL SIZE, INCH
mm	Inch	N•m	Lbf•ft	
9.5	3/8	40 to 47	25 to 35	3/32
12.7	1/2	81 to 115	60 to 85	1/8
19.1	3/4	237 to 339	175 to 250	3/16
25.4	1	420 to 481	310 to 355	1/4
31.8	1-1/4	827 to 908	610 to 670	1/4

1. With a restricted-trim seat ring construction, install the adaptor gasket (key 14) and seat ring adaptor (key 5).
2. Install the seat ring gasket (key 13), seat ring or liner (key 9).
3. Install the cage or cage/baffle assembly (key 3). Any rotational orientation of the cage or assembly with respect to the valve is acceptable. A Whisper Trim III cage designated by level A3, B3, or C3 may be installed with either end up. The level D3 cage/baffle assembly, however, must be installed with the hole pattern end next to the seat ring. If a cage retainer (key 31) is to be used, place it on top of the cage.
4. Slide the valve plug (key 2) and stem assembly, or valve plug and ENVIRO-SEAL bellows seal assembly, into the cage until the piston ring(s) is level with the top of the cage (key 3) or cage retainer (key 31).
5. Installing piston rings (key 6):
 - a. For valve plugs with a single piston ring: Make sure the piston ring is evenly engaged into the entrance chamfer at the top of the cage or cage retainer ring. Carefully press the piston ring into the cage or cage retainer ring.
 - b. For valve plugs with multiple piston rings: As each piston ring is slid into the cage, make sure the ring is evenly engaged in the entrance chamfer at the top of the cage or cage retainer. Also, make sure to offset the fracture in the rings to minimize leakage. Carefully press each piston ring into the cage or cage retainer ring.
6. Place the gaskets (keys 12, 11 or 14 if used, and 10) and the shim (key 27 or 51) if used, on top of the cage or cage retainer. If there is a cage adaptor (key 4) or a bonnet spacer (key 32), set it on the cage or cage retainer gaskets and place another flat sheet gasket (key 10) on top of the adaptor or spacer. If there is only a cage retainer, place another flat sheet gasket on the retainer.
7. With an NPS 8 ED valve, install the load ring (key 26).
8. Mount the bonnet on the valve and complete assembly according to steps 10 through 14 of the Replacing Packing procedure. Be sure to observe the note prior to step 10.

Retrofit: Installing C-seal Trim

Note

Additional actuator thrust is required for a valve with C-seal trim. When installing C-seal trim in an existing valve, contact your [Emerson sales office](#) for assistance in determining new actuator thrust requirements.

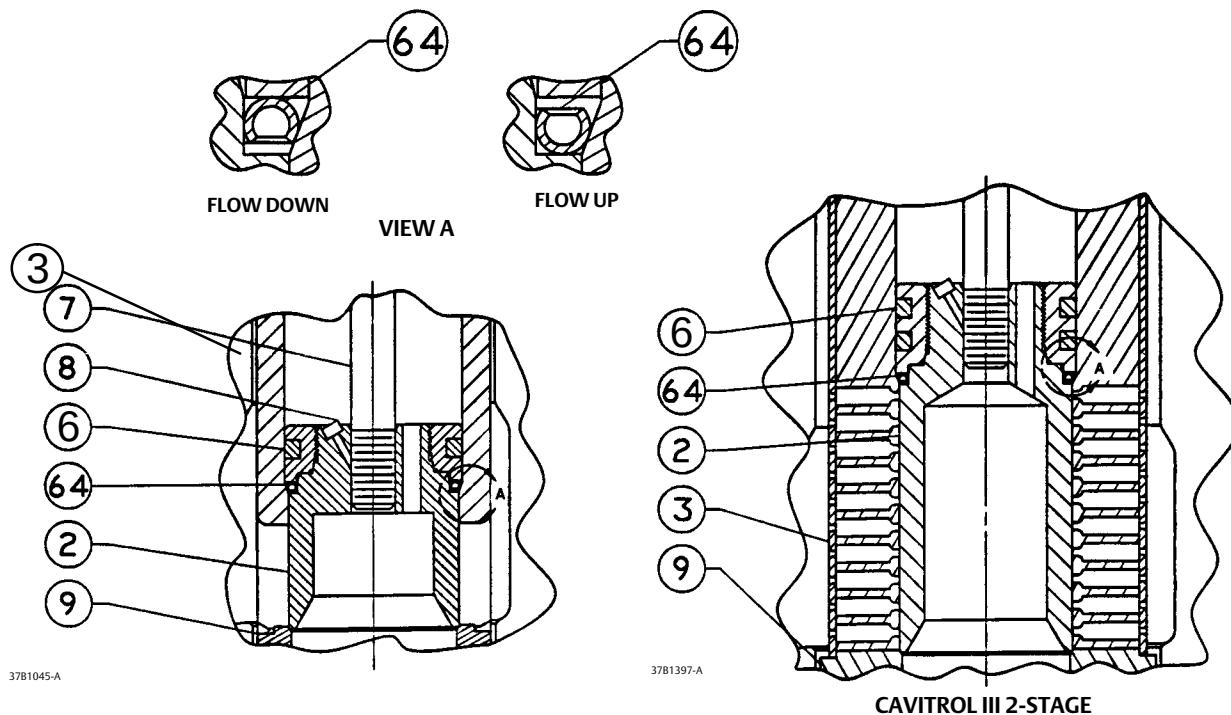
Assemble the new valve plug/retainer assembly (with C-seal plug seal) using the following instructions:

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the new trim parts while assembling the individual parts and during installation in the valve body.

1. Apply a suitable high-temperature lubricant to the inside diameter of the C-seal plug seal. Also, lubricate the outside diameter of the valve plug where the C-seal plug seal must be pressed into the proper sealing position (figure 6).
2. Orient the C-seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the C-seal plug seal must face up in a valve with flow-up construction (figure 6).
 - The open interior of the C-seal plug seal must face down in a valve with flow-down construction (figure 6).

Figure 6. Fisher ED with C-seal Trim



Note

An installation tool must be used to properly position the C-seal plug seal on the valve plug. A tool is available as a Fisher spare part or a tool could be manufactured following the dimensions given in figure 7.

3. Place the C-seal plug seal over the top of the valve plug and press the C-seal plug seal onto the plug using the C-seal installation tool. Carefully press the C-seal plug seal onto the plug until the installation tool contacts the horizontal reference surface of the valve plug (figure 8).
4. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the C-seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.

5. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 9) to secure the C-seal retainer.
6. Install the new plug/retainer assembly with C-seal plug seal on the new stem following the appropriate instructions in the Trim Replacement section of this manual.
7. Install piston rings by following instructions in the Trim Replacement section of this manual.
8. Remove the existing valve actuator and bonnet following the appropriate instructions in the Replacing Packing section of this manual.

CAUTION

Do not remove the existing valve stem from the valve plug unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

9. Remove the existing valve stem and plug, cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section of this manual.
10. Replace all gaskets according to appropriate instructions in the Trim Replacement section of this manual.
11. Install the new seat ring, cage, valve plug/retainer assembly, and stem into the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section of this manual.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the C-seal plug seal and contact the seat ring. You can correctly seat the valve plug by applying the full actuator load. This force will adequately drive the valve plug to the seat ring, thus giving the C-seal plug seal a predetermined permanent set. Once this is done, the plug/retainer assembly, the cage, and the seat ring become a matched set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Replacement of Installed C-seal Trim

Trim Removal (C-seal Constructions)

1. Remove the valve actuator and bonnet following the appropriate instructions in the Replacing Packing section of this manual.

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance.

Use caution when removing piston ring(s) and C-seal plug seal to avoid scratching any sealing surface.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

ED Valve
February 2020

Instruction Manual
D100390X012

FOR VALVE PLUGS FITTING PORT SIZE (Inches)	DIMENSIONS, mm (See Drawing Below)								Part Number (To Order A Tool)
	A	B	C	D	E	F	G	H	
2.875	82.55	52.324 - 52.578	4.978 - 5.029	3.708 - 3.759	41.148	52.680 - 52.781	55.118 - 55.626	70.891 - 71.044	24B9816X012
3.4375	101.6	58.674 - 58.928	4.978 - 5.029	3.708 - 3.759	50.8	61.011 - 61.112	63.449 - 63.957	85.166 - 85.319	24B5612X012
3.625	104.394	65.024 - 65.278	4.978 - 5.029	3.708 - 3.759	50.8	68.936 - 69.037	71.374 - 71.882	89.941 - 90.094	24B3630X012
4.375	125.984	83.439 - 83.693	4.978 - 5.029	3.708 - 3.759	50.8	87.351 - 87.452	89.789 - 90.297	108.991 - 109.144	24B3635X012
5.375	142.748	100.076 - 100.33	4.978 - 5.029	3.708 - 3.759	45.974	103.835 - 103.937	106.274 - 106.782	128.219 - 128.372	23B9193X012
7	184.15	141.376 - 141.630	4.978 - 5.029	3.708 - 3.759	60.198	145.136 - 145.237	147.574 - 148.082	169.520 - 169.672	23B9180X012
8	209.55	166.776 - 167.030	4.978 - 5.029	3.708 - 3.759	55.88	170.536 - 170.637	172.974 - 173.482	194.920 - 195.072	24B9856X012
FOR VALVE PLUGS FITTING PORT SIZE (Inches)	DIMENSIONS, INCHES (See Drawing Below)								Part Number (To Order A Tool)
	A	B	C	D	E	F	G	H	
2.875	3.25	2.060 - 2.070	0.196 - 0.198	0.146 - 0.148	1.62	2.074 - 2.078	2.170 - 2.190	2.791 - 2.797	24B9816X012
3.4375	4.00	2.310 - 2.320	0.196 - 0.198	0.146 - 0.148	2.00	2.402 - 2.406	2.498 - 2.518	3.353 - 3.359	24B5612X012
3.625	4.11	2.560 - 2.570	0.196 - 0.198	0.146 - 0.148	2.00	2.714 - 2.718	2.810 - 2.830	3.541 - 3.547	24B3630X012
4.375	4.96	3.285 - 3.295	0.196 - 0.198	0.146 - 0.148	2.00	3.439 - 3.443	3.535 - 3.555	4.291 - 4.297	24B3635X012
5.375	5.62	3.940 - 3.950	0.196 - 0.198	0.146 - 0.148	1.81	4.088 - 4.092	4.184 - 4.204	5.048 - 5.054	23B9193X012
7	7.25	5.566 - 5.576	0.196 - 0.198	0.146 - 0.148	2.37	5.714 - 5.718	5.810 - 5.830	6.674 - 6.680	23B9180X012
8	8.25	6.566 - 6.576	0.196 - 0.198	0.146 - 0.148	2.20	6.714 - 6.718	6.810 - 6.830	7.674 - 7.680	24B9856X012

Figure 7. C-seal Plug Seal Installation Tool

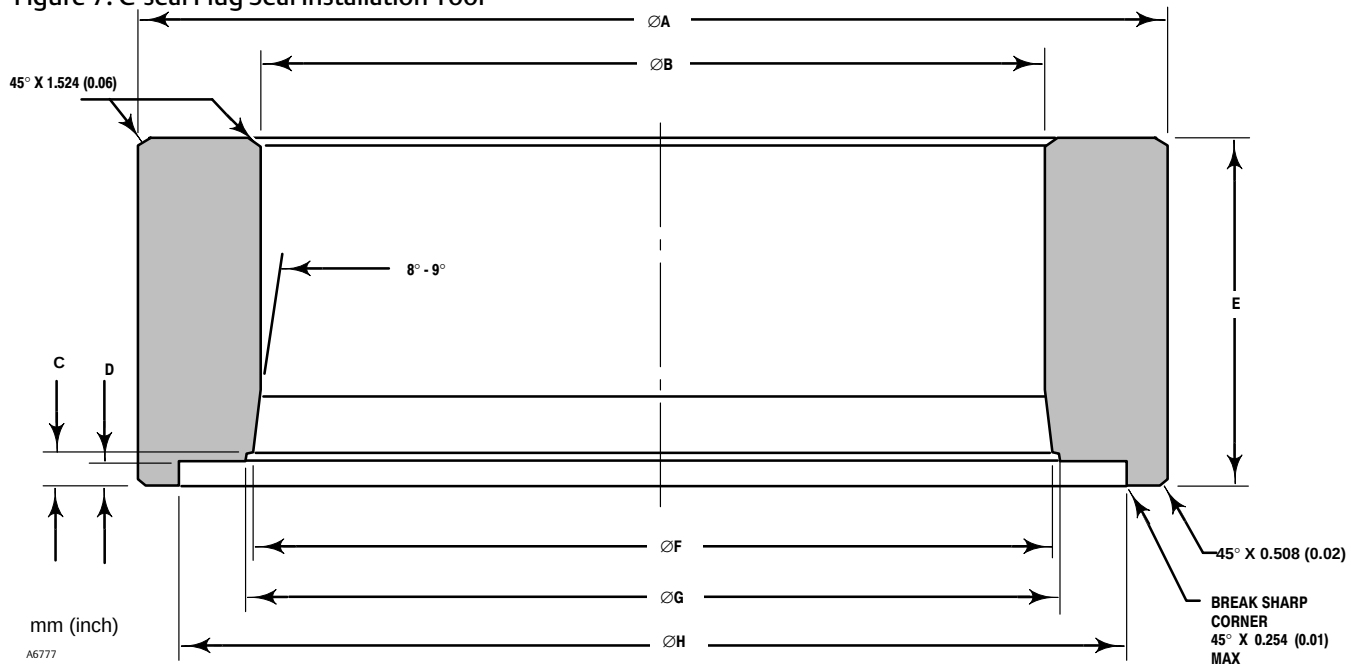
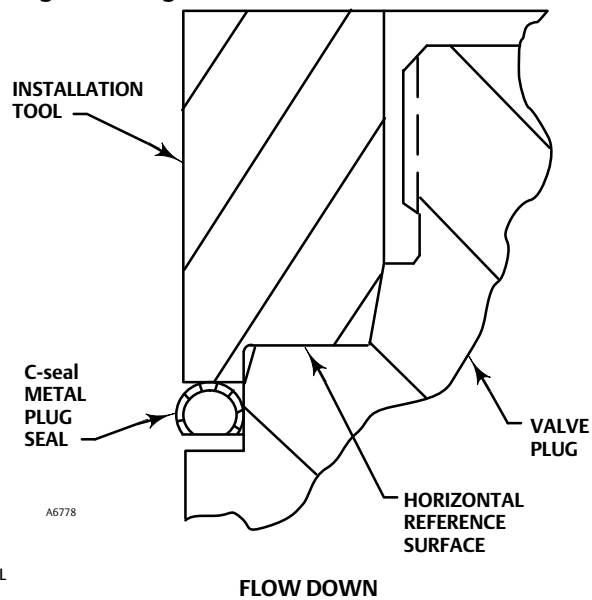
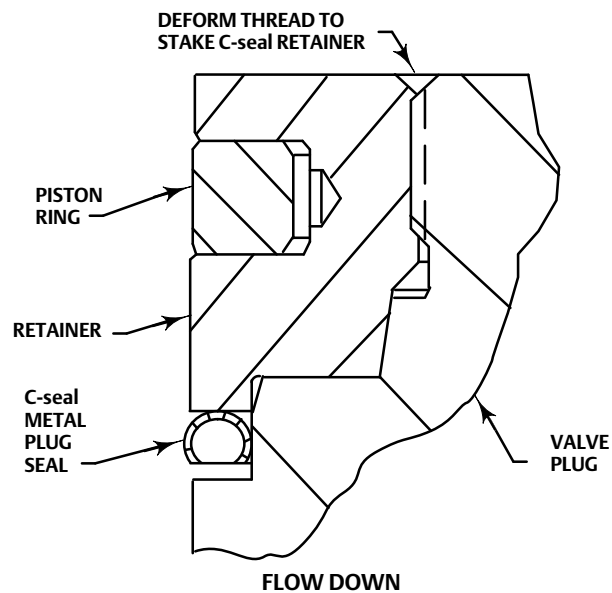


Figure 8. Installing the C-seal Plug Seal Using the Installation Tool



NOTE:
PRESS INSTALLATION TOOL OVER VALVE PLUG
UNTIL THE TOOL CONTACTS THE HORIZONTAL
REFERENCE SURFACE OF THE VALVE PLUG.

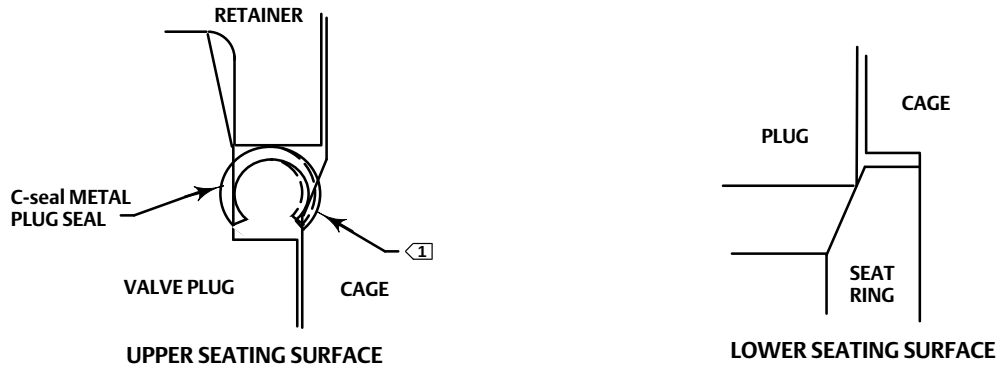
Figure 9. Stake the Threads of the C-seal Retainer



CAUTION

Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem. Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

Figure 10. Lower (Valve Plug to Seat Ring) and Upper (C-seal Plug Seal to Cage) Seating Surfaces

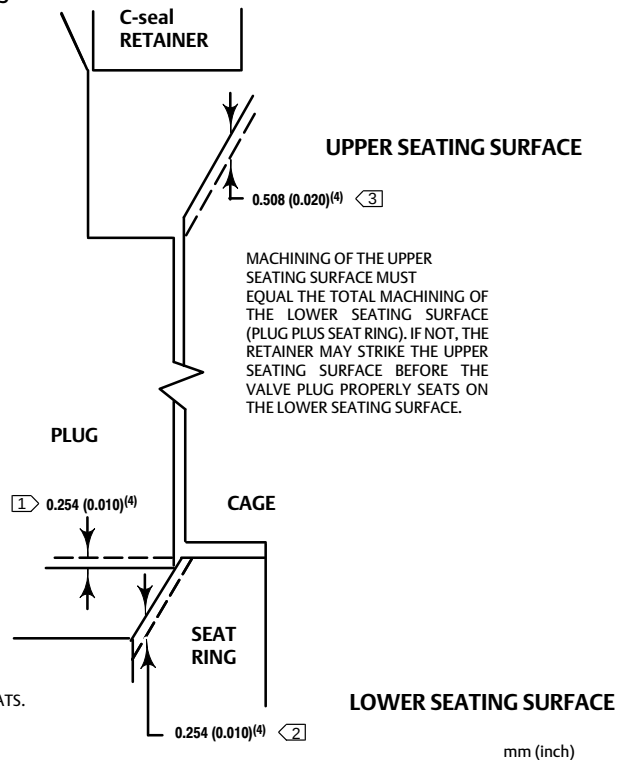


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NOTE:

1 UPPER SEATING SURFACE IS THE AREA OF CONTACT BETWEEN THE C-seal METAL PLUG SEAL AND THE CAGE.

Figure 11. Example of Machining the Lower (Valve Plug to Seat Ring) and Upper (C-seal Plug Seal to Cage) Seating Surfaces



NOTE:

- 1 REMOVAL OF 0.254 mm (0.010 inch) FROM THE VALVE PLUG
PLUS 2 REMOVAL OF 0.254 mm (0.010 inch) FROM THE SEAT RING
MUST EQUAL 3 REMOVAL OF 0.508 mm (0.020 inch) FROM THE
UPPER SEATING SURFACE IN THE CAGE
4. THESE VALUES ARE FOR EXAMPLE ONLY. REMOVE ONLY THE
MINIMUM AMOUNT OF MATERIAL REQUIRED TO REFURBISH THE SEATS.

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mm (inch)

- Remove the plug/retainer assembly (with C-seal plug seal), cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section of this manual.
- Locate the staked thread on top of the valve plug (figure 9). The staked thread secures the retainer. Use a drill with a 1/8 inch bit to drill out the staked area of the thread. Drill approximately 3 mm (1/8 inch) into the metal to remove the staking.
- Locate the break between sections of the piston ring(s). Using an appropriate tool such as a flat-blade screwdriver, carefully pry out the piston ring(s) from the groove(s) in the C-seal retainer.

5. After removing the piston ring(s), locate the 1/4-inch diameter hole in the groove. In a retainer with two piston ring grooves, the hole will be found in the upper groove.
6. Select an appropriate tool such as a punch and place the tip of the tool into the hole with the body of the tool held tangent to the outside diameter of the retainer. Strike the tool with a hammer to rotate the retainer and free it from the valve plug. Remove the retainer from the plug.
7. Use an appropriate tool such as a flat-blade screwdriver to pry the C-seal plug seal off the plug. Use caution to avoid scratches or other damage to the sealing surfaces where the C-seal plug seal makes contact with the valve plug (figure 10).
8. Inspect the lower seating surface where the valve plug contacts the seat ring for wear or damage which would prevent proper operation of the valve. Also, inspect the upper seating surface inside the cage where the C-seal plug seal contacts the cage, and inspect the sealing surface where the C-seal plug seal makes contact with the plug (figure 10).
9. Replace or repair trim parts according to the following procedure for Lapping Metal Seats, Remachining Metal Seats, or other valve plug maintenance procedures as appropriate.

Lapping Metal Seats (C-seal Constructions)

Before installing a new C-seal plug seal, lap the lower seating surface (valve plug to seat ring, figure 10) following appropriate procedures in the Lapping Metal Seats section of this manual.

Remachining Metal Seats (C-seal Constructions)

See figure 11. A valve plug with a C-seal metal plug seal features two seating surfaces. One seating surface is found where the valve plug contacts the seat ring. The second seating surface is found where the C-seal plug seal contacts the upper seating surface in the cage. If you machine the seats on the seat ring and/or plug, you must machine an equal dimension from the seating area in the cage.

CAUTION

If metal is removed from the seat ring and plug and a corresponding amount is not removed from the cage seating area, the C-seal plug seal will be crushed as the valve closes and the C-seal retainer will strike the seating area of the cage, preventing the valve from closing.

Trim Replacement (C-seal Constructions)

1. Apply a suitable high-temperature lubricant to the inside diameter of the C-seal plug seal. Also, lubricate the outside diameter of the valve plug where the C-seal plug seal must be pressed into the proper sealing position (figure 6).
2. Orient the C-seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the C-seal plug seal must face up in a valve with flow-up construction (figure 6).
 - The open interior of the C-seal plug seal must face down in a valve with flow-down construction (figure 6).

Note

An installation tool must be used to properly position the C-seal plug seal on the valve plug. A tool is available as a Fisher spare part or a tool could be manufactured following the dimensions given in figure 7.

3. Place the C-seal plug seal over the top of the valve plug and press it onto the plug using the installation tool. Carefully press the C-seal plug seal onto the plug until the installation tool contacts the horizontal reference surface of the valve plug (figure 8).

4. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the C-seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
5. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 9) to secure the C-seal retainer.
6. Replace the piston ring(s) following instructions in the Trim Replacement section of this manual.
7. Return the seat ring, cage, plug/retainer assembly, and stem to the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section of this manual.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the C-seal plug seal and contact the seat ring. You can correctly seat the valve plug by applying the full actuator load. This force will adequately drive the valve plug to the seat ring, thus giving the C-seal plug seal a predetermined permanent set. Once this is done, the plug/retainer assembly, the cage, and the seat ring become a matched set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

ENVIRO-SEAL Bellows Seal Bonnet

Replacing a Plain or Extension Bonnet with an ENVIRO-SEAL Bellows Seal Bonnet (Stem/Bellows Assembly)

1. Remove the actuator and bonnet according to steps 1 through 5 of the Replacing Packing procedure in the Maintenance section.
2. Lift out the cage.
3. Remove and discard the existing bonnet gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

Note

The ENVIRO-SEAL stem/bellows assembly for easy-e valves is available only with a threaded and drilled plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed.

4. Inspect the existing valve plug. If the plug is in good condition, it can be reused with the new ENVIRO-SEAL stem/bellows assembly. To remove the existing valve plug from the stem, first, place the existing plug stem assembly in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 8).
5. Then, reverse the plug stem assembly in the soft-jaw chuck or vise. Grip the valve stem in an appropriate place and unscrew the existing plug from the valve stem.

CAUTION

When installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

Note

The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

6. To attach the valve plug to the stem of the new ENVIRO-SEAL stem/bellows assembly, it is necessary to first attach the plug to the adaptor (key 24). Locate the adaptor. Notice that a hole has not been drilled in the threads where the plug screws onto the adaptor. Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor. Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Select the proper size of drill bit and drill through the adaptor using the hole in the valve plug as a guide. Remove any metal chips or burrs and drive in a new pin (key 8, figures 19, 20, and 21) to lock the plug/adaptor assembly together.
8. Attach the plug/adaptor assembly to the ENVIRO-SEAL stem/bellows assembly by first securing the stem/bellows assembly in a soft-jaw chuck or other type of vise so that the jaws of the chuck or vise grip the flats of the stem extending out of the top of the bellows shroud. Screw the valve plug/adaptor assembly onto the valve stem. Tighten the plug/adaptor assembly until it is snug. Then turn the plug/adaptor assembly to the next pin hole in the valve stem. Drive in new pin (key 36, figure 18) to lock the assembly.
9. Inspect the seat ring (key 9). Replace, if necessary.

Table 6. Recommended Torque for ENVIRO-SEAL Bellows Seal Bonnet Packing Flange Nuts

VALVE SIZE, NPS	VALVE STEM DIAMETER THROUGH PACKING	MINIMUM TORQUE		MAXIMUM TORQUE	
		N•m	Lbf•in	N•m	Lbf•in
1/2 - 2	1/2	2	22	4	33
3 - 8	1	5	44	8	67

10. Place a new gasket (key 10) into the valve body in place of the bonnet gasket. Install the new stem/bellows assembly with valve plug/adaptor by placing it into the valve body on top of the new bellows gasket.
11. Place a new gasket (key 22) over the stem/bellows assembly. Place the new ENVIRO-SEAL bonnet over the stem/bellows assembly.

Note

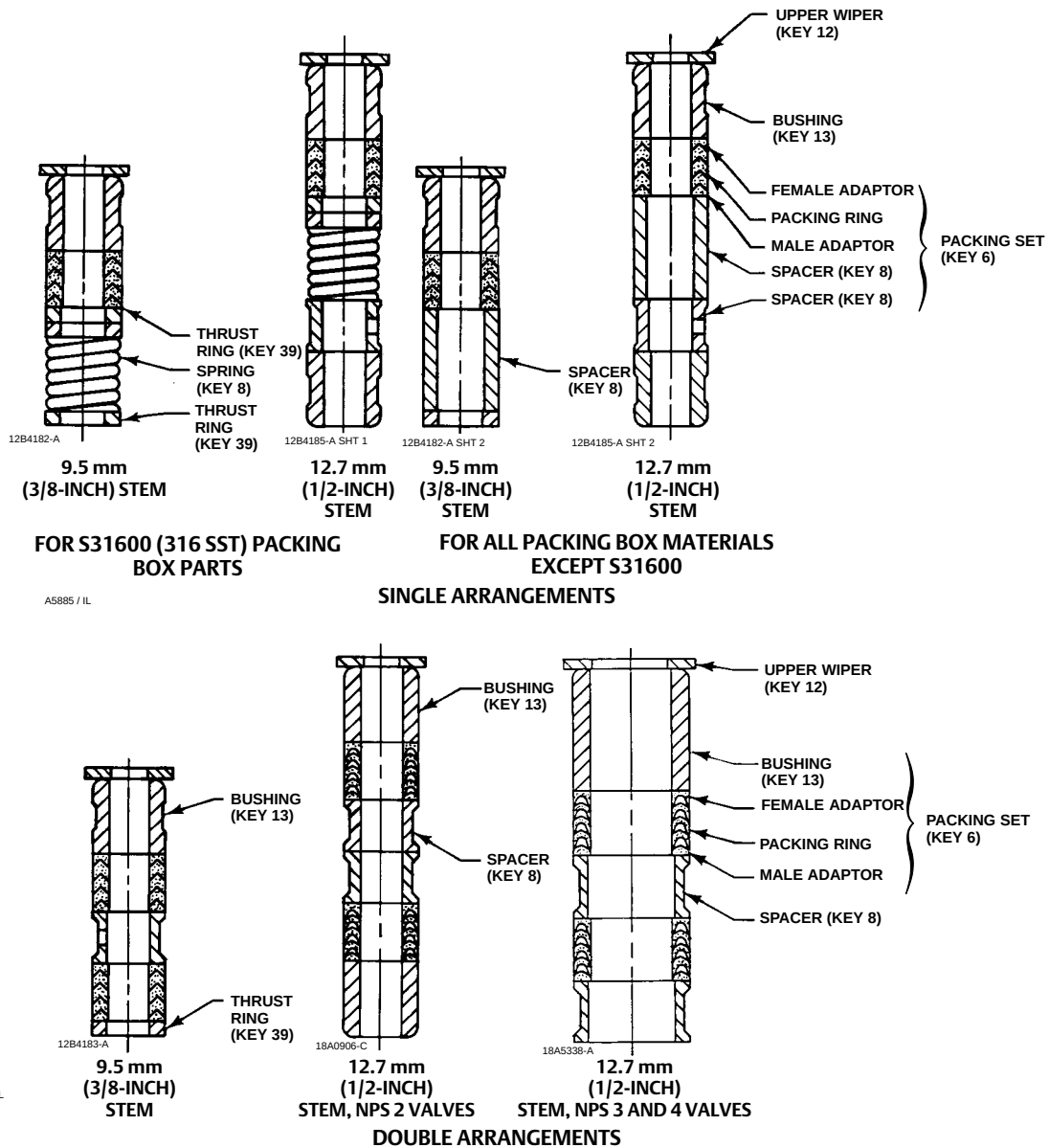
Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) immediately if a discrepancy between actual parts and approved parts is suspected.

12. Properly lubricate the bonnet stud bolts. Install and tighten the bonnet hex nuts to the proper torque.
13. Install the new packing and the metal packing box parts according to the appropriate arrangement in figure 12 or 13.

Figure 12. PTFE Packing Arrangement for Use in ENVIRO-SEAL Bellows Seal Bonnets



14. Install the packing flange. Properly lubricate the packing flange stud bolts and the faces of the packing flange nuts.

For **graphite packing**, tighten the packing flange nuts to the maximum recommended torque shown in table 6. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 6.

For **other packing types**, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 6. Then, tighten the remaining flange nut until the packing flange is level and at a 90-degree angle to the valve stem.

15. Install the travel indicator parts and stem locknuts; mount the actuator on the valve body according to the procedure in the appropriate actuator instruction manual.

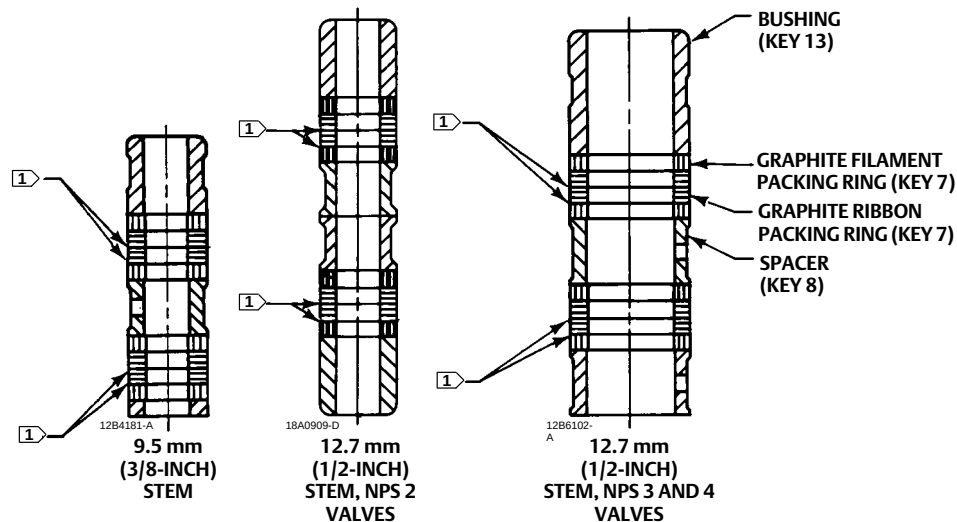
Replacement of an Installed ENVIRO-SEAL Bellows Seal Bonnet (Stem/Bellows Assembly)

1. Remove the actuator and bonnet according to steps 1 through 5 of the Replacing Packing procedure of the Maintenance section.
2. Lift out the cage. Remove and discard the existing bonnet gasket and bellows gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

Note

The ENVIRO-SEAL stem/bellows assembly for easy-e valves is available only with a threaded and pinned plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed. If the existing valve plug is reused, and the adaptor is in good condition, it may be reused also. However, never reuse an old adaptor with a new valve plug. Using an old adaptor with a new valve plug requires drilling a new pin hole in the adaptor. This drilling weakens the adaptor and may cause failure in service. However, a used valve plug may be reused with a new adaptor.

Figure 13. Double Graphite Ribbon/Filament Arrangements for Use in ENVIRO-SEAL Bellows Seal Bonnets



A5887

NOTES:

- 1 > 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS;
USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

3. Inspect the existing valve plug and adaptor. If they are in good condition, they can be reused with the new stem/bellows assembly and they do not need to be separated.

CAUTION

When removing/installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

Note

The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

4. If the valve plug and adaptor are not in good condition and must be replaced, the valve plug/adaptor assembly must first be removed from the stem/bellows assembly and then the valve plug removed from the adaptor. First, place the stem/bellows assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 8, figure 19, 20, or 21). Drive out the pin (key 36, figure 18).
5. Then, reverse the stem/bellows and plug/adaptor assembly in the soft-jaw chuck or vise. Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the plug/adaptor assembly from the stem/bellows assembly. Unscrew the valve plug from the adaptor.
6. To attach either the existing or a new valve plug to the stem of the new ENVIRO-SEAL stem/bellows assembly, first attach the plug to the adaptor (if the valve plug was removed from the adaptor) as follows:
 - a. Locate the adaptor. Notice that a hole has not been drilled in the new adaptor threads where the plug screws onto the adaptor.
 - b. Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor.
 - c. Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Complete the installation by following steps 7 through 15 of the ENVIRO-SEAL Bellows Seal Bonnet installation instructions given above.

Purging the ENVIRO-SEAL Bellows Seal Bonnet

The ENVIRO-SEAL bellows seal bonnet has been designed so that it can be purged or leak tested. Refer to figure 18 for an illustration of an ENVIRO-SEAL bellows seal bonnet. Perform the following steps for purging or leak testing.

1. Remove the two diametrically opposed pipe plugs (key 16).
2. Connect a purging fluid to one of the pipe plug connections.
3. Install appropriate piping or tubing in the other pipe plug connection to pipe away the purging fluid or to make a connection to an analyzer for leak testing.
4. When purging or leak testing has been completed, remove the piping or tubing and reinstall the pipe plugs (key 16).

Parts Ordering

Each valve body-bonnet assembly is assigned a serial number which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and to the 11-character part number for each part required from the following Parts Kit or Parts List information.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

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Parts Kits

Note

Kits do not apply to N10276, N08020, or N04400 trims.

Gasket Kits

Gasket Kits (includes keys 10, 12, 13, and 51; plus 11, 14, and 20 on some restricted capacity valves)

DESCRIPTION	Standard Trim Cage Whisper Trim I Cage Cavitrol III - 1 Stage Cage	Cavitrol III - 2 Stage Cage Whisper Trim III Cage WhisperFlo Cage
	-198 to 593° C (-325 to 1100°F)	-198 to 593° C (-325 to 1100°F)
Full Capacity Valves	Part Number	Part Number
NPS 1 & 1-1/4 (NPS 1 EAD)	RGASKETX162	RGASKETX422
NPS 1-1/2 (NPS 2 EAD)	RGASKETX172	RGASKETX432
NPS 2	RGASKETX182	RGASKETX442
NPS 2-1/2 (NPS 3 EAD)	RGASKETX192	RGASKETX452
NPS 3 (NPS 4 EAD)	RGASKETX202	RGASKETX462
NPS 4 (NPS 6 EAD)	RGASKETX212	RGASKETX472
NPS 6	RGASKETX222	RGASKETX482
NPS 8	RGASKETX232	10A3265X152
Restricted Capacity Valves		
NPS 1-1/2 x 1 (NPS 2 x 1 EAD)	RGASKETX242	---
NPS 2 x 1	RGASKETX252	---
NPS 2-1/2 x 1-1/2 (NPS 3 x 1-1/2 EAD)	RGASKETX262	---
NPS 3 x 2 (NPS 4 x 2 EAD)	RGASKETX272	---
NPS 4 x 2-1/2 (NPS 6 x 2-1/2 EAD)	RGASKETX282	---

Packing Kits

Standard Packing Repair Kits (Non Live-Loaded)

REPAIR KIT MATERIAL	STEM DIAMETER, mm (INCH) YOKE BOSS DIAMETER, mm (INCH)				
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
	Part Number				
PTFE (Contains keys 6, 8, 10, 11, and 12)	RPACKX00012	RPACKX00022	RPACKX00032	RPACKX00342	RPACKX00352
Double PTFE (Contains keys 6, 8, 11, and 12)	RPACKX00042	RPACKX00052	RPACKX00062	RPACKX00362	RPACKX00372
PTFE/Composition (Contains keys 7, 8, 11, and 12)	RPACKX00072	RPACKX00082	RPACKX00092	---	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00102	RPACKX00112	RPACKX00122	---	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], and 11)	---	---	---	RPACKX00532	RPACKX00542
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring])	RPACKX00132	RPACKX00142	RPACKX00152	---	---
Double Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00162	RPACKX00172	RPACKX00182	---	---

Figure 14. Typical HIGH-SEAL Graphite ULF Packing System

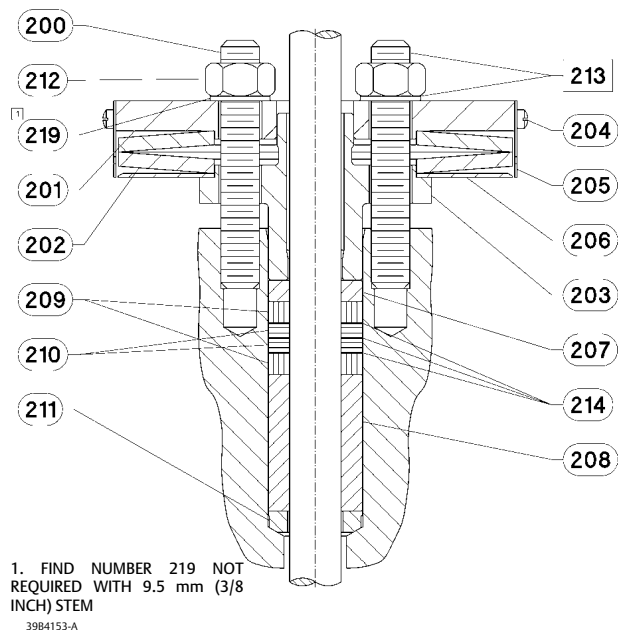


Figure 16. Typical ENVIRO-SEAL Packing System with Graphite ULF Packing

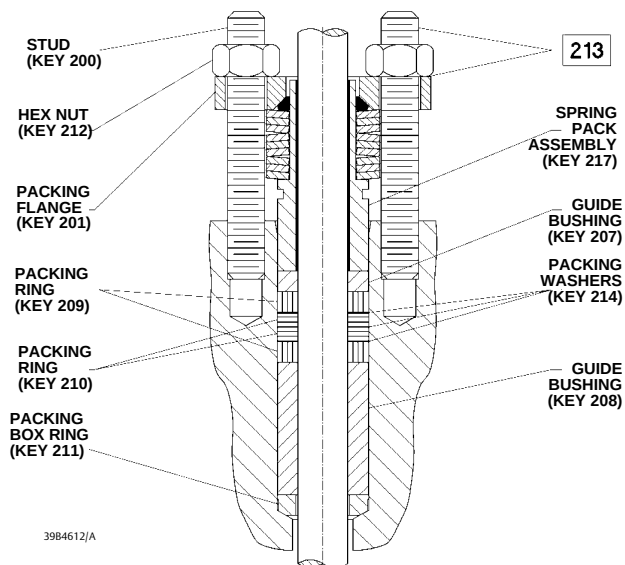


Figure 15. Typical ENVIRO-SEAL Packing System with PTFE Packing

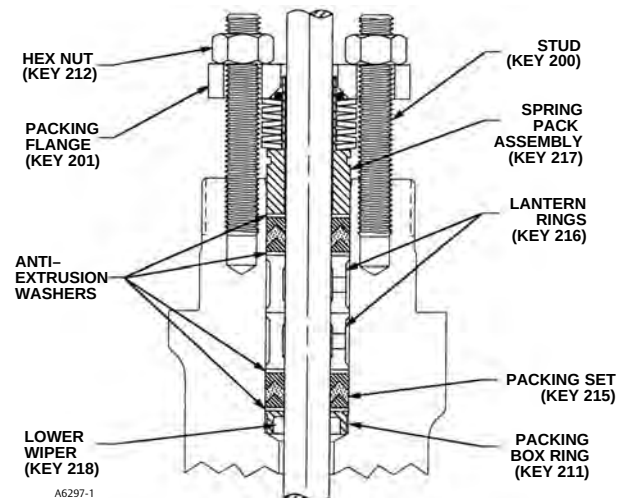
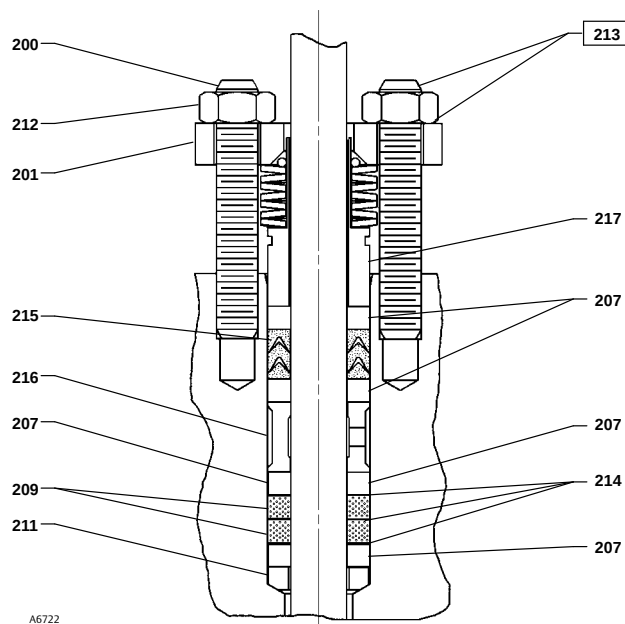


Figure 17. Typical ENVIRO-SEAL Packing System with Duplex Packing



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ENVIRO-SEAL Packing Retrofit Kits

Retrofit kits include parts to convert valves with existing standard bonnets to the ENVIRO-SEAL packing box construction. Refer to figure 15 for key numbers for PTFE packing, figure 16 for key numbers for Graphite ULF packing, and figure 17 for key numbers for duplex packing. PTFE kits include keys 200, 201, 211, 212, 214, 215, 217, 218, tag, and cable tie. Graphite ULF kits include keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 216, 217, tag, and cable tie. Duplex kits include keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, and cable tie.

Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of this packing kit.

For part numbers of individual components, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#).

ENVIRO-SEAL Packing Retrofit Kits

PACKING MATERIAL	STEM DIAMETER, mm (INCH) YOKE BOSS DIAMETER, mm (INCH)				
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
	Part Number				
Double PTFE	RPACKXRT012	RPACKXRT022	RPACKXRT032	RPACKXRT042	RPACKXRT052
Graphite ULF	RPACKXRT262	RPACKXRT272	RPACKXRT282	RPACKXRT292	RPACKXRT302
Duplex	RPACKXRT212	RPACKXRT222	RPACKXRT232	RPACKXRT242	RPACKXRT252

ENVIRO-SEAL Packing Repair Kits

Repair kits include parts to replace the "soft" packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits. Refer to figure 15 for key numbers for PTFE packing, figure 16 for key numbers for Graphite ULF packing, and figure 17 for key numbers for duplex packing. PTFE repair kits include keys 214, 215, and 218. Graphite ULF repair kits include keys 207, 208, 209, 210, and 214. Duplex repair kits include keys 207, 209, 214, and 215.

Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of this packing kit.

For part numbers of individual components, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#).

ENVIRO-SEAL Packing Repair Kits

PACKING MATERIAL	STEM DIAMETER, mm (INCH) YOKE BOSS DIAMETER, mm (INCH)				
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
	Part Number				
Double PTFE (contains keys 214, 215, & 218)	RPACKX00192	RPACKX00202	RPACKX00212	RPACKX00222	RPACKX00232
Graphite ULF (contains keys 207, 208, 209, 210, and 214)	RPACKX00592	RPACKX00602	RPACKX00612	RPACKX00622	RPACKX00632
Duplex (contains keys 207, 209, 214, and 215)	RPACKX00292	RPACKX00302	RPACKX00312	RPACKX00322	RPACKX00332

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easy-e Low-e Bonnet Repair Kits

Kit consists of plain bonnet, Graphite / Inconel gasket set, ENVIRO-SEAL packing retro-fit kit, packing flange, packing flange studs and nuts. New stem is not included.

Bonnet Material	Packing Type	Valve Size, NPS	Stem Size	Part Number
WCC ⁽¹⁾	ENVIRO-SEAL PTFE	0.5-1.25	3/8"	RLEPBNTX012
		1.5	3/8"	RLEPBNTX022
		2	1/2"	RLEPBNTX032
		2.5	1/2"	RLEPBNTX042
		3	1/2"	RLEPBNTX052
		4	1/2"	RLEPBNTX062
		6	3/4"	RLEPBNTX072
	ENVIRO-SEAL Graphite ULF	0.5-1.25	3/8"	RLEPBNTX152
		1.5	3/8"	RLEPBNTX162
		2	1/2"	RLEPBNTX172
		2.5	1/2"	RLEPBNTX182
		3	1/2"	RLEPBNTX192
		4	1/2"	RLEPBNTX202
		6	3/4"	RLEPBNTX212
SST ⁽¹⁾	ENVIRO-SEAL PTFE	0.5-1.25	3/8"	RLEPBNTX082
		1.5	3/8"	RLEPBNTX092
		2	1/2"	RLEPBNTX102
		2.5	1/2"	RLEPBNTX112
		3	1/2"	RLEPBNTX122
		4	1/2"	RLEPBNTX132
	ENVIRO-SEAL Graphite ULF	0.5-1.25	3/8"	RLEPBNTX222
		1.5	3/8"	RLEPBNTX232
		2	1/2"	RLEPBNTX242
		2.5	1/2"	RLEPBNTX252
		3	1/2"	RLEPBNTX262
		4	1/2"	RLEPBNTX272
WCC	ENVIRO-SEAL Duplex	0.5-1.25	3/8"	RLEPBNTX292
		1.5	3/8"	RLEPBNTX302
		2	1/2"	RLEPBNTX322
		2.5	1/2"	RLEPBNTX332
		3	1/2"	RLEPBNTX342
		4	1/2"	RLEPBNTX352
		6	3/4"	RLEPBNTX362
SST	ENVIRO-SEAL Duplex	0.5-1.25	3/8"	RLEPBNTX372
		1.5	3/8"	RLEPBNTX392
		2	1/2"	RLEPBNTX412
		2.5	1/2"	RLEPBNTX422
		3	1/2"	RLEPBNTX432
		4	3/4"	RLEPBNTX442

1. Compliant with NACE MR0175-2003 and prior, NACE MR0175 / ISO 15156 (all revisions), and NACE MR0103 (all revisions).

Parts List

Note

Contact your [Emerson sales office](#) for part numbers.

Bonnet (figure 18)

Key Description

- | | |
|----|---|
| 1 | Bonnet
If you need a bonnet and/or an ENVIRO-SEAL bellows seal bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material. |
| 2 | Extension Bonnet Baffle |
| 3 | Packing Flange |
| 3 | ENVIRO-SEAL bellows seal packing flange |
| 4 | Packing Flange Stud |
| 4 | ENVIRO-SEAL bellows seal stud bolt |
| 5 | Packing Flange Nut |
| 5 | ENVIRO-SEAL bellows seal packing flange nut |
| 6* | Packing set |
| 6* | ENVIRO-SEAL bellows seal packing set |
| 7* | Packing Ring |
| 7* | ENVIRO-SEAL bellows seal packing ring (4 req'd) |
| 7* | ENVIRO-SEAL bellows seal packing ring (4 req'd) |

Key Description

- | | |
|-----|--|
| 8 | Spring |
| 8 | Lantern Ring |
| 8 | ENVIRO-SEAL bellows seal spring |
| 8 | ENVIRO-SEAL bellows seal spacer |
| 10 | Special Washer |
| 11* | Packing Box Ring |
| 12* | Upper Wiper |
| 12* | ENVIRO-SEAL bellows seal upper wiper |
| 13 | Packing Follower |
| 13* | ENVIRO-SEAL bellows seal bushing |
| 13* | ENVIRO-SEAL bellows seal bushing/liner |
| 14 | Pipe Plug, for 1/4 NPT tapping in packing box |
| 14 | Lubricator |
| 14 | Lubricator/Isolating Valve |
| 15 | Yoke Locknut |
| 15 | ENVIRO-SEAL bellows seal yoke locknut |
| 16 | Pipe Plug for 1/2 NPT tapped extension bonnets |
| 16 | ENVIRO-SEAL bellows seal pipe plug |
| 20* | ENVIRO-SEAL bellows seal stem/bellows assembly |
| 22* | ENVIRO-SEAL bellows seal bonnet gasket |
| 24 | ENVIRO-SEAL bellows seal adaptor |
| 25 | Cap Screw |
| 26 | Hex Nut |
| 27 | Pipe Nipple for lubricator/isolating valve |
| 28 | Warning Nameplate for ENVIRO-SEAL bellows |
| 29 | Drive Screw for ENVIRO-SEAL bellows |
| 34 | Lubricant, anti-seize (not furnished with valve) |
| 36* | ENVIRO-SEAL bellows seal pin |
| 37 | Warning Tag for ENVIRO-SEAL bellows |
| 38 | Tie for ENVIRO-SEAL bellows |
| 39 | ENVIRO-SEAL bellows seal thrust ring |

Key Description

Valve Body (figures 19-24)

- | | |
|-----|---|
| 1 | Valve Body |
| | If you need a valve body as a replacement part, order by valve size, serial number, and desired material. |
| 2* | Valve Plug |
| 3* | Cage |
| 4 | Cage Adaptor |
| 5 | Seat Ring Adaptor |
| 6* | Piston Ring(s) |
| 7* | Valve Plug Stem |
| 8* | Pin |
| 9* | Seat Ring |
| 9* | EAD liner |
| 10* | Bonnet Gasket |
| 11* | Cage Gasket |
| 12* | Spiral Wound Gasket |
| 13* | Seat Ring Gasket |
| 14* | Adaptor Gasket |
| 15 | Cap Screw |
| 15 | Stud Bolt |
| 16 | Hex Nut |

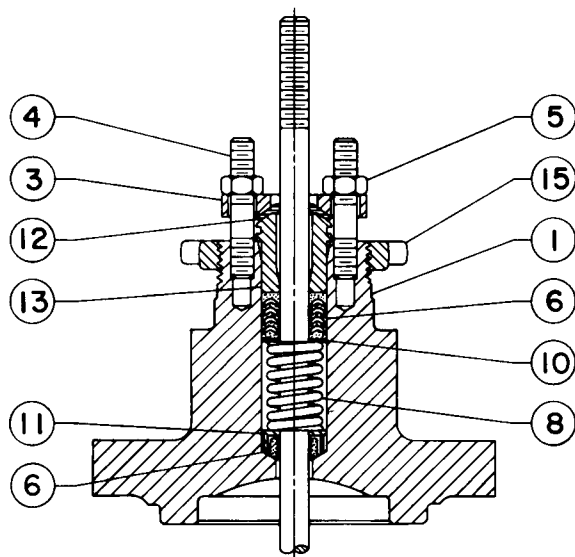
Key Description

- | | |
|-----|--|
| 17 | Pipe Plug, for use in valves with drain tapping only |
| 18 | Flow Direction Arrow |
| 19 | Drive Screw |
| 20* | Adaptor Gasket |
| 26 | Load Ring |
| 27* | Shim |
| 31* | Whisper Trim III Cage Retainer for Levels A3, B3 & C3 (NPS 6 ED only) |
| 31* | Whisper Trim III Cage Retainer & Baffle Ass'y for Level D3 (NPS 6 ED only) |
| 32 | Whisper Trim III Bonnet Spacer |
| 51* | Shim |
| 54 | Wire |

C-seal Trim (figure 6)

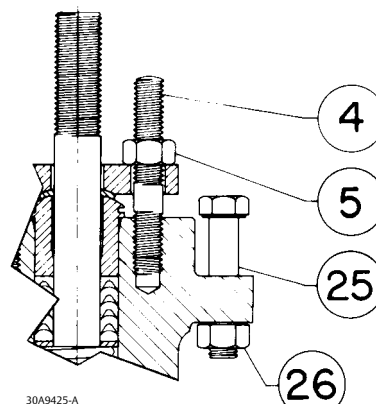
- | | |
|-----|---------------------|
| 2* | Valve Plug/Retainer |
| 3* | Cage |
| 6* | Piston Ring |
| 7* | Valve Plug Stem |
| 9* | Seat Ring |
| 64* | C-seal |

Figure 18. Typical Bonnets



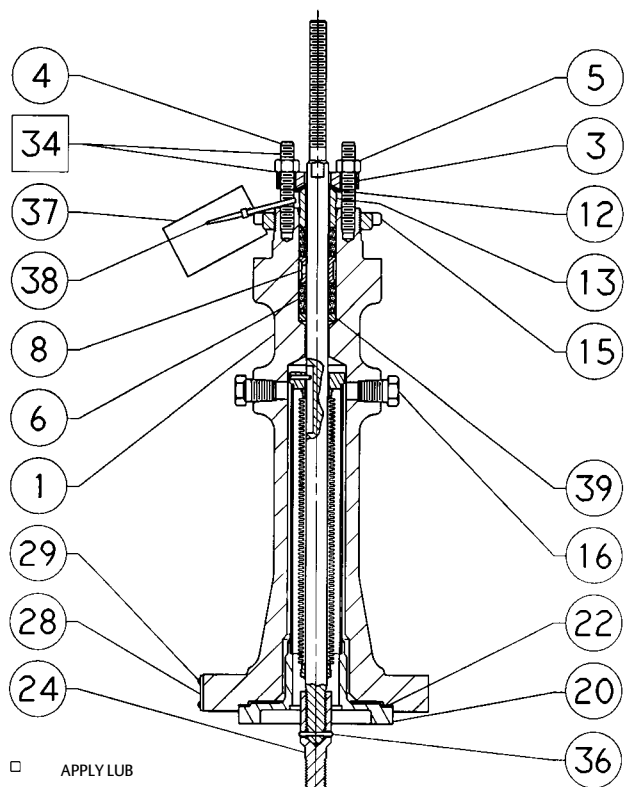
E0201

PLAIN BONNET



30A9425-A

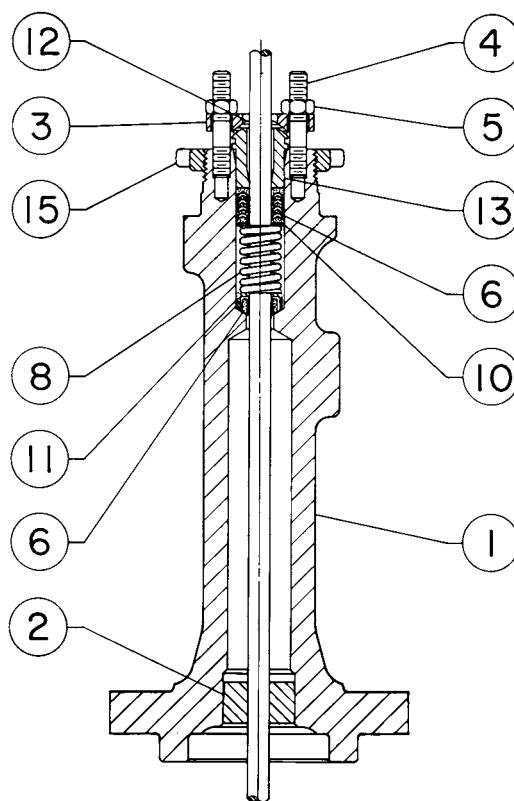
DETAIL OF 127 mm (5-INCH) YOKE
BOSS ACTUATOR BOLTING



□ APPLY LUB

42B3947-A

ENVIRO-SEAL
BELLOWS SEAL BONNET



CU3911-C

STYLE 1 OR 2
EXTENSION BONNET

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Gaskets and Shims Parts Kits⁽⁷⁾

VALVE SIZE, NPS		Standard Trim Cage Whisper Trim I Cage Cavitrol III - 1 Stage Cage	Cavitrol III - 2 Stage Cage Whisper Trim III Cage WhisperFlo Cage	VALVE SIZE, NPS		Standard Trim Cage Whisper Trim I Cage Cavitrol III - 1 Stage Cage	Cavitrol III - 2 Stage Cage Whisper Trim III Cage WhisperFlo Cage
ED	EAD	-198 to 593°C (-325 to 1100°F)		ED	EAD	-198 to 593°C (-325 to 1100°F)	
		Part Number				Part Number	
1 or 1-1/4	1	RGASKETX162 ⁽¹⁾⁽²⁾	RGASKETX422 ⁽³⁾	3	4	RGASKETX202 ⁽¹⁾⁽²⁾	RGASKETX462 ⁽³⁾
1-1/2	2	RGASKETX172 ⁽¹⁾⁽²⁾	RGASKETX432 ⁽³⁾	3 x 2	4 x 2	RGASKETX272 ⁽¹⁾⁽⁴⁾	---
1-1/2 x 1	2 x 1	RGASKETX242 ⁽¹⁾⁽⁵⁾	---	4	6	RGASKETX212 ⁽¹⁾⁽²⁾	RGASKETX472 ⁽³⁾
2	---	RGASKETX182 ⁽²⁾	RGASKETX442 ⁽³⁾	4 x 2-1/2	6 x 2-1/2	RGASKETX282 ⁽¹⁾⁽⁴⁾	---
2 x 1	---	RGASKETX252 ⁽⁴⁾	---	6	---	RGASKETX222 ⁽²⁾	RGASKETX482 ⁽³⁾
2-1/2	3	RGASKETX192 ⁽¹⁾⁽²⁾	RGASKETX452 ⁽³⁾	8	---	RGASKETX232 ⁽⁵⁾	10A3265X152 ⁽⁶⁾
2-1/2 x 1-1/2	3 x 1-1/2	RGASKETX262 ⁽¹⁾⁽⁴⁾	---				

1. Set number good for both ED and EAD valve.
2. Kit includes key 10, 12, 13, 27 or 51
3. Kit includes key 10, qty 2; 12; 13; 51
4. Kit includes key 10, 11, 12, 13, 14, 27 or 51
5. Kit includes key 10 and 13
6. Kit includes key 10, qty 2; and 13
7. See table below for gasket descriptions

Gasket Descriptions

KEY NUMBER	DESCRIPTION	MATERIAL
		FGM -198° to 593° C (-325° to 1100°F)
10	Bonnet Gasket	Graphite/S31600
11	Cage Gasket	
13	Seat Ring or Liner Gasket	
14 or 20	Adapter Gasket	
12	Spiral-Wound Gasket	N06600/Graphite
27 or 51	Shim	S31600 (316 SST)

Actuator Groups (by Type Number)

Group 1 54 mm (2-1/8 inches), 71 mm (2-13/16 inches) or 90 mm (3-9/16 inches) Yoke Boss	Group 100 127 mm (5 inches) Yoke Boss	Group 403 90.5 mm (3-9/16 inches) Yoke Boss
585C 1B 644 & 645 655 657 & 667—76.2 mm (3 inches) travel 1008—71.4 mm (2-13/16 inches) yoke boss	585C 657 1008 Group 101 127 mm (5 inches) Yoke Boss 667	585C 1008

Figure 19. Standard NPS 1 through 6 Fisher ED and EAD Valves

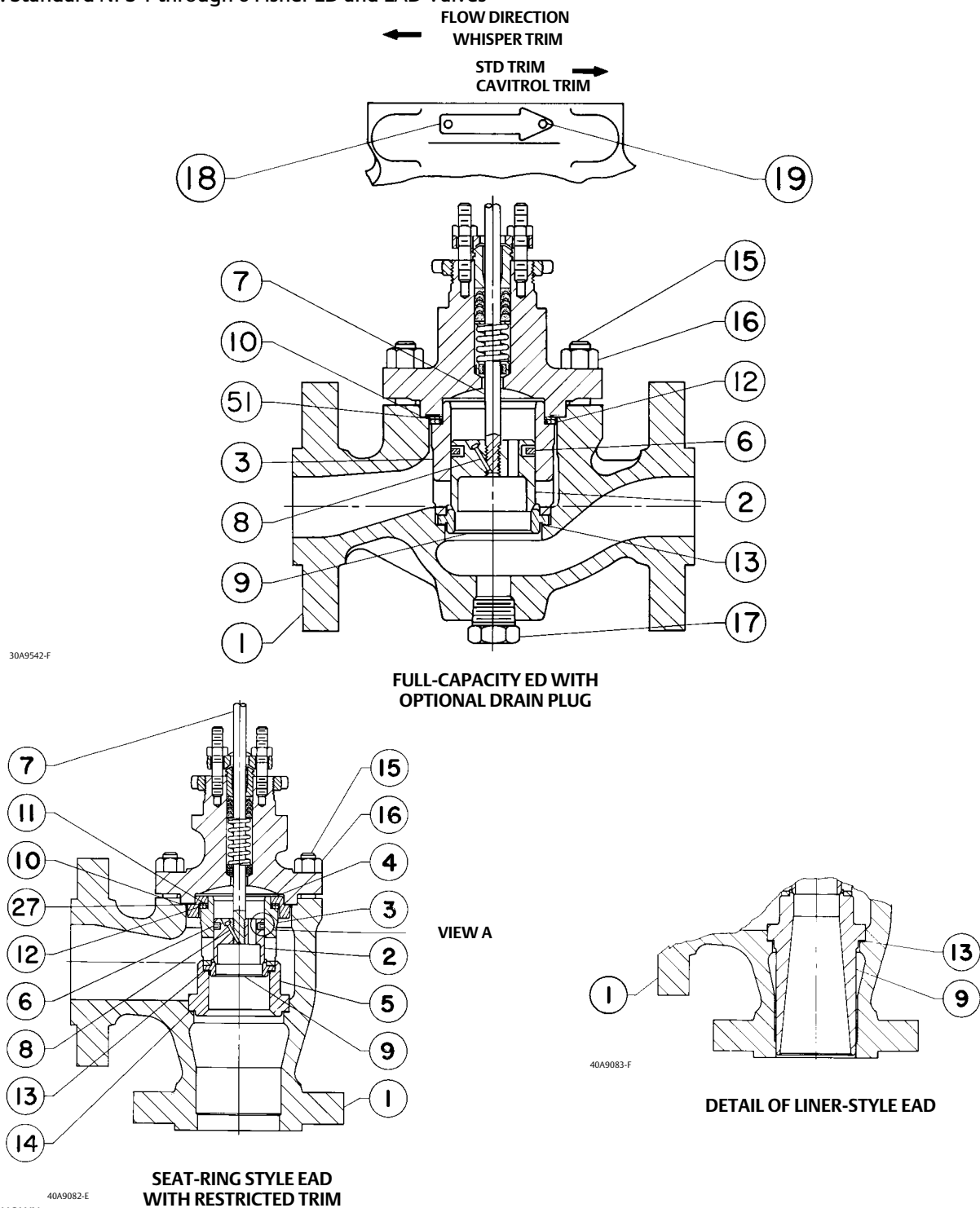


Figure 20. Whisper Trim III Detail with Optional Drain Plug

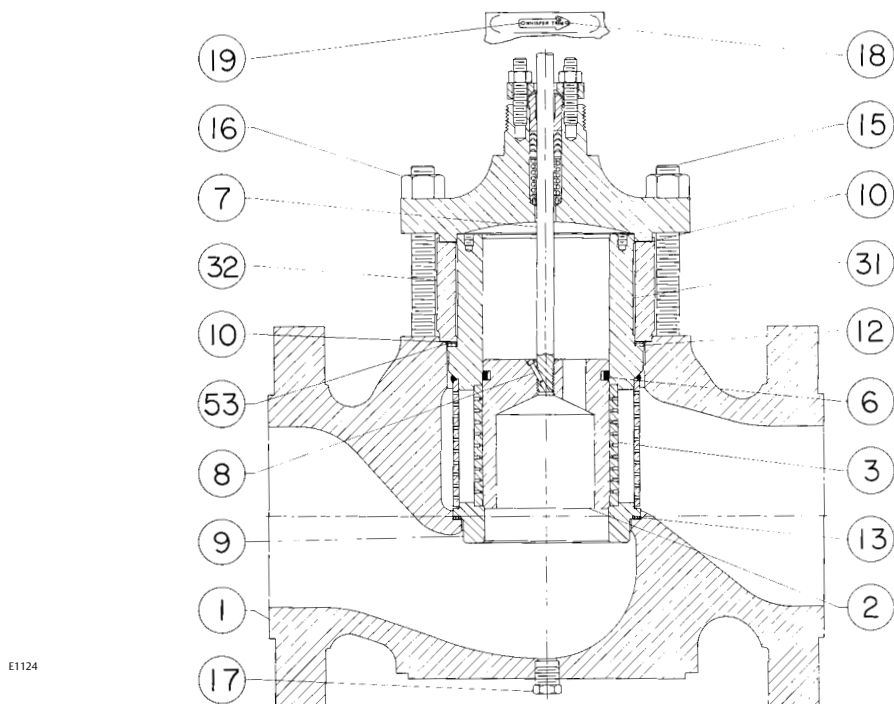


Figure 21. NPS 8 Fisher ED Valve with Graphite Piston Ring and Optional Drain Plug

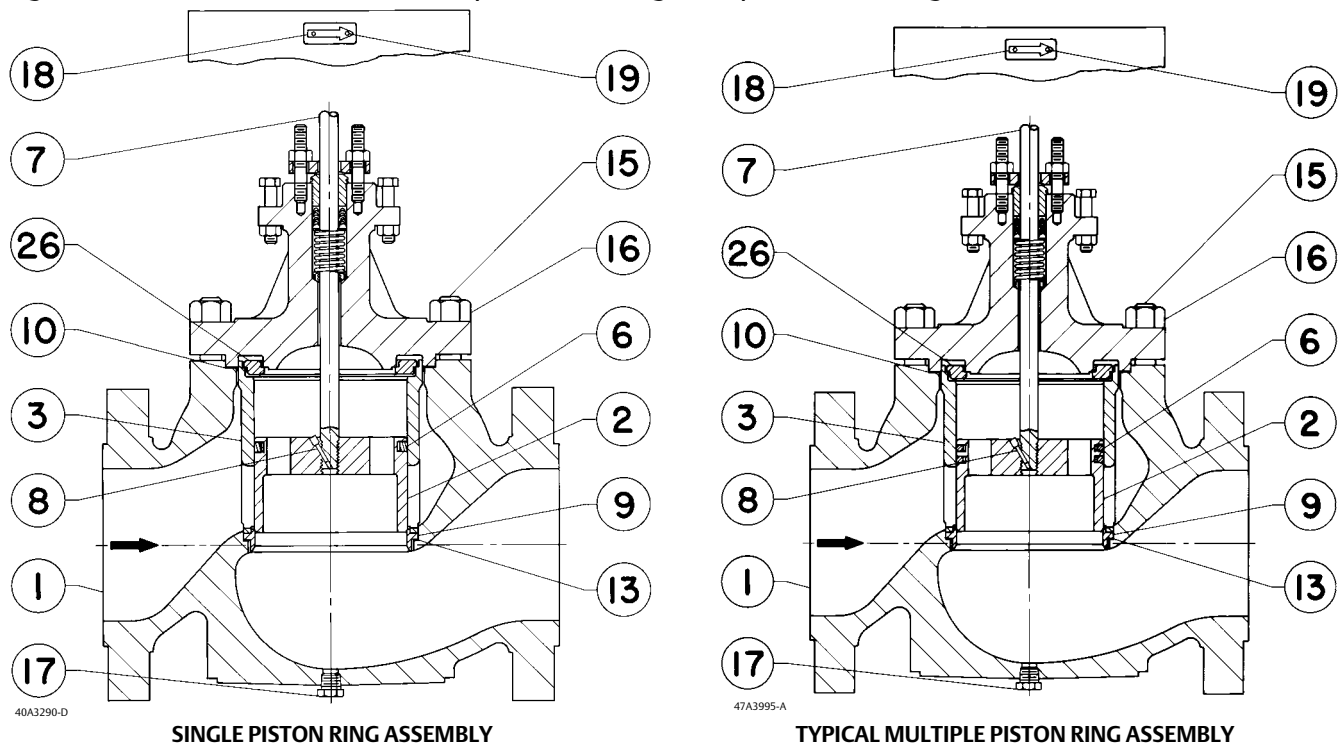
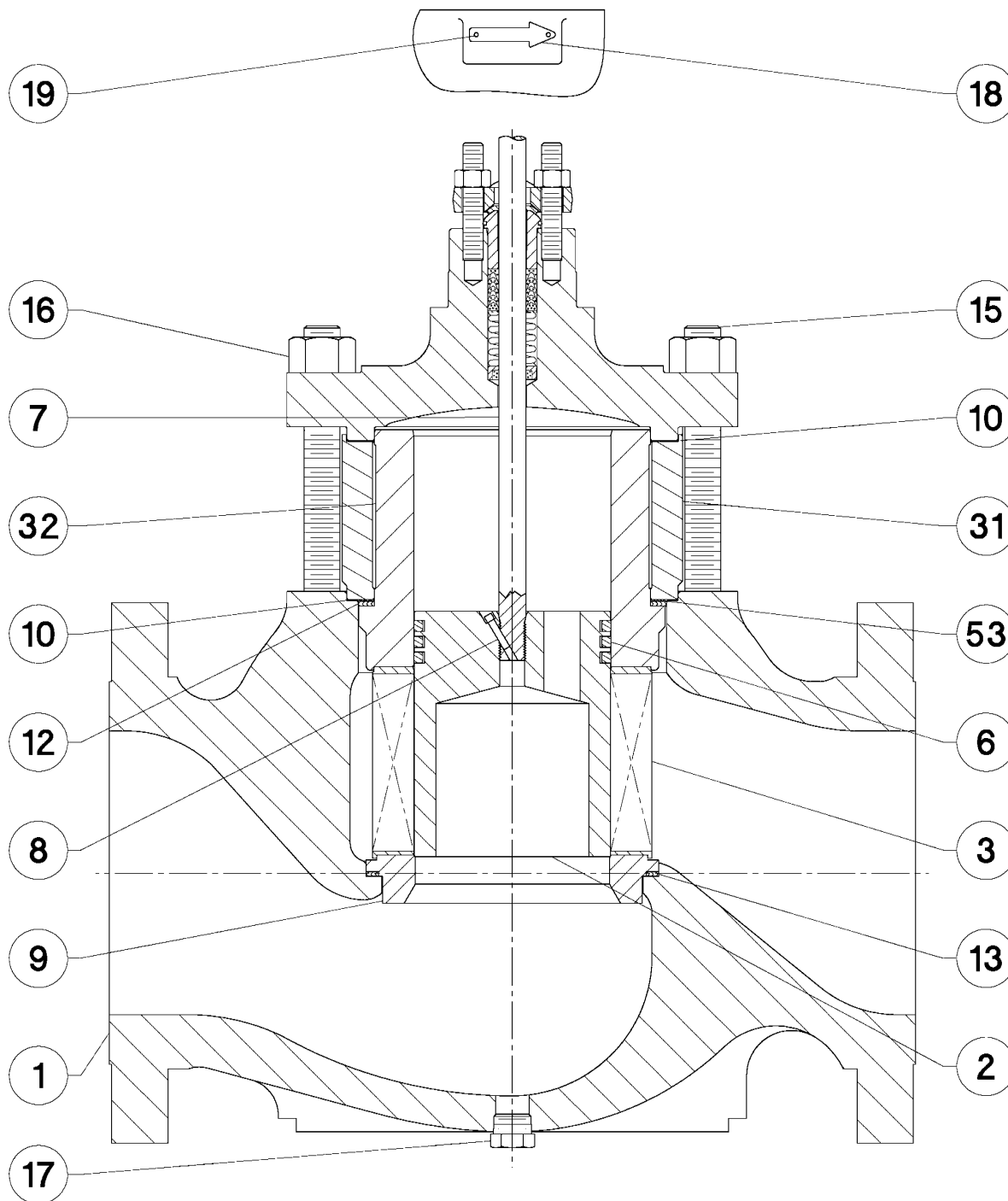
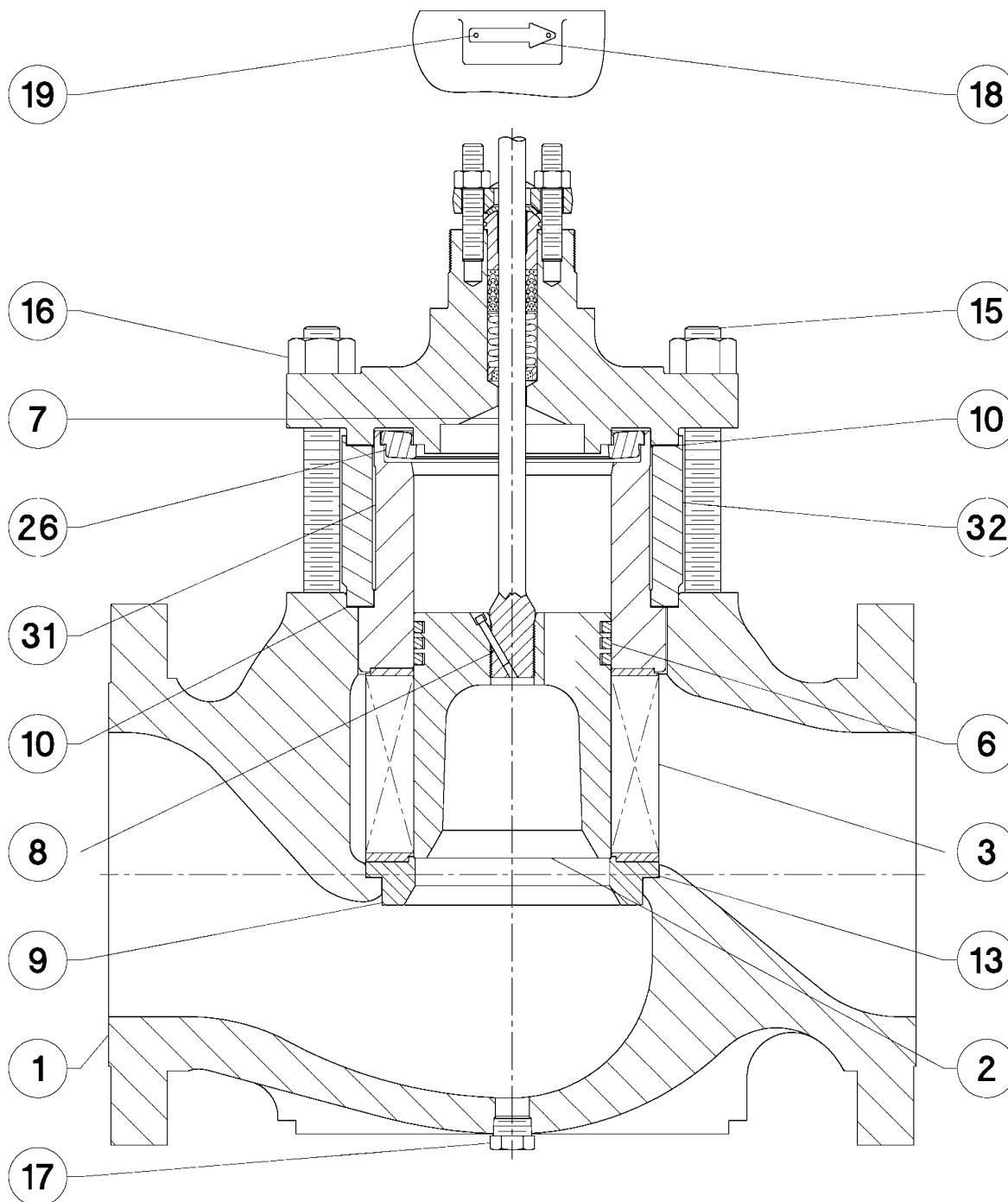


Figure 22. Fisher ED Valve Assembly with WhisperFlo Cage and Optional Drain Plug



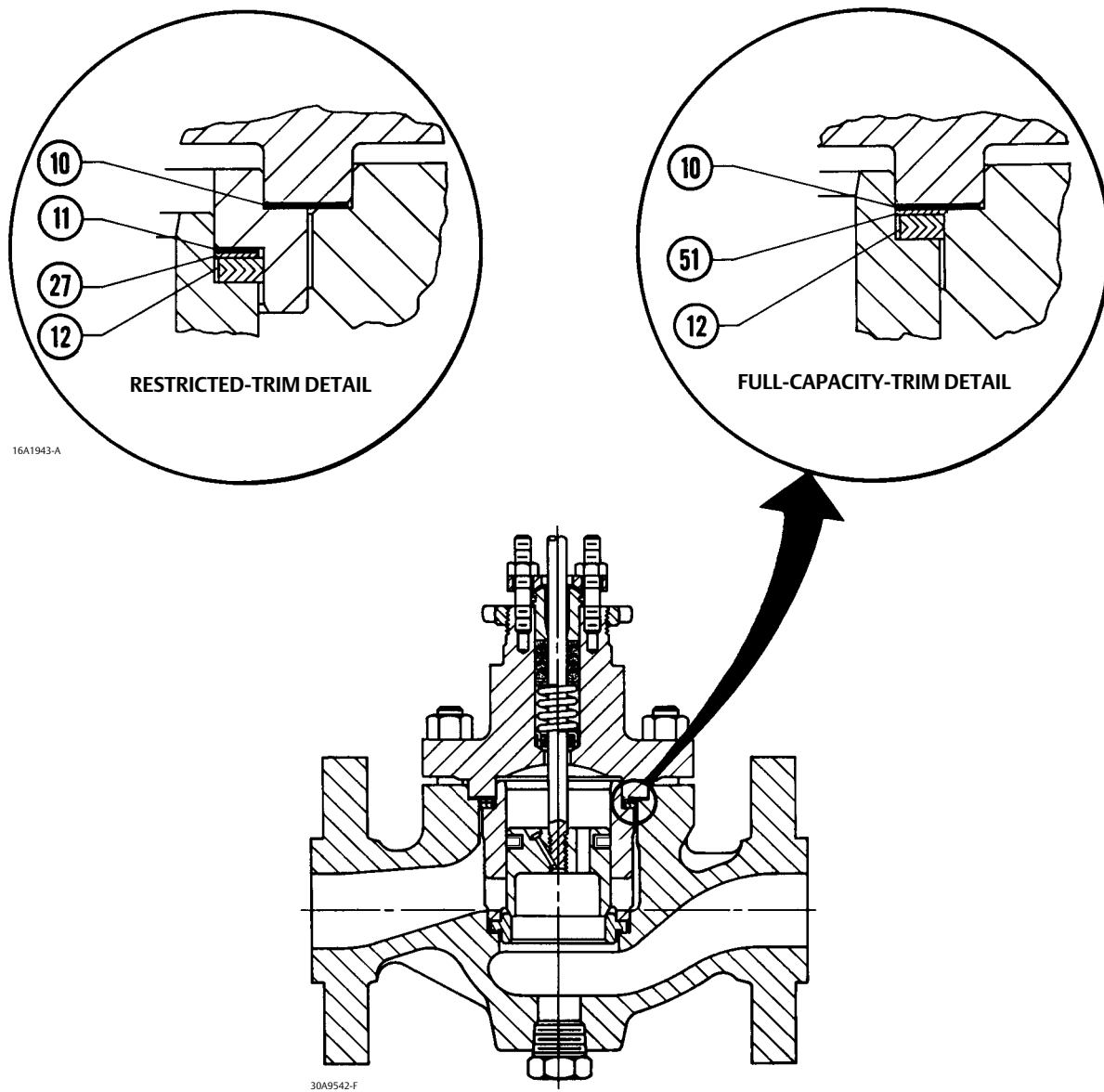
E1125

Figure 23. NPS 8 Fisher ED Valve Assembly with WhisperFlo Cage and Optional Drain Plug



E1123

Figure 24. Gasket Set Detail with Optional Drain Plug



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

ED Valve
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Fisher™ EDR and ETR easy-e™ Valves

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Figure 1. Reverse Acting easy-e Valve with Actuator



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 1 through 4 EDR and ETR valves (see figure 1). The valves are available in CL150 through 600 ratings.

The valves are also available with full-size and restricted-trim designs. Refer to separate manuals for instructions covering the actuator and accessories.

Do not install, operate, or maintain an EDR or ETR valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The EDR and ETR are single-port, globe-style valves that feature cage guiding, a balanced plug design, and push-down-to-open valve plug action. The valve constructions are available with metal-to-metal or metal-to-composition seats. These constructions permit access to the internal trim parts through the bottom flange without removing the actuator from the valve.

Table 1. Specifications

Available Valve Constructions

See table 2

End Connection Styles

Cast Iron Valves

Flanged: CL125 flat-face or 250 raised-face flanges per ASME B16.1

Steel and Stainless Steel Valves

Flanged: CL150, 300, and 600 raised-face or ring-type joint flanges per ASME B16.5

Screwed or Socket Welding: All available ASME B16.11 schedules that are consistent with CL600 per ASME B16.34

Buttwelding: Consistent with ASME B16.25

Maximum Inlet Pressure⁽¹⁾

Cast Iron Valves

Flanged: Consistent with CL125B or 250B pressure-temperature ratings per ASME B16.1

Steel and Stainless Steel Valves

Flanged: Consistent with CL150, 300, and 600⁽²⁾ pressure-temperature ratings per ASME B16.34

Screwed or Welding: Consistent with CL600 pressure-temperature ratings per ASME B16.34

Shutoff Classification

EDR: ANSI/FCI 70-2 and IEC 60534-4 Class II (standard); Class III for valves with a graphite piston ring and 78 mm (3.4375 inch) or larger port diameter

ETR: Standard air test (0.05 mL/minute/psid/inch of port diameter) using air at service pressure drop or 3.5 bar (50 psi), whichever is lower; or ANSI/FCI 70-2 and IEC 60534-4 Class V (optional) with PTFE seats; Class IV or V (optional) with metal seats

Flow Characteristics

Linear (all cages), quick-opening, or equal percentage

Flow Directions

Linear, Quick Opening, or Equal Percentage Cage: Normally up,
Whisper Trim™ I Cage: Always down

Approximate Weights

VALVE SIZE, NPS	WEIGHT	
	kg	Pounds
1 & 1-1/4	14	30
1-1/2	20	45
2	39	67
2-1/2	45	100
3	54	125
4	77	170

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for the valve should not be exceeded.

2. Certain bonnet bolting material selections may require a CL600 easy-e valve assembly to be derated. Contact your [Emerson sales office](#) or Local Business Partner.

Educational Services

For information on available courses for Fisher EDR and ETR valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

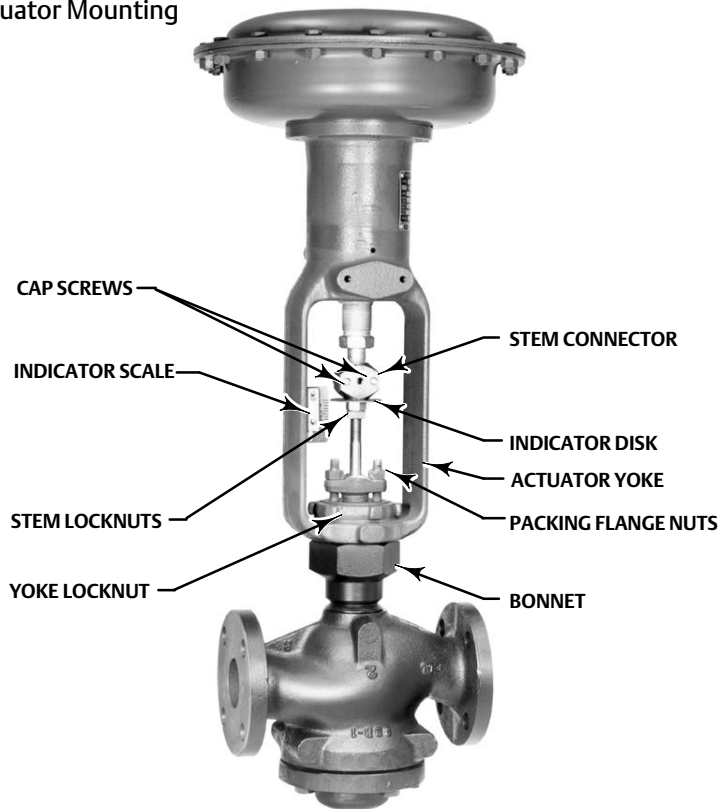
Instruction Manual

D100391X012

EDR and ETR Valves

July 2017

Figure 2. Actuator Mounting



W2080-1

Table 2. Available Valve Constructions

VALVE DESIGN	VALVE SIZE, NPS	VALVE MATERIAL AND END CONNECTION STYLE							
		Carbon Steel, Alloy Steel, or Stainless Steel Valve						Cast Iron Valve	
		Screwed	RF or RTJ Flanged			Butt-welding	Socket Weld	CL125B FF Flanged	CL250B RF Flanged
			CL150	CL300	CL600				
EDR	1, 1-1/2, or 2	X	X	X	X	X	X	X	X
	1-1/4	X	---	---	---	---	---	---	---
	2-1/2, 3, or 4	---	X	X	X	X	---	X	X
ETR	1, 1-1/2, or 2	X	X	X	X	X	X	---	---
	1-1/4	X	---	---	---	---	---	---	---
	2-1/2, 3, or 4	---	---	---	---	---	---	---	---

X = Available Construction

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations.

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given on the valve and actuator nameplates. Use pressure-relieving devices as required by accepted industry, local, state, or Federal codes, and good engineering practices. Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

The valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Because some body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not exceed these conditions without first contacting your [Emerson sales office](#) or Local Business Partner.

Inspect the valve and pipelines to ensure they are not damaged, are clean, and free of foreign material.

1. Before installing the valve, inspect the valve and associated equipment for any damage and any foreign material.
2. Make certain the valve body interior is clean, that pipelines are free of foreign material, and that the valve is oriented so that pipeline flow is in the same direction as the arrow (see figure 2) on the side of the valve.
3. The control valve assembly can be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve body (see figure 2). Other positions may result in uneven valve plug and cage wear, and improper operation. With some valves, the actuator may also need to be supported when it is not vertical. For more information, consult your Emerson sales office or Local Business Partner.
4. Use accepted piping and welding practices when installing the valve in the line. If a post-weld heat treatment process is to be applied to the valve end connections, and the valve has composition or elastomer trim parts, remove the trim to avoid damage to the soft parts.

CAUTION

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Shrunk-fit pieces and threaded connections may loosen. In general, if post weld heat treating is to be performed, all trim parts should be removed. Contact your Emerson sales office or Local Business Partner for additional information.

5. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
6. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual and also see figure 2.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however some readjustment will be required to meet specific service conditions.

Maintenance

WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for trim maintenance, packing maintenance, and packing lubrication. All maintenance operations may be performed with the valve installed in the pipeline.

Note

If the valve has ENVIRO-SEAL™ live-loaded packing installed (figure 8, 9, or 10), see the Fisher instruction manual entitled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) for packing instructions.

Trim Maintenance

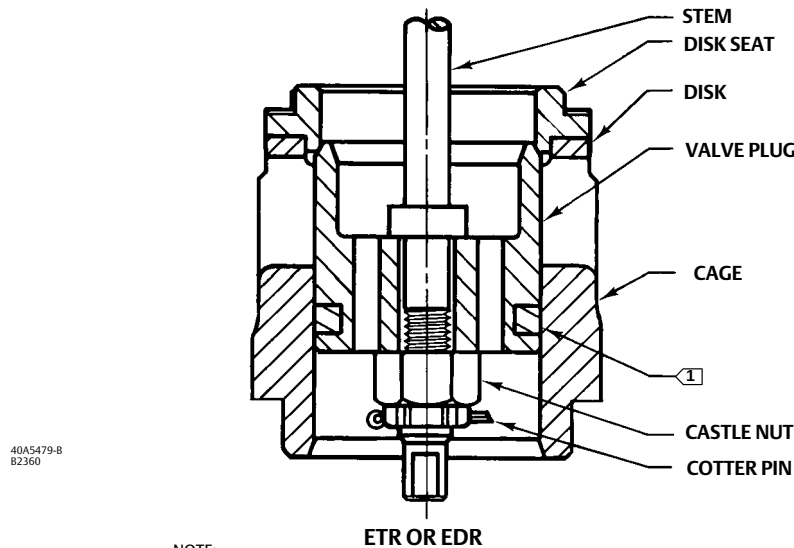
Disassembly

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket upon reassembly. This is necessary to ensure a good gasket seal.

Key number locations are shown in figure 11 or 12 unless otherwise indicated.

Figure 3. Valve Plug Assembly



ETR USES A SEAL RING (KEY 24) AND A BACKUP RING (KEY 25) (SEE FIGURE 11).

CAUTION

Take care when removing the bottom flange (key 31) in the following procedure, to prevent possible product damage from parts unexpectedly falling out of the valve body.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment. When removing the bottom flange (key 31), be careful that the cage and other parts are not damaged by unexpectedly falling out of the valve body. Remove the nuts (key 16) or cap screws from the bottom flange.
2. Removing the valve plug from the valve body, the valve plug can be removed independently of the valve stem by removing the cotter pin and castle nut (keys 30 and 8). Then, slide the valve plug out of the cage (see figure 3).
 - Disconnect the stem connector, and loosen the packing flange nuts (see figure 2).
 - Move the valve stem away from the actuator stem allowing room to remove the indicator disk and stem locknuts. Remove the parts indicated.
 - Remove the valve plug by pulling the valve plug/stem assembly through the packing and out of the bottom of the bonnet.
 - If the valve plug is to be re-used but the stem needs to be replaced, drive the pin (key 8) out of the plug/stem assembly and unscrew the valve stem.

CAUTION

Take care during disassembly in the following procedure, to prevent possible damage to sealing surfaces.

- Remove the seat ring (key 9), gaskets (keys 10, 11, 12, and 13), and any remaining parts if they did not come out with the valve plug. If the seat ring (key 9) is stuck in the valve body, strike the outside of the valve body at the seat ring line with a rubber hammer while pulling down on the seat ring. Carefully remove the seat ring without damaging sealing surfaces.

If necessary, machine or grind metal seats before installing the piston ring/seal ring or packing, or refer to the Lapping Metal Seats procedure in this section.

CAUTION

The pressure balancing holes in the valve plug are necessary for the proper and safe operation of the valve. Inspect the balancing holes every time the valve is disassembled for service. Any build-up, blockage, or clogging of the balance holes should be removed.

Lapping Metal Seats

A certain amount of leakage should be expected with metal-to-metal seating in any valve body. If the leakage becomes excessive, however, the condition of the seating surfaces of the valve plug and seat ring can be improved by lapping. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit.

Assemble the valve to the extent that the seat ring (key 9), cage (key 3), cage adaptor (key 4, if used), and bonnet are in place. Also, remove the piston ring or seal ring from the valve plug (if used).

- Insert the valve stem (key 7) into the bonnet and thread the plug (key 2) onto the end of the stem. Make a simple handle from a piece of strap iron; lock it to the valve with the stem locknuts.
- Apply the lapping compound to the seating surfaces. Rotate the handle alternately in each direction to lap the seats. After lapping the seats, remove the valve plug and stem, then clean all parts. Repeat the lapping procedure if necessary.

Trim Assembly

Carefully clean all gasket surfaces. Use new gaskets during reassembly of the valve.

Table 3. Valve Body-to-Flange Nut Torques⁽³⁾

VALVE SIZE, NPS	TORQUES ⁽¹⁾			
	SA193-B7		SA193-B8M ⁽²⁾	
	N•m	Lbf•ft	N•m	Lbf•ft
1 and 1-1/4	129	95	64	47
1-1/2, 1-1/2 x 1, 2, or 2 x 1	96	71	45	33
2-1/2, 2-1/2 x 1-1/2, or 3 x 1-1/2	129	95	64	47
3, 3 x 2, 3 x 2-1/2, or 4 x 2	169	125	88	65
4, 4 x 2-1/2, or 4 x 3	271	200	156	115
1. Determined from laboratory tests. 2. SA193-B8M annealed. 3. For other materials, contact your Emerson sales office or Local Business Partner.				

Replacing the Seal or Piston Ring

CAUTION

Be careful not to scratch the surface of the ring groove in the valve plug (key 2), or the new ring may not seal properly.

- For EDR, if the piston ring (key 6) is visibly damaged, remove the ring and replace it with a new part. Refer to the Parts List at the end of this manual for a replacement part.
- For ETR, if the seal ring and backup ring (keys 24 and 25) are visibly damaged, remove the rings by prying or cutting them from the groove. Be careful not to scratch valve plug surfaces. Refer to the Parts List at the end of this manual for replacement parts.

Assembling the Valve Plug and Stem

1. For EDR and ETR, perform the following steps:

- Insert the stem (key 7) into the plug (key 2, figure 3) and thread the castle nut (key 8) onto the end of the stem and hand tighten.

CAUTION

To prevent possible product damage, take care that the stem and plug are not damaged during the following tightening procedure.

- When tightening the castle nut with a wrench, line up the hole in the end of the stem with a slot in the castle nut. Ensure that the stem and plug are not damaged during the tightening procedure.
- Insert the cotter pin (key 30) and lock it in place.

Installing the Piston Rings or Backup Ring/Seal Rings

1. For EDR: When using a carbon-filled PTFE piston ring, spread the ring apart slightly at the split, start one end of the split into the groove in the valve plug. Work the ring around the valve plug inserting the ring into the groove in the valve plug.

The replacement graphite piston rings will arrive in one piece. Use a vise with smooth or tapered jaws to break the replacement piston ring into two halves. Place the new ring in the vise so that the jaws compress the ring into an oval. Compress the ring slowly until the ring snaps on both sides. If one side snaps first, do not try to tear or cut the other side. Instead, keep compressing the ring until the other side snaps. The piston ring can also be fractured by scoring and snapping over a hard surface such as a table edge. Sawing or cutting the ring is not recommended.

2. For ETR: Apply a lubricant to both backup and seal rings (keys 25 and 24). Place the backup ring over the stem (key 7) and into the groove in the valve plug (key 3). Slowly and gently stretch the seal ring over the valve plug and work it into the groove. Stretching the ring over the valve plug can cause it to appear too large for the groove, but it will contract to its original size when inserted into the cage.

CAUTION

When installing the EDR or ETR valve plug into the cage, make sure the piston or seal ring is evenly engaged in the entrance chamfer of the cage to avoid damage to the ring.

Note

Use the preceding procedures to assemble the valve plug and stem before installing the parts into the valve body. Insert the valve plug into the cage (figure 3), then stack the parts as recommended in steps below.

Installing the Parts into the Valve Body

1. Stack the valve trim parts using figures 11 and 12 to determine the sequence of parts.
2. Lubricate the stud bolts (key 15) before installing the valve trim into the valve body. (Note: For ease of installing trim parts, remove all packing parts from the packing box before installing the trim parts.)
3. When inserting the stack of trim parts into the valve body, carefully align the parts in the recess of the valve body.
4. Slide the bottom flange onto the stud bolts (key 15). Secure the bottom flange (key 31) in place on the valve body with the hex nuts (key 16). Tighten the hex nuts to the torque value shown in table 3.
5. Torque the nuts in a criss-cross pattern. Repeat the pattern until all nuts are torqued to the value indicated in table 3.
6. Refer to the Packing Maintenance procedures below.

Packing Maintenance

This procedure covers PTFE V-ring, graphite ribbon/filament, and PTFE composition packing rings. Key numbers refer to figure 5 for PTFE V-ring packing and PTFE/composition packing, unless otherwise indicated.

Note

If the valve has ENVIRO-SEAL live-loaded packing installed (figure 8, 9, or 10), see the Fisher instruction manual entitled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) for packing instructions.

For all except spring-loaded packing, if the packing is relatively new and tight on the stem, and if tightening the packing flange nuts does not stop the leakage, it is possible that the valve stem is worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing follower, it is possible that the leakage is caused by nicks or scratches around the inside of the packing box wall.

For spring-loaded single PTFE V-ring packing, the spring (key 8) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5, figure 4) until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the Removing Packing and Installing Packing procedures below.

Removing Packing

WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

The packing may have been removed in earlier steps, or during trim maintenance procedures. Use the following steps, when necessary, to remove packing and associated assemblies.

Key number locations for packing parts are shown in figures 5 and 6. For valve parts and the live loaded packing system, refer to figures 8 through 10 (in the Parts List section), for key number locations.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power

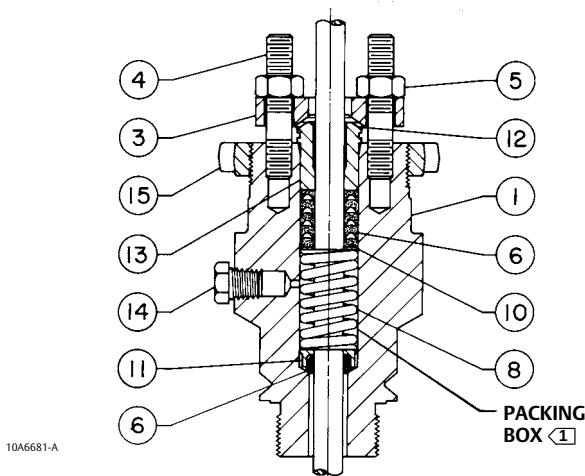
actuator and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

2. Exhaust all actuator pressure, disconnect the operating lines from the actuator, and disconnect any leakoff piping from the actuator. Relieve any actuator precompression from the stem connector. (If necessary, refer to the appropriate actuator instruction manual for warnings, cautions, and disassembly procedures.)
3. When removing the bottom flange (key 31), be careful that the cage and other parts are not damaged by unexpectedly falling out of the valve body. Remove the nuts (key 16) or cap screws from the bottom flange.
4. To remove the packing for maintenance, disconnect the stem connector (see figure 2). Remove the yoke locknut, and lift the actuator off the valve.
5. Remove the packing flange nuts (key 5, figure 4), packing flange (key 15), upper wiper (key 12), and packing follower (key 13). If maintaining the packing while the valve stem is in place, ensure that the valve stem surface is not scratched or marred while working with the packing.

Table 4. Recommended Torque for Packing Flange Nuts

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE PACKING				PTFE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
mm	Inches		N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in
9.5	3/8	CL125, 150	3	24	5	48	1	12	3	24
		CL250, 300	4	36	7	60	2	18	3	30
		CL600	5	48	8	72	3	24	4	36
12.7	1/2	CL125, 150	5	48	8	72	3	24	4	36
		CL250, 300	7	60	10	84	3	30	5	42
		CL600	10	84	14	120	5	42	7	60
19.1	3/4	CL125, 150	11	96	16	144	5	48	8	72
		CL250, 300	14	120	20	180	7	60	10	90
		CL600	20	180	30	264	10	90	15	132

Figure 4. Bonnet Assembly



10A6681-A

NOTE:

1

REFER TO FIGURE 5 OR 6 FOR PACKING ARRANGEMENTS.

CAUTION

To prevent possible product damage, avoid scratching the packing box walls when removing old packing parts. Also inspect valve stem threads and packing box surfaces for sharp edges which may damage packing.

6. Avoid scratching the packing box walls when removing the old packing parts. Clean the packing box (see figure 4), and clean, inspect, or replace metal packing parts. Generally, the metal packing parts are not part of the packing kits listed in the Parts List section, and they must be ordered individually.
7. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs on the stem surfaces can cause packing box leakage or damage to new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts by following the appropriate steps in the Trim Maintenance procedure.

Note

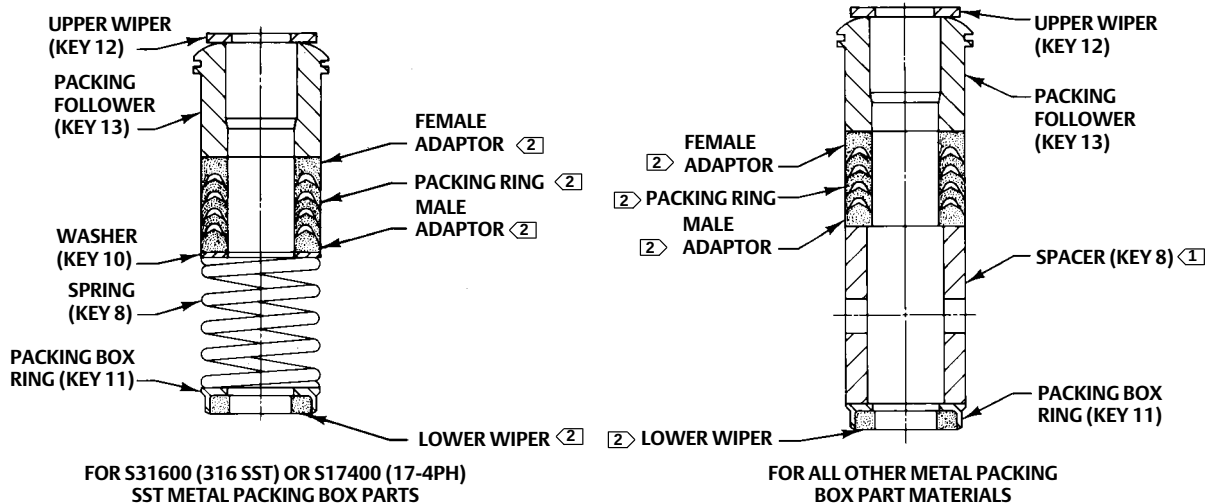
If the control valve assembly was purchased for an application where the service temperatures are under 232°C (450°F), the bonnet may be unscrewed from the valve body. Where temperatures are greater than 232°C (450°F), the bonnet is seal welded to the valve body.

CAUTION

To prevent possible product damage, set the bonnet on a protective surface in the following procedure.

8. If necessary, remove the bonnet assembly from the valve by unscrewing it. Some applications require seal welding the bonnet to the valve body, and the bonnet should not be removed. Set the bonnet on a protective surface to prevent damage to the bonnet gasket surface.

Figure 5. Packing Arrangements



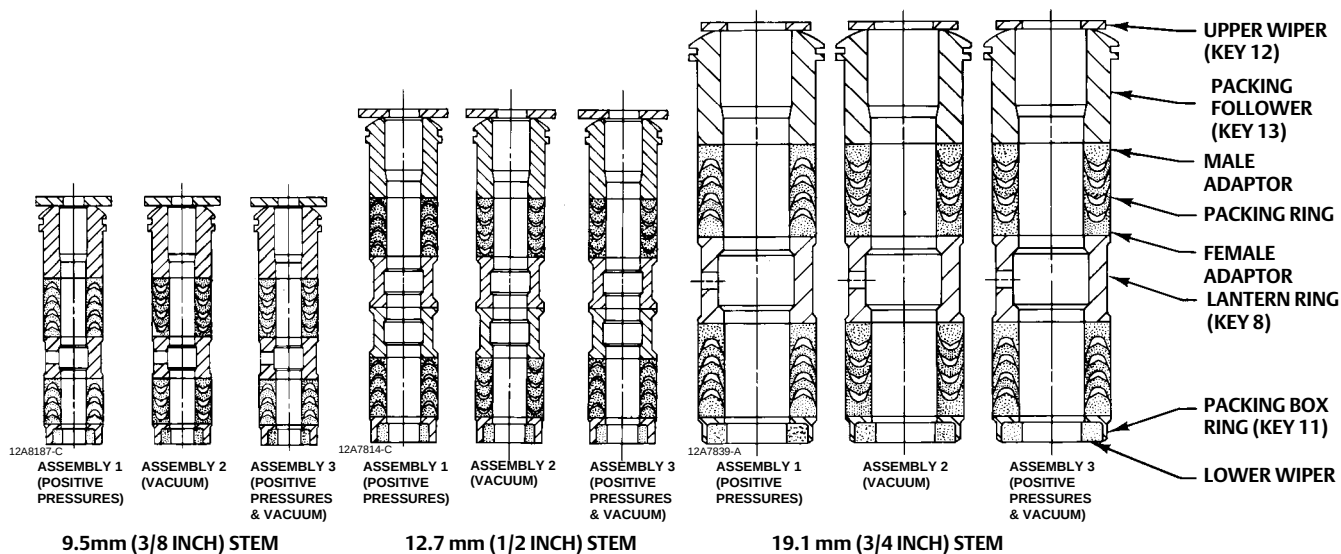
NOTES:

1 REFER TO THE VALVE SERIAL NUMBER AND THE PARTS ORDERING SECTION FOR THE SPACER AND OTHER METAL PARTS.

2 PACKING SET (KEY 6) (2 REQ'D FOR DOUBLE ARRANGEMENTS).

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B2358-1

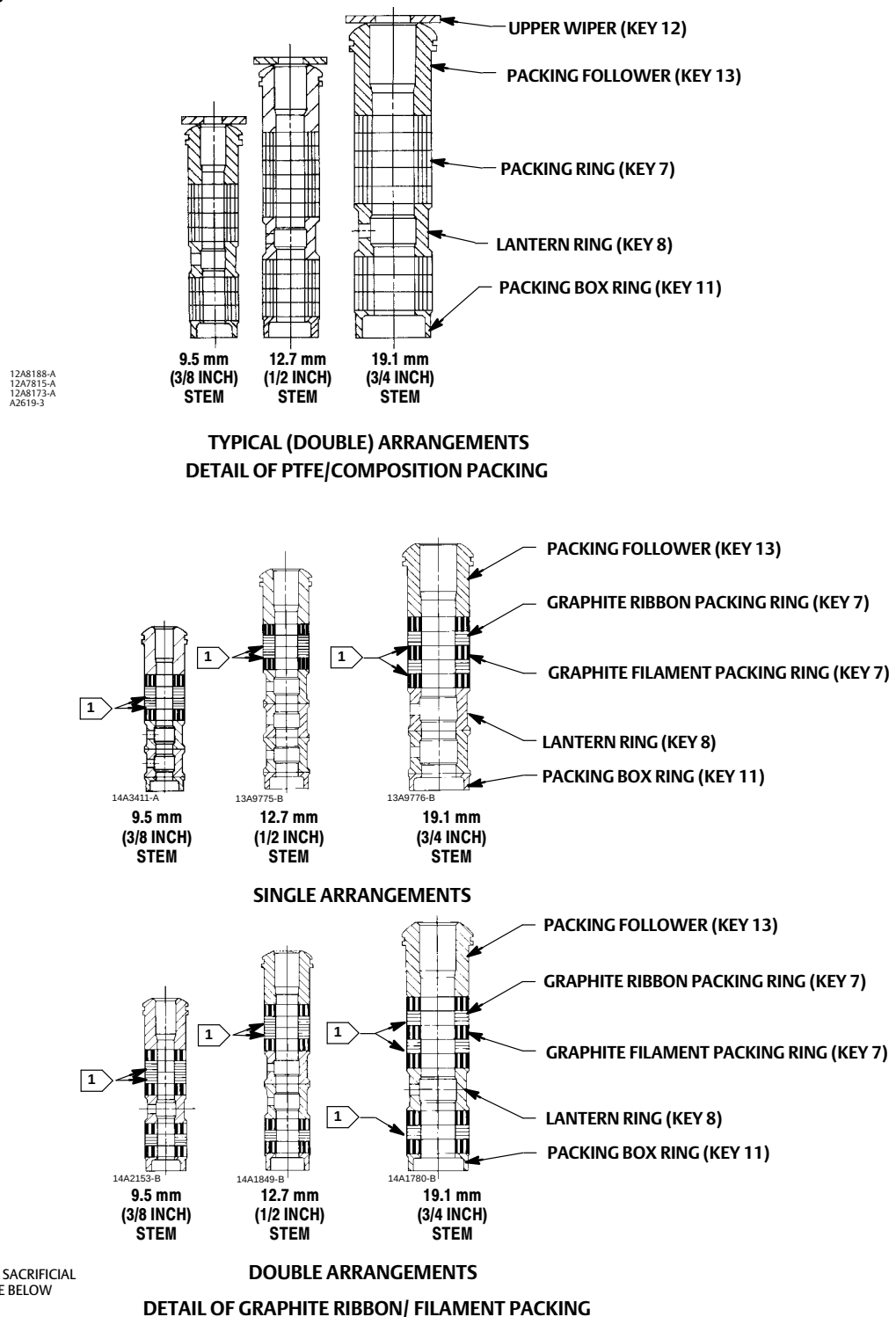
TYPICAL SINGLE ARRANGEMENTS



TYPICAL DOUBLE ARRANGEMENTS

B2359

Figure 6. Packing Arrangements



Installing Packing

If the trim is removed, refer to Trim Maintenance procedures, and install the trim (including the valve stem) before installing the packing. If necessary, use the Lapping Metal Seats procedures before installing packing. Key number locations are shown in figure 5 or 6 unless otherwise indicated.

CAUTION

To prevent possible product damage, take care when installing the bonnet over the valve stem in the following procedure.

1. If the bonnet has been removed from the valve body, install the replacement bonnet (see figure 4). Carefully slide the bonnet over the valve stem without damaging the stem surfaces.
2. Refer to figure 5 or 6 for the sequence of parts to make up the appropriate packing set for your application. Arrange the packing parts in sequence before installing them into the packing box.
3. For split-ring packing, alternate the positions of the splits to avoid creating a leak path. Place a smooth-edged pipe over the valve stem and gently tap each soft packing ring into the packing box. Be sure that air is not trapped between adjacent soft parts.
4. Install the packing follower (key 13), packing flange (key 3), and upper wiper (key 12, if required). Install the packing flange nuts (key 5).
5. Refer to actuator installation procedures in the actuator instruction manual, and the installation procedures in the manual when mounting and connecting the actuator to the valve. If lubrication is required, refer to the Packing Lubrication section below.
6. For spring-loaded PTFE V-ring packing, tighten the packing flange nuts until the shoulder on the packing follower (key 13, figure 4) contacts the bonnet.

For **graphite packing**, tighten the packing flange nuts to the maximum recommended torque shown in table 4. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 4.

For **other packing types**, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 4. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

Note

If the valve has ENVIRO-SEAL live-loaded packing installed (figure 8, 9, or 10), see the Fisher instruction manual entitled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) for packing instructions.

Packing Lubrication

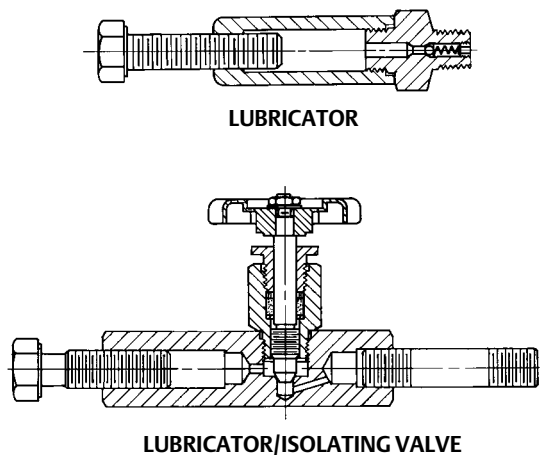
⚠ WARNING

To avoid personal injury or property damage resulting from fire or explosion, do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F).

Packing used in oxygen service or in processes with temperatures over 260°C (500°F) should not be lubricated. If a lubricator or lubricator/isolating valve (see figure 7) is required for the packing, install the lubricator or lubricator/isolating valve into the threaded hole in the side of the bonnet (see figure 7). Use a good quality silicon-base lubricant.

To operate the lubricator, simply turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except the isolating valve must first be opened and then closed after lubrication is completed.

Figure 7. Lubricator and Lubricator/Isolating Valve



10A9421-A
A15428-D
A0832-2

Parts Ordering

Each body-bonnet assembly is assigned a serial number which can be found on the valve body. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) or Local Business Partner for technical assistance. When ordering replacement parts, refer to the serial number and to the eleven-character part number for each part required from the following parts kit or parts list information.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Packing Kits

Standard Packing Repair Kits (Non Live-Loaded)

Standard Packing Repair Kits (non live-loaded)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)
PTFE (Contains keys 6, 8, 10, 11, and 12)	RPACKX00012	RPACKX00022	RPACKX00032
Double PTFE (Contains keys 6, 8, 11, 12)	RPACKX00042	RPACKX00052	RPACKX00062
PTFE/Composition (Contains keys 7, 8, 11, and 12)	RPACKX00072	RPACKX00082	RPACKX00092
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00102	RPACKX00112	RPACKX00122
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring])	RPACKX00132	RPACKX00142	RPACKX00152
Double Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00162	RPACKX00172	RPACKX00182

ENVIRO-SEAL Packing Retrofit Kits

Retrofit kits include parts to convert valves with existing standard bonnets to the ENVIRO-SEAL packing box construction. Refer to figure 8 for key numbers for PTFE packing, to figure 9 for key numbers for graphite packing, and to figure 10 for key numbers for duplex packing. PTFE kits include keys 200, 201, 211, 212, 214, 215, 216, 217, 218, tag, and cable tie. Graphite kits include keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 217, tag, and cable tie. Duplex kits include keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, and cable tie.

Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of this packing kit.

For part numbers of individual components in the ENVIRO-SEAL packing kits, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)).

ENVIRO-SEAL Packing Retrofit Kits

PACKING MATERIAL	STEM DIAMETER AND YOKE BOSS DIAMETER, mm (INCH)		
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)
Double PTFE	RPACKXRT012	RPACKXRT022	RPACKXRT032
Graphite ULF	RPACKXRT262	RPACKXRT272	RPACKXRT282
Duplex	RPACKXRT212	RPACKXRT222	RPACKXRT232

ENVIRO-SEAL Packing Repair Kits

Repair kits include parts to replace the “soft” packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits. Refer to figure 8 for key numbers for PTFE packing, to figure 9 for key numbers for graphite packing, and to figure 10 for key numbers for duplex packing. PTFE repair kits include keys 214, 215, and 218. Graphite repair kits include keys 207, 208, 209, 210, and 214. Duplex repair kits include keys 207, 209, 214, and 215.

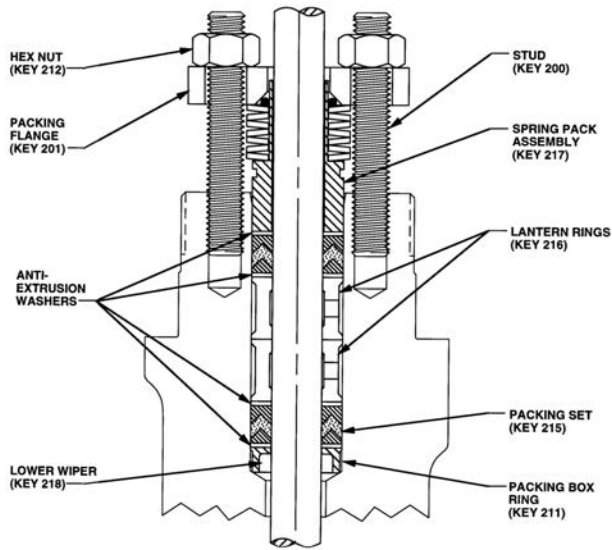
Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of this packing kit.

For part numbers of individual components in the ENVIRO-SEAL packing kits, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)).

ENVIRO-SEAL Packing Repair Kits

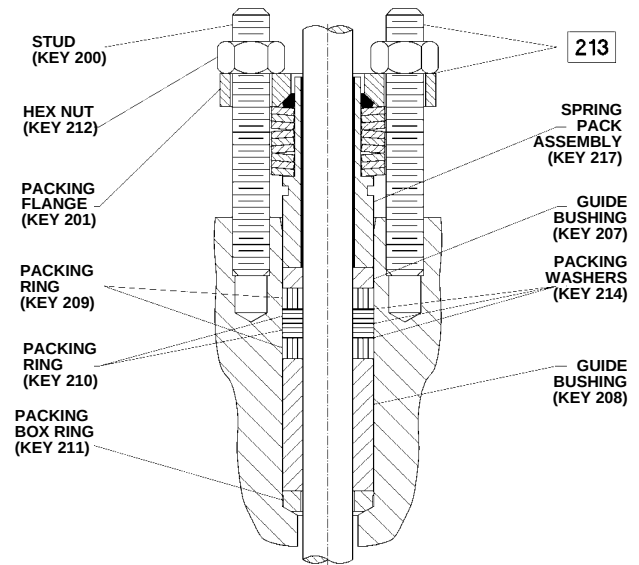
Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)
Double PTFE (contains keys 214, 215, & 218)	RPACKX00192	RPACKX00202	RPACKX00212
Graphite ULF (contains keys 207, 208, 209, 210, and 214)	RPACKX00592	RPACKX00602	RPACKX00612
Duplex (contains keys 207, 209, 214, and 215)	RPACKX00292	RPACKX00302	RPACKX00312

Figure 8. Typical ENVIRO-SEAL Packing System with PTFE Packing



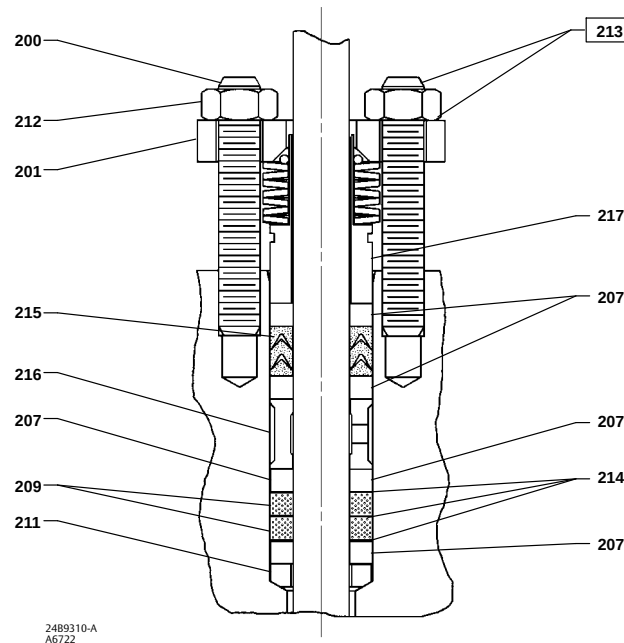
A6297-1

Figure 9. Typical ENVIRO-SEAL Packing System with Graphite ULF Packing



39B4612/A

Figure 10. Typical ENVIRO-SEAL Packing System with Duplex Packing



24B9310-A
A6722

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EDR and ETR Valves

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Parts Kits

Note

Kits do not apply to alloy C (N10276 & CW2M), Alloy 20 (N08020 & CN7M), or alloy 400 (N04400 & M35-1) trims.

Kits for full- and restricted- capacity trims with service temperature to 593°C (1100°F) include S31600 [316 stainless steel (SST)] shim and N06600/graphite spiral wound gasket.

Gasket Kits and Shims⁽¹⁾

Valve Size, NPS	Key Number	To 593°C (To 1100°F)	Valve Size, NPS	Key Number	To 593°C (To 1100°F)
1 or 1-1/4	Set 10 12 13 32	RGASKETX162 1R2859X0042 1R286099442 1R2862X0062 16A1936X012	2-1/2 x 1-1/2	Set 10 11 12 13 14 32	RGASKETX262 1R3847X0032 1R3100X0032 1R309999442 1R3098X0052 1R3844X0052 16A1937X012
1-1/2	Set 10 12 13 32	RGASKETX172 1R3101X0032 1R309999442 1R3098X0052 16A1937X012	3	Set 10 12 13 32	RGASKETX202 1R3484X0042 1R348299442 1R3481X0052 16A1940X012
1-1/2 x 1	Set 10 11 12 13 20 32	RGASKETX242 1R3101X0032 1R2861X0042 1R286099442 1R3098X0052 1U2152X0042 16A1936X012	3 x 2	Set 10 11 12 13 14 32	RGASKETX272 1R3484X0042 1R3298X0032 1R329799442 1R3296X0042 1R3481X0052 16A1938X012
2	Set 10 12 13 32	RGASKETX182 1R3299X0042 1R329799442 1R3296X0042 16A1938X012	4	Set 10 12 13 32	RGASKETX212 1R3724X0042 1R372299442 1J5047X0062 16A1941X012
2 x 1	Set 10 11 12 13 14 32	RGASKETX252 1R3299X0042 1R2861X0042 1R286099442 1R2862X0062 1R3296X0042 16A1936X012	4 x 2-1/2	Set 10 11 12 13 14 32	RGASKETX282 1R3724X0042 1R3846X0042 1R384599442 1R3844X0052 1J5047X0062 16A1939X012
2-1/2	Set 10 12 13 32	RGASKETX192 1R3847X0032 1R384599442 1R3844X0052 16A1939X012			

1. The bonnet gasket (key 10), spiral gasket (key 12), seat gasket (key 13), adapter gasket (key 14), adapter gasket (key 20) and shim (key 32) are included in gasket kit (RGASKET).

Gasket Descriptions

KEY NUMBER	DESCRIPTION	MATERIAL
		FGM -198° to 593°C (-325° to 1100°F)
10	Bonnet Gasket	Graphite/S31600
11	Cage Gasket	
13	Seat Ring or Liner Gasket	
14 or 20	Adapter Gasket	
12	Spiral-Wound Gasket	N06600/Graphite
32	Shim	S31600

Parts List

Note

Contact your [Emerson sales office](#) or Local Business Partner for Part Ordering information.

Bonnet Assembly (figure 4)

Note

For ENVIRO-SEAL packing box parts, see instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)).

Key Description

1	Bonnet
	If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.
3	Packing flange
4	Packing flange stud
5	Packing flange nut
6*	Packing Set, Single PTFE V-ring, (2 req'd)
7*	Packing ring
8	Spring
8	Lantern ring
8	Spacer
	Please refer to the valve serial number and the Parts Ordering section for the spacer and packing replacement parts information.
11*	Packing Box ring, S31600 (standard)
14	Pipe plug
14	Optional lubricator
14	Optional lubricator/isolating valve
15	Yoke Locknut

Key Description

27	Pipe nipple for optional lubricator/isolating valve
30*	Lower Wiper, PTFE
31*	Male Adapter, PTFE
32*	Female Adaptor, PTFE

Valve Assembly (figures 11 and 12)

1	Valve Body
	If you need a valve body as a replacement part, order by valve size, serial number, and desired material.
2*	Valve plug
3*	Cage
4	Cage adaptor
5	Seat Ring Adaptor
6*	Piston Ring
7*	Valve Stem
8*	Castle Nut (standard), SST
9*	Seat Ring
10*	Bonnet Gasket
11*	Cage Gasket
12*	Spiral-Wound Gasket
13*	Seat Ring or Liner Gasket
14*	
	or
20*	Adapter Gasket
15	Cap Screw or Stud Bolt
16	Hex Nut
17	Pipe plug for tapped bottom flanges
18	Flow Arrow
19	Drive screw
21*	Disk retainer, S31600, For ETR only
22*	Disk Seat, For ETR only
23*	Disk
24*	Seal ring, carbon filled PTFE, For ETR only
25*	Backup ring, For ETR only
30	Cotter pin
31	Bottom Flange
32*	Shim
33	Nameplate

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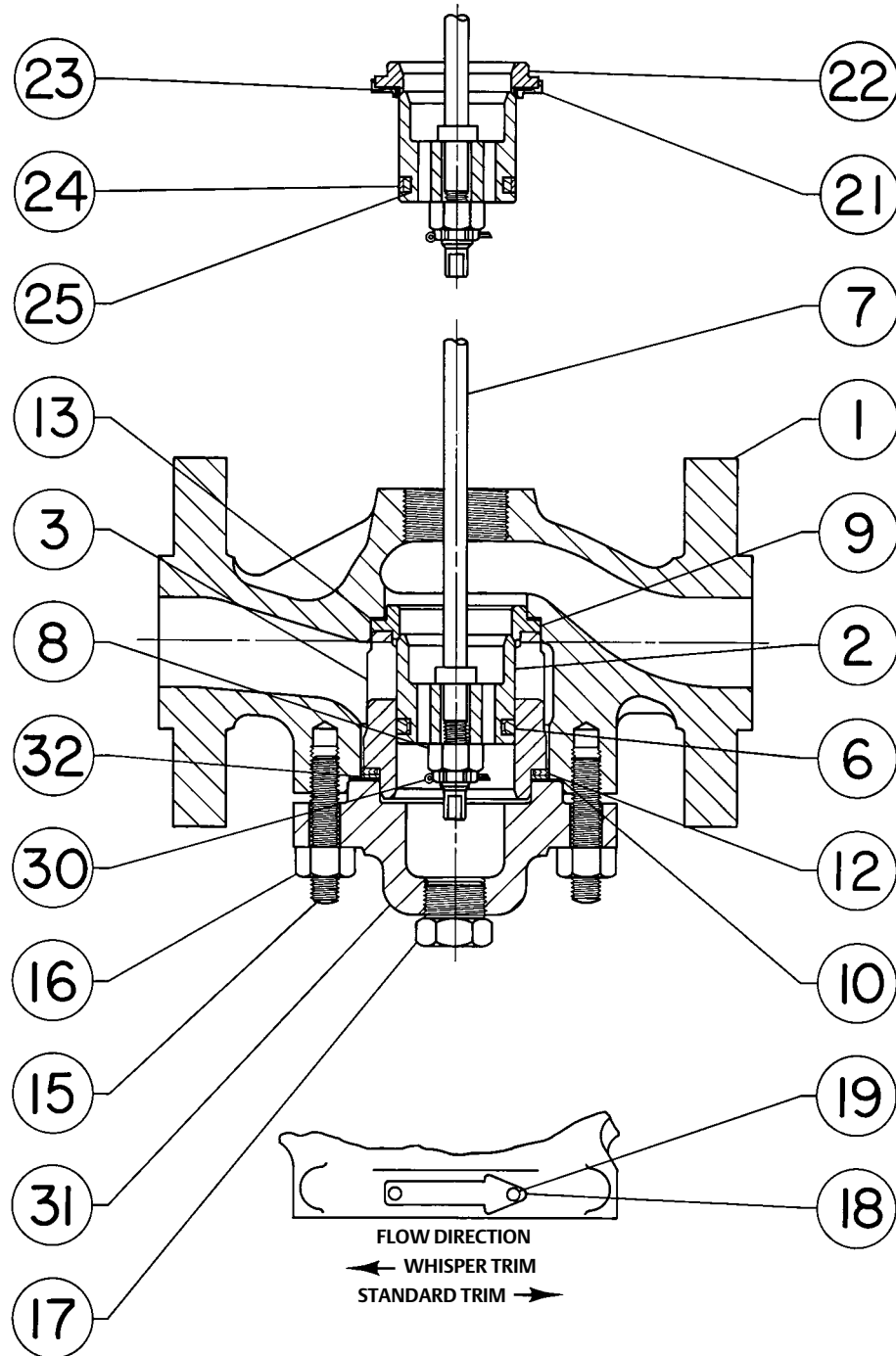
EDR and ETR Valves

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Group 1 Actuators by Type Number

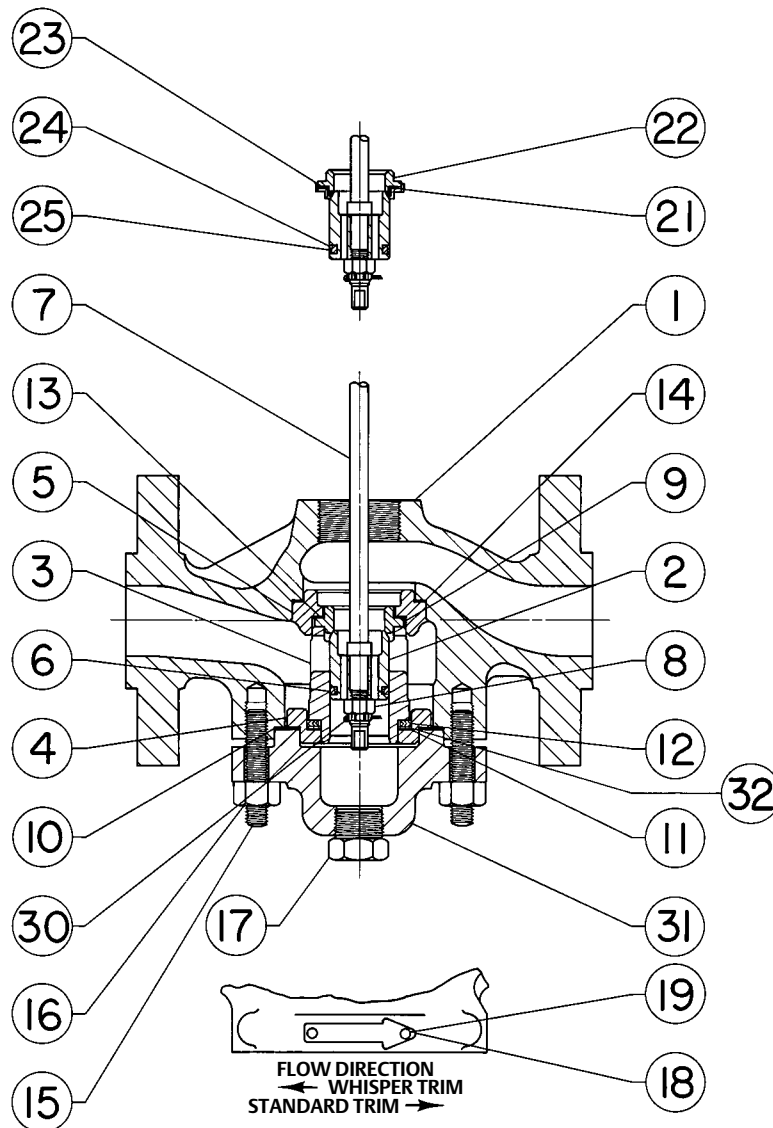
54 mm (2-1/8 inches), 71 mm (2-13/16 inches), or 90 mm (3-9/16 inches) Yoke Boss
585C Series—50.8 mm (2 inches) maximum travel 585C 1B 644 & 645 655 657 & 667—76.2 mm (3 inches) maximum travel 1008—71.4 mm (2-13/16 inches) yoke boss

Figure 11. EDR and ETR with Full-Size Trim Valve Assembly



40A5480-D

Figure 12. EDR and ETR with Restricted Trim Valve Assembly



40A5482-D

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Fisher™ EHD and EHT NPS 8 through 14 Sliding-Stem Control Valves

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Figure 1. Fisher EH Series Control Valve with 667 Actuator



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts ordering information for NPS 8 through 14 Fisher EHD and EHT sliding-stem globe-style control valves. Refer to separate manuals for instructions covering the actuator, positioner, and accessories.

Do not install, operate, or maintain an EH valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

EH Valves NPS 8 through 14

June 2017

Instruction Manual

D100392X012

Table 1. Specifications

End Connection Styles⁽¹⁾ Buttwelding: All available ASME B16.25 schedules that are compatible with ASME B16.34 pressure/temperature ratings Flanged Ends: CL1500 or 2500 ■ raised-face (RF) or ■ ring-type joint (RTJ) flanges per ASME B16.5 Shutoff Classifications See table 2 Bore seal trim: High-temperature, Class V. See table 3 Flow Characteristic Standard Cages: ■ Linear, ■ equal percentage, or ■ modified equal percentage ⁽²⁾	Whisper Trim™ III Cages: ■ Linear or ■ modified characteristics available upon request Flow Direction Normally flow down (in through the cage windows and out through the seat ring) for all cage styles except for applications using either a Whisper Trim III cage or a diverter cone plug, both of which are flow up only Additional Specifications For specifications such as materials, valve plug travels, and port, yoke boss, and stem diameters, see the Parts List section Approximate Weights See table 4
--	---

1. The pressure or temperature limits in this manual and any applicable standard limitations should not be exceeded.

2. Valves using an equal percentage cage may be travelled an additional 13 mm (0.5 inch) if desired to obtain additional capacity; flow characteristic becomes modified equal percentage.

Table 2. Shutoff Classifications⁽¹⁾

Valve Design	ANSI/FCI LEAKAGE CLASS
EHD	III—Standard
	IV—Optional
EHT	IV—Standard
	V—Optional
EHT w/ PEEK ⁽²⁾ Anti-Extrusion Rings	V to 316°C (600°F)

1. Per ANSI/FCI 70-2 and IEC 60534-4
2. Poly Ether Ether Ketone

Description

The EHD and EHT valves, shown in figure 1, are large, sliding-stem, high-pressure, globe-style valves. These valves have metal seats, cage guiding, and push-down-to-close valve plug action.

The EHD and EHT valves feature balanced valve plugs. To provide a seal between the valve plug and cage, the EHD valve plug has piston rings; the EHT valve plug has a pressure-assisted seal ring.

Bore seal trim is available for EHD valves, CL1500, NPS 8 and 10 and CL2500, NPS 8, 10, 12, and 14.

With Bore seal trim, a balanced valve can achieve high-temperature, Class V shutoff. Because the Bore seal plug seal is formed from metal (N07718 nickel alloy) rather than an elastomer, a valve equipped with the Bore seal trim can be applied in processes with a fluid temperature of up to 593°C (1100°F), provided other material limits are not exceeded.

Specifications

Specifications for the EHD and EHT valves are shown in table 1.

Educational Services

For information on available courses for the Fisher EH NPS 8 through 14 valve, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Table 3. Additional Shutoff Classification

Valve Design (PRESSURE RATING)	Valve Size, NPS	Port Diameter, Inches	Cage Style	ANSI/FCI Leakage Class
EHD (CL1500)	8 10	7	Equal Percentage Modified Equal Percentage Linear (std. cage) Linear (Whisper III, A1, B3, C3)	V with optional Bore seal trim
EHD (CL2500)	8 10	5.375	Equal Percentage, Modified Equal Percentage, Linear (std. cage), Linear (Whisper III, A1, B3, C3, D3)	V with optional Bore seal trim
	12 14	7	Equal Percentage, Modified Equal Percentage, Linear (std. cage), Linear (Whisper III, A1, B3, C3, D3)	V with optional Bore seal trim

Table 4. Approximate Weights (Valve Body and Bonnet Assemblies)

VALVE SIZE, NPS	WEIGHTS							
	CL1500				CL2500			
	Buttwelding Ends		Flanged		Buttwelding Ends		Flanged	
	Kilograms	Pounds	Kilograms	Pounds	Kilograms	Pounds	Kilograms	Pounds
8	1400	3100	1700	3700	1900	4100	2200	4700
10	1500	3300	1900	4100	2000	4400	---	---
12	3400	7300	3900	8600	3400	7600	---	---
14	3400	7300	---	---	3400	7600	---	---

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given in this manual or on the appropriate nameplates. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

The valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Because some body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#) or Local Business Partner.

If hoisting the valve, use a nylon sling to protect the painted surfaces. Carefully position the sling to prevent damage to the actuator tubing or any accessories. Also, take precautions to prevent personnel from being injured in case the hoist or rigging slips unexpectedly. Refer to table 4 for valve assembly weights and the appropriate actuator instruction manual for actuator assembly weights. Be sure to use adequately sized hoists and chains or slings to handle the valve and actuator assembly.

1. Before installing the valve, inspect it to ensure that the valve body cavity is free of foreign material.
2. Clean out all pipelines to remove scale, welding slag, and other foreign materials before installing the valve.

Note

If installing a valve with small internal flow passages, such as with Whisper Trim III or Cavitrol™ III cages, consider installing an upstream strainer to prevent the lodging of particles in these passages. This is especially important if the pipeline cannot be thoroughly cleaned or if the flowing medium is not clean.

3. Install the control valve with the valve body in a horizontal pipeline and the actuator vertical above the valve. Other orientations may result in shortened trim life and difficulty with field maintenance. Flow through the valve body must be in the direction indicated by the flow arrow (key 15, figure 12 or 14) on the valve body.

CAUTION

Depending on valve body materials used, post-weld heat treating might be needed. Post-weld heat treatment can damage internal elastomeric, plastic, and metal parts. Shrink-fit pieces and threaded connections might also loosen. In general, if post-weld heat treating is needed, remove all trim parts. Contact your Emerson sales office or Local Business Partner for additional information.

4. Use accepted piping and welding practices when installing the valve in the line. For flanged valve bodies, use suitable gaskets between the valve body flanges and pipeline flanges.
5. Install a three-valve bypass around the control valve if continuous operation is required during maintenance.
6. If the actuator and valve are shipped separately, see the Actuator Mounting procedure.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however some readjustment will be required to meet specific service conditions.

7. If the valve was shipped without packing installed in the packing box, install the packing prior to putting the valve into service. Refer to instructions given in the Packing Maintenance section of this manual.

Principle of Operation

Key numbers referenced in this section are shown in figure 12 for the EHD valve and in figure 14 for the EHT valve.

EHD and EHT valves are balanced designs. When they are opening or closing, pressure registers on top of the valve plug (key 3) through the registration holes in the plug. The force of the pressure on top of the plug balances the force of the pressure on the bottom of the plug to reduce the actuator force required.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication and maintenance, trim maintenance, and lapping of metal seats. All maintenance operations can be performed with the valve in the line.

WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

WARNING

Refer to table 4 for valve assembly weights and the appropriate actuator instruction manual for actuator assembly weights. Due to the size and weight of the valve and actuator assembly, be sure adequately sized hoists and chains or slings are used to handle it. Also, take proper precautions to prevent personnel from being injured if the hoist or rigging slips unexpectedly.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket upon reassembly. This is necessary to ensure a good gasket seal.

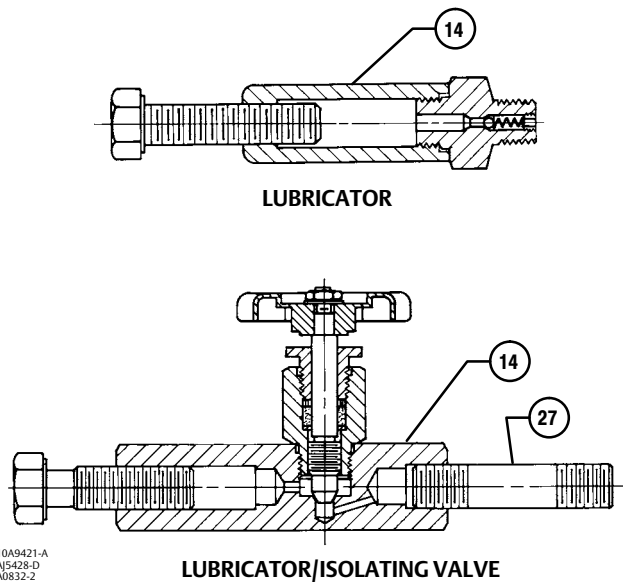
8. After all maintenance is complete, refer to the Trim Replacement procedure to assemble the valve body.

Note

If the valve has ENVIRO-SEAL™ live-loaded packing installed, see the Fisher instruction manual titled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) for packing instructions.

If the valve has HIGH-SEAL live-loaded packing installed, see the Fisher instruction manual titled HIGH-SEAL Live-Loaded Packing System ([D101453X012](#)) for instructions.

Figure 2. Lubricator and Lubricator/Isolating Valve



Packing Lubrication

⚠ WARNING

To avoid personal injury or property damage resulting from fire or explosion, do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F).

CAUTION

Do not lubricate graphite packing. Graphite packing is self-lubricated. Additional lubrication may result in slip-stick movement of the valve.

Note

ENVIRO-SEAL or HIGH-SEAL packing does not require lubrication.

A lubricator or lubricator/isolating valve (figure 2) is recommended for PTFE-impregnated composition packing. The lubricator or lubricator/isolating valve is installed in place of the pipe plug in the bonnet. Use a good quality silicon-base lubricant. Do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F). To operate the lubricator, turn the cap screw clockwise to force lubricant into the packing box. The lubricator/isolating valve operates the same way except open the isolating valve before turning the cap screw and then close the isolating valve after lubrication is completed.

Packing Maintenance

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require readjustment to meet specific service conditions.

Valves with ENVIRO-SEAL live-loaded packing or HIGH-SEAL live-loaded packing installed probably will not require this initial re-adjustment. See the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) or HIGH-SEAL Live-Loaded Packing System ([D101453X012](#)) (as appropriate) for packing instructions. To convert an existing packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section near the end of this manual. Figure 10 shows typical ENVIRO-SEAL packing systems.

For spring-loaded PTFE V-ring packing (figure 4), the spring maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13, figure 11), check to be sure the shoulder on the packing follower is touching the bonnet (key 1, figure 11). If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5, figure 11) until the shoulder on the packing follower is against the bonnet. If the packing leakage is still excessive, replace the packing by following the Replacing Packing procedure.

If packing leakage is undesirable with other than spring-loaded PTFE V-ring packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts (key 5, figure 11) to at least the minimum recommended torque in table 5. However, do not exceed the maximum recommended torque in table 5 or excessive friction may result.

Table 5. Recommended Packing Flange Nut Torques

STEM DIAMETER		VALVE RATING	N•m		Lbf•ft	
mm	Inches		Min	Max	Min	Max
31.8	1-1/4	CL1500	68	102	50	75
		CL2500	81	122	60	90
50.8	2	CL1500	98	146	72	108
		CL2500	115	170	85	125

If the packing is relatively new and tight on the stem, and if tightening the packing flange nuts does not stop the leakage, the valve stem may be worn or nicked so that a seal cannot be made. The surface finish of a new stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches around the packing box wall. While replacing the packing according to the Replacing Packing procedure, inspect the stem and packing box wall for nicks or scratches.

Replacing Packing

⚠ WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

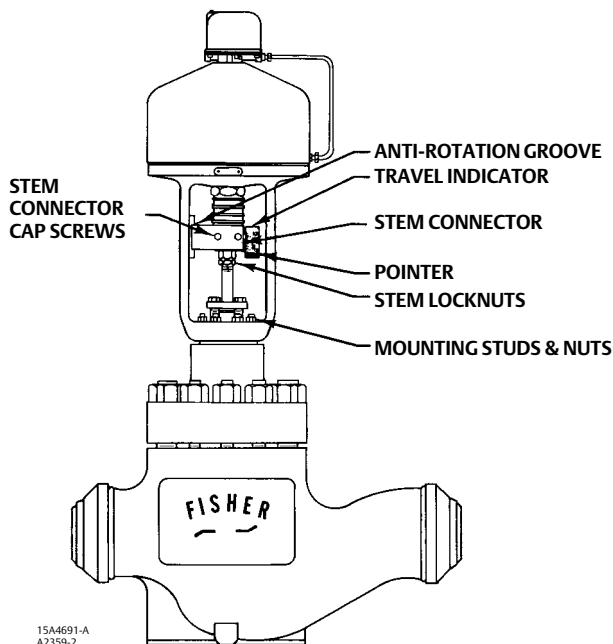
Key numbers referred to in this procedure are shown in figure 11 unless otherwise indicated.

1. Remove the stem connector cap screws shown in figure 3, and separate the two halves of the stem connector. Then exhaust all actuator pressure, if any was applied, and disconnect the actuator supply and any leakoff piping.
2. Remove the hex nuts (key 26) and remove the actuator from the bonnet (key 1). Loosen the packing flange nuts (key 5) so that the packing (key 6, or 7 and 9, figure 4) is not tight on the valve plug stem (key 4, figure 12 or 14). Remove any travel indicator disk and stem locknuts from the valve plug stem threads.

⚠ WARNING

Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step.

Figure 3. Actuator Mounting



Note

The following step also provides additional assurance that the valve fluid pressure has been relieved.

3. Hex nuts (key 14, figures 12 and 14) attach the bonnet to the valve body. Loosen these nuts approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed with the bonnet removal in step 5.

⚠ WARNING

If the cage sticks to the bonnet, proceed carefully with bonnet removal until the cage windows are accessible. Do not extend hands or arms through the windows at this point as a sudden separation of bonnet and cage will cause personal

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injury. Use a stick or other device to thread a rope or sling through the windows. Use this rigging to secure the cage to the bonnet or hoist to prevent damage or injury should the cage suddenly separate from the bonnet.

CAUTION

When lifting the bonnet (key 1), be sure that the valve plug and stem assembly (keys 3 and 4, figure 12 or 14) remains on the seat ring (key 6, figure 12 or 14). This avoids damage to the seating surfaces as a result of the assembly dropping from the bonnet after being lifted part way out. The parts are also easier to handle separately.

4. Remove the hex nuts (key 14, figure 12 or 14) and washers (key 29 and 33, figure 12, 13, or 14). Carefully lift the bonnet off the valve plug stem. If the valve plug assembly starts to lift with the bonnet, use a brass or similar hammer to tap the end of the stem and tap it back down. Set the bonnet on a protective surface to prevent damage to the bonnet gasket surface.

CAUTION

Use care to avoid damaging gasket sealing surfaces.

EHD piston rings (key 8) are brittle and in two halves. Use care to avoid damage to the piston rings caused by dropping or rough handling.

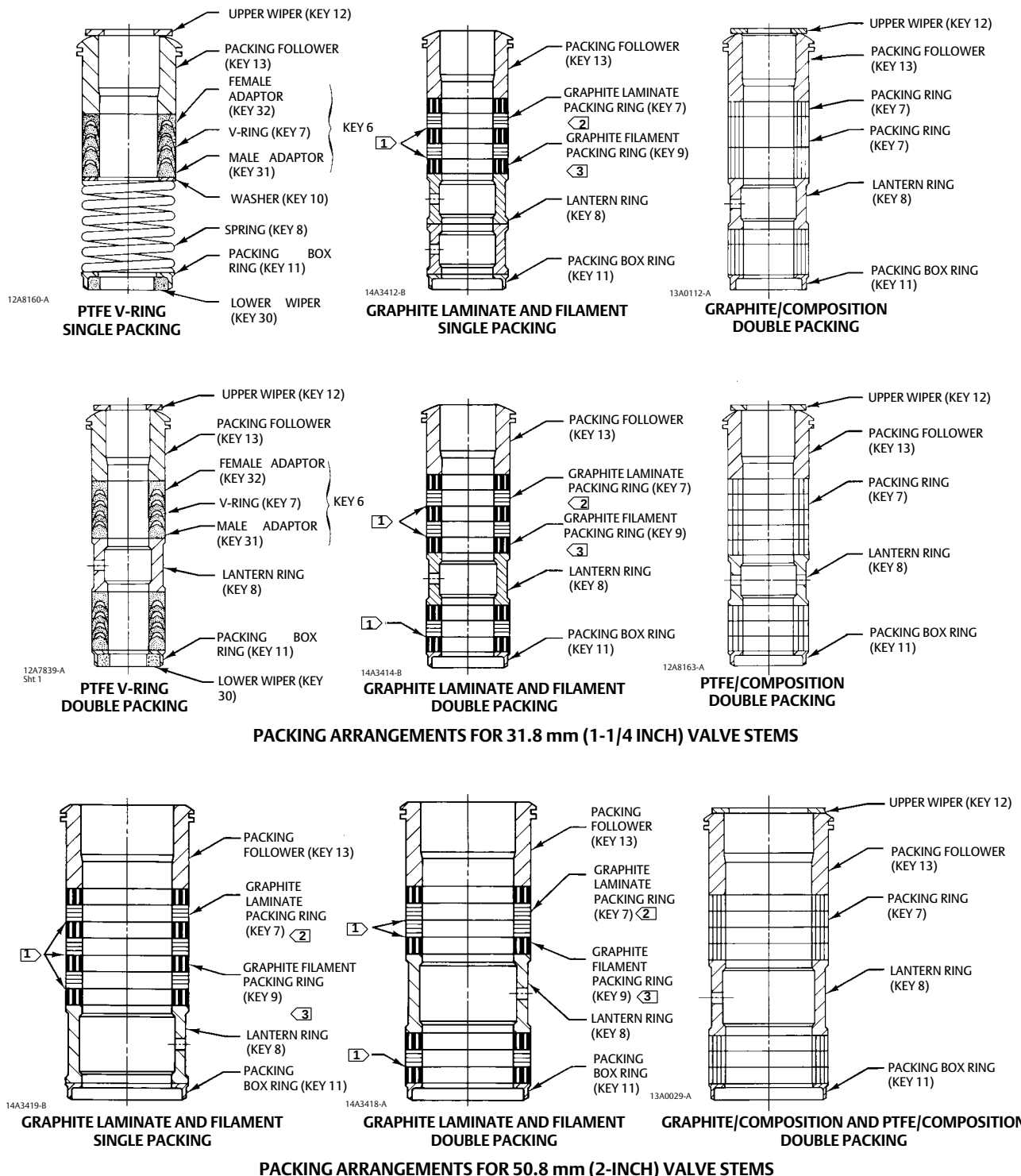
5. Lift the plug assembly (keys 3 and 4, figure 12 or 14) out of the valve body.
6. To remove the cage (key 2, figure 12 or 14), if it remained in the valve body, install eyebolts or similar devices into the 1/2 inch 13-UNC tapped holes in the top of the cage. Using the eyebolts, carefully lift the cage out of the valve body. Remove the top and bottom cage gaskets (key 11, figure 12 or 14). Carefully remove any residual silver or tin from the gasket surfaces.
7. Cover the opening in the valve body to protect the gasket surface and to prevent foreign material from getting into the valve body cavity.

Table 6. Body-to-Bonnet Bolting Torques

VALVE SIZE NPS	VALVE RATING	B7, B16, BD, 660 STUDS		B8, B8M STUDS	
		N•m	lbf•ft	N•m	lbf•ft
8, 10	CL1500	2710	2000	2035	1500
	CL2500	4070	3000	3050	2250
12, 14	CL1500	8130	6000	6100	4500
	CL2500	5830	4300	4370	3225

8. Remove the packing flange nuts, packing flange, upper wiper and packing follower. Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and these metal packing parts shown in the figure 4 arrangements: packing box ring, spring, lantern ring, washer if used, and packing follower (keys 11, 8, 10, and 13).
9. Inspect the valve plug stem threads for any sharp edges that might cut the packing. Use a whetstone or emery cloth to smooth the threads if necessary.
10. Remove the protective covering from the valve body cavity, and install the cage using new cage gaskets (key 11, figure 12 or 14).
11. Install the plug and stem assembly. Be sure the seal ring or piston rings are installed correctly as described under Trim Replacement.

Figure 4. Packing Arrangements



NOTES:

- ① 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS. USE ONLY ONE BELOW EACH GRAPHITE LAMINATE RING.

- ② HAS THE APPEARANCE OF FLAT WASHERS PRESSED TOGETHER.
③ HAS THE APPEARANCE OF A WOVEN OR BRAIDED RING.

C0634-1

12. Slide the bonnet over the stem and onto the bonnet studs (key 13, figure 12 or 14).

Note

Proper performance of the bolting procedures in step 13 compresses the cage gaskets (key 11, figure 12 or 14) enough to seal the body-to-bonnet joint.

The prelubricated hex nuts (key 14, figure 12 or 14) referred to in step 13 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 13 include, but are not limited to, ensuring that the bonnet stud threads are clean, Belleville washers (if present) are installed in the correct orientation, and that the hex nuts are evenly tightened to the specified torque values.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 6 may result in cage crushing, cage diameter reduction, and/or bonnet deformation. Do not use cheater bars or slug wrenches for this procedure.

Hot torquing is not recommended; it may result in damage to valve components.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) or Local Business Partner immediately if a discrepancy between actual parts and approved parts is suspected.

13. Lubricate the stud threads and the faces of the hex nuts (key 14, figure 12 or 14) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Replace the flat washers (key 29, figure 12 or 14) and Belleville washers (key 33, figure 13), if included with the valve body assembly. Belleville washers must be installed so that the concave side is facing towards the valve body or flat washer. Replace the hex nuts and torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 6. When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.
14. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 4. Slip a smooth-edged pipe over the valve stem, and gently tamp each soft packing part into the packing box.
15. Slide the packing follower, wiper, and packing flange into position. Lubricate the packing flange studs (key 4) and the faces of the packing flange nuts (key 5) and then install the packing flange nuts.

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For spring-loaded PTFE V-ring packing: Tighten the packing flange nuts until the shoulder on the packing follower (key 13) contacts the bonnet (key 1).

For other kinds of packing, except ENVIRO-SEAL and HIGH-SEAL: Tighten the packing flange nuts to the maximum recommended torque shown in table 5. Then, loosen the packing flange nuts and retighten them to the recommended minimum torque in table 5.

For ENVIRO-SEAL and HIGH-SEAL packing: See the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) or HIGH-SEAL Live-Loaded Packing System ([D101453X012](#)) (as appropriate) for packing instructions.

Table 7. Seat Ring and Seat Ring Cap Screw Lubricants and Recommended Torque for Seat Ring Cap Screws

LUBRICANT	VALVE SIZE, NPS	VALVE RATING	RECOMMENDED TORQUE			
			Spiral Wound Gasket Construction		O-Ring Construction or Constructions for Sour Gas Service	
			N•m	lbf•ft	N•m	lbf•ft
Lithium Grease or Anti-Seize Lubricant	8, 10	CL1500	61	45	41	30
		CL2500	95	70	61	45
	12, 14	CL1500	95	70	61	45
		CL2500	95	70	61	45
Dry Film Lubricant	8, 10	CL1500	47	35	34	25
		CL2500	75	55	47	35
	12, 14	CL1500	75	55	47	35
		CL2500	75	55	47	35

16. Mount the actuator on the valve body assembly, and reconnect the actuator and valve plug stem according to the Actuator Mounting procedure. After the control valve is returned to service, retighten the hex nuts (key 14, figure 12 or 14) to the torque recommended in table 6.

Trim Removal

WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

For Bore seal construction, see the appropriate Bore seal sections in this instruction manual.

Key numbers referenced in this procedure are shown in figure 12 for the EHD valve and figure 14 for the EHT valve except where indicated.

1. Remove the actuator and bonnet by following steps 1 through 9 of the Replacing Packing procedure.
2. To remove the seat ring (key 6), remove the cap screws (key 7). Install eyebolts or similar devices in the 5/8 inch 11-UNC tapped holes (9/16 inch 12-UNC for an NPS 8 or 10 CL1500 valve). Use the eyebolts to carefully lift the seat ring out of the valve body. If the seat ring is to be reused, exercise care to protect the gasket surfaces on the bottom of the seat ring.
3. Remove the spiral wound seat ring gasket or O-ring (key 12).
4. Refer to the following appropriate valve plug maintenance procedure or to the Lapping Seats procedure.

EHD and EHT Valve Plug Maintenance

Key numbers used in this procedure are shown in figure 12 for the EHD valve and in figure 14 for the EHT valve.

1. With the valve plug (key 3) removed per the Trim Removal procedure, proceed as appropriate:

For the EHD valve, the piston rings (key 8) are each in two sections; remove the sections from the grooves in the valve plug.

For all EHT valves, work the retaining ring (key 10) off the valve plug with a screwdriver. Carefully slide the backup ring and seal ring (keys 9 and 8) off the valve plug. Additionally, for the EHT valve with Whisper Trim Level D cage, remove the two sections of the piston ring (key 30, figure 14).

2. To replace the valve plug stem (key 4), drive out the pin (key 5) and unscrew the stem from the valve plug (key 3).

CAUTION

Never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem. This weakens the stem and may cause the stem to fail in service. If a new valve plug is required, always order a valve plug, stem, and pin as an assembly. Specify the correct part number of each of the three parts but state that the parts are being ordered as an assembly.

A used valve plug may be reused with a new stem.

3. Thread the new stem into the valve plug until the stem wedges tightly at the end of the thread. Using the valve plug pin hole as a guide, drill the pin hole through the stem. Use a 1/4 inch drill for 31.8 mm (1-1/4 inch) stems and a 3/8 inch drill for 50.8 mm (2-inch) stems.
4. Drive in the pin to lock the assembly.
5. If seat lapping is necessary, complete the Lapping Seats procedure before installing the EHD piston rings or the EHT seal ring. Piston ring and seal ring installation instructions and valve body-to-bonnet reassembly instructions are presented in the Trim Replacement procedure.

Lapping Seats

Key numbers referenced in this procedure are shown in figure 12 for the EHD valve and in figure 14 for the EHT valve.

A certain amount of leakage should be expected with metal-to-metal seating in any valve. If the leakage becomes excessive, however, the condition of the seating surfaces of the valve plug (key 3) and seat ring (key 6) can be improved by lapping. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound with a mixture that contains 280 to 600 grit. Apply the compound to the bottom of the valve plug.

Use the following procedure to lap the seating surfaces.

1. For all designs, install the seat ring gasket or O-ring (key 12), seat ring (key 6), seat ring cap screws (key 7), lower cage gasket (key 12), cage (key 2), and upper cage gasket (key 12) into the valve body per the instructions in the Trim Replacement procedure.
2. Install the assembled valve plug and stem (keys 3 and 4)--without piston rings or seal ring (key 8)-- into the cage.
3. For all seating surfaces, install the bonnet (key 1, figure 11) over the valve stem and secure the bonnet with four of the hex nuts (key 14).
4. Attach a handle, such as a piece of strap iron secured by stem locknuts, to the valve plug stem. Rotate the handle alternately in each direction to lap the seats.

Note

In order to preserve the effects of lapping, do not change either the position of the seat ring in the valve body cavity or the position of the cage on the seat ring after lapping the seating surfaces. If possible, clean the parts without disturbing their positions. If the parts must be removed for cleaning, return them to the original positions.

5. After lapping, again disassemble as necessary, clean the seating surfaces, reassemble, and test for shutoff. Repeat the lapping procedure if necessary.

Trim Replacement

After all trim maintenance has been completed, reassemble the valve by following the numbered steps below. Be certain that all gasketed surfaces are clean. Key numbers referenced in this procedure are shown in figure 12 for the EHD valve and in figure 14 for the EHT valve.

CAUTION

Thoroughly clean the seat ring (key 6), the seat ring cap screws (key 7), and the cap screw threads in the valve body with a good-quality degreaser. Unless the valve is to be used for oxygen service, thoroughly lubricate the cap screw threads and the underside of the cap screw heads with one of the lubricants (or equivalent) shown in table 7.

Failure to lubricate as described may cause galling and improper seat ring gasket or O-ring (key 12) loading which may result in leakage.

⚠ WARNING

If the control valve is to be used for oxygen service, use the lubrication procedure above, but substitute a lubricant that has been approved for oxygen service. Use of unapproved lubricants creates a fire or explosion hazard.

1. Install either the seat ring gasket or the O-ring (key 12). Place the O-ring in the O-ring groove in the seat ring before installing the seat ring in the valve body. Install the seat ring (key 6) and secure it with the seat ring cap screws (key 7). Torque the hex socket head cap screws in a criss-cross pattern with no more than 20 N•m (15 lbf•ft) of torque. When all are tightened to 20 N•m (15 lbf•ft), increase the torque 20 N•m (15 lbf•ft) without exceeding the torque value specified in table 7, and repeat the crisscross pattern. Repeat until all cap screws are tightened to the torque value specified in table 7. Repeat the final torque and if any cap screw still turns, tighten every cap screw again.
2. Install one of the cage gaskets (key 11) between the valve body and cage (key 2), and install the cage.
3. If the cage used has multiple sizes of windows, attempt to orient the largest window toward the valve body web (a shelf-like projection of the casting into the flow cavity). As an alternate reference, orient the largest window toward the process outlet for a flow-down and toward the process inlet for a flow-up valve.
4. Inspect the valve plug stem threads for any sharp edges that might cut the packing. Use a whetstone or emery cloth to smooth the threads if necessary.
5. To install the piston rings or seal ring (key 8), proceed as appropriate:

For an EHD valve, if installing a new piston ring, the replacement piston ring will arrive in one piece. Use a vise with smooth or taped jaws to break this replacement piston ring into halves. Place the new ring in the vise so that the jaws compress the ring into an oval. Slowly compress the ring until the ring snaps on both sides. If one side snaps first, do not try to tear or cut the other side. Instead, keep compressing until the other side snaps.

Remove any protective tape or covering from the valve plug and stem assembly, and set it on a protective surface. Then place the piston ring in the piston ring groove with the fractured ends matched.

For an EHT valve, install the seal ring (key 8) onto the valve plug (key 3). Install the ring with the open side facing the seat ring end of the valve plug for a flow-down application (view B of figure 14) or with the open side facing the valve stem end of the valve plug for a flow-up application. Slide the backup ring (key 9) onto the valve plug. Secure with the retaining ring (key 10). For an EHT valve with a Whisper Trim Level D cage, install the piston ring (key 30, figure 14) using the procedure given in the EHD instructions immediately preceding this paragraph.

6. Install the valve plug into the cage.
7. Install the other cage gasket (key 11) between the cage and the bonnet.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 6 may result in cage crushing, cage diameter reduction, and/or bonnet deformation. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended; it may result in damage to valve components.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) or Local Business Partner immediately if a discrepancy between actual parts and approved parts is suspected.

8. Install the bonnet over the valve stem and onto the valve body. Lubricate the threads of the studs (key 13) and the faces of the hex nuts (key 14) with anti-seize lubricant (key 24). Secure the bonnet with hex nuts (key 14) and washers (key 29). Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 6. When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified torque value and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Repeat the final torque value and if any nut still turns, tighten every nut again.
9. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 4. Slip a smooth-edged pipe over the valve stem, and gently tamp each soft packing part into the packing box.
10. Slide the packing follower, wiper, and packing flange into position. Lubricate the packing flange studs (key 4) and the faces of the packing flange nuts (key 5) and then install the packing flange nuts.

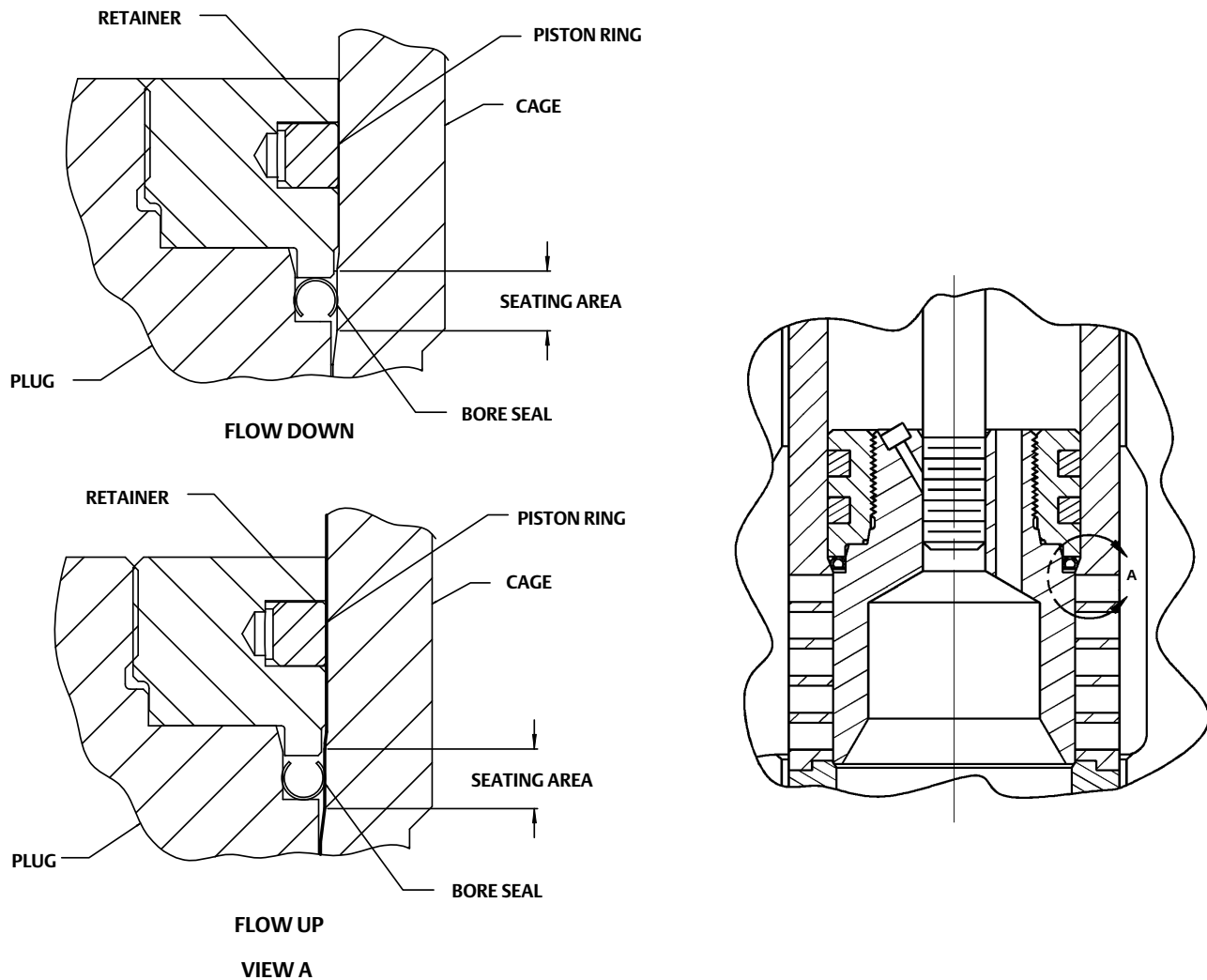
For spring-loaded PTFE V-ring packing: Tighten the packing flange nuts until the shoulder on the packing follower (key 13) contacts the bonnet (key 1).

For other kinds of packing, except ENVIRO-SEAL and HIGH-SEAL: Tighten the packing flange nuts to the maximum recommended torque shown in table 5. Then, loosen the packing flange nuts and retighten them to the recommended minimum torque in table 5.

For ENVIRO-SEAL and HIGH-SEAL packing: See the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) or HIGH-SEAL Live-Loaded Packing System ([D101453X012](#)) (as appropriate) for packing instructions.

11. Mount the actuator by following the Actuator Mounting procedure. Check for packing leakage as the valve is being put into service. Retorque the packing flange nuts as required (see table 5). Then, retighten the hex nuts (key 14) to the torque shown in table 6.

Figure 5. Fisher EHD with Bore Seal Trim



Retrofit: Installing Bore Seal Trim

Note

Additional actuator thrust is required for a valve with Bore Seal trim. When installing Bore Seal trim in an existing valve, contact your [Emerson sales office](#) or Local Business Partner for assistance in determining new actuator thrust requirements.

Assemble the new valve plug/retainer assembly (with Bore Seal plug seal) using the following instructions:

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the new trim parts while assembling the individual parts and during installation in the valve body.

1. Apply a suitable high-temperature lubricant to the inside diameter of the Bore Seal plug seal. Also, lubricate the outside diameter of the valve plug where the Bore Seal plug seal must be pressed into the proper sealing position (figure 5).
2. Orient the Bore Seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the Bore Seal plug seal must face up in a valve with flow-up construction (figure 5).
 - The open interior of the Bore Seal plug seal must face down in a valve with flow-down construction (figure 5).
3. Place the Bore Seal plug seal over the top of the valve plug. The retainer will help guide the Bore Seal down onto the plug (figure 5). Do not force the Bore Seal over the plug. For flow down constructions, skip to step 5.
4. An installation tool (see table 8) must be inserted into the Bore Seal prior to using the retainer to guide it down the plug.
5. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the Bore Seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench. For flow down constructions, skip to step 7.
6. Remove the retainer and then the installation tool. Place the Bore Seal retainer back onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
7. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 7) to secure the Bore Seal retainer.
8. Install the new plug/retainer assembly with Bore Seal plug seal on the new stem following the appropriate instructions in the Trim Replacement section of this manual.
9. Install piston rings by following instructions in the Trim Replacement section of this manual.
10. Remove the existing valve actuator and bonnet following the appropriate instructions in the Replacing Packing section of this manual.

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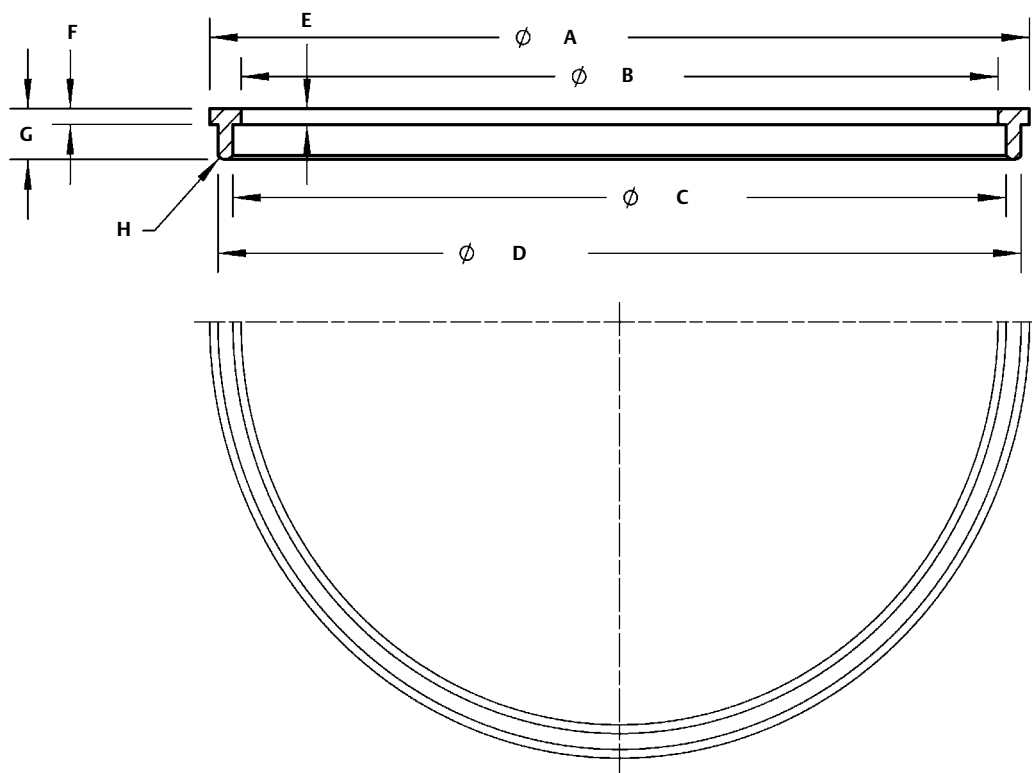
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Figure 6. Bore Seal Installation Tool



GE22109-A

Table 8. Bore Seal Installation Tool Dimensions

VALVE PORT SIZE, INCH	Dimensions, Inches (See Figure 6)								Tool Part Number
	A	B	C	D	E	F	G	H	
5.375	5.49	5.07	5.17-5.19	5.39-5.37	0.10	0.10	0.32	R.06	GE22109X012
7.00	7.11	6.69	6.79-6.81	7.01-6.99	0.09	0.10	0.32	R.06	GE18264X012
10.00	10.12	9.7	9.80-9.82	10.02-10.00	0.10	0.10	0.32	R.06	GE17914X012

CAUTION

Do not remove the existing valve stem from the valve plug unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

- Remove the existing valve stem and plug, cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section of this manual.
- Replace all gaskets according to appropriate instructions in the Trim Replacement section of this manual.
- Install the new seat ring, cage, valve plug/retainer assembly, and stem into the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section of this manual.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the Bore Seal plug seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop across the valve, this force will adequately drive the valve plug to the seat ring, thus giving the Bore Seal plug seal a predetermined permanent set. Once this is done, the plug/retainer assembly, the cage, and the seat ring become a matched set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Replacement of Installed Bore Seal Trim

Trim Removal (Bore Seal Constructions)

1. Remove the valve actuator and bonnet following the appropriate instructions in the Replacing Packing section of this manual.

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance.

Use caution when removing piston ring(s) and the Bore Seal plug seal to avoid scratching any sealing surface.

CAUTION

Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

2. Remove the plug/retainer assembly (with Bore Seal plug seal), cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section of this manual.
3. Locate the staked thread on top of the valve plug (figure 7). The staked thread secures the retainer. Use a drill with a 1/8 inch bit to drill out the staked area of the thread. Drill approximately 1/8 inch into the metal to remove the staking.
4. Locate the break between sections of the piston ring(s). Using an appropriate tool such as a flat-blade screwdriver, carefully pry out the piston ring(s) from the groove(s) in the Bore Seal retainer.
5. After removing the piston ring(s), locate the 1/4-inch diameter hole in the groove. In a retainer with two piston ring grooves, the hole will be found in the upper groove.
6. Select an appropriate tool such as a punch and place the tip of the tool into the hole with the body of the tool held tangent to the outside diameter of the retainer. Strike the tool with a hammer to rotate the retainer and free it from the valve plug. Remove the retainer from the plug.

Figure 7. Stake the Threads of the Bore Seal Retainer

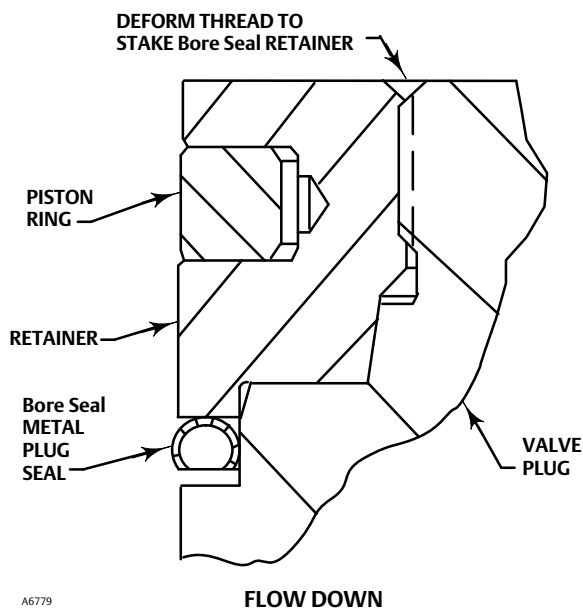
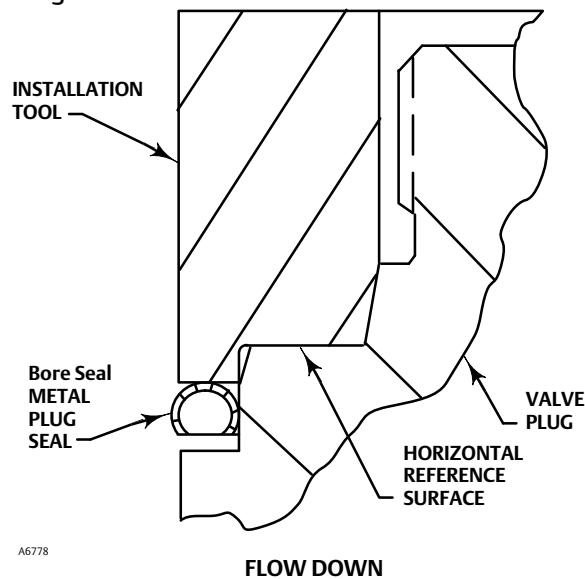


Figure 8. Installing the Bore Seal Plug Seal Using the Installation Tool



NOTE: PRESS THE INSTALLATION TOOL OVER THE VALVE PLUG UNTIL THE TOOL CONTACTS THE HORIZONTAL REFERENCE SURFACE OF THE VALVE PLUG.

7. Use an appropriate tool such as a flat-blade screwdriver to pry the Bore Seal plug seal off the plug. Use caution to avoid scratches or other damage to the sealing surfaces where the Bore Seal plug seal makes contact with the valve plug (figure 9).
8. Inspect the lower seating surface where the valve plug contacts the seat ring for wear or damage which would prevent proper operation of the valve. Also, inspect the upper seating surface inside the cage where the Bore Seal plug seal contacts the cage, and inspect the sealing surface where the Bore Seal plug seal makes contact with the plug (figure 9).
9. Replace or repair trim parts according to the following procedure for lapping metal seats, remachining metal seats, or other valve plug maintenance procedures as appropriate.

Lapping Metal Seats (Bore Seal Constructions)

Before installing a new Bore Seal plug seal, lap the lower seating surface (valve plug to seat ring, figure 9) following appropriate procedures in the Lapping Seats section of this manual.

Remachining Metal Seats (Bore Seal Constructions)

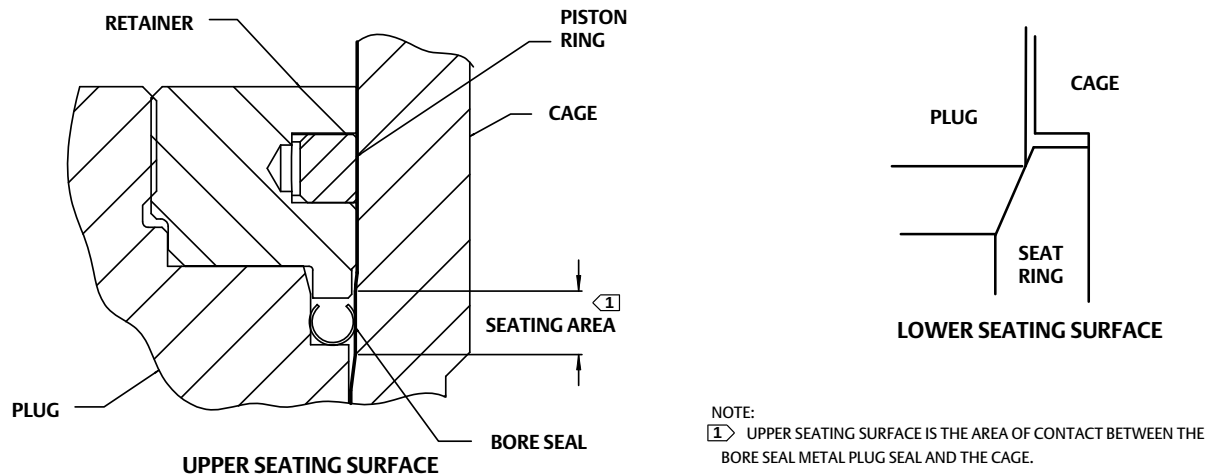
A valve plug with a Bore Seal metal plug seal features two seating surfaces. One seating surface is found where the valve plug contacts the seat ring. The second seating surface is found where the Bore Seal plug seal contacts the upper seating surface in the cage. The cage does not require any machining, even when the plug and / or seat ring have been machined.

Trim Replacement (Bore Seal Constructions)

1. Apply a suitable high-temperature lubricant to the inside diameter of the Bore Seal plug seal. Also, lubricate the outside diameter of the valve plug where the Bore Seal plug seal must be pressed into the proper sealing position (figure 5).
2. Orient the Bore Seal plug seal for correct sealing action based on the process fluid flow direction through the valve.

- The open interior of the Bore Seal plug seal must face up in a valve with flow-up construction (figure 5).
- The open interior of the Bore Seal plug seal must face down in a valve with flow-down construction (figure 5).

Figure 9. Lower (Valve Plug to Seat Ring) and Upper (Bore Seal Plug Seal to Cage) Seating Surfaces



- Place the Bore Seal plug seal over the top of the valve plug. The retainer will help guide the Bore Seal down onto the plug. Do not force the Bore Seal over the plug. For flow down constructions, skip to step 5.
- An installation tool (see table 8) must be inserted into the Bore Seal prior to using the retainer to guide it down the plug.
- Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the Bore Seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench. For flow down constructions, skip to step 7.
- Remove the retainer and then the installation tool. Place the Bore Seal retainer back onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
- Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 7) to secure the Bore Seal retainer.
- Replace the piston ring(s) following instructions in the Trim Replacement section of this manual.
- Return the seat ring, cage, plug/retainer assembly, and stem to the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section of this manual.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the Bore Seal plug seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop across the valve, this force will adequately drive the valve plug to the seat ring, thus giving the Bore Seal plug seal a predetermined permanent set. Once this is done, the plug/retainer assembly, the cage, and the seat ring become a matched set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Actuator Mounting

The following procedure assumes that the valve and actuator are fully assembled, but with the actuator removed from the valve. Unless otherwise identified, the parts involved in making up the actuator-valve stem connection are shown in figure 3.

CAUTION

Never use a wrench or pliers on the valve plug stem and never turn the valve plug stem while the valve plug assembly is seated. A damaged stem could cut the packing and allow leakage. Turning the plug while seated could damage the seats allowing leakage at shutoff.

1. Turn the stem locknuts onto the valve stem.
2. Move the valve plug to the closed position.
3. Place the actuator on the bonnet and secure with the hex nuts (key 26, figure 11). Connect supply pressure to the actuator.
4. Make sure the actuator stem is fully retracted. With a properly assembled direct-acting spring-return actuator, spring compression forces the actuator stem to the fully retracted position. A double-acting piston actuator or a reverse-acting spring-return actuator requires air pressure (or a side-mounted handwheel) to stroke the actuator stem to the fully retracted position.
5. Extend the actuator stem a distance equal to the travel (as specified on the nameplate).
6. Attach both halves of the stem connector, making sure the connector fully engages both the actuator threads and valve plug stem threads. Install the cap screws in the stem connector, but tighten them only slightly at this time.
7. Stroke the valve to the fully open position. The travel indicator should show the valve to be wide open. If it does not, loosen the screws that hold the travel indicator scale, and shift the scale to the required position.
8. Stroke the valve to the closed position. The travel indicator should show the valve to be closed.
9. If travel is not correct, lift the valve plug assembly (key 3, figure 12 or 14) off its seat approximately 6.4 mm (1/4 inch) and screw the valve plug stem into or out of the stem connector as follows. To lengthen travel, turn the valve plug stem into the stem connector slightly. To shorten travel, turn the valve plug stem out of the stem connector slightly. (Turning it out too far will limit the stroke.)
10. After adjusting the stem connection so that the actuator will properly stroke the valve plug assembly, tighten the cap screws in the stem connector, tightening the one opposite the anti-rotation groove first. Then lock the stem locknuts against the stem connector.

Parts Ordering

Each valve is assigned a serial number, which can be found on the valve body. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the number when contacting your [Emerson sales office](#) or Local Business Partner for technical assistance or when ordering replacement parts.

When ordering replacement parts, also be sure to include the 11-character part number for each part required from the following parts list.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

ENVIRO-SEAL Packing Retrofit Kits

Retrofit kits include parts to convert existing packing to the ENVIRO-SEAL packing system. PTFE kits include keys 200, 201, 211, 212, 214, 215, 217, 218, tag, and cable tie. Graphite kits include keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 216, 217, tag, and cable tie. Duplex kits include keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, and cable tie. Stems and packing box constructions that do not meet Emerson stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of the packing kit.

Stem Diameter mm (Inches)	Yoke Boss Diameter mm (Inches)	Kits Packing Material		
		Double PTFE	Graphite ULF	Duplex
31.8 (1-1/4)	127 (5, 5H)	RPACKXRT052	RPACKXRT302	RPACKXRT252

ENVIRO-SEAL Packing Repair Kits

Repair kits include parts to replace the “soft” packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits. PTFE repair kits include keys 214, 215, and 218. Graphite repair kits include keys 207, 208, 209, 210, and 214. Duplex repair kits include keys 207, 209, 214, and 215.

Stem Diameter mm (Inches)	Yoke Boss Diameter mm (Inches)	Kits Packing Material		
		Double PTFE	Graphite ULF	Duplex
31.8 (1-1/4)	127 (5, 5H)	RPACKX00232	RPACKX00632	RPACKX00332

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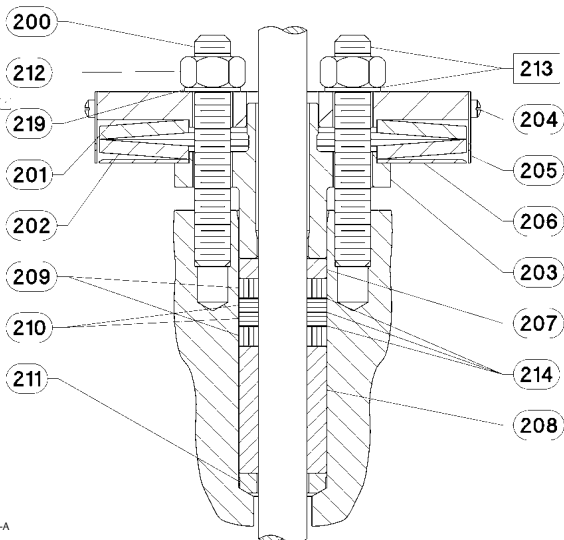
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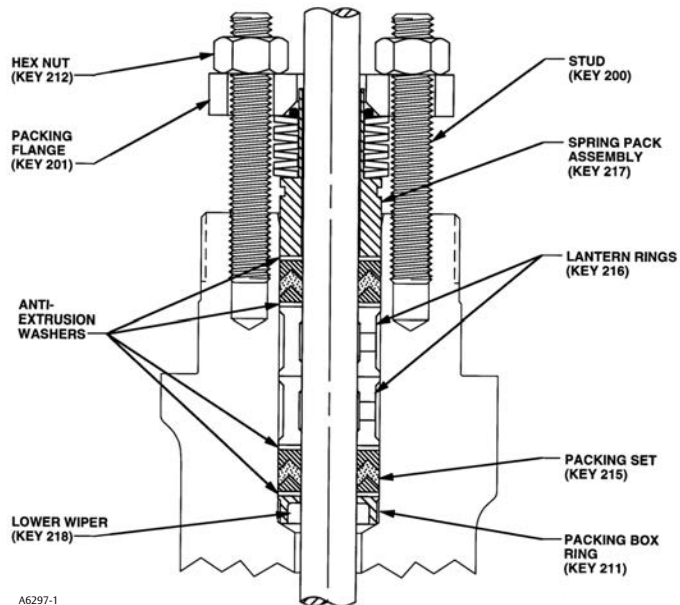
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Figure 10. Live-Loaded Packing



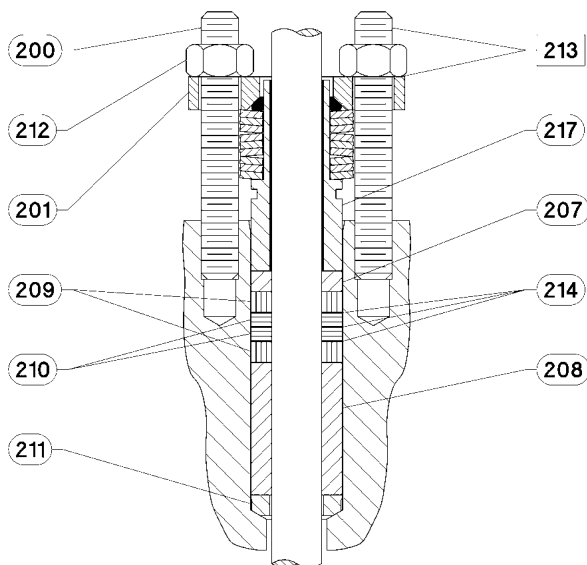
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Typical HIGH-SEAL ULF Packing System



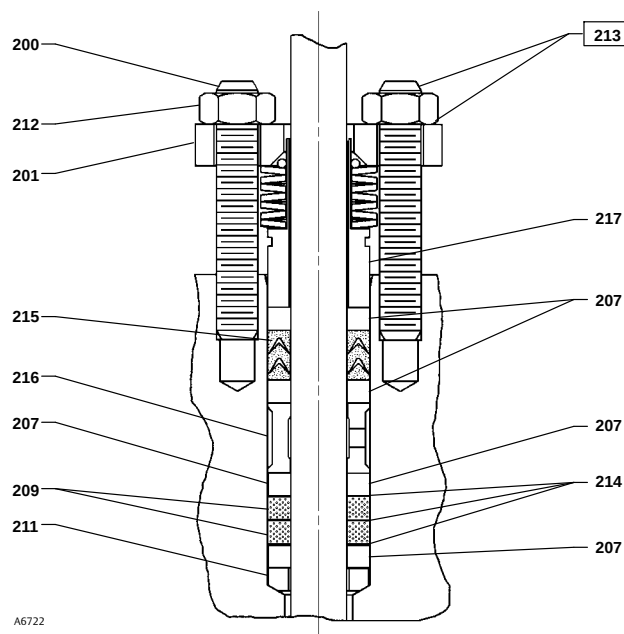
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Typical ENVIRO-SEAL Packing System with PTFE Packing



3984612/A

Typical ENVIRO-SEAL Packing System with Graphite ULF Packing



A6722

Typical ENVIRO-SEAL Packing System with Duplex Packing

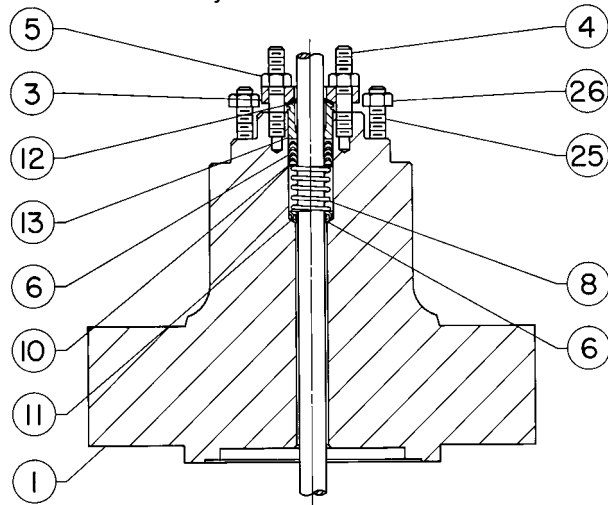
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Figure 11. Bonnet Assembly



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Parts List

Note

Contact your [Emerson sales office](#) or Local Business Partner for Part Ordering information.

Bonnet Assembly (figures 4 and 11)

Key	Description	Key	Description
1	Bonnet If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.	8	Spring or Lantern Ring
3	Packing Flange	9*	Packing Ring
4	Packing Flange Stud 127 mm (5-inch) yoke boss diameter (2 req'd) 178 mm (7-inch) yoke boss diameter (3 req'd)	10	Washer
5	Packing Flange Nut 127 mm (5-inch) yoke boss diameter (2 req'd) 178 mm (7-inch) yoke boss diameter (3 req'd)	11*	Packing Box Ring
6*	Packing Set	12*	Upper Wiper, felt
7*	Packing Ring	13	Packing Follower, 316 stainless steel
		14	Pipe Plug (not shown) Steel 316 stainless steel
		14	Lubricator, steel (not shown)
		14	Lubricator/Isolating Valve (not shown)
		25	Actuator Mounting Stud, steel (8 req'd)
		26	Hex Nut, steel (8 req'd)
		30*	Lower Wiper, PTFE
		31*	Male Adapter, PTFE
		32*	Female Adapter, PTFE/glass

* Recommended spare parts

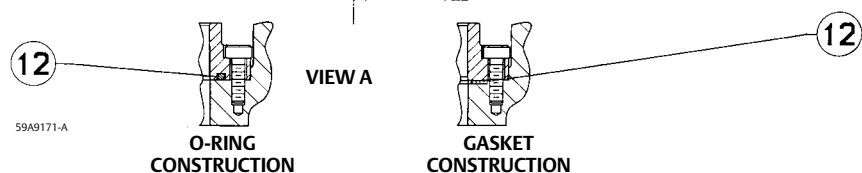
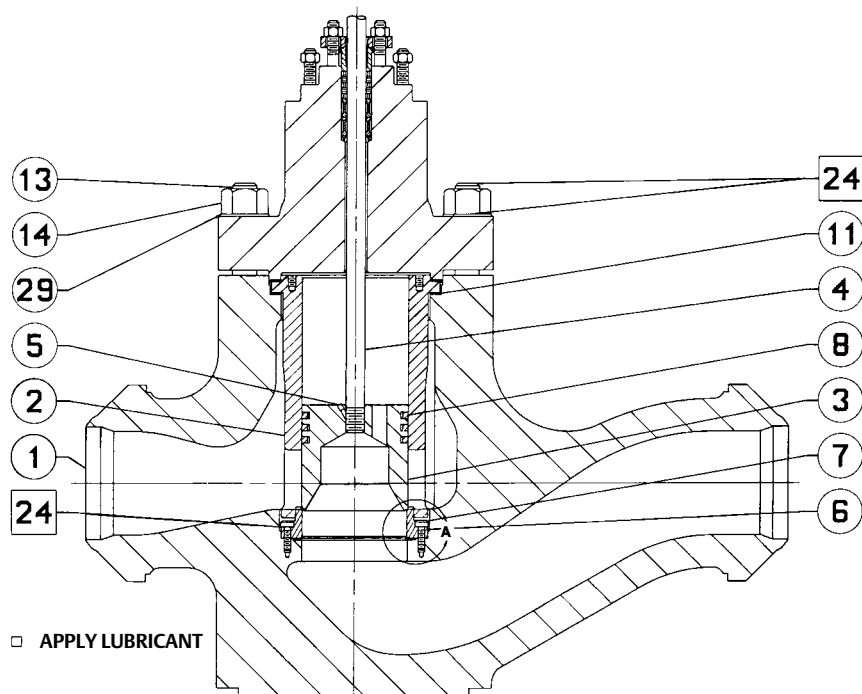
Valve Assembly (figures 12, 13, and 14)

[illegible]

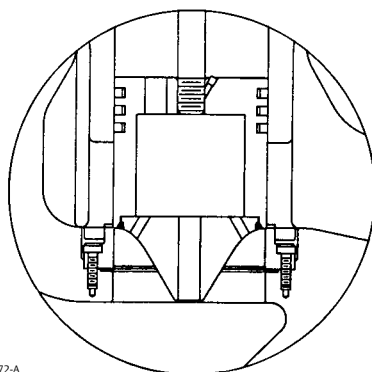
Figure 12. Fisher EHD Valve



FLOW DIRECTION FOR ALL TRIMS EXCEPT THOSE WITH WHISPER TRIM III CAGES

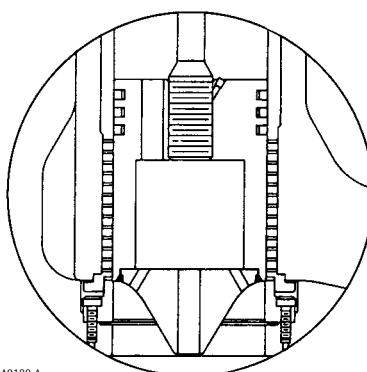


COMPLETE VALVE SHOWING VALVE PLUG WITHOUT DIVERter CONE



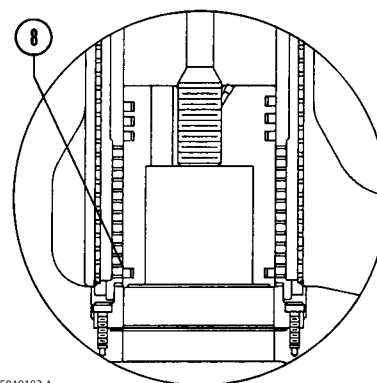
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DIVERter CONE DETAIL



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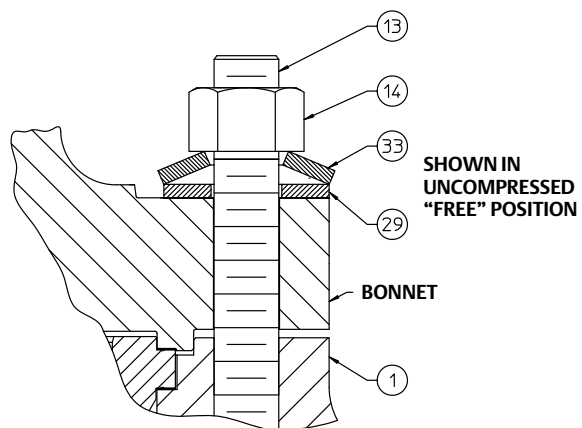
WHISPER TRIM
LEVEL A, B, OR C DETAIL



59A9182-A

WHISPER TRIM
LEVEL D DETAIL

Figure 13. Belleville Washer Body-to-Bonnet Bolting



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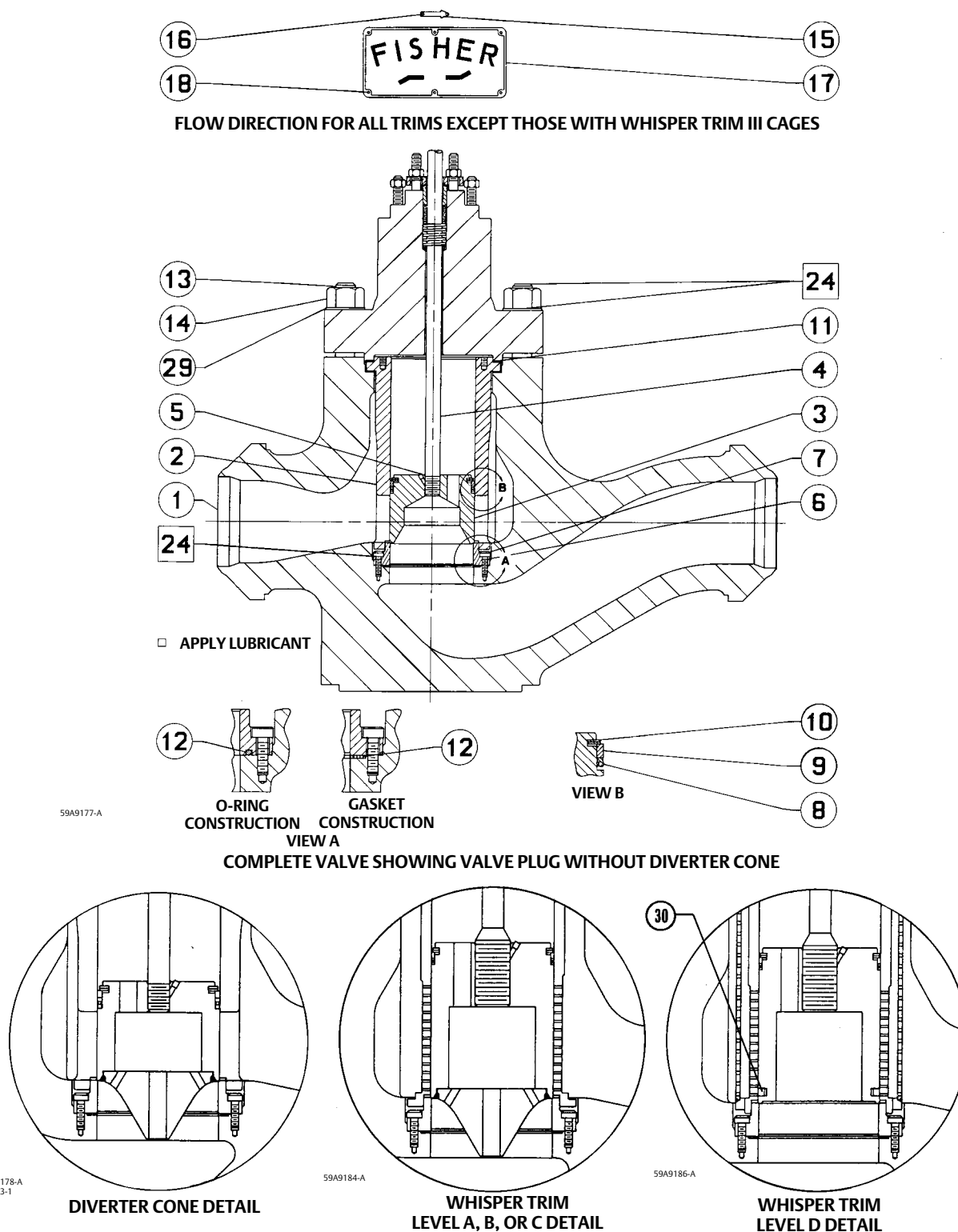
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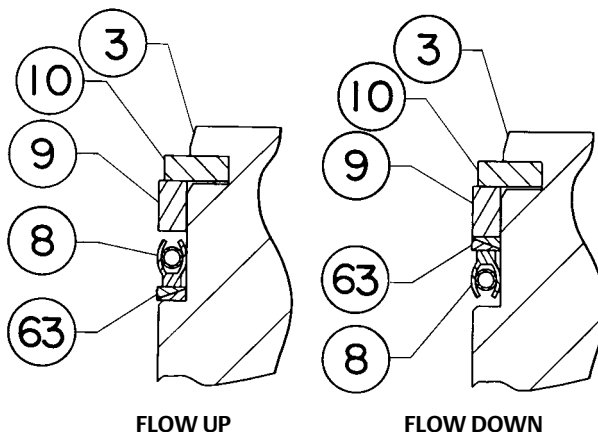
Figure 14. Fisher EHT Valve



Key Description

- 11* Cage Gasket (2 req'd)
For standard service, silver pl
N04400
NPS 8 and 10 valves
CL1500
CL2500
NPS 12 and 14 valves
CL1500
CL2500
For sour gas service, tin pl N04400
NPS 8 and 10 valves
CL1500
CL2500
NPS 12 and 14 valves
CL1500
CL2500
- 12* Seat Ring Gasket
Spiral wound N06600
NPS 8 and 10 valves
CL1500
CL2500
NPS 12 and 14 valves
CL1500
CL2500
- 12* Seat Ring O-Ring
NPS 8 and 10 valves
CL1500
Nitrile
Ethylene/propylene
Fluorocarbon
CL2500
Nitrile
Ethylene/propylene
Fluorocarbon
NPS 12 and 14 valves
CL1500
Nitrile
Ethylene/propylene
Fluorocarbon
CL2500
Nitrile
Ethylene/propylene
Fluorocarbon
- 13 Bonnet Stud (12 required)

Figure 15. Fisher EHT Valve Using PEEK Anti-Extrusion Rings



Key Description

- 14 Hex Nut (12 req'd)
15 Flow Arrow, stainless steel
16 Drive Screw, stainless steel
(2 req'd)
17 Nameplate, stainless steel
18 Drive Screw, stainless steel
(6 req'd)
24 Anti-seize lubricant,
(not furnished with valve)
29 Flat Washer (12 req'd)
30* Piston Ring, graphite (for EHD
valve with Level D Whisper Trim III
cage only)
NPS 8 and 10 valves
CL1500
CL2500
NPS 12 and 14 valves
CL1500
CL2500
33 Belleville Washer, N07718 (12 req'd)
63 Anti-Extrusion Ring

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Actuator Groups by Type Number

Group 100 127 mm (5-Inch) Yoke Boss	Group 406 127 mm (5-Inch) Yoke Boss
472	667 MO
473	667-4 MO
474	
476	Group 407 127 mm (5-Inch) Yoke Boss
585C	474
657	585C
1008	657
	Group 408 127 mm (5H) and 178 mm (7-Inch) Yoke Boss
Group 101 127 mm (5-Inch) Yoke Boss	657 Size 100
	1008
667	Group 409 127 mm (5H) and 178 mm (7-Inch) Yoke Boss
Group 404 127 mm (5-Inch) Yoke Boss	667 Size 100
	Group 802 127 mm (5-Inch) Yoke Boss
667	
667-4	
Group 405 127 mm (5-Inch) Yoke Boss	585C
657 MO	
657-4 MO	

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Fisher™ EHD, EHS, and EHT Valves NPS 1-1/2x1 through NPS 8x6

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Figure 1. Fisher EH Valve with 657 Actuator



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher EHD, EHS, and EHT control valves in NPS 1-1/2 x 1 through NPS 8x6. Refer to separate manuals for instructions covering the actuator, positioner, ENVIRO-SEAL™ packing, HIGH-SEAL packing, and accessories.

Do not install, operate, or maintain EHD, EHS, or EHT valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Unless otherwise noted, all NACE references are to NACE MR0175-2002.

Table 1. Specifications

End Connection Styles Buttwelding: All available ASME B16.25 schedules that are compatible with ASME B16.34 pressure/temperature ratings Flanged: CL2500 ■ ring-type joint (RTJ) or ■ raised-face (RF) flanges according to ASME B16.5 Socket Welding: Consistent with ASME B16.11 Maximum Inlet Pressure⁽¹⁾ Buttwelding: Consistent with CL2500 pressure-temperature ratings per ASME B16.34 Flanged: Consistent with CL2500 pressure-temperature ratings per ASME B16.34 Socket Welding: Consistent with CL2500 pressure-temperature ratings per ASME B16.34 Shutoff Classifications See table 2 C-seal trim: High-temperature, Class V. See table 3 TSO (Tight Shutoff) trim: See tables 4 and 5	Flow Characteristic Standard Cage: ■ Equal percentage, ■ modified equal percentage⁽²⁾, ■ or linear Cavitrol™ III or Whisper Trim™ III Cage: Linear Flow Direction EHD or EHT: Flow down, except with either a Whisper Trim III cage or a valve plug with diverter cone, both of which are flow up EHS: Flow up, except flow down with Cavitrol III cage Approximate Weights (Valve Body and Bonnet Assemblies) See table 6 Additional Specifications For specifications such as materials, valve plug travels, and port, yoke boss, and stem diameters, see the Parts List section
--	---

1. The pressure or temperature limits in this manual and any applicable standard limitations should not be exceeded.

2. Modified equal percentage characteristic is equal-percentage for the first 90% of travel, then quick-opening for additional capacity.

Table 2. Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4

Valve	Valve Size, NPS	ANSI/FCI Leakage Class
EHD	3x2	II
	3, 4x3, 4, 6x4	II—Standard
		III—Optional ⁽¹⁾
	6, 8x6	III—Standard
		IV—Optional ⁽¹⁾
EHS w/Cavitrol III, or EHT w/Cavitrol III	All	V ⁽¹⁾
EHS, EHT, EHS w/Micro-Form or EHS w/Micro Flute	All	IV—Standard
		V—Optional ⁽¹⁾
EHT w/ PEEK Anti-Extrusion Rings	3 to 6	V to 600°F (316°C)

1. O-ring seat ring construction recommended for this shutoff classification; for temperatures below 232°C (450°F) only.

Description

The EHD, EHS, and EHT high-pressure globe valves (figure 1) have metal seats, cage guiding, and push-down-to-close valve plug action. The EHD and EHT valves use balanced valve plugs.

The EHS valve uses an unbalanced valve plug. To provide a seal between the cage and a balanced valve plug, the EHD valve plug uses piston rings; the EHT valve plug uses a pressure-assisted seal ring. A Whisper Trim cage can be used with an EHD, EHS, or EHT valve plug. A Cavitrol III cage can be used with an EHS or EHT valve plug.

C-seal trim is available for EHD valves, CL2500, in sizes 4, 6, 6x4, and 8x6.

With C-seal trim, a balanced valve can achieve high-temperature, Class V shutoff. Because the C-seal plug seal is formed from metal (N07718 nickel alloy) rather than an elastomer, a valve equipped with the C-seal trim can be

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applied in processes with a fluid temperature of up to 593°C (1100°F), provided other material limits are not exceeded. Contact your [Emerson sales office](#) or Local Business Partner for information.

Specifications

Specifications for the EHD, EHS, and EHT valves are shown in table 1.

Educational Services

For information on available courses for the Fisher EH valve, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Table 3. Additional Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4

Valve (Class)	Valve Size, NPS	Port Diameter, Inches	Cage Style	ANSI/FCI Leakage Class
EHD (CL2500)	4 6x4	2.875	Equal Percentage, Modified Equal Percentage, Linear (std. cage), Linear (Whisper III, A1, B3, C3)	V (for port diameters from 2.875 through 7-inch with optional C-seal trim)
			Linear (Cavitrol III, 2-stage)	
	6 8x6	4.375	Equal Percentage, Modified Equal Percentage, Linear (std. cage), Linear (Whisper III, A1, B3, C3, D3)	
			Linear (Cavitrol III, 2- and 3-stage)	

Table 4. TSO (Tight Shutoff) Leakage Class per ANSI/FCI 70-2 and IEC 60534-4

Leakage Class	Maximum Leakage	Test Medium	Test Pressure	ANSI/FCI Leakage Class
TSO (Tight Shutoff)	Valves with TSO trim are factory tested to a more stringent Emerson Automation Solutions test requirement of no leakage at time of shipment.	Water	Service ΔP ⁽¹⁾	V

1. Specify service ΔP when ordering.

Table 5. TSO Shutoff Availability

VALVE	CONSTRUCTION	LEAKAGE CLASS	
		Standard	Optional
EHS, EHT	Cavitrol III trim. Replaceable, protected soft seat	TSO	---

Table 6. Approximate Weights (Valve Body and Bonnet Assemblies)

VALVE SIZE, NPS	CL2500			
	Kilograms		Pounds	
	Flg	SWE & BWE	Flg	SWE & BWE
1-1/2 x 1	---	46	---	101
2x1	78	47	173	104
3x2	161	94	355	207
3	223	163	492	359
4x3	265	162	585	357
4	338	243	745	536
6x4	526	257	1160	567
6	785	544	1731	1199
8x6	955	558	2106	1231

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given in this manual or on the appropriate nameplates. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. The valve configuration and construction materials meet particular pressure, temperature, pressure drop, and controlled fluid conditions specified in the customer's order. Because some body/trim material combinations are limited in their pressure drop and temperature range capabilities (especially due to differences in thermal expansion rates), do not apply any other conditions to the valve without first contacting your [Emerson sales office](#) or Local Business Partner.

CAUTION

If hoisting the valve, use a nylon sling to protect the painted surfaces. Carefully position the sling to prevent damage to the tubing or any accessories. Use adequately sized hoists and chains or slings to handle the valve and take precautions to prevent personnel from being injured in case the hoist or rigging slips unexpectedly. Refer to table 6 for valve assembly weights.

WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however some readjustment will be required to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

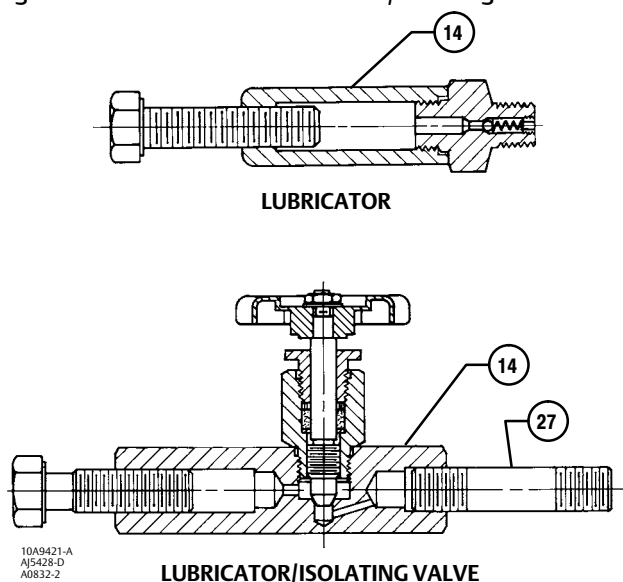
1. Before installing the valve, inspect it to ensure that the valve body cavity is free of foreign material.
2. Clean out all pipelines to remove scale, welding slag, and other foreign materials before installing the valve.

Note

If the valve being installed has small internal flow passages, such as with Whisper Trim III or Cavitrol III cages, consideration should be given to installing an upstream strainer to prevent the lodging of particles in these passages. This is especially important if the pipeline cannot be thoroughly cleaned or if the flowing medium is not clean.

3. The control valve must be installed with the actuator vertical above the valve body for proper operation. Flow through the valve must be in the direction indicated by the flow arrow (key 15, figure 18, 19, or 20) on the valve body.
4. Use accepted piping and welding practices when installing the valve in the line. For welding end valve bodies, completely disassemble the valve removing all trim parts before welding the valve body in the line. For flanged valve bodies, use suitable gaskets between the valve body flanges and pipeline flanges.

Figure 2. Lubricator and Lubricator/Isolating Valve



CAUTION

Depending on valve body materials used, post-weld heat treating might be needed. Post-weld heat treatment can damage internal elastomeric, plastic, and metal parts. Shrunk-fit pieces and threaded connections might loosen.

If post-weld heat treating is needed, remove all trim parts to avoid any damage to internal elastomeric, plastic, and metal parts. Contact your [Emerson sales office](#) or Local Business Partner for additional information.

5. Install a three-valve bypass around the valve if continuous operation is required during maintenance.
6. If the actuator and valve body are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.
7. If the valve was shipped without packing installed in the packing box, install the packing before putting the valve into service. Refer to instructions given in the Packing Maintenance procedure.

Valves with ENVIRO-SEAL live-loaded packing or HIGH-SEAL Heavy-Duty live-loaded packing will not require this initial re-adjustment. See the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) or HIGH-SEAL Live-Loaded Packing System ([D101453X012](#)) (as appropriate) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section near the end of this manual.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance, adding packing rings, replacing packing, trim removal, valve plug maintenance, lapping seats, and trim replacement. All maintenance operations can be performed with the valve in the line.

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Table 7. Recommended Torque for Packing Flange Nuts

STEM DIAMETER		VALVE BODY RATING(1)	TORQUE			
			N•m		Lbf•Ft	
mm	Inches		Min	Max	Min	Max
12.7	1/2	CL1500	15	22	11	16
		CL2500	18	24	13	18
19.1	3/4	CL1500	34	50	25	37
		CL2500	41	61	30	45
25.4	1	CL1500	52	77	38	57
		CL2500	61	91	45	67
31.8	1-1/4	CL1500	68	102	50	75
		CL2500	81	122	60	90

1. Includes intermediate class ratings.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal.

Note

If the valve has ENVIRO-SEAL live-loaded packing installed (figure 3), see the Fisher instruction manual entitled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) for packing instructions.

If the valve has HIGH-SEAL heavy-duty live-loaded packing installed, see Fisher instruction manual entitled HIGH-SEAL Live-Loaded Packing System ([D101453X012](#)) for packing instructions.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however some readjustment will be required to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Packing Lubrication

CAUTION

Do not lubricate graphite packing. Graphite packing is self-lubricated. Additional lubrication may result in slip-stick movement of the valve.

⚠ WARNING

To avoid personal injury or property damage resulting from fire or explosion, do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F).

A lubricator or lubricator/isolating valve (figure 2) is recommended for PTFE-composition packing. The lubricator or lubricator/isolating valve is installed in place of the pipe plug (key 14, figure 16). It is recommended that a good quality silicon-base lubricant be used. To operate the lubricator, simply turn the cap screw clockwise to force lubricant into the packing box. The lubricator/isolating valve operates the same way except the isolating valve must first be opened and then closed after lubrication is completed.

Packing Maintenance

If there is undesirable packing leakage in spring-loaded PTFE V-ring packing (figure 4), tighten the packing flange nuts (key 5, figure 16) until the shoulder on the packing follower (key 13, figure 16) contacts the bonnet (key 1, figure 16). If leakage continues, replace the packing by following the numbered steps presented in the Replacing Packing procedure.

CAUTION

When tightening packing flange nuts, do not exceed the maximum recommended torque in table 7 or excessive friction may result, resulting in keeping the valve from stroking fully and not attaining proper seat load.

If there is undesirable packing leakage with other than spring-loaded PTFE V-ring packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts (key 5, figure 16) to at least the minimum recommended torque in table 7. However, do not exceed the maximum recommended torque in table 7 or excessive friction may result. If leakage continues, replace the packing by following the numbered steps presented in the Replacing Packing procedure.

If the packing is relatively new and tight on the valve plug stem, and if tightening the packing flange nuts does not stop the leakage, it is possible that the stem is worn or nicked so that a seal cannot be made. The surface finish of a stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. While replacing the packing according to the Replacing Packing procedure, inspect the valve plug stem and packing box wall for nicks or scratches.

Replacing Packing

Key numbers referred to in this procedure are shown in figure 16 unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve.

Remove the cap screws in the stem connector, and separate the two halves of the stem connector. Then exhaust all actuator pressure, if any was applied, and disconnect the actuator supply and any leakoff piping.

2. Remove either the yoke locknut (key 15) or the hex nuts (key 26), and remove the actuator from the bonnet (key 1).
3. Loosen the packing flange nuts (key 5) so that the packing is not tight on the valve plug stem (key 4, figure 18, 19, or 20). Remove any travel indicator disk and stem locknuts from the valve plug stem threads.

Table 8. Torque for Body-to-Bonnet Bolting Using Anti-Seize Lubricant(1)

VALVE SIZE, NPS	VALVE BODY RATING	TORQUE			
		N•m		Lbf•Ft	
		B7, B16, BD and 660 Studs	B8 and B8M Studs	B7, B16, BD and 660 Studs	B8 and B8M Studs
1, 1-1/2 x 1, 2x1	CL1500	163	122	120	90
	CL2500	258	195	190	140
2, 3x2	CL1500	258	195	190	140
	CL2500	380	285	280	210
3, 4x3	CL1500	556	420	410	310
	CL2500	786	597	580	440
4, 6x4	CL1500	786	597	580	440
	CL2500	1058	800	780	590
6, 8x6	CL1500	1383	1044	1020	770
	CL2500	2807	2102	2070	1550

1. For other materials, contact your [Emerson sales office](#) or Local Business Partner for torques.

CAUTION

When lifting the bonnet (key 1), be sure that the valve plug and stem assembly (keys 3 and 4, figure 18, 19, or 20) remains on the seat ring (key 6, figure 18, 19, or 20). This avoids damage to the seating surfaces as a result of the assembly dropping from the bonnet after being lifted part way out. The parts are also easier to handle separately.

Use care to avoid damaging gasket sealing surfaces.

The EHD piston rings (key 8, figure 18) are brittle and in two halves. Avoid damaging the piston rings by dropping or rough handling.

⚠ WARNING

If the cage adheres to the bonnet as the bonnet is lifted, secure the cage to the bonnet so that it will not cause personal injury or equipment damage should it fall unexpectedly.

4. Unscrew the hex nuts (key 14, figure 18, 19, or 20) and carefully lift the bonnet off the valve stem. If present, remove the Belleville washers (key 33, figure 17) and flat washers (key 29, figure 18, 19, 17, or 20). If the valve plug and stem assembly starts to lift with the bonnet, use a brass or lead hammer on the end of the stem and tap it back down. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.
5. Remove the valve plug (key 3, figure 18, 19, or 20), the cage (key 2, figure 18, 19, or 20), and the top and bottom cage gaskets (key 11, figure 18, 19, or 20).

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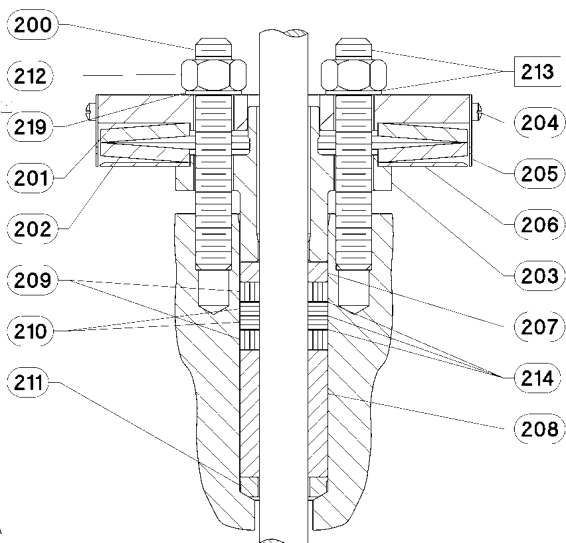
Instruction Manual

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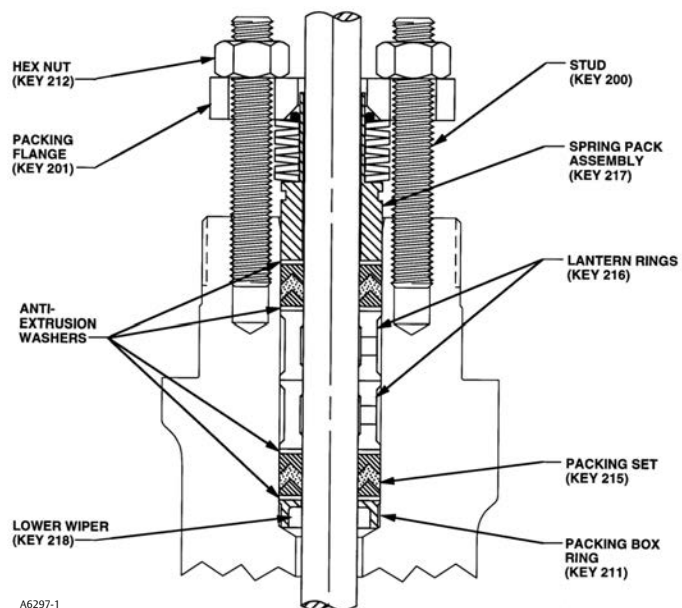
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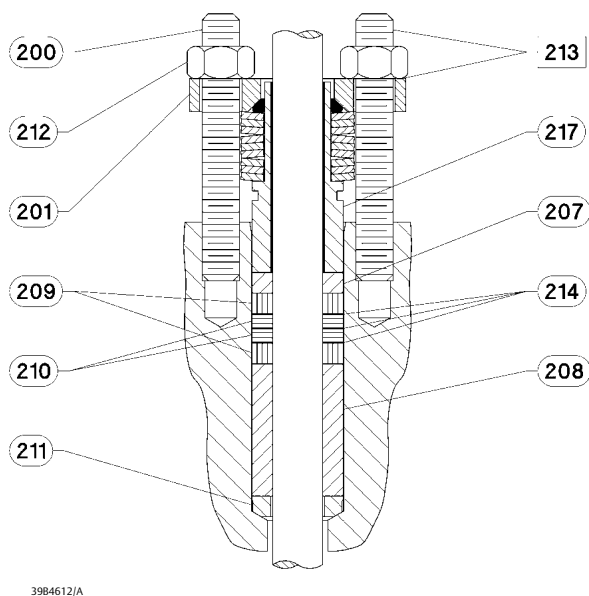
Figure 3. Live-Loaded Packing



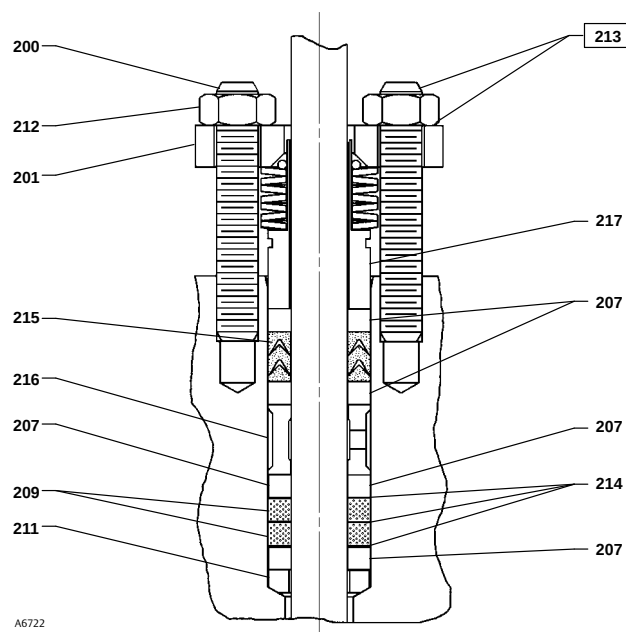
Typical HIGH-SEAL ULF Packing System



Typical ENVIRO-SEAL Packing System
with PTFE Packing

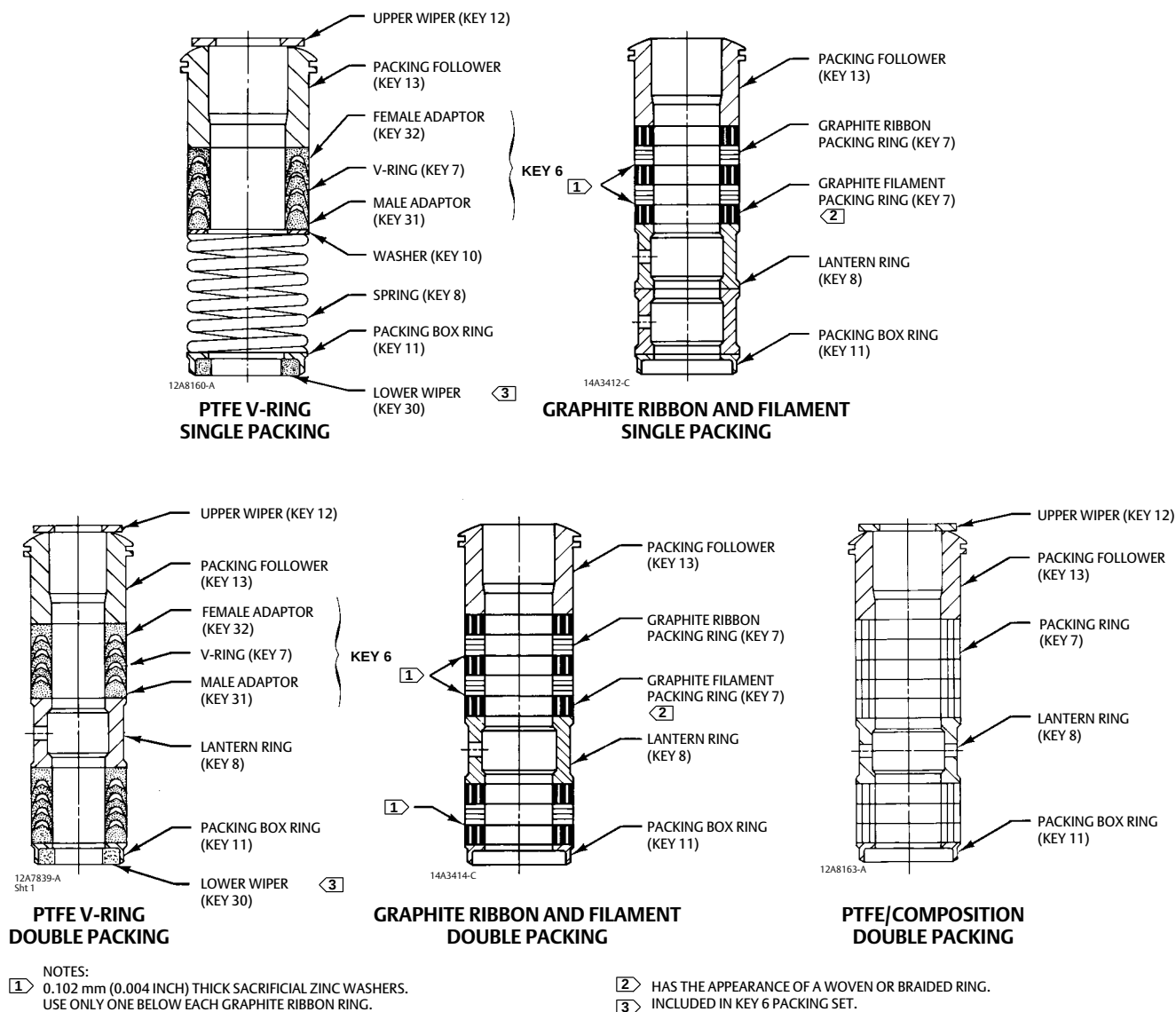


Typical ENVIRO-SEAL Packing System
with Graphite ULF Packing



Typical ENVIRO-SEAL Packing System
with Duplex Packing

Figure 4. Packing Arrangements



CAUTION

All residual gasket material must be removed from the cage gasket surfaces. If the gasket surfaces are scored or damaged during this process, smooth them by hand sanding with 360 grit paper using long, sweeping strokes. Failure to remove all residual gasket material and/or burrs from the gasket surfaces will result in leakage.

6. Clean all gasket surfaces with a good quality degreaser. Remove all residual tin or silver from all gasket surfaces.
7. Cover the opening in the valve body to protect the gasket surface and to prevent foreign material from getting into the valve body cavity.
8. Remove the packing flange nuts (key 5), packing flange (key 3), upper wiper (key 12), and packing follower (key 13, figures 4 and 16). Carefully push out all the remaining packing parts from the valve side of the bonnet using a

rounded rod or other tool that will not scratch the packing box wall. For extension bonnets, also remove the baffle (key 2) and retaining ring (key 35).

9. Clean the packing box and the following metal packing parts: packing follower (key 13), packing box ring (key 11), spring or lantern ring (key 8, figures 4 and 16), and, for single arrangements of PTFE V-ring packing only, special washer (key 10, figures 4 and 16).
10. Inspect the valve stem threads for any sharp edges that might cut the packing. A whetstone or emery cloth may be used to smooth the threads if necessary.
11. Remove the protective covering from the valve body cavity. Using new top and bottom cage gaskets (key 11, figure 18, 19, or 20), place the cage into the valve body. Be sure the cage lugs are engaged in the corresponding recesses of the seat ring retainer. Turn the cage clockwise until the lugs contact the seat ring retainer. Install the plug, then slide the bonnet over the stem and onto the studs (key 13, figure 18, 19, or 20).

Note

The prelubricated hex nuts (key 14, figure 18, 19, or 20) referred to in step 12 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 12 include--but are not limited to--ensuring that the bonnet stud threads are clean, Belleville washers (if present) are installed in the correct orientation, and that the hex nuts are evenly tightened to the specified torque values.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 8 may result in cage crushing, cage diameter reduction, and/or bonnet deformation. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

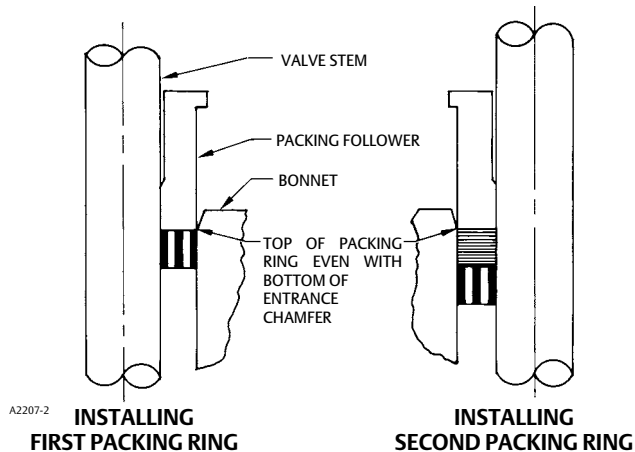
⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) or Local Business Partner immediately if a discrepancy between actual parts and approved parts is suspected.

12. Lubricate the stud threads and the faces of the hex nuts (key 14, figure 18, 19, or 20) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Replace the flat washers (key 29, figure 18, 19, 17, or 20) if present. If the valve assembly includes Belleville washers (key 33, figure 17) install these onto the studs (key 14, figure 17) with the concave side facing towards the valve body. Replace the hex nuts but do not tighten them. Torque the nuts in a crisscross pattern to no more than one fourth of the nominal torque value specified in table 8.

When all nuts are tightened to that torque value, increase the torque by one fourth of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

Figure 5. Installing Graphite Ribbon/Filament Packing Rings One at a Time



Note

If graphite ribbon/filament packing rings are used, special procedures must be observed to prevent entrapping air between the rings. Add the rings one at a time without forcing them below the chamfer of the packing box entrance chamber. As each successive ring is added, the stack should not be pushed down more than the thickness of the added ring (figure 5).

13. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 4. If desired, packing parts may be pre-lubricated with a silicon base grease for easier installation. Slip a smooth-edged pipe over the valve stem, and gently tamp each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts. For a valve with extension bonnet, also install the baffle and retaining rings (keys 2 and 35).

14. Slide the packing follower, wiper, and packing flange into position. Lubricate the packing flange studs (key 4) and the faces of the packing flange nuts (key 5). Replace the packing flange nuts.

For spring-loaded PTFE V-ring packing, tighten the packing flange nuts until the shoulder on the packing follower (key 13) contacts the bonnet.

For other packing types, tighten the packing flange nuts to the maximum recommended torque shown in table 7. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 7.

For ENVIRO-SEAL or HIGH-SEAL live-loaded packing, refer to the note at the beginning of the Maintenance section.

15. Mount the actuator on the valve body assembly, and reconnect the actuator and valve plug stems according to the procedures in the appropriate actuator instruction manual.

Trim Removal

For C-seal construction, see the appropriate C-seal sections in this instruction manual.

Trim removal and replacement requires the use of a seat ring retainer tool (key 25). If specifically ordered, a tool is supplied with a valve; but, the tool can also be ordered separately by referencing the tool part number in the Parts List. If desired, a tool can also be machined for a valve of specific size and valve class using the dimensions shown in figure 9. Machine the tool from a material listed in figure 9 or from a material with a yield strength of at least 827 MPa (120,000 psi). Using a tool of lower strength material may result in damage to the seat ring retainer or valve body threads.

Key numbers referenced in this procedure are shown in figure 18 for the EHD valve, figure 19 for the EHS valve, and figure 20 for the EHT valve except where indicated.

1. Remove the actuator and bonnet by following steps 1 through 4 of the Replacing Packing procedure. Observe all warnings and cautions.
2. Lift the valve stem and attached valve plug out of the valve body. If the valve plug is to be reused, tape or otherwise protect the valve plug stem and the valve plug seating surface to prevent scratches.
3. Lift out the cage (key 2) and the top and bottom cage gaskets (key 11). For a valve with Cavitrol III two-or three-stage cage, also remove the O-ring (key 26, figure 21) that fits between the cage and the seat ring (key 6).

Constructions other than TSO trim

1. Use the seat ring retainer tool (figure 9) to remove the seat ring retainer (key 7) as follows:
 - a. Insert the tool into the valve body. Be certain the tool lugs are engaged in the corresponding recesses in the retainer.
 - b. Use a power torque wrench or driver having torque capabilities equal to or greater than those shown in table 9. Connect the torque wrench to an extension if necessary. The tool or extension must snugly fit the square hole in the seat ring retainer tool. Refer to figure 9 for square hole sizes.
 - c. Insert the tool or extension into the square hole in the seat ring retainer tool.
 - d. Use the bonnet studs (key 13) to prevent a power torque wrench from rotating.

CAUTION

Hold the torque wrench or driver at right angles to the seat ring retainer when applying torque. Tilting the tool or extension while applying torque may cause the lugs on the seat ring retainer tool to suddenly disengage from the recesses in the retainer, damaging the retainer and seat ring.

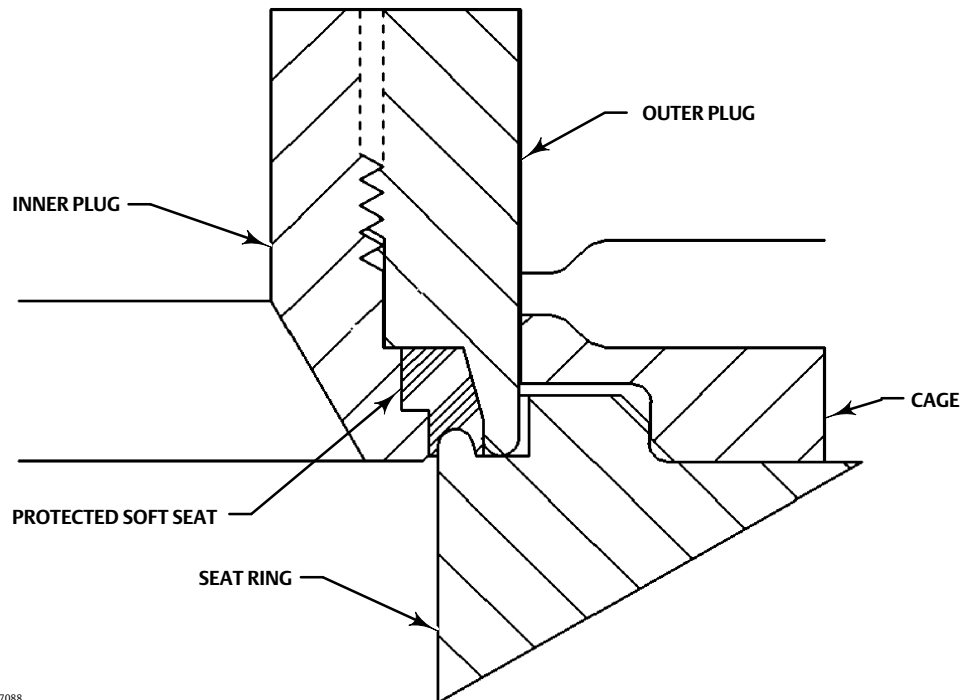
- e. Unscrew and remove the seat ring retainer.
2. Remove the seat ring (key 6) and the seat ring gasket or O-ring (key 12).
 3. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

TSO Trim

Refer to figure 7.

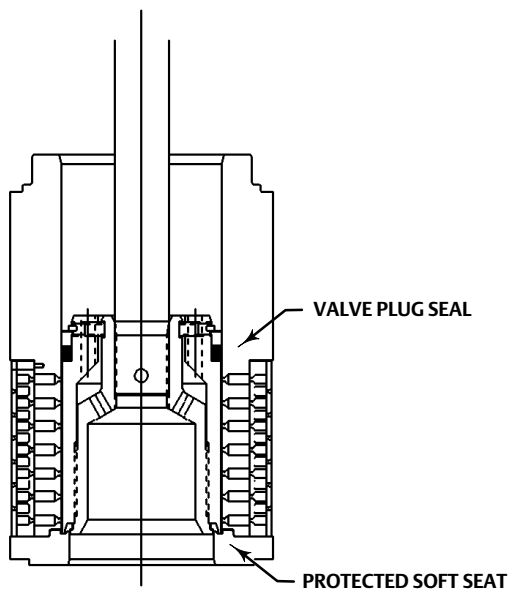
1. Remove the retainer, backup ring, anti-extrusion rings, and piston ring.
2. Remove the set screws that lock the outer plug to the inner plug.
3. Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
4. Remove the protected soft seat seal (see figure 5).
5. Inspect the parts for damage and replace if needed.
6. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

Figure 6. Detail of Protected Soft Seat



A7088

Figure 7. Typical Balanced TSO Trim



A7096

Valve Plug Maintenance

Key numbers used in this procedure are shown in figure 18 for the EHD valve, in figure 19 for the EHS valve, and in figure 20 for the EHT valve.

1. With the valve plug (key 3) removed according to the Trim Removal procedure, proceed as appropriate:

For the EHD valve, the piston rings (key 8) are each in two sections; remove the sections from the grooves in the valve plug.

For the EHS valve, proceed to step 2.

For the EHT valve, work the retaining ring (key 10) off the valve plug with a screwdriver. Carefully slide the backup ring and seal ring (keys 9 and 8) off the valve plug. For an NPS 6 valve with a level D Whisper Trim III cage, also remove the piston ring (key 30) from the grooves in the valve plug.

2. To replace the valve plug stem (key 4), drive out the pin (key 5), and unscrew the stem from the valve plug.

CAUTION

Never reuse an old stem with a new valve plug or reinstall a valve stem after it has been removed. Using an old stem with a new plug requires drilling a new pin hole in the stem. This weakens the stem and may cause the stem to fail in service. If a new valve plug is required, always order a valve plug, stem, and pin as an assembly. Specify the correct part number of each of the three parts, but state that the parts are being ordered as an assembly.

A used valve plug may be reused with a new stem. An exception is the Cavitrol III plug/stem assembly which must be ordered and replaced as a unit.

3. Thread the new stem into the valve plug and tighten it to the appropriate torque value given in table 10. Using the valve plug pin hole as a guide, drill the pin hole through the stem. Refer to table 10 for drill sizes.
4. Drive in the pin to lock the assembly.
5. If it is necessary to lap the seating surfaces, complete the Lapping Seats procedure before installing the EHD piston rings or the EHT seal ring. The Trim Replacement procedure provides piston ring and seal ring installation instructions and valve reassembly instructions.

Lapping Seats

Key numbers referenced in this procedure are shown in figure 18 for the EHD valve, in figure 19 for the EHS valve, and in figure 20 for the EHT valve unless otherwise indicated.

Seating surfaces of the valve plug (key 3) and the seat ring (key 6) can be lapped for improved shutoff. Use a good quality lapping compound with a mixture that contains 280 to 600 grit. Apply the compound to the bottom of the valve plug. Use the following procedure to lap the seating surfaces.

1. Install the following parts according to the instructions presented in the Trim Replacement procedure: seat ring gasket or O-ring (key 12), seat ring (key 6), seat ring retainer (key 7), cage (key 2), cage gaskets (key 11), and if used, the O-ring (key 26, figure 21).
2. Proceed as appropriate:

For an EHD or EHT valve, install the valve plug and stem assembly (keys 3 and 4)—without piston rings or seal ring (keys 8 and 30)—into the cage.

For an EHS valve, install the valve plug and stem assembly (keys 3 and 4) into the cage.

3. Install the bonnet (key 1, figure 16) over the valve stem, and secure the bonnet with four of the hex nuts (key 14).
4. Attach a handle, such as a piece of strap iron secured by stem locknuts, to the valve stem. Rotate the handle alternately in each direction to lap the seats.

Note

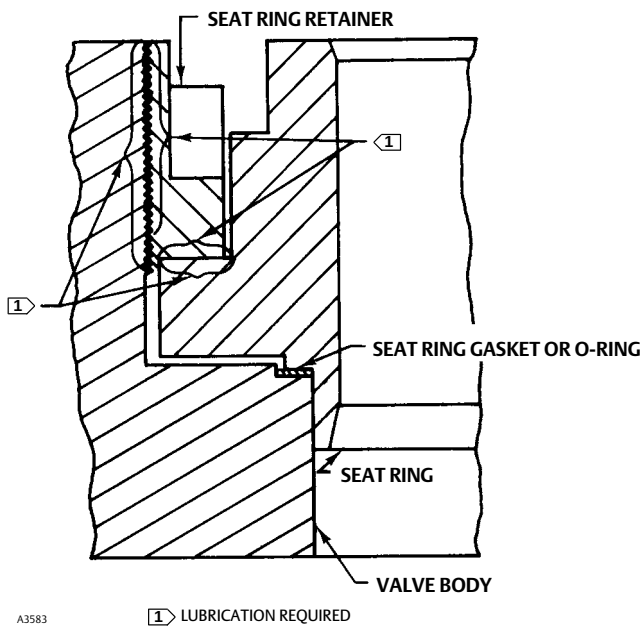
To preserve the effects of lapping, do not change either the position of the seat ring in the valve body cavity or the position of the cage on the seat ring after lapping the seating surfaces. If possible, clean the parts without disturbing their positions. If the parts must be removed for cleaning, return them to the original positions.

5. After lapping, again disassemble as necessary, clean the seating surfaces, reassemble, and test for shutoff. Repeat the lapping procedure if necessary.

Trim Replacement

After all trim maintenance has been completed, reassemble the valve by following the numbered steps below. Be certain that all gasketed surfaces have been well cleaned. Key numbers referenced in this procedure are shown in figure 18 for the EHD valve, in figure 19 for the EHS valve, and in figure 20 for the EHT valve.

Figure 8. Trim Surfaces Requiring Lubrication



A3583

1 LUBRICATION REQUIRED

CAUTION

Thoroughly clean the seat ring (key 6), seat ring retainer (key 7), and the retainer threads in the valve body with a good-quality degreaser. Also clean all cage gasket surfaces. All residual gasket material must be removed from the cage gasket surfaces and, in gasketed seat ring constructions, from the serrated valve body and seat ring gasket surfaces. If the serrations are scored or damaged during this process, smooth them by hand sanding with 360 grit paper using long, sweeping strokes. Failure to remove all residual gasket material and/or burrs from the seat ring, cage, and valve body gasket surfaces will result in leakage.

Thoroughly lubricate the surfaces indicated in figure 8 with the appropriate lubricant shown in table 11. Be certain to lubricate the mating surfaces of both parts involved (i.e., lubricate the threads on the seat ring retainer and the threads in the valve body; lubricate the mating surfaces of the seat ring retainer and seat ring).

Failure to lubricate as described may cause galling and improper gasket or O-ring (key 12) loading that may result in leakage.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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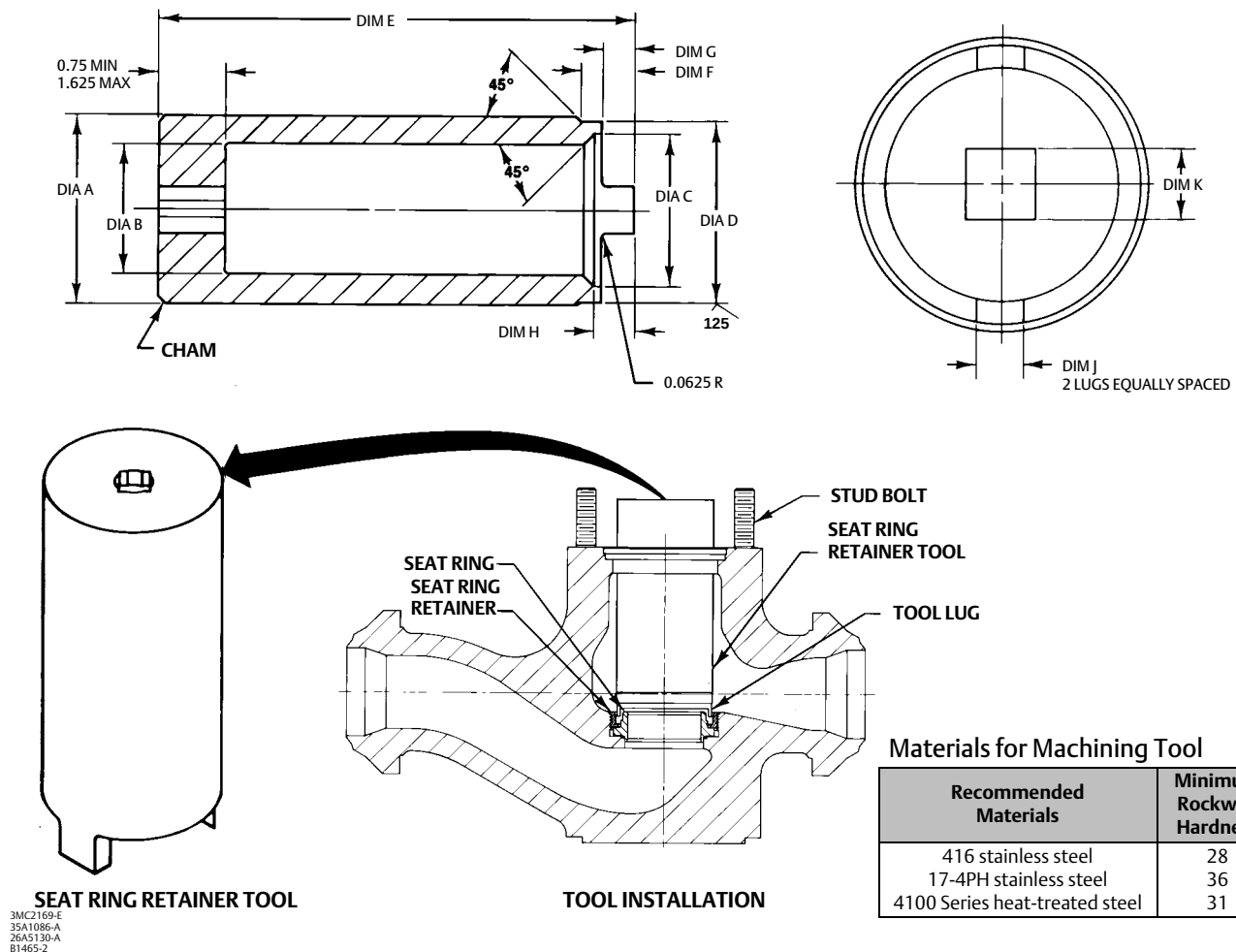
EH (1-1/2x1 through 8x6)

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VALVE SIZE, NPS/ RATING	VALVE RATING	TOOL DIMENSIONS																			
		mm										Inches									
		A	B	C	D ⁽¹⁾	E	F	G	H	J ⁽¹⁾	K	A	B	C	D ⁽¹⁾	E	F	G	H	J ⁽¹⁾	K
1-1/2 x 1	CL1500	57.2	31.8	41.1	<u>54.4</u> 51.9	120.7	11.2	7.9	11.2	<u>12.4</u> 12.2	19.1	2.25	1.25	1.62	<u>2.140</u> 2.120	4.75	0.44	0.31	0.44	<u>0.49</u> 0.48	0.75
	CL2500	50.8	31.8	34.1	<u>46.4</u> 45.9	111.3	11.2	7.9	11.2	<u>12.4</u> 12.2	19.1	2.00	1.25	1.34	<u>1.827</u> 1.807	4.38	0.44	0.31	0.44	<u>0.49</u> 0.48	0.75
2 x 1	CL1500	57.2	31.8	41.1	<u>54.4</u> 51.9	120.7	11.2	7.9	11.2	<u>12.4</u> 12.2	19.1	2.25	1.25	1.62	<u>2.140</u> 2.120	4.75	0.44	0.31	0.44	<u>0.49</u> 0.48	0.75
	CL2500	50.8	31.8	34.1	<u>46.4</u> 45.9	111.3	11.2	7.9	11.2	<u>12.4</u> 12.2	19.1	2.00	1.25	1.34	<u>1.827</u> 1.807	4.38	0.44	0.31	0.44	<u>0.49</u> 0.48	0.75
3 x 2	CL1500	79.2	53.8	63.5	<u>76.6</u> 76.1	157.2	12.7	9.7	12.7	<u>12.4</u> 12.2	19.1	3.12	2.12	2.50	<u>3.015</u> 2.995	6.19	0.50	0.38	0.50	<u>0.49</u> 0.48	0.75
	CL2500	69.9	50.8	53.0	<u>67.1</u> 66.5	150.9	12.7	9.7	12.7	<u>12.4</u> 12.2	19.1	2.75	2.00	2.12	<u>2.640</u> 2.620	5.94	0.50	0.38	0.50	<u>0.49</u> 0.48	0.75
3, 4 x 3	CL2500	90.5	65.0	74.6	<u>86.1</u> 85.6	185.7	12.7	9.7	12.7	<u>18.8</u> 18.5	25.4	3.56	2.36	2.94	<u>3.390</u> 3.370	7.31	0.50	0.38	0.50	<u>0.74</u> 0.73	1.00
4, 6 x 4	CL2500	117.3	88.9	91.9	<u>108.3</u> 107.8	195.3	14.2	10.4	14.2	<u>25.1</u> 24.9	25.4	4.62	3.50	3.62	<u>4.265</u> 4.245	7.69	0.56	0.41	0.56	<u>0.99</u> 0.98	1.00
6, 8 x 6	CL2500	177.8	130.0	134.9	<u>156.0</u> 155.4	254.0	14.2	10.4	14.2	<u>25.1</u> 24.9	38.1	7.00	5.12	5.31	<u>6.140</u> 6.120	10.00	0.56	0.41	0.56	<u>0.99</u> 0.96	1.50
1. D and J dimensions list maximum and minimum values.																					

1. D and J dimensions list maximum and minimum values.

Figure 9. Information for Machining and Use of Seat Ring Retainer Tool



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Table 9. Recommended Torque for Installing Seat Ring Retainer

VALVE SIZE, NPS	VALVE BODY RATING	TORQUE							
		For All Valves with Gasketed Seat Ring Construction Except Those with Cavitrol III Cage		For All Valves with O-Ring Seat Ring Construction ⁽¹⁾ or for Sour Gas Service		For Valve with 2-Stage Cavitrol III Cage and Gasketed Seat Ring Construction		For Valve with 3-Stage Cavitrol III Cage and Gasketed Seat Ring Construction	
		N•m	Lbf•Ft	N•m	Lbf•Ft	N•m	Lbf•Ft	N•m	Lbf•Ft
1, 1-1/2x1, 2x1	CL1500	509	375	68	50	339	250	---	---
	CL2500	373	275	68	50	203	150	---	---
2, 3x2	CL1500	1187	875	136	100	881	650	678	500
	CL2500	848	625	102	75	542	400	407	300
3, 4x3	CL1500	2203	1625	271	200	1491	1100	1356	1000
	CL2500	1593	1175	203	150	949	700	678	500
4, 6x4	CL1500	3118	2300	373	275	2712	2000	2373	1750
	CL2500	2373	1750	271	200	2373	1750	1695	1250
6, 8x6	CL1500	6780	5000	780	575	6101	4500	5423	4000
	CL2500	5017	3700	576	425	4745	3500	4745	3500

1. Includes valves with Cavitrol III trim.

Table 10. Valve Stem Connection Torque and Drill Size for Pin Hole

VALVE SIZE, NPS	VALVE STEM DIAMETER		VALVE BODY RATING	VALVE	VALVE STEM CONNECTION TORQUE (MINIMUM - MAXIMUM)		DRILL SIZE FOR PIN
	mm	Inches			N•m	Lbf•Ft	Inches
1, 1-1/2x1, 2x1	12.7	1/2	CL1500, CL2500	EHS	81 - 115	60 - 85	1/8
	19.1	3/4	CL1500	EHS	237 - 339	175 - 250	3/16
2, 3x2	12.7	1/2	CL1500, CL2500	EHD, EHS, EHT	81 - 115	60 - 85	1/8
	19.1	3/4	CL1500, CL2500	EHS	237 - 339	175 - 250	3/16
				EHD, EHT	237 - 339	175 - 250	1/8
	25.4	1	CL1500, CL2500	EHS	420 - 481	310 - 355	1/4
3, 4x3	12.7	1/2	CL1500, CL2500	EHD, EHS, EHT	81 - 115	60 - 85	1/8
	19.1	3/4	CL1500, CL2500	EHD, EHS, EHT	237 - 339	175 - 250	3/16
	25.4	1	CL1500, CL2500	EHS	420 - 481	310 - 355	1/4
			CL1500	EHD, EHT	420 - 481	310 - 355	1/4
4, 6x4	19.1	3/4	CL1500, CL2500	EHD, EHS, EHT	237 - 339	175 - 250	3/16
			CL1500, CL2500	EHD, EHS, EHT	420 - 481	310 - 355	1/4
	25.4	1	CL1500, CL2500	EHD, EHS, EHT	420 - 481	310 - 355	1/4
			CL1500, CL2500	EHD, EHS, EHT	420 - 481	310 - 355	1/4
6, 8x6	19.1	3/4	CL1500, CL2500	EHD, EHS, EHT	237 - 339	175 - 250	3/16
	25.4	1	CL1500, CL2500	EHD, EHS, EHT	420 - 481	310 - 355	1/4
	31.8	1-1/4	CL1500, CL2500	EHD, EHS, EHT	827 - 908	610 - 670	1/4
	50.8	2	CL1500, CL2500	EHD, EHT	Contact factory for torque values and installation procedure		3/8

Table 11. Seat Ring and Seat Ring Retainer Lubricants

VALVE BODY MATERIAL	SEAT RING MATERIAL	LUBRICANT
WCC, WC9, C5, or LCC steel	S41600 (416 stainless steel)	Lithium grease, dry film lubricant, or anti-seize lubricant
	R30006 (Alloy 6)	Anti-seize lubricant
CF8M (316 stainless steel)	R30006	Dry film lubricant or anti-seize lubricant

1. For gasketed seat ring constructions, install the seat ring gasket (key 12) into the valve body. For O-ring seat ring constructions, install the O-ring (key 12) into the groove on the underside of the seat ring (key 6). Install the seat ring (key 6). Screw in the seat ring retainer (key 7). Use the seat ring retainer tool (figure 9) to tighten the seat ring retainer as follows:

- Insert the tool into the valve body. Be certain the tool lugs are engaged in the corresponding recesses in the retainer.

- b. Use a power torque wrench or driver having torque capabilities equal to or greater than those shown in table 9. Connect the torque tool to an extension if necessary. The tool or extension must snugly fit the square hole in the seat ring retainer tool. Refer to figure 9 for square hole sizes.
- c. Insert the tool or extension into the square hole in the seat ring retainer tool.
- d. Use the stud bolts (key 13) to prevent a power torque wrench from rotating.

CAUTION

Hold the torque wrench at right angles to the seat ring retainer when applying torque. Tilting the tool and extension while applying torque may cause the lugs on the seat ring retainer tool to suddenly disengage from the recesses in the retainer, damaging the retainer and seat ring.

- e. Tighten the seat ring retainer to the torque shown in table 9.

Note

Some cages have one large window and several small windows. In step 2, install a cage that has different size windows so that the largest window faces toward the process outlet for a flow-down and toward the process inlet for a flow-up valve. Though it may not be possible to align the large window directly opposite the inlet or outlet, orient the window in the appropriate direction as much as possible. Incorrect orientation of cage windows causes a reduction of capacity.

2. Proceed as appropriate:

For a valve with a Cavitrol III cage, slide the O-ring (key 26, figure 21) over the seat ring (key 6) and against the shoulder in the outer diameter of the seat ring. Install the lower gasket (key 11) between the valve body and cage (key 2), and install the cage. Be certain the lugs on the bottom of the cage engage the corresponding slots in the seat ring retainer.

For all other valves, install the lower gasket (key 11) between the valve body and cage (key 2), and install the cage. Be certain the lugs on the bottom of the cage engage the corresponding slots in the seat ring retainer.

Note

Rotate the cage clockwise by hand as much as possible once the cage lugs engage the slots in the seat ring retainer. Failure to do so may result in leakage at the seat ring to valve body seal.

Constructions other than TSO trim

1. To install the piston rings and seal rings (keys 8 and 30), proceed as appropriate:

For an EHD valve (figure 18), if it is necessary to install new piston rings, the replacement piston rings will arrive in one piece. Use a vise with smooth or taped jaws to break a replacement piston ring into halves. Place the new ring in the vise so that the jaws compress the ring into an oval. Compress the ring slowly until the ring snaps on both sides. If one side snaps first, do not try to tear or cut the other side. Instead, keep compressing until the other side snaps. The piston ring can also be fractured by scoring and snapping over a hard surface such as a table edge. Sawing or cutting is not recommended.

Remove any protective tape or covering from the valve plug and stem assembly, and set it on a protective surface. Then, place the piston ring in the piston ring groove with the fractured ends matched.

For an EHT valve (figure 20), install the seal ring (key 8) onto the valve plug (key 3). Install the ring with the open side facing the seat ring end of the valve plug for flow-down applications (view A of figure 20) or with the open side facing the valve plug stem end of the valve plug for flow-up applications. Slide the backup ring (key 9) onto the valve plug. Secure with the retaining ring (key 10). For an NPS 6 valve with a level D Whisper Trim III cage, reinstall the piston ring (key 30) following the instructions given in the paragraph immediately preceding.

2. Install the valve plug into the cage.

TSO Trim

Refer to figure 7.

1. Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
2. Mark the top of the inner plug and outer plug with alignment marks in the assembled position.
3. Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
4. Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is compressed properly. Do not damage the outer plug guide surfaces.
5. Install set screws centering the inner plug in the outer plug and torque to 11 N•m (8 lbf•ft).
6. Assemble the piston ring, anti-extrusion rings, backup ring, and retainer.

All Constructions

1. Install the top cage gasket (key 11) on the cage.
2. Install the bonnet over the valve stem and onto the valve body.

Note

The prelubricated hex nuts (key 14, figure 18, 19, or 20) referred to in step 3 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 3 include--but are not limited to--ensuring that the bonnet stud threads are clean, Belleville washers (if present) are installed in the correct orientation, and that the hex nuts are evenly tightened to the specified torque values.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 8 may result in cage crushing, cage diameter reduction, and/or bonnet deformation. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) or Local Business Partner immediately if a discrepancy between actual parts and approved parts is suspected.

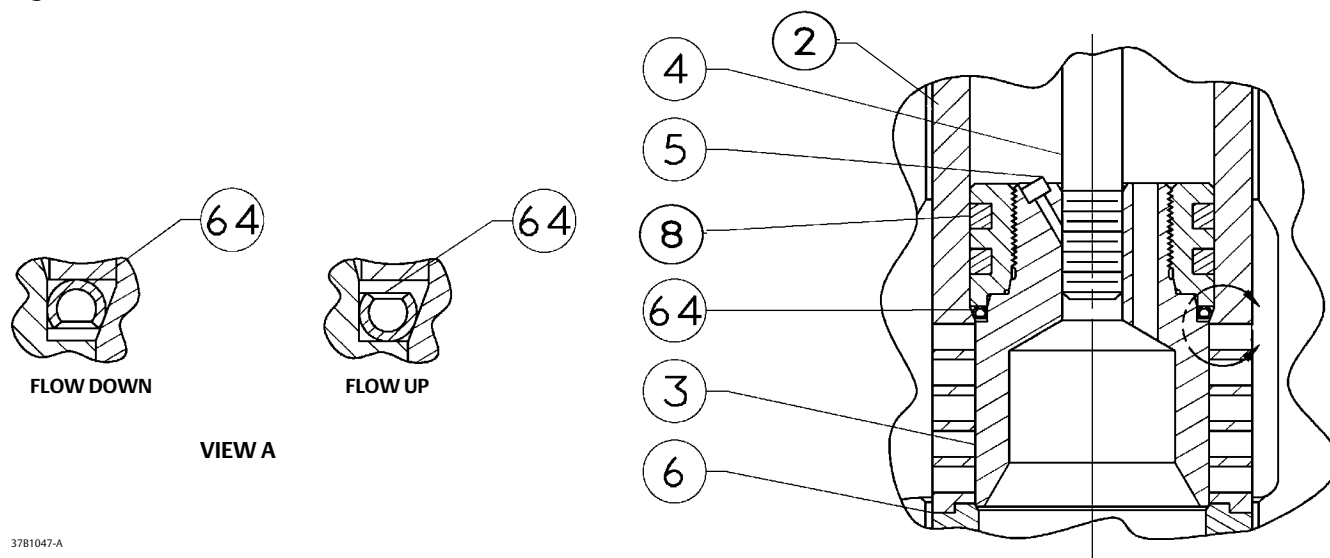
3. Lubricate the stud threads and the faces of the hex nuts (key 14, figure 18, 19, or 20) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Replace the flat washers (key 29, figure 18, 19, 17, or 20) if present. If the valve assembly includes Belleville washers (key 33, figure 17) install these onto the studs (key 14, figure 17) with the concave side facing towards the valve body. Replace the hex nuts but do not tighten them. Torque the nuts in a crisscross pattern to no more than one fourth of the nominal torque value specified in table 8. When all nuts are tightened to that torque value, increase the torque by one fourth of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.
4. Install new packing and packing box parts per steps 13 and 14 of the Replacing Packing procedure. Be certain to observe the note given prior to step 13 of that procedure.
5. Mount the actuator by following the procedures in the actuator instruction manual. Check for packing leakage as the valve is being put into service. Retorque the packing flange nuts as required (see table 7).

Retrofit: Installing C-seal Trim

Note

Additional actuator thrust is required for a valve with C-seal trim. When installing C-seal trim in an existing valve, contact your [Emerson sales office](#) or Local Business Partner for assistance in determining new actuator thrust requirements.

Figure 10. Fisher EHD with C-seal Trim



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Assemble the new valve plug/retainer assembly (with C-seal plug seal) using the following instructions:

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the new trim parts while assembling the individual parts and during installation in the valve body.

1. Apply a suitable high-temperature lubricant to the inside diameter of the C-seal plug seal. Also, lubricate the outside diameter of the valve plug where the C-seal plug seal must be pressed into the proper sealing position (figure 10).
2. Orient the C-seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the C-seal plug seal must face up in a valve with flow-up construction (figure 10).
 - The open interior of the C-seal plug seal must face down in a valve with flow-down construction (figure 10).

Note

An installation tool must be used to properly position the C-seal plug seal on the valve plug. A tool is available as a spare part from your [Emerson sales office](#) or Local Business Partner or a tool could be manufactured following the dimensions given in figure 11.

3. Place the C-seal plug seal over the top of the valve plug and press the C-seal plug seal onto the plug using the C-seal installation tool. Carefully press the C-seal plug seal onto the plug until the installation tool contacts the horizontal reference surface of the valve plug (figure 12).
4. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the C-seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
5. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 13) to secure the C-seal retainer.
6. Install the new plug/retainer assembly with C-seal plug seal on the new stem following the appropriate instructions in the Trim Replacement section of this manual.
7. Install piston rings by following instructions in the Trim Replacement section of this manual.
8. Remove the existing valve actuator and bonnet following the appropriate instructions in the Replacing Packing section of this manual.

CAUTION

Do not remove the existing valve stem from the valve plug unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service.

However, a used valve plug may be reused with a new valve stem. An exception is the Cavitrol III plug/stem assembly which must be ordered and replaced as a unit.

9. Remove the existing valve stem and plug, cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section of this manual.
10. Replace all gaskets according to appropriate instructions in the Trim Replacement section of this manual.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

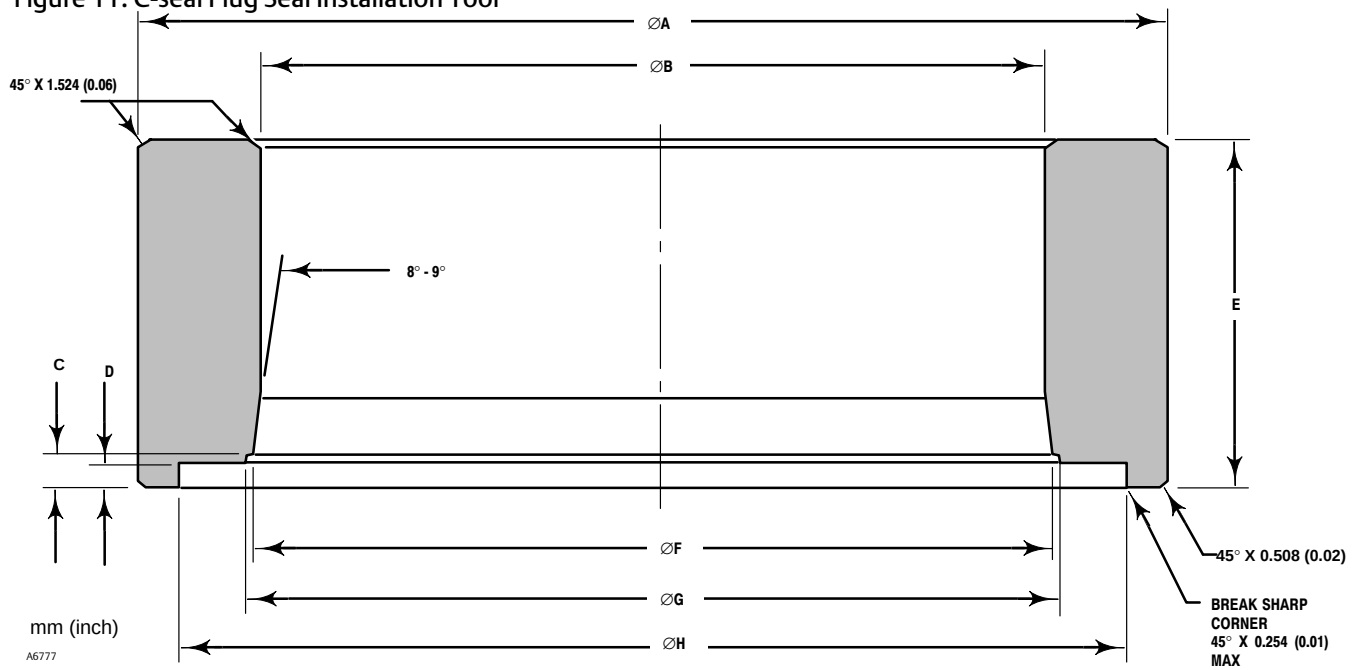
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FOR VALVE PLUGS FITTING PORT SIZE (Inches)	DIMENSIONS, mm (See Drawing Below)								Part Number (To Order A Tool)
	A	B	C	D	E	F	G	H	
2.875	82.55	52.324 - 52.578	4.978 - 5.029	3.708 - 3.759	41.148	52.680 - 52.781	55.118 - 55.626	70.891 - 71.044	24B9816X012
3.4375	101.6	58.674 - 58.928	4.978 - 5.029	3.708 - 3.759	50.8	61.011 - 61.112	63.449 - 63.957	85.166 - 85.319	24B5612X012
3.625	104.394	65.024 - 65.278	4.978 - 5.029	3.708 - 3.759	50.8	68.936 - 69.037	71.374 - 71.882	89.941 - 90.094	24B3630X012
4.375	125.984	83.439 - 83.693	4.978 - 5.029	3.708 - 3.759	50.8	87.351 - 87.452	89.789 - 90.297	108.991 - 109.144	24B3635X012
5.375	142.748	100.076 - 100.33	4.978 - 5.029	3.708 - 3.759	45.974	103.835 - 103.937	106.274 - 106.782	128.219 - 128.372	23B9193X012
7	184.15	141.376 - 141.630	4.978 - 5.029	3.708 - 3.759	60.198	145.136 - 145.237	147.574 - 148.082	169.520 - 169.672	23B9180X012
8	209.55	166.776 - 167.030	4.978 - 5.029	3.708 - 3.759	55.88	170.536 - 170.637	172.974 - 173.482	194.920 - 195.072	24B9856X012
FOR VALVE PLUGS FITTING PORT SIZE (Inches)	Dimensions, Inches (See Drawing Below)								Part Number (To Order A Tool)
	A	B	C	D	E	F	G	H	
2.875	3.25	2.060 - 2.070	0.196 - 0.198	0.146 - 0.148	1.62	2.074 - 2.078	2.170 - 2.190	2.791 - 2.797	24B9816X012
3.4375	4.00	2.310 - 2.320	0.196 - 0.198	0.146 - 0.148	2.00	2.402 - 2.406	2.498 - 2.518	3.353 - 3.359	24B5612X012
3.625	4.11	2.560 - 2.570	0.196 - 0.198	0.146 - 0.148	2.00	2.714 - 2.718	2.810 - 2.830	3.541 - 3.547	24B3630X012
4.375	4.96	3.285 - 3.295	0.196 - 0.198	0.146 - 0.148	2.00	3.439 - 3.443	3.535 - 3.555	4.291 - 4.297	24B3635X012
5.375	5.62	3.940 - 3.950	0.196 - 0.198	0.146 - 0.148	1.81	4.088 - 4.092	4.184 - 4.204	5.048 - 5.054	23B9193X012
7	7.25	5.566 - 5.576	0.196 - 0.198	0.146 - 0.148	2.37	5.714 - 5.718	5.810 - 5.830	6.674 - 6.680	23B9180X012
8	8.25	6.566 - 6.576	0.196 - 0.198	0.146 - 0.148	2.20	6.714 - 6.718	6.810 - 6.830	7.674 - 7.680	24B9856X012

Figure 11. C-seal Plug Seal Installation Tool



11. Install the new seat ring, cage, valve plug/retainer assembly, and stem into the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section of this manual.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the C-seal plug seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop through the valve, this force will adequately drive the valve plug to the seat ring, thus giving the C-seal plug seal a predetermined permanent set. Once this is done, the plug/retainer assembly, the cage, and the seat ring become a matched set.

12. With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Replacement of Installed C-seal Trim

Trim Removal (C-seal Constructions)

1. Remove the valve actuator and bonnet following the appropriate instructions in the Replacing Packing section of this manual.

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance.

Use caution when removing piston ring(s) and C-seal plug seal to avoid scratching any sealing surface.

CAUTION

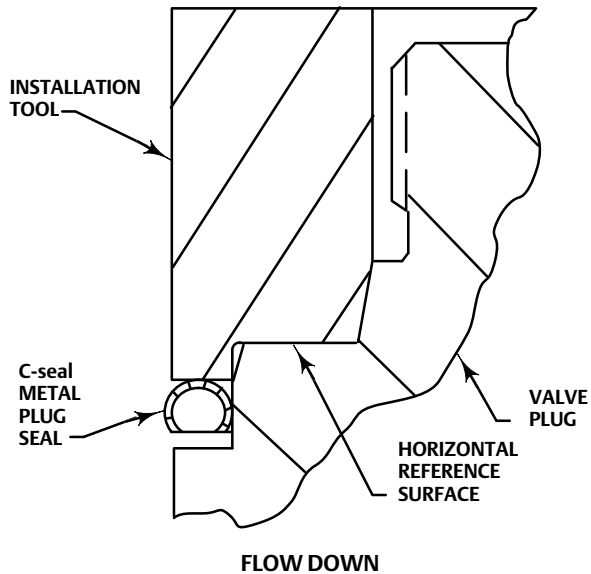
Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service.

However, a used valve plug may be reused with a new valve stem. An exception is the Cavitrol III plug/stem assembly which must be ordered and replaced as a unit.

2. Remove the plug/retainer assembly (with C-seal plug seal), cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section of this manual.
3. Locate the staked thread on top of the valve plug (figure 13). The staked thread secures the retainer. Use a drill with a 1/8-inch bit to drill out the staked area of the thread. Drill approximately 1/8-inch into the metal to remove the staking.
4. Locate the break between sections of the piston ring(s). Using an appropriate tool such as a flat-blade screwdriver, carefully pry out the piston ring(s) from the groove(s) in the C-seal retainer.
5. After removing the piston ring(s), locate the 1/4-inch diameter hole in the groove. In a retainer with two piston ring grooves, the hole will be found in the upper groove.

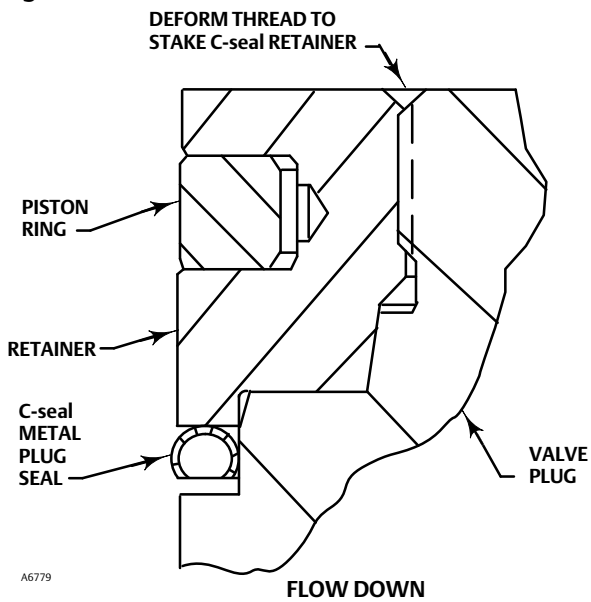
Figure 12. Installing the C-seal Plug Seal Using the Installation Tool



NOTE:
PRESS INSTALLATION TOOL OVER VALVE PLUG UNTIL THE TOOL CONTACTS THE HORIZONTAL REFERENCE SURFACE OF THE VALVE PLUG.

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Figure 13. Stake the Threads of the C-seal Retainer



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6. Select an appropriate tool such as a punch and place the tip of the tool into the hole with the body of the tool held tangent to the outside diameter of the retainer. Strike the tool with a hammer to rotate the retainer and free it from the valve plug. Remove the retainer from the plug.
7. Use an appropriate tool such as a flat-blade screwdriver to pry the C-seal plug seal off the plug. Use caution to avoid scratches or other damage to the sealing surfaces where the C-seal plug seal makes contact with the valve plug (figure 14).
8. Inspect the lower seating surface where the valve plug contacts the seat ring for wear or damage which would prevent proper operation of the valve. Also, inspect the upper seating surface inside the cage where the C-seal plug

seal contacts the cage, and inspect the sealing surface where the C-seal plug seal makes contact with the plug (figure 14).

9. Replace or repair trim parts according to the following procedure for lapping metal seats, remachining metal seats, or other valve plug maintenance procedures as appropriate.

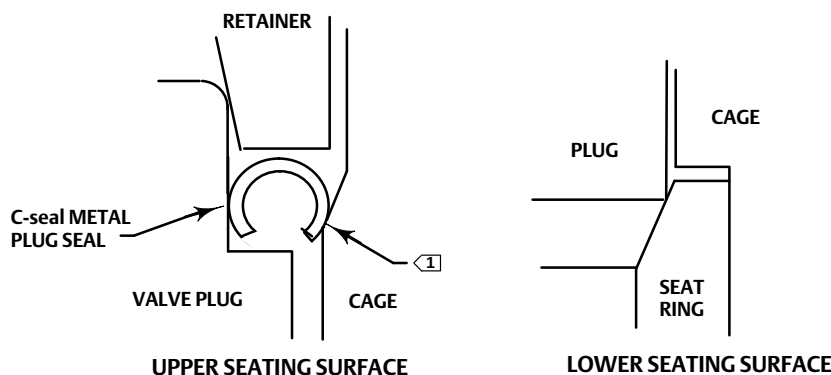
Lapping Metal Seats (C-seal Constructions)

Before installing a new C-seal plug seal, lap the lower seating surface (valve plug to seat ring, figure 14) following appropriate procedures in the Lapping Seats section of this manual.

Remachining Metal Seats (C-seal Constructions)

See figure 15. A valve plug with a C-seal metal plug seal features two seating surfaces. One seating surface is found where the valve plug contacts the seat ring. The second seating surface is found where the C-seal plug seal contacts the upper seating surface in the cage. If you machine the seats on the seat ring and/or plug, you must machine an equal dimension from the seating area in the cage.

Figure 14. Lower (Valve Plug to Seat Ring) and Upper (C-seal Plug Seal to Cage) Seating Surfaces



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NOTE:

1 UPPER SEATING SURFACE IS THE AREA OF CONTACT BETWEEN THE C-seal METAL PLUG SEAL AND THE CAGE.

CAUTION

If metal is removed from the seat ring and plug and a corresponding amount is not removed from the cage seating area, the C-seal plug seal will be crushed as the valve closes and the C-seal retainer will strike the seating area of the cage, preventing the valve from closing.

Trim Replacement (C-seal Constructions)

1. Apply a suitable high-temperature lubricant to the inside diameter of the C-seal plug seal. Also, lubricate the outside diameter of the valve plug where the C-seal plug seal must be pressed into the proper sealing position (figure 10).
2. Orient the C-seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the C-seal plug seal must face up in a valve with flow-up construction (figure 10).
 - The open interior of the C-seal plug seal must face down in a valve with flow-down construction (figure 10).

Note

An installation tool must be used to properly position the C-seal plug seal on the valve plug. A tool is available as a spare part from your [Emerson sales office](#) or Local Business Partner or a tool could be manufactured following the dimensions given in figure 11.

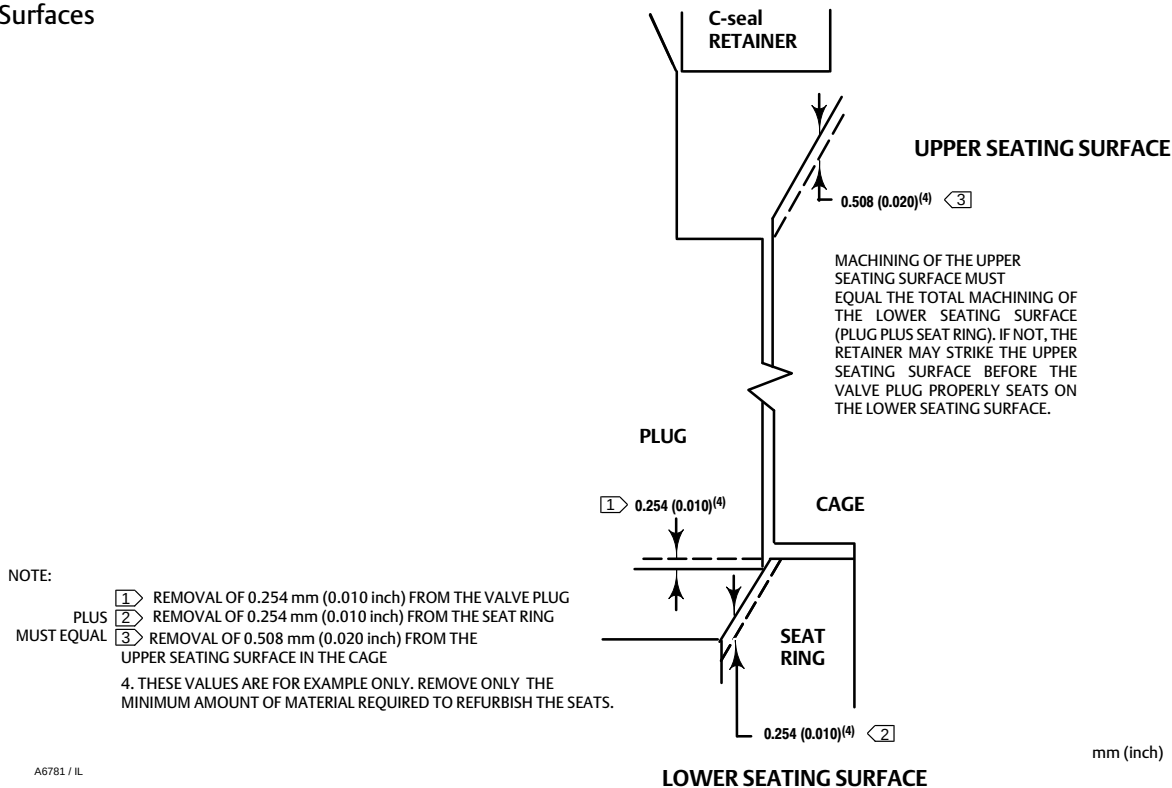
3. Place the C-seal plug seal over the top of the valve plug and press it onto the plug using the installation tool. Carefully press the C-seal plug seal onto the plug until the installation tool contacts the horizontal reference surface of the valve plug (figure 12).
4. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the C-seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
5. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 13) to secure the C-seal retainer.
6. Replace the piston ring(s) following instructions in the Trim Replacement section of this manual.
7. Return the seat ring, cage, plug/retainer assembly, and stem to the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section of this manual.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the C-seal plug seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop through the valve, this force will adequately drive the valve plug to the seat ring, thus giving the C-seal plug seal a predetermined permanent set. Once this is done, the plug/retainer assembly, the cage, and the seat ring become a matched set.

8. With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Figure 15. Example of Machining the Lower (Valve Plug to Seat Ring) and Upper (C-seal Plug Seal to Cage) Seating Surfaces



Parts Ordering

Each body-bonnet assembly is assigned a serial number, which can be found on the valve body. This same number also appears on the actuator nameplate when the valve body is shipped from the factory as part of a control valve assembly. Refer to the number when contacting your [Emerson sales office](#) or Local Business Partner for technical assistance or when ordering replacement parts.

When ordering replacement parts, also be sure to include the 11-character part number for each part required from the following parts list.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Standard Packing Repair Kits (Non Live-Loaded)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
PTFE (Contains keys 6, 8, 10, 11, and 12)	RPACKX00022	RPACKX00032	RPACKX00342	RPACKX00352
Double PTFE (Contains keys 6, 8, 11, and 12)	RPACKX00052	RPACKX00062	RPACKX00362	RPACKX00372
PTFE/Composition (Contains keys 7, 8, 11, and 12)	RPACKX00082	RPACKX00092	---	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00112	RPACKX00122	---	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], and 11)	---	---	RPACKX00532	RPACKX00542
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring])	RPACKX00142	RPACKX00152	---	---
Double Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00172	RPACKX00182	---	---

Repair Kits (ENVIRO-SEAL)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
Double PTFE (Contains keys 214, 215, 218)	RPACKX00202	RPACKX00212	RPACKX00222	RPACKX00232
Single Graphite ULF (Contains keys 207, 208, 209, 210, 214)	RPACKX00602	RPACKX00612	RPACKX00622	RPACKX00632
Duplex (Contains keys 207, 209, 214, 215)	RPACKX00302	RPACKX00312	RPACKX00322	RPACKX00332

Retrofit Kits (ENVIRO-SEAL)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
Double PTFE (Contains keys 200, 201, 211, 212, 214, 215, 216, 217, 218, tag, cable tie)	RPACKXRT022	RPACKXRT032	RPACKXRT042	RPACKXRT052
Single Graphite ULF (Contains keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 217, tag, cable tie)	RPACKXRT272	RPACKXRT282	RPACKXRT292	RPACKXRT302
Duplex (Contains keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, cable tie)	RPACKXRT222	RPACKXRT232	RPACKXRT242	RPACKXRT252

Parts List

Note

Contact your [Emerson sales office](#) or Local Business Partner for Part Ordering information.

Bonnet Assembly (figure 16)

Key	Description
1	Bonnet If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.
2	Baffle, for use with extension bonnet only
3	Packing Flange
4	Packing Flange Stud (2 req'd)
5	Packing Flange Nut (2 req'd)
6*	Packing Set or Arrangement
7*	Packing Ring, low chloride graphite
8	Packing Spring, 316 stainless steel
8	Lantern Ring, 316 stainless steel
10	Special Washer, 316 stainless steel
11*	Packing Box Ring, 316 stainless steel
12*	Upper Wiper, felt
13	Packing Follower, 316 stainless steel
14	Pipe Plug
14	Lubricator
14	Lubricator/Isolating Valve
15	Yoke Locknut
25	Actuator Mounting Stud (8 req'd)
26	Hex Nut (8 req'd)
35	Retaining Ring, for use with extension bonnet only

Valve Body (figures 18-21)

1	Valve Body, order by valve size, serial number, and desired material
2*	Cage
3*	Valve Plug
4*	Valve Plug Stem
5*	Pin
6*	Seat Ring
7*	Seat Ring Retainer

Key	Description
8*	Piston Ring or Seal Ring
9*	Backup Ring
10*	Retaining Ring
10*	Retaining Ring (for EHT valve body only)
11*	Cage Gasket (2 req'd)
12*	Seat Ring O-Ring or Gasket
13	Bonnet Stud (8 req'd)
14	Hex Nut (8 req'd)
15	Flow Arrow
16	Drive Screw (4 req'd)
24	Anti-seize Lubricant
25	Seat Ring Retainer Tool (see figure 9) 416 stainless steel
26*	O-Ring (for valve with Cavitrol III trim only), ethylene/propylene
27	Nameplate
28	Nameplate Wire
29	Bonnet Washer
29	Flat Washer (8 req'd)
30*	Piston Ring (for EHT with Level D Whisper Trim III cage only)
33	Belleville Washer, N07718 (8 req'd)
63*	Anti-Extrusion Ring

C-seal Trim (figure 10)

2*	Cage
3*	Valve Plug/Retainer
4*	Valve Plug Stem, S20910
6*	Seat Ring
8*	Piston Ring, graphite (2 req'd)
64*	C-seal, N07718

TSO Trim (figure 7)

2*	Cage
4*	Seat Ring
5*	Plug/Stem Assembly
8*	Seal Ring
63*	Anti-Extrusion Ring
9*	Back Up Ring
10*	Retaining Ring

Figure 16. Fisher EH Bonnet Assembly

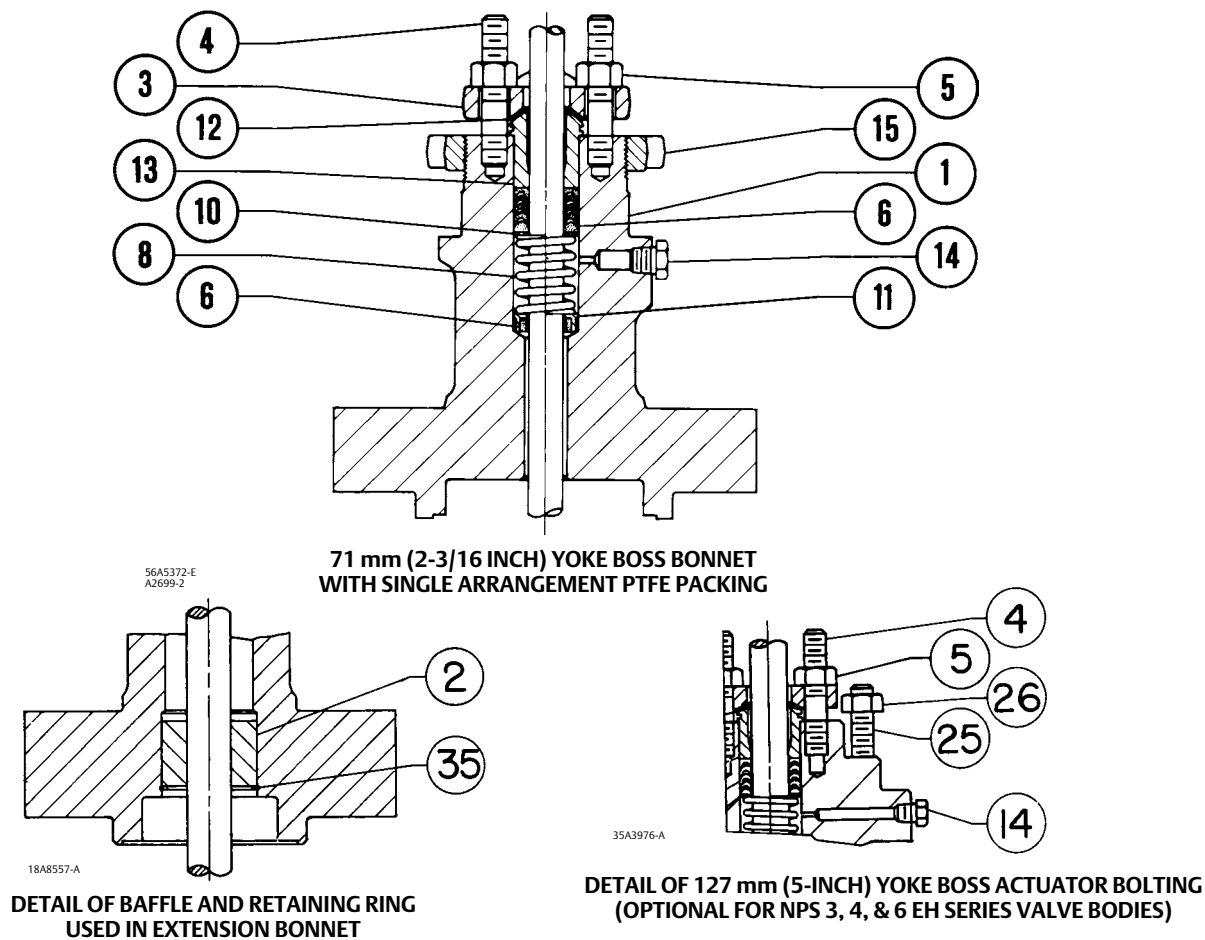
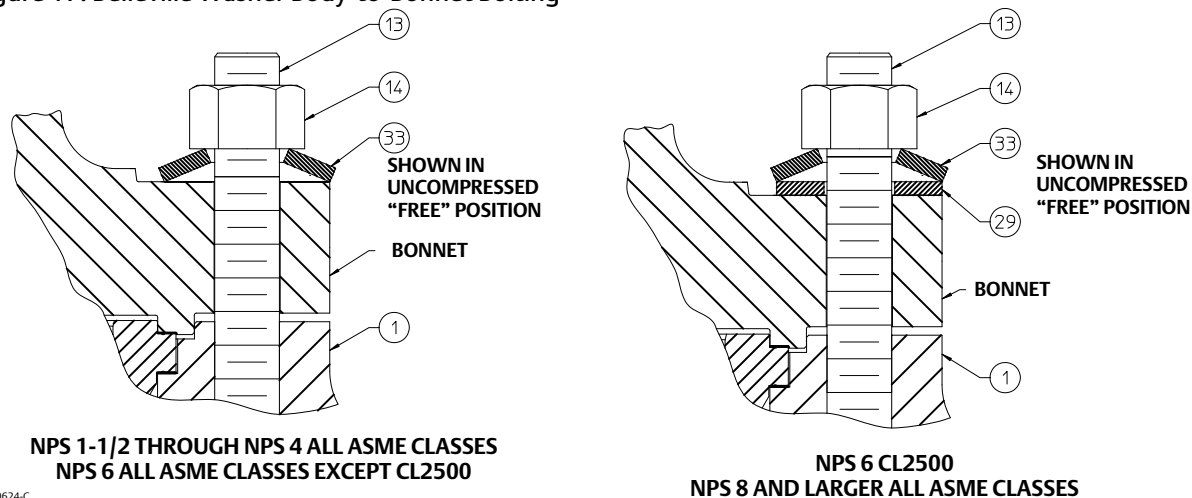


Figure 17. Belleville Washer Body-to-Bonnet Bolting



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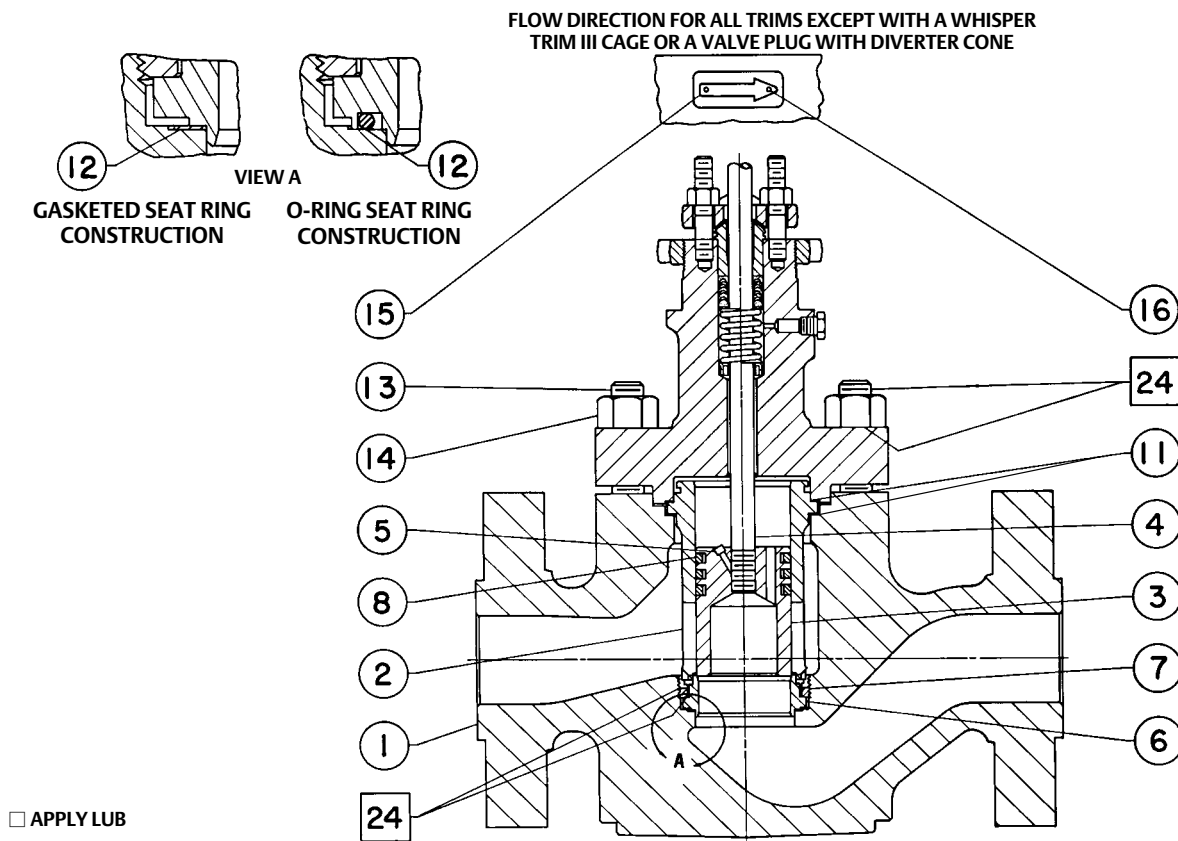
Instruction Manual

D100394X012

EH (1-1/2x1 through 8x6)

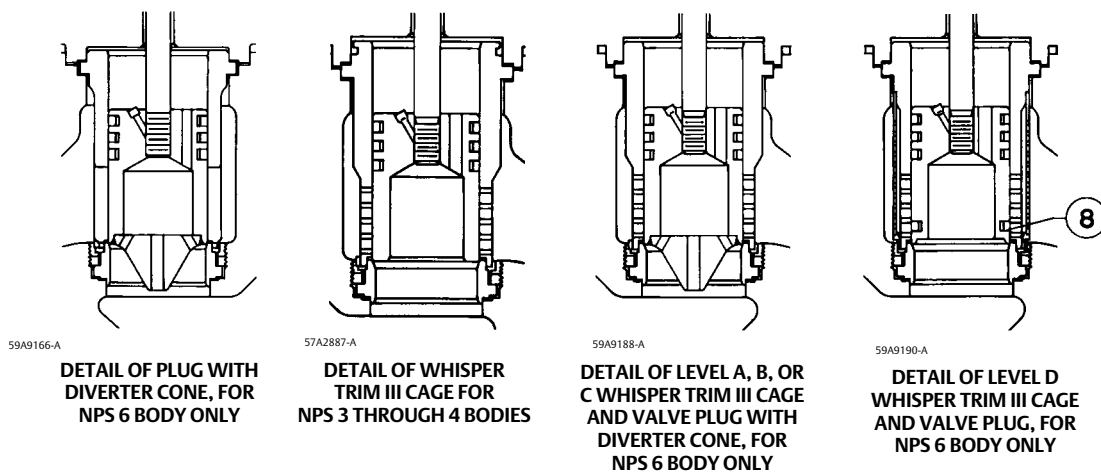
July 2017

Figure 18. Fisher EHD Valve



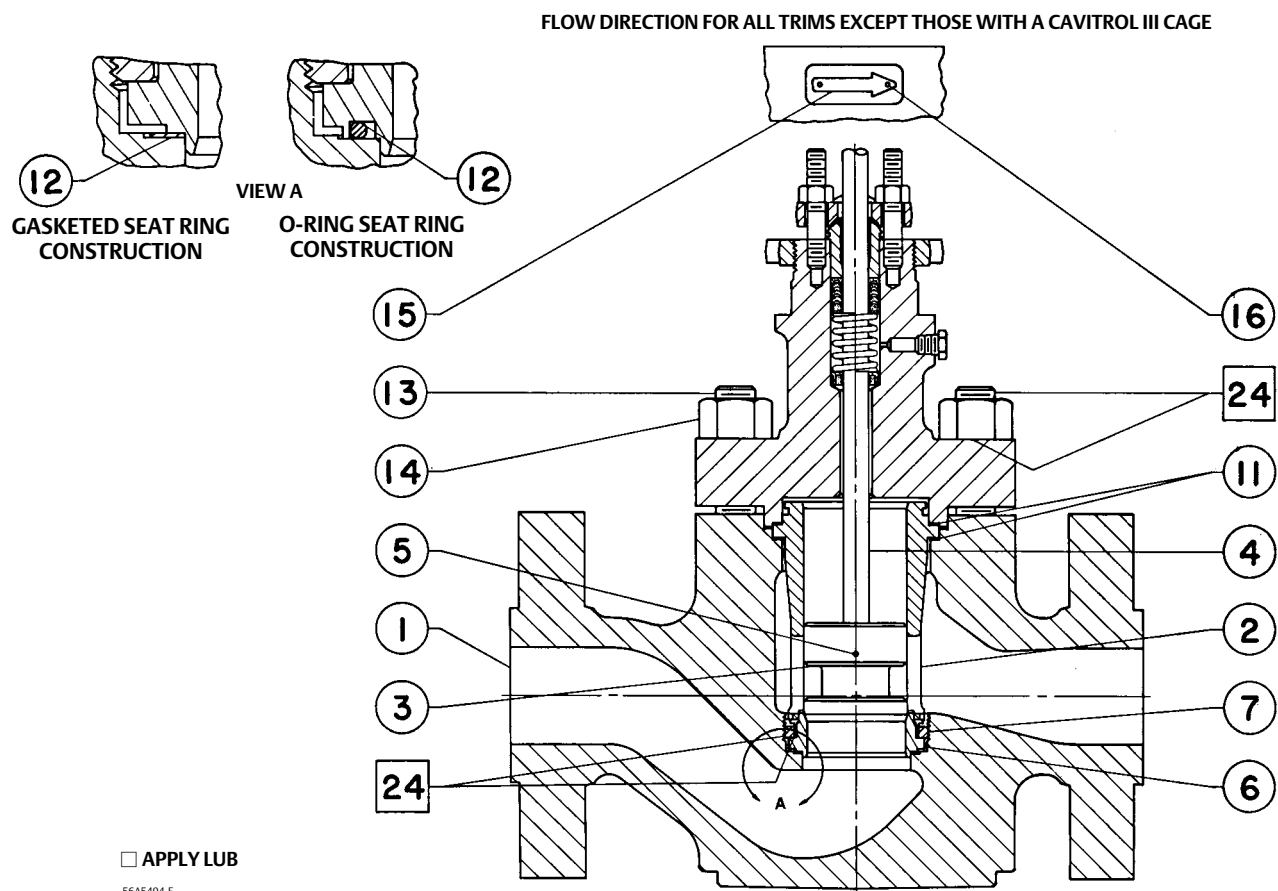
PARTS NOT SHOWN: KEY 29 FLAT WASHER

EHD BODY WITH STANDARD TRIM



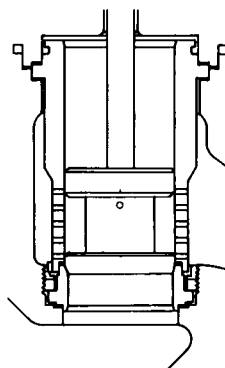
ALTERNATE CONFIGURATIONS
REFERENCE STANDARD TRIM KEY NUMBERS EXCEPT AS SHOWN

Figure 19. Fisher EHS Valve



PARTS NOT SHOWN: KEY 29 FLAT WASHER

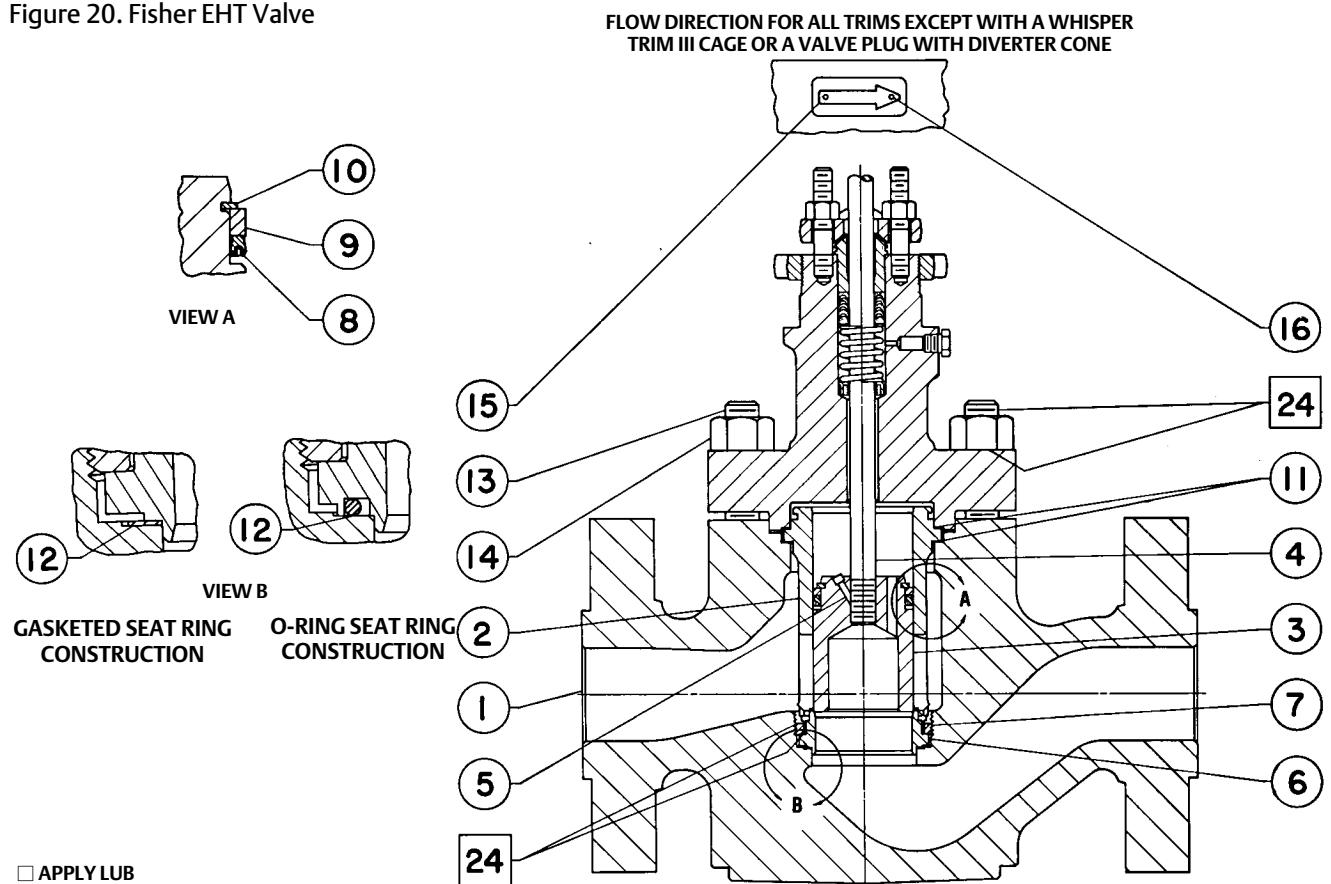
EHS BODY WITH STANDARD TRIM



DETAIL OF WHISPER TRIM III CAGE,
FOR NPS 2 THROUGH 6 BODIES

ALTERNATE CONFIGURATIONS
REFERENCE STANDARD TRIM KEY NUMBERS EXCEPT AS SHOWN

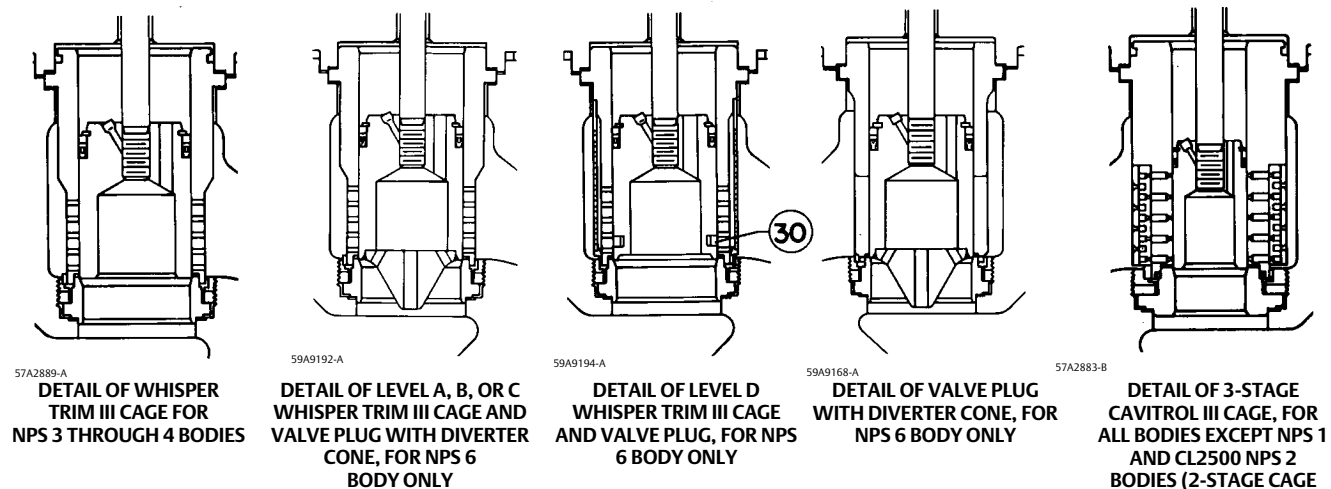
Figure 20. Fisher EHT Valve



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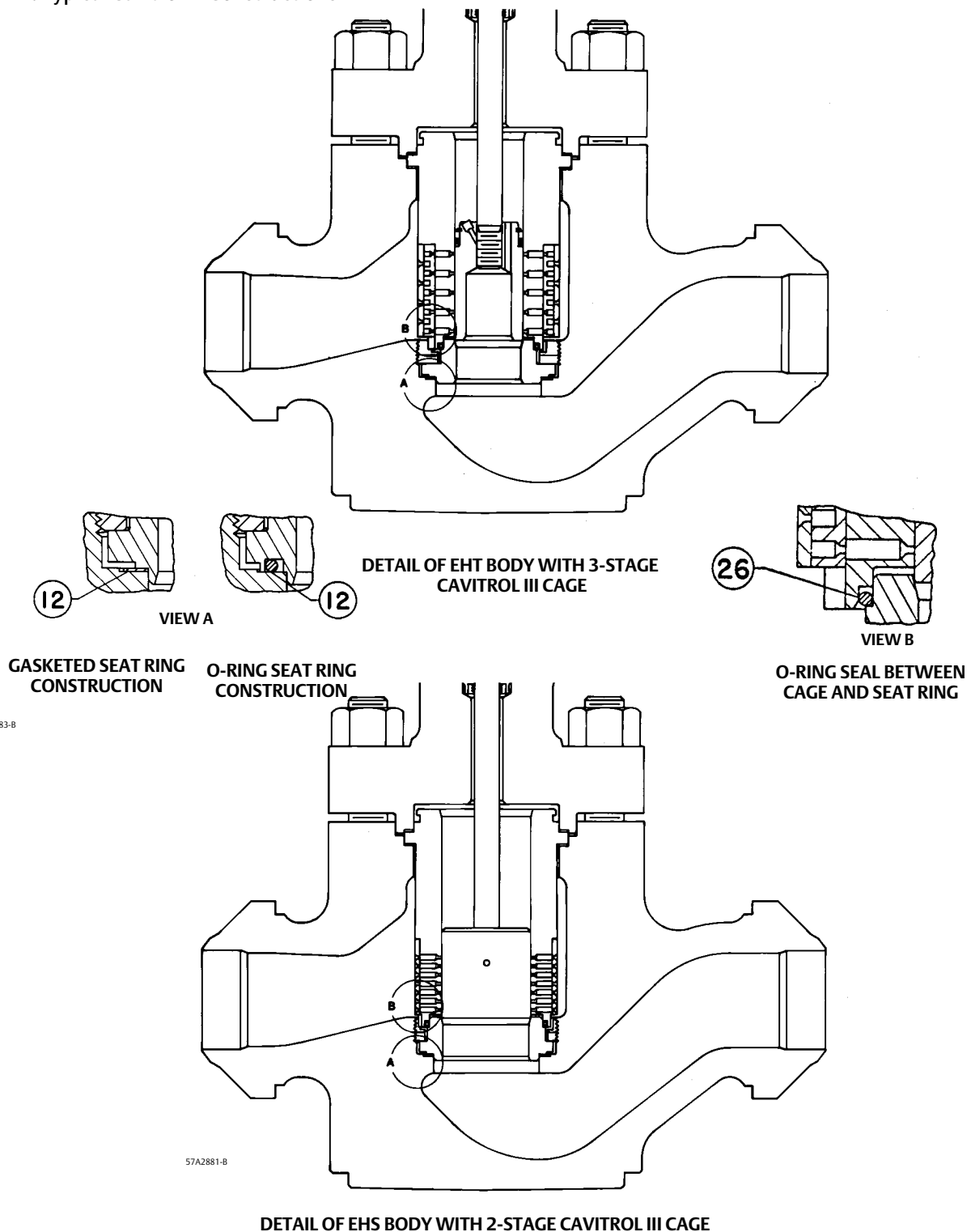
PARTS NOT SHOWN: KEY 29 FLAT WASHER

EHT BODY WITH STANDARD TRIM



ALTERNATE CONFIGURATIONS
REFERENCE STANDARD TRIM KEY NUMBERS EXCEPT AS SHOWN

Figure 21. Typical Cavitrol III Constructions



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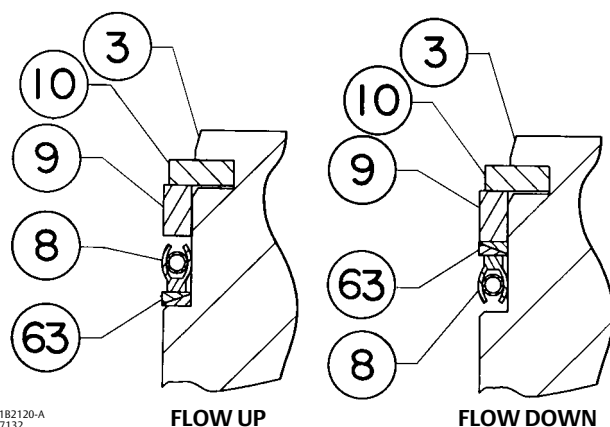
EH (1-1/2x1 through 8x6)

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Table 12. Valve Plug Diameters and Operating Temperatures

CAGE MATERIAL	STEM MATERIAL	OPERATING TEMPERATURE RANGE		DIAMETER CODE	VALVE BODY DESIGN
		°C	°F		
S31600 (316 Stainless Steel) Chrome-coated	S31600	-198 to +427	-325 to +800	A	EHD, EHS
	S31600 Chrome-coated	-29 to +593	-20 to +1100		
S31600 ENC (NACE)	S20910	-40 to +232	-40 to +450	A	EHD, EHS
S17400 (17-4PH Stainless Steel) H1150 (NACE)	S20910	-40 to +232	-40 to +450	A	EHS
S17400 H1150 (NACE)	S20910	-40 to +232	-40 to +450	B	EHD
S31600 Chrome-coated	S31600	-198 to +427	-325 to +800	B	EHS
	S31600 Chrome-coated	-29 to +593	-20 to +1100		
S31600 ENC (NACE)	S20910	-40 to +232	-40 to +450	B	EHS
S42200 (422 Stainless Steel) Ion Nitride	S31600 Chrome-coated	427 to 566	+800 to 1050	C	EHD, EHS
S42200 Ion Nitride	S31600 Chrome-coated	427 to 510	+800 to 950	D	EHD, EHS
S31600 Chrome-coated	S31600	-198 to +427	-325 to +800	D	EHD, EHS
	S31600 Chrome-coated	-29 to +593	-20 to +1100		
S31600 ENC (NACE)	S20910	-40 to +232	-40 to +450	D	EHD, EHS
S42200 Ion Nitride	S31600 Chrome-coated	427 to 510	+800 to 950	E	EHD, EHS
S42200 Ion Nitride	S31600 Chrome-coated	510 to 566	+950 to 1050	F	EHD, EHS
S31600 Chrome-coated	S31600	-198 to +427	-325 to +800	K	EHD
	S31600 Chrome-coated	-29 to +593	-20 to +1100		
S31600 ENC (NACE)	S20910	-40 to +232	-40 to +450	K	EHD

Figure 22. NPS 3 to 6 Fisher EHT Valve Using PEEK Anti-Extrusion Rings



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Actuator Groups by Type Number

Group 1 54 mm (2-1/8 Inch), 71 mm (2-13/16 Inch), or 90 mm (3-9/16 Inch) Yoke Boss	Group 101 127 mm (5 Inch) Yoke Boss	Group 404 127 mm (5 Inch, 5H) Yoke Boss 101.6 mm (4 Inch) Maximum Travel	Group 408 177.8 mm (5H, 7 Inch) Yoke Boss 101.6 mm (4 Inch) Maximum Travel
472 & 473 585C, 585CR (50.8 mm [2 inch] maximum travel) 1B & 655 657 & 667—76.2 mm (3 Inch) maximum travel 657-4, 667-4 (76.2 mm [3 inch] travel) 1008—Except 90 mm (3-9/16 Inch) yoke boss with 50.8 mm (2 inch) travel 3024C, 3025 685SE, 685SR (76.2 mm [3 inch] maximum travel)	667, 667 MO	667, 667-4 3025 (ATO)	657 Size 100 1008 Size 100 3025 (ATC)
	Group 401 90.5 mm (3-9/16 Inch) Yoke Boss 88.9 to 101.6 mm (3.25 to 4 inch) Travel	Group 405 127 mm (5 Inch, 5H) Yoke Boss 101.6 mm (4 Inch) Maximum Travel	Group 409 177.8 mm (5H, 7 Inch) Yoke Boss 101.6 mm (4 Inch) Maximum Travel
	657, 657 MO 667, 667 MO 657-4, 657-4 MO 667-4, 667-4 MO 3025 685SE, 685SR	657 MO, 657-4 MO	667 Size 100 3025 (ATO)
	Group 402 90.5 mm (3-9/16 Inch) Yoke Boss 101.6 mm (4 Inch) Maximum Travel	Group 406 127 mm (5 Inch, 5H) Yoke Boss 101.6 mm (4 Inch) Maximum Travel	Group 801 90.5 mm (3-9/16 Inch) Yoke Boss 203.2 mm (8 Inch) Maximum Travel
		667 MO, 667-4 MO	585C, 585C MO Size 60 685SE, 685SR
Group 100 127 mm (5 Inch, 5H) Yoke Boss	Group 402 90.5 mm (3-9/16 Inch) Yoke Boss 101.6 mm (4 Inch) Maximum Travel	Group 407 127 mm (5 Inch, 5H) Yoke Boss 101.6 mm (4 Inch) Maximum Travel	Group 802 127 mm (5 Inch, 5H) Yoke Boss 203.2 mm (8 Inch) Maximum Travel
472, 473 585C, 585C MO 657, 657 MO 1008 PDTC	585C MO Size 60	585C, 585C MO 657 3025 (ATC) 685SE, 685SR	585C, 585C MO 685SE, 685SR
	Group 403 90.5 mm (3-9/16 Inch) Yoke Boss 101.6 mm (4 Inch) Maximum Travel		
	585C Size 60 1008 Size 50		

*Recommended spare parts

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Fisher™ EHU Control Valves for Urea Plants

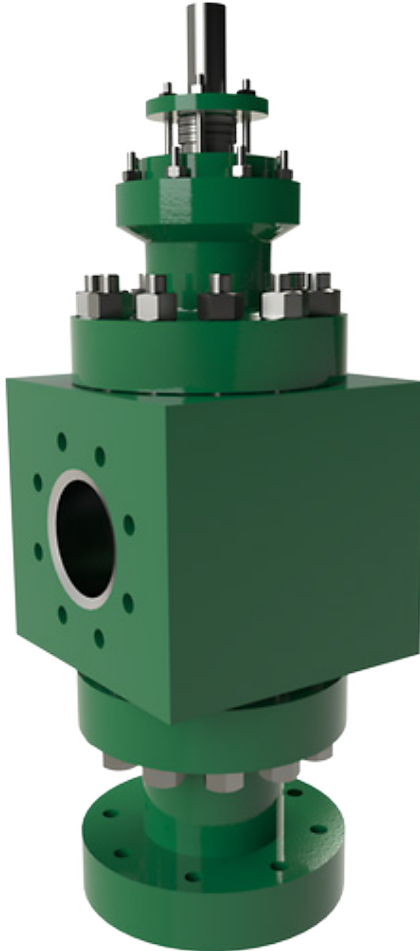


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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for Fisher EHU Urea valves. Refer to separate manuals for instructions covering the actuator, positioner and accessories.



WARNING



Do not install, operate or maintain EHU Series valves without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. EHU Valve with Optional Bonnet for Top Entry



Table 1. Specifications

End Connection Styles and Ratings ^(1,2)	Shutoff Classifications
■ Lens Ring Flanges, ■ Flanged Ends: Ring-Type Joint (RTJ) or Raised-Face (RF) flanges according to ASME B16.5 and ■ EN flanges according to EN1092-1 As specified for the application. Valves can be rated in accordance with various ASME B16 or EN 1092 rating classifications.	Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4 Metal Seat ■ CL IV (Standard) ■ CL V (Optional)
Flow Characteristic	Flow Direction
Standard Plug: ■ Equal percentage, ■ Linear or ■ Quick Open	Flow Up or Flow Down depending on application and installation
Approximate Weights (Valve Body and Bonnet Assemblies)	Additional Specifications
See order information for weight.	For specifications such as materials, valve plug travels and port, yoke boss and stem diameters, see the Parts List section.
1. The pressure or temperature limits in this manual and any applicable standard limitations should not be exceeded. 2. Consult your Emerson sales office for additional options.	

1.2 Description

The Fisher EHU Series valve is specially designed for severe service applications in urea plants. These plants containing urea, ammonium carbamate and ammonia applications demand highly engineered valves in specialty alloys to provide long life in service. The EHU is engineered with specific features to provide long life and quick serviceability in the full range of applications found in urea synthesis processes. The EHU valve body, optional bonnet and trim are available in several austenitic, super-austenitic and super-duplex stainless steels that are common in urea plants and are specified by some process licensors. Combined with a special urea service version of the industry-leading Fisher ENVIRO-SEAL™ live-loaded, low emissions packing, the EHU valve provides a design with maximum corrosion-resistance, friendly maintenance and protection against packing leaks.

1.3 Specifications

Specifications for the EHU valves are shown in Tables 1 and 2.

1.4 Education Services

Emerson Education Services
 Phone: 800-338-8158
 E-mail: education@emerson.com
emerson.com/en/final-control/services/valve-training

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Table 2. Torque for Body-to-Bonnet Bolting Using Anti-Seize Lubricant⁽¹⁾

STUD SIZE	TORQUE	
	N•m	lbf•ft
	B7, B8M CL2, S32760, and 660 Studs	B7, B8M CL2, S32760, and 660 Studs
7/8	370	275
1-1/8	710	525
1-1/4	940	695
1-3/8	1270	935
1-1/2	1650	1220
1-5/8	2130	1570
1-3/4	2670	1970
1-7/8	3310	2440
2	4030	2970
2-1/4	5780	4260
STUD SIZE	B8M CL 1 Studs	B8M CL 1 Studs
7/8	240	175
1-1/8	510	375
1-1/4	710	520
1-3/8	950	700
1-1/2	1250	920
1-5/8	1600	1180
1-3/4	2010	1480
1-7/8	2490	1830
2	3030	2230
2-1/4	4340	3200
1. For other lubricants or bolting materials, contact your Emerson sales office for torques.		

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in Table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

WARNING

Some bonnet flanges have a tapped hole that was used to handle the bonnet during manufacture. Do not use this tapped hole to lift the valve assembly or personal injury may result.

WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions indicated when the valve was ordered. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Because some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

NOTICE

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag or other foreign material from the pipeline.

1. Before installing the valve, inspect it to ensure that the valve body cavity is free of foreign material.
2. Clean out all pipelines to remove scale, welding slag and other foreign materials before installing the valve.
3. Flow through the valve must be in the direction indicated by the flow arrow, which is stamped on or attached to the valve body.

4. Use accepted piping and welding practices when installing the valve in the pipeline. For flanged valve bodies, use a suitable gasket between the body and pipeline flanges.
5. Install a three-valve bypass around the valve if continuous operation is required during maintenance.
6. If the actuator and valve body are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.
7. If the valve body was shipped without packing installed in the packing box, install the packing before putting the valve body into service. Refer to instructions given in the Packing Maintenance procedure.

WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some re-adjustment to meet specific service conditions.

Valves with ENVIRO-SEAL live-loaded packing will not require this initial re-adjustment. See the instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves (D101642X012) for packing instructions.

2.1 Lifting Valve Assembly

WARNING

Failure to follow these lifting guidelines and accepted lifting and rigging practices could result in property damage and personal injury or death.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Only personnel trained in proper lifting and rigging practices shall perform valve/actuator assembly lifting, rigging and installation. Because each lift will be unique, the method of lifting the valve assembly, the correct location for attaching and lifting the valve assembly and what the valve assembly will do when lifted shall be considered for each lift.

Lifting and rigging equipment used to lift, install or remove a valve assembly or component must be properly selected and sized for the weight and configuration of the valve assembly or component being lifted. The weight of the complete valve assembly, including attached accessories, must be taken in consideration for this purpose. The lifting and rigging equipment must be properly maintained and inspected for damage before each use.

If the valve is supplied with an actuator or handwheel, do not use the actuator or handwheel to lift the complete valve assembly. Lifting lugs attached to the actuator must not be used to lift the complete valve assembly unless clearly marked as being rated to support the complete valve assembly weight.

Lifting lugs or other lifting equipment attached to the valve or actuator must never be used to lift or support the weight of attached piping.

NOTICE

Care must be taken when lifting the valve/actuator assembly to ensure all accessories and tubing are not damaged in the process. Accessories and tubing may need to be removed prior to lifting to prevent damage and properly reinstalled before use. Protect valve flange faces, butt weld ends and other connection surfaces from damage during lifting.

Remove the valve/actuator assembly from its shipping container with appropriate lifting and rigging equipment for the valve/actuator assembly weight and configuration to be lifted. The valve and bonnet assembly weight is provided in the order information. Consult the appropriate actuator and valve accessory instruction manuals for the weight of each additional component, then determine the total weight of the complete valve assembly. The location of the valve/actuator assemblies center of gravity must be considered during lifting, installation and removal. Additional slings or other lifting equipment, such as a load leveler, may be necessary to prevent toppling of the equipment during lifting or to rotate the valve assembly into a different orientation for installation.

If the valve body includes attached lifting lugs, use all the lugs provided to lift the complete valve assembly. If lifting lugs are not provided on the valve body, lift the valve assembly with lifting straps secured around the valve body flanges, valve body neck and/or bonnet neck area.

Section 3: Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance and trim maintenance. All maintenance operations may be performed with the valve in the line.

** WARNING**

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

NOTE

The EHU Series valve may use spiral-wound gaskets which are crushed to provide their seal. A spiral-wound gasket should never be reused. Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket must be installed upon reassembly. This is necessary to ensure a good gasket seal, since the used gasket will not seal properly.

NOTICE

The spiral-wound gaskets are of special design. Failure to use Fisher replacement parts may result in valve damage.

3.1 Packing Lubrication

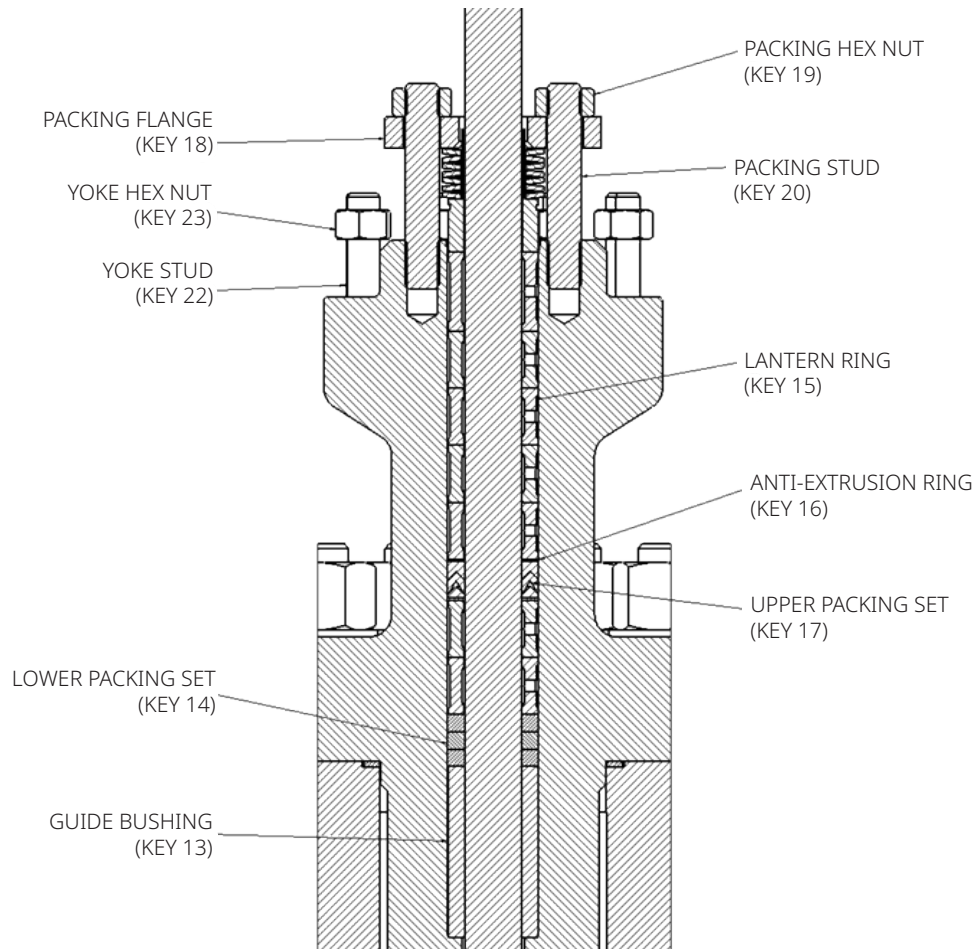
NOTE

To avoid lubricants breaking down at elevated temperatures, do not lubricate packing used in processes with temperatures over 260°C / 500°F.

3.2 Packing Maintenance

If there is undesirable packing leakage in the Urea Grade ENVIROSEAL packing as shown in Figure 2, ensure that the proper tightening technique has been followed per the ENVIROSEAL instruction manual ([D101642X012](#)).

If the packing is relatively new and tight on the valve plug stem and if tightening the packing flange nuts does not stop the leakage, it is possible that the stem is worn or nicked so that a seal cannot be made. The surface finish of a new stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. While replacing the packing according to the Replacing Packing procedure, inspect the valve plug stem and packing box wall for nicks or scratches.

Figure 2. Live-Loaded Packing

Replacing Packing

For bottom entry constructions, see the appropriate bottom entry sections in this manual.
For top entry constructions, see the appropriate top entry sections in this manual.

WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Bottom Entry Constructions

Key numbers referred to in this procedure are shown in Figure 2 unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the cap screws in the stem connector and separate the two halves of the stem connector. Then exhaust all actuator pressure, if any was applied and disconnect the actuator supply and any leakoff piping.
3. Remove valve assembly from piping.
4. Remove yoke hex nuts (key 23) and remove the actuator from the valve body (key 1).
5. Hex nuts (key 4) attach the spool to the valve body. Loosen these nuts or cap screws approximately 3 mm / 1/8 in. Then loosen the body-to-spool gasketed joint by either rocking the spool or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed to the next step.
6. Unscrew the hex nuts (key 4) and carefully lift the spool off the studs. Set the spool on a cardboard or wooden surface to prevent damage to the spool gasket surface.
7. Remove the seat ring (key 3) using the provided lift holes. Inspect the seat ring and body sealing surfaces for damage.
8. Loosen the packing flange nuts (key 19) so that the packing (keys 14 and 17, Figure 2) is not tight on the valve plug stem (key 7). Remove any travel indicator disk and stem locknuts from the valve plug stem threads.
9. Lift the valve stem/plug (key 7) out of the valve body. If the valve plug is to be reused, tape or otherwise protect the valve plug/stem and the valve plug seating surface to prevent scratches.
10. Remove the packing flange nuts (key 19), packing flange (key 18) and packing follower (key 21). Carefully push out all the remaining packing parts from the valve side of the packing box using a rounded rod or other tool that will not scratch the packing box wall.
11. Clean the packing box and the following metal packing parts: packing follower (key 21) and lantern ring (key 15).
12. Inspect the valve stem threads for any sharp edges that might cut the packing. A whetstone or emery cloth may be used to smooth the threads, if necessary.
13. Install the plug. Install the seat ring then slide the spool onto the studs (key 5).
14. Lubricate the stud threads, the faces of the hex nuts (key 4) and washer face with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Replace the hex nuts and tighten them finger-tight. Stroke the valve several times to center the trim. Torque the nuts in a crisscross pattern to no more than 1/8 of the nominal torque value specified in the order documents.

When all nuts are tightened to that torque value, increase the torque by 1/8 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

NOTE

When installing packing rings, prevent entrapping air between the rings. Add the rings one at a time without forcing them below the chamfer of the packing box entrance chamber. As each successive ring is added, the stack should not be pushed down more than the thickness of the added ring (Figure 2).

15. Use Figure 2 to ensure that the packing parts are installed in the correct order.
16. Install the spring pack assembly (key 21), with the attached springs, onto the stem.
17. Install the packing flange (key 18) and packing box nuts (key 20). Hand tighten them.
18. For Urea Grade ENVIRO-SEAL live-loaded packing, refer to the ENVIRO-SEAL IM (D101642X012) for tightening instructions. Follow the PTFE/Duplex packing instructions.
19. Mount the actuator on the valve body assembly and reconnect the actuator and valve plug stems according to the procedures in the appropriate actuator instruction manual.
20. Reinstall valve assembly in line.

Top Entry Constructions

Key numbers referred to in this procedure are shown in Figure 2 unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the cap screws in the stem connector and separate the two halves of the stem connector. Then exhaust all actuator pressure, if any was applied and disconnect the actuator supply and any leakoff piping.
3. Remove yoke hex nuts (key 23) and remove the actuator from the bonnet (key 8).
4. Loosen the packing flange nuts (key 19) so that the packing (keys 14 and 17, Figure 2) is not tight on the valve plug stem (key 7). Remove any travel indicator disk and stem locknuts from the valve plug stem threads.

NOTICE

When lifting the bonnet (key 8), be sure that the valve plug/stem (key 7) remains on the seat ring (key 3). This avoids damage to the seating surfaces as a result of the assembly dropping from the bonnet after being lifted part way out. The parts are also easier to handle separately.

Use care to avoid damaging gasket sealing surfaces.

**WARNING**

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet.

NOTE

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

5. Hex nuts (key 12) attach the bonnet to the valve body. Loosen these nuts or cap screws approximately 3 mm / 1/8 in. Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed to the next step.
6. Unscrew the hex nuts (key 12) and carefully lift the bonnet off the valve stem. If the valve plug and stem assembly starts to lift with the bonnet, use a dead blow hammer on the end of the stem and tap it back down. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.
7. Remove the valve plug (key 7) and bonnet gasket (key 9).

NOTE

Inspect the bonnet and body gasket surface. This surface must be in good condition, with all foreign material removed. Scratches or burrs that run across the serrations are not permitted under any conditions, since they will prevent the gaskets from sealing properly.

8. Clean body to bonnet gasket surface. Clean in the same direction as the surface serrations, not across them.
9. Cover the opening in the valve body to protect the gasket surface and to prevent foreign material from getting into the valve body cavity.
10. Remove the packing flange nuts (key 19), packing flange (key 18) and packing follower (key 21). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall.
11. Clean the packing box and the following metal packing parts: packing follower (key 21) and lantern ring (key 15).
12. Inspect the valve stem threads for any sharp edges that might cut the packing. A whetstone or emery cloth may be used to smooth the threads, if necessary.
13. Remove the protective covering from the valve body cavity and install the bonnet gasket (key 9). Install the plug, then slide the bonnet over the stem and onto the studs (key 10).

NOTE

The prelubricated hex nuts (key 12) referred to in step 14 can be identified by a black film coating on the nut threads. The proper bolting procedures in step 14 include—but are not limited to—ensuring that the bonnet stud threads are clean and that the hex nuts are evenly tightened to the specified torque values.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) immediately if a discrepancy between actual parts and approved parts is suspected.

NOTICE

Failure to follow the bonnet-to-body bolting procedures in step 14 and the torque values shown in Table 2 may result in damage to the valve.

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

14. Lubricate the stud threads, the faces of the hex nuts (key 12) and washer face with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Replace the hex nuts and tighten them finger-tight. Stroke the valve several times to center the trim. Torque the nuts in a crisscross pattern to no more than 1/8 of the nominal torque value specified in Table 2.

When all nuts are tightened to that torque value, increase the torque by 1/8 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

NOTE

When installing packing rings, prevent entrapping air between the rings. Add the rings one at a time without forcing them below the chamfer of the packing box entrance chamber. As each successive ring is added, the stack should not be pushed down more than the thickness of the added ring (Figure 2).

15. Use Figure 2 to ensure that the packing parts are installed in the correct order.
16. Install the spring pack assembly (key 21), with the attached springs, onto the stem.
17. Install the packing flange (key 18) and packing box nuts (key 20). Hand tighten them.
18. For Urea Grade ENVIRO-SEAL live-loaded packing, refer to the ENVIRO-SEAL IM (D101642X012) for tightening instructions. Follow the PTFE/Duplex packing instructions.
19. Mount the actuator on the valve body assembly and reconnect the actuator and valve plug stems according to the procedures in the appropriate actuator instruction manual.

3.3 Valve Plug Replacement

WARNING

Observe the warning at the start of the Maintenance section.

This procedure describes how the valve plug can be removed and replaced. Be certain that all gasketed surfaces have been well cleaned. Key numbers referenced in this procedure are shown in Figure 3 except where indicated.

Bottom Entry Constructions

1. Remove the actuator, spool, seat and plug/stem by following steps 1 through 8 of the bottom entry replacing packing procedure. Observe all warning and notice messages.
2. With the new plug/stem, follow steps 11 and 12 of the bottom entry replacing packing procedure.

Top Entry Constructions

1. Remove the actuator and bonnet by following steps 1 through 7 of the top entry replacing packing procedure. Observe all warning and notice messages.
2. With the new plug/stem, follow steps 12 and 13 of the top entry replacing packing procedure.

3.4 Seat Replacement

WARNING

Observe the warning at the start of the Maintenance section.

Bottom Entry Constructions

This procedure describes how the valve seat ring can be removed and replaced. Be certain that all gasketed and sealing surfaces have been well cleaned. Key numbers referenced in this procedure are shown in Figure 3 except where indicated.

1. Remove the actuator, spool and seat by following steps 1 through 6 of the replacing packing procedure. Observe all warning and notice messages.

NOTICE

The seat ring lifting holes are provided for ease of disassembly. To prevent damage to the seat lifting hole, fully engage the threaded rod into the cage hole, but do not overtighten the hoist rod. It only needs to be hand tight.

2. Take new seat ring and follow steps 12 through 13 of the bottom entry packing maintenance.

Top Entry Constructions

This procedure describes how the valve seat ring can be removed and replaced. Be certain that all gasketed and sealing surfaces have been well cleaned. Key numbers referenced in this procedure are shown in Figure 3 except where indicated.

1. Remove the actuator and bonnet by following steps 1 through 7 of the replacing packing procedure. Observe all warning and notice messages.
2. Hex nuts (key 4) attach the spool to the valve body. Loosen these nuts or cap screws approximately 3 mm / 1/8 in. If no fluid leaks from the joint, proceed to the next step.
3. Unscrew the hex nuts (key 4) and carefully lift the spool off the studs. Set the spool on a cardboard or wooden surface to prevent damage to the spool gasket surface.
4. Remove the seat ring using the provided lift holes. Inspect the seat ring and body sealing surfaces for damage.

NOTICE

The seat ring lifting holes are provided for ease of disassembly. To prevent damage to the seat lifting hole, fully engage the threaded rod into the cage hole, but do not overtighten the hoist rod. It only needs to be hand tight.

5. Take new seat ring and install into the body. Place the spool over the studs (key 5).
6. Lubricate the stud threads, the faces of the hex nuts (key 4) and washer face with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Replace the hex nuts and tighten them finger-tight. Stroke the valve several times to center the trim. Torque the nuts in a crisscross pattern to no more than 1/8 of the nominal torque value specified in order documents.

When all nuts are tightened to that torque value, increase the torque by 1/8 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

Section 4: Parts

4.1 Parts Ordering

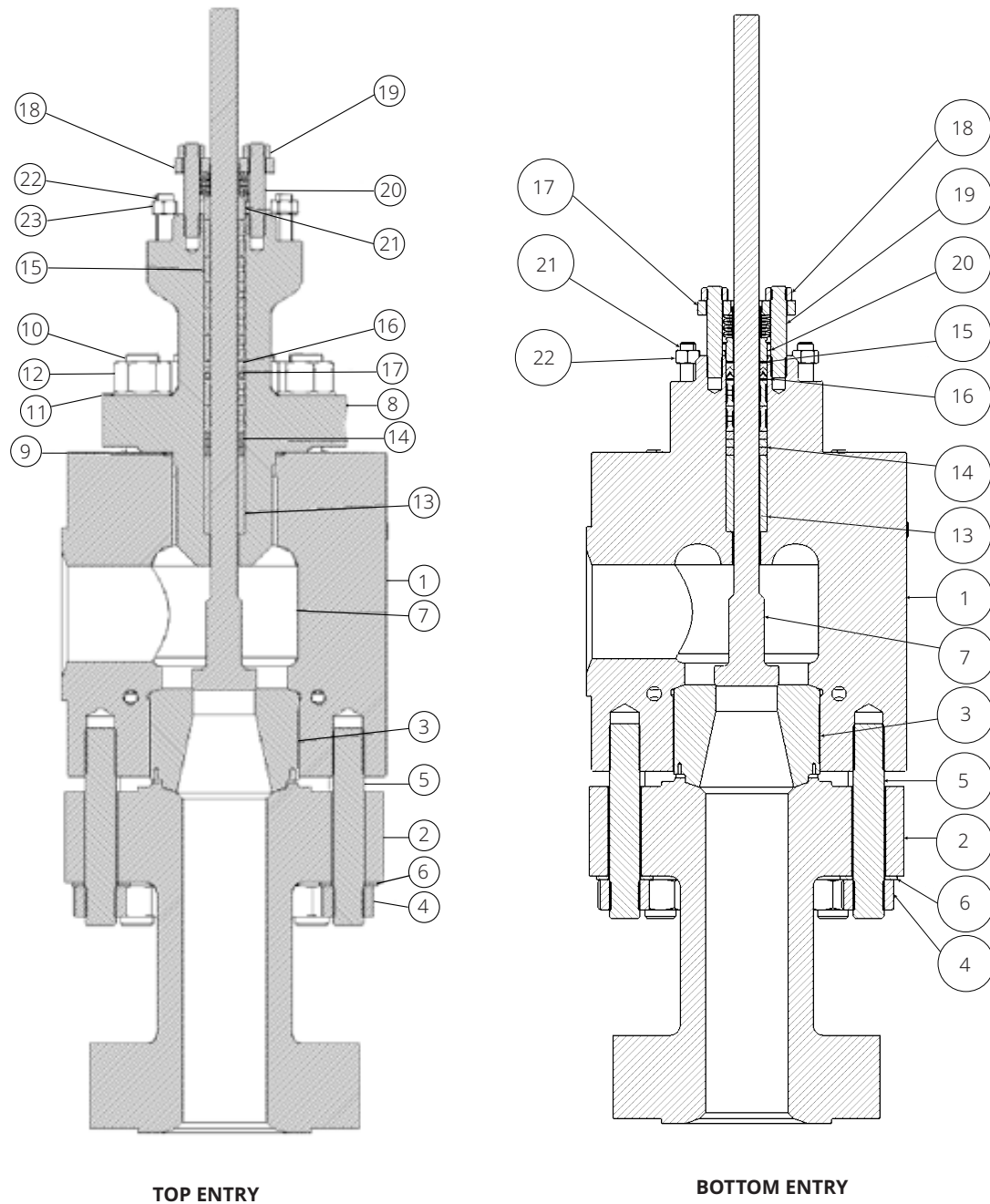
Each body-bonnet assembly is assigned a serial number, which can be found on the valve body. This same number also appears on the actuator nameplate when the valve body is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance or when ordering replacement parts.



WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

Figure 3. NPS 6 EHU Valve Assembly



4.2 Parts List

NOTE

Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description	Key	Description
1	Valve body If you need a valve body as a replacement part, order by valve size, serial number and desired material.	13*	Guide bushing
2	Spool	14*	Lower packing set
3*	Seat ring	15*	Lantern ring
4*	Spool hex nut	16*	Anti-extrusion ring
5*	Spool stud	17*	Upper packing set
6*	Spool washer	18	Packing flange
7*	Plug/Stem	19	Packing nut
8	Bonnet ⁽¹⁾ If you need a bonnet as a replacement part, order by serial number and desired material.	20	Packing stud
9*	Bonnet gasket ⁽¹⁾	21	Spring pack assembly
10*	Bonnet stud ⁽¹⁾	22	Yoke stud
11*	Bonnet washer ⁽¹⁾	23	Yoke nut
12*	Bonnet nut ⁽¹⁾	---	---
*Recommended spare parts 1. These components are for top entry constructions only.			

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Enhanced ENVIRO-SEAL™ Packing Systems for Fisher™ Rotary Valves

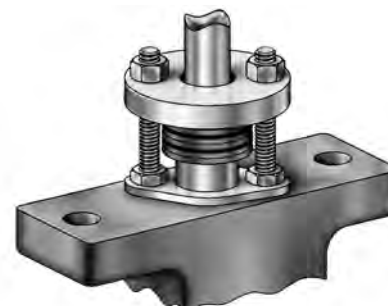
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Figure 1. Typical Enhanced ENVIRO-SEAL Packing Systems



W5882-1



W9058-1

Introduction

Scope of Manual

This instruction manual includes installation and parts information for Fisher enhanced ENVIRO-SEAL live-loaded packing systems (see figure 1). These systems are available for Fisher rotary valves with 12.7 through 88.9 mm (1/2 through 3-1/2 inch) shaft diameters. The system can be used with many rotary valves, as shown in tables 1 and 3. Refer to appropriate valve and actuator instruction manuals for necessary information relating to the disassembly and assembly of the valve and actuator. Enhanced ENVIRO-SEAL packing systems utilize a Belleville (coned-disk) spring system.



Do not install, operate, or maintain the enhanced ENVIRO-SEAL packing systems, valve, actuator or accessories without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

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Table 1. Specifications

Applicable Valve Designs^(3,4) Fisher 8560 and 8532 eccentric disk control valves; A11 control valves; V150, V200 and V300 Vee-Ball™ control valves (Series B and Non-Series B ⁽¹⁾); V250 and V260 and BV500, CV500 and V500 eccentric plug rotary valves. Also see table 3.	Applicable Shaft Diameters See table 3 Pressures and Temperatures⁽²⁾ See table 2
1. Refer to Fisher Vee-Ball V150, V200, and V300 instruction manual, for distinctions between Series B and Non-Series B. 2. The pressure/temperature limits in this manual, in the valve literature, and any applicable code or standard limitation should not be exceeded. 3. Whenever 8532 is referenced, A31A and A31D can be applied. 4. Whenever 8560 is referenced, A41, 8510, 8510B can be applied.	

Table 2. Maximum Application Temperature and Pressure for 50 PPM Service

ENVIRO-SEAL PACKING MATERIAL	MAXIMUM APPLICATION TEMPERATURE		MAXIMUM APPLICATION PRESSURE
	°C	°F	
Single PTFE	232	450	Not Restricted ⁽¹⁾
Double PTFE ⁽²⁾	177	350	20.7 bar (300 Psi)
Graphite	316	600	Not Restricted ⁽¹⁾
1. For pressure ratings through CL600 of valves listed in this instruction manual. 2. These application conditions apply for double PTFE only in the valve types where double PTFE is available.			

Valve/Actuator Shaft Coupler

To install an enhanced ENVIRO-SEAL packing system on an A11 or 8532 valve with a non-standard, non-Fisher produced actuator may require a special valve/actuator shaft coupler.

Table 10 contains a list of valve/actuator combinations and part numbers for the new coupler. If you are considering installation of an enhanced ENVIRO-SEAL packing system in another existing valve/actuator package, check table 10 to see if a new coupler is required.

In some cases, coupler replacement is not required when retrofitting valve/actuator combinations. Table 11 contains a list of valve/actuator combinations that can use existing couplers.

Description

Fisher packing systems are offered with exceptional sealing capabilities that you can easily install in existing valves or that you can purchase with new valves. These systems help you conserve valuable process fluid. The external live-loading provides a constant load over the life of the packing material, which reduces the need for packing box adjustment and maintenance.

The system design, coupled with very smooth shaft finishes and spring-loading of the packing, provides longer service with lower maintenance than many other designs.

Installation

Use these instructions to install enhanced ENVIRO-SEAL packing in valves that have standard packing, or when inspecting or replacing ENVIRO-SEAL packing.

If you are changing the packing system material from standard graphite to ENVIRO-SEAL graphite or ENVIRO-SEAL PTFE packing, the packing friction for ENVIRO-SEAL packing will be lower than it was for the standard packing. Therefore, no change should be needed in actuator sizing.

If you are changing the packing system material from standard PTFE to ENVIRO-SEAL graphite or ENVIRO-SEAL PTFE packing, the packing friction will increase. Contact your [Emerson sales office](#) to determine if your existing actuator will be large enough.

WARNING

Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given in this manual, the appropriate valve instruction manual, or the limits on the appropriate name plates. Use pressure relieving devices as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Removing the Actuator section in this instruction manual.

Removing the Actuator

WARNING

Avoid personal injury from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

You must remove the actuator from the valve when you install enhanced ENVIRO-SEAL packing systems. To allow proper readjustment of the valve disk position, it is recommended that you remove the valve from the pipeline. Refer to appropriate valve and actuator instruction manuals.

⚠ WARNING

If a spring-return actuator is used, be sure the actuator spring is resting on its travel stop. If something is obstructing shaft rotation, it is possible that disconnecting the shaft connector will allow the spring to force the actuator to the end of its rotation, resulting in possible personal injury or property damage. Refer to the appropriate valve and actuator instruction manuals to remove the actuator.

Installing an enhanced ENVIRO-SEAL Packing System

Note

When installing an enhanced ENVIRO-SEAL packing system into an insulated valve, do not cover the packing springs with insulation.

Note

The valve shaft surface condition is critical in obtaining a good seal. If the valve shaft surface is scratched, nicked, or worn, replace the valve shaft before installing the enhanced ENVIRO-SEAL Packing System.

Refer to the appropriate valve instruction manual to replace the valve shaft.

Key number locations are shown in figures 2 and 4 for Vee-Ball, eccentric plug, 8560, and A41 valves, and in figures 3 and 5 for A11 and 8532 valves.

1. If you are installing an enhanced ENVIRO-SEAL packing system in an existing valve, remove existing packing nuts, packing flange, jam nuts, anti-blowout flange, packing follower, and any other external packing components from the valve body.

⚠ WARNING

To avoid personal injury from packing leakage, take care when removing the old packing parts from the packing box. Do not scratch, nick or dent the valve shaft surface or packing box wall.

2. For A11, 8532, 8580, 8590, and Control-Disk valves, remove the anti-blowout wire that surrounds the valve shaft.
3. For all valves, remove packing and all other internal components from the packing box.
4. Inspect the existing valve shaft. If necessary, replace the valve shaft. Refer to the appropriate valve instruction manual to replace the valve shaft.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

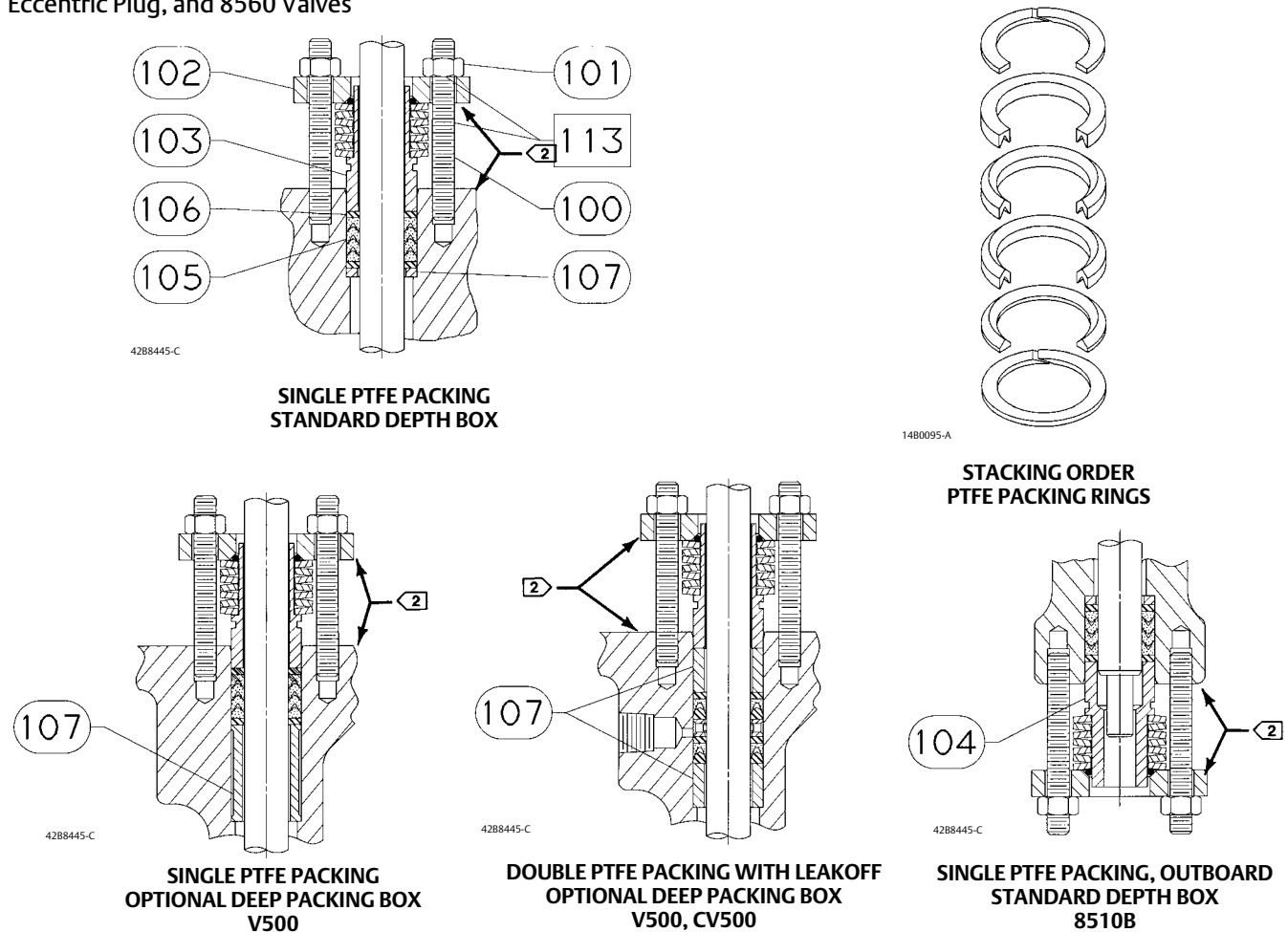
Instruction Manual

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Enhanced ENVIRO-SEAL Packing Systems - Rotary Valves

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Figure 2. Typical Enhanced ENVIRO-SEAL Rotary Packing Arrangements with PTFE Packing for Fisher Vee-Ball, Eccentric Plug, and 8560 Valves



NOTES:

- ① APPLY LUBRICANT
- ② THESE TWO SURFACES MUST REMAIN PARALLEL AS YOU ALTERNATELY AND EVENLY TIGHTEN THE PACKING NUTS (KEY 101)

Note

Enhanced ENVIRO-SEAL PTFE packing systems can be used in either vacuum or positive pressure service. It is not necessary to reverse ENVIRO-SEAL PTFE packing components in vacuum service.

Make sure that the Belleville springs are stacked properly and packing box parts are assembled in the correct order (see figure 6). Packing parts cannot function properly if the Belleville springs or other packing parts are not stacked correctly.

5. With the shaft in place in the valve, install the packing parts into the valve packing box.

Note

Be sure to install the packing rings in the sequence shown in figures 2 through 5.

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- a. Place one of the packing box rings (key 107) into the packing box. Be sure the packing box ring is properly seated. This does not apply to NPS 3, 4 and 6 CL600 A11 valves.
- b. For PTFE packing, place an anti-extrusion washer (key 106) into the packing box and push it in until it rests next to the packing box ring (key 106 is not used with graphite packing).

Note

The graphite packing set has a carbon anti-extrusion ring on the top and bottom of the packing. These anti-extrusion rings are designed to have a slight interference fit on the shaft. The rings have a single fracture to allow the ring to be installed on the shaft. Additional fractures may develop while the valve is in service, however, these additional fractures will not affect the performance of the ENVIRO-SEAL packing.

- c. Place the packing set (key 105) into the packing box. Refer to figure 3 or 5 for the proper orientation of the packing set.
 - d. For PTFE packing, place another anti-extrusion washer (key 106) into the packing box after the packing set (key 106 is not used with graphite packing).
 - e. Place the second packing box ring (key 107) into the packing box.
 - f. Locate the new spring pack assembly (key 103). Remove the O-ring and packing springs from the packing follower. Use the packing follower to press the packing components into the packing box. Remove the packing follower.
6. For A11, 8532, 8580, 8590, and Control-Disk valves, install the anti-blowout wire (key 16) in the groove around the valve shaft.
 7. Slide the packing follower from the new spring pack assembly over the valve shaft and the anti-blowout wire until it rests against the packing box ring.
 8. For all valves, install the longer packing studs (key 100).
 9. For A11, 8532, 8580, 8590, and Control-Disk valves, install the new anti-blowout flange (key 10) over the valve shaft, packing studs, and packing follower. Secure the anti-blowout flange with the new jam nuts (key 17).
 10. For all valves, install the spring pack assembly (key 103 or 104) which includes the Belleville springs, packing follower, and O-ring arranged as shown in figures 2 through 6. (The O-ring is a non-functional part and is used to retain the packing springs during assembly.)

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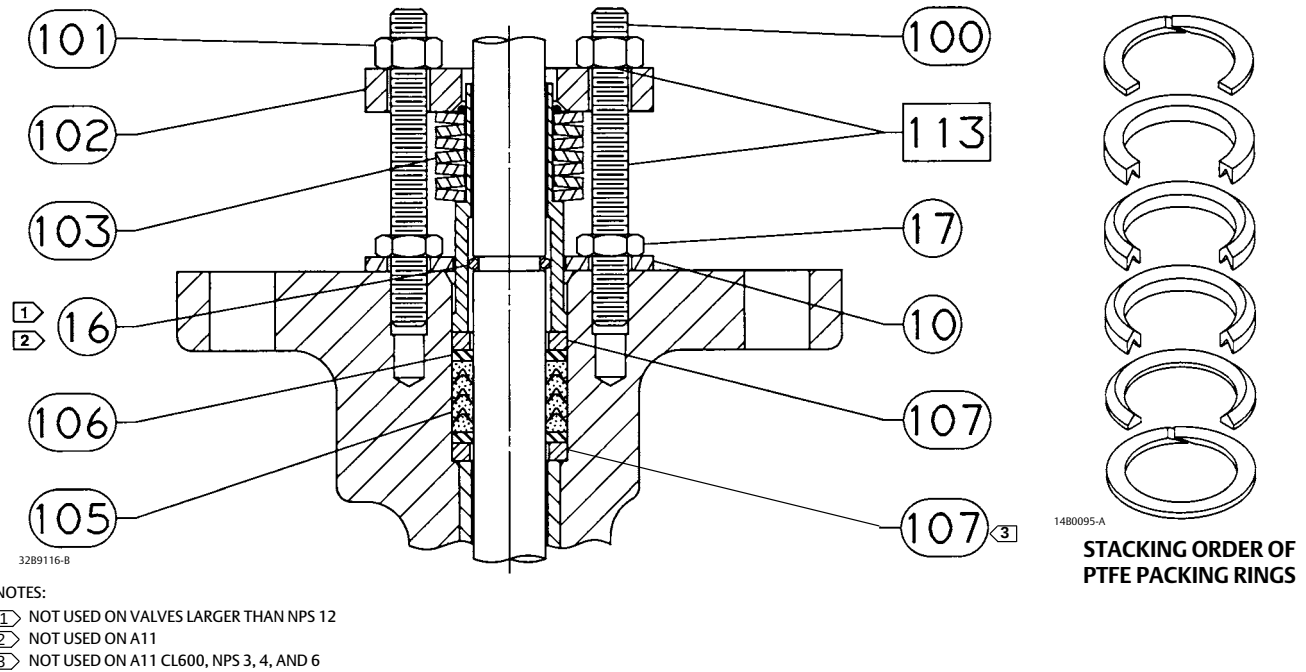
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Figure 3. Enhanced ENVIRO-SEAL PTFE Packing System for Fisher A11, 8532, 8580, 8590, and Control-Disk Valves



11. Install the packing flange (key 102) on the shaft, and install the packing nuts (key 101). Hand tighten them.

Note

In general, the following tightening procedure applies to all enhanced ENVIRO-SEAL packing systems—both sliding-stem and rotary.

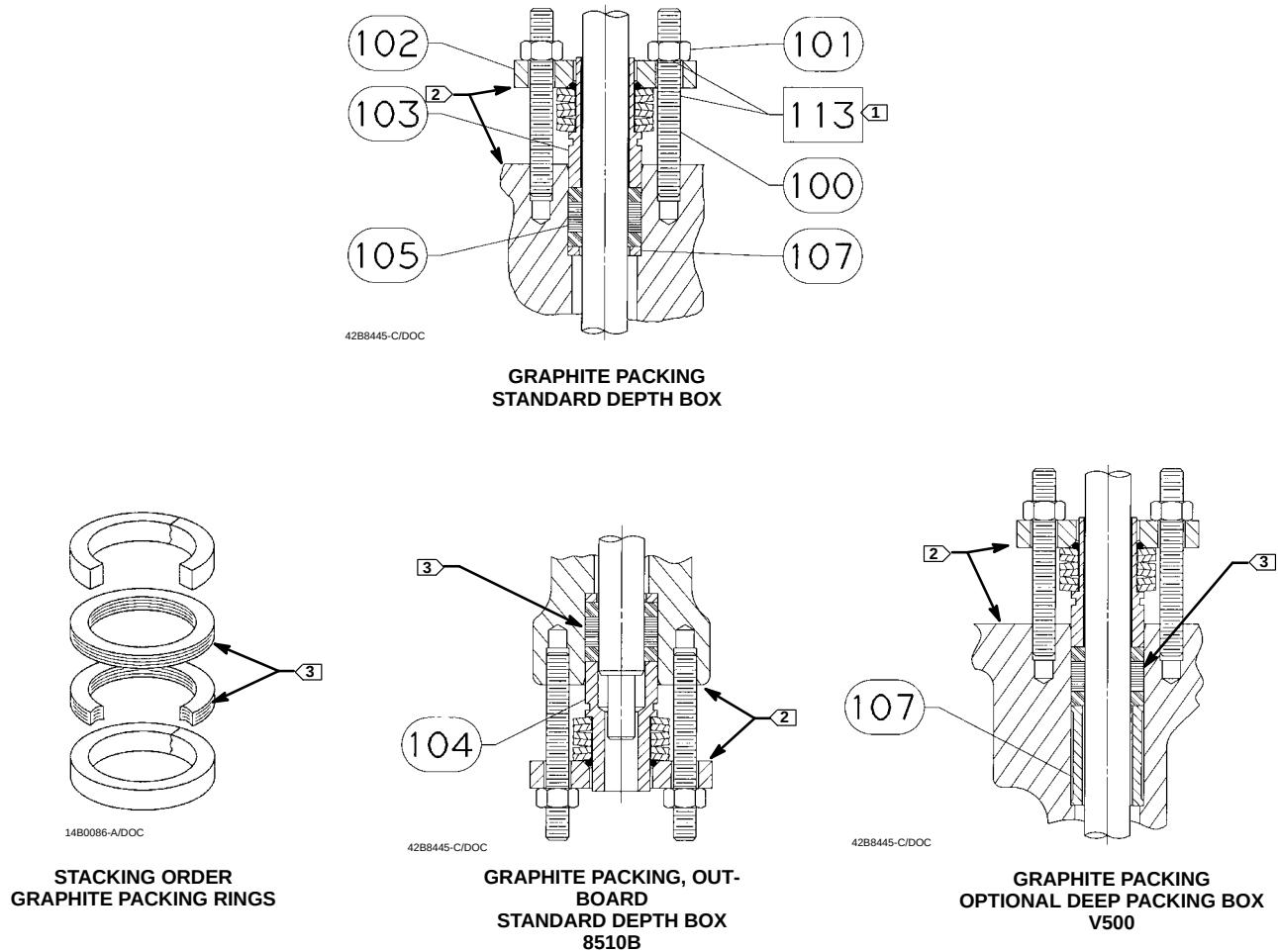
NOTICE

Excessive force could cause valve body bushing displacement in Non-Series B Vee-Ball valves, allowing Vee-Ball misalignment, excessive seat leakage, or stalling of the actuator.

Note

Lubrication is required for the packing studs and nuts. Although it is important to properly lubricate the stud threads and internal nut threads, it is also important to properly lubricate the contacting face of the nut. See figures 2 through 5 and 7 for lubrication locations.

Figure 4. Typical Enhanced ENVIRO-SEAL Rotary Packing Arrangements with Graphite Packing for Fisher Vee-Ball, Eccentric Plug, and 8560 Valves



NOTES:

- 1 APPLY LUBRICANT
- 2 THESE TWO SURFACES MUST REMAIN PARALLEL AS YOU ALTERNATELY AND EVENLY TIGHTEN THE PACKING NUTS (KEY 101)
- 3 VALVE WITH SHAFTS LARGER THAN 38.1 mm (1-1/2 INCH) USE THREE GRAPHITE RINGS

Note the following definitions. You will need them for the next few steps. The **target load** is the point where the Belleville springs are designed for optimum performance, when they are compressed to 85% of their maximum deflection, or nearly flat. **Maximum deflection** is when the springs are 100% compressed, or completely flat.

12. You will obtain maximum benefit from your enhanced ENVIRO-SEAL packing system when you tighten the packing flange nuts and compress the Belleville springs to their “target load”.

To obtain the target load of 85% compression of maximum deflection, perform the following:

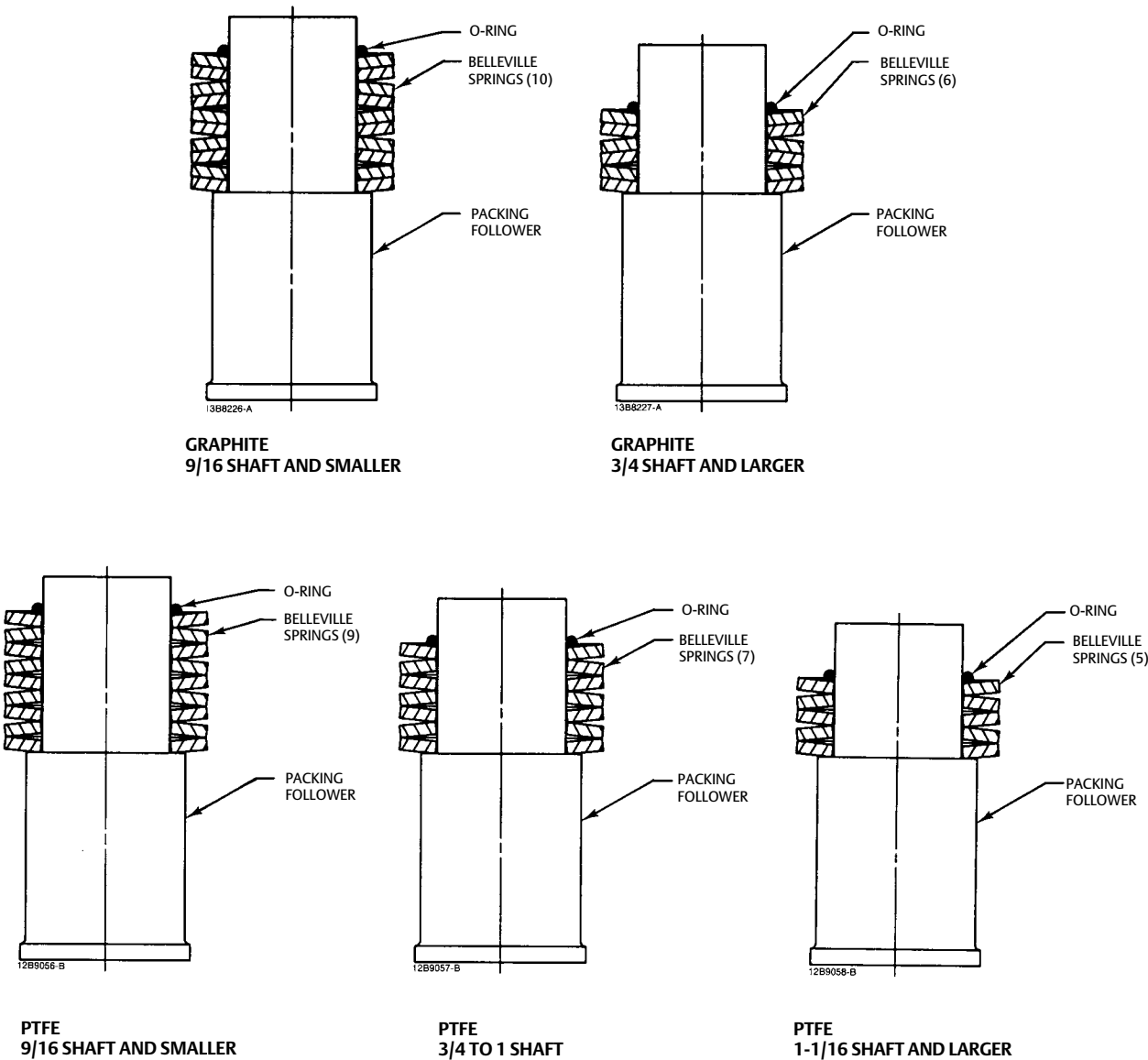
- Tighten the packing flange nuts alternately and evenly, keeping the packing flange parallel with the valve flange (see figure 7), until the Belleville springs are compressed 100% (or completely flat).

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NOTES:

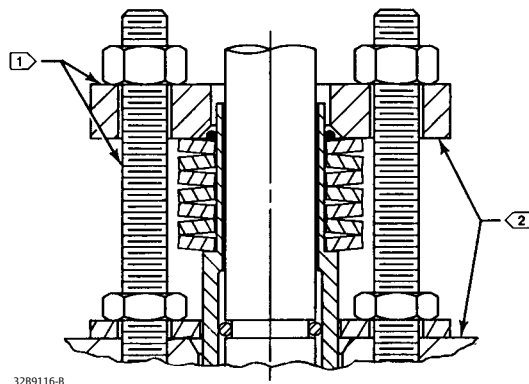
- ① VALVES WITH SHAFTS LARGER THAN 38.1 mm (1-1/2 INCH) USE 3 GRAPHITE RINGS
- ② NOT USED ON VALVES LARGER THAN NPS 12
- ③ NOT USED ON A11 VALVES
- ④ NOT USED ON A11 CL600 NPS 3, 4, AND 6

Figure 6. Belleville Spring Stacking Order (See Table 3)



INCH
B2410-2

Figure 7. Enhanced ENVIRO-SEAL PTFE Packing System Detail



32B9116-B

NOTES:

- 1 APPLY LUBRICANT
- 2 THESE TWO SURFACES MUST REMAIN PARALLEL AS YOU ALTERNATELY AND EVENLY TIGHTEN THE PACKING NUTS.

Other Considerations

Note

The following check is only valid for rotary enhanced ENVIRO-SEAL packing systems and sliding-stem enhanced ENVIRO-SEAL or HIGH-SEAL packing systems.

When retrofitting an existing packing system or repacking a valve with enhanced ENVIRO-SEAL packing that has been in service, check the condition of the packing bore after you have removed the packing. An easy method for cleaning debris and minor imperfections from the bore is to use a brake cylinder hone attached to an electric drill. This method will do a good job of cleaning the packing bore without changing the dimension of the bore.

When you have completed this exercise, a good guideline to use in checking the condition of the packing bore is the 20/20 rule. If less than 20% of the surface area of the bore is pitted and if no pits are deeper than 0.010 inch, then your packing will work fine. This does not need to be an exact measurement; visual inspection is adequate. If the packing bore does not meet this criteria, however, you should replace the valve or have your Emerson service center repair it.

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Table 3. Applicable Valve Sizes and Shaft Diameters⁽¹⁾

VALVE	VALVE SIZE, NPS	PRESSURE CLASS	VALVE SHAFT DIAMETER	
			mm	Inches
8510B	2	See 8560 bulletin (D102028X012)	12.7	1/2
	3		15.9	5/8
	4		19.1	3/4
	6		25.4	1
	8		31.8	1-1/4
	10		31.8	1-1/4
	12		38.1	1-1/2
8532	14	150	34.9	1-3/8
	16		38.1	1-1/2
	18		44.5	1-3/4
	20		50.8	2
	24		63.5	2-1/2
	14	300	50.8	2
	16		57.2	2-1/4
	18		63.5	2-1/2
	20		76.2	3
	24		88.9	3-1/2
8560	2	150	12.7	1/2
	3		12.7	1/2
	4		15.9	5/8
	6		19.1	3/4
	8		25.4	1
	10		31.8	1-1/4
	12		38.1	1-1/2
	2	300	12.7	1/2
	3		15.9	5/8
	4		19.1	3/4
	6		25.4	1
	8		31.8	1-1/4
	10		38.1	1-1/2
	12		44.5	1-3/4
V150	1	150	12.7	1/2
	1-1/2		15.9	5/8
	2		15.9	5/8
	3		19.1	3/4
	4		19.1	3/4
	6		25.4	1
	8		31.8	1-1/4
	10		31.8	1-1/4
	12		38.1	1-1/2
	14		44.5	1-3/4
	16		54	2-1/8
	20		63.5	2-1/2
V200	1	150/300/ 600	12.7	1/2
	1-1/2		15.9	5/8
	2		15.9	5/8
	3		19.1	3/4
	4		19.1	3/4
	6		25.4	1
	8		31.8	1-1/4
	10		31.8	1-1/4
V300	1	300	12.7	1/2
	1-1/2		15.9	5/8
	2		15.9	5/8
	3		19.1	3/4
	4		19.1	3/4
	6		25.4	1
	8		31.8	1-1/4
	10		31.8	1-1/4
	12		38.1	1-1/2
	14		44.5	1-3/4
	16		54	2-1/8

Table 3. Applicable Valve Sizes and Shaft Diameters (cont.)

VALVE	VALVE SIZE, NPS	PRESSURE CLASS	VALVE SHAFT DIAMETER	
			mm	Inches
CV500	3	150/300/ 600	25.4	1
	4		31.8	1-1/4
	6		38.1	1-1/2
	8		38.1	1-1/2
	10		44.5	1-3/4
	12		53.8	2-1/8
V500	1	150/300/ 600	12.7	1/2
	1-1/2		15.9	5/8
	2		15.9	5/8
	3		25.4	1
	4		31.8	1-1/4
	6		31.8	1-1/2
	8		38.1	1-1/2
A31A and A31D	10		44.5	1-3/4
	3	150	14.3	9/16
	4		17.5	11/16
	6		23.8	15/16
	8		23.8	15/16
	10		28.5	1-1/8
	12		31.8	1-1/4
	14		34.9	1-3/8
	16		38.1	1-1/2
	18		44.5	1-3/4
	20		50.8	2
	24		63.5	2-1/2
	3	300	14.3	9/16
	4		17.5	11/16
	6		23.8	15/16
	8		31.8	1-1/4
	10		41.3	1-5/8
	12		47.6	1-7/8
	14		50.8	2
	16		57.2	2-1/4
	18		63.5	2-1/2
	20		76.2	3
	24		88.9	3-1/2
A41	2	150	12.7	1/2
	3		12.7	1/2
	4		15.9	5/8
	6		19.1	3/4
	8		25.4	1
	10		31.8	1-1/4
	12		38.1	1-1/2
	2	300	12.7	1/2
	3		15.7	5/8
	4		19.0	3/4
	6		25.4	1
	8		31.8	1-1/4
	10		38.1	1-1/2
A11	12	600	44.4	1-3/4
	3		14.3	9/16
	4		19.1	3/4
	6		28.5	1-1/8
	8		38.1	1-1/2
	10		44.5	1-3/4
	12		57.2	2-1/4
	14		63.5	2-1/2
	16		76.2	3
	18		88.9	3-1/2

1. Shaft Diameter through the packing box.

Parts Ordering

Each valve assembly is assigned a serial number that can be found on the valve body. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance.

When ordering replacement parts, refer to the serial number and to the 11-character kit number for each kit required from the following list. Kits for valves with shaft sizes greater than 38.4 mm (1-1/2 inch) will not be available, however, ENVIRO-SEAL parts may be ordered separately. Consult your Emerson sales office for details.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Retrofit Kits

Retrofit kits include all parts required for installation of the enhanced ENVIRO-SEAL packing system into existing rotary and high performance butterfly valves. Retrofit kits are available for single PTFE or graphite packing. See tables 5 through 7 for retrofit kit part numbers.

The 8510B has two packing boxes, one at the actuator end and one at the outboard end. Select a kit from each column of the following table.

Packing boxes in V500 and CV500 valve bodies may be deep drilled, (at one time standard on all CV500 and always available as an option). If the valve body being retrofitted has a deep packing box, use the longer packing box ring (key 107) from the original packing. Discard the 3 mm (1/8-inch) packing box ring from the retrofit kit. If a replacement packing box ring (long, key 107) is required, refer to the valve instruction manual for parts, or consult your Emerson sales office. Refer to figure 2, the view titled: Double PTFE Packing with Leakoff—Optional Deep Packing Box.

Note

1. Use the existing long packing box ring (key 107) that was furnished with the original valve when installing the retrofit kit in:

- V200 NPS 8 and 10 valves, or
 - V150 and V300 NPS 8, 10, and 12 valves
-

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Table 4. Retrofit Kit Included Parts

Key	Description	Quantity
10 ⁽⁵⁾	Anti-blowout follower ⁽⁵⁾	1
17 ⁽⁵⁾	Jam nut ⁽⁵⁾	1
100	Packing stud	2 ⁽⁶⁾ or 4 ⁽⁷⁾
101	Packing nut	2 ⁽⁶⁾ or 4 ⁽⁷⁾
102	Packing flange	1
103	Spring pack assembly ⁽¹⁾	1
104	Spring pack assembly ⁽²⁾	1
105	Packing Set	1
106	Anti-extrusion washer	2 ⁽³⁾
107	Packing box ring	2 ⁽⁴⁾
111	Tag	1
112	Cable	1

1. For use on Actuator end. The spring pack assembly is made up of the packing spring stack held in place by an O-ring on the packing follower.
 2. For use on Outboard end. The spring pack assembly is made up of the packing spring stack held in place by an O-ring on the packing follower.
 3. Not included in graphite packing kit.
 4. Only 1 req'd for NPS 18 CL300, NPS 20 CL150 and NPS 24 CL150. Two packing box rings required for 8560, 44.5 mm (1-3/4 inch) shaft. Not required on V150, V200 or V300 with 31.8 or 38.1 mm (1-1/4 or 1-1/2 inch) shafts.
 5. These are included in retrofit kits for 8532 and A11 valves.
 6. NPS 3 through 12 CL150 and NPS 3 through 8 CL300 for 8532; NPS 3 through 6 CL600, A11.
 7. NPS 14 through 24 CL150/300 for 8532; NPS 8 through 18 CL600, A11.

Table 5. Retrofit Kits for Fisher Vee-Ball, Eccentric Plug, 8560 and 8510B Valves with Spline Shafts

SHAFT DIAMETER, mm (INCH)	PTFE RETROFIT KITS PACKING BOX END		GRAPHITE RETROFIT KITS PACKING BOX END	
	Actuator End	Outboard End for 8510B Only	Actuator End	Outboard End for 8510B Only
12.7 (1/2)	RRTYXRT0012	RRTYXRT0082	RRTYXRT0312	RRTYXRT0382
15.9 (5/8)	RRTYXRT0022	RRTYXRT0092	RRTYXRT0322	RRTYXRT0392
19.1 (3/4)	RRTYXRT0032	RRTYXRT0102	RRTYXRT0332	RRTYXRT0402
25.4 (1)	RRTYXRT0052	RRTYXRT0112	RRTYXRT0352	RRTYXRT0412
31.8 (1-1/4)	RRTYXRT0062	RRTYXRT0122	RRTYXRT0362	RRTYXRT0422
38.1 (1-1/2)	RRTYXRT0072	RRTYXRT0132	RRTYXRT0372	RRTYXRT0432
8560 NPS 10 (CL 300)	RRTYXRT0672	---	RRTYXRT0812	---
8560 NPS 12 (CL 150)	RRTYXRT0672	---	RRTYXRT0812	---
44.5 (1-3/4)	RRTYXRT0682	RRTYXRT0762	RRTYXRT0822	RRTYXRT0902
8560 NPS 12 (CL 300)	RRTYXRT0692	---	RRTYXRT0832	---
V500 NPS 10	RRTYXRT0702	---	RRTYXRT0842	---
54 (2-1/8)	RRTYXRT0722	---	RRTYXRT0862	---
63.5 (2-1/2)	RRTYXRT0732	RRTYXRT0782	RRTYXRT0872	RRTYXRT0922

Table 6. Retrofit Kits for Fisher Vee-Ball, Eccentric Plug, 8510B and A41 valves with Double D and Keyed End Connection

SHAFT DIAMETER, mm (INCH)	PTFE RETROFIT KITS PACKING BOX END		GRAPHITE RETROFIT KITS PACKING BOX END	
	Actuator End	Outboard End for 8510B Only	Actuator End	Outboard End for 8510B Only
Double D				
12.7 (1/2)	RRTYXRT0972	RRTYXRT0082	RRTYXRT1072	RRTYXRT0382
15.9 (5/8)	RRTYXRT0982	RRTYXRT0092	RRTYXRT1082	RRTYXRT0392
19.1 (3/4)	RRTYXRT0992	RRTYXRT0102	RRTYXRT1092	RRTYXRT0402
25.4 (1)	RRTYXRT1012	RRTYXRT0112	RRTYXRT1102	RRTYXRT0412
31.8 (1-1/4)	RRTYXRT1022	RRTYXRT0122	RRTYXRT1112	RRTYXRT0422
38.1 (1-1/2)	RRTYXRT1032	RRTYXRT0132	RRTYXRT1122	RRTYXRT0432
44.5 (1-3/4)	RRTYXRT1042	RRTYXRT0762	RRTYXRT1132	RRTYXRT0902
Keyed				
54 (2-1/8)	RRTYXRT1052	---	RRTYXRT1142	---
63.5 (2-1/2)	RRTYXRT1062	RRTYXRT0782	RRTYXRT1152	RRTYXRT0922

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Table 7. Retrofit Kit Part Numbers for Fisher 8532 and A11 Butterfly Valves

8532				
Valve Size, NPS	Pressure Class	Shaft Diameter ⁽¹⁾⁽²⁾ , mm (Inch)	Retrofit Kits	
			PTFE	Graphite
3	150, 300	14.3 (9/16)	RRTYXRT0202	RRTYXRT0502
4	150, 300	17.5 (11/16)	RRTYXRT0212	RRTYXRT0512
6	150, 300	23.8 (15/16)	RRTYXRT0222	RRTYXRT0522
8	150	23.8 (15/16)	RRTYXRT0232	RRTYXRT0532
	300	31.8 (1-1/4)	RRTYXRT0242	RRTYXRT0542
10	150	28.5 (1-1/8)	RRTYXRT0252	RRTYXRT0552
	300	41.3 (1-5/8)	RRTYXRT0572	---
12	150	31.8 (1-1/4)	RRTYXRT0262	RRTYXRT0562
	300	47.6 (1-7/8)	RRTYXRT0582	---
14	150	34.9 (1-3/8)	RRTYXRT0592	
	300	50.8 (2)	RRTYXRT0602	
16	150	38.1 (1-1/2)	RRTYXRT0612	
	300	57.2 (2-1/4)	RRTYXRT0622	
18	150	44.5 (1-3/4)	RRTYXRT0632	
	300	63.5 (2-1/2)	RRTYXRT0642	
20	150	50.8 (2)	RRTYXRT0652	
24	150	63.5 (2-1/2)	RRTYXRT0662	
A11				
Valve Size, NPS	Pressure Class	Shaft Diameter	PTFE Retrofit Kits	Graphite Retrofit Kits
3	600	14.3 (9/16)	12B4122X012	12B4125X012
4		19.1 (3/4)	14B3988X012	14B3989X012
6		28.6 (1-1/8)	12B4105X012	12B4107X012
8		38.1 (1-1/2)	13B9289X012	14B3985X012
10		44.5 (1-3/4)	13B9285X012	13B9286X012
12		57.2 (2-1/4)	14B1323X012	14B3978X012
14		63.5 (2-1/2)	12B4111X012	12B4116X012
16		76.2 (3)	14B5651X022	14B5660X022
18		88.9 (3-1/2)	14B5729X042	14B5736X042
1. Shaft diameter: Diameter through the packing box. 2. For larger shaft sizes, consult your Emerson sales office .				

Repair Kits

PTFE repair kits include one packing set and two anti-extrusion washers. Graphite packing sets include two packing rings and two anti-extrusion rings. See table 8.

The 8510B has two packing boxes, one at the actuator end and one at the outboard end. A quantity of two of the appropriate kit is required to repair both ends.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Table 8. Repair Kits for Fisher Vee-Ball, Eccentric Plug, and 8560 Valves

Shaft Diameter mm (Inch)	PTFE Kits	Graphite Packing Set
12.7 (1/2)	RRTYX000012	13B8816X012
15.9 (5/8)	RRTYX000022	13B8816X032
19.1 (3/4)	RRTYX000032	13B8816X052
25.4 (1)	RRTYX000052	13B8816X092
31.8 (1-1/4)	RRTYX000062	13B8816X112
38.1 (1-1/2)	RRTYX000072	13B8816X142
44.5 (1-3/4)	RRTYX000232	13B8816X152
54.0 (2-1/8)	RRTYX000252	13B8816X182
63.5 (2-1/2)	RRTYX000262	13B8816X162

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Table 9. Repair Kit Part Numbers for Fisher 8532 and A11 Butterfly Valves

8532						
Valve Size, NPS	Pressure Class	Shaft Diameter ⁽¹⁾⁽²⁾ , mm (Inch)	Repair Kits			
			PTFE		Graphite Packing Set	
3	150, 300	14.3 (9/16)	RRTYX000112		13B8816X022	
4	150, 300	17.5 (11/16)	RRTYX000122		13B8816X042	
6	150, 300	23.8 (15/16)	RRTYX000132		13B8816X082	
8	150	23.8 (15/16)	RRTYX000132		13B8816X082	
	300	31.8 (1-1/4)	RRTYX000142		13B8816X122	
10	150	28.5 (1-1/8)	RRTYX000092		13B8816X102	
	300	41.3 (1-5/8)	RRTYX000152		---	
12	150	31.8 (1-1/4)	RRTYX000142		13B8816X122	
	300	47.6 (1-7/8)	RRTYX000162		---	
14	150	34.9 (1-3/8)	RRTYX000172			
	300	50.8 (2)	RRTYX000182			
16	150	38.1 (1-1/2)	RRTYX000192			
	300	57.2 (2-1/4)	RRTYX000202			
18	150	44.5 (1-3/4)	RRTYX000212			
	300	63.5 (2-1/2)	RRTYX000222			
20	150	50.8 (2)	RRTYX000182			
24	150	63.5 (2-1/2)	RRTYX000222			
A11						
Valve Size, NPS	Pressure Class	Shaft Diameter	PTFE Packing Kits	Anti-Extrusion Ring ⁽³⁾	Graphite Packing Kits	Packing Box Ring
3	600	14.3 (9/16)	12B9122X012	12B9121X012	13B8816X022	12B9118X012
4		19.1 (3/4)	12B7414X012	12B7418X012	13B8816X052	16A6084X012
6		28.6 (1-1/8)	12B9078X012	12B9084X012	13B8816X102	12B9077X012
8		38.1 (1-1/2)	12B7462X012	12B7466X012	13B8816X142	16A6087X012
10		44.5 (1-3/4)	13B9155X012	13B9159X012	14B3541X032	13B9160X012
12		57.2 (2-1/4)	14B3647X012	14B3642X012	14B3541X052	13B2187X012
14		63.5 (2-1/2)	12B7782X012	12B7783X012	14B3541X042	13B8709X012
16		76.2 (3)	14B5652X012	14B5656X012	14B3541X062	18A4189X012
18		88.9 (3-1/2)	14B5730X012	14B5734X012	14B3541X072	14B5735X012
1. Shaft diameter: Diameter through the packing box. 2. For larger shaft sizes, consult your Emerson sales office. 3. The A11 requires 2 Anti-Extrusion Rings.						

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A coupler is required for the following valve/actuator combinations when retrofitting an existing A31A or A31D with an ENVIRO-SEAL packing system.

Table 10. Coupler Part Number for Fisher A31A or A31D Valves with Selected Actuators

SHAFT DIAMETER, mm (INCH)	Valve Size	Actuator Type	Coupler Part No.
14.3 (9/16)	NPS 3 CL150/300 NPS 3 CL150/300 NPS 3 CL150/300	Fisher 1032 XL70 thru XL280 Fisher 1032 XL425 thru XL680 D and S Series (Elomatic) SR15	13B1596X012 13B1907X012 13B1595X012
17.5 (11/16)	NPS 4 CL150/300 NPS 4 CL150/300 NPS 4 CL150/300 NPS 4 CL150/300	Fisher 1032 XL185 thru XL280 Fisher 1032 XL425 thru XL680 Bettis HD 521, 721, 722 D and S Series (Elomatic) S20	13B1600X012 13B1908X012 13B1597X012 13B1599X012
23.8 (15/16)	NPS 6 CL150/300, NPS 8 CL150 NPS 6 CL150/300, NPS 8 CL150 NPS 6 CL150/300, NPS 8 CL150 NPS 6 CL150/300, NPS 8 CL150 NPS 6 CL150/300, NPS 8 CL150 NPS 6 CL150/300, NPS 8 CL150 NPS 6 CL150/300, NPS 8 CL150 NPS 6 CL150/300, NPS 8 CL150 NPS 6 CL150/300, NPS 8 CL150 NPS 6 CL150/300, NPS 8 CL150 NPS 6 CL150/300, NPS 8 CL150 NPS 6 CL150/300, NPS 8 CL150 NPS 6 CL150/300, NPS 8 CL150 NPS 6 CL150/300, NPS 8 CL150	Fisher 1031 Size 26 Fisher 1031 Size 33 Fisher 1032 XL680-XL1370 5M Gear Bettis CB 315 Bettis CB 415 Bettis CB 420 Bettis CB 520 Bettis CB 525 Bettis CB 725 Bettis HD 251.5 Bettis HD 521, 721, 722 Fire Sentry Limitorque T-100	13B1610X012 13B1611X012 13B1613X012 13B1601X012 13B1602X012 13B1905X012 13B1605X012 13B1906X012 13B1604X012 13B1606X012 13B1609X012 13B1603X012 13B1608X012 13B1607X012
28.5 (1-1/8)	NPS 10 CL150 NPS 10 CL150 NPS 10 CL150 NPS 10 CL150 NPS 10 CL150 NPS 10 CL150 NPS 10 CL150 NPS 10 CL150	Fisher 1031 Size 26 Fisher 1031 Size 33 Fisher 1032 XL680-XL1370 Bettis CB 525 Bettis CB 725 Bettis HD 521, 721, 722 Fire Sentry Limitorque T-100	13B1620X012 13B1621X012 13B1624X012 13B1614X012 13B1617X012 13B1615X012 13B1619X012 13B1618X012
31.8 (1-1/4)	NPS 8 CL300, NPS 12 CL150 NPS 8 CL300, NPS 12 CL150 NPS 8 CL300, NPS 12 CL150 NPS 8 CL300, NPS 12 CL150 NPS 8 CL300, NPS 12 CL150 NPS 8 CL300, NPS 12 CL150 NPS 8 CL300, NPS 12 CL150 NPS 8 CL300, NPS 12 CL150 NPS 8 CL300, NPS 12 CL150 NPS 8 CL300, NPS 12 CL150 NPS 8 CL300, NPS 12 CL150 NPS 8 CL300, NPS 12 CL150	Fisher 1031 Size 26 Fisher 1031 Size 33 Fisher 1032 XL680 - XL1370 Bettis CB 525 Bettis CB 725 Bettis HD 521, 721, 722 150 Bettis HD 731, 732 D and S Series (Elomatic) SR110 Limitorque SMB-000-5-HOBC Limitorque T-250 Rotork 250	13B1081X012 13B1082X012 13B1086X012 13B1073X012 13B1077X012 13B1074X012 13B1075X012 13B1076X012 13B1084X012 13B1246X012 13B1079X012

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D101643X012

Enhanced ENVIRO-SEAL Packing Systems - Rotary Valves

February 2024

The existing couplers, listed below, can accommodate a retrofit with an ENVIRO-SEAL packing system. Coupler replacement is not required when retrofitting the valve/actuator combinations listed below. For information about couplers for the A11 CL600 valves, contact your [Emerson sales office](#).

Table 11. Coupler Part Number for Fisher A31A or A31D Valves with Selected Actuators

SHAFT DIAMETER, mm (INCH)	Valve Size	Actuator Type	Coupler Part No.
14.3 (9/16)	NPS 3 CL150/300	Bettis CB 315	V160124X012
	NPS 3 CL150/300	Bettis CB 415	V160125X012
	NPS 3 CL150/300	Bettis CB 420	V151828X012
	NPS 3 CL150/300	Bettis CB 520	V154549X012
17.5 (11/16)	NPS 4 CL150/300	Bettis CB 315	V160108X012
	NPS 4 CL150/300	Bettis CB 415	V160107X012
	NPS 4 CL150/300	Bettis CB 420	V151731X012
	NPS 4 CL150/300	Bettis CB 520	V154600X012
28.5 (1-1/8)	NPS 10 CL150	Bettis CB 420	V160209X012
	NPS 10 CL150	Bettis CB 520	V160212X012
31.8 (1-1/4)	NPS 8 CL300, NPS 12 CL150	Bettis CB 420	V160208X012
	NPS 8 CL300, NPS 12 CL150	Bettis CB 520	V160213X012

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Enhanced ENVIRO-SEAL Packing Systems - Rotary Valves

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Instruction Manual

D101643X012

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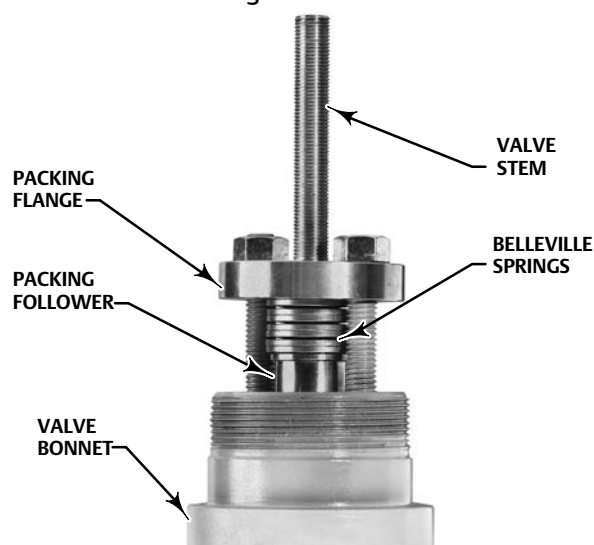


Fisher™ ENVIRO-SEAL™ Packing System for Sliding-Stem Valves

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Figure 1. Fisher easy-e Valve Bonnet with ENVIRO-SEAL Packing



W5814-1*

Introduction

Scope of Manual

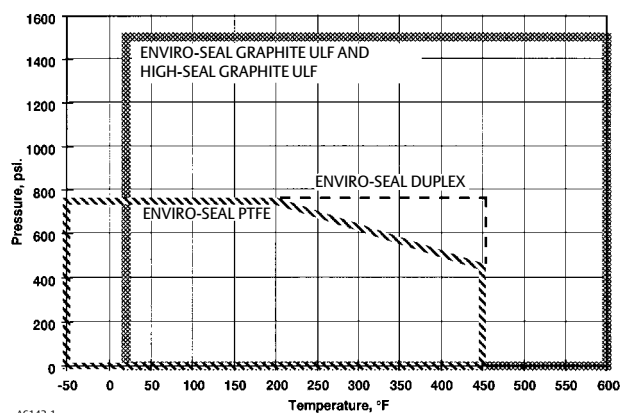
This instruction manual includes installation and parts information for Fisher ENVIRO-SEAL live-loaded packing systems (see figure 1). These systems are available for Fisher sliding-stem valves with 9.5, 12.7, 19.1, 25.4, 31.8, and 50.8 mm (3/8, 1/2, 3/4, 1, 1-1/4, and 2 inch) diameter stems. The system can be used with many sliding-stem valves as shown in the Applications section of the Specifications. Refer to appropriate valve and actuator instruction manuals for necessary information relating to the disassembly and assembly of the valve and actuator. ENVIRO-SEAL packing systems for sliding-stem valves utilize a Belleville (coned-disk) spring system in the pressure/temperature ranges shown in the specifications. For higher pressure/temperature ratings, refer to the HIGH-SEAL ULF Live-Loaded Packing System instruction manual, [D101453X012](#).

Do not install, operate, or maintain ENVIRO-SEAL live-loaded packing systems without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Table 1. Specifications

Applicable Product Types and Stem Diameters See tables 2 and 3 TÜV Certification TÜV has certified the stem sealing capabilities of ENVIRO-SEAL PTFE and Graphite ULF packing systems for sliding-stem valves with TA Luft emission control requirements. See figures 8 and 9 for copies of these certificates	Pressures and Temperatures⁽²⁾ See figure 2. Figure 2 applies only to ENVIRO-SEAL packing for 100 ppm service. Pressure and temperature ratings for non-environmental service are in the packing bulletins. See the appropriate valve instruction manual for additional pressure and temperature ratings.
1. For availability of ENVIRO-SEAL packing system with a specific valve, please contact your Emerson sales office or Local Business Partner. 2. The pressure/temperature limits in this manual, in the valve literature, and any applicable code or standard limitation, should not be exceeded.	

Figure 2. Applications Guidelines for 100 ppm Service



A6142-1

NOTE:

FOR MAXIMUM CYCLE LIFE, GRAPHITE ULF PACKING SHOULD BE USED IN SERVICES WHERE THE VAST MAJORITY OF THE VALVE CYCLES OCCUR AT TEMPERATURES OF 150°C (300°F) OR GREATER.

Description

ENVIRO-SEAL packing systems, with exceptional sealing capabilities, can be easily installed into your existing valves or can be purchased with new valves. These systems help seal your process to conserve valuable fluids, and protect the environment against the emission of hazardous or polluting liquids and gases. The external live-loading provides a constant load over the life of the packing material, which reduces your need for packing box adjustment and maintenance.

If the piping and valve are insulated, do not allow insulation to extend above the yoke boss surface, covering the ENVIRO-SEAL packing arrangement. Keep the ENVIRO-SEAL packing arrangement exposed to ambient air conditions.

Installation

ENVIRO-SEAL packing systems are designed for quality performance over extended periods. This longevity allows for packing maintenance to be performed as it should be, at regularly scheduled plant outages or turn-arounds.

Use these instructions to install ENVIRO-SEAL packing in valves that have standard packing or when inspecting or replacing ENVIRO-SEAL packing.

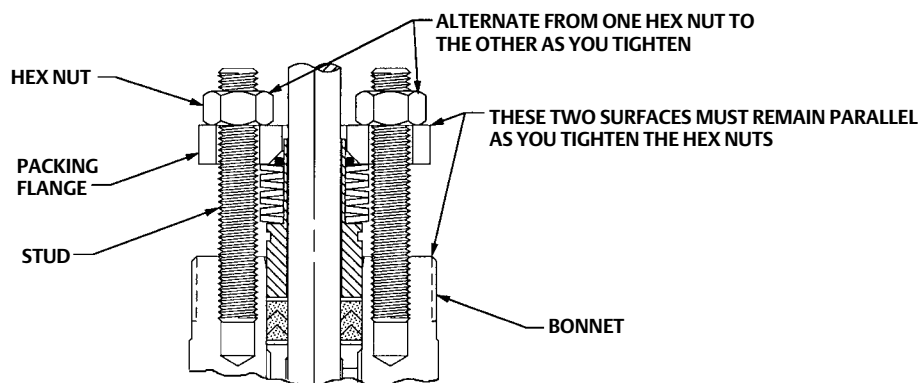
If you are changing the packing system material to a different material, such as PTFE to Graphite ULF, it is good practice to review actuator sizing, as packing friction will change. See tables 4, 5, and 6 for information on packing friction.

⚠ WARNING

Avoid personal injury from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

Figure 3. ENVIRO-SEAL Packing Assembly Procedure



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Table 2. Fisher Sliding-Stem Product Availability for ENVIRO-SEAL Duplex Packing

VALVE (1)	STEM DIAMETER, mm (INCHES)						
	9.5 (3/8)	12.7 (1/2)	15.9 (5/8)	19.1 (3/4)	25.4 (1)	31.8 (1-1/4)	50.8 (2)
A	X	X	---	X	X	X	---
DBQ	---	X	---	X	X	X	---
easy-e (ED, ES, ET, EW, EZ)	X	X	---	X	X	X	---
EH	---	X	---	X	X	X	X
FB	---	---	---	---	X	X	X
HP	---	X	---	X	X	X	---
HS	---	X	---	X	X	---	---
SS-83	---	---	---	X	X	X	---
YD	X	X	---	X	X	X	---
YS	X	X	---	X	X	X	---

1. Contact your [Emerson sales office](#) for valves not listed.

Table 3. Fisher Sliding-Stem Product Availability for ENVIRO-SEAL PTFE and Graphite ULF Packing Systems

VALVE (1)	STEM DIAMETER, mm (INCHES)							STEM DIAMETER, mm	
	9.5 (3/8)	12.7 (1/2)	15.9 (5/8)	19.1 (3/4)	25.4 (1)	31.8 (1-1/4)	50.8 (2)	12 mm	16 mm
A	X	X	---	X	X	X	---	---	---
CAV4	---	---	---	X	X	X	X	---	---
D	---	X	---	---	---	---	---	---	---
DA	---	X	---	---	---	---	---	---	---
DBQ	---	X	---	X	X	X	---	---	---
DBQ-NS	---	X	---	---	---	---	---	---	---
easy-e (ED, ES, ET, EW, EZ)	X	X	---	X	X	X	---	---	---
E-NS	---	X	---	---	---	---	---	---	---
EH	---	X	---	X	X	X	X	---	---
ENA	---	---	---	---	---	X	X	---	---
ET-C	---	X	---	X	X	---	---	---	---
EWT-C	---	X	---	X	X	---	---	---	---
EZ-C	X	X	---	X	---	---	---	---	---
FB	---	---	---	---	X	X	X	---	---
HP	---	X	---	X	X	X	---	---	---
HS	---	X	---	X	X	---	---	---	---
SS-79	---	---	---	X	---	---	---	---	---
SS-83	---	---	---	X	X	X	X	---	---
SS-85	---	X	---	---	---	---	---	---	---
SS-95	---	X	---	---	---	---	---	---	---
SS-98	---	---	---	---	X	---	---	---	---
YD	X	X	---	X	X	X	---	---	---
YS	X	X	---	X	X	X	---	---	---

1. Contact your Emerson sales office for valves not listed.

If you are installing the system in a valve that is still connected to an actuator, remove the actuator from the valve to provide sufficient space to install the packing assembly. If a spring-return actuator is used, it is possible that disconnecting the stem connector will allow the spring to force the actuator to the end of its travel. Be sure the actuator spring is resting on its travel stop. Refer to the appropriate valve and actuator instruction manuals to remove the actuator.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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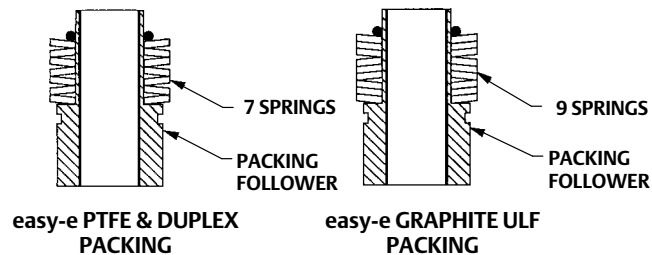
D101642X012

ENVIRO-SEAL Sliding-Stem Valves

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Remove old packing parts from the packing box by using the valve instruction manual procedures. Both the valve stem surface condition and the packing bore are critical in obtaining a good seal. If the valve stem surface is scratched, nicked, or worn, replace the valve stem before installing the ENVIRO-SEAL Packing System. Check the condition of the packing bore and clean or hone it out, as necessary. Refer to the appropriate valve instruction manual to replace the valve stem.

Figure 4. Belleville Spring Stacking Order



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Table 4. Packing Friction with ENVIRO-SEAL PTFE Packing

VALVE STEM DIAMETER		PTFE PACKING	
mm	Inches	Newtons	Pounds (Force)
9.5	3/8	555	125
12.7	1/2	755	170
19.1	3/4	1110	250
25.4	1	1515	340
31.8	1-1/4	1890	425
50.8	2	3220	725

Table 5. Packing Friction with ENVIRO-SEAL Duplex Packing

VALVE STEM DIAMETER		DUPLEX PACKING	
mm	Inches	Newtons	Pounds (Force)
9.5	3/8	555	125
12.7	1/2	755	170
19.1	3/4	1110	250
25.4	1	1515	340
31.8	1-1/4	1890	425
50.8	2	3220	725

Table 6. Packing Friction with ENVIRO-SEAL Graphite ULF Packing

VALVE STEM DIAMETER		GRAPHITE ULF PACKING	
mm	Inches	Newtons	Pounds (Force)
9.5	3/8	935	210
12.7	1/2	1250	280
19.1	3/4	2350	530
25.4	1	3740	840
31.8	1-1/4	4800	1100
50.8	2	6000	1350

For key number locations refer to figures 5, 6, or 7. Then proceed as follows:

1. The original packing flange studs used for standard packing arrangements should be long enough to accommodate the retrofit kit parts. If you determine that the existing studs and nuts should be replaced however, due to their condition, replace them with the studs and nuts (keys 200 and 212) supplied in the retrofit kit.

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Table 7. Graphite ULF Packing Torque⁽¹⁾

STEM SIZE		TORQUE		
mm	Inch	N•m	lbf•in	lbf•ft
9.5	3/8	4.3	38	3.2
12.7	1/2	8.5	76	6.3
19.1	3/4	21	187	16
25.4	1	47	420	35
31.8	1-1/4	56	495	41

1. For A, DBQ, easy-e, EH, FB, HP, YD, and YS valves.

CAUTION

To prevent product damage caused by scratching or damaging the packing box wall, take care when removing the old packing parts from the packing box.

2. Carefully remove the old packing parts from the packing box. If the valve stem or packing box wall is scratched or damaged, it can cause excessive leakage. If the valve stem needs to be replaced, or any other valve part, refer to the appropriate valve instruction manual for replacement procedures. Complete all valve maintenance before installing the ENVIRO-SEAL packing system into the bonnet.

Note

ENVIRO-SEAL PTFE packing systems can be used in either vacuum or positive pressure service. It is not necessary to reverse ENVIRO-SEAL packing components in vacuum service.

Note

Ensure that the Belleville springs are stacked properly (see figure 4) and packing box parts are assembled in the correct order (see figures 5, 6, or 7). Packing parts cannot function properly if the Belleville springs or other packing parts are not stacked correctly.

3. Use figures 5, 6, or 7 to ensure that the packing parts and spring pack are assembled in the correct order. Install the ENVIRO-SEAL packing parts into the packing box.
4. Install the spring pack assembly (key 217), with the attached springs, onto the stem.
5. Install the packing flange (key 201) and packing box nuts (key 212). Hand tighten them.

Note

In general, the following tightening procedure applies to all ENVIRO-SEAL packing systems--both sliding-stem and rotary.

Note

Lubrication is required for the packing studs and nuts.

Although it is important to properly lubricate the stud threads and internal nut threads, it is also important to properly lubricate the contacting face of the nut. See figures 5, 6, or 7 for lubrication locations.

Tightening Procedures

1. You will obtain maximum benefit from your ENVIRO-SEAL packing system when you tighten the packing flange nuts and compress the Belleville springs to their “target load”. The target load is the point where the Belleville springs are designed for optimum performance, when they are compressed to 85% of their maximum deflection, or nearly flat. (Maximum deflection is when the springs are 100% compressed, or completely flat.)

To obtain the target load of 85% compression of maximum deflection, perform the following:

- Tighten the packing flange nuts alternately and evenly, keeping the packing flange parallel with the valve flange (see figure 3), until the Belleville springs are compressed 100% (or completely flat), as detected by a rapid increase in nut torque.
- For PTFE or Duplex packing, loosen each packing flange nut 1/2 turn (180° of rotation).
- For Graphite ULF packing, loosen each packing flange nut 1/4 turn (90° of rotation).

The “target load” of 85% compression has now been reached.

2. Refer to the appropriate valve and actuator instruction manuals when connecting the valve to the actuator. Under normal conditions, the packing nuts should not require retightening.

However, when servicing, if the springs do not remain at the target load of 85% compression, retighten the packing box nuts according to step 1 above.

3. The “springs flat” procedure described above in steps 1 and 2 of Tightening Procedures is the preferred method of adjusting ENVIRO-SEAL packing. However, for Graphite ULF packing, the torque values in table 7 can also be used as a guideline for 85% spring compression. These values are based on generous lubrication of the packing studs and nuts with anti-seize lubricant. Loosening of the packing flange nuts is not required when these torques are used.

Other Considerations

When retrofitting an existing packing system or repacking a valve with ENVIRO-SEAL packing that has been in service, check the condition of the packing bore after you have removed the packing. An easy method for cleaning debris and minor imperfections from the bore is to use a brake cylinder hone attached to an electric drill. This method will do a good job of cleaning the packing bore without changing the dimension of the bore.

When you have completed this exercise, a good guideline to use in checking the condition of the packing bore is the 20/20 rule. If less than 20% of the surface area of the bore is pitted and if there are no pits deeper than 0.020 inch, then your packing should work as designed. This does not need to be an exact measurement; visual inspection is adequate. If the packing bore does not meet this criteria, however, you should replace the bonnet.

Note

This check is only valid for rotary ENVIRO-SEAL packing systems and sliding-stem ENVIRO-SEAL or HIGH-SEAL packing systems.

Parts Ordering

Each valve assembly is assigned a serial number that can be found on the valve body. Refer to this serial number when contacting your [Emerson sales office](#) or Local Business Partner for technical assistance. When ordering replacement

parts, refer to this serial number and to the part description and part number from the following parts list. When ordering replacement parts, refer to the serial number and to the 11-character part number for each part required from the following parts list.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Retrofit Kits

Stems and packing box constructions that do not meet Emerson stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of this packing kit.

easy-e, A, EH, HP, YD, and YS Retrofit Kits

Retrofit kits include parts to convert existing easy-e, A, EH, HP, YD, and YS valves to the ENVIRO-SEAL packing box construction. See table 3 for a complete listing of ENVIRO-SEAL packing systems for sliding-stem valves. PTFE kits include keys 200, 201, 211, 212, 214, 215, 217, 218, tag, and tie cable. Graphite ULF kits include keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 216, 217, tag, and tie cable. Duplex kits include keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, and tie cable.

Fisher easy-e, A, EH, HP, YD, and YS Retrofit Kits

STEM DIAMETER	YOKE BOSS DIAMETER	KITS PACKING MATERIAL		
		Double PTFE (carbon-filled)	Single Graphite ULF	Duplex
9.5 (3/8)	54 (2-1/8)	RPACKXRT012	RPACKXRT262	RPACKXRT212
12.7 (1/2)	71 (2-13/16)	RPACKXRT022	RPACKXRT272	RPACKXRT222
19.1 (3/4)	90 (3-9/16)	RPACKXRT032	RPACKXRT282	RPACKXRT232
25.4 (1)	127 (5)	RPACKXRT042	RPACKXRT292	RPACKXRT242
31.8 (1-1/4)	127 (5, 5H)	RPACKXRT052	RPACKXRT302	RPACKXRT252

Repair Kits

Stems and packing box constructions that do not meet Emerson stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of this packing kit.

easy-e, A, EH, HP, YD, and YS Repair Kits

Repair kits include parts to replace the “soft” packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits. PTFE repair kits include keys 214, 215, and 218. Graphite ULF repair kits include keys 207, 208, 209, 210, and 214. Duplex repair kits include keys 207, 209, 214, and 215.

Fisher easy-e, A, EH, HP, YD, and YS Repair Kits

STEM DIAMETER	YOKE BOSS DIAMETER	KITS PACKING MATERIAL		
		Double PTFE (carbon-filled)	Single Graphite ULF	Duplex
9.5 (3/8)	54 (2-1/8)	RPACKX00192	RPACKX00592	RPACKX00292
12.7 (1/2)	71 (2-13/16)	RPACKX00202	RPACKX00602	RPACKX00302
19.1 (3/4)	90 (3-9/16)	RPACKX00212	RPACKX00612	RPACKX00312
25.4 (1)	127 (5)	RPACKX00222	RPACKX00622	RPACKX00322
31.8 (1-1/4)	127 (5, 5H)	RPACKX00232	RPACKX00632	RPACKX00332

Figure 5. PTFE Sliding-Stem ENVIRO-SEAL Packing for Fisher easy-e Valves

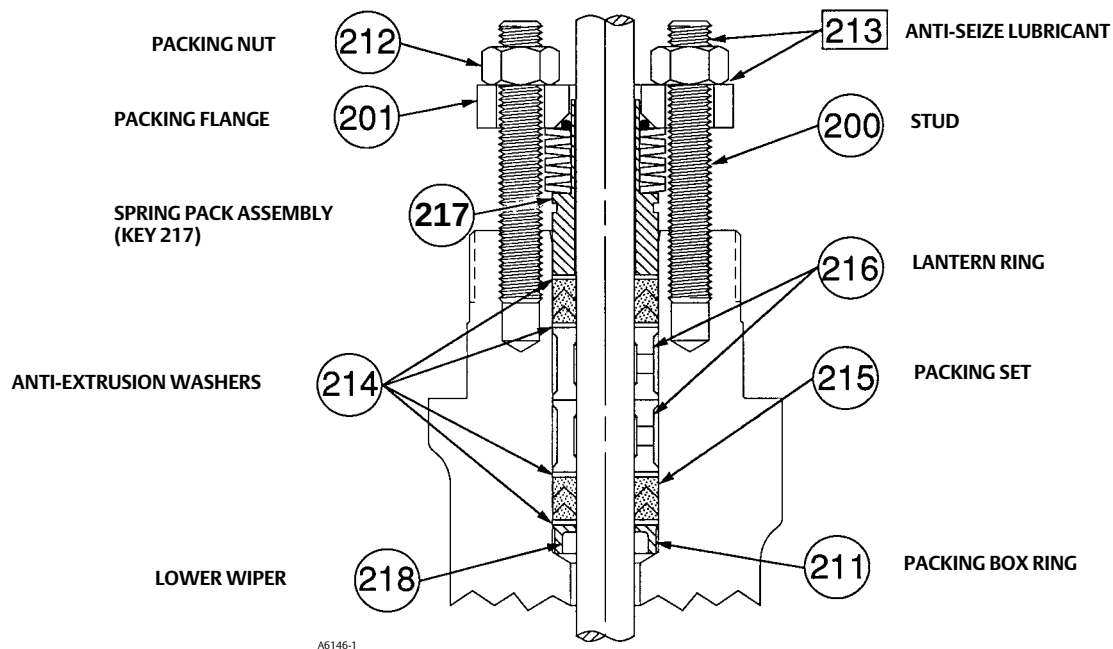


Figure 6. ENVIRO-SEAL Duplex Packing for Fisher easy-e Valves

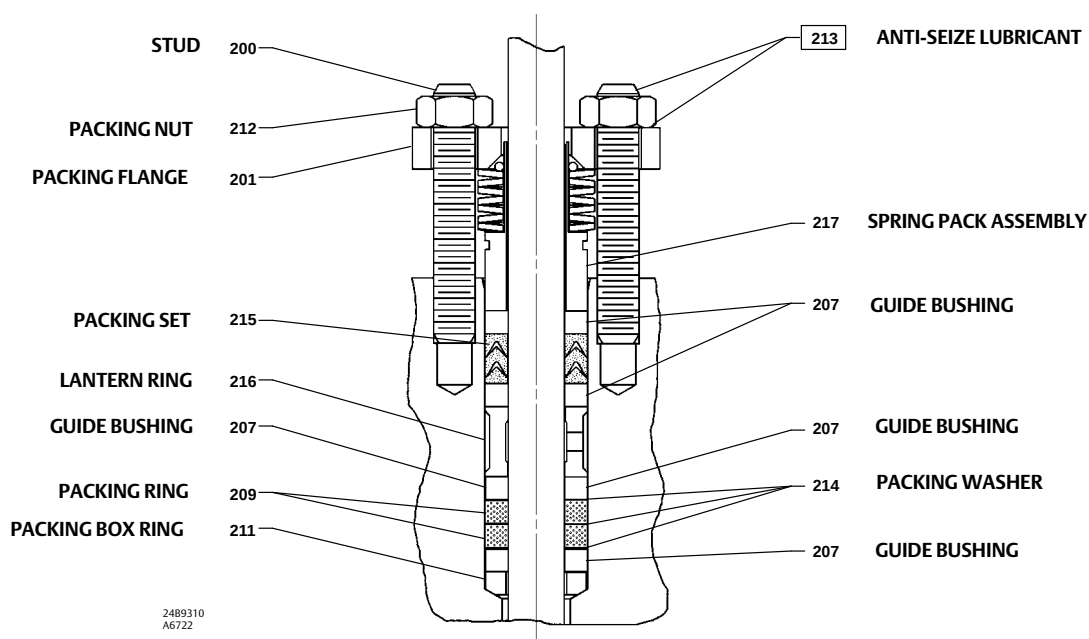


Figure 7. ENVIRO-SEAL Graphite ULF Packing for Fisher easy-e Valves

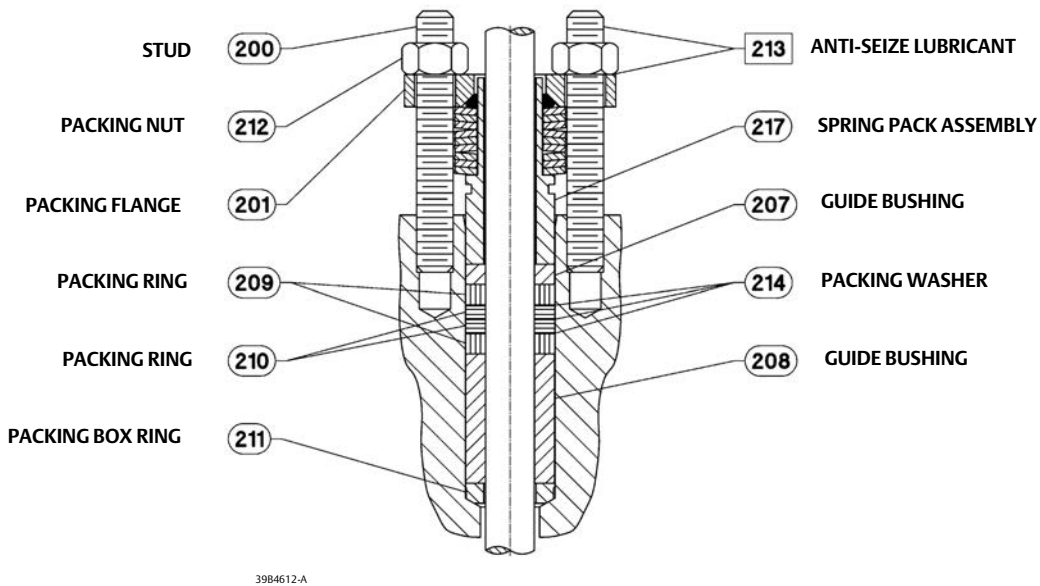


Figure 8. Copy of TÜV Certificate

TÜV
SAARLAND

C E R T I F I C A T E

TÜV Saarland e.V.
We herewith certify the equivalence of stem sealing
With TA-Luft-Packing

Type : Drawing Nr. 13 B 7183 / B and 12 B 6932 / A
Type : Drawing Nr. 12 B 8529 / B and 12 B 6927 / A

EMERSON PROCESS MANAGEMENT
Rue Paul Baudry
B.P. 10
F- 68701 Cernay Cedex

to stem sealing with pre-boding system additional safety packing

This comparison is based on the requirements as described in
TA-Luft Section 5.2.6.4

The required tightness was achieved on a representative test specimen with nearly 1 000
cycles, 40 bar internal pressure and room temperatur.

Register-Nr.: 842-99-5010

Montigny-lès-Metz, 21.06.2004

TÜV Saarland e.V.
Dipl. Ing. J. Maffert

TAH.FB.008, Rev. 0

Figure 9. Copy of TÜV Certificate



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Fisher™ ES and EAS easy-e™ Valves CL125 through CL600



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for NPS 1/2 through 8 Fisher ES valves and NPS 1 through 6 EAS valves, through CL600 ratings. Refer to separate manuals for instructions covering the actuator and accessories.



WARNING



Do not install, operate or maintain an ES valve without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. Fisher ES Valve with 657 Actuator



W2174-3

Table 1. Specifications

End Connection Sizes	Flow Characteristics		
Cast Iron Valves Flanged: CL125 flat-face or CL250 raised-face flanges per ASME B16.1 Steel and Stainless Steel Valves Flanged: CL150, 300 and 600 raised-face or ring-type joint flanges per ASME B16.5 Screwed or Socket Welding: All available ASME B16.11 schedules that are consistent with CL600 per ASME B16.34 Buttwelding: Consistent with ASME B16.25	Standard Cages: Linear, quick opening or equal percentage Whisper Trim™, WhisperFlo™ and Whisper NXG Trim Cages: Linear		
	Flow Directions Standard Cages: Normally up Whisper Trim, WhisperFlo and Whisper NXG Trim Cages: Always up		
Maximum Inlet Pressure ⁽¹⁾	Approximate Weights		
Cast Iron Valves Flanged: Consistent with CL125B or 250B pressure-temperature ratings per ASME B16.1 Steel and Stainless Steel Valves Flanged: Consistent with CL150, 300 and 600 ⁽²⁾ pressure-temperature ratings per ASME B16.34 Screwed or Welding: Consistent with CL600 pressure-temperature ratings per ASME B16.34	VALVE SIZE, NPS	WEIGHT	
		kg	lbs
Shutoff Classifications See Table 2.	1/2 and 3/4	11	25
	1 and 1-1/4	14	30
	1-1/2	20	45
	2	39	67
	2-1/2	45	100
	3	54	125
	4	77	170
	6	459	350
	8	408	900
1. The pressure/temperature limits in this manual and any applicable standard or code limitation for the valve should not be exceeded. 2. Certain bonnet bolting material selections may require a CL600 easy-e valve assembly to be derated. Contact your Emerson sales office .			

1.2 Description

These single-port valves have cage guiding, quick-change trim and unbalanced push-down-to-close valve plug action. Valve configurations are as follows:

ES—Globe style valve (Figure 1) with metal-to-metal seating as standard for all general applications over a wide range of pressure drops and temperatures and metal-to-PTFE seating is optional for more stringent shutoff requirements.

EAS—Angle valve version of ES, used to facilitate piping or in applications where a self draining valve body is required.

1.3 Specifications

Typical specifications for these valves are shown in Table 1.

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in Table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Table 2. Available Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4

Seating	Shutoff Class
Metal	IV (standard)
	V
PTFE	VI

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

Before installing the valve, inspect the valve and pipelines for any damage and any foreign material which may cause product damage.

1. Before installing the valve, inspect the valve and associated equipment for any damage and any foreign material.
2. Make certain the valve body interior is clean, that pipelines are free of foreign material and that the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.

3. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven valve plug and cage wear and improper operation. With some valves, the actuator may also need to be supported when it is not vertical. For more information, consult your [Emerson sales office](#).
4. Use accepted piping and welding practices when installing the valve in the line. Internal elastomeric parts may stay in place during the welding procedure. For flanged valves, use a suitable gasket between the valve and pipeline flanges.



CAUTION

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Shrunk-fit pieces and threaded connections may also loosen. In general, if post weld heat treating is to be performed, all trim parts should be removed. Contact your [Emerson sales office](#) for additional information.

5. With a leak-off bonnet construction, remove the pipe plugs (keys 14 and 16, Figure 8) to hook up the leak-off piping. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
6. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.



WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

Valves with ENVIRO-SEAL live-loaded packing or HIGH-SEAL Heavy-Duty live-loaded packing will not require this initial re-adjustment. See the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) or Heavy-Duty Live-Loaded Packing System ([D101453X012](#)) (as appropriate) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the Parts Kits sub-section near the end of this manual.

Section 3: Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance, trim maintenance and ENVIRO-SEAL bellows seal replacement. All maintenance operations may be performed with the valve in the line.

WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring compression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

CAUTION

Follow instructions carefully to avoid damaging the product surfaces, which could result in damage to the product.

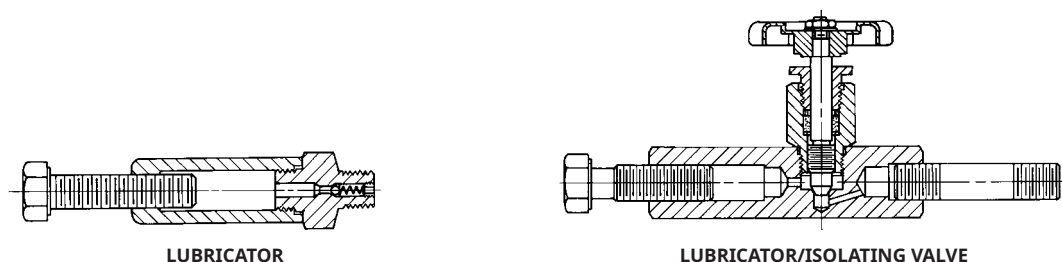
NOTE

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal since the used gasket may not seal properly.

NOTE

If the valve has ENVIRO-SEAL or HIGH-SEAL live-loaded packing installed, refer to Instruction Manuals ENVIRO-SEAL Packing System for Sliding-Stem Valves (D101642X012) or HIGH-SEAL Live-Loaded Packing System (D101453X012), for packing instructions. Figure 9 shows a typical HIGH-SEAL Packing system. Figures 10, 11 and 12 show typical ENVIRO-SEAL packing systems.

If the valve has an ENVIRO-SEAL bellows seal bonnet installed, refer to this manual. See the ENVIRO-SEAL Bellows Seal and Bonnet section for information on the bellows seal bonnet.

Figure 2. Optional Lubricator and Lubricator/Isolating Valve

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AJ5428-D
A0832-2

Table 3. Body-to-Bonnet Bolt Torque Guidelines

VALVE SIZE, NPS		BOLT TORQUES ^(1,4)			
ES	EAS	SA193-B7, SA193-B8M ⁽³⁾		SA193-B8M ⁽²⁾	
		N•m	Lbf•ft	N•m	Lbf•ft
1-1/4 or less	1	129	95	64	47
1-1/2, 1-1/2 x 1, 2 or 2 x 1	2 or 2 x 1	96	71	45	33
2-1/2 or 2-1/2 x 1-1/2	3 or 3 x 1-1/2	129	95	64	47
3, 3 x 2 or 3 x 2-1/2	4 or 4 x 2	169	125	88	65
4, 4 x 2-1/2 or 4 x 3	6 or 6 x 2-1/2	271	200	156	115
6	- - -	549	405	366	270
8	- - -	746	550	529	390

1. Determined from laboratory tests.

2. SA193-B8M annealed.

3. SA193-B8M strain hardened.

4. For other materials, contact your [Emerson sales office](#) for torques.

3.1 Packing Lubrication

NOTE

ENVIRO-SEAL or HIGH-SEAL packing does not require lubrication.



WARNING

To avoid personal injury or property damage resulting from fire or explosion, do not lubricate packing used in oxygen service or in processes with temperatures over 260°C / 500°F.

If a lubricator or lubricator/isolating valve (Figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the pipe plug (key 14, Figure 8). Use a good quality silicon-base lubricant. Packing used in oxygen service or in processes with temperatures over 260°C / 500°F should not be lubricated. To operate the lubricator, simply turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except the isolating valve must first be opened and then closed after lubrication is completed.

3.2 Packing Maintenance

Key numbers refer to Figure 3 for PTFE V-ring packing and to Figure 5 for PTFE/composition packing, unless otherwise indicated.

For spring-loaded single PTFE V-ring packing, the spring (key 8, Figure 3) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13, Figure 3), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5, Figure 8) until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the replacing packing procedure.

If there is undesirable packing leakage with other than spring-loaded packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

If the packing is relatively new and tight on the stem and if tightening the packing flange nuts does not stop the leakage, it is possible that the valve stem is worn or nicked so that a seal cannot be made. The surface finish of a new valve stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

Replacing Packing

WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

1. Isolate the control valve from the line pressure and release pressure from the valve.
2. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet. Disconnect the stem connector, then remove the actuator from the valve by unscrewing the yoke locknut (key 15, Figure 8) or the hex nuts (key 26, Figure 8).

WARNING

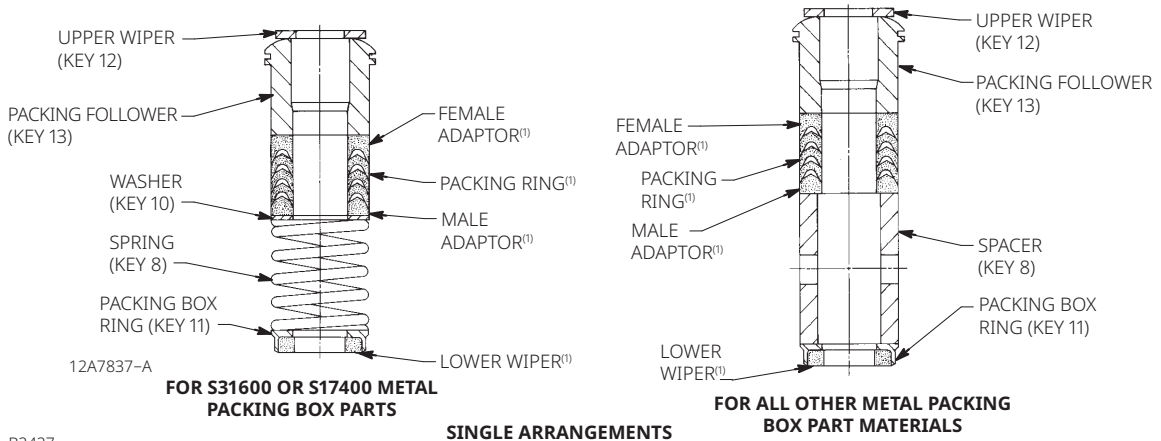
To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. If the cage sticks to the bonnet, proceed carefully with bonnet removal.

NOTE

The following step also helps to provide additional assurance that the valve body fluid pressure has been relieved.

3. Hex nuts (key 5, Figure 8) attach the bonnet to the valve. Loosen these nuts or cap screws approximately 3 mm / 1/8 in. Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens.

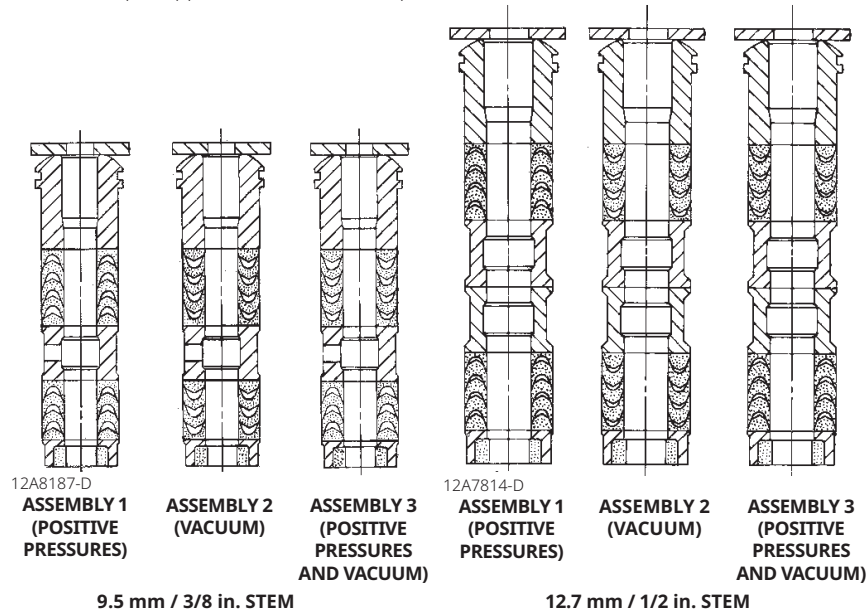
Figure 3. PTFE V-Ring Packing Arrangements for Plain and Extension Bonnets



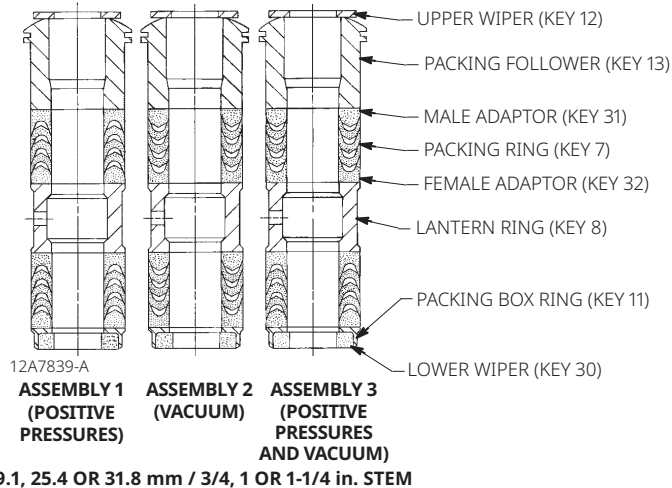
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NOTE:

1. PART OF PACKING SET (KEY 6) (SEE TABLE IN PARTS LIST).

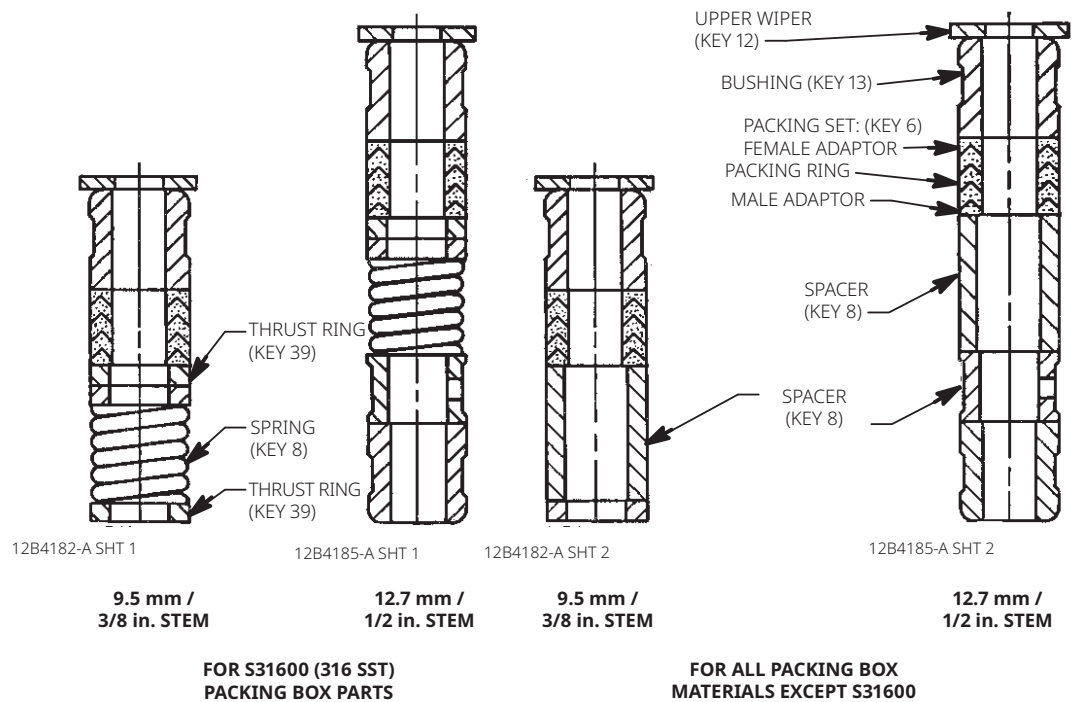


DOUBLE ARRANGEMENTS

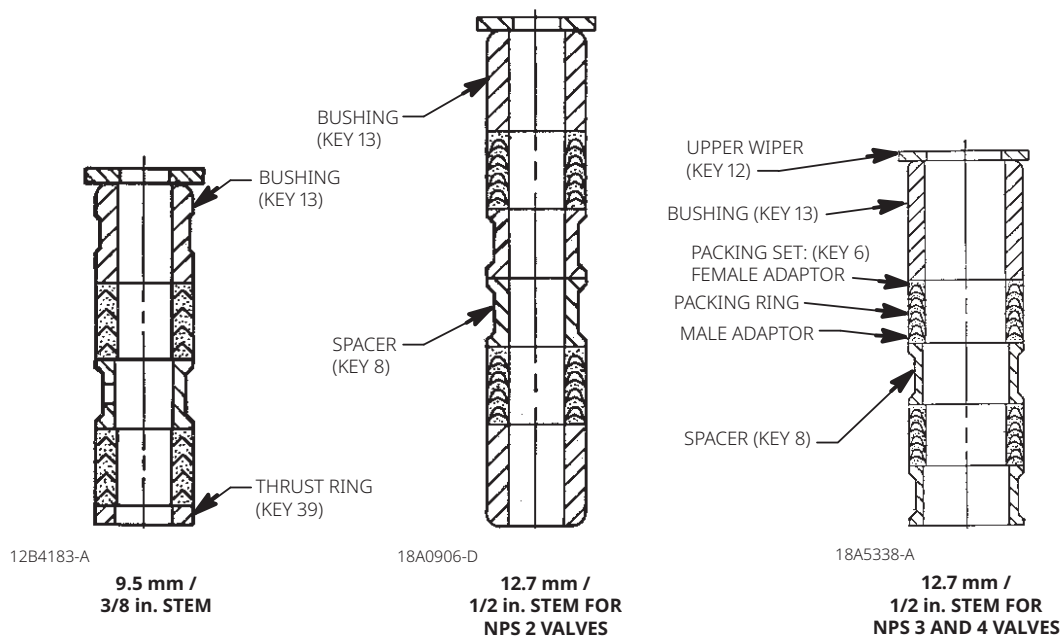


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Figure 4. PTFE Packing Arrangements for Use in ENVIRO-SEAL Bellows Seal Bonnets



SINGLE ARRANGEMENTS



DOUBLE ARRANGEMENTS

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4. Loosen the packing flange nuts (key 5, Figure 8) so that the packing is not tight on the valve stem. Remove any travel indicator parts from the valve stem threads.

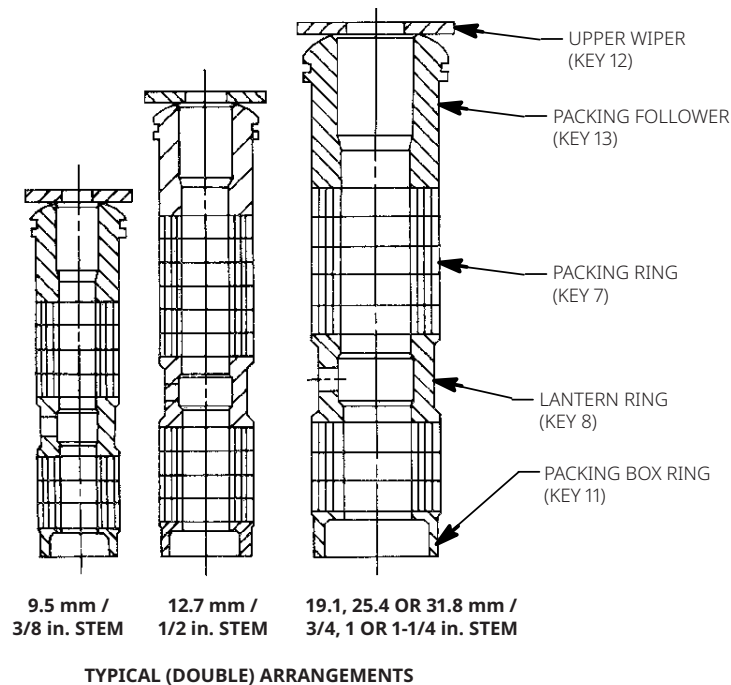
⚠ CAUTION

Avoid damage to the seating surface caused by the valve plug and stem assembly dropping from the bonnet after being lifted part way out. When lifting the bonnet, temporarily install a valve stem locknut on the valve stem. This locknut will prevent the valve plug and stem assembly from dropping out of the bonnet.

If the cage starts to lift with the bonnet, tap it with a plastic mallet or other soft material, to be sure it stays in the valve.

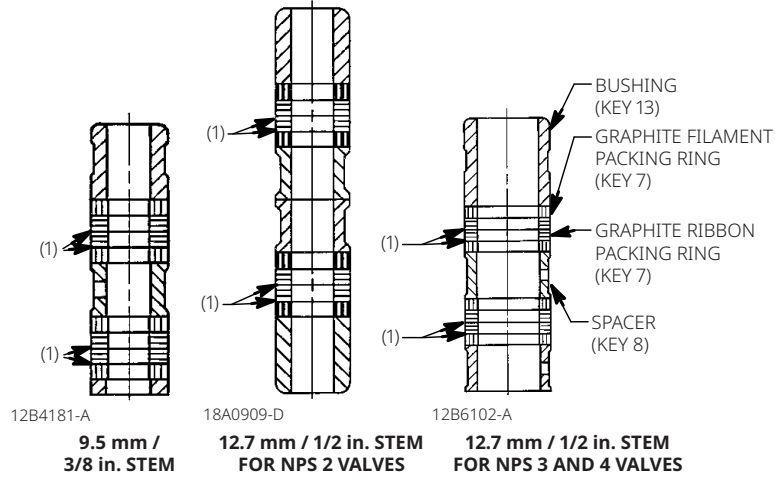
5. Completely remove the cap screws (not shown) or hex nuts (key 16; Figure 13, 14 or 15) that bolt the bonnet and valve together and carefully lift the bonnet off.
6. Remove the locknut and separate the valve plug and stem from the bonnet. Set the parts on a protective surface to prevent damage to gasket or seating surfaces.

Figure 5. Detail of PTFE/Composition Packing Arrangements for Plain and Extension Bonnets



12A8188-A
12A7815-A
12A8173-A
A2619-2

Figure 6. Double Graphite Ribbon/Filament Arrangements for use in ENVIRO-SEAL Bellows Seal Bonnets

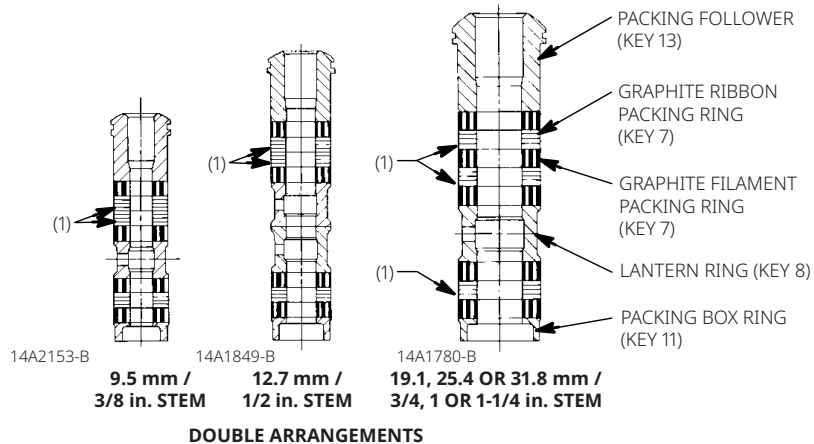
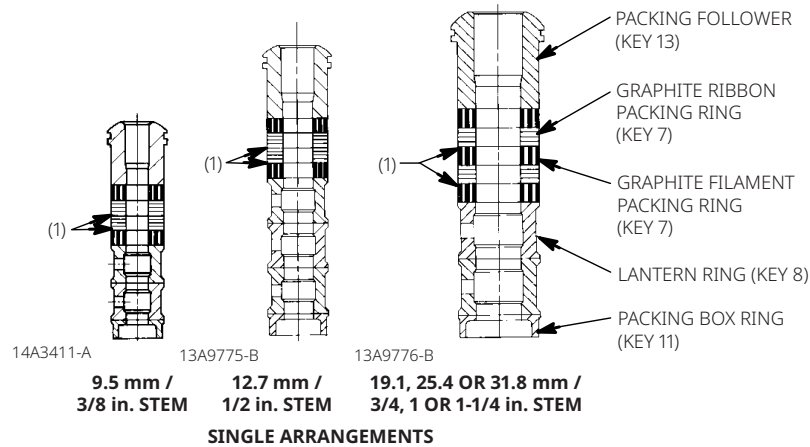


A5870-1

NOTE:

1. 0.102 mm / 0.004 in. THICK SACRIFICIAL ZINC WASHERS; USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

Figure 7. Detail of Graphite Ribbon/Filament Packing for Plain and Extension Bonnets



A5864-1

NOTE:

1. 0.102 mm / 0.004 in. THICK SACRIFICIAL ZINC WASHERS; USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

⚠ WARNING

To avoid personal injury due to leaking fluid, avoid damaging gasket sealing surfaces. The seating surface of the valve plug (key 2) is critical for proper shutoff. Protect these surfaces accordingly.

⚠ CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to prevent foreign material from getting into the valve body cavity.

7. Remove the bonnet gasket (key 10, Figures 13 through 15) and cover the opening in the valve to protect the gasket surface and prevent foreign material from getting into the valve body cavity.
8. Remove the packing flange nuts, packing flange, upper wiper and packing follower (keys 5, 3, 12 and 13, Figure 8). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
9. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts by following the appropriate steps in the Trim Maintenance procedure.
10. Remove the covering protecting the valve body cavity and install a new bonnet gasket (key 10, Figures 13 through 15), making sure the gasket seating surfaces are clean and smooth. Then slide the bonnet over the stem and onto the stud bolts (key 15, Figure 13, 14 or 15) or onto the valve body cavity if cap screws (not shown) will be used instead.

NOTE

Proper performance of the bolting procedures in step 11 compresses the spiral wound gasket (key 12, Figures 13 through 15) or load ring (key 26, Figure 14) enough to both load and seal the seat ring gasket (key 13, Figure 13, 14 or 15). It also compresses the outer edge of the bonnet gasket (key 10, Figures 13 through 15) enough to seal the body-to-bonnet joint.

The proper bolting procedures in step 11 include—but are not limited to—ensuring that bolting threads are clean and evenly tightening the cap screws or the nuts onto the studs, in a crisscross pattern. Because of the boltup characteristics of spiral wound gaskets, tightening one cap screw or nut may loosen an adjacent cap screw or nut. Repeat the crisscross tightening pattern several times until each cap screw or nut is tight and the body-to-bonnet seal is made.

11. Install bolting, using proper bolting procedures during tightening so that the body-to-bonnet joint will withstand test pressures and application service conditions. The bolt torques in Table 3 may be used as guidelines.

12. Install new packing and the metal packing box parts according to the appropriate arrangement in Figure 3, 5 or 7. For split ring packing, alternate the positions of the splits to avoid creating a leak path. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.
13. Slide the packing follower, upper wiper and packing flange (keys 13, 12 and 3, Figure 8) into position. Lubricate the packing flange studs (key 4, Figure 8) and the faces of the packing flange nuts (key 5, Figure 8). Install the packing flange nuts.
14. For spring-loaded PTFE V-ring packing, tighten the packing flange nuts until the shoulder on the packing follower (key 13, Figure 8) contacts the bonnet.

For ENVIRO-SEAL or HIGH-SEAL live-loaded packing, refer to the note at the beginning of the Maintenance section.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in Table 4. Then, loosen the packing flange nuts and retighten them to the recommended minimum torque shown in Table 4.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in Table 4. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.
15. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

3.3 Trim Maintenance

WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

In the following applicable procedures, to avoid damaging parts, do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

Except where indicated, key numbers in this section are referenced in Figure 13 for standard NPS 1/2 through 6 constructions, Figure 14 for NPS 8 ES valves, Figure 15 for Whisper Trim III and Whisper NXG trim cage detail and Figure 16 for WhisperFlo trim.

Disassembly

1. Remove the actuator and the bonnet according to steps 1 through 6 of the Replacing Packing procedure of the Maintenance section.

**Table 4. Recommended Torque for Packing Flange Nuts
(Not for Spring-Loaded Packing)**

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE TYPE PACKING				PTFE TYPE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
mm	in.		N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in
9.5	3/8	CL125, 150	3	24	5	48	1	12	3	24
		CL250, 300	4	36	7	60	2	18	3	30
		CL600	5	48	8	72	3	24	4	36
12.7	1/2	CL125, 150	5	48	8	72	3	24	4	36
		CL250, 300	7	60	10	84	3	30	5	42
		CL600	10	84	14	120	5	42	7	60
19.1	3/4	CL125, 150	11	96	16	144	5	48	8	72
		CL250, 300	14	120	20	180	7	60	10	90
		CL600	20	180	30	264	10	90	15	132
25.4	1	CL300	24	216	37	324	12	108	16	144
		CL600	34	300	50	444	16	144	24	216
31.8	1-1/4	CL300	33	288	49	432	16	144	24	216
		CL600	45	396	66	588	22	192	33	288

WARNING

To avoid personal injury due to leaking fluid, avoid damaging gasket sealing surfaces. The surface finish of the valve stem (key 7) is critical for making a good packing seal. The inside surface of the cage or cage/baffle assembly (key 3) or cage retainer (key 31), is critical for smooth operation of the valve plug. The seating surfaces of the valve plug (key 2) and seat ring (key 9) are critical for proper shutoff. Unless inspection reveals otherwise, assume all these parts are in good condition and protect them accordingly.

2. Packing parts can be removed if desired. Replace these parts as described in the Replacing Packing procedure. Remove the load ring (key 26) from an NPS 8 ES valve or the cage adaptor (key 4) from any restricted trim valve and wrap it for protection.

2. Packing parts can be removed if desired. Replace these parts as described in the Replacing Packing procedure. Remove the load ring (key 26) from an NPS 8 ES valve or the cage adaptor (key 4) from any restricted trim valve and wrap it for protection.
3. Lift the valve plug and stem assembly out of the valve and set it on a protective surface. If the valve plug is to be reused, protect the valve plug seating surface to prevent scratches. On an NPS 6 ES valve with Whisper Trim III cage or WhisperFlo trim, also remove the bonnet spacer (key 32) and bonnet gasket (key 10) on top of the spacer. Then on any construction with a cage retainer (key 31), remove the cage retainer and its associated gaskets.
A Whisper Trim III and WhisperFlo trim cage retainer has two 3/8 in.-16 UNC tappings in which screws or bolts can be installed for lifting.
4. Remove the cage or cage/baffle assembly (key 3), the associated gaskets (keys 10, 11 and 12) and shim (key 51 for the ES valve, key 27 for the EAS valve). If the cage is stuck in the valve body, use a rubber mallet to strike the exposed portion of the cage at several points around its circumference.
5. Remove the seat ring or liner (key 9) or disk seat (key 22), seat ring gasket (key 13) and the seat ring adaptor (key 5) and adaptor gasket (key 14) where used in a restricted trim seat ring construction. PTFE seat constructions use a disk (key 23) sandwiched between the disk seat and disk retainer (key 21).
6. Inspect parts for wear or damage which would prevent proper operation of the valve. Replace or repair trim parts according to the following procedure for lapping metal seats or other valve plug maintenance procedures as appropriate.

Table 5. Valve Stem Connection Torque and Pin Replacement

VALVE STEM CONNECTION (VSC)		BOLT TORQUE, MINIMUM TO MAXIMUM		HOLE SIZE	
mm	in.	N•m	Lbf•ft	mm	in.
9.5	3/8	40 to 47	25 to 35	2.41 to 2.46	0.095 to 0.097
12.7	1/2	81 to 115	60 to 85	3.20 to 3.25	0.126 to 0.128
19.1	3/4	237 to 339	175 to 250	4.80 to 4.88	0.189 to 0.192
25.4	1	420 to 481	310 to 355	6.38 to 6.45	0.251 to 0.254
31.8	1-1/4	827 to 908	610 to 670	6.38 to 6.45	0.251 to 0.254

Table 6. Standard Material Designations

Standard Designation	Common Name or Trade Name
CoCr-A Hardfacing Alloy R30006 S17400 SST S31600 SST	CoCr-A Alloy 6 Casting 17-4PH Stainless Steel 316 Stainless Steel
S41000, S41600, CA15 WCC Carbon Steel Casting	13Cr 400-Series SST WCC

⚠ CAUTION

To avoid damaging the ENVIRO-SEAL bellows seal bonnet assembly, do not attempt to lap the metal seating surfaces. The design of the assembly prevents rotation of the stem and any forced lapping rotation will damage internal components of the ENVIRO-SEAL bellows seal bonnet.

Lapping Metal Seats

A certain amount of leakage should be expected with metal-to-metal seating in any valve body. If the leakage becomes excessive, however, the condition of the seating surfaces of the valve plug and seat ring can be improved by lapping. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Assemble the valve to the extent that the cage and the cage retainer and bonnet spacer (if used) are in place and the bonnet is bolted to the valve body. A simple handle can be made from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction to lap the seats. After lapping, remove the bonnet and clean the seat surfaces. Completely assemble as described in the assembly portion of the trim maintenance procedure and test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

⚠ CAUTION

To avoid weakening the stem or adaptor that may cause failure in service, never reuse an old stem or adaptor with a new valve plug. Using an old stem or adaptor with a new plug requires drilling a new pin hole in the stem (or adaptor in case an ENVIRO-SEAL bellows seal bonnet is being used), which will weaken the stem. However, a used valve plug may be reused with a new stem or adaptor.

Valve Plug Maintenance

Except where indicated, key numbers in this section are referenced in Figure 13 for standard NPS 1/2 through 6 constructions, Figure 14 for NPS 8 ES valves, Figure 15 for Whisper Trim III and Whisper NXG trim cage detail and Figure 16 for WhisperFlo trim.

1. Remove the valve plug (key 2) according to the disassembly portion of the trim maintenance procedure.
2. To replace the valve stem (key 7), drive out the pin (key 8). Unscrew the valve plug from the stem or adaptor.

3. To replace the adaptor (key 24, Figure 8) on ENVIRO-SEAL bellows seal bonnets, place the plug stem assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 36, Figure 8). Reverse the plug stem assembly in the soft-jaw chuck or vise. Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the valve plug/adaptor assembly (key 24, Figure 8) from the valve stem assembly (key 20, Figure 8).
4. Screw the stem or adaptor into the valve plug. Tighten to the torque value given in Table 5. Refer to Table 5 to select the proper hole size. Drill through the stem or adaptor, using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin to lock the assembly.
5. For ENVIRO-SEAL bellows seal bonnets, grip the flats of the stem extending out of the top of the bellows shroud with a soft-jaw chuck or other type of vise. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.

Assembly

Except where indicated, key numbers in this section are referenced in Figure 13 for standard NPS 1/2 through 6 constructions, Figure 14 for NPS 8 ES valves, Figure 15 for Whisper Trim III and Whisper NXG trim cage detail and Figure 16 for WhisperFlo trim.

1. With a restricted trim seat ring construction, install the adaptor gasket (key 14) and seat ring adaptor (key 5).
2. Install the seat ring gasket (key 13), seat ring or liner (key 9) or disk seat (key 22). With a PTFE seat construction, install the disk and disk retainer (keys 21 and 23).
3. Install the cage or cage/baffle assembly (key 3). Any rotational orientation of the cage or assembly with respect to the valve is acceptable. A Whisper Trim III cage designated by level A3, B3 or C3 may be installed with either end up. The level D3 cage/baffle assembly, however, must be installed with the hole pattern end next to the seat ring. If a cage retainer (key 31) is to be used, place it on top of the cage.
4. Slide the valve plug (key 2) and stem assembly or valve plug and ENVIRO-SEAL bellows seal assembly, into the cage.
5. Place the gaskets (key 10 or keys 11, 12 and 14, if used) and the shim (key 27 or key 51) on top of the cage or cage retainer. If there is a cage adaptor (key 4) or a bonnet spacer (key 32), set it on the cage or cage retainer gaskets and place another flat sheet gasket (key 10) on top of the adaptor or spacer. If there is only a cage retainer, place another flat sheet gasket on the retainer.
6. With an NPS 8 ES valve, install the load ring (key 26).



CAUTION

To avoid damaging packing with the valve stem threads, use care when installing the bonnet if the packing was not removed from the bonnet.

Table 7. Recommended Torque for ENVIRO-SEAL Bellows Seal Packing Flange Nuts

VALVE SIZE	VALVE STEM DIAMETER THROUGH PACKING	MINIMUM TORQUE		MAXIMUM TORQUE	
		N•m	Lbf•in	N•m	Lbf•in
1/2 to 2	1/2	3	24	5	48
3 to 4	1	7	60	10	84

7. Mount the bonnet on the valve and complete assembly according to steps 10 through 14 of the Replacing Packing procedure, omitting steps 11 and 12 if new packing is not being installed and being sure to observe the note prior to step 11.

3.4 ENVIRO-SEAL Bellows Seal and Bonnet

Replacing a Plain or Extension Bonnet with an ENVIRO-SEAL Bellows Seal (Stem/Bellows Assembly) and Bonnet

1. Remove the actuator and bonnet according to steps 1 through 6 of the Replacing Packing procedure of the Maintenance section.
2. With care, remove the valve plug and stem assembly from the valve body. If necessary, lift out the cage, also.



CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to protect the sealing surfaces and to prevent foreign material from getting into the valve body cavity.

3. Remove and discard the existing bonnet gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

NOTE

The ENVIRO-SEAL stem/bellows assembly for easy-e valves is available only with a threaded and drilled plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed.

4. Inspect the existing valve plug. If the plug is in good condition, it can be reused with the new ENVIRO-SEAL stem/bellows assembly. To remove the existing valve plug from the stem, first, place the existing plug stem assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 8).

5. Then, reverse the plug stem assembly in the soft-jaw chuck or vise. Grip the valve stem in an appropriate place and unscrew the existing plug from the valve stem.

**CAUTION**

When installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

To avoid damaging parts, do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

NOTE

The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

6. To attach the valve plug to the stem of the new ENVIRO-SEAL stem/bellows assembly, it is necessary to first attach the plug to the adaptor (key 24). Locate the adaptor. Notice that a hole has not been drilled in the threads where the plug screws onto the adaptor. Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor. Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Select the proper size of drill bit and drill through the adaptor using the hole in the valve plug as a guide. Remove any metal chips or burrs and drive in a new pin to lock the plug/adaptor assembly together.
8. Attach the plug/adaptor assembly to the ENVIRO-SEAL stem/bellows assembly by first securing the stem/bellows assembly in a soft-jaw chuck or other type of vise so that the jaws of the chuck or vise grip the flats of the stem extending out of the top of the bellows shroud. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.
9. Inspect the seat ring (key 9) and soft seat parts (keys 21, 22 and 23). Replace, if necessary.
10. Place a new gasket (key 10) into the valve body in place of the bonnet gasket. Install the new stem/bellows assembly with valve plug/adaptor by placing it into the valve body on top of the new bellows gasket.
11. Place a new gasket (key 22) over the stem/bellows assembly. Place the new ENVIRO-SEAL bonnet over the stem/bellows assembly.

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

12. Properly lubricate the bonnet stud bolts. Install and tighten the bonnet hex nuts to the proper torque.
13. Install new packing and the metal packing box parts according to the appropriate arrangement in Figure 3.
14. Install the packing flange. Properly lubricate the packing flange stud bolts and the faces of the packing flange nuts.

For ENVIRO-SEAL or HIGH-SEAL live-loaded packing, refer to the note at the beginning of the Maintenance section.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in Table 7. Then, loosen the packing flange nuts and retighten them to the recommended minimum torque shown in Table 7.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in Table 7. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.
15. Install travel indicator parts, stem locknuts and mount the actuator on the valve body according to the procedure in the appropriate actuator instruction manual.

Replacement of an Installed ENVIRO-SEAL Bellows Seal (Stem/Bellows Assembly)

1. Remove the actuator and bonnet according to steps 1 through 6 of the Replacing Packing procedure of the Maintenance section.

⚠ CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to protect the sealing surfaces and to prevent foreign material from getting into the valve body cavity.

2. With care, remove the ENVIRO-SEAL stem/bellows assembly. If necessary, lift out the cage, also. Remove and discard the existing bonnet gasket and bellows gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

NOTE

The ENVIRO-SEAL stem/bellows assembly for easy-e valves is available only with a threaded and drilled plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed.

3. Inspect the existing valve plug. If the plug is in good condition, it can be reused with the new stem/bellows assembly.

**CAUTION**

When removing/installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

To avoid damaging parts, do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

NOTE

The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

4. To remove the existing valve plug from the stem, first, place the existing plug stem assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin.
5. Then, reverse the plug stem assembly in the soft-jaw chuck or vise. Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the existing plug from the valve stem.
6. To attach either the existing valve plug or a new one to the stem of the new ENVIRO-SEAL stem/bellows assembly, it is necessary to first attach the plug to the adaptor. Locate the adaptor. Notice that a hole has not been drilled in the threads where the plug screws onto the adaptor. Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor. Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Complete the installation by following steps 7 through 9 and steps 12 through 15 of the ENVIRO-SEAL Bellows Seal and Bonnet installation instructions given above.

Purging the ENVIRO-SEAL Bellows Seal Bonnet

The ENVIRO-SEAL bellows seal bonnet has been designed so that it can be purged or leak tested. Refer to Figure 8 for an illustration of an ENVIRO-SEAL bellows seal bonnet and perform the following steps for purging or leak testing.

1. Remove the two diametrically opposed pipe plugs (key 16).
2. Connect a purging fluid to one of the pipe plug connections.
3. Install appropriate piping or tubing in the other pipe plug connection to pipe away the purging fluid or to make a connection to an analyzer for leak testing.
4. When purging or leak testing has been completed, remove the piping or tubing and reinstall the pipe plugs (key 16).

Section 4: Parts

4.1 Parts Ordering

Each body-bonnet assembly is assigned a serial number which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and to the eleven-character part number for each part required from the following parts kit or parts list information.

Refer to Table 6 for standard and common material designations.



WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

4.2 Parts Kits

NOTE

Kits do not apply to Alloy C (N10276 and CW2M), Alloy 20 (N08020 and CN7M) or Alloy 400 (N04400 and M35-1) trims.

Gasket Kits

Gasket Kits (includes keys 10, 11, 12, 13 and 51); Plus 14 and 20 on Some Restricted Capacity Valves

Table 8. Gasket Kits

DESCRIPTION	Standard Trim Cage Whisper Trim I Cage	Whisper Trim III/NXG Cage WhisperFlo Cage
	-198 to 593°C / -325 to 1100°F	
Full Capacity Valves	Part Number	
NPS 1/2, 3/4, 1 and 1-1/4 (NPS 1 EAS)	RGASKETX162	RGASKETX422
NPS 1-1/2 (NPS 2 EAS)	RGASKETX172	RGASKETX432
NPS 2	RGASKETX182	RGASKETX442
NPS 2-1/2 (NPS 3 EAS)	RGASKETX192	RGASKETX452
NPS 3 (NPS 4 EAS)	RGASKETX202	RGASKETX462
NPS 4 (NPS 6 EAS)	RGASKETX212	RGASKETX472
NPS 6	RGASKETX222	RGASKETX482
NPS 8	RGASKETX232	10A3265X152
Restricted Capacity Valves with Metal Seating		
NPS 1-1/2 x 1 (NPS 2 x 1 EAS)	RGASKETX242	---
NPS 2 x 1	RGASKETX252	---
NPS 2-1/2 x 1-1/2 (NPS 3 x 1-1/2 EAS)	RGASKETX262	---
NPS 3 x 2 (NPS 4 x 2 EAS)	RGASKETX272	---
NPS 4 x 2-1/2 (NPS 6 x 2-1/2 EAS)	RGASKETX282	---

Packing Kits

Standard Packing Repair Kits (Non Live-Loaded)

Table 9. Packing Kits

REPAIR KIT MATERIAL	STEM DIAMETER, mm / in. YOKE BOSS DIAMETER, mm / in.				
	9.5 / 3/8 54 / 2-1/8	12.7 / 1/2 71 / 2-13/16	19.1 / 3/4 90 / 3-9/16	25.4 / 1 127 / 5	31.8 / 1-1/4 127 / 5, 5H
	Part Number				
PTFE (Contains keys 6, 8, 10, 11 and 12)	RPACKX00012	RPACKX00022	RPACKX00032	RPACKX00342	RPACKX00352
Double PTFE (Contains keys 6, 8, 11 and 12)	RPACKX00042	RPACKX00052	RPACKX00062	RPACKX00362	RPACKX00372
PTFE/Composition (Contains keys 7, 8, 11 and 12)	RPACKX00072	RPACKX00082	RPACKX00092	---	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8 and 11)	RPACKX00102	RPACKX00112	RPACKX00122	---	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring] and 11)	---	---	---	RPACKX00532	RPACKX00542
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring])	RPACKX00132	RPACKX00142	RPACKX00152	---	---
Double Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8 and 11)	RPACKX00162	RPACKX00172	RPACKX00182	---	---

ENVIRO-SEAL Packing Retrofit Kits

Retrofit kits include parts to convert valves with existing standard bonnets to the ENVIRO-SEAL packing box construction.

Refer to Figure 10 for key numbers for PTFE packing, to Figure 11 for key numbers for Graphite ULF packing and to Figure 12 for key numbers for duplex packing.

PTFE kits include keys 200, 201, 211, 212, 214, 215, 217, 218, tag and cable tie. Graphite ULF kits include keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 216, 217, tag and cable tie. Duplex kits include keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag and cable tie.

Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances and design specifications may adversely alter the performance of this packing kit.

For part numbers of individual components in the ENVIRO-SEAL packing kits, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#).

Table 10. ENVIRO-SEAL Packing Retrofit Kits

PACKING MATERIAL	STEM DIAMETER, mm / in. YOKE BOSS DIAMETER, mm / in.				
	9.5 / 3/8 54 / 2-1/8	12.7 / 1/2 71 / 2-13/16	19.1 / 3/4 90 / 3-9/16	25.4 / 1 127 / 5	31.8 / 1-1/4 127 / 5, 5H
	Part Number				
Double PTFE	RPACKXRT012	RPACKXRT022	RPACKXRT032	RPACKXRT042	RPACKXRT052
Graphite ULF	RPACKXRT262	RPACKXRT272	RPACKXRT282	RPACKXRT292	RPACKXRT302
Duplex	RPACKXRT212	RPACKXRT222	RPACKXRT232	RPACKXRT242	RPACKXRT252

ENVIRO-SEAL Packing Repair Kits

Repair kits include parts to replace the “soft” packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits.

Refer to Figure 10 for key numbers for PTFE packing, to Figure 11 for key numbers for Graphite ULF packing and to Figure 12 for key numbers for duplex packing.

PTFE repair kits include keys 214, 215 and 218. Graphite ULF repair kits include keys 207, 208, 209, 210 and 214. Duplex repair kits include keys 207, 209, 214 and 215.

Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances and design specifications may adversely alter the performance of this packing kit.

For part numbers of individual components in the ENVIRO-SEAL packing kits, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#).

Table 11. ENVIRO-SEAL Packing Repair Kits

PACKING MATERIAL	STEM DIAMETER, mm / in. YOKE BOSS DIAMETER, mm / in.				
	9.5 / 3/8 54 / 2-1/8	12.7 / 1/2 71 / 2-13/16	19.1 / 3/4 90 / 3-9/16	25.4 / 1 127 / 5	31.8 / 1-1/4 127 / 5, 5H
	Part Number				
Double PTFE (contains keys 214, 215 and 218)	RPACKX00192	RPACKX00202	RPACKX00212	RPACKX00222	RPACKX00232
Graphite ULF (contains keys 207, 208, 209, 210 and 214)	RPACKX00592	RPACKX00602	RPACKX00612	RPACKX00622	RPACKX00632
Duplex (contains keys 207, 209, 214 and 215)	RPACKX00292	RPACKX00302	RPACKX00312	RPACKX00322	RPACKX00332

easy-e Low-e Bonnet Repair Kits

Kit consists of plain bonnet, Graphite / Inconel gasket set, ENVIRO-SEAL packing retro-fit kit, packing flange, packing flange studs and nuts. New stem is not included.

Table 12. easy-e Low-e Bonnet Repair Kits

Bonnet Material	Packing Type	Valve Size, NPS	Stem Size, in.	Part Number
WCC ⁽¹⁾	ENVIRO-SEAL PTFE	0.5 to 1.25	3/8	RLEPBNTX012
		1.5	3/8	RLEPBNTX022
		2	1/2	RLEPBNTX032
		2.5	1/2	RLEPBNTX042
		3	1/2	RLEPBNTX052
		4	1/2	RLEPBNTX062
		6	3/4	RLEPBNTX072
	ENVIRO-SEAL Graphite ULF	0.5 to 1.25	3/8	RLEPBNTX152
		1.5	3/8	RLEPBNTX162
		2	1/2	RLEPBNTX172
		2.5	1/2	RLEPBNTX182
		3	1/2	RLEPBNTX192
		4	1/2	RLEPBNTX202
		6	3/4	RLEPBNTX212
SST ⁽¹⁾	ENVIRO-SEAL PTFE	0.5 to 1.25	3/8	RLEPBNTX082
		1.5	3/8	RLEPBNTX092
		2	1/2	RLEPBNTX102
		2.5	1/2	RLEPBNTX112
		3	1/2	RLEPBNTX122
		4	1/2	RLEPBNTX132
	ENVIRO-SEAL Graphite ULF	0.5 to 1.25	3/8	RLEPBNTX222
		1.5	3/8	RLEPBNTX232
		2	1/2	RLEPBNTX242
		2.5	1/2	RLEPBNTX252
		3	1/2	RLEPBNTX262
		4	1/2	RLEPBNTX272

- continued -

Table 12. easy-e Low-e Bonnet Repair Kits (continued)

Bonnet Material	Packing Type	Valve Size, NPS	Stem Size, in.	Part Number
WCC	ENVIRO-SEAL Duplex	0.5 to 1.25	3/8	RLEPBNTX292
		1.5	3/8	RLEPBNTX302
		2	1/2	RLEPBNTX322
		2.5	1/2	RLEPBNTX332
		3	1/2	RLEPBNTX342
		4	1/2	RLEPBNTX352
		6	3/4	RLEPBNTX362
SST	ENVIRO-SEAL Duplex	0.5 to 1.25	3/8	RLEPBNTX372
		1.5	3/8	RLEPBNTX392
		2	1/2	RLEPBNTX412
		2.5	1/2	RLEPBNTX422
		3	1/2	RLEPBNTX432
		4	3/4	RLEPBNTX442
1. Compliant with NACE MR0175-2003 and prior, NACE MR0175 / ISO 15156 (all revisions) and NACE MR0103 (all revisions).				

4.3 Parts List

NOTE

Contact your [Emerson sales office](#) for part numbers.

Table 13. Bonnet (Figures 3 to 12)

Key	Description	Key	Description
1	Bonnet/ENVIRO-SEAL bellows seal bonnet If you need a bonnet or an ENVIRO-SEAL bellows seal bonnet as a replacement part, order by valve size and stem diameter, serial number and desired material.	10	Special washer
		11*	Packing Box Ring
		12*	Upper Wiper
		12*	ENVIRO-SEAL bellows seal upper wiper
2	Extension Bonnet Baffle	13*	Packing Follower
3	Packing Flange	13*	ENVIRO-SEAL bellows seal bushing
3	ENVIRO-SEAL bellows seal packing flange	13*	ENVIRO-SEAL bellows seal bushing/liner
4	Packing Flange Stud	14	Pipe Plug for 1/4 NPT Tapping in Packing Box
4	ENVIRO-SEAL bellows seal stud bolt	14	Lubricator
5	Packing Flange Nut	14	Lubricator/Isolating Valve
5	ENVIRO-SEAL bellows seal hex nut	15	Yoke Locknut
6*	Packing set	15	ENVIRO-SEAL bellows seal Locknut
6*	ENVIRO-SEAL bellows seal packing set	16	Pipe Plug for 1/2 NPT Tapped Extension Bonnets
7*	Packing ring	16	ENVIRO-SEAL bellows seal pipe plug
7*	ENVIRO-SEAL bellows seal packing ring	20*	ENVIRO-SEAL bellows seal stem/bellows assembly
8	Spring	22*	ENVIRO-SEAL bellows seal bonnet gasket
8	Lantern ring	24	ENVIRO-SEAL bellows seal adaptor
8	ENVIRO-SEAL bellows seal spring	25	Cap Screw for 127 mm / 5 in. yoke boss
8	ENVIRO-SEAL bellows seal spacer	26	Hex Nut for 127 mm / 5 in. Yoke Boss

- continued -

Table 13. Bonnet (Figures 3 to 12) (continued)

Key	Description	Key	Description
27	Pipe Nipple for Lubricator/Isolating Valve	36	ENVIRO-SEAL bellows seal pin
28	ENVIRO-SEAL bellows seal nameplate, warning	37	ENVIRO-SEAL bellows seal warning tag
29	ENVIRO-SEAL bellows seal drive screw	38	ENVIRO-SEAL bellows seal tie
34	Lubricant, anti-seize	39	ENVIRO-SEAL bellows seal thrust ring
*Recommended spare parts.			

Figure 8. Typical Bonnets

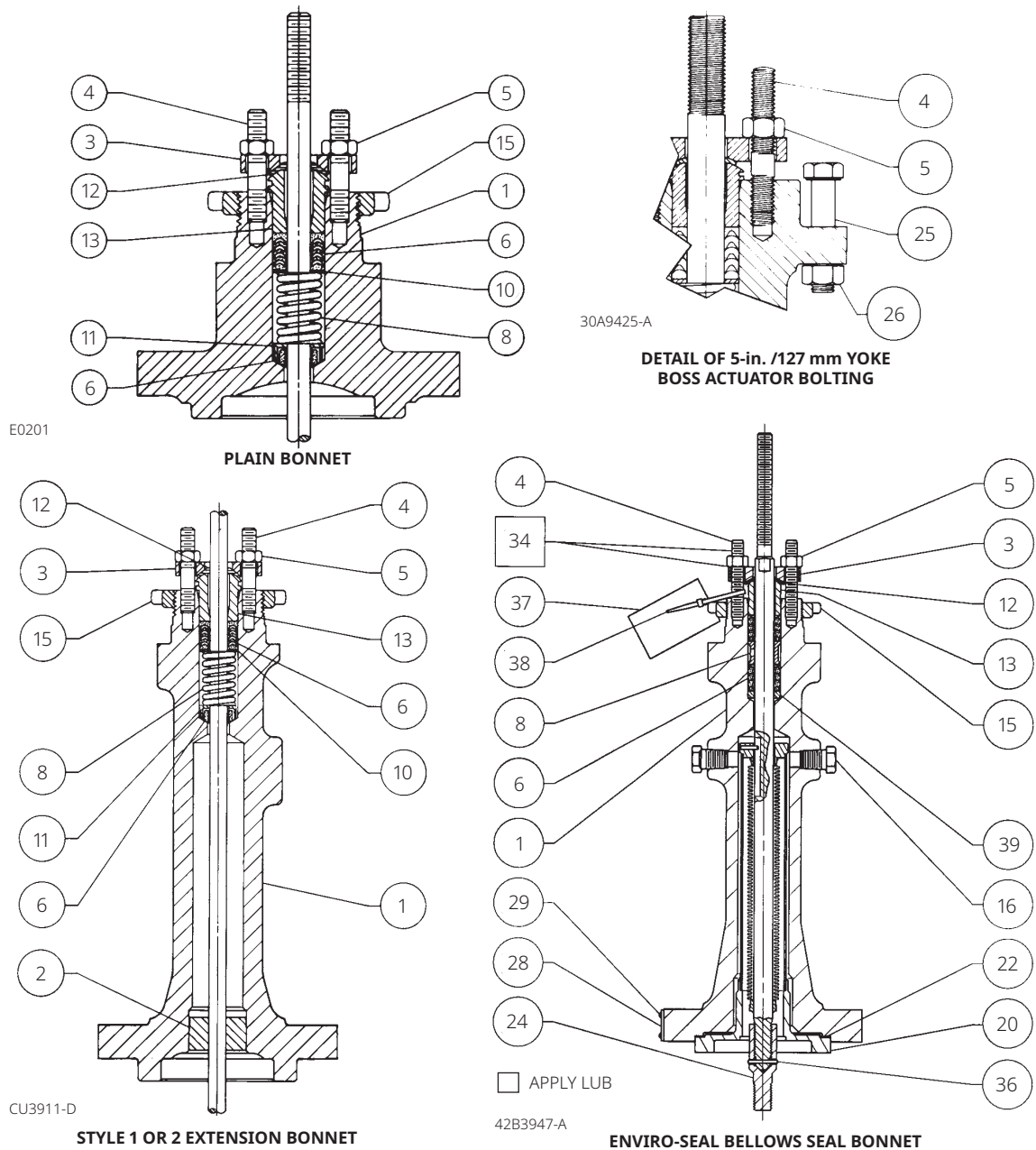
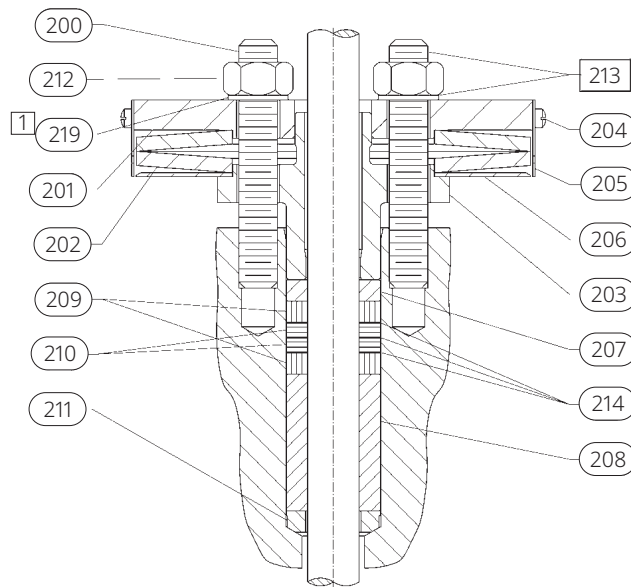


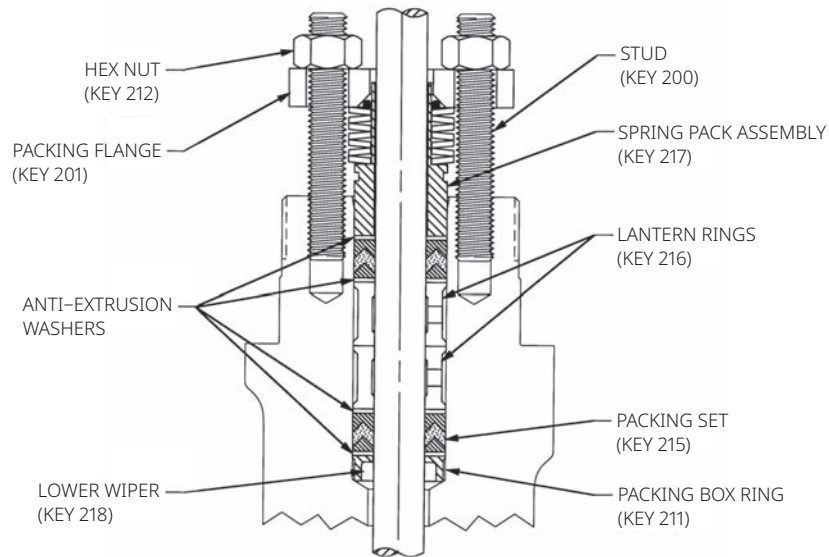
Figure 9. Typical HIGH-SEAL Graphite ULF Packing System



39B4153-A

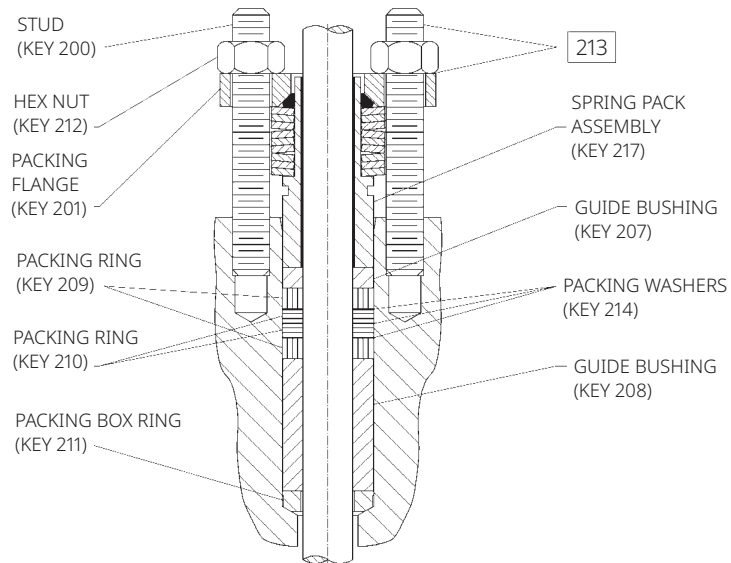
1. FIND NUMBER 219 NOT REQUIRED WITH 3/8 IN. STEM

Figure 10. Typical ENVIRO-SEAL Packing System with PTFE Packing



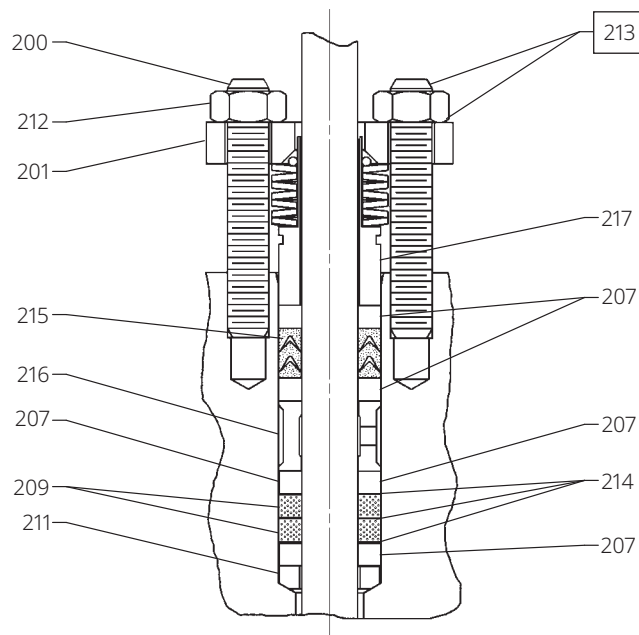
A6297-1

Figure 11. Typical ENVIRO-SEAL Packing System with Graphite ULF Packing



39B4612/A

Figure 12. Typical ENVIRO-SEAL Packing System with Duplex Packing



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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D100397X012

ES Valve

September 2025

Table 14. Valve Body (Figures 13 to 15)

Key	Description	Key	Description
1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number and desired material.	26	Load Ring
		27*	Shim
2*	Valve plug	31*	Whisper Trim III Cage Retainer for Levels A3, B3 and C3 (NPS 6 ES only)
3*	Cage	31*	Whisper Trim III Cage retainer and Baffle Ass'y for Level D3 (NPS 6 ES only)
4	Trim adaptor		
5	Trim adaptor	32	Whisper Trim III Bonnet Spacer
7*	Valve plug stem	51*	Shim
8*	Pin	53	Nameplate
9*	Liner	54	Wire
9*	Seat Ring	15	Cap Screw
10*	Bonnet Gasket	15	Stud
11*	Cage Gasket	16	Nut
12*	Spiral-Wound Gasket	17	Pipe Plug
13*	Seat Ring or Liner Gasket	18	Flow Direction Arrow
14*	Adaptor Gasket	19	Drive Screw
22*	Disk Seat	20*	Adaptor Gasket
23*	Disk	21*	Seat Disk Retainer
*Recommended spare parts.			

Figure 13. NPS 1/2 through 6 Fisher ES and EAS Valves

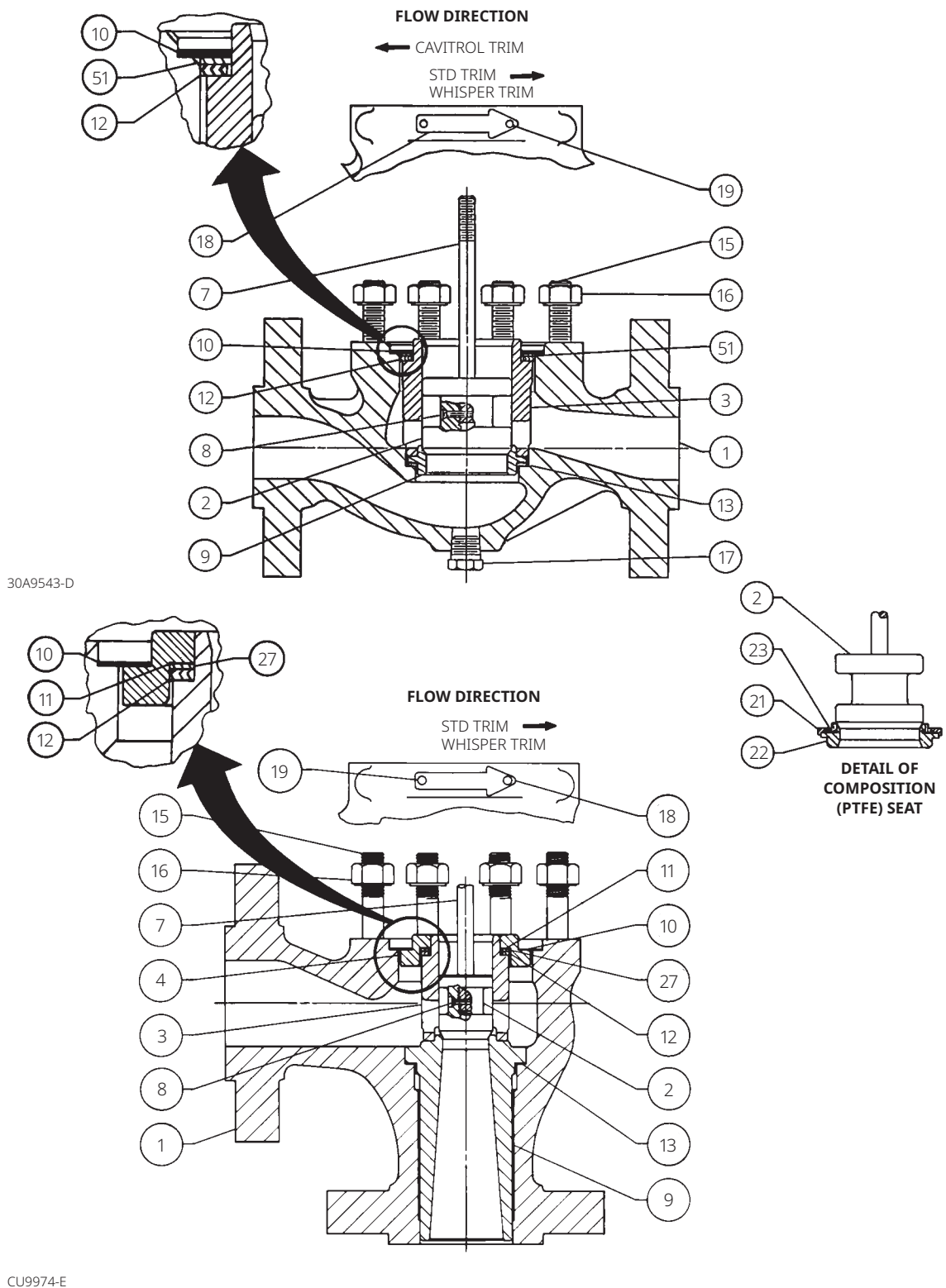
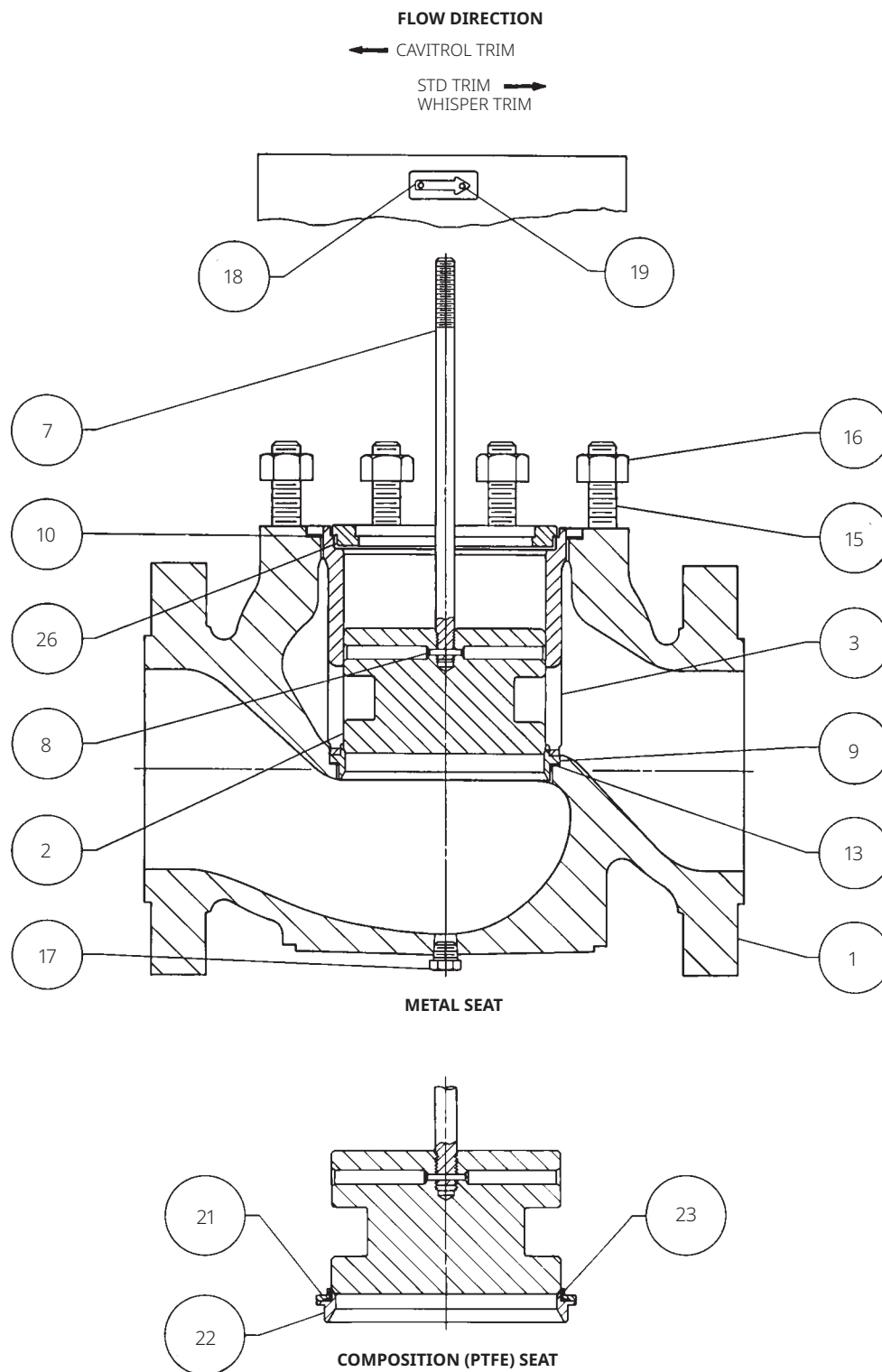
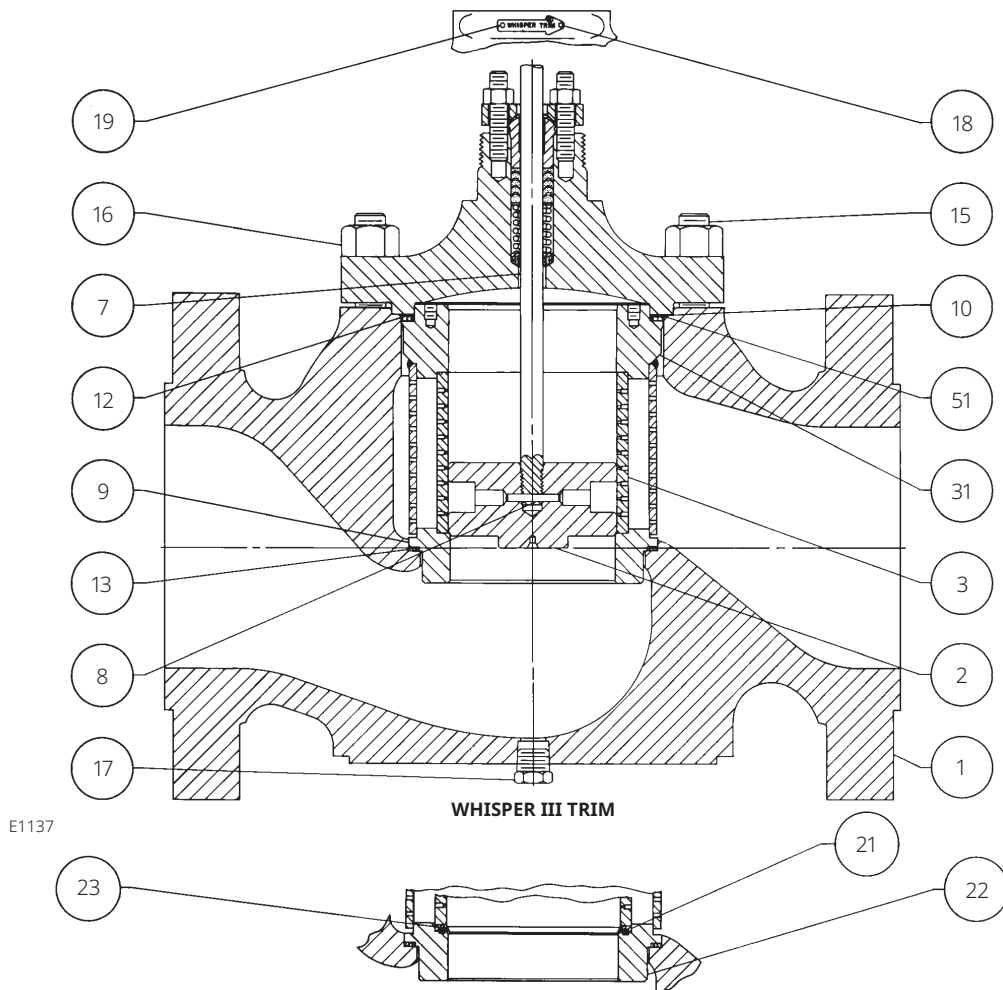


Figure 14. NPS 8 Fisher ES Valve with Optional Drain Plug



40A3288-C
B1884-1

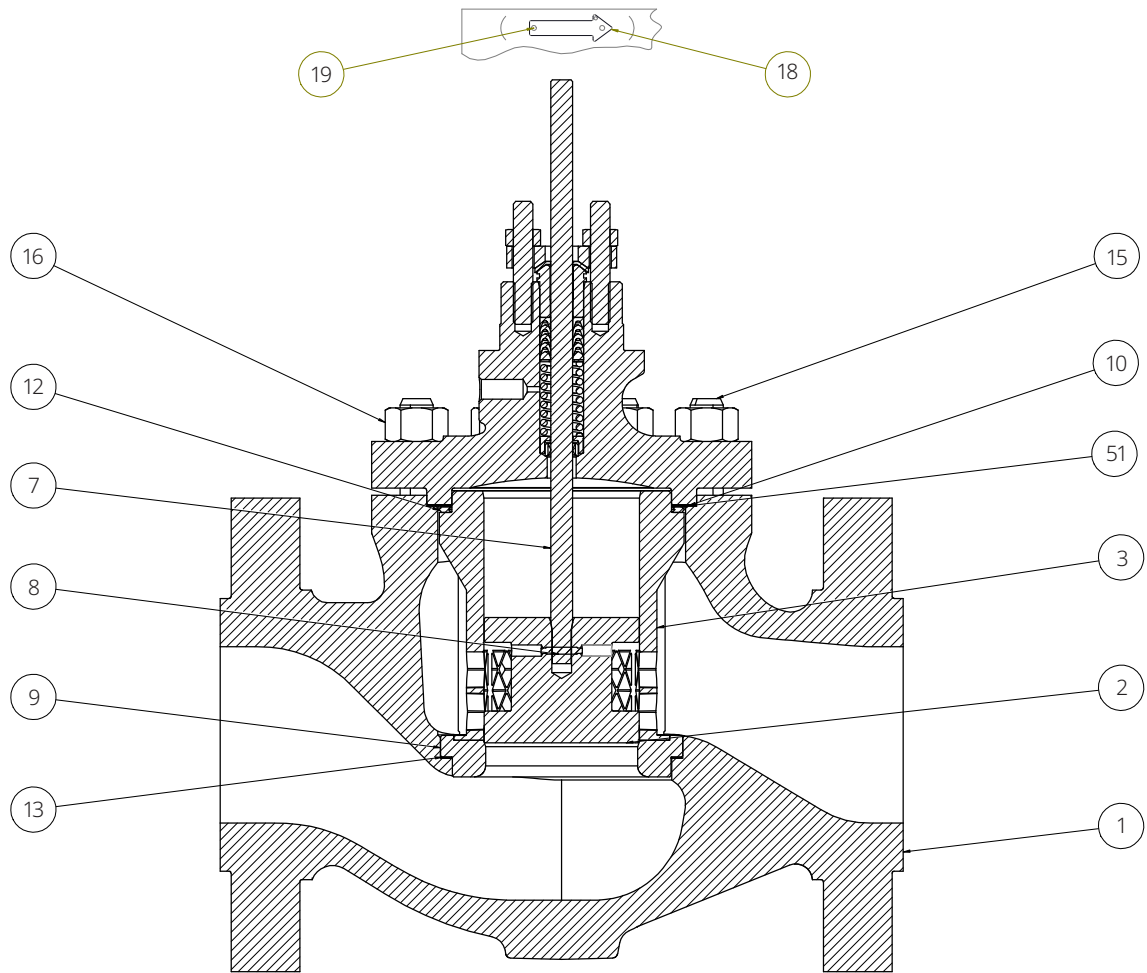
Figure 15. Whisper Trim III and Whisper NXG Trim Detail with Optional Drain Plug



E1137

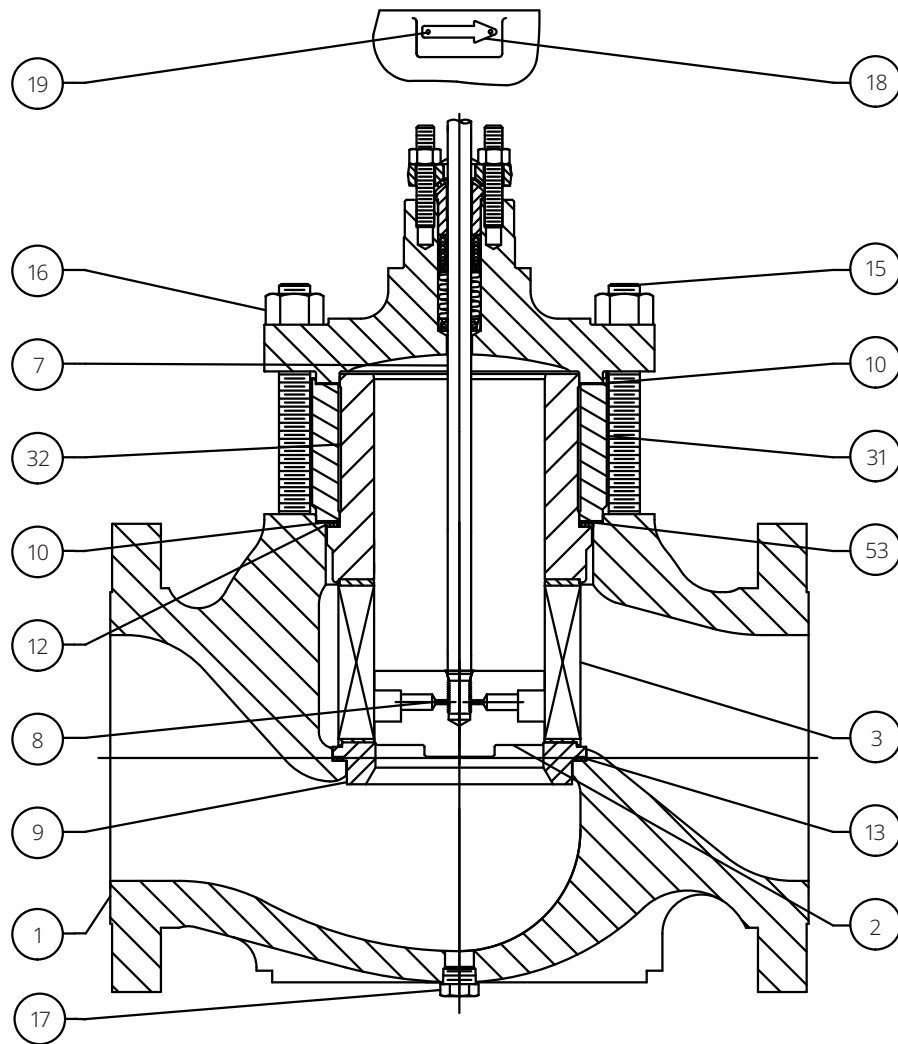
52A3326-D

Figure 15. Whisper Trim III and Whisper NXG Trim Detail with Optional Drain Plug (continued)



WHISPER NXG TRIM

Figure 16. Fisher ES Valve Assembly with WhisperFlo Cage with Optional Drain Plug



E1138

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D100397X012

ES Valve

September 2025

Table 15. Gaskets and Shims Parts Kit⁽⁹⁾

VALVE SIZE, NPS		Standard Trim Cage Whisper Trim I Cage Cavitrol III - 1 Stage Cage	Cavitrol III - 2 Stage Cage Whisper Trim III/NXG Cage WhisperFlo Cage
ET	EAT	-198 to 593°C / -325 to 1100°F	
		Part Number	
1/2, 3/4, 1 or 1-1/4	1	RGASKETX162 ⁽¹⁾⁽²⁾	RGASKETX422 ⁽³⁾
1-1/2	2	RGASKETX172 ⁽¹⁾⁽²⁾	RGASKETX432 ⁽³⁾
1-1/2 x 1	2 x 1	RGASKETX242 ⁽¹⁾⁽⁵⁾	- - -
2	- - -	RGASKETX182 ⁽⁶⁾	RGASKETX442 ⁽³⁾
2 x 1	- - -	RGASKETX252 ⁽⁴⁾	- - -
2-1/2	3	RGASKETX192 ⁽¹⁾⁽²⁾	RGASKETX452 ⁽³⁾
2-1/2 x 1-1/2	3 x 1-1/2	RGASKETX262 ⁽¹⁾⁽⁴⁾	- - -
3	4	RGASKETX202 ⁽¹⁾⁽²⁾	RGASKETX462 ⁽³⁾
3 x 2	4 x 2	RGASKETX272 ⁽¹⁾⁽⁴⁾	- - -
4	6	RGASKETX212 ⁽¹⁾⁽²⁾	RGASKETX472 ⁽³⁾
4 x 2-1/2	6 x 2-1/2	RGASKETX282 ⁽¹⁾⁽⁴⁾	- - -
6	- - -	RGASKETX222 ⁽⁶⁾	RGASKETX482 ⁽⁶⁾
8	- - -	RGASKETX232 ⁽⁷⁾	- - -

1. Set number good for both ES and EAS valve.

2. Kit includes key 10, 12, 13, 27 or 51.

3. Kit includes key 10, qty 2; 12; 13; 51.

4. Kit includes key 10, 11, 12, 13, 14, 27 or 51.

5. Kit includes key 10, 11, 12, 13, 20, 27 or 51.

6. Kit includes key 10, 12, 13, 51.

7. Kit includes key 10 and 13.

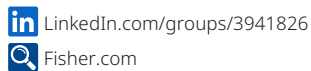
8. Kit includes key 10, qty 2; and 13.

9. See table below for gasket descriptions.

Table 16. Gasket Descriptions

KEY NUMBER	DESCRIPTION	MATERIAL
		FGM -198 to 593°C / -325 to 1100°F
10	Bonnet Gasket	Graphite/S31600
11	Cage Gasket	
13	Seat Ring or Liner Gasket	
14 or 20	Adapter Gasket	
12	Spiral Wound Gasket	N06600/Graphite
27 or 51	Shim	S31600

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS



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FISHER™



Fisher™ ET and EAT easy-e™ Valves CL125 through CL600



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for NPS 1 through 8 Fisher ET valves and NPS 1 through 6 EAT valves, through CL600 ratings. Refer to separate manuals for instructions covering the actuator and accessories.



WARNING



Do not install, operate or maintain ET valves without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. Fisher ET Control Valve with 667 Actuator



W1916-4

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

ET Valve

February 2026

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Table 1. Specifications

End Connection Styles	Flow Characteristics																															
Cast Iron Valves <i>Flanged:</i> CL125 flat-face or 250 raised-face flanges per ASME B16.1 Steel and Stainless Steel Valves <i>Flanged:</i> CL150, 300 and 600 raised-face or ring-type joint flanges per ASME B16.5 <i>Screwed or Socket Welding:</i> All available ASME B16.11 schedules that are consistent with CL600 per ASME B16.34 <i>Buttwelding:</i> Consistent with ASME B16.25 Valves with R31233 Dirty Service Trim (DST) <i>Flanged:</i> CL300, CL 600 raised-face or ring-type joint flanges per ASME B16.5 <i>Buttwelding:</i> Schedules 40 or 80 consistent with ASME B16.25 NPS 3 through 8 CL300/CL600	Linear (all cages), quick-opening (all except Whisper NXG Trim, Whisper Trim™, WhisperFlo™ and Cavitrol™ cages) or equal percentage (all except Whisper Trim, WhisperFlo, Whisper NXG Trim and Cavitrol cages) R31233 DST Constructions Linear																															
Maximum Inlet Pressure ⁽¹⁾	Flow Directions																															
Cast Iron Valves <i>Flanged:</i> Consistent with CL125B or 250B pressure-temperature ratings per ASME B16.1 Steel and Stainless Steel Valves <i>Flanged:</i> Consistent with CL150, 300 and 600 ⁽²⁾ pressure-temperature ratings per ASME B16.34 <i>Screwed or Welding:</i> Consistent with CL600 pressure-temperature ratings per ASME B16.34 Valves with R31233 DST Consistent with applicable CL300 or CL600 pressure/temperature ratings per ASME B16.34. See the Installation section of this manual.	Linear, Quick Opening or Equal Percentage Cage: Normally down Whisper Trim and WhisperFlo, Whisper NXG Trim Cages: Always up Cavitrol Cage: Always down R31233 DST Cage: Always down																															
Maximum Pressure Drop for R31233 DST	Approximate Weights																															
2-Stage Trim: 750 psi 3-Stage Trim: 1500 psi Trim Material: R31233 Cobalt Chrome Alloy	<table><tr><th rowspan="2">VALVE SIZE, NPS</th><th colspan="2">WEIGHT</th></tr><tr><th>kg</th><th>lb</th></tr><tr><td>1 and 1-1/4</td><td>14</td><td>30</td></tr><tr><td>1-1/2</td><td>20</td><td>45</td></tr><tr><td>2</td><td>39</td><td>67</td></tr><tr><td>2-1/2</td><td>45</td><td>100</td></tr><tr><td>3</td><td>54</td><td>125</td></tr><tr><td>4</td><td>77</td><td>170</td></tr><tr><td>6</td><td>159</td><td>350</td></tr><tr><td>8</td><td>408</td><td>900</td></tr></table>	VALVE SIZE, NPS	WEIGHT		kg	lb	1 and 1-1/4	14	30	1-1/2	20	45	2	39	67	2-1/2	45	100	3	54	125	4	77	170	6	159	350	8	408	900		
VALVE SIZE, NPS	WEIGHT																															
	kg	lb																														
1 and 1-1/4	14	30																														
1-1/2	20	45																														
2	39	67																														
2-1/2	45	100																														
3	54	125																														
4	77	170																														
6	159	350																														
8	408	900																														
Shutoff Classifications	Approximate Weights with R31233 DST																															
See Table 2	<table><tr><th rowspan="2">VALVE SIZE, NPS</th><th rowspan="2">STAGE</th><th colspan="2">WEIGHT</th></tr><tr><th>kg</th><th>lb</th></tr><tr><td rowspan="2">3</td><td>2-stage</td><td>63</td><td>138</td></tr><tr><td>3-stage</td><td>68</td><td>150</td></tr><tr><td rowspan="2">4</td><td>2-stage</td><td>93</td><td>206</td></tr><tr><td>3-stage</td><td>105</td><td>232</td></tr><tr><td rowspan="2">6</td><td>2-stage</td><td>212</td><td>467</td></tr><tr><td>3-stage</td><td>234</td><td>515</td></tr><tr><td>8</td><td>3-stage</td><td>518</td><td>1143</td></tr></table>	VALVE SIZE, NPS	STAGE	WEIGHT		kg	lb	3	2-stage	63	138	3-stage	68	150	4	2-stage	93	206	3-stage	105	232	6	2-stage	212	467	3-stage	234	515	8	3-stage	518	1143
VALVE SIZE, NPS	STAGE			WEIGHT																												
		kg	lb																													
3	2-stage	63	138																													
	3-stage	68	150																													
4	2-stage	93	206																													
	3-stage	105	232																													
6	2-stage	212	467																													
	3-stage	234	515																													
8	3-stage	518	1143																													
1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded. 2. Certain bonnet bolting material selections may require a CL600 easy-e valve assembly to be derated. Contact your Emerson sales office.																																

Table 2. Available Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4

Valve	Seating	Shutoff Class
All except those with Cavitrol III cages	PTFE (standard)	V - air test
		V - water test (optional)
	Metal	IV
		V (optional) ⁽²⁾
ET with Cavitrol III 1-stage cage	Metal	IV (standard)
		V (optional)
ET with Cavitrol III 2-stage cages	Metal	V
ET with PEEK Anti-Extrusion Rings	Metal	V to 316°C / 600°F
ET with 3.4375 to 7-in. port	Soft or Metal	VI
ET and EAT with TSO (Tight Shutoff Trim)	Replaceable, protected soft seat	TSO ⁽¹⁾
ET with R31233 DST	Metal	V
1. This is a special non-ANSI/FCI leakage class. 2. Class V shutoff requires spring-loaded seal ring, radiused-seat plug and wide-bevel seat ring (not available with 8-in. port, quick-opening cage). Not available with trims 4, 29 and 85.		

1.2 Description

These single-port valves have cage guiding, quick-change trim and balanced push-down-to-close valve plug action. Valve configurations are as follows:

ET-Globe-style valve (Figure 1) with metal-to-PTFE seating (standard for all except Cavitrol III cages and DST) for stringent shutoff requirements or metal-to-metal seating (standard for Cavitrol III cages and DST, optional for all others) for higher temperatures.

EAT-Angle version of ET, used to facilitate piping or in applications which require a self-draining valve.

1.3 Specifications

Typical specifications for these valves are shown in Table 1.

1.4 Education Services

Emerson Education Services
 Phone: +1-800-338-8158
 E-mail: education@emerson.com
emerson.com/mytraining

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in Table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some valve body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

Before installing the valve, inspect the valve and pipelines for any damage and any foreign material which may cause product damage.

1. Before installing the valve, inspect the valve and associated equipment for any damage and any foreign material.
2. Make certain the valve body interior is clean, that pipelines are free of foreign material and that the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.
3. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven valve plug and cage wear and improper operation. With some valves, the actuator may also need to be supported when it is not vertical. For more information, consult your [Emerson sales office](#).
4. Use accepted piping and welding practices when installing the valve in the line. For flanged valves, use a suitable gasket between the valve and pipeline flanges.

CAUTION

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Shrink-fit pieces and threaded connections may also loosen. In general, if post weld heat treating is to be performed, all trim parts should be removed. Contact your [Emerson sales office](#) for additional information.

5. With a leak-off bonnet construction, remove the pipe plugs (keys 14 and 16, Figure 14) to hook up the leak-off piping. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
6. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.

WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valves with ENVIRO-SEAL live-loaded packing or HIGH-SEAL live-loaded packing will not require this initial readjustment. See the Fisher instruction manuals, ENVIRO-SEAL Packing System for Sliding-Stem Valves or HIGH-SEAL Live-Loaded Packing System (as appropriate), for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the Parts Kits section.

Section 3: Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance, trim maintenance and ENVIRO-SEAL bellows seal bonnet replacement. All maintenance operations may be performed with the valve in the line.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

⚠ CAUTION

Follow instructions carefully to avoid damaging the product surfaces, which could result in damage to the product.

Trim Cartridge is a single use repair solution. It is not recommended to remove and reinstall Trim Cartridge after initial installation so valve assemblies with Trim Cartridge will not support an open and inspect maintenance strategy. If the valve contains Trim Cartridge (Trim Cartridges can be identified by a name plate on the bonnet flange, the use of a packing nut and “Fisher” embossed below the yoke mounting), please refer to Fisher ET and EZ easy-e Valves with Trim Cartridge Instruction Manual ([D104358X012](#)) for appropriate maintenance procedures.

NOTE

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This ensures a good gasket seal because the used gasket may not seal properly.

3.1 Packing Lubrication

NOTE

ENVIRO-SEAL and HIGH-SEAL packing do not require lubrication.

⚠ WARNING

To avoid personal injury or property damage resulting from fire or explosion, do not lubricate packing used in oxygen service or in processes with temperatures over 260°C / 500°F.

If a lubricator or lubricator/isolating valve (Figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the pipe plug (key 14, Figure 14). Use a good quality silicon-base lubricant. Do not lubricate packing used in oxygen service or in processes with temperatures over 260°C / 500°F. To operate the lubricator, simply turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except open the isolating valve before turning the cap screw and then close the isolating valve after lubrication is completed.

3.2 Packing Maintenance

NOTE

For valves with ENVIRO-SEAL packing, see the Fisher instruction manual, ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#), for packing instructions.

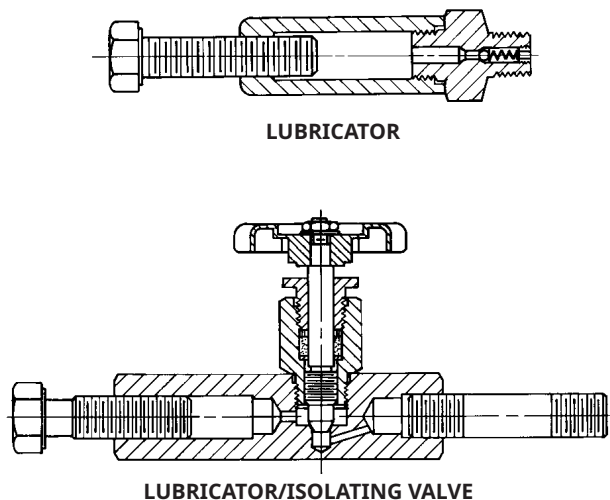
For valves with HIGH-SEAL packing, see the Fisher instruction manual, HIGH-SEAL Live-Loaded Packing System, [D101453X012](#), for packing instructions.

Valve assemblies with Trim Cartridge utilize a packing nut design and are only available with ENVIRO-SEAL packing. If the valve contains Trim Cartridge (Trim Cartridges can be identified by a name plate on the bonnet flange, the use of a packing nut and “Fisher” embossed below the yoke mounting), please refer to Fisher ET and EZ easy-e Valves with Trim Cartridge Instruction Manual ([D104358X012](#)) for appropriate packing maintenance instructions.

Key numbers refer to Figure 3 for PTFE V-ring packing and to Figure 4 for PTFE/composition packing, unless otherwise indicated.

For spring-loaded single PTFE V-ring packing, the spring (key 8) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5, Figure 14) until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the Replacing Packing procedure.

Figure 2. Lubricator and Lubricator/Isolating Valve (Optional)



10A9421-A
AJ5428-D
A0832-2

If there is undesirable packing leakage with other than spring-loaded packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

If the packing is relatively new and tight on the stem and if tightening the packing flange nuts does not stop the leakage, the valve stem may be worn or nicked so that a seal cannot be made. The surface finish of a new valve stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

Replacing Packing

WARNING

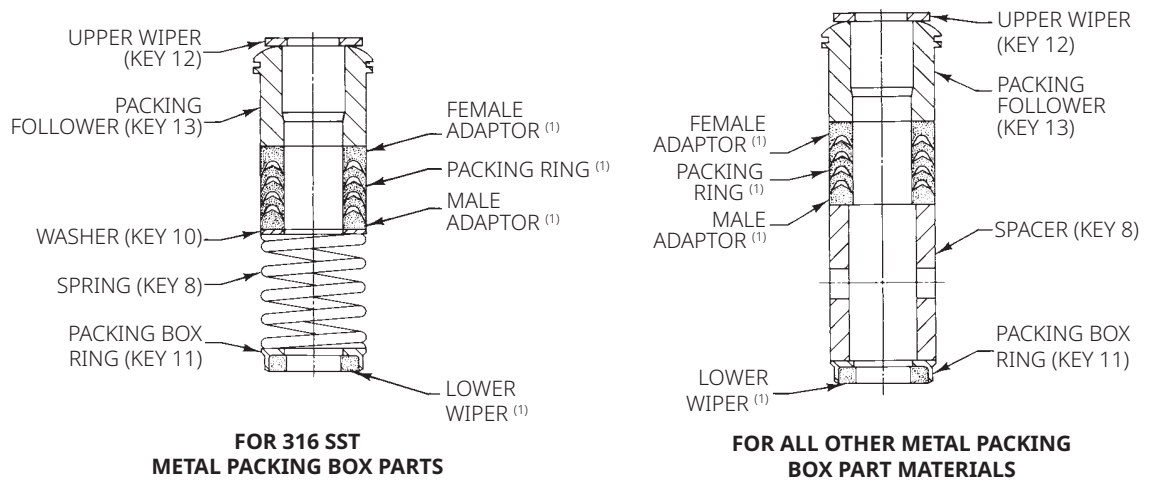
Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet. Disconnect the stem connector, then remove the actuator from the valve by unscrewing the yoke locknut (key 15, Figure 14) or the hex nuts (key 26, Figure 14).
3. Loosen the packing flange nuts (key 5, Figure 14) so that the packing is not tight on the valve stem. Remove any travel indicator parts and stem locknuts from the valve stem threads.

WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet.

Figure 3. PTFE V-Ring Packing Arrangements for Plain and Extension Bonnets

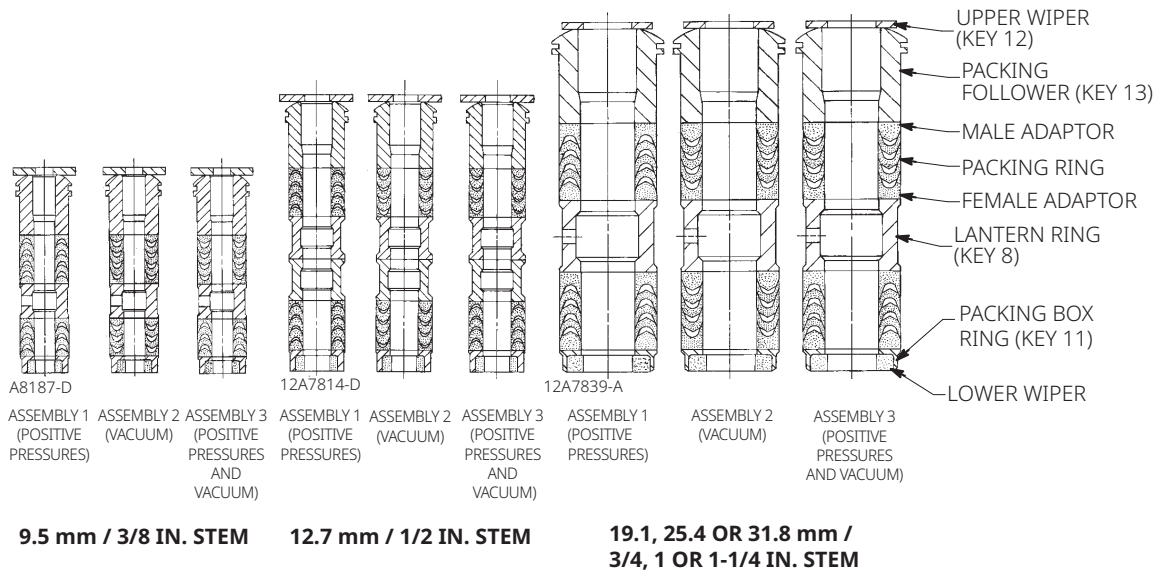


12A7837-A
B1429-5

NOTES:

1. MALE ADAPTOR, PACKING RING, FEMALE ADAPTOR AND LOWER WIPER ARE PART OF PACKING SET (KEY 6).
2. REQ'D FOR DOUBLE ARRANGEMENTS, EXCEPT LOWER WIPER.

SINGLE ARRANGEMENTS



DOUBLE ARRANGEMENTS

B1428-5

Figure 4. Detail of PTFE/Composition Packing Arrangements for Plain and Extension Bonnets

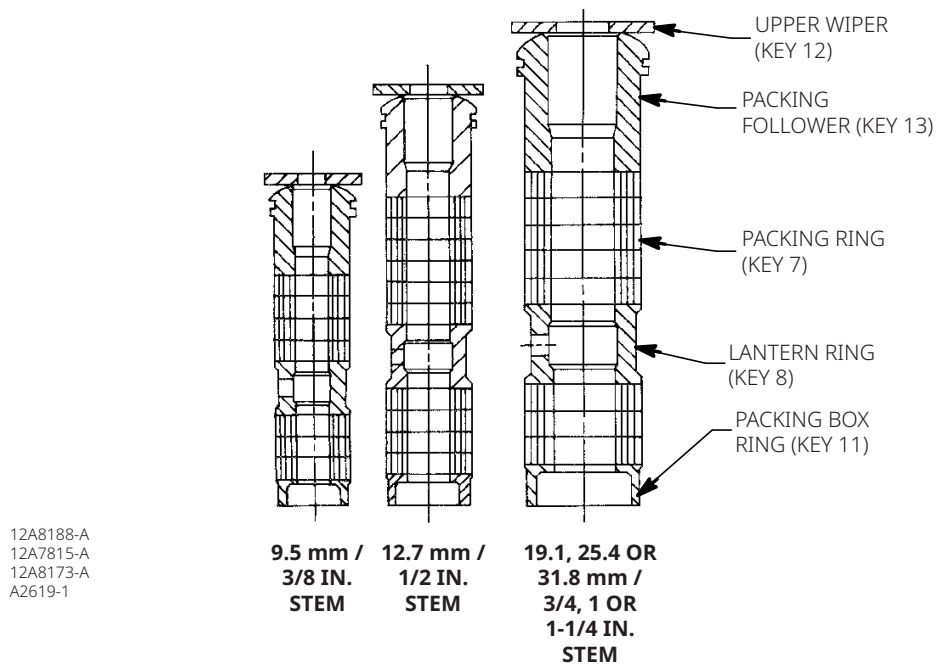


Table 3. Body-to-Bonnet Bolt Torque Guidelines⁽¹⁾

VALVE SIZE, NPS		BOLT TORQUES ⁽²⁾			
ET	EAT	SA193-B7, SA193-B8M ^(4,5)		SA193-B8M ^(3,5)	
		N·m	Lbf·ft	N·m	Lbf·ft
1-1/4 or less	1	129	95	64	47
1-1/2, 1-1/2 x 1, 2 or 2 x 1	2 or 2 x 1	96	71	45	33
2-1/2 or 2-1/2 x 1-1/2	3 or 3 x 1-1/2	129	95	64	47
3, 3 x 2 or 3 x 2-1/2	4 or 4 x 2	169	125	88	65
4, 4 x 2-1/2 or 4 x 3	6 or 6 x 2-1/2	271	200	156	115
6	---	549	405	366	270
8	---	746	550	529	390

1. Torque guideline using lithium-based grease. For other lubricants, contact your [Emerson sales office](#).

2. Determined from laboratory tests.

3. SA193-B8M annealed.

4. SA193-B8M strain hardened.

5. For other materials, contact your [Emerson sales office](#).

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Instruction Manual

D100398X012

ET Valve

February 2026

NOTE

The following step also helps to provide additional assurance that the valve body fluid pressure has been relieved.



CAUTION

Avoid damaging the seating surface caused by the valve plug and stem assembly dropping from the bonnet (key 1, Figure 14) after being lifted part way out. When lifting the bonnet, temporarily install a valve stem locknut on the valve stem. The locknut will prevent the valve plug and stem assembly from dropping out of the bonnet.

4. Hex nuts (key 16, Figure 16, 17 or 20) or cap screws (not shown) attach the bonnet (key 1, Figure 14) to the valve body (key 1, Figure 16, 17 or 20). Loosen these nuts or cap screws approximately 3 mm / 1/8 in. Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, remove the nuts or cap screws completely and carefully lift the bonnet off the valve.

Table 4. Recommended Torque for Packing Flange Nuts

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE TYPE PACKING				PTFE TYPE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
mm	in.		N-m	Lbf-in	N-m	Lbf-in	N-m	Lbf-in	N-m	Lbf-in
9.5	3/8	CL125, 150	3	27	5	40	1	13	2	19
		CL250, 300	4	36	6	53	2	17	3	26
		CL600	6	49	8	73	3	23	4	35
12.7	1/2	CL125, 150	5	44	8	66	2	21	4	31
		CL250, 300	7	59	10	88	3	28	5	42
		CL600	9	81	14	122	4	39	7	58
19.1	3/4	CL125, 150	11	99	17	149	5	47	8	70
		CL250, 300	15	133	23	199	7	64	11	95
		CL600	21	182	31	274	10	87	15	131
25.4	1	CL300	26	226	38	339	12	108	18	162
		CL600	35	310	53	466	17	149	25	223
31.8	1-1/4	CL300	36	318	54	477	17	152	26	228
		CL600	49	437	74	655	24	209	36	314

5. Remove the locknut and separate the valve plug and stem from the bonnet. Set the parts on a protective surface to prevent damage to gasket or seating surfaces.

 CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to prevent foreign material from getting into the valve body cavity.

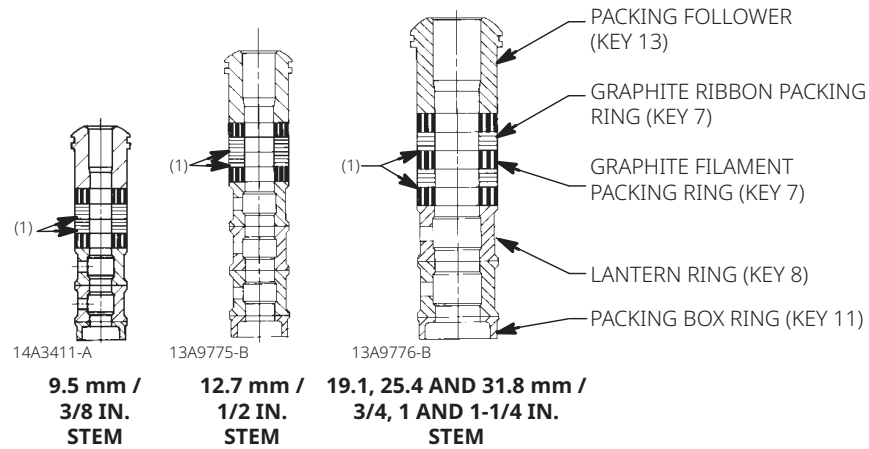
6. Remove the bonnet gasket (key 10, Figure 16, 17 or 20) and cover the opening in the valve to protect the gasket surface and prevent foreign material from getting into the valve body cavity.
7. Remove the packing flange nuts, packing flange, upper wiper and packing follower (keys 5, 3, 12 and 13, Figure 14). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
8. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts by following the appropriate steps in the Trim Maintenance procedure.
9. Remove the covering protecting the valve body cavity and install a new bonnet gasket (key 10, Figure 16, 17 or 20), making sure the gasket seating surfaces are clean and smooth. Then slide the bonnet over the stem and onto the stud bolts (key 15, Figure 16, 17 or 20) or onto the valve body cavity if cap screws (not shown) will be used instead.

NOTE

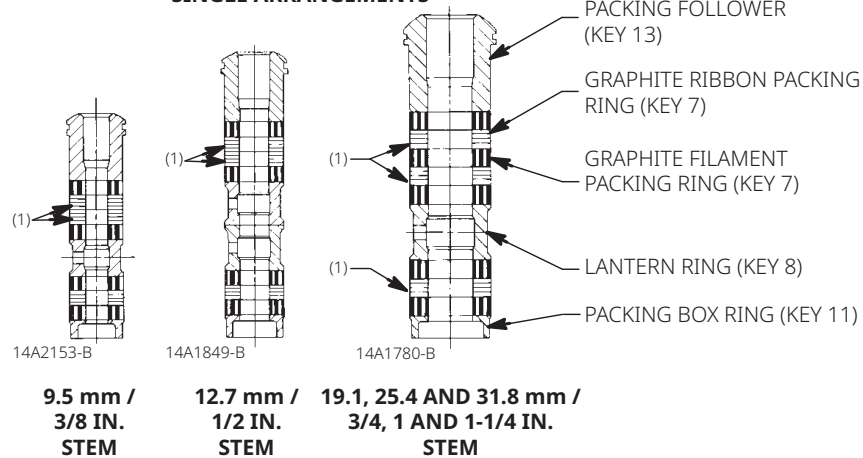
Proper performance of the bolting procedures in step 10 compresses the spiral wound gasket (key 12, Figure 16 or 17) or load ring (key 26, Figure 20) enough to both load and seal the seat ring gasket (key 13, Figure 16, 17 or 20). It also compresses the outer edge of the bonnet gasket (key 10, Figure 16 through 20) enough to seal the body-to-bonnet joint.

The proper bolting procedures in step 10 include—but are not limited to—ensuring that bolting threads are clean and evenly tightening the cap screws or the nuts onto the studs, in a crisscross pattern. Tightening one cap screw or nut may loosen an adjacent cap screw or nut. Repeat the crisscross tightening pattern several times until each cap screw or nut is tight and the body-to-bonnet seal is made.

Figure 5. Detail of Graphite Ribbon/Filament Packing for Plain and Extension Bonnets



SINGLE ARRANGEMENTS



A5864

DOUBLE ARRANGEMENTS

NOTE:

1. 0.102 mm / 0.004 IN. THICK SACRIFICIAL ZINC WASHERS; USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

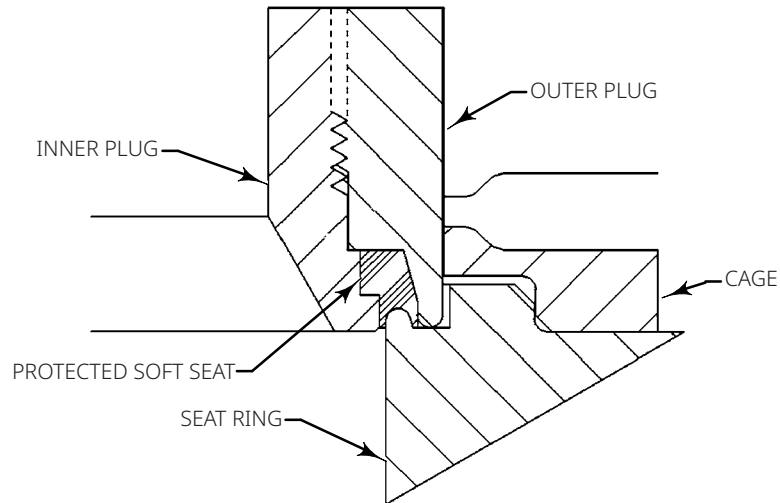
10. Lubricate the bolting (not necessary if factory pre-lubricated stud bolt nuts are used) and install it, using accepted bolting procedures during tightening, so that the body-to-bonnet joint will withstand test pressures and application service conditions. Use the bolt torques in Table 3 as guidelines.
11. Install new packing and the metal packing box parts according to the appropriate arrangement in Figure 3, 4 or 5. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box.
12. Slide the packing follower, upper wiper and packing flange (keys 13, 12 and 3, Figure 14) into position. Lubricate the packing flange studs (key 4, Figure 14) and the faces of the packing flange nuts (key 5, Figure 14). Install the packing flange nuts.
13. For spring-loaded PTFE V-ring packing, tighten the packing flange nuts until the shoulder on the packing follower (key 13, Figure 14) contacts the bonnet.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in Table 4. Then, loosen the packing flange nuts and retighten them to the recommended minimum torque shown in Table 4.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in Table 4. Then, tighten the remaining flange nut until the packing flange is level and at a 90° angle to the valve stem.

For ENVIRO-SEAL or HIGH-SEAL live-loaded packing, refer to the note at the beginning of Packing Maintenance.

14. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

Figure 6. TSO (Tight Shutoff Trim), Detail of Protected Soft Seat

A7088

3.3 Trim Maintenance

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

NOTE

If the valve contains Trim Cartridge (check if a Trim Cartridge name plate is present on the bonnet) please refer to Fisher ET and EZ easy-e Valves with Trim Cartridge Instruction Manual ([D104358X012](#)).

⚠ CAUTION

Trim Cartridge is a single use repair solution. It is not recommended to remove and reinstall Trim Cartridge after initial installation so valve assemblies with Trim Cartridge will not support an open and inspect maintenance strategy. If the valve contains Trim Cartridge (Trim Cartridges can be identified by a name plate on the bonnet flange, the use of a packing nut and "Fisher" embossed below the yoke mounting), please refer to Fisher ET and EZ easy-e Valves with Trim Cartridge Instruction Manual ([D104358X012](#)) for appropriate maintenance procedures.

Except where indicated, key numbers in this section are referenced in Figure 16 for standard NPS 1 through 6 constructions, Figure 17 for Whisper Trim III and Whisper NXG detail, Figures 18 and 19 for WhisperFlo trim, Figure 20 for Cavitrol III detail and the NPS 8 ET valve and Figures 22 through 25 for R31233 DST.

Disassembly

1. Remove the actuator and the bonnet according to steps 1 through 6 of the Replacing Packing procedure in the Maintenance section.



WARNING

To avoid personal injury due to leaking fluid, avoid damaging gasket sealing surfaces. The surface finish of the valve stem (key 7) is critical for making a good packing seal. The inside surface of the cage or cage/baffle assembly (key 3) or cage retainer (key 31), is critical for smooth operation of the valve plug. The seating surfaces of the valve plug (key 2) and seat ring (key 9) are critical for proper shutoff. Unless inspection reveals otherwise, assume all these parts are in good condition and protect them accordingly.

2. Remove the packing flange nuts, packing flange, upper wiper and packing follower (keys 5, 3, 12 and 13 in Figure 14). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
3. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
4. Remove the load ring (key 26) from an NPS 8 ET valve or the cage adaptor (key 4) from any restricted-trim valve through NPS 4 and wrap it for protection.
5. On an NPS 6 ET valve with Whisper Trim III/NXG or WhisperFlo cage, also remove the bonnet spacer (key 32) and bonnet gasket (key 10) on top of the spacer. Then on any construction with a cage retainer (key 31), remove the cage retainer and its associated gaskets. A Whisper Trim III and WhisperFlo cage retainer has two 3/8-in.-16 UNC tappings in which screws or bolts can be installed for lifting.
6. Remove the cage or cage/baffle assembly (key 3), the associated gaskets (keys 10, 11 and 12) and shim (key 51). If the cage is stuck in the valve, use a rubber mallet to strike the exposed portion of the cage at several points around its circumference.
7. For constructions other than TSO (tight shutoff) trim, remove the seat ring or liner (key 9) or disk seat (key 22), seat ring gasket (key 13) and the seat ring adaptor (key 5) and adaptor gasket (key 14) where used in a restricted-trim seat ring construction. PTFE-seat constructions use a disk (key 23) sandwiched between the disk seat and disk retainer (key 21).

8. For TSO (tight shutoff) trim constructions, perform the following steps (refer to Figures 6 and 7):
 - a. Remove the retainer, backup ring, anti-extrusion rings and piston ring.
 - b. Remove the set screws that lock the outer plug to the inner plug.
 - c. Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
 - d. Remove the protected soft seat seal.
 - e. Inspect the parts for damage and replace if needed.
9. For all constructions, inspect parts for wear or damage which would prevent proper operation of the valve. Replace or repair trim parts according to the following procedure for Lapping Metal Seats or other valve plug maintenance procedures as appropriate.

Disassembly for R31233 DST Constructions

1. Remove the actuator and the bonnet according to steps 1 through 6 of the Replacing Packing procedure in the Maintenance section.
2. Remove the packing flange nuts, packing flange, upper wiper and packing follower (keys 5, 3, 12 and 13 in Figure 14). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
3. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
4. Carefully lift the valve plug/stem assembly (key 5) out of the valve and protect the stem and plug seating surfaces.



CAUTION

When lifting the valve plug/stem assembly out of the valve (key 5), be certain that the cage elements (key 2 or key 2A and 2B and key 4) remain in the valve. This will prevent cage damage that might be caused by the cages dropping back into the valve after being lifted part way out. Use care to avoid damaging gasket sealing surfaces.

The surface finish of the valve stem is critical for making a good packing seal. The inside surface of the cage is critical for smooth operation of the valve plug and for making a seal with the seal ring (key 8). The seating surfaces of the valve plug and the seat ring (if applicable, some designs may integrate the seat ring with the cage as a single element) on a metal-seat construction are critical for tight shutoff. Assume all these parts are in good condition and protect them accordingly, unless inspection reveals otherwise.

5. Remove the spiral wound gaskets (load ring used in the NPS 8 design as shown in Figure 25) from the top of the cage (key 2) (some designs may refer to the cage as the upper cage, key 2A).

6. Remove the cage (key 2) or upper cage (key 2A), bonnet spacer (key 3 if applicable), seat ring (key 4 if applicable, some designs may integrate the seat ring with the cage as a single element) and remaining cage elements (key 2A and 2B if applicable) from the valve body. A gasket is used between the cage and body. Where applicable, gaskets are also used between the cages or between cage and seat ring. Remove and discard these gaskets. The gaskets should not be reused.

NOTE

The NPS 6 design (see Figure 24) uses unique trim packaging method, so its bonnet spacer (key 3) should be removed first, followed by the spiral wound gaskets (key 65) and upper/lower cage parts (keys 2A and 2B). The bonnet spacer has two 1/4-20 tapping holes into which bolts or screws can be installed for lifting.

7. Inspect parts for wear or damage that would prevent proper operation of the valve. All gasket surfaces on the trim parts and in the body must be cleaned of any graphite residue and must be free from nicks and scratches. The seating surfaces of the valve plug and seat ring need to be free from nicks, scratches or any other damage for proper shut off. Replace or repair trim parts as needed.

Lapping Metal Seats

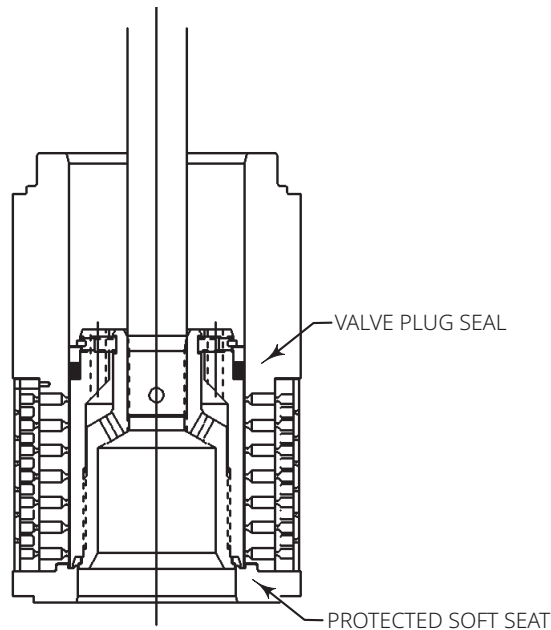


CAUTION

To avoid damaging the ENVIRO-SEAL Bellows Seal Bonnet assembly, do not attempt to lap the metal seating surfaces. The design of the assembly prevents rotation of the stem and any forced lapping rotation will damage internal components of the ENVIRO-SEAL Bellows Seal bonnet.

Except with respect to the ENVIRO-SEAL Bellows Seal Bonnet assembly, with metal-seat constructions, lapping seating surfaces of the valve plug and seat ring or liner (keys 2 and 9, Figure 16, 17 or 20) can improve shutoff. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Assemble the valve to the extent that the cage and the cage retainer and bonnet spacer (if used) are in place and the bonnet is bolted to the valve body. A simple handle can be made from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction to lap the seats. After lapping, remove the bonnet and clean the seat surfaces. Completely assemble as described in the Assembly portion of the Trim Maintenance procedure and test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

Figure 7. Typical Balanced TSO Trim

Valve Plug Maintenance

Except where indicated, key numbers in this section are referenced in Figure 16 for standard NPS 1 through 6 constructions, Figure 17 for Whisper Trim III and Whisper NXG detail, Figures 18 and 19 for WhisperFlo trim, Figure 20 for Cavitrol III detail and the NPS 8 ET valve and Figures 22 through 25 for R31233 DST.

⚠ CAUTION

To avoid the valve plug seal ring (key 28) not sealing properly, be careful not to scratch the surfaces of the ring groove in the valve plug or any of the surfaces of the replacement ring.

1. With the valve plug (key 2) removed according to the Disassembly portion of the Trim Maintenance procedure, proceed as appropriate:

For the two-piece seal ring, The ring cannot be reused because it is a closed ring which must be pried and/or cut from the groove. Once the seal ring is removed, the elastomeric backup ring (key 29), which is also a closed ring, can be pried from the groove.

⚠ CAUTION

To avoid damaging the seal ring, slowly and gently stretch it for the following procedure. Avoid jerking sharply on the ring.

To install a new two-piece seal ring, apply a general purpose silicone-base lubricant to both the backup ring and seal ring (keys 29 and 28). Place the backup ring over the stem (key 7) and into the groove. Place the seal ring over the top edge of the valve plug (key 2) so that it enters the groove on one side of the valve plug. Slowly and gently stretch the seal ring and work it over the top edge of the valve plug. The PTFE material in the seal ring must be permitted time to cold-flow during the stretching procedure, so avoid jerking sharply on this ring. Stretching the seal ring over the valve plug may make it seem unduly loose when in the groove, but it will contract to its original size after insertion into the cage.

For the spring-loaded seal ring, the ring used on a valve plug having a 136.5 mm / 5.375 in. or less port diameter may be removed undamaged by first working the retaining ring (key 27) off with a screwdriver. Then carefully slide the metal backup ring (key 29) and seal ring (key 28) off the valve plug (key 2). The spring-loaded seal ring used on a valve plug having a 178 mm / 7-in. or greater port diameter must be carefully pried and/or cut from its groove. Therefore, it cannot be reused.

A spring-loaded seal ring must be installed so that its open side faces toward the valve stem or toward the seat of the plug depending on flow direction, as shown in view A of Figure 16 or 20. To install a spring-loaded seal ring on a valve plug with a 136.5 mm / 5.375 in. or less port diameter, slide the seal ring (key 28) onto the valve plug followed by the metal backup ring (key 29). Then install the retaining ring (key 27) by inserting one end in the groove and, while turning the plug, press the ring into the groove. Again, be careful not to scratch any surfaces of the ring or plug.

CAUTION

To avoid damaging the seal ring, slowly and gently stretch it for the following procedure. Avoid jerking sharply on the ring.

To install the seal ring on a valve plug with 178 mm / 7-in. or greater port diameter, lubricate it with a general purpose silicone-base lubricant. Then gently stretch the seal ring and work it over the top edge of the valve plug. The PTFE material in the seal ring must be permitted time to cold-flow during the stretching procedure, so avoid jerking sharply on the ring. Stretching the seal ring over the valve plug may make it seem unduly loose when in the groove, but it will contract to its original size after insertion into the cage.

CAUTION

Never reuse an old stem or adaptor with a new valve plug. Using an old stem or adaptor with a new plug requires drilling a new pin hole in the stem (or adaptor, in case an ENVIRO-SEAL bellows seal bonnet is being used). This drilling weakens the stem or adaptor and may cause failure in service. However, a used valve plug may be reused with a new stem or adaptor, except with Cavitrol III trim.

NOTE

The valve plug and valve plug stem for 2-stage Cavitrol III trim are a matched set and must be ordered together. If the 2-stage Cavitrol III valve plug or valve plug stem is damaged, replace the entire assembly (key 2, Figure 20).

For plain bonnets and style 1 extension bonnets, the valve plug (key 2), valve stem (key 7) and pin (key 8) are available completely assembled. Refer to the keys 2, 7 and 8 Valve Plug and Stem Assembly tables in the Parts List.

2. To replace the valve stem (key 7), drive out the pin (key 8). Unscrew the valve plug from the stem or adaptor.
3. To replace the adaptor (key 24, Figure 14) on ENVIRO-SEAL bellows seal bonnets, place the plug stem assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out the pin (key 36, Figure 14). Reverse the plug stem assembly in the soft-jaw chuck or vise.
Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the valve plug/adaptor assembly (key 24, Figure 14) from the valve stem assembly (key 20, Figure 14).
4. Screw the new stem or adaptor into the valve plug. Tighten to the torque value given in Table 5. Refer to Table 5 to select the proper hole size. Drill through the stem or adaptor, using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin to lock the assembly.

Table 5. Valve Stem Connection Assembly Torque and Pin Replacement

VALVE STEM DIAMETER		TORQUE, MINIMUM TO MAXIMUM		HOLE SIZE	
mm	in.	N·m	Lbf·ft	mm	in.
9.5	3/8	40 to 47	25 to 35	2.41 to 2.46	0.095 to 0.097
12.7	1/2	81 to 115	60 to 85	3.20 to 3.25	0.126 to 0.128
19.1	3/4	237 to 339	175 to 250	4.80 to 4.88	0.189 to 0.192
25.4	1	420 to 481	310 to 355	6.38 to 6.45	0.251 to 0.254
31.8	1-1/4	827 to 908	610 to 670	6.38 to 6.45	0.251 to 0.254

5. For ENVIRO-SEAL bellows seal bonnets, grip the flats of the stem extending out of the top of the bellows shroud with a soft-jaw chuck or other type of vise. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.

Valve Plug Maintenance for R31233 DST Constructions

Except where indicated, key numbers in this section are referenced in Figures 22 through 25 for NPS 3 through 8 valve constructions with R31233 DST.

With the valve plug removed, according to the Trim Disassembly section of this manual, proceed as appropriate:

1. Inspect the valve plug (key 5) and stem for nicks, scratches or other damage that would prevent proper operation of the valve. If replacement of either is necessary, replace as a complete valve plug and stem assembly (key 5).
2. All DST trims use the spring-loaded seal ring (key 8) as the sealing element between plug and cage (key 2 or 2A). The spring-loaded seal ring may be removed by first working the retaining ring (key 10) off with a screwdriver. Then, carefully slide the metal backup ring (key 9), anti-extrusion ring (key 63) and seal ring (key 8) off the valve plug. Inspect the retaining ring and backup ring for damage and replace as needed. Discard the old plug seal ring and anti-extrusion ring.
3. The spring-loaded seal ring (key 8) must be installed so that the open side faces toward the seat of the plug, as shown in Figures 22 through 25. To install the spring-loaded seal ring on a valve plug, first lubricate it with a general purpose silicone-base lubricant, then gently slide the seal ring (key 8) and anti-extrusion ring (key 63) onto the valve plug followed by the metal backup ring (key 9). Then, install the retaining ring (key 10) by inserting one end in the groove end, while turning the plug, press the ring into the groove. Use caution not to scratch any surfaces of the ring or plug.



CAUTION

To avoid damaging the seal ring (key 8), slowly and gently stretch it prior to assembly. Avoid jerking sharply on the ring.

Assembly

Except where indicated, key numbers in this section are referenced in Figure 16 for standard NPS 1 through 6 constructions, Figure 17 for Whisper Trim III and Whisper NXG detail, Figures 18 and 19 for WhisperFlo trim, Figure 20 for Cavitrol III detail and the NPS 8 ET valve and Figures 22 through 25 for R31233 DST.

1. With a restricted-trim seat ring construction, install the adaptor gasket (key 14) and seat ring adaptor (key 5).
2. Install the seat ring gasket (key 13), seat ring or liner (key 9) or disk seat (key 22). With a PTFE-seat construction, install the disk and disk retainer (keys 21 and 23).
3. Install the cage or cage/baffle assembly (key 3). Any rotational orientation of the cage or assembly with respect to the valve body is acceptable. A Whisper Trim III cage designated by level A3, B3 or C3 may be installed with either end up. The level D3 cage/baffle assembly or Cavitrol III cage assembly, however, must be installed with the hole pattern end next to the seat ring. If a cage retainer (key 31) is to be used, place it on top of the cage.

4. For constructions other than TSO (tight shutoff) trim, slide the valve plug (key 2) and stem assembly or valve plug and ENVIRO-SEAL bellows seal assembly, into the cage. Make sure the seal ring (key 28) is evenly engaged in the entrance chamfer at the top of the cage (key 3) or cage retainer (key 31) to avoid damaging the ring.
5. For TSO (tight shutoff) trim constructions, perform the following steps (refer to Figures 6 and 7).
 - a. Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
 - b. Mark the top of the inner plug and outer plug with alignment marks in the assembled position.
 - c. Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
 - d. Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is compressed properly. Do not damage the outer plug guide surfaces.
 - e. Install set screws centering the inner plug in the outer plug and torque to 11 N•m / 8 lbf•ft.
 - f. Assemble the piston ring, anti-extrusion rings, backup ring and retainer.
6. For all constructions, place the gaskets (keys 12, 11 or 14 if used and 10) and the shim (key 51) on top of the cage or cage retainer. If there is a cage adaptor (key 4) or a bonnet spacer (key 32), set it on the cage or cage retainer gaskets and place another flat sheet gasket (key 10) on top of the adaptor or spacer. If there is only a cage retainer, place another flat sheet gasket on the retainer.
7. With an NPS 8 ET valve, install the load ring (key 26).
8. Mount the bonnet on the valve body and complete assembly according to steps 10 through 14 of the Replacing Packing procedure. Be sure to observe the note prior to step 10.

Assembly for R31233 DST Constructions

After all trim maintenance has been completed, reassemble the valve by following the numbered steps below. Be certain that all gasket surfaces have been well cleaned.



CAUTION

Inspect the gasket surfaces of all parts. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm / 0.003 in. in height can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, because they will prevent the gaskets from sealing properly.

Proceed as appropriate:

For construction with a one-piece cage:

1. Install the body-cage gasket (key 19) into the gasket surface in the bottom of the valve body (key 1). Install the cage (key 2) into the valve body, being careful that the gasket remains in proper alignment.
2. If a bonnet spacer (key 3) is used in the assembly, install a new body-to-bonnet spacer gasket (key 68) into the groove on top of the valve. Lower the bonnet spacer onto the valve body.
3. Install the spiral wound gaskets (key 65) on top of the cage (key 2).
4. Install new seal ring (key 8) on the valve plug (see the Valve Plug Maintenance section). Inspect and replace as necessary. Install the valve plug/stem assembly (key 5) into the cage (key 2), being careful not to damage the rings, make sure the plug/stem assembly is properly centered on the seating position. Also, make sure the valve plug sealing parts are evenly engaged by the chamfer in the top inside diameter of the cage (key 2).
5. Install a new bonnet gasket (key 11) into the gasket groove of the bonnet spacer (key 3, if equipped). Slide the bonnet (key 18) over the valve stem and complete the assembly according to steps 11 through 15 of the Replacing Packing section. Be sure to observe the note and caution prior to step 11.

For construction with multi-cage elements:

1. Install the body-cage gasket (key 19) into the gasket surface in the bottom of the valve body (key 1). Install the lower cage (key 2B) into the valve body, being careful the gasket remains in proper alignment.
2. If a separated seat ring part (key 4) is used in the assembly (see Figure 25), install the gasket (key 12) into the gasket seating surface on the top of the lower cage (key 2B). Install the seat ring (key 4) into the valve body, being careful that the gasket remains in proper alignment. The seat ring must fit over the guide boss on the lower cage.
3. If a bonnet spacer (key 3) is used in the assembly, install a new body-to-bonnet spacer gasket (key 68) into the groove on top of the valve body (key 1). Lower the bonnet spacer onto the valve body. For NPS 6 design, the upper cage (key 2A) should be installed first, then the bonnet spacer (key 3).

For NPS 6, 3-stage (see Figure 24), a gasket (key 12) is used between upper cage (key 2A) and lower cage (key 2B). Install the gasket into the gasket seating surface on the top of the lower cage (key 2B). Install the upper cage (key 2A) into the valve body, being careful that the gasket remains in proper alignment. The upper cage (key 2A) must fit over the guide boss on the lower cage (key 2B). Install the spiral wound gaskets (key 65) next and then the bonnet spacer (key 3).

4. Install the upper cage (key 2A) on top of the seat ring (key 4) or lower cage (key 2B) depending on different constructions. Attention should be paid to make sure appropriate guiding and fit. Install the spiral wound gasket (key 65) or load ring (key 69 in Figure 25) on top of the upper cage (key 2A).

5. Install new seal on the valve plug (see the Valve Plug Maintenance section). Inspect and replace as necessary. Install the valve plug/stem assembly (key 5) into the cage(s), being careful not to damage the rings, make sure the plug/stem assembly is properly centered on the seating position. Also, make sure the valve plug sealing parts are evenly engaged by the chamfer in the top inside diameter of the cage.
6. Install a new bonnet gasket (key 11) into the gasket groove of the bonnet spacer (key 3, if equipped). Slide the bonnet (key 18) over the valve stem and complete the assembly according to steps 11 through 15 of the Replacing Packing section. Be sure to observe the note and caution prior to step 11.

3.4 ENVIRO-SEAL Bellows Seal Bonnet

Replacing a Plain or Extension Bonnet with an ENVIRO-SEAL Bellows Seal Bonnet (Stem/Bellows Assembly)

1. Remove the actuator and bonnet according to steps 1 through 5 of the Replacing Packing procedure in the Maintenance section.
2. With care, remove the valve plug and stem assembly from the valve body. If necessary, also lift out the cage.



CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to protect the sealing surfaces and to prevent foreign material from getting into the valve body cavity.

3. Remove and discard the existing bonnet gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

NOTE

The ENVIRO-SEAL stem/bellows assembly for easy-e valves is available only with a threaded and drilled plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed.

4. Inspect the existing valve plug. If the plug is in good condition, it can be reused with the new ENVIRO-SEAL stem/bellows assembly. To remove the existing valve plug from the stem, first, place the existing plug stem assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 8).
5. Reverse the plug stem assembly in the soft-jaw chuck or vise. Grip the valve stem in an appropriate place and unscrew the existing plug from the valve stem.

Table 6. Recommended Torque for ENVIRO-SEAL Bellows Seal Packing Flange Nuts

VALVE SIZE, NPS	VALVE STEM DIAMETER THROUGH PACKING	MINIMUM TORQUE		MAXIMUM TORQUE	
		N·m	Lbf·in	N·m	Lbf·in
1 to 2	1/2	2	22	4	33
3 to 8	1	5	44	8	67

**CAUTION**

When installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

To avoid product damage, do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

NOTE

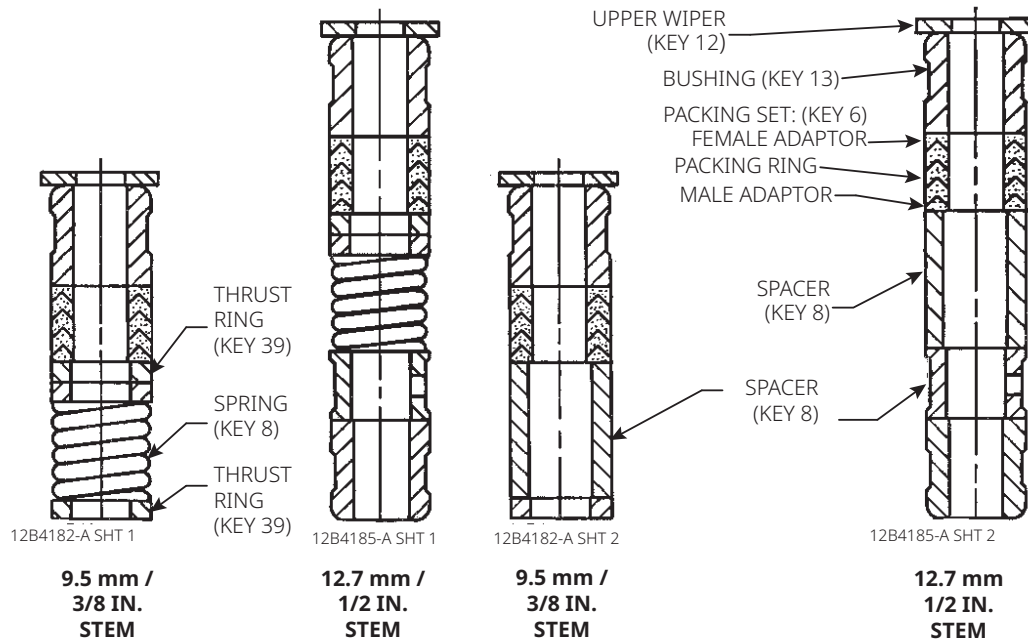
The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

**CAUTION**

To avoid damaging parts, do not grip the valve plug on any seating surface in the following procedure.

6. To attach the valve plug to the stem of the new ENVIRO-SEAL stem/bellows assembly, first attach the plug to the adaptor (key 24). Locate the adaptor. Notice that a hole has not been drilled in the threads where the plug screws onto the adaptor. Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor. Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Select the proper size of drill bit and drill through the adaptor using the hole in the valve plug as a guide. Remove any metal chips or burrs and drive in a new pin to lock the plug/adaptor assembly together.
8. Attach the plug/adaptor assembly to the ENVIRO-SEAL stem/bellows assembly by first securing the stem/bellows assembly in a soft-jaw chuck or other type of vise so that the jaws of the chuck or vise grip the flats of the stem extending out of the top of the bellows shroud. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.
9. Inspect the seat ring (key 9) and soft seat parts (keys 21, 22 and 23); replace, if necessary.
10. Place a new gasket (key 10) into the valve body in place of the bonnet gasket. Install the new stem/bellows assembly with valve plug/adaptor by placing it into the valve body on top of the new bellows gasket.
11. Place a new gasket (key 22) over the stem/bellows assembly. Place the new ENVIRO-SEAL bonnet over the stem/bellows assembly.

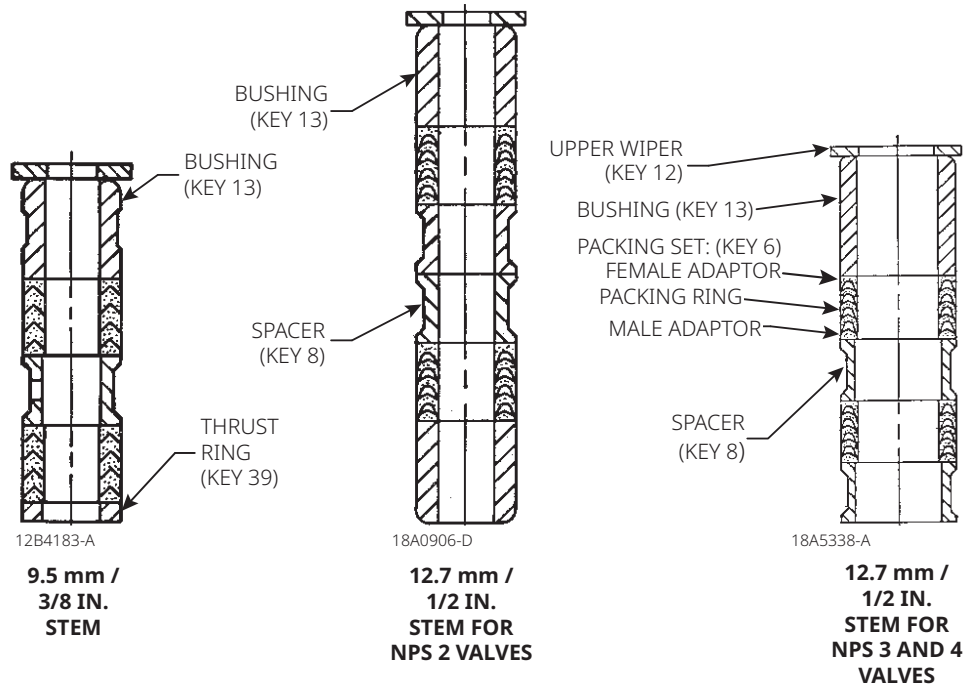
Figure 8. PTFE Packing Arrangements for Use in ENVIRO-SEAL Bellows Seal Bonnets



**FOR S31600 (316 SST)
PACKING BOX PARTS**

**FOR ALL PACKING BOX
MATERIALS EXCEPT S31600**

SINGLE ARRANGEMENTS



DOUBLE ARRANGEMENTS

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

**CAUTION**

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

12. Properly lubricate the bonnet stud bolts. Install and tighten the bonnet hex nuts to the proper torque.
13. Install new packing and the metal packing box parts according to the appropriate arrangement in Figure 8 or 9.
14. Install the packing flange. Properly lubricate the packing flange stud bolts and the faces of the packing flange nuts.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in Table 6. Then, loosen the packing flange nuts and retighten them to the recommended minimum torque shown in Table 6.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in Table 6. Then, tighten the remaining flange nut until the packing flange is level and at a 90° angle to the valve stem.
15. Install travel indicator parts and stem locknuts; mount the actuator on the valve body according to the procedure in the appropriate actuator instruction manual.

Replacement of an Installed ENVIRO-SEAL Bellows Seal Bonnet (Stem/Bellows Assembly)

1. Remove the actuator and bonnet according to steps 1 through 5 of the Replacing Packing procedure in the Maintenance section.

**CAUTION**

To prevent possible product damage, cover the opening in the valve in the following procedure to protect the sealing surfaces and to prevent foreign material from getting into the valve body cavity.

2. Carefully remove the ENVIRO-SEAL stem/bellows assembly. If necessary, also lift out the cage. Remove and discard the existing bonnet gasket and bellows gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.



CAUTION

The ENVIRO-SEAL stem/bellows assembly for easy-e valves is available only with a threaded and drilled plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed. If the existing valve plug is reused and the adaptor is in good condition, it may be also reused. However, never reuse an old adaptor with a new valve plug. Using an old adaptor with a new valve plug requires drilling a new pin hole in the adaptor. This drilling weakens the adaptor and may cause failure in service. However, a used valve plug may be reused with a new adaptor, except with Cavitrol III trim.

3. Inspect the existing valve plug and adaptor. If they are in good condition, they can be reused with the new stem/bellows assembly and they do not need to be separated.



CAUTION

When removing/installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

To avoid product damage, do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

NOTE

The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

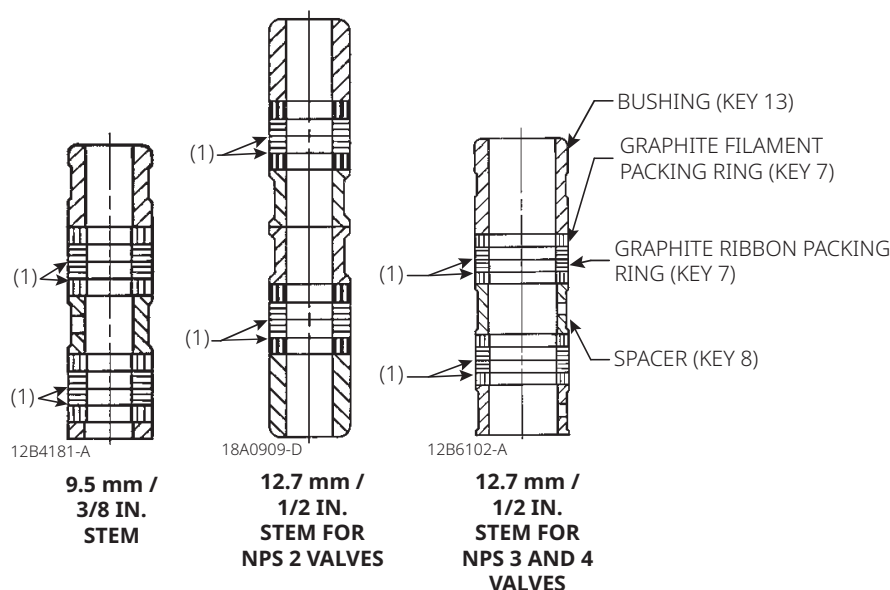
4. If the valve plug and adaptor are not in good condition and must be replaced, first remove the valve plug/adaptor assembly from the stem/bellows assembly; then remove the valve plug from the adaptor. First, place the stem/bellows assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 8, Figure 16, 17 or 20). Drive out the pin (key 36, Figure 14).
5. Reverse the stem/bellows and plug/adaptor assembly in the soft-jaw chuck or vise. Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the plug/adaptor assembly from the stem/bellows assembly. Unscrew the valve plug from the adaptor.

6. To attach either the existing valve plug or a new one to the stem of the new ENVIRO-SEAL stem/bellows assembly, first attach the plug to the adaptor (if the valve plug was removed from the adaptor) as follows:
 - a. Locate the adaptor. Notice that a hole has not been drilled in the threads where the plug screws onto the adaptor.

CAUTION

To avoid damaging parts, do not grip the valve plug on any seating surface in the following procedure.

Figure 9. Double Graphite Ribbon/Filament Arrangements for Use in ENVIRO-SEAL Bellows Seal Bonnets



A5870

NOTE:

1. 0.102 mm / 0.004 IN. THICK SACRIFICIAL ZINC WASHERS; USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

- b. Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor.
 - c. Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Complete the installation by following steps 7 through 9 and steps 12 through 15 of the ENVIRO-SEAL Bellows Seal Bonnet installation instructions found on pages 25 through 28.

Purging the ENVIRO-SEAL Bellows Seal Bonnet

The ENVIRO-SEAL bellows seal bonnet can be purged or leak tested. Refer to Figure 14 for an illustration of an ENVIRO-SEAL bellows seal bonnet and perform the following steps for purging or leak testing.

1. Remove the two diametrically opposed pipe plugs (key 16).
2. Connect a purging fluid to one of the pipe plug connections.
3. Install appropriate piping or tubing in the other pipe plug connection to pipe away the purging fluid or to make a connection to an analyzer for leak testing.
4. When purging or leak testing has been completed, remove the piping or tubing and reinstall the pipe plugs (key 16).

Table 7. Standard Material Designations

Standard Designation	Common Name or Tradename
CoCr-A Hardfacing alloy R30006 S17400 SST S31600 SST	CoCr-A Alloy 6 casting 17-4PH Stainless steel 316 Stainless steel
S41000 SST S41600 SST WCC Carbon steel casting	410 Stainless steel 416 Stainless steel WCC

Section 4: Parts

4.1 Parts Ordering

Each body-bonnet assembly is assigned a serial number which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and to the eleven-character part number for each part required from the following parts kit or parts list information.

Refer to Table 7 for standard and common material designations.

NOTE

If the valve contains Trim Cartridge (Trim Cartridges can be identified by a name plate on the bonnet flange, the use of a packing nut and "Fisher" embossed below the yoke mounting), please refer to Fisher ET and EZ easy-e Valves with Trim Cartridge Instruction Manual ([D104358X012](#)) for parts ordering guidance.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

4.2 Parts Kits

Gasket Kits

Gasket Kits (includes keys 10, 11, 12, 13 and 51; plus 14 and 20 on some restricted capacity valves)

DESCRIPTION	Standard Trim Cage Whisper Trim I Cage Cavitrol III - 1 Stage Cage	Cavitrol III - 2 Stage Cage Whisper Trim III/NXG Cage WhisperFlo Cage
	-198 to +593°C / -325 to +1100°F	-198 to +593°C / -325 to +1100°F
Full Capacity Valves	Part Number	Part Number
NPS 1 and 1-1/4	RGASKETX162	RGASKETX422
NPS 1-1/2 (NPS 2 EAT)	RGASKETX172	RGASKETX432
NPS 2	RGASKETX182	RGASKETX442
NPS 2-1/2 (NPS 3 EAT)	RGASKETX192	RGASKETX452
NPS 3 (NPS 4 EAT)	RGASKETX202	RGASKETX462
NPS 4 (NPS 6 EAT)	RGASKETX212	RGASKETX472
NPS 6	RGASKETX222	RGASKETX482
NPS 8	RGASKETX232	10A3265X152
Restricted Capacity Valves with Metal Seating	Part Number	Part Number
NPS 1-1/2 x 1 (NPS 2 x 1 EAT)	RGASKETX242	---
NPS 2 x 1	RGASKETX252	---
NPS 2-1/2 x 1-1/2 (NPS 3 x 1-1/2 EAT)	RGASKETX262	---
NPS 3 x 2 (NPS 4 x 2 EAT)	RGASKETX272	---
NPS 4 x 2-1/2 (NPS 6 x 2-1/2 EAT)	RGASKETX282	---

4.3 Packing Kits

Standard Packing Repair Kits (Non Live-Loaded)

REPAIR KIT MATERIAL	STEM DIAMETER, mm / IN. YOKE BOSS DIAMETER, mm / IN.				
	9.5 / 3/8 54 / 2-1/8	12.7 / 1/2 71 / 2-13/16	19.1 / 3/4 90 / 3-9/16	25.4 / 1 127 / 5	31.8 / 1-1/4 127 / 5, 5H
	Part Number				
PTFE (Contains keys 6, 8, 10, 11 and 12)	RPACKX00012	RPACKX00022	RPACKX00032	RPACKX00342	RPACKX00352
Double PTFE (Contains keys 6, 8, 11 and 12)	RPACKX00042	RPACKX00052	RPACKX00062	RPACKX00362	RPACKX00372
PTFE/Composition (Contains keys 7, 8, 11 and 12)	RPACKX00072	RPACKX00082	RPACKX00092	---	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8 and 11)	RPACKX00102	RPACKX00112	RPACKX00122	---	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring] and 11)	---	---	---	RPACKX00532	RPACKX00542
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring])	RPACKX00132	RPACKX00142	RPACKX00152	---	---
Double Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8 and 11)	RPACKX00162	RPACKX00172	RPACKX00182	---	---

ENVIRO-SEAL Packing Retrofit Kits

Retrofit kits include parts to convert valves with existing standard bonnets to the ENVIRO-SEAL packing box construction. Refer to Figure 11 for key numbers for PTFE packing, to Figure 12 for key numbers for Graphite ULF packing and to Figure 13 for key numbers for duplex packing. PTFE kits include keys 200, 201, 211, 212, 214, 215, 216, 217, 218, tag and cable tie. Graphite ULF kits include keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 217, tag and cable tie. Duplex kits include keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag and cable tie.

Stems and packing box constructions that do not meet Emerson stem finish specifications, dimensional tolerances and design specifications, may adversely alter the performance of this packing kit.

For part numbers of individual components in the ENVIRO-SEAL packing kits, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#).

ENVIRO-SEAL Packing Retrofit Kits

PACKING MATERIAL	STEM DIAMETER, mm / IN. YOKE BOSS DIAMETER, mm / IN.				
	9.5 / 3/8 54 / 2-1/8	12.7 / 1/2 71 / 2-13/16	19.1 / 3/4 90 / 3-9/16	25.4 / 1 127 / 5	31.8 / 1-1/4 127 / 5, 5H
	Part Number				
Double PTFE	RPACKXRT012	RPACKXRT022	RPACKXRT032	RPACKXRT042	RPACKXRT052
Graphite ULF	RPACKXRT262	RPACKXRT272	RPACKXRT282	RPACKXRT292	RPACKXRT302
Duplex	RPACKXRT212	RPACKXRT222	RPACKXRT232	RPACKXRT242	RPACKXRT252

ENVIRO-SEAL Packing Repair Kits

Repair kits include parts to replace the “soft” packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits. Refer to Figure 11 for key numbers for PTFE packing, to Figure 12 for key numbers for Graphite ULF packing and to Figure 13 for key numbers for duplex packing. PTFE repair kits include keys 214, 215 and 218. Graphite ULF repair kits include keys 207, 208, 209, 210 and 214. Duplex repair kits include keys 207, 209, 214 and 215.

Stems and packing box constructions that do not meet Emerson stem finish specifications, dimensional tolerances and design specifications, may adversely alter the performance of this packing kit.

For part numbers of individual components in the ENVIRO-SEAL packing kits, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#).

ENVIRO-SEAL Packing Repair Kits

PACKING MATERIAL	STEM DIAMETER, mm / IN. YOKE BOSS DIAMETER, mm / IN.				
	9.5 / 3/8 54 / 2-1/8	12.7 / 1/2 71 / 2-13/16	19.1 / 3/4 90 / 3-9/16	25.4 / 1 127 / 5	31.8 / 1-1/4 127 / 5, 5H
	Part Number				
Double PTFE (Contains keys 214, 215 and 218)	RPACKX00192	RPACKX00202	RPACKX00212	RPACKX00222	RPACKX00232
Graphite ULF (Contains keys 207, 208, 209, 210 and 214)	RPACKX00592	RPACKX00602	RPACKX00612	RPACKX00622	RPACKX00632
Duplex (Contains keys 207, 209, 214 and 215)	RPACKX00292	RPACKX00302	RPACKX00312	RPACKX00322	RPACKX00332

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D100398X012

ET Valve

February 2026

easy-e Low-e Bonnet Repair Kits

Kit consists of plain bonnet, Graphite / Inconel gasket set, ENVIRO-SEAL packing retro-fit kit, packing flange, packing flange studs and nuts. New stem is not included.

Bonnet Material	Packing Type	Valve Size, NPS	Stem Size, in.	Part Number
WCC ⁽¹⁾	ENVIRO-SEAL PTFE	0.5 to 1.25	3/8	RLEPBNTX012
		1.5	3/8	RLEPBNTX022
		2	1/2	RLEPBNTX032
		2.5	1/2	RLEPBNTX042
		3	1/2	RLEPBNTX052
		4	1/2	RLEPBNTX062
		6	3/4	RLEPBNTX072
	ENVIRO-SEAL Graphite ULF	0.5 to 1.25	3/8	RLEPBNTX152
		1.5	3/8	RLEPBNTX162
		2	1/2	RLEPBNTX172
		2.5	1/2	RLEPBNTX182
		3	1/2	RLEPBNTX192
		4	1/2	RLEPBNTX202
		6	3/4	RLEPBNTX212
SST ⁽¹⁾	ENVIRO-SEAL PTFE	0.5 to 1.25	3/8	RLEPBNTX082
		1.5	3/8	RLEPBNTX092
		2	1/2	RLEPBNTX102
		2.5	1/2	RLEPBNTX112
		3	1/2	RLEPBNTX122
		4	1/2	RLEPBNTX132
	ENVIRO-SEAL Graphite ULF	0.5 to 1.25	3/8	RLEPBNTX222
		1.5	3/8	RLEPBNTX232
		2	1/2	RLEPBNTX242
		2.5	1/2	RLEPBNTX252
		3	1/2	RLEPBNTX262
		4	1/2	RLEPBNTX272
WCC	ENVIRO-SEAL Duplex	0.5 to 1.25	3/8	RLEPBNTX292
		1.5	3/8	RLEPBNTX302
		2	1/2	RLEPBNTX322
		2.5	1/2	RLEPBNTX332
		3	1/2	RLEPBNTX342
		4	1/2	RLEPBNTX352
		6	3/4	RLEPBNTX362
SST	ENVIRO-SEAL Duplex	0.5 to 1.25	3/8	RLEPBNTX372
		1.5	3/8	RLEPBNTX392
		2	1/2	RLEPBNTX412
		2.5	1/2	RLEPBNTX422
		3	1/2	RLEPBNTX432
		4	3/4	RLEPBNTX442
1. Compliant with NACE MR0175-2003 and prior, NACE MR0175 / ISO 15156 (all revisions) and NACE MR0103 (all revisions).				

Figure 10. Typical HIGH-SEAL Graphite ULF Packing System

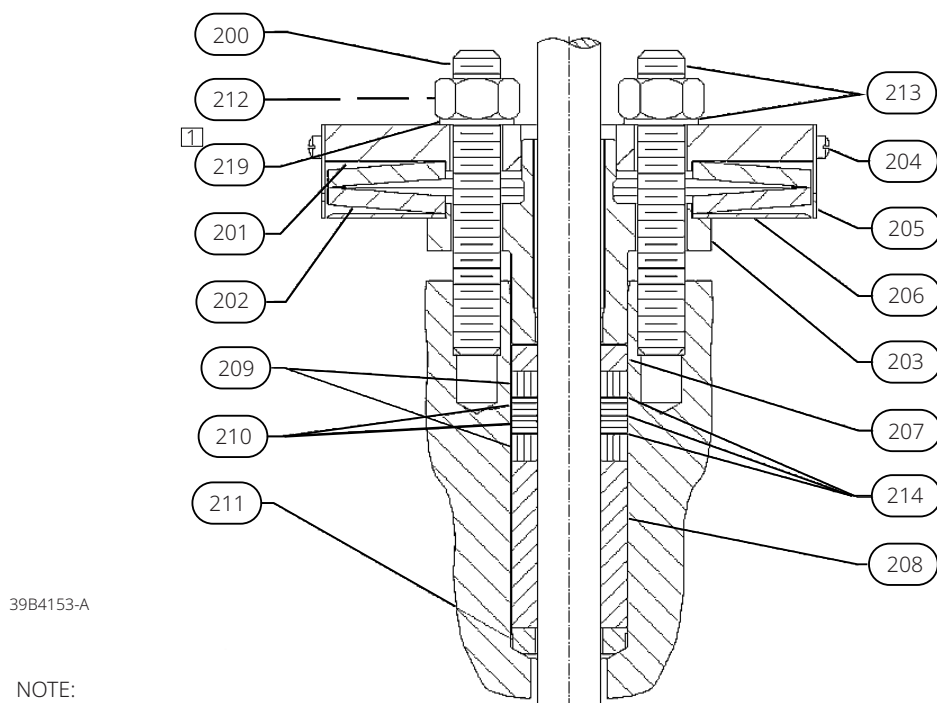


Figure 11. Typical ENVIRO-SEAL Packing System with PTFE Packing

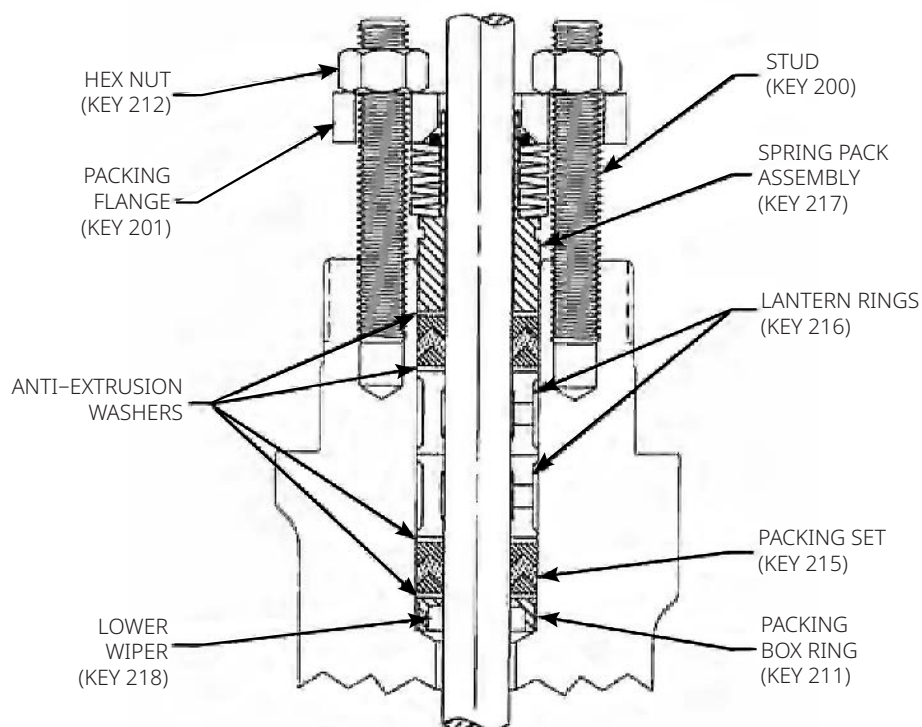
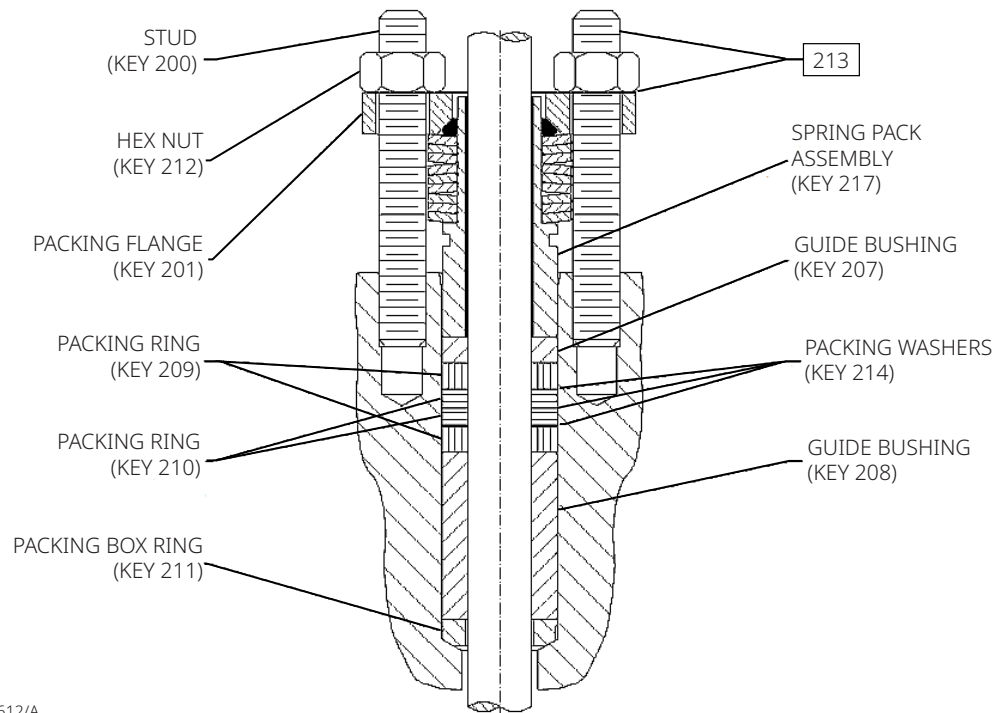
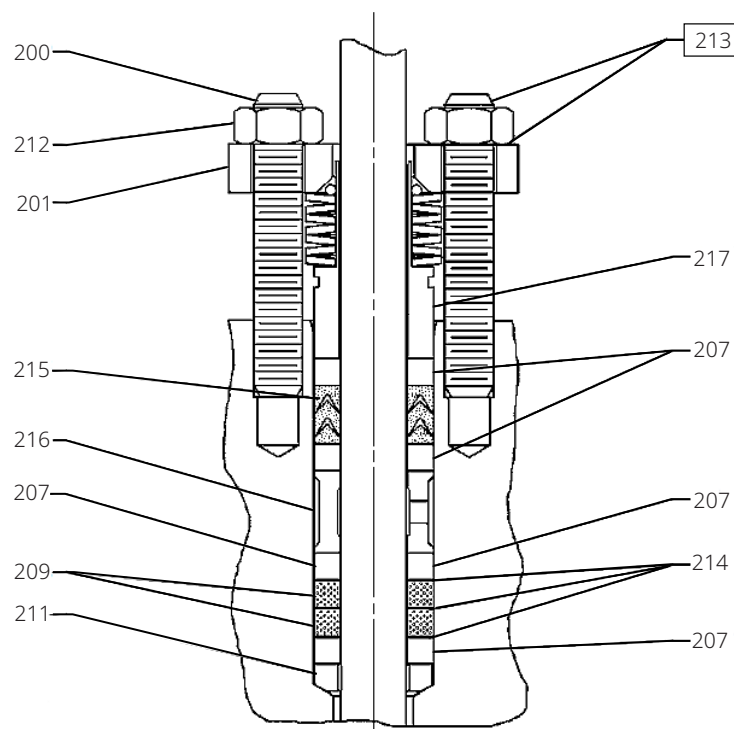


Figure 12. Typical ENVIRO-SEAL Packing System with Graphite ULF Packing



39B4612/A

Figure 13. Typical ENVIRO-SEAL Packing System with Duplex Packing



A6722

4.4 Parts List

NOTE

Contact your [Emerson sales office](#) for part numbers.

Bonnet (Figures 3 through 9, Figure 14)

Key	Description	Key	Description
1	Bonnet/ENVIRO-SEAL bellows seal bonnet If you need a bonnet or an ENVIRO-SEAL bellows seal bonnet as a replacement part, order by valve size and stem diameter, serial number and desired material.	13*	ENVIRO-SEAL bellows seal bushing/liner
2	Extension bonnet baffle	14	Pipe plug
3	Packing flange	14	Lubricator
3	ENVIRO-SEAL bellows seal packing flange	14	Lubricator/Isolating valve
4	Packing flange stud	15	Yoke locknut
4	ENVIRO-SEAL bellows seal stud bolt	15	ENVIRO-SEAL bellows seal locknut
5	Packing flange nut	16	Pipe plug
5	ENVIRO-SEAL bellows seal hex nut	16	ENVIRO-SEAL bellows seal pipe plug
6*	Packing set	20*	ENVIRO-SEAL bellows seal stem/bellows assembly
6*	ENVIRO-SEAL bellows seal packing set	22*	ENVIRO-SEAL bellows seal bonnet gasket
7*	Packing ring	24	ENVIRO-SEAL bellows seal adaptor
7*	ENVIRO-SEAL bellows seal packing ring	25	Cap screw
8	Spring	26	Hex nut
8	Lantern ring	27	Pipe nipple for lubricator/isolating valve
8	ENVIRO-SEAL bellows seal spring	28	ENVIRO-SEAL bellows seal nameplate, warning
8	ENVIRO-SEAL bellows seal spacer	29	ENVIRO-SEAL bellows seal drive screw
10	Special washer	34	Lubricant, Anti-seize (not included with valve)
11*	Packing box ring	36*	ENVIRO-SEAL bellows seal pin
12*	Upper wiper	37	ENVIRO-SEAL bellows seal warning tag
12*	ENVIRO-SEAL bellows seal upper wiper	38	ENVIRO-SEAL bellows seal tie
13	Packing follower	39	ENVIRO-SEAL bellows seal thrust ring
13*	ENVIRO-SEAL bellows seal bushing	- - -	- - -

*Recommended spare parts

Figure 14. Typical Bonnets

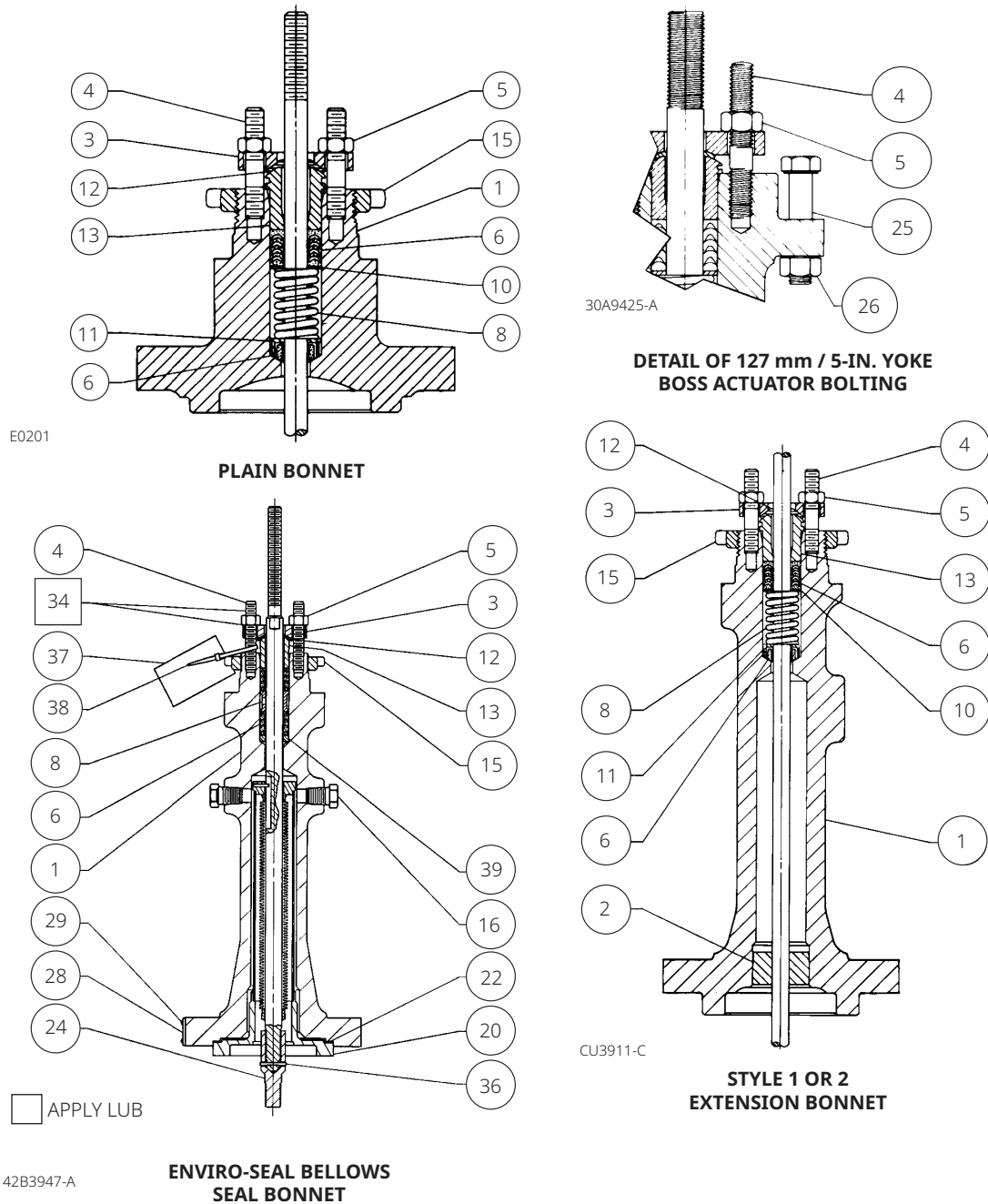
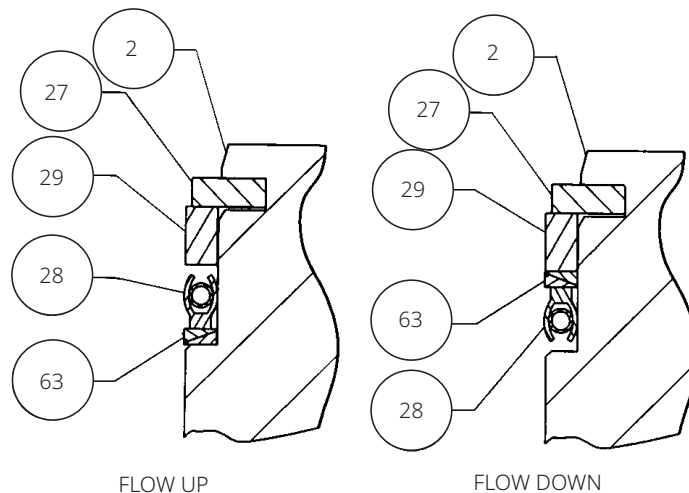


Figure 15. Alternate Configurations

21B2120-A
A6137

NPS 1 TO 8 ET USING PEEK ANTI-EXTRUSION RINGS

Valve Body (Figures 16 through 21)

Key	Description	Key	Description
1	Valve body If you need a valve body as a replacement part, order by valve size, serial number and desired material.	19	Drive screw
2*	Valve plug	20*	Adaptor gasket
3*	Cage	21*	Seat disk retainer
4	Trim adaptor	22*	Disk seat
5	Trim adaptor	23*	Disk
7*	Valve plug stem	24*	Seal ring (EAT)
8*	Pin	25*	Backup ring (EAT)
9*	Liner	26	Load ring (for NPS 8 ET only)
9*	Seat ring	27*	Retaining ring
10*	Bonnet gasket	27*	Shim (EAT)
11*	Cage gasket	28*	Seal ring (ET)
12*	Spiral-wound gasket	29*	Backup ring (ET)
13*	Seat ring or Liner gasket	31*	Whisper Trim III cage retainer for Levels A3, B3 and C3 (NPS 6 ET only)
14*	Adaptor gasket	31*	Whisper Trim III cage retainer and baffle
15	Cap screw	32	Cavitrol III bonnet spacer
15	Stud	32	Whisper Trim III bonnet spacer (NPS 6 ET only)
16	Nut	51*	Shim
17	Pipe plug, for use in valves with drain tapping only	54	Wire
18	Flow direction arrow	63*	Anti-extrusion ring
*Recommended spare parts			

Figure 16. NPS 1 through 6 Fisher ET and EAT Valves

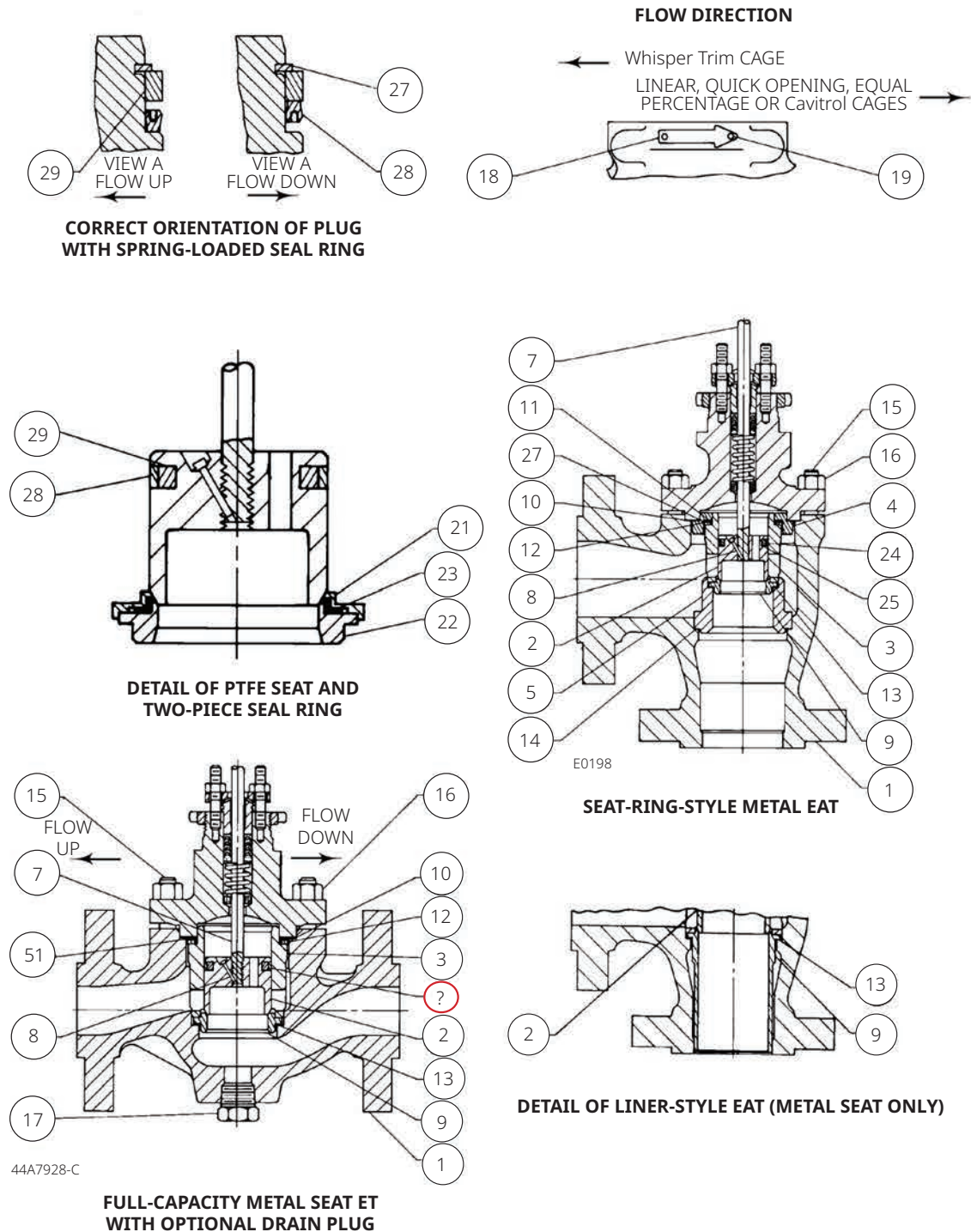
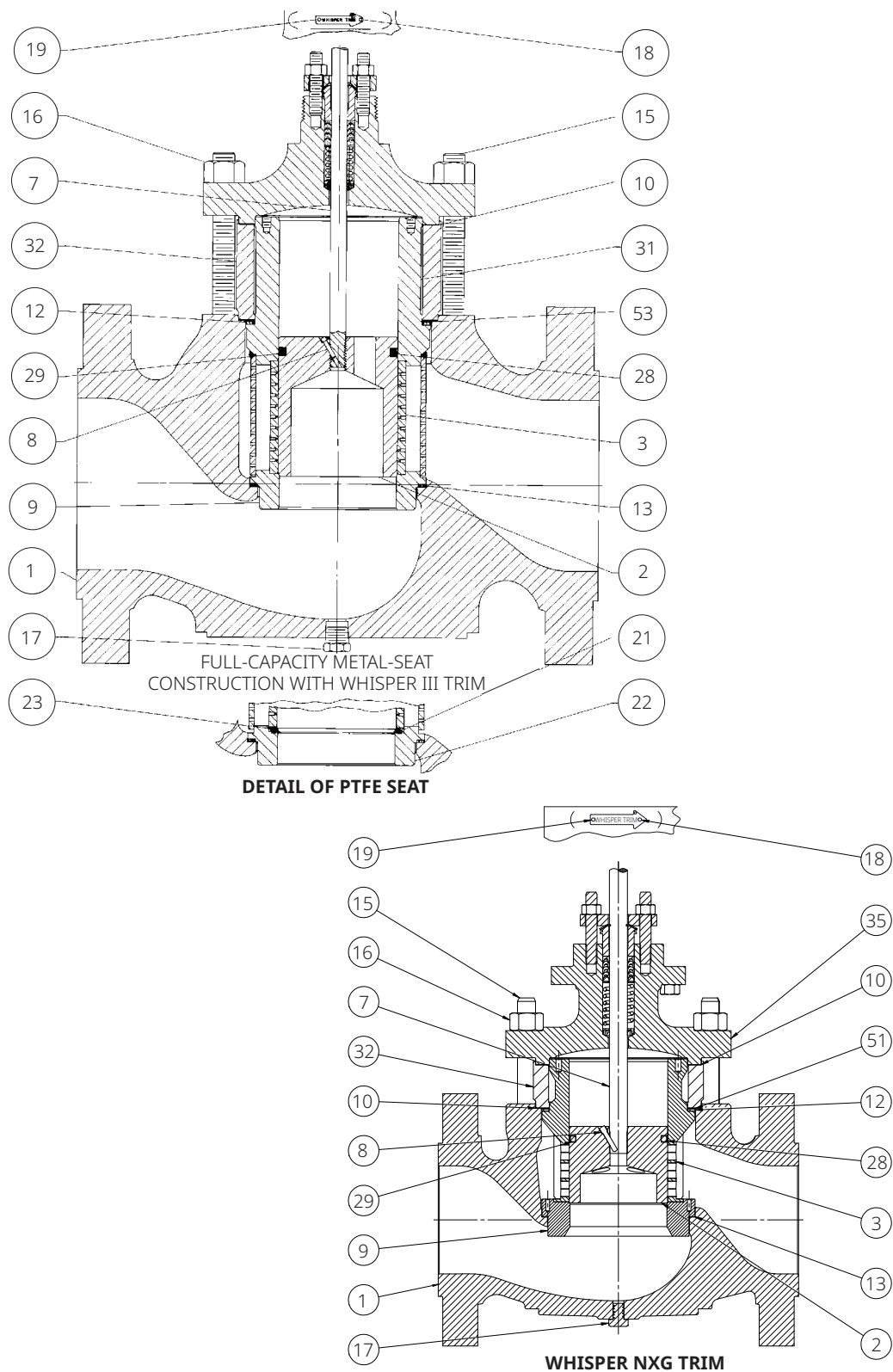
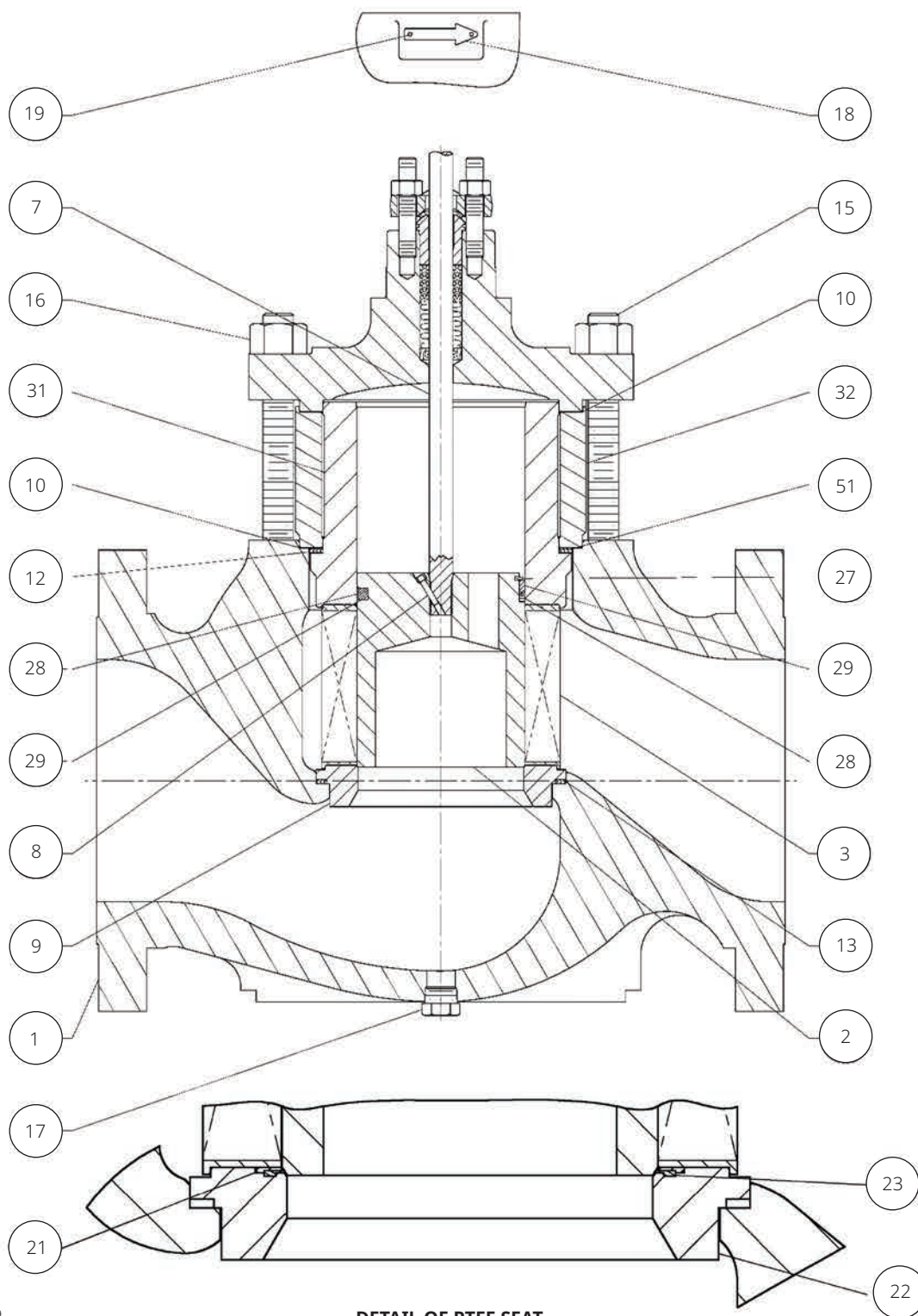


Figure 17. Fisher ET Valve Assembly with Whisper Trim III and Whisper NXG Trim Cage and Optional Drain Plug



E0197

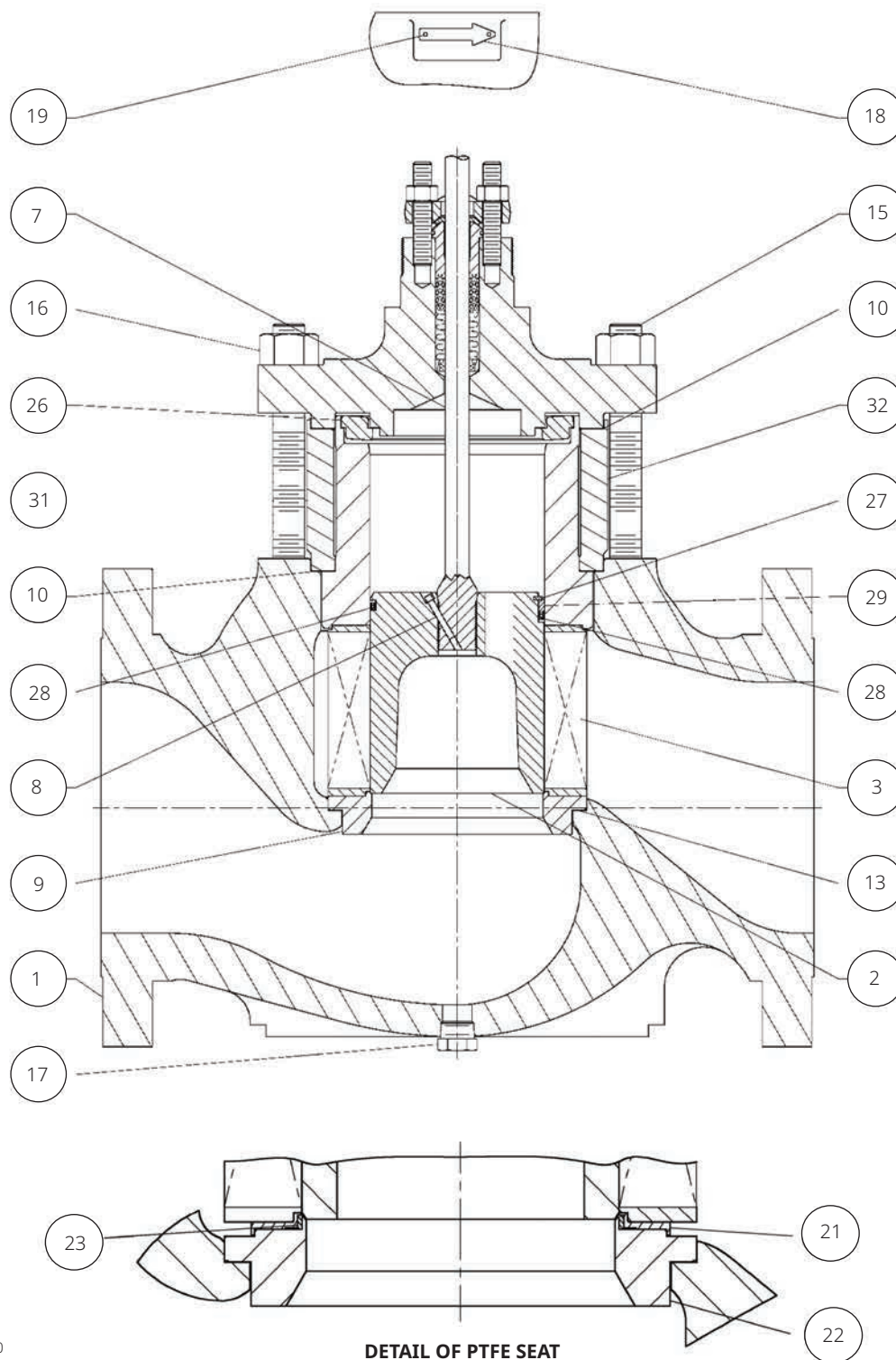
Figure 18. Fisher ET Valve Assembly with WhisperFlo Cage and Optional Drain Plug



E0199

DETAIL OF PTFE SEAT

Figure 19. NPS 8 Fisher ET Valve Assembly with WhisperFlo Cage and Optional Drain Plug



E0200

Figure 20. Details of Cavitrol III and NPS 8 Fisher ET Valves with Optional Drain Plug

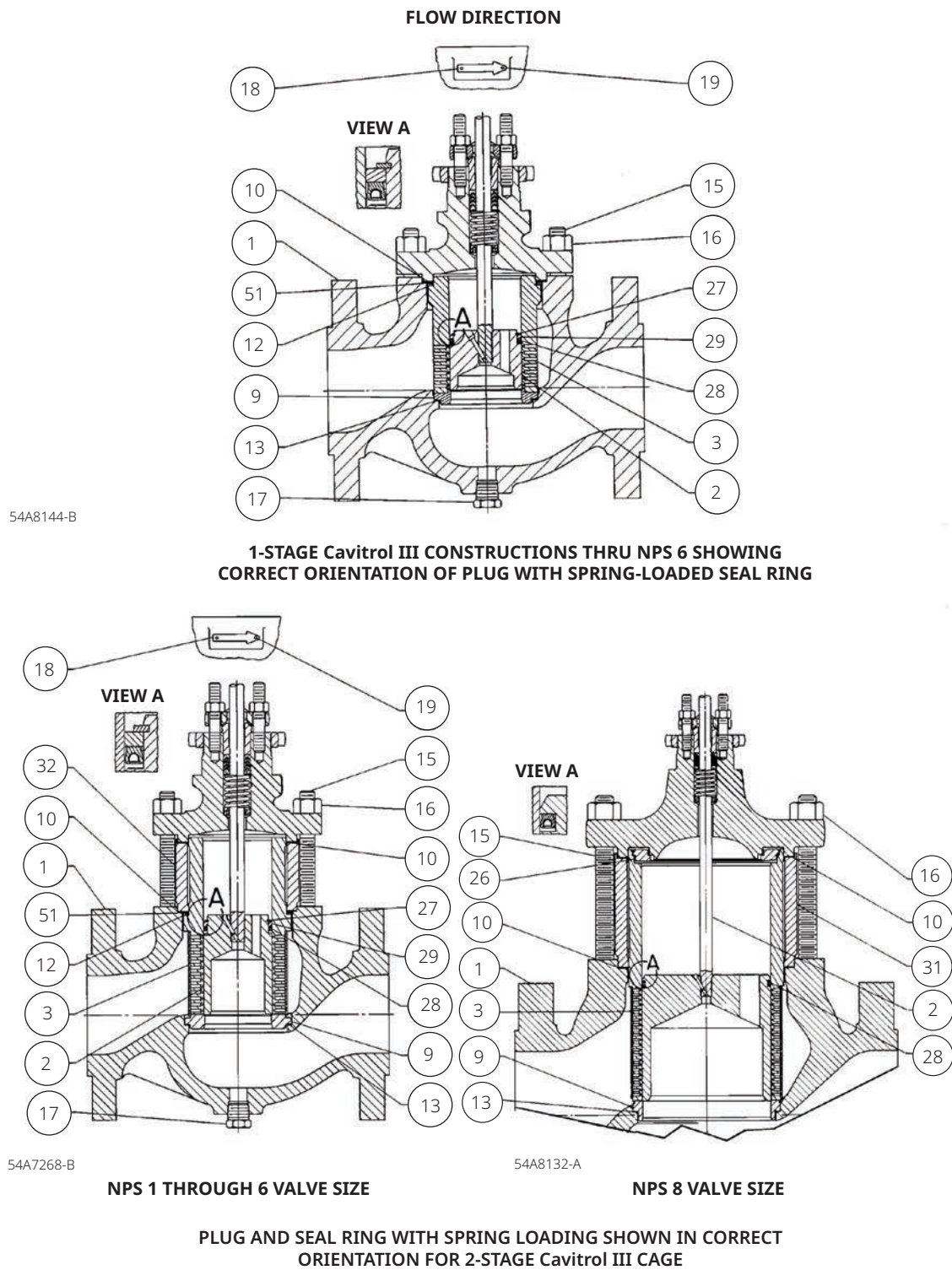
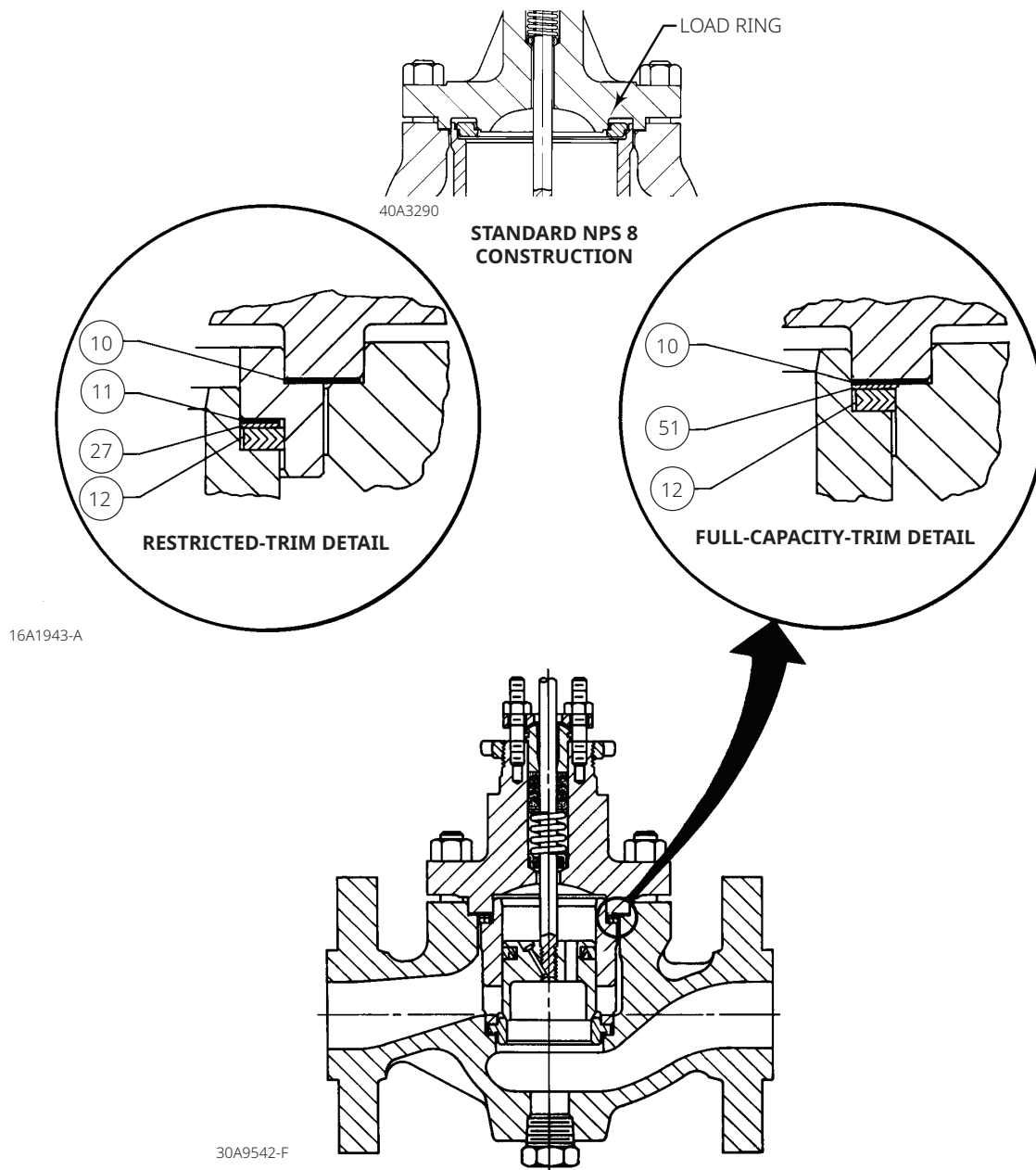


Figure 21. Gasket Set Detail Shown with Optional Drain Plug



Valve Body with R31233 DST (Figures 22 through 25)

Key	Description	Key	Description
1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number and desired material.	14	Nut, Hex, Heavy
2*	Cage (for constructions with a one-piece cage)	15	Lub, Anti-seize
2A*	Upper cage	16	Nameplate
2B*	Lower cage	17	Seal and wire
3	Bonnet spacer	18	Bonnet
4*	Seat ring	19*	Gasket
5*	Valve plug / Stem assembly	38	Screw, Drive
8*	Seal ring, Spring loaded	41	Flow arrow
9*	Ring, Back-up	63*	Ring, Anti-extrusion
10*	Ring, Retaining, Ext.	65*	Gasket, Spiral wound
11*	Bonnet gasket	68*	Gasket
12*	Gasket	69	Load ring (for NPS 8 only)
13	Stud bolt, Cont. Thd/s	---	---

*Recommended spare parts

Figure 22. Typical Valve Assembly with 2-Stage DST

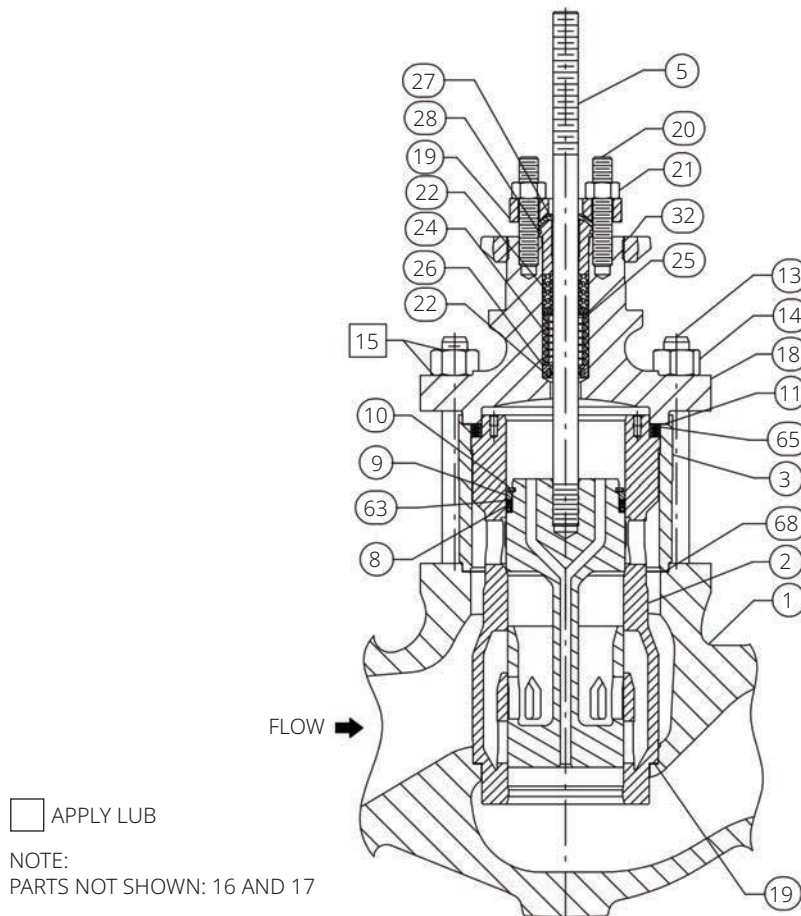


Figure 23. Typical Valve Assembly with 3-Stage DST

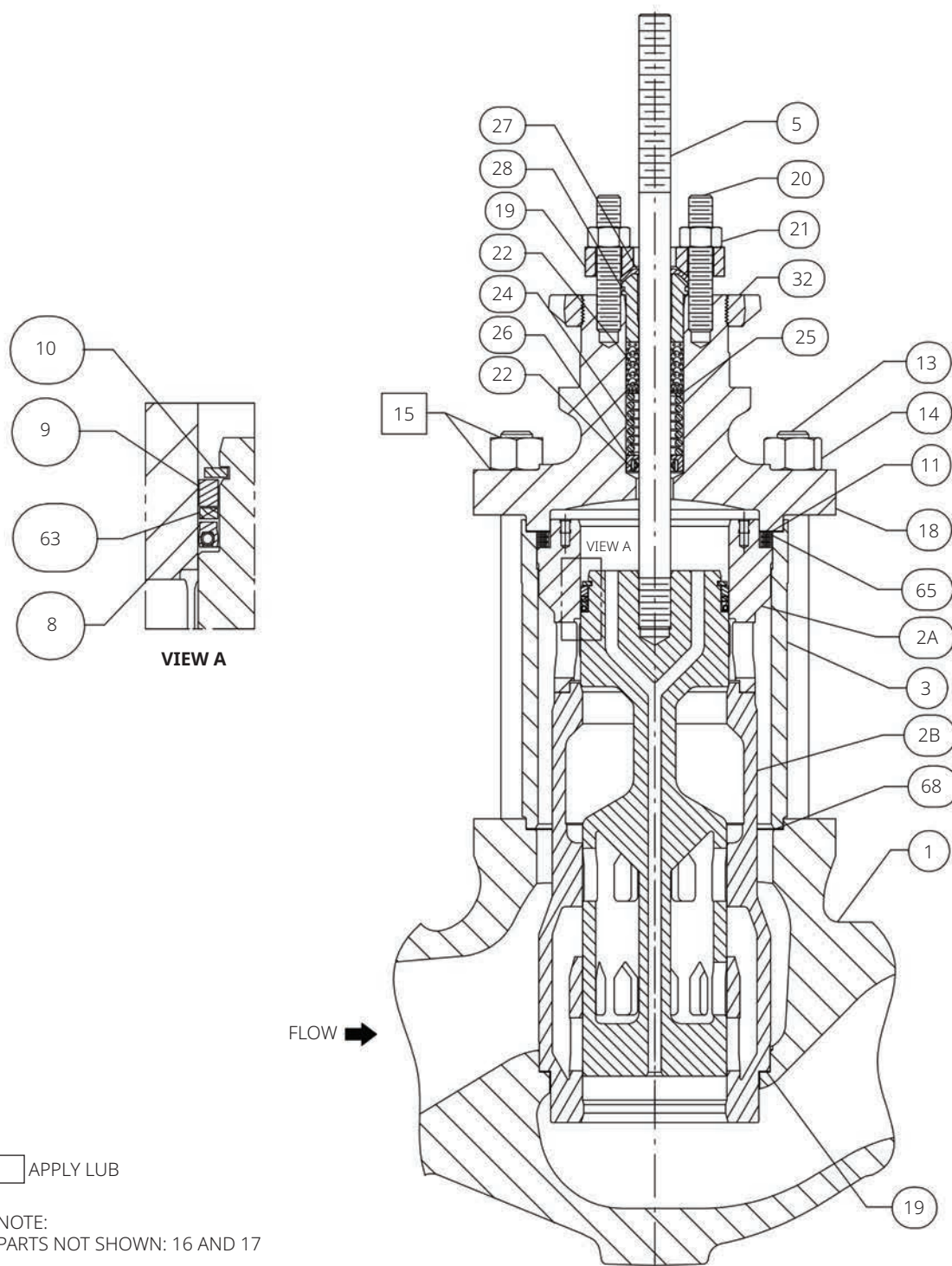


Figure 24. NPS 6 Valve Assembly with 3-Stage DST

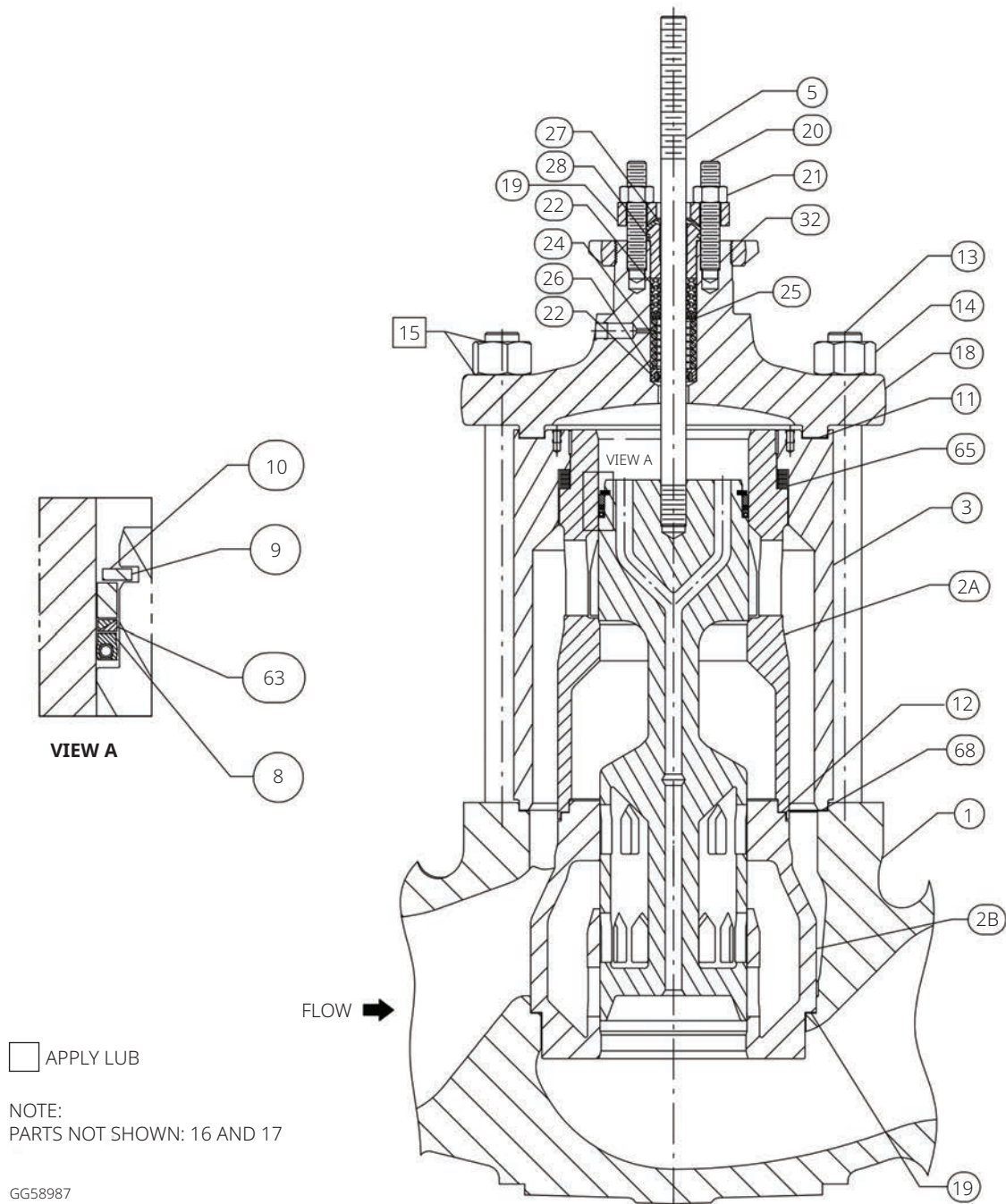
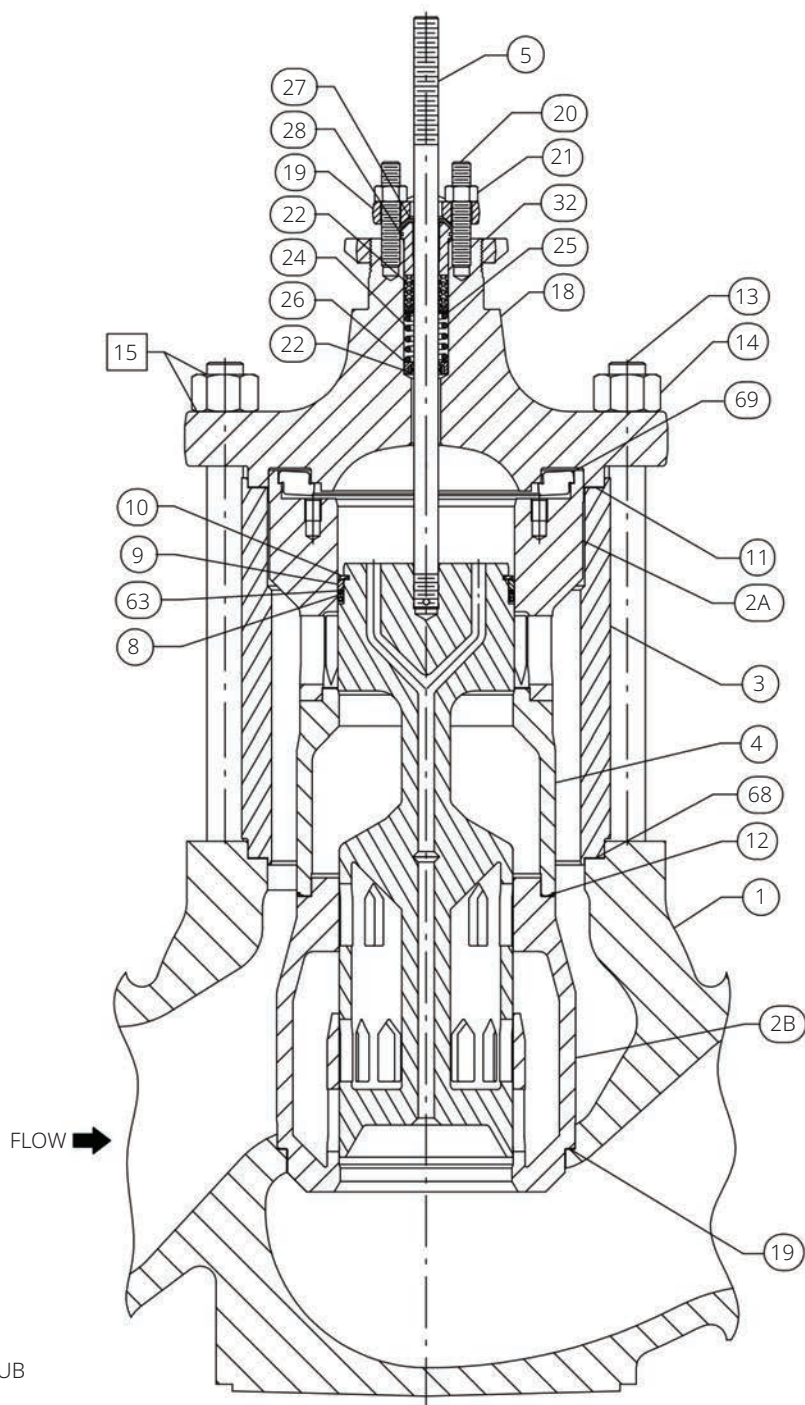


Figure 25. NPS 8 Valve Assembly with 3-Stage DST



NOTE:
PARTS NOT SHOWN: 16 AND 17

GG59212

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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ET Valve

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Actuator Groups

Group 1 54 mm / 2-1/8 in., 71 mm / 2-13/16 in. or 90 mm / 3-9/16 in. Yoke Boss	Group 100 127 mm / 5 in. Yoke Boss 3 in. maximum travel	Group 401 90.5 mm / 3-9/16 in. Yoke Boss 3.25 to 4 in. maximum travel	Group 404 127 mm / 5 in. Yoke Boss 4 in. maximum travel
585C 1B 618 644 and 645 657 and 667-76.2 mm / 3 in. maximum travel 1008-71.4 mm / 2-13/16 in. Yoke Boss	585C 657 1008	657 657 MO 657-4 657-4 MO 667 667 MO 667-4 667-4 MO	667 667-4
		Group 402 90.5 mm / 3-9/16 in. Yoke Boss 4 in. maximum travel	Group 405 127 mm / 5 in. Yoke Boss 4 in. maximum travel
			657 MO 657-4 MO
	Group 101 127 mm / 5 in. Yoke Boss 3 in. maximum travel	457-7 585C	667 MO 667-4 MO
	667	Group 403 90.5 mm / 3-9/16 in. Yoke Boss 4 in. maximum travel	Group 407 127 mm / 5 in. Yoke Boss 4 in. maximum travel
	Group 400 71.4 mm / 2-13/16 in. Yoke Boss 4 in. maximum travel	585C 1008	585C 657
	585C	Group 801 90.5 mm / 3-9/16 in. Yoke Boss 8 in. maximum travel	Group 802 127 mm / 5 in. Yoke Boss 8 in. maximum travel
		585C	585C

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Gaskets and Shims Parts Kits⁽⁸⁾

VALVE SIZE, NPS		Standard Trim Cage Whisper Trim I Cage Cavitrol III - 1 Stage Cage	Cavitrol III - 2 Stage Cage Whisper Trim III/ NXG Cage WhisperFlo Cage	VALVE SIZE, NPS		Standard Trim Cage Whisper Trim I Cage Cavitrol III - 1 Stage Cage	Cavitrol III - 2 Stage Cage Whisper Trim III/ NXG Cage WhisperFlo Cage
ET	EAT	-198 to +593°C / -325 to +1100°F		ET	EAT	-198 to +593°C / -325 to +1100°F	
		Part Number				Part Number	
1 or 1-1/4	1	RGASKETX162 ⁽¹⁾	RGASKETX422 ⁽²⁾	3	4	RGASKETX202 ⁽¹⁾	RGASKETX462 ⁽²⁾
1-1/2	2	RGASKETX172 ⁽¹⁾	RGASKETX432 ⁽²⁾	3 x 2	4 x 2	RGASKETX272 ⁽³⁾	---
1-1/2 x 1	2 x 1	RGASKETX242 ⁽⁴⁾	---	4	6	RGASKETX212 ⁽¹⁾	RGASKETX472 ⁽²⁾
2	---	RGASKETX182 ⁽¹⁾	RGASKETX442 ⁽²⁾	4 x 2-1/2	6 x 2-1/2	RGASKETX282 ⁽³⁾	---
2 x 1	---	RGASKETX252 ⁽³⁾	---	6	---	RGASKETX222 ⁽⁵⁾	RGASKETX482 ⁽²⁾
2-1/2	3	RGASKETX192 ⁽¹⁾	RGASKETX452 ⁽²⁾	8	---	RGASKETX232 ⁽⁶⁾	10A3265X152 ⁽⁷⁾
2-1/2 x 1-1/2	3 x 1-1/2	RGASKETX262 ⁽³⁾	---				
1. Kit includes key 10, 12, 13, 27 or 51 2. Kit includes key 10, qty 2; 12; 13; 51 3. Kit includes key 10, 11, 12, 13, 14, 27 or 51 4. Kit includes key 10, 11, 12, 13, 20, 27 or 51 5. Kit includes key 10, 12, 13, 51 6. Kit includes key 10 and 13 7. Kit includes key 10, qty 2; and 13 8. See table below for gasket descriptions.							

Gasket Descriptions

KEY NUMBER	DESCRIPTION	MATERIAL
		FGM -198 to +593°C / -325 to +1100°F
10 ⁽¹⁾	Bonnet gasket	Graphite/S31600
11	Cage gasket	
13	Seat ring or Liner gasket	
14 or 20	Adapter gasket	
12	Spiral-wound gasket	N06600/Graphite
27 or 51	Shim	S31600/316 SST
1. 2 req'd for 2-stage Cavitrol III cage.		

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FISHER™



Trim Cartridge for Fisher™ ET and EZ easy-e™ Control Valves

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Figure 1. Fisher ET Control Valve with Trim Cartridge and 667 Actuator



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 1 through 4 Fisher ET and EZ valves with Trim Cartridge. Refer to separate manuals for instructions covering the actuator and accessories.



Do not install, operate, or maintain an ET or EZ valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

Maximum Inlet Pressure^(1,2)**Cast Iron Valves**

Flanged: Consistent with CL125B or 250B pressure-temperature ratings per ASME B16.1

Steel and Stainless Steel Valves

Flanged: Consistent with CL150, 300, or 600⁽³⁾ pressure-temperature ratings per ASME B16.34

Screwed or Welding: Consistent with CL600 pressure-temperature ratings per ASME B16.34

Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4

■ Class IV, standard ■ Class V, optional

Flow Characteristics

■ Equal percentage ■ Linear

Flow Direction

ET Linear or Equal Percentage Cage: Normally down

EZ Linear or Equal Percentage Cage: Normally up

Approximate Weights

VALVE SIZE, NPS	TRIM CARTRIDGE WEIGHT		VALVE ASSEMBLY WEIGHT	
	kg	lb	kg	lb
1	7	14	14	30
1-1/2	8	16	20	45
2	10	22	30	67
3	15	32	54	125
4	21	46	77	170

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

2. Trim Cartridge contains a pressure retaining bonnet. Ensure Trim Cartridge is suitable for the application's required pressure class rating.

3. Certain bonnet bolting material selections may require a CL600 easy-e valve assembly to be derated. Contact your [Emerson sales office](#).

Description

Trim Cartridge is a complete control valve repair solution that incorporates a full trim recommended spare parts list (RSPPL) replacement plus a new bonnet in a single, factory assembled repair cartridge. Trim Cartridge has the same fit and function of traditional easy-e trim, making it backwards compatible into existing easy-e constructions. In addition to being pre-assembled, each Trim Cartridge is tested to ensure CL V shutoff capability and has the live loaded ENVIRO-SEAL™ packing set, allowing for a simplified installation that reduces trim repair time and complexity.

Specifications

Typical specifications for these valves are shown in table 1.

Educational Services

For information on available courses for the Fisher ET and EZ valve, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

Before installing the valve, inspect the valve and pipelines for any damage and any foreign material which may cause product damage.

1. Isolate the control valve from the pipeline pressure.
2. Release pressure and drain process media from both sides of the control valve.
3. If using a power actuator, also shut off all pressure lines to the power actuator, and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while the working on the equipment.
4. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet.
5. Disconnect the stem connector and remove the actuator from the valve by unscrewing the yoke locknut. Remove any travel indicator parts and stem locknuts from the valve stem threads.

⚠ WARNING

To avoid personal injury due to leaking fluid, avoid damaging gasket sealing surfaces on the valve body, bonnet, and cage. The surface finish of the valve stem is critical for making a good packing seal. Unless inspection reveals otherwise, assume all these parts are in good condition and protect them accordingly.

6. Loosen the body/bonnet nuts (figure 2, key 2) approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasket joint by either rocking the bonnet or prying between the bonnet and valve. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, remove the nuts completely (see figure 6, key 2).
7. Remove the bonnet and all trim components.
8. Remove and discard the cage gasket (key 4) and the bonnet gasket (key 3).
9. Clean and inspect the cage and bonnet gasket surfaces.
10. Install a new cage gasket (key 4) and a new bonnet gasket (key 3) into the valve body.

11. Install the new Trim Cartridge (key 1) into the valve body.

Note

Trim Cartridge is a single use repair solution. Once the spiral wound gasket has been compressed during installation, it may not provide the proper seat load if the Trim Cartridge is removed and reinstalled.

12. Apply lithium-based lubricant to body-to-bonnet bolting, install bolting, and tighten in a criss-cross pattern using the torque guidelines in table 2.

Note

The proper bolting procedures include--but are not limited to--ensuring that bolting threads are undamaged and lubricated, and evenly tightening the cap screws, or the nuts onto the studs, in a criss-cross pattern. Tightening one cap screw or nut may loosen an adjacent cap screw or nut. Repeat the crisscross tightening pattern several times until each cap screw or nut is tight and the body- to - bonnet seal is made.

Proper performance of the bolting procedures compresses the spiral wound gasket enough to both load and seal the cage gasket (key 4). It also compresses the bonnet gasket (key 3) enough to seal the body-to-bonnet joint.

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easy-e Trim Cartridge

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Figure 2. Fisher ET Valve with Trim Cartridge Assembly

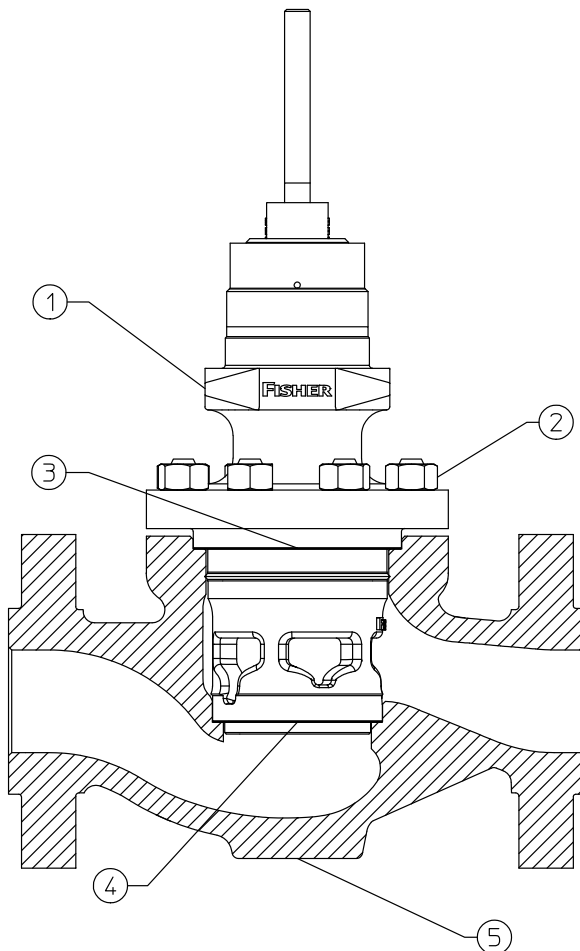


Table 2. Body-to-Bonnet Torque Guidelines using Lithium-based Lubricant⁽³⁾

VALVE SIZE, NPS	TORQUES ^(1,3)			
	Bolt Material			
	SA193-B7		SA193-B8M ⁽²⁾	
	N•m	Lbf•ft	N•m	Lbf•ft
1	129	95	64	47
1-1/2 or 2	96	71	45	33
3	169	125	88	65
4	271	200	156	115

1. Determined from laboratory tests.
2. SA193-B8M annealed.
3. For other lubricants, bolting materials, or coated bolting, contact your [Emerson sales office](#) for torques.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

Maintenance

Inspection and maintenance frequency depends on the severity of service conditions. When the Trim Cartridge is installed, the spiral wound gasket (which is not repairable) is compressed in order to load and seal the cage gasket (figure 2, key 4). If the Trim Cartridge is removed and reinstalled, the spiral wound gasket may not provide sufficient load after initial compression. Therefore, it is not recommended to remove and reinstall Trim Cartridge after initial installation. Valve packing can be serviced as it does not require decompression of the spiral wound gasket. This section includes instructions for packing maintenance in the Trim Cartridge.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

CAUTION

Follow instructions carefully to avoid damaging the product surfaces, which could result in damage to the product

Packing Replacement

ENVIRO-SEAL packing systems are designed for quality performance over extended periods. This longevity allows for packing maintenance to be performed at regularly scheduled plant outages or turnarounds.

Use the following instructions when inspecting or replacing ENVIRO SEAL packing. Additional information can be found in the ENVIRO-SEAL Sliding-Stem Valves Instruction Manual ([D101642X012](#))

If changing the packing system material to a different material, such as PTFE to Graphite ULF, it is good practice to review the actuator sizing, as packing friction will change.

CAUTION

To prevent product damage caused by scratching or damaging the packing box wall, take care when removing the old packing parts from the packing box.

1. Isolate the control valve from the line pressure.
2. Release pressure and drain process media from both sides of the control valve.
3. If using a power actuator, also shut off all pressure lines to the power actuator, and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.
4. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet.
5. Disconnect the stem connector and then remove the actuator from the valve by unscrewing the yoke locknut.
6. Remove any travel indicator parts and stem locknuts from the valve stem threads.
7. Remove the packing nut (figure 3, 4, or 5, key 3) from bonnet.
8. Remove packing parts from bore using a packing extraction tool and check for damage to valve stem or packing box bore.
9. Install the ENVIRO-SEAL packing parts into the packing box. Use figure 3, 4, or 5 to ensure the packing parts and spring pack are assembled in correct order.
10. Install the spring pack assembly with the attached springs, onto the stem, ensuring the Belleville springs are stacked properly and packing box parts are assembled in the correct order (figures 3, 4, or 5). Packing parts cannot function properly if the Belleville springs or other packing parts are not stacked correctly.
11. Lubricate the packing nut (figure 3, 4, or 5, key 3) with anti-seize lubricant and install hand tight.

Tightening Procedures - Packing Nut

1. To achieve maximum benefit from the ENVIRO-SEAL packing system, the packing nut must compress the Belleville springs to their “target load.” The target load is the point where the Belleville springs are designed for optimum performance, when compressed to 85% of their maximum deflection, or nearly flat. (Maximum deflection is when the springs are 100% compressed, or completely flat). To obtain the target load of 85% compression of maximum deflection, perform the following:
 - Tighten the packing nut until the Belleville springs are compressed 100% (or completely flat), as detected by a rapid increase in nut torque.
 - For PTFE or Duplex packing, loosen packing flange nut 1/2 turn (180° of rotation).
 - For Graphite ULF packing, loosen packing flange nut 1/4 turn (90° of rotation).

The “target load” of 85% compression has now been reached.

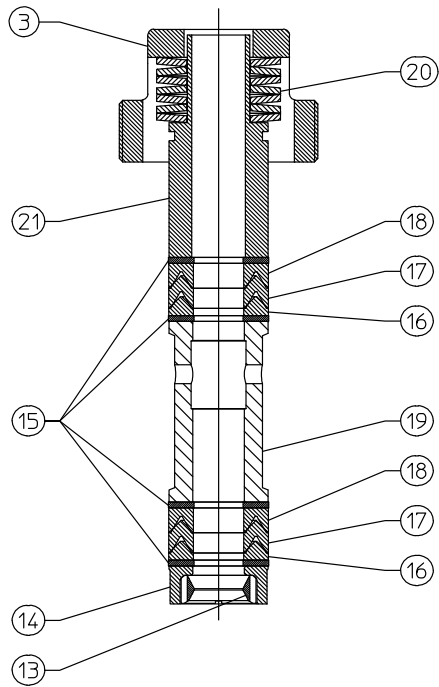
Refer to the appropriate valve and actuator instruction manuals when connecting the valve to the actuator. Under normal conditions, the packing nut should not require retightening.

2. However, when servicing, if the springs do not remain at the target load of 85% compression, retighten the packing box nut according to step 1 above.

Other Considerations

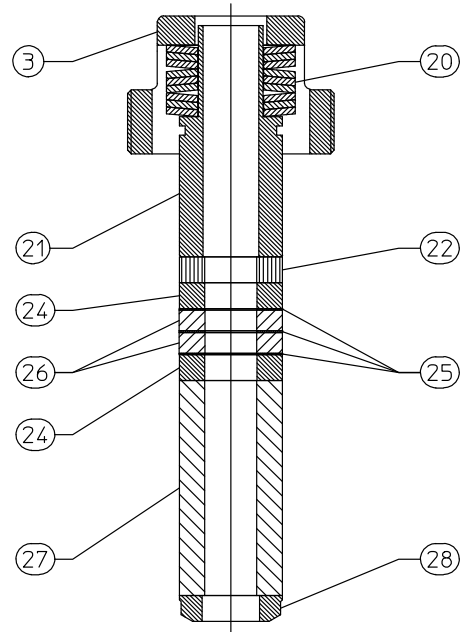
When repacking a valve with ENVIRO-SEAL packing that has been in service, check the condition of the packing bore after the packing has been removed. A good guideline to use in checking the condition of the packing bore is the 20/20 rule. If less than 20% of the surface area of the bore is pitted and if there are no pits deeper than 0.020 inch, then the packing should work as designed. This does not need to be an exact measurement; visual inspection is adequate. If the packing bore does not meet these criteria, the unit should be replaced.

Figure 3. ENVIRO-SEAL PTFE Packing Arrangement



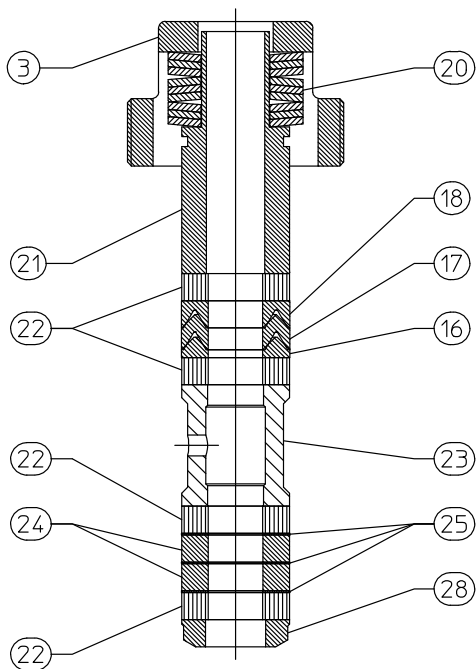
GH10958

Figure 5. ENVIRO-SEAL Graphite ULF Packing Arrangement



GH10958

Figure 4. ENVIRO-SEAL Duplex Packing Arrangement



GH10958

Parts Ordering

Each body-bonnet assembly is assigned a serial number which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. In addition, each Trim Cartridge is assigned a part serial number which can be found on the Trim Cartridge bonnet. Refer to either the body-bonnet serial number or Trim Cartridge part serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number or part serial number and to the eleven-character part number for each part required from the following parts kit information.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

ENVIRO-SEAL Packing Repair Kits

Repair kits include parts to replace the “soft” packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits. Refer to figure 3 for key numbers for PTFE packing, to figure 4 for key numbers for Graphite ULF packing, and to figure 5 for key numbers for duplex packing. PTFE repair kits include keys 13, 15, 16, 17, and 18. Graphite ULF repair kits include keys 22, 24, 25, 26, and 27. Duplex repair kits include keys 16, 17, 18, 22, 24, and 25.

Stems and packing box constructions that do not meet Emerson stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of this packing kit.

Packing Kits (ENVIRO-SEAL) Repair

PACKING MATERIAL	STEM DIAMETER, mm (INCH) YOKE BOSS DIAMETER, mm (INCH)	
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)
	Part Number	
Double PTFE (Contains keys 13, 15, 16, 17, and 18)	RPACKX00192	RPACKX00202
Graphite ULF (Contains keys 22, 24, 25, 26, and 27)	RPACKX00592	RPACKX00602
Duplex (Contains keys 16, 17, 18, 22, 24, and 25)	RPACKX00292	RPACKX00302

Parts List

Note

Contact your [Emerson sales office](#) for part numbers.

Trim Cartridge Assembly (Figure 2)

Key	Description
1	Bonnet
2	Body/Bonnet Nut
3	Bonnet Gasket
4	Cage Gasket
5	Valve Body

ENVIRO-SEAL Packing Assembly (Figures 3, 4, and 5)

Key	Description
3	Packing Nut
13	Packing Lower Wiper
14	Packing Box Ring
15	Anti-Extrusion Washer
16	Packing Ring, Male Adaptor
17	Packing Ring
18	Packing Ring, Female Adaptor
19	Lantern Ring
20	Belleville Spring
21	Packing Follower
22	Guide Bushing
23	Lantern Ring
24	Packing Ring
25	Packing Washer
26	Packing Ring
27	Guide Bushing
28	Packing Box Ring

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Fisher™ EU and EW Valves NPS 12 through 24 x 20 (Obsolete)

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Introduction

The product covered in this document is no longer in production. This document, which includes the latest published version of the instruction manual, is made available to provide updates of newer safety procedures. Be sure to follow the safety procedures in this supplement as well as the specific instructions in the included instruction manual.

Part numbers in the included instruction manual should not be relied on to order replacement parts. For replacement parts, contact your [Emerson sales office](#).

For more than 30 years, Fisher products have been manufactured with asbestos-free components. The included manual might mention asbestos containing parts. Since 1988, any gasket or packing which may have contained some asbestos, has been replaced by a suitable non-asbestos material. Replacement parts in other materials are available from your sales office.

Safety Instructions

Please read these safety warnings, cautions, and instructions carefully before using the product.

These instructions cannot cover every installation and situation. Do not install, operate, or maintain this product without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson sales office before proceeding.

Specifications

This product was intended for a specific range of service conditions--pressure, pressure drop, process and ambient temperature, temperature variations, process fluid, and possibly other specifications. **Do not expose the product to service conditions or variables other than those for which the product was intended.** If you are not sure what these conditions or variables are, contact your [Emerson sales office](#) for assistance. Provide the product serial number and all other pertinent information that you have available.

Inspection and Maintenance Schedules

All products must be inspected periodically and maintained as needed. The schedule for inspection can only be determined based on the severity of your service conditions. Your installation might also be subject to inspection schedules set by applicable governmental codes and regulations, industry standards, company standards, or plant standards.

In order to avoid increasing dust explosion risk, periodically clean dust deposits from all equipment.

When equipment is installed in a hazardous area location (potentially explosive atmosphere), prevent sparks by proper tool selection and avoiding other types of impact energy.

Parts Ordering

Whenever ordering parts for older products, always specify the serial number of the product and provide all other pertinent information that you can, such as product size, part material, age of the product, and general service conditions. If you have modified the product since it was originally purchased, include that information with your request.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher product, because they may void your warranty, might adversely affect the performance of the product, and could cause personal injury and property damage.

Installation

⚠ WARNING

- Personal injury or equipment damage caused by sudden release of pressure or bursting of parts may result if the valve assembly is installed where service conditions could exceed the limits given in the applicable product literature, the limits on the appropriate nameplates, or the mating pipe flange rating. Use pressure-relieving devices as required by government or relevant industry codes and good engineering practices. If you cannot determine the ratings and limits for this product, contact your [Emerson sales office](#) before proceeding.
- To avoid personal injury, always wear protective gloves, clothing, and eyewear when performing any installation operations.
- To avoid personal injury or property damage, use proper lifting and rigging practices while lifting, installing or removing the valve assembly. Be sure to use lifting and rigging equipment properly sized and selected for the weight and configuration of the valve assembly or component being lifted.
- Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.
- Many rotary shaft valves are not necessarily grounded to the pipeline when installed in a flammable, hazardous, oxygen service, or explosive atmospheres. An explosion is possible, due to the discharge of static electricity from the valve components. To avoid personal injury or property damage, make sure that the valve is grounded to the pipeline before placing the control valve assembly into service. Use and maintain alternate shaft-to-body bonding, such as a shaft-to-body bonding strap assembly.
- Rotary shaft valves are designed and intended for installation between flanges. Personal injury or property damage may result from improper installation. To avoid personal injury or property damage caused by the sudden release of pressure or bursting of parts, do not use or install rotary shaft valves (including single lug constructions) for dead-end service.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- If installing into an existing application, also refer to the WARNING in the Maintenance section.
- When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. To avoid possible personal injury and because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson sales office.

CAUTION

- Ensure that the valve and adjacent pipelines are free of foreign material that could damage the valve seating surfaces.

Maintenance

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Always wear protective gloves, clothing, and eyewear.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure.
- Do not remove the actuator while the valve is pressurized.
- Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring pre-compression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box might contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids might spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug. Cautiously remove parts so that fluid escapes slowly and safely.
- Many valve parts that are moving can injure you by pinching, cutting, or shearing. To help prevent such injury, stay clear of any moving part.
- Never apply pressure to a partially assembled valve.
- To avoid personal injury or property damage caused by uncontrolled movement of a valve bonnet, loosen the bonnet by following these instructions: Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. Loosen bonnet nuts approximately 3 mm (0.125 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed with bonnet removal.
- As you remove parts, such as valve shafts, other parts, such as disks can fall from the valve body or suddenly move to another position in the valve. To avoid injury from falling or moving parts, be sure to support parts and be sure they are in a stable position as you disassemble the valve.
- Personal injury could result from packing leakage. Do not scratch the drive shaft or packing box wall while removing packing parts.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Neither Emerson, Emerson Automation Solutions, nor any of their affiliated entities assumes responsibility for the selection, use or maintenance of any product. Responsibility for proper selection, use, and maintenance of any product remains solely with the purchaser and end user.

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Fisher™ EU and EW Valves NPS 12 through 24 x 20

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Figure 1. NPS 24 x 20 Fisher EWT Valve with Piston Actuator and FIELDVUE™ DVC6200 Digital Valve Controller



W9156-2

Introduction

Scope of Manual

This instruction manual includes installation and maintenance information for NPS 12 through 24 x 20 CL150 through 600 Fisher EUD, EUT, EUT-2, EWD, EWT, and EWT-2 valves, and the NPS 12 and 20 x 16 CL900 EUD, EUT-2, EWD, and EWT-2 valves. (Size designations such as NPS 20 x 16 are end connection size x nominal trim size.)

Refer to separate manuals for instructions covering the actuator and accessories.

Do not install, operate, or maintain an EUD, EUT, EUT-2, EWD, EWT, or EWT-2 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Table 1. Specifications

Valve Sizes EUT, EUT-2, and EUD: NPS ■ 12, ■ 16, ■ 20, and ■ 16x20 EWT, EWT-2, and EWD: NPS ■ 20x16, ■ 24x16, and ■ 24x20 valves (size designations are end connection size x nominal trim size) End Connection Styles <i>Flanged:</i> CL150, 300, 600, and 900⁽¹⁾ raised-face or ring-type joint flanges per ASME B16.5 <i>Buttwelding:</i> All ASME B16.25 schedules through schedule 120 that are compatible with the ASME B16.34 valve body rating For other end connections, contact your Emerson sales office or Local Business Partner for details Maximum Inlet Pressure and Temperature⁽²⁾ <i>Flanged:</i> Consistent with CL150, 300, 600, and 900⁽¹⁾ pressure/temperature ratings per ASME B16.34 <i>Buttwelding:</i> Consistent with CL600 per ASME B16.34 Also see the Installation section Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4 EUT, EUT-2, EWT, and EWT-2 with Metal Seats <i>Standard (for all trims except 2-Stage Cavitrol™ Trim):</i> Class IV <i>Standard (for 2-Stage Cavitrol Trim):</i> Class V <i>Optional (for all trims except 2-Stage Cavitrol Trim):</i> Class V EUT, EUT-2, EWT, and EWT-2 with Soft Metal Seats: Class V	Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4 (continued) EUD and EWD with Metal Seats <i>Standard:</i> Class III <i>Optional:</i> Class IV and V (Bore Seal) Flow Characteristics <i>Standard Cages:</i> ■ Linear or ■ equal percentage WhisperFlo™, Whisper Trim™ III, and Cavitrol III <i>Cages:</i> Linear Flow Direction <i>Standard and Cavitrol III Cages:</i> Down <i>WhisperFlo and Whisper Trim III Cages:</i> Up Port Diameters NPS 12 Trim: ■ 279.4 mm (11.00 inches), NPS 16 Trim: ■ 355.6 mm (14 inches), ■ 374.7 mm (14.75 inches), and ■ 412.8 mm (16.25 inches) NPS 20 Trim: ■ 431.8 mm (17 inches), ■ 463.6 mm (18.25 inches) and ■ 501.7 mm (19.75 inches) Valve Plug Travel 102 through 432 mm (4 to 17 inches). Contact your Emerson sales office or Local Business Partner for further details if needed Yoke Boss and Stem Diameters ■ 127 mm (5-inch) or ■ 127 mm (5H-inch) diameter yoke boss, each with 31.8 mm (1-1/4 inch) diameter valve stem Approximate Weights See table 6
--	---

1. CL900 end connections are available only for NPS 16 and 20 x 16 EUD, EUT-2, EWD, or EWT-2 valves.

2. Do not exceed the pressure or temperature limits in this manual, on the equipment nameplate, and any applicable code limitations.

Educational Services

For information on available courses for the Fisher EU and EW Series, NPS 12 through 24x20 valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Table 2. WhisperFlo Trim Specifications

Trim Material and Selection ■ 316 Stainless Steel w/ hardfacing ■ 410 Stainless Steel, hardened ■ Others per application Temperature Capability ■ EUT and EWT: -73 to 316°C (-100 to 600°F) ■ EUT-2 and EWT-2: -73 to 232°C (-100 to 450°F) ■ EUD and EWD: -29 to 538°C (-20 to 1000°F) ■ Others per application Maximum Pressure Drops As shown in this bulletin. Also see Bulletin 80.3:010 WhisperFlo Aerodynamic Attenuation Trims WhisperFlo Aerodynamic Trim Pressure Ratings^(1,2) Up to 1500 psi drop Velocity Limits WhisperFlo trim is designed for 0.3 MACH as an inherent outlet velocity limit. This velocity limit of 0.3 MACH may be exceeded for demanding applications	with adequate care and corrections in aerodynamic noise prediction - consult your Emerson Automation Solutions sales office Flow Characteristic Linear (restricted linear cages and special, characterized cages are available--consult your Emerson Automation Solutions sales office) Rangeability 65:1 High rangeability in excess of 250:1 is available in some constructions. Contact your Emerson sales office or Local Business Partner for details Flow Direction <i>Standard:</i> Flow up--through the seat ring and out through the cage orifices Noise Attenuation Approximately -40 dBA maximum depending on the $\Delta P/P_1$ ratio per IEC 60534-8-3 calculation procedure
---	---

1. Other pressures on application.

2. The pressure/temperature limits in this instruction manual and in any applicable standard limitations should not be exceeded.

Description

All valve types covered in this manual (EUD, EUT, EUT-2, EWD, EWT, and EWT-2 valves) can be used for either throttling or on-off control of a wide variety of liquids and gasses. They are single-port, globe-style valves with cage guiding, balanced valve plugs, and a push-down-to-close action. EUT, EWT, and EWT-2 valves have a spring-loaded PTFE seal between the plug and cage; the EUD and EWD valves have two graphite piston rings between the plug and cage. See figure 5, 6, or 7 for seal details.

EUT-2 and EWT-2 valves have a seat ring threaded into the cage. A spring-loaded PTFE seal is used to seal between the seat ring and the valve body. Standard seating is metal-to-metal, but optional soft metal seats are also available. A typical EUT-2 or EWT-2 valve is shown in figure 5.

EUD and EWD valves have a seat ring bolted into the valve body with cap screws. Seating is metal-to-metal. A typical EUD or EWD valve is shown in figure 6.

EUT and EWT valves have a seat ring bolted into the valve body with cap screws. These valves have metal-to-metal seating and use PEEK anti-extrusion rings in the plug seal arrangement to increase the upper temperature limit of the seal to 316°C (600°F). A typical EUT valve is shown in figure 7.

Cavitrol III, Whisper Trim III, and WhisperFlo trim cages are available in these valves. Cavitrol trim helps eliminate cavitation damage in liquid service in a properly sized valve and Whisper Trim III and WhisperFlo trim cages help attenuate aerodynamic noise in gas service.

Fisher WhisperFlo trim represents state of the art solutions for applications that demand ultimate aerodynamic noise attenuation.

Control valves with WhisperFlo cages provide additional aerodynamic noise attenuation in very demanding vapor or gas applications with high-pressure drops. A WhisperFlo cage with an appropriately sized valve body is designed to reduce the noise level up to -40 dBA. For special applications, -50 dBA attenuation can be achieved.

Specifications

Typical specifications for these valves are shown in tables 1 and 2. Some of the specifications for a given valve assembly as it comes from the factory appear on the actuator nameplate if the valve is part of a complete control valve assembly.

Installation

⚠ WARNING

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given in this manual or on the appropriate nameplates. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

The valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Because some valve body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#) or Local Business Partner.

⚠ WARNING

If you are hoisting the valve, use nylon slings to protect the surfaces.

Carefully position the slings to prevent damage to the actuator tubing and any accessories. Also, take care to prevent people from being injured in case the hoist or rigging slips unexpectedly. Refer to table 6 for valve assembly weights. It is important to use adequately sized hoists and chains or slings to handle the valve.

1. Before installing the valve, inspect the valve and associated equipment for any damage and any foreign material.
2. Make certain that the valve body interior is clean, that pipelines are free of foreign material, and the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.

CAUTION

For long service life and more effective operation, the process liquid must be clean. If the valve being installed has a Whisper Trim, WhisperFlo, or Cavitrol Trim cage with small internal flow passages, impurities or entrained solids in the

process liquid may cause irreparable erosion damage to the seating surfaces and may plug cage holes and passages, causing cavitation damage. During valve installation or the plant cleaning cycle, install a strainer upstream from the valve to help free pipelines of foreign material.

3. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven valve plug and cage wear and in improper operation. Support the actuator if it is not installed in the vertical position. For more information, consult your [Emerson sales office](#) or Local Business Partner.
4. Use accepted piping and welding practices when installing the valve in the line. You can leave internal elastomeric parts in place when welding. For flanged valves, use a suitable gasket between the valve and pipeline flanges.

CAUTION

Depending on valve body materials used, post weld heat treating might be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Shrunk-fit pieces and threaded connections might also loosen. If post weld heat treating is to be performed, all trim parts should be removed. Contact your Emerson sales office or Local Business Partner for additional information.

5. With a leak-off bonnet construction, remove the 1/4 NPT pipe plugs (key 14, figure 4) from the bonnet to hook up the leak-off piping.
6. If continuous operation of the plant is required during inspection or maintenance of the valve, install a three-valve bypass around the control valve assembly.
7. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however some readjustment will be required to meet specific service conditions.

If the valve has ENVIRO-SEAL™ live-loaded packing or HIGH-SEAL ULF live-loaded packing installed, this initial re-adjustment will probably not be required. See the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) or HIGH-SEAL ULF Live-Loaded Packing System ([D101453X012](#)) (as appropriate) for packing instructions.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance, trim maintenance, lapping seating surfaces, and valve plug maintenance. All maintenance operations may be performed with the valve in the line.

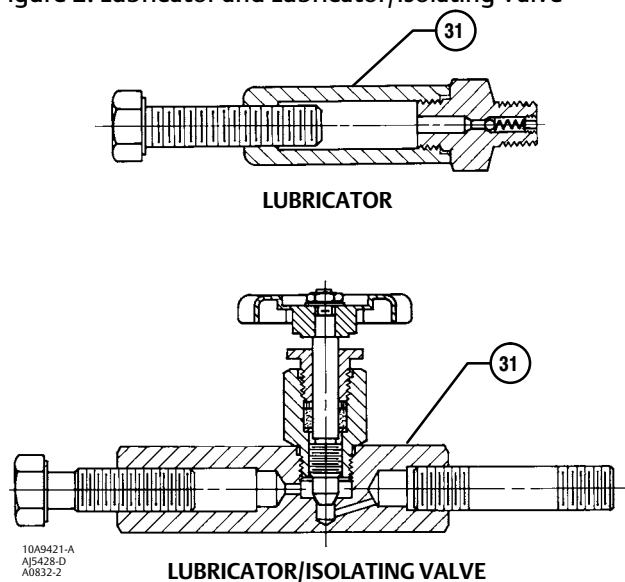
⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator, and use lock-out procedures to prevent injury while you work on the equipment.

Figure 2. Lubricator and Lubricator/Isolating Valve



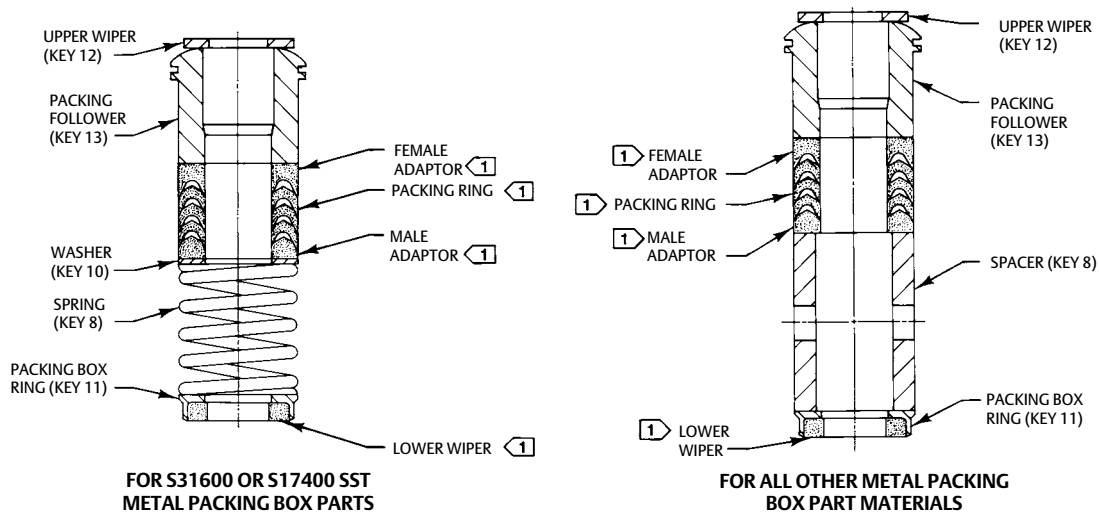
Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal because the used gasket might not seal properly.

Note

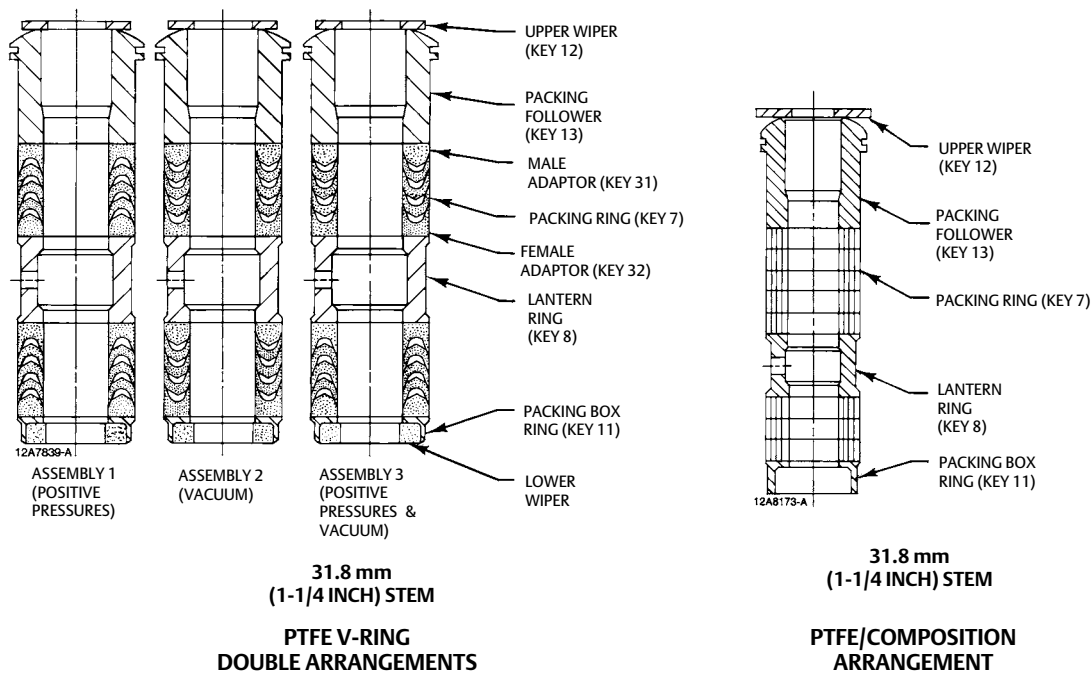
If the valve has ENVIRO-SEAL live-loaded packing or HIGH-SEAL ULF live-loaded packing installed, see the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) or HIGH-SEAL ULF Live-Loaded Packing System ([D101453X012](#)) (as appropriate) for packing instructions.

Figure 3. Typical Packing



12A7837-A

PTFE V-RING SINGLE ARRANGEMENTS



12A7839-A

12A8173-A

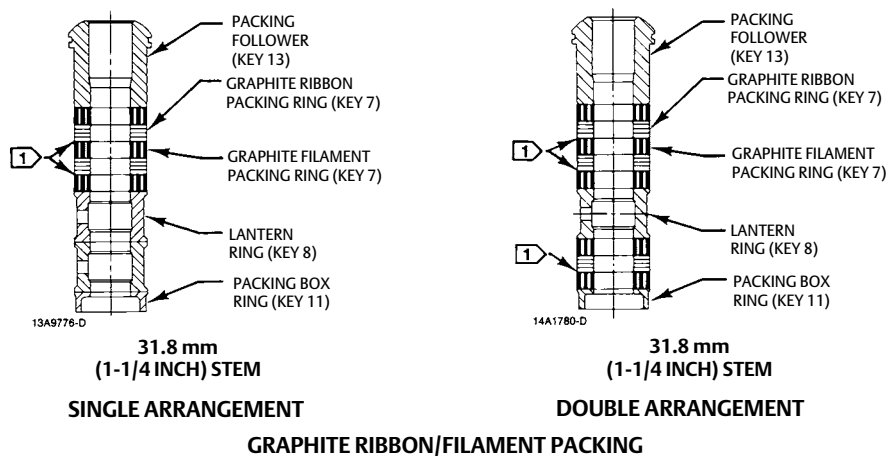
NOTE:

1

PACKING SET (KEY 6) (2 REQUIRED FOR DOUBLE ARRANGEMENTS)

82398

Figure 3. Typical Packing (Continued)



NOTE:
 ① 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS:
 USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING
 A6060

Packing Lubrication

CAUTION

Do not lubricate graphite packing. Graphite packing is self-lubricated. Additional lubrication may result in slip-stick movement of the valve.

If a lubricator or lubricator/isolating valve (figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the 1/4 NPT pipe plug (key 14, figure 4). Use a silicon-base lubricant. To operate the lubricator, turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except the isolating valve must first be opened and then closed after lubrication is completed.

Packing Maintenance

This procedure does not cover ENVIRO-SEAL or HIGH-SEAL packing; refer to separate manuals for instructions on those packing types.

Key numbers are shown in figure 3 unless otherwise indicated.

For spring-loaded single PTFE V-ring packing, the spring (key 8) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5, figure 4) until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the Replacing Packing section.

If there is undesirable packing leakage with other than spring-loaded packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

If the packing is relatively new and tight on the stem and if tightening the packing flange nuts does not stop the leakage, it is possible that the valve stem is worn or nicked so that a seal cannot be made. The surface finish of a new

valve stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

Replacing Packing

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator, and use lock-out procedures to prevent injury while you work on the equipment.
2. Remove any leak-off piping from the bonnet. Disconnect the stem connector, and then remove the actuator from the valve by unscrewing the hex nuts (key 26, figure 4).
3. Loosen the packing flange nuts (key 5, figure 4) so that the packing is not tight on the valve stem. Remove any travel indicator parts and stem locknuts from the valve stem threads.

CAUTION

Avoid damage to the seating surfaces caused by the valve plug and stem assembly dropping from the bonnet after being lifted part way out.

When lifting the bonnet (key 1, figure 4), either be sure that the valve plug and stem assembly remains in the valve and on the seat or, temporarily install a valve stem locknut on the valve stem. This locknut will prevent the valve plug and stem assembly from dropping out of the bonnet.

⚠ WARNING

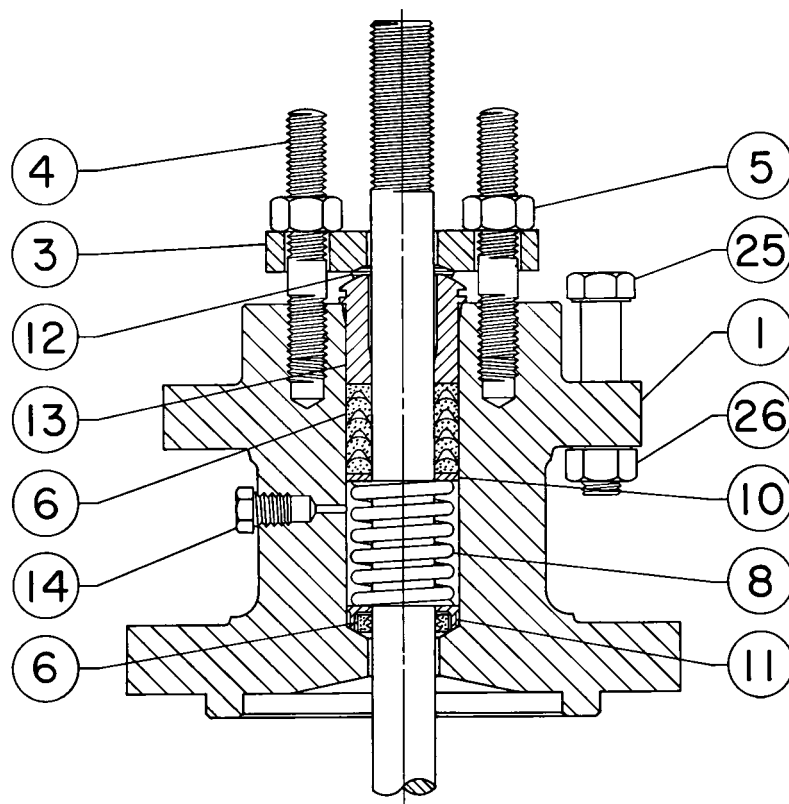
To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. If the cage sticks to the bonnet, proceed carefully with bonnet removal.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

4. Hex nuts (key 16, figures 5 or 6) attach the bonnet to the valve body. Loosen these nuts or cap screws approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, remove the nuts completely and carefully lift the bonnet (key 1, figure 4).
5. Set the bonnet on a protective surface to prevent damage to the bonnet gasket surface.
6. Whenever the bonnet has been removed, replace the bonnet gasket and the cage gasket (keys 10 and 11, figures 5 and 6). Remove the bonnet gasket.
7. Lift the valve plug and stem assembly out of the valve body and set it on a protective surface. If the valve plug is to be reused, protect the valve plug seating surface to prevent scratches.
8. Install screws or bolts into the tapped holes in the top of the cage assembly (key 3), and carefully lift it out of the valve body. Remove the cage gasket (key 11).
9. If further trim maintenance is required, refer to the Trim Maintenance section.

Figure 4. Typical Globe Valve Bonnet



CU4317

Table 3. Packing Flange Nut Torque for Packing Without a Spring

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE-TYPE PACKING				PTFE-TYPE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
			N•m	Lbf•ft	N•m	Lbf•ft	N•m	Lbf•ft	N•m	Lbf•ft
31.8	1-1/4	CL150 & 300	33	24.3	49	36.1	16	11.8	25	18.4
		CL600	45	33.2	67	49.4	21	15.5	33	24.3
		CL900	56	41.3	83	61.2	27	19.9	41	30.2

Table 4. Body-to-Bonnet Bolt Torque

VALVE SIZE, NPS	PRESSURE RATING	BOLTING TORQUE ⁽¹⁾	
		N•m	Lbf•ft
12, 16x12	CL150 - 600	1750	1290
16	CL150 - 600	2800	2070
16	CL900	1750	1290
20 x 16, 24 x 16	CL150 - 600	2800	2070
20 x 16	CL900	1750	1290
20, 24 x 20	CL150 - 600	4240	3130

1. For B7, B7M, B16, and 660 bolting materials. For other materials, contact your [Emerson sales office](#) or Local Business Partner for torque values.

CAUTION

To prevent damage to the valve cavity, packing box wall, and packing surfaces, observe the instructions in the next three steps.

10. Cover the opening in the valve body to protect the gasket surface and prevent foreign material from getting into the valve cavity.
11. Remove the packing flange nuts, packing flange, upper wiper, and packing follower (keys 5, 3, 12, and 13, figure 4). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
12. Inspect the valve stem threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding or honing with a tool similar to an automotive brake-cylinder hone, replace the damaged parts.
13. Remove the covering protecting the valve cavity, and install a new cage gasket (key 11, figure 5 and 6), making sure the gasket seating surfaces are clean and smooth.
14. Re-install the trim parts by following the Trim Replacement section. Install a new bonnet gasket (key 10, figure 5 and 6).

Note

Proper performance of the tightening procedures in step 15 compresses the bonnet and cage gaskets (keys 10 and 11, figure 5 and 6) enough to seal the body-to-bonnet joint.

The bolting procedures in step 15 include--but are not limited to--ensuring that bolting threads are clean and evenly tightening the hex nuts onto the studs in a crisscross pattern. Because of the boltup characteristics of the gaskets, tightening one nut may loosen an adjacent nut. Repeat the crisscross tightening pattern several times until each nut is tight and the body-to-bonnet seal is made.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

15. Lubricate the stud bolts (key 15, figure 5 and 6) with anti-seize lubricant, slide the bonnet over the stem and onto the bolts, and secure with the stud bolt nuts (key 16, figure 5 and 6), using accepted bolting procedures during tightening so that the body-to-bonnet joint will withstand test pressures and application service conditions. Refer to table 4 for bolting torque guidelines.
16. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 3. Place a smooth-edged pipe over the valve stem, and gently tap each soft packing part into the packing box one piece at a time, being sure that air is not trapped between adjacent soft parts.
17. Slide the packing follower, upper wiper, and packing flange (keys 13, 12, and 3, figure 4) into position. Lubricate the packing flange studs (key 4, figure 4) and the faces of the packing flange nuts (key 5, figure 4). Replace the packing flange nuts.

18. For spring-loaded PTFE V-ring packing, tighten the packing flange nuts until the shoulder on the packing follower (key 13, figure 4) contacts the bonnet.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 3. Then, loosen the packing flange nuts and retighten them to the recommended minimum torque shown in table 3.

For other packing types, tighten the packing flange nuts alternately in small, equal increments until one of the nuts reaches the minimum recommended torque shown in table 3. Then, tighten the remaining flange nut until the packing flange (key 3, figure 4) is at a 90-degree angle to the valve stem.

19. Mount the actuator on the valve assembly, and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual. Check for leakage around the packing follower when the valve is being put into service. Retighten the packing flange nuts as required.

Trim Maintenance

Trim Removal

Except where indicated, key numbers in this section are shown in figure 5 for EUT-2 and EWT-2 valves and in figure 6 for EUD and EWD valves.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator, and use lock-out procedures to prevent injury while you work on the equipment.
2. Remove the actuator and the bonnet according to steps 2 through 5 of the Replacing Packing Section.

CAUTION

Use care to avoid damaging gasket surfaces.

The surface finish of the valve stem (key 7) is critical for making a good packing seal. The inside surface of the cage or cage assembly (key 3) is critical for smooth operation of the valve plug and for making a seal with the seal ring (key 28). The seating surfaces of the valve plug (key 2) and seat ring (key 9) are critical for proper shutoff. Assume all these parts are in good condition, and protect them accordingly unless inspection reveals otherwise.

3. Packing parts can be removed if desired. Replace these parts as described in the Packing Replacement section.
4. Lift the valve plug and stem assembly out of the valve body and set it on a protective surface. If the valve plug is to be reused, protect the valve plug seating surface to prevent scratches.
5. Install screws or bolts into the tapped holes in the top of the cage assembly (key 3), and carefully lift it out of the valve body. Remove the gaskets (keys 10 and 11).
6. Proceed as appropriate:

For EUT-2 or EWT-2 valves (figure 5), the valve has a seat ring seal ring (key 6). Inspect this seal ring, and remove it if replacement is necessary. The seat ring is screwed into the cage and secured with two tack welds, one on each side of the cage. Remove the tack welds by grinding or filing them off.

- For all sizes except NPS 12 and 16x12, there are slots cut in the seat ring. Insert a bar through the slots and turn the seat ring out of the cage.
- For NPS 12 and 16x12, there are two 3/8 inch UNC tapped holes in the bottom of the seat ring. Screw cap screws into these holes. Use a bar to pry against the cap screws and turn the seat ring out of the cage.

For EUD, EWD, EUT, and EWT valves (figure 6), unscrew the seat ring cap screws (key 49). Install screws or bolts into the tapped holes in the top of the seat ring (key 9) and carefully lift it out of the valve body. Remove the gasket (key 13).

7. Inspect parts for wear or damage that would prevent proper operation of the valve. Replace or repair trim parts according to the following Lapping Seating Surfaces or Valve Plug Maintenance procedures as appropriate.

Lapping Seating Surfaces

A certain amount of leakage should be expected with metal-to-metal seating in any valve body. If the leakage becomes excessive, however, the condition of the seating surfaces of the valve plug and seat ring can be improved by lapping. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Assemble the valve to the extent that the cage or cage assembly is in place and the bonnet is bolted to the valve body. A simple handle can be made from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction to lap the seats. After lapping, remove the bonnet, and clean the seat surfaces. Completely assemble the valve as described in the Trim Replacement section, and test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

Valve Plug Maintenance

Except where indicated, key numbers in this section are shown in figure 5 for EUT-2 and EWT-2 valves and in figure 6 for EUD and EWD valves.

CAUTION

For valves with a PTFE seal ring (figure 5, 6, or 7), if replacing the valve plug seal ring (key 28), be careful not to scratch the surfaces of the ring groove in the valve plug or any of the surfaces of the replacement ring, or the replacement ring may not seal properly.

1. Remove the valve plug (key 2) according to the Disassembly section.
2. For seal-ring constructions, carefully pry or cut the seal ring (key 28, figure 5, 6, or 7) from its groove in the plug.

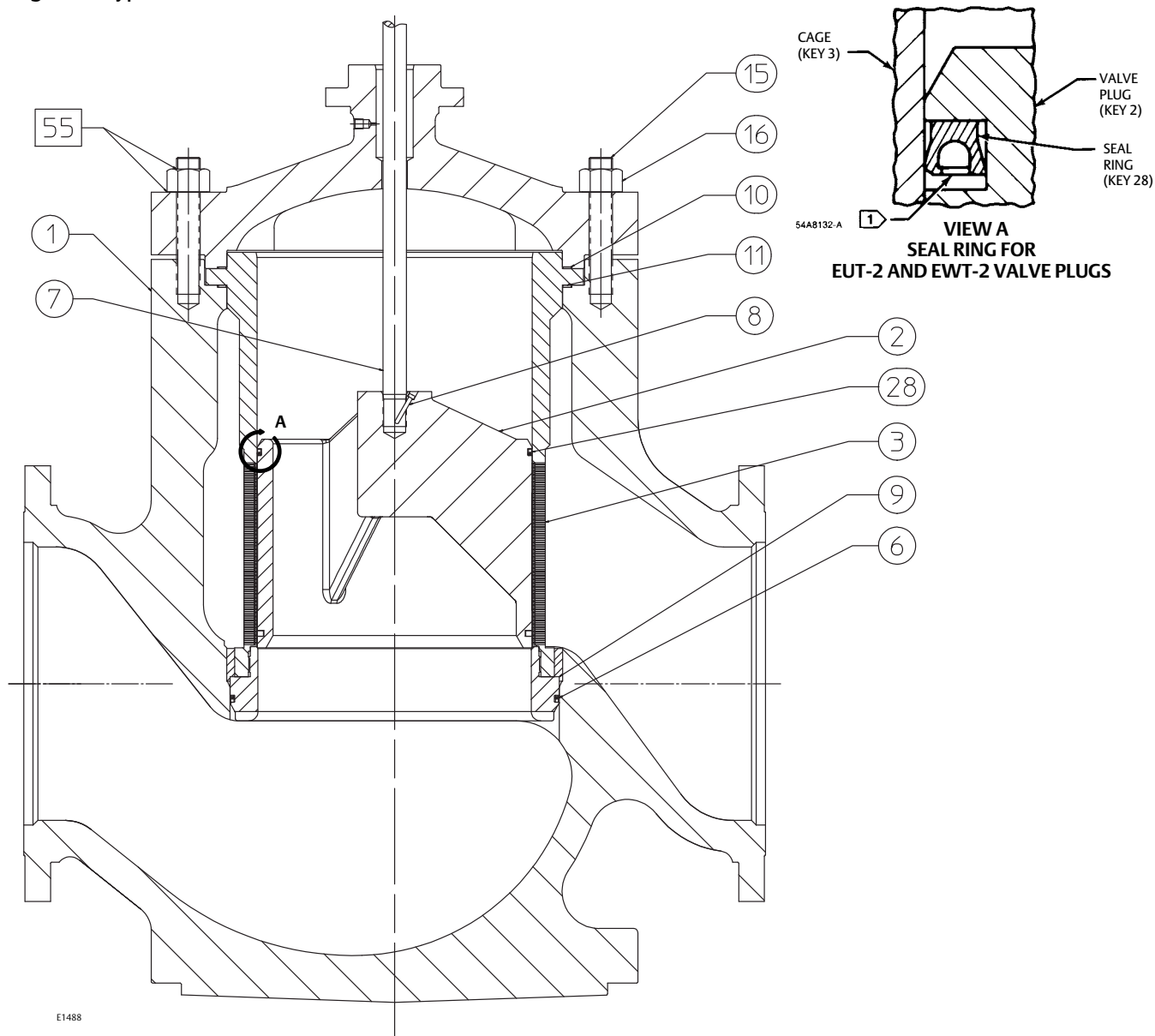
Install the replacement spring-loaded seal ring with the open side facing the top or bottom of the valve plug, depending on flow direction. The open side of the seal ring should face up (toward the actuator) in flow-up installations and down in flow-down installations.

To install the seal ring, first lubricate it with general-purpose, lithium-base lubricant. Then gently stretch the seal ring and work it over the top edge of the valve plug. Give the PTFE material in the seal ring time to cold flow during the stretching procedure. Avoid jerking sharply on the ring. Stretching the seal ring over the valve plug might make it seem loose when it is in the groove, but it will shrink to its original size after you have installed the plug into the cage.

3. For piston-ring constructions, each of the piston rings (key 28, figure 5, 6, or 7) is in two halves; remove the halves.

Each new graphite piston ring is furnished as a complete ring, and each must be broken into two approximately equal portions. Do this by placing the ring on edge on a smooth, hard surface and striking the ring squarely with a hammer. Be sure to match the broken ends when installing the ring sections in the valve plug grooves.

Figure 5. Typical Fisher EUT-2 or EWT-2 Valve



E1488

NOTE:

1> SEAL RING OPENING MUST FACE SEAT RING FOR FLOW DOWN APPLICATIONS AND MUST FACE ACTUATOR FOR FLOW UP APPLICATIONS

CAUTION

Never reuse an old stem (key 7) with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem. This weakens the stem and may cause it to fail in service. However, a used valve plug may be reused with a new stem.

4. To replace the valve stem (key 7), drill out the pin (key 8) and unscrew the stem from the valve plug.

5. Screw the new stem tightly into the valve plug. Drill through the stem, using a 1/4-inch diameter drill for the 31.8 mm (1-1/4 inch) stem diameter used in this valve. Use the hole in the valve plug as a guide. Remove any chips or burrs, and drive in a new pin to lock the assembly.

Trim Replacement

Except where indicated, key numbers are shown in figure 5 and 6.

1. Proceed as appropriate:

For EUT-2 or EWT-2 valves:

For all sizes except NPS 12 and 16x12, turn the seat ring (key 9) into the cage (key 3) with a bar inserted through the seat ring slots.

For NPS 12 and 16x12, insert cap screws into the two 3/8 inch UNC tapped holes in the bottom of the seat ring (key 9). Use a bar to pry against the cap screws and turn the seat ring (key 9) into the cage (key 3).

For all sizes, tack weld the seat ring to the cage using minimal heat. Two welds, 6 mm (1/4-inch) long and 180 degrees apart, are required. Install the seat ring seal ring (key 6) so that its open side faces the valve stem for Cavitrol III trim and flow-down standard cages. Reverse the seal ring for Whisper Trim III, WhisperFlo, and flow-up standard cages. Lubricate the seal ring with a general-purpose, lithium-base lubricant, and place it over the bottom end of the seat ring. Start the ring in the groove on one side of the seat ring, and gently work it over the seat ring.

For EUD and EWD valves (figure 6) and EUT and EWT valves (figure 7), install the seat ring gasket (key 13).

Temporarily install screws or bolts into the tapped holes in the seat ring (key 9), making sure the seating surface is facing up. Lower the seat ring into the valve body. Remove the temporary screws or bolts.

Secure the seat ring (key 9) with the cap screws (key 49). Tighten the cap screws in a criss-cross pattern to a torque of 39 N•m (29 lbf•ft) for NPS 12 and NPS 16x12 valves and to 92 N•m (68 lbf•ft) for NPS 16 through NPS 24x20 valves.

2. Install a cage gasket (key 11) into the valve. Temporarily install screws or bolts into the tapped holes in the top of the cage assembly (key 3) to help while installing this piece into the valve. Any rotational orientation of the cage or assembly with respect to the valve is acceptable.

For EUT-2 and EWT-2 valves, use care to avoid damaging the seat ring seal ring and cage seating surfaces while handling the heavy parts. To help insert the cage or assembly into the valve, lubricate the outside diameter of the seat ring seal ring with lithium grease.

3. Slide the valve plug (key 2) and stem assembly into the cage.

For valves with a seal ring, make sure the valve plug seal ring (key 28) is evenly engaged in the entrance chamfer at the top of the cage or cage assembly to avoid damaging the ring.

For valves with piston rings, make sure the rings are fully engaged into the piston ring groove and flush with the outside diameter of the plug.

4. Install the bonnet gasket (key 10).

CAUTION

If the packing is to be reused and was not removed from the bonnet, use care when installing the bonnet to avoid damaging the packing with the valve stem threads.

5. Mount the bonnet on the valve, and complete assembly according to steps 15 through 19 of the Replacing Packing section, omitting steps 16 and 17 if new packing is not being installed and being sure to observe the note before step 15.

Figure 6. Typical Fisher EUD Valve

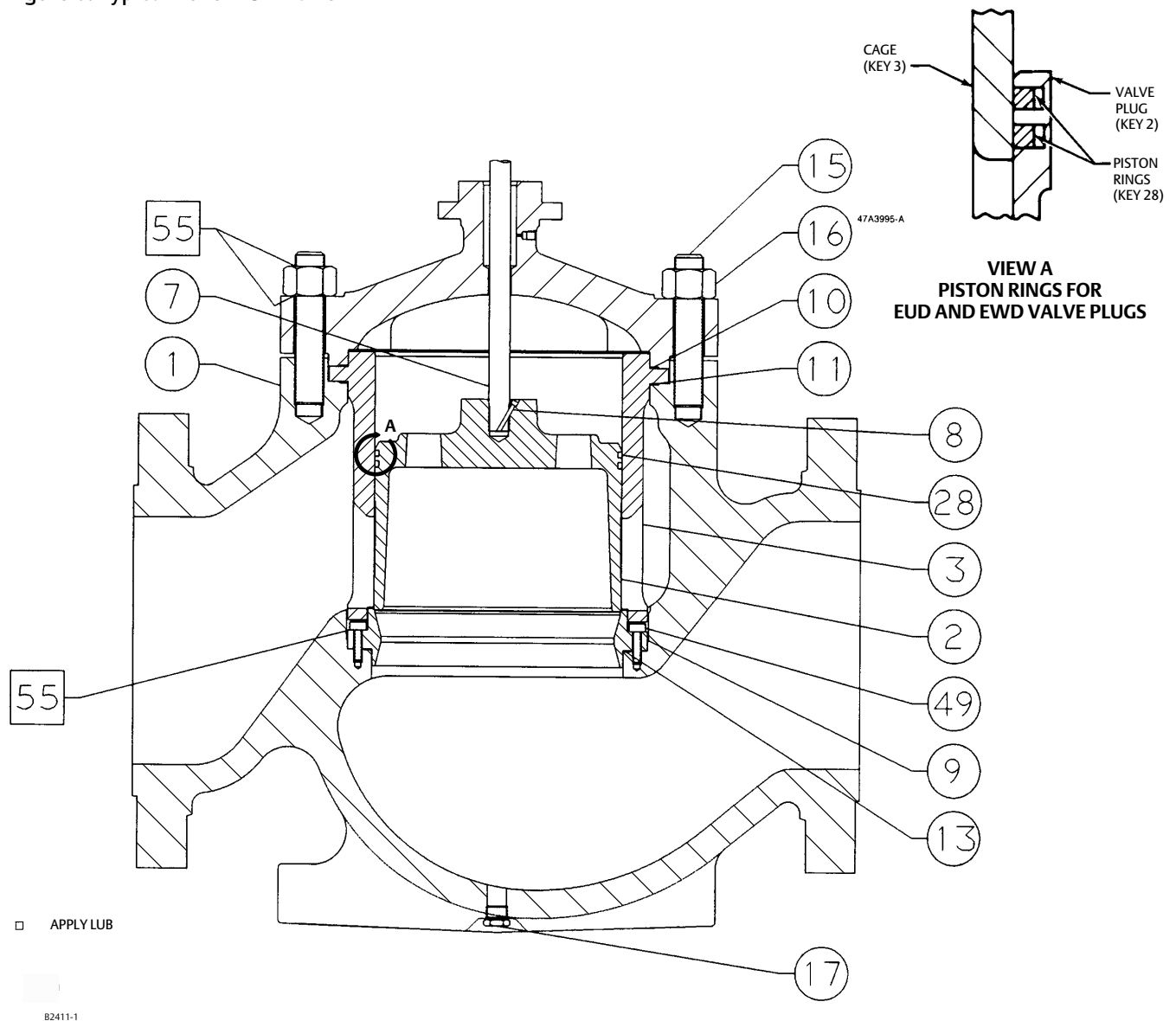
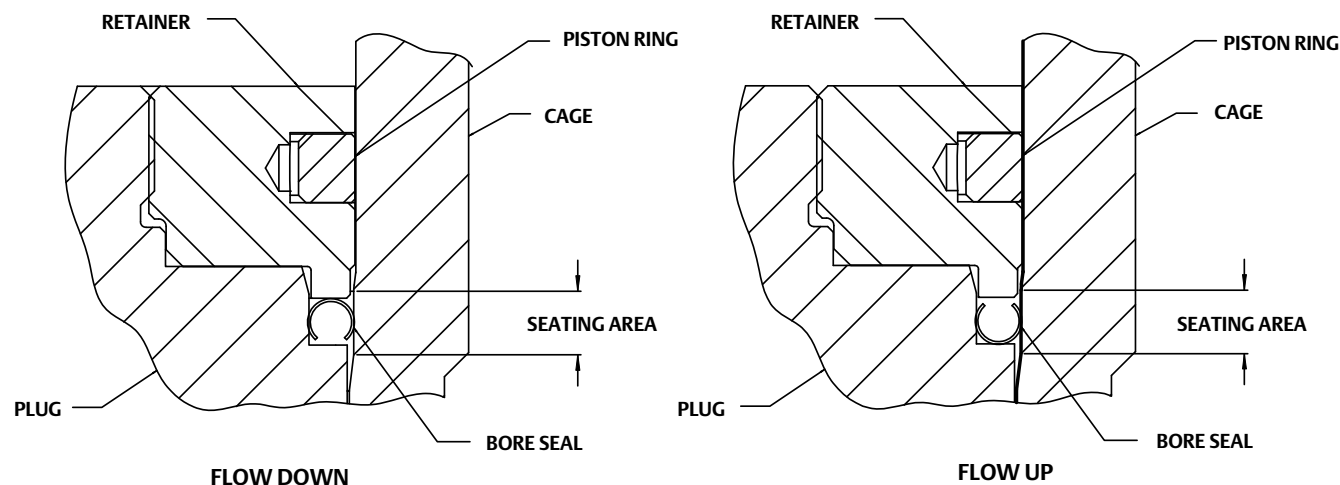


Figure 8. Fisher EUD and EWD with Bore Seal Trim



Retrofit: Installing Bore Seal Trim

Note

Additional actuator thrust is required for a valve with Bore Seal trim. When installing Bore Seal trim in an existing valve, contact your [Emerson sales office](#) or Local Business Partner for assistance in determining new actuator thrust requirements.

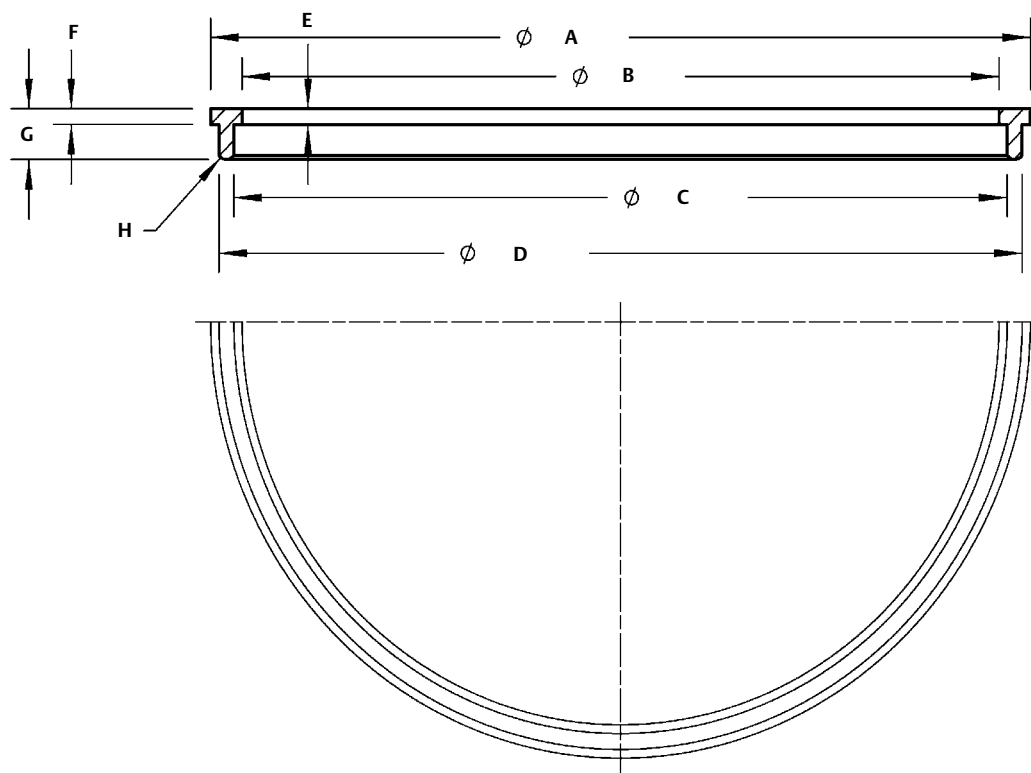
Assemble the new valve plug/retainer assembly (with Bore Seal plug seal) using the following instructions:

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the new trim parts while assembling the individual parts and during installation in the valve body.

1. Apply a suitable high-temperature lubricant to the inside diameter of the Bore Seal plug seal. Also, lubricate the outside diameter of the valve plug where the Bore Seal plug seal must be pressed into the proper sealing position (figure 8).
2. Orient the Bore Seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the Bore Seal plug seal must face up in a valve with flow-up construction (figure 8).
 - The open interior of the Bore Seal plug seal must face down in a valve with flow-down construction (figure 8).
3. Place the Bore Seal plug seal over the top of the valve plug. The retainer will help guide the Bore Seal down onto the plug (figure 8). Do not force the Bore Seal over the plug. For flow down constructions, skip to step 5.
4. An installation tool (see table 5) must be inserted into the Bore Seal prior to using the retainer to guide it down the plug.

Figure 9. Bore Seal Installation Tool



GE22109-A

Table 5. Bore Seal Installation Tool Dimensions

VALVE PORT SIZE, INCH	Dimensions, Inches (See Figure 9)								Tool Part Number
	A	B	C	D	E	F	G	H	
10.00	10.12	9.7	9.80-9.82	10.02-10.00	0.10	0.10	0.32	R.06	GE17914X012
11.00	(1)								n/a
14.00	(1)								n/a
14.75	14.84	14.424-14.416	14.516-14.536	14.736-14.716	0.10	0.10	0.32	R.05	GE34073X012
16.25	(1)								n/a
18.25	(1)								n/a
19.75	(1)								n/a

1. For sizes, contact your Emerson sales office.

5. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the Bore Seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench. For flow down constructions, skip to step 7.
6. Remove the retainer and then the installation tool. Place the Bore Seal retainer back onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
7. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 10) to secure the Bore Seal retainer.
8. Install the new plug/retainer assembly with Bore Seal on the new stem following the appropriate instructions in the Trim Replacement section of this manual.
9. Install piston rings by following instructions in the Trim Replacement section of this manual.
10. Remove the existing valve actuator and bonnet following the appropriate instructions in the Replacing Packing section of this manual.

CAUTION

Do not remove the existing valve stem from the valve plug unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

11. Remove the existing valve stem and plug, cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section of this manual.
12. Replace all gaskets according to appropriate instructions in the Trim Replacement section of this manual.
13. Install the new seat ring, cage, valve plug/retainer assembly, and stem into the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section of this manual.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the Bore Seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop across the valve, this force will adequately drive the valve plug to the seat ring, thus giving the Bore Seal a predetermined permanent set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Replacement of Installed Bore Seal Trim

Trim Removal (Bore Seal Constructions)

1. Remove the valve actuator and bonnet following the appropriate instructions in the Replacing Packing section of this manual.

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance.

Use caution when removing piston ring(s) and the Bore Seal to avoid scratching any sealing surface.

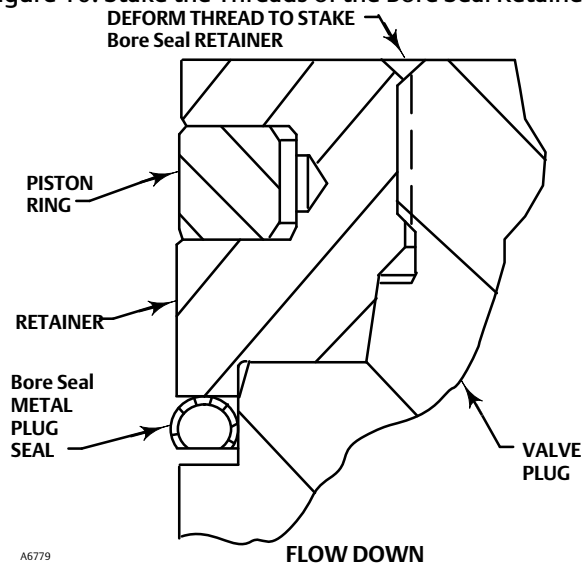
CAUTION

Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

2. Remove the plug/retainer assembly (with Bore Seal), cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section of this manual.
3. Locate the staked thread on top of the valve plug (figure 10). The staked thread secures the retainer. Use a drill with a 1/8 inch bit to drill out the staked area of the thread. Drill approximately 1/8 inch into the metal to remove the staking.

Figure 10. Stake the Threads of the Bore Seal Retainer



4. Locate the break between sections of the piston ring(s). Using an appropriate tool such as a flat-blade screwdriver, carefully pry out the piston ring from the groove in the Bore Seal retainer.
5. After removing the piston ring, locate the 1/4-inch diameter hole in the groove.
6. Select an appropriate tool such as a punch and place the tip of the tool into the hole with the body of the tool held tangent to the outside diameter of the retainer. Strike the tool with a hammer to rotate the retainer and free it from the valve plug. Remove the retainer from the plug.
7. Use an appropriate tool such as a flat-blade screwdriver to pry the Bore Seal plug seal off the plug. Use caution to avoid scratches or other damage to the sealing surfaces where the Bore Seal plug seal makes contact with the valve plug (figure 11).
8. Inspect the lower seating surface where the valve plug contacts the seat ring for wear or damage which would prevent proper operation of the valve. Also, inspect the upper seating surface inside the cage where the Bore Seal plug seal contacts the cage, and inspect the sealing surface where the Bore Seal plug seal makes contact with the plug (figure 11).
9. Replace or repair trim parts according to the following procedure for lapping metal seats, remachining metal seats, or other valve plug maintenance procedures as appropriate.

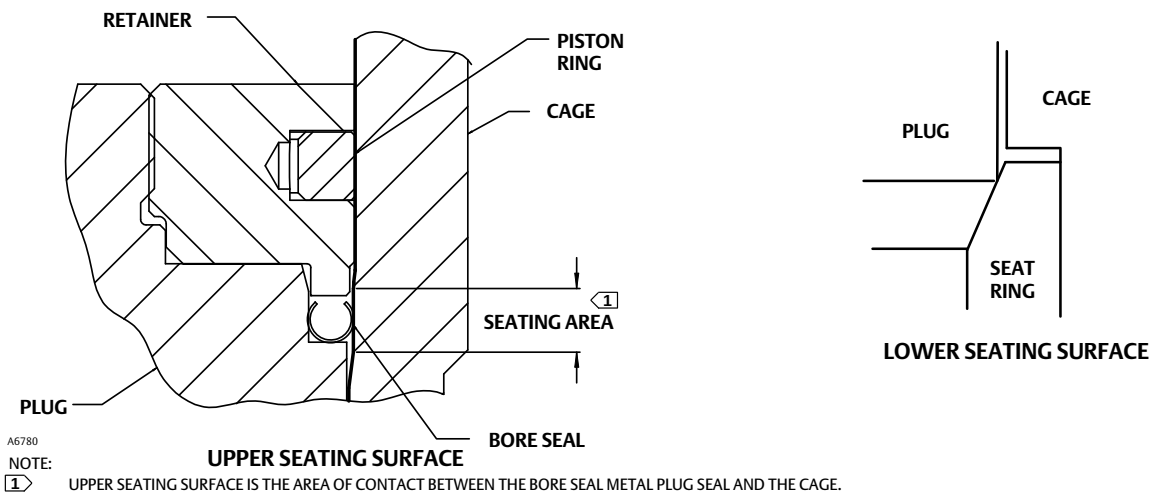
Lapping Metal Seats (Bore Seal Constructions)

Before installing a new Bore Seal plug seal, lap the lower seating surface (valve plug to seat ring, figure 11) following appropriate procedures in the Lapping Seats section of this manual.

Remachining Metal Seats (Bore Seal Constructions)

A valve plug with a Bore Seal metal plug seal features two seating surfaces. One seating surface is found where the valve plug contacts the seat ring. The second seating surface is found where the Bore Seal contacts the upper seating surface in the cage. The cage does not require any machining, even when the plug and / or seat ring have been machined.

Figure 11. Lower (Valve Plug to Seat Ring) and Upper (Bore Seal to Cage) Seating Surfaces



Trim Replacement (Bore Seal Constructions)

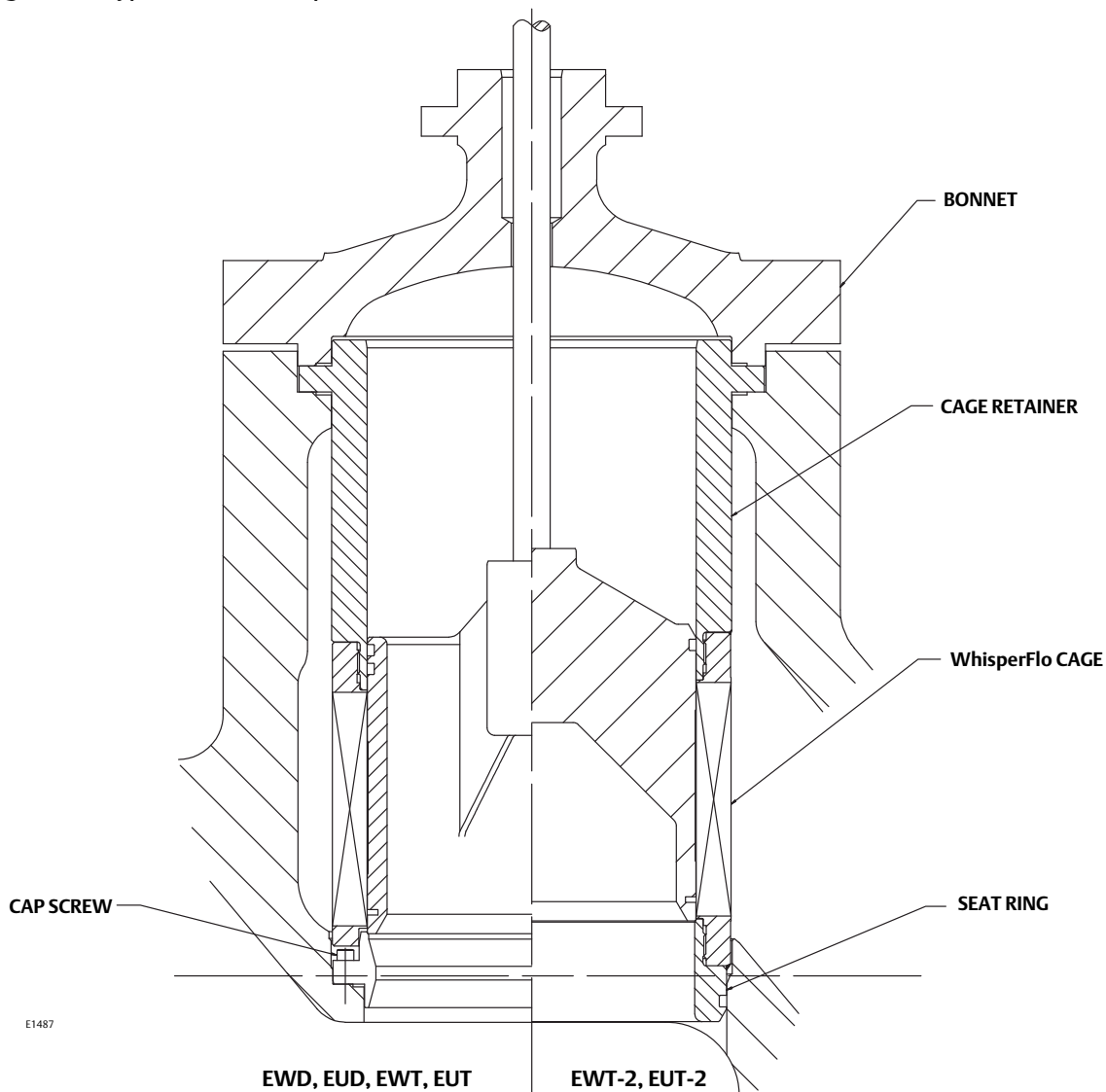
1. Apply a suitable high-temperature lubricant to the inside diameter of the Bore Seal plug seal. Also, lubricate the outside diameter of the valve plug where the Bore Seal plug seal must be pressed into the proper sealing position (figure 8).
2. Orient the Bore Seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the Bore Seal plug seal must face up in a valve with flow-up construction (figure 8).
 - The open interior of the Bore Seal plug seal must face down in a valve with flow-down construction (figure 8).
3. Place the Bore Seal plug seal over the top of the valve plug. The retainer will help guide the Bore Seal down onto the plug. Do not force the Bore Seal over the plug. For flow down constructions, skip to step 5.
4. An installation tool (see table 5) must be inserted into the Bore Seal prior to using the retainer to guide it down the plug.
5. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the Bore Seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench. For flow down constructions, skip to step 7.
6. Remove the retainer and then the installation tool. Place the Bore Seal retainer back onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
7. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 10) to secure the Bore Seal retainer.
8. Replace the piston ring(s) following instructions in the Trim Replacement section of this manual.
9. Return the seat ring, cage, plug/retainer assembly, and stem to the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section of this manual.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the Bore Seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop across the valve, this force will adequately drive the valve plug to the seat ring, thus giving the Bore Seal a predetermined permanent set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Figure 12. Typical Fisher WhisperFlo Trims



Parts Ordering

Each body-bonnet assembly is assigned a serial number, which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) or Local Business Partner for technical assistance. When ordering replacement parts, refer to the serial number and to the key number and part name from the following list. Specify the desired material, if known. Part numbers are shown for packing box parts. Specify the part number if you are ordering packing parts.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

EU and EW Series Valves

July 2017

Instruction Manual

D102010X012

Table 6. Approximate Weights

END CONNECTION		APPROXIMATE WEIGHT	
Size, NPS	Type ⁽¹⁾	kg	lb
12	RF	1410	3100
	RTJ		
	BW	1220	2700
16 x 12	RF	1720	3800
	RTJ		
	BW	1450	3200
16	RF	2540	5600
	RTJ		
	BW	2270	5000
16 CL900	RF	2680	5900
	RTJ		
20 x 16 CL600	RF	3540	7800
	RTJ		
	BW	3130	6900
20 x 16 CL900	RF	3720	8200
	RTJ		
20	RF	5220	11500
	RTJ		
	BW	4810	10600
24 x 16	RF	5220	11500
	RTJ		
	BW	4630	10200
24 x 20	RF	7710	17000
	RTJ		
	BW	7120	15700

1. RF—raised face; RTJ—ring-type joint; BW—butt welding.

Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your [Emerson sales office](#) or Local Business Partner.

Valve Body

Key	Description	Part Number
1	Valve Body	
2*	Valve Plug	
3*	Cage	

Key	Description	Part Number
6*	Seat Ring Seal (EUT-2 & EWT-2 Valves Only)	
7*	Valve Plug Stem	
8*	Pin	
9*	Seat Ring	
10*	Bonnet Gasket	
11*	Cage Gasket	
13*	Seat Ring Gasket (EUD, EWD, EUT, and EWT valves only)	
15	Stud	
16	Hex Nut	
17	Drain Plug, optional	
28*	Seal Ring (EUT-2 and EWT-2 valves only)	
28*	Piston Ring (2 req'd) (EUD and EWD valves only)	
49*	Cap Screw (EUD, EWD, EUT, and EWT valves only)	
219*	PEEK Anti-extrusion ring (EUT and EWT valves only)	

Bonnet

- 1 Valve Bonnet
- 3 Packing Box Flange
- 4 Packing Flange Stud (2 req'd)
- 5 Packing Flange Nut (2 req'd)

PTFE V-Ring Packing

- 6* Packing Set, PTFE (1 req'd for single packing; 2 req'd for double packing) 1R290801012
- 8 Spring, SST (single packing only) 1D387437012
- 8 Lantern Ring, SST (double packing only) 0W087135072
- 10 Special Washer, SST (single packing only) 1H995936042

PTFE/Composition Packing

- 7* Packing Ring, PTFE/composition (8 req'd) 1D7520X0012
- 8 Lantern Ring, stainless steel 0W087135072

Graphite Ribbon/Filament Packing

- 7* Packing Ring, Graphite Ribbon (2 req'd for single packing; 3 req'd for double packing) 1V5666X0022
- 7* Packing Ring, Graphite Filament (3 req'd for single packing; 3 req'd for double packing) 1D7520X0162
- 8 Lantern Ring, stainless steel (2 req'd for single packing; 1 req'd for double packing) 0W087135072
- 11 Packing Box Ring
- 12* Upper Wiper, Felt (PTFE packings only) 1J873006332
- 13 Packing Follower
- 14 Pipe Plug
- 25 Cap Screw (8 req'd)
- 26 Hex Nut (8 req'd)

* Recommended spare parts

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Fisher™ EWD, EWS and EWT Valves through NPS 12x8



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for Fisher NPS 4x2 through 12x8 EWD, EWS and EWT valves (Figure 1). Refer to separate manuals for instructions covering the actuator and accessories.



WARNING



Do not install, operate or maintain an EW valve without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. Fisher NPS 12x6 EW Series Valve with 667 Actuator



W2777-2

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

EW Valve

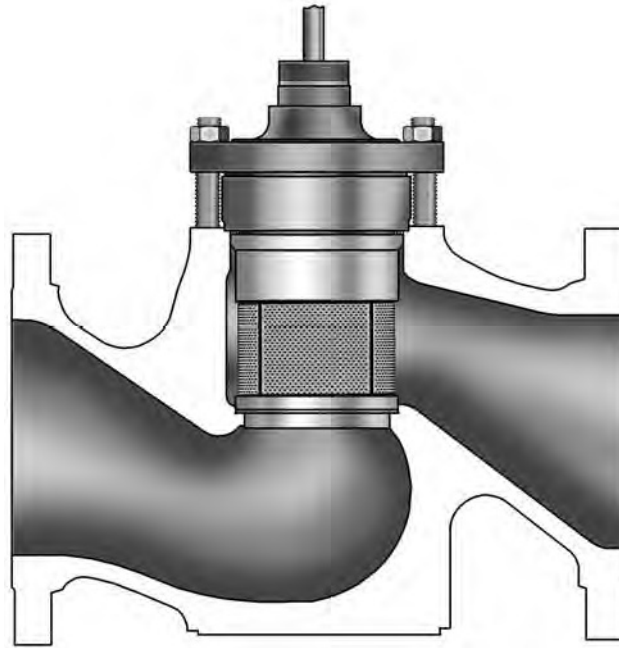
March 2026

Instruction Manual

D100399X012

Table 1. Specifications

End Connection Sizes	Approximate Weights
Flanged Ends: CL300, CL600 or CL900 Raised-face or ring-type joint flanges per ASME B16.5 Butt welding Ends: Styles per ASME B16.25 schedules consistent with ASME B16.34 are: Schedules ■ 40 or ■ 80 for all CL300 and CL600 valves, Schedule ■ 80 or ■ XXS for NPS 8x6 CL900 valves or Schedule ■ 80, ■ 100 or ■ 120 for NPS 12x8 CL900 valves	See Table 4
Maximum Inlet Pressures, Temperatures and Pressure Drops ⁽¹⁾	WhisperFlo Trim Material and Selection
Consistent with applicable ■ CL300, ■ CL600 ⁽²⁾ or ■ CL900 ⁽³⁾ pressure/temperature ratings per ASME B16.34, but do not exceed the pressure, temperature and pressure drop conditions specified when the valve was ordered. Also see the Installation section. Also see Bulletin 80.3:010 WhisperFlo™ Aerodynamic Attenuation Trims, D102362X012.	■ 410 Stainless Steel ■ Others per application See appropriate valve body bulletin.
Shutoff Classifications	WhisperFlo Pressure/Temperature Capability
See Table 2 C-seal trim: High-temperature, Class V per ANSI/FCI 70-2 and IEC 60534-4 See Table 3 WhisperFlo Trim: ■ Class IV per ANSI/FCI 70-2 and IEC 60534-4 ■ Others per application	■ -29 to +427°C / -20 to +800°F ■ Others per application See appropriate valve body bulletin for complementary information.
Flow Characteristics	WhisperFlo Aerodynamic Trim Pressure Ratings ^(1,2)
Standard Cages: ■ Linear, ■ quick opening or ■ equal percentage Whisper Trim™ and Cavitrol™ Cages: Linear WhisperFlo Trim: Linear (restricted linear cages and special, characterized cages are available—consult your Emerson sales office)	Up to 1500 psi drop
Flow Directions	WhisperFlo Velocity Limits
EWS and Standard Cage: Normally up EWD or EWT with Standard Cage: Normally down Whisper Trim Cages: Always up Cavitrol Cages: Always down WhisperFlo Trim: Flow up (standard)—through the seat ring and out through the cage orifices	WhisperFlo trim is designed for 0.3 MACH as an inherent outlet velocity limit. Variations higher and lower may be applied per special applications
	WhisperFlo Rangeability
	100:1
	WhisperFlo Noise Attenuation
	Approximately -40 dBA maximum depending on the $\Delta P/P_1$ ratio per IEC 534-8-3 calculation procedure. See Fisher Specification Manager.
	Additional Specifications
	For specifications such as materials, port diameters, valve plug travels, yoke boss diameters and stem diameters, refer to the Parts List.
1. The pressure or temperature limits in this manual and any applicable standard limitations should not be exceeded. 2. Certain bonnet bolting material selections may require a CL600 easy-e valve assembly to be derated. Contact your Emerson sales office. 3. There are two different CL900 NPS 8x6 valve bodies, one for use only with Cavitrol III cages and the other for use with all other constructions. A CL900 valve with Cavitrol III cage can take full CL900 pressure drops. For information on other NPS 8x6 constructions that can take full CL900 pressure drops, contact your Emerson sales office. All other trim constructions are limited to CL600 pressure/temperature limits even though installed in a CL900 valve.	

Figure 2. Cutaway Detail of the Fisher WhisperFlo Trim, Valve Body Typical

W6825-1

1.2 Description

These single-port globe-style valves have cage guiding, clamped seat rings and push-down-to-close valve plug action. Valve configurations are as follows:

EWD: Balanced valve plug with metal-to-metal seating for all general applications over a wide range of pressure drops and temperatures.

C-seal trim is available for EWD valves, CL300 and CL600, in sizes NPS 6x4x2-1/2, 6x4, 8x4, 8x6, 12x6, 10x8 and 12x8.

With C-seal trim, a balanced valve can achieve high-temperature, Class V shutoff. Because the C-seal plug seal is formed from metal (N07718 nickel alloy) rather than an elastomer, a valve equipped with the C-seal trim can be applied in processes with a fluid temperature of up to 593°C / 1100°F, provided other material limits are not exceeded.

EWS: Unbalanced valve plug with metal-to-metal or optional metal-to-PTFE seating for all general applications requiring better shutoff capabilities than can be obtained with the EWD valve.

EWT: Balanced valve plug with either metal-to-PTFE seating (standard for all except Cavitrol III cages) for stringent shutoff requirements or metal-to-metal seating (standard for Cavitrol III cages, optional for all others) for higher temperatures.

Control valves with WhisperFlo cages (Figure 2) provide additional attenuation for aerodynamic noise in very demanding vapor or gas applications with high-pressure drops. A WhisperFlo cage with an appropriately sized valve body is designed to reduce the noise level up to -40 dBA. For special applications, -50 dBA attenuation can be achieved.

1.3 Specifications

Typical specifications for these valves are shown in Table 1.

Table 2. Shutoff Classification Per ANSI/FCI 70-2 and IEC 60534-4

Valve	Seating	Shutoff Class
EWD	Metal	II (standard)
		III (optional for NPS 6x4 through 12x6 valves with optional single graphite piston ring or for NPS 10x8 and 12x8 valves with optional double piston rings)
		IV (optional for NPS 6x4 through 12x8 valves with optional multiple graphite piston rings)
EWS	Metal	IV (standard)
		V (optional, consult your Emerson sales office)
EWS	PTFE	VI
EWT with all except Cavitrol III cages	PTFE	Standard Air Test (maximum leakage is 0.05 mL/min/psid/inch port diameter)
		V (optional)
	Metal	IV (standard)
	Metal	V (optional) ⁽¹⁾
EWT with 1-stage Cavitrol III cage	Metal	IV (standard)
		V (optional)
EWT with 2-stage Cavitrol III cage	Metal	V

1. Class V shutoff for EWT requires spring loaded seal ring, radius-seat plug, wide-bevel seat ring and seat lapping. Not available with 8-in. port, quick-opening cage. Not available with S31600 (316 SST) valve plug and seat ring.

Table 3. Additional Shutoff Classification for C-seal Trim Per ANSI/FCI 70-2 and IEC 60534-4

Valve	Valve Size, NPS	Port Diameter, in.	Cage Style	Leakage Class
EWD (CL300, CL600)	6x4x2-1/2	2.875	Equal Percentage, Linear, Whisper I, Cavitrol III (2-stage)	V (for port diameters from 2.875 through 8-in. with optional C-seal trim)
	6x4 8x4	4.375	Equal Percentage, Linear, Whisper I, Cavitrol III (1-stage)	
	8x6 and 12x6	5.375	Whisper III (A3, B3, D3, D3), Cavitrol III (2-stage)	
	8x6 12x6	7	Equal Percentage, Linear, Whisper I, Cavitrol III (1-stage)	
	10x8 12x8	8	Equal Percentage, Linear, Whisper I, Cavitrol III (1-stage)	

1.4 Education Services

Emerson Education Services
 Phone: 800-338-8158
 Email: education@emerson.com
emerson.com/mytraining

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in Table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

Table 4. Approximate Weights

END CONNECTION		VALVE SIZE, NPS													
		4X2		6X4		8X4		8X6		10X8		12X6		12X8	
		Kg	Lb	Kg	Lb	Kg	Lb	Kg	Lb	Kg	Lb	Kg	Lb	Kg	Lb
CL300 (flanged only)		84	185	150	330	234	515	284	625	567	1250	500	1102	653	1440
CL600	Flanged	100	220	195	430	272	600	308	680	744	1640	721	1590	857	1890
	Buttwelding	61	135	122	270	177	390	272	600	512	1130	526	1160	658	1450
CL900	Flanged	---	---	---	---	---	---	612	1350	---	---	---	---	1361	3000
	Buttwelding	---	---	---	---	---	---	454	1000	---	---	---	---	1293	2850

NOTICE

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag or other foreign material from the pipeline.

1. Before installing the valve, inspect the valve body cavity and associated equipment for any damage and any foreign material.
2. Make certain the valve body interior is clean, that pipelines are free of foreign material and that the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.
3. Install the control valve assembly in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven valve plug and cage wear and in improper operation. With some valves, the actuator may also need to be supported when it is not vertical. For more information, consult your Emerson sales office.

NOTE

If installing a valve with small internal flow passages, such as with WhisperFlo, Whisper Trim or Cavitrol cages, consider installing an upstream strainer to prevent the lodging of particles in these passages. This is especially important if the pipeline cannot be thoroughly cleaned or if the flowing medium is not clean.

4. Use accepted piping and welding practices when installing the valve in the line. For flanged valve bodies, use a suitable gasket between the valve body and pipeline flanges.

NOTICE

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Shrink-fit pieces and threaded connections may also loosen. In general, if post weld heat treating is to be performed, remove all trim parts. Contact your Emerson sales office for additional information.

5. With a leak-off bonnet construction, remove the pipe plugs (keys 14 and 16, Figure 21) from the bonnet to hook up the leak-off piping. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
6. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.

**WARNING**

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valves with ENVIRO-SEAL live-loaded packing or HIGH-SEAL live-loaded packing will not require this initial re-adjustment. See Fisher instruction manuals, ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#) or HIGH-SEAL Live-Loaded Packing System, [D101453X012](#), (as appropriate), for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section near the end of this manual.

2.1 Lifting Valve Assembly

WARNING

Failure to follow these lifting guidelines and accepted lifting and rigging practices could result in property damage and personal injury or death.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Only personnel trained in proper lifting and rigging practices shall perform valve/actuator assembly lifting, rigging and installation. Because each lift will be unique, the method of lifting the valve assembly, the correct location for attaching and lifting the valve assembly and what the valve assembly will do when lifted shall be considered for each lift.

Lifting and rigging equipment used to lift, install or remove a valve assembly or component must be properly selected and sized for the weight and configuration of the valve assembly or component being lifted. The weight of the complete valve assembly, including attached accessories, must be taken in consideration for this purpose. The lifting and rigging equipment must be properly maintained and inspected for damage before each use.

If the valve is supplied with an actuator or handwheel, do not use the actuator or handwheel to lift the complete valve assembly. Lifting lugs attached to the actuator must not be used to lift the complete valve assembly unless clearly marked as being rated to support the complete valve assembly weight.

Lifting lugs or other lifting equipment attached to the valve or actuator must never be used to lift or support the weight of attached piping.

NOTICE

Care must be taken when lifting the valve/actuator assembly to ensure all accessories and tubing are not damaged in the process. Accessories and tubing may need to be removed prior to lifting to prevent damage and properly reinstalled before use. Protect valve flange faces, butt weld ends and other connection surfaces from damage during lifting.

Remove the valve/actuator assembly from its shipping container with appropriate lifting and rigging equipment for the valve/actuator assembly weight and configuration to be lifted. The valve and bonnet assembly weight is provided in Table 4. Consult the appropriate actuator and valve accessory instruction manuals for the weight of each additional component, then determine the total weight of the complete valve assembly. The location of the valve/actuator assemblies center of gravity must be considered during lifting, installation and removal. Additional slings or other lifting equipment, such as a load leveler, may be necessary to prevent toppling of the equipment during lifting or to rotate the valve assembly into a different orientation for installation.

2.2 Inverted Globe Valve Applications (Actuator Below Valve)

Due to space restrictions in your application, you may be required to mount the valve/actuator assembly in an inverted orientation, with the actuator positioned below the valve. If so, the following procedures will help you with disassembly and assembly techniques.



WARNING

Avoid personal injury or property damage caused by components dropping.

With the valve/actuator upside down, components may drop during disassembly or assembly. Be careful not to position yourself below the valve in the path of falling parts.

As the bonnet/plug/cage is lowered from the valve body, the center of gravity will be above the lifting points. Take care to prevent the assembly from tipping over as it is lowered. Either leave the actuator attached to the plug and bonnet, attach straps to the stem or provide other means to prevent tipping.

Disassembly

1. Provide adequate support to the actuator while removing it from the bonnet.
2. Provide adequate support to the bonnet while removing the bonnet nuts.
3. Be aware that the bonnet/plug/cage may tip over as they are lowered from the valve body. Make provision to prevent tipping.
4. Be aware that the cage and seat ring may not come out with the bonnet and plug/stem assembly. If this occurs, make provision to support these parts, as they may fall out unexpectedly.

Assembly

1. Start this assembly procedure with the plug/stem assembly already installed in the bonnet.
2. Put the gaskets and cage onto the bonnet and plug.
3. Place the seat ring with the seat ring gasket onto the cage, if applicable with the valve design.
4. Raise this bonnet/plug/cage assembly up into the valve body. Make provision to prevent tipping of these parts as they are being raised into the valve body.
5. Torque the bonnet nuts.
6. Mount the actuator.

Section 3: Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance, trim maintenance and ENVIRO-SEAL bellows seal bonnet replacement. All maintenance operations may be performed with the valve in the line.

WARNING

Avoid personal injury or property damage from sudden release of process pressure. Before performing any maintenance operations:

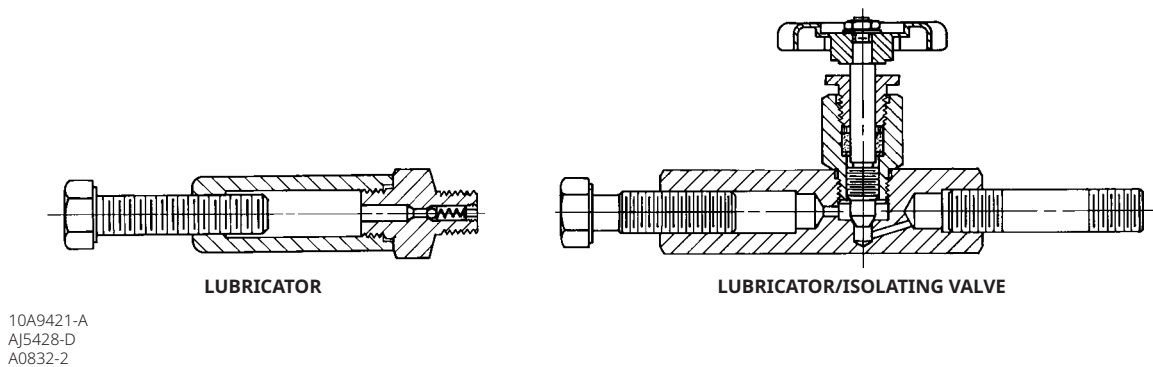
- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

NOTICE

Follow instructions carefully to avoid damaging the product surfaces, which could result in damage to the product.

NOTE

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket upon reassembly. This is necessary to ensure a good gasket seal because the used gasket may not seal properly.

Figure 3. Lubricator and Lubricator/Isolating Valve (Optional)

3.1 Packing Lubrication

NOTE

Do not lubricate graphite packing. Graphite packing is self-lubricated. Additional lubrication may result in slip-stick movement of the valve.

NOTE

ENVIRO-SEAL or HIGH-SEAL packing does not require lubrication.

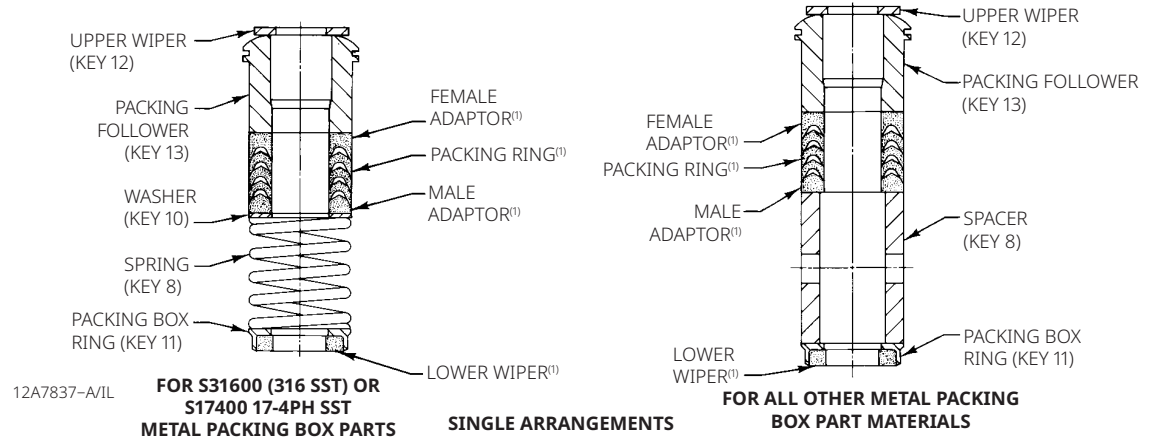


WARNING

To avoid personal injury or property damage resulting from fire or explosion, do not lubricate packing used in oxygen service or in processes with temperatures over 260°C / 500°F.

If a lubricator or lubricator/isolating valve (Figure 3) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the pipe plug (key 14, Figure 21). Use a good quality silicon-base lubricant. Do not lubricate packing used in oxygen service or in processes with temperatures over 260°C / 500°F. To operate the lubricator, simply turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way, except open the isolating valve before turning the cap screw and then close the isolating valve after lubrication is completed.

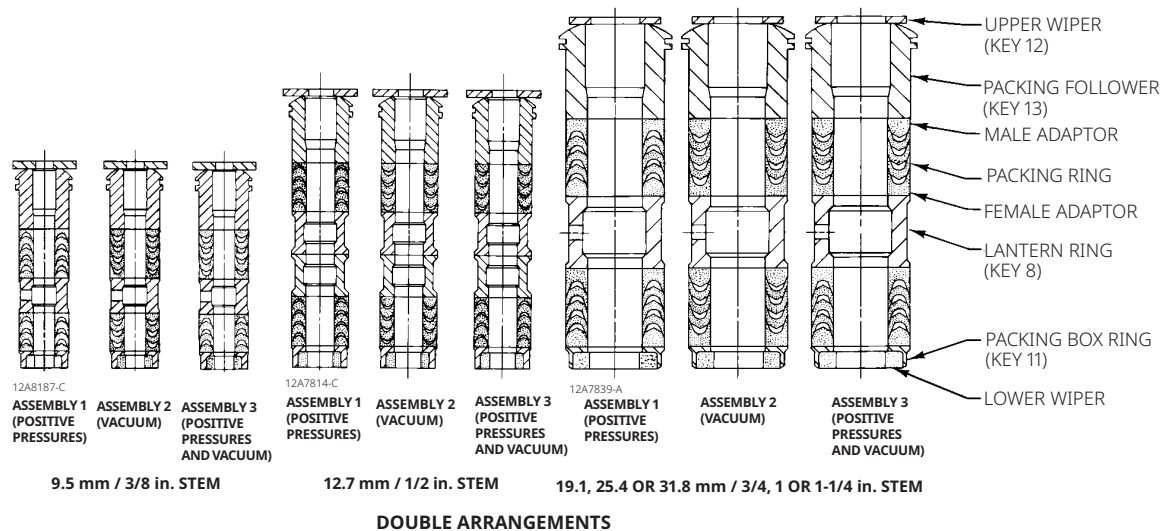
Figure 4. PTFE V-Ring Packing Arrangements



B2398

NOTE:

1. PACKING SET (KEY 6) (2 REQ'D FOR DOUBLE ARRANGEMENTS).



12A8187-C
ASSEMBLY 1
(POSITIVE
PRESSURES)

ASSEMBLY 2
(VACUUM)

ASSEMBLY 3
(POSITIVE
PRESSURES
AND VACUUM)

12A7814-C
ASSEMBLY 1
(POSITIVE
PRESSURES)

ASSEMBLY 2
(VACUUM)

ASSEMBLY 3
(POSITIVE
PRESSURES
AND VACUUM)

12A7839-A
ASSEMBLY 1
(POSITIVE
PRESSURES)

ASSEMBLY 2
(VACUUM)

ASSEMBLY 3
(POSITIVE
PRESSURES
AND VACUUM)

UPPER WIPER
(KEY 12)

PACKING FOLLOWER
(KEY 13)

MALE ADAPTOR

PACKING RING

FEMALE ADAPTOR

LANTERN RING
(KEY 8)

PACKING BOX RING
(KEY 11)

LOWER WIPER

9.5 mm / 3/8 in. STEM

12.7 mm / 1/2 in. STEM

19.1, 25.4 OR 31.8 mm / 3/4, 1 OR 1-1/4 in. STEM

DOUBLE ARRANGEMENTS

B1428-2

3.2 Packing Maintenance

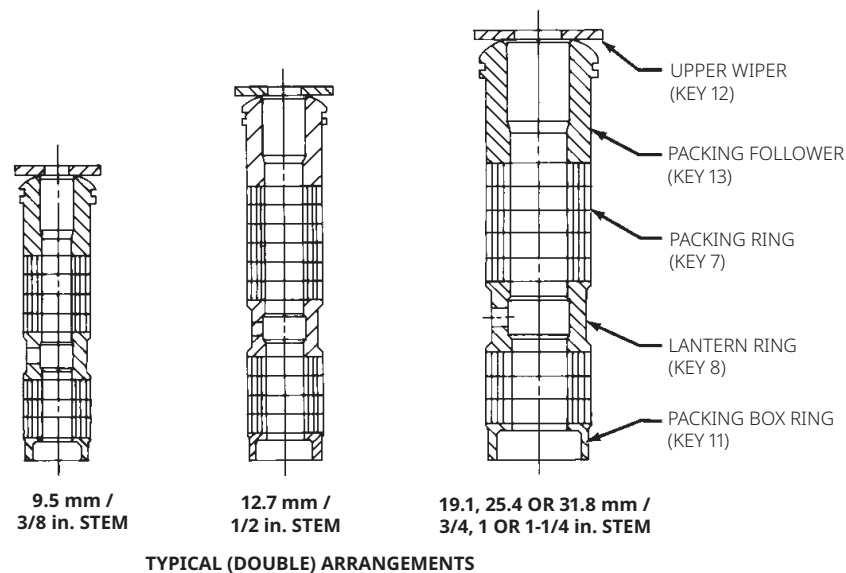
NOTE

For valves with ENVIRO-SEAL live-loaded packing, see the Fisher instruction manual, ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#), for packing instructions. For valves with HIGH-SEAL live-loaded packing, see the Fisher instruction manual, HIGH-SEAL Live-Loaded Packing System, [D101453X012](#), for packing instructions.

Key numbers refer to Figure 4 for PTFE V-ring packing and to Figure 5 for PTFE/composition packing, unless otherwise indicated.

For spring-loaded single PTFE V-ring packing, the spring (key 8, Figure 4) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13, Figure 4), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5, Figure 21) until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, go to the Replacing Packing procedure.

Figure 5. Detail of PTFE/Composition Packing Arrangements



12A8188-A
12A7815-A
12A8173-A
A2619-1

If there is undesirable packing leakage with other than spring-loaded packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

If the packing is relatively new and tight on the stem and if tightening the packing flange nuts does not stop the leakage, the valve stem may be worn or nicked so that a seal cannot be made. The surface finish of a new valve stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

Replacing Packing

WARNING

Avoid personal injury or property damage from sudden release of process pressure. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet. Disconnect the stem connector and then remove the actuator from the valve by unscrewing the yoke locknut (key 15, Figure 21) or the hex nuts (key 26, Figure 21).
3. Loosen the packing flange nuts (key 5, Figure 21) so that the packing is not tight on the valve stem. Remove any travel indicator parts and stem locknuts from the valve stem threads.

WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet.

NOTE

The following step also helps to provide additional assurance that the valve body fluid pressure has been relieved.

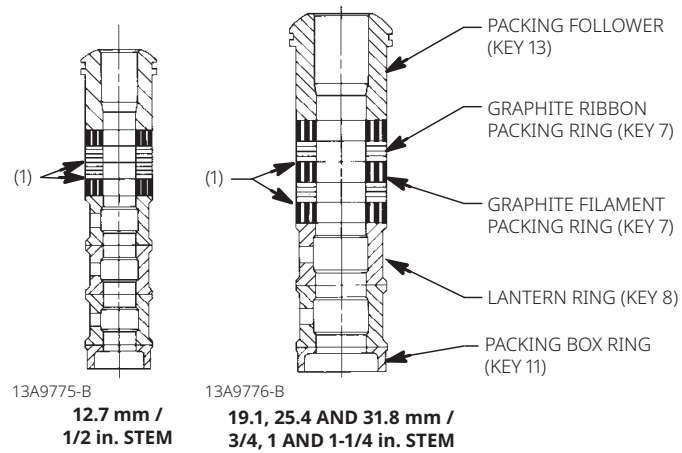
4. Hex nuts (key 16, Figure 22, 23 or 24) attach the bonnet (key 1, Figure 21) to the valve body (key 1, Figure 22, 23 or 24). Loosen these nuts approximately 3 mm / 1/8 in. Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed with bonnet removal as described in the following steps.

NOTICE

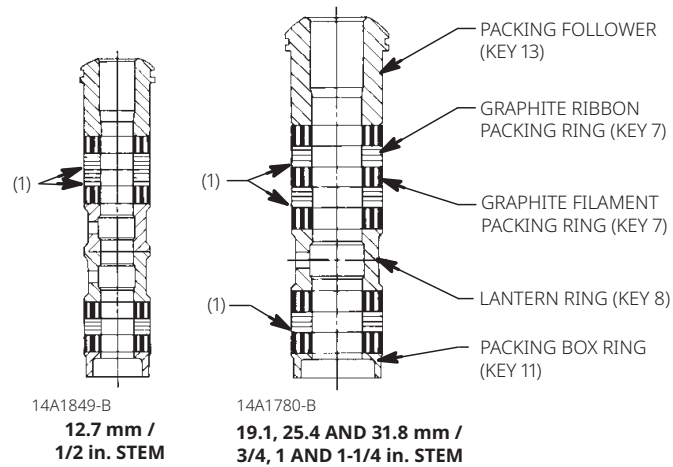
To avoid damage to the seating surface caused by the valve plug and stem assembly dropping from the bonnet after being lifted part way out, temporarily install a valve stem locknut on the valve stem when lifting the bonnet. The locknut prevents the valve plug and stem assembly from dropping out of the bonnet.

5. Completely remove the hex nuts (key 16) and carefully lift the bonnet off the valve body.
6. Remove the locknut and separate the valve plug and stem from the bonnet. Set the parts on a protective surface to prevent damage to gasket or seating surfaces.
7. Remove the bonnet gasket (key 10, Figures 22 through 24) and cover the opening in the valve body to protect the gasket surface and prevent foreign material from getting into the valve body cavity.
8. Remove the packing flange nuts, packing flange, upper wiper and packing follower (keys 5, 3, 12 and 13, Figure 21). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
9. Inspect the valve stem threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts by following the appropriate steps in the Trim Maintenance procedure.
10. Remove the covering protecting the valve cavity and install a new bonnet gasket (key 10, Figures 22 through 24), making sure the gasket seating surfaces are clean and smooth. Place the stem and valve plug into the valve body and slide the bonnet over the stem and onto the stud bolts (key 15, Figure 22, 23 or 24).

Figure 6. Detail of Graphite Ribbon/Filament Packing



SINGLE ARRANGEMENTS



DOUBLE ARRANGEMENTS

A6067

NOTE:

1. 0.102 mm / 0.004 in. THICK SACRIFICIAL ZINC WASHERS; USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

NOTE

Proper performance of the tightening procedures in step 11 compresses the spiral wound gasket (key 12, Figures 22 through 23) or load ring (key 26, Figure 24) enough to both load and seal the seat ring gasket (key 13, Figure 22, 23 or 24). It also compresses the outer edge of the bonnet gasket (key 10, Figures 22 through 24) enough to seal the body-to-bonnet joint.

The proper bolting procedures in step 11 include—but are not limited to—ensuring that bolting threads are clean and evenly tightening the nuts onto the studs in a criss-cross pattern. Because of the bolt-up characteristics of spiral wound gaskets, tightening one nut may loosen an adjacent nut. Repeat the criss-cross tightening pattern several times until each nut is tight and the body-to-bonnet seal is made.

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

**WARNING**

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

11. Lubricate the bolting (not necessary if factory pre-lubricated stud bolt nuts are used) and install it, using proper bolting procedures during tightening so that the body-to-bonnet joint will withstand test pressures and application service conditions. Use the bolt torques in Table 5 as guidelines.
12. Install new packing and the metal packing box parts according to the appropriate arrangement in Figure 4, 5 or 6. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box.
13. Slide the packing follower, upper wiper and packing flange (keys 13, 12 and 3, Figure 21) into position. Lubricate the packing flange studs (key 4, Figure 21) and the faces of the packing flange nuts (key 5, Figure 21). Install the packing flange nuts.

14. For spring-loaded PTFE V-ring packing, tighten the packing flange nuts until the shoulder on the packing follower (key 13, Figure 21) contacts the bonnet.
For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in Table 6.
Then, loosen the packing flange nuts and retighten them to the recommended minimum torque shown in Table 6.
For ENVIRO-SEAL or HIGH-SEAL live-loaded packing, refer to the note at the beginning of the Packing Maintenance section.
For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.
15. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

3.3 Trim Maintenance



WARNING

Avoid personal injury or property damage from sudden release of process pressure. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

Table 5. Body-to-Bonnet Bolt Torque Guidelines Using Anti-Seize Lubricant⁽²⁾

VALVE SIZE, NPS		BOLT TORQUES ^(1,2)	
		N•m	Lbf•ft
4x2		102	75
6x4 or 8x4		259	191
8x6	CL300 or CL600	548	404
	CL900	1315	970
10x8		745	550
12x6		548	404
12x8	CL300 or CL600	732	540
	CL900	2712	2000

1. Determined from laboratory tests.
2. For other lubricants or bolting materials, contact your [Emerson sales office](#) for torques.

Table 6. Recommended Torque for Packing Flange Nuts⁽¹⁾

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE TYPE PACKING				PTFE TYPE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
mm	in.		N•m	Lbf•In	N•m	Lbf•In	N•m	Lbf•In	N•m	Lbf•In
12.7	1/2	CL300	7	59	10	88	3	28	5	42
12.7		CL600	9	81	14	122	4	39	7	58
19.1	3/4	CL300	15	133	23	199	7	64	11	95
19.1		CL600	21	182	31	274	10	87	15	131
25.4	1	CL300	26	226	38	339	12	108	18	162
25.4		CL600	35	310	53	466	17	149	25	223
31.8	1-1/4	CL300	36	318	54	477	17	152	26	228
31.8		CL600	49	437	74	655	24	209	36	314

1. Lubricate with anti-seize compound.

NOTICE

In the following applicable procedures, to avoid damaging parts, do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

For C-seal construction, see the appropriate C-seal sections in this instruction manual.

Except where indicated, key numbers in this section are referenced in Figure 22 for EWD constructions, Figure 22 for restricted trim detail, Figure 23 for EWS constructions and Figure 24 for EWT constructions. Refer to Figures 26 and 27 for Cavitrol III, Figure 28 for Whisper Trim III and Whisper NXG trim detail and Figure 29 for WhisperFlo construction.

Trim Removal

1. Remove the actuator and the bonnet according to steps 1 through 5 of the Replacing Packing procedure.

NOTICE

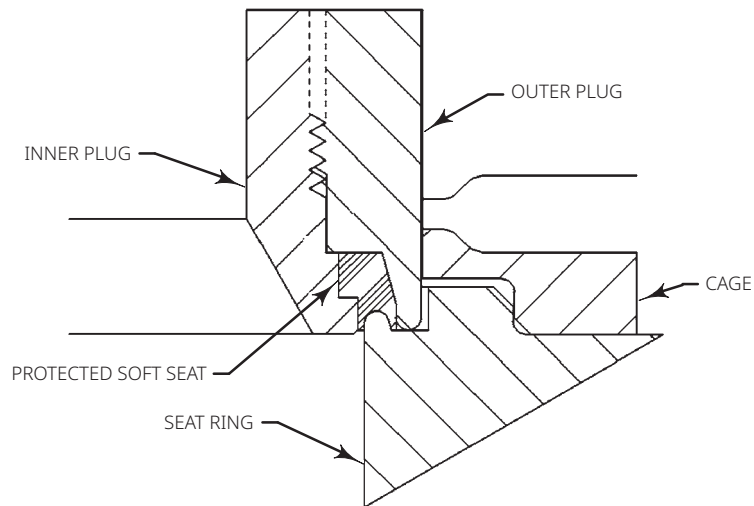
When lifting the valve plug stem (key 7) and attached valve plug (key 2) out of the valve, be certain that the cage (key 3) remains in the valve (key 1). This will prevent cage damage that might be caused by the cage dropping back into the valve after being lifted part way out.

Use care to avoid damaging gasket sealing surfaces. Any damage to the gasket sealing surfaces could cause the valve to leak.

Each graphite piston ring (key 6) in an EWD valve is brittle and in two pieces. Use care to avoid damage to the piston ring(s) caused by dropping or rough handling.

The surface finish of the valve stem (key 7) is critical for making a good packing seal. The inside surface of the cage or cage/baffle assembly (key 3) or cage retainer (key 31) is critical for smooth operation of the valve plug and for making a seal with the piston ring (key 6) or seal ring (key 28). The seating surfaces of the valve plug (key 2) and the seat ring (key 9) on a metal-seat construction are critical for tight shutoff. Protect these parts accordingly while disassembling the trim.

2. Remove the packing flange nuts, packing flange, upper wiper and packing follower (keys 5, 3, 24 and 25, Figure 21). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
3. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
4. Remove the load ring (key 26) from an NPS 10x8 or 12x8 valve or the cage adaptor (key 4) from any restricted-trim valve through NPS 8x4 and wrap it for protection.
5. On a 102 mm / 4-in. travel valve with Whisper Trim I cage or on any NPS 8x6 or 12x6 valve with Whisper Trim III cage, remove the bonnet spacer (key 32) and bonnet gasket (key 10) on top of the spacer. Then on any construction with a cage retainer (key 31), remove the cage retainer and its associated gaskets. A Whisper Trim III cage retainer has two 3/8-in - 16 UNC tappings in which screws or bolts can be installed for lifting.
6. Remove the cage or cage/baffle assembly (key 3) and the associated gaskets (keys 10, 11 and 12). With full-capacity constructions that have FGM gasket sets, a shim (key 53) is used instead of the cage gasket (key 11). If the cage is stuck in the valve, use a rubber mallet to strike the exposed portion of the cage at several points around its circumference.

Figure 7. TSO (Tight Shutoff Trim), Detail of Protected Soft Seat

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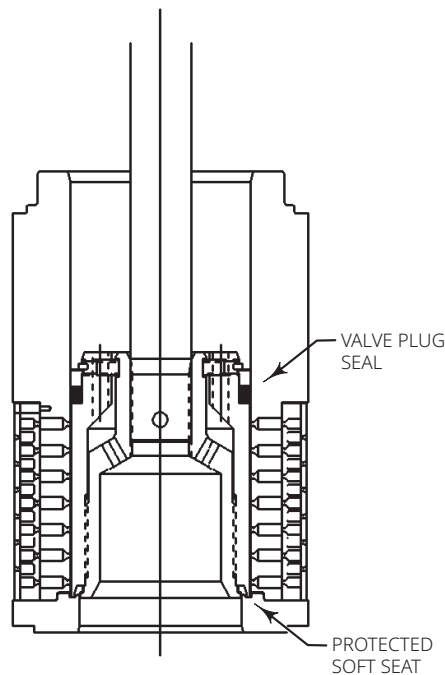
7. For constructions other than TSO (tight shutoff trim), remove the seat ring (key 9) or disk seat (key 22), seat ring gasket (key 13) and the seat ring adaptor (key 5) and adaptor gasket (key 14) where used in a restricted-capacity construction. EWS and EWT PTFE-seat constructions use a disk (key 23) sandwiched between the disk seat and disk retainer (key 21). A CL900 NPS 8x6 EWT construction with Cavitrol III cage has its spiral wound gasket (key 12) on the side of the seat ring opposite the seat ring gasket.
8. For TSO (tight shutoff trim) constructions, perform the following steps (refer to Figures 7 and 8):
 - Remove the piston ring, anti-extrusion rings, backup ring and retainer.
 - Remove the set screws that lock the outer plug to the inner plug.
 - Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
 - Remove the protected soft seat seal.
 - Inspect the parts for damage and replace if needed.
9. For all constructions, inspect parts for wear or damage that would prevent proper operation of the valve. Replace or repair trim parts according to the following procedures for lapping metal seats or other valve plug maintenance procedures, as appropriate.

Lapping Metal Seats

NOTICE

To avoid damaging the ENVIRO-SEAL bellows seal bonnet assembly, do not attempt to lap the metal seating surfaces. The design of the assembly prevents rotation of the stem and any forced rotation will damage internal components of the ENVIRO-SEAL bellows seal bonnet.

Figure 8. Typical Balanced TSO Trim



A7096

Except with respect to the ENVIRO-SEAL Bellows Seal Bonnet assembly, with metal seat constructions, seating surfaces of the valve plug and seat ring (keys 2 and 9, Figures 24 through 26) can be lapped for improved shutoff. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Assemble the valve to the extent that the cage (and cage retainer and bonnet spacer, if used) is in place and the bonnet is bolted to the valve. A simple handle can be made from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction to lap the seats. After lapping, remove the bonnet and clean the seat surfaces. Completely assemble the valve as described in the Trim Replacement portion of the Trim Maintenance section and test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

Valve Plug Maintenance

Except where indicated, key numbers in this section are referenced in Figure 22 for EWD valve plugs, Figure 23 for EWS valve plugs and Figure 24 for EWT valve plugs.

NOTICE

If replacing the piston ring (key 6) or seal ring (key 28), be careful not to scratch the surfaces of the ring groove in the valve plug or any of the surfaces of the replacement ring or the replacement ring may not seal properly.

1. With the valve plug (key 2) removed, according to the Trim Removal section, proceed as appropriate:

For the EWD carbon-filled PTFE piston ring, the ring is split in one place. If there is visible damage, spread the ring slightly and remove it from the groove in the valve plug. To install a carbon-filled PTFE piston ring, spread the ring apart slightly at the split and install it over the stem and into the groove in the valve plug. The open side must face along the stem, depending on flow direction, as shown in Figure 22.

For each EWD graphite piston ring, the ring can be easily removed since it is in two pieces. A new graphite piston ring is furnished as a complete ring. Use a vise with smooth or taped jaws to break this replacement ring into halves. Place the new ring in the vise so that the jaws will compress the ring into an oval. Slowly compress the ring until it snaps on both sides. If one side snaps first, do not try to tear or cut the other side. Instead, keep compressing the ring until the other side snaps. Be sure to match the broken ends when installing the ring in the valve plug groove.

For the EWT two-piece seal ring, the ring cannot be reused as it is a closed ring, which must be pried and/or cut from the groove. Then the elastomeric backup ring (key 29) can be spread slightly and removed.

To install a new two-piece seal ring, apply a general purpose silicone-base lubricant to both the backup ring and seal ring (keys 29 and 28). Place the backup ring over the stem (key 7) and into the groove. Place the seal ring over the top edge of the valve plug (key 2) so that it enters the groove on one side of the valve plug. Slowly and gently stretch the seal ring and work it over the top edge of the valve plug. The PTFE material in the seal ring must be permitted time to cold-flow during the stretching procedure; so avoid jerking sharply on this ring. Stretching the seal ring over the valve plug may make it seem unduly loose when in the groove, but it will contract to its original size after insertion into the cage.

For the EWT spring-loaded seal ring, the ring used on a valve plug having a 136.5 mm / 5.375 in. or less port diameter may be removed undamaged by first working the retaining ring (key 27) off with a screwdriver. Then carefully slide the metal backup ring (key 29) and seal ring (key 28) off the valve plug (key 2). The spring-loaded seal ring used on a valve plug having a 178 mm / 7-in. or greater port diameter must be carefully pried and/or cut from its groove. Therefore, it cannot be reused.

A spring-loaded seal ring must be installed so that its open side faces toward either the top or the bottom of the valve plug, depending on flow direction, as shown in view A of Figure 24. To install a spring-loaded seal ring on a valve plug with a 136.5 mm / 5.375 in. or less port diameter, slide the seal ring (key 28) onto the valve plug followed by the metal backup ring (key 29). Then install the retaining ring (key 27) by inserting one end in the groove and, while turning the plug, press the ring into the groove. Again, be careful not to scratch any surfaces of the ring or plug.

To install the seal ring on a valve plug with 178 mm / 7-in. or greater port diameter, lubricate it with a general purpose silicone-base lubricant. Then gently stretch the seal ring and work it over the top edge of the valve plug. The PTFE material in the seal ring must be permitted time to cold-flow during the stretching procedure; so avoid jerking sharply on the ring. Stretching the seal ring over the valve plug may make it seem unduly loose when in the groove, but it will contract to its original size after insertion into the cage.

NOTICE

Never reuse an old stem or adaptor with a new valve plug. Using an old stem or adaptor with a new plug requires drilling a new pin hole in the stem (or adaptor in case an ENVIRO-SEAL bellows seal bonnet is being used). This drilling weakens the stem or adaptor and may cause failure in service. However, a used valve plug may be reused with a new stem or adaptor except with Cavitrol III trim.

NOTE

The valve plug and valve plug stem for Cavitrol III trim are a matched set and must be ordered together. If the Cavitrol III valve plug or valve plug stem is damaged, replace the entire assembly (key 2, Figures 26 and 27).

2. To replace the valve stem (key 7), drive out the pin (key 8). Unscrew the valve plug from the stem or adaptor.
3. To replace the adaptor (key 24, Figure 21) on ENVIRO-SEAL bellows seal bonnets, place the plug stem assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out the pin (key 36, Figure 21). Reverse the plug stem assembly and valve plug in the soft-jaw chuck or vise. Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the valve plug/adaptor assembly (key 24, Figure 21) from the valve stem assembly (key 20, Figure 21).
4. Screw the new stem or adaptor into the valve plug. Tighten to the torque value given in Table 7. Refer to Table 7 to select the proper drill size. Drill through the stem or adaptor, using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin to lock the assembly.
5. For ENVIRO-SEAL bellows seal bonnets, grip the flats of the stem extending out of the top of the bellows shroud with a soft-jaw chuck or other type of vise. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.

Trim Replacement

Except where indicated, key numbers in this section are referenced in Figure 22 for EWD constructions, Figure 22 for restricted trim detail, Figure 23 for EWS construction and Figure 24 for EWT constructions. Refer to Figures 26 and 27 for Cavitrol III, Figure 28 for Whisper Trim III and Whisper NXG trim detail and Figure 29 for WhisperFlo constructions.

1. With a restricted-trim seat ring construction, install the adaptor gasket (key 14) and seat ring adaptor (key 5).
2. Install the seat-ring gasket (key 13), seat ring (key 9) or disk seat (key 22). With a PTFE-seat construction install the disk and disk retainer (keys 21 and 23). With an NPS 8x6 CL900 EWT valve with Cavitrol III cage, install the spiral wound gasket (key 12) on the seat ring.
3. Install the cage or cage/baffle assembly (key 3). Any rotational orientation of the cage or assembly with respect to the valve is acceptable. A Whisper Trim III cage designated by level A3, B3 or C3 may be installed with either end up. The level D3 cage/baffle assembly or Cavitrol III cage assembly, however, must be installed with the hole pattern end next to the seat ring. If a cage retainer (key 31) is to be used, place it on top of the cage.
4. For constructions other than TSO (tight shutoff trim), slide the valve plug (key 2) and stem assembly or valve plug and ENVIRO-SEAL bellows seal assembly into the cage. Make sure the piston ring or seal ring (key 6 or 28) is evenly engaged in the entrance chamfer at the top of the cage (key 3) or cage retainer (key 31) to avoid damaging the ring.
5. For TSO (tight shutoff) trim constructions, perform the following steps (refer to Figures 7 and 8).
 - Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
 - Mark the top of the inner plug and outer plug with alignment marks in the assembled position.

Table 7. Valve Stem to Plug Torque and Pin Replacement Data

VALVE STEM DIAMETER		STEM TORQUE, MINIMUM TO MAXIMUM ⁽¹⁾		DRILL SIZE, in.
mm	in.	N•m	Lbf•ft	
12.7	1/2	81 to 115	60 to 85	1/8
19.1	3/4	237 to 339	175 to 250	3/16
25.4	1	420 to 481	310 to 355	1/4
31.8	1-1/4	827 to 908	610 to 670	1/4

1. Lubricate with anti-seize compound.

- Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
- Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is compressed properly. Do not damage the outer plug guide surfaces.

- Install set screws centering the inner plug in the outer plug and torque to 11 Nm / 8 lbf•ft.
 - Assemble the piston ring, anti-extrusion rings, backup ring and retainer.
6. For all constructions, place the gaskets (keys 12, 11 or 14 if used and 10) and the shim, if used (key 53), on top of the cage or cage retainer. If there is a cage adaptor (key 4) or a bonnet spacer (key 32), set it on the cage or cage retainer gaskets and place another flat sheet gasket (key 10) on top of the adaptor or spacer. If there is only a cage retainer or bonnet spacer, place another flat sheet gasket on the retainer or spacer.
 7. With an NPS 10x8 or 12x8 valve, install the load ring (key 26).
 8. Mount the bonnet on the valve and complete assembly according to steps 11 through 15 of the Replacing Packing section. Be sure to observe the note prior to step 11.

3.4 Retrofit: Installing C-seal Trim

NOTE

Additional actuator thrust is required for a valve with C-seal trim. When installing C-seal trim in an existing valve, contact your [Emerson sales office](#) for assistance in determining new actuator thrust requirements.

Assemble the new valve plug/retainer assembly (with C-seal plug seal) using the following instructions:

NOTICE

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the new trim parts while assembling the individual parts and during installation in the valve body.

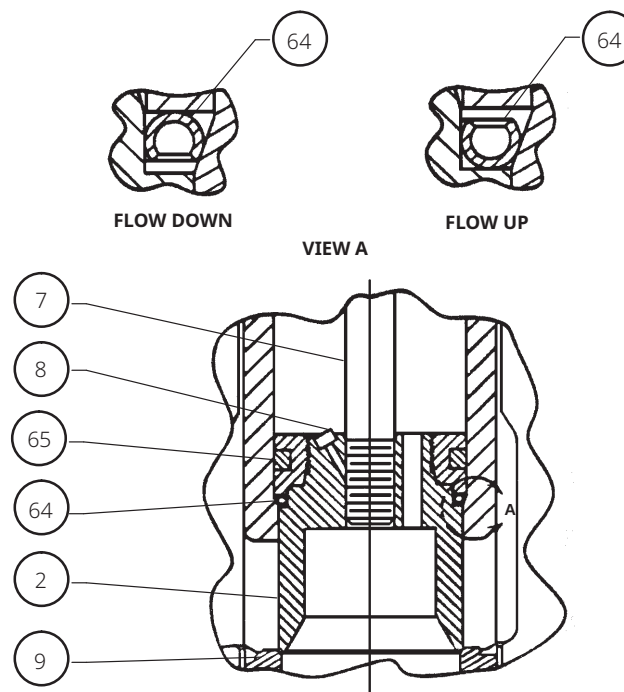
1. Apply a suitable high-temperature lubricant to the inside diameter of the C-seal plug seal. Also, lubricate the outside diameter of the valve plug where the C-seal plug seal must be pressed into the proper sealing position (Figure 9).
2. Orient the C-seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the C-seal plug seal must face up in a valve with flow-up construction (Figure 9).
 - The open interior of the C-seal plug seal must face down in a valve with flow-down construction (Figure 9).

NOTE

An installation tool must be used to properly position the C-seal plug seal on the valve plug. A tool is available as a spare part from Emerson or a tool could be manufactured following the dimensions given in Figure 10.

3. Place the C-seal plug seal over the top of the valve plug and press the C-seal plug seal onto the plug using the C-seal installation tool. Carefully press the C-seal plug seal onto the plug until the installation tool contacts the horizontal reference surface of the valve plug (Figure 11).
4. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the C-seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
5. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (Figure 12) to secure the C-seal retainer.

Figure 9. Fisher EWD with C-seal Trim



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6. Install the new plug/retainer assembly with C-seal plug seal on the new stem following the appropriate instructions in the Trim Replacement section of this manual.
7. Install piston rings by following instructions in the Trim Replacement section of this manual.
8. Remove the existing valve actuator and bonnet following the appropriate instructions in the Replacing Packing section in this manual.

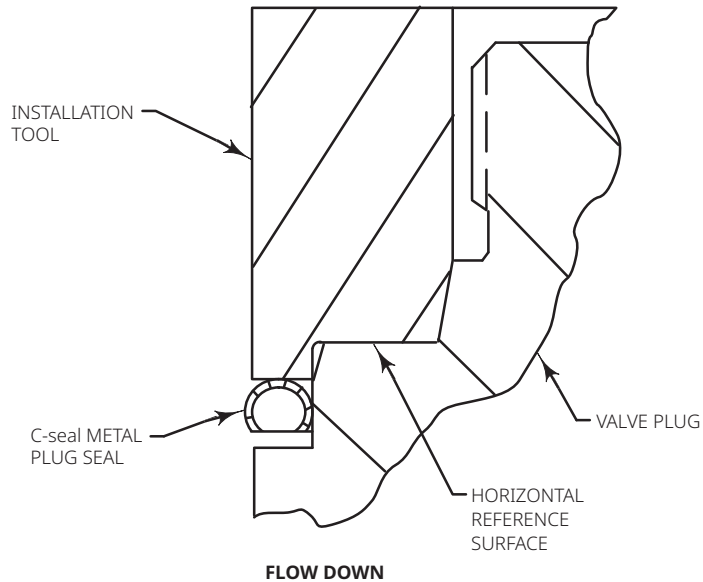
NOTICE

Do not remove the existing valve stem from the valve plug unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

9. Remove the existing valve stem and plug, cage and seat ring from the valve body following the appropriate instructions in the Trim Removal section in this manual.
10. Replace all gaskets according to appropriate instructions in the Trim Replacement section in this manual.
11. Install the new seat ring, cage, valve plug/retainer assembly and stem into the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section in this manual.
12. With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

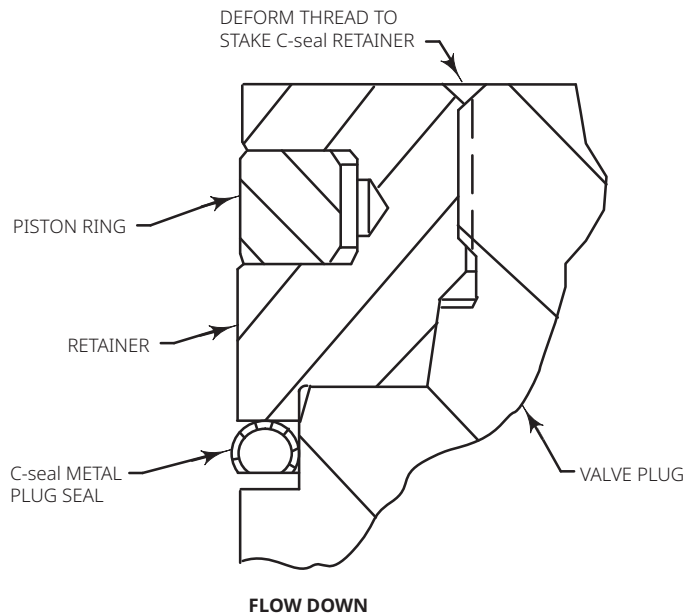
Figure 11. Installing the C-seal Plug Seal Using the Installation Tool



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NOTE: PRESS INSTALLATION TOOL OVER VALVE PLUG UNTIL THE TOOL CONTACTS THE HORIZONTAL REFERENCE SURFACE OF THE VALVE PLUG.

Figure 12. Stake the Threads of the C-seal Retainer



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NOTICE

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the C-seal plug seal and contact the seat ring. You can correctly seat the valve plug by applying the full actuator load. This force will adequately drive the valve plug to the seat ring, thus giving the C-seal plug seal a predetermined permanent set. Once this is done, the plug/retainer assembly, the cage and the seat ring become a matched set.

3.5 Replacement of Installed C-seal Trim

Trim Removal (C-seal Constructions)

1. Remove the valve actuator and bonnet following the appropriate instructions in the Replacing Packing section in this manual.

NOTICE

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance.

Use caution when removing piston ring(s) and C-seal plug seal to avoid scratching any sealing surface.

NOTICE

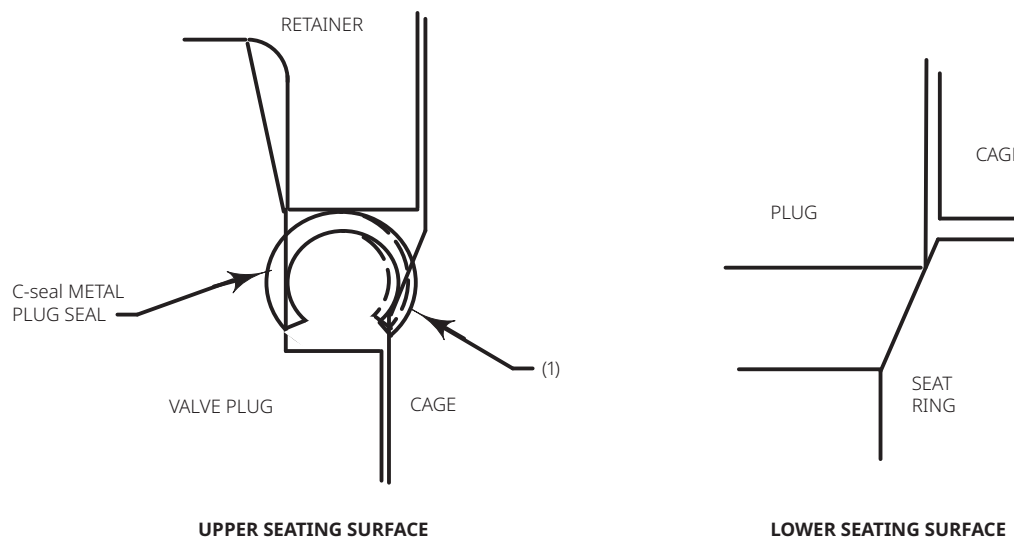
Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

2. Remove the plug/retainer assembly (with C-seal plug seal), cage and seat ring from the valve body following the appropriate instructions in the Trim Removal section of this manual.
3. Locate the staked thread on top of the valve plug (Figure 12). The staked thread secures the retainer. Use a drill with a 1/8 inch bit to drill out the staked area of the thread. Drill approximately 1/8 in. into the metal to remove the staking.

4. Locate the break between sections of the piston ring(s). Using an appropriate tool such as a flat-blade screwdriver, carefully pry out the piston ring(s) from the groove(s) in the C-seal retainer.
5. After removing the piston ring(s), locate the 1/4-inch diameter hole in the groove. In a retainer with two piston ring grooves, the hole will be found in the upper groove.
6. Select an appropriate tool such as a punch and place the tip of the tool into the hole with the body of the tool held tangent to the outside diameter of the retainer. Strike the tool with a hammer to rotate the retainer and free it from the valve plug. Remove the retainer from the plug.
7. Use an appropriate tool such as a flat-blade screwdriver to pry the C-seal plug seal off the plug. Use caution to avoid scratches or other damage to the sealing surfaces where the C-seal plug seal makes contact with the valve plug (Figure 13).

Figure 13. Lower (Valve Plug to Seat Ring) and Upper (C-seal Plug Seal to Cage) Seating Surfaces



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NOTE:

1. UPPER SEATING SURFACE IS THE AREA OF CONTACT BETWEEN THE C-SEAL METAL PLUG SEAL AND THE CAGE.

8. Inspect the lower seating surface where the valve plug contacts the seat ring for wear or damage which would prevent proper operation of the valve. Also, inspect the upper seating surface inside the cage where the C-seal plug seal contacts the cage and inspect the sealing surface where the C-seal plug seal makes contact with the plug (Figure 13).
9. Replace or repair trim parts according to the following procedure for lapping metal seats, remachining metal seats or other valve plug maintenance procedures as appropriate.

Lapping Metal Seats (C-seal Constructions)

Before installing a new C-seal plug seal, lap the lower seating surface (valve plug to seat ring, Figure 13) following appropriate procedures in the Lapping Metal Seats section of this manual.

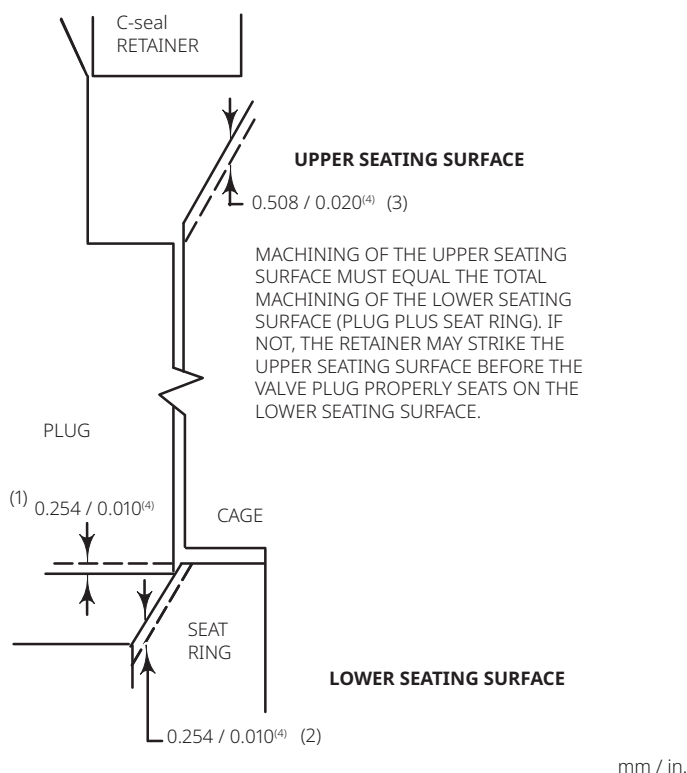
Remachining Metal Seats (C-seal Constructions)

See Figure 14. A valve plug with a C-seal metal plug seal features two seating surfaces. One seating surface is found where the valve plug contacts the seat ring. The second seating surface is found where the C-seal plug seal contacts the upper seating surface in the cage. If you machine the seats on the seat ring and/or plug, you must machine an equal dimension from the seating area in the cage.

NOTICE

If metal is removed from the seat ring and plug and a corresponding amount is not removed from the cage seating area, the C-seal plug seal will be crushed as the valve closes and the C-seal retainer will strike the seating area of the cage, preventing the valve from closing.

Figure 14. Example of Machining the Lower (Valve Plug to Seat Ring) and Upper (C-seal Plug Seal to Cage) Seating Surfaces



A6781 / IL

NOTES:

- PLUS
1. REMOVAL OF 0.254 mm / 0.010 in. FROM THE VALVE PLUG
 2. REMOVAL OF 0.254 mm / 0.010 in. FROM THE SEAT RING
 3. REMOVAL OF 0.508 mm / 0.020 in. FROM THE UPPER SEATING SURFACE IN THE CAGE
 4. THESE VALUES ARE FOR EXAMPLE ONLY. REMOVE ONLY THE MINIMUM AMOUNT OF MATERIAL REQUIRED TO REFURBISH THE SEATS.

Trim Replacement (C-seal Constructions)

1. Apply a suitable high-temperature lubricant to the inside diameter of the C-seal plug seal. Also, lubricate the outside diameter of the valve plug where the C-seal plug seal must be pressed into the proper sealing position (Figure 9).
2. Orient the C-seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the C-seal plug seal must face up in a valve with flow-up construction (Figure 9).
 - The open interior of the C-seal plug seal must face down in a valve with flow-down construction (Figure 9).

NOTE

An installation tool must be used to properly position the C-seal plug seal on the valve plug. A tool is available as a spare part from Emerson or a tool could be manufactured following the dimensions given in Figure 10.

3. Place the C-seal plug seal over the top of the valve plug and press it onto the plug using the installation tool. Carefully press the C-seal plug seal onto the plug until the installation tool contacts the horizontal reference surface of the valve plug (Figure 11).
4. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the C-seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
5. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (Figure 12) to secure the C-seal retainer.
6. Replace the piston ring(s) following instructions in the Trim Replacement section of this manual.
7. Return the seat ring, cage, plug/retainer assembly and stem to the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section of this manual.
8. With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

NOTICE

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the C-seal plug seal and contact the seat ring. You can correctly seat the valve plug by applying the full actuator load. This force will adequately drive the valve plug to the seat ring, thus giving the C-seal plug seal a predetermined permanent set. Once this is done, the plug/retainer assembly, the cage and the seat ring become a matched set.

3.6 ENVIRO-SEAL Bellows Seal Bonnet

Replacing a Plain or Extension Bonnet with an ENVIRO-SEAL Bellows Seal Bonnet (Stem/Bellows Assembly)

Except where indicated, key numbers in this section are referenced in Figure 22 for EWD constructions, Figure 22 for restricted trim detail, Figure 23 for EWS constructions and Figure 24 for EWT constructions. Refer to Figures 26 and 27 for Cavitrol III, Figure 28 for Whisper Trim III and Whisper NXG trim detail and Figure 29 for WhisperFlo constructions.

Table 8. Recommended Torque for ENVIRO-SEAL Bellows Seal Bonnet Packing Flange Nuts⁽¹⁾

VALVE SIZE, NPS	VALVE STEM DIAMETER THROUGH PACKING	MINIMUM TORQUE		MAXIMUM TORQUE	
		N•m	Lbf•in	N•m	Lbf•in
4x2	1/2	2	22	4	33
6x4 to 12x8	1	5	44	8	67

1. Lubricate with anti-seize compound.

1. Remove the actuator and bonnet according to steps 1 through 6 of the Replacing Packing procedure in the Maintenance section.
2. Lift out the cage.
3. Remove and discard the existing bonnet gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

NOTE

The ENVIRO-SEAL stem/bellows assembly for easy-e™ valves is available only with a threaded and drilled plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed.

4. Inspect the existing valve plug. If the plug is in good condition, it can be reused with the new ENVIRO-SEAL stem/bellows assembly. To remove the existing valve plug from the stem, first, place the existing plug stem assembly in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 8).
5. Then, reverse the plug stem assembly in the soft-jaw chuck or vise. Grip the valve stem in an appropriate place and unscrew the existing plug from the valve stem.

NOTICE

When installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

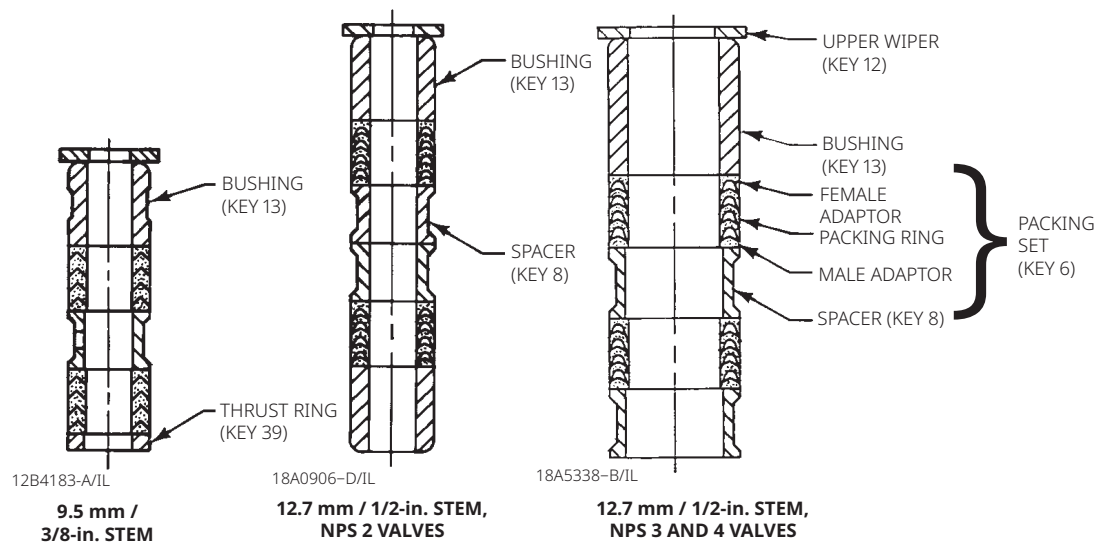
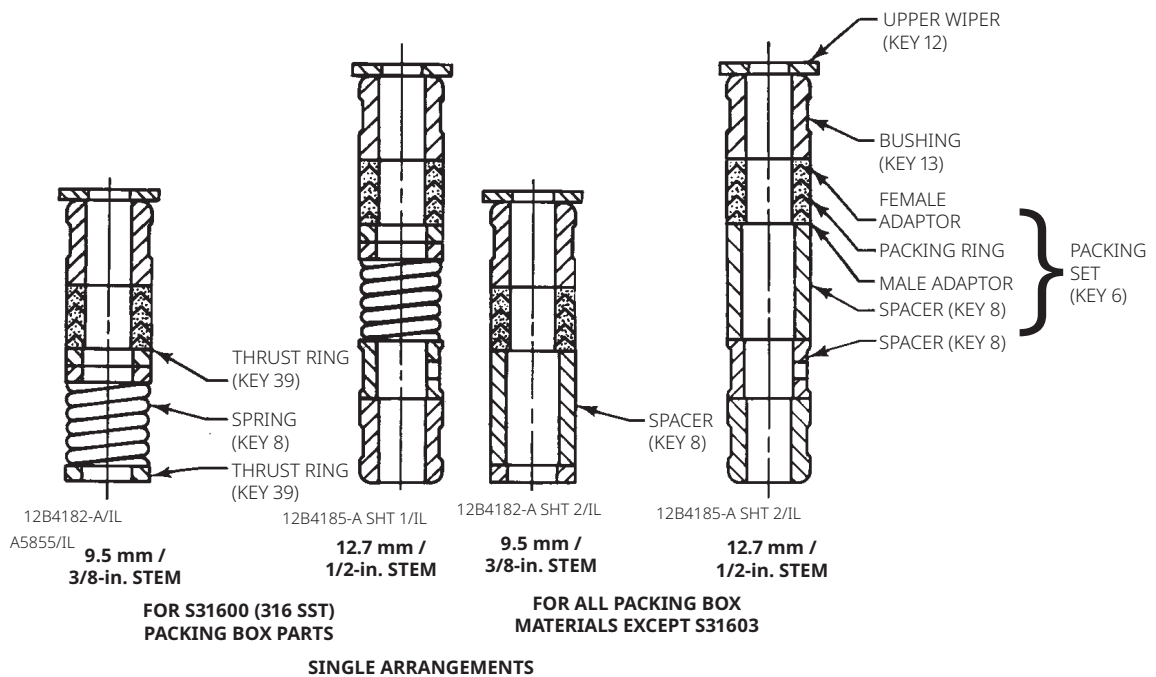
Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

NOTE

The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

6. To attach the valve plug to the stem of the new ENVIRO-SEAL stem/bellows assembly, it is necessary to first attach the plug to the adaptor (key 24, Figure 21). Locate the adaptor. Notice that a hole has not been drilled in the threads where the plug screws onto the adaptor. Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor. Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Select the proper size of drill bit and drill through the adaptor using the hole in the valve plug as a guide. Remove any metal chips or burrs and drive in a new pin (key 8) to lock the plug/adaptor assembly together.
8. Attach the plug/adaptor assembly to the ENVIRO-SEAL stem/bellows assembly by first securing the stem/bellows assembly in a soft-jaw chuck or other type of vise so that the jaws of the chuck or vise grip the flats of the stem extending out of the top of the bellows shroud. Screw the valve plug/adaptor assembly onto the valve stem. Tighten the plug/adaptor assembly until it is snug. Then turn the plug/adaptor assembly to the next pin hole in the valve stem. Drive in new pin (key 36, Figure 21) to lock the assembly.

Figure 15. PTFE Packing Arrangement for Use in ENVIRO-SEAL Bellows Seal Bonnets



A5886-1

9. Inspect the seat ring (key 9). Replace, if necessary.
10. Place a new gasket (key 10) into the valve body in place of the bonnet gasket. Install the new stem/bellows assembly with valve plug/adaptor by placing it into the valve body on top of the new bellows gasket.
11. Place a new gasket (key 22, Figure 21) over the stem/bellows assembly. Place the new ENVIRO-SEAL bonnet over the stem/bellows assembly.

NOTE

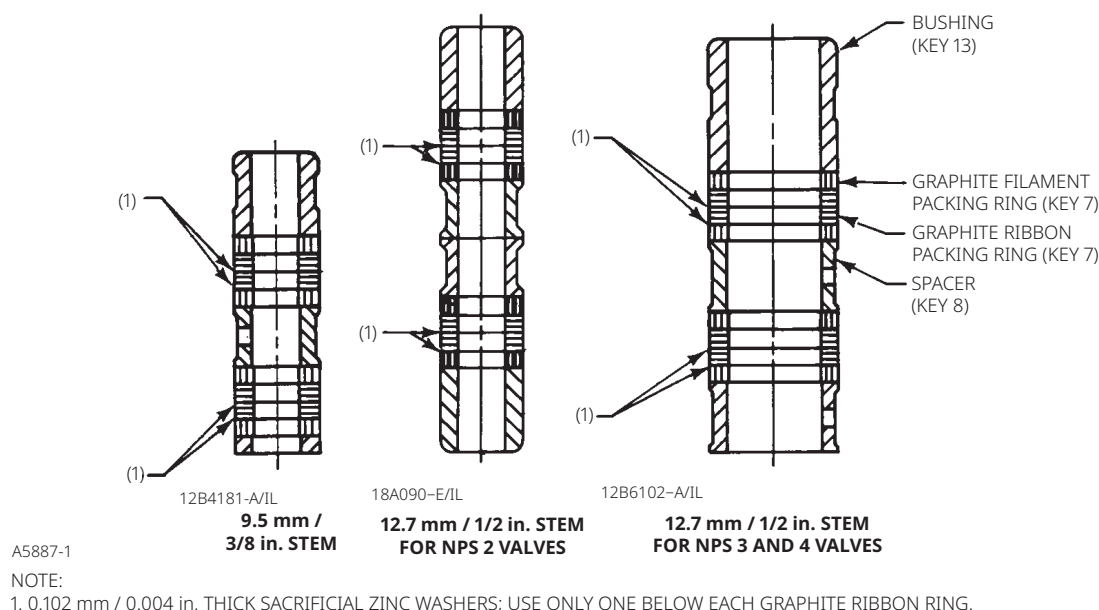
Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.



WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

12. Properly lubricate the bonnet stud bolts. Install and tighten the bonnet hex nuts to the proper torque.
13. Install the new packing and the metal packing box parts according to the appropriate arrangement in Figure 15 or 16.
14. Install the packing flange. Properly lubricate the packing flange stud bolts and the faces of the packing flange nuts.

Figure 16. Double Graphite Ribbon/Filament Arrangements for Use in ENVIRO-SEAL Bellows Seal Bonnets

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in Table 8. Then, loosen the packing flange nuts and retighten them to the recommended minimum torque shown in Table 8.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in Table 8. Then, tighten the remaining flange nut until the packing flange is level and at a 90-degree angle to the valve stem.

15. Install the travel indicator parts and stem locknuts; mount the actuator on the valve body according to the procedure in the appropriate actuator instruction manual.

Replacement of an Installed ENVIRO-SEAL Bellows Seal Bonnet (Stem/Bellows Assembly)

1. Remove the actuator and bonnet according to steps 1 through 6 of the Replacing Packing procedure of the Maintenance section.
2. Lift out the cage. Remove and discard the existing bonnet gasket and bellows gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

NOTICE

The ENVIRO-SEAL stem/bellows assembly for easy-e valves is available only with a threaded and pinned plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed. If the existing valve plug is reused and the adaptor is in good condition, it may be reused also. However, never reuse an old adaptor with a new valve plug. Using an old adaptor with a new valve plug requires drilling a new pin hole in the adaptor. This drilling weakens the adaptor and may cause failure in service. However, a used valve plug may be reused with a new adaptor.

3. Inspect the existing valve plug and adaptor. If they are in good condition, they can be reused with the new stem/bellows assembly and they do not need to be separated.

NOTICE

When removing/installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

NOTE

The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

4. If the valve plug and adaptor are not in good condition and must be replaced, the valve plug/adaptor assembly must first be removed from the stem/bellows assembly and then the valve plug removed from the adaptor. First, place the stem/bellows assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 8). Drive out the pin (key 36, Figure 21).
5. Then, reverse the stem/bellows and plug/adaptor assembly in the soft-jaw chuck or vise. Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the plug/adaptor assembly from the stem/bellows assembly. Unscrew the valve plug from the adaptor.
6. To attach either the existing or a new valve plug to the stem of the new ENVIRO-SEAL stem/bellows assembly, first attach the plug to the adaptor (if the valve plug was removed from the adaptor) as follows:
 - Locate the adaptor. Notice that a hole has not been drilled in the new adaptor threads where the plug screws onto the adaptor.
 - Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor.
 - Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Complete the installation by following steps 7 through 15 of the ENVIRO-SEAL Bellows Seal Bonnet installation instructions given above.

Purging the ENVIRO-SEAL Bellows Seal Bonnet

The ENVIRO-SEAL bellows seal bonnet has been designed so that it can be purged or leak tested. Refer to Figure 21 for an illustration of an ENVIRO-SEAL bellows seal bonnet. Perform the following steps for purging or leak testing.

1. Remove the two diametrically opposed pipe plugs (key 16, Figure 21).
2. Connect a purging fluid to one of the pipe plug connections.
3. Install appropriate piping or tubing in the other pipe plug connection to pipe away the purging fluid or to make a connection to an analyzer for leak testing.
4. When purging or leak testing has been completed, remove the piping or tubing and reinstall the pipe plugs (key 16, Figure 21).

Section 4: Parts

4.1 Parts Ordering

Each body-bonnet assembly is assigned a serial number, which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and to the 11-character part number for each part required from the following parts list.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

4.2 Parts Kits

Gasket Kits

Gasket Kits (includes keys 10, 12, 13 and 53; plus 11 and 14 for restricted trim)

Table 9. Gasket Kits

VALVE SIZE, NPS	Standard Trim Cage Whisper Trim I Cage Cavitrol III - 1 Stage Cage	Cavitrol III - 2 Stage Cage Whisper Trim III / NXG Cage WhisperFlo Cage
	-198 to +593°C / -325 to +1100°F	
	Part Number	
4x2	RGASKETX182	RGASKETX442
6x4x2-1/2	RGASKETX282	- - -
6x4 or 8x4	RGASKETX212	RGASKETX472
8x6 or 12x6 CL300, CL600 or CL900	RGASKETX392	- - -
8x6 or 12x6 Whisper Trim I	RGASKETX412 ⁽¹⁾	- - -
10x8 or 12x8	RGASKETX232	10A3265X152
1. Includes a quantity 2 of key 10.		

4.3 Packing Kits

Standard Packing Repair Kits

Packing repair kits for standard packing include keys 6, 8, 10, 11 and 12.

NOTE

Kits do not apply to alloy C (N10276 and CW2M), Alloy 20 (N08020 and CN7M) or alloy 400 (N04400 and M35-1) trims.

Table 10. Standard Packing Repair Kits (Non Live-Loaded)

Stem Diameter, mm / in. Yoke Boss Diameter, mm / in.	12.7 / 1/2 71 / 2-13/16	19.1 / 3/4 90 / 3-9/16	25.4 / 1 127 / 5	31.8 / 1-1/4 127 / 5, 5H
PTFE (Contains keys 6, 8, 10, 11 and 12)	RPACKX00022	RPACKX00032	RPACKX00342	RPACKX00352
Double PTFE (Contains keys 6, 8, 11 and 12)	RPACKX00052	RPACKX00062	RPACKX00362	RPACKX00372
PTFE/Composition (Contains keys 7, 8, 11 and 12)	RPACKX00082	RPACKX00092	---	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8 and 11)	RPACKX00112	RPACKX00122	---	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring] and 11)	---	---	RPACKX00532	RPACKX00542
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring])	RPACKX00142	RPACKX00152	---	---
Double Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8 and 11)	RPACKX00172	RPACKX00182	---	---

HIGH-SEAL and ENVIRO-SEAL Packing Retrofit Kits

Retrofit kits include parts to convert valves with existing standard bonnets to the HIGH-SEAL or ENVIRO-SEAL packing box construction. Refer to Figure 17 for key numbers for HIGH-SEAL packing. For ENVIRO-SEAL packing, refer to Figure 18 for PTFE packing key numbers, Figure 19 for Graphite ULF packing key numbers and Figure 20 for duplex packing key numbers.

Stems and packing box constructions that do not meet Emerson stem finish specifications, dimensional tolerances and design specifications, may adversely alter the performance of this packing kit.

Table 11. HIGH-SEAL Packing Retrofit Kits

Stem Diameter, mm / in. Yoke Boss Diameter, mm / in.	12.7 / 1/2 71 / 2-13/16	19.1 / 3/4 90 / 3-9/16	25.4 / 1 127 / 5	31.8 / 1-1/4 127 / 5, 5H
4200 psi Process Pressure Rating (Contains keys 200 through 212)	11B2182X052	11B2184X052	11B2187X052	11B2189X052

Table 12. ENVIRO-SEAL Packing Retrofit Kits

Stem Diameter, mm / in. Yoke Boss Diameter, mm / in.	12.7 / 1/2 71 / 2-13/16	19.1 / 3/4 90 / 3-9/16	25.4 / 1 127 / 5	31.8 / 1-1/4 127 / 5, 5H
Double PTFE (Contains keys 200, 201, 211, 212, 214, 215, 217, 218, tag, cable tie)	RPACKXRT022	RPACKXRT032	RPACKXRT042	RPACKXRT052
Graphite ULF (Contains keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 217, tag, cable tie)	RPACKXRT272	RPACKXRT282	RPACKXRT292	RPACKXRT302
Duplex (Contains keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, cable tie)	RPACKXRT222	RPACKXRT232	RPACKXRT242	RPACKXRT252

ENVIRO-SEAL Packing Repair Kits

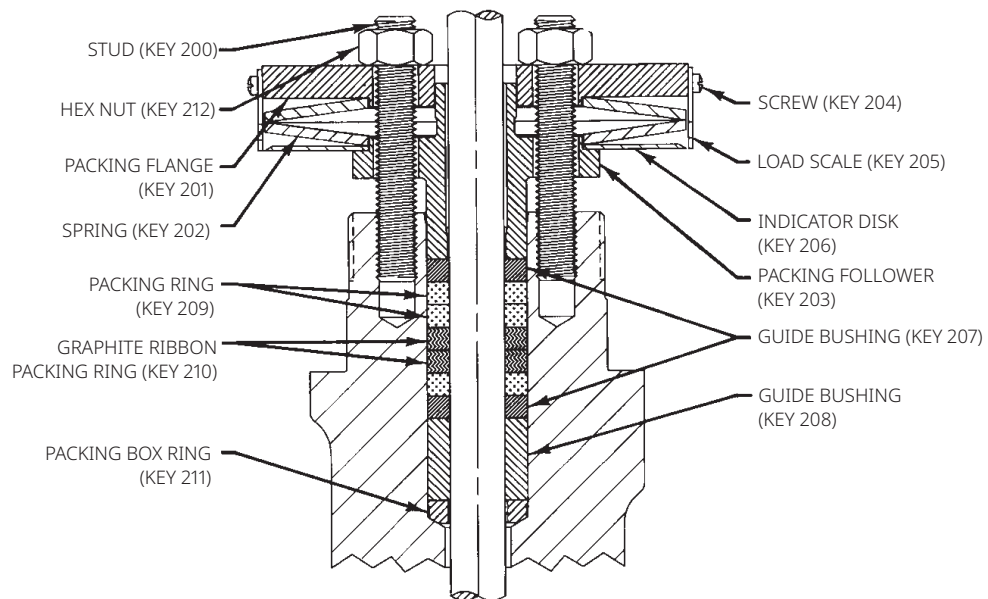
Repair kits include parts to replace the "soft" packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits. Refer to Figure 18 for key numbers for PTFE packing, Figure 19 for key numbers for Graphite ULF packing and Figure 20 for key numbers for duplex packing.

Stems and packing box constructions that do not meet Emerson stem finish specifications, dimensional tolerances and design specifications, may adversely alter the performance of this packing kit.

Table 13. ENVIRO-SEAL Packing Repair Kits

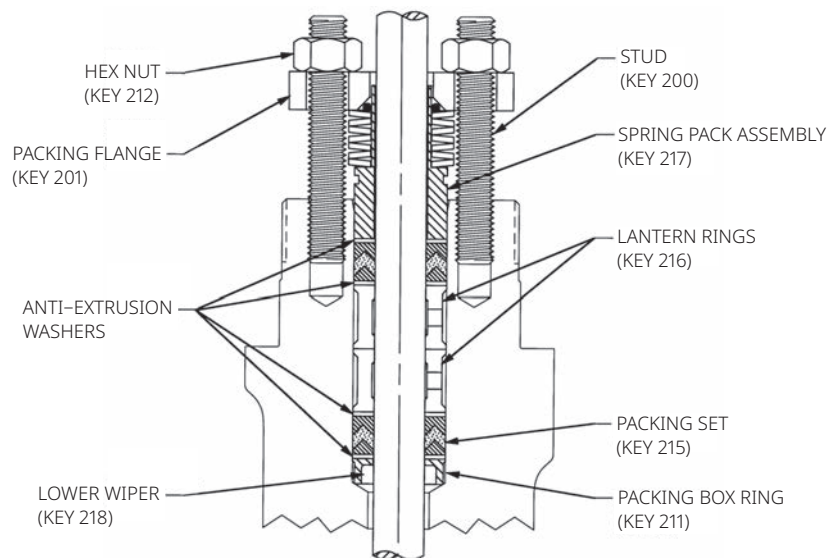
Stem Diameter, mm / in. Yoke Boss Diameter, mm / in.	12.7 / 1/2 71 / 2-13/16	19.1 / 3/4 90 / 3-9/16	25.4 / 1 127 / 5	31.8 / 1-1/4 127 / 5, 5H
Double PTFE (Contains keys 214, 215, 218)	RPACKX00202	RPACKX00212	RPACKX00222	RPACKX00232
Graphite ULF (Contains keys 207, 208, 209, 210, 214)	RPACKX00602	RPACKX00612	RPACKX00622	RPACKX00632
Duplex (Contains keys 207, 209, 214, 215)	RPACKX00302	RPACKX00312	RPACKX00322	RPACKX00332

Figure 17. Typical Fisher HIGH-SEAL Packing System



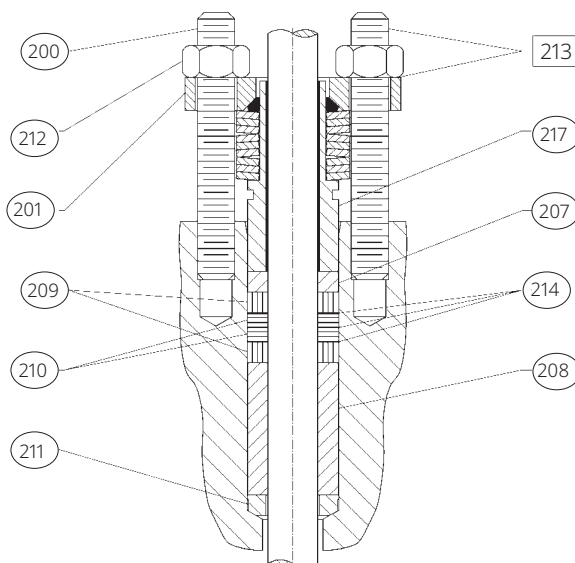
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Figure 18. Typical ENVIRO-SEAL Packing System with PTFE Packing



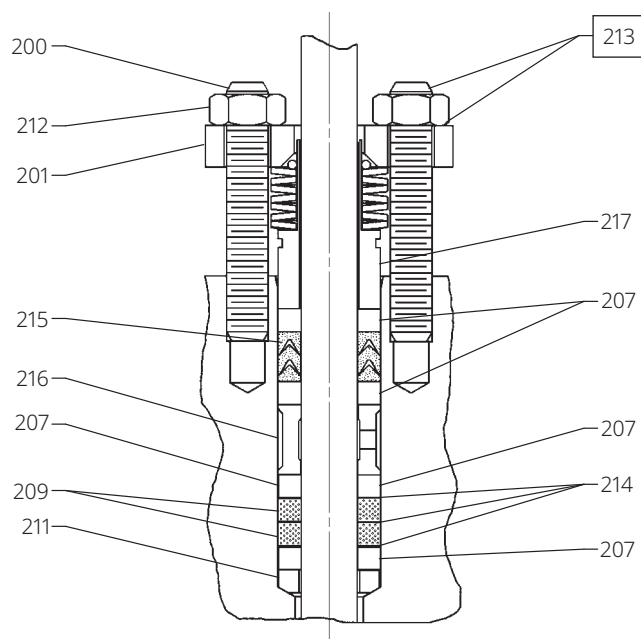
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Figure 19. Typical ENVIRO-SEAL Packing System with Graphite ULF Packing



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Figure 20. Typical Fisher ENVIRO-SEAL Packing System with Duplex Packing



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4.4 Parts List

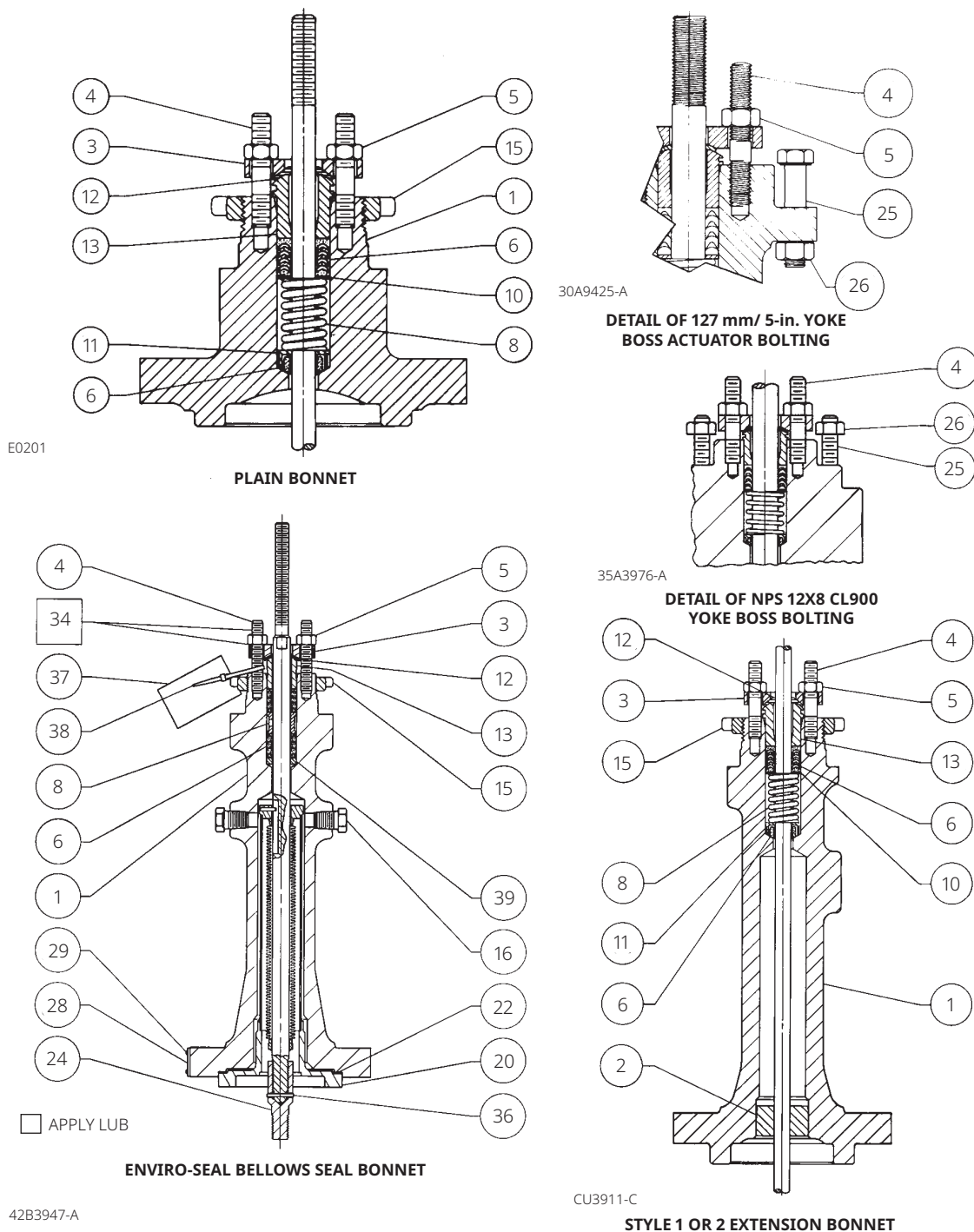
NOTE

Contact your [Emerson sales office](#) for part numbers.

Table 14. Bonnet (Figures 4, 5, 6 and 21)

Key	Description	Key	Description
1	Bonnet	13*	ENVIRO-SEAL bellows seal bushing
2	Extension Bonnet Bushing	13*	ENVIRO-SEAL bellows seal bushing/liner
3	Packing flange	14	Packing Box Pipe Plug
3	ENVIRO-SEAL bellows seal packing flange	14	Lubricator
4	Packing flange stud	14	Lubricator/Isolating Valve Assembly
4	ENVIRO-SEAL bellows seal stud bolt (2 req'd)	15	Yoke locknut
5	Packing flange nut	15	ENVIRO-SEAL bellows seal yoke locknut
5	ENVIRO-SEAL bellows seal packing flange nut (2 req'd)	16	Pipe Plug for double-tapped bonnet
6*	Single PTFE V-Ring Packing Set	16	ENVIRO-SEAL bellows seal pipe plug (2 req'd)
6*	ENVIRO-SEAL bellows seal packing set	20*	ENVIRO-SEAL bellows seal stem/bellows assembly
7*	Individual Packing Ring	22*	ENVIRO-SEAL bellows seal bonnet gasket
7*	ENVIRO-SEAL bellows seal packing ring	24	ENVIRO-SEAL bellows seal adaptor
7*	ENVIRO-SEAL bellows seal packing ring	25	Cap Screw for yoke boss (8 req'd)
8	Packing Box Spring or Lantern Ring	26	Hex Nut for yoke boss (8 req'd)
8	ENVIRO-SEAL bellows seal spring	27	Pipe Nipple for lubricator/isolating valve
8	ENVIRO-SEAL bellows seal spacer	28	Warning Nameplate for ENVIRO-SEAL bellows
9*	Individual Packing Ring	29	Drive Screw for ENVIRO-SEAL bellows (2 req'd)
10	Special washer	36*	ENVIRO-SEAL bellows seal pin
11*	Packing box ring	37	Warning tag for ENVIRO-SEAL bellows
12*	Upper wiper	38	Tie for ENVIRO-SEAL bellows
12*	ENVIRO-SEAL bellows seal upper wiper	39	ENVIRO-SEAL bellows seal thrust ring
13	Packing follower	- - -	- - -
*Recommended spare parts.			

Figure 21. Typical Fisher Bonnet with Single PTFE V-Ring Packing Set



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D100399X012

EW Valve

March 2026

Table 15. Valve Body (Figures 22 through 24)

Key	Description	Key	Description
1	Valve body If you need a valve body as a replacement part, order by valve size, serial number and desired material.	19	Drive screw (6 req'd)
		21*	Disk Retainer
2*	Valve plug	22*	Disk Seat
3*	Cage	23*	Disk
4	Cage adaptor	26	Load Ring for Size 10x8 or 12x8 valve only
5	Seat ring adaptor	27*	Retaining Ring for spring-loaded EWT seal rings
6*	EWD Piston Ring	28*	EWT 2-Piece Seal Ring for all except Cavitrol III constructions
7*	Valve Plug Stem	29*	Backup Ring
8*	Pin	31*	Cage Retainer Required for Whisper Trim III and Cavitrol III cages only.
9*	Seat ring	32	Bonnet Spacer
10* through 14*	Gaskets	51	Anti-seize lubricant (not furnished)
15	Stud Bolt	52	Cage Spacer
16	Stud Bolt Nut	53*	Shim
17	Pipe Plug for drain-tapped valve	55	Wire
18	Flow Arrow		
*Recommended spare parts.			

Table 16. C-seal Trim (Figure 9)

Key	Description	Key	Description
2*	Valve plug/Retainer	9*	Seat ring
3*	Cage	64*	C-seal
7*	Valve plug stem	- - -	- - -
*Recommended spare parts.			

Table 17. TSO Trim (Figures 7 and 8)

Key	Description	Key	Description
3*	Cage	63*	Anti-Extrusion Ring
9*	Seat Ring	29*	Back Up Ring
2*	Plug/Stem Assembly	27*	Retaining Ring
28*	Seal Ring	- - -	- - -
*Recommended spare parts.			

Figure 22. Fisher EWD Valve through NPS 12x6 with Optional Drain Plug

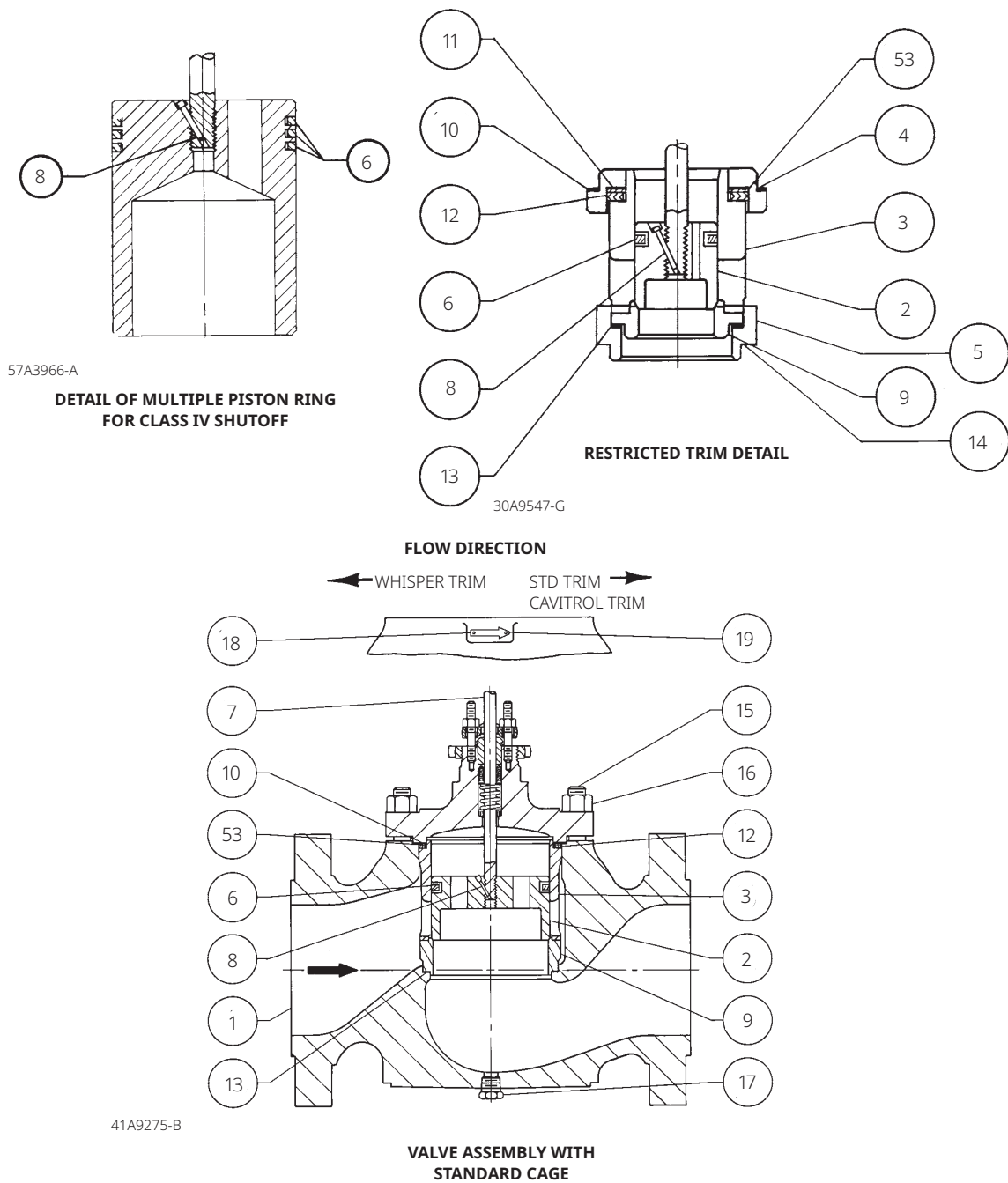


Figure 23. Fisher EWS Valve through NPS 12x6

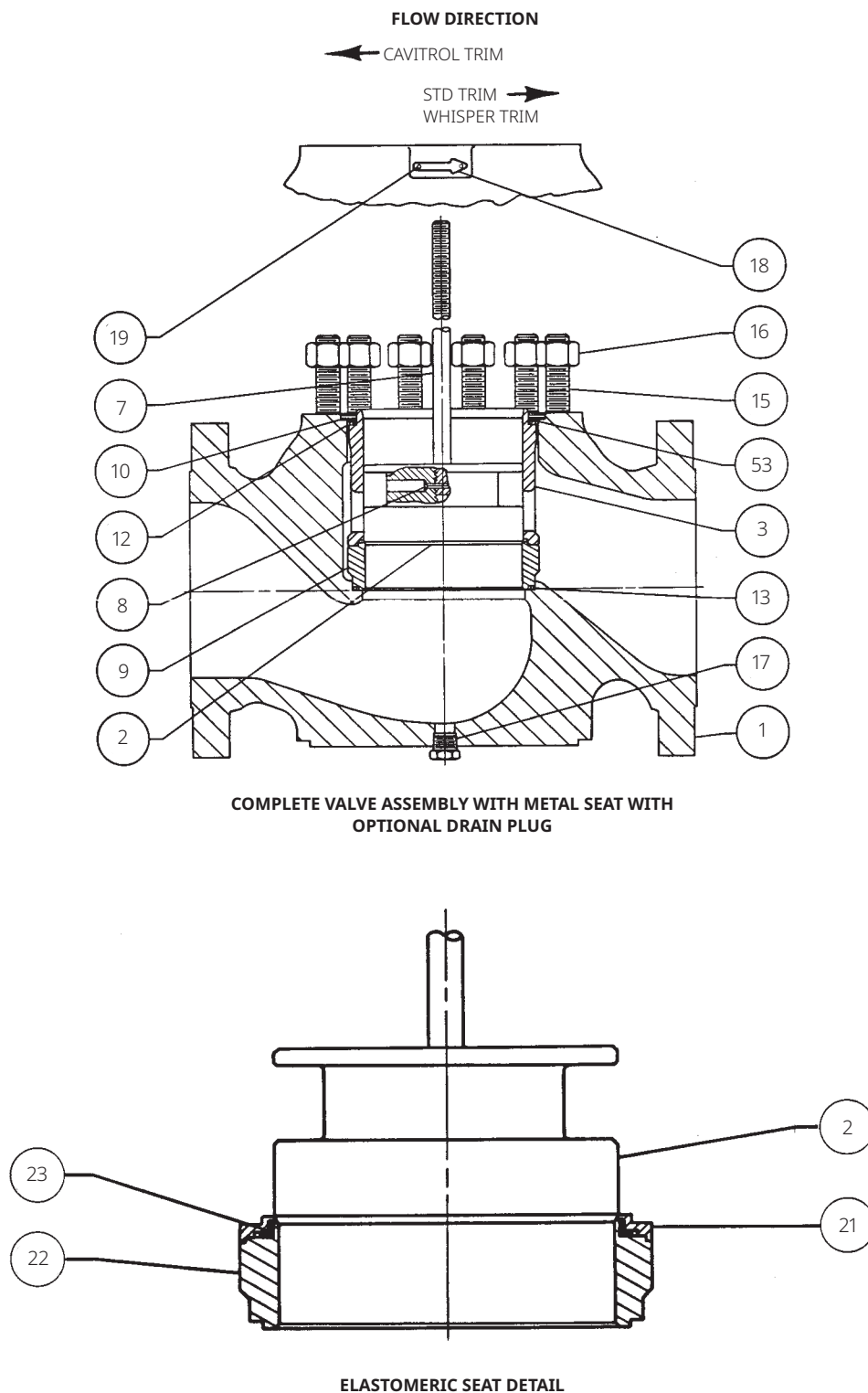


Figure 24. Typical Fisher EWT Valve Assemblies

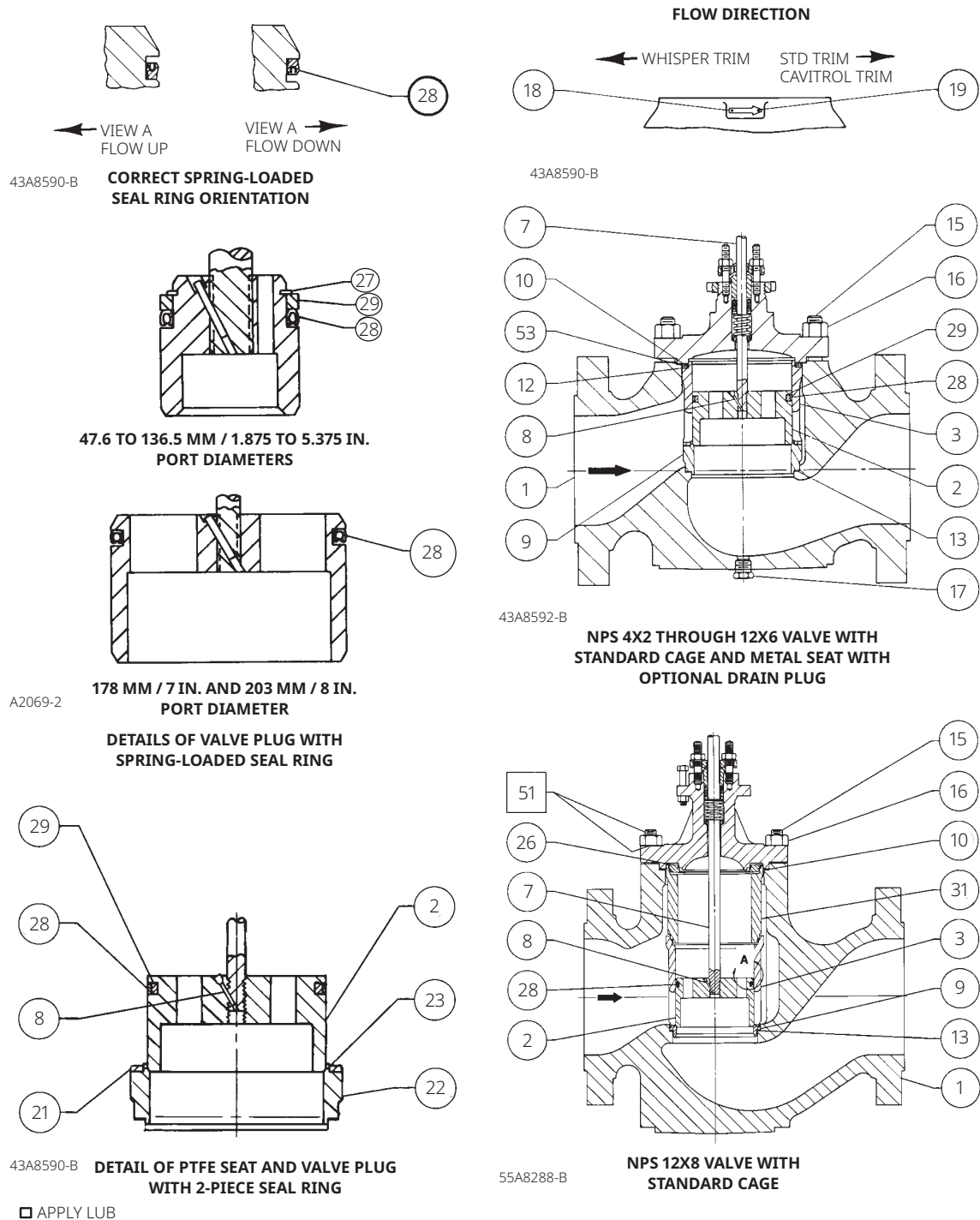
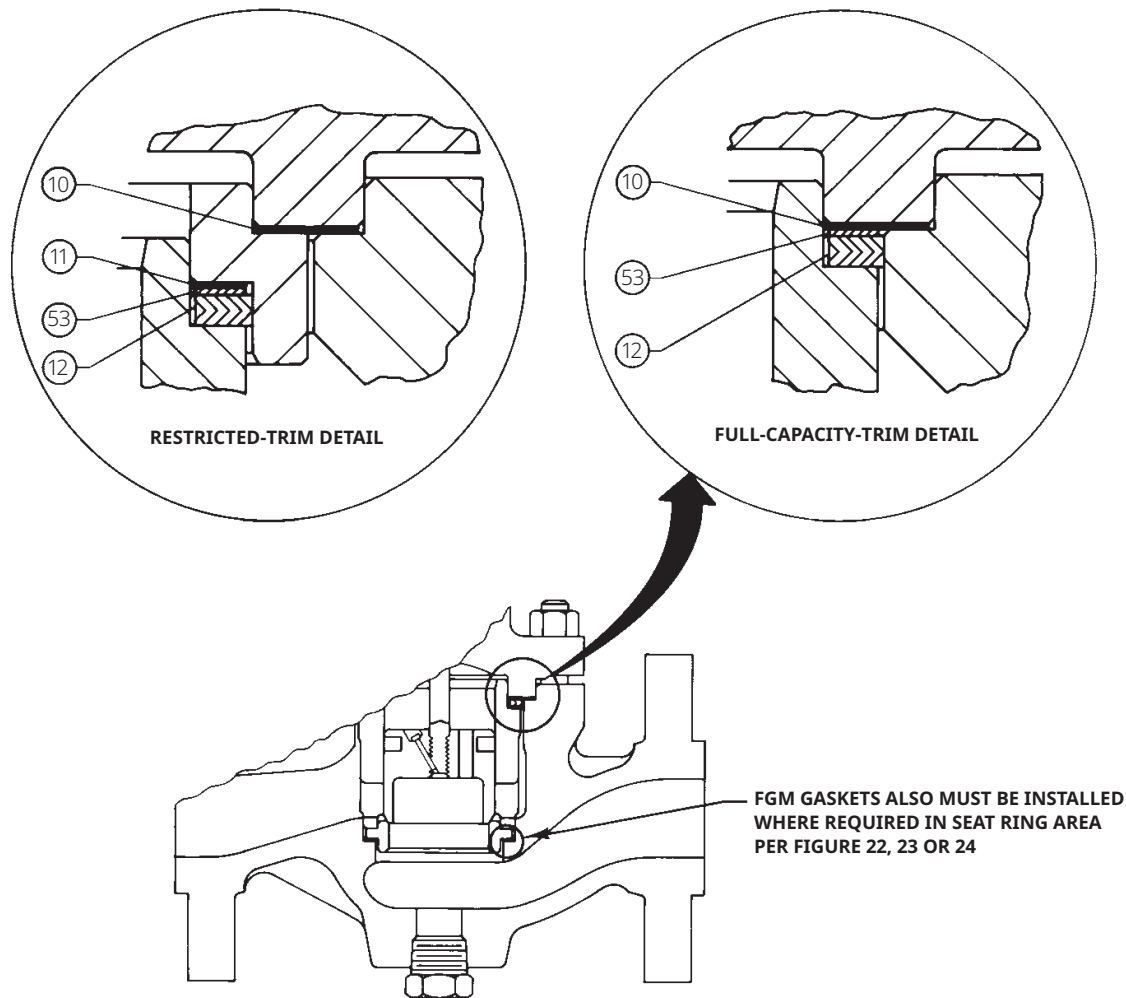


Figure 25. FGM Gasket Detail with Optional Drain Plug



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Figure 26. NPS 4x2 Through 12x8 Fisher Valves with 1-Stage Cavitrol III Cage

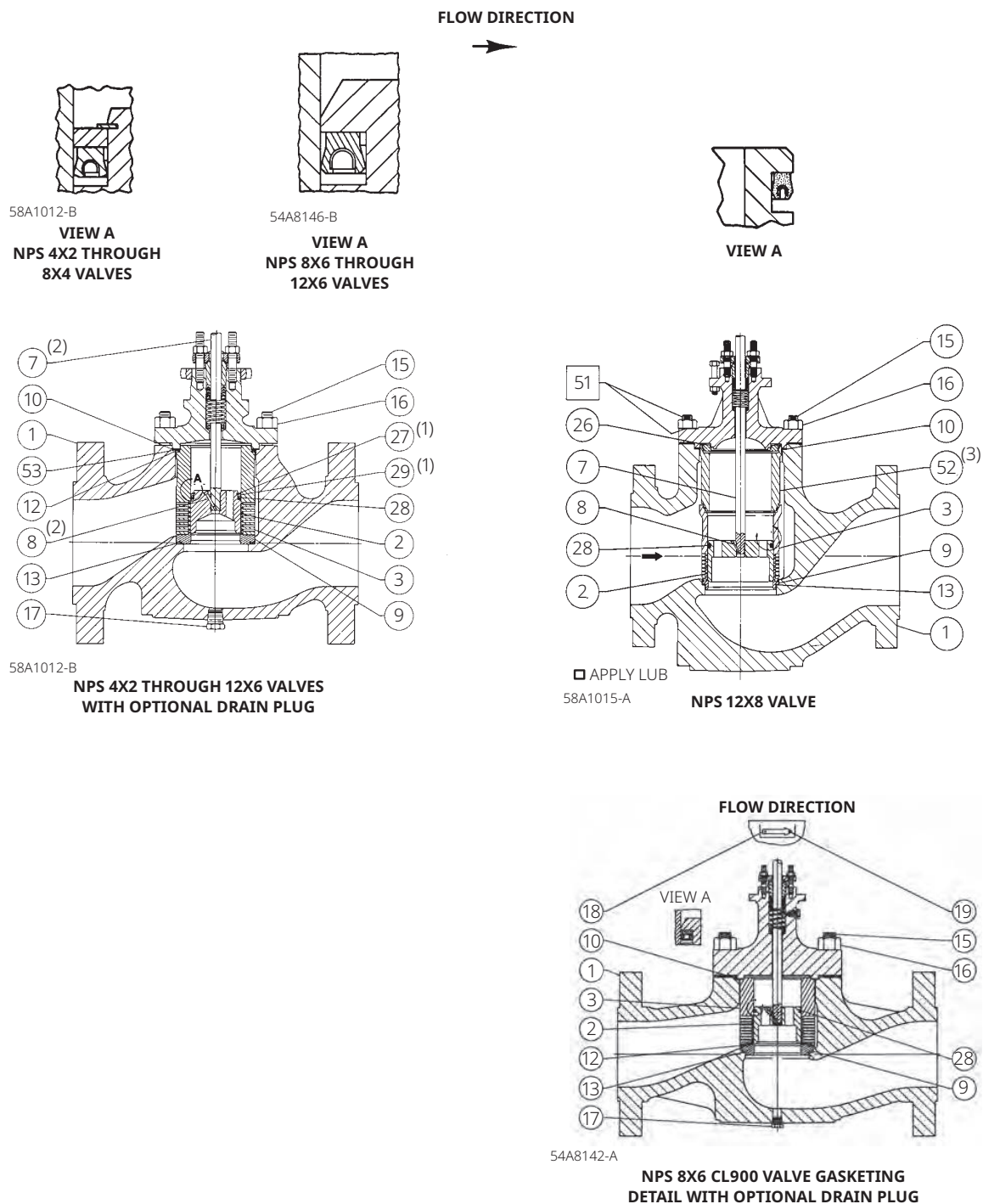


Figure 27. NPS 4x2 Through 12x8 Fisher Valves with 2-Stage Cavitrol III Cage

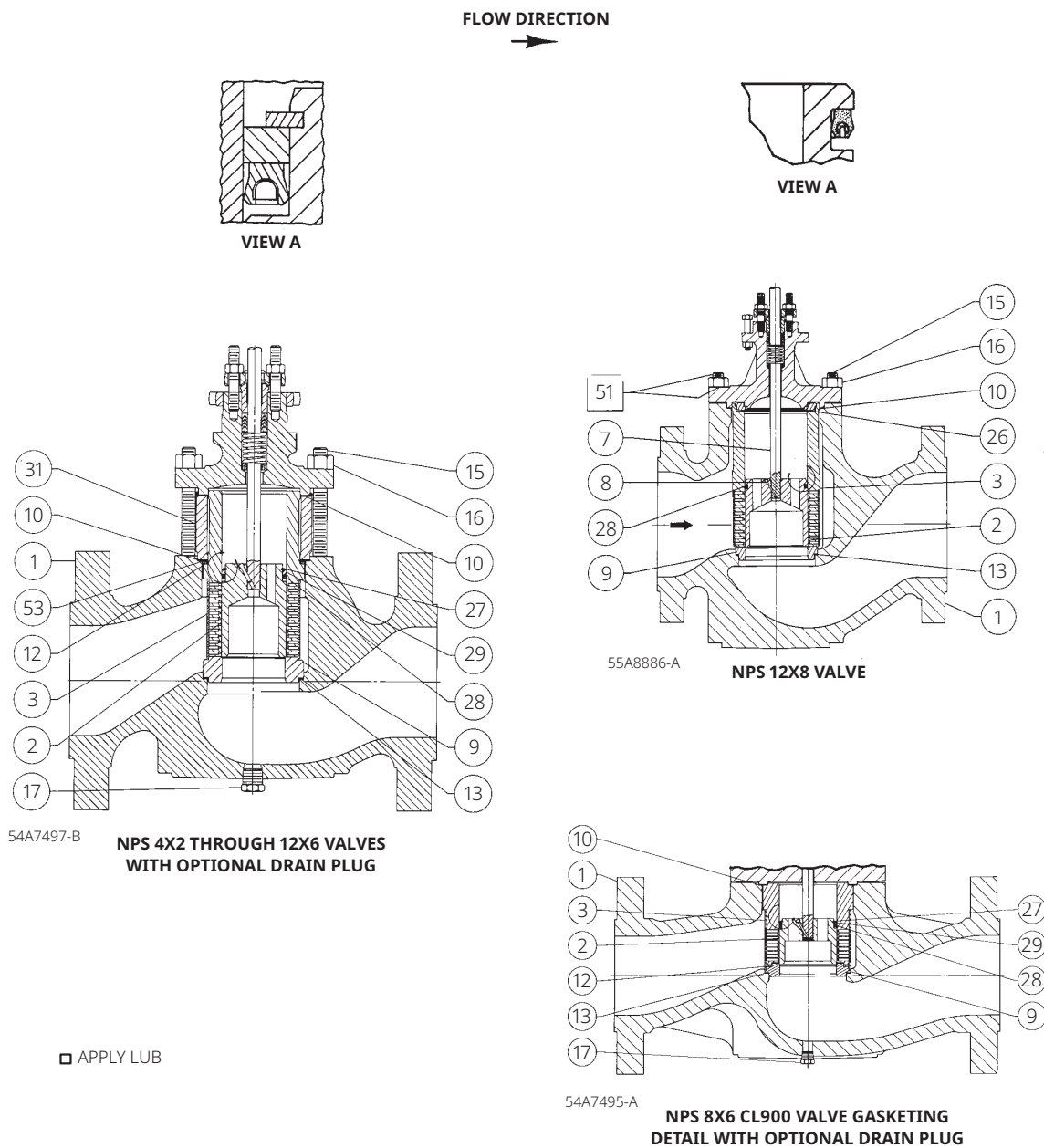


Figure 28. Typical Fisher EWD Valve with Whisper Trim III and Whisper trim NXG Cage

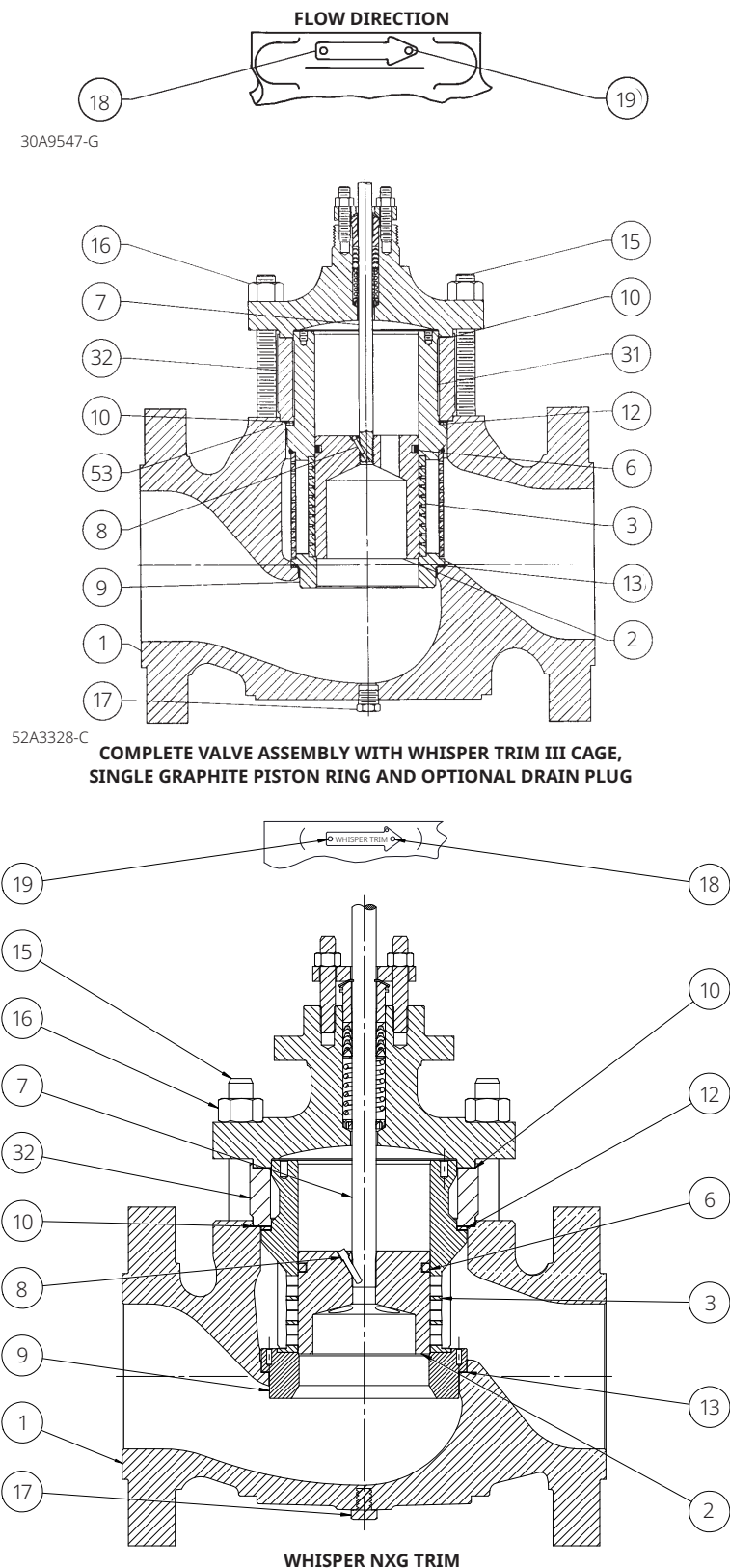


Figure 29. Typical Fisher WhisperFlo Trims

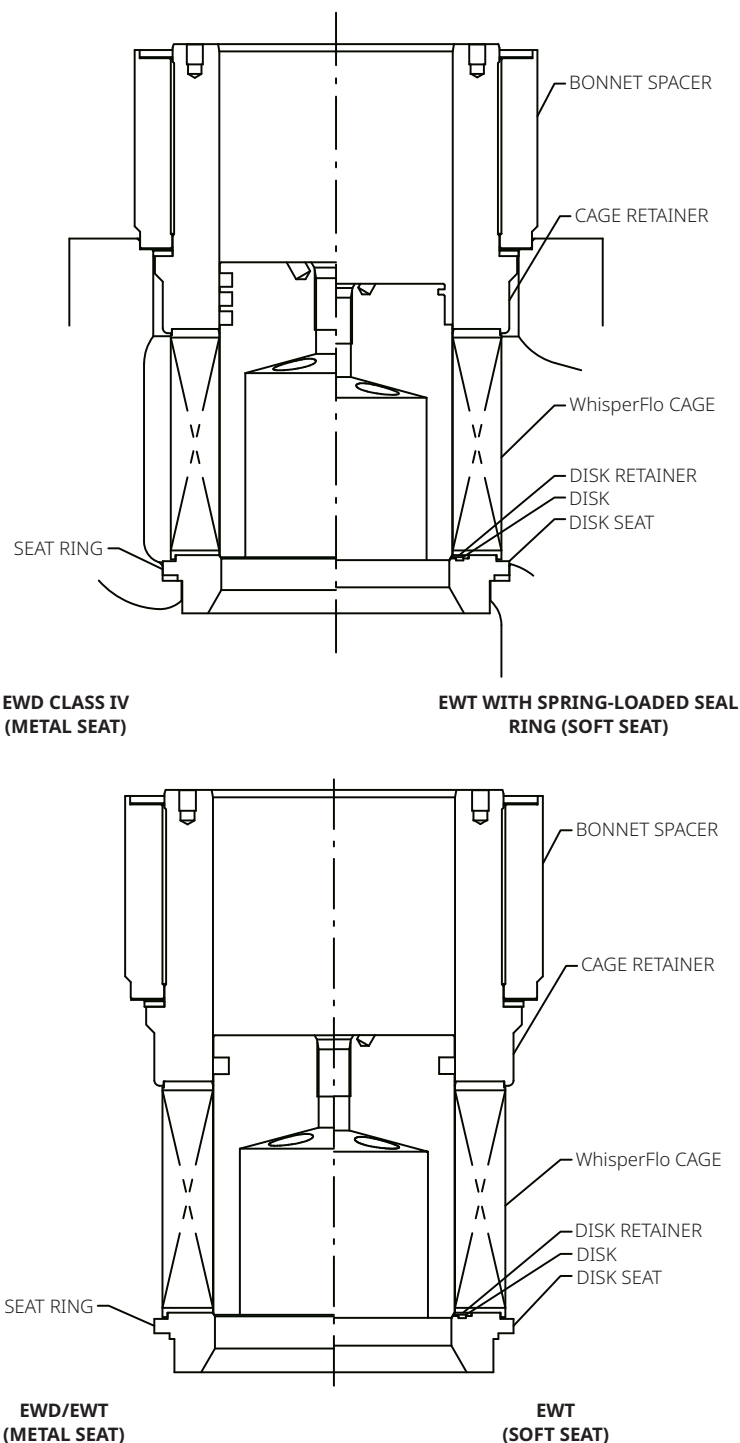


Table 18. Gasket Descriptions

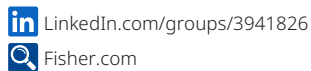
KEY NUMBER	DESCRIPTION	MATERIAL
		FGM -198 to +593°C / -325 to +1100°F
10	Bonnet Gasket	Graphite/S31600
11	Cage Gasket	
13	Seat Ring or Liner Gasket	
14	Adapter Gasket	
12	Spiral-Wound Gasket	N06600/Graphite
53	Shim	S31600

Table 19. Actuator Groups (by Type Number)

Group 1 54 mm / 2-1/8 in., 71 mm / 2-13/16 in. or 90 mm / 3-9/16 in. Yoke Boss	Group 100 127 mm / 5 in. Yoke Boss	Group 101 127 mm / 5 in. Yoke Boss	Group 403 90.5 mm / 3-9/16 in. Yoke Boss
585C Series—50.8 mm / 2 in. travel 472 and 473 657 and 667—76.2 mm / 3 in. travel 1008—71.4 mm / 2-13/16 in. yoke boss	585C 472 473 657 1008	667	585C 1008

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS



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Fisher™ EWN Series and EW-1 Series Valves

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Figure 1. Fisher EWNT-2 NPS 12 x 8 EWNT-2 Valve with Typical Actuator



W3310

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for Fisher NPS 8 x 6 and 12 x 8 EWN Series and EW-1 Series valves (figure 1). Refer to separate manuals for instructions covering the actuator and accessories.

Do not install, operate, or maintain an EWN or EW-1 Series valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

These single-port globe-style valves have cage guiding, threaded seat rings, metal-to-metal seating, and push-down-to-close valve plug action. Additional details are given in tables 1 and 2.

Specifications

Typical specifications for these valves are shown in table 1. Some of the specifications for a given valve assembly as it was shipped from the factory appear on the actuator nameplate if the valve is part of a complete control valve assembly.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

EWN and EW-1 Valves

July 2017

Instruction Manual

D100400X012

Table 1. Specifications

Available Configurations and Valve Body Sizes See table 2 End Connection Styles Flanged Ends: Styles per ASME B16.5 are CL300, 600, or 900 ■ raised-face or ■ ring-type joint Buttwelding Ends: Styles per ASME B16.25 are Schedule ■ 40 or ■ 80 for all CL300 and 600 valves or Schedule ■ 80, ■ 100, or ■ 120 for all CL900 valves Maximum Inlet Pressures and Temperatures and Pressure Drops⁽¹⁾ Consistent with applicable ■ CL300, ■ 600, or ■ 900 pressure/temperature ratings per ASME B16.34, but do not exceed the pressure, temperature, and pressure drop conditions specified when the valve was ordered. Also see the Installation section Shutoff Classifications See table 3 Flow Characteristics Standard Cages: ■ Linear, ■ quick-opening, or ■ equal percentage	Whisper Trim™ Cages: Linear, except equal percentage for first 38.1 mm (1.5 inch) of travel with level D cage for NPS 8 x 6 valve Flow Directions EWS-1 with Standard Cage: Normally up All Others with Standard Cages: Normally down Whisper Trim Cages: Always up Valve Plug Travels See table 2 Approximate Weights NPS 8 x 6 CL900 Valve Body Flanged Ends: 839 kg (1850 lb) Buttwelding Ends: 703 kg (1550 lb) NPS 12 x 8 Valve Body CL300 (Flanged Ends Only): 721 kg (1590 lb) CL600 Flanged Ends: 930 kg (2050 lb) CL600 Buttwelding Ends: 726 kg (1600 lb) CL900 Flanged Ends: 1497 kg (3300 lb) CL900 Buttwelding Ends: 1293 kg (2850 lb) Additional Specifications For specifications such as materials, cage levels, and stem diameters, refer to the Parts List section.
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1. The pressure or temperature limits in this manual and any applicable standard limitations should not be exceeded.

Table 2. Available Configurations

PRESSURE RATING	VALVE SIZE, NPS	VALVE PLUG TRAVEL		VALVE BODY DESIGN & CAGE STYLE	DESCRIPTION
		mm	Inches		
CL900	12 x 8	76	3	EWD-1 with standard cage	Seat ring threaded to valve body; balanced valve plug with piston ring
		152	6	EWD-1 with Whisper Trim III cage	
CL900	8 x 6	127	5	EWND-1 with Whisper Trim III cage only	
CL300, 600, or 900	12 x 8	203	8	EWNT-1 with Whisper Trim III cage only	Seat ring threaded to valve body; balanced valve plug with spring-loaded seat ring
	8 x 6	127	5		
CL900	12 x 8	203	8	EWNT-2 with Whisper Trim III cage only	Seat ring threaded to cage; balanced valve plug; spring-loaded seal rings on both seat ring and valve plug
CL900	12 x 8	76	3	EWS-1 with standard cage only	Seat ring threaded to valve body; unbalanced valve plug
		76	3	EWT-1 with standard cage	Seat ring threaded to valve body; balanced valve plug with spring-loaded seal ring
		152	6	EWT-1 with Whisper Trim III cage	

Table 3. Shutoff Classification Per ANSI/FCI 70-2 and IEC 60534-4

Valve	Seating	Shutoff Class
EWD-1 or EWND-1	Metal	II (standard)
		III (optional for CL300 or CL600 valves only)
EWND-1	Metal	IV (optional with extra piston rings)
EWS-1	Metal	IV (standard)
		V (optional, consult your Emerson Automation Solutions sales office)
EWNT-1, EWNT-2, or EWT-1	Metal	IV (standard)

Educational Services

For information on available courses for the Fisher EWN series and EW-1 series valves, as well as a variety of other products, contact:

Emerson Automation Solutions
 Educational Services - Registration
 Phone: 1-641-754-3771 or 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a suitable overpressure protection device as required by local, state, and Federal codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

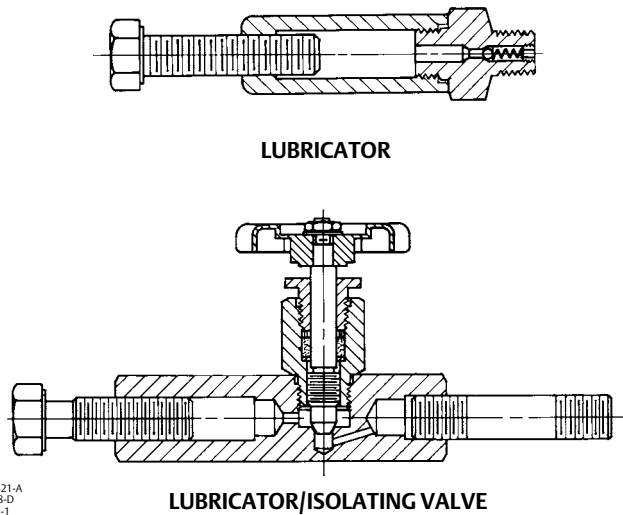
When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some valve body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#) or Local Business Partner.

If hoisting the valve, the use of a nylon sling is recommended to protect the painted surfaces. Also be careful to position the sling so there will be no damage to the tubing or any accessories.

1. Before installing the valve, inspect the valve body and associated equipment for any damage and any foreign material. Make certain that the valve body interior is clean, pipelines are free of foreign material, and the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve body.

2. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven valve plug and cage wear and in improper operation. With some valves, the actuator may also need to be supported when it is not vertical. For more information, consult your [Emerson sales office](#) or Local Business Partner.

Figure 2. Lubricator and Lubricator/Isolating Valve (Key 14)



Note

If the valve being installed has a Whisper Trim cage with small internal flow passages, consideration should be given to installing an upstream strainer to prevent the lodging of particles in these passages. This is especially important if the pipeline cannot be thoroughly cleaned or if the flowing medium is not clean.

3. Use accepted piping and welding practices when installing the valve in the line. Internal elastomeric parts may stay in place during the welding procedure. For flanged valves, use a suitable gasket between the valve body and pipeline flanges.

CAUTION

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Shrunk-fit pieces and threaded connections may also loosen. In general, if post weld heat treating is to be performed, all trim parts should be removed. Contact your [Emerson sales office](#) or Local Business Partner for additional information.

4. With a leak-off bonnet construction, remove the 1/4 NPT pipe plugs (keys 14 and 16, figure 6) to hook up the leak-off piping. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
5. If the actuator and valve are shipped separately, refer to the appropriate actuator instruction manual for the actuator mounting procedure.

WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing replacement, trim maintenance, and lapping seating surfaces. All maintenance operations may be performed with the valve body in the line.

WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal.

Packing Lubrication

CAUTION

Do not lubricate graphite packing. Graphite packing is self-lubricated. Additional lubrication may result in slip-stick movement of the valve.

⚠ WARNING

To avoid personal injury or property damage resulting from fire or explosion, do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F).

If a lubricator or lubricator/isolating valve (figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the 1/4 NPT pipe plug (key 14, figure 6). Use a silicon-base lubricant. Packing used in oxygen service or in processes with temperatures over 260°C (500°F) should not be lubricated. To operate the lubricator, turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except the isolating valve must first be opened and then closed after lubrication is completed.

Packing Maintenance

This section covers only PTFE V-ring and PTFE/composition packing. Refer to a separate manual for graphite laminate/filament packing if used. Key numbers refer to figure 3 for PTFE V-ring packing and to figure 4 for PTFE/composition packing unless otherwise indicated.

For spring-loaded single PTFE V-ring packing, the spring (key 8, figure 3) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13, figure 3), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5, figure 6) until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the Replacing Packing section.

If there is undesirable packing leakage with other than spring-loaded packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

If the packing is relatively new and tight on the stem and if tightening the packing flange nuts does not stop the leakage, it is possible that the valve stem is worn or nicked so that a seal cannot be made. The surface finish of a new valve stem is 0.1 micro-meter (4 micro-inches) rms. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

Adding Packing Rings

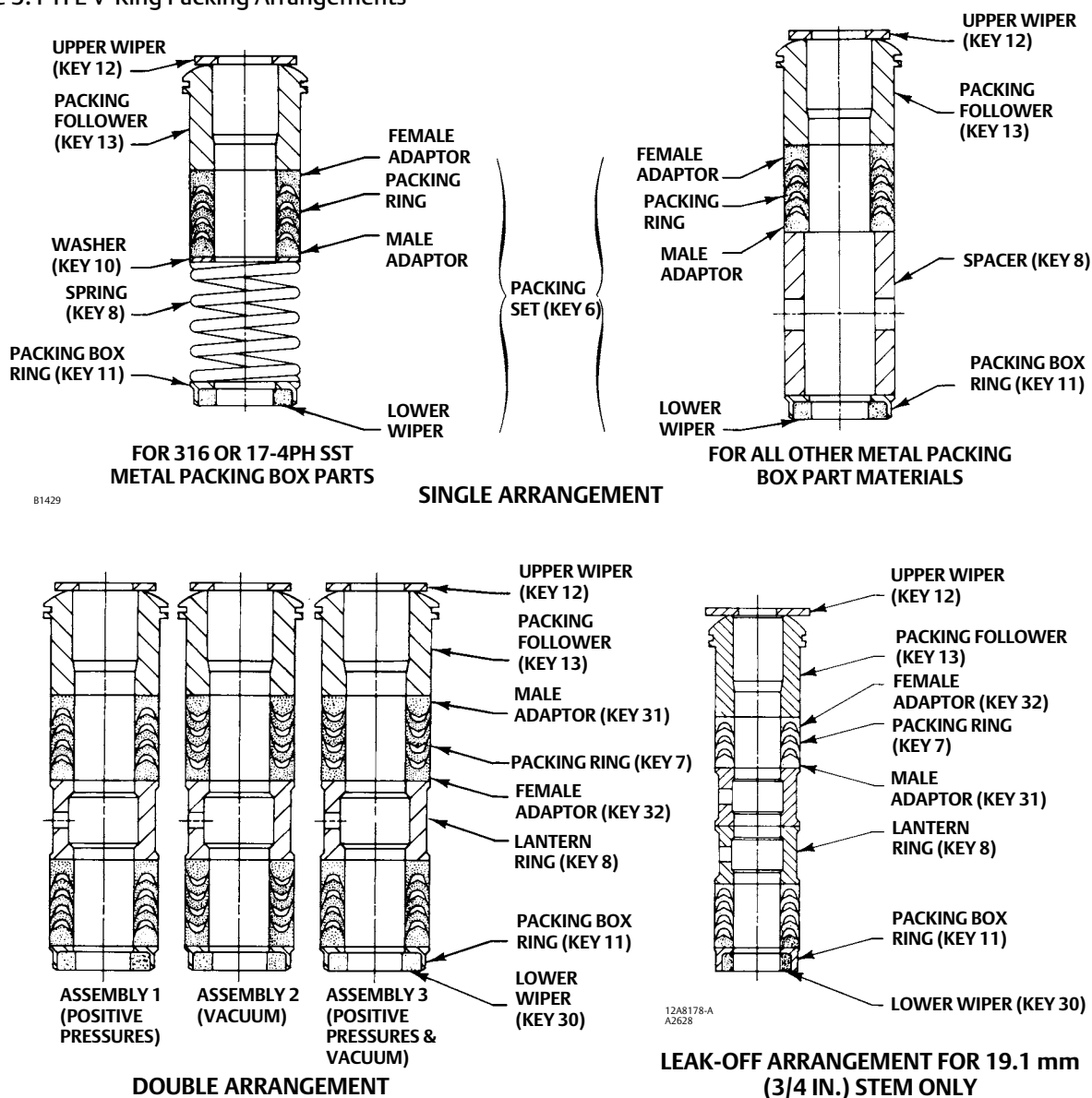
When using packing with a lantern ring (key 8, figure 3 or 4), it is possible to add packing rings above the lantern ring as a temporary measure without removing the actuator from the valve body.

1. Remove the packing flange nuts (key 5, figure 6), and lift the packing flange and follower (keys 3 and 13, figure 6) away from the valve body.
2. It may be possible to dig out the old packing rings on top of the lantern ring, but use care to avoid scratching the valve stem or packing box wall. Clean all metal parts to remove particles that would prevent the packing from sealing.
3. If split-ring packing is being added, spread the rings over the stem, and slide the rings into the packing box.

If solid-ring packing is being added, remove the stem connector, and slip the rings over the end of the valve stem.

4. Replace the packing flange and packing follower. Tighten the packing flange nuts (key 5, figure 6) only far enough to stop leakage under operating conditions.
5. If the valve-actuator stem connection was taken apart, reconnect according to the appropriate actuator instruction manual.
6. Check for leakage around the packing follower when the valve is being put into service. Retighten the packing flange nuts as required.

Figure 3. PTFE V-Ring Packing Arrangements



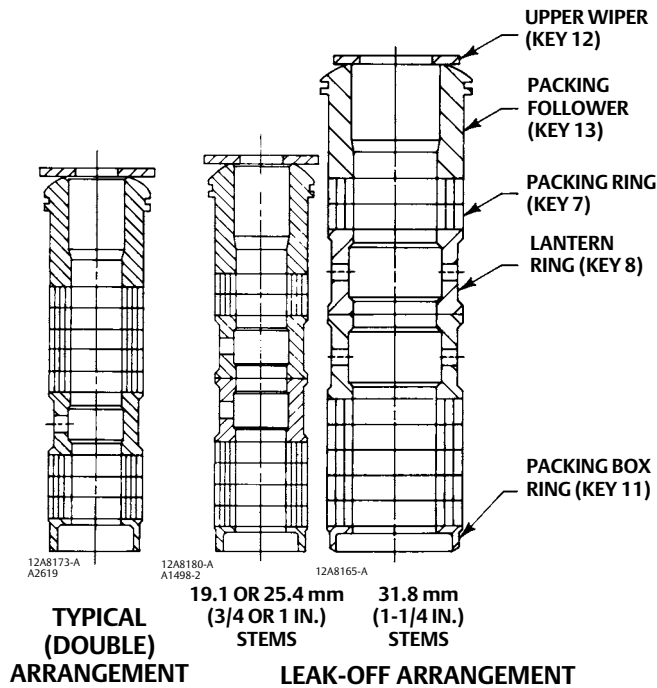
Replacing Packing

⚠ WARNING

Observe the warning at the start of the Maintenance section.

1. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet. Disconnect the stem connector, and then remove the actuator from the valve by unscrewing the yoke locknut (key 15, figure 6) or the hex nuts (key 26, figure 6).

Figure 4. Detail of PTFE/Composition Packing Arrangements



2. Loosen the packing flange nuts (key 5, figure 6) so that the packing is not tight on the valve stem. Remove any travel indicator parts and stem locknuts from the valve stem threads.

CAUTION

When lifting the bonnet (key 1, figure 6), be sure that the valve plug and stem assembly remains in the valve and on the seat. This will avoid damage to the seating surfaces as a result of the assembly dropping from the bonnet after being lifted part way out. The parts are also easier to handle separately.

3. Unscrew the hex nuts (key 16, figure 7 through 10) that bolt the bonnet and valve body together, and carefully lift the bonnet off the valve stem.
4. If the valve plug and stem assembly starts to lift with the bonnet, use a brass or lead hammer on the end of the stem and tap it back down. Set the bonnet on a protective surface to prevent damage to the bonnet gasket surface.
5. Remove the bonnet gasket (key 10, figure 7 through 10), and cover the opening in the valve body to protect the gasket surface and prevent foreign material from getting into the valve body cavity.
6. Remove the packing flange nuts, packing flange, upper wiper, and packing follower (keys 5, 3, 12, and 13, figure 6). Carefully push out all the remaining packing parts from the valve body side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
7. Inspect the valve stem threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
8. Remove the covering protecting the valve body cavity, and install a new bonnet gasket (key 10, figure 7 through 10), making sure the gasket seating surfaces are clean and smooth.

Table 4. Valve Body-to-Bonnet Bolt Torque Guidelines⁽¹⁾

VALVE SIZE, NPS		BOLT TORQUES ⁽²⁾ FOR FIELD-LUBRICATED BOLTING	
		N•m	Lbf•Ft
8 x 6 CL900		542	400
12 x 8	CL300 or 600	691	510
	CL900 with steel or alloy steel bolting	2440	1800
	CL900 with stainless steel bolting	2712	2000
1. For other materials, contact your Emerson sales office or Local Business Partner for torques. 2. Determined from laboratory tests.			

Note

Proper performance of the tightening procedures in step 9 compresses the outer edge of the bonnet gasket (key 10, figure 7 through 10) enough to seal the valve body-to-bonnet joint.

The bolting procedures in step 9 include -- but are not limited to -- ensuring that bolting threads are clean and evenly tightening the hex nuts onto the studs in a crisscross pattern. Because of the boltup characteristics of the bonnet gasket, tightening one nut may loosen an adjacent nut. Repeat the crisscross tightening pattern several times until each nut is tight and the valve body-to-bonnet seal is made. When the operating temperature has been reached, perform this torquing procedure once again.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

9. Lubricate the stud bolts (key 15, figure 7 through 10) with anti-seize lubricant, slide the bonnet over the stem and onto the bolts, and secure with the stud bolt nuts (key 16, figure 7 through 10), using accepted bolting procedures during tightening so that the valve body-to-bonnet joint will withstand test pressures and application service conditions. The bolt torques in table 4 may be used as guidelines unless accepted bolting procedures dictate otherwise.
10. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 3 or 4. Place a smooth-edged pipe over the valve stem, and gently tap each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.
11. Slide the packing follower, upper wiper, and packing flange (keys 13, 12, and 3, figure 6) into position. Lubricate the packing flange studs (key 4, figure 6) and the faces of the packing flange nuts (key 5, figure 6). Replace the packing flange nuts.
12. For spring-loaded PTFE V-ring packing, tighten the packing flange nuts until the shoulder on the packing follower (key 13, figure 6) contacts the bonnet.

For other packing types, tighten the packing flange nuts far enough to stop leakage under operating conditions.

13. Mount the actuator on the valve body assembly, and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual. Check for leakage around the packing follower when the valve is being put into service. Retighten the packing flange nuts as required.

Trim Removal

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Except where indicated, key numbers in this section are referenced in figures 7 and 8 for EWN Series constructions and in figures 9 and 10 for EW-1 Series constructions.

1. Remove the actuator and the bonnet according to steps 1 through 5 of the Replacing Packing section.

CAUTION

When lifting the valve plug stem (key 7) and attached valve plug (key 2) out of the valve body, be certain that the cage or cage assembly (key 3) remains in the valve body (key 1). This is to prevent damage caused by the cage or cage assembly dropping back into the valve body after being lifted part way out.

Use care to avoid damaging gasket sealing surfaces. Any damage to the gasket sealing surfaces could cause the valve to leak.

The graphite piston ring (key 5) in an EWD-1 or EWND-1 valve body is brittle and in two pieces. Use care to avoid damage to the piston ring caused by dropping or rough handling.

The surface finish of the valve stem (key 7) is critical for making a good packing seal. The inside surface of the cage or cage assembly (key 3) is critical for smooth operation of the valve plug and for making a seal with the piston ring or seal ring (key 5). The seating surfaces of the valve plug (key 2) and seat ring (key 9) are critical for tight shutoff. Protect these parts accordingly while disassembling the trim.

Table 5. Pin Replacement

VALVE STEM CONNECTION (VSC)		DRILL SIZE, INCH
mm	Inches	
19.1	3/4	3/16
25.4	1	1/4
31.8	1-1/4	1/4

2. Packing parts can be removed if desired. Replace these parts as described in the Packing Replacement section.
3. Lift the valve plug and stem assembly out of the valve body and set it on a protective surface. If the valve plug is to be reused, protect the valve plug seating surface to prevent scratches.
4. Install screws or bolts into the tapped holes in the top of the cage or cage assembly, and carefully lift it out of the valve body. Remove the associated gaskets (key 10 and, if used, key 11).
5. The EWNT-2 valve body has a seat ring seal ring (key 6). Inspect this seal ring, and remove it if replacement is necessary. The EWNT-2 seat ring is screwed into the cage and secured with two tack welds, one on each side of the cage. The seat ring can be removed by grinding or filing off the tack welds and then inserting a bar through slots cut in the seat ring to turn it out of the cage.
6. To remove the seat ring (key 9) from an EW-1 or EWN-1 Series valve, use a seat ring removal tool made as shown in figure 5. Use a piece of pipe of the indicated size and schedule, machine as appropriate, and then weld a collar of the indicated dimensions around the pipe. Engage the seat ring lugs with the 44.5 mm (1-3/4-inch) groove of the tool, and then remove the seat ring by slipping a suitable length of pipe through the 76.2 mm (3-inch) diameter hole in the other end of the tool to provide leverage.

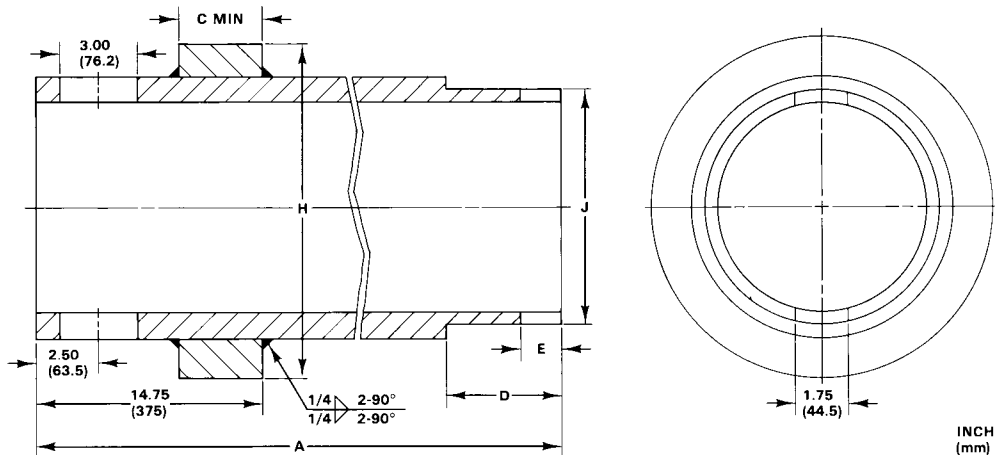
- Inspect parts for wear or damage that would prevent proper operation of the valve. Replace or repair trim parts according to the following Lapping Seating Surfaces or Valve Plug Maintenance procedures as appropriate.

Lapping Seating Surfaces

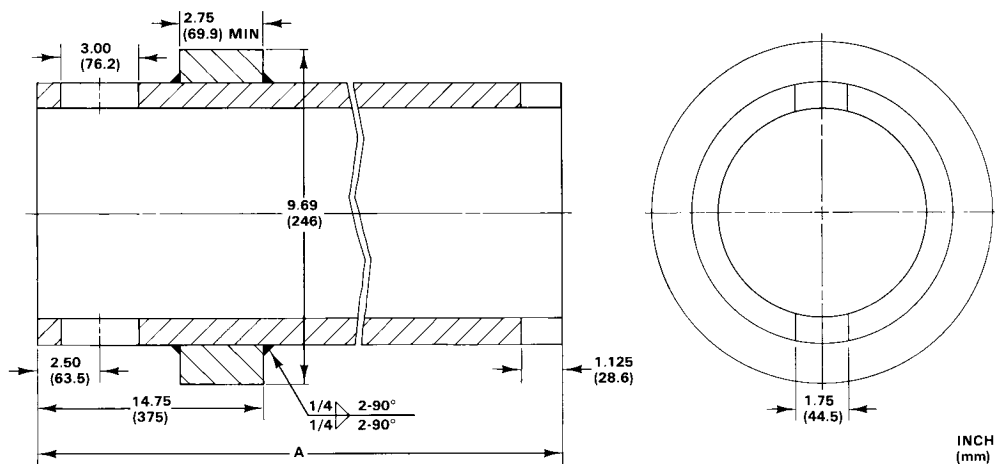
Seating surfaces of the valve plug and seat ring (keys 2 and 9, figure 7 through 10) can be lapped for improved shutoff. (Deep nicks should be machined out rather than ground out.) Use a commercial lapping compound or a mixture of 600-grit carborundum and solidified vegetable oil.

Assemble the valve to the extent that the cage or cage assembly is in place and the bonnet bolted to the valve. A simple handle can be made from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction to lap the seats. After lapping, remove the bonnet, and clean the seat surfaces. Completely assemble the valve as described in the Trim Replacement section, and test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

Figure 5. Removal Tool Required for Seat Ring Threaded to Valve Body (also see tables 6 and 7)



FOR 136, 197, OR 203 mm (5-3/8, 7-3/4, OR 8-INCH) SEAT RINGS



FOR 172 mm (6-3/4 INCH) SEAT RINGS

Table 6. Removal Tool Required for Seat Ring Threaded to Valve Body (For 136, 197, or 203 mm (5-3/8, 7-3/4, or 8-inch) Seat Rings)

VALVE SIZE AND DESIGN		PIPE TO MACHINE		DIMENSION											
				A		C Min		D		E		H		J	
		Size, Inch	Schedule	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
8 x 6 EWN-1 Series		5	120	610	24.00	12.7	0.50	63.5	2.50	25.4	1.00	210	8.25	133	5.25
12 x 8	EW-1 Series	8	XXS	678	26.69	69.9	2.75	76.2	3.00	28.6	1.125	246	9.69	194	7.62
	EWN-1 Series	8	XXS	825	32.50	69.9	2.75	88.9	3.50						

Table 7. Removal Tool Required for Seat Ring Threaded to Valve Body (For 172 mm (6-3/4-inch) Seat Rings)

VALVE SIZE AND DESIGN		PIPE TO MACHINE		DIMENSION A	
		Size, Inch	Schedule	mm	Inch
12 x 8	EW-1 Series	6	XS	678	26.69
	EWN-1 Series	6	XS	825	32.50

Valve Plug Maintenance

Except where indicated, key numbers in this section are referenced in figures 7 and 8 for EWN Series valve plugs and in figures 9 and 10 for EW-1 Series valve plugs.

CAUTION

If replacing the valve plug piston ring or seal ring (key 5), be careful not to scratch the surfaces of the ring groove in the valve plug or any of the surfaces of the replacement ring, or the replacement ring may not seal properly.

1. With the valve plug (key 2) removed according to the Disassembly section, proceed as appropriate:

For the EWD-1 or EWND-1 graphite piston ring, the ring or rings can be easily removed since each ring is in two halves. A new graphite piston ring is furnished as a complete ring and must be broken into two approximately equal portions. Do this by placing the ring horizontally in a vise and applying pressure until the ring snaps. An alternate method is to place the ring on edge on a smooth, hard surface and strike the ring squarely with a hammer. Be sure to match the broken ends when installing the ring in the valve plug groove.

For the EWT-1, EWNT-1, or EWNT-2 spring-loaded seal ring, the ring used on the valve plug for an NPS 8 x 6 valve body may be removed undamaged by first working the retaining ring (key 13) off with a screwdriver. Then carefully slide the metal backup ring (key 12) and seal ring (key 5) off the valve plug (key 2). The spring-loaded seal ring used on the valve plug for an NPS 12 x 8 valve body must be carefully pried and/or cut from its groove. Therefore, it cannot be reused.

A spring-loaded seal ring must be installed so that its open side faces toward either the top or the bottom of the valve plug, depending on flow direction, as shown in view A of figure 7, 8, or 10. To install a spring-loaded seal ring on the valve plug for an NPS 8 x 6 valve body, slide the seal ring (key 5) onto the valve plug followed by the metal backup ring (key 12). Then install the retaining ring (key 13) by inserting one end in the groove and, while turning the plug, press the ring into the groove. Again, be careful not to scratch any surfaces of the ring or plug.

To install the seal ring on the valve plug for an NPS 12 x 8 valve body, lubricate it with a general purpose silicone-base lubricant. Then gently stretch the seal ring, and work it over the top edge of the valve plug. The PTFE material in the seal ring must be permitted time to cold-flow during stretching procedure; so avoid jerking sharply on the ring. Stretching the seal ring over the valve plug may make it seem unduly loose when in the groove, but it will contract to its original size after insertion into the cage.

CAUTION

Never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem. This weakens the stem and may cause it to fail in service. However, a used valve plug may be reused with a new stem.

2. To replace the valve stem (key 7) on all designs, drive out the pin (key 8) and unscrew the stem from the valve plug.
3. Tightly turn in the new stem; then refer to table 5 to select the proper drill size. Drill through the stem, using the hole in the valve plug as a guide. Remove any chips or burrs, and drive in a new pin to lock the assembly.

Trim Replacement

Except where indicated, key numbers are referenced in figures 7 and 8 for EWN Series constructions and in figures 9 and 10 for EW-1 Series constructions.

1. With an EW-1 or EWN-1 Series construction, lubricate the threads of the seat ring (key 9) with anti-seize lubricant and then install the seat ring into the valve body according to figure 5. Engage the seat ring lugs with the grooved end of the tool, and then secure the seat ring by slipping a suitable length of pipe through the hole in the other end to provide leverage. For NPS 8x6 valves, tighten to 6800 N•m (5000 lbf•ft). For NPS 12x8 valves, tighten to 10,800 N•m (8000 lbf•ft).
2. With an EWNT-2 construction, turn the seat ring into the cage with a bar inserted through the seat ring slots. Tack weld the seat ring to the cage using minimal heat. Two welds, 6 mm (1/4 inch) long and 180 degrees apart, are required. Install the seat ring seal ring (key 6) so that its open side faces along the valve stem as shown in view B of figure 8. Lubricate the seal ring with a general purpose silicone-base lubricant, and place it over the bottom end of the seat ring. Start the ring in the groove on one side of the seat ring, and gently work it over the seat ring.
3. Install a bonnet gasket (key 10) or the cage gasket if used (key 11) into the valve body. Temporarily install screws or bolts into the tapped holes in the top of the cage or cage assembly (key 3) to help while installing this piece into the valve body. Any rotational orientation of the cage or assembly with respect to the valve body is acceptable.

Use care to avoid damaging the seat ring seal ring and cage seating surfaces while handling the heavy parts. To help insert the cage or assembly into the valve body, lubricate the outside diameter of the seat ring seal ring if used or the cage/seat ring seating surfaces with a general purpose silicone-base lubricant.

4. Slide the valve plug (key 2) and stem assembly into the cage. Make sure the valve plug piston ring or seal ring (key 5) is evenly engaged in the entrance chamfer at the top of the cage or cage assembly to avoid damaging the ring.

CAUTION

If the packing is to be reused and was not removed from the bonnet, use care when installing the bonnet to avoid damaging the packing with the valve stem threads.

5. Mount the bonnet on the valve body, and complete assembly according to steps 9 through 13 of the Replacing Packing section, omitting steps 10 and 11 if new packing is not being installed and being sure to observe the note prior to step 9.

Parts Ordering

Each valve body-bonnet assembly is assigned a serial number, which can be found on the valve body. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) or Local Business Partner for technical assistance. When ordering replacement parts, refer to the serial number and to the 11-character part number for each part required from the following parts list.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

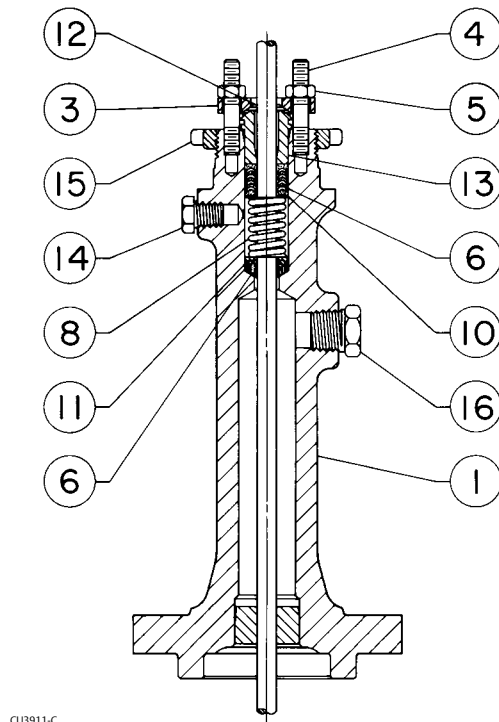
Part numbers are shown for recommended spares only. For part numbers not shown, contact your [Emerson sales office](#) or Local Business Partner.

Bonnet Assembly (figure 2, 3, 4, or 6)

Key	Description	Part Number
1	Bonnet If you need a bonnet, order by valve size and stem diameter, serial number, and desired material.	
5	Packing Flange Nuts (2 req'd)	

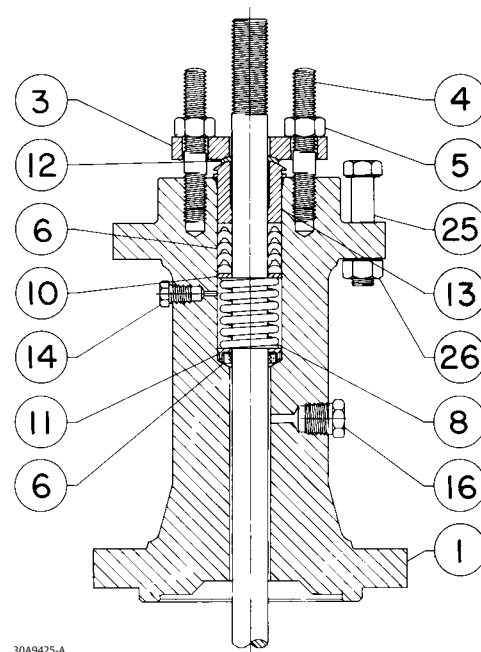
Key	Description	Part Number
6*	Single PTFE V-Ring Packing Set	See following table
7*	Individual Packing Ring	See following table
8	Packing Box Spring or Lantern Ring	See following table
10	Special Washer	See following table
11	Packing Box Ring	See following table
12*	Upper Wiper	See following table
13	Packing Follower	See following table
14	Packing Box Pipe Plug	
14	Packing Box Lubricator, steel/ 440 SST	
14	Packing Box Lubricator/Isolating Valve Assy, Cd pl steel	
15	Yoke Locknut for 19.1 mm (3/4 in.) stem dia bonnet	
16	Pipe Plug for double-tapped bonnet	
25	Cap Screw for 25.4 mm (1 in.) or 31.8 mm (1-1/4 in.) stem dia bonnet, steel (8 req'd)	
26	Hex Nut for 25.4 mm (1 in.) or 31.8 mm (1-1/4 in.) stem dia bonnet, pl steel (8 req'd)	
27	Pipe Nipple (for use only w/lube/iso valve)	
30*	Lower Wiper	See following table
31*	Male Adaptor	See following table
32*	Female Adaptor	See following table

Figure 6. Typical Bonnet Assemblies



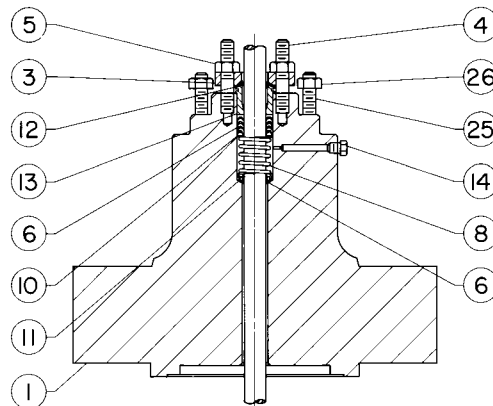
CU3911-C

**CL300 OR CL600 DOUBLE-TAPPED EXTENSION
BONNET FOR 19.1 mm (3/4 IN.) STEM**



30A9425-A
C0363

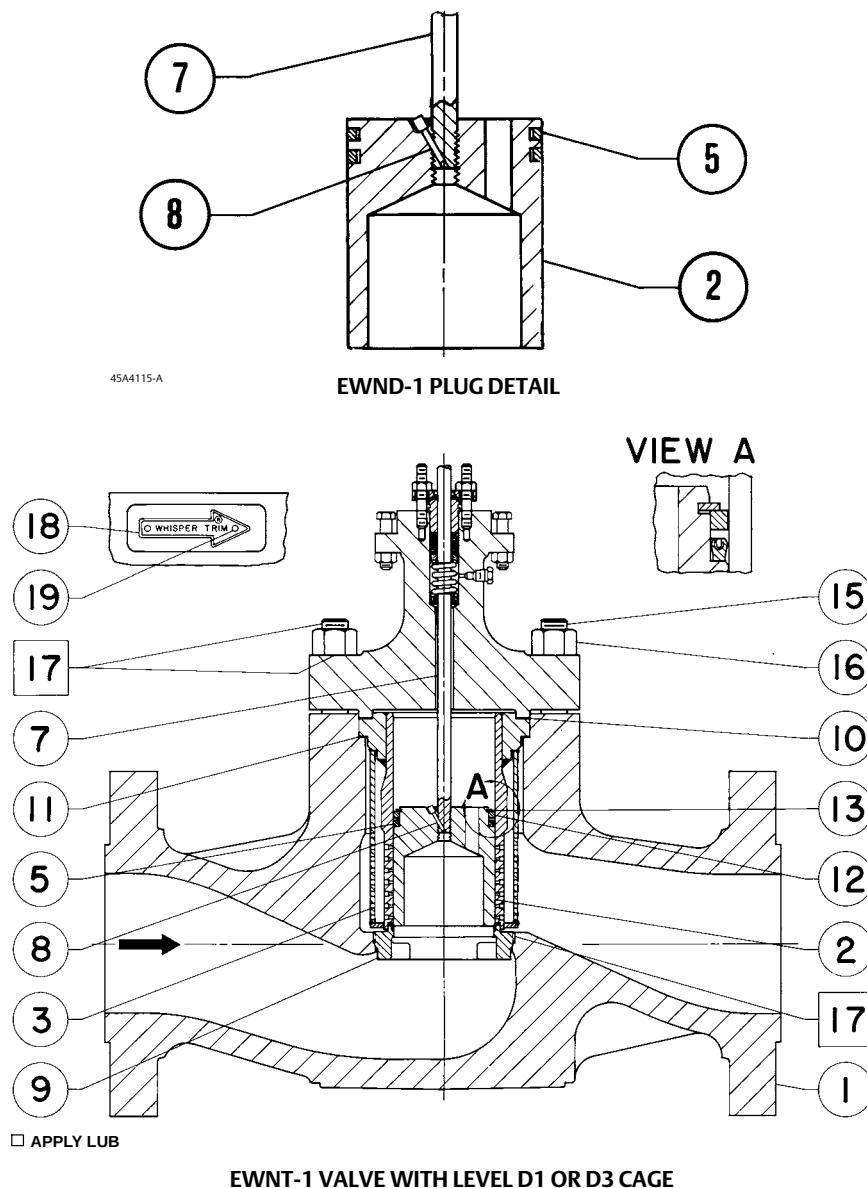
**CL300 OR CL600 DOUBLE-TAPPED EXTENSION
BONNET FOR 25.4 mm (1 IN.) STEM**



35A3976-A

DETAIL OF CL900 BONNET FOR 31.8 mm (1-1/4 IN.) STEM

Figure 7. Typical NPS 8 x 6 CL900 EWN Series Valve Body Assemblies



Valve Body Assembly (figure 7-10)

Key	Description	Part Number	Key	Description	Part Number
1	Valve Body			NPS 8 x 6 EWND-1 w/ Whisper Trim III cage, all levels (2 req'd)	
	If you need a valve body as a replacement part, order by valve size, serial number, and desired material.			Steam or nonoxidizing service to 316°C (600°F)	11A9727X012
2*	Valve Plug	See following tables		Steam or nonoxidizing service to 482°C (900°F) or air or oxidizing service to 427°C (800°F)	11A9727X022
3	Cage, Cage Assembly, or Cage/Seat Ring Assembly			Steam or nonoxidizing service to 593°C (1100°F) or air or oxidizing service to 538°C (1000°F)	11A9727X032
5*	Valve Plug Piston Ring, graphite (not used w/ EWNT-1, EWNT-2, EWS-1, or EWT-1)				

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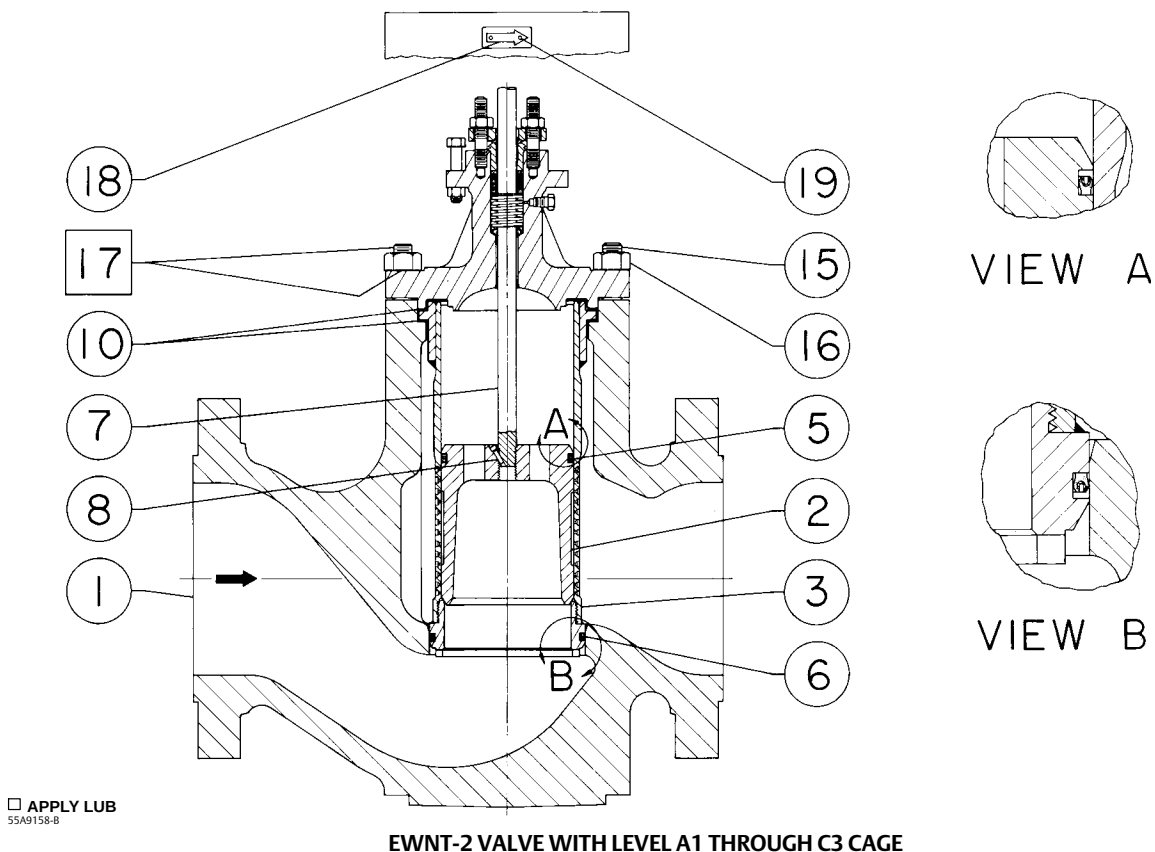
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EWN and EW-1 Valves

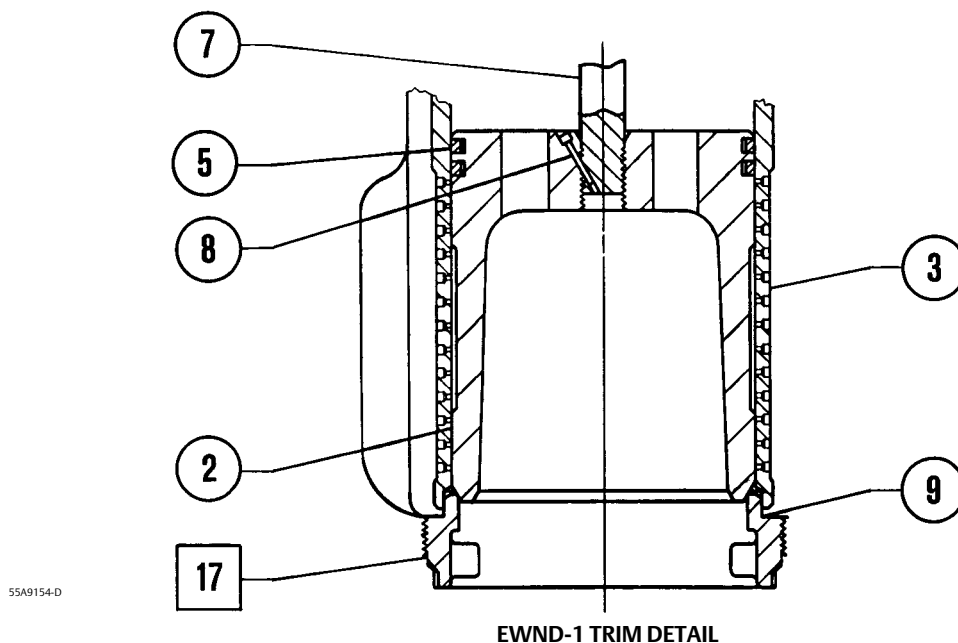
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Key	Description	Part Number	Key	Description	Part Number
	NPS 12 x 8 EWD-1 or EWND-1 (1 req'd)			W/ 657 actuator w/o handwheel	
	Steam or nonoxidizing service to 316°C (600°F)			and 585C Series actuators	
	Std or Level A, B, or C Whisper Trim III cage	10A3262X012		for use w/sliding stem valves	11A3429X722
	Level D Whisper Trim III cage	15A9019X012		For 127 mm (5 in.) max travel w/ 585C Series actuator	11A3429X112
	Steam or nonoxidizing service to 482°C (900°F)			31.8 mm (1-1/4 in.) stem dia	
	or air or oxidizing service to 427°C (800°F)			For 102 mm (4 in.) max travel	
	Std or Level A, B, or C Whisper Trim III cage	10A3262X022		W/ 667 & 667-4 actuators	
	Level D Whisper Trim III cage	15A9019X022		w/o handwheel	1K747735162
	Steam or nonoxidizing service to 593°C (1100°F)			W/ 657, 657-4, 667, & 667-4 actuators	
	or air or oxidizing service to 538°C (1000°F)			w/handwheel	11A3430X0142
	Std or Level A, B, or C Whisper Trim III cage	10A3262X032		W/ 657 actuator w/o	
	Level D Whisper Trim III cage	15A9019X032		handwheel and all 585C Series	
				sliding stem actuators	11A3430X432
				For 127 mm (5 in.) max travel	
5*	Valve Plug Seal Ring (not used w/ EWD-1, EWND-1, or EWS-1)			W/ 585C Series actuators	1V4641X00A2
	NPS 8 x 6 EWNT-1 w/Whisper Trim III cage (all levels)			NPS 12 x 8 CL900 EWND-1	
	Spring-loaded PTFE for -73 to 232°C (-100 to 450°F) service, except -73 to 149°C (-100 to 300°F) for sour gas service	10A5411X022		or EWNT-1	11A3430X552
	NPS 12 x 8 EWNT-1, EWNT-2, or EWT-1			NPS 12 x 8 CL600 EWND-1 or EWNT-2	
	Spring-loaded PTFE for -18 to 232°C (0 to 450°F) service			19.1 mm (3/4 in.) stem dia	
	Std or Level A, B, or C Whisper Trim III cage	10A3261X012		Std service	15A9152X022
	Level D Whisper Trim III cage	13A1239X012		Sour gas service	15A9152X042
6*	Seat Ring Seal Ring (used only w/ EWNT-2)			25.4 mm (1 in.) stem dia	
	Spring-loaded PTFE for -18 to 232°C (0 to 450°F) service	15A9044X012		Std service	13A9942X042
7*	Valve Plug Stem, S31600			Sour gas service	13A9942X132
	EWD-1, EWS-1, or EWT-1 w/			31.8 mm (1-1/4 in.) stem dia	
	31.8 mm (1-1/4 in.) stem dia only			Std service	13A4764X112
	For 585C Series or 657, 667, or 1008 actuator used w/std cage	11A3430X592		Sour gas service	13A4764X142
	For 585C Series actuator used		8*	Pin, S31600	
	w/Whisper Trim III cage	11A3430X092		All except EWS-1	
	NPS 8 x 6 EWND-1 or EWNT-1			19.1 mm (3/4 in.) stem dia	1V326035072
	19.1 mm (3/4 in.) stem dia			25.4 mm (1 in.) or 31.8 mm (1-1/4 in.) stem dia	1V334035072
	For 102 mm (4 in.) max travel			EWS-1 w/31.8 mm (1-1/4 in.) stem dia only	1K249838992
	W/585C Series actuator w/o handwheel and all 657, 657-4, 667, 667-4, & 1008 actuators	10A9265X592	9*	Seat Ring	
	W/585C Series actuator w/handwheel	10A9265XF72		EWD-1, EWS-1, or EWT-1 w/std cage	
	For 127 mm (5 in.) max travel w/ 585C Series actuator	10A9265X882		Heat-treated CA6NM	25A9300X022
	25.4 mm (1 in.) stem dia			S31600	25A9300X012
	For 102 mm (4 in.) max travel			S31600 w/seat hard faced w/Alloy 6	25A9301X012
	W/ 667 & 667-4 actuators w/o handwheel	11A3429X102		CY40	25A9300X032
	W/ 657, 657-4, 667, & 667-4 actuators w/handwheel	1K7891X0012		EWD-1 or EWT-1 w/Whisper Trim III cage	
				Level A, B, or C	
				Heat-treated CA6NM	36A0584X012
				S31600 w/seat hard faced w/Alloy 6	36A4108X012
				Level D	
				Heat-treated CA6NM	36A0582X012
				S31600 w/seat hard faced w/Alloy 6	36A0583X022
				NPS 8 x 6 EWND-1 or EWNT-1	
				S31600 w/seat hard faced w/Alloy 6	26A1135X022
				NPS 12 x 8 CL600 EWND-1	
				Level A, B, or C cage	
				S31600 w/seat hard faced w/Alloy 6	35A9046X012
				Level D cage	
				S31600 w/seat hard faced w/Alloy 6	35A9021X012
				NPS 12 x 8 CL900 EWND-1 or EWNT-1	
				Level A, B, or C cage	
				Heat-treated CA6NM	35A9284X012
				S31600 w/seat hard faced w/Alloy 6	35A9285X012
				Level D cage	
				Heat-treated CA6NM	35A9286X012
				S31600 w/seat hard faced w/Alloy 6	35A9287X012

Figure 8. Typical NPS 12 x 8 CL600 EWN Series Valve Body Assemblies

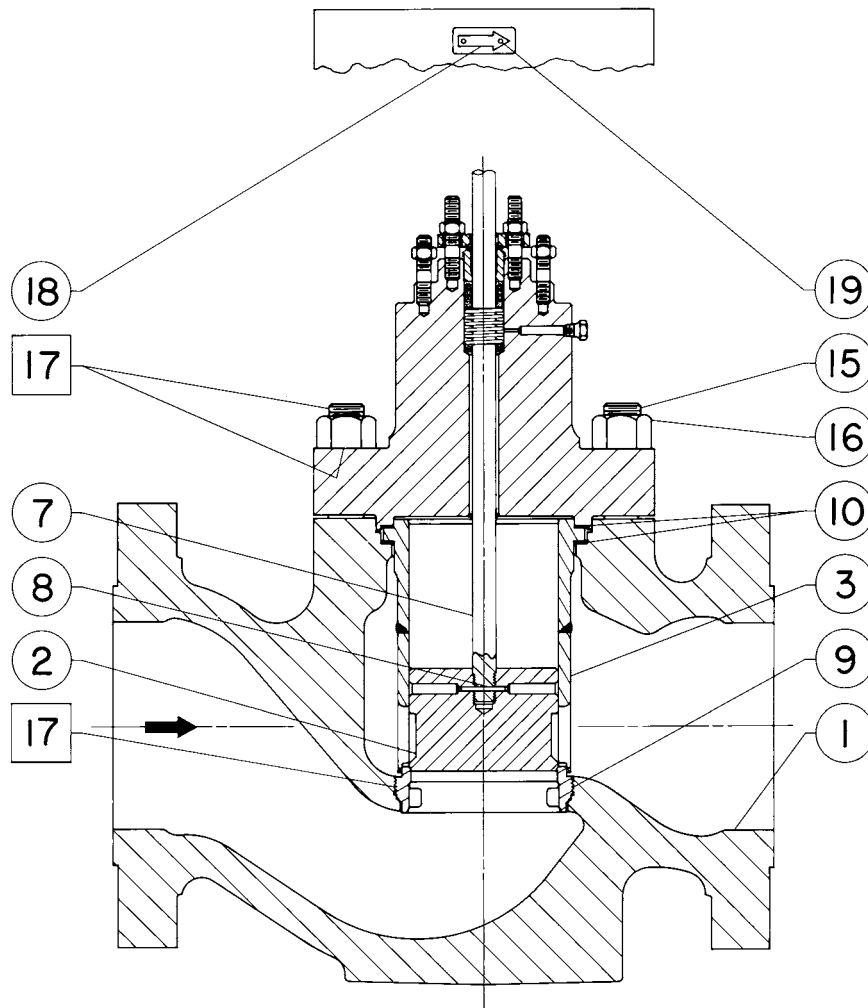


EWNT-2 VALVE WITH LEVEL A1 THROUGH C3 CAGE



EWND-1 TRIM DETAIL

Figure 9. NPS 12 x 8 CL900 EWS-1 Valve Body Assembly

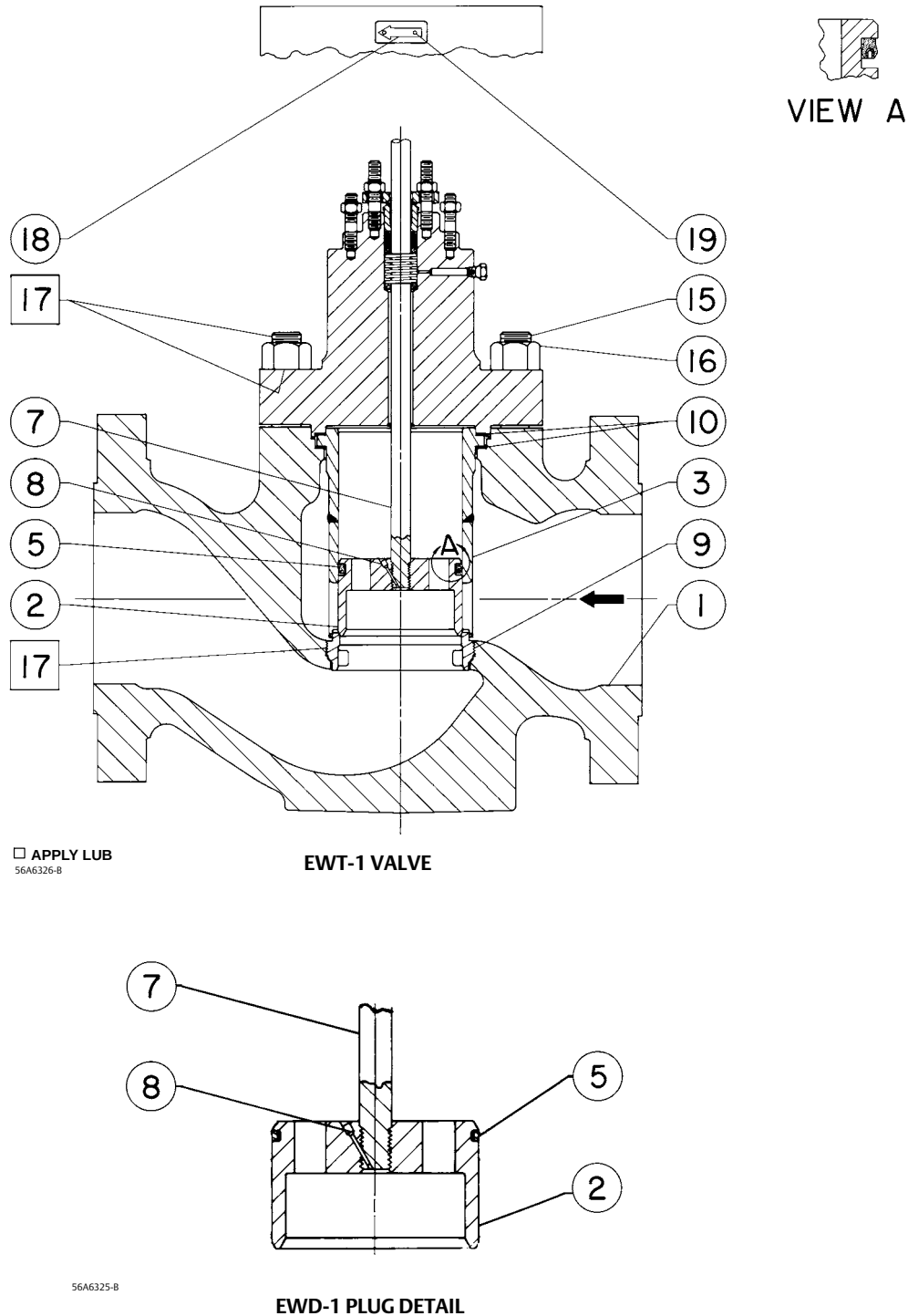


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Key	Description	Part Number	Key	Description	Part Number
10*	Bonnet Gasket NPS 8 x 6 EWND-1 or EWNT-1 (1 req'd) Standard service, silver plated N04400	11A8244X012	13	Retaining Ring (for use only w/ NPS 8 x 6 EWNT-1)	
	Sour gas service, tin plated N04400	11A8244X032	15	Stud Bolt NPS 8 x 6 EWND-1 or EWNT-1 (12 req'd) NPS 12 x 8 CL600 EWND-1 or EWNT-2 (16 req'd)	
	NPS 12 x 8 EWD-1, EWND-1, EWNT-1, EWNT-2, EWS-1, or EWT-1 to 427°C (800°F), graphite (2 req'd)	10A3265X112		NPS 12 x 8 CL900 EWD-1, EWND-1, EWNT-1, EWS-1, or EWT-1 (12 req'd)	
11*	Cage Gasket (for use only w/ NPS 8 x 6 EWND-1 or EWNT-1) Standard service, silver plated N04400	13A3183X022	16	Stud Bolt Nut NPS 8 x 6 EWND-1 or EWNT-1 (12 req'd) NPS 12 x 8 CL600 EWND-1 or EWNT-2 (16 req'd)	
	Sour gas service, tin plated N04400	13A3183X032		NPS 12 x 8 CL900 EWD-1, EWND-1, EWNT-1, or EWT-1 (12 req'd)	
12	Backup Ring (for use only w/ NPS 8 x 6 EWNT-1)		17	Anti-seize lubricant (not furnished)	
			18	Flow Arrow	
			19	Drive Screw, 18-8 SST (2 req'd)	

* Recommended spare parts

Figure 10. NPS 12 x 8 CL900 EWD-1 and EWT-1 Valve Body Assemblies



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EWN and EW-1 Valves

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Keys 6*, 7*, 8, 10, 11, 12*, 13, 30*, 31*, and 32* Packing Box Parts

DESCRIPTION			KEY NO.	STEM DIAMETER, mm (INCHES)		
				19.1 (3/4)	25.4 (1)	31.8 (1-1/4)
PTFE V-Ring Packing	Single packing set, PTFE		6	1R290401012	1R290601012	1R290801012
	Packing ring, PTFE		7	1C752801012	1C752901012	1D387601012
	Quantity req'd	Single	---	3	3	3
		Double	---	6	6	6
		Leak-off	---	5	---	---
	Lower wiper, PTFE		30	1J872306992	1J872406992	1J872506992
	Male adaptor, PTFE (1 req'd for single or 2 req'd for double or leak-off)		31	1F124601012	1H982501012	1H995701012
	Female adaptor, PTFE (1 req'd for single or 2 req'd for double or leak-off)		32	1F124201012	1H982401012	1H995801012
	Spring, stainless steel (for single only)		8	1F125637012	1D582937012	1D387437012
	Lantern ring, stainless steel (for double or leak-off only)		8	0N028435072	0U099735072	0W087135072
PTFE/Composition Packing	Quantity req'd	Double	---	1	1	1
		Leak-off	---	2	---	---
	Special washer, stainless steel (for single only)		10	1F125036042	1H982236042	1H995936042
PTFE/Composition Packing	Packing Ring, PTFE/Composition		7	1E319101042	1D7518X0012	1D7520X0012
	Quantity req'd	Double	---	8	8	8
		Leak-off	---	6	6	7
Common Parts	Lantern ring, stainless steel (1 req'd for double or 2 req'd for leak-off)		8	0N028435072	0U099735072	0W087135072
	Packing box ring	S31600	11	1J873335072	---	---
		S17400	11	---	1J873435012	1J873535012
	Upper wiper, felt		12	1J872806332	1J872906332	1J873006332
	Packing follower, S31600		13	1E944735072	1H982335072	1H998435072

Key 2* EWD-1, EWS-1, or EWT-1 Valve Plug

VALVE DESIGN	CAGE STYLE		S41600	HEAT-TREATED CA6NM	S31600	S31600 W/ SEAT HARD FACED W/ALLOY 6 (CoCr-A)	S31600 W/SEAT & GUIDE HARD FACED w/ ALLOY 6	
							To 427°C (800°F) ⁽¹⁾	Over 427°C (800°F)
EWD-1	Standard		21A5358X012	---	21A5358X022	21A5361X012	21A5364X012	21A5367X012
	Whisper Trim III	Level A, B, or C	---	---	---	---	---	36A4114X012
		Level D	---	---	---	---	---	36A4111X012
EWS-1	Standard		21A5264X012	---	21A5264X022	21A5267X012	21A5270X012	21A5273X012
EWT-1	Standard		21A5358X012	---	21A5358X022	21A5361X012	21A5364X012	---
	Whisper Trim III	Level A, B, or C	---	36A4112X012	---	---	36A4113X012	
		Level D	---	36A4109X012	---	---	36A4110X012	
1. To 232°C (450°F) for EWT-1.								

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Key 2* EWND-1 Valve Plug

VALVE SIZE, NPS.	STEM DIA		WHISPER TRIM III CAGE LEVEL	S41600	S31600 W/SEAT & GUIDE HARD FACED w/ ALLOY 6	
	mm	Inches			To 427°C (800°F)	Over 427°C (800°F)
8 x 6	19.1 25.4 31.8	3/4 1 1-1/4	A, B, C, or D A, B, C, or D A, B, C, or D	26A2986X012 26A2988X012 25A8795X012	26A2980X012 26A2985X012 25A8794X012	26A2987X012 26A2989X012 25A4126X012
12 x 8 CL300 or 600	19.1	3/4	A B or C D	--- --- ---	35A9657X012 25A9026X012 25A9016X012	---
	25.4	1	A B or C D	--- --- ---	35A9658X012 25A9027X012 25A9017X012	
	31.8	1-1/4	A B or C D	--- --- ---	35A9659X012 25A9028X012 25A9018X012	
12 x 8 CL900	31.8	1-1/4	A B or C D	--- --- ---	--- --- ---	35A9659X012 25A9028X012 25A9018X012

Key 2* EWNT-1 or EWNT-2 Valve Plug

VALVE DESIGN	STEM DIA		WHISPER TRIM III CAGE LEVEL	S41600	HEAT-TREATED CA6NM	S31600 W/SEAT & GUIDE HARD FACED w/ ALLOY 6
	mm	Inches				
NPS 8 X 6 EWNT-1	19.1 25.4 31.8	3/4 1 1-1/4	A, B, C, or D A, B, C, or D A, B, C, or D	22A3307X032 22A3310X032 25A4104X012	--- --- ---	22A3309X012 22A3312X012 25A4109X012
NPS 12 x 8 EWNT-1	31.8	1-1/4	A B or C D	--- --- ---	35A9656X012 25A9025X012 25A9004X012	35A9839X012 25A9837X012 25A9834X012
NPS 12 x 8 EWNT-2	19.1	3/4	A B or C D	--- --- ---	35A9654X012 25A9023X012 25A9002X012	35A9838X012 ⁽¹⁾ 25A9835X012 ⁽¹⁾ 25A9832X012 ⁽¹⁾
	25.4	1	A B or C D	--- --- ---	35A9655X012 25A9024X012 25A9003X012	35A9840X012 ⁽¹⁾ 25A9836X012 ⁽¹⁾ 25A9833X012 ⁽¹⁾
	31.8	1-1/4	A B or C D	--- --- ---	35A9656X012 25A9025X012 25A9004X012	35A9839X012 ⁽¹⁾ 25A9837X012 ⁽¹⁾ 25A9834X012 ⁽¹⁾

1. For sour gas service.

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EWN and EW-1 Valves

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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

EWN and EW-1 Valves

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Instruction Manual

D100400X012

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Fisher™ EZ easy-e™ Control Valve

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Figure 1. Fisher EZ Valve with 657 Actuator and DVC6000 Digital Valve Controller



W8120A-1

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 1/2 through 4 Fisher EZ valves through CL600 ratings. Refer to separate manuals for instructions covering the actuator and accessories.



Do not install, operate, or maintain an EZ valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

EZ valves (figure 1) are globe-style with integral end connections, post guiding, and quick-change trim. These valves are used in chemical or hydrocarbon processing applications or in applications that require control of non-lubricating, viscous, or other hard-to-handle fluids.

Table 1. Specifications

End Connection Styles Cast Iron Valves <i>Flanged:</i> CL125 flat-face or 250 raised-face flanges per ASME B16.1 Steel and Stainless Steel Valves <i>Flanged:</i> CL150, 300, and 600 raised-face or ring-type joint flanges per ASME B16.5 <i>Screwed or Socket Welding:</i> Consistent with ASME B16.11 <i>Buttwelding:</i> All available ASME B16.25 schedules that are consistent with ASME B16.34 Maximum Inlet Pressure⁽¹⁾ Cast Iron Valves <i>Flanged:</i> Consistent with CL125B or 250B per ASME B16.1 Steel and Stainless Steel Valves <i>Flanged:</i> Consistent with CL150, 300, or 600 per ASME B16.34 <i>Screwed or Welding:</i> Consistent with CL600 per ASME B16.34	Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4 Metal Seats: Class IV is standard, Class V is optional PTFE Composition Seats: Class VI Flow Characteristics ■ Equal percentage, ■ quick opening, and ■ linear Flow Direction Up through the seat ring Approximate Weights NPS 1/2 and 3/4 Valves: 9.1 kg (20 pounds) NPS 1 Valve: 11 kg (25 pounds) NPS 1-1/2 Valve: 18 kg (40 pounds) NPS 2 Valve: 36 kg (80 pounds) NPS 3 Valve: 54 kg (120 pounds) NPS 4 Valve: 75 kg (165 pounds)
--	--

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

Specifications

Typical specifications for these valves are shown in table 1.

Educational Services

For information on available courses for the Fisher EZ valve, as well as a variety of other products, contact:

Emerson Automation Solutions
 Educational Services - Registration
 Phone: 1-641-754-3771 or 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

⚠ WARNING

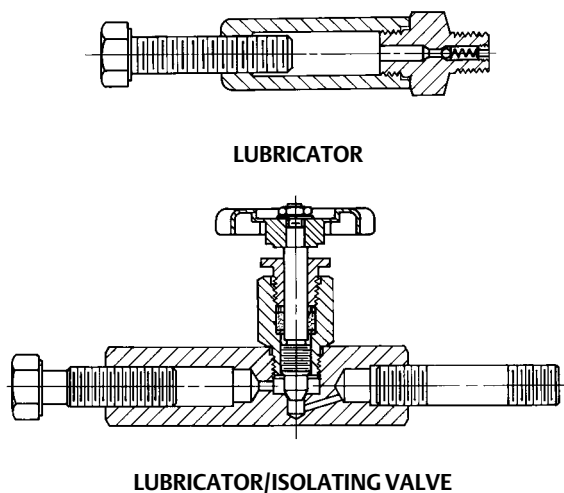
Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Figure 2. Optional Packing Lubricator and Lubricator/Isolating Valve



CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson Automation Solutions sales office.

1. Before installing the valve, inspect it and any associated equipment for damage and any foreign material. Make certain the valve interior is clean, that pipelines are free of foreign material, and that the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.
2. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven valve plug and seat ring retainer wear, and improper operation. With some valves, the actuator may also need to be supported when it is not vertical. For more information, consult your [Emerson sales office](#).
3. Use accepted piping and welding practices when installing the valve in the line. Internal elastomeric parts may stay in place during the welding procedure. For flanged valves, use a suitable gasket between the valve body flange and pipeline flanges.

CAUTION

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Shrunk-fit pieces and threaded connections may also loosen. In general, if post weld heat treating is to be performed, all trim parts should be removed. Contact your Emerson sales office for additional information.

4. With a leak-off bonnet construction, remove the pipe plugs (key 14) to hook up the leak-off piping. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
5. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valves with ENVIRO-SEAL live-loaded packing or HIGH-SEAL Heavy-Duty live-loaded packing will not require this initial re-adjustment. See the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves or Heavy-Duty Live-Loaded Packing System (as appropriate) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the Parts Kits sub-section near the end of this manual.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance, trim maintenance, and ENVIRO-SEAL bellows seal replacement. All maintenance operations may be performed with the valve in the line.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

CAUTION

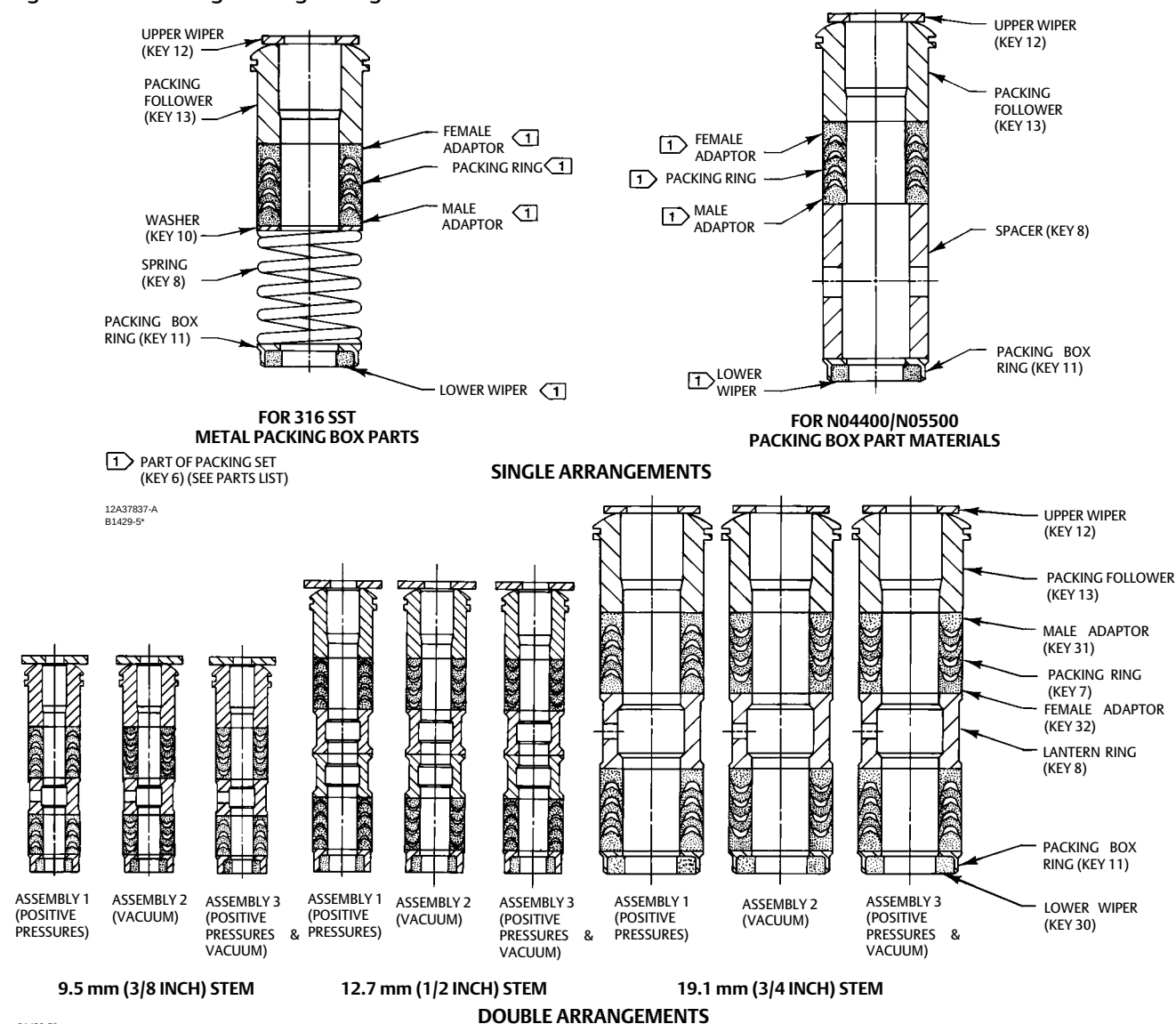
Trim Cartridge is a single use repair solution. It is not recommended to remove and reinstall Trim Cartridge after initial installation so valve assemblies with Trim Cartridge will not support an open and inspect maintenance strategy. If the valve contains Trim Cartridge (Trim Cartridges can be identified by a name plate on the bonnet flange, the use of a packing nut, and “Fisher” embossed below the yoke mounting), please refer to Fisher ET and EZ easy-e Valves with Trim Cartridge Instruction Manual ([D104358X012](#)) for appropriate maintenance procedures.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal since the used gasket may not seal properly.

If the valve has ENVIRO-SEAL or HIGH-SEAL live-loaded packing installed, refer to instruction manuals ENVIRO-SEAL Packing System for Sliding Stem Valves, [D101642X012](#), or HIGH-SEAL Live Loaded Packing System, [D101453X012](#), for packing instructions. Figure 6 shows a typical HIGH-SEAL packing system. Figures 7 and 8 show typical ENVIRO-SEAL systems.

Figure 3. PTFE V-Ring Packing Arrangements for Plain and Extension Bonnets



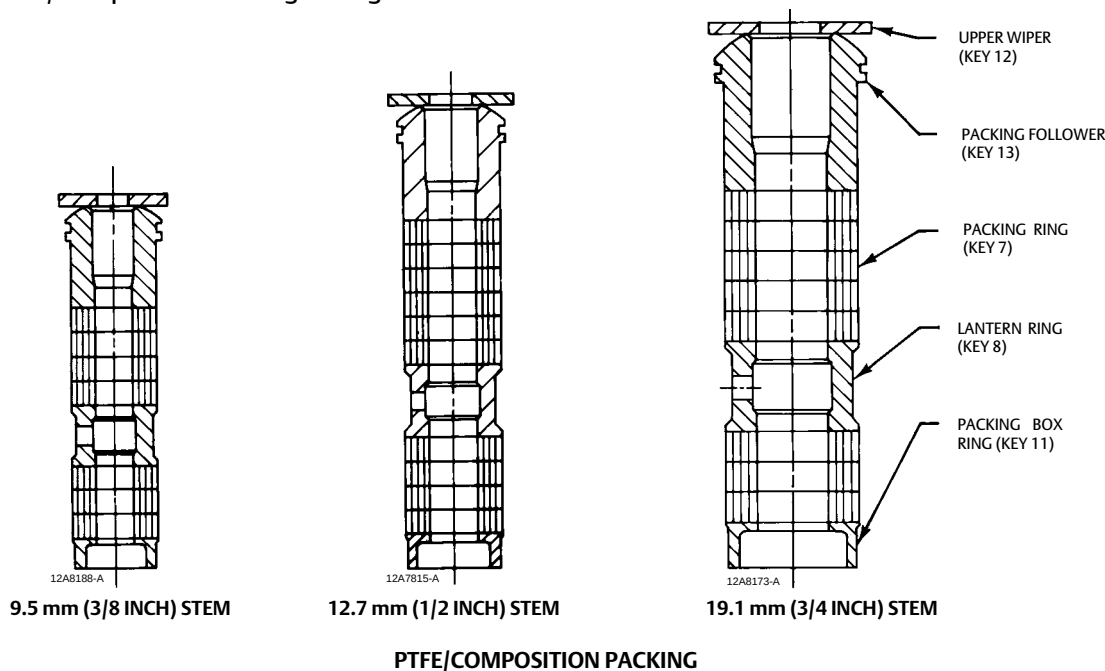
Packing Lubrication

Note

ENVIRO-SEAL or HIGH-SEAL packing does not require lubrication.

If an optional lubricator or lubricator/isolating valve (figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in an optional tapped hole in the bonnet. Use a good quality silicon-base lubricant. Packing used in oxygen service or in processes with temperatures over 260°C (500°F) should not be lubricated. To operate the lubricator, simply turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve must first be opened and then closed after lubrication is completed.

Figure 4. PTFE/Composition Packing Arrangements for Plain and Extension Bonnets



Packing Maintenance

This section covers PTFE V-ring, PTFE/composition, and graphite/ribbon packing as used in plain and extension bonnets. Unless otherwise indicated, key numbers refer to figure 3 for PTFE V-ring packing, figure 4 for PTFE/composition packing, and figure 5 for graphite ribbon/filament packing.

For spring-loaded single PTFE V-ring packing, the spring (key 8, figure 3) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13, figure 3), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5, figure 11), until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the Replacing Packing procedure.

If there is unacceptable packing leakage with other than spring-loaded packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

Note

Valve assemblies with Trim Cartridge utilize a packing nut design and are only available with ENVIRO-SEAL packing. If the valve contains Trim Cartridge (Trim Cartridges can be identified by a name plate on the bonnet flange, the use of a packing nut, and "Fisher" embossed below the yoke mounting), please refer to Fisher ET and EZ easy-e Valves with Trim Cartridge Instruction Manual ([D104358X012](#)) for appropriate packing maintenance instructions.

If the packing is relatively new and tight on the stem, and if tightening the packing flange nuts does not stop the leakage, the valve stem may be worn or nicked so that a seal cannot be made. The surface finish of a valve stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, the leakage

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may be caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

An illustration of a HIGH-SEAL live-loaded packing system is shown in figure 6. Illustrations of ENVIRO-SEAL live-loaded packing systems are shown in figures 7, 8, and 9.

Figure 5. Graphite Ribbon/Filament Packing Arrangements for Plain and Extension Bonnets

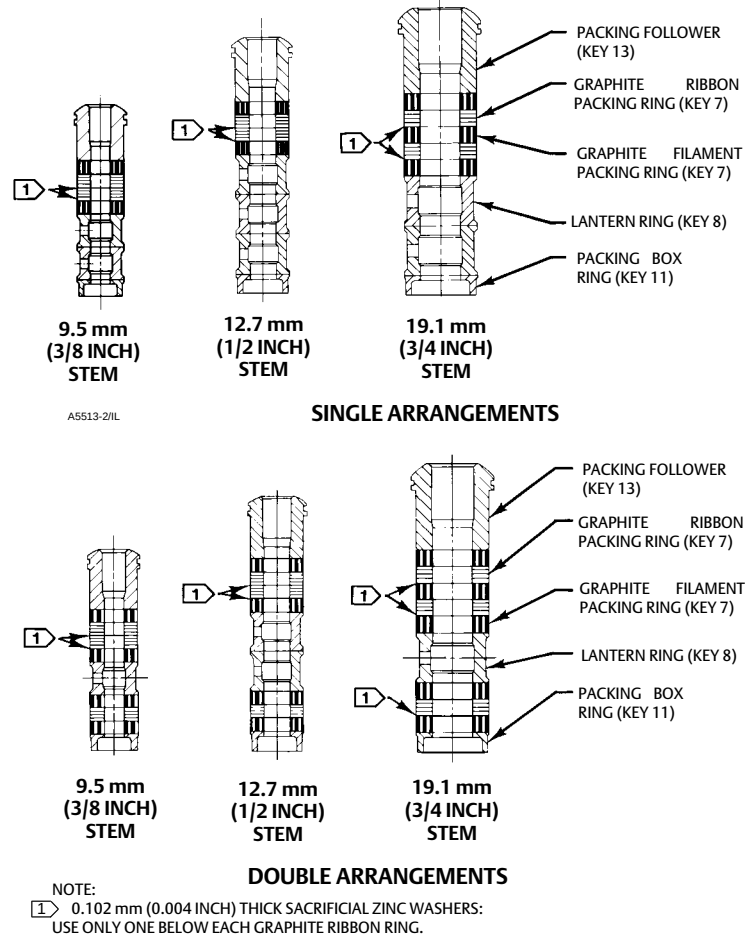


Table 2. Body-to-Bonnet Torque Guidelines

VALVE SIZE, NPS	TORQUES ^(1, 3)			
EZ	Bolt Material			
	SA193-B7		SA193-B8M ⁽²⁾	
	N•m	Lbf•ft	N•m	Lbf•ft
1 or smaller	129	95	64	47
1-1/2 or 2	96	71	45	33
3	169	125	88	65
4	271	200	156	115

1. Determined from laboratory tests.
2. SA193-B8M annealed.
3. For other materials, contact your [Emerson sales office](#) for torques.

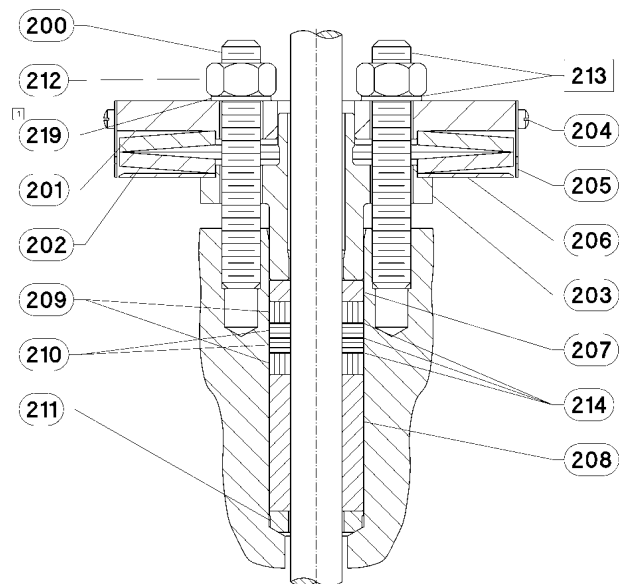
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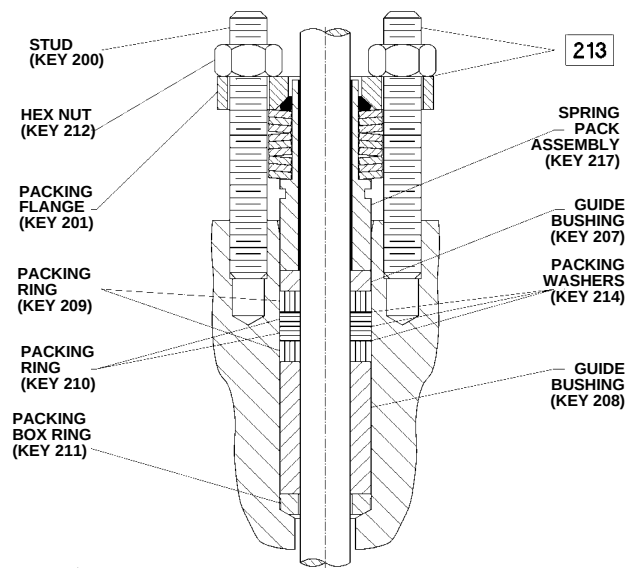
Figure 6. Typical HIGH-SEAL Graphite ULF Packing System



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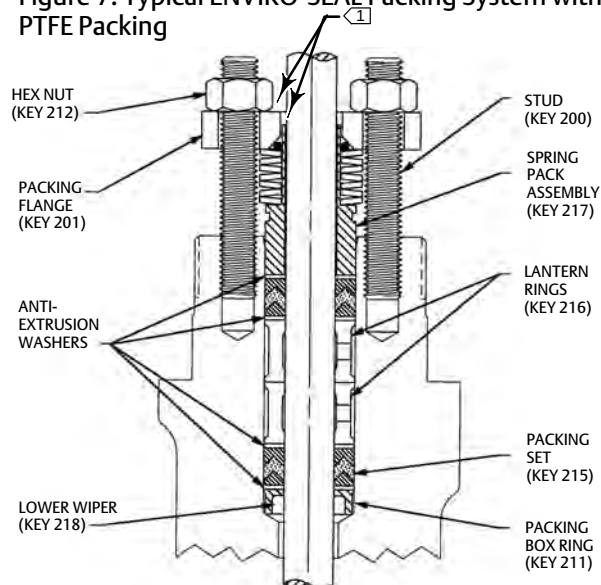
1. Find number 219 not required with 3/8-inch stem

Figure 8. Typical ENVIRO-SEAL Packing System with Graphite ULF Packing



39B4612/A

Figure 7. Typical ENVIRO-SEAL Packing System with PTFE Packing

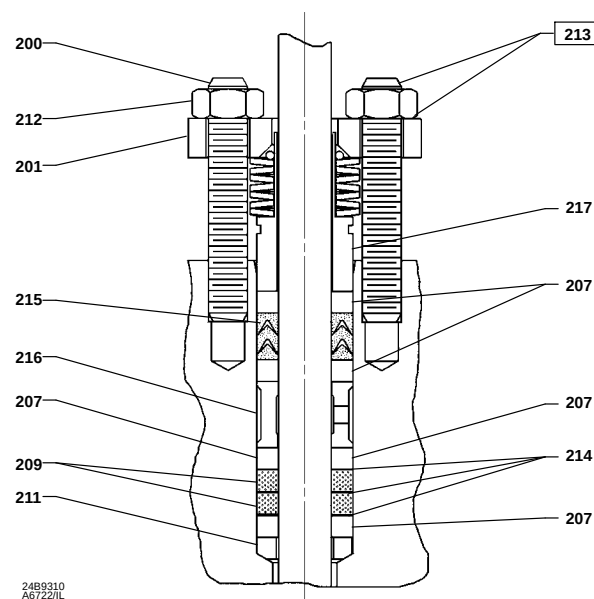


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Note:

1. For PTFE packing, tighten the packing box hex nuts until the top of the flange is even with the top of the sleeve on the follower (spring pack assembly).

Figure 9. Typical ENVIRO-SEAL Packing System with Duplex Packing



24B9310
A67227L

Replacing Packing

⚠ WARNING

Observe the warning at the start of the Maintenance section.

This section covers replacing packing used in plain and extension bonnets. PTFE V-ring packing is shown in figure 3, PTFE/composition packing is shown in figure 4, and graphite/ribbon packing is shown in figure 5.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet. Disconnect the stem connector and then remove the actuator from the valve by unscrewing the yoke locknut (key 15, figure 11).

⚠ WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. If the seat ring retainer sticks to the bonnet, proceed carefully with bonnet removal.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

3. Hex nuts (key 16, figure 11) attach the bonnet to the valve. Loosen these nuts or cap screws approximately 3 mm (1/8-inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens.
4. Loosen the packing flange nuts (key 5, figure 11) so that the packing is not tight on the valve stem. Remove any travel indicator parts and stem locknuts from the valve stem threads.

CAUTION

Avoid damaging the seating surface caused by the valve plug and stem assembly dropping from the bonnet after being lifted part way out. When lifting the bonnet, temporarily install a valve stem locknut on the valve stem. This locknut will prevent the valve plug and stem assembly from dropping out of the bonnet.

5. Completely remove the cap screws (not shown) or hex nuts (key 16, figure 12) that bolt the bonnet and valve body together and carefully lift the bonnet off.
6. Remove the locknut and separate the valve plug and stem from the bonnet. Set the parts on a protective surface to prevent damage to gasket or seating surfaces.
7. Remove the bonnet gasket (key 10, figure 12) and cover the opening in the valve to protect the gasket surface and to prevent foreign material from getting into the valve body cavity.
8. Remove the packing flange nuts, packing flange, upper wiper, and packing follower (keys 5, 3, 12, and 13, figure 11). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.

9. Inspect the valve stem threads and the packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
10. Remove the covering protecting the valve cavity and install a new bonnet gasket (key 10, figure 12), making sure the gasket seating surfaces are clean and smooth. Then slide the bonnet over the stem and onto the stud bolts (key 15, figure 12), or onto the valve cavity if cap screws (not shown) are used instead.

Note

Proper performance of the tightening procedures in step 11 compresses the spiral wound gasket (key 12, figure 12) enough to both load and seal the seat ring gasket (key 13, figure 12). The tightening procedures also compresses the outer edge of the bonnet gasket (key 10, figure 12) enough to seal the body-to-bonnet joint.

The accepted bolting procedures referred to in step 11 include--but are not limited to--ensuring that bolting threads are clean, and evenly tightening the cap screws, or the nuts onto the studs, in a crisscross pattern. Because of the boltup characteristics of spiral wound gaskets, tightening one cap screw or nut may loosen an adjacent cap screw or nut. Repeat the crisscross tightening pattern several times until each cap screw or nut is tight and the body-to-bonnet seal is made.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

11. Install bolting, using accepted bolting procedures during tightening so that the body-to-bonnet joint can withstand test pressures and application service conditions. The bolt torques in table 2 may be used as guidelines unless accepted bolting procedures dictate otherwise.
12. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 3, 4, or 5. If split-ring packing is being added, alternate the position of the splits to avoid a leak path. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.

Installation of graphite ribbon packing requires special care to avoid trapping air between the rings. Start with only one ring at a time without forcing the top of the packing ring below the bottom of the entrance chamfer of the packing box. Thus, when a ring is added, the stack should not be pushed into the cavity more than the thickness of the added ring.

13. Slide the packing follower, upper wiper, and packing flange (keys 13, 12, and 3, figure 11) into position. Lubricate the packing flange studs (key 4, figure 11) and the faces of the packing flange nuts (key 5, figure 11). Install the packing flange nuts.

Note

The torque values discussed in step 14 and shown in table 3 are recommended guidelines only and are presented as a starting point for this procedure. Tightening the packing flange nuts to a torque value that exceeds the table guidelines, in order to obtain a seal, may indicate other problems.

14. For spring-loaded PTFE V-ring packing, tighten the packing flange nuts until the shoulder on the packing follower (key 13, figure 11) contacts the bonnet.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 3. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 3.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 3. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

For ENVIRO-SEAL or HIGH-SEAL live-loaded packing, refer to the note at the beginning of the Maintenance section on page 5 of this manual.

15. Mount the actuator on the valve body and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

Table 3. Recommended Torque for Packing Flange Nuts (Not for Spring-Loaded Packing)

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE TYPE PACKING				PTFE TYPE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
mm	Inches		N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in
9.5	3/8	CL125, CL150	3	27	5	40	1	13	2	19
		CL250 CL300	4	36	6	53	2	17	3	26
		CL600	6	49	8	73	3	23	4	35
12.7	1/2	CL125, CL150	5	44	8	66	2	21	4	31
		CL250 CL300	7	59	10	88	3	28	5	42
		CL600	9	81	14	122	4	39	7	58
19.1	3/4	CL125, CL150	11	99	17	149	5	47	8	70
		CL250 CL300	15	133	23	199	7	64	11	95
		CL600	21	182	31	274	10	87	15	131

Trim Maintenance

WARNING

Observe the warning at the start of the Maintenance section.

CAUTION

Trim Cartridge is a single use repair solution. It is not recommended to remove and reinstall Trim Cartridge after initial installation so valve assemblies with Trim Cartridge will not support an open and inspect maintenance strategy. If the valve contains Trim Cartridge (Trim Cartridges can be identified by a name plate on the bonnet flange, the use of a packing nut, and “Fisher” embossed below the yoke mounting), please refer to Fisher ET and EZ easy-e Valves with Trim Cartridge Instruction Manual ([D104358X012](#)) for appropriate maintenance procedures.

This procedure describes how the valve trim can be completely disassembled. When inspection or repairs are required, perform only those steps necessary to accomplish the task.

Disassembly

Except where indicated, key numbers referenced in the following steps are found in figure 12.

1. Remove the actuator and the bonnet according to steps 1 through 6 of the Replacing Packing procedure of the Maintenance section.

⚠ WARNING

Avoid personal injury or property damage from valve or packing leakage.

Any damage to the gasket sealing surfaces could cause the valve to leak.

The surface finish of the valve stem (key 7) is critical for making a good packing seal. The inside surface of the seat ring retainer is critical for smooth operation of the valve plug.

The seating surfaces of the valve plug and seat ring (keys 2 and 9) are critical for proper shutoff.

Protect these parts accordingly while disassembling the trim. Gasket selection criteria is provided on page 34 of this instruction manual.

2. Packing parts can be removed if desired. Replace these parts as described in the Replacing Packing procedure.

Valves with Plain or Extension Bonnets

Perform the following steps to remove the valve trim.

1. Lift the valve plug and stem assembly [or the plug guide, disk retainer, and disk (keys 27, 28, and 29, figure 13) if used], out of the valve body and set it on a protective surface.

Note

With some valve plug sizes and configurations, the seat ring retainer and bushing assembly (keys 3 and 26, figures 12 and 13) will come out of the valve body with the valve plug and stem assembly, and in other valve plug sizes and configurations, the valve plug or tip will slide through the seat ring retainer and bushing assembly, leaving the retainer and bushing assembly in the valve body.

2. With the valve plug and stem assembly out of the valve, either slide the seat ring retainer and bushing assembly (keys 3 and 26), and gaskets and shim (keys 10, 12, and 25) up over the valve plug and stem or lift the seat ring retainer and bushing assembly and associated gaskets and shim out of the valve body. If the valve plug is to be reused, protect the valve plug seating surface to prevent scratches.

3. For valves with metal seats, drive out the pin (key 8) and unscrew the valve stem (key 7) from the valve plug (key 2).
4. For valves with 0.25 and 0.375-inch ports and composition seats, refer to figure 13. Drive out the pin (key 8) and unscrew the valve stem (key 7) from the valve plug guide (key 27). Unscrew the disk retainer (key 28) from the valve plug guide. Remove the disk (key 29) from the valve plug tip (key 30).

For valves with 0.5 through 2-inch ports and composition seats, refer to figure 13. Drive out the pin (key 8) and unscrew the valve stem (key 7) from the valve plug guide (key 27). Drive out pin (key 31) and unscrew the tip (key 30) from the valve plug guide. Remove the disk (key 29) from the valve plug guide.

For valves with 3 and 4-inch ports and composition seats, refer to figure 13. Drive out the pin (key 8) and unscrew the valve stem from the valve plug guide (key 27). Remove the cap screw (key 32) to remove the tip (key 30) from the valve plug guide. Remove the disk (key 29).

5. Remove the seat ring and seat ring gasket (keys 9 and 13).
6. Inspect parts for wear or damage that would prevent proper operation of the valve. Replace or repair trim parts according to the following Lapping Metal Seats or Assembly procedure as appropriate.

Valves with Overtravel (EZ-OVT) Trim

Perform the following steps to remove the valve trim.

1. Lift the bonnet flat sheet gasket, gasket shim, and spiral wound gasket (keys 10, 25, and 12) from the valve body. Discard the old gaskets.
2. Lift the valve plug and stem assembly (key 30, figure 13) out of the valve body and set it on a protective surface.

Note

The seat ring retainer and bushing assembly (keys 3 and 26) will come out of the valve body with the valve plug and stem assembly.

3. Lift the seat ring (key 9) out of the valve body. There will be a flat sheet gasket located between the seat ring and valve body shelf (key 13). If the gasket does not come out of the valve body with the seat ring, be sure to remove the gasket from the valve body. Discard the gasket and tape or otherwise protect the seating surface of the seat ring to prevent damage.
4. Inspect all parts for wear and damage which would prevent proper operation of the valve. All gasket surfaces on the trim parts and in the valve body must be cleaned of any graphite residue and must be free from nicks and scratches. The seating surfaces of the valve plug post and seat ring must be free from nicks, scratches, or any other damage which could affect the proper shutoff. Replace or repair trim parts as appropriate.

Note

If the soft seat disk is damaged, the entire plug assembly must be replaced.

Valves with ENVIRO-SEAL Bellows Seal Bonnets

Perform the following steps to remove the valve trim.

1. Lift the stem/bellows assembly with valve plug attached [or the plug guide, disk retainer, and disk (keys 27, 28, and 29, figure 13) if used], seat ring retainer and gaskets out of the valve body and set them on a protective surface.

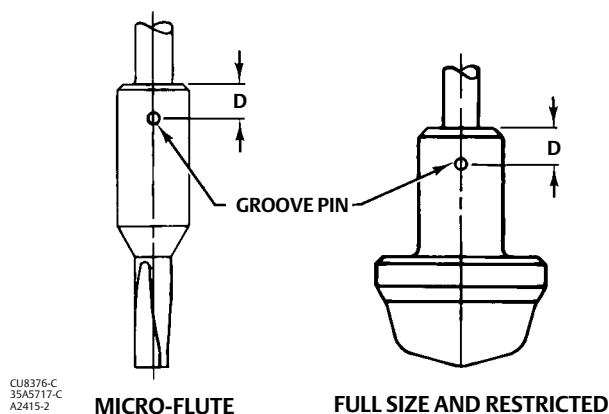
Note

With some valve plug sizes and configurations, the seat ring retainer and bushing assembly (keys 3 and 26, figures 12 and 13) will come out of the valve body with the stem/bellows, and in other valve plug sizes and configurations, the valve plug or tip will slide through the seat ring retainer and bushing assembly, leaving the retainer and bushing assembly in the valve body.

2. If the seat ring retainer and bushing assembly (keys 3 and 26) stayed in the valve, lift them out along with gaskets and shim (keys 10, 12, and 25).
3. If the seat ring retainer and bushing assembly (keys 3 and 26) came out of the valve with the stem/bellows assembly, move the seat ring retainer and bushing assembly against the shoulder of the valve plug (key 2) or valve plug guide (key 27, figure 13) to provide access to the pin (key 36, figure 11).

VALVE STEM		BOLT TORQUE		DRILL SIZE, INCH	D DIMENSION	
mm	Inch	N•m	Lbf•ft		mm	Inch
9.5	3/8	40-47	25-35	3/32	16	0.625
12.7	1/2	81-115	60-85	1/8	19	0.75
19.0	3/4	237-339	175-250	3/16	25	1

Figure 10. Bolt Torque for Plug/Stem Connection and Plug/Adaptor Connection and Pin Replacement



4. Place the stem/bellows assembly and valve plug or valve plug guide in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug or valve plug guide that is not a seating or guiding surface. Drive out the pin (key 36, figure 11).
5. Remove the stem/bellows assembly from the soft-jaw chuck or vise. Place a wrench on the flat areas on the valve stem just below the threads for the actuator/stem connection to keep the stem from turning. Then, unscrew the adaptor (key 24, figure 11), which also includes the valve plug (key 2) or valve plug guide (key 27, figure 13), from the stem/bellows assembly (key 20, figure 11).
6. Remove the seat ring retainer and bushing assembly (keys 3 and 26) by sliding it over the adaptor. If the valve plug is to be reused, protect the valve plug seating surface to prevent scratches.
7. For valves with metal seats, drive out the pin (key 8) and unscrew the adaptor (key 24, figure 11) from the valve plug (key 2).
8. For valves with 0.25 and 0.375-inch ports and composition seats, refer to figure 13. Drive out the pin (key 8) and unscrew the adaptor (key 24, figure 11) from the valve plug guide (key 27). Unscrew the disk retainer (key 28) from the valve plug guide. Remove the disk (key 29) from the valve plug tip (key 30).

For valves with 0.5 through 2-inch ports and composition seats, refer to figure 13. Drive out the pin (key 8) and unscrew the adaptor (key 24, figure 11) from the valve plug guide (key 27). Drive out the pin (key 31) and unscrew the tip (key 30) from the valve plug guide. Remove the disk (key 29) from the valve plug guide.

For valves with 3 and 4-inch ports and composition seats, refer to figure 13. Drive out the pin (key 8) and unscrew the adaptor (key 24, figure 11) from the valve plug guide (key 27). Remove the cap screw (key 32) to remove the tip (key 30) from the valve plug guide. Remove the disk (key 29).

9. Remove the seat ring and seat ring gasket (keys 9 and 13).
10. Inspect parts for wear or damage that would prevent proper operation of the valve. Replace or repair trim parts according to the following Assembly procedure as appropriate.

Lapping Metal Seats on Valves with Plain and Extension Bonnets

CAUTION

To avoid damaging the ENVIRO-SEAL Bellows Seal Bonnet assembly, do not attempt to lap the metal seating surfaces on valves with ENVIRO-SEAL bellows seal bonnets. The design of the bonnet assembly prevents rotation of the stem and any forced lapping rotation will damage internal components of the ENVIRO-SEAL Bellows Seal bonnet.

With metal-seat constructions, seating surfaces of the valve plug and seat ring (key 2, figure 12) can be lapped for improved shutoff. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Assemble the valve to the extent that the seat ring retainer is in place and the bonnet is bolted to the valve body. A simple handle can be made from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction to lap the seats. After lapping, remove the bonnet and clean the seat surfaces. Completely assemble as described in the assembly portion of the Trim Maintenance procedure and test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

Note

EZ valves with Overtravel (EZ-OVT) trim should not be lapped.

Assembly

This procedure assumes that all the trim and associated gaskets were removed from the valve body. If these parts were not all removed, start the assembly procedure at the appropriate step. Except where indicated, key numbers referenced in the following steps are found in figure 12.

Valves with Plain or Extension Bonnets

Perform the following steps to assemble and install the trim.

CAUTION

To avoid weakening the stem that may cause failure in service, never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem, which will weaken the stem. However, a used valve plug may be reused with a new stem.

1. For valves with metal seats, screw the valve stem (key 7) into the valve plug (key 2). Tighten to the torque value given in figure 10. Refer to figure 10 to select the proper drill size. Drill through the stem using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin (key 8) to lock the assembly.
2. For valves with 0.25 and 0.375-inch ports and composition seats, refer to figure 13. Place the disk (key 29) on the valve plug tip (key 30). Place the disk retainer (key 28) over the disk, and then thread the disk retainer onto the valve plug guide (key 27).

CAUTION

To avoid failure in service for valves with 0.5 through 1-inch ports and composition seats, never reuse an old valve plug guide with a new valve plug tip. Using an old valve plug guide with a new plug tip requires drilling a new pin hole in the valve plug guide, which will weaken the guide. However, a used valve plug tip may be reused with a new valve plug guide.

For valves with 0.5 through 1-inch ports and composition seats, refer to figure 13. Insert the disk (key 29) in the valve plug guide (key 27). Screw the tip (key 30) onto the valve plug guide to clamp the disk in place. Using a 3/32-inch bit, drill through the valve plug guide using the hole in the tip as a drilling guide. Remove any chips or burrs and drive in a new pin (key 31).

CAUTION

To avoid failure in service for valves with 1.5 and 2-inch ports and composition seats, never reuse an old valve plug tip with a new valve plug guide. Using an old valve plug tip with a new valve plug guide requires drilling a new pin hole in the valve plug tip which will weaken the tip. However, a used valve plug guide may be reused with a new valve plug tip.

For valves with 1.5 and 2-inch ports and composition seats, refer to figure 13. Insert the disk (key 29) in the valve plug guide (key 27). Screw the tip (key 30) into the valve plug guide to clamp the disk in place. Using a 3/32-inch bit, drill through the valve plug tip using the hole in the valve plug guide as a drilling guide. Remove any chips or burrs and drive in a new pin (key 31).

For valves with 3 and 4-inch ports and composition seats, refer to figure 13. Insert the disk (key 29) in the valve plug guide (key 27). Place the tip (key 30) against the valve plug guide to clamp the disk in place. Insert the cap screw (key 32) through the tip and thread it into valve plug guide to secure the tip to the valve plug guide.

CAUTION

To avoid failure in service, never reuse an old stem with a new valve plug guide. Using an old stem with a new valve plug guide requires drilling a new pin hole in the stem, which will weaken the stem. However, a used valve plug guide may be reused with a new stem except for valves with 0.5 through 1-inch ports and composition seats (see to figure 13). For these constructions, a used valve plug guide should only be used if the tip is reused.

3. For all valves with composition seats, screw the valve stem (key 7) into the valve plug guide (key 27, figure 13). Tighten to the torque value given in figure 10. Refer to figure 10 to select the proper drill size. Drill through the stem, using the hole in the valve plug guide as a drilling guide. Remove any chips or burrs and drive in a new pin (key 8) to lock the assembly.

4. Install the seat ring gasket (key 13), and replace the seat ring (key 9).

Note

With some valve plug sizes and configurations, the valve plug or tip will slide through the seat ring retainer and bushing assembly (keys 3 and 26), and in other configurations it won't.

5. If the valve plug (key 2) or valve plug tip (key 30, figure 13) will not slide through the seat ring retainer and bushing assembly (keys 3 and 26), proceed as follows:
 - a. Place the seat ring retainer and bushing assembly (keys 3 and 26) over the stem of valve plug and stem assembly or over the stem of the valve plug guide and stem assembly.
 - b. Install the seat ring retainer and bushing assembly, which also includes the valve plug and stem assembly or valve plug guide and stem assembly, on the top of the seat ring, ensuring that the seat ring retainer slips onto the seat ring properly. Any rotation orientation of the seat ring retainer with respect to the valve body is acceptable.
 - c. Place the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10) on the shoulder of the seat ring retainer.
6. If the valve plug (key 2) or the valve plug tip (key 30, figure 13) will slide through the seat ring retainer and bushing assembly (keys 3 and 26), proceed as follows:
 - a. Install the seat ring retainer and bushing assembly on the top of the seat ring, ensuring that the seat ring retainer slips onto the seat ring properly. Any rotation orientation of the seat ring retainer with respect to the valve body is acceptable.
 - b. Place the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10) on the shoulder of the seat ring retainer.
 - c. Slide the valve plug and stem assembly or the valve plug guide and stem assembly into the seat ring retainer and bushing assembly (keys 3 and 26).
7. Mount the bonnet on the valve body and complete the assembly according to steps 10 through 15 of the Replacing Packing procedure, omitting steps 12 and 13 if new packing is not being installed, and being sure to observe the note prior to step 11.

Valves with Overtravel (EZ-OVT) Trim

Perform the following steps to assemble and install the trim

1. Install the seat ring gasket (key 13) and replace the seat ring (key 9).
2. Place the seat ring retainer and bushing assembly (key 3) over the stem of the valve plug and stem assembly (key 30, figure 13).
3. Install the seat ring retainer and bushing assembly, which also includes the valve plug and stem assembly, on top of the seat ring. Ensure that the seat ring retainer slips onto the seat ring properly. Any rotation orientation of the seat ring retainer with respect to the valve body is acceptable.
4. Place the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, 10) on the shoulder of the seat ring retainer.

5. Mount the bonnet on the valve body and complete the assembly according to steps 10 through 15 of the Replacing Packing procedure, omitting steps 12 and 13 if new packing is not being installed. Be sure to observe the note prior to step 11.

Note

When connecting the valve stem to the stem connecting block on the actuator, extra stem force is required on the valve plug to ensure proper seating of the plug to the seat ring. This is required to deform the soft seat disk ensuring a backup metal-to-metal mating surface between the valve plug guide post and the seat ring.

Valves with ENVIRO-SEAL Bellows Seal Bonnets

Perform the following steps to assemble and install the trim.

1. For valves with 0.25 and 0.375-inch ports and composition seats, refer to figure 13. Place the disk (key 29) on the valve plug tip (key 30). Place the disk retainer (key 28) over the disk, and then thread the disk retainer onto the valve plug guide (key 27).

CAUTION

To avoid failure in service of valves with 0.5 through 1-inch ports and composition seats, never reuse an old valve plug guide with a new valve plug tip. Using an old valve plug guide with a new plug tip requires drilling a new pin hole in the valve plug guide, which will weaken the guide. However, a used valve plug tip may be reused with a new valve plug guide.

For valves with 0.5 through 1-inch ports and composition seats, refer to figure 13. Insert the disk (key 29) in the valve plug guide (key 27). Screw the tip (key 30) onto the valve plug guide to clamp the disk in place. Using a 3/32-inch bit, drill through the valve plug guide using the hole in the tip as a drilling guide. Remove any chips or burrs and drive in a new pin (key 31).

CAUTION

To avoid failure in service of valves with 1.5 and 2-inch ports and composition seats, never reuse an old valve plug tip with a new valve plug guide. Using an old valve plug tip with a new valve plug guide requires drilling a new pin hole in the valve plug tip, which will weaken the tip. However, a used valve plug guide may be reused with a new valve plug tip.

For valves with 1.5 and 2-inch ports and composition seats, refer to figure 13. Insert the disk (key 29) in the valve plug guide (key 27). Screw the tip (key 30) into the valve plug guide to clamp the disk in place. Using a 3/32-inch bit, drill through the valve plug tip using the hole in the valve plug guide as a drilling guide. Remove any chips or burrs and drive in a new pin (key 31).

For valves with 3 and 4-inch ports and composition seats, refer to figure 13. Insert the disk (key 29) in the valve plug guide (key 27). Place the tip (key 30) against the valve plug guide to clamp the disk in place. Insert the cap screw (key 32) through the tip and thread it into valve plug guide to secure the tip to the valve plug guide.

CAUTION

To avoid weakening the adaptor that may cause failure in service, never reuse an old adaptor with a new valve plug or valve plug guide. Using an old adaptor with a new valve plug or valve plug guide requires drilling a new pin hole in the adaptor, which will weaken the adaptor. However, a used valve plug or valve plug guide may be reused with a new adaptor.

2. Thread the valve plug (key 2) or, the valve plug guide (key 27, figure 13) if the valve has composition seats, onto the adaptor (key 24, figure 11). Tighten to the torque value given in figure 10.

Note

Valve plugs may not be pre-drilled. Follow the procedure in the following step.

3. If the valve plug is not pre-drilled, drill a hole according to figure 10. Otherwise, select the proper drill size (figure 10) and drill through the adaptor using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin (key 8) to lock the assembly.

Note

With some valve plug sizes and configurations, the valve plug or tip will slide through the seat ring retainer and bushing assembly, and in other configurations it will not.

4. If the valve plug (key 2) or valve plug tip (key 30, figure 13) will not slide through the seat ring retainer and bushing assembly (keys 3 and 26), proceed as follows:
 - a. Slide the seat ring retainer and bushing assembly (keys 3 and 26) over the adaptor (key 24, figure 11) so that the bushing rests on the shoulder of the valve plug or valve plug guide.
 - b. Place the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10) on the shoulder of the seat ring retainer.
 - c. Place a wrench on the flat areas of the stem just below the threads for the actuator/stem connection to keep the stem from turning.
 - d. Screw the adaptor (key 24, figure 11), which also includes the valve plug or valve plug guide and seat ring retainer and bushing assembly and gaskets, onto the stem/bellows assembly (key 20, figure 11). Tighten the adaptor until it is snug. Then, turn the adaptor until the valve stem hole lines up with the next adaptor pin hole. Drive in a new pin (key 36) to lock the assembly.
 - e. Install the seat ring gasket (key 13), and replace the seat ring (key 9).
 - f. Install the seat ring retainer and bushing assembly, which also contains the valve plug/adaptor assembly or valve plug guide/adaptor assembly, on the top of the seat ring, ensuring that the seat ring retainer slips onto the seat ring properly. Any rotation orientation of the seat ring retainer with respect to the valve body is acceptable.
 - g. Place a new gasket (key 22, figure 11) over the stem and bellows assembly.
5. If the valve plug (key 2) or the valve plug tip (key 30, figure 13) will slide through the seat ring retainer and bushing assembly (keys 3 and 26), proceed as follows:
 - a. Place a wrench on the flat areas of the stem just below the threads for the actuator/stem connection to keep the stem from turning.
 - b. Screw the adaptor (key 24, figure 11), which also includes the valve plug or valve plug guide onto the stem/bellows assembly (key 20, figure 11). Tighten the adaptor until it is snug. Then, turn the adaptor until the valve stem hole lines up with the next adaptor pin hole. Drive in a new pin (key 36) to lock the assembly.
 - c. Install the seat ring gasket (key 13), and replace the seat ring (key 9).

- d. Install the seat ring retainer and bushing assembly on the top of the seat ring, ensuring that the seat ring retainer slips onto the seat ring properly. Any rotation orientation of the seat ring retainer with respect to the valve body is acceptable.
 - e. Place the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10) on the shoulder of the seat ring retainer.
 - f. Slide the valve plug/adaptor assembly or the valve plug guide/adaptor assembly and the connected stem and bellows assembly into the seat ring retainer and bushing assembly (keys 3 and 26).
 - g. Place a new gasket (key 22, figure 11) over the stem and bellows assembly.
6. Mount the bonnet on the valve body and complete the assembly according to steps 10 through 15 of the Replacing Packing procedure, omitting steps 12 and 13 if new packing is not being installed, and being sure to observe the note prior to step 11.

ENVIRO-SEAL Bellows Seal and Bonnet

Replacing a Plain or Extension Bonnet with an ENVIRO-SEAL Bellows Seal (Stem/Bellows Assembly) and Bonnet

Instructions are provided for replacing a plain or extension bonnet with an ENVIRO-SEAL bellows seal bonnet when the existing valve has a metal seat. If the valve has a composition seat, refer to figure 13 and to composition seat information in the Valves with ENVIRO-SEAL Bellows Seal Bonnet procedure of the Trim Maintenance section.

1. Remove the actuator and bonnet according to steps 1 through 6 of the Replacing Packing procedure of the Maintenance section.

Note

With some valve plug sizes and configurations, the valve plug will slide through the seat ring retainer and bushing assembly, and in other configurations it won't. If the valve plug will not slide through the seat ring retainer and bushing assembly, then the valve plug and stem assembly and the seat ring retainer and bushing assembly must be removed together.

2. Using care, remove the valve plug and stem assembly, and, if necessary, the seat ring retainer and bushing assembly from the valve body.
3. Remove and discard the existing bonnet gasket (key 10, figure 12). Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

Note

The ENVIRO-SEAL stem/bellows assembly for easy-e valves is available only with a threaded and drilled plug/adaptor connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed.

4. Inspect the existing valve plug. If the plug is in good condition, it can be reused with the new ENVIRO-SEAL stem/bellows assembly. To remove the existing valve plug from the stem, first, place the existing plug stem assembly in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 8, figure 12).
5. Place a wrench on the flat areas on the existing valve stem just below the threads for the actuator/stem connection. Then, unscrew the stem from the valve plug (key 2, figure 12).

CAUTION

When installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

Note

The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

Table 4. Recommended Torque for ENVIRO-SEAL Bellows Seal Packing Flange Nuts

VALVE SIZE, NPS	VALVE STEM DIAMETER THROUGH PACKING	MINIMUM TORQUE		MAXIMUM TORQUE	
		N•m	Lbf•in	N•m	Lbf•in
1/2 - 2	1/2	2	22	4	33
3 - 4	1	5	44	8	67

6. To attach the valve plug to the stem of the new ENVIRO-SEAL stem/bellows assembly, it is necessary to first attach the valve plug to the adaptor (key 24, figure 11). Locate the adaptor. Notice that a hole has not been drilled in the adaptor threads where the valve plug screws onto the adaptor.

Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor. Thread the adaptor into the valve plug and tighten to the torque value given in figure 10.

Note

Valve plugs may not be pre-drilled. Follow the procedure in the following step.

7. If the valve plug is not pre-drilled, drill a hole according to figure 10. Otherwise, select the proper size of drill bit (figure 10) and drill through the adaptor using the hole in the valve plug as a guide. Remove any metal chips or burrs and drive in a new pin (key 8, figure 12) to lock the valve plug/adaptor assembly together.

Note

For some valve plug configurations, you must place the valve plug/adaptor assembly inside the seat ring retainer and bushing assembly before attaching the adaptor to the stem extending from the bottom of the ENVIRO-SEAL stem/bellows assembly. If this task is necessary, then place the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10, figure 12) on the shoulder of the seat ring retainer. Check the existing seat ring retainer and bushing assembly for clearances. If necessary, use appropriate procedures to support the seat ring retainer while screwing the valve plug/adaptor assembly onto the valve stem extending from the ENVIRO-SEAL stem/bellows assembly.

8. Place a wrench on the flat areas of the valve stem just below the threads for the actuator/stem connection to keep the stem from turning.
9. Screw the adaptor (key 24, figure 11), which also includes the valve plug or valve plug guide and may include the seat ring retainer and bushing assembly and gaskets, onto the valve stem. Tighten the adaptor until it is

finger-tight. Then, tighten the adaptor with a wrench until the valve stem hole lines up with the next adaptor pin hole. Drive in a new pin (key 36, figure 11) to lock the assembly. Make certain the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10, figure 12) are located on the shoulder of the seat ring retainer.

10. Inspect the seat ring. Replace, if necessary.
11. Install the new stem/bellows assembly with valve plug/adaptor by placing it into the valve body.
12. Place a new gasket (key 22, figure 11) over the stem/bellows assembly. Place the new ENVIRO-SEAL bonnet over the stem/bellows assembly.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

13. Properly lubricate the bonnet stud bolts. Install and tighten the bonnet hex nuts to the proper torque.
14. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 14 or 15.
15. Install the packing flange. Properly lubricate the packing flange stud bolts and the faces of the packing flange nuts.

For **graphite packing**, tighten the packing flange nuts to the maximum recommended torque shown in table 4. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 4.

For **other packing types**, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 4. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.
16. Install travel indicator parts, stem locknuts, and mount the actuator on the valve body according to the procedure in the appropriate actuator instruction manual.

Replacing an Installed ENVIRO-SEAL Bellows Seal (Stem/Bellows Assembly)

Instructions are provided for replacing an ENVIRO-SEAL bellows seal (stem/bellows assembly) when the existing valve has a metal seat. If the valve has a composition seat, refer to figure 13 and to composition seat information in the Valves with ENVIRO-SEAL Bellows Seal Bonnet procedure of the Trim Maintenance section.

1. Remove the actuator and bonnet according to steps 1 through 5 of the Replacing Packing procedure of the Maintenance section.

Note

With some valve plug sizes and configurations, the valve plug will slide through the seat ring retainer and bushing assembly, and in other configurations it won't. If the valve plug will not slide through the seat ring retainer and bushing assembly, then the valve plug and stem assembly and the seat ring retainer and bushing assembly must be removed together.

- Using care, remove the valve plug and stem assembly, and, if necessary, the seat ring retainer and bushing assembly from the valve body. Remove and discard the existing bonnet gasket (key 10, figure 12) and gasket (key 22, figure 11). Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

CAUTION

The ENVIRO-SEAL stem/bellows assembly for easy-e valves is available only with a threaded and pinned adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed. If the existing valve plug is reused, and the adaptor is in good condition, it may be reused also. However, to avoid weakening the adaptor that may cause failure in service, never reuse an old adaptor with a new valve plug. Using an old adaptor with a new plug requires drilling a new pin hole in the adaptor, which will weaken the adaptor. However, a used valve plug may be reused with a new adaptor.

- Inspect the existing valve plug and adaptor. If they are in good condition, they can be reused with the new stem/bellows assembly, and they do not need to be separated.

CAUTION

When removing/installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

Note

The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

- If the existing valve plug and adaptor are not in good condition and must be replaced, first, place the existing stem/bellows assembly and valve plug and adaptor assembly in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out pin (key 8, figure 12). Drive out pin (key 36, figure 11).
- Use a wrench on the flat areas on the valve stem just below the threads for the actuator/stem connection in a soft-jaw chuck or vice to keep the stem from turning. Then, unscrew the valve plug from the adaptor and the adaptor from the stem/bellows assembly.
- To attach either the existing valve plug or a new one to the stem of the new ENVIRO-SEAL stem/bellows assembly, it is necessary to first attach the valve plug to the adaptor (key 24, figure 11), if the valve plug was removed from the adaptor. Locate the adaptor. Notice that a hole has not been drilled in the new adaptor threads where the valve plug screws onto the adaptor.

If installing either a new valve plug and/or a new adaptor, secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor. Thread the adaptor into the valve plug and tighten to the torque values given in figure 10.
- Complete the installation by following steps 7 through 16 of the Replacing a Plain or Extension Bonnet with an ENVIRO-SEAL Bellows Seal and Bonnet procedure provided in the previous section.

Purging the ENVIRO-SEAL Bellows Seal Bonnet

The ENVIRO-SEAL bellows seal bonnet has been designed so that it can be purged or leak tested. Refer to figure 11 for an illustration of an ENVIRO-SEAL bellows seal bonnet, and perform the following steps for purging or leak testing.

1. Remove the two diametrically opposed pipe plugs (key 16).
2. Connect a purging fluid to one of the pipe plug connections.
3. Install appropriate piping or tubing in the other pipe plug connection to pipe away the purging fluid or to make a connection to an analyzer for leak testing.
4. When purging or leak testing has been completed, remove the piping or tubing and reinstall the pipe plugs (key 16).

Parts Ordering

Each valve is assigned a serial number which can be found on the valve body. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and to the 11-character part number for each part required from the following parts list.

Note

If the valve contains Trim Cartridge (Trim Cartridges can be identified by a name plate on the bonnet flange, the use of a packing nut, and "Fisher" embossed below the yoke mounting), please refer to Fisher ET and EZ easy-e Valves with Trim Cartridge Instruction Manual ([D104358X012](#)) for parts ordering guidance.

Parts Kits

Gasket parts kits are in key 10 table.

Packing Kits (non-live-loaded)

REPAIR KIT MATERIAL	STEM DIAMETER, mm (INCH) YOKE BOSS DIAMETER, mm (INCH)		
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)
	Part Number		
PTFE (Contains keys 6, 8, 10, 11, and 12)	RPACKX00012	RPACKX00022	RPACKX00032
Double PTFE (Contains keys 6, 8, 11, and 12)	RPACKX00042 ⁽¹⁾⁽²⁾	RPACKX00052 ⁽¹⁾	RPACKX00062 ⁽¹⁾
PTFE/Composition (Contains keys 7, 8, 11, and 12)	RPACKX00072	RPACKX00082	RPACKX00092
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00102	RPACKX00112	RPACKX00122
Double Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00162	RPACKX00172	RPACKX00182
1. These parts kits contain one extra lower wiper (key 30). Discard this extra part upon assembly. 2. This parts kit contains one extra packing ring (key 7). Discard this extra part upon assembly.			

Packing Kits (ENVIRO-SEAL) Repair

REPAIR KIT MATERIAL	STEM DIAMETER, mm (INCH) YOKE BOSS DIAMETER, mm (INCH)		
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)
	Part Number		
Double PTFE (Contains keys 214, 215, and 218)	RPACKX00192	RPACKX00202	RPACKX00212
Graphite ULF (Contains keys 207, 208, 209, 210, and 214)	RPACKX00592	RPACKX00602	RPACKX00612
Duplex (Contains keys 207, 209, 214, and 215)	RPACKX00292	RPACKX00302	RPACKX00312

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

EZ Valve

August 2021

Instruction Manual

D100401X012

Packing Kits (ENVIRO-SEAL) Retrofit

REPAIR KIT MATERIAL	STEM DIAMETER, mm (INCH) YOKE BOSS DIAMETER, mm (INCH)		
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)
	Part Number		
Double PTFE (Contains keys 200, 201, 211, 212, 214, 215, 216, 217, and 218)	RPACKXRT012	RPACKXRT022	RPACKXRT032
Graphite ULF (Contains keys 200, 201, 207, 208, 209, 210, 211, 212, 214, and 217)	RPACKXRT262	RPACKXRT272	RPACKXRT282
Duplex (Contains keys 200, 201, 207, 209, 211, 212, 214, 215, 216, and 217)	RPACKXRT212	RPACKXRT222	RPACKXRT232

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D100401X012

EZ Valve

August 2021

easy-e Low-e Bonnet Repair Kits

Kit consists of plain bonnet, Graphite / Inconel gasket set, ENVIRO-SEAL packing retro-fit kit, packing flange, packing flange studs and nuts. New stem is not included.

Bonnet Material	Packing Type	Valve Size, NPS	Stem Size	Part Number
WCC ⁽¹⁾	ENVIRO-SEAL PTFE	0.5-1.25	3/8"	RLEPBNTX012
		1.5	3/8"	RLEPBNTX022
		2	1/2"	RLEPBNTX032
		2.5	1/2"	RLEPBNTX042
		3	1/2"	RLEPBNTX052
		4	1/2"	RLEPBNTX062
		6	3/4"	RLEPBNTX072
	ENVIRO-SEAL Graphite ULF	0.5-1.25	3/8"	RLEPBNTX152
		1.5	3/8"	RLEPBNTX162
		2	1/2"	RLEPBNTX172
		2.5	1/2"	RLEPBNTX182
		3	1/2"	RLEPBNTX192
		4	1/2"	RLEPBNTX202
		6	3/4"	RLEPBNTX212
SST ⁽¹⁾	ENVIRO-SEAL PTFE	0.5-1.25	3/8"	RLEPBNTX082
		1.5	3/8"	RLEPBNTX092
		2	1/2"	RLEPBNTX102
		2.5	1/2"	RLEPBNTX112
		3	1/2"	RLEPBNTX122
		4	1/2"	RLEPBNTX132
	ENVIRO-SEAL Graphite ULF	0.5-1.25	3/8"	RLEPBNTX222
		1.5	3/8"	RLEPBNTX232
		2	1/2"	RLEPBNTX242
		2.5	1/2"	RLEPBNTX252
		3	1/2"	RLEPBNTX262
		4	1/2"	RLEPBNTX272
WCC	ENVIRO-SEAL Duplex	0.5-1.25	3/8"	RLEPBNTX292
		1.5	3/8"	RLEPBNTX302
		2	1/2"	RLEPBNTX322
		2.5	1/2"	RLEPBNTX332
		3	1/2"	RLEPBNTX342
		4	1/2"	RLEPBNTX352
		6	3/4"	RLEPBNTX362
SST	ENVIRO-SEAL Duplex	0.5-1.25	3/8"	RLEPBNTX372
		1.5	3/8"	RLEPBNTX392
		2	1/2"	RLEPBNTX412
		2.5	1/2"	RLEPBNTX422
		3	1/2"	RLEPBNTX432
		4	3/4"	RLEPBNTX442

1. Compliant with NACE MR0175-2003 and prior, NACE MR0175 / ISO 15156 (all revisions), and NACE MR0103 (all revisions).

Parts List

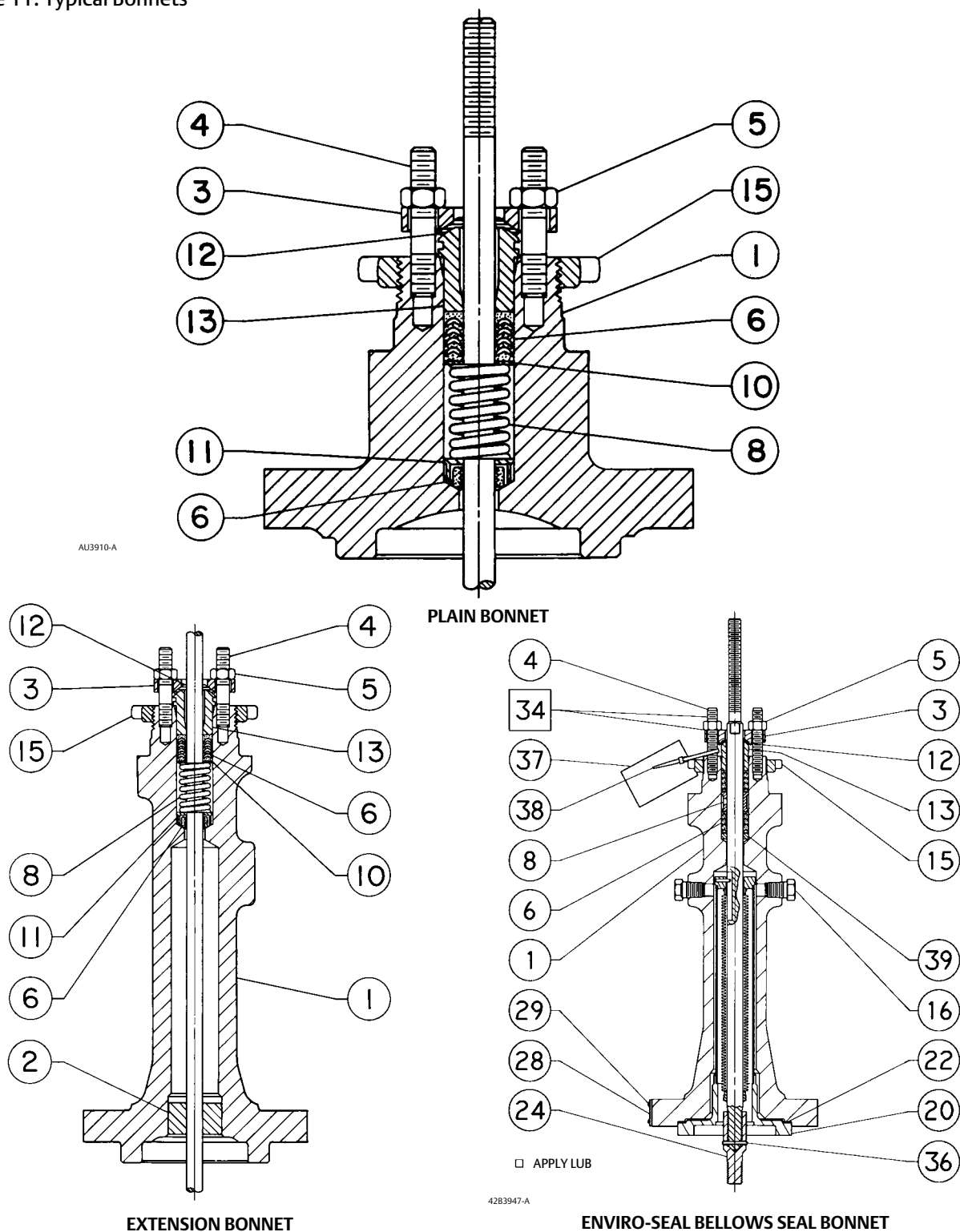
Bonnet

Note

Contact your [Emerson sales office](#) for part numbers.

Key	Description	Key	Description
1	Bonnet/ENVIRO-SEAL bellows seal bonnet If you need a bonnet or an ENVIRO-SEAL bellows seal bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.	14	Pipe Plug (not shown)
2	Baffle, (for extension bonnets only)	14	Lubricator
3	Packing Flange	14	Lubricator/Isolating Valve
3	ENVIRO-SEAL Bellows Seal Packing Flange	15	Yoke Locknut
4	Packing Flange Stud (2 req'd)	15	ENVIRO-SEAL Bellows Seal Yoke Locknut
4	ENVIRO-SEAL Bellows Seal Stud Bolt	16	Pipe Plug (not shown)
5	Packing Flange Nut (2 req'd)	16	ENVIRO-SEAL Bellows Seal Pipe Plug (2 req'd)
5	ENVIRO-SEAL Bellows Seal Hex Nut	20*	ENVIRO-SEAL Bellows Seal Stem/Bellows
6*	Packing Set, PTFE (2 req'd for double packing)	22*	ENVIRO-SEAL Bellows Seal Bonnet Gasket
6*	ENVIRO-SEAL Bellows Seal Packing Set	24	ENVIRO-SEAL Bellows Seal Adaptor
7*	Packing Ring, PTFE/comp (for double packing)	27	Pipe Nipple, for lub/isolating valve
7*	Packing Ring (2 req'd for single packing, 3 req'd for double packing)	28	ENVIRO-SEAL Bellows Seal Nameplate, Warning
7*	Packing Ring	29	ENVIRO-SEAL Bellows Seal Drive Screw (2 req'd)
7*	ENVIRO-SEAL Bellows Seal Packing Ring	34	Lubricant, anti-seize (not furnished with valve)
8	Spring (for single PTFE packing only)	36*	ENVIRO-SEAL Bellows Seal Pin
8	Spacer (for single PTFE packing only)	37	ENVIRO-SEAL Bellows Seal Warning Tag
8	Lantern Ring (for double PTFE packing)	38	ENVIRO-SEAL Bellows Seal Tie
8	ENVIRO-SEAL Bellows Seal Spring	39	ENVIRO-SEAL Bellows Seal Thrust Ring
8	ENVIRO-SEAL Bellows Seal Spacer	200	Stud (2 req'd)
10	Special Washer (for single PTFE packing)	201	Packing Flange
11*	Packing Box Ring	202	Spring, (2 req'd)
12*	Upper Wiper	203	Spring guide packing follower
12*	ENVIRO-SEAL Bellows Seal Upper Wiper	204	Screw, (4 req'd)
13	Packing Follower	205	Load Scale, (2 req'd)
13*	ENVIRO-SEAL Bellows Seal Bushing	206	Indicator Disk
13*	ENVIRO-SEAL Bellows Seal Bushing/Liner	207*	Guide Bushing, white (2 req'd)
		208*	Guide Bushing, no color
		209*	Packing Ring ⁽¹⁾ (3 req'd)
		210*	Packing Ring (2 req'd)
		211*	Packing Box Ring
		212	Hex Nut (2 req'd)
		213	Lubricant, anti-seize
		214*	Anti-Extrusion washer (4 req'd)
		214*	Packing Washer (5 req'd)
		215*	Packing Set (2 req'd)
		216	Lantern Ring
		217	Spring Pack Assembly
		218*	Lower wiper

Figure 11. Typical Bonnets



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

EZ Valve

August 2021

Instruction Manual

D100401X012

Key Description

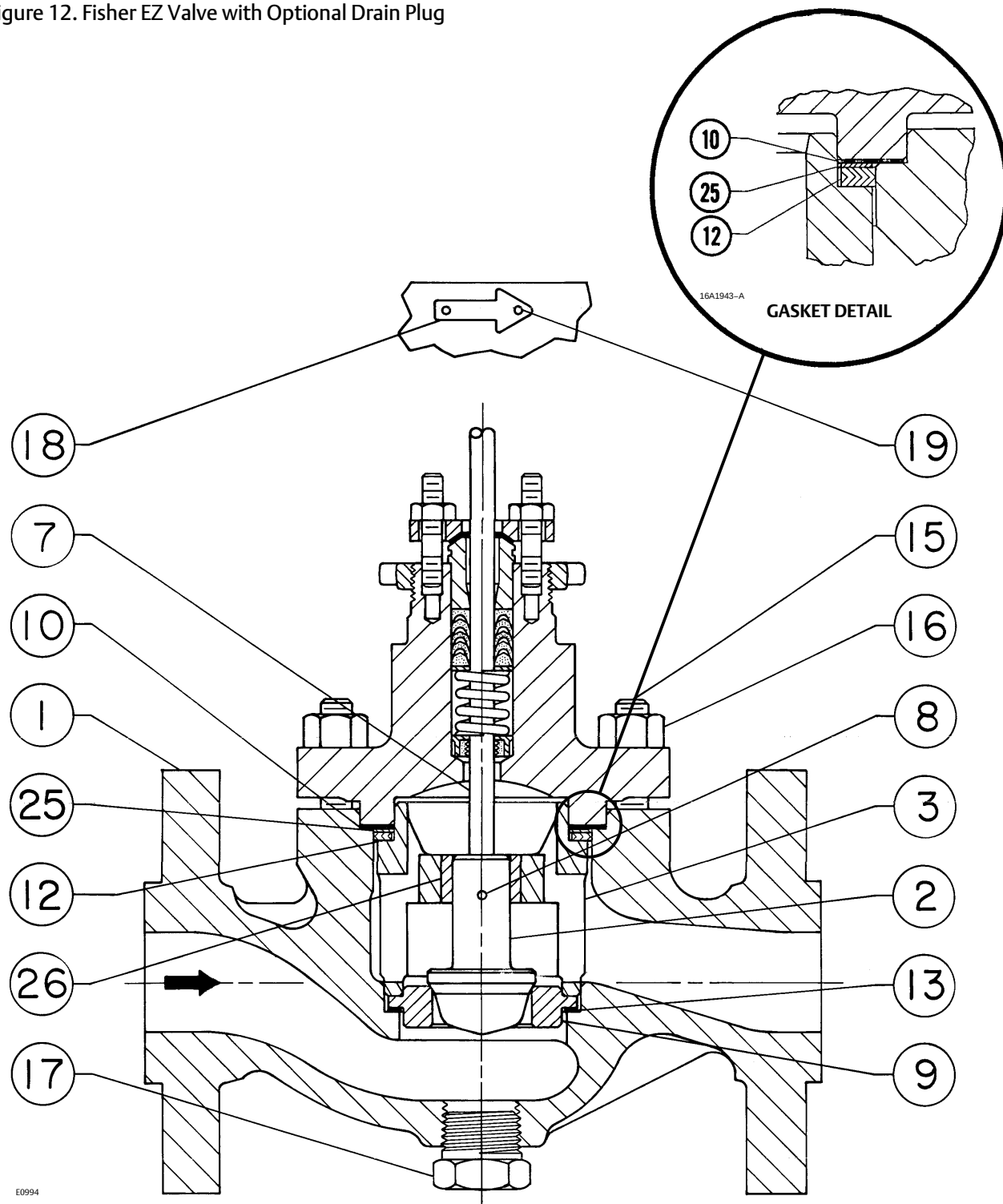
Valve Body

- | | |
|-----|---|
| 1 | Valve Body |
| | If you need a valve body as a replacement part, order by valve size, serial number, and desired material. |
| 2* | Valve Plug |
| 3* | Seat Ring Retainer |
| 7* | Stem |
| 8* | Pin |
| 9* | Seat Ring |
| 10* | Bonnet Gasket |
| 12* | Spiral Wound Gasket |
| 13* | Seat Ring Gasket |

Key Description

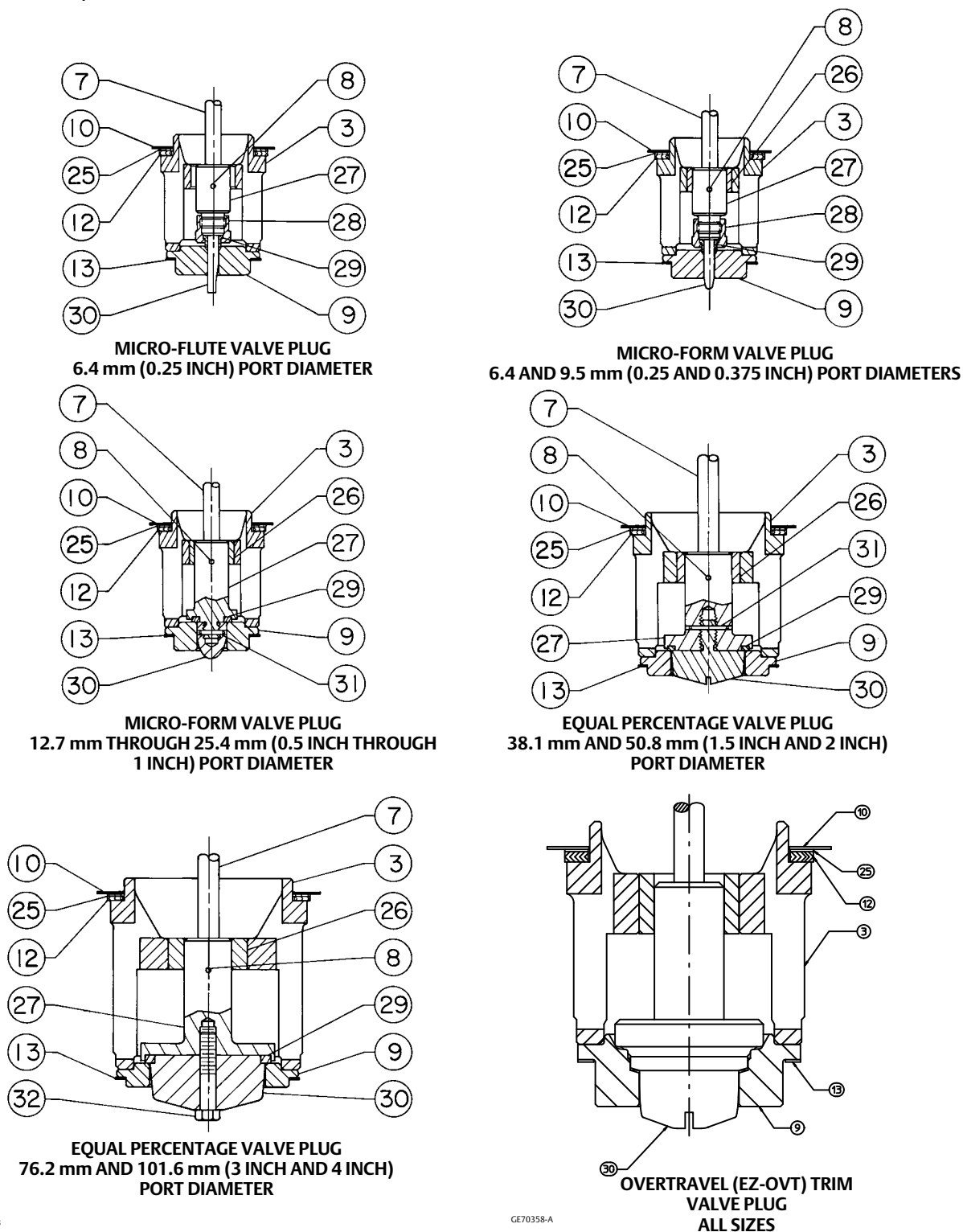
- | | |
|-----|--|
| 15 | Cap Screw or Stud Bolt |
| 16 | Nut |
| 17 | Pipe Plug, for use in valve bodies with drain tapping only |
| 18 | Flow Arrow |
| 19 | Drive Screw (4 req'd) |
| 25* | Shim |
| 26* | Bushing |
| 27* | Valve Plug Guide (for composition seats only) |
| 28* | Disk Retainer (composition seats only) |
| 29* | Disk (composition seats only) |
| 30* | Tip (composition seats only) |
| 31* | Pin (composition seats only) |
| 32 | Cap Screw (composition seat only) |
| 33 | Nameplate |
| 34 | Wire |

Figure 12. Fisher EZ Valve with Optional Drain Plug



E0994

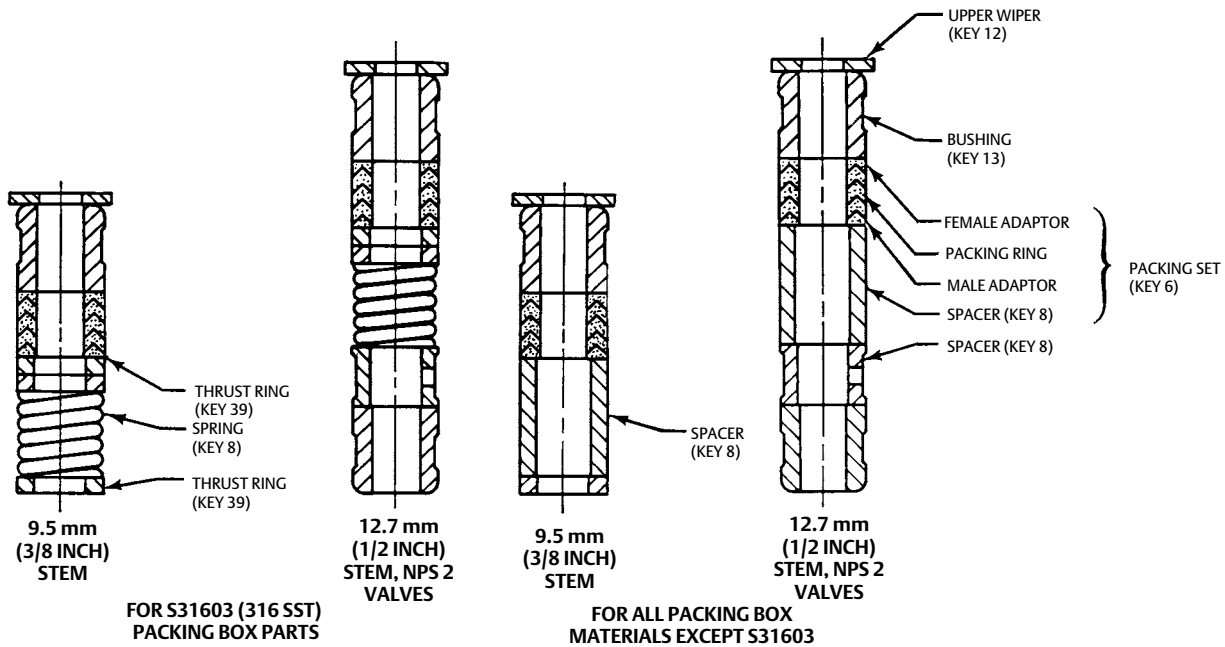
Figure 13. Composition Seats for Fisher EZ Valve



46A1842-B

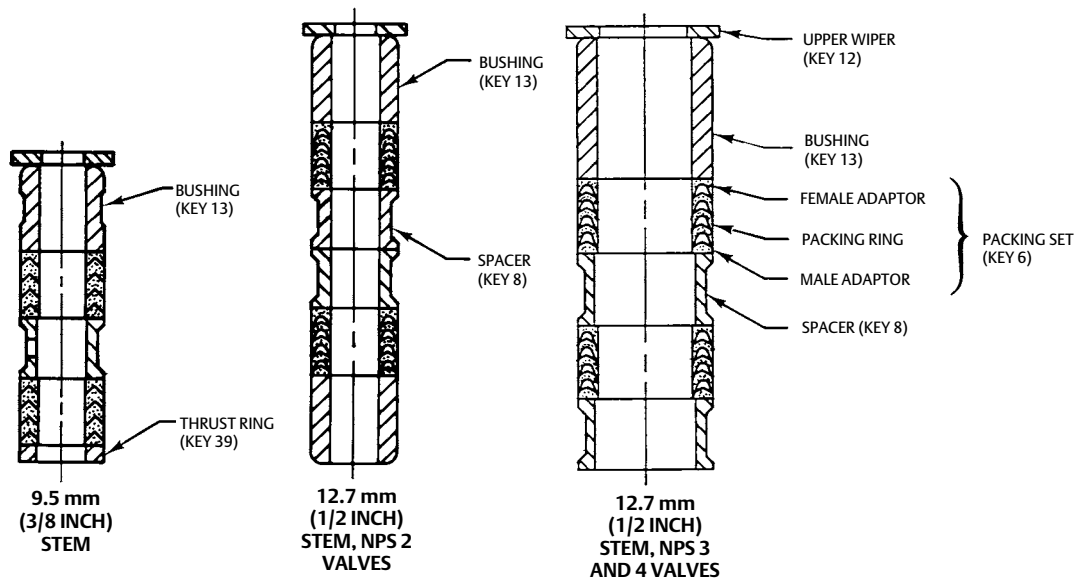
GE70358-A

Figure 14. PTFE Packing Arrangements for ENVIRO-SEAL Bellows Seal Bonnets



A5885

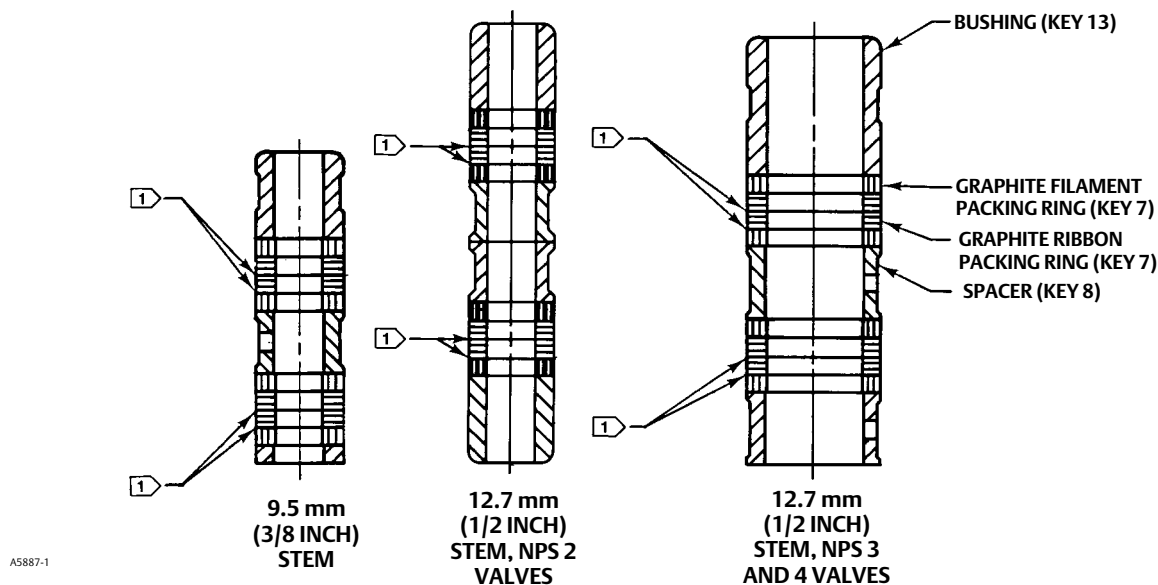
SINGLE ARRANGEMENTS



A5886-1

DOUBLE ARRANGEMENTS

Figure 15. Double Graphite Ribbon/Filament Arrangements for ENVIRO-SEAL Bellows Seal Bonnets



Note:

1 > 0.102 mm (0.004 inch) thick sacrificial zinc washers: Use only one below each graphite ribbon ring.

Group 1 Actuators

54, 71, & 90 mm (2-1/8, 2-13/16, & 3-9/16 Inch) Yoke Boss
472 & 473 585C & 585CR 1B 644 & 645 655 657 & 667--76 mm (3-inch) max travel 1008--except 90 mm (3-9/16 inch) yoke boss with 51 mm (2-inch) travel

Gasket Kit*

Valve Size, NPS	Gasket Kits 2 ⁽¹⁾⁽²⁾	Gasket Kits 3 ⁽¹⁾⁽²⁾
1/2 - 3/4 & 1	RGASKETX162	10A8170X042
2	RGASKETX182	10A8172X032
3	RGASKETX202	10A8174X032
4	RGASKETX212	---(3)

1. Gasket kits contain key 10, 12, 13, and 25.
 2. See table below for description of gasket sets.
 3. Consult your [Emerson sales office](#) for gasket set part number.

Gasket Selection Criteria

Gasket Set	Seat Ring Gasket	Bonnet Gasket	Spiral Wound Gasket	Shim	Temperature Capabilities
2 ⁽¹⁾	316 SST/graphite flat sheet	316 SST/graphite flat sheet	N06600 / graphite	S31600	-198 to 593°C (-325 to 1100°F)
3	PTFE-coated N04400	PTFE-coated N04400	N04400/PTFE	N04400	-73 to 149°C (-100 to 300°F)

1. FGM gasket set.

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EZ Valve

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www.Fisher.com



Fisher™ EZ-C, ET-C, and EWT-C Cryogenic Sliding-Stem Control Valves

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Figure 1. Typical Fisher Cryogenic Valve with Extension Bonnet and 585C Series Actuator



W6370

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for Fisher EZ-C, ET-C and EWT-C valves (see figure 1). Refer to separate manuals for instructions covering the actuator and accessories.



Do not install, operate, or maintain EZ-C, ET-C or EWT-C valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

EZ-C: globe-style, single-port, unbalanced valves with integral end connections, post guiding, metal-to-metal seating, and quick-change trim. They feature stainless steel construction materials and extension bonnets.

ET-C and EWT-C: metal-to-metal seated globe-style, single-port, cage-guided, pressure-balanced valves featuring stainless steel construction materials and extension bonnets.

Table 1. Specifications

Valve Sizes

EZ-C: NPS 1, 1-1/2, 2, 3, and 4
 ET-C: NPS 3, 4, 6, and 8
 EWT-C: NPS 6X4⁽¹⁾, 8X4, 8X6, 12X6, and 10X8

End Connection Styles⁽²⁾

CL150, 300, and 600 raised-face flanges per ASME B16.5

Maximum Inlet Pressure⁽²⁾

CL150 and 300—Valves are consistent with pressure-temperature ratings per ASME B16.34

CL600—Valves with B8M Class 2 bolting are consistent with CL600 pressure-temperature ratings per ASME B16.34 except as shown below:

EZ-C VALVES		
Valve Size, NPS	Maximum Inlet Pressure	
	Bar	Psig
1	77	1110
2	83	1200
3	94	1370

ET-C AND EWT-C VALVES		
Valve Size, NPS	Maximum Inlet Pressure	
	Bar	Psig
3	94	1370
6, 8 x 6, 12 x 6	75	1085
8, 10 x 8	96	1390

CL600—Valves with optional S20910 (XM-19) bolting are consistent with CL600 pressure-temperature ratings per ASME B16.34

Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4

VALVE	SHUTOFF CLASS
EZ-C	Class IV—Standard
	Class VI—Optional
ET-C and EWT-C	Class IV—Standard
	Class V Air Test ⁽³⁾ —Optional

Material Temperature Capability⁽²⁾

EZ-C: -198 to 149°C (-325 to 300°F)

ET-C and EWT-C:
 -198 to 66°C (-325 to 150°F)

Maximum Allowable Actuator Thrust

See table 2

Flow Characteristics

EZ-C: Equal percentage, linear, and quick opening
 ET-C and EWT-C: Equal percentage and linear

Flow Directions

EZ-C: Up through the seat ring only
 ET-C and EWT-C: Normally down⁽⁴⁾

Approximate Weights

EZ-C:

NPS 1: 11 kg (33 lb)

NPS 1-1/2: 23 kg (48 lb)

NPS 2: 41 kg (90 lb) / 43 kg (95 lb)⁽⁵⁾

NPS 3: 60 kg (130 lb)

NPS 4: 95 kg (210 lb)

ET-C:

NPS 3: 51 kg (135 lb)

NPS 4: 95 kg (210 lb)

NPS 6: 211 kg (465 lb) / 216 kg (476 lb)⁽⁵⁾

NPS 8: 372 kg (820 lb)

EWT-C

NPS 6X4: 200 kg (440 lb)

NPS 8X4: 277 kg (610 lb)

NPS 8X6: 318 kg (700 lb)

NPS 12X6: 730 kg (1610 lb) / 323 kg (711 lb)⁽⁵⁾

NPS 10X8: 753 kg (1660 lb) / 735 kg (1621 lb)⁽⁵⁾

1. Valve size number is end connection size by normal trim size. For example, an NPS 6X4 valve has NPS 6 end connections with NPS 4 trim.

2. Do not exceed the pressure/temperature limits in this manual and any applicable code limitation.

3. Class V Air Test is optional. Test will be 50 psid air. Class V shutoff cannot be performed with water. The residual trapped moisture from testing with water can cause valve and trim damage from ice crystals formed at below freezing service temperatures.

4. Down is in through the cage and out the seal ring. (see figure 9).

5. Weight with one-piece extension bonnet. The one-piece extension bonnet for this valve size is larger than the fabricated extension bonnet.

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EZ-C, ET-C, and EWT-C Valves

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Table 2. Maximum Allowable Actuator Thrust for Standard Style 3 Bonnet Extension Length

VALVE SIZE, NPS	STEM DIAMETER		MAXIMUM ALLOWABLE STEM LOAD FOR S20910 (XM-19) STEM MATERIAL	
	mm	Inches	N	Lb
1	9.5	3/8	5382	1210
	12.7	1/2	13166	2960
1-1/2	9.5	3/8	5338	1200
	12.7	1/2	13166	2960
2	12.7	1/2	14367	3230
	19.1	3/4	44169	9930
3	12.7	1/2	15301	3440
	19.1	3/4	45459	10220
4, 6X4, 8X4	12.7	1/2	16458	3700
	19.1	3/4	46971	10560
6, 8X6, 12X6	19.1	3/4	36385	8180
	25.4	1	81487	18320
8, 10X8	19.1	3/4	41366	9300
	25.4	1	87003	19560

Educational Services

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Installation

Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Remove actuator supply pressure, and use lockout procedures to be sure that the above measures stay in effect while you work on the equipment. Refer to the Warnings at the beginning of the Maintenance section for additional information.

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

The valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions indicated when the valve was ordered. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. To avoid possible personal injury and because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

NOTICE

Before installing the valve, inspect the valve and pipelines for any damage and any foreign material which may cause product damage.

1. Before installing the valve, inspect the valve and associated equipment for any damage and any foreign material.
2. Make certain the valve body interior is clean, that pipelines are free of foreign material, and that the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.
3. **Gas Service:** The normal method of mounting for gas service is with the actuator vertical above the valve body. However, the control valve assembly may be installed in any orientation unless limited by seismic criteria. Other positions may result in uneven valve plug and cage wear that could result in improper operation. For mounting assistance, consult your Emerson sales office.

NOTICE

To avoid possible damage to the packing, do not allow the installed actuator angle to be so flat as to allow liquid inside the bonnet to come in contact with the packing.

Also, if insulation is applied, do not let the insulation run up the extension bonnet. This could cause the packing to freeze and be damaged.

Liquid Service: The preferred method of mounting for liquid service is with the actuator vertical above the valve body. This will allow a vapor layer to form between the liquid and the packing. If there are piping constraints, the actuator can be angled slightly from vertical. However, in no case should the angle be so flat as to allow liquid inside the bonnet to come in contact with the packing. For mounting assistance, consult your Emerson sales office.

4. If insulation is applied, make sure it is applied only to the body/bonnet joint. Do not let the insulation run up the extension bonnet.
5. Use accepted piping and welding practices when installing the valve in the line. For flanged valve bodies, use a suitable gasket between the valve body and pipeline flanges.
6. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

Valves with ENVIRO-SEAL™ live-loaded packing will not require this initial readjustment. See the Fisher instruction manual titled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section near the end of this manual.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing maintenance and trim maintenance. All maintenance operations may be performed with the valve in the line.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

NOTICE

Follow instructions carefully to avoid damaging the product surfaces, which could result in damage to the product.

Note

Whenever a gasket seal is disturbed by removing or shifting parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal since the used gasket may not seal properly.

Figure 2. Single PTFE V-Ring Packing Arrangement

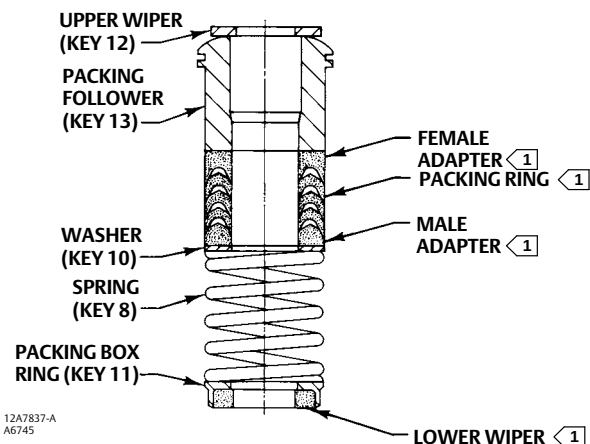
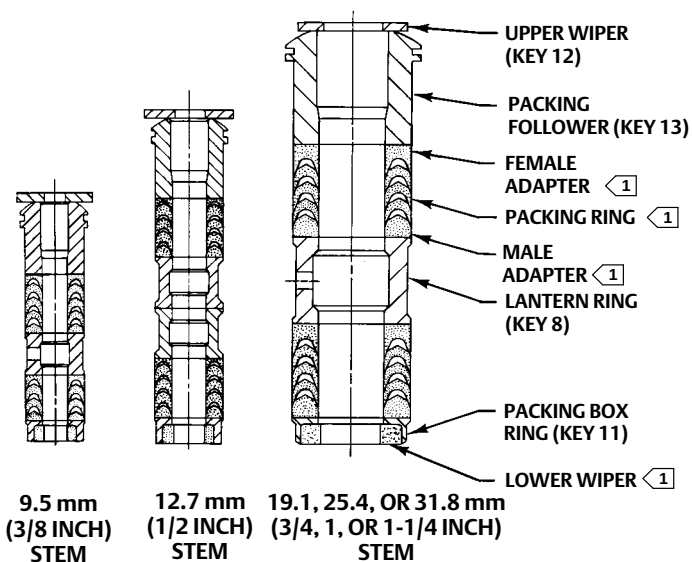


Figure 3. Double PTFE V-Ring Packing Arrangements

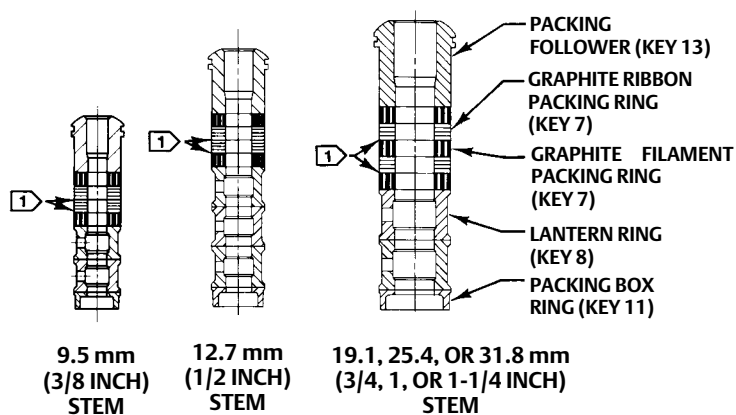


NOTE:

(1) PACKING SET (KEY 6) CONTAINS A FEMALE ADAPTER, V-RING PACKING RINGS, MALE ADAPTER, AND LOWER WIPER RINGS.

A6746

Figure 4. Graphite Ribbon/Filament Packing Arrangements



NOTE:

(1) 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS: USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

A6747

Packing Maintenance

This section covers PTFE V-ring, double PTFE, and graphite packing used in extension bonnets (figures 2, 3, and 4).

Note

If the valve has ENVIRO-SEAL live-loaded packing installed, refer to the instruction manual ENVIRO-SEAL Packing System for Sliding Stem Valves for packing instructions. Figure 6 shows typical ENVIRO-SEAL arrangements.

Standard packing key numbers are shown in figures 2, 3, and 4. ENVIRO-SEAL packing key numbers are shown in figure 6. Bonnet key number locations are shown in figure 7, and valve key numbers are shown in figures 8 and 9.

For spring-loaded single PTFE V-ring packing, the spring (key 8) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5), until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed with replacing packing procedures.

If there is undesirable packing leakage with other than spring-loaded packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

If the packing is relatively new and tight on the stem, and if tightening the packing flange nuts does not stop the leakage, it is possible that the valve stem is worn or nicked so that a seal cannot be made. The surface finish of a new valve stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

Replacing Packing

WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

Key numbers and sequence of assembly of packing parts are shown in figures 2, 3, and 4. Bonnet key number locations are shown in figure 7, and valve key number locations are shown in figures 8 and 9, unless otherwise noted.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment. Observe the **Warnings** at the start of the Maintenance section.
2. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet. Disconnect the stem connector and remove the actuator from the valve by unscrewing the yoke locknut (key 15) or hex nuts (key 26, not shown).
3. Loosen the packing flange nuts (key 5) so that the packing is not tight on the valve stem. Remove any travel indicator parts and stem locknuts from the valve stem threads.

WARNING

- To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next steps.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

EZ-C, ET-C, and EWT-C Valves

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Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet.

- To avoid personal injury or damage to the seating surface caused by the valve plug and stem assembly dropping from the bonnet after being lifted out of the valve body, observe the following instructions.

4. When lifting an EZ-C bonnet, temporarily install a valve stem locknut on the valve stem. This locknut will prevent the valve plug and stem assembly from dropping out of the bonnet.
5. When lifting an ET-C or EWT-C bonnet, be sure the plug and stem assembly and cage remain in the valve body.

⚠ WARNING

To avoid possible personal injury, review your process shutdown procedures to be sure process pressure is not applied to the valve for the following procedure.

6. Hex nuts (key 16) attach the bonnet to the valve body (key 1). Loosen these nuts or cap screws approximately 3 mm (1/8 inch). Then, loosen the body-to-bonnet joint by either rocking the bonnet or prying between the bonnet and valve body. Work with a prying tool around the bonnet until the bonnet loosens.

Table 3. Recommended Torque for Packing Flange Nuts

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE PACKING				PTFE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
			N•m	Lbf-in	N•m	Lbf-in	N•m	Lbf-in	N•m	Lbf-in
9.5	3/8	150	3	27	5	40	1	13	2	19
		300	4	36	6	53	2	17	3	26
		600	6	49	8	73	3	23	4	35
12.7	1/2	150	5	44	8	66	2	21	4	31
		300	7	59	10	88	3	28	5	42
		600	9	81	14	122	4	39	7	58
19.1	3/4	150	11	99	17	149	5	47	8	70
		300	15	133	23	199	7	64	11	95
		600	21	182	31	274	10	87	15	131
25.4	1	150	19	169	29	254	9	80	14	120
		300	26	226	38	339	12	108	18	162
		600	35	310	53	466	17	149	25	223
31.8	1-1/4	150	27	238	40	357	13	113	19	169
		300	36	318	54	477	17	152	26	228
		600	49	437	74	655	24	209	36	314

Table 4. Body-to-Bonnet Torque Guidelines

VALVE SIZE, NPS	BOLT TORQUES ⁽¹⁾	
	Bolt Material ⁽²⁾	
	B8M ⁽³⁾ or S20910 (XM-19) ⁽⁴⁾	
	N•m	Lbf-ft
1	122	90
1-1/2 or 2	91	67
3	163	120
4, 6X4, or 8X4	258	190
6, 8X6, or 12X6	522	385
8 or 10X8	712	525

1. Determined from laboratory testing.
2. For bolting materials not listed in table 4, contact your [Emerson sales office](#) for torque information.
3. SA193-B8M strain hardened.
4. Hot rolled.

- If fluid leaks from the joint, it may indicate that process pressure is applied to the valve. Review your process shutdown procedures, and be sure process pressure is not applied to the valve.
 - If no fluid leaks from the joint, remove the nuts completely and carefully lift the bonnet off the valve body.
7. For EZ-C valves, remove the stem locknut. Separate the valve plug and stem from the bonnet, and set the parts on a protective surface to prevent damage to gasket or seating surfaces.
 8. For ET-C and EWT-C: If it is necessary to remove and inspect the valve trim, refer to the following Trim Maintenance section.
 9. Remove the bonnet gasket (key 10) and cover the opening in the valve to protect the gasket surface and prevent foreign material from getting into the valve body cavity.
 10. Remove the packing flange nuts, packing flange, upper wiper, and packing follower (keys 5, 3, 12, and 13). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and metal packing parts.
 11. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs in the packing box surfaces could cause leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
 12. If necessary, go to the Trim Maintenance procedures to remove, inspect or replace trim parts. Return to this section when installing the bonnet on the valve body.

Installing the Bonnet

13. Remove the covering protecting the valve body cavity and install a new bonnet gasket (key 10), making sure the gasket seating surfaces are clean and smooth. Then slide the bonnet over the stem and onto the stud bolts (key 15).

Note

Proper performance of the bolting procedures in step 10 compresses the spiral wound gasket (key 12) or load ring (key 26) to both load and seal the seat ring gasket (key 13). It also compresses the outer edge of the bonnet gasket (key 10) to seal the body-to-bonnet joint.

The proper bolting procedures in step 14 include, but are not limited to, ensuring that bolting threads are clean and evenly tightening the cap screws or nuts onto the studs in a crisscross pattern. Tightening one cap screw or nut may loosen an adjacent cap screw or nut. Repeat the crisscross tightening pattern several times until each cap screw or nut is tight and the body-to-bonnet seal is made.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

14. Lubricate the bolting with anti-seize lubricant and install it, using accepted bolting procedures during tightening, so that the body-to-bonnet joint will withstand test pressures and application service conditions. Use the bolt torques in table 4 as guidelines.
15. Install new packing and the metal packing box parts according to the appropriate arrangement in figures 2, 3, or 4. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box.
16. Slide the packing follower, upper wiper, and packing flange (keys 12, 13, and 3) into position. Lubricate the packing flange studs (key 4) and faces of the packing flange nuts (key 5). Install the packing flange nuts.
17. Tightening packing flange nuts (key 5):
 - a. For **spring-loaded PTFE V-ring packing**, tighten the packing flange nuts until the shoulder on the packing follower (key 13) contacts the bonnet.
 - b. For **graphite packing**, tighten the packing flange nuts to the maximum recommended torque shown in table 3. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 3.
 - c. For **double PTFE V-ring packing**, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 3. Then, tighten the remaining nut until the packing flange is level and at a 90 degree angle to the valve stem.
 - d. For **ENVIRO-SEAL live-loaded packing**, refer to the Fisher instruction manual titled: ENVIRO-SEAL Packing System for Sliding-Stem Valves.
18. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

Trim Maintenance

WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

This procedure describes how the valve trim can be completely disassembled. When inspection or repairs are required, perform only those steps necessary to accomplish the task. Observe the **Warning** at the start of the Maintenance section.

Key number locations are shown in figures 8 and 9, unless otherwise noted.

EZ-C Trim Disassembly

Key number locations are shown in figure 8, unless otherwise noted.

1. Remove the actuator and the bonnet according to steps 1 through 9 of the Replacing Packing procedures in the Maintenance section.

WARNING

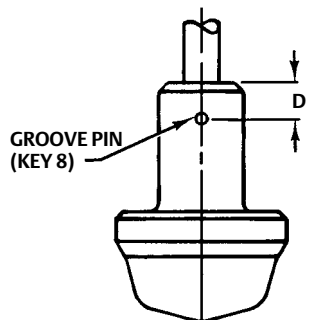
To avoid personal injury due to leaking fluids, avoid damaging gasket sealing surfaces.

The surface finish of the valve stem (key 7) is critical for making a good packing seal.

The seating surfaces of the valve plug (key 2) and seat ring (key 9) are critical for proper shutoff.

Protect these surfaces accordingly.

Figure 5. Fisher EZ-C Valve Stem Torque and Pin Replacement



35A5717-C

VALVE STEM		STEM TORQUE		DRILL SIZE, INCHES	D DIMENSION	
mm	Inch	N•m	Lbf-ft		mm	Inch
9.5	3/8	40-47	25-35	3/32	16	0.625
12.7	1/2	81-115	60-85	1/8	19	0.75
19.1	3/4	237-339	175-250	3/16	25	1

Perform the following steps to remove the valve trim.

Note

With some valve plug sizes and configurations, the seat ring retainer and bushing assembly (keys 3 and 26, figure 7, 8, and 9) will come out of the valve body with the valve plug and stem assembly, and in other valve plug sizes and configurations, the valve plug will slide through the seat ring retainer and bushing assembly, leaving the retainer and bushing assembly in the valve body.

2. With the valve plug and stem assembly out of the valve body, either slide the seat ring retainer, bushing assembly (keys 3 and 26), gaskets, and shim (keys 10, 12, and 25) up over the valve plug and stem or, lift the seat ring retainer and bushing assembly, associated gaskets, and shim out of the valve body. If the valve plug is to be reused, protect the valve plug seating surface to prevent damage.
3. To disassemble the stem, plug, and pin, drive or drill out the pin (key 8) and unscrew the valve stem (key 7) from the valve plug (key 2).
4. Remove the seat ring and seat ring gasket (keys 9 and 13).
5. Inspect parts for wear or damage that could prevent proper operation of the valve. Clean, inspect and obtain replacement parts as necessary for reassembly.

EZ-C Trim Assembly

This procedure assumes that all the trim and associated gaskets were removed from the valve body. If these parts were not all removed, start the assembly procedure at the appropriate step.

NOTICE

To avoid weakening the stem that may cause failure in service, never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem, which will weaken the stem. However, a used valve plug may be reused with a new stem.

Key number locations are shown in figure 8, unless otherwise noted.

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1. Screw the valve stem (key 7) into the valve plug (key 2). Tighten to the torque valve given in figure 5. Refer to figure 5 to select the proper drill size. Drill through the stem using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin (key 8) to lock the assembly.
2. Install the seat ring gasket (key 13) and seat ring (key 9).

Note

With some valve plug sizes and configurations, the valve plug will slide through the seat ring retainer and bushing assembly (keys 3 and 26), and in other configurations, it will not.

3. If the valve plug (key 2) will not slide through the seat ring retainer and bushing assembly (keys 3 and 26), proceed as follows:
 - a. Place the seat ring retainer and bushing assembly (keys 3 and 26) over the stem of the valve plug and stem assembly.
 - b. Install the seat ring retainer and bushing assembly, which also includes the valve plug and stem assembly, on top of the seat ring, ensuring that the seat ring retainer slips onto the seat ring properly. Any rotational orientation of the seat ring retainer with respect to the valve body is acceptable.

Table 5. Fisher ET-C and EWT-C Valve Stem Torque and Pin Replacement

VALVE STEM DIAMETER		TORQUE, MINIMUM TO MAXIMUM		DRILL SIZE, INCHES
mm	Inches	N•m	Lbf-ft	
9.5	3/8	40-47	25-35	3/32
12.7	1/2	81-115	60-85	1/8
19.1	3/4	238-339	175-250	3/16
25.4	1	421-482	310-355	1/4
31.8	1-1/4	827-908	610-670	1/4

- c. Place the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10) on the shoulder of the seat ring retainer.
4. If the valve plug (key 2) will slide through the seat ring retainer and bushing assembly (keys 3 and 26), proceed as follows:
 - a. Install the seat ring retainer and bushing assembly on top of the seat ring, ensuring that the seat ring retainer slips onto the seat ring properly. Any rotational orientation of the seat ring retainer with respect to the valve body is acceptable.
 - b. Place the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10) on the shoulder of the seat ring retainer.
 - c. Slide the valve plug and stem assembly or the valve plug guide and stem assembly into the seat ring retainer and bushing assembly (keys 3 and 26).
 5. Mount the bonnet on the valve body and complete assembly using the Replacing Packing procedures in the Maintenance section.
 6. If the valve has soft metal-to-metal seats, refer to the Coining Soft Metal-to-Metal Seats section.

ET-C and EWT-C Trim Disassembly

Key number locations are shown in figure 9, unless otherwise noted.

1. Remove the actuator and the bonnet according to steps 1 through 9 of the Replacing Packing procedure in the Maintenance section.

⚠ WARNING

To avoid personal injury due to leaking fluids, avoid damaging gasket sealing surfaces.

The surface finish of the valve stem (key 7) is critical for making a good packing seal.

The inside surface of the cage (key 3) is critical for tight shutoff and smooth operation of the valve plug.

The seating surfaces of the valve plug (key 2) and seat ring (key 9) are critical for proper shutoff.

Protect these surfaces accordingly.

Perform the following steps to remove the valve trim.

2. Remove the load ring (key 26) from an NPS 8 ET-C or NPS 10X8 EWT-C valve, and wrap it for protection.
3. Remove the plug and stem assembly from the valve body. The cage (key 3) might come out of the valve body with the plug, due to seal ring friction.
 - a. If so, carefully separate the cage from the plug and stem assembly.
 - b. If the cage was not removed from the valve body with the plug and stem assembly, remove it, the associated gaskets (keys 10 and 12), and shim (key 51).
4. Remove the seat ring (key 9) and seat ring gasket (key 13). Composition seat constructions use a disk (key 23) sandwiched between a disk seat (key 22) and disk retainer (key 21).
5. Clean, inspect, and if necessary obtain replacement parts.

ET-C and EWT-C Valve Plug Maintenance

NOTICE

To avoid the valve plug seal ring (key 28) not sealing properly and affecting valve performance, be careful not to scratch the surfaces of the ring groove on the valve plug or any of the surfaces of the replacement ring.

1. With the valve plug (key 2) removed, according to the disassembly portion of the Trim Maintenance procedure, proceed as follows:
2. The spring-loaded seal ring may be removed by first working the retaining ring (key 27) off with a screwdriver. Then carefully slide the metal backup ring (key 29) and seal ring (key 28) off the valve plug (key 2).
3. A spring-loaded seal ring must be installed so that its open side faces toward the valve stem, or toward the seat of the plug depending on flow direction, as shown in view A of figure 9. To install a spring-loaded seal ring, slide the seal ring (key 28) onto the valve plug followed by the metal backup ring (key 29).
4. Then install the retaining ring (key 27) by inserting one end in the groove and, while turning the plug, press the ring into the groove. Again, be careful not to scratch any surfaces of the ring or plug.

NOTICE

To avoid weakening the stem that may cause failure in service, never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem, which will weaken the stem. However, a used valve plug may be reused with a new stem.

5. To replace the valve stem (key 7), drive or drill out the pin (key 8). Unscrew the valve plug from the stem.
6. Screw the new stem into the valve plug. Tighten to the torque value given in table 5. Refer to table 5 to select the proper drill size. Drill through the stem using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin to lock the assembly.

ET-C and EWT-C Trim Assembly

Key number locations are shown in figure 9, unless otherwise noted.

1. Install the seat ring gasket (key 13), and seat ring (key 9) or disk seat (key 22). With composition seat constructions, install the disk (key 23) and disk retainer (key 21).
2. Install the cage (key 3). Any rotational orientation of the cage with respect to the valve body is acceptable.
3. Lower the valve plug (key 2) and stem assembly into the cage. Make sure the seal ring (key 28) is evenly engaged in the entrance chamfer at the top of the cage (key 3) to avoid damaging the ring.
4. Place the gaskets (keys 12 and 10) and the shim (key 51) on top of the cage.
5. With an NPS 8 ET-C or NPS 10X8 EWT-C valve, install the load ring (key 26).
6. Mount the bonnet on the valve body and complete assembly using the Replacing Packing procedures in the Maintenance section. Torque guidelines for body-to-bonnet bolting are shown in table 4.
7. If the valve has soft metal-to-metal seats, refer to the Coining Soft Metal-to-Metal Seats section, below.

Coining Soft Metal-to-Metal Seats

Soft metal-to-metal seat constructions consist of a valve plug with hardfaced CoCr-A seat and a non-hardfaced S31600 seat ring. For optimum shutoff performance of these constructions, coin seats by stroking the valve plug into the seat ring at least three times with maximum actuator force.

NOTICE

To avoid possible product damage which may affect performance, do not lap soft metal-to-metal seats.

Parts Ordering

Each body-bonnet assembly is assigned a serial number which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly.

Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and to the eleven-character part number for each part required from the following parts kit or parts list information.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

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Parts Kits

Gasket Kits

Includes keys 10, 12, 13, and 25 for EZ-C valves. Includes keys 10, 12, 13, and 51 for ET-C and EWT-C valves.

VALVE SIZE, NPS	KIT PART NUMBER
1	RGASKETX162
1-1/2	RGASKETX172
2	RGASKETX182
3	RGASKETX202
4, 6X4, 8X4	RGASKETX212
6	RGASKETX222
8X6, 12X6	RGASKETX392
8, 10X8	RGASKETX232

Packing Kits

Packing kits for standard packing includes keys 6, 8, 10, 11, and 12. Packing kits do not apply to N10276, N08020, or N04400 trims.

Standard Packing Repair Kits (Non Live-Loaded)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)
PTFE (Contains keys 6, 8, 10, 11, and 12)	RPACKX00012	RPACKX00022	RPACKX00032	RPACKX00342
Double PTFE (Contains keys 6, 8, 11, and 12)	RPACKX00042	RPACKX00052	RPACKX00062	RPACKX00362
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00102	RPACKX00112	RPACKX00122	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], and 11)	---	---	---	RPACKX00532
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring])	RPACKX00132	RPACKX00142	RPACKX00152	---
Double Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00162	RPACKX00172	RPACKX00182	---

ENVIRO-SEAL Packing Retrofit Kits

Retrofit kits include parts to convert valves with existing standard bonnets to the ENVIRO-SEAL packing box construction. Refer to figure 6 for key numbers for PTFE and Graphite ULF packing.

Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of this packing kit.

ENVIRO-SEAL Packing Retrofit Kits

PACKING MATERIAL	STEM DIAMETER AND YOKE BOSS DIAMETER, mm (INCH)			
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)
Double PTFE	RPACKXRT012	RPACKXRT022	RPACKXRT032	RPACKXRT042
Graphite ULF	RPACKXRT262	RPACKXRT272	RPACKXRT282	RPACKXRT292
Duplex	RPACKXRT212	RPACKXRT222	RPACKXRT232	RPACKXRT242

ENVIRO-SEAL Packing Repair Kits

Repair kits include parts to replace the “soft” packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits. Refer to figure 6 for key numbers for PTFE and Graphite ULF packing.

Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of this packing kit.

ENVIRO-SEAL Packing Repair Kits

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)
Double PTFE (Contains keys 214, 215, & 218)	RPACKX00192	RPACKX00202	RPACKX00212	RPACKX00222
Graphite ULF (Contains keys 207, 208, 209, 210, and 214)	RPACKX00592	RPACKX00602	RPACKX00612	RPACKX00622
Duplex (Contains keys 207, 209, 214, and 215)	RPACKX00292	RPACKX00302	RPACKX00312	RPACKX00322

Figure 6. ENVIRO-SEAL Packing System

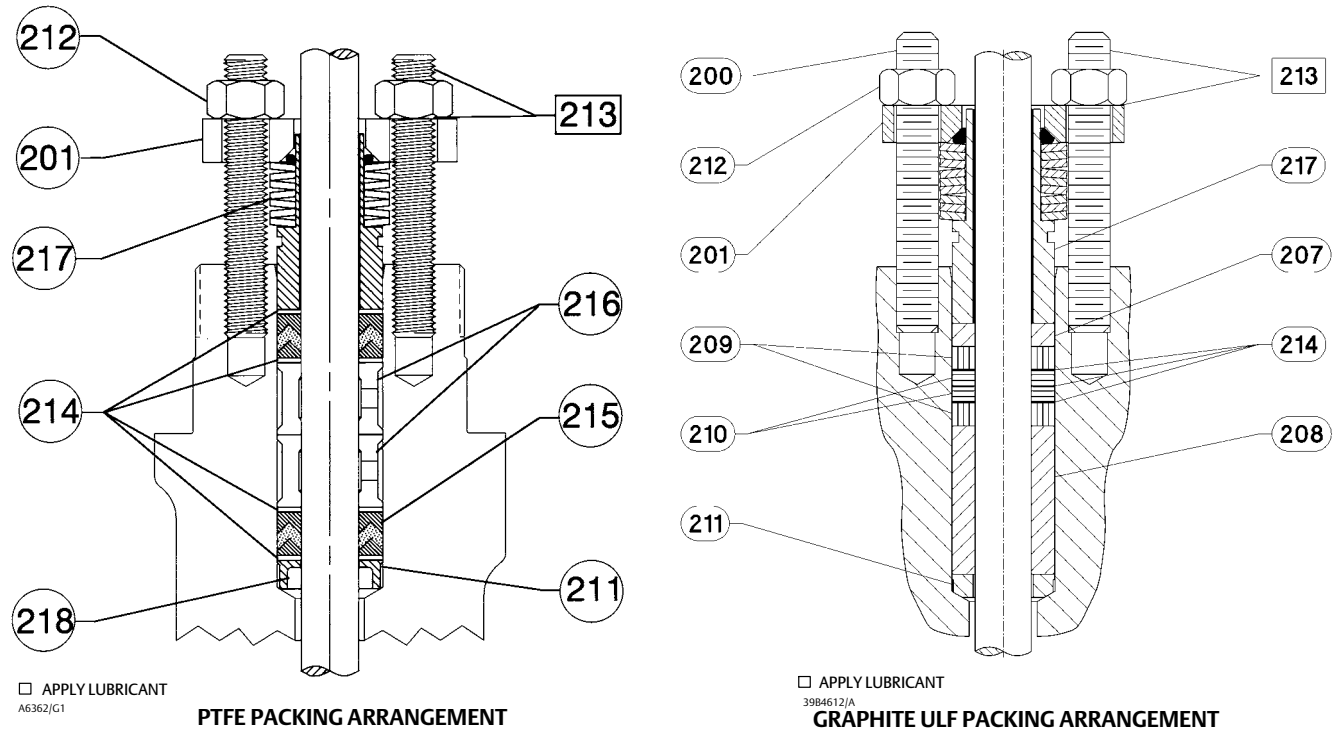
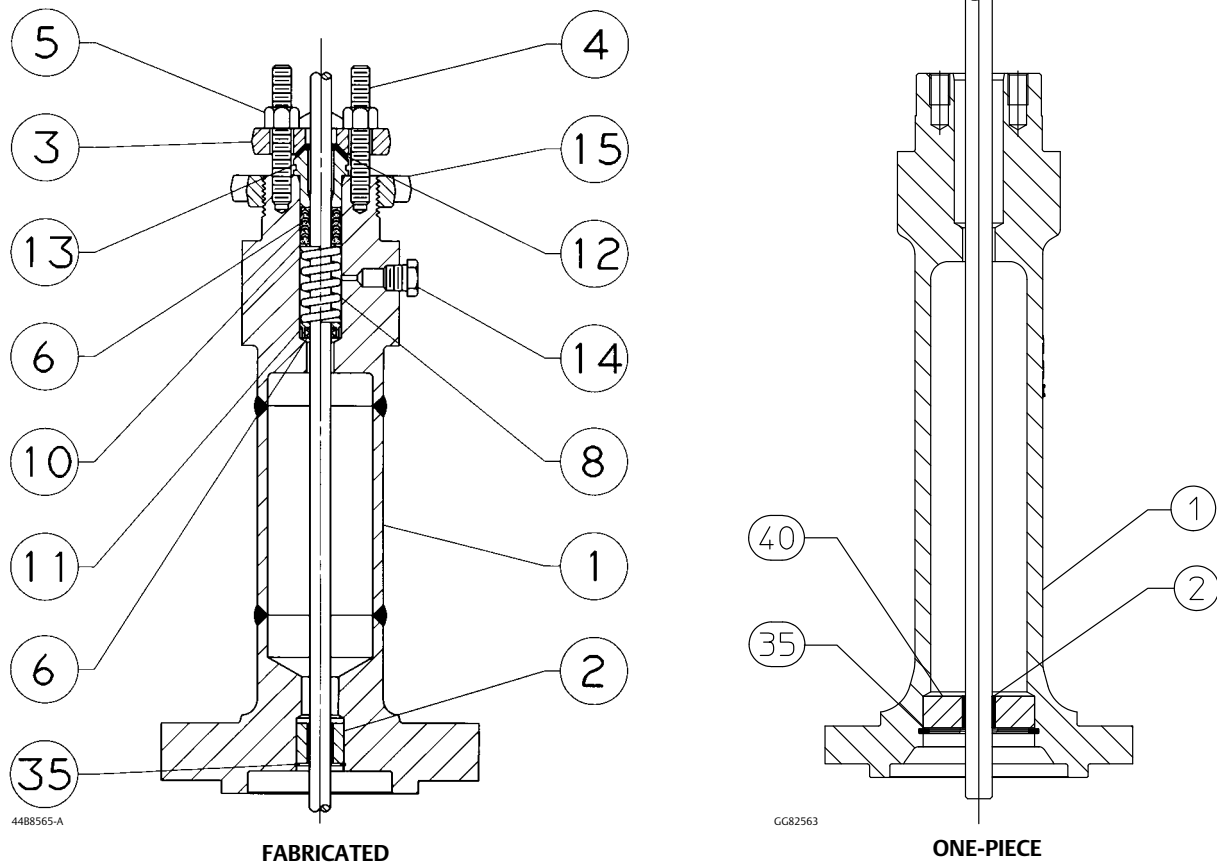


Figure 7. Extension Bonnet Assembly



NOTE:

- 1 KEY 6 CONTAINS SEVERAL PARTS; REFER TO FIGURES 2, 3, AND 4 FOR PACKING ARRANGEMENTS.
- 2 KEY 2 CONTAINS INFORMATION FOR BOTH THE FABRICATED AND ONE-PIECE EXTENSION BONNETS.

Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your [Emerson sales office](#).

Bonnet Parts (figure 7)

Key	Description
1	Bonnet If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.
2	Bushing
3	Packing Flange
4	Packing Flange Stud
5	Packing Flange Nut
6*	Single V-Ring Packing Set
7*	Individual Packing Ring
8	Packing Box Ring or Lantern Ring
10	Special Washer
11	Packing Box Ring
12*	Upper Wiper
13	Packing Follower
14	Pipe Plug
15	Yoke Locknut
25	Cap Screw
26	Hex Nut
35	Retaining Ring
40	Spacer for one-piece bonnet (NPS 3, 4, 6, and 8)

EZ-C Valve Body Parts (figure 8)

Key	Description
1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number, and desired material.
2*	Valve Plug
3*	Seat Ring Retainer
7*	Stem
8*	Pin
9*	Seat Ring
10*	Bonnet Gasket
12*	Gasket
13*	Seat Ring Gasket
15	Stud Bolt
16	Hex Nut
18	Flow Arrow
19	Drive Screw
25*	Shim
26*	Bushing,
33	Nameplate
---	Warning Plate
34	Wire
55	Lubricant, anti-seize (not included with valve)

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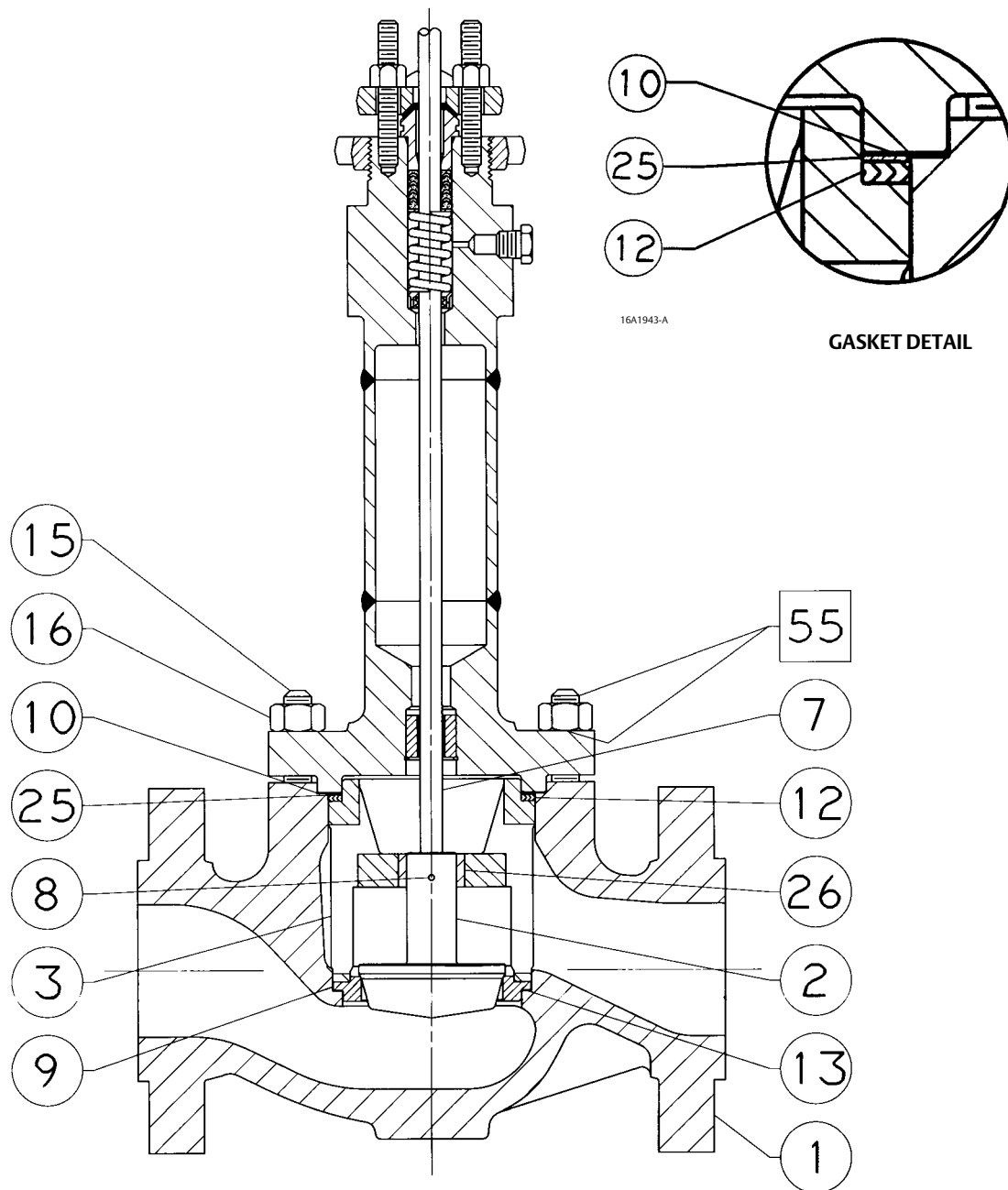
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Figure 8. Fisher EZ-C Valve Assembly



□ APPLY LUBRICANT

NOTE:

EZ-C KEY NUMBERS NOT SHOWN ARE: 18, 19, 33, AND 34.

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ET-C and EWT-C Valve Body Parts (figure 9)

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your [Emerson sales office](#).

Key	Description
1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number, and desired material.
2*	Valve Plug
3*	Cage
7*	Stem
8*	Pin
9*	Seat Ring
10*	Bonnet Gasket

Key	Description
1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number, and desired material.
2*	Valve Plug
3*	Cage
7*	Stem
8*	Pin
9*	Seat Ring
10*	Bonnet Gasket

Key	Description
12*	Spiral Gasket
13*	Seat Ring Gasket
15	Stud Bolt
16	Hex Nut
18	Flow Arrow
19	Drive Screw
21*	Disk Retainer, w/Composition Seat
22*	Disk Seat, w/Composition Seat
23*	Disk
26	Load Ring
27	Retaining Ring
28*	Seal Ring
29	Back-Up Ring
51*	Shim
53	Nameplate
55	Lubricant, anti-seize (not included with valve)

Key	Description
12*	Spiral Gasket
13*	Seat Ring Gasket
15	Stud Bolt
16	Hex Nut
18	Flow Arrow
19	Drive Screw
21*	Disk Retainer, w/Composition Seat
22*	Disk Seat, w/Composition Seat
23*	Disk
26	Load Ring
27	Retaining Ring
28*	Seal Ring
29	Back-Up Ring
51*	Shim
53	Nameplate
55	Lubricant, anti-seize (not included with valve)

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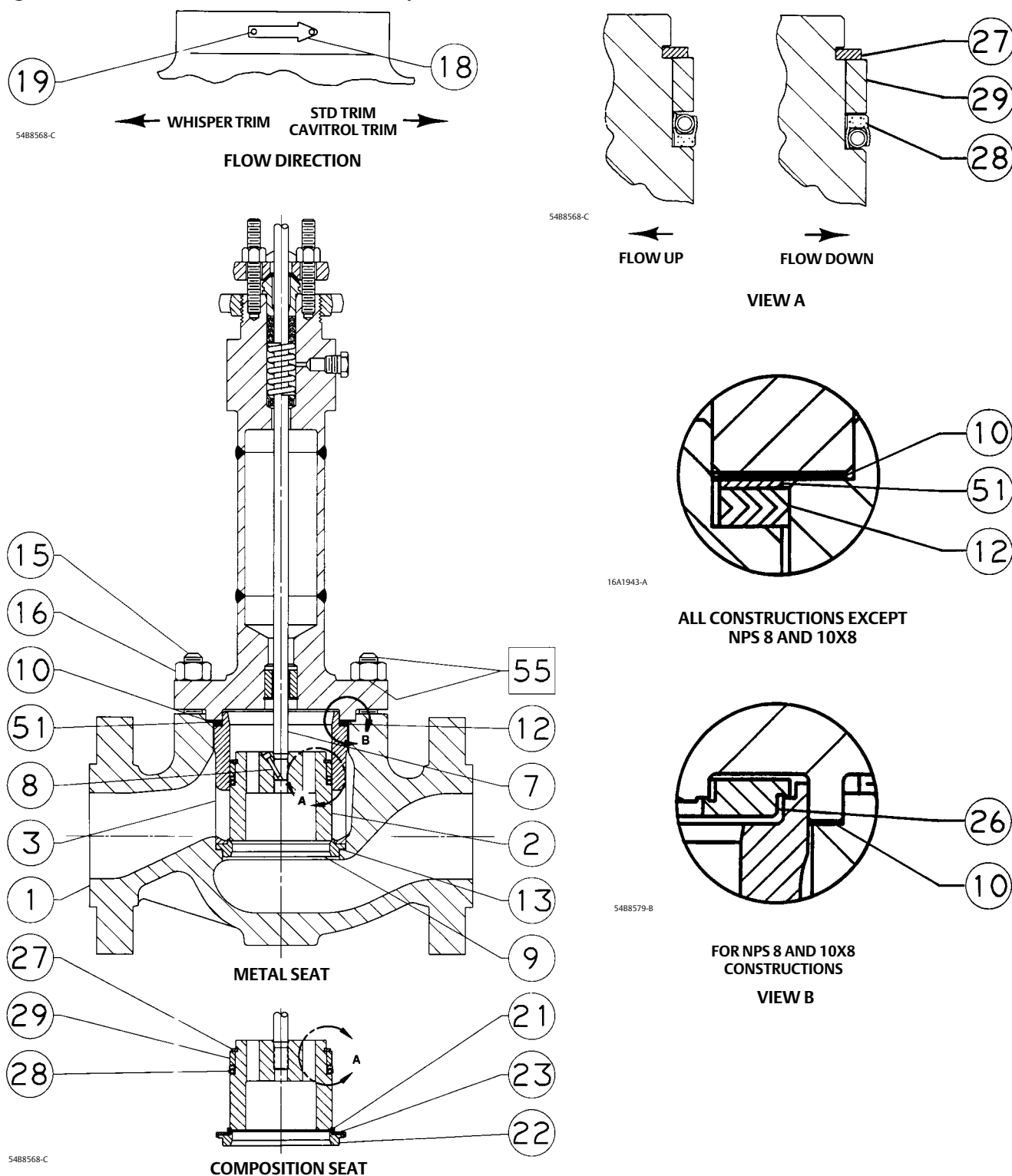
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Figure 9. Fisher ET-C and EWT-C Valve Assembly



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Fisher™ FB Control Valve

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Figure 1. Fisher FBT Valve with ODV High Performance Actuation Package



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Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for Fisher FB valves. For information on availability of complete assemblies and spare parts, contact your local [Emerson sales office](#). Refer to separate manuals for instructions covering the actuator and accessories.



Do not install, operate, or maintain an FB valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson sales office before proceeding.

Description

FB valves, which include FBD and FBT (figure 1), are fabricated or cast angle valves that are custom built for special applications. The basic construction, however, is similar in all the valves. For applications up to 232°C (450°F) or up to 316°C (600°F) with the use of anti-extrusion rings, the seat ring is screwed to the free end of the cage assembly of the FBT valve.

Table 1. Specifications

Valve Sizes See table 2 End Connection Styles⁽¹⁾ <i>Flanged:</i> CL150, 300, and 600 raised-face or ring-type joint flanges per ASME B16.5 <i>Buttwelding:</i> All available ASME B16.25 schedules that are consistent with ASME B16.34 Maximum Inlet Pressure⁽¹⁾ <i>Flanged:</i> Consistent with CL150, 300, and 600 pressure-temperature ratings per ASME B16.34 <i>Buttwelding:</i> Consistent with CL600 pressure-temperature ratings per ASME B16.34	Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4 FBD: ■ Standard--Class II, ■ Optional--Class IV(with multiple piston rings), and ■ Optional Class V with Bore seal trim FBT: ■ Standard--Class IV ■ Optional--Class V Flow Characteristic Linear Flow Direction Flow direction is typically up through the valve body port and out through the cage Approximate Weights See tables 3, 4, 5, and 6
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1. The pressure or temperature limits in this manual and any applicable standard limitations should not be exceeded.

The top of the cage assembly is clamped between the valve flange and bonnet, permitting unrestricted movement during thermal expansion and contraction (see figures 9 and 16). A spring-loaded seal ring provides a seal around the outside of the seat ring. The top of the cage assembly is also clamped between the valve flange and the bonnet for applications above 232°C (450°F), leaving the cage assembly free to expand and contract. For these high temperature applications, however, the seat ring is separate from the cage assembly and is welded into the FBD valve (see figure 10). No seat ring seal ring is required. The cage assembly is free to expand and contract.

These valves are available in CL150, 300, or 600 with flanged or butt weld ends. Special constructions with a CL900 rating, or with the inlet designed for a valve class rating greater than the outlet, are available on an individual basis. If the valve has an inlet pressure rating greater than the outlet pressure rating, it is especially important to have adequate overpressure protection downstream to protect against the possibility of full inlet pressure reaching the downstream system.

Specifications

Typical specifications for these valves are shown in table 1.

Educational Services

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Installation

⚠ WARNING

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given in this manual or on the appropriate nameplates. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Table 2. Valve Sizes

FABRICATED FB VALVE SIZE INLET X OUTLET, NPS	Whisper Trim™ III Levels A, B, C		Whisper Trim III Level D		WhisperFlo™ Trim	
	Port Diameter		Port Diameter		Port Diameter	
	mm	Inches	mm	Inches	mm	Inches
8 x 12 10 x 12	171	6.75	132	5.18	178	7
10 x 16 12 x 16 16 x 16	197	7.75	171	6.75	178	7
12 x 18 16 x 18	252	9.93	197	7.75	178	7
10 x 20 12 x 20 16 x 20 20 x 20	275	10.81	224	8.81	279	11
12 x 24 16 x 24 18 x 24 20 x 24 24 x 24	352	13.87	275	10.81	375	14.75
16 x 30 20 x 30 24 x 30 30 x 30	430	16.93	378	14.87	464	18.25
20 x 36 24 x 36 30 x 36 36 x 36	506	19.93	430	16.93	464	18.25
CAST FBT VALVE SIZE INLET X OUTLET, NPS						
8 x 12	171	6.75	132	5.18	---	---
10 x 16	197	7.75	171	6.75	---	---
12 x 16	197	7.75	171	6.75	---	---
12 x 18	252	9.93	197	7.75	---	---
12 x 20	275	10.81	224	8.81	---	---
16 x 24	352	13.87	275	10.81	---	---
20 x 30	430	16.93	378	14.87	---	---
24 x 36	506	19.93	430	16.93	---	---
30 x 36	506	19.93	430	16.93	---	---
36 x 42	660	26.0	559	22.0	---	---
42 x 48	813	32.0	660	26.0	---	---

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⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Because some body/trim material combinations are limited in their pressure drop and temperature range capabilities, do not apply any other conditions to the valve without first contacting your Emerson sales office.

1. Before installing the valve, inspect the valve and associated equipment for any damage and any foreign material. A strainer should be installed upstream of the valve to prevent particles from plugging the holes in the cage.
2. It is important to remember to install all FB valves in a flow up direction.
3. The control valve assembly should be installed with the actuator vertical above the valve. This orientation facilitates sliding the cage assembly into the valve without the use of special tools and rigging. In addition, vertical installation minimizes the possibility of damaging the seat ring seal ring or the mating chamfers, minimizes the possibility of bending the stem, and greatly reduces wear on the cage. Vertical installation, therefore, significantly extends valve life.

Table 3. Fisher Fabricated FB Approximate Weights

FABRICATED VALVE SIZE (NPS) INLET X OUTLET	VALVE AND BONNET ASSEMBLY					
	Pressure Rating ⁽¹⁾					
	CL150		CL300		CL600	
	Approximate Weight		Approximate Weight		Approximate Weight	
	kg	lb	kg	lb	kg	lb
8 X 12	416	925	509	1130	509	1130
10 X 12	421	935	526	1170	545	1210
10 X 16	612	1360	801	1780	1125	2500
12 X 16	619	1375	810	1800	1148	2550
16 X 16	666	1480	761	1690	1260	2800
12 X 18	810	1800	1071	2380	1496	3325
16 X 18	833	1850	1112	2470	1609	3575
10 X 20	1060	2355	1418	3150	1980	4400
12 X 20	1013	2250	1373	3050	1901	4225
16 X 20	1037	2305	1395	3100	2009	4465
20 X 20	1062	2360	1418	3150	2104	4675
12 X 24	1575	3500	2070	4600	2894	6430
16 X 24	1564	3475	2106	4680	3011	6690
18 X 24	1575	3500	2115	4700	3060	6800
20 X 24	1589	3530	2129	4730	3105	6900
24 X 24	1620	3600	2160	4800	3231	7180
16 X 30	2610	5800	3330	7400	---	---
20 X 30	2651	5890	3357	7460	---	---
24 X 30	2684	5965	3420	7600	---	---
30 X 30	2745	6100	3555	7900	---	---
20 X 36	3848	8500	4928	10,950	---	---
24 X 36	3897	8660	4995	11,100	---	---
30 X 36	4019	8860	5130	11,400	---	---
36 X 36	4100	9110	5400	12,000	---	---

1. Pressure rating for all sizes through NPS 24 outlet. The NPS 30 and 36 outlets conform to ASME B16.47. Dimensions and weights and or butt welding-end valves are available on request.

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Table 4. Fisher Cast FBT CL150 Flanged Body Information⁽¹⁾

VALVE SIZE, NPS	Free-Standing						Integral Flange					
	Approximate Weight		G Dimension		A Dimension		Approximate Weight		A Dimension		G Dimension	
	kg	lb	mm	in	mm	in	kg	lb	mm	in	mm	in
8 x 12	628	1385	406	16	386	15.2	644	1420	381	15	386	15.2
16 x 24	2531	5580	620	24.4	597	23.5	2377	5240	476	18.74	597	23.50
20 x 30 ⁽²⁾	4260	9392	997	39.25	717	28.22	4133	9111	761	29.97	717	28.22
24 x 36 ⁽²⁾	4947	10907	959	37.75	794	31.25	4823	10632	749	29.50	794	31.25
36 x 42 ⁽²⁾	10974	24193	932	36.7	1011	39.82	10106	22279	747	29.40	1011	39.82
42 x 48 ⁽³⁾	---	---	---	---	---	---	9993	22031	851.41	33.52	755.65	29.75

1. For FBD face-to-face dimensions, please contact your [Emerson sales office](#) for additional information.
2. Option for ASME B16.47 series A or series B flange(s).
3. Option for ASME B16.47 series B flange(s).

Table 5. Fisher Cast FBT CL300 Flanged Body Information⁽¹⁾

VALVE SIZE, NPS	Free-Standing						Integral Flange					
	Approximate Weight		G Dimension		A Dimension		Approximate Weight		A Dimension		G Dimension	
	kg	lb	mm	in	mm	in	kg	lb	mm	in	mm	in
8 x 12	628	1385	406	16	386	15.2	644	1420	381	15	386	15.2
10 x 16	816	1800	521	20.5	432	17	830	1830	457	18	432	17
12 x 16	839	1850	533	21	432	17	853	1880	514	20.25	432	17
12 x 18	1217	2682	559	22	483	19	1221	2691	521	20.5	483	19
12 x 20	1313	2895	610	24	508	20	1324	2920	508	20	508	20
16 x 24	2672	5890	620	24.4	597	23.5	2458	5420	476	18.74	597	23.5
20 x 30 ⁽²⁾	4512	9947	997	39.25	717	28.22	4322	9528	761	29.97	717	28.22
24 x 36 ⁽²⁾	5322	11732	917	36.12	803	31.62	4897	10797	756	29.75	803	31.62
30 x 36 ⁽²⁾	5671	12502	943	37.12	803	31.62	5633	12419	857	33.75	803	31.62
36 x 42 ⁽²⁾	11014	24281	932	36.7	1011	39.82	10081	22224	747	29.4	1011	39.82
42 x 48 ⁽²⁾	14158	31213	1041	41	1067	42	12551	27671	768	30.25	1067	42

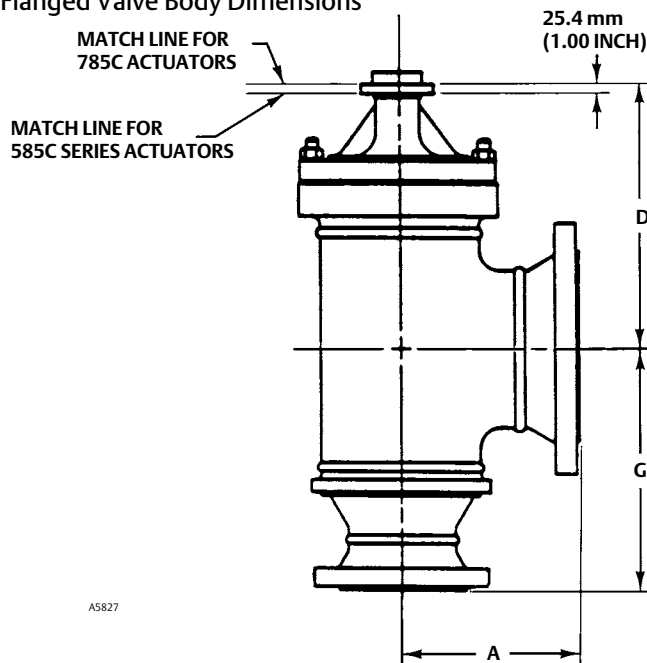
1. For FBD face-to-face dimensions, please contact your [Emerson sales office](#) for additional information.
2. Option for ASME B16.47 series A or series B flange(s).

Table 6. Fisher Cast FBT CL600 Flanged Body Information⁽¹⁾

VALVE SIZE, NPS	Free-Standing						Integral Flange					
	Approximate Weight		G Dimension		A Dimension		Approximate Weight		A Dimension		G Dimension	
	kg	lb	mm	in	mm	in	kg	lb	mm	in	mm	in
8 x 12	923	2035	457	18	432	17	953	2100	445	17.5	432	17
10 x 16	1016	2240	565	22.25	457	18	1066	2350	513	20.19	457	18
12 x 16	1039	2290	591	23.25	457	18	1129	2490	559	22	457	18
12 x 18	1491	3288	584	23	508	20	1504	3315	521	20.5	508	20
12 x 20	1581	3485	610	24	533	21	1592	3510	508	20	508	20
16 x 24	2889	6370	787	31	641	25.25	2898	6390	660	26	641	25.25
20 x 30 ⁽²⁾	5512	12152	997	39.25	762	30	5193	11448	761	29.97	762	30
24 x 36 ⁽²⁾	6644	14647	965	38	883	34.75	6145	13547	756	29.75	883	34.75

1. For FBD face-to-face dimensions, please contact your [Emerson sales office](#) for additional information.
2. Option for ASME B16.47 series A or series B flange(s).

Figure 2. Fisher Cast FBT Flanged Valve Body Dimensions



4. Use accepted piping and welding practices when installing the valve in the line. You can leave internal elastomeric parts in the valve when you weld it. For flanged valves, use suitable gaskets between the valve flanges and pipeline flanges.

Note

Depending on valve body materials used, post-weld heat treating might be needed. Post-weld heat treatment can damage internal elastomeric, plastic, and metal parts. Shrunk-fit pieces and threaded connections might loosen. In general, if post-weld heat treating is needed, remove all trim parts. Contact your [Emerson sales office](#) for additional information.

5. If continuous operation is required during maintenance, install a three-valve bypass around the valve.
6. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however some readjustment will be required to meet specific service conditions.

Lifting Valve Assembly

⚠ WARNING

Failure to follow these lifting guidelines and accepted lifting and rigging practices could result in property damage and personal injury or death.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Only personnel trained in proper lifting and rigging practices shall perform valve/actuator assembly lifting, rigging and installation. Because each lift will be unique, the method of lifting the valve assembly, the correct location for attaching and lifting the valve assembly, and what the valve assembly will do when lifted shall be considered for each lift.

Lifting and rigging equipment used to lift, install or remove a valve assembly or component must be properly selected and sized for the weight and configuration of the valve assembly or component being lifted. The weight of the complete valve assembly, including attached accessories, must be taken in consideration for this purpose. The lifting and rigging equipment must be properly maintained and inspected for damage before each use.

If the valve is supplied with an actuator or handwheel, do not use the actuator or handwheel to lift the complete valve assembly. Lifting lugs attached to the actuator must not be used to lift the complete valve assembly unless clearly marked as being rated to support the complete valve assembly weight.

Lifting lugs or other lifting equipment attached to the valve or actuator must never be used to lift or support the weight of attached piping.

NOTICE

Care must be taken when lifting the valve/actuator assembly to ensure all accessories and tubing are not damaged in the process. Accessories and tubing may need to be removed prior to lifting to prevent damage and properly reinstalled before use. Protect valve flange faces, butt weld ends, and other connection surfaces from damage during lifting.

Remove the valve/actuator assembly from its shipping container with appropriate lifting and rigging equipment for the valve/actuator assembly weight and configuration to be lifted. The valve and bonnet assembly weight is provided in tables 3, 4, 5, and 6. Consult the appropriate actuator and valve accessory instruction manuals for the weight of each additional component, then determine the total weight of the complete valve assembly. The location of the valve/actuator assemblies center of gravity must be considered during lifting, installation, and removal. Additional slings or other lifting equipment, such as a load leveler, may be necessary to prevent toppling of the equipment during lifting or to rotate the valve assembly into a different orientation for installation.

For cast FB valve constructions that include lifting lugs cast integral to the body, use of properly sized shackles in each lifting lug eye is required. The correct shackle pin diameter is provided in table 7. If the valve body includes attached lifting lugs, use all the lugs provided to lift the complete valve assembly. If lifting lugs are not provided on the valve body, lift the valve assembly with lifting straps secured around the valve body flanges, valve body neck, and/or bonnet neck area.

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Table 7. Fisher Cast FB Lifting Lug Dimensions

VALVE SIZE, NPS	CLASS	LIFTING EYE ID	SHACKLE PIN DIAMETER
		inch	inch
8x12	CL150	0.8	0.75
	CL300		
	CL600	1.06	1
10x16	CL300	0.93	0.88
	CL600	1.06	1
12x16	CL300	0.93	0.88
	CL600	1.06	1
12x18	CL300	0.93	0.88
	CL600	1.06	1
12x20	CL300	1.06	1
	CL600		
16x24	CL150	1.32	1.13
	CL300		
	CL600		
20x30	CL150	2.1	2.0
	CL300		
	CL600		
24x36	CL150	1.73	1.63
	CL300		
	CL600		
30x36	CL300	1.73	1.63
36x42	CL150	2.12	2.0
	CL300	2.12	2.0
42x48	CL150	2.13	2.0
	CL300	2.4	2.25

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, temporary packing maintenance, packing replacement, trim maintenance, and lapping metal seats. All maintenance operations may be performed with the valve in the line.

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal since the used gasket may not seal properly.

Note

If the valve has ENVIRO-SEAL™ live-loaded packing installed, see the Fisher instruction manual entitled ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#), for packing instructions.

If the valve has HIGH-SEAL Heavy-Duty live-loaded packing installed, see the Fisher instruction manual entitled HIGH-SEAL ULF Live-Loaded Packing System, [D101453X012](#), for packing instructions.

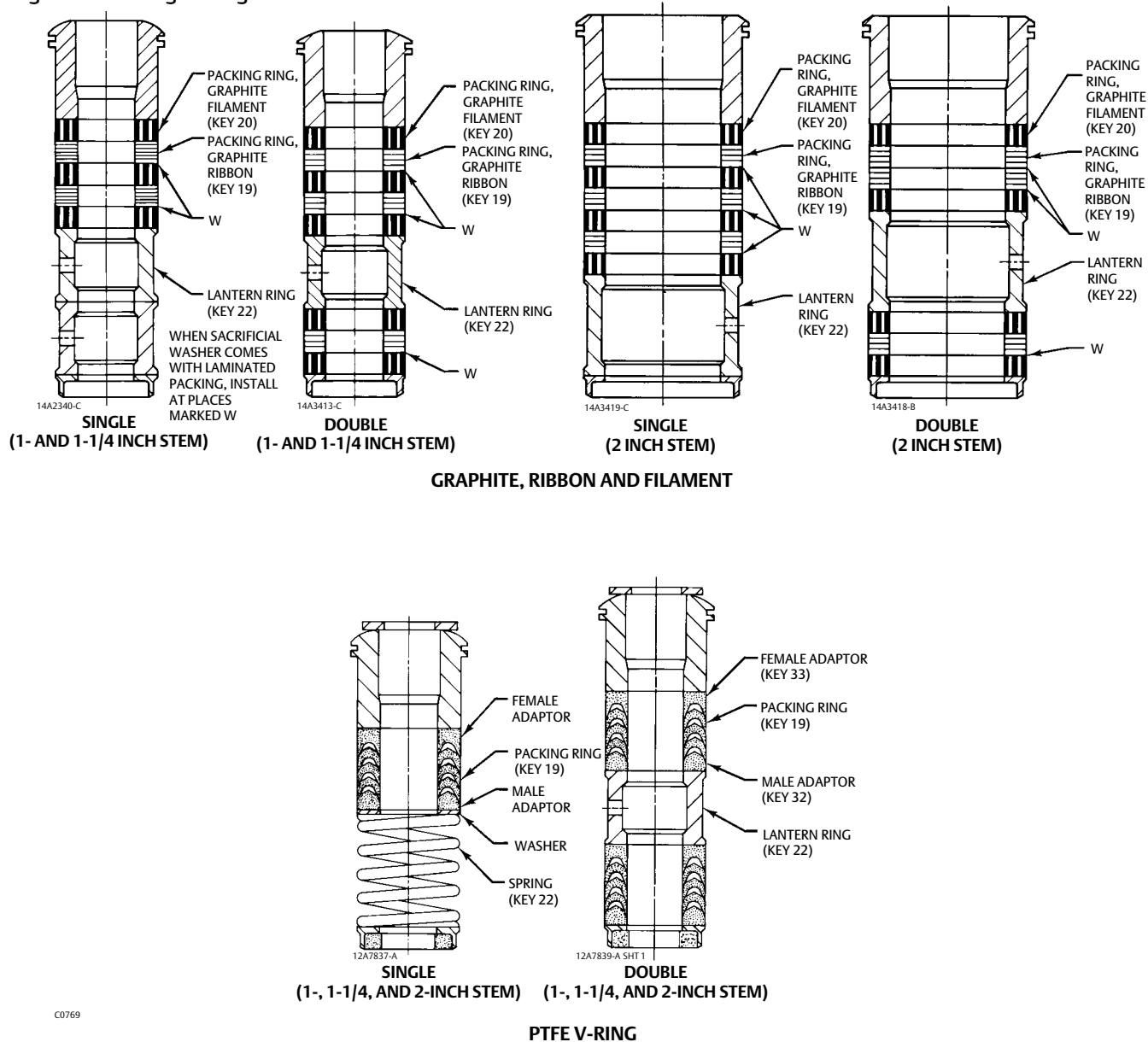
Packing Lubrication

If a lubricator or lubricator/isolating valve (figure 4) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the pipe plug (key 28, figures 11 and 13). Use a good quality silicon-base lubricant. Packing used in oxygen service or in processes with temperatures over 260°C (500°F) should not be lubricated. To operate the lubricator, simply turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except the isolating valve must first be opened and then closed after lubrication is completed.

Temporary Packing Maintenance

With most jam-type packing, new packing rings can be added on top of the old packing rings as a temporary measure until a more complete disassembly and packing replacement can be made.

Figure 3. Packing Arrangements



To do this with split ring packing, isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Pressurize the actuator to open the valve. Unbolt the packing flange (key 15, figures 11 and 13) and slide the packing flange wiper (key 21, figures 11 and 13) and packing follower (key 25, figures 11 and 13) up the valve stem to add packing rings. To improve the seal, the old packing rings on top of the lantern ring (key 22, figure 3) may be removed with a packing hook whenever possible. If this is done, use care to avoid scratching the valve stem or packing box wall. Clean all metal parts to remove any particles which would prevent the packing from sealing evenly against the valve stem or packing box wall.

Table 8. Recommended Torque for Packing Flange Nuts

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE TYPE PACKING				PTFE TYPE PACKING (NON SPRING-LOADED)			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
mm	Inches		N•m	Lbf•ft	N•m	Lbf•ft	N•m	Lbf•ft	N•m	Lbf•ft
25.4	1	CL150/300	24	18	37	27	12	9	16	12
		CL600	34	25	50	37	16	12	24	18
31.8	1-1/4	CL150/300	33	24	49	36	16	12	24	18
		CL600	45	33	66	49	22	16	33	24
50.8	2	CL150/300	43	32	65	48	20	15	31	23
		CL600	61	45	91	67	27	20	41	30

⚠ WARNING

To prevent injury to personnel and damage to equipment, make certain the valve is fully closed before separating the stem connector.

If solid ring packing is used, separate the stem connector and raise the actuator so that the packing flange and packing follower can be removed, and the packing rings can be slipped over the end of the valve stem. After the packing has been tightened down, reconnect the valve/actuator stem connection according to the appropriate actuator instruction manual.

Replacing Packing

⚠ WARNING

To prevent injury to personnel and damage to equipment, handle tools carefully around the valve plug stem (key 12, figures 9, 10, and 16) and the packing box. A gouge or scratch in the packing box wall could create a leak path. A damaged valve stem could cut a groove in the packing, allowing leakage.

1. Before removing the actuator, disconnect air, electrical, and leakoff lines which would interfere with actuator removal or valve maintenance. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve.

⚠ WARNING

To prevent injury to personnel and damage to equipment, make certain the valve is fully closed before separating the stem connector.

2. With the plug seated, remove the stem connector by loosening the stem locknuts and unscrewing the cap screws which hold the two halves together.

NOTICE

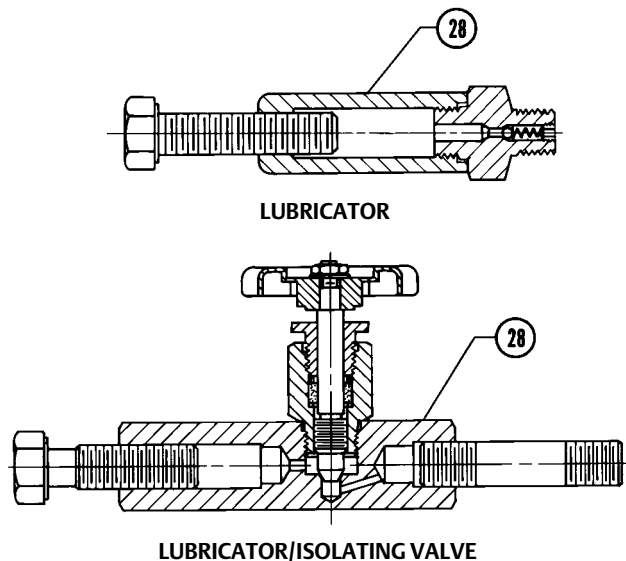
To avoid damaging the seating surface caused by the valve plug and stem assembly dropping from the bonnet after being lifted part way out, be sure that the assembly remains in the valve and on the seat. The parts are also easier to handle separately.

3. Remove the hex nuts (key 27, figures 11 and 13) from the yoke boss cap screws or stud bolts (key 26, figures 11 and 13) and lift off the actuator.
4. Remove the stem locknuts and loosen the packing flange nuts (key 17, figures 11 and 13) so that the packing is not tight on the valve stem (key 12, figures 9, 10, and 16). Then remove the large hex nuts (key 11, figures 9, 10, and 16) that bolt the bonnet and valve together.

Table 9. Recommended Bolt Torque⁽¹⁾⁽²⁾

Stud Bolt Size, Inches	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2
Torque (N•m)	271	393	549	746	990	1329	1749
Torque (Lbf•ft)	200	290	405	550	730	980	1290

1. Based on alloy steel bolting ASME SA 193-B7 with heavy hex nuts. For other materials, contact your [Emerson sales office](#) for torques.
 2. Lubricate with lithium grease. For other lubricants or coated bolting, contact your Emerson sales office for torques.

Figure 4. Lubricator and Lubricator/Isolating Valve


10A9421-A
 A5428-D
 A0832-2"

5. Attach the ringed ends of a lifting chain (not furnished) to two of the yoke boss stud bolts 180 degrees apart. Then replace the nuts on the two stud bolts selected. (Use washers to retain the chain rings if necessary).
6. Check to be sure that the chain will not damage the stem threads and lift the bonnet straight up with the hoist. If the valve plug and stem assembly starts to lift with the bonnet, use a brass or lead hammer on the end of the stem and tap it back down. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.
7. Remove the packing flange nuts (key 17), packing flange (key 15), upper wiper (key 21), and packing follower (key 25), all shown in figures 11 and 13.
8. Using care to avoid scratching the packing box wall, pull the packing box components out with a wire hook. The packing box components can also be pushed out of the packing cavity with a rod inserted from the bottom of the bonnet, whenever the bonnet can be positioned to permit access from the bottom.
9. Clean the packing box and the metal packing box components. Spray PTFE packing with a silicone-based lubricant.
10. Install new bonnet gaskets (key 6, figures 9, 10, and 16) and replace the bonnet.
11. Install the new packing as shown in figure 3, 11, or 13.

For spring-loaded PTFE V-ring packing, tighten the packing flange nuts until the shoulder on the packing follower (key 25, figures 11 and 13) contacts the bonnet.

For **graphite packing**, tighten the packing flange nuts to the maximum recommended torque shown in table 8. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 8.

For **other packing types**, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 8. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

For **ENVIRO-SEAL or HIGH-SEAL live-loaded packing**, refer to the note at the beginning of the Maintenance section.

12. Lubricate the stud bolts (key 10, figures 9, 10, and 16) and replace the nuts (key 11, figures 9, 10, and 16). Tighten the nuts down gradually in a criss-cross pattern to ensure that the bonnet is drawn down evenly. The maximum recommended torque values are shown in table 9 for the various stud bolt sizes used in the fabricated valves.
13. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.
14. After the valve has operated at line temperature for a time, retighten the hex nuts to the recommended torque value.

Trim Maintenance

The following procedure provides instruction for replacing the trim. Complete only those steps necessary to accomplish the required maintenance operations.

Key numbers in this section are referenced in figures 9, 10, and 16 and apply to FB valves, unless otherwise specified.

1. Remove the actuator and the bonnet according to steps 1 through 6 of the Replacing Packing section.
2. Screw an eyed adaptor (not furnished) onto the valve stem threads and lift the valve plug and stem assembly out of the valve. Lower it onto a cushioned surface to protect the valve plug seating surface.
3. If the valve plug (key 2) is damaged and requires replacement, always replace the entire valve plug and stem assembly.

NOTICE

To avoid weakening the stem that may cause failure in service, never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem, which weakens the stem. However, a used valve plug may be reused with a new stem.

- a. Drive out the old pin (key 13), unscrew the old stem, and replace it with a new stem. Screw the new stem completely into the valve plug until the thread bottoms out against the plug.
- b. Locate the pin guide hole in the valve plug and drill a matching hole through a new stem. Use a 6.4 mm (1/4-inch) diameter drill for constructions with port sizes through 378 mm (14.875 inches); use a 9.5 mm (3/8 inch) diameter drill for constructions with 430 mm (16.9375 inch) or 506 mm (19.9375 inch) port sizes. Install a new pin.
4. If the piston ring (key 4, figure 10) in FBD or the seal ring (key 4, figures 9 and 16) in FBT is visibly damaged, remove it and replace it with a new part. Be careful not to scratch the surface of the ring groove in the valve plug or the new ring may not seal properly. Because the FBT seal ring must be pried and/or cut from the groove, it cannot be used over again.

Note

Lapping metal seats, if required, should be done before installing the piston or seal ring.

- a. Before replacing the piston ring or the valve plug seal ring, be sure the ring groove in the valve plug is clean and free of scratches. The FBD piston ring is split and can be easily placed in the groove.

NOTICE

Avoid jerking sharply on the seal ring. The PTFE or FEP material in the seal ring must be permitted time to cold-flow during the stretching procedure.

- b. The FBT seal ring is a one-piece, spring-loaded ring which must be carefully stretched over the top end of the valve plug and into the groove. First lubricate the seal ring generously and place it over the valve stem. Since the flow direction is up through the seat ring and out through the cage, the open portion of the seal ring should be up. Start the ring in the groove on one side of the valve plug and slowly and gently work it over the top edge of the valve plug.

Stretching the seal over the valve plug may make it seem unduly loose when first placed in the groove, but it will contract to its original size without requiring a waiting period before insertion into the cage.

- c. If no further trim maintenance is required, the valve can be reassembled at this point by carefully replacing the valve plug, and proceeding to step 10. If an FBT valve plug is being replaced, make sure the seal ring is evenly engaged in the entrance chamfer at the top of the cage assembly (key 3) to avoid damaging the seal ring.
5. Attach a lifting chain to the cage assembly. The cage is tapped on the top in two places to facilitate rigging. Hoist the cage assembly straight out of the valve and set it on a flat surface.

NOTICE

Avoid jerking sharply on the seal ring. The PTFE or FEP material in the seal ring must be permitted time to cold-flow during the stretching procedure.

6. The standard design for applications up to 232°C (450°F) will have a seat ring seal ring (key 5). Inspect this seal ring and, if necessary, remove it and install a new seal ring. Lubricate the seal ring generously, and place it over the bottom end of the seat ring. Start the ring in the groove on one side of the seat ring, and gently work it over the seat ring. The open portion of the seat ring seal ring should be down since flow is up through the seat ring and out through the cage.
7. In the standard design where the seat ring is screwed into the cage, it is secured with two tack welds, one on each side of the cage. The seat ring can be removed by grinding or filing off the tack welds, then inserting a bar through slots cut in the seat ring to turn it out of the cage.
8. Tack weld the new seat ring to the cage using minimal heat. Two welds, 6.4 mm (1/4-inch) long and 180 degrees apart, are required. Using a hoist, lower the cage assembly into the valve. Use care to avoid damaging the seal rings or other sealing surfaces while handling the heavy parts. To facilitate inserting the cage assembly into the valve, lubricate the outside diameter of the seat ring and the seal with lithium grease.
9. Replace the valve plug/stem assembly.

NOTICE

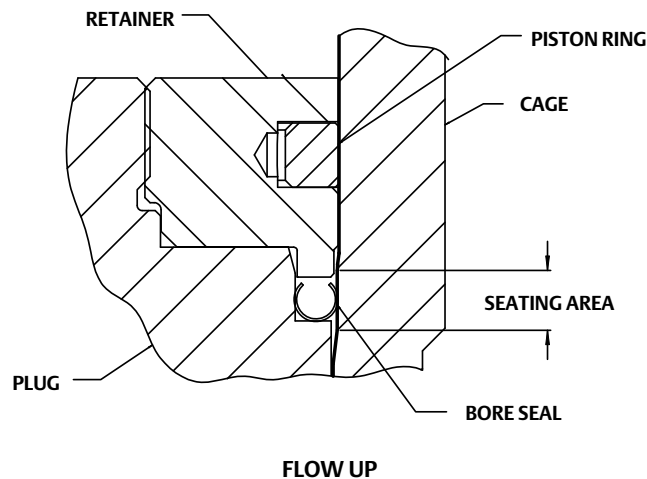
Place the bonnet carefully over the stem to avoid damaging the packing.

10. Install new gaskets (key 6), and replace the bonnet.
11. Lubricate the stud bolts (key 10, figures 9, 10, and 16) and replace the nuts (key 11, figures 9, 10, and 16). Tighten the nuts down gradually in a criss-cross pattern to ensure that the bonnet is drawn down evenly. The maximum recommended torque values are shown in table 9 for the various stud bolt sizes used in the fabricated valves.
12. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

Lapping Metal Seats

A certain amount of leakage should be expected with metal-to-metal seating in any valve. If the leakage becomes excessive, however, the condition of the seating surfaces of the valve plug and seat ring can be improved by lapping. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Figure 5. Fisher FB with Bore Seal Trim



Assemble the valve to the extent that the cage is in place and the bonnet is bolted to the valve. A simple handle can be made from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction to lap the seats. After lapping, remove the bonnet and clean the seating surfaces. Completely assemble and test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

Retrofit: Installing Bore Seal Trim

Note

Additional actuator thrust is required for a valve with Bore Seal trim. When installing Bore Seal trim in an existing valve, contact your [Emerson sales office](#) for assistance in determining new actuator thrust requirements.

Assemble the new valve plug/retainer assembly (with Bore Seal plug seal) using the following instructions:

NOTICE

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the new trim parts while assembling the individual parts and during installation in the valve body.

1. Apply a suitable high-temperature lubricant to the inside diameter of the Bore Seal plug seal. Also, lubricate the outside diameter of the valve plug where the Bore Seal plug seal must be pressed into the proper sealing position (figure 5).
2. Orient the Bore Seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - a. The open interior of the Bore Seal plug seal must face up in a valve with flow-up construction (figure 5).
3. Place the Bore Seal plug seal over the top of the valve plug. The retainer will help guide the Bore Seal down onto the plug (figure 5). Do not force the Bore Seal over the plug.
4. An installation tool (see table 10) must be inserted into the Bore Seal prior to using the retainer to guide it down the plug.
5. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the Bore Seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
6. Remove the retainer and then the installation tool. Place the Bore Seal retainer back onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
7. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 7) to secure the Bore Seal retainer.
8. Install the new plug/retainer assembly with Bore Seal plug seal on the new stem following the appropriate instructions in the Trim Replacement section of this manual.
9. Install piston rings by following instructions in the Trim Replacement section of this manual.
10. Remove the existing valve actuator and bonnet following the appropriate instructions in the Replacing Packing section of this manual.

NOTICE

Do not remove the existing valve stem from the valve plug unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

11. Remove the existing valve stem and plug, cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section of this manual.
12. Replace all gaskets according to appropriate instructions in the Trim Replacement section of this manual.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

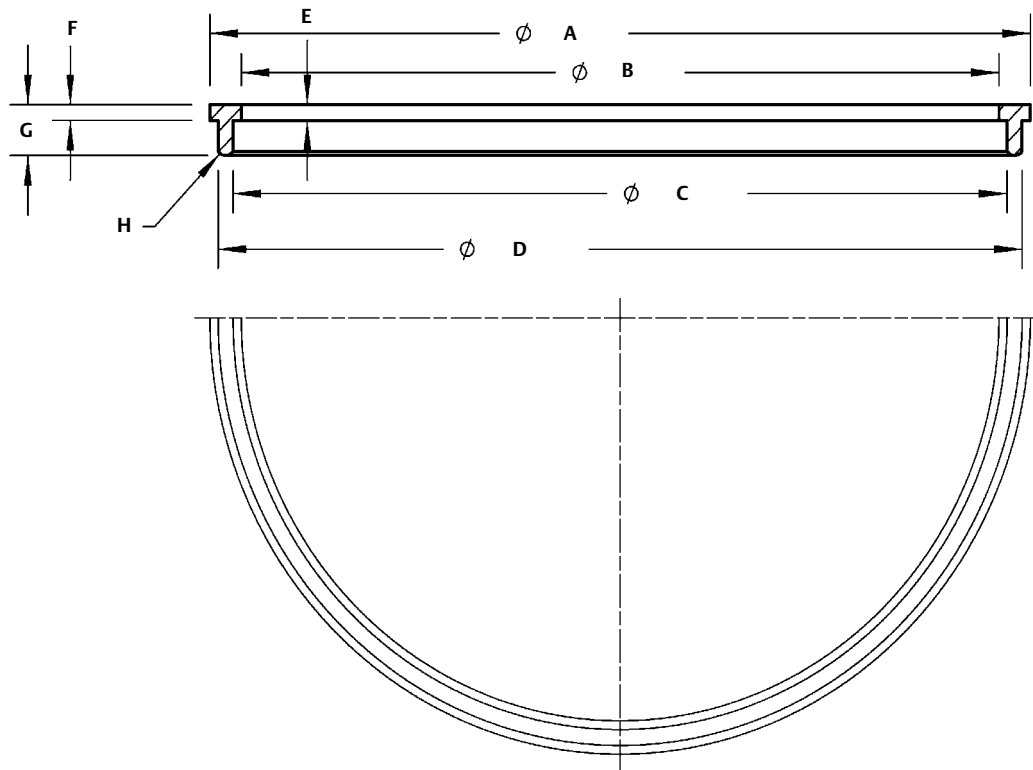
Instruction Manual

D100402X012

FB Valve

January 2023

Figure 6. Bore Seal Installation Tool



GE22109-A

Table 10. Bore Seal Installation Tool Dimensions

VALVE PORT SIZE, INCH	Dimensions, Inches (See Figure 6)								Tool Part Number
	A	B	C	D	E	F	G	H	
5.1875	---(1)								n/a
6.75	7.11	6.69	6.79-6.81	7.01-6.99	0.09	0.10	0.32	R.06	GE18264X012
7.00	7.11	6.69	6.79-6.81	7.01-6.99	0.09	0.10	0.32	R.06	GE18264X012
7.75	---(1)								n/a
8.8125	---(1)								n/a
9.9375	---(1)								n/a
10.8125	---(1)								n/a
11.00	---(1)								n/a
13.875	---(1)								n/a
14.75	14.84	14.424-14.416	14.516-14.536	14.736-14.716	0.1	0.1	0.32	R.05	GE34073X012
14.875	---(1)								n/a
16.9375	---(1)								n/a
18.25	---(1)								n/a
19.9375	---(1)								n/a

1. For sizes, contact your [Emerson sales office](#).

13. Install the new seat ring, cage, valve plug/retainer assembly, and stem into the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section of this manual.

NOTICE

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the Bore Seal plug seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop across the valve, this force will adequately drive the valve plug to the seat ring, thus giving the Bore Seal plug seal a predetermined permanent set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Replacement of Installed Bore Seal Trim

Trim Removal (Bore Seal Constructions)

1. Remove the valve actuator and bonnet following the appropriate instructions in the Replacing Packing section of this manual.

NOTICE

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance.

Use caution when removing piston ring(s) and the Bore Seal plug seal to avoid scratching any sealing surface.

NOTICE

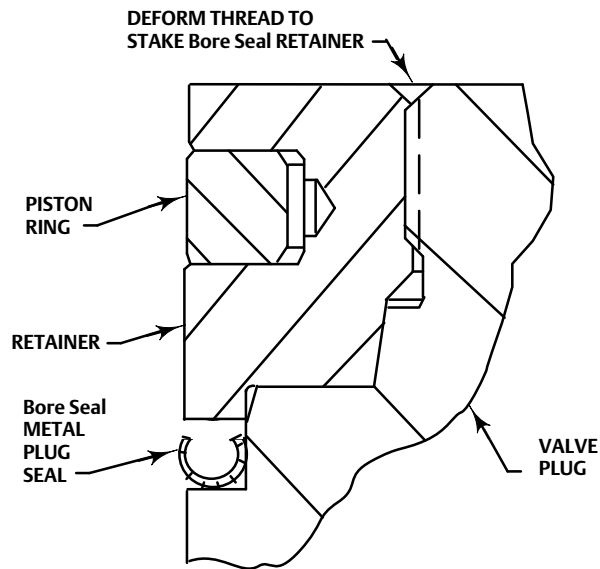
Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

2. Remove the plug/retainer assembly (with Bore Seal plug seal) and cage from the valve body following the appropriate instructions in the Trim Removal section of this manual.
3. Locate the staked thread on top of the valve plug (figure 7). The staked thread secures the retainer. Use a drill with a 1/8 inch bit to drill out the staked area of the thread. Drill approximately 1/8 inch into the metal to remove the staking.
4. Locate the break between sections of the piston ring(s). Using an appropriate tool such as a flat-blade screwdriver, carefully pry out the piston ring(s) from the groove(s) in the Bore Seal retainer.
5. After removing the piston ring(s), locate the 1/4-inch diameter hole in the groove. In a retainer with two piston ring grooves, the hole will be found in the upper groove.
6. Select an appropriate tool such as a punch and place the tip of the tool into the hole with the body of the tool held tangent to the outside diameter of the retainer. Strike the tool with a hammer to rotate the retainer and free it from the valve plug. Remove the retainer from the plug.

7. Use an appropriate tool such as a flat-blade screwdriver to pry the Bore Seal plug seal off the plug. Use caution to avoid scratches or other damage to the sealing surfaces where the Bore Seal plug seal makes contact with the valve plug (figure 5).
8. Inspect the lower seating surface where the valve plug contacts the seat ring for wear or damage which would prevent proper operation of the valve. Also, inspect the upper seating surface inside the cage where the Bore Seal plug seal contacts the cage, and inspect the sealing surface where the Bore Seal plug seal makes contact with the plug (figure 5).

Figure 7. Stake the Threads of the Bore Seal Retainer



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9. Replace or repair trim parts according to the following procedure for lapping metal seats, remachining metal seats, or other valve plug maintenance procedures as appropriate.

Lapping Metal Seats (Bore Seal Constructions)

Before installing a new Bore Seal plug seal, lap the lower seating surface (valve plug to seat ring, figure 5) following appropriate procedures in the Lapping Seats section of this manual.

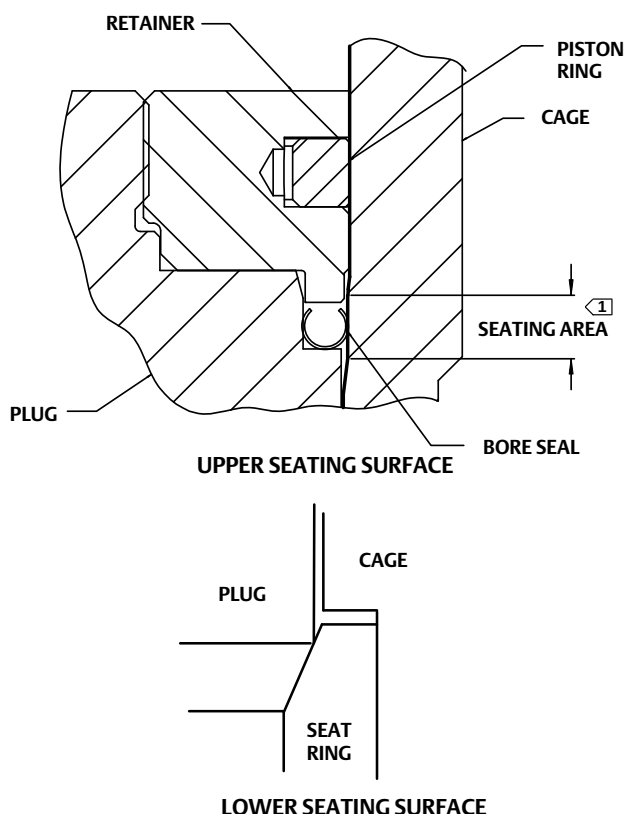
Remachining Metal Seats (Bore Seal Constructions)

A valve plug with a Bore Seal metal plug seal features two seating surfaces. One seating surface is found where the valve plug contacts the seat ring. The second seating surface is found where the Bore Seal plug seal contacts the upper seating surface in the cage. The cage does not require any machining, even when the plug and / or seat ring have been machined.

Trim Replacement (Bore Seal Constructions)

1. Apply a suitable high-temperature lubricant to the inside diameter of the Bore Seal plug seal. Also, lubricate the outside diameter of the valve plug where the Bore Seal plug seal must be pressed into the proper sealing position (figure 5).
2. Orient the Bore Seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - a. The open interior of the Bore Seal plug seal must face up in a valve with flow-up construction (figure 5).
3. Place the Bore Seal plug seal over the top of the valve plug. The retainer will help guide the Bore Seal down onto the plug. Do not force the Bore Seal over the plug.

Figure 8. Lower (Valve Plug to Seat Ring) and Upper (Bore Seal Plug Seal to Cage) Seating Surfaces



NOTE:

A6780

1 UPPER SEATING SURFACE IS THE AREA OF CONTACT BETWEEN THE BORE SEAL METAL PLUG SEAL AND THE CAGE.

4. An installation tool (see table 10) must be inserted into the Bore Seal prior to using the retainer to guide it down the plug.
5. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the Bore Seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
6. Remove the retainer and then the installation tool. Place the Bore Seal retainer back onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
7. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 7) to secure the Bore Seal retainer.
8. Replace the piston ring(s) following instructions in the Trim Replacement section of this manual.

9. Return the cage, plug/retainer assembly, and stem to the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section of this manual.

NOTICE

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the Bore Seal plug seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop across the valve, this force will adequately drive the valve plug to the seat ring, thus giving the Bore Seal plug seal a predetermined permanent set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Parts Ordering

Each body-bonnet assembly is assigned a serial number, which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and to the key number and part name from the following list. Specify the desired material, if known. Part numbers are shown for packing box parts. Specify the part number if you are ordering packing parts.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your [Emerson sales office](#) for part ordering information.

Valve (figures 9, 10, and 16)

Key	Description
1	Valve Body
2*	Valve Plug
3*	Cage Assembly

- | | |
|-----|---|
| 4* | Seal Ring (Plug Ass'y) FBT valve
PTFE Spring Loaded
FBD Valve - Piston Ring |
| 5* | Seal Ring (Seat Ring-Cage Ass'y) |
| 6* | Gasket (2 req'd) |
| 8 | Flow Arrow |
| 9 | Drive Screw |
| 10 | Stud Bolt |
| 11 | Hex Nut |
| 12* | Valve Plug Stem |
| 13* | Pin |
| 29* | Retaining Ring (not shown) |
| 30* | Back-Up Ring (not shown) |
| 36 | Nameplate |
| 37 | Wire |

Key Description

Key Description

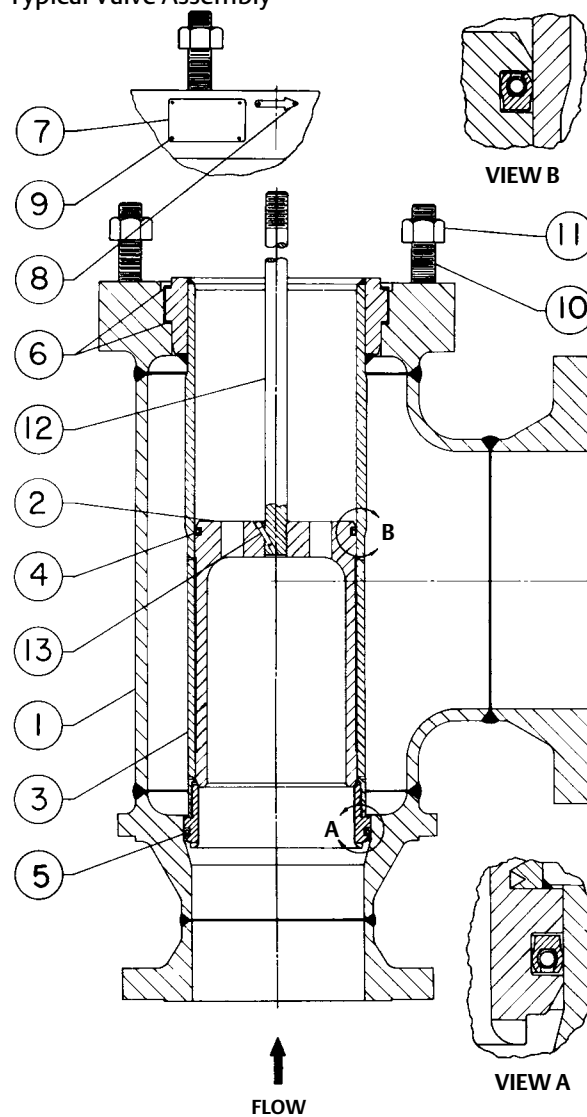
Bonnet (figures 11, 13, 12, 14, and 15)

14	Bonnet
15	Packing Flange
16	Packing Flange Stud
17	Packing Flange Nut
18*	PTFE V-Ring Packing Set
19*	Packing Ring
20*	Packing Ring
21*	Upper Wiper
22	Spring (single PTFE packing only)
22	Lantern Ring
23	Washer (single PTFE packing only)
24	Packing Box Ring
25	Packing Follower
26	Stud
27	Hex Nut
28	Pipe Plug or Lubricator or Lubr/Iso Valve
34	Bearing
35	Retaining Ring

Key Description

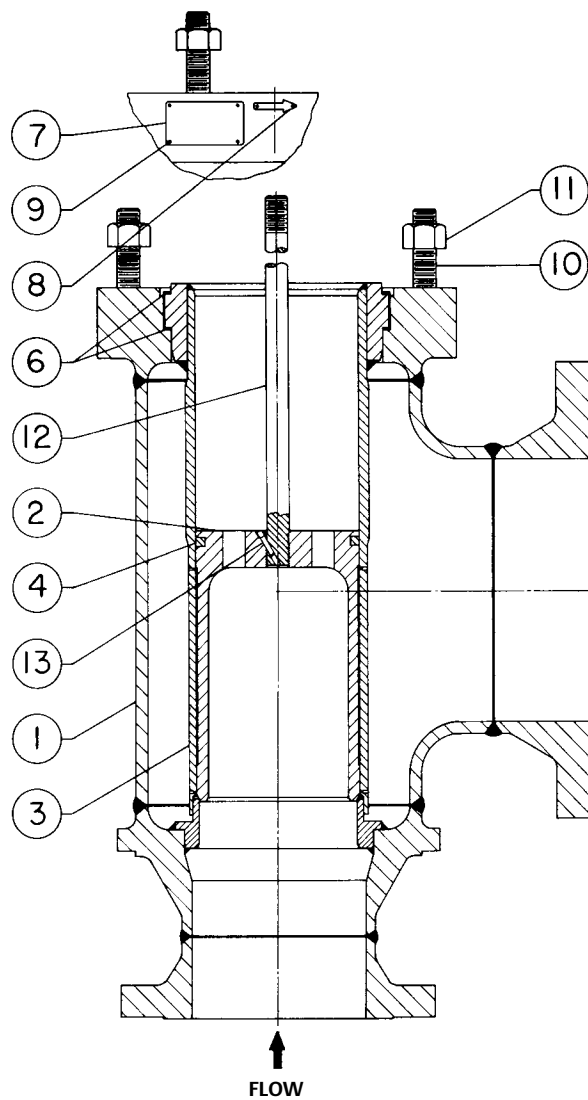
200	Stud (2 req'd)
201	Packing Flange
202	Spring, (2 req'd)
203	Spring guide packing follower
204	Screw (4 req'd) For HIGH-SEAL packing
205	Load Scale (2 req'd)
206	Indicator Disk
207*	Guide Bushing, white (2 req'd)
208*	Guide Bushing, no color
209*	Packing Ring (3 req'd)
210*	Packing Ring (2 req'd)
211*	Packing Box Ring
212	Hex Nut (2 req'd)
213	Anti-Seize Lubricant
214*	Anti-extrusion washer (4 req'd)
214*	Packing washer (5 req'd)
215*	Packing set (2 req'd)
217	Spring pack assembly
218*	Lower wiper
216	Lantern ring

Figure 9. Fisher Fabricated FBT—Typical Valve Assembly



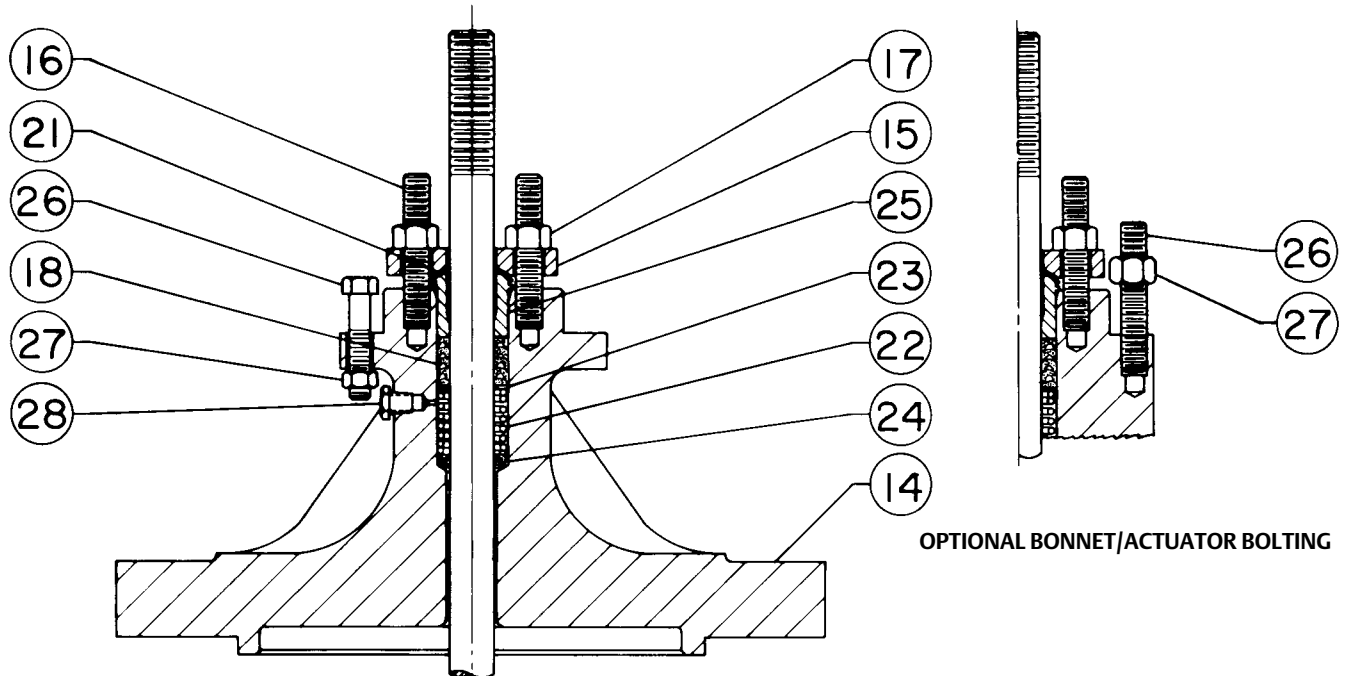
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Figure 10. Fisher Fabricated FBD—Typical Valve Assembly



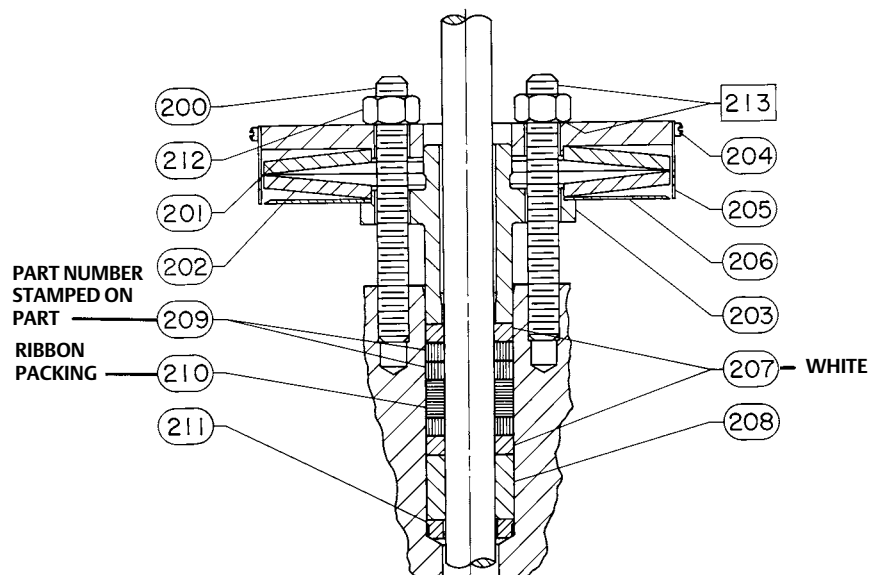
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Figure 11. Bonnet Assembly with PTFE V-Ring Packing



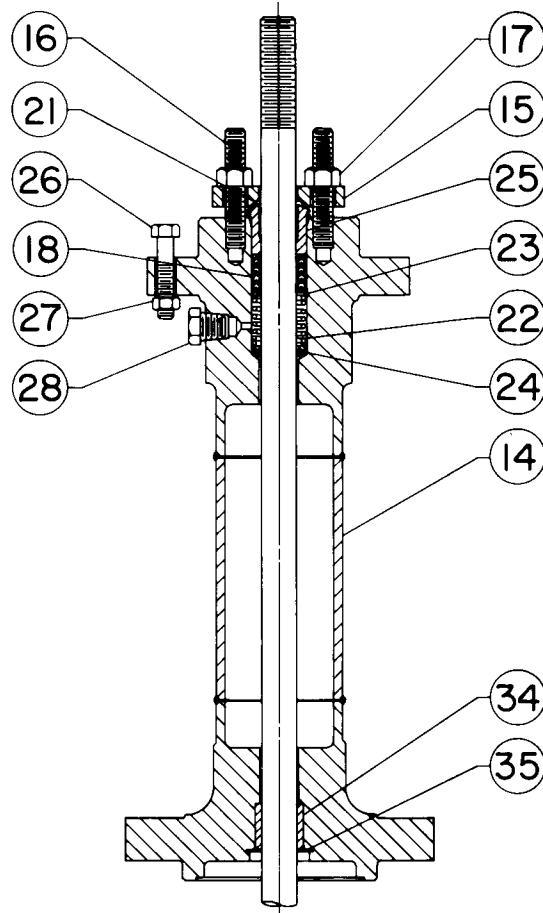
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Figure 12. Typical HIGH-SEAL Packing System



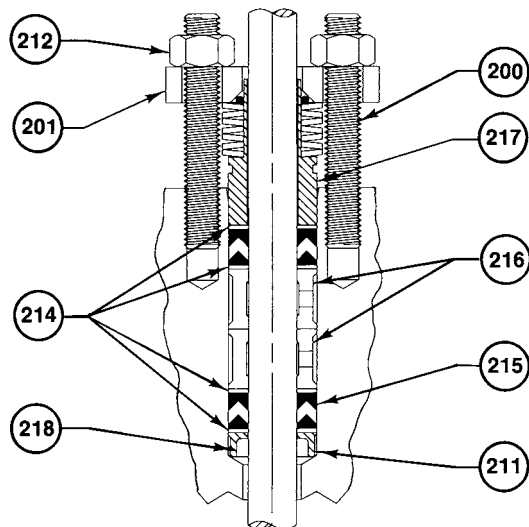
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Figure 13. Extension Bonnet Assembly Style 3



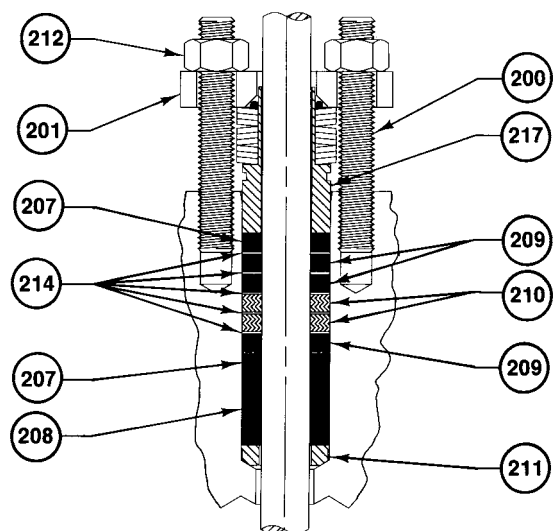
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Figure 14. Typical ENVIRO-SEAL Packing System with PTFE Packing



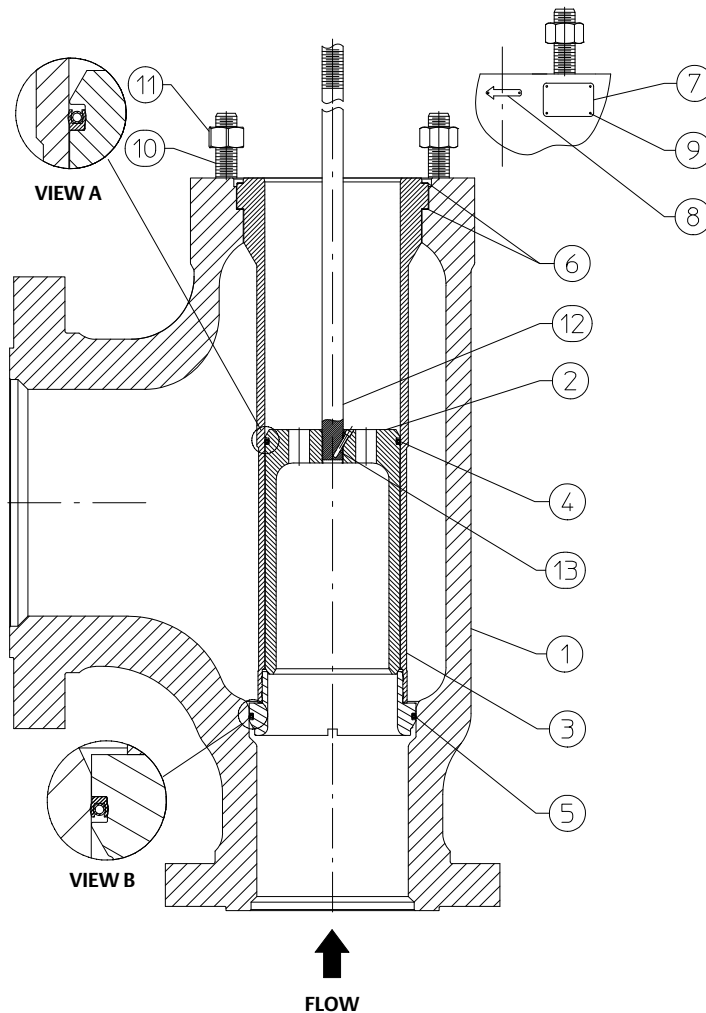
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Figure 15. Typical ENVIRO-SEAL Packing System with Graphite Packing



A6110

Figure 16. Fisher Cast FBT Typical Valve Assembly



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Graphite Ribbon/Filament Packing for Fisher™ Sliding-Stem Valves

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Packing Installation	2
Parts Ordering	7

Introduction

Scope of Manual

This manual provides instructions for installing graphite ribbon and filament packing in sliding-stem valves--either as part of the field maintenance procedure for valves that originally were equipped with this kind of packing or when field-replacing other kinds of packing.

Use this manual along with the appropriate valve body instruction manual. Refer to the valve body manual for disassembly, packing removal, reassembly after the packing has been installed, and for packing part numbers and kits.

Do not install, operate, or maintain this packing without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

Graphite ribbon/filament packing is a low-chloride, corrosion-resistant packing for use with hard-to-handle fluids, especially high-temperature steam or water. It can be used in temperatures from -18 to 538°C (0 to 1000°F) in non-oxidizing service or from -18 to 371°C (0 to 700°F) in oxidizing service. Because the packing rings are certified to contain no more than 100 ppm of chloride, this packing is also frequently used in radioactive nuclear service and will withstand a gamma radiation dosage to 1.0×10^7 Rads or 50 R/hour.

Graphite ribbon/filament packing comes in three different arrangements of graphite ribbon rings, graphite filament rings, and sacrificial zinc washers. The three different arrangements are single (figures 1 and 2), double (figure 3), and leak-off (figure 4).

The graphite ribbon rings are made from a long ribbon of flexible graphite which is wound into a ring and then pressed tightly together. The flexible graphite contains a non-metallic, inorganic, passivating inhibitor for corrosion and oxidation resistance. Graphite filament rings consist of filaments of graphite braided together. One sacrificial zinc washer is used under each graphite ring to protect the valve from pitting and corrosion attack.

Storage and Startup

If a valve will be stored for a long period of time, remove the packing rings from the packing box to prevent corrosion. When ordering a valve that will be stored, notify Emerson Automation Solutions and the valve will be shipped from the factory with the packing box empty and a special packing follower with O-ring gland seal installed between the packing flange and bonnet shoulder. All the other packing parts shown in figure 2, 3, or 4 will be shipped with the control valve assembly but in a separate bag or wrapper.

Leave the special packing follower in place until after any hydrostatic testing is completed. Then remove the follower, thoroughly air-dry the packing box, and install all the packing parts according to the appropriate arrangement drawing. The special packing follower can be saved for future hydrostatic testing, or discarded if it will no longer be used.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however some readjustment will be required to meet specific service conditions.

CAUTION

When using any packing at low temperatures, frost must not be allowed to form on the valve stem. Valve stem frost can damage packing as the stem travels through the packing rings.

Packing Installation

Packing parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement of parts depends upon the severity of service conditions or the requirements of local, state, and federal rules and regulations.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.

- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

1. Refer to the appropriate valve body and actuator instruction manuals. Disassemble the control valve as required to gain access to the packing box. Remove the packing box components.
2. Examine the valve stem. The surface that contacts the packing must be smooth and free of scratches and nicks. If another style of graphite packing had been installed, the packing may have left a black deposit of graphite coating on the stem. If this deposit has built up or has affected the valve stem finish, the stem should be polished to a 0.1 micro-meter (4 micro-inch) RMS finish.
3. Thoroughly clean and dry the packing cavity, valve stem, and all metal packing parts (packing box ring, lantern ring, and packing follower). Also, clean the threads of the packing flange studs and nuts (figure 1). Lubricate these threads and the faces of the packing flange nuts during the remainder of the installation with a moly disulfide or equivalent type of lubricant.
4. Select the correct installation figure reference according to the valve design and packing arrangement (single, double, or leak-off).
5. Install the metal packing parts (figures 2, 3, or 4) that go to the bottom of the packing cavity.

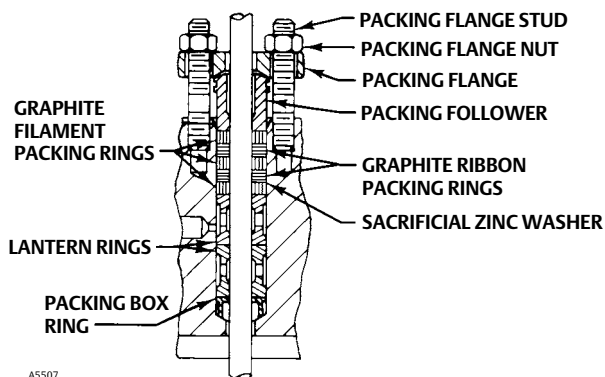
⚠ WARNING

To avoid valve leakage during operation or personal injury, it is necessary, when installing the packing, to avoid trapping air between the rings and to give side support to the rings so they do not spread out under the compression of adding more rings. This may be accomplished by installing only one ring at a time.

6. Install only one packing ring at a time. Push each of the new packing rings into the packing box until it presses against the ring below it.

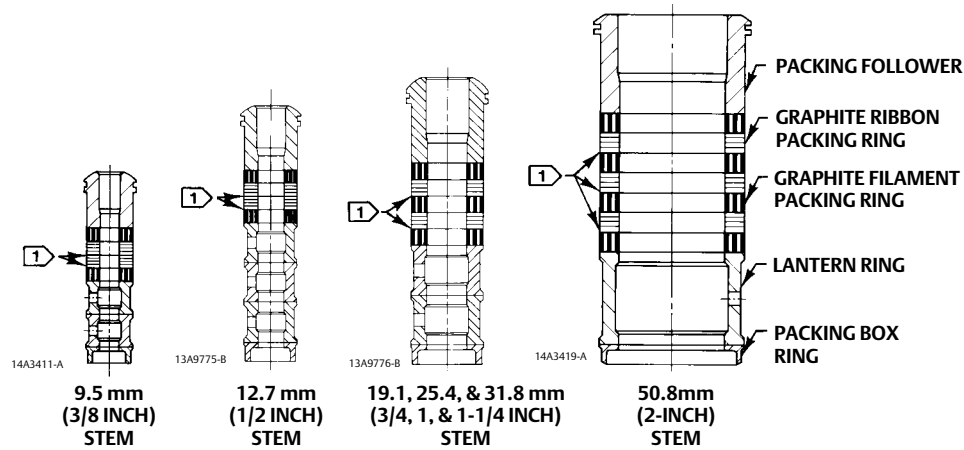
If installing double or leak-off packing, start the last lower packing ring and then force all the lower packing rings and lantern ring(s) all the way into the packing cavity. Then install the upper packing rings in the same manner.

Figure 1. Typical Single Packing Arrangement Shown Installed in Bonnet



A5507

Figure 2. Single Packing Arrangements



NOTE:

1 > 0.102mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS;
USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

A5513

Table 1. Single Packing Arrangements

STEM DIAMETER		ARRANGEMENT ASSEMBLY DRAWING
mm	Inch	
9.5	3/8	14A3411
12.7	1/2	13A9775
19.1	3/4	13A9776
25.4	1	14A2340
31.8	1-1/4	14A3412
50.8	2	14A3419

CAUTION

Loss of packing performance and damage to the valve stem could result if metal parts such as the packing follower come in contact with the valve stem. When installing packing parts or making packing adjustments, make sure that the inside diameter of the packing follower does not contact the valve stem.

7. Replace the packing follower, packing flange, and packing flange nuts.

Note

If the packing needs additional tightening after the valve is in service, the packing flange nuts may be tightened to the recommended maximum torque. Excessive valve stem friction may result if the recommended maximum torque is exceeded. The recommended minimum torque is necessary to maintain a stem seal.

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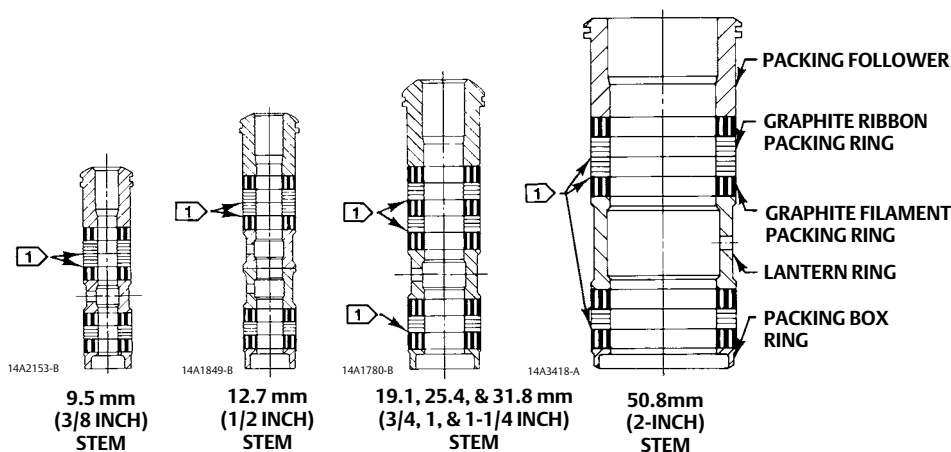
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Graphite Packing for Sliding-Stem

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Figure 3. Double Packing Arrangements



NOTE:
1 0.102mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS;
USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

A5514

Table 2. Double Packing Arrangements

STEM DIAMETER		ARRANGEMENT ASSEMBLY DRAWING
mm	Inch	
9.5	3/8	14A2153
12.7	1/2	14A1849
19.1	3/4	14A1780
25.4	1	14A3413
31.8	1-1/4	14A3414
50.8	2	14A3418

- Evenly tighten the packing flange nuts to force the packing rings against the lantern ring(s). Continue to evenly tighten the nuts until the maximum recommended torque shown in table 4 is reached. Then, loosen the packing flange nuts and retighten to the recommended minimum torque in table 4.
- Reassemble the control valve assembly according to the instructions in the appropriate instruction manual.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

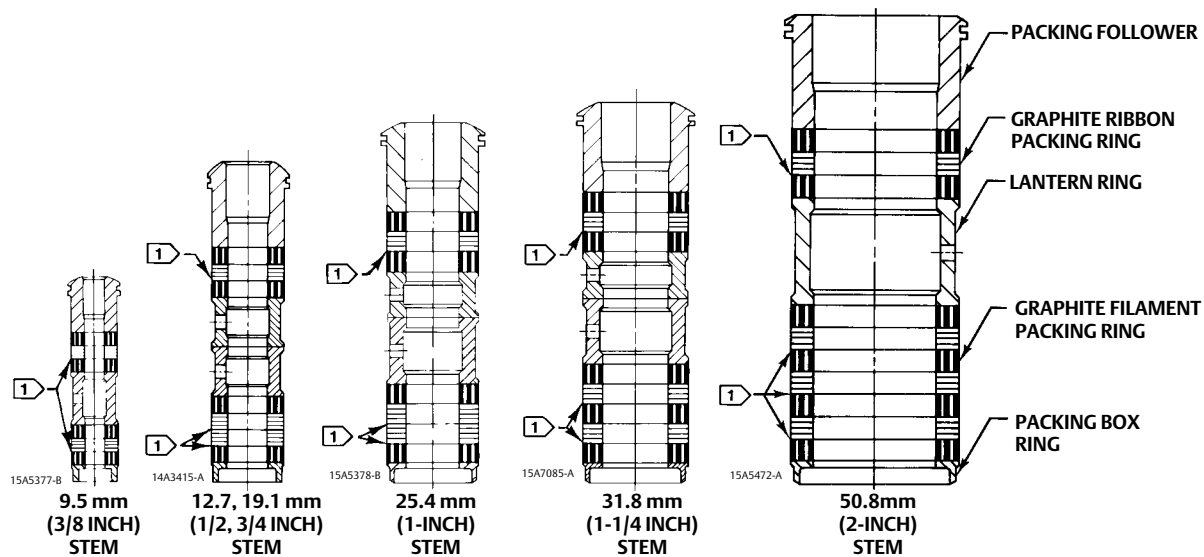
Graphite Packing for Sliding-Stem

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Figure 4. Leak-Off Packing Arrangements



NOTE:
 1 0.102mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS;
 USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

A5508

Table 3. Leak-Off Packing Arrangements

STEM DIAMETER		ARRANGEMENT ASSEMBLY DRAWING
mm	Inch	
9.5	3/8	15A5377
12.7	1/2	14A2485
19.1	3/4	14A3415
25.4	1	15A5378
31.8	1-1/4	15A7085
50.8	2	15A5472

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Table 4. Recommended Packing Flange Nut Torques⁽¹⁾

VALVE STEM DIAMETER		VALVE RATING	MAXIMUM		MINIMUM	
mm	Inch		N•m	Lbf•ft	N•m	Lbf•ft
9.5	3/8	CL150	5	4	3	2
		CL300	7	5	4	3
		CL600	8	6	5	4
		CL900	10	7	7	5
		CL1500	12	9	8	6
12.7	1/2	CL150	8	6	5	4
		CL300	10	7	7	5
		CL600	14	10	10	7
		CL900	18	13	12	9
		CL1500	22	16	15	11
15.9	5/8	CL2500	24	18	18	13
		CL150	7	5	4	3
		CL300	8	6	5	4
		CL600	12	9	8	6
19.1	3/4	CL150	16	12	11	8
		CL300	20	15	14	10
		CL600	30	22	20	15
		CL900	41	30	27	20
		CL1500	50	37	34	25
25.4	1	CL2500	61	45	41	30
		CL300	37	27	24	18
		CL600	50	37	34	25
		CL900	62	46	42	31
		CL1500	77	57	52	38
31.8	1-1/4	CL2500	91	67	61	45
		CL300	49	36	32	24
		CL600	66	49	45	33
		CL900	83	61	56	41
		CL1500	102	75	68	50
50.8	2	CL2500	122	90	81	60
		CL300	65	48	43	32
		CL600	91	67	61	45
		CL900	119	88	80	59
		CL1500	146	108	98	72
		CL2500	170	125	115	85

1. With lubricated packing flange studs.

Parts Ordering

Refer to the appropriate valve body instruction manual for all bonnet packing parts.

Determine the parts needed from the appropriate packing arrangement in figures, 2, 3, or 4. Include the serial number of the valve in all correspondence concerning replacement parts or maintenance.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Fisher™ GX 3-Way Control Valve and Actuator System

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Figure 1. Fisher GX 3-Way Control Valve, Actuator, and FIELDVUE DVC2000 Digital Valve Controller



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher GX 3-Way control valve and actuator system.

Do not install, operate, or maintain a GX 3-Way valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The GX 3-Way meets the requirements of both EN and ASME standards. It is available with a complete accessory package, including the FIELDVUE™ DVC2000 integrated digital valve controller.

Table 1. Fisher GX 3-Way Valve Specifications⁽¹⁾

Specifications	EN	ASME	
Valve Body Sizes	DN 25, 40, 50, 80, 100	NPS 1, 1-1/2, 2, 3, 4	
Pressure Rating	PN 10 / 16 / 25 / 40 per EN 1092-1	CL150 / 300 per ASME B16.34	
End Connections	Flanged raised face per EN 1092-1	Flanged raised face per ASME B16.5	
Valve Body Materials	1.0619 steel	ASME SA216 WCC steel	
	1.4409 stainless steel	ASME SA351 CF3M stainless steel	
Bonnet Materials	1.4409 stainless steel / CoCr-A	ASME SA351 CF3M SST / CoCr-A	
Face-to-Face Dimensions	Based on ISA 75.08.01, see bulletin 51.1:GX 3-Way for details		
Shutoff per IEC 60534-4 and ANSI/FCI 70-2	Metal seat - Class IV (standard) Side port common high temperature construction: Metal seat - Class IV for bottom seat, Class II for upper seat		
Flow Direction	Converging and Diverging		
Trim Style	Type	Plug Style	Type
	Side-Port Common	All sizes	Unbalanced Port-Guided
	Bottom-Port Common	All sizes	Balanced Cage-Guided
1. Stainless steel valve body is recommended for steam service when the high temperature (HT) construction is selected.			

1. Stainless steel valve body is recommended for steam service when the high temperature (HT) construction is selected.

Educational Services

For information on available courses for the Fisher GX 3-Way control valve and actuator system, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Valve Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure or bursting of pressure retaining parts might result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

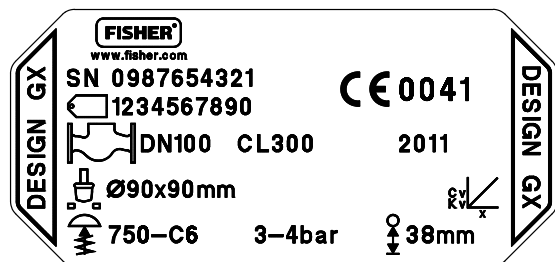
This valve is intended for a specific range of pressures, temperatures and other application specifications. Applying different pressure and temperatures to the valve could result in parts damage, malfunction of the control valve or loss of control of the process. *Do not expose this product to service conditions or variables other than those for which the product was intended.* If you are not sure what these conditions are you should contact your [Emerson sales office](#) or Local Business Partner for more complete specifications. Provide the product serial number (shown on the nameplate, figure 2) and all other pertinent information.

⚠ WARNING

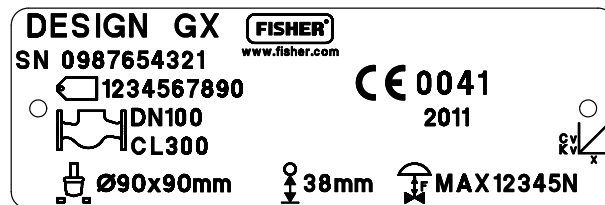
If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs. Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

If hoisting the valve take care to prevent people from being injured in case the hoist or rigging slips. Be sure to use adequately sized hoists and chains or slings to handle the valve.

Figure 2. Fisher GX 3-Way Nameplate (Key 35)



GE35409-D



GG12218-A

ELECTRIC ACTUATOR

1. Before installing the valve, inspect it to be certain that the valve body cavity is free of all foreign material. Clean out all pipelines to remove scale, welding slag and other foreign material.
2. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven trim wear, and improper operation. With some valves, the actuator may also need to be supported when it is not vertical. For more information, consult your [Emerson sales office](#) or Local Business Partner. Flow through the valve must be in the direction indicated by the flow arrow nameplate on the valve. See figures 3 and 4.
3. Use accepted piping practices when installing the valve in the pipeline. Use a suitable gasket between the valve and the pipeline flanges.
4. If continuous operation is required during inspection or maintenance, install isolating valves on either side of the control valve with a bypass valve to control the flow while the control valve is receiving maintenance.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however the packing might require some readjustment to meet specific service conditions.

Maintenance

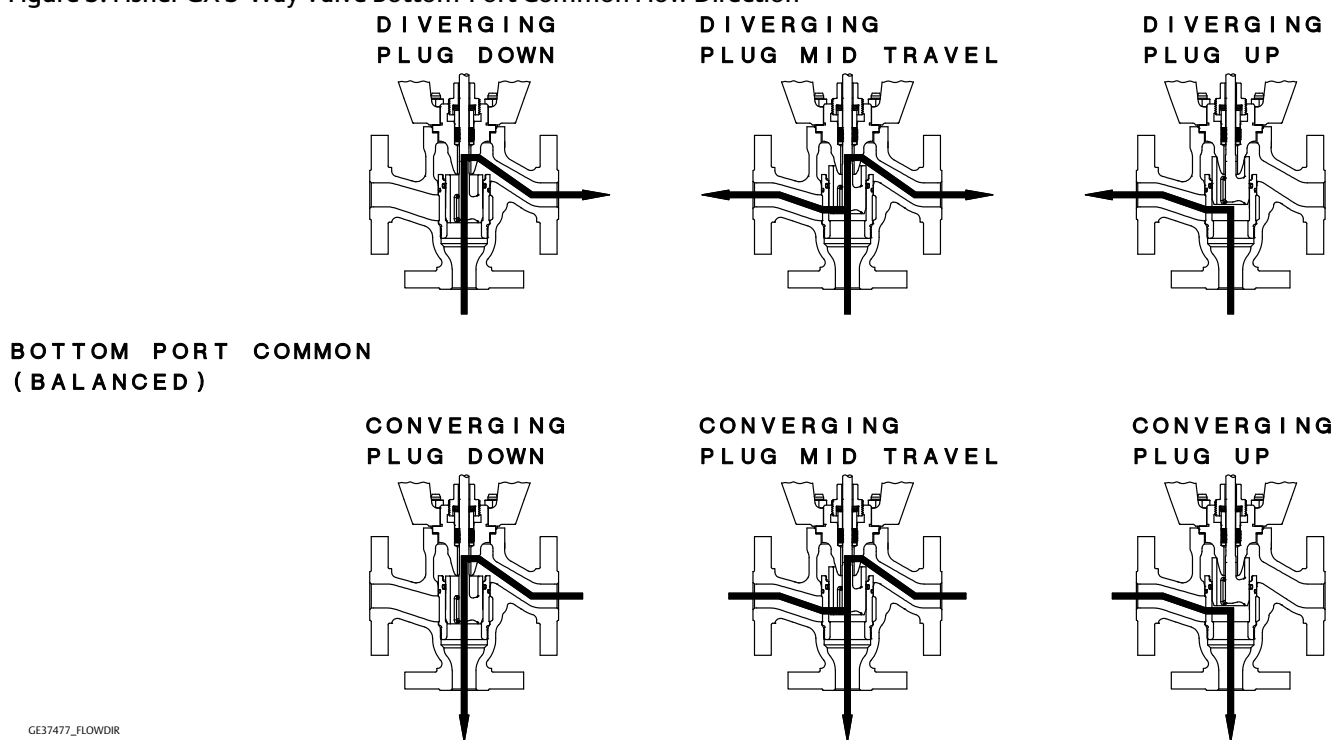
⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.

- Use bypass valves or completely shut off the process to isolate the valve from the process pressure. Relieve the process pressure from all three inlets/outlet of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator loading pressure and any actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to ensure safe removal of the actuator from the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Figure 3. Fisher GX 3-Way Valve Bottom-Port Common Flow Direction



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GX 3-Way Valve and Actuator

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Figure 4. Fisher GX 3-Way Valve Side-Port Common Flow Direction

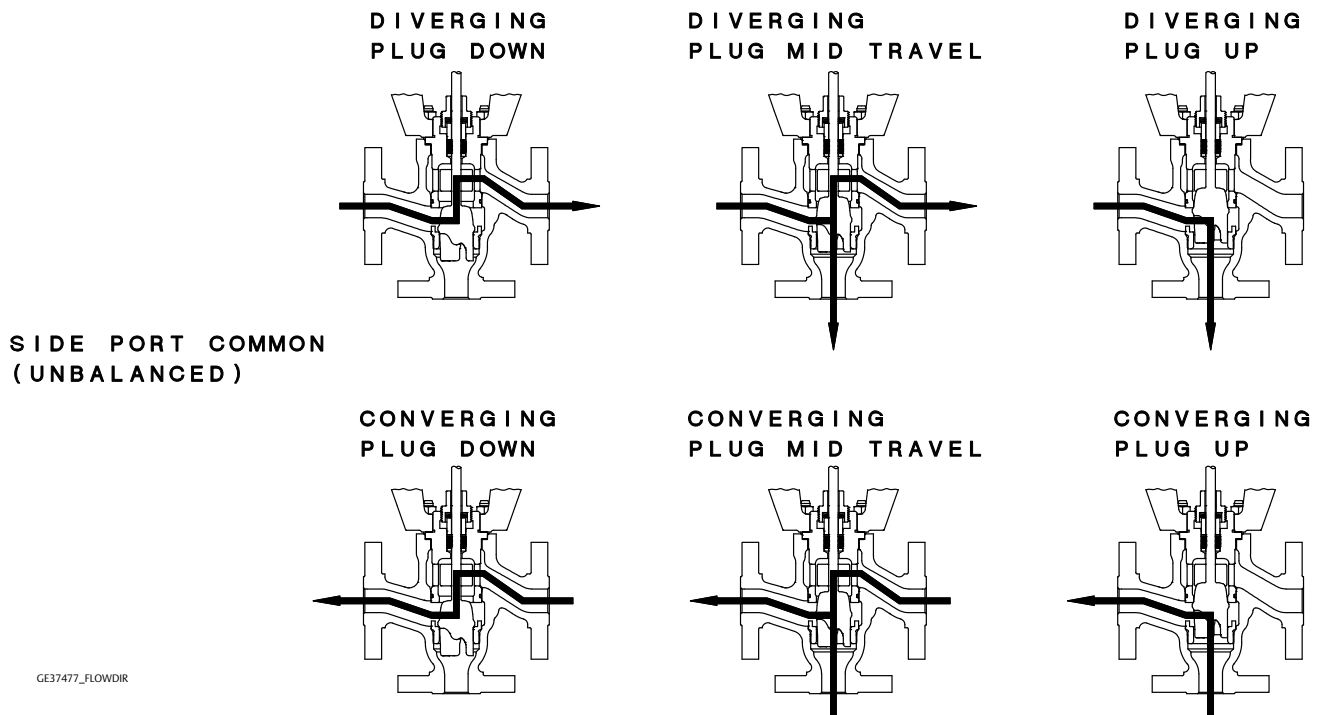


Table 2. Fisher GX 3-Way Rated Travel

VALVE SIZE NPS	ACTUATOR SIZE	NUMBER OF CASING BOLTS	TRAVEL	STEM CONNECTOR GAP SETTINGS
			mm	mm
1, 1-1/2	225	6	19	21
2	750	10	19	21
3, 4	750	10	38	40

Table 3. Body Nut (Key 7) Torque Requirements

VALVE SIZE	TORQUE	
	N•m	lbf•ft
DN 25 and 40 (NPS 1 and 1-1/2)	79.8	58.9
DN 50 (NPS 2)	163	120
DN 80 and 100 (NPS 3 and 4)	282	208

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This ensures a good gasket seal because the used gasket may not seal properly.

Actuator Maintenance

For electric actuators, see the supplier's instruction manual.

The following sections provide procedures for actuator maintenance. Refer to figures 8, 11, and 13.

The actuator soft parts may require periodic replacement. This includes the diaphragm (key 10), diaphragm O-ring (key 109), actuator rod bushing (key 19), and the actuator rod seal (key 20).

If the actuator stroking direction is unknown, refer to the nameplate on top of the actuator casing and figure 2.

Note

When the GX 3-Way actuator is equipped with the integrated FIELDVUE DVC2000 digital valve controller (figure 1), additional considerations may be required. Refer to the FIELDVUE DVC2000 Digital Valve Controller quick start guide, [D103203X012](#), for mounting instructions.

Actuator Disassembly (For Fail-Down Constructions, see figure 11)

1. Connect a separate air supply to the lower diaphragm casing via the air supply connection on the yoke (as shown in figure 11) and apply sufficient air pressure to raise the valve plug/stem off the lower seat to mid-travel.
2. Remove the stem connector nut half (key 23), stem connector bolt half (key 24), and travel indicator (key 26).
3. Push the valve plug/stem (key 3) down until it contacts the seat.
4. Loosen the locknut (key 28) and thread the lower stem connector (key 27) down until it clears the top of the valve plug/stem (key 3).
 - For HT construction, loosen locknut (key 108) and thread the stem extension (key 106) down as far as possible (see figure 12).
5. Shut off the air pressure and disconnect the separate air supply to the lower diaphragm casing (as shown in figure 11).

WARNING

To avoid personal injury or property damage due to actuator springs (key 12) being under compression, remove the long cap screws (key 16) last.

The upper actuator casing may remain fixed to the diaphragm and lower casing during disassembly, even if the casing cap screws have been loosened. If this happens, the actuator springs are still under compression. The upper casing could suddenly come loose and jump, due to the compressed energy of the springs. If the upper casing is stuck to the diaphragm and lower casing when you begin loosening the casing cap screws, pry the casings apart with a prying tool. Always ensure that the springs are dispersing energy and the upper casing is moving against the long bolts during disassembly.

6. Remove the short actuator casing cap screws and hex nuts (keys 17 and 18) first. Once these have been removed from the actuator assembly, carefully remove the long actuator cap screws and hex nuts (keys 16 and 18), alternating between them to gradually release the spring energy (compression).
7. Remove the upper diaphragm casing (key 9) and the actuator springs (key 12).
8. Lift off the actuator stem/diaphragm assembly (includes keys 22, 11, 10, 14, 13, 109, and 15) and remove the cap screw (key 14), actuator spacer (key 13), actuator rod (key 22), and washer (key 15).
9. Replace the diaphragm (key 10), actuator rod bushing (key 19), actuator rod seal (key 20), and diaphragm O-ring (key 109), as needed.

Actuator Disassembly (For Fail-Up Constructions, see figure 8)

1. Connect a separate air supply to the air supply connection on the upper casing (shown in figure 8) and apply sufficient air pressure to move the plug/stem to mid-travel.

2. Remove the stem connector nut half (key 23), stem connector bolt half (key 24), and travel indicator (key 26).
3. Shut off the air pressure and disconnect the air supply to the upper casing.

⚠ WARNING

To avoid personal injury or property damage due to actuator springs (key 12) being under compression, remove the long cap screws (key 16) last.

The upper actuator casing may remain fixed to the diaphragm and lower casing during disassembly, even if the casing cap screws have been loosened. If this happens, the actuator springs are still under compression. The upper casing could suddenly come loose and jump, due to the compressed energy of the springs. If the upper casing is stuck to the diaphragm and lower casing when you begin loosening the casing cap screws, pry the casings apart with a prying tool. Always ensure that the springs are dispersing energy and the upper casing is moving against the long bolts during disassembly.

4. Remove the short actuator casing cap screws and hex nuts (keys 17 and 18) first. Once these have been removed from the actuator assembly, carefully remove the long actuator cap screws and hex nuts (keys 16 and 18), alternating between them to gradually release the spring energy (compression).
5. Remove the upper diaphragm casing (key 9).
6. Lift off the actuator stem/diaphragm assembly (includes keys 22, 11, 10, 14, 13, 109, and 15) and remove the cap screw (key 14), actuator spacer (key 13), actuator rod (key 22), and washer (key 15).
7. Remove the actuator springs (key 12).
8. Replace the diaphragm (key 10), actuator rod bushing (key 19), actuator rod seal (key 20), and diaphragm O-ring (key 109), as needed.

Actuator Assembly (For Fail-Down Constructions, see figure 11)

1. Install the diaphragm (key 10) on the diaphragm plate (key 11). Insert the cap screw (key 14) through the actuator spacer (key 13) and place this assembly through the diaphragm/diaphragm plate assembly.
2. Place the diaphragm O-ring (key 109) and the washer (key 15) over the center hole of the diaphragm, so that the convex part of the washer is facing down toward the diaphragm and contains the O-ring. Ensure the convex part of the washer is guided in the diaphragm center hole as shown in figure 11.
3. Screw the actuator rod (key 22) onto the cap screw (key 14) and torque to 80.0 N•m (59.1 lbf•ft). Install the actuator stem/diaphragm assembly back into the actuator yoke (key 8).
4. Place the actuator springs (key 12) onto the spring locators in the diaphragm plate (key 11).
5. Install the upper diaphragm casing (key 9) so that the ribs on the top of the upper diaphragm casing are perpendicular with the yoke legs.
6. Install the 2 long cap screws (key 16) and hex nuts (key 18) 180 degrees apart from each other and in line with the actuator yoke legs.
7. Tighten the long cap screws (key 16) and hex nuts (key 18), alternating between them to gradually compress the springs, until the two casing halves and diaphragm touch.
8. Install the remaining short cap screws (key 17) and hex nuts (key 18) to the casing.
9. Tighten the actuator casing cap screws evenly using a cross-tightening procedure. Torque to 55 N•m (40 lbf•ft).
10. If you had previously removed the actuator assembly from the valve, place the actuator assembly back onto the valve body (key 1) or yoke extension (key 105, figure 12) for HT constructions. Install the four body nuts (key 7), but tighten them only finger-tight.
11. Connect a separate air supply to the actuator air supply connection (as shown on the yoke in figure 11) and apply sufficient air pressure to raise the actuator rod (key 22) to the travel stop.
12. Tighten the body nuts (key 7) evenly using a cross-tightening procedure. See table 3 for torque requirements.

- For HT constructions, the valve body nuts (key 7) are tightened at the valve body (key 1) and at the top of the yoke extension (key 105), see figure 12.
13. With the valve plug/stem (key 3) on the lower seat, thread the lower stem connector (key 27) up to match the gap setting between the actuator rod and stem adjuster nut specified in table 2. Thread the locknut (key 28) up against the stem adjuster nut and tighten to a torque of 48 N•m (35 lbf•ft) for the 10mm stems or 175 N•m (129 lbf•ft) for 14mm stems.
 - For HT constructions see figure 12. With the valve plug/stem (key 3) on the lower seat, thread the stem extension (key 106) up to match the gap setting between the actuator rod and stem extension specified in table 2. Thread the locknut (key 108) up against the stem extension and tighten to a torque of 48 N•m (35 lbf•ft) for the 10mm stems or 175 N•m (129 lbf•ft) for 14mm stems.
 14. Stroke the actuator rod until it contacts the lower stem connector (key 27), or the stem extension (key 106, figure 12) for HT construction, and install the stem connector halves and travel indicator (keys 23, 24, and 26) with the cap screws (key 25). Install the stem connector halves in the proper orientation so that when looking at the inside of the stem connector halves, the flats are down and the beveled surfaces are up.
 15. Align the pointer of the travel indicator (key 26) with the appropriate mark on the travel scale.
 16. Tighten the stem connector cap screws (key 25) to 35 N•m (26 lbf•ft).
 17. Release the actuator pressure.

Actuator Assembly (For Fail-Up Constructions, see figure 8)

1. Position the upper diaphragm casing (key 9) upside down on the bench so that it lays flat and not off balance.

Note

If converting from fail-down to fail-up action, first move the vent cap (key 21) from the top of the casing (see figure 8) and thread into the air supply connection on the yoke leg (see figure 11).

2. Install the diaphragm (key 10) on the diaphragm plate (key 11). Place the diaphragm O-ring (key 109) and the washer (key 15) over the center hole of the diaphragm, so that the convex part of the washer is facing down toward the diaphragm and contains the O-ring. Ensure the convex part of the washer is guided in the diaphragm center hole as shown in figure 8.
3. Insert the cap screw (key 14) through the washer and diaphragm, install the actuator spacer (key 13), and screw the actuator rod (key 22) onto the cap screw (key 14) finger-tight.
4. Radially align the spring locators in the diaphragm plate assembly (key 11) with the casing cap screw holes in the diaphragm (key 10). This will ensure that the springs do not cover the air path in the yoke.
5. Torque the cap screw (key 14) to the actuator rod (key 22) to 80.0 N•m (59.1 lbf•ft) and lay this assembly into the upper diaphragm casing (key 9).
6. Place the actuator springs (key 12) onto the spring locators in the diaphragm plate (key 11).
7. Set the actuator yoke (key 8) down onto the assembly that is resting in the upper diaphragm casing (key 9) so that the yoke legs are perpendicular with the ribs on the top of the upper diaphragm casing (key 9).
8. Install the 2 long cap screws (key 16) and hex nuts (key 18) 180 degrees apart from each other and in line with the actuator yoke legs.
9. Tighten the long cap screws (key 16) and hex nuts (key 18), alternating between them to gradually compress the springs, until the two casing halves and diaphragm touch.
10. Install the remaining short cap screws (key 17) and hex nuts (key 18) to the casing.
11. Tighten the actuator casing cap screws evenly using a cross-tightening procedure. Torque to 55 N•m (40 lbf•ft).

12. If you had previously removed the actuator assembly from the valve, place the actuator assembly back onto the valve body (key 1) or yoke extension (key 105, figure 12) for HT construction. Install the body nuts (key 7) and tighten evenly using a cross-tightening procedure. See table 3 for torque requirements.
 - For HT constructions, see figure 12. Ensure the valve body nuts (key 7) are tightened at the valve body (key 1) and at the top of the yoke extension (key 105).
13. With the valve plug/stem (key 3) on the lower seat, thread the lower stem connector (key 27) up to match the gap setting between the actuator rod and stem adjuster nut specified in table 2. Thread the locknut (key 28) up against the stem locknut and tighten to a torque of 48 N•m (35 lbf•ft) for 10mm stems or 175 N•m (129 lbf•ft) for 14mm stems.
 - For HT constructions see figure 12. With the valve plug/stem (key 3) on the lower seat, thread the stem extension (key 106) up to match the gap setting between the actuator rod and stem extension specified in table 2. Thread the locknut (key 108) up against the stem extension and tighten to a torque of 48 N•m (35 lbf•ft) for the 10mm stems or 175 N•m (129 lbf•ft) for 14mm stems.
14. Stroke the actuator rod until it contacts the lower stem connector (key 27), or stem extension (key 106, figure 12), and install the stem connector halves and travel indicator (keys 23, 24, and 26) with the cap screws (key 25). Install the stem connector halves in the proper orientation so that when looking at the inside of the stem connector halves, the flats are down and the beveled surfaces are up.
15. Align the pointer of the travel indicator (key 26) with the appropriate mark on the travel scale.
16. Tighten the stem connector cap screws (key 25) to 35 N•m (26 lbf•ft).

Note

For fail-up action, the air supply tubing must be connected to the actuator upper casing at the air supply connection, see figure 8. (If converting from fail-down to fail-up, the tubing will need to be re-routed to this location).

Packing Maintenance

Key numbers refer to figure 7.

Packing Adjustment

For ENVIRO-SEAL™ spring-loaded single PTFE V-ring packing (figure 7) or for ENVIRO-SEAL graphite ULF packing (figure 7), the Belleville spring pack (key 34) maintains a sealing force on the packing. If leakage is detected around the packing follower (key 29) check to be sure that the packing follower (key 29) is tight. Using a wrench, tighten the packing follower (key 29) in 1/4 turn intervals until the leakage is stopped. If leakage cannot be stopped in this manner, proceed to the Replacing Packing section in this manual.

Replacing Packing (Pneumatic Actuators)

Isolate the control valve from the line pressure, release pressure from all three inlets/outlets of the valve body and drain the process media from the valve. Shut off all pressure lines to the actuator and release all pressure from the actuator. Use lock-out procedures to ensure that the above measures stay in effect while you work on the equipment.

1. For fail-down constructions, as shown in figure 11:
 - a. Connect a separate air supply to the lower diaphragm casing via the air supply connection on the yoke (as shown in figure 11) and apply sufficient air pressure to raise the valve plug/stem off the lower seat to mid travel.

- b. Remove the stem connector nut half (key 23), stem connector bolt half (key 24), and travel indicator (key 26).
- c. Push the valve plug stem (key 3) down until it contacts the lower seat.
- d. Loosen the locknut (key 28) and thread the lower stem connector (key 27) down until it clears the top of the valve plug stem (key 3).
 - For HT construction, loosen locknut (key 108) and thread the stem extension (key 106) down as far as possible (see figure 12).
- e. Shut off the air pressure and disconnect the separate air supply to the lower diaphragm casing (as shown in figure 11).

⚠ WARNING

To avoid personal injury or property damage by uncontrolled movement of the actuator yoke (key 8), loosen the body/yoke nuts (figure 11, key 7) by following the instructions in the next step. Do not remove a stuck actuator yoke by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the actuator yoke.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

2. For fail-up constructions, as shown in figure 8:
 - a. Connect a separate air supply to the air supply connection on the upper casing (shown in figure 8) and apply sufficient air pressure to move the plug/stem to mid-travel.
 - b. Remove the stem connector nut half (key 23), stem connector bolt half (key 24), and travel indicator (key 26).
 - c. Shut off the air pressure and disconnect the air supply to the upper casing.
3. Valve body nuts (key 7) attach the actuator yoke (key 8) to the valve body (key 1). Loosen these nuts approximately 3mm (1/8 inch).
 - For HT constructions, see figure 12. Nuts (key 7) attach the yoke extension (key 105) to the valve body (key 1). Loosen these nuts approximately 3mm (1/8 inch). It is not necessary to loosen the nuts which attach the actuator yoke (key 8) to the yoke extension.
4. Then loosen the valve-to-yoke gasketed joint by either rocking the actuator yoke or prying between the valve and yoke. Work the prying tool around the yoke until it loosens.

⚠ WARNING

If there is evidence of process fluid under pressure leaking from the joint, retighten the valve body/joint nuts and return to the Warning at the beginning of the Maintenance section to ensure proper steps have been taken to isolate the valve and relieve process pressure.

5. If no fluid leaks from the joint, loosen the packing follower (key 29) two turns to relieve the packing compression load.
6. Remove the body nuts (key 7) completely.

CAUTION

To avoid property damage, place the actuator yoke on a protective surface, as described in the following procedure.

7. Carefully lift off the actuator and set it on a protective surface to prevent damage. If the bonnet (key 4) together with the valve stem plug assembly has a tendency to lift with the actuator, ensure it does not drop from the actuator.
8. Remove the lower stem connector (key 27) and locknut (key 28).
 - For HT constructions, see figure 12. Remove the stem extension (key 106) and locknut (key 108).
9. Remove the bonnet and the valve plug/stem assembly and set on a protective surface.
10. Remove the valve/yoke gasket (key 5) and cover the opening of the valve to protect the gasket surface and prevent foreign matter from getting into the valve cavity.
11. Remove the packing follower (key 29) from the bonnet (key 4).
12. Remove the Belleville spring pack (key 34) and packing spacer (key 30) from the bonnet (key 4). Carefully push out the remaining packing box parts from the bonnet (key 4) using a rounded rod or other tool which will not scratch the packing box wall. Clean the packing box and the metal packing box parts.

CAUTION

Inspect the valve stem, threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage the new packing.

13. Inspect the valve stem, threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
14. Remove the covering protecting the valve cavity and install a new valve/yoke gasket (key 5) making sure that the gasket seating surfaces are clean and smooth.

Table 4. Packing Follower Torque

Valve Size	Packing Style	Torque N•m (lbf•ft)	Packing Style	Torque N•m (lbf•ft)
DN25 and 40	ENVIRO-SEAL PTFE	10 (7.4)	ENVIRO-SEAL ULF	35 (26)
DN50, 80, and 100	ENVIRO-SEAL PTFE	23 (17)	ENVIRO-SEAL ULF	50 (37)

15. Install a new O-ring (key 81) in the groove on the bottom of the side-port common bonnet (key 4). See figure 9. Apply a general purpose silicone base lubricant.
 - For HT constructions, see figure 12. Install a new graphite seal ring (key 107). Apply a general purpose silicone base lubricant.
16. Carefully install the bonnet (key 4) onto the valve stem.
17. Install the new packing and the metal packing box parts according to figure 7 for ENVIRO-SEAL PTFE packing and according to figure 7 for ENVIRO-SEAL graphite ULF packing. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box. Apply anti-seize lubricant to the threads and install the packing follower (key 29).
18. Install the locknut (key 28) and lower stem connector (key 27). Install the valve plug/bonnet sub assembly into the valve body (key 1).

- For HT constructions, see figure 12. Install the locknut (key 108) and stem extension (key 106). Install the valve plug/bonnet sub assembly into the valve body (key 1).
19. Mount the actuator onto the valve and install the body nuts (figure 8 key 7), but tighten them only finger-tight.
 20. For fail-down constructions, connect a separate air supply to the lower diaphragm casing air supply connection (as shown in figure 11) and apply sufficient air pressure to raise the actuator rod (key 22) to the travel stop. Proceed to the next step.
For fail-up constructions, proceed to the next step.
 21. Tighten the valve body nuts (key 7) evenly using a cross-tightening procedure. See table 3 for torque requirements.
 - For HT constructions, see figure 12. Ensure the valve body nuts (key 7) are tightened at the valve body (key 1) and at the top of the yoke extension (key 105).
 22. Thread the lower stem connector (key 27) up to match the gap setting between the actuator rod and stem adjuster nut specified in table 2. Thread the locknut (key 28) up against the stem locknut and tighten to a torque of 48 N•m (35 lbf•ft) for 10mm stems or 175 N•m (129 lbf•ft) for 14mm stems.
 - For HT constructions see figure 12. With the valve plug/stem (key 3) on the lower seat, thread the stem extension (key 106) up to match the gap setting between the actuator rod and stem extension specified in table 2. Thread the locknut (key 108) up against the stem extension and tighten to a torque of 48 N • m (35 lbf • ft) for the 10mm stems or 175 N • m (129 lbf • ft) for 14mm stems.
 23. Stroke the actuator rod until it contacts the lower stem connector (key 27) or stem extension (key 106, figure 12) and install the stem connector halves and travel indicator (keys 23, 24, and 26) with the cap screws (key 25). Install the stem connector halves in the proper orientation so that when looking at the inside of the stem connector halves, the flats are down and the beveled surfaces are up.
 24. Align the pointer of the travel indicator (key 26) with the appropriate mark on the travel scale.
 25. Tighten the stem connector cap screws (key 25) to 35 N•m (26 lbf•ft).
 26. Tighten the packing follower (key 29) to the torque specified in table 4.
- Alternately, the packing follower can be tightened by the following method:
- a. Tighten the packing follower until the Belleville springs are compressed 100% (or completely flat), as detected by a rapid increase in nut torque.
 - b. Loosen the packing follower 60° of rotation.
27. For fail-down constructions, release the actuator pressure.
 28. For fail-down constructions, ensure the vent (key 21) is installed into the upper diaphragm casing (see figure 11).
 29. For fail-up constructions, ensure the vent (key 21) is installed into the actuator yoke air supply connection. See figure 8.

Replacing Packing (Electric Actuators)

Isolate the control valve from the line pressure, release pressure from all three inlets/outlets of the valve body and drain the process media from the valve. Use lock-out procedures to ensure that the above measures stay in effect while you work on the equipment.

1. Stroke the actuator so the valve plug/stem (key 3) is at mid travel.
2. Remove the stem connector nut half (key 23), stem connector bolt half (key 24), and travel indicator (key 26).
3. Use precaution to ensure the actuator is locked in position and cannot stroke.
4. Mark the position of the locknut (key 28) on the stem for reassembly.

5. Push the valve plug stem (key 3) down until it contacts the lower seat.
6. Loosen the locknut (key 28) and thread the lower stem connector (key 27) down until it clears the top of the valve plug stem (key 3).
 - For HT construction, loosen locknut (key 108) and thread the stem extension (key 106) down as far as possible (see figure 12).

⚠ WARNING

To avoid personal injury or property damage by uncontrolled movement of the actuator yoke (key 8), loosen the body/yoke nuts (figure 11, key 7) by following the instructions in the next step. Do not remove a stuck actuator yoke by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the actuator yoke.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

7. Valve body nuts (key 7) attach the actuator yoke (key 8) to the valve body (key 1). Loosen these nuts approximately 3mm (1/8 inch).
 - For HT constructions, see figure 12. Nuts (key 7) attach the yoke extension (key 105) to the valve body (key 1). Loosen these nuts approximately 3mm (1/8 inch). It is not necessary to loosen the nuts which attach the actuator yoke (key 8) to the yoke extension.
8. Then loosen the valve-to-yoke gasketed joint by either rocking the actuator yoke or prying between the valve and yoke. Work the prying tool around the yoke until it loosens.

⚠ WARNING

If there is evidence of process fluid under pressure leaking from the joint, retighten the valve body/joint nuts and return to the Warning at the beginning of the Maintenance section to ensure proper steps have been taken to isolate the valve and relieve process pressure.

9. If no fluid leaks from the joint, loosen the packing follower (key 29) two turns to relieve the packing compression load.
10. Remove the body nuts (key 7) completely.

CAUTION

To avoid property damage, place the actuator yoke on a protective surface, as described in the following procedure.

11. Carefully lift off the actuator and set it on a protective surface to prevent damage. If the bonnet (key 4) together with the valve stem plug assembly has a tendency to lift with the actuator, ensure it does not drop from the actuator.
12. Remove the lower stem connector (key 27) and locknut (key 28).
 - For HT constructions, see figure 12. Remove the stem extension (key 106) and locknut (key 108).

13. Remove the bonnet and the valve plug/stem assembly and set on a protective surface.
14. Remove the valve/yoke gasket (key 5) and cover the opening of the valve to protect the gasket surface and prevent foreign matter from getting into the valve cavity.
15. Remove the packing follower (key 29) from the bonnet (key 4).
16. Remove the Belleville spring pack (key 34) and packing spacer (key 30) from the bonnet (key 4). Carefully push out the remaining packing box parts from the bonnet (key 4) using a rounded rod or other tool which will not scratch the packing box wall. Clean the packing box and the metal packing box parts.

CAUTION

Inspect the valve stem, threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage the new packing.

17. Inspect the valve stem, threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
18. Remove the covering protecting the valve cavity and install a new valve/yoke gasket (key 5) making sure that the gasket seating surfaces are clean and smooth.
19. Install a new O-ring (key 81) in the groove on the bottom of the side-port common bonnet (key 4). See figure 9. Apply a general purpose silicone base lubricant.
 - For HT constructions, see figure 12. Install a new graphite seal ring (key 107). Apply a general purpose silicone base lubricant.
20. Carefully install the bonnet (key 4) onto the valve stem.
21. Install the new packing and the metal packing box parts according to figure 7 for ENVIRO-SEAL PTFE packing and according to figure 7 for ENVIRO-SEAL graphite ULF packing. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box. Apply anti-seize lubricant to the threads and install the packing follower (key 29).
22. Install the locknut (key 28) and lower stem connector (key 27). Ensure they are aligned with the mark made on the stem disassembly and tighten. Install the valve plug/bonnet sub assembly into the valve body (key 1).
 - For HT constructions, see figure 12. Install the locknut (key 108) and stem extension (key 106). Install the valve plug/bonnet sub assembly into the valve body (key 1).
23. Mount the actuator onto the valve and install the body nuts (figure 8 key 7), but tighten them only finger-tight.
24. Tighten the valve body nuts (key 7) evenly using a cross-tightening procedure. See table 3 for torque requirements.
 - For HT constructions, see figure 12. Ensure the valve body nuts (key 7) are tightened at the valve body (key 1) and at the top of the yoke extension (key 105).
25. Push the valve plug/stem to the valve seat. Thread the lower stem connector (key 27) and the locknut (key 28) to the previously marked position and tighten to a torque of 48 N•m (35 lbf•ft) for 10mm stems or 175 N•m (129 lbf•ft) for 14mm stems.
 - For HT constructions see figure 12. With the valve plug/stem (key 3) on the lower seat, thread the stem extension (key 106) and the locknut (key 108) to the previously marked position and tighten to a torque of 48 N•m (35 lbf•ft) for the 10mm stems or 175 N•m (129 lbf•ft) for 14mm stems.
26. Stroke the actuator rod until it contacts the lower stem connector (key 27) or stem extension (key 106, figure 12) and install the stem connector halves and travel indicator (keys 23, 24, and 26) with the cap screws (key 25). Install

the stem connector halves in the proper orientation so that when looking at the inside of the stem connector halves, the flats are down and the beveled surfaces are up.

27. Align the pointer of the travel indicator (key 26) with the appropriate mark on the travel scale.

28. Tighten the stem connector cap screws (key 25) to 35 N•m (26 lbf•ft).

29. Tighten the packing follower (key 29) to the torque specified in table 4.

Alternately, the packing follower can be tightened by the following method:

- Tighten the packing follower until the Belleville springs are compressed 100% (or completely flat), as detected by a rapid increase in nut torque.
- Loosen the packing follower 60° of rotation.

30. Ensure that the electric actuator maximum thrust output does not exceed the values in table 5.

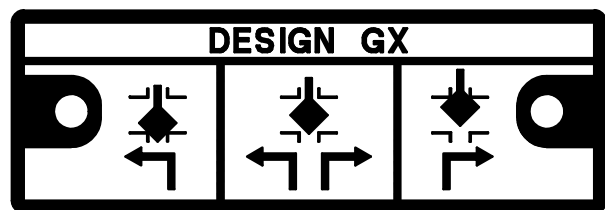
Table 5. GX 3-Way Electric Actuator Maximum Allowable Thrust

VALVE SIZE	STEM DIAMETER mm	TRAVEL mm	STEM MATERIAL	MAXIMUM THRUST FOR ACTUATOR TRAVEL UP AND DOWN	
				N	lbf
DN25-DN40 (NPS 1 to 1-1/2)	10	19	316L SST	6900	1550
DN50 (NPS 2)	14	19	316L SST	14000	3150
DN80-DN100 (NPS 3 to 4)	14	38	316L SST	14000	3150

Valve Trim Maintenance

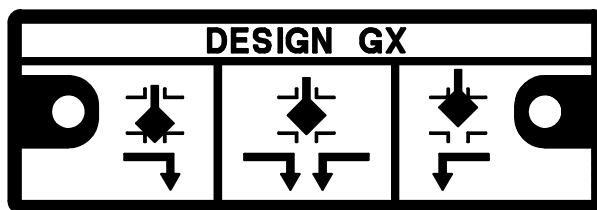
Key numbers in this section refer to figures 9 and 10. Reference the flow direction nameplate (figure 5) to determine side-port common (unbalanced) or bottom-port common (balanced) trim style.

Figure 5. Fisher GX 3-Way Flow Direction Nameplate



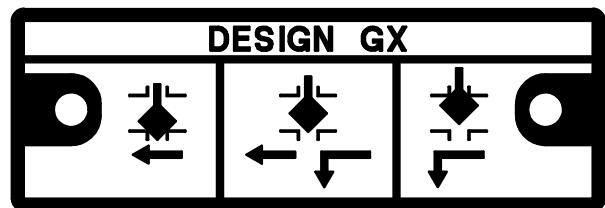
GE34806-B

BOTTOM-PORT COMMON - DIVERGING



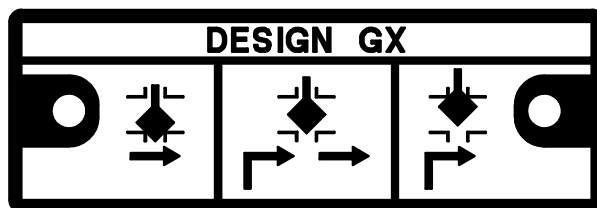
GE34807-B

BOTTOM-PORT COMMON - CONVERGING



GE34804-B

SIDE-PORT COMMON - DIVERGING



GE34805-B

SIDE-PORT COMMON - CONVERGING

Side-Port Common and Bottom-Port Common Trim Disassembly

1. Remove the actuator and bonnet assembly as described in the Replacing Packing section (steps 1 through 10).

CAUTION

Use care to avoid damaging the gasket sealing surfaces.

The surface finish of the valve stem (key 3) is critical for making a good packing seal. The seating surfaces of the seat ring or cage (key 2) and the valve plug (key 3) are critical for tight shutoff and should therefore also be treated with care and properly protected.

1. Packing parts can be removed from the bonnet if desired. Replace these parts as described in the section on Packing Maintenance.
2. Use a seat ring or cage tool made according to the dimensions in figure 6 and table 6 to remove the seat ring or cage (key 2) as follows:
 - a. Insert the tool into the valve body. Be certain the tool lugs are engaged in the corresponding recesses in the seat ring or cage.
 - b. Use care to avoid damaging or scratching the bonnet and cage guide surfaces (see figures 9 and 10).
 - c. Use a torque gun or driver having sufficient torque capabilities according to table 7. Connect the gun to a socket that snugly fits the hex head on the seat ring or cage tool.
 - d. Insert the socket onto the hex head of the seat ring or cage tool.

⚠ WARNING

Be careful to hold the torque gun, attached socket, and tool at right angles to the seat ring or cage when applying torque. Tilting the gun and socket while applying torque may cause the lugs on the seat ring or cage tool to suddenly disengage from the lugs on the seat ring or cage thus causing possible damage to the seat ring or cage and possible personal injury.

3. Remove the seat ring or cage (key 2) from the valve body.
4. Inspect parts for wear or damage that would prevent proper operation of the valve.

Side-Port Common Trim Assembly

Refer to figure 9.

1. Before installing the new seat ring, thoroughly clean the threads in the valve body. Apply suitable lubricant to the threads and to the radius surface of the seat ring (key 2). Screw the seat ring into the valve body. Using the seat ring tool, tighten the seat ring and torque according to the values in table 7. Remove all excess lubricant after tightening.
2. Clean the body/yoke gasket surfaces and install a new body/yoke gasket (key 5).
3. Remove any protective tape or covering from the valve plug/stem assembly.
4. Insert the plug/stem assembly into the seat ring.
5. Install a new bonnet O-ring (key 81) in the groove on the bonnet (see figure 9). Apply a general purpose silicone-based lubricant.
 - For HT constructions, see figure 12. Install a new graphite seal ring (key 107) in the groove on the bonnet. Apply a general purpose silicone lubricant.

CAUTION

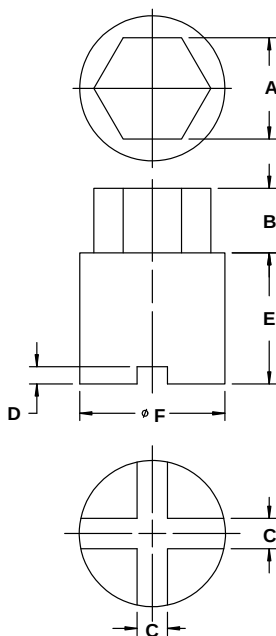
If the packing is to be reused and was not removed from the bonnet, perform the following step carefully to avoid damaging the packing with the stem threads.

6. Install bonnet, and actuator yoke onto the valve body by completing the assembly according to steps 14 to 27 of the section Replacing Packing, omitting step 17 if new packing is not being installed.

Bottom Port Common Trim Assembly

1. Once the seal ring (key 37) is removed, the elastomeric backup ring (key 38) can be pried from the groove.
2. To install a new backup ring (key 38) and seal ring (key 37) into the cage (key 2), apply a general purpose silicone-based lubricant. Slide the backup ring into the cage and into the groove. Slide the seal ring from the top into the cage over the backup ring.
3. Install a new cage O-ring (key 81) in the outer groove on the cage (see figure 10). Apply a general purpose silicone-based lubricant.
4. Before installing a new cage, thoroughly clean the threads in the valve body. Apply a suitable lubricant to the threads and to the radius surface of the cage (key 2). Screw the cage into the valve body. Using the cage tool, tighten the cage and torque according to the values in table 7. Remove all excess lubricant after tightening.

Figure 6. Seat Ring or Cage Removal and Installation Tool



GE02918-6

Table 6. Seat Ring or Cage Driver Dimensions

Valve Size		A	B	C	D	E	FØ
DN	NPS	mm					
Side-Port Common							
25	1	36	20	2X 13.2	7.5	100	53
40	1-1/2	46	28	2X 13.2	7.5	105	63
50	2	60	36	2X 15.2	8.5	121.5	93
80	3	70	44	2X 17.2	9.5	169	113
100	4	70	44	2X 17.2	9.5	169	113
Bottom-Port Common							
25	1	36	20	2X 13.2	7.5	58	53
40	1-1/2	46	28	2X 13.2	7.5	63	63
50	2	60	36	2X 15.2	8.5	80	93
80	3	70	44	2X 17.2	9.5	105	113
100	4	70	44	2X 17.2	9.5	105	113

Table 7. Seat Ring and Cage Torque Requirements

VALVE SIZE		TORQUE	
DN	NPS	N•m	lbf•ft
25	1	320	234
40	1-1/2	460	337
50	2	1020	747
80 and 100	3 and 4	1520	1113

5. Clean the body/yoke gasket surfaces and install a new body/yoke gasket (key 5).
6. Remove any protective tape or covering from the valve plug/stem assembly.

CAUTION

Be careful when inserting the plug/stem assembly into the cage. Lower the plug into the cage slowly as this will seat the seal ring to the plug. Make sure the seal ring (key 37) or backup ring (key 38) does not become disengaged from the cage groove.

7. To insert the plug/stem assembly (key 3) into the cage (key 2), apply a general purpose silicone-based lubricant. Slowly insert the plug/stem assembly into the cage.

CAUTION

If the packing is to be reused and was not removed from the bonnet, perform the following step carefully to avoid damaging the packing with the stem threads.

8. Insert the bonnet and actuator yoke onto the valve body by completing the assembly according to steps 14 to 27 of the section Replacing Packing, omitting step 17 if new packing is not being installed.

Parts Ordering

Each valve is assigned a serial number which can be found on the valve or on the nameplate (figure 2 and key 35, not shown). The nameplate will normally be fitted to the actuator. Refer to this serial number when contacting your [Emerson sales office](#) or Local Business Partner for technical assistance. When ordering replacement parts refer to this serial number and give the part description from the following parts list.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Packing Kits

PACKING KITS	Valve Size Stem Diameter	DN 25 and 40 (NPS 1 and 1-1/2) 10 mm	DN 50, 80 and 100 (NPS 2, 3 and 4) 14 mm
	ENVIRO-SEAL PTFE packing (Contains keys 32 and 33)	RGXPACX012	RGXPACX022
	ENVIRO-SEAL Graphite ULF packing (Contains keys 42, 43, and 44)	RGXPACX052	RGXPACX042

Actuator Kits

ACTUATOR KITS	Actuator Size	225	750
	Actuator (Contains keys 10, 15, 19, 109, and 20)	RGX225X0022	RGX750X0032

Bottom-Port Common Seal Kits

BOTTOM-PORT COMMON SEAL KITS ⁽¹⁾	Valve Size	DN 25 (NPS 1)	DN 40 (NPS 1-1/2)	DN 50 (NPS 2)	DN 80 and 100 (NPS 3 and 4)
	Nitrile (Contains keys 37 and 38)	RGX3WAYX012	RGX3WAYX042	RGX3WAYX072	RGX3WAYX102
	Ethylene Propylene (EPDM) (Contains keys 37 and 38)	RGX3WAYX022	RGX3WAYX052	RGX3WAYX082	RGX3WAYX112
	FKM Fluorocarbon (Contains keys 37 and 38)	RGX3WAYX032	RGX3WAYX062	RGX3WAYX092	RGX3WAYX122

1. A Gasket Kit is required when replacing the seals.

Bonnet and Cage O-Rings (not used on HT constructions)

BONNET AND CAGE O-RINGS ⁽¹⁾	Valve Size	DN 25 (NPS 1)	DN 40 (NPS 1-1/2)	DN 50 (NPS 2)	DN 80 and 100 (NPS 3 and 4)
	Nitrile O-ring (Contains key 81)	GE29466X012	GE29467X012	GE29468X012	GE29469X012
	Ethylene Propylene O-ring (EPDM) (Contains key 81)	GE29466X022	GE29467X022	GE29468X022	GE29469X022
	FKM Fluorocarbon O-ring (Contains key 81)	GE29466X032	GE29467X032	GE29468X032	GE29469X032

1. The bonnet O-ring applies to Side-Port Common trim. The cage O-ring applies to Bottom-Port Common trim.

Seal Rings (HT Construction Only)

SEAL RINGS	Valve Size	DN 25 (NPS 1)	DN 40 (NPS 1-1/2)	DN 50 (NPS 2)	DN 80 and 100 (NPS 3 and 4)
	Graphite Seal Ring (Contains key 107)	GE49062X012	GE49063X012	GE49064X012	GE49065X012

Gasket Kits

GASKET KITS	Valve Size	DN 25 (NPS 1)	DN 40 (NPS 1-1/2)	DN 50 (NPS 2)	DN 80 (NPS 3)	DN 100 (NPS 4)
	Body / Bonnet Gasket Kit (Graphite Laminate) (Contains key 5)	GE00078X012	GE00079X012	GE00080X012	GE00052X012	GE00052X012

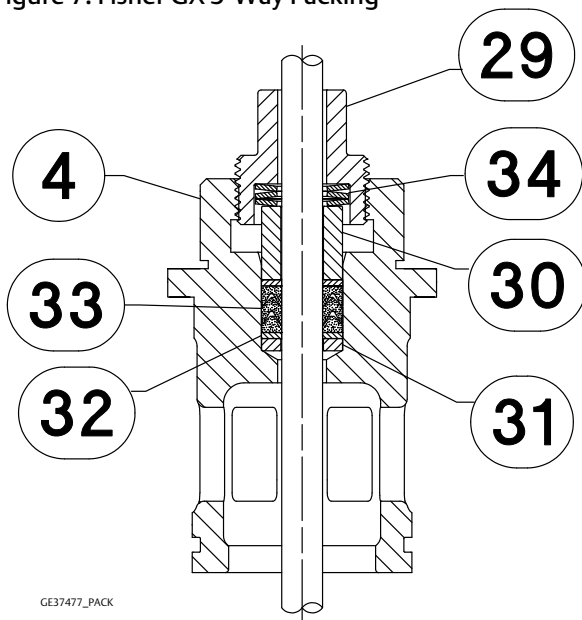
Parts List

Note

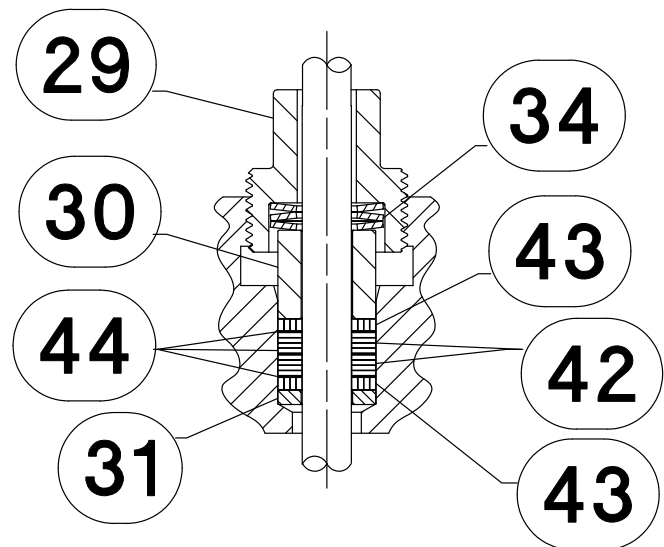
Contact your [Emerson sales office](#) or Local Business Partner for part numbers.

Key	Description	
1	Valve Body	
2*	Seat Ring or Cage	
3*	Valve Plug/Stem	
4	Bonnet	
5*	Body/Bonnet Gasket, graphite laminate	see gasket kits table
6	Body/Bonnet Bolting	
7	Body/Bonnet Nut	
8	Actuator Yoke	
9	Upper Diaphragm Casing	
10*	Diaphragm	see actuator kits table
11	Diaphragm Plate	
12	Actuator Springs	
13	Actuator Spacer	
14	Cap Screw	
15	Washer	see actuator kits table
16	Cap Screw, long	
17	Cap Screw, short	
18	Hex Nut	
19*	Yoke Bushing	see actuator kits table
20*	O-ring	see actuator kits table
21	Vent Cap	
22	Actuator Rod	
23	Stem Connector Nut Half	
24	Stem Connector Bolt Half	
25	Cap Screw	
26	Travel Indicator	
27	Lower Stem Connector	
28	Hex Nut	
29	Packing Nut	
30	Packing Spacer	
31*	Packing Box Ring	
32*	Anti-Extrusion Washer	see packing kits table
33*	ENVIRO-SEAL Packing Set	see packing kits table
34	Belleville Spring	
35	Nameplate	
36	Warning Label	
37*	Seal Ring	see bottom-port common seal kits table
38*	Backup Ring	see bottom-port common seal kits table
42*	ENVIRO-SEAL Packing Set	see packing kits table
43*	ENVIRO-SEAL Packing Set	see packing kits table
44*	Packing Washer	see packing kits table
53	Handjack Body	
54	Handjack Lever	
55	Operating Nut	
56	Drive Screw	
57	Drive Screw Washer	
58	Retaining Ring, Extension	
59	Thrust Bearing	
60	Pin Pivot	
61	Bushing	
62	Retaining Ring, Extension	
63	Lever Spacer	
64	Hex Head Cap Screw	
66	Hex Head Cap Screw	
68	Stud Bolt, Continuous Thread	
70	Lubricant, Lithium Grease	
71	Lubricant, Anti-Seize	
72	Cap Plug	
74	Travel Indicator Scale	
75	Lubricant Fitting, Straight	
76	Handwheel	
77	Hex Nut, Lock	
78	Pipe Plug	
81*	Bonnet / Cage O-ring	see bonnet and cage O-ring table
91	Protection Plate	
96	Cap Screw	
97	Warning Label	
99	Travel Stop Assy	
101	Travel Stop Warning Tag	
102	Drive Screw	
103	Flow Arrow	
105	Yoke Extension	
106	Stem Extension	
107*	Graphite Seal Ring	see seal ring table
108	Hex Nut	
109*	O-ring	see actuator kits table
110	Rod Adaptor	
111	Stud	
112	Nut	
113	Drive Screw	
114	Electric Actuator Spacer	
115	Lead Seal and Wire (not shown)	

Figure 7. Fisher GX 3-Way Packing



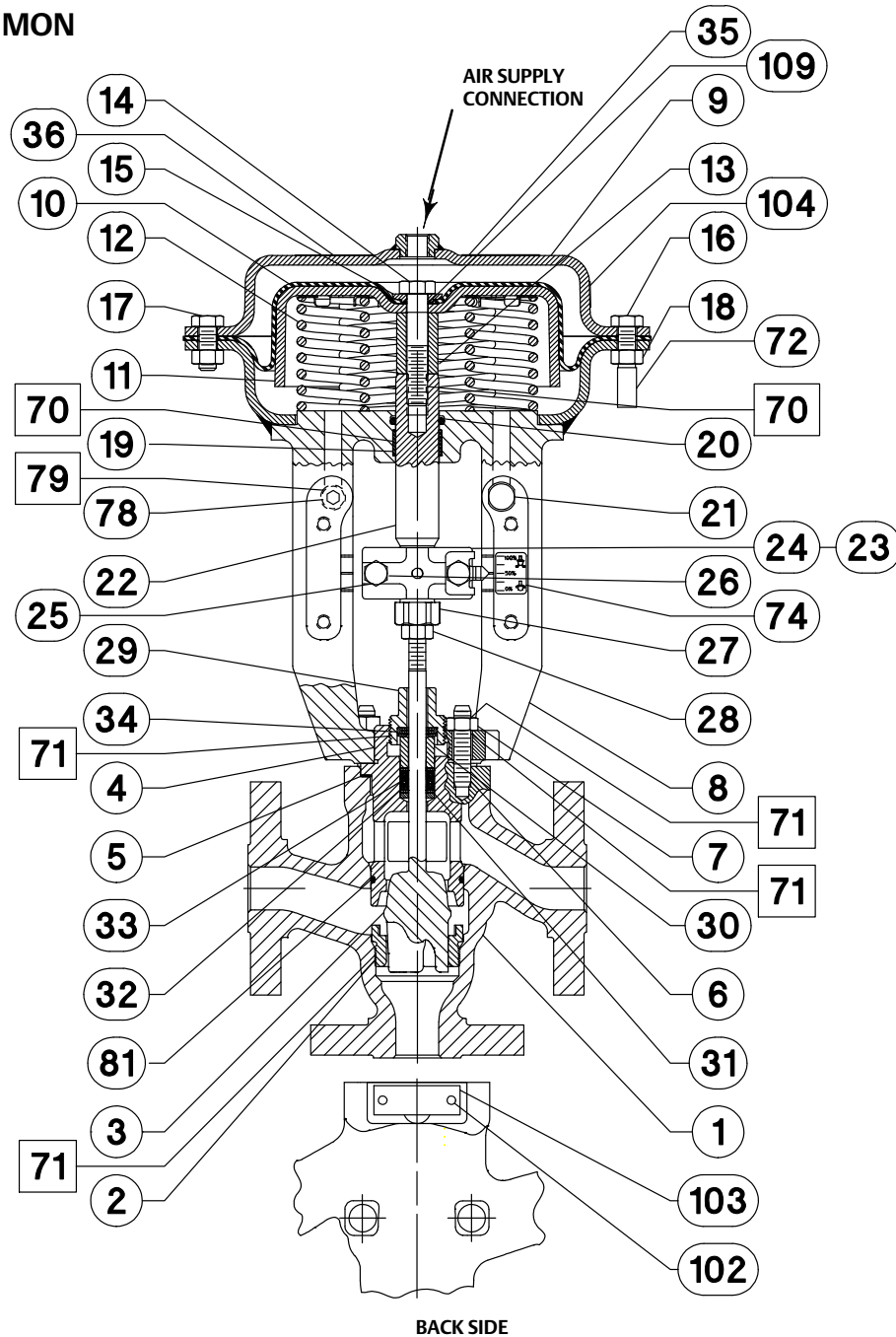
ENVIRO-SEAL PTFE PACKING



ENVIRO-SEAL GRAPHITE ULF PACKING

Figure 8. Fisher GX 3-Way Control Valve and Actuator System Assembly, Fail-Up, Side-Port Common

SIDE-PORT COMMON



☐ APPLY LUBRICANT

GE35775-D

Figure 9. Fisher GX 3-Way Side Port Common Trim Construction

SIDE-PORT COMMON

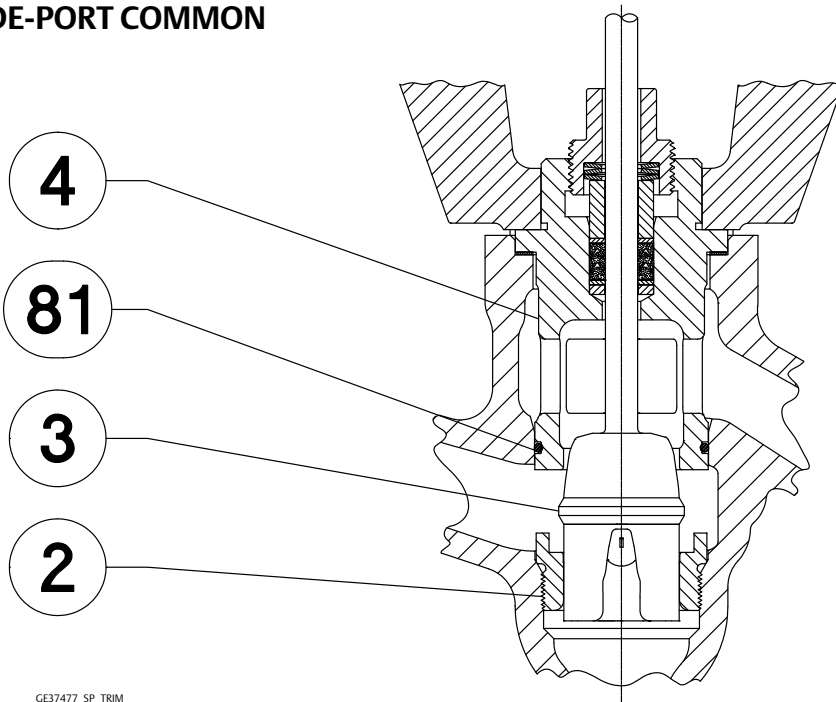


Figure 10. Fisher GX 3-Way Bottom-Port Common Trim Construction

BOTTOM-PORT COMMON

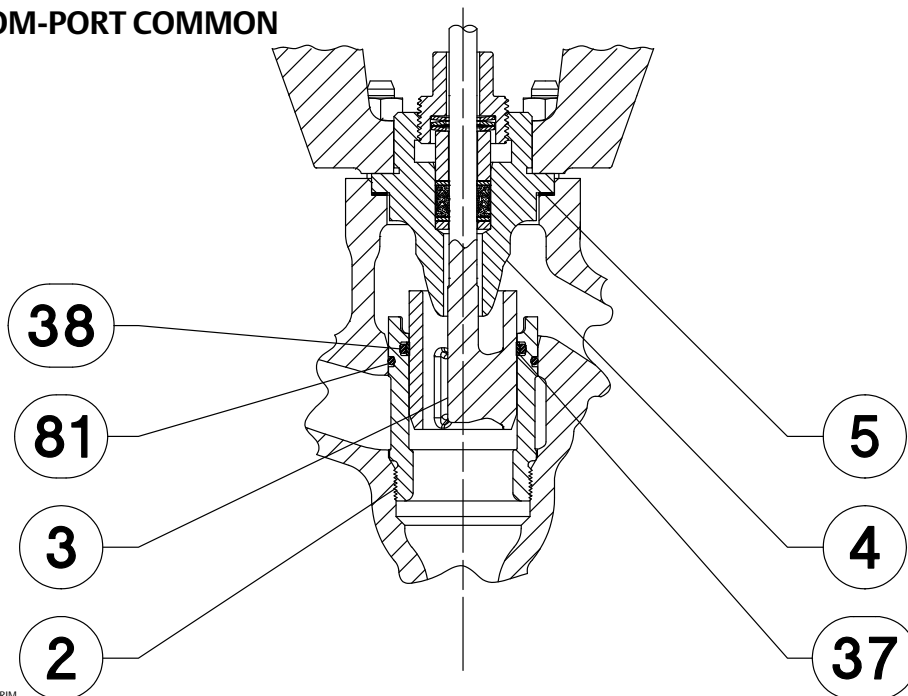
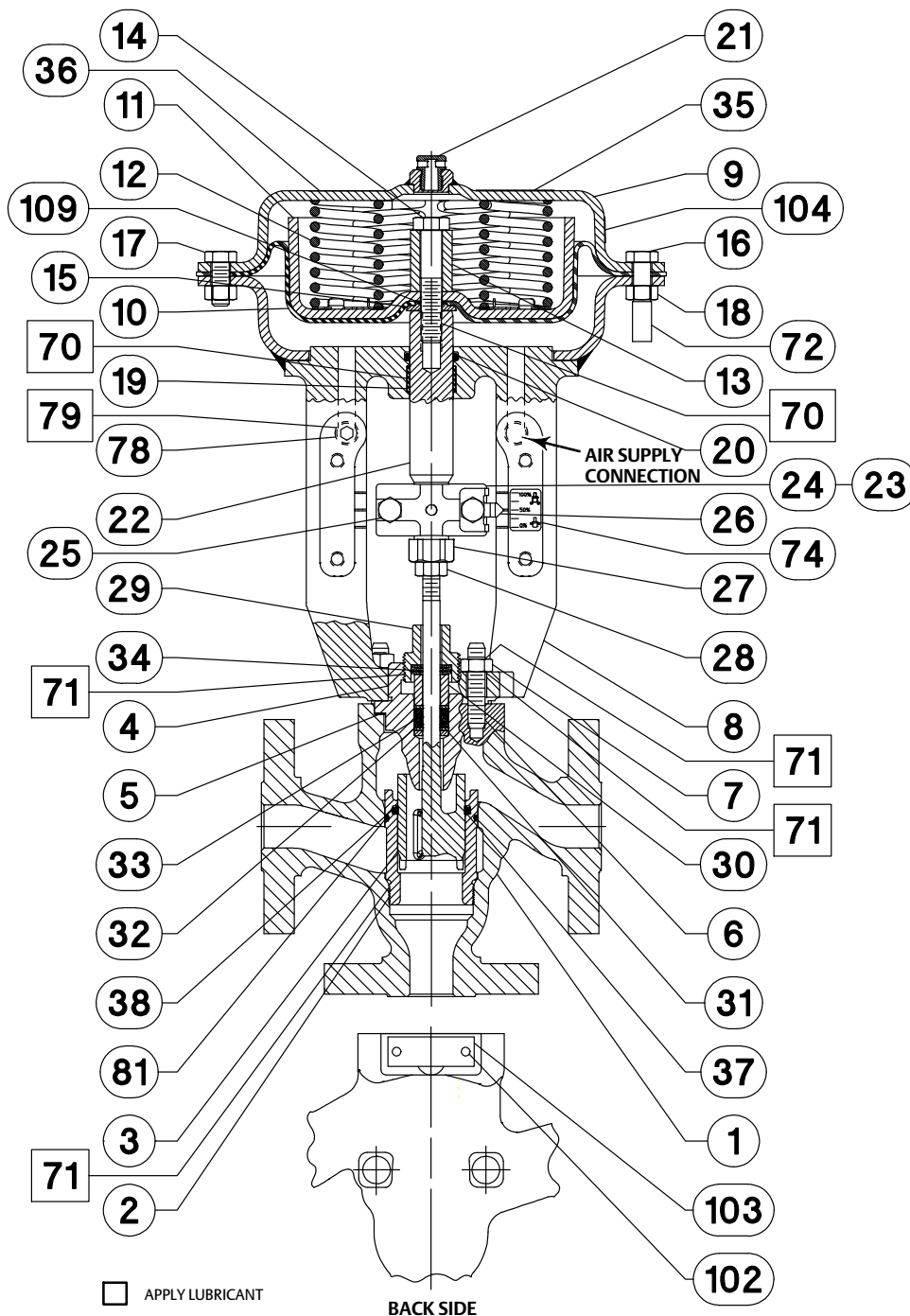


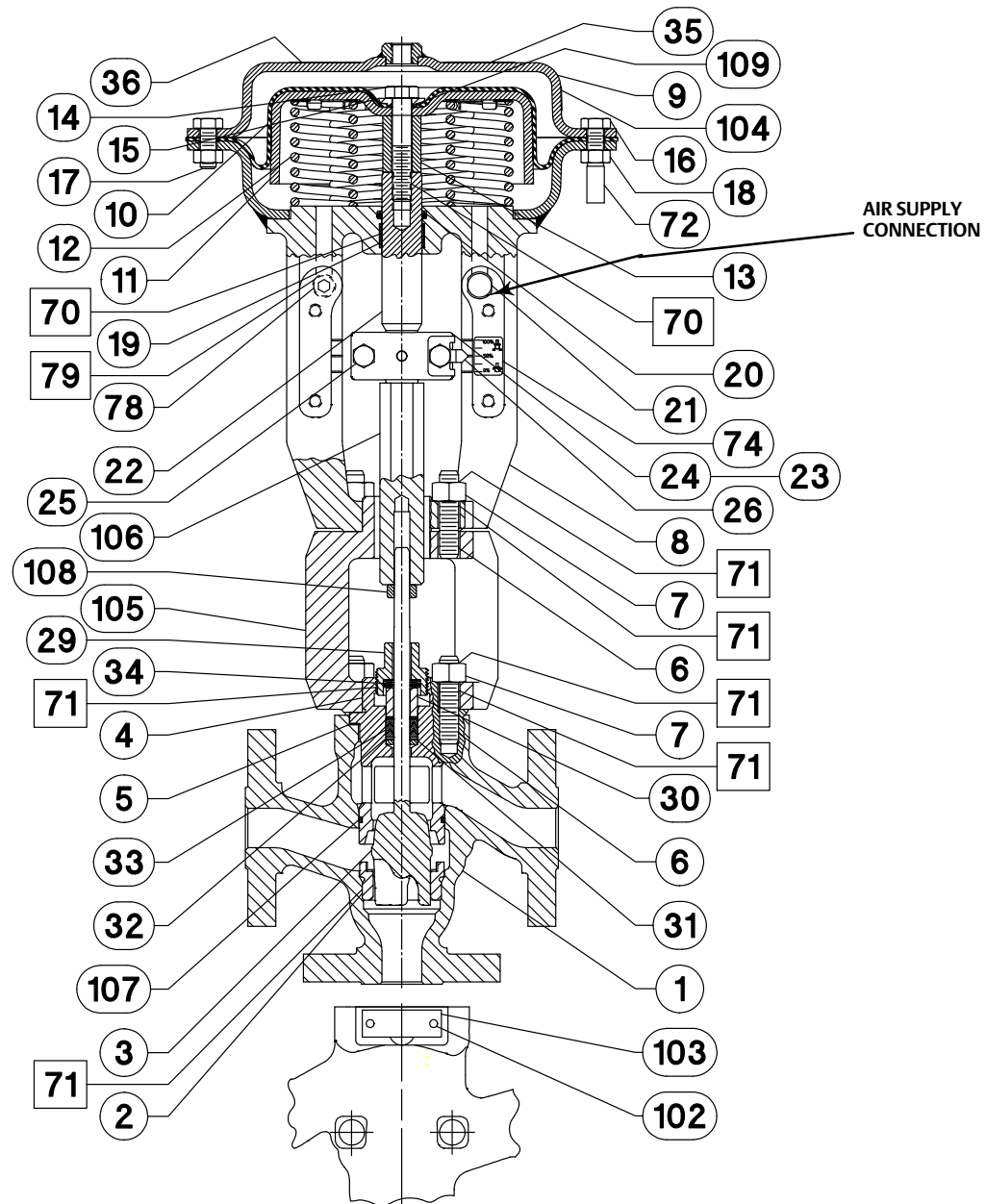
Figure 11. Fisher GX 3-Way Control Valve and Actuator System Assembly, Fail-Down, Bottom-Port Common
BOTTOM-PORT COMMON



GE35776-d

Figure 12. Fisher GX 3-Way High-Temperature Control Valve and Actuator System Assembly, Fail-Up, Side-Port Common

SIDE-PORT COMMON

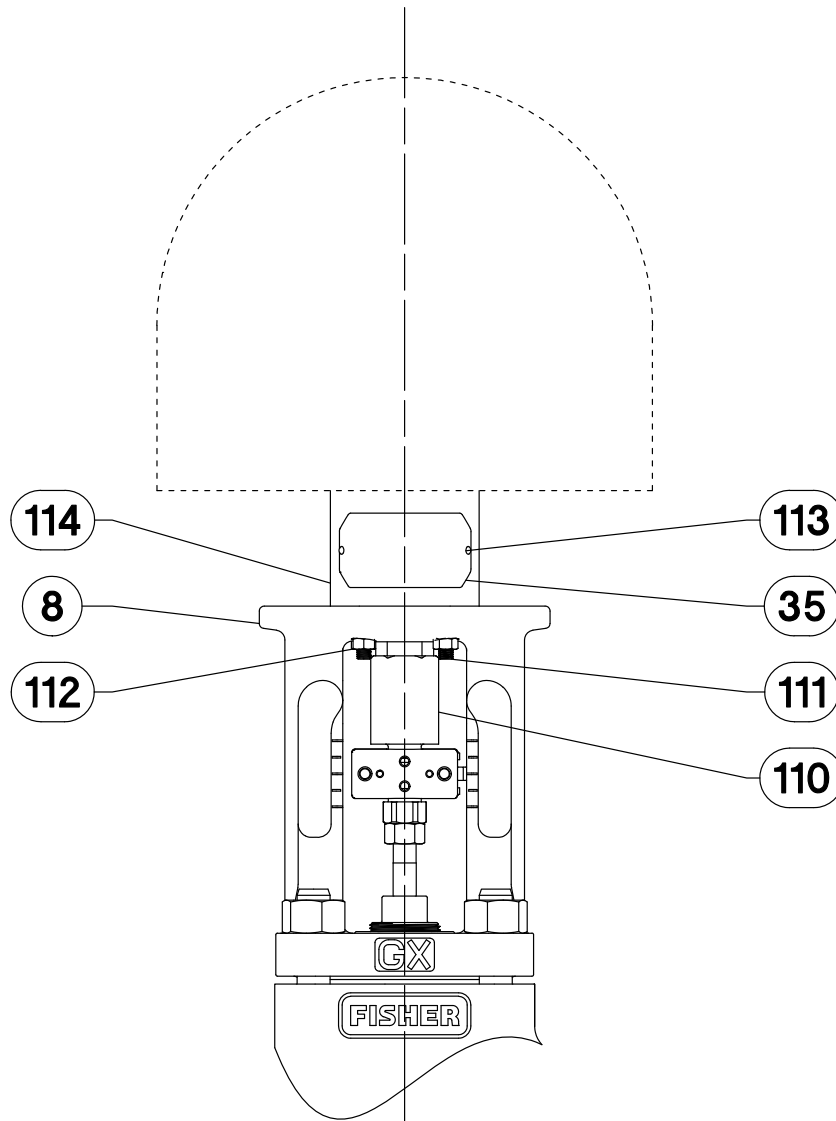


BACK SIDE

GE49204-C

☐ APPLY LUBRICANT

Figure 13. Fisher GX 3-Way Electric Actuator Mounting



GG12175-A

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D103312X012

GX 3-Way Valve and Actuator

July 2017

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

GX 3-Way Valve and Actuator

July 2017

Instruction Manual

D103312X012

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Fisher™ GX Control Valve and Actuator System



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for the Fisher GX control valve and actuator system.

WARNING



Do not install, operate or maintain a GX valve without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

1.2 Description

The GX is a compact, state-of-the-art control valve and actuator system, designed to control a wide range of process gases, vapors and fluids.

The GX is rugged, reliable and easy to select. It requires no actuator sizing—the actuator selection is automatic once the valve body construction is selected.

The GX meets the requirements of both EN and ASME standards. It is available with a complete accessory package, including the Fisher FIELDVUE™ instruments.

Figure 1. Fisher GX Control Valve, Actuator and Fisher FIELDVUE DVC7K Digital Valve Controller



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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

GX Valve and Actuator

July 2026

Instruction Manual

D103175X012

Table 1. Fisher GX Valve Specifications

Specifications	EN	ASME
Valve Body Size	DN 15, 20, 25, 40, 50, 80, 100, 150	NPS 1/2, 3/4, 1, 1-1/2, 2, 3, 4, 6
Pressure Rating	PN 10 / 16 / 25 / 40 per EN 1092-1	CL150 / 300 per ASME B16.34
End Connections	Flanged raised face per EN 1092-1	Flanged raised face per ASME B16.5
Valve Body/Bonnet Materials	1.0619 steel	ASME SA216 WCC steel
	1.4409 stainless steel	ASME SA351 CF3M stainless steel
	CW2M (sizes DN 25 through 100 only)	CW2M (NPS 1 through 4 only)
	ASME SA352 LCC	ASME SA352 LCC
	ASTM A990 CN3MCu/ASME SA351 CN7M (Cast Alloy 20) (sizes DN 25 through 100 only)	ASTM A990 CN3MCu/ASME SA351 CN7M (Cast Alloy 20) (NPS 1 through 4 only)
	CD3MN Duplex SST (sizes DN 25 through 100 only)	CD3MN Duplex SST (NPS 1 through 4 only)
	CF3 304L SST (sizes DN 25 through 100 only)	CF3 304L SST (NPS 1 through 4 only)
	- - -	M35-2 (NPS 1 through 4 only)
	- - -	N7M Alloy B2 (NPS 1 through 4 only)
Face-to-Face Dimensions	Consistent with EN 558-1 Series 1	Consistent with ANSI/ISA 75.08.01
Shutoff per IEC 60534-4 and ANSI/FCI 70-2	Metal seat - Class IV (standard)	
	Metal seat - Class V (optional)	
	PTFE seat - Class VI (optional) ⁽¹⁾	
Flow Direction	Flow-up (Cavitrol™ III trim, Flow down)	
Flow Control Characteristics	Equal Percentage and Linear	
Trim Style	Port Diameters	Trim Style Description
	4.8 mm	Micro-Flow trim (unbalanced)
	9.5, 14, 22 mm	Stem-Guided with Contoured Plug (unbalanced) or Port-Guided with Cavitrol III trim (unbalanced)
	36, 46 mm	Port-Guided Plug (unbalanced)
	70, 90, 136 mm	Balanced Trim with Contoured plug or Unbalanced Port-Guided Plug
Handwheel	Available as an option	
Travel Stop	Available as an option	
1. For 4.8 to 14 mm ports, Class VI shutoff is achieved without PTFE seat.		

1.3 Education Services

Emerson's Education Services
Phone: 800-338-8158
Email: education@emerson.com
emerson.com/en/final-control/services/valve-training

Section 2: Valve Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure or bursting of pressure retaining parts might result if service conditions exceed those for which the product was intended. To avoid injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

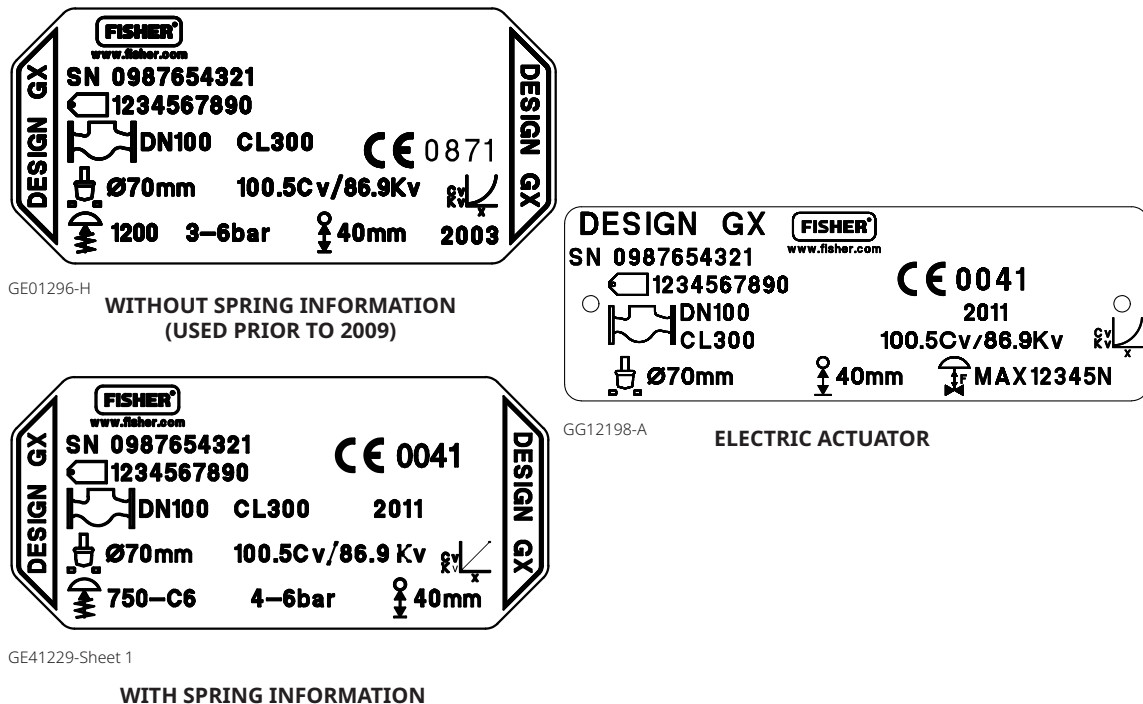
WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#). Provide the product serial number (shown on the nameplate, Figure 2) and all other pertinent information.

NOTE

The acronym of CWP may appear on the nameplate. CWP (Cold Working Pressure) denotes the pressure rating at normal ambient temperature. A normal ambient temperature range being -4 to +100°F / -20 to +38°C.

Figure 2. Fisher GX Nameplate Examples (Key 35)

**WARNING**

If you move or work on an actuator installed on a valve with loading pressure applied, keep your hands and tools away from the stem travel path to avoid personal injury. Be especially careful when removing the stem connector to release all loading on the actuator stem whether it be from air pressure on the diaphragm or compression in the actuator springs. Likewise take similar care when adjusting or removing any optional travel stop. Refer to the relevant actuator Maintenance Instructions.

NOTICE

Ensure the valve and adjacent pipelines are free of foreign material that could damage the valve seating surfaces.

1. Before installing the valve, inspect it to be certain that the valve body cavity is free of all foreign material. Clean out all pipelines to remove scale, welding slag and other foreign material.
2. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven trim wear and improper operation. With some valves, the actuator may also need to be supported when it is not vertical. For more information, consult your [Emerson sales office](#). Flow through the valve must be in the direction indicated by the arrow cast on the valve.

3. Use accepted piping practices when installing the valve in the pipeline. Use a suitable gasket between the valve and the pipeline flanges.
4. If continuous operation is required during inspection or maintenance, install isolating valves on either side of the control valve with a bypass valve to control the flow while the control valve is receiving maintenance.

WARNING

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however the packing might require some readjustment to meet specific service conditions.

Section 3: Maintenance

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from the process pressure. Relieve the process pressure from both sides of the valve.**
- **Depending on the actuator construction, it will be necessary to manage the pneumatic actuator loading pressure and any actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to ensure safe removal of the actuator from the valve.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

NOTE

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This ensures a good gasket seal because the used gasket may not seal properly.

3.1 Actuator Maintenance

For electric actuators, see the supplier's instruction manual.

The following sections provide procedures for actuator maintenance. Refer to Figures 17, 18, 19 and 20.

The actuator soft parts may require periodic replacement. This includes the diaphragm (key 10), diaphragm O-ring (key 109), actuator rod bushing (key 19) and the actuator rod seal (key 20).

If the actuator stroking direction (air-to-open or air-to-close) is unknown, refer to the nameplate on top of the actuator casing and Figure 2.

There are several optional actuator constructions, depending on supply pressure. Refer to the nameplate on the top of the actuator to determine the construction installed. Refer to Figure 3 and Table 2 for proper spring configuration.

NOTE

Older GX actuator nameplates do not contain spring configuration information. If you require replacement springs or wish to switch to an optional actuator construction, consult your [Emerson sales office](#).

NOTE

When the Fisher GX actuator is equipped with a Fisher FIELDVUE instrument, additional considerations may be required. Refer to the appropriate FIELDVUE instrument quick start guide for mounting instructions:

- Fisher FIELDVUE DVC7K Digital Valve Controller quick start guide, [D104766X012](#)
 - Fisher FIELDVUE DVC2000 Digital Valve Controller quick start guide, [D103203X012](#)
 - Fisher FIELDVUE DVC6200 Digital Valve Controller quick start guide, [D103556X012](#)
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Actuator Disassembly (For Air-to-Open Constructions - see Figure 17 or 18)

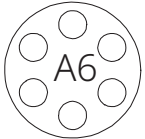
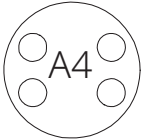
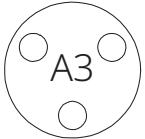
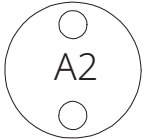
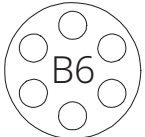
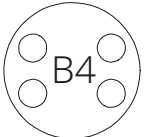
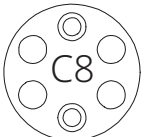
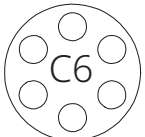
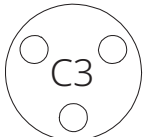
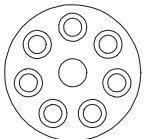
1. Connect a separate air supply to the lower diaphragm casing via the air supply connection on the yoke (as shown in Figure 17 or 18) and apply sufficient air pressure to raise the valve plug/stem off the seat to mid-travel.
2. Remove the stem connector nut half (key 23), stem connector bolt half (key 24) and travel indicator (key 26).
3. Push the valve plug/stem (key 3) down until it contacts the seat.
4. Loosen the locknut (key 28) and thread the stem adjuster nut (key 27) down until it clears the top of the valve plug/stem (key 3).
5. Shut off the air pressure and disconnect the separate air supply to the lower diaphragm casing (as shown in Figure 17 or 18).

⚠ WARNING

To avoid personal injury or property damage due to actuator springs (keys 12 and 82) being under compression, remove the long cap screws (key 16) last.

The upper actuator casing may remain fixed to the diaphragm and lower casing during disassembly, even if the casing cap screws have been loosened. If this happens, the actuator springs are still under compression. The upper casing could suddenly come loose and jump, due to the compressed energy of the springs. If the upper casing is stuck to the diaphragm and lower casing when you begin loosening the casing cap screws, pry the casings apart with a prying tool. Always ensure that the springs are dispersing energy and the upper casing is moving against the long bolts during disassembly.

Figure 3. Spring Configuration

ACTUATOR	TRAVEL	GX ACTUATOR - SPRING QUANTITY AND ARRANGEMENT				
225	20					
		6 - GE37264X012	4 - GE37264X012	3 - GE37264X012	2 - GE37264X012	
750	20					
		6 - GE00366X012	4 - GE00366X012			
750	40					
		6 - GE37344X012 AND 6 - GE40917X012	6 - GE37344X012 AND 2 - GE40917X012	6 - GE37344X012	4 - GE37344X012	3 - GE37344X012
1200	40 AND 60					
		8 - GE13551X012 AND 7 - GE13552X012				

NOTE:
CONCENTRIC CIRCLES INDICATE NESTED SPRINGS.
SPRING ARRANGEMENTS ARE SHOWN LOOKING DOWN AT LOWER CASING FROM ABOVE.

6. Remove the short actuator casing cap screws and hex nuts (keys 17 and 18) first. Once these have been removed from the actuator assembly, carefully remove the long actuator cap screws and hex nuts (keys 16 and 18), alternating between them to gradually release the spring energy (compression).
7. Remove the upper diaphragm casing (key 9) and the actuator springs (key 12 and/or 82).
8. Lift off the actuator stem/diaphragm assembly (includes keys 22, 11, 10, 14, 13, 109 and 15) and remove the cap screw (key 14), actuator spacer (key 13), actuator rod (key 22) and washer (key 15).
9. Replace the diaphragm (key 10), diaphragm O-ring (key 109), actuator rod bushing (key 19) and actuator rod seal (key 20), as needed.

Actuator Disassembly (For Air-to-Close Constructions - see Figure 19 or 20)

1. Remove the stem connector nut half (key 23), stem connector bolt half (key 24) and travel indicator (key 26).

WARNING

To avoid personal injury or property damage due to actuator springs (key 12) being under compression, remove the long cap screws (key 16) last.

The upper actuator casing may remain fixed to the diaphragm and lower casing during disassembly, even if the casing cap screws have been loosened. If this happens, the actuator springs are still under compression. The upper casing could suddenly come loose and jump, due to the compressed energy of the springs. If the upper casing is stuck to the diaphragm and lower casing when you begin loosening the casing cap screws, pry the casings apart with a prying tool. Always ensure that the springs are dispersing energy and the upper casing is moving against the long bolts during disassembly.

2. Remove the short actuator casing cap screws and hex nuts (keys 17 and 18) first. Once these have been removed from the actuator assembly, carefully remove the long actuator cap screws and hex nuts (keys 16 and 18), alternating between them to gradually release the spring energy (compression).
3. Remove the upper diaphragm casing (key 9).
4. Lift off the actuator stem/diaphragm assembly (includes keys 22, 11, 10, 14, 13, 109 and 15) and remove the cap screw (key 14), actuator spacer (key 13), actuator rod (key 22) and washer (key 15).
5. Remove the actuator springs (key 12 and/or 82).
6. Replace the diaphragm (key 10), diaphragm O-ring (key 109), actuator rod bushing (key 19) and actuator rod seal (key 20), as needed.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D103175X012

GX Valve and Actuator

July 2026

Table 2. Actuator Spring Configuration Based on Minimum Supply Pressure⁽¹⁾

ACTUATOR SIZE	TRAVEL	STEM MATERIAL	MINIMUM SUPPLY PRESSURE	SPRING CONFIGURATION	
	mm			Air-to-Open	Air-to-Close
225	20	S20910, N05500 S31603	4 bar / 58 psi	A6	A3
				A4 ⁽²⁾	A4 ⁽²⁾
			3 bar / 44 psi	A4	A3
			2 bar / 29 psi	A3	A2
225	20	S31803, N10675, N06022	4 bar / 58 psi	A6	A3
			3 bar / 44 psi	A4	A3
			2 bar / 29 psi	A3	A2
750	20	S20910, N05500 S31603	4 bar / 58 psi	B6	B4
				B6 ⁽²⁾	B6 ⁽²⁾
			3 bar / 44 psi	B6	B4
			2 bar / 29 psi	B4	B4
750	20	S31803, N10675, N06022	4 bar / 58 psi	B4	B4
			3 bar / 44 psi	B4	B4
			2 bar / 29 psi	B4	B4
750	40	S20910, N05500 S31603	4 bar / 58 psi	C12	C6
			3 bar / 44 psi	C8	C3
			2 bar / 29 psi	C4	C3
750	40	S31803, N10675, N06022	4 bar / 58 psi	C8	C6
			3 bar / 44 psi	C8	C3
			2 bar / 29 psi	C4	C3
1200	40 or 60	S20910, N05500 S31603	4 bar / 58 psi	D15	D15
			3 bar / 44 psi	D15	D15
			2 bar / 29 psi	N/A	N/A

1. Only applicable to actuators with spring information on the nameplate (see Figure 2).
2. Only applicable to Cavitrol III constructions.

Table 3. Fisher GX Maximum Rated Travel

ACTUATOR SIZE	NUMBER OF CASING BOLTS	TRAVEL
		mm
225	6	20
750	10	20 or 40
1200	16	40 or 60

Table 4. Body Nut (Key 7) Torque Requirements⁽¹⁾

VALVE SIZE	TORQUE	
	N•m	lbf•ft
DN 15, 20, 25 / NPS 1/2, 3/4, 1	45.5	33.5
DN 40 / NPS 1-1/2	79.8	58.9
DN 50 / NPS 2	79.8	58.9
DN 80 / NPS 3	163	120
DN 100 and 150 / NPS 4 and 6	282	208

1. Lubricate with anti-seize compound.

Table 5. Yoke/Extension Bonnet Nut (Key 46) Torque Requirements (used on Extension Bonnet and Bellows Bonnet Constructions)⁽¹⁾

VALVE SIZE	TORQUE	
	N•m	lbf•ft
DN 15, 20, 25, 40 and 50 / NPS 1/2, 3/4, 1, 1-1/2 and 2	79.8	58.9
DN 80 and 100 / NPS 3 and 4	163	120

1. Lubricate with anti-seize compound.

Actuator Assembly For Air-to-Open Constructions (or to Change Action to Air-to-Open - see Figure 17 or 18)

1. Install the diaphragm (key 10) on the diaphragm plate (key 11). Insert the cap screw (key 14) through the actuator spacer (key 13) and place this assembly through the diaphragm/diaphragm plate assembly.
2. Place the diaphragm O-ring (key 109) and the washer (key 15) over the center hole of the diaphragm, so that the convex part of the washer is facing down toward the diaphragm and contains the O-ring. Ensure the convex part of the washer is guided in the diaphragm center hole as shown in Figure 17 or 18.
3. Screw the actuator rod (key 22) onto the cap screw (key 14) and torque to 80 N•m / 59.1 lbf•ft. Install the actuator stem/diaphragm assembly back into the actuator yoke (key 8).
4. Place the actuator springs (key 12 and/or 82) onto the spring locators in the diaphragm plate (key 11). See Figure 3 and Table 2 for proper spring quantity and arrangement.
 - If the nameplate does not contain spring information, use the same quantity and arrangement as originally installed.
5. Install the upper diaphragm casing (key 9) so that the ribs on the top of the upper diaphragm casing are perpendicular with the yoke legs.
 - For Sizes 225 and 750 actuators, install the 2 long cap screws (key 16) and hex nuts (key 18) 180 degrees apart from each other and in line with the actuator yoke legs.
 - For Size 1200 actuators, install the 4 long cap screws (key 16) and hex nuts (key 18) 90 degrees from each other, with two of them in line with the actuator yoke legs.
6. Tighten the long cap screws (key 16) and hex nuts (key 18), alternating between them to gradually compress the springs, until the two casing halves and diaphragm touch.

7. Install the remaining short cap screws (key 17) and hex nuts (key 18) to the casing.
8. Tighten the actuator casing cap screws evenly using a cross-tightening procedure. Torque to 55 N•m / 40 lbf•ft.
9. If you had previously removed the actuator assembly from the valve, place the actuator assembly back onto the valve body (key 1). Install the four body nuts (key 7), but tighten them only finger-tight.
10. Connect a separate air supply to the actuator air supply connection (as shown on the yoke in Figure 17 or 18) and apply sufficient air pressure to raise the actuator rod (key 22) to the travel stop.

NOTE

If converting from air-to-close to air-to-open action, first move the vent cap (key 21) from the air supply connection on the yoke leg (see Figure 19 or 20) to the top of the casing (see Figure 17 or 18).

11. For standard bonnet constructions (Figures 17, 18, 19 and 20), tighten the body nuts (key 7) evenly using a cross-tightening procedure. See Table 4 for torque requirements.
For extension and bellows bonnet constructions (Figures 21 and 22), tighten the bonnet nuts (key 46) evenly using a cross-tightening procedure. See Table 5 for torque requirements.
12. With the valve plug/stem (key 3) on the seat, thread the stem adjuster nut (key 27) up until it is the rated travel distance specified in Table 3 from the actuator rod (key 22). Thread the locknut (key 28) up against the stem locknut and tighten per Table 6.

Table 6. Stem Connector Torque Values

PART	STEM MATERIAL	TORQUE	
		N•m	lbf•ft
M8 Stem Connector Cap Screws	All	35	26
M10 Stem Connector Jam Nut (Rie 4606 Coated)	S31603, S20910, N05500	48	35
	N06022, S31803, N10675	35	26
M14 Stem Connector Jam Nut	S31603, S20910, N05500	175	129
	N06022, S31803, N10675	138	102

13. Stroke the actuator rod until it contacts the stem adjuster nut (key 27) and install the stem connector halves and travel indicator (keys 23, 24 and 26) with the cap screws (key 25). Install the stem connector halves in the proper orientation so that when looking at the inside of the stem connector halves, the flats are down and the beveled surfaces are up.
14. Align the pointer of the travel indicator (key 26) with the appropriate mark on the travel scale.
15. Tighten the stem connector cap screws (key 25) to 35 N•m / 26 lbf•ft.
16. Release the actuator pressure.

NOTE

For air-to-open action, the air supply tubing must be connected to the actuator yoke at the air supply connection, see Figure 17 or 18. (If converting from air-to-close to air-to-open, the tubing will need to be re-routed to this location).

Actuator Assembly For Air-to-Close Constructions (or to Change Action to Air-to-Close - see Figure 19 or 20)

1. Position the upper diaphragm casing (key 9) upside down on the bench so that it lays flat and not off balance.

NOTE

If converting from air-to-open to air-to-close action, first move the vent cap (key 21) from the top of the casing (see Figure 17 or 18) and thread into the air supply connection on the yoke leg (see Figure 19 or 20).

2. Install the diaphragm (key 10) on the diaphragm plate (key 11). Place the diaphragm O-ring (key 109) and the washer (key 15) over the center hole of the diaphragm, so that the convex part of the washer is facing down toward the diaphragm and contains the O-ring. Ensure the convex part of the washer is guided in the diaphragm center hole as shown in Figure 19 or 20.
3. Insert the cap screw (key 14) through the washer and diaphragm, install the actuator spacer (key 13) and screw the actuator rod (key 22) onto the cap screw (key 14) finger-tight.
4. Radially align the spring locators in the diaphragm plate assembly (key 11) with the casing cap screw holes in the diaphragm (key 10). This will ensure that the springs do not cover the air path in the yoke.
5. Torque the cap screw (key 14) to the actuator rod (key 22) to 80 N•m / 59.1 lbf•ft and lay this assembly into the upper diaphragm casing (key 9).
6. Place the actuator springs (key 12 and/or 82) onto the spring locators in the diaphragm plate (key 11). See Figure 3 and Table 2 for proper spring quantity and arrangement.
 - If the nameplate does not contain spring information, use the same quantity and arrangement as originally installed.
7. Remove and replace the actuator rod bushing (key 19) and actuator rod seal (key 20) in the actuator yoke (key 8), if necessary.
8. Set the actuator yoke (key 8) down onto the assembly that is resting in the upper diaphragm casing (key 9) so that the yoke legs are perpendicular with the ribs on the top of the upper diaphragm casing (key 9).
 - For Sizes 225 and 750 actuators, install the 2 long cap screws (key 16) and hex nuts (key 18) 180 degrees apart from each other and in line with the actuator yoke legs.
 - For Size 1200 actuators, install the 4 long cap screws (key 16) and hex nuts (key 18) 90 degrees from each other, with two of them in line with the actuator yoke legs.
9. Tighten the long cap screws (key 16) and hex nuts (key 18), alternating between them to gradually compress the springs, until the two casing halves and diaphragm touch.

10. Install the remaining short cap screws (key 17) and hex nuts (key 18) to the casing.
 11. Tighten the actuator casing cap screws evenly using a cross-tightening procedure. Torque to 55 N•m / 40 lbf•ft.
 12. If you had previously removed the actuator assembly from the valve, place the actuator assembly back onto the valve body (key 1). For standard bonnet constructions (Figures 17, 18, 19 and 20), install the body nuts (key 7) and tighten evenly using a cross-tightening procedure. See Table 4 for torque requirements.

For extension and bellows bonnet constructions (Figures 21 and 22), install the bonnet nuts (key 46) and tighten evenly using a cross-tightening procedure. See Table 5 for torque requirements.
 13. With the valve plug/stem (key 3) in the closed position (on the seat), thread the stem adjuster nut (key 27) up until it is at the rated travel (see Table 3) from the actuator rod (key 22). Thread the locknut (key 28) up against the stem locknut and tighten per Table 6.
 14. Stroke the actuator rod until it contacts the stem adjuster nut (key 27) and install the stem connector halves and travel indicator (keys 23, 24 and 26) with the cap screws (key 25). Install the stem connector halves in the proper orientation so that when looking at the inside of the stem connector halves, the flats are down and the beveled surfaces are up.
 15. Align the pointer of the travel indicator (key 26) with the appropriate mark on the travel scale.
 16. Tighten the stem connector cap screws (key 25) to 35 N•m / 26 lbf•ft.
-

NOTE

For air-to-close action, the air supply tubing must be connected to the actuator upper casing at the air supply connection, see Figure 19 or 20. (If converting from air-to-open to air-to-close, the tubing will need to be re-routed to this location.)

3.2 Packing Maintenance

Key numbers refer to Figures 14, 17, 18, 19, 20, 21 and 22.

Packing Adjustment

For Fisher enhanced ENVIRO-SEAL™ spring-loaded single PTFE V-ring packing (Figure 14) or for Fisher enhanced ENVIRO-SEAL graphite ULF packing (Figure 15), the Belleville spring pack (key 34) maintains a sealing force on the packing. If leakage is detected around the packing follower (key 29) check to be sure that the packing follower (key 29) is tight. Using a wrench, tighten the packing follower (key 29) in 1/4 turn intervals until the leakage is stopped. If leakage cannot be stopped in this manner, proceed to the Replacing Packing section in this manual.

3.3 Replacing Packing (Pneumatic Actuators)

This section provides instruction on replacing packing in standard bonnets, extension bonnets and bellows extension bonnets.

Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve. Shut off all pressure lines to the actuator and release all pressure from the actuator. Use lock-out procedures to ensure that the above measures stay in effect while you work on the equipment.

1. For air-to-open constructions:
 - a. Connect a separate air supply to the lower diaphragm casing via the air supply connection on the yoke (as shown in Figure 17 or 18) and apply sufficient air pressure to raise the valve plug/stem off the seat to mid travel.
 - b. Remove the stem connector nut half (key 23), stem connector bolt half (key 24) and travel indicator (key 26).
 - c. Push the valve plug stem (key 3) down until it contacts the seat.
 - d. Loosen the locknut (key 28) and thread the stem adjustor nut (key 27) down until it clears the top of the valve plug stem (key 3).
 - e. Shut off the air pressure and disconnect the separate air supply to the lower diaphragm casing (as shown in Figure 17 or 18).
2. For air-to-close constructions, as shown in Figure 19 or 20, remove the stem connector nut half (key 23), stem connector bolt half (key 24) and travel indicator (key 26).

**WARNING**

To avoid personal injury or property damage by uncontrolled movement of the actuator yoke (key 8), loosen the body/yoke nuts (Figures 17, 18, 19 and 20, key 7) or bonnet/yoke nuts (Figures 21 and 22, key 46) by following the instructions in the next step. Do not remove a stuck actuator yoke by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the actuator yoke.

NOTE

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

3. For standard bonnet constructions (Figures 17, 18, 19 and 20), body nuts (key 7) attach the actuator yoke (key 8) to the valve body (key 1). Loosen these nuts approximately 3 mm / 1/8 in.
For extension and bellows bonnet constructions, bonnet nuts (key 46) attach the actuator yoke (key 8) to the extension bonnet (key 39). Loosen these nuts approximately 3 mm / 1/8 in.
4. Then loosen the valve-to-yoke gasketed joint by either rocking the actuator yoke or prying between the valve and actuator yoke. Work the prying tool around the actuator yoke until it loosens.

**WARNING**

If there is evidence of process fluid under pressure leaking from the joint, retighten the valve body/joint nuts and return to the Warning at the beginning of the Maintenance section to ensure proper steps have been taken to isolate the valve and relieve process pressure, thus avoiding property damage or personal injury.

5. If no fluid leaks from the joint, loosen the packing follower (key 29) two turns to relieve the packing compression load.
6. For standard bonnet constructions (Figures 17, 18, 19 and 20), remove the body nuts (key 7) completely. For extension and bellows bonnet constructions (Figures 21 and 22), remove the bonnet nuts (key 46) completely.

NOTICE

To avoid property damage, place the actuator yoke on a protective surface, as described in the following procedure.

7. Carefully lift off the actuator yoke and set it on a protective surface to prevent damage. For standard bonnet constructions, if the bonnet (key 4) together with the valve stem plug assembly has a tendency to lift with the actuator yoke, ensure it does not drop from the actuator. For extension and bellows constructions, ensure the bonnet (key 4) does not lift with the actuator yoke. For DN 150 balanced constructions, if the bonnet, guide sleeve or valve stem assembly have a tendency to lift with the actuator yoke, ensure they do not drop from the actuator.

NOTICE

For extension and bellows bonnet constructions, lifting the bonnet with the actuator yoke may cause possible damage to the valve plug and to the bellows.

8. Remove the stem adjuster nut (key 27) and locknut (key 28).
9. For standard bonnet constructions, remove the bonnet and the valve plug/stem assembly and set on a protective surface.
For extension and bellows bonnet constructions, remove only the bonnet (key 4).
For DN 150 balanced constructions, remove the guide sleeve, bonnet and valve plug stem assembly.

Table 7. Packing Follower Torque⁽¹⁾

Valve Size	Packing Style	Torque N•m / lbf•ft	Packing Style	Torque N•m / lbf•ft
DN 15, 20, 25, 40 and 50	Fisher enhanced ENVIRO-SEAL PTFE	10 / 7.4	Fisher enhanced ENVIRO-SEAL ULF	35 / 26
DN 80 and 100		23 / 17		50 / 37
DN 150		36 / 26		68 / 50

1. Lubricate with anti-seize compound.

10. Remove the valve/yoke gasket (Figures 17, 18, 19 and 20 key 5, Figures 21 and 22 key 47) and cover the opening of the valve to protect the gasket surface and prevent foreign matter from getting into the valve cavity.
11. Remove the packing follower (key 29) from the bonnet (key 4).
12. Remove the Belleville spring pack (key 34) and packing spacer (key 30) from the bonnet (key 4). Carefully push out the remaining packing box parts from the bonnet (key 4) using a rounded rod or other tool which will not scratch the packing box wall. Clean the packing box and the metal packing box parts.

**WARNING**

Inspect the valve stem, threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage the new packing.

13. Inspect the valve stem, threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
14. Remove the covering protecting the valve cavity and install a new valve/yoke gasket (Figures 17, 18, 19 and 20 key 5, Figures 21 and 22 key 47) making sure that the gasket seating surfaces are clean and smooth.

For DN 150 balanced constructions, two gaskets are required; one between the valve body and guide sleeve and the other between the guide sleeve and bonnet. Ensure the gasket seating surfaces are clean and smooth for both gaskets.
15. Carefully install the bonnet (key 4) onto the valve stem.
16. Install the new packing and the metal packing box parts according to Figure 14 for Fisher enhanced ENVIRO-SEAL PTFE packing and according to Figure 15 for Fisher enhanced ENVIRO-SEAL graphite ULF packing. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box. Apply anti-seize lubricant to the threads and install the packing follower (key 29).
17. Install the locknut (key 28) and stem adjuster nut (key 27).

For standard bonnet constructions, install the valve plug/bonnet sub assembly into the valve body (key 1).
18. Mount the actuator onto the valve and install the body nuts (Figures 17, 18, 19 and 20 key 7, Figures 21 and 22 key 46), but tighten them only finger-tight.
19. For air-to-open, connect a separate air supply to the lower diaphragm casing air supply connection (as shown in Figure 17 or 18) and apply sufficient air pressure to raise the actuator rod (key 22) to the travel stop. Proceed to the next step.

For air-to-close, proceed to the next step.
20. For standard bonnet constructions, tighten the body nuts (key 7) evenly using a cross-tightening procedure. See Table 4 for torque requirements.

For extension and bellows bonnet constructions, tighten the bonnet nuts (key 46) evenly using a cross-tightening procedure. See Table 5 for torque requirements.
21. Thread the stem lock adjuster (key 27) up until it is the rated travel distance specified in Table 3 from the actuator rod (key 22). Thread the locknut (key 28) up against the stem locknut and tighten to the torque specified in Table 6.
22. Stroke the actuator rod until it contacts the stem adjuster nut (key 27) and install the stem connector halves and travel indicator (keys 23, 24 and 26) with the cap screws (key 25). Install the stem connector halves in the proper orientation so that when looking at the inside of the stem connector halves, the flats are down and the beveled surfaces are up.
23. Align the pointer of the travel indicator (key 26) with the appropriate mark on the travel scale.
24. Tighten the stem connector cap screws (key 25) to 35 N•m / 26 lbf•ft.

Table 8. Seat Ring / Cage Torque Requirements⁽¹⁾

VALVE SIZE		TORQUE	
DN	NPS	N•m	lbf•ft
15, 20, 25	1/2, 3/4, 1	170	124
40	1-1/2	320	234
50	2	460	337
80	3	1020	747
100	4	1520	1113
150	6	3400	2500

1. Lubricate with anti-seize compound.

Table 9. Stem Extension Torque Requirements

VALVE SIZE		TORQUE	
DN	NPS	N•m	lbf•ft
15, 20, 25, 40, 50	1/2, 3/4, 1, 1-1/2, 2	40	30
80, 100	3, 4	120	89

Table 10. Bellows Nut Torque Requirements⁽¹⁾

VALVE SIZE		TORQUE	
DN	NPS	N•m	lbf•ft
15, 20, 25, 40, 50	1/2, 3/4, 1, 1-1/2, 2	350	260
80, 100	3, 4	650	480

1. Lubricate with anti-seize compound.

25. Tighten the packing follower (key 29) to the torque specified in Table 7.
Alternately, the packing follower can be tightened by the following method:
- Tighten the packing follower until the Belleville springs are compressed 100% (or completely flat), as detected by a rapid increase in nut torque.
 - For DN 15 through 100 / NPS 1/2 through 4, loosen the packing follower 60° of rotation.
For DN 150 / NPS 6, loosen the packing follower 90° of rotation.
26. For air-to-open, release the actuator pressure.
27. For air-to-open, ensure the vent (key 21) is installed into the upper diaphragm casing (see Figure 17 or 18).
For air-to-close, ensure the vent (key 21) is installed into the actuator yoke air supply connection (see Figure 19 or 20).

3.4 Replacing Packing (Electric Actuators)

This section provides instruction on replacing packing in standard bonnets, extension bonnets and bellows extension bonnets.

Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve. Use lock-out procedures to ensure that the above measures stay in effect while you work on the equipment.

1. Stroke the actuator so the valve plug/stem (key 3) is at mid travel.
2. Remove the stem connector nut half (key 23), stem connector bolt half (key 24) and travel indicator (key 26).
3. Use precaution to ensure the actuator is locked in position and cannot stroke.
4. Mark the position of the locknut (key 28) on the stem for reassembly.
5. Push the valve plug/stem (key 3) down until it contacts the seat.
6. Loosen the locknut (key 28) and thread the stem adjuster nut (key 27) down until it clears the top of the valve plug stem (key 3).



WARNING

To avoid personal injury or property damage by uncontrolled movement of the actuator yoke (key 8), loosen the body/yoke nuts (Figures 17, 18, 19 and 20, key 7) or bonnet/yoke nuts (Figures 21 and 22, key 46) by following the instructions in the following step 7 below. Do not remove a stuck actuator yoke by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the actuator yoke.

NOTE

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

7. For standard bonnet constructions (Figures 17, 18, 19 and 20), body nuts (key 7) attach the actuator yoke (key 8) to the valve body (key 1). Loosen these nuts approximately 3 mm / 1/8 in.

For extension and bellows bonnet constructions, bonnet nuts (key 46) attach the actuator yoke (key 8) to the extension bonnet (key 39). Loosen these nuts approximately 3 mm / 1/8 in.
8. Then loosen the valve-to-yoke gasketed joint by either rocking the actuator yoke or prying between the valve and actuator yoke. Work the prying tool around the actuator yoke until it loosens.



WARNING

If there is evidence of process fluid under pressure leaking from the joint, retighten the valve body/joint nuts and return to the Warning at the beginning of the Maintenance section to ensure proper steps have been taken to isolate the valve and relieve process pressure, thus avoiding property damage or personal injury.

9. If no fluid leaks from the joint, loosen the packing follower (key 29) two turns to relieve the packing compression load.
10. For standard bonnet constructions (Figures 17, 18, 19 and 20), remove the body nuts (key 7) completely.
For extension and bellows bonnet constructions (Figures 21 and 22), remove the bonnet nuts (key 46) completely.

NOTICE

To avoid property damage, place the actuator yoke on a protective surface, as described in the following procedure.

11. Carefully lift off the actuator yoke and set it on a protective surface to prevent damage.
For standard bonnet constructions, if the bonnet (key 4) together with the valve stem plug assembly has a tendency to lift with the actuator yoke, ensure it does not drop from the actuator.
For extension and bellows constructions, ensure the bonnet (key 4) does not lift with the actuator yoke.

NOTICE

For extension and bellows bonnet constructions, lifting the bonnet with the actuator yoke may cause possible damage to the valve plug and to the bellows.

12. Remove the stem adjuster nut (key 27) and locknut (key 28).
13. For standard bonnet constructions, remove the bonnet and the valve plug/stem assembly and set on a protective surface.
For extension and bellows bonnet constructions, remove only the bonnet (key 4).
14. Remove the valve/yoke gasket (Figures 17, 18, 19 and 20 key 5, Figures 21 and 22 key 47) and cover the opening of the valve to protect the gasket surface and prevent foreign matter from getting into the valve cavity.
15. Remove the packing follower (key 29) from the bonnet (key 4).
16. Remove the Belleville spring pack (key 34) and packing spacer (key 30) from the bonnet (key 4). Carefully push out the remaining packing box parts from the bonnet (key 4) using a rounded rod or other tool which will not scratch the packing box wall. Clean the packing box and the metal packing box parts.

Table 11. GX Electric Actuator Maximum Allowable Thrust

VALVE SIZE	STEM DIAMETER	TRAVEL	BONNET STYLE	STEM MATERIAL STRENGTH	MAXIMUM THRUST	
	mm	mm			N	lbf
DN 25 to 50 / NPS 1 to 2	10	20	Plain	High ⁽¹⁾	17,000	3820
				Low ⁽²⁾	7600	1710
			Bellows/ Extension	High ⁽¹⁾	11,400	2560
				Low ⁽²⁾	6700	1500
DN 80 to 100 / NPS 3 to 4	14	20, 40	Plain	High ⁽¹⁾	20,000	4500
				Low ⁽²⁾	20,000	4500
			Bellows/ Extension	High ⁽¹⁾	20,000	4500
				Low ⁽²⁾	14,500	3260

1. High strength stem materials consist of S200910, N05500 and S31603.
2. Low strength materials consist of S31803, N10675 and N06022.

WARNING

Inspect the valve stem, threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage the new packing.

17. Inspect the valve stem, threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
18. Remove the covering protecting the valve cavity and install a new valve/yoke gasket (Figures 17, 18, 19 and 20 key 5, Figures 21 and 22 key 47) making sure that the gasket seating surfaces are clean and smooth.
19. Carefully install the bonnet (key 4) onto the valve stem.
20. Install the new packing and the metal packing box parts according to Figure 14 for Fisher enhanced ENVIRO-SEAL PTFE packing and according to Figure 15 for Fisher enhanced ENVIRO-SEAL graphite ULF packing. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box. Apply anti-seize lubricant to the threads and install the packing follower (key 29).
21. Install the locknut (key 28) and stem adjustor nut (key 27). Ensure they are aligned with the mark made on the stem disassembly and tighten.
For standard bonnet constructions, install the valve plug/bonnet sub assembly into the valve body (key 1).
22. Mount the actuator onto the valve and install the body nuts (Figures 17, 18, 19 and 20 key 7, Figures 21 and 22 key 46), but tighten them only finger-tight.

23. For standard bonnet constructions, tighten the body nuts (key 7) evenly using a cross-tightening procedure. See Table 4 for torque requirements.
For extension and bellows bonnet constructions, tighten the bonnet nuts (key 46) evenly using a cross-tightening procedure. See Table 5 for torque requirements.
24. Push the valve plug/stem to the valve seat. Thread the stem adjuster nut (key 27) and locknut (key 28) to the previously marked position. Thread the locknut (key 28) up against the stem locknut and tighten to the torque specified in Table 6.
25. Stroke the actuator rod until it contacts the stem adjuster nut (key 27) and install the stem connector halves and travel indicator (keys 23, 24 and 26) with the cap screws (key 25). Install the stem connector halves in the proper orientation so that when looking at the inside of the stem connector halves, the flats are down and the beveled surfaces are up.
26. Align the pointer of the travel indicator (key 26) with the appropriate mark on the travel scale.
27. Tighten the stem connector cap screws (key 25) to 35 N•m / 26 lbf•ft.
28. Tighten the packing follower (key 29) to the torque specified in Table 7.
Alternately, the packing follower can be tightened by the following method:
 - a. Tighten the packing follower until the Belleville springs are compressed 100% (or completely flat), as detected by a rapid increase in nut torque.
 - b. For DN 15 through 100 / NPS 1/2 through 4, loosen the packing follower 60° of rotation.

NOTICE

Ensure that the electric actuator maximum thrust output does not exceed the values in Table 11. The up travel stop must be set in the electric actuator in order to prevent damage to the valve trim.

Valve Trim Maintenance

Key numbers in this section refer to Figures 17, 18, 19, 20, 21 and 22.

3.5 Valve Trim Disassembly

1. Remove the actuator and bonnet assembly as described in the Replacing Packing section (steps 1 through 10).
 - For standard bonnet constructions (Figures 17, 18, 19, 20 and 24), proceed to the Seat Ring / Cage Removal section.
 - For extension bonnet constructions (Figure 21), proceed to step 3.
 - For bellows bonnet constructions (Figure 22), proceed to step 2.

2. For bellows bonnet constructions (Figure 22), use a bellows nut tool made according to the dimensions in Figure 25 and Table 13 to remove the bellows nut (key 51) as follows:
 - a. Insert the bellows nut tool into the extension bonnet (key 39). Be certain the tool lugs are engaged in the corresponding recesses in the bellows nut.
 - b. Use a torque gun or driver having sufficient torque capabilities according to Table 10. Connect the gun to a socket that snugly fits the hex head on the bellows nut tool.
 - c. Insert the socket onto the hex head of the bellows nut tool.

**WARNING**

Be careful to hold the torque gun, attached socket and tool at right angles to the bellows nut when applying torque. Tilting the gun and socket while applying torque may cause the lugs on the bellows nut tool to suddenly disengage from the lugs on the bellows nut thus causing possible damage to the bellows nut and possible personal injury.

- d. Remove the bellows nut (key 51).
3. For both extension and bellows bonnet constructions: Body nuts (key 7) attach the extension bonnet (key 39) to the valve body (key 1). Loosen these nuts approximately 3 mm / 1/8 in. Then loosen the extension bonnet-to-body gasketed joint by either rocking the extension bonnet or prying between the body and extension bonnet. Work the prying tool around the extension bonnet until it loosens.
4. Remove the body nuts (key 7) completely and carefully lift the extension bonnet (key 39) and valve plug/stem extension assembly (keys 3, 40 and 48) or plug/bellows/stem extension assembly (keys 3, 49 and 48) from the top of the valve body.
5. Use a wrench to unscrew the plug/stem assembly (key 3) from the stem extension (key 40) or from bellows/stem assembly (key 49) as follows:
 - a. Insert the wrench onto the stem extension hex flats (see Figures 21 and 22).

NOTICE

In the following procedure, take precautions to ensure the valve plug and stem finish are not damaged.

- b. Clamp the plug/stem assembly (key 3) and holding it stable, unscrew the stem extension (key 40) or bellows/stem assembly (key 49). Take precautions to ensure the valve plug and stem finish are not damaged.

NOTE

There is a stem assembly locking insert (Figures 21 and 22, key 48) in the valve plug/stem extension assembly. It is possible this insert may drop out during stem disassembly. If this is the case, ensure it is retained for reassembly of the valve stem to the stem extension.

6. Remove the plug/stem assembly (key 3) and bellows/stem assembly (key 49) from the extension bonnet. Remove the bellows gasket (key 50).
7. Proceed to the seat ring removal section.

3.6 Seat Ring / Cage Removal

NOTICE

Use care to avoid damaging the gasket sealing surfaces.

The surface finish of the valve stem (key 3) is critical for making a good packing seal. The seating surfaces of the seat ring (key 2), cage (key 99) and the valve plug (key 3) are critical for tight shutoff and should therefore also be treated with care and properly protected.

1. Packing parts can be removed from the bonnet if desired. Replace these parts as described in the section on Packing Maintenance.
2. Use a seat ring tool made according to the dimensions in Figure 4 and Table 12 to remove the seat ring (key 2) as follows:
 - a. Insert the tool into the valve body. Be certain the tool lugs are engaged in the corresponding recesses in the seat ring.
 - b. Use a torque gun or driver having sufficient torque capabilities according to Table 8. Connect the gun to a socket that snugly fits the hex head on the seat ring tool.
 - c. Insert the socket onto the hex head of the seat ring tool.



WARNING

Be careful to hold the torque gun, attached socket and tool at right angles to the seat ring when applying torque. Tilting the gun and socket while applying torque may cause the lugs on the seat ring tool to suddenly disengage from the lugs on the seat ring thus causing possible damage to the seat ring and possible personal injury.

3. Remove the seat ring (key 2) from the valve body.
4. Inspect parts for wear or damage that would prevent proper operation of the valve body.
5. Replace trim parts as necessary.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

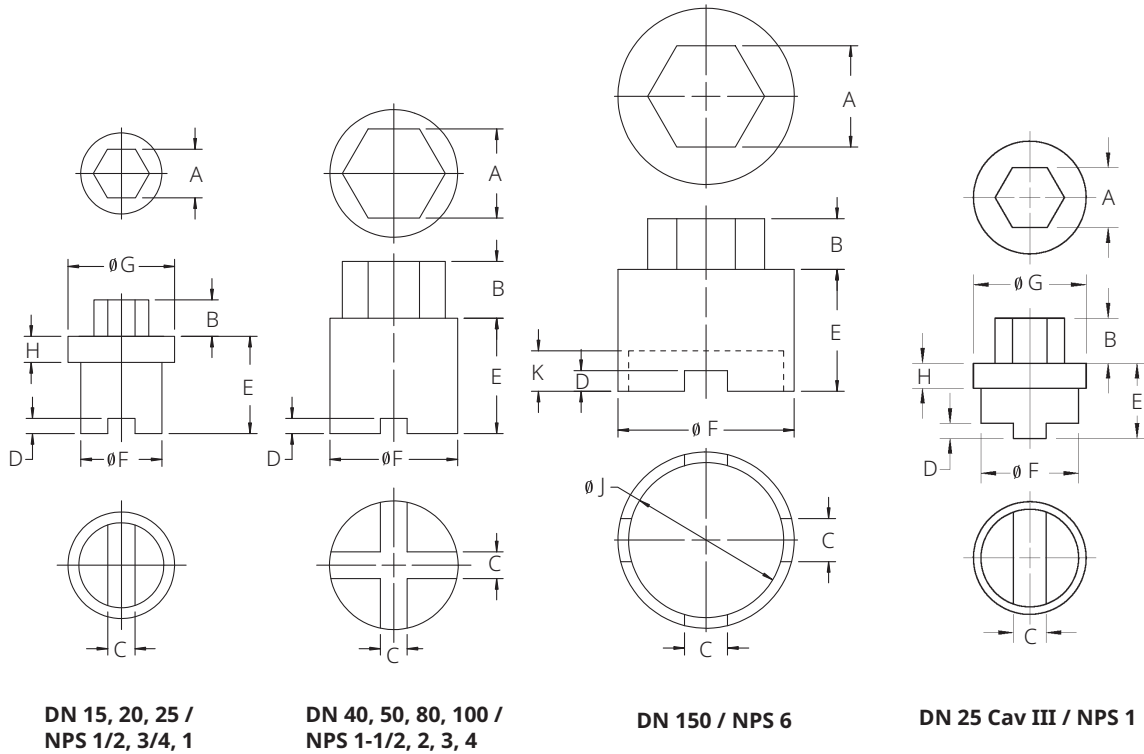
Instruction Manual

D103175X012

GX Valve and Actuator

July 2026

Figure 4. Seat Ring Removal and Installation Tool



GE02918-6

GG01215

Table 12. Seat Ring Removal and Installation Tool Dimensions

VALVE SIZE		PART NUMBER	A	B	C	D	E	FØ	GØ	H	JØ	K
DN	NPS		mm									
15, 20, 25	1/2, 3/4, 1	GE02918X012	24	15	15.2	9	54	40	45	10	---	---
25 (Cavitrol III)	1 (Cavitrol III)	Not Available	24	18	13	6	30	39	45	10	---	---
40 ⁽¹⁾	1-1/2 ⁽¹⁾	GE02918X022	36	20	2 X 13.2	7.5	58	53	---	---	---	---
50 ⁽¹⁾	2 ⁽¹⁾	GE02918X032	46	28	2 X 13.2	7.5	63	63	---	---	---	---
80	3	GE02918X042	60	36	2 X 15.2	8.5	100	93	---	---	---	---
100	4	GE02918X052	70	44	2 X 17.2	9.5	114	113	---	---	---	---
150	6	GE02918X062	100	50	2 X 43	10.5	170.5	174	---	---	153	20

1. Also used for Cavitrol III cage removal.

3.7 Valve Trim Assembly

Assembly of Unbalanced Trim

Refer to Figures 11, 17, 18, 19, 20, 21, 22 and 24.

1. Before installing the new seat ring / cage, thoroughly clean the threads in the valve body port. Apply suitable lubricant to the threads and to the 60° surface of the new seat ring (key 4). Screw the seat ring into the valve body. Using the seat ring tool, tighten the seat ring and torque according to the values in Table 8. Remove all excess lubricant after tightening.
2. For standard bonnet constructions, perform the following. (Proceed to step 3 for extension and bellows bonnets.)
 - a. Clean the body/yoke gasket seating surfaces and install a new body/yoke gasket (key 5).
 - b. Remove any protective tape or covering from the valve plug/stem assembly.
 - c. Insert the valve plug/stem assembly into the seat ring.

NOTICE

If the packing is to be reused and was not removed from the bonnet, perform the following step carefully to avoid damaging the packing with the stem threads.

- d. Install bonnet and actuator yoke onto the valve body by completing the assembly according to steps 15 to 27 of the section Replacing Packing, omitting step 16 if new packing is not being installed.
3. For extension and bellows bonnet constructions, perform the following.
 - a. For bellows bonnet constructions, clean the extension bonnet/bellows gasket seating surfaces and install a new bellows gasket (key 50).
 - b. Remove any protective tape or covering from the valve plug/stem assembly (key 3). Then insert the plug/stem assembly (key 3) through the extension bonnet bushing (key 41).
 - c. Remove any protective tape or covering from the stem extension (key 40) or the bellows stem assembly (key 49). Screw the plug/stem assembly (key 3) into the stem extension or bellows/stem assembly. Note: Do not apply lubricant to the threads of the plug/stem assembly (key 3) or the bellows/stem assembly (key 49).

NOTE

Ensure the stem assembly locking insert (Figures 21 and 22, key 48) has been first inserted in the bottom of the threaded hole in the stem extension.

NOTICE

In the following procedure, take precautions to ensure the valve plug and stem finish are not damaged.

- d. Clamp the plug/stem assembly (key 3) and hold it stable. Using a box spanner tool tighten the plug/stem assembly (key 3) into the stem extension (key 40) or into the bellows/stem assembly (key 49) according to the stem extension torque requirements listed in Table 9. Take precautions to ensure the valve plug and stem finish are not damaged.
- e. For bellows bonnet constructions, if using a N10276/PTFE bellows gasket install PTFE washer (key 120) on top of the bellows flange. Apply suitable lubricant to the threads and to the bottom surface of the bellows nut (key 51). Screw the bellows nut into the extension bonnet. Using the bellows nut tool, a lathe or boring mill, tighten the bellows nut or torque according to the values in Table 10. Remove all excess lubricant.
- f. Clean the body/extension bonnet seating gasket surface and install the gasket (key 5).
- g. Install the extension bonnet and plug/stem assembly onto the valve body. Install the body/yoke nuts (key 7) and tighten evenly using a cross-tightening procedure. See Table 4 for torque requirements.

NOTICE

If the packing is to be reused and was not removed from the bonnet, perform the following step carefully to avoid damaging the packing with the stem threads.

- h. Install the bonnet and actuator yoke onto the extension bonnet by completing the assembly according to steps 15 to 27 of the section Replacing Packing, omitting step 16 if new packing is not being installed.

Assembly of Balanced Trim

(Available in DN 80, 100 and 150 / NPS 3, 4 and 6 only.)

Refer to Figure 9.

NOTICE

To protect the valve plug seal ring (key 37) and to ensure it seals properly, be careful not to scratch the surfaces of the ring groove in the valve plug or any of the surfaces of the replacement ring.

1. With the valve plug (key 3) removed according to the Disassembly portion of the Valve Trim Maintenance procedure, proceed as appropriate:

The seal ring (key 37) cannot be reused because it is a closed ring which must be pried and/or cut from the groove. Once the seal ring is removed, the elastomeric backup ring (key 38), which is also a closed ring, can be pried from the groove.

To install a new backup ring and seal ring onto the valve plug, apply a general purpose silicone-base lubricant to both rings (keys 38 and 37). Place the backup ring over the valve plug (key 3) and into the groove. Place the seal ring over the top edge of the valve plug (key 3) so that it enters the groove on one side of the valve plug. Slowly and gently stretch the seal ring and work it over the top edge of the valve plug. The PTFE material in the seal ring must be permitted time to cold-flow during the stretching procedure, so avoid jerking sharply on this ring. Stretching the seal ring over the valve plug may make it seem unduly loose when in the groove, but it will contract to its original size after insertion into the bonnet.

2. Install the seat ring, valve plug/stem, bonnet and actuator yoke into the valve body by completing the assembly according to steps 1 to 3 of the section Assembly of Unbalanced Trim.

3.8 Repair Nameplate

If required by the end-user, an optional repair nameplate is available for recording changes made to the valve trim during maintenance (see Figure 28). This nameplate can be ordered as a spare part and is easily mounted to the actuator casing using a casing bolt. (Reference the Parts Ordering section of this manual.)

As shown in Figure 28, the repair nameplate provides locations for maintenance personnel to record trim data, such as:

- Date of maintenance
- Trim material
- Port diameter
- Flow capacity (C_V / K_V)
- Flow characteristic
- Actuator Action ATO/ATC

Bellows Maintenance

This section provides instruction on the replacement of the bellows / stem assembly (see key 49 in Figure 22).

1. Remove the actuator, bonnet assembly as described in the Replacing Packing section (steps 1 through 10).
2. Remove the plug/stem assemblies as described in the Valve Trim Disassembly section (steps 2 through 6).
3. To install the new bellows / stem assembly (key 49), perform the Valve Trim Assembly (step 3).

Figure 5. Fisher GX Handwheel Assembly

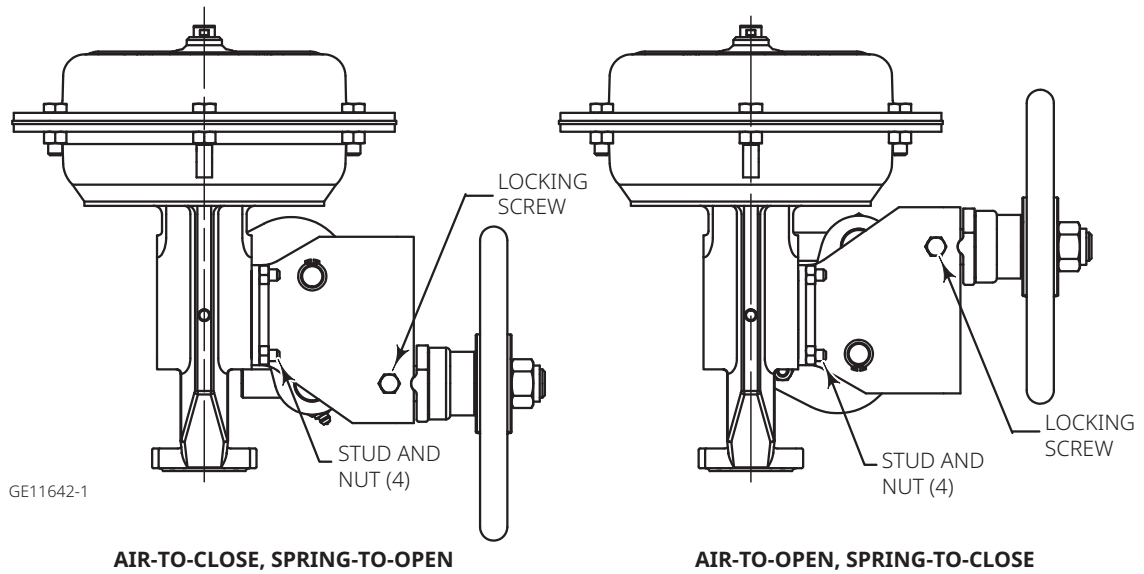
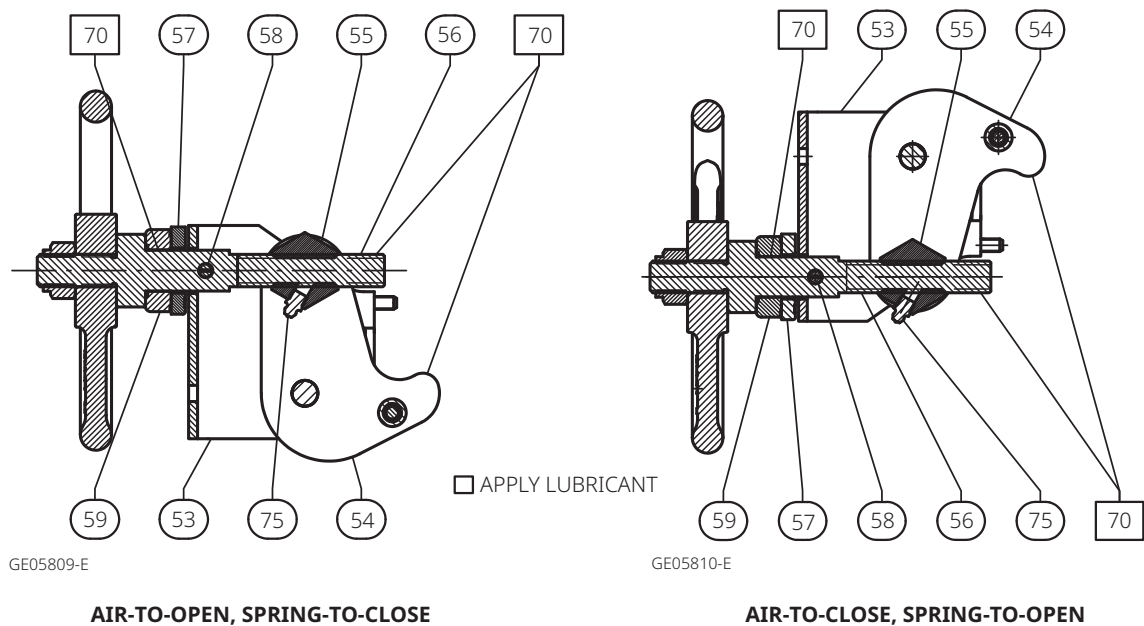


Figure 6. Fisher GX Handwheel Orientation and Grease Zerk Location



Section 4: Handwheel Operation

NOTICE

This handwheel is designed only for use with Sizes 225 and 750 actuators with 20 mm travel. To avoid equipment damage, do not assemble this handwheel on Size 750 actuators with 40 mm travel or Size 1200 actuators.

4.1 Principle of Operation

The GX handwheel is designed to compress the actuator springs and override the actuator fail action. Turning the handwheel drives the screw, nut and levers. The levers push against the stem connector to transfer this motion. Reversing the direction of the handwheel will move the nut and levers in the opposite direction. Once the levers are no longer in contact with the stem connector, the locking screw should be used to secure the handwheel against undesired movement. To prevent damage due to overtravel, the handwheel should not be turned more than 2 full turns past the point at which the levers no longer contact the stem connector.

⚠ WARNING

To avoid personal injury or loss of process control due to equipment damage, ensure the levers are completely disengaged and the locking screw is tight while the valve is in normal pneumatic operation.

During normal pneumatic operation when the handwheel is not needed, a locking screw (see Figure 5) is provided on the side of the handwheel housing to lock the handwheel levers out of the way.

⚠ WARNING

To avoid personal injury or equipment damage due to possible sudden shifting or falling of the valve assembly, do not lift the valve assembly by the handwheel.

4.2 GX Handwheel Installation (for use with 20 mm travel only)

1. Note the orientation of the levers to the stem connector for either the air-to-close, spring-to-open configuration or for the air-to-open, spring-to-close configuration, as shown in Figure 6.
2. Adjust the handwheel to allow positioning the levers above the stem connector before installation.
3. Install the handwheel to the GX mounting pad with four studs and nuts, as shown in Figure 5. Torque to 24 N•m / 18 lbf•ft.
4. Apply lithium grease to the grease zerk and to the tip of the levers (where they contact the stem connector), as shown in Figure 6.

Section 5: Travel Stop Operation

5.1 Principle of Operation

NOTICE

This travel stop is designed only for use with Sizes 225 and 750 actuators with 20 mm travel. To avoid equipment damage, do not assemble this travel stop on Size 750 actuators with 40 mm travel or Size 1200 actuators.

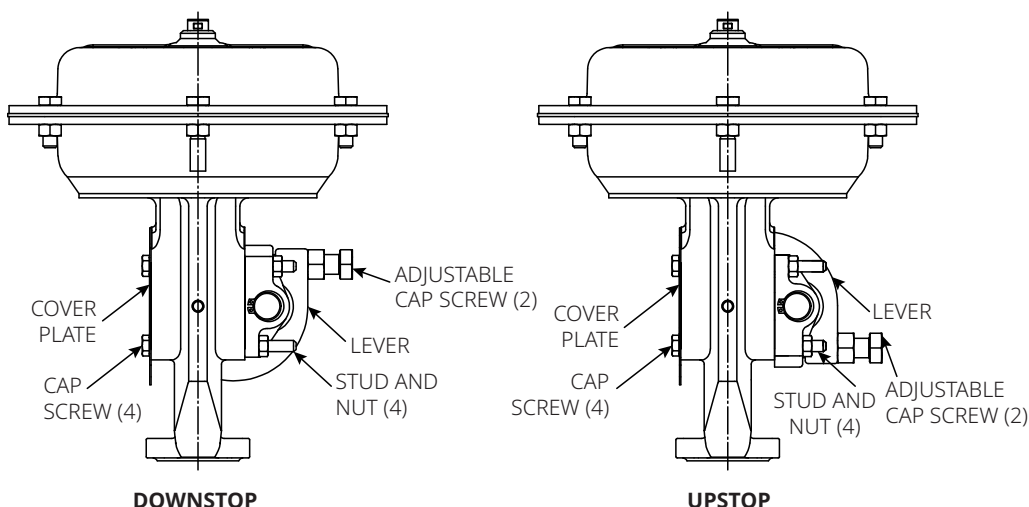
The GX travel stop is designed to mechanically limit and stop the valve at a preset position in an emergency or upon loss of instrument air. This assembly is mounted on the yoke with four studs. The lever pushes against the stem connector to stop the travel. Travel position can be adjusted by two adjustable cap screws on the lever, as shown in Figure 7. A cover plate assembly is available to prevent pinch point damage caused by the lever, as shown in Figure 7.

⚠ WARNING

To avoid personal injury or equipment damage due to possible sudden shifting or falling of the valve assembly, do not lift the valve assembly by the travel stop.

To avoid personal injury or loss of process control due to equipment damage, screw the adjustable cap screws to ensure the lever is completely disengaged while the valve is in normal pneumatic operation.

Figure 7. Fisher GX Travel Stop Assembly



5.2 GX Travel Stop Installation

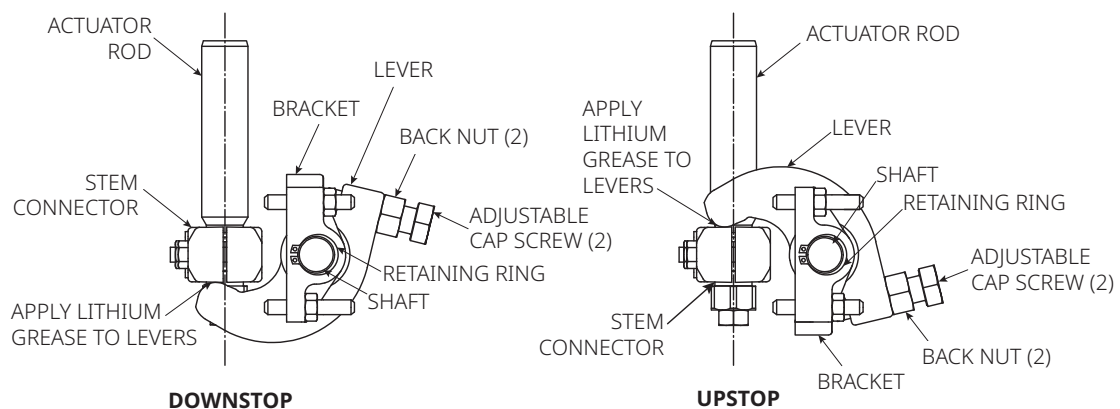
Downstop

1. Note the orientation of the lever to the stem connector for downstop positioning, as shown in Figure 8. Adjust the travel stop to allow positioning the lever below the stem connector before installation.
2. Install the travel stop to the GX mounting pad with four studs and nuts, as shown in Figure 7. Torque to 24.5 N•m / 18 lbf•ft.
3. Apply lithium grease to the tip of the lever (where it contacts the stem connector) and to the two adjustable cap screws, as shown in Figure 8.

Upstop

1. Note the orientation of the lever to the stem connector for upstop positioning, as shown in Figure 8. Adjust the travel stop to allow positioning the lever above the stem connector before installation.
2. Install the travel stop to the GX mounting pad with four studs and nuts, as shown in Figure 7. Torque to 24.5 N•m / 18 lbf•ft.
3. Apply lithium grease to the tip of the lever (where it contacts the stem connector) and to the two adjustable cap screws, as shown in Figure 8.

Figure 8. Fisher GX Travel Stop Orientation



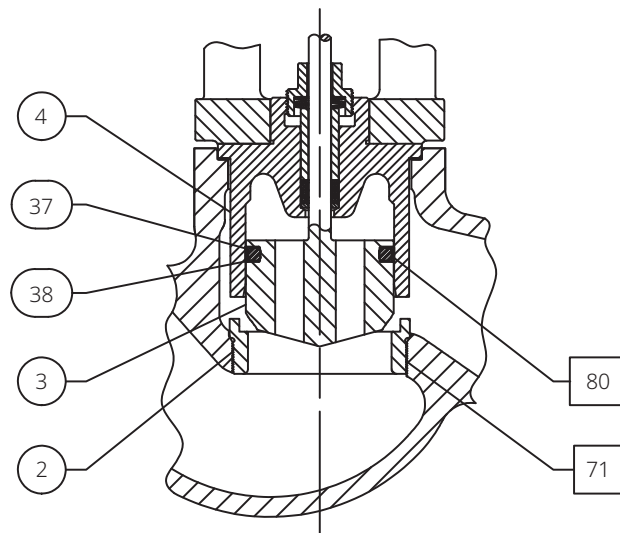
5.3 Setting the Travel Stop Position

After sending the required position air signal to the actuator, screw the adjustable cap screws to assure the lever contacts with the stem connector tightly, then tighten the back nut. Check the actual stem position when giving the 100% air signal.

Standard Accuracy for the travel stop position is $\pm 10\%$ for 20 mm travel. For added precision, use the following procedure.

1. Send the desired position air signal to the actuator.
2. Set the travel stop, screw the adjustable cap screws to assure the lever contacts with the stem connector tightly, then tighten the back nut.
3. Send a 100% air signal.
4. Measure the difference between the actual stem position and the desired position.
5. Send the air signal for the desired position minus the differential position measured in step 4.
6. Reset the travel stop by adjusting the two cap screws and then tighten the back nut.

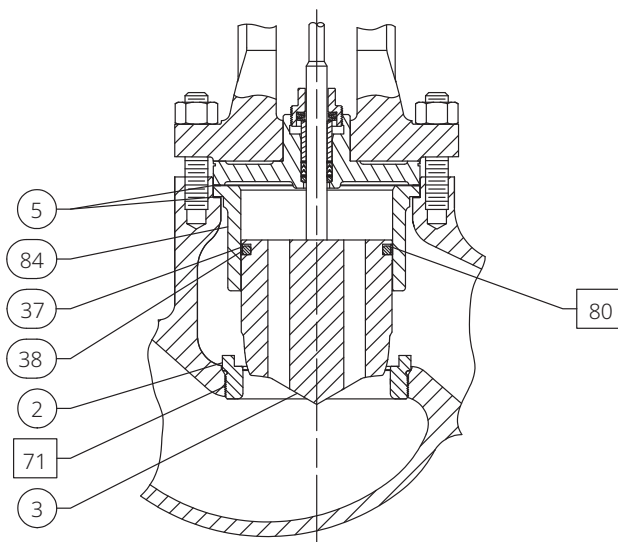
Figure 9. Fisher GX Balanced Trim (Standard for DN 80 and 100 / NPS 3 and 4)



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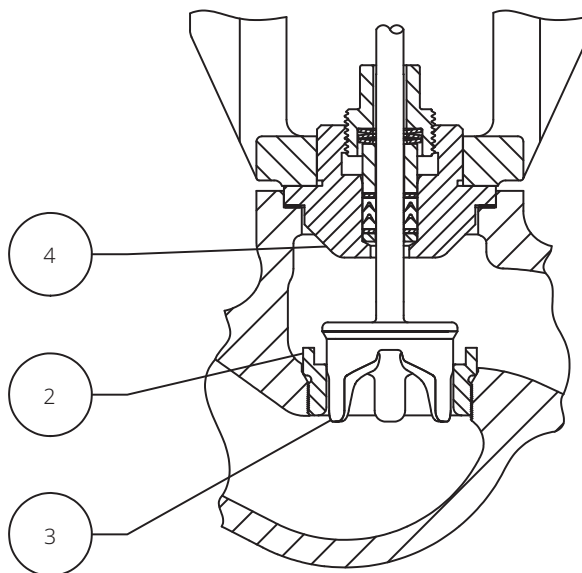
Figure 10. Fisher GX Balanced Trim (DN 150 / NPS 6)



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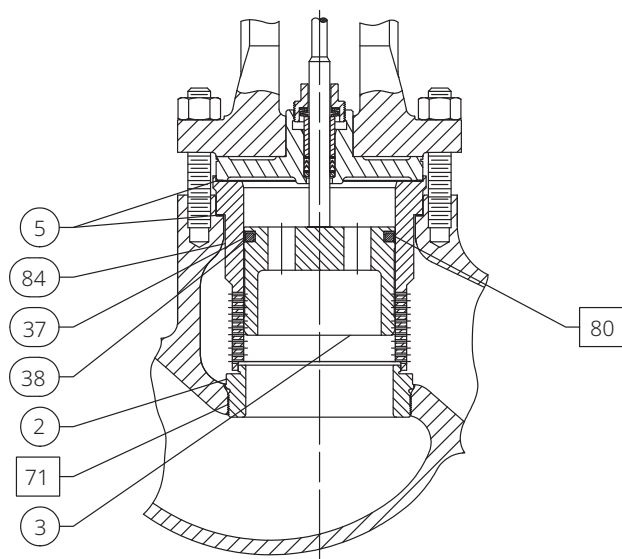
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Figure 11. Fisher GX Unbalanced Port-Guided Trim (DN 40 to 150 / NPS 1-1/2 to 6)



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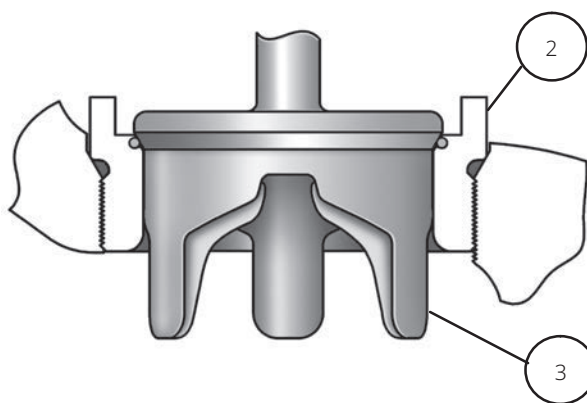
Figure 12. Fisher GX with Fisher Whisper Trim™ III (DN 150 / NPS 6)



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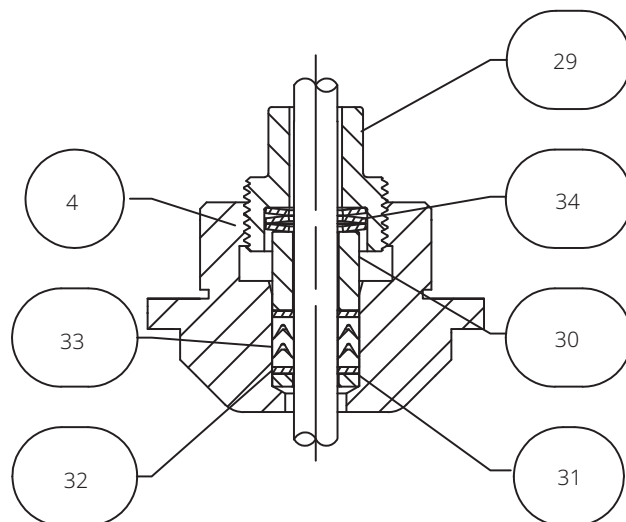
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Figure 13. Fisher GX Control Valve with Typical Soft Seat Trim Construction (Port Sizes of 36 to 136 mm)



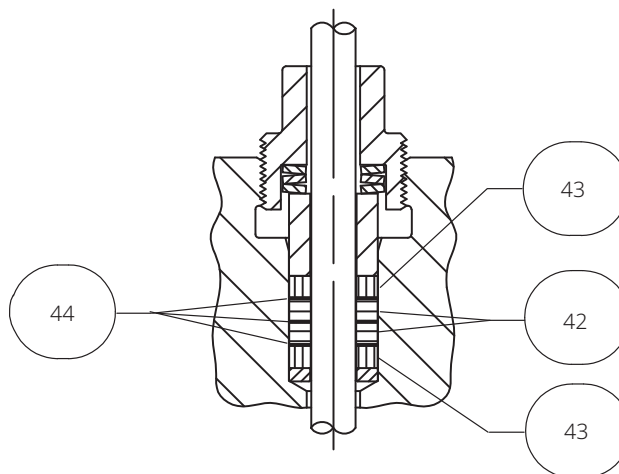
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**Figure 14. Fisher GX with Fisher enhanced ENVIRO-SEAL PTFE Packing
DN 5 through 150 / NPS 1/2 through 6**



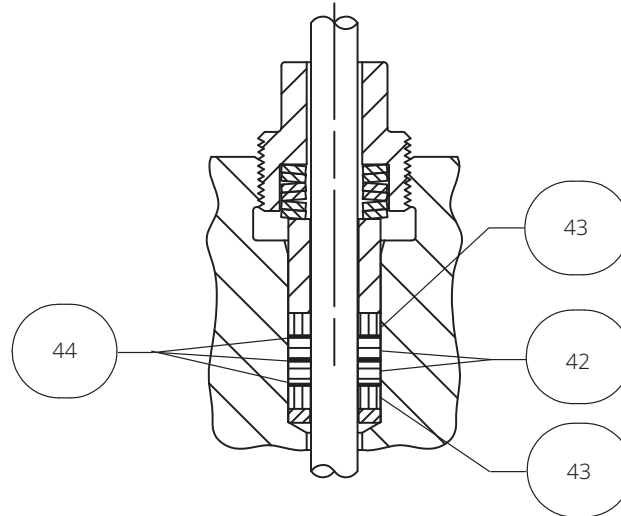
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**Figure 15. Fisher GX with Fisher enhanced ENVIRO-SEAL Graphite ULF Packing
DN 15 through 100 / NPS 1/2 through 4**



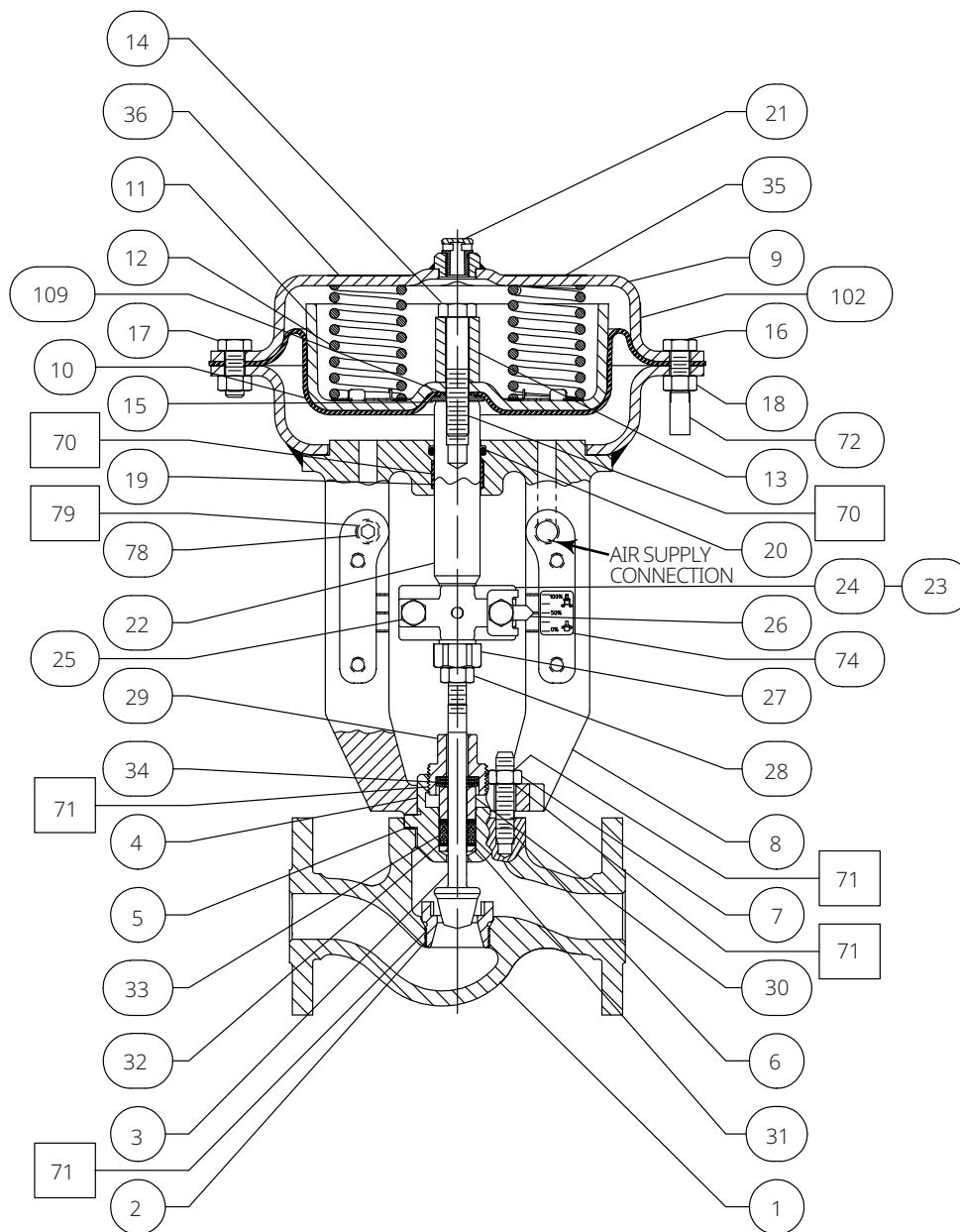
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**Figure 16. Fisher GX with Fisher enhanced ENVIRO-SEAL Graphite ULF Packing
DN 150 Only / NPS 6 Only**



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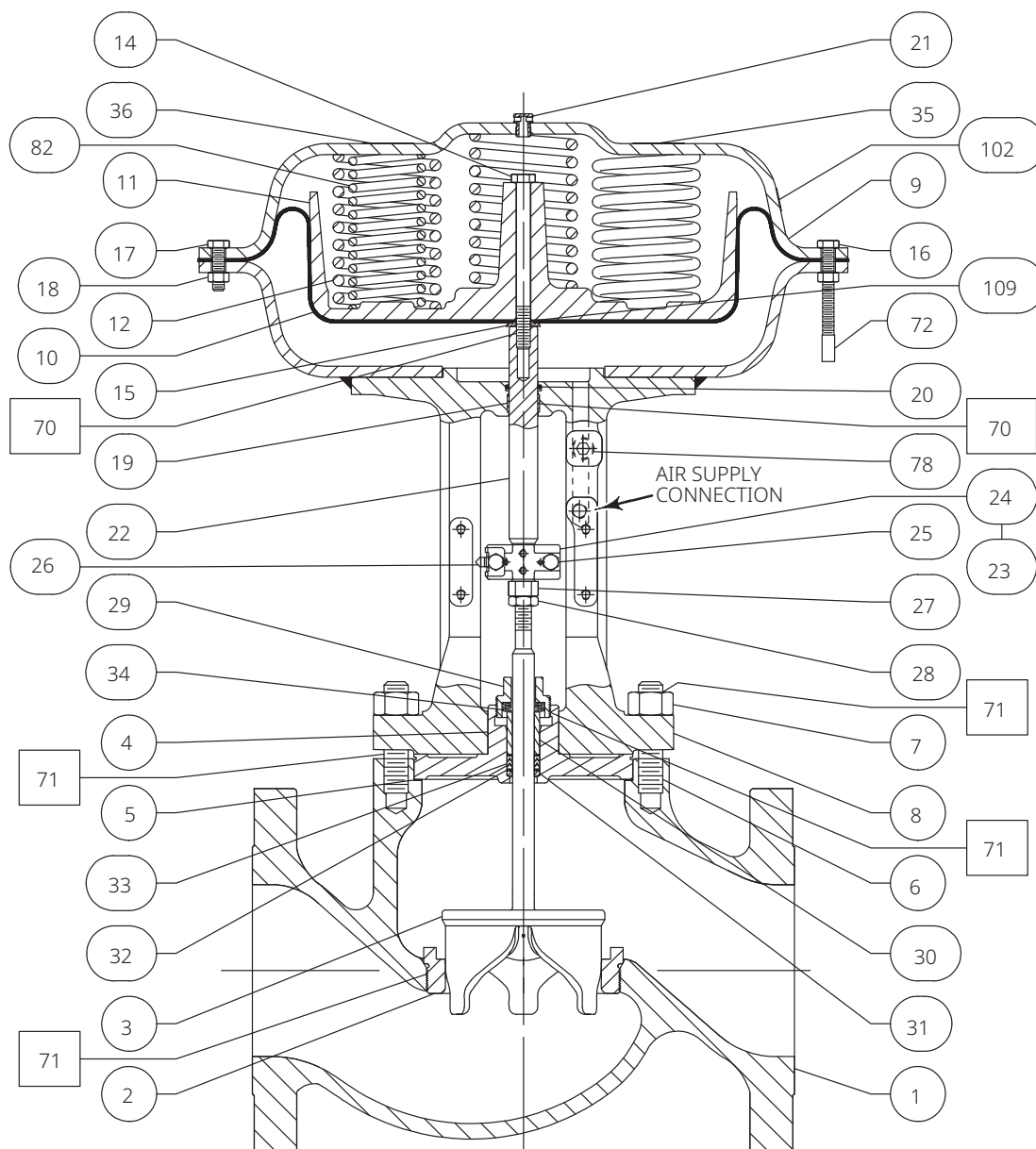
Figure 17. Fisher GX Control Valve and Actuator System Assembly, Air-to-Open (Spring-to-Close) (DN 25 / NPS 1 with Unbalanced Contoured Plug)



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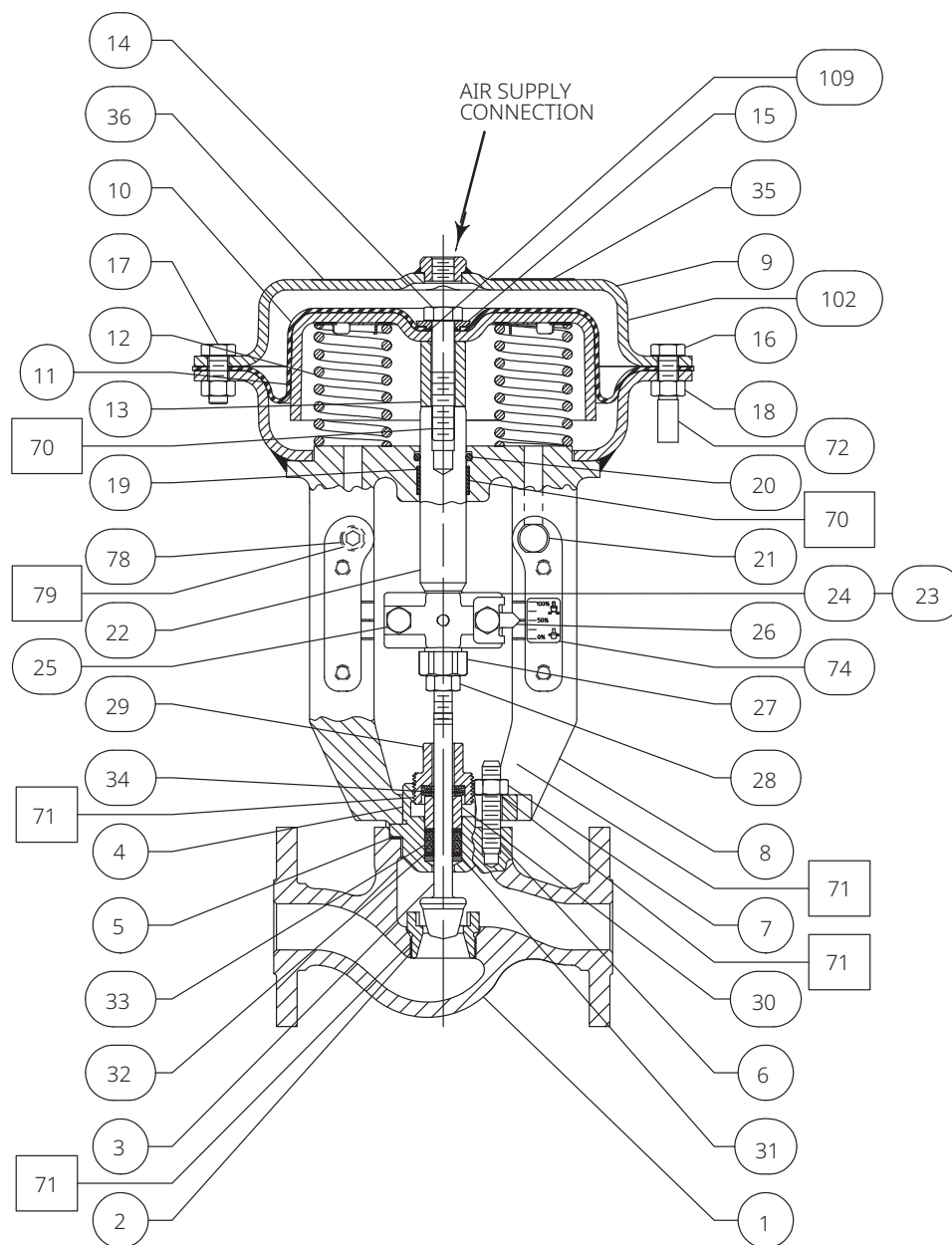
Figure 18. Fisher GX Control Valve and Actuator System Assembly, Air-to-Open (Spring-to-Close) (DN 150 / NPS 6 with Unbalanced Contoured Plug)



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Figure 19. Fisher GX Control Valve and Actuator System Assembly, Air-to-Close (Spring-to-Open) (DN 25 / NPS 1 with Unbalanced Contoured Plug)



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Figure 20. Fisher GX Control Valve and Actuator System Assembly, Air-to-Close (Spring-to-Open) (DN 150 / NPS 6 with Unbalanced Contoured Plug)

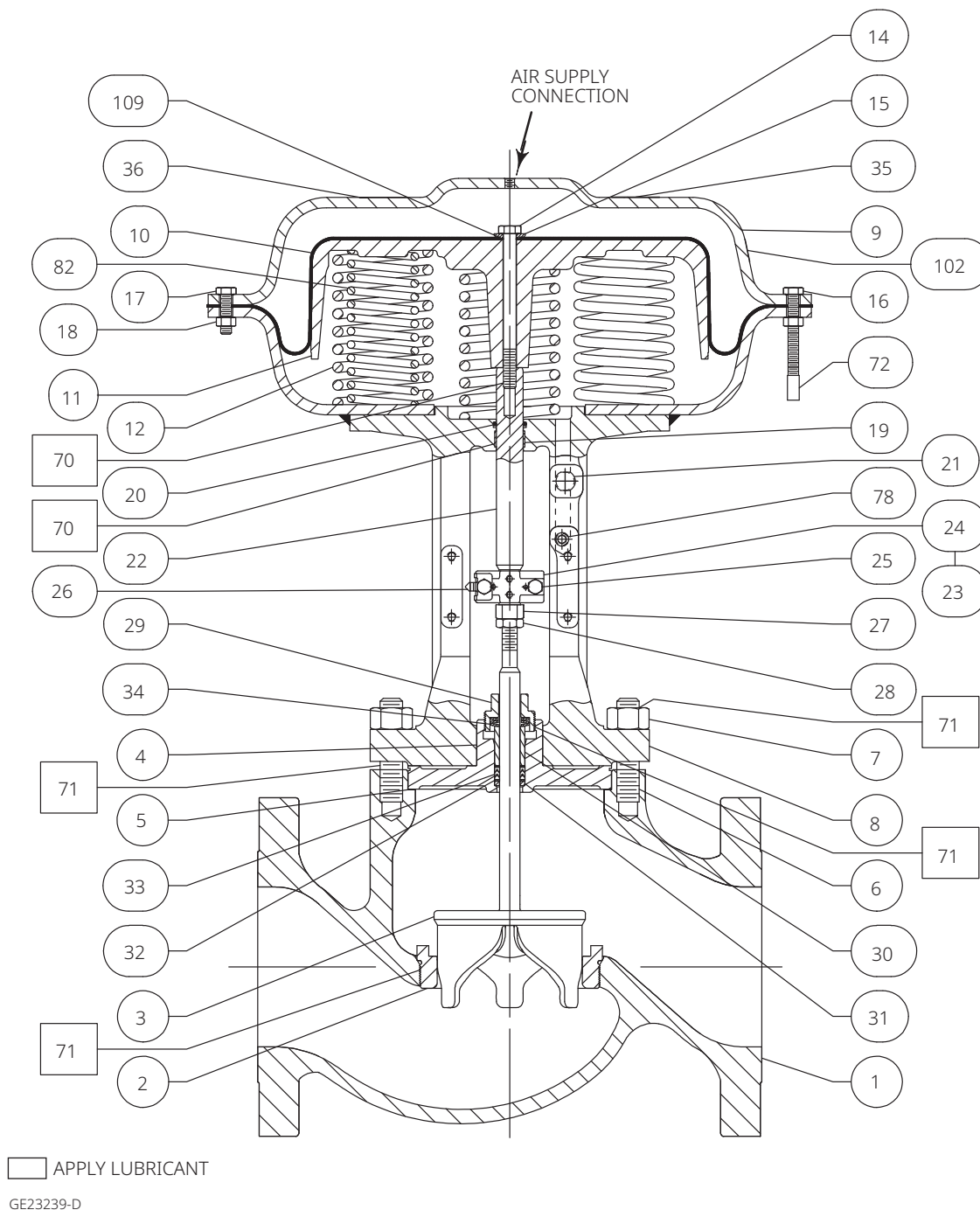
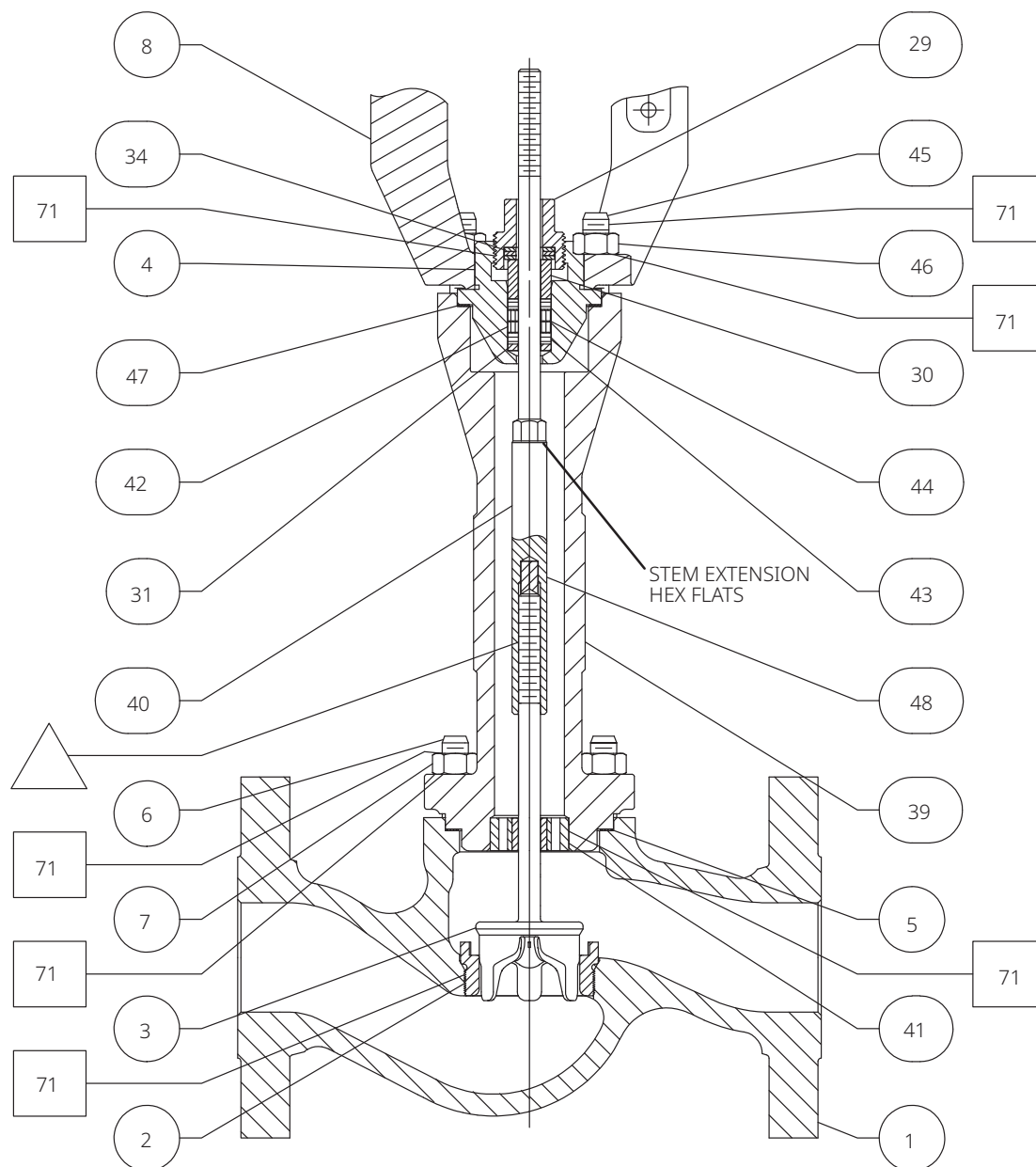


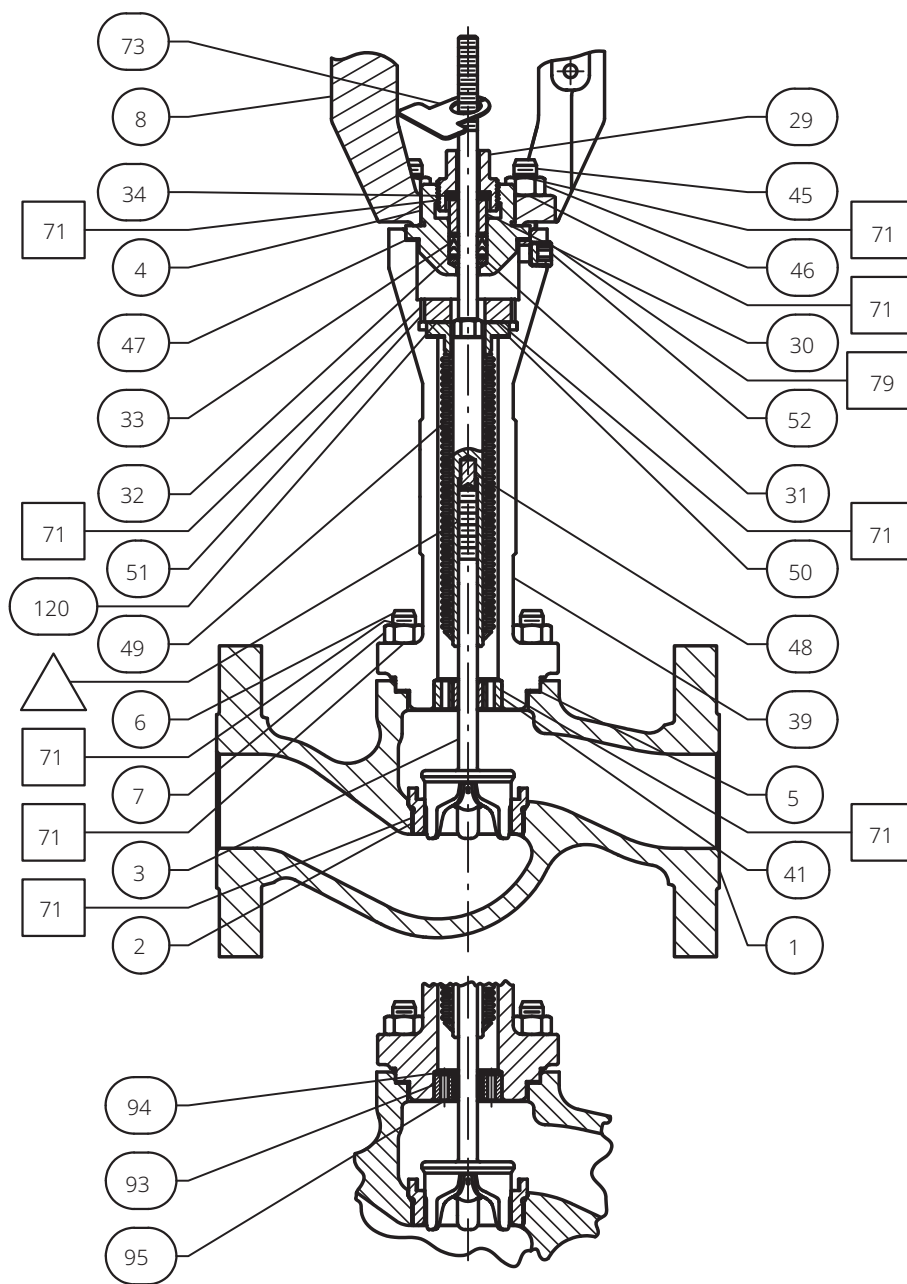
Figure 21. Extension Bonnet with Fisher enhanced ENVIRO-SEAL Graphite ULF Packing



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Figure 22. Bellows Extension Bonnet with Fisher enhanced ENVIRO-SEAL PTFE Packing

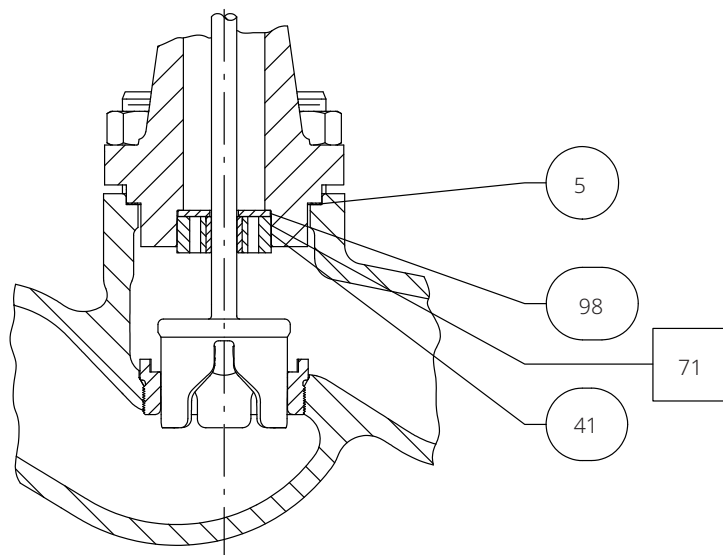


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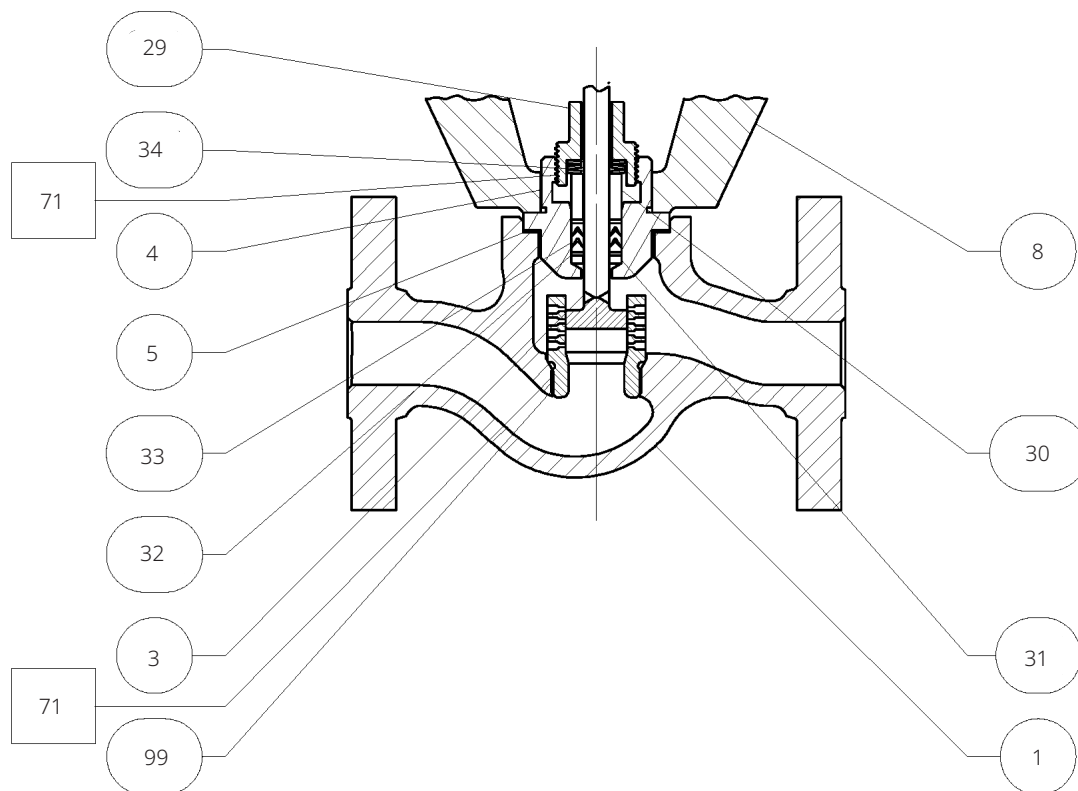
Figure 23. Cryogenic Extension Bonnet



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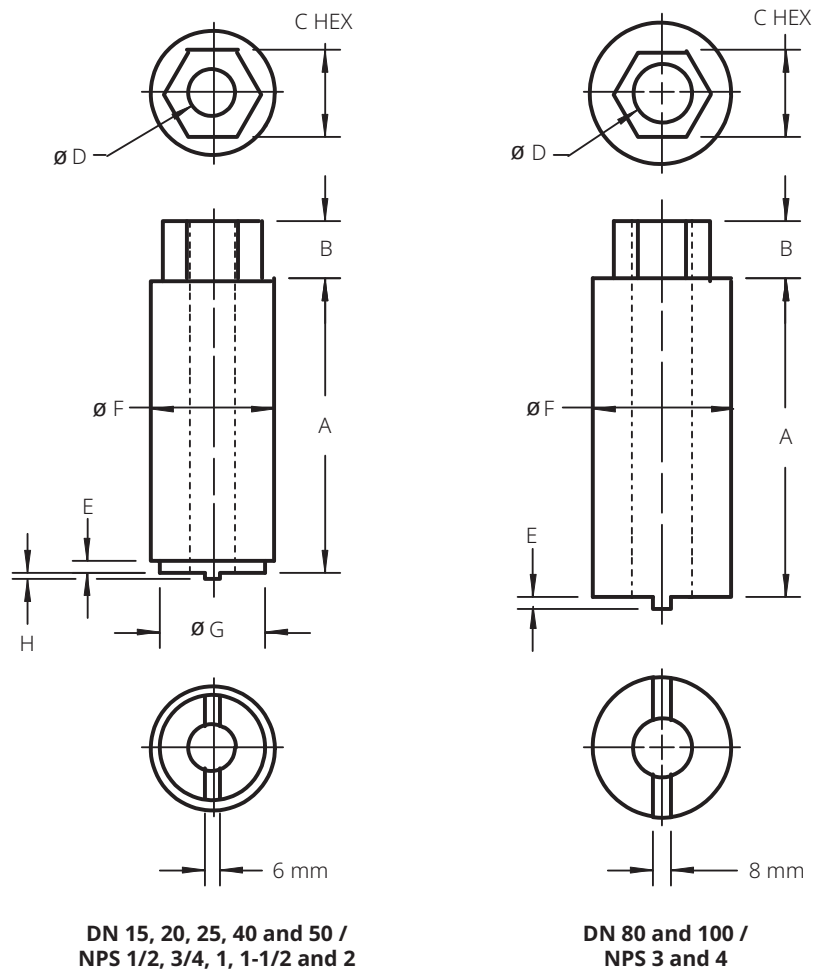
Figure 24. Fisher Cavitrol III Trim, DN 25, 40 and 50 / NPS 1, 1-1/2 and 2



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Figure 25. Bellows Nut Removal and Installation Tool

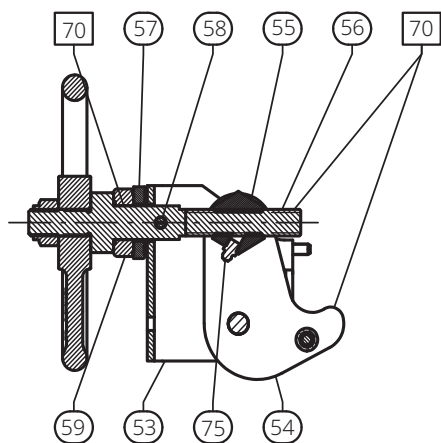
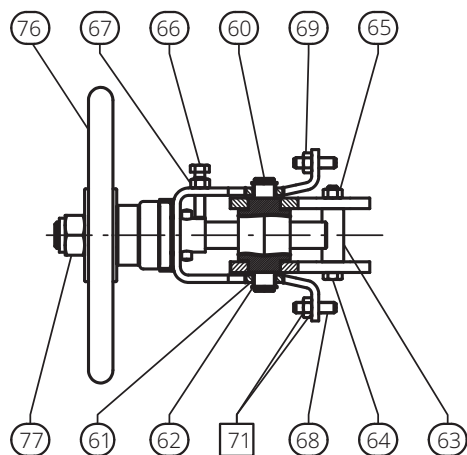
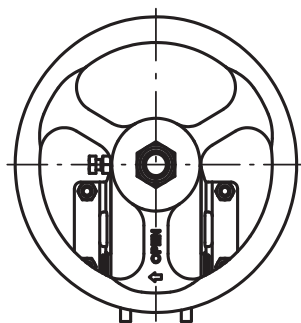
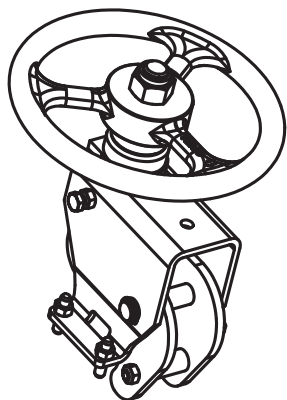


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Table 13. Bellows Nut Removal and Installation Tool Dimensions

VALVE SIZE		A	B	C	D	E	FØ	GØ	H
DN	NPS	mm							
15, 20, 25, 40, 50	1/2, 3/4, 1, 1-1/2, 2	125	25	36	20	5	53	45	3
80, 100	3, 4	135	25	1.42	25	5	60	---	---

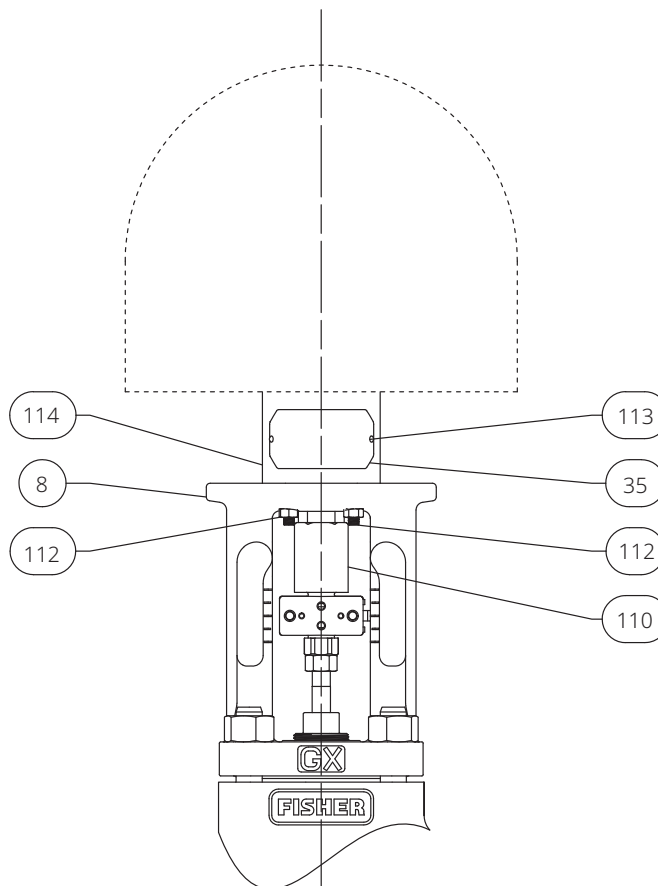
Figure 26. Handwheel Assembly



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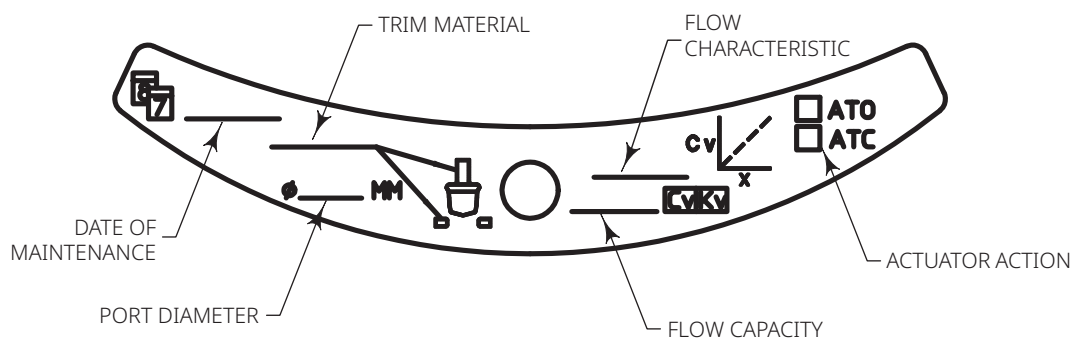
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Figure 27. Fisher GX Electric Actuator Mounting



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Figure 28. Repair Nameplate (Spaces Provided for Recording Trim Maintenance Data)



GE11233-B

Section 6: Parts

6.1 Parts Ordering

Each valve is assigned a serial number which can be found on the valve or on the nameplate (Figure 2 and key 35, not shown). The nameplate will normally be fitted to the actuator. Refer to this serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts refer to this serial number and give the part description from the following parts list.



WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

6.2 Parts Kits

Table 14. Packing Kits

VALVE SIZE	DN 15 TO 50 / NPS 1/2 to 2	DN 80 AND 100 / NPS 3 and 4	DN 150 / NPS 6
Stem Diameter	10 mm	14 mm	19 mm
Fisher enhanced ENVIRO-SEAL PTFE packing (Contains keys 32 and 33)	RGXPACKX012	RGXPACKX022	RGXPACKX072
Fisher enhanced ENVIRO-SEAL Graphite ULF packing (Contains keys 42, 43 and 44)	RGXPACKX052	RGXPACKX042	RGXPACKX082

Table 15. Actuator Kits

Actuator Size	225	750	1200
Actuator (Contains keys 10, 15, 19, 109 and 20)	RGX225X0022	RGX750X0032	RGX1200X042

Table 16. Balanced Seal Kits⁽¹⁾

Valve Size	DN 80 / NPS 3	DN 100 / NPS 4	DN 150 / NPS 6
Nitrile (Contains keys 37 and 38)	RGXSEALX012	RGXSEALX022	RGXSEALX072
Ethylene Propylene (EPDM) (Contains keys 37 and 38)	RGXSEALX032	RGXSEALX042	RGXSEALX082
Fluorocarbon (FKM) (Contains keys 37 and 38)	RGXSEALX052	RGXSEALX062	RGXSEALX092

1. A Gasket Kit is required when replacing the seals.

Table 17. Gasket Kits

Valve Size	DN 15 to 25 / NPS 1/2 to 1	DN 40 / NPS 1-1/2	DN 50 / NPS 2	DN 80 / NPS 3	DN 100 / NPS 4	DN 150 / NPS 6
Body / Bonnet Gasket Kit (Graphite Laminate) (Contains key 5)	GE00077X012	GE00078X012	GE00079X012	GE00080X012	GE00052X012	RGASKETXA62
Body / Bonnet Gasket and Extension Bonnet Gasket Kit (Graphite Laminate) (Contains keys 5 and 47)	RGASKETXA12	RGASKETXA22	RGASKETXA32	RGASKETXA42	RGASKETXA52	---
Body / Bonnet Gasket, Extension Bonnet Gasket and Bellows Gasket (Graphite Laminate) (Contains keys 5, 47 and 50)	RGASKETXB12	RGASKETXB22	RGASKETXB32	RGASKETXB42	RGASKETXB52	---

Table 18. Repair Nameplate

Description	DN 15 to 150 / NPS 1/2 to 6
18-8 stainless steel nameplate. Will mount to all GX actuator sizes using casing bolt. See Figure 28.	GE11233X012

6.3 Parts List

NOTE

Contact your [Emerson sales office](#) for part numbers.

Table 19. Parts List

Key	Description	Key	Description
1	Valve body	13	Actuator spacer
2*	Seat ring	14	Cap screw
2*	Cavitrol III cage	15	Washer ⁽²⁾
3*	Valve plug/Stem	16	Cap screw, long Size 225 actuator (2 req'd) Size 750 actuator (2 req'd) Size 1200 actuator (4 req'd)
4	Bonnet		
5*	Body/Bonnet gasket, Graphite laminate ⁽¹⁾		
6	Body/Bonnet bolting (4 req'd)	17	Cap screw, short Size 225 actuator (4 req'd) Size 750 actuator (8 req'd) Size 1200 actuator (12 req'd)
7	Body/Bonnet nut (4 req'd)		
8	Actuator yoke		
9	Upper diaphragm casing	18	Hex nut Size 225 actuator (6 req'd) Size 750 actuator (10 req'd) Size 1200 actuator (16 req'd)
10*	Diaphragm ⁽²⁾		
11	Diaphragm plate		
12	Actuator springs	19*	Actuator rod bushing ⁽²⁾
*Recommended spare parts. See Parts Kits. 1. See gasket kits table. 2. See actuator kits table. 3. See packing kits table. 4. See balanced seal kits table.			

- continued -

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

GX Valve and Actuator

July 2026

Instruction Manual

D103175X012

Table 19. Parts List (continued)

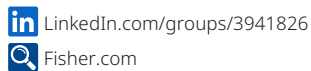
Key	Description	Key	Description
20*	Actuator rod seal ⁽²⁾	56	Drive screw
21	Vent cap	57	Pivot washer
22	Actuator rod	58	Grooved pin
23	Stem connector nut half	59	Bearing
24	Stem connector bolt half	60	Pivot pin
25	Cap screw (2 req'd)	61	Bushing
26	Travel indicator	62	Retainer ring
27	Stem adjustor nut	63	Spacer
28	Locknut	64	Cap screw
29	Packing follower	65	Hex nut
30	Packing spacer	66	Lock screw
31*	Packing box ring	67	Hex nut
32*	Anti-extrusion washer (2 req'd) ⁽³⁾	68	Stud
33*	Fisher enhanced ENVIRO-SEAL PTFE packing set ⁽³⁾	69	Hex nut
34	Belleville spring (3 req'd)	70	Lubricant, Lithium grease
35	Nameplate	71	Lubricant, Anti-seize
36	Warning tag	72	Cap plug
37*	Seal ring ⁽⁴⁾	73	Warning tag
38*	Backup ring ⁽⁴⁾	74	Travel indicator scale
39	Extension bonnet	75	Zerk fitting
40*	Stem extension	76	Handwheel
41*	Extension bonnet lower bushing	77	Locknut
42*	Graphite ULF packing ring (2 req'd) ⁽³⁾	78	Pipe plug
43*	Packing ring (2 req'd) ⁽³⁾	79	Anti-seize sealant
44*	Packing washer (3 req'd) ⁽³⁾	80	Lubricant, Silicone sealant
45	Yoke/Extension bonnet bolting (4 req'd)	81	Pipe plug
46	Yoke/Extension bonnet nut (4 req'd)	82	Inner actuator spring
47*	Extension bonnet gasket ⁽¹⁾	84	Guide sleeve
48*	Insert (req'd for assembly of valve stem to extension stem)	84*	Fisher Whisper Trim III cage
		109*	O-ring ⁽²⁾
49*	Bellows/Stem assembly	110	Rod adaptor
50*	Bellows gasket ⁽¹⁾	111	Stud
51	Bellows nut	112	Nut
52	Pipe plug	113	Drive screw
53	Handjack body	114	Electric actuator spacer
54	Lever	115	Lead seal and wire (not shown)
55	Operating nut	120	PTFE washer
*Recommended spare parts. See Parts Kits. 1. See gasket kits table. 2. See actuator kits table. 3. See packing kits table. 4. See balanced seal kits table.			

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Fisher™ HP and HPA Control Valves



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for NPS 1 through 24 HP valves with CL900 and CL1500 ratings; NPS 1 through 14 HP with CL2500 ratings; NPS 1 through 8 HPA valves with CL900 and CL1500 ratings; NPS 1, 2, 6, 8 and 12 HPA valves with CL2500 ratings; NPS 8 through 12 HPD and HPT valves with CL3200 ratings. Refer to separate manuals for instructions covering the actuator, positioner and accessories.



WARNING



Do not install, operate or maintain HP series valves without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding. Unless otherwise noted, all NACE references are to NACE MR0175-2002 and MR0103.

Figure 1. HP Valve with 667 Actuator and FIELDVUE™ DVC6200 Digital Valve Controller



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Table 1. Specifications

End Connection Styles and Ratings ^(1,2,3,4)	Shutoff Classifications
Flanged: Consistent with CL900, CL1500 and CL2500 per ASME B16.34 Socket Welding: Consistent with CL900, CL1500 and CL2500 per ASME B16.34 Buttwelding: Consistent with CL900, CL1500 CL2500 and intermediate rating CL3200 per ASME B16.34 Also see Table 2	See Table 3 C-seal trim: High-temperature, Class V Bore seal trim: High-temperature, Class V TSO (Tight Shutoff) trim: See Tables 4 and 5
Flow Characteristic	Flow Direction
Standard Cage: ■ Equal percentage, ■ Modified equal percentage or ■ Linear Standard Cage with Micro-Form Valve Plug: (HPS and HPAS only): ■ Equal percentage or ■ Modified equal percentage Standard Cage with Micro-Flute Valve Plug: (HPS and HPAS only): ■ Equal percentage Standard Cage with Micro-Flat Valve Plug: (HPAS only): ■ Linear Cavitrol™ III, Whisper Trim™ III or WhisperFlo™ Cage: ■ Linear Special cages: Special characterized flow cages are available. Consult your local Emerson sales office.	Standard Cage ■ HPD and HPAD: Normally flow down⁽⁶⁾ ■ HPS and HPAS: Normally flow up⁽⁵⁾ ■ HPAS Micro-Flat: Flow down ■ HPT and HPAT: Normally flow down⁽⁶⁾ ■ HPS and HPAS Micro-Form: Flow up only Cavitrol III Cage: Flow down Whisper Trim III or WhisperFlo Cage: Flow up
Approximate Weights (valve body and bonnet assemblies)	Additional Specifications
See Table 2	For specifications such as materials, valve plug travels and port, yoke boss and stem diameters, see the Parts List section.
1. EN (or other) ratings and end connections can usually be supplied; consult your Emerson sales office. 2. CL900 and CL1500 globe valves are identical for NPS 1 and 2 valves. CL900 and CL1500 globe valves for NPS 3, 4, 6, 8, 10 and 12 valves, however, are not identical. 3. The centerline-to-face dimension for CL2500 NPS 1 and 2 HPA valves does not conform to ANSI/ISA S75.12. 4. The pressure or temperature limits in this manual and any applicable standard limitations should not be exceeded. 5. HPS and HPAS valves may be used flow down for on-off service only or where further limited by trim design. HPAS valves may be used flow down for erosive service. 6. NPS 16, 18, 20 and 24 valves for flow down only.	

1.2 Description

HP Series high-pressure globe and angle valves (Figure 1) have metal seats, cage guiding, quick change trim and push-down-to-close valve plug action. HPD, HPAD, HPT and HPAT valves use balanced valve plugs. HPS and HPAS valves use an unbalanced valve plug. To provide a seal between the cage and a balanced valve plug, the HPD and HPAD valves use piston rings; the HPT and HPAT valves use a pressure-assisted seal ring. A Whisper Trim or WhisperFlo cage can be used with an HPD, HPAD, HPS, HPAS, HPT or HPAT valve plug. A Cavitrol III cage can be used with an HPS, HPAS, HPT or HPAT valve plug.

C-seal or bore seal trims are available for HPD and for HPAD valves.

With C-seal trim and bore seal trim, a balanced valve can achieve high-temperature, Class V shutoff. Because the seal is formed from metal (N07718 nickel alloy) rather than an elastomer, a valve equipped with the C-seal trim or bore seal trim can be applied in processes with a fluid temperature of up to 593 °C / 1100 °F, provided other material limits are not exceeded.

HP Series globe valves are available in short (short) and or long (long) face-to-face designs depending on size and pressure class.

1.3 Specifications

Specifications for the HP Series valves are shown in Tables 1 through 7.

1.4 Educational Services

Emerson Educational Services
Phone: -800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Table 2. Approximate Weights (Valve and Bonnet Assemblies)

VALVE TYPE	VALVE SIZE, NPS	PRESSURE RATING	kg		lbs	
			Flg	SWE, BWE	Flg	SWE, BWE
Globe Valves	1	CL900 and 1500	42	38	93	85
		CL2500	45	34	100	76
	1-1/2 x 2	CL2500	- - -	34	- - -	76
	2	CL900 and 1500	72	52	158	115
		CL2500	104	74	229	164

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Table 2. Approximate Weights (Valve and Bonnet Assemblies) (continued)

VALVE TYPE	VALVE SIZE, NPS	PRESSURE RATING	kg		lbs	
			Flg	SWE, BWE	Flg	SWE, BWE
Globe Valves	3	CL900	125	---	276	---
		CL1500	129	97	284	213
		CL2500	228	163	502	358
	4 (long) ⁽²⁾	CL900	230	---	507	---
		CL1500	249	201	548	444
	4 (short) ⁽²⁾	CL900	167	136	368	---
		CL1500	194	162	428	444
		CL2500	321	206	708	444
	6 (long) ⁽²⁾	CL900	511	---	1127	---
		CL1500	557	455	1228	1003
	6 (short) ⁽²⁾	CL900	317	227	699	500
		CL1500	575	269	1268	593
		CL2500	757	481	1669	1060
	8	CL900	720	510	1587	1124
		CL1500	930	640	2050	1411
		CL2500	1630	1050	3594	2315
		CL3200	---	1460	---	3219
	10	CL900	1030	750	2271	1653
		CL1500	1490	1010	3285	2227
		CL2500	2560	1550	5644	3417
		CL3200	---	2200	---	4850
	12	CL900	1340	940	2954	2072
		CL1500	1950	1250	4299	2756
		CL2500	3380	2000	7452	4409
		CL3200	---	2950	---	6504
	14	CL2500	---	2297	---	5064
	16	CL900	3343	---	7371	---
		CL1500	5039	---	11109	---
	18	CL900	4387	---	9671	---
		CL1500	6168	---	13598	---
	20	CL900	7942	---	17509	---
		CL1500	11396	---	25123	---
	24	CL900	9757	---	21510	---
		CL1500	13644	---	30080	---

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Table 2. Approximate Weights (Valve and Bonnet Assemblies) (continued)

VALVE TYPE	VALVE SIZE, NPS	PRESSURE RATING	kg		lbs	
			Flg	SWE, BWE	Flg	SWE, BWE
Angle Valves	1	CL900 and 1500	40	36	88	80
		CL2500	---	72 ⁽¹⁾	---	160 ⁽¹⁾
	2	CL900 and 1500	69	50	153	110
		CL2500	---	109 ⁽¹⁾	---	240 ⁽¹⁾
	3	CL1500	123	78	272	173
	4	CL1500	181	117	399	258
	6	CL1500	357	202	788	445
		CL2500	658	325	1451	716
	8	CL1500	648	405	1428	893
		CL2500	971	663	2141	1462
	12	CL2500	2471	1660	5448	3660
1. Only SWE is available for CL2500. 2. (Long) indicates industry standard long face-to-face. (Short) indicates industry standard short face-to-face.						

Table 3. Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4

Valve Design		Port Diameter, mm / in.		ANSI/FCI and IEC Leakage Class	
HPD, HPAD		57.15 / 2.25 and smaller		II	
		58.7 / 2.3125 to 92.1 / 3.625		II - Standard	
				III - Optional	
		105.9 / 4.17 and larger		III - Standard	
				IV - Optional	
		317.5 / 12.5 to 489 / 19.25		IV - Standard	
HPD, HPAD with C-seal trim	Valve Size, NPS		Port Diameter, mm / in.	Cage Style	ANSI/FCI and IEC Leakage Class
	HPD	HPAD			
	3	4	73 / 2.875	Eq. %, Mod Eq. %, Linear (std. cage), Linear (Whisper III, A1, B1)	V - Standard to 593 °C / 1100 °F (for port diameters from 73 mm / 2.875 in. through 136.5 mm / 5.375 in. with optional C-seal trim) IV - Optional (for port diameters 73 mm / 2.875 in. through 136.5 mm / 5.375 in.)
	4	6	73 / 2.875	Linear (Whisper III, D3)	
			92.1 / 3.625	Eq. %, Mod. Eq. %, Linear (std. cage), Linear (Whisper III, A1, B3, C3)	
	6	8	111.1 / 4.375	Linear (Whisper III, D3)	
			136.5 / 5.375	Eq. %, Mod. Eq. %, Linear (std. cage), Linear (Whisper III, A1, B3, C3)	

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Table 3. Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4 (continued)

	Valve Size, NPS		Port Diameter, mm / in.	Cage Style	ANSI/FCI and IEC Leakage Class
	HPD	HPAD			
HPD ⁽²⁾ , HPAD ⁽²⁾ with Bore-seal trim	8	---	139.7 / 5.5	Eq. %, Linear (std. cage), Whisper III, Cavitrol III	V - Standard to 593 °C / 1100 °F) (for port diameters from 139.7 mm / 5.5 in. through 215.9 mm / 8.5 in. with optional Bore-seal trim)
			152.4 / 6		
	10	---	165.1 / 6.5		
			177.8 / 7		
	12	12	165.1 / 6.5		
			190.5 / 7.5		
			203.2 / 8		
	14	---	215.9 / 8.5		
HPS, HPAS, HPT, HPAT			All	Cavitrol III and Micro-Flat	V - Standard
				Micro-Form, Micro-Flute, Eq. %, Mod Eq. %, Linear, Whisper III	IV - Standard V - Optional
HPS and HPT with TSO (Tight Shutoff trim)			See Tables 4 and 5	See Tables 4 and 5	TSO - Optional TSO is not an ANSI/FCI or IEC leakage class. Valves with TSO trim are factory tested to a more stringent Fisher test requirement of no leakage at time of shipment. Test medium is water. Specify service ΔP when ordering. Test procedure is ANSI/FCI Class V test procedure B.
HPT and HPAT with PEEK ⁽¹⁾ Anti-Extrusion Rings			47.6 / 1.875 to 489 / 19.25	All	V - Standard (to 316 °C / 600 °F) IV - Optional (47.6 mm / 1.875 in. through 489 mm / 19.25 in. ports)
1. PEEK (PolyEtherEtherKetone), required for all boiler feedwater applications. 2. Trims 263, 2635, 264, 2645, 265 and 2655 are not available in bore-seal.					

Table 4. TSO (Tight Shutoff) Leakage Class per ANSI/FCI 70-2 and IEC 60534-4⁽¹⁾

Leakage Class	Maximum Leakage	Test Medium	Test Pressure	Leakage Class
TSO (Tight Shutoff)	Valves with TSO trim are factory tested to a more stringent Emerson test requirement of no leakage at time of shipment.	Water	Service ΔP ⁽²⁾	V
1. Not available for NPS 8 to 12 HPD and HPT. 2. Specify service ΔP when ordering.				

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Table 5. TSO Shutoff Availability⁽¹⁾

VALVE DESIGN	CONSTRUCTION	LEAKAGE CLASS
HPS, HPT	Std or Cavitrol III trim. Replaceable, protected soft seat	TSO - Standard
1. Not available for NPS 8 to 12 HPD and HPT.		

Table 6. Recommended Torque for Packing Flange Nuts (Non Live-loaded Graphite Packing)⁽¹⁾

STEM DIAMETER		VALVE BODY RATING ⁽²⁾	TORQUE			
			N•m		lbf•ft	
mm	in.		Min	Max	Min	Max
12.7	1/2	CL900	12	18	9	13
12.7	1/2	CL1500	15	22	11	16
12.7	1/2	CL2500	18	24	13	18
19.1	3/4	CL900	27	41	20	30
19.1	3/4	CL1500	34	50	25	37
19.1	3/4	CL2500	41	61	30	45
25.4	1	CL900	42	62	31	46
25.4	1	CL1500	52	77	38	57
25.4	1	CL2500	61	91	45	67
31.8	1-1/4	CL900	56	83	41	61
31.8	1-1/4	CL1500	68	102	50	75
31.8	1-1/4	CL2500	81	122	60	90
31.8	1-1/4	CL3200	81	122	60	90
50.8	2	CL900	80	119	59	88
50.8	2	CL1500	98	146	72	108
50.8	2	CL2500	115	170	85	125
50.8	2	CL3200	115	170	85	125
1. Lubricate with anti-seize lubricant.						
2. For intermediate class ratings, use the same torque as the next lower standard class.						

Table 7. Torque for Body-to-Bonnet Bolting Using Anti-Seize Lubricant⁽¹⁾

STUD SIZE	TORQUE	
	N•m	lbf•ft
	B7, B16, B8M2, BD, S20910, N07718 and 660 Studs	B7, B16, B8M2, BD, S20910, N07718 and 660 Studs
3/4	260	190
7/8	370	275
1-1/8	710	525
1-1/4	940	695
1-3/8	1270	935
1-1/2	1650	1220
1-5/8	2130	1570
1-3/4	2670	1970
1-7/8	3310	2440
2	4030	2970
2-1/4	5780	4260
2-1/2	7990	5890
1. For other lubricants or bolting materials, contact your Emerson sales office for torques.		

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in Table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

Some bonnet flanges have a tapped hole that was used to handle the bonnet during manufacture. Do not use this tapped hole to lift the valve assembly or personal injury may result.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions indicated when the valve was ordered. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Because some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

NOTICE

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag or other foreign material from the pipeline.

1. Before installing the valve, inspect it to ensure that the valve body cavity is free of foreign material.
2. Clean out all pipelines to remove scale, welding slag, and other foreign materials before installing the valve.

NOTE

If the valve body being installed has small internal flow passages, such as with Whisper Trim III, WhisperFlo or Cavitrol III cages, consideration should be given to installing an upstream strainer to prevent the lodging of particles in these passages. This is especially important if the pipeline cannot be thoroughly cleaned or if the flowing medium is not clean.

3. Flow through the valve must be in the direction indicated by the flow arrow, which is stamped on or attached to the valve body.

NOTE

NPS 8 to 14 CL900, CL1500, CL2500 and CL3200 HPD and HPT valves contain a flow vane in the lower flow passage. This is critical to the proper function of the valve, and is not a defect.

NOTICE

Depending on valve body materials used, post-weld heat treating might be needed. Post-weld heat treatment can damage internal elastomeric, plastic and metal parts. Shrink-fit pieces and threaded connections might also loosen. In general, if post-weld heat treating is needed, remove all trim parts. Contact your [Emerson sales office](#) for additional information.

4. Use accepted piping and welding practices when installing the valve in the pipeline. For flanged valve bodies, use a suitable gasket between the body and pipeline flanges.
5. Install a three-valve bypass around the valve if continuous operation is required during maintenance.
6. If the actuator and valve body are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.
7. If the valve body was shipped without packing installed in the packing box, install the packing before putting the valve body into service. Refer to instructions given in the Packing Maintenance procedure.

**WARNING**

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

Valves with ENVIRO-SEAL™ live-loaded packing or HIGH-SEAL ULF live-loaded packing will not require this initial re-adjustment. See the instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves (D101642X012) or HIGH-SEAL ULF Live-Loaded Packing System (D101453X012) (as appropriate) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section near the end of this manual.

2.1 Lifting Valve Assembly

**WARNING**

Failure to follow these lifting guidelines and accepted lifting and rigging practices could result in property damage and personal injury or death.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Only personnel trained in proper lifting and rigging practices shall perform valve/actuator assembly lifting, rigging and installation. Because each lift will be unique, the method of lifting the valve assembly, the correct location for attaching and lifting the valve assembly and what the valve assembly will do when lifted shall be considered for each lift.

Lifting and rigging equipment used to lift, install or remove a valve assembly or component must be properly selected and sized for the weight and configuration of the valve assembly or component being lifted. The weight of the complete valve assembly, including attached accessories, must be taken in consideration for this purpose. The lifting and rigging equipment must be properly maintained and inspected for damage before each use.

If the valve is supplied with an actuator or handwheel, do not use the actuator or handwheel to lift the complete valve assembly. Lifting lugs attached to the actuator must not be used to lift the complete valve assembly unless clearly marked as being rated to support the complete valve assembly weight.

Lifting lugs or other lifting equipment attached to the valve or actuator must never be used to lift or support the weight of attached piping.

NOTICE

Care must be taken when lifting the valve/actuator assembly to ensure all accessories and tubing are not damaged in the process. Accessories and tubing may need to be removed prior to lifting to prevent damage and properly reinstalled before use. Protect valve flange faces, butt weld ends and other connection surfaces from damage during lifting.

Remove the valve/actuator assembly from its shipping container with appropriate lifting and rigging equipment for the valve/actuator assembly weight and configuration to be lifted. The valve and bonnet assembly weight is provided in Table 2. Consult the appropriate actuator and valve accessory instruction manuals for the weight of each additional component, then determine the total weight of the complete valve assembly. The location of the valve/actuator assemblies center of gravity must be considered during lifting, installation and removal. Additional slings or other lifting equipment, such as a load leveler, may be necessary to prevent toppling of the equipment during lifting or to rotate the valve assembly into a different orientation for installation.

For HP valve constructions that include lifting lugs cast integral to the body (NPS 16 through 24), use of properly sized shackles in each lifting lug eye is required. The correct shackle pin diameter is provided in Table 8. If the valve body includes attached lifting lugs, use all the lugs provided to lift the complete valve assembly. If lifting lugs are not provided on the valve body, lift the valve assembly with lifting straps secured around the valve body flanges, valve body neck and/or bonnet neck area.

Table 8. Fisher HP Lifting Lug Dimensions

VALVE SIZE	CLASS	LIFTING EYE ID		SHACKLE PIN DIAMETER	
		mm	in.	mm	in.
16	900	33.78	1.33	31.75	1.25
	1500	40.38	1.59	38.10	1.50
18	900	37.08	1.46	35.05	1.38
	1500	43.94	1.73	41.40	1.63
20	900	53.84	2.12	50.80	2.00
	1500	60.70	2.39	57.15	2.25
24	900	53.84	2.12	50.80	2.00
	1500	60.70	2.39	57.15	2.25

Section 3: Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance and trim maintenance. All maintenance operations may be performed with the valve in the line.

⚠ WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

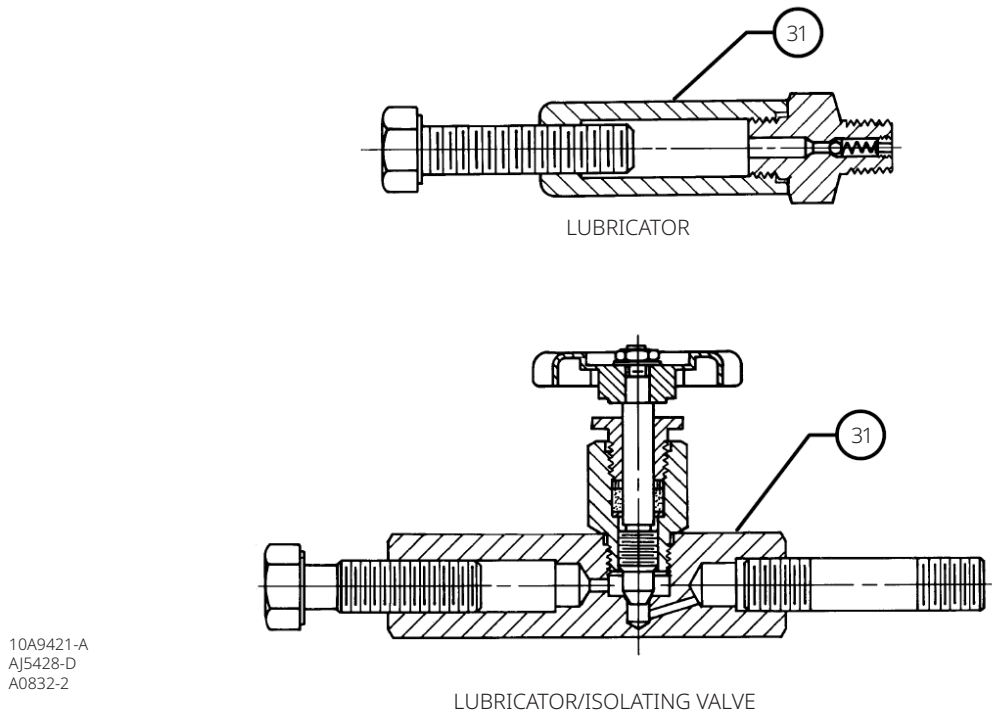
- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

NOTE

The HP series valve uses spiral-wound gaskets which are crushed to provide their seal. A spiral-wound gasket should never be reused. Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket must be installed upon reassembly. This is necessary to ensure a good gasket seal, since the used gasket will not seal properly.

NOTICE

The spiral-wound gaskets are of special design. Failure to use Fisher replacement parts may result in valve damage.

Figure 2. Lubricator and Lubricator/Isolating Valve**NOTE**

If the valve has ENVIRO-SEAL live-loaded packing installed (Figure 4), see the instruction manual entitled ENVIRO-SEAL Packing System for Sliding-Stem Valves (D101642X012) for packing instructions.

If the valve has HIGH-SEAL ULF live-loaded packing installed (Figure 4), see the instruction manual entitled HIGH-SEAL ULF Live-Loaded Packing System (D101453X012) for packing instructions.

3.1 Packing Lubrication

NOTE

Do not lubricate graphite packing. Graphite packing is self-lubricated. Additional lubrication may result in slip-stick movement of the valve.

NOTE

To avoid lubricants breaking down at elevated temperatures, do not lubricate packing used in processes with temperatures over 260 °C / 500 °F.

⚠ WARNING

Do not lubricate parts when used in oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

If a lubricator or lubricator/isolating valve (Figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the pipe plug (key 31, Figure 22, 23 or 24). Use a good quality silicon-base lubricant. Packing used in oxygen service or in processes with temperatures over 260 °C / 500 °F) should not be lubricated. To operate the lubricator, turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except the isolating valve must first be opened and then closed after lubrication is completed.

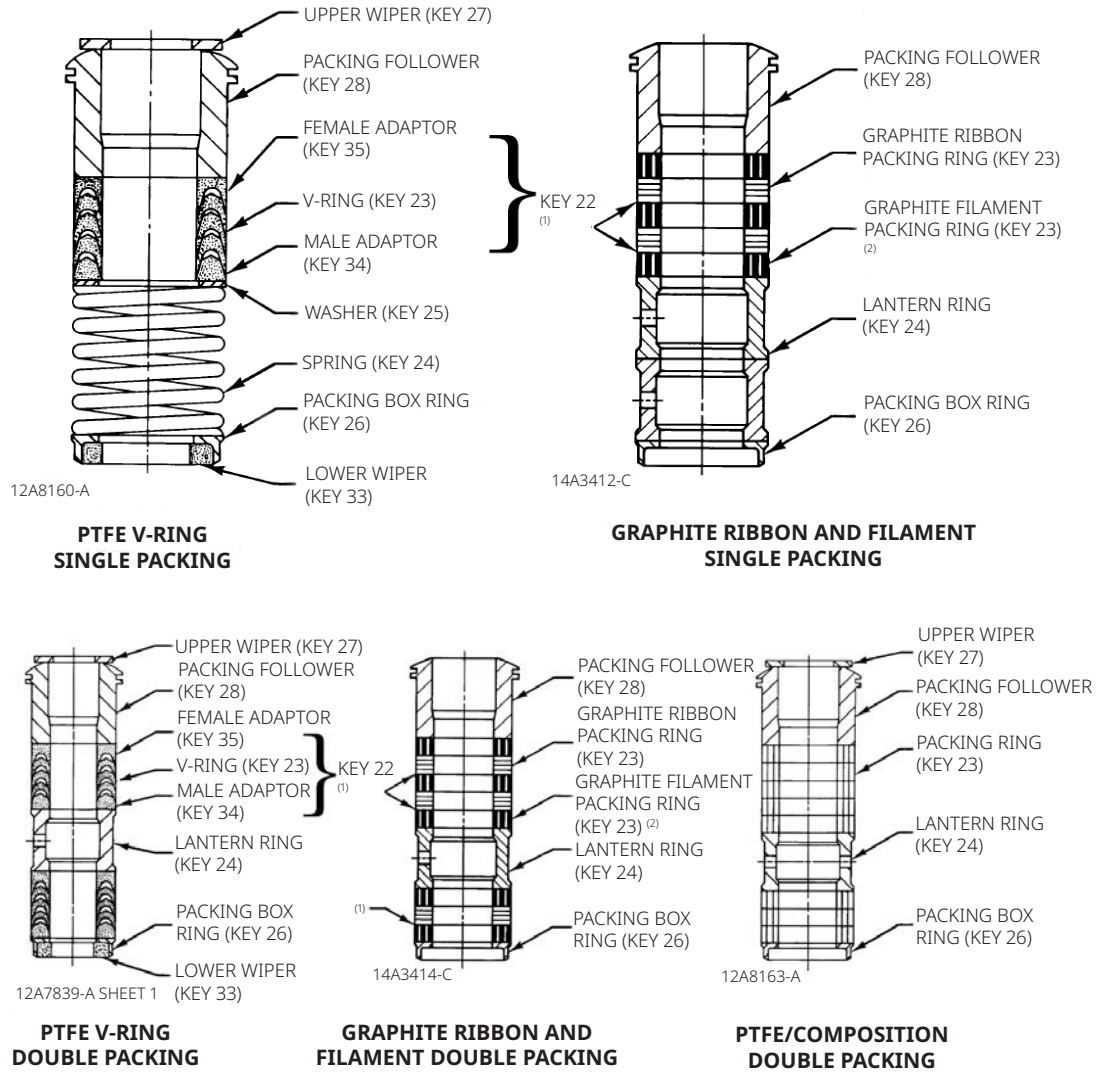
3.2 Packing Maintenance

If there is undesirable packing leakage in the spring-loaded PTFE V-ring packing shown in Figure 3, tighten the packing flange nuts (key 21, Figure 22, 23, 24, 26, 28, 30, 32, 34, 36 or 38) until the shoulder on the packing follower (key 28, Figure 22, 23, 24, 26, 28, 30, 32, 34, 36 or 38) contacts the bonnet (key 18, Figure 22, 23, 24, 26, 28, 30, 32, 34, 36 or 38). If leakage continues, replace the packing by following the numbered steps presented in the replacing packing procedure.

If there is undesirable packing leakage with other than spring-loaded PTFE V-ring packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts (key 21, Figure 22, 23, 24, 26, 28, 30, 32, 34, 36 or 38) to at least the minimum recommended torque in Table 6. However, do not exceed the maximum recommended torque in Table 6 or excessive friction may result. If leakage continues, replace the packing by following the numbered steps presented in the Replacing Packing procedure.

If the packing is relatively new and tight on the valve plug stem, and if tightening the packing flange nuts does not stop the leakage, it is possible that the stem is worn or nicked so that a seal cannot be made. The surface finish of a new stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. While replacing the packing according to the Replacing Packing procedure, inspect the valve plug stem and packing box wall for nicks or scratches.

Figure 3. Packing Arrangements

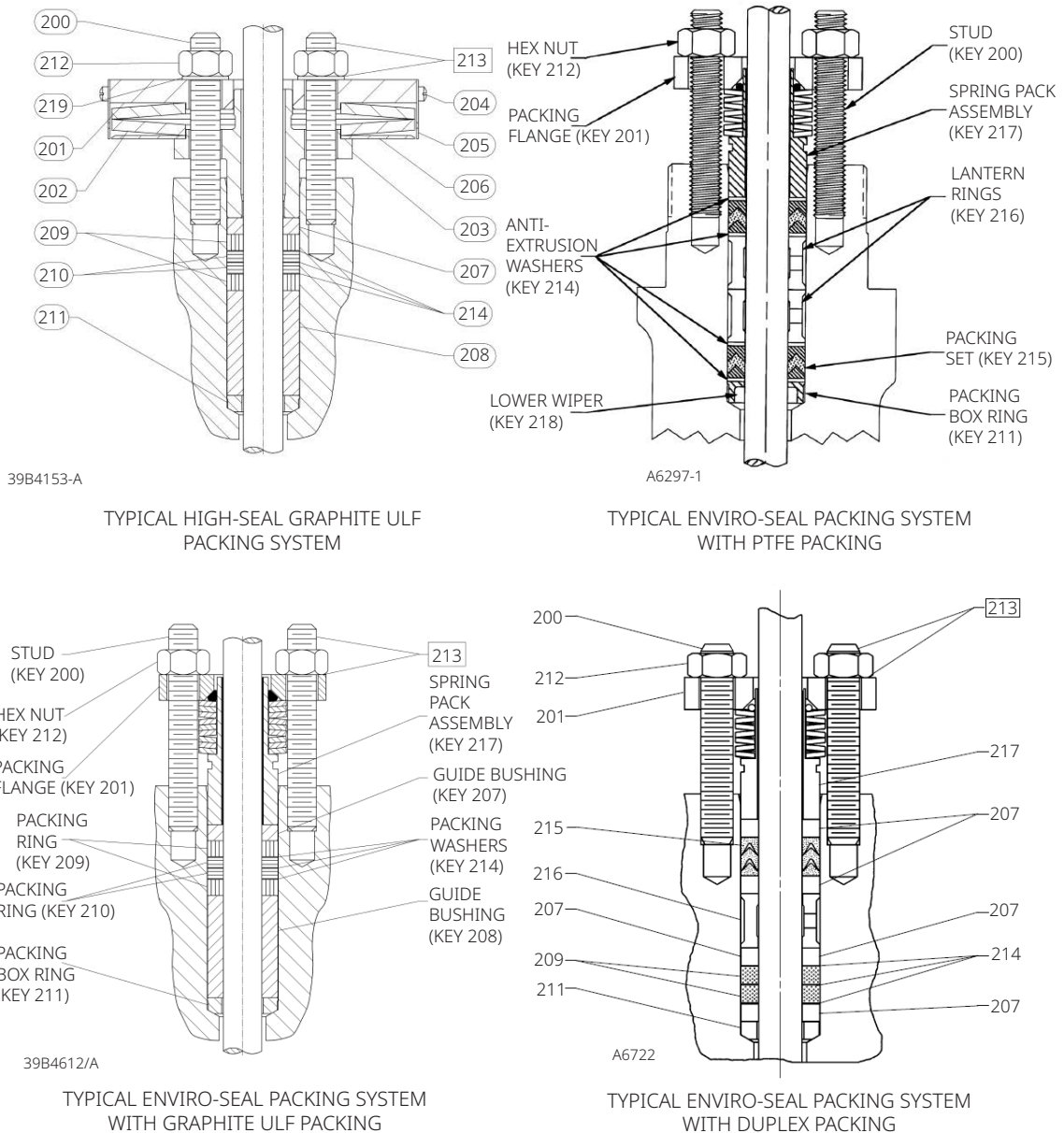


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NOTES:

1. 0.102 mm / 0.004 IN. THICK SACRIFICIAL ZINC WASHERS. USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.
2. HAS THE APPEARANCE OF A WOVEN OR BRAIDED RING.

Figure 4. Live-Loaded Packing



Adding Packing Rings

Key numbers referred to in this procedure are shown in Figure 22, 23, 24, 26, 28, 30, 32, 34, 36 or 38 unless otherwise indicated. When using packing with a lantern ring (key 24), it may be possible to add packing rings above the lantern ring as a temporary measure without removing the actuator from the valve body.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the packing flange nuts (key 21) and lift the packing flange, upper wiper and packing follower (keys 19, 27 and 28) away from the valve body.
3. It may be possible to dig out the old packing rings on top of the lantern ring, but use care to avoid scratching the valve plug stem or packing box wall. Clean all metal parts to remove particles that would prevent the packing from sealing.
4. Remove the stem connector and slip the packing rings over the end of the valve plug stem.
5. Reassemble the packing follower, upper wiper, packing flange and packing flange nuts (keys 28, 27, 19 and 21).
6. Reconnect the body-actuator stem connection according to the appropriate actuator instruction manual.
7. Tighten the packing flange nuts only far enough to stop leakage under operating conditions. Check for leakage around the packing follower when the valve is being put into service. Retighten the packing flange nuts as required (see Table 6).

Replacing Packing

WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Key numbers referred to in this procedure are shown in Figure 22, 23, 24, 26, 28, 30, 32, 34, 36 or 38 unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the cap screws in the stem connector, and separate the two halves of the stem connector. Then exhaust all actuator pressure, if any was applied, and disconnect the actuator supply and any leakoff piping.

3. Remove either the yoke locknut (key 32) or the hex nuts (key 30) and remove the actuator from the bonnet (key 18).
4. Loosen the packing flange nuts (key 21) so that the packing (keys 22, 23, 209 or 210, Figure 3) is not tight on the valve plug stem (key 6). Remove any travel indicator disk and stem locknuts from the valve plug stem threads.

NOTICE

When lifting the bonnet (key 18), be sure that the valve plug and stem assembly (keys 5 and 6) remains on the seat ring (key 4). This avoids damage to the seating surfaces as a result of the assembly dropping from the bonnet after being lifted part way out. The parts are also easier to handle separately.

Use care to avoid damaging gasket sealing surfaces.

The HPD and HPAD piston rings (key 8) are brittle and in two pieces. Avoid damaging the piston rings by dropping or rough handling.



WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. If the cage sticks to the bonnet, proceed carefully with bonnet removal and support the cage so that it will not fall unexpectedly from the bonnet.

NOTE

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

5. Hex nuts (key 14) attach the bonnet to the valve body. Loosen these nuts or cap screws approximately 3 mm / 1/8 in. Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed to the next step.
6. Unscrew the hex nuts (key 14) and carefully lift the bonnet off the valve stem. If the valve plug and stem assembly starts to lift with the bonnet, use a brass or lead hammer on the end of the stem and tap it back down. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.
7. Remove the valve plug (key 5), bonnet gasket (key 11), cage (key 2), seat ring (key 4) and the seat ring gasket (key 12).

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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NOTE

Inspect the seat ring, cage, bonnet and body gasket surfaces. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm / 0.003 in. in height (the thickness of a human hair) can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, since they will prevent the gaskets from sealing properly.

8. Clean all gasket surfaces with a good wire brush. Clean in the same direction as the surface serrations, not across them.
9. Cover the opening in the valve body to protect the gasket surface and to prevent foreign material from getting into the valve body cavity.
10. Remove the packing flange nuts (key 21), packing flange (key 19), upper wiper (key 27) and packing follower (key 28). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. For extension bonnets, also remove the baffle (key 36) and retaining ring (key 37).
11. Clean the packing box and the following metal packing parts: packing follower, packing box ring (key 26), spring or lantern ring (key 24) and, for single arrangements of PTFE V-ring packing only, special washer (key 25).
12. Inspect the valve stem threads for any sharp edges that might cut the packing. A whetstone or emery cloth may be used to smooth the threads, if necessary.
13. Remove the protective covering from the valve body cavity, and install the seat ring, cage and cage retainer (as provided) using a new seat ring gasket (key 12) and bonnet gasket (key 11). Install the plug, then slide the bonnet over the stem and onto the studs (key 13). For a valve body with extension bonnet, also install the baffle and retaining rings (keys 36 and 37).

NOTE

The prelubricated hex nuts (key 14) referred to in step 14 can be identified by a black film coating on the nut threads. The proper bolting procedures in step 14 include—but are not limited to—ensuring that the bonnet stud threads are clean and that the hex nuts are evenly tightened to the specified torque values.

Table 9. Valve Stem Connection Torque and Drill Size for Pin Hole

HP	HPA	VALVE STEM DIAMETER		DESIGN	VALVE STEM CONNECTION TORQUE ⁽²⁾ (MINIMUM-MAXIMUM)		DRILL SIZE FOR PIN
		mm	in.		N•m	Lbf•ft	in.
1	1	12.7	1/2	HPS, HPAS	81 to 115	60 to 85	1/8
		19.1	3/4	HPS, HPAS	237 to 339	175 to 250	3/16
2	2, 3	12.7	1/2	HPD, HPAD, HPS, HPAS ⁽¹⁾ , HPT, HPAT	81 to 115	60 to 85	1/8
		19.1	3/4	HPS, HPAS ⁽¹⁾	237 to 339	175 to 250	3/16
				HPD, HPAD, HPT, HPAT	237 to 339	175 to 250	1/8
		25.4	1	HPS, HPAS ⁽¹⁾	420 to 481	310 to 355	1/4

- continued -

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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HP and HPA Valves

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Table 9. Valve Stem Connection Torque and Drill Size for Pin Hole (continued)

HP	HPA	VALVE STEM DIAMETER		DESIGN	VALVE STEM CONNECTION TORQUE ⁽²⁾ (MINIMUM-MAXIMUM)		DRILL SIZE FOR PIN
		mm	in.		N•m	Lbf•ft	
3	4	12.7	1/2	HPD, HPS, HPT, HPAD, HPAT	81 to 115	60 to 85	1/8
		19.1	3/4	HPD, HPS, HPT, HPAD, HPAT	237 to 339	175 to 250	3/16
		25.4	1	HPD, HPS, HPT, HPAD, HPAT	420 to 481	310 to 355	1/4
4	6	19.1	3/4	HPD, HPT, HPAD, HPAT	237 to 339	175 to 250	3/16
		25.4	1	HPD, HPT, HPAD, HPAT	420 to 481	310 to 355	1/4
6	8	19.1	3/4	HPD, HPT, HPAD, HPAT	237 to 339	175 to 250	3/16
		25.4	1	HPD, HPT, HPAD, HPAT	420 to 481	310 to 355	1/4
		31.8	1-1/4	HPD, HPT, HPAD, HPAT	827 to 908	610 to 670	1/4
8	N/A	25.4	1	HPD, HPT	420 to 481	310 to 355	1/4
		31.8	1-1/4	HPD, HPT	827 to 908	610 to 670	1/4
		50.8	2	HPD, HPT	3515 to 3885	2600 to 2880	3/8
10	12	25.4	1	HPD, HPT, HPAD, HPAT	420 to 481	310 to 355	1/4
		31.8	1-1/4	HPD, HPT, HPAD, HPAT	827 to 908	610 to 670	1/4
		50.8	2	HPD, HPT, HPAD, HPAT	3515 to 3885	2600 to 2880	3/8
12	N/A	25.4	1	HPD, HPT	420 to 481	310 to 355	1/4
		31.8	1-1/4	HPD, HPT	827 to 908	610 to 670	1/4
		50.8	2	HPD, HPT	3515 to 3885	2600 to 2880	3/8
14	N/A	31.8	1-1/4	HPD, HPT	827 to 908	610 to 670	1/4
		50.8	2	HPD, HPT	3515 to 3885	2600 to 2880	3/8
16	N/A	31.8	1-1/4	HPD, HPT	827 to 908	610 to 670	1/4
		50.8	2	HPD, HPT	3515 to 3885	2600 to 2880	3/8
18	N/A	31.8	1-1/4	HPD, HPT	827 to 908	610 to 670	1/4
		50.8	2	HPD, HPT	3515 to 3885	2600 to 2880	3/8
20	N/A	31.8	1-1/4	HPD, HPT	827 to 908	610 to 670	1/4
		50.8	2	HPD, HPT	3515 to 3885	2600 to 2880	3/8
24	N/A	31.8	1-1/4	HPD, HPT	827 to 908	610 to 670	1/4
		50.8	2	HPD, HPT	3515 to 3885	2600 to 2880	3/8

1. HPAS available in NPS2 only.
2. Lubricate with anti-seize lubricant.

NOTICE

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in Table 7 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended.

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

**WARNING**

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson sales office immediately if a discrepancy between actual parts and approved parts is suspected.

14. Lubricate the stud threads, the faces of the hex nuts (key 14) and washer face with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Replace the hex nuts and tighten them finger-tight. Stroke the valve several times to center the trim. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in Table 7.

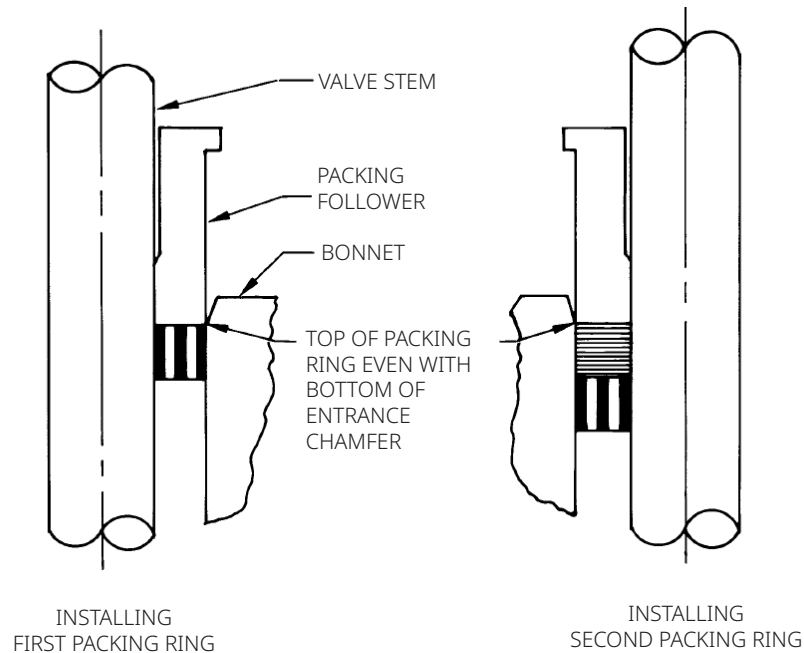
When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

NOTE

When installing packing rings, prevent entrapping air between the rings. Add the rings one at a time without forcing them below the chamfer of the packing box entrance chamber. As each successive ring is added, the stack should not be pushed down more than the thickness of the added ring (Figure 5).

15. Install new packing and the metal packing box parts according to the appropriate arrangement in Figure 3. If desired, packing parts may be pre-lubricated with a silicon base grease for easier installation. Slip a smooth-edged pipe over the valve stem, and gently tamp each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.
16. Slide the packing follower, wiper and packing flange into position. Lubricate the packing flange studs (key 20) and the faces of the packing flange nuts (key 21). Replace the packing flange nuts.

For the spring-loaded PTFE V-ring packing shown in Figure 3, tighten the packing flange nuts until the shoulder on the packing follower (key 28) contacts the bonnet.

Figure 5. Installing Graphite Ribbon/Filament Packing Rings One at a Time

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For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in Table 6. Then, loosen the packing flange nuts and retighten them to the recommended minimum torque shown in Table 6.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in Table 6. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

For ENVIRO-SEAL or HIGH-SEAL live-loaded packing, refer to the note at the beginning of the Maintenance section.

17. Mount the actuator on the valve body assembly, and reconnect the actuator and valve plug stems according to the procedures in the appropriate actuator instruction manual.

3.3 Trim Removal

For C-seal construction, see the appropriate C-seal sections in this manual.

For bore seal construction, see the appropriate bore seal sections in this manual.

Key numbers referenced in this procedure are shown in Figure 22, 23, 24, 26, 28, 30, 32, 34, 36 or 38 except where indicated.

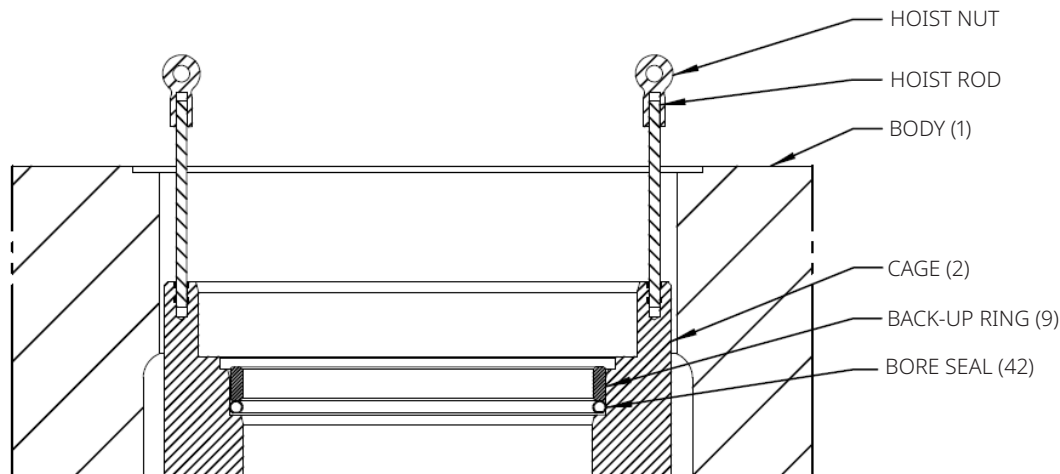
1. Remove the actuator and bonnet by following steps 1 through 6 of the replacing packing procedure. Observe all warnings and cautions.
2. Lift the valve stem and attached valve plug out of the valve body. If the valve plug is to be reused, tape or otherwise protect the valve plug stem and the valve plug seating surface to prevent scratches.
3. Lift out the cage retainer (key 45) (as required), cage (key 2) and the bonnet gasket (key 11). For an NPS 2 valve body with a Cavitrol III two stage cage, also remove the bonnet spacer and two gaskets. For NPS 8 to 24 HPD and HPT, follow step 4 to lift the cage.
4. Remove the seal rings (key 42), as required, and retainer ring (key 37) and set aside.
5. Install threaded rods (about 6-in. long) in to the holes on the top of the cage vertically, as required. Install hoist rings, nuts or eye bolt on to the threaded rods. Lift the cage with the hoist nut from the valve body.

WARNING

Lifting of the cage must be done with a vertical, or straight, lift using the equipment shown in Figure 6. Lifting at an angle may damage the lifting equipment and cause property damage or personal injury.

6. Remove and discard all spiral wound gaskets (keys 43 and 11).

Figure 6. Removal of Cage with Hoist Rod and Nut



NOTE

The cage and cage retainer lifting holes are provided for ease of disassembly. To prevent damage to the cage lifting hole, fully engage the threaded rod into the cage hole, but do not overtighten the hoist rod. It only needs to be hand tight.

If it is hard to lift the cage, a piece of wood and a hammer can be used to strike on the top chamfer of the cage to loosen it from the body or seat ring gasket.

ASTM A193 B7 or comparable threaded rods are required for cage removal.

Contact your [Emerson sales office](#) for more information.

Constructions other than TSO Trim

1. Remove the seat ring (key 4) and the seat ring gasket (key 12).
2. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

TSO Trim

TSO Trim: 0.8125 In. Port Diameter (Figure 8)

1. Remove the pin that locks the inner plug to the stem.
2. Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
3. Remove the protected soft seat seal.
4. Inspect the parts for damage and replace, if needed.
5. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

TSO Trim: 1.6875 In. Port Diameter (Figure 9)

1. Remove the retainer, backup ring, anti-extrusion rings and piston ring.
2. Remove the set screws that lock the outer plug to the stem.
3. Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
4. Remove the protected soft seat seal.
5. Inspect the parts for damage and replace if needed.
6. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

TSO Trim: 2.6875 In. and Larger Port Diameters (Figure 10)

1. Remove the retainer, backup ring, anti-extrusion rings and piston ring.
2. Remove the set screws that lock the outer plug to the inner plug.
3. Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
4. Remove the protected soft seat seal.
5. Inspect the parts for damage and replace, if needed.
6. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

3.4 Valve Plug Maintenance

Key numbers used in this procedure are shown in Figure 22, 23, 24, 26, 28, 30, 32, 34, 36 or 38 except where indicated.

1. With the valve plug (key 5) removed according to the trim removal procedure, proceed as appropriate:

For HPD and HPAD valves, the piston rings (key 8) are each in at least two sections; remove the sections from the grooves in the valve plug.

For HPS and HPAS valves, proceed to step 2.

For HPT and HPAT valves, work the retaining ring (key 10) off the valve plug with a screwdriver. Carefully slide the backup ring and seal ring (keys 9 and 8) off the valve plug.

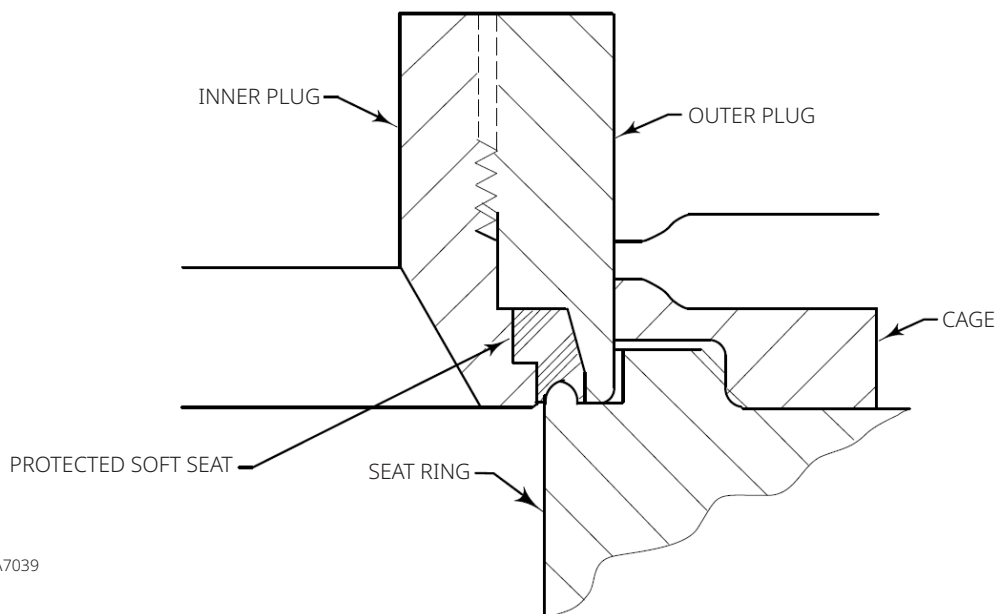
2. To replace the valve plug stem (key 6), drive out the pin (key 7) and unscrew the stem from the valve plug.

NOTICE

Never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem. This weakens the stem and may cause the stem to fail in service. If a new valve plug is required, always order a valve plug, stem and pin as an assembly. Specify the correct part number of each of the three parts, but state that the parts are being ordered as an assembly.

A used valve plug may be reused with a new stem.

Figure 7. Detail of Protected Soft Seat



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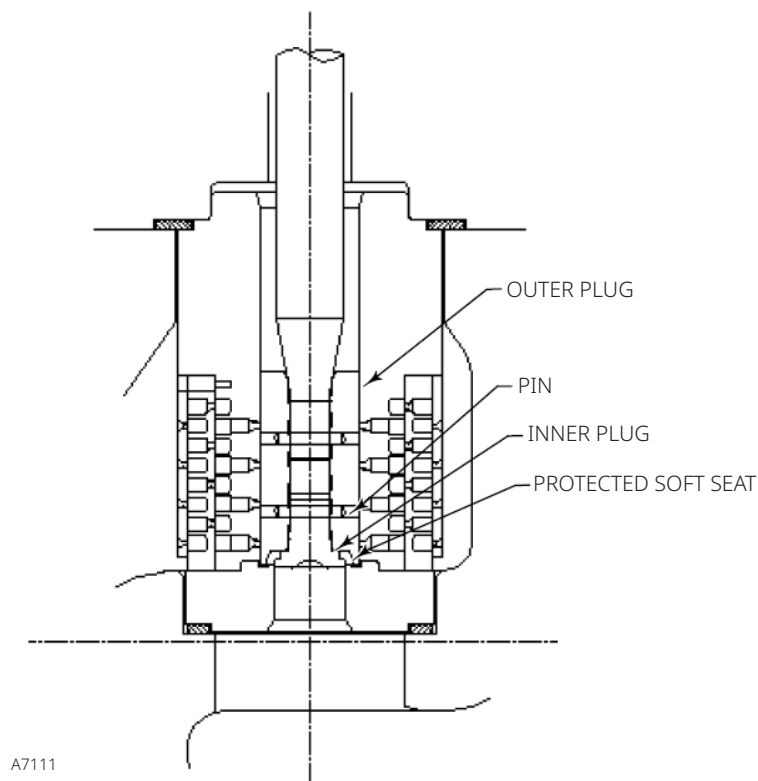
3. Thread the new stem into the valve plug and tighten it to the appropriate torque value given in Table 9. Using the valve plug pin hole as a guide, drill the pin hole through the stem. Refer to Table 9 for drill sizes.
4. Drive in the pin to lock the assembly.
5. If it is necessary to lap the seating surfaces, complete the lapping seats procedure before installing the HPD/HPAD piston rings or the HPT/HPAT seal ring. The Trim Replacement procedure provides piston ring and seal ring installation instructions and valve reassembly instructions.

3.5 Lapping Seats

Key numbers referenced in this procedure are shown in Figure 22, 23, 24, 26, 28, 30, 32, 34, 36 or 38 except where indicated.

A certain amount of leakage should be expected with metal-to-metal seating in any valve body. If the leakage becomes excessive, however, the condition of the seating surfaces of the valve plug and seat ring can be improved by lapping. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Figure 8. Typical Unbalanced TSO Trim Assembly, Small Port Designs (0.8125 In. Port Diameter)



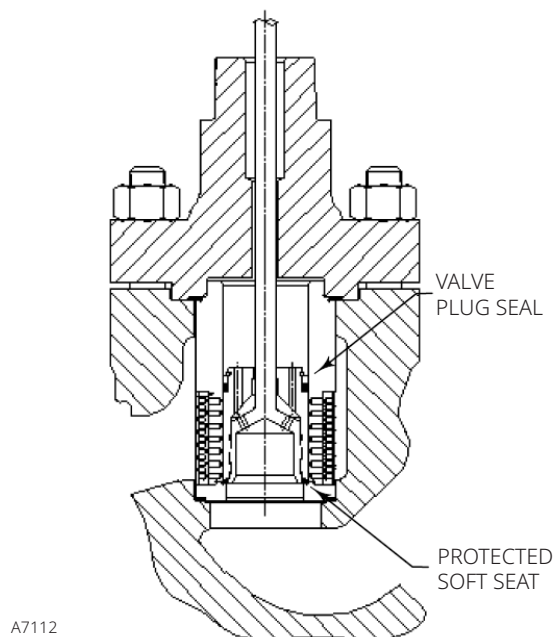
NOTE

HP Series valves use spiral-wound gaskets. These gaskets provide their seal by being crushed and therefore should never be reused. This includes reusing a gasket after the lapping procedure has been performed.

An “old” gasket can be used to lap the seat, however the gasket must be replaced with a new gasket.

To preserve the effects of lapping, do not change either the position of the seat ring in the valve body cavity or the position of the cage on the seat ring after lapping the seating surfaces. When the parts are removed for cleaning and replacement of the “old” gaskets, return them to the original positions.

Figure 9. Typical Balanced TSO Trim (1.6875 In. Port Diameter)



Use the following procedure to lap the seating surfaces.

1. Install the following parts according to the instructions presented in the trim replacement procedure: “old” seat ring gasket (key 12), seat ring (key 4), cage (key 2) and “old” bonnet gasket (key 11).
2. Proceed as appropriate:
For an HPD, HPAD, HPT or HPAT valve, install the valve plug and stem assembly (keys 5 and 6)–without piston rings or seal ring (key 8) –into the cage.
For an HPS or HPAS valve, install the valve plug and stem assembly (keys 5 and 6) into the cage.
3. Install the bonnet (key 18) over the valve stem, and secure the bonnet with four of the hex nuts (key 14).
4. Attach a handle, such as a piece of strap iron secured by stem locknuts, to the valve stem. Rotate the handle alternately in each direction to lap the seats.
5. After lapping, disassemble as necessary (you may mark the position of the seat ring and cage with a soft tip marker). Clean the seating surfaces, replace the gaskets, reassemble (taking care to return the seat ring and cage to their original positions) and test for shutoff. Repeat the lapping procedure if necessary.

Figure 10. Typical Balanced TSO Trim, Large Port Designs (2.6875 In. and Larger Port Diameters)

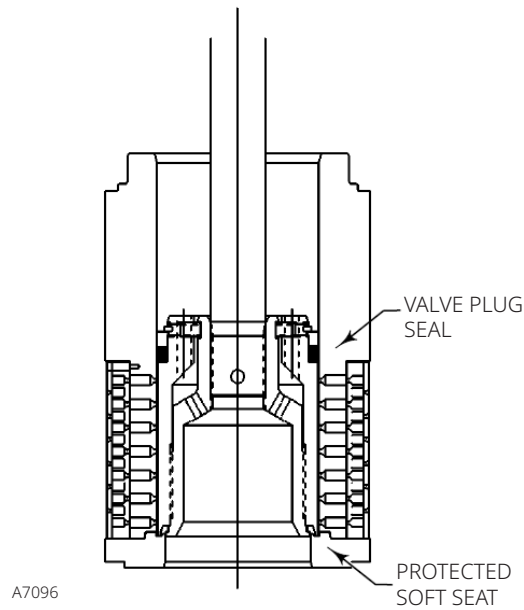


Table 10. Actuator Groups by Type Number

Group 1 71 and 90 mm / 2-13/16 and 3-9/16 in. Yoke Boss	Group 100 127 mm / 5-in. Yoke Boss
472 and 473 585C 1B 644 and 645 655 657 and 667 685SE and 685SR 1008	472 473 474 476 585C 657 685 785C
	Group 101 127 mm / 5-in. Yoke Boss
	667
Group 407 127 mm / 5-in. Yoke Boss	Group 802 127 mm / 5-in. Yoke Boss
585C 657 685 785C	585C 685 785C
Group 803 127 mm / 5-in. Yoke Boss 178 mm / 7-in. Yoke Boss	Group 805 178 mm / 7-in. Yoke Boss
685 785C	685 785C

3.6 Trim Replacement

WARNING

Observe the warning at the start of the Maintenance section.

After all trim maintenance has been completed, reassemble the valve body by following the numbered steps below. Be certain that all gasketed surfaces have been well cleaned. Key numbers referenced in this procedure are shown in Figure 22, 23, 24, 26, 28, 30, 32, 34, 36 or 38 except where indicated.

NOTE

Inspect the seat ring, cage, cage retainer (as provided), bonnet and body gasket surfaces. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm / 0.003 in. in height (the thickness of a human hair) can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, since they will prevent the gaskets from sealing properly.

NOTE

The pressure balancing holes in the valve plug are necessary for the proper and safe operation of the valve. Inspect the balancing holes every time the valve is disassembled for service. Any build-up, blockage or clogging of the balance holes should be removed.

NPS 2 to 6 HPD (Long), HPT (Long) and NPS 2 to 8 CL1500 HPAD and HPAT

Constructions other than TSO Trim

NOTE

When installing the standard cage, align two of the holes in the cage with the centerline of the valve body. Refer to Figure 23.

1. Install the seat ring gasket (key 12) into the valve body. Install the seat ring (key 4).
2. Install the cage.
3. To install the piston rings and seal rings (key 8), proceed as appropriate:

For an HPD or HPAD valve, if it is necessary to install new piston rings, the replacement piston rings will arrive in one piece. Use a vise with smooth or taped jaws to break a replacement piston ring into halves. Place the new ring in the vise so that the jaws compress the ring into an oval. Compress the ring slowly until the ring snaps on both sides. If one side snaps first, do not try to tear or cut the other side. Instead, keep compressing until the other side snaps. The piston ring can also be fractured by scoring and snapping over a hard surface such as a table edge. Sawing or cutting is not recommended.

Remove any protective tape or covering from the valve plug and stem assembly, and set it on a protective surface. Then, place the piston rings in the piston ring grooves with the fractured ends matched.

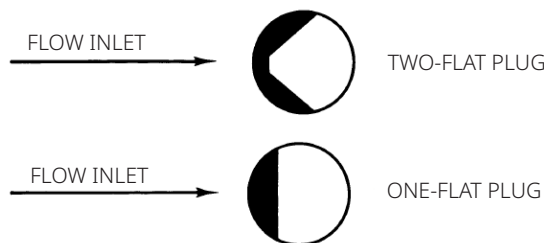
For an HPT or HPAT valve, install the seal ring (key 8) onto the valve plug (key 5). Install the ring with the open side facing the seat ring end of the valve plug for flow-down applications (view A of Figure 25) or with the open side facing the valve plug stem end of the valve plug for flow-up applications (view B of Figure 25). Slide the backup ring (key 9) onto the valve plug. Secure with the retaining ring (key 10).

For an HPAS Micro-Flat valve, ensure the Micro-Flat valve plug and stem assembly is oriented as shown in Figure 11 when replacing the bonnet on the valve body. Then slide the bonnet over the stem and onto the stud bolts.

NOTE

Micro-flat plugs must be installed as shown in Figures 11 and 23. This proper plug orientation increases the guide support area for the plug and stem.

Figure 11. Micro-Flat Valve Plug Orientation



A5602

4. Install the valve plug into the cage.
5. Install the bonnet gasket (key 11) on the cage.
6. Install the bonnet over the valve stem and onto the valve body.

TSO Trim

TSO Trim: 0.8125 In. Port Diameter (Figure 8)

1. Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
2. Mark the inner plug and outer plug with alignment marks in the assembled position.
3. Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
4. Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is compressed properly. Do not damage the outer plug guide surfaces.
5. Drill through the inner plug with the proper size drill bit (same size as stem pinning) and install the pin.
6. Install the bonnet gasket (key 11) on the cage.
7. Install the bonnet over the valve stem and onto the valve body.

TSO Trim: 1.6875 In. Port Diameter (Figure 9)

1. Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
2. Mark the top of the outer plug and stem with alignment marks in the assembled position.
3. Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
4. Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is compressed properly. Do not damage the outer plug guide surfaces.
5. Install set screws centering the stem in the outer plug and torque to 11 N•m / 8 lbf•ft.
6. Assemble the piston ring, anti-extrusion rings, backup ring and retainer.
7. Install the bonnet gasket (key 11) on the cage.
8. Install the bonnet over the valve stem and onto the valve body.

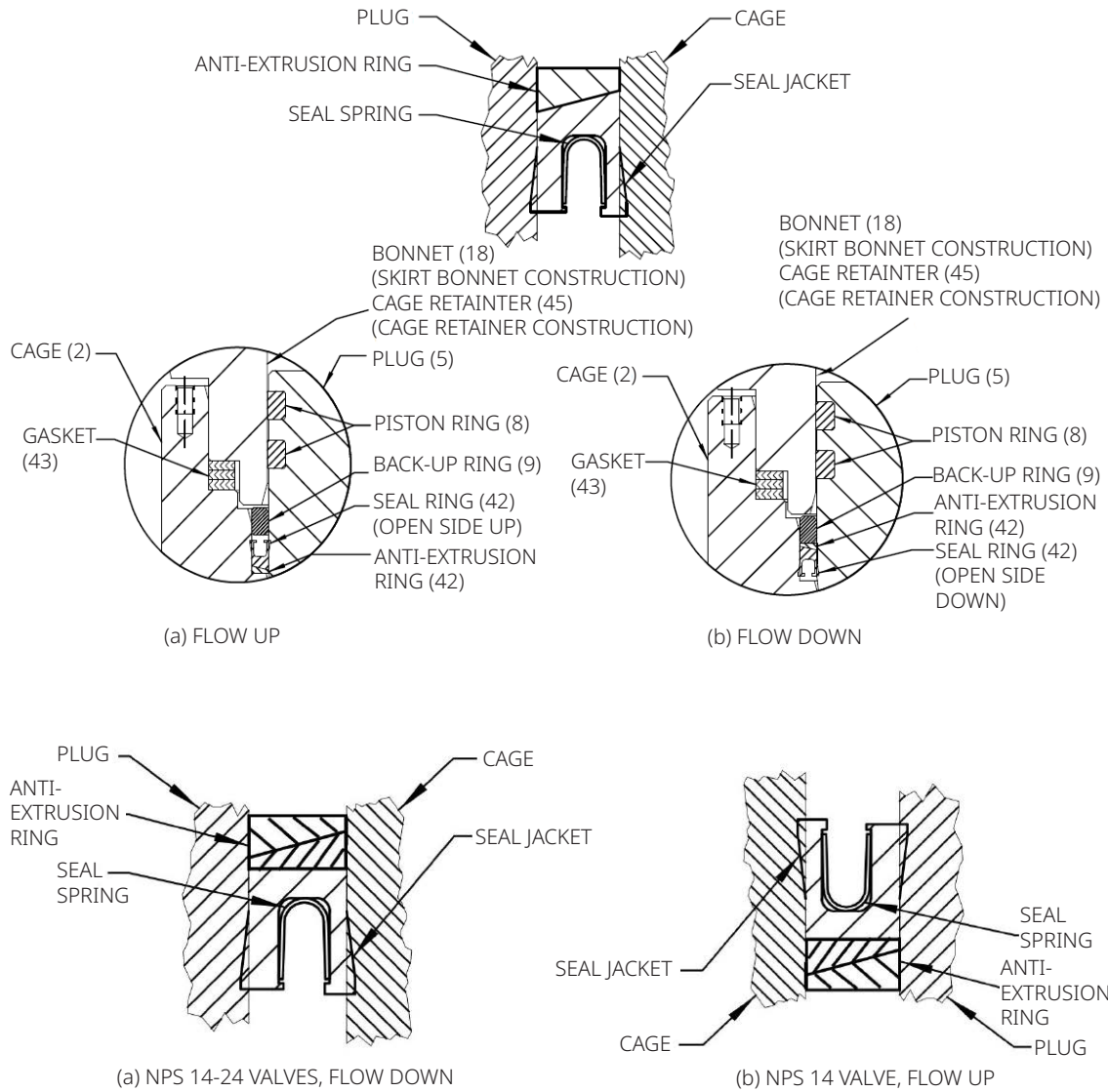
TSO Trim: 2.6875 In. and Larger Port Diameters (Figure 10)

1. Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
2. Mark the top of the inner plug and outer plug with alignment marks in the assembled position.
3. Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
4. Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is compressed properly. Do not damage the outer plug guide surfaces.
5. Install set screws centering the inner plug in the outer plug and torque to 11 N•m / 8 lbf•ft.
6. Assemble the piston ring, anti-extrusion rings, backup ring and retainer.
7. Install the bonnet gasket (key 11) on the cage.
8. Install the bonnet over the valve stem and onto the valve body.

NPS 8 to 24 HPD and HPT and NPS 12 HPAD/HPAT Constructions (Figures 26, 27, 28, 29, 30, 31, 32, 33, 38, 39 and 40)

1. Install the seat ring flat sheet gasket (key 12) in the lower gasket groove in the valve body (key 1), making sure the gasket is centered in the groove and the bottom of the gasket is flush with the mating surface in the body.
2. If applicable, install the seat ring (key 4) into the valve body. Lift using hoist rings on threaded rods threaded into the lift holes provided. Take care to lower the seat ring evenly and ensure the seat ring will not damage the flat sheet gasket (key 12).
3. If required, slip quantity-1 seal ring (key 42) onto the lowest groove of cage with the open side of the seal ring facing the top or bottom of the seat ring, depending on flow direction. Make sure the anti-extrusion ring is on the closed side of the seal ring and the tapered face of anti-extrusion ring and the seal ring match correctly, see Figure 12.

Figure 12. Soft Seal Detail and Installed Orientation



NOTE

The anti-extrusion ring is NOT reversible. There is a flat face side and a tapered face side. The tapered face side of the anti-extrusion ring matches a tapered face on the seal ring. The seal will not function properly if it is not assembled correctly. The seal installation should be done prior to cage installed into the valve. When install a bore seal ring, refer to the bore seal Trim section.

4. Place the backup ring (key 9) into the seal groove until it touches the seal ring (key 42).
5. Install threaded rods (about 6 in. long) in to the holes on the top of the cage. Install hoist rings, nuts or eye bolt on to the threaded rod.

NOTE

To prevent damage to the cage/seat ring lifting holes, fully engage the threaded rod into the cage/seat ring hole, but do not overtighten the hoist rod. It only needs to be hand tight. ASTM A193 B7 or comparable threaded rods are required for cage/seat ring installation.

6. Install the cage (key 2) into the valve body, lift the cage using the hoist rings on the threaded rods. When installing the cage (key 2), take care to lower the cage evenly and ensure that cage (key 2) will not damage the flat sheet gasket (key 12) or the seat ring (key 4).

NOTE

If a drilled hole cage is used, blow out the cage and drilled holes before installing into the body to make sure the burrs and debris will not be trapped between cage and plug and cause damage.

7. For NPS 8 through 12 valves with skirted bonnet install quantity-3 cage spiral wound gaskets (key 43) for NPS 8 through 14 valves with cage retainer (key 45) install quantity-2, for NPS 16 through 24 valves with cage retainer (key 45) install quantity 3, making sure the gaskets sits flush on the surface of the groove.
8. If applicable, install the cage retainer (key 45) on top of the cage. For NPS 8 through 12 valves install a single spiral wound gasket (key 43) in the gasket groove on top of the cage retainer. For the NPS 14 valve install quantity-2 gaskets in the gasket groove on top of the cage retainer. For NPS 8 through 12 valves install a single spiral wound gasket (key 43) in the gasket groove on top of the cage retainer.
9. Install the bonnet gasket (key 11) in to the groove around the valve body trim opening.
10. Install quantity-2 piston rings (key 8) into the grooves on the plug (key 5).

NOTE

If it is necessary to install new piston rings, the replacement piston rings will arrive in one piece. Use a vise with smooth or taped jaws to break a replacement piston ring into halves. Place the new ring in the vise so that the jaws compress the ring into an oval. Compress the ring slowly until the ring snaps on both sides. If one side snaps first, do not try to tear or cut the other side. Instead, keep compressing until the other side snaps. The piston ring can also be fractured by scoring and snapping over a hard surface such as a table edge. Sawing or cutting is not recommended.

11. Place the plug/stem assembly into the bore of the cage (key 2) and gently rest the plug seating surface against the seating surface in the cage and make sure piston rings do not come out.
12. Lower the bonnet (key 18) over the valve plug stem, ensuring the valve stem is centered with the bonnet. This is important so that the top of the stem will engage the packing bore hole in the bonnet. Continue to lower the bonnet over the cage retainer.

NOTE

Be careful to prevent the bonnet from crushing the spiral wound gaskets as the bonnet is lowered on to the valve.

Damaging the gaskets will require that they are replaced.

The prelubricated hex nuts (key 14) referred to in step 13 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 13 include--but are not limited to--ensuring the bonnet stud threads are clean, and the hex nuts are evenly tightened to the specified torque values.

NOTICE

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in Table 7 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure. Hot torquing is not recommended.

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

**WARNING**

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) immediately if a discrepancy between actual parts and approved parts is suspected.

13. Lubricate the stud threads, the faces of the hex nuts (key 14), and washers (key 40) (if provided) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Replace the hex nuts, but do not tighten them. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in Table 7. When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.
14. Install new packing and packing box parts per steps 15 and 16 of the Replacing Packing procedure. Be certain to observe the note given prior to step 15 of that procedure.
15. Mount the actuator by following the procedures in the actuator instruction manual. Check for packing leakage as the valve is being put into service. Retorque the packing flange nuts as required (see Table 6).

NPS 3 to 6 HPD (Short), HPT (Short), HPS (Short) and NPS 6 and 8 CL2500 HPAD, HPAT (Figures 34, 35, 36 and 37)

1. Install the seat ring flat sheet gasket (key 12) in the lower gasket groove in the valve body (key 1), making sure the gasket is centered in the groove and the bottom of the gasket is flush with the mating surface in the body.
2. Install the seat ring (key 4) on top of the gasket in the body.
3. Install the cage (key 2) on top of the seat ring.
4. If applicable, install the backup ring (key 9) on cage groove.
5. For HPT constructions, slip quantity-1 seal ring (key 42) into the cage retainer (key 45) with the open side of the seal ring facing the top or bottom of the seat ring, depending on flow direction. For flow up the seal will need to be oriented with the opening toward the bonnet side of the retainer; for flow down the seal opening needs to be facing toward the cage side of the retainer. Make sure the anti-extrusion ring is on the closed side of the seal ring (see Figure 34).

NOTE

The anti-extrusion ring is NOT reversible. There is a flat face side and angle side. The angle face sides must be installed mating to each other. The seal will not function properly if it is not assembled correctly. The seal installation should be done prior to cage retainer installation into the valve. To hold the anti-extrusion ring in while lowering the cage, a dollop of grease can be used.

6. Install the cage retainer (key 45) on top of the cage.
7. For HPD and HPT constructions, install piston rings (key 39) into the grooves on the plug (key 6).

NOTE

If it is necessary to install new piston rings, the replacement piston rings will arrive in one piece. Use a vise with smooth or taped jaws to break a replacement piston ring into halves. Place the new ring in the vise so that the jaws compress the ring into an oval. Compress the ring slowly until the ring snaps on both sides. If one side snaps first, do not try to tear or cut the other side. Instead, keep compressing until the other side snaps. The piston ring can also be fractured by scoring and snapping over a hard surface such as a table edge. Sawing or cutting is not recommended.

8. Install the plug (key 6) into the assembly through the cage retainer. Lower until it contacts the seat.
9. Install quantity-2 spiral wound gaskets onto the gasket groove on the cage retainer.
10. Install the bonnet gasket (key 11) into the groove around the valve body trim opening.
11. Lower the bonnet (key 18) over the valve plug stem, ensuring the valve stem is centered with the bonnet. This is important so that the top of the stem will engage the packing bore hole in the bonnet. Continue to lower the bonnet over the cage retainer.

NOTE

Be careful to prevent the bonnet from crushing the spiral wound gaskets as the bonnet is lowered on to the valve. Damaging the gaskets will require that they are replaced.

The prelubricated hex nuts (key 14) referred to in step 12 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 12 include--but are not limited to--ensuring that the bonnet stud threads are clean and that the hex nuts are evenly tightened to the specified torque values.

Tapped holes are provided in the cage and cage retainer as lifting provisions should they be needed for installation.

Contact your [Emerson sales office](#) for additional information.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) immediately if a discrepancy between actual parts and approved parts is suspected.

NOTICE

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in Table 7 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure. Hot torquing is not recommended.

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

12. Lubricate the stud threads, the faces of the hex nuts (key 14) and washers (key 40) (if provided) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Replace the hex nuts, but do not tighten them. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in Table 9. When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.
13. Install new packing and packing box parts per steps 15 and 16 of the Replacing Packing procedure. Be certain to observe the note given prior to step 15 of that procedure.
14. Mount the actuator by following the procedures in the actuator instruction manual. Check for packing leakage as the valve is being put into service. Retorque the packing flange nuts as required (see Table 6).

3.7 Retrofit: Installing C-seal Trim

Apply to NPS 2 to 6 HPD (Long), HPT (Long) and NPS 2 to 8 CL1500 HPAD and HPAT Constructions

NOTE

Additional actuator thrust is required for a valve with C-seal trim. When installing C-seal trim in an existing valve, contact your [Emerson sales office](#) for assistance in determining new actuator thrust requirements.

Assemble the new valve plug/retainer assembly (with C-seal plug seal) using the following instructions:

NOTICE

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the new trim parts while assembling the individual parts and during installation in the valve body.

1. Apply a suitable high-temperature lubricant to the inside diameter of the C-seal plug seal. Also, lubricate the outside diameter of the valve plug where the C-seal plug seal must be pressed into the proper sealing position (Figure 13).
 2. Orient the C-seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the C-seal plug seal must face up in a valve with flow-up construction (Figure 13).
 - The open interior of the C-seal plug seal must face down in a valve with flow-down construction (Figure 13).
-

NOTE

An installation tool must be used to properly position the C-seal plug seal on the valve plug. A tool is available as a Fisher spare part or a tool could be manufactured following the dimensions given in Figure 14.

3. Place the C-seal plug seal over the top of the valve plug and press the C-seal plug seal onto the plug using the C-seal installation tool. Carefully press the C-seal plug seal onto the plug until the installation tool contacts the horizontal reference surface of the valve plug (Figure 15).
4. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the C-seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
5. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (Figure 16) to secure the C-seal retainer.
6. Install the new plug/retainer assembly with C-seal plug seal on the new stem following the appropriate instructions in the Trim Replacement section in this manual.
7. Install piston rings by following instructions in the Trim Replacement section in this manual.
8. Remove the existing valve actuator and bonnet following the appropriate instructions in the Replacing Packing section in this manual.

August 2024

37B1399-A

Technical drawing of a shaft-hub assembly. The drawing shows a shaft with diameter $\varnothing A$ and a hub with inner diameter $\varnothing B$. The shaft has a length of $45^\circ \times 1.524 / 0.06$. The hub has a length of $45^\circ \times 0.508 / 0.02$. The shaft has a diameter of $\varnothing C$ and $\varnothing D$. The hub has a diameter of $\varnothing B$. The shaft has a taper of $8^\circ - 9^\circ$. The hub has a break sharp corner with a radius of $45^\circ \times 0.254 / 0.01$ MAX. The drawing includes a scale of mm / in. and a reference number A6777.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

HP and HPA Valves

August 2024

Instruction Manual

D101634X012

FOR VALVE PLUGS FITTING PORT SIZE, In.	DIMENSIONS, mm (See Figure 14)								Part Number (To Order A Tool)
	A	B	C	D	E	F	G	H	
2.875	82.55	52.324 to 52.578	4.978 to 5.029	3.708 to 3.759	41.148	52.680 to 52.781	55.118 to 55.626	70.891 to 71.044	24B9816X012
3.4375	101.6	58.674 to 58.928	4.978 to 5.029	3.708 to 3.759	50.8	61.011 to 61.112	63.449 to 63.957	85.166 to 85.319	24B5612X012
3.625	104.394	65.024 to 65.278	4.978 to 5.029	3.708 to 3.759	50.8	68.936 to 69.037	71.374 to 71.882	89.941 to 90.094	24B3630X012
4.375	125.984	83.439 to 83.693	4.978 to 5.029	3.708 to 3.759	50.8	87.351 to 87.452	89.789 to 90.297	108.991 to 109.144	24B3635X012
5.375	142.748	100.076 to 100.33	4.978 to 5.029	3.708 to 3.759	45.974	103.835 to 103.937	106.274 to 106.782	128.219 to 128.372	23B9193X012
FOR VALVE PLUGS FITTING PORT SIZE, In.	DIMENSIONS, in. (See Figure 14)								Part Number (To Order A Tool)
	A	B	C	D	E	F	G	H	
2.875	3.25	2.060 to 2.070	0.196 to 0.198	0.146 to 0.148	1.62	2.074 to 2.078	2.170 to 2.190	2.791 to 2.797	24B9816X012
3.4375	4.00	2.310 to 2.320	0.196 to 0.198	0.146 to 0.148	2.00	2.402 to 2.406	2.498 to 2.518	3.353 to 3.359	24B5612X012
3.625	4.11	2.560 to 2.570	0.196 to 0.198	0.146 to 0.148	2.00	2.714 to 2.718	2.810 to 2.830	3.541 to 3.547	24B3630X012
4.375	4.96	3.285 to 3.295	0.196 to 0.198	0.146 to 0.148	2.00	3.439 to 3.443	3.535 to 3.555	4.291 to 4.297	24B3635X012
5.375	5.62	3.940 to 3.950	0.196 to 0.198	0.146 to 0.148	1.81	4.088 to 4.092	4.184 to 4.204	5.048 to 5.054	23B9193X012

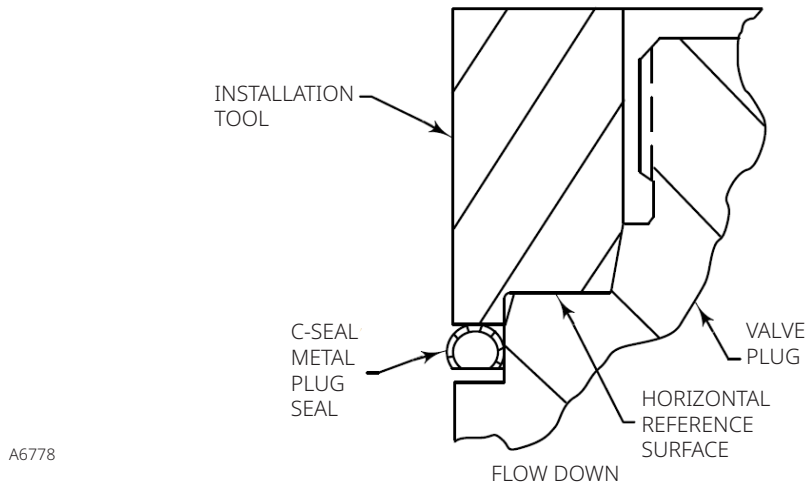
NOTICE

Do not remove the existing valve stem from the valve plug unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

9. Remove the existing valve stem and plug, cage and seat ring from the valve body following the appropriate instructions in the Trim Removal section in this manual.
10. Replace all gaskets according to appropriate instructions in the Trim Replacement section in this manual.
11. Install the new seat ring, cage, valve plug/retainer assembly and stem into the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section in this manual.

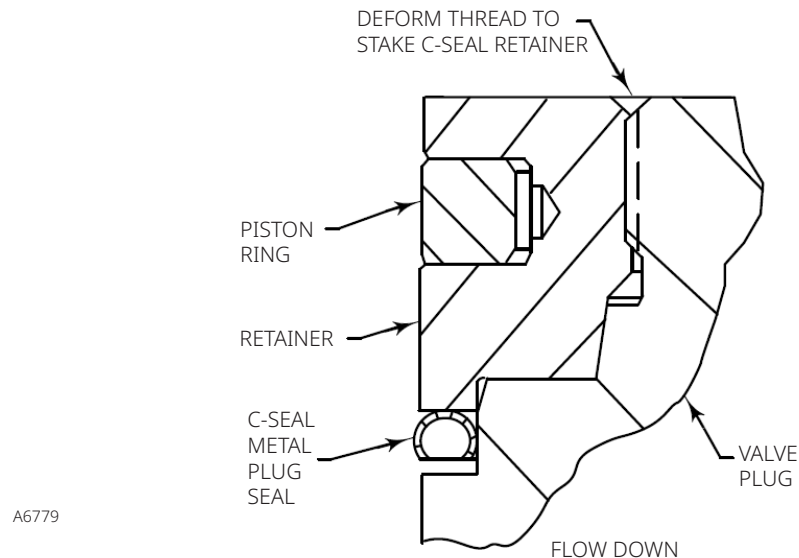
Figure 15. Installing the C-seal Plug Seal Using the Installation Tool



NOTE:

PRESS THE INSTALLATION TOOL OVER THE VALVE PLUG UNTIL THE TOOL CONTACTS THE HORIZONTAL REFERENCE SURFACE OF THE VALVE PLUG.

Figure 16. Stake the Threads of the C-seal Retainer



NOTICE

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the C-seal plug seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop through the valve, this force will adequately drive the valve plug to the seat ring, thus giving the C-seal plug seal a predetermined permanent set. Once this is done, the plug/retainer assembly, the cage and the seat ring become a matched set.

12. With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

3.8 Replacement of Installed C-seal Trim

Apply to NPS 2 to 6 HPD (Long), HPT (Long) and NPS 2 to 8 HPAD (Long) and HPAT (Long) Constructions

Trim Removal (C-seal Constructions)

1. Remove the valve actuator and bonnet following the appropriate instructions in the Replacing Packing section in this manual.

NOTICE

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance.

Use caution when removing piston ring(s) and C-seal plug seal to avoid scratching any sealing surface.

NOTICE

Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

2. Remove the plug/retainer assembly (with C-seal plug seal), cage and seat ring from the valve body following the appropriate instructions in the Trim Removal section in this manual.
3. Locate the staked thread on top of the valve plug (Figure 16). The staked thread secures the retainer. Use a drill with a 1/8 inch bit to drill out the staked area of the thread. Drill approximately 1/8-in. into the metal to remove the staking.
4. Locate the break between sections of the piston ring(s). Using an appropriate tool such as a flat-blade screwdriver, carefully pry out the piston ring(s) from the groove(s) in the C-seal retainer.
5. After removing the piston ring(s), locate the 1/4-inch diameter hole in the groove. In a retainer with two piston ring grooves, the hole will be found in the upper groove.
6. Select an appropriate tool such as a punch and place the tip of the tool into the hole with the body of the tool held tangent to the outside diameter of the retainer. Strike the tool with a hammer to rotate the retainer and free it from the valve plug. Remove the retainer from the plug.
7. Use an appropriate tool such as a flat-blade screwdriver to pry the C-seal plug seal off the plug. Use caution to avoid scratches or other damage to the sealing surfaces where the C-seal plug seal makes contact with the valve plug (Figure 17).
8. Inspect the lower seating surface where the valve plug contacts the seat ring for wear or damage which would prevent proper operation of the valve. Also, inspect the upper seating surface inside the cage where the C-seal plug seal contacts the cage and inspect the sealing surface where the C-seal plug seal makes contact with the plug (Figure 17).
9. Replace or repair trim parts according to the following procedure for Lapping Metal Seats, Remachining Metal Seats or other valve plug maintenance procedures as appropriate.

Lapping Metal Seats (C-seal Constructions)

Before installing a new C-seal plug seal, lap the lower seating surface (valve plug to seat ring, Figure 17) following appropriate procedures in the Lapping Seats section in this manual.

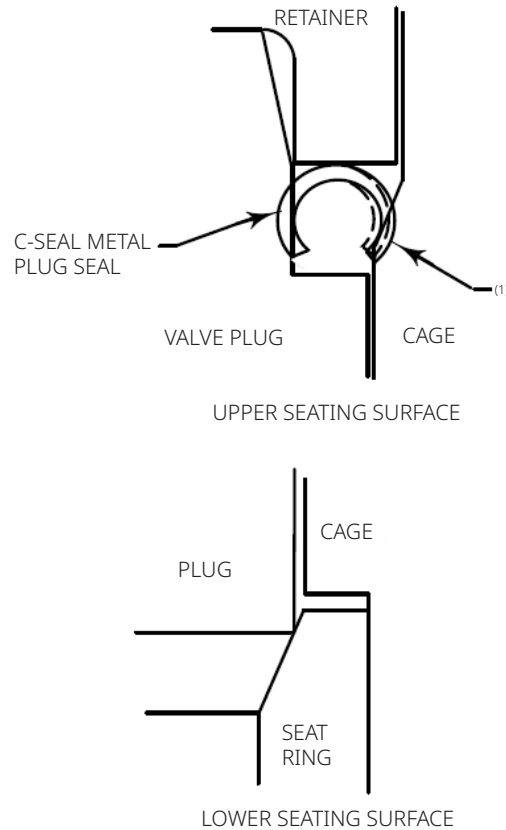
Remachining Metal Seats (C-seal Constructions)

See Figure 18. A valve plug with a C-seal metal plug seal features two seating surfaces. One seating surface is found where the valve plug contacts the seat ring. The second seating surface is found where the C-seal plug seal contacts the upper seating surface in the cage. If you machine the seats on the seat ring and/or plug, you must machine an equal dimension from the seating area in the cage.

NOTICE

If metal is removed from the seat ring and plug and a corresponding amount is not removed from the cage seating area, the C-seal plug seal will be crushed as the valve closes and the C-seal retainer will strike the seating area of the cage, preventing the valve from closing.

Figure 17. Lower (Valve Plug to Seat Ring) and Upper (C-seal Plug Seal to Cage) Seating Surfaces



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NOTE:

1. UPPER SEATING SURFACE IS THE AREA OF CONTACT BETWEEN THE C-seal METAL PLUG SEAL AND THE CAGE.

Trim Replacement (C-seal Constructions)

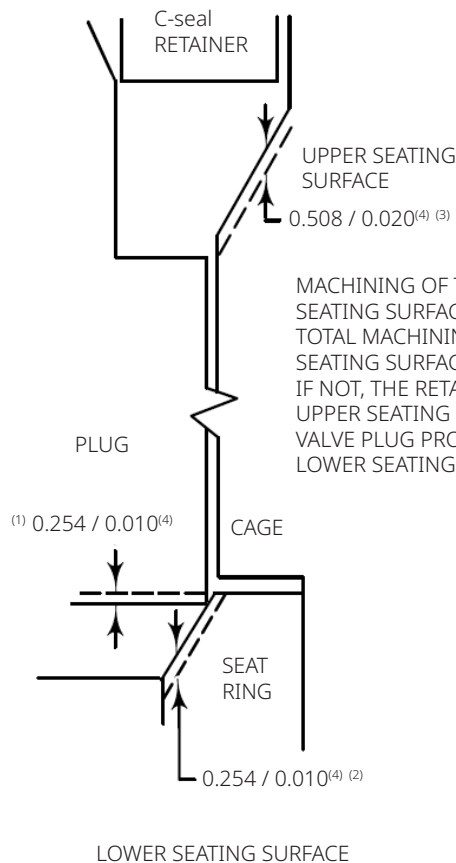
1. Apply a suitable high-temperature lubricant to the inside diameter of the C-seal plug seal. Also, lubricate the outside diameter of the valve plug where the C-seal plug seal must be pressed into the proper sealing position (Figure 13).
2. Orient the C-seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the C-seal plug seal must face up in a valve with flow-up construction (Figure 13).
 - The open interior of the C-seal plug seal must face down in a valve with flow-down construction (Figure 13).

NOTE

An installation tool must be used to properly position the C-seal plug seal on the valve plug. A tool is available as a Fisher spare part or a tool could be manufactured following the dimensions given in Figure 14.

3. Place the C-seal plug seal over the top of the valve plug and press it onto the plug using the installation tool. Carefully press the C-seal plug seal onto the plug until the installation tool contacts the horizontal reference surface of the valve plug (Figure 15).
4. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the C-seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.

Figure 18. Example of Machining the Lower (Valve Plug to Seat Ring) and Upper (C-seal Plug Seal to Cage) Seating Surfaces



NOTE:

1. REMOVAL OF 0.254 mm / 0.010 in. FROM THE VALVE PLUG
2. REMOVAL OF 0.254 mm / 0.010 in. FROM THE SEAT RING
3. REMOVAL OF 0.508 mm / 0.020 in. FROM THE UPPER SEATING SURFACE IN THE CAGE
4. THESE VALUES ARE FOR EXAMPLE ONLY. REMOVE ONLY THE MINIMUM AMOUNT OF MATERIAL REQUIRED TO REFURBISH THE SEATS.

5. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (Figure 16) to secure the C-seal retainer.
6. Replace the piston rings following instructions in the Trim Replacement section in this manual.
7. Return the seat ring, cage, plug/retainer assembly and stem to the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section in this manual.

NOTICE

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the C-seal plug seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop through the valve, this force will adequately drive the valve plug to the seat ring, thus giving the C-seal plug seal a predetermined permanent set. Once this is done, the plug/retainer assembly, the cage and the seat ring become a matched set.

8. With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

3.9 Replacement of Installed Bore Seal Trim

Apply to NPS 8 to 14 HPD, HPT and NPS 12 HPAD

Trim Removal (Bore Seal Constructions)

1. Remove the valve actuator and bonnet following the appropriate instructions in the Replacing Packing section in this manual.

NOTICE

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance.

Use caution when removing piston ring(s) and bore seal plug seal to avoid scratching any sealing surface.

NOTICE

Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem.

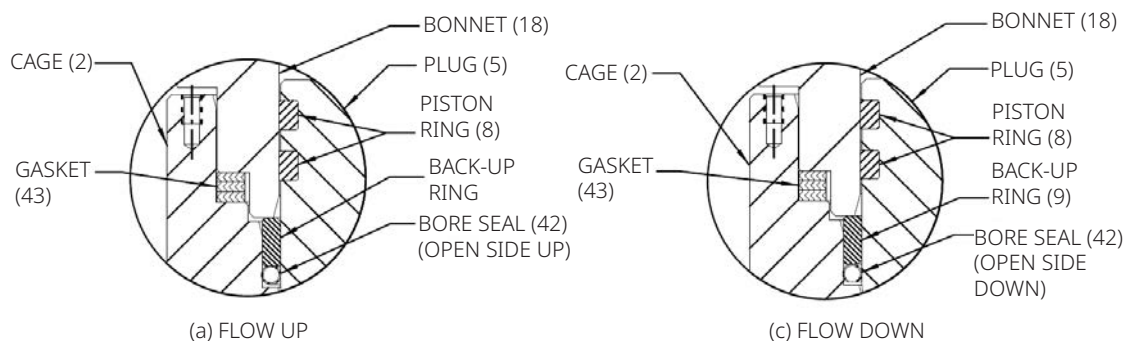
Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

2. Remove the plug assembly, cage retainer (key 45) (as required) and cage (key 5) (with bore seal) from the valve body following the appropriate instructions in the Trim Removal section in this manual.
3. Remove the piston rings from the grooves on plug.
4. Remove cage gaskets (key 43) and discard.
5. Inspect the lower seating surface where the valve plug contacts the seat ring for wear or damage which would prevent proper operation of the valve.
6. Replace or repair trim parts according to the following procedure of valve plug maintenance procedures as appropriate.

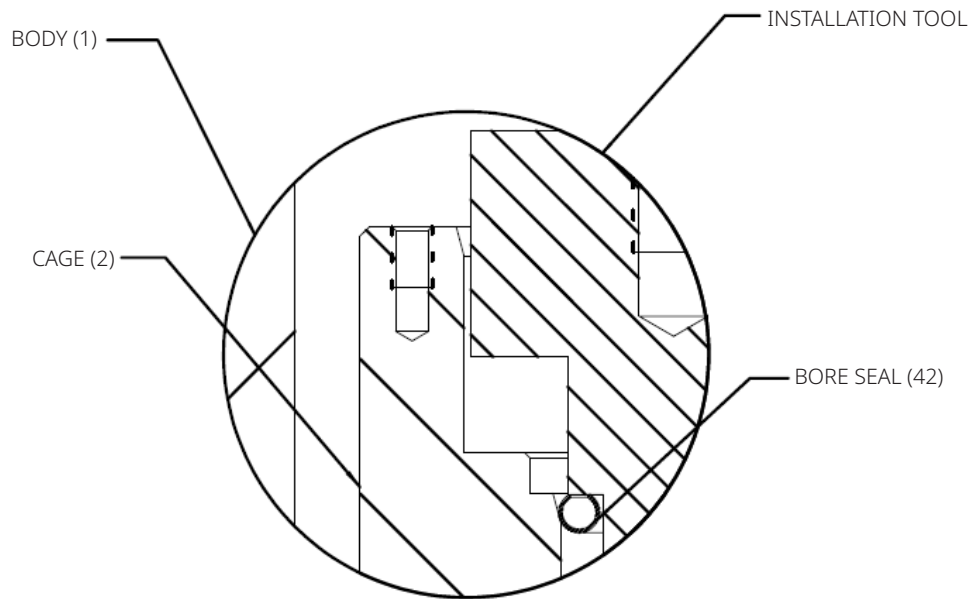
Trim Replacement (Bore Seal Constructions)

1. Unless the order does not allow lubrication in contact with the process media, apply a suitable high-temperature lubricant to the outside diameter of the bore seal (key 42). Also, lubricate the inside diameter of the cage where the bore seal must be pressed into the proper sealing position.
2. Orient the bore seal (key 42) for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the bore seal must face up in a valve with flow-up construction (Figure 19).
 - The open interior of the bore seal must face down in a valve with flow-down construction (Figure 20).

Figure 19. Bore Seal Installed Orientation



3. Place the bore seal (key 42) at the top of the seal groove in cage. The seal will not fit completely into the groove with hand force alone. Forcing the seal in by hand may damage the seal.

Figure 20. Bore Seal Installation with Tool

4. Use the installation tool to help press the seal ring evenly on to the cage and make sure the seal ring is centered until the installation tool and cage come to metal-to-metal. See Figure 22 for tool dimensions and part numbers.
5. Place the backup ring (key 9) into the seal groove until it touches the seal ring (key 42).
6. Install the new cage, gaskets, valve plug/stem assembly and bonnet into the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section in this manual.

NOTICE

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the bore seal plug seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop through the valve, this force will adequately drive the valve plug to the seat ring, thus giving the bore seal a predetermined permanent set. Once this is done, the plug assembly, the cage and the seat ring become a matched set.

7. With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

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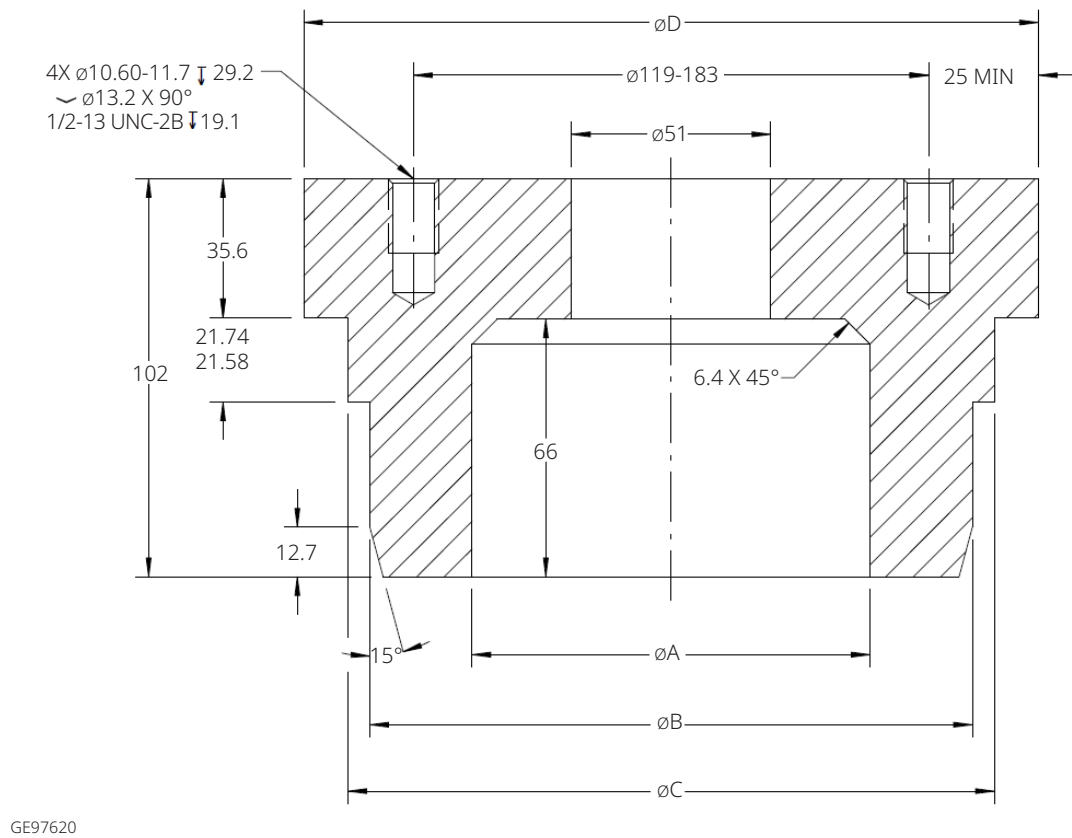
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Figure 21. Bore Seal Installation Tool



PORT SIZE, In.	DIMENSIONS, mm (See Figure 21)				Part Number (To Order A Tool)
	A	B	C	D	
5.5	89.0	141.68 to 141.78	152.75 to 153.25	179.72 to 180.22	GE96935X012
6	102.0	154.38 to 154.48	165.45 to 165.95	181.10 to 181.60	GE96941X012
6.5	114.0	167.08 to 167.18	178.15 to 178.65	208.68 to 209.18	GE96910X012
7	127.0	179.78 to 179.88	190.85 to 191.35	219.12 to 219.62	GE96919X012
7.5	140.0	192.48 to 192.58	203.55 to 204.05	232.55 to 233.05	GE95212X012
8	152.0	205.18 to 205.28	216.25 to 216.75	239.00 to 239.50	GE96879X012
8.5	167	218.11 to 218.01	229.46 to 228.96	261.36 to 260.86	GEH08051X012

- continued -

PORT SIZE, in.	DIMENSIONS, in. (See Figure 21)				Part Number (To Order A Tool)
	A	B	C	D	
5.5	3.50	5.578 to 5.582	6.014 to 6.033	7.076 to 7.095	GE96935X012
6	4.02	6.078 to 6.082	6.514 to 6.533	7.406 to 7.425	GE96941X012
6.5	4.49	6.578 to 6.582	7.014 to 7.033	8.216 to 8.235	GE96910X012
7	5.00	7.078 to 7.082	7.514 to 7.533	8.627 to 8.646	GE96919X012
7.5	5.51	7.578 to 7.582	8.014 to 8.033	9.156 to 9.175	GE95212X012
8	5.984	8.078 to 8.082	8.514 to 8.533	9.409 to 9.429	GE96879X012
8.5	6.57	8.583 to 8.587	9.014 to 9.034	10.270 to 10.290	GH08051X012

Section 4: Parts Ordering

Each body-bonnet assembly is assigned a serial number, which can be found on the valve body. This same number also appears on the actuator nameplate when the valve body is shipped from the factory as part of a control valve assembly. Refer to the number when contacting your [Emerson sales office](#) for technical assistance or when ordering replacement parts.



WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Section 5: Parts Kits

Standard Packing Kits (Non Live-Loaded)

Stem Diameter, mm/ in. Yoke Boss Diameter, mm / in.	12.7 / 1/2 71 / 2-13/16	19.1 / 3/4 90 / 3-9/16	25.4 / 1 127 / 5	31.8 / 1-1/4 127 / 5, 5H	50.8 / 2 178 / 7
PTFE (Contains keys 22, 24, 25, 26, 27)	RPACKX00022	RPACKX00032	RPACKX00342	RPACKX00352	Consult Sales Office
Double PTFE (Contains keys 22, 24, 26, 27)	RPACKX00052	RPACKX00062	RPACKX00362	RPACKX00372	Consult Sales Office
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring], 24 and 26)	RPACKX00112	RPACKX00122	---	---	Consult Sales Office
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring] and 26)	---	---	RPACKX00532	RPACKX00542	RPACKX00552
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring])	RPACKX00142	RPACKX00152	---	---	Consult Sales Office

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Repair Kits (ENVIRO-SEAL)

Stem Diameter, mm/ in. Yoke Boss Diameter, mm / in.	12.7 / 1/2 71 / 2-13/16	19.1 / 3/4 90 / 3-9/16	25.4 / 1 127 / 5	31.8 / 1-1/4 127 / 5, 5H	50.8 / 2 178 / 7
Double PTFE (Contains keys 214, 215, 218)	RPACKX00202	RPACKX00212	RPACKX00222	RPACKX00232	Consult Sales Office
Graphite ULF (Contains keys 207, 208, 209, 210, 214)	RPACKX00602	RPACKX00612	RPACKX00622	RPACKX00632	Consult Sales Office
Duplex (Contains keys 207, 209, 214, 215)	RPACKX00302	RPACKX00312	RPACKX00322	RPACKX00332	Consult Sales Office

Retrofit Kits (ENVIRO-SEAL)

Stem Diameter, mm/ in. Yoke Boss Diameter, mm / in.	12.7 / 1/2 71 / 2-13/16	19.1 / 3/4 90 / 3-9/16	25.4 / 1 127 / 5	31.8 / 1-1/4 127 / 5, 5H	50.8 / 2 178 / 7
Double PTFE (Contains keys 200, 201, 211, 212, 214, 215, 216, 217, 218, tag, cable tie)	RPACKXRT022	RPACKXRT032	RPACKXRT042	RPACKXRT052	Consult Sales Office
Graphite ULF (Contains keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 217, tag, cable tie)	RPACKXRT272	RPACKXRT282	RPACKXRT292	RPACKXRT302	Consult Sales Office
Duplex (Contains keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, cable tie)	RPACKXRT222	RPACKXRT232	RPACKXRT242	RPACKXRT252	Consult Sales Office

Table 11. Gasket Set* (Includes Key 11 Bonnet Gasket, Key 43 Cage Gasket and Key 12 Seat Ring Gasket)⁽¹⁾ NPS 3 to NPS 24 HPD (Short), HPT (Short) and CL2500 HPAD and HPAT

VALVE RATING	VALVE STYLE AND SIZE, NPS		MATERIAL		
	HP Globe	HPA Angle	Bonnet Spiral Wound Gasket N06600/Graphite	Cage Spiral Wound Gasket N06600/Graphite	Seat Ring Flat Sheet Gasket S31600/Graphite
CL900	4 (short)	---	GG62142X012	GG62143X012	GG62144X012
	6 (short)	---	GG62162X012	GG62163X012	GG62164X012
	8 (short)	---	GG53667X012	GG53677X012	GG53849X012
	10 (short)	---	GG53684X012	GG53685X012	GG53852X012
	12 (short)	---	GG53692X012	GG53693X012	GG53854X012
	16	---	GG86318X012	GG86322X012	GG86323X012
	18	---	GG83736X012	GG83737X012	GG85745X012
	20	---	GG85746X012	GG85747X012	GG85748X012
	24	---	GG85749X012	GG85750X012	GG85751X012

- continued -

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Table 11. Gasket Set* (Includes Key 11 Bonnet Gasket, Key 43 Cage Gasket and Key 12 Seat Ring Gasket)⁽¹⁾ NPS 3 to NPS 24 HPD (Short), HPT (Short) and CL2500 HPAD and HPAT (continued)

VALVE RATING	VALVE STYLE AND SIZE, NPS		MATERIAL		
	HP Globe	HPA Angle	Bonnet Spiral Wound Gasket N06600/Graphite	Cage Spiral Wound Gasket N06600/Graphite	Seat Ring Flat Sheet Gasket S31600/Graphite
CL1500 ⁽²⁾	4 (short)	---	GG62142X012	GG62143X012	GG62144X012
	6 (short)	---	GG62162X012	GG62163X012	GG62164X012
	8 (short)	---	GG53678X012	GG53679X012	GG53849X012
	10 (short)	---	GG53686X012	GG53687X012	GG53852X012
	12 (short)	---	GG53694X012	GG53695X012	GG53854X012
	16	---	GG86318X022	GG86322X022	GG86323X012
	18	---	GG83736X022	GG83737X022	GG85745X012
	20	---	GG85746X022	GG85747X022	GG85748X012
	24	---	GG85749X022	GG85750X022	GG85751X012
CL2500	3 (short)	---	GG62130X012	GG62131X012	GG62132X012
	4 (short)	6	GG62142X012	GG62143X012	GG62144X012
	6 (short)	8	GG62162X012	GG62163X012	GG62164X012
	8 (short)	---	GG53680X012	GG53681X012	GG53850X012
	10 (short)	12	GG53688X012	GG53689X012	GG53853X012
	12 (short)	---	GG53696X012	GG53697X012	GG53855X012
	14 (short)	---	GG62165X012	GG62169X012	GG62170X012
CL3200	8 (short)	---	GG53682X012	GG53683X012	GG53850X012
	10 (short)	---	GG53690X012	GG53691X012	GG53853X012
	12 (short)	---	GG53698X012	GG53699X012	GG53855X012
* Recommended spare parts 1. Gaskets should always be replaced as sets, not separately. 2. Refer the serial card content to select the part number if it is hard to confirm the face-to-face information.					

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Table 12. Gasket Set* (Includes Key 11 Bonnet Gasket and Key 12 Seat Ring Gasket⁽¹⁾)
NPS 1 to NPS 6 HPD (Long), HPT (Long) and NPS 1 to NPS 8 HPAD (Long) and
HPAT (Long)

VALVE RATING	VALVE STYLE AND SIZE, NPS		MATERIAL	
	HP Globe	HPA Angle	N06600/Graphite	N07750/Graphite
CL1500 Globe and Angle Valves	1 (std)	1 (std)	12B7100X012	12B7100X022
	2 (std)	2 (std) and 3 (std)	12B7100X032	12B7100X042
	2 (Cavitrol III, 2-Stage)	2 (Cavitrol III, 2-Stage)	12B7100X072	---
	3 (std)	4 (std)	12B7100X052	12B7100X062
	4 (std)	6 (std)	12B7100X082	---
	6 (std)	8 (std)	12B7100X112	---
CL2500 Globe and Angle Valves	1 (std)	1 (std)	12B7100X152	12B7100X122
	2 (std)	2 (std)	12B7100X162	12B7100X132
	2 (Cavitrol III, 2-Stage)	2 (Cavitrol III, 2-Stage)	12B7100X172	12B7100X142
*Recommended spare parts 1. Gaskets should always be replaced as sets, not separately.				

Figure 22. NPS 1 HPS Valve

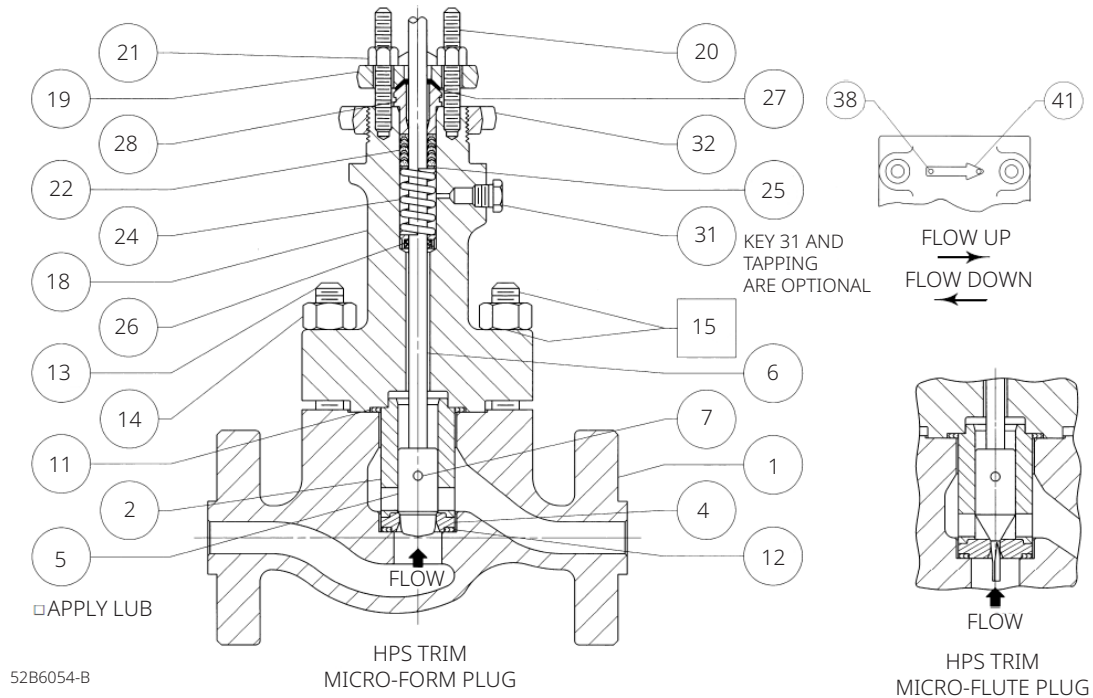


Figure 23. NPS 2 HPAD Valve

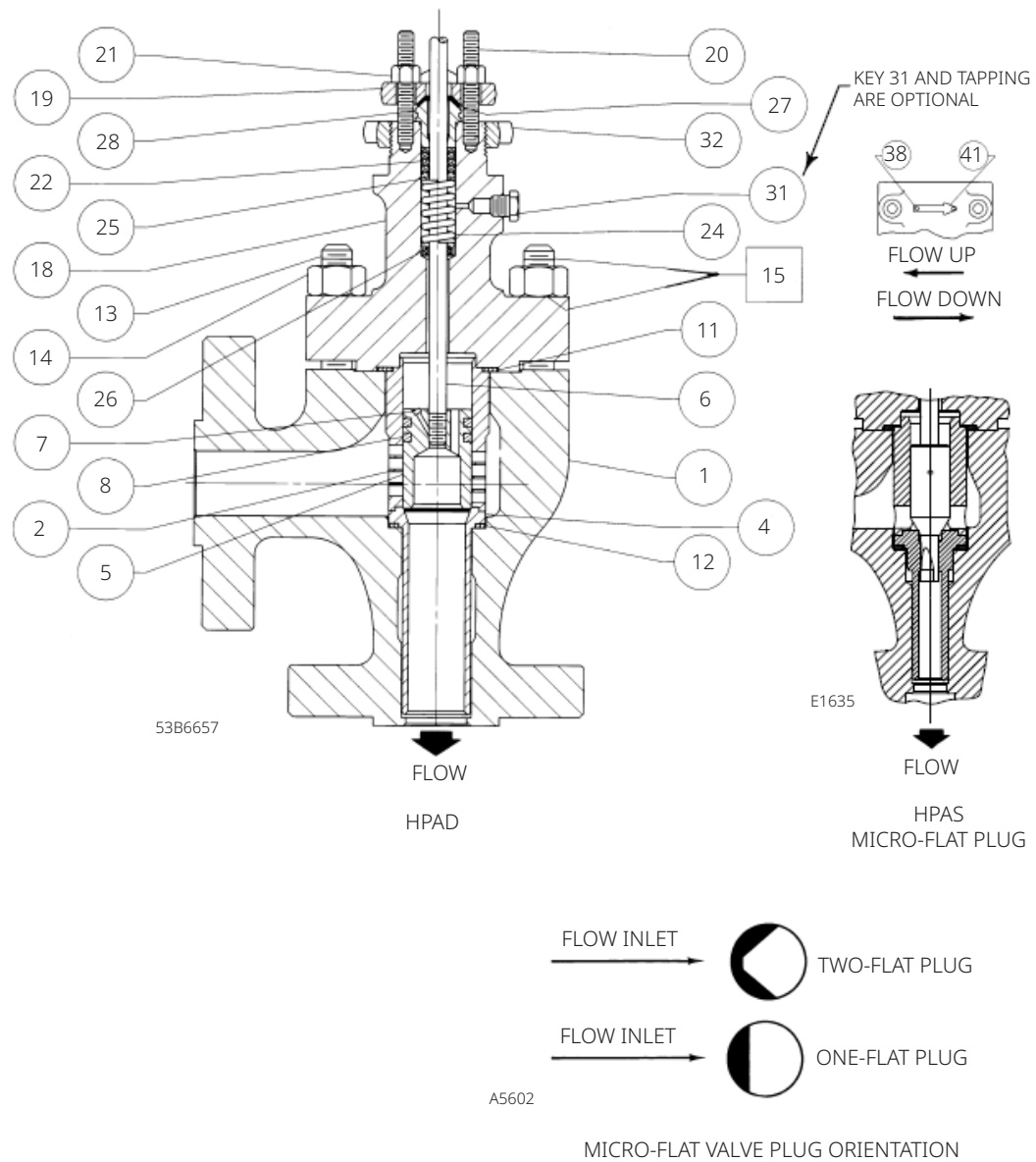
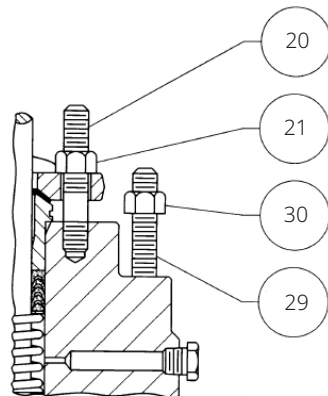
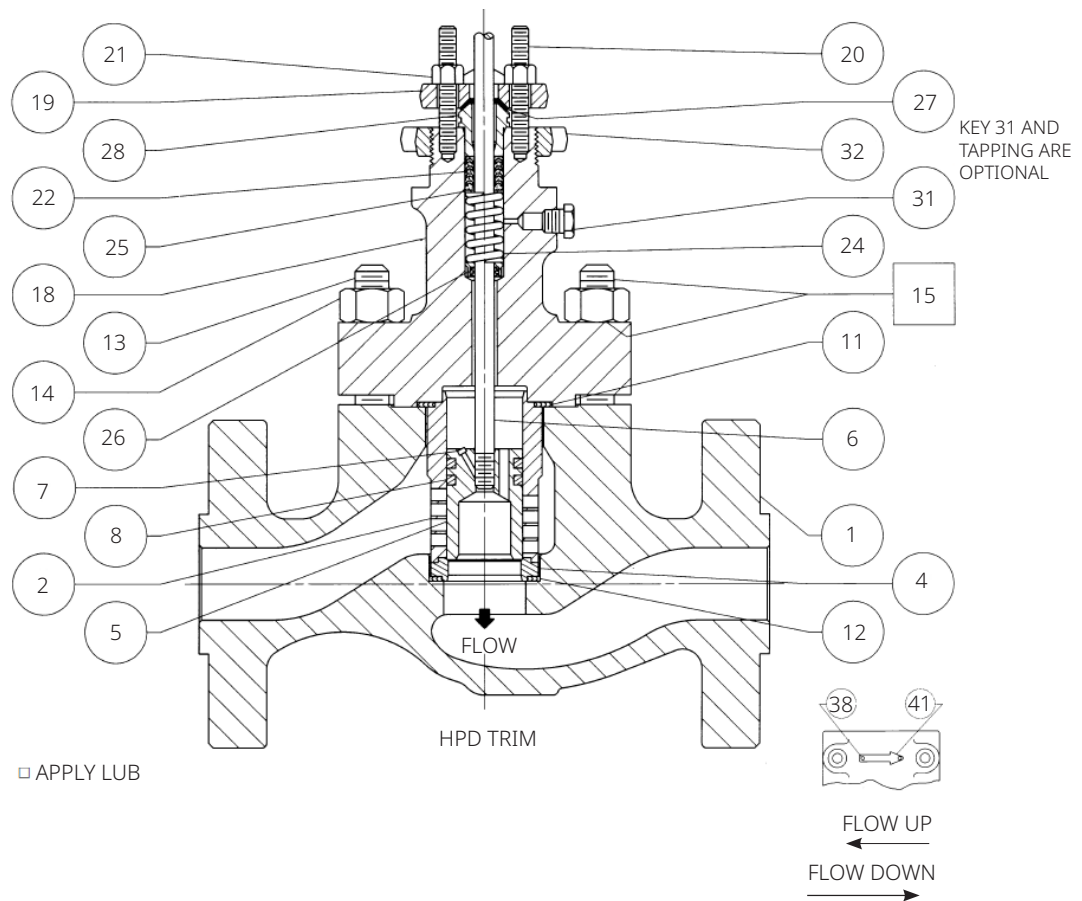
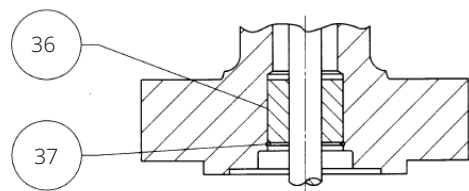


Figure 24. NPS 2 through 6 HPD (Long) Valve



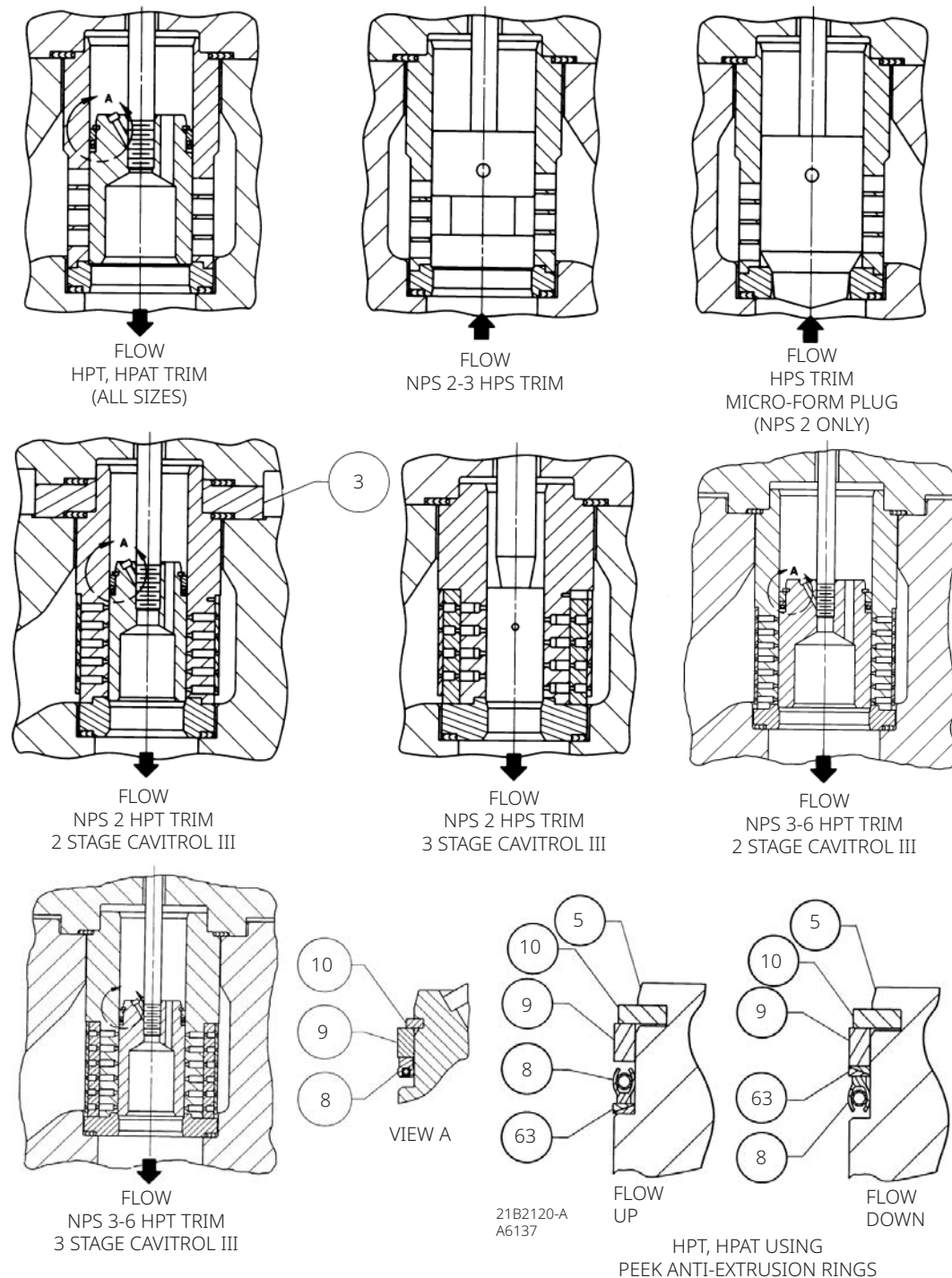
127 mm / 5-IN. YOKE BOSS
(GLOBE AND ANGLE)



EXTENSION BONNET BAFFLE ASSEMBLY
(NPS 2 ONLY) (GLOBE AND ANGLE)

52B6045-C

Figure 25. NPS 2 through 6 HP (Long) Valve - Alternate Configurations



52B6045-C

Figure 25. NPS 2 through 6 HP (Long) Valve - Alternate Configurations (continued)

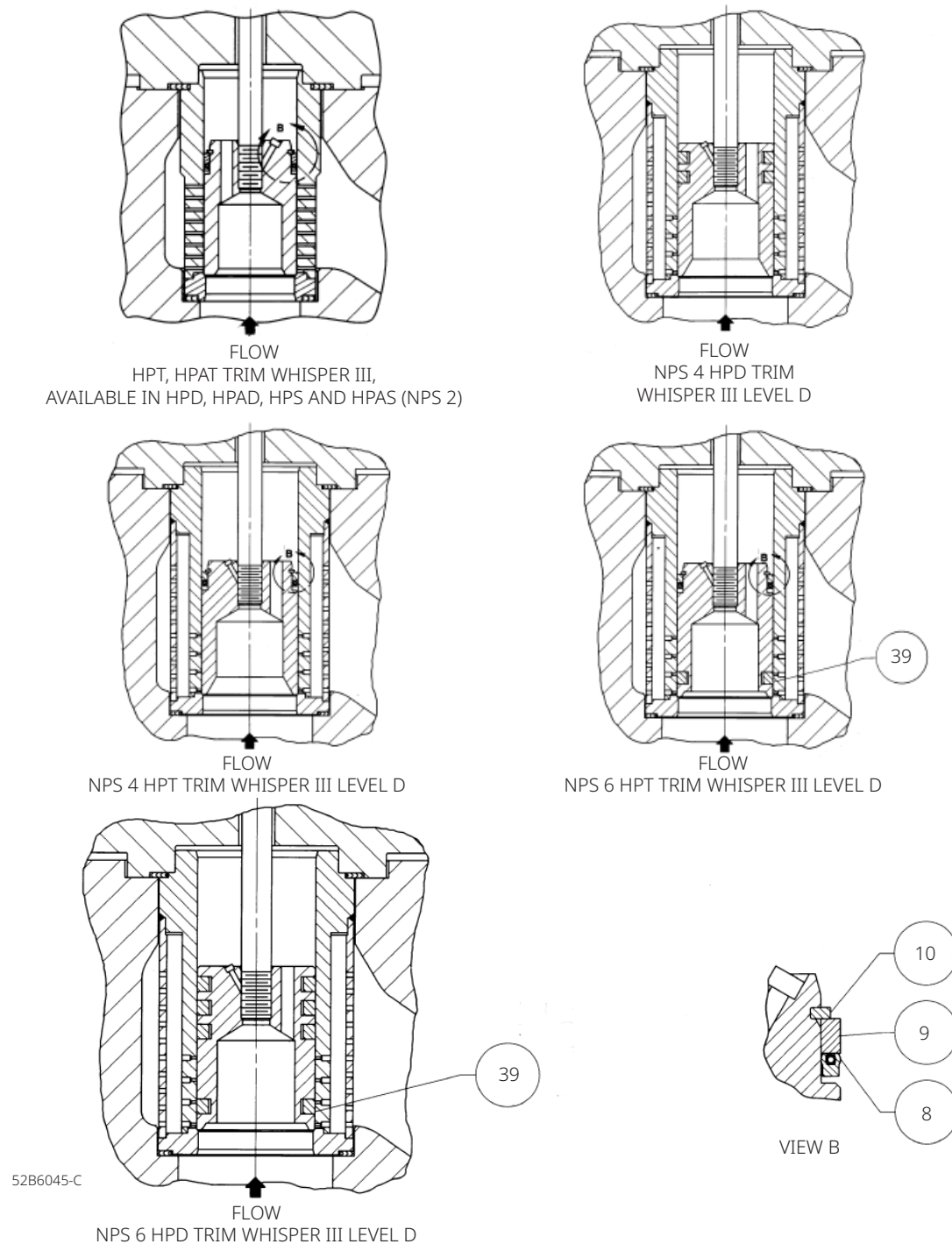
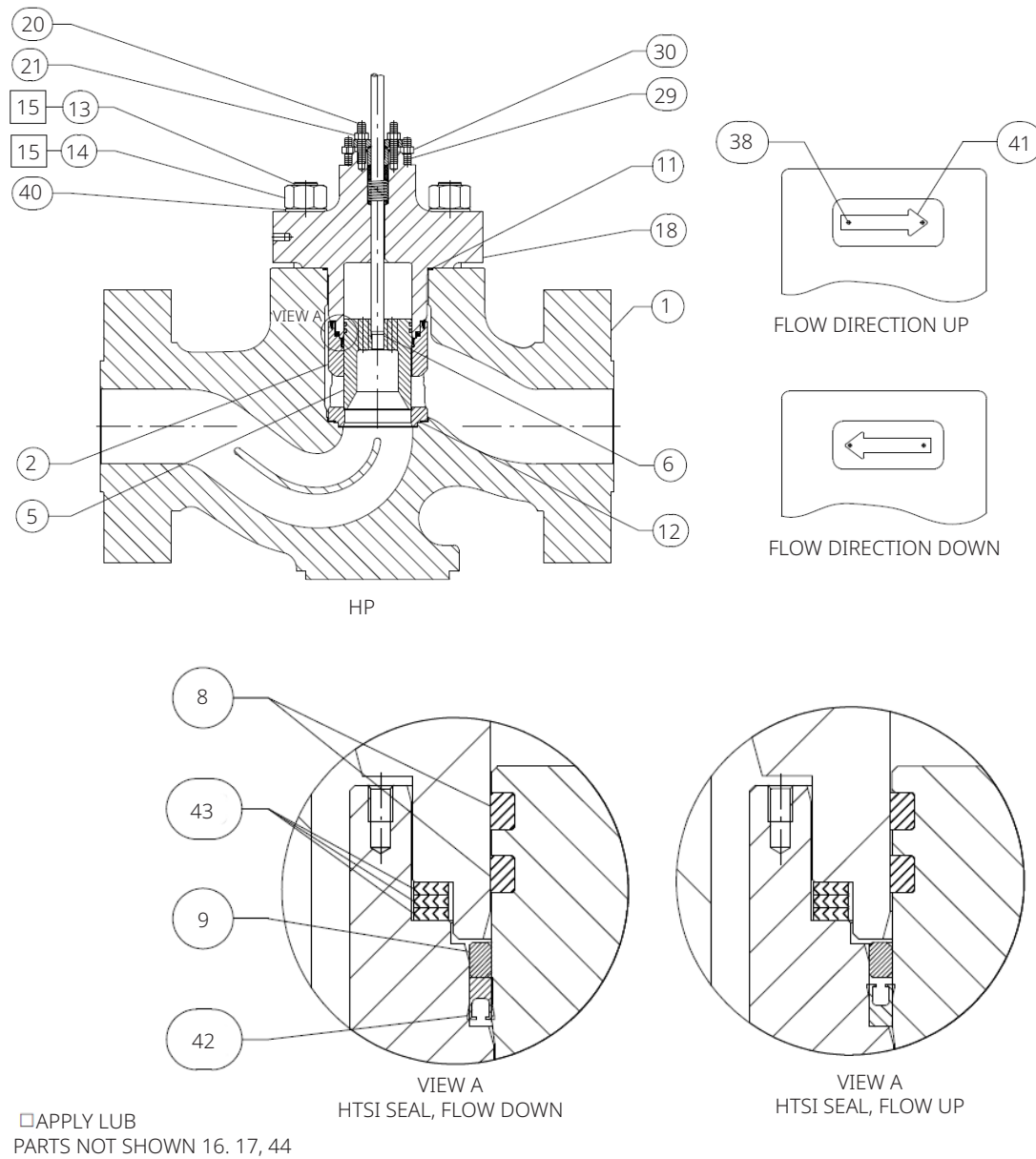
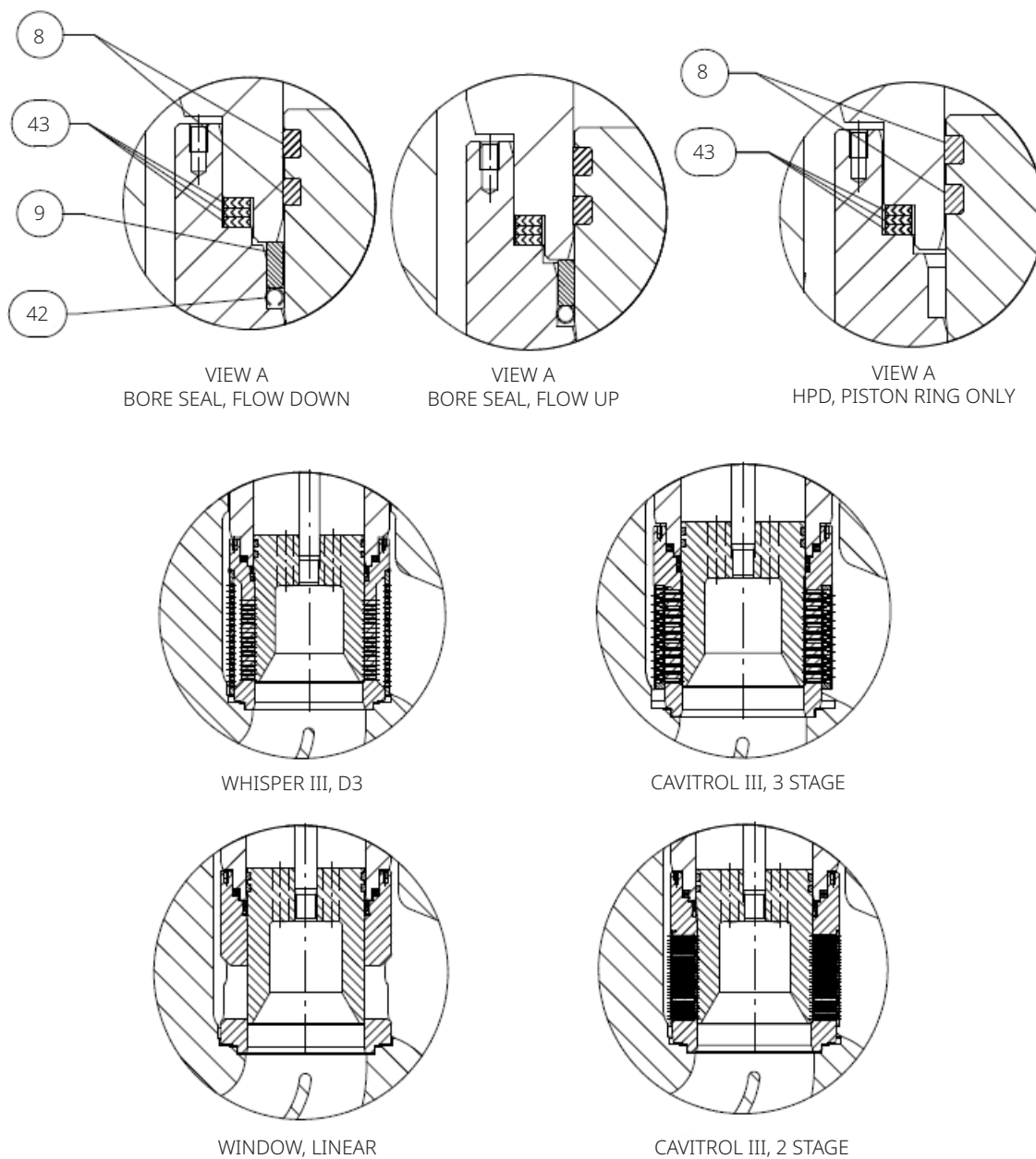


Figure 26. NPS 8 to 12 HPD and HPT Valve with Skirted Bonnet



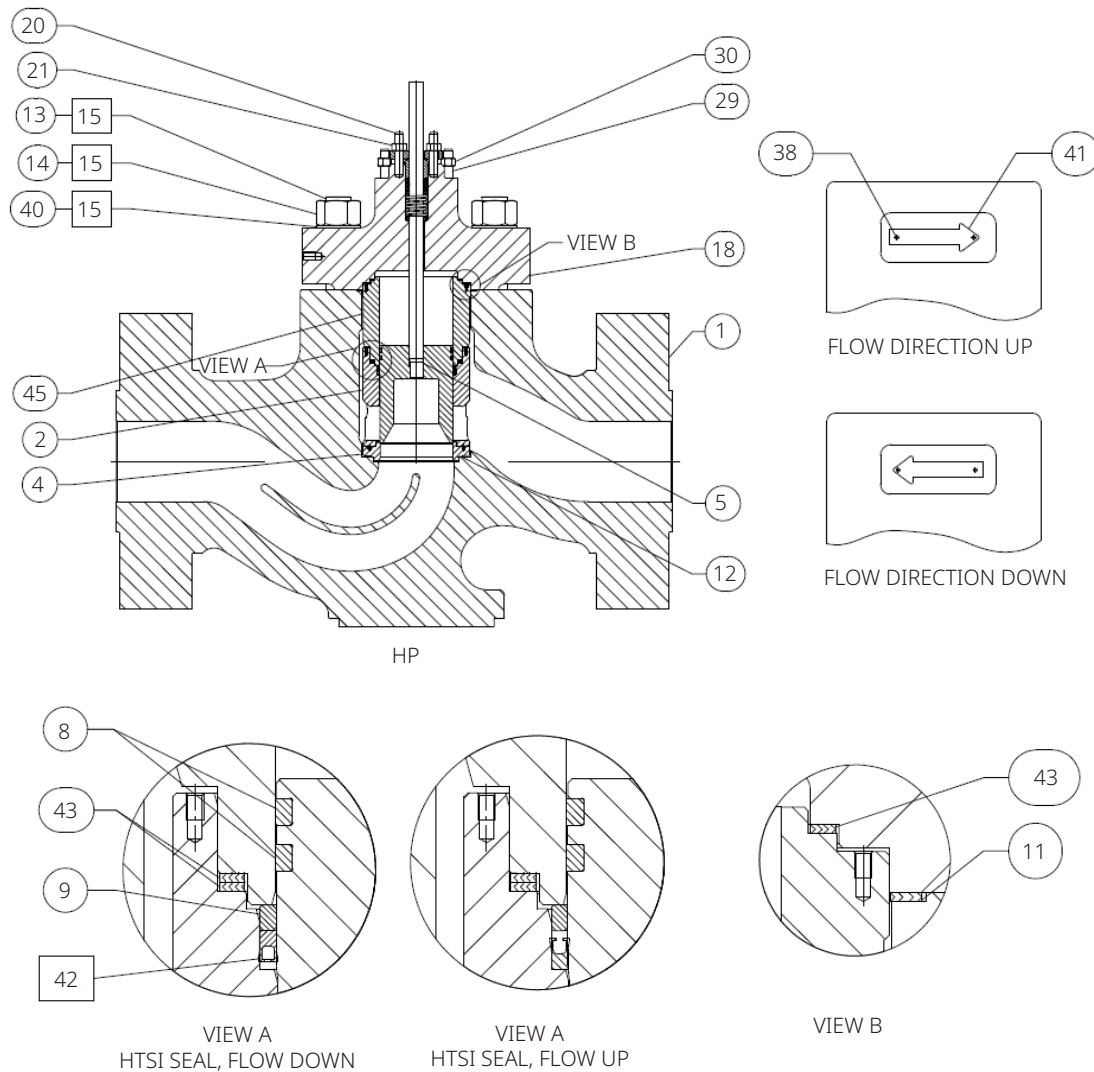
GG54316

Figure 27. 8 to 12 HPD and HPT Valve with Skirted Bonnet - Alternate Configurations



GG54316

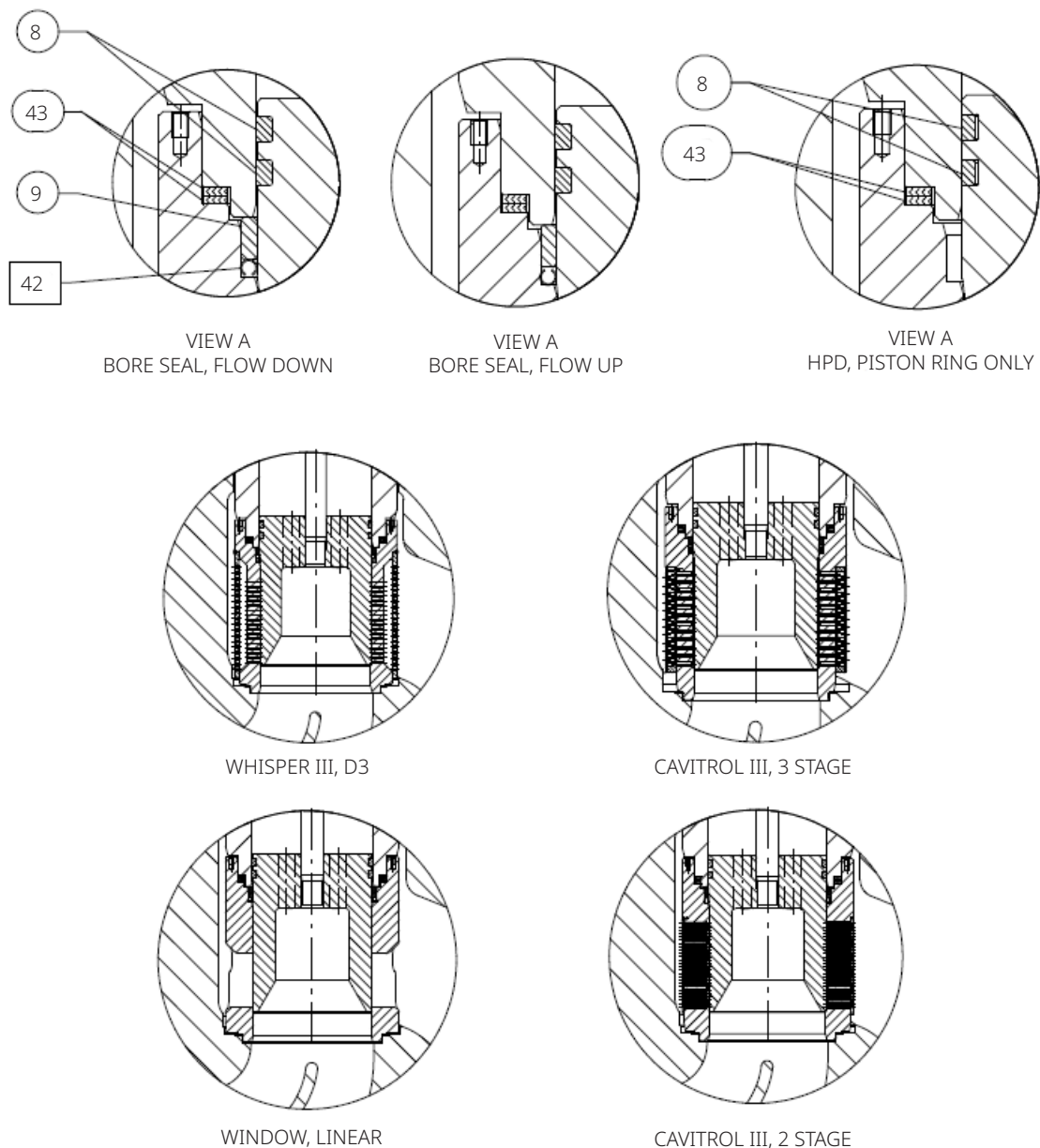
Figure 28. NPS 8 to 12 HPD and HPT Valve with Cage Retainer



□ APPLY LUB
PARTS NOT SHOWN 16, 17, 44

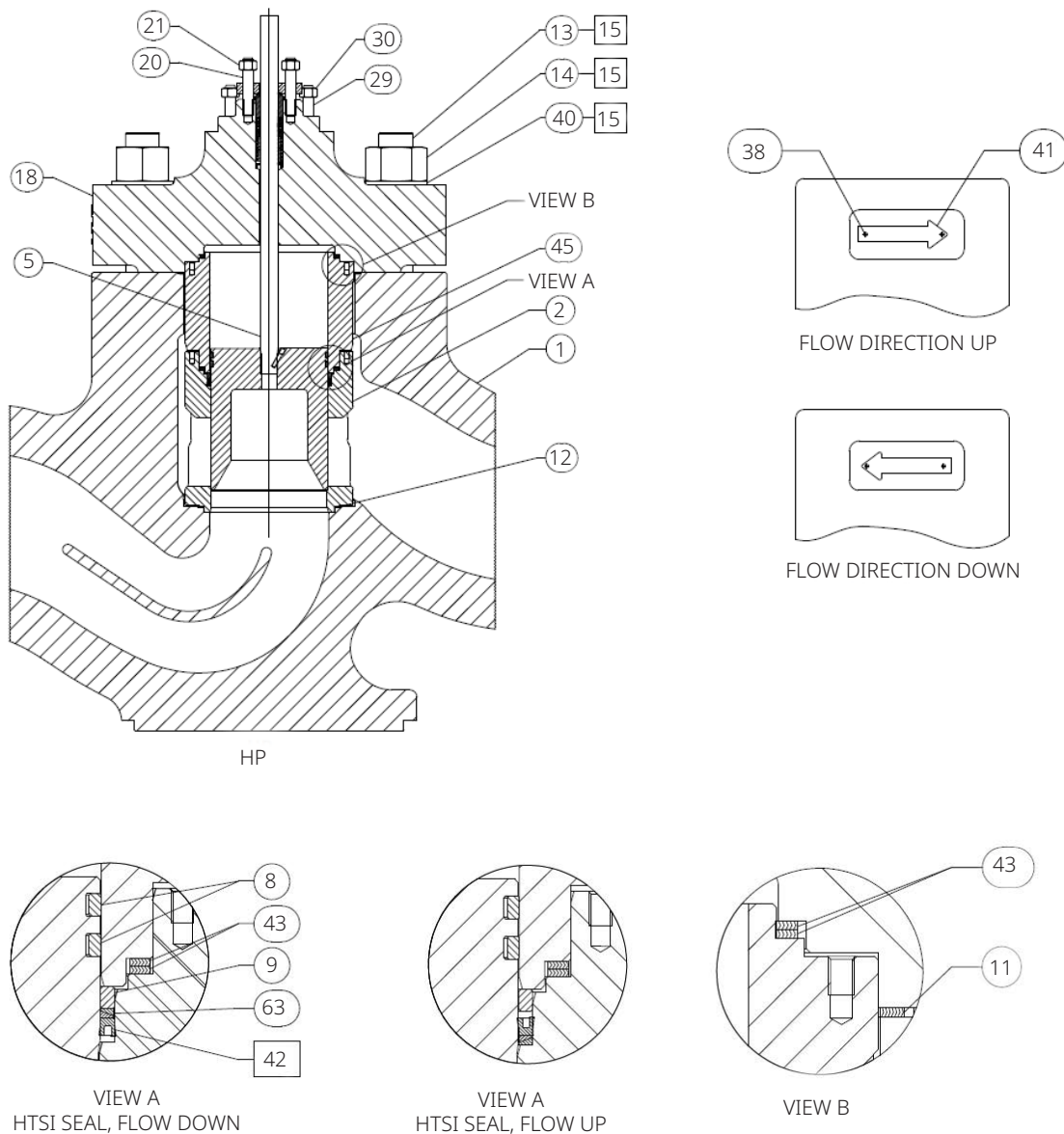
GG60128_C

Figure 29. NPS 8 to 12 HPD and HPT Valve with Cage Retainer - Alternate Configurations



GG60128_C

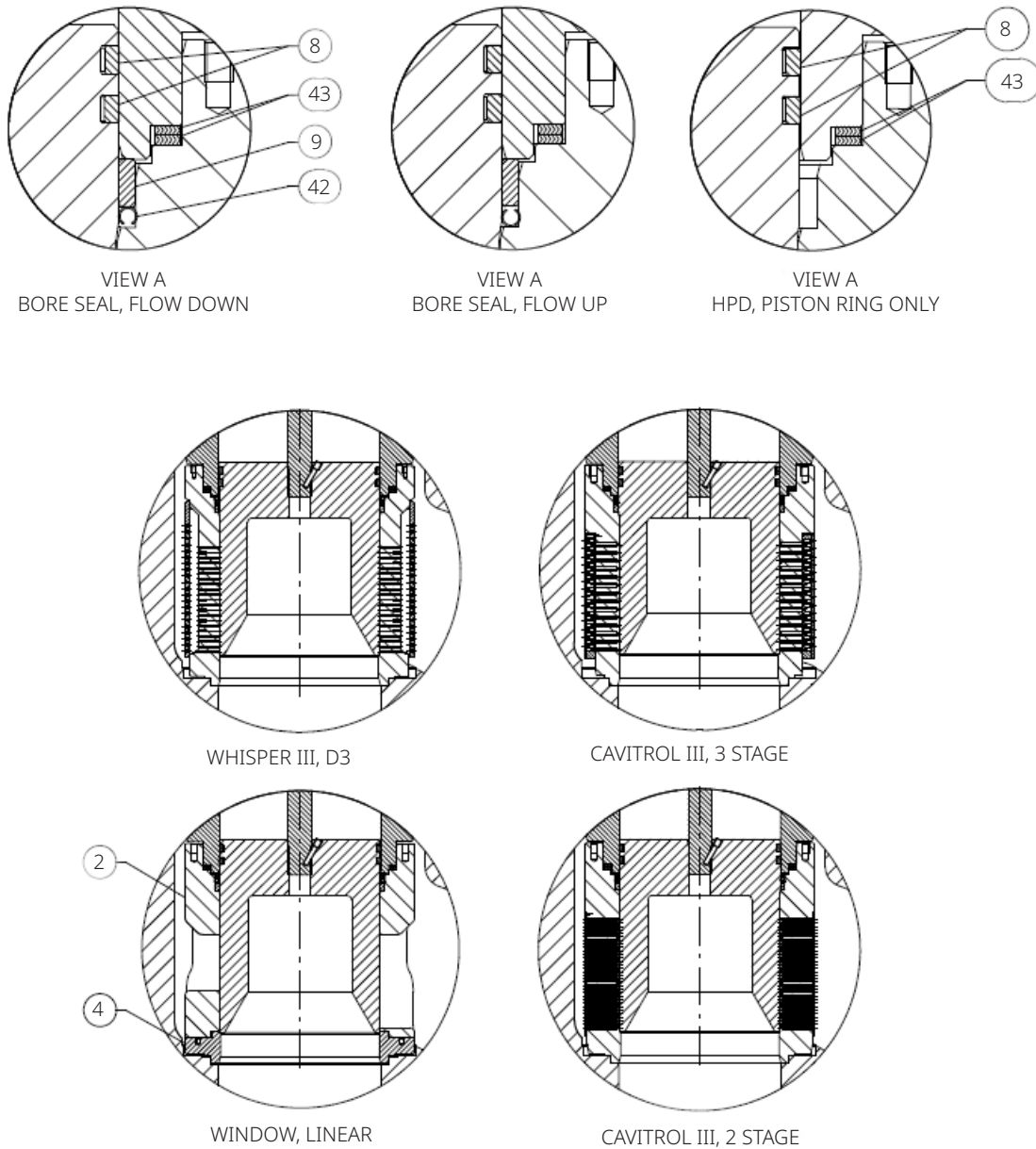
Figure 30. NPS 14 HPD and HPT Valve



□ APPLY LUB
PARTS NOT SHOWN 16, 17, 44

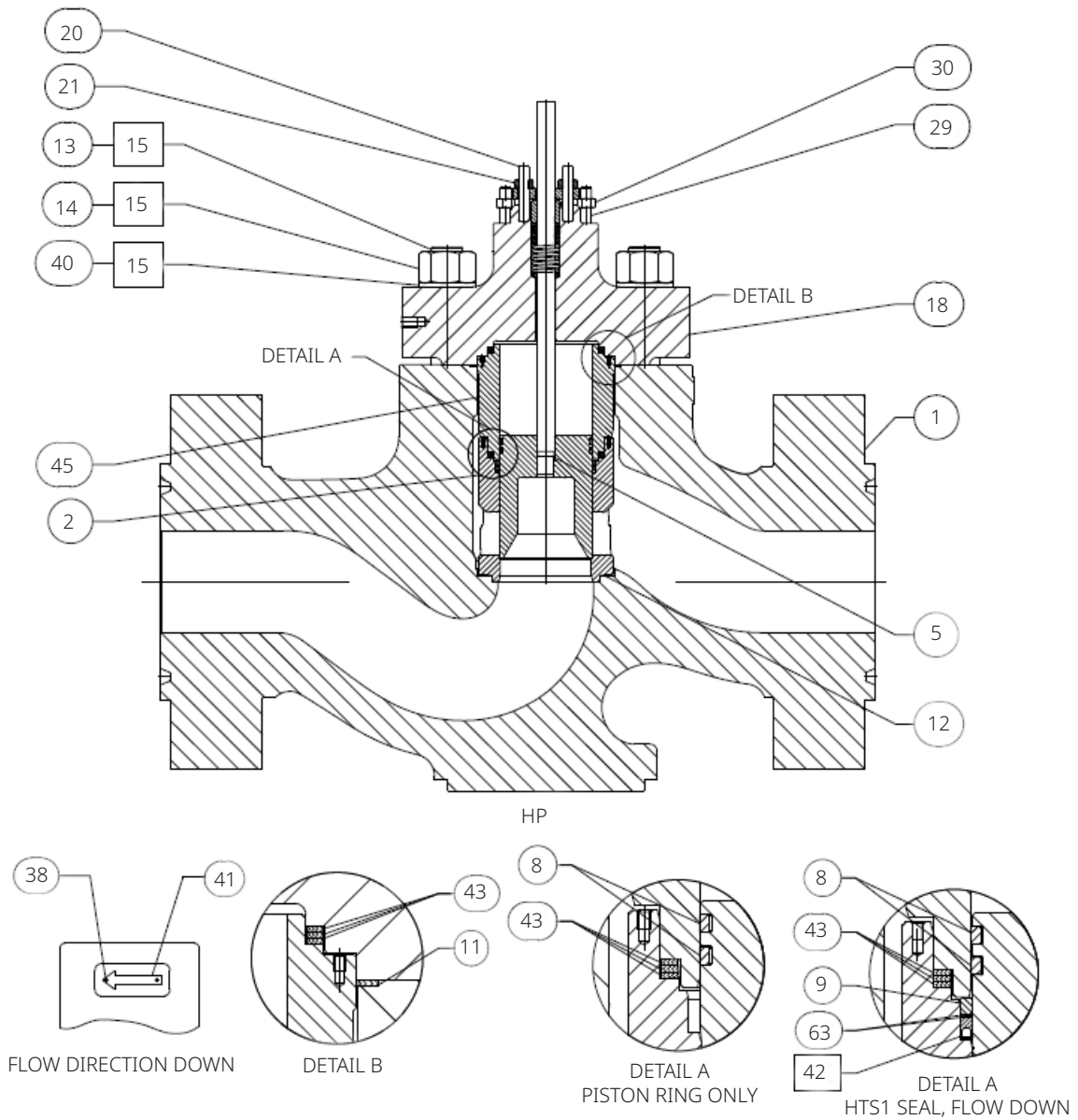
GH08059_D

Figure 31. NPS 14 HPD and HPT Valve - Alternate Configurations



GH08059_D

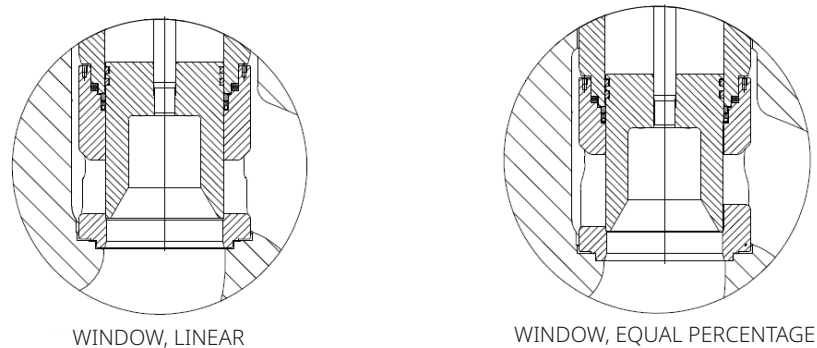
Figure 32. NPS 16 through 24 HPD and HPT Valve



□ APPLY LUB
PARTS NOT SHOWN 16, 17, 44

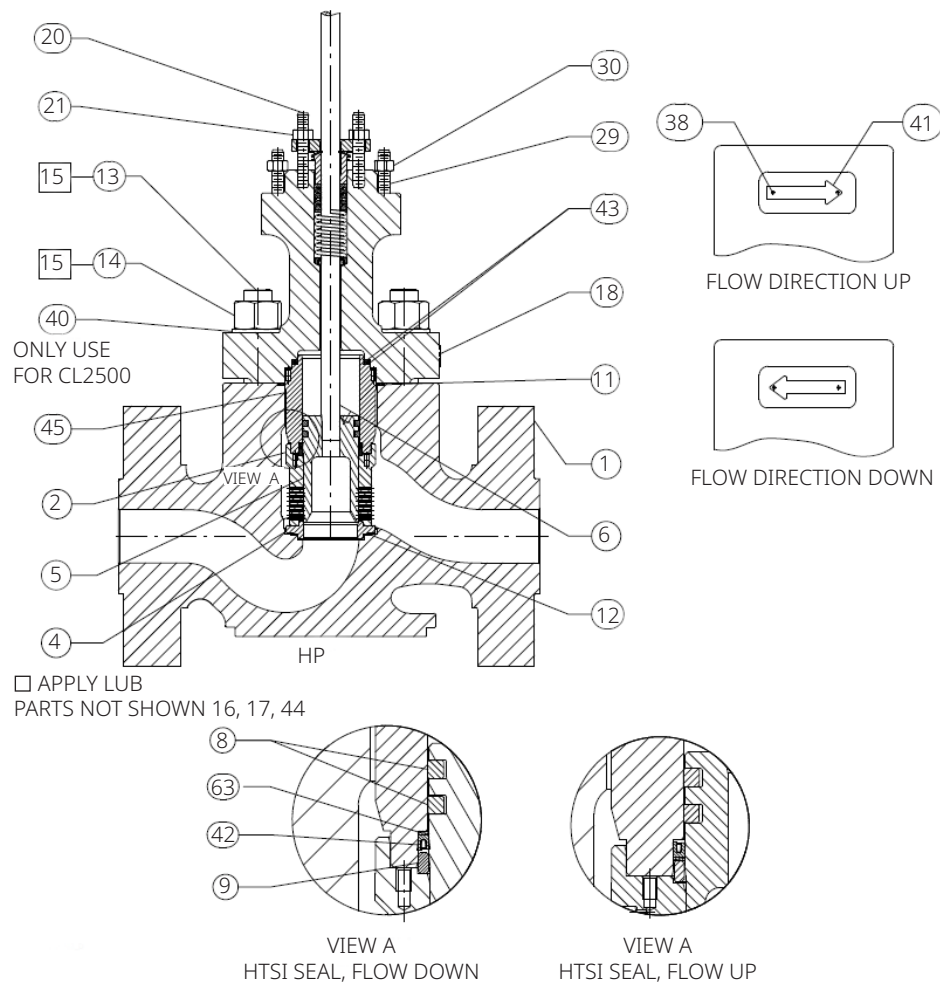
GG88282_A

Figure 33. NPS 16 through 24 HPD and HPT Valve, Alternate Configurations



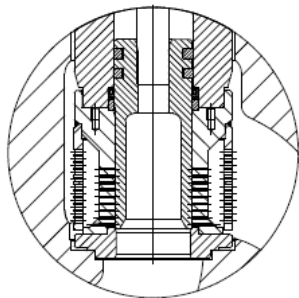
GG88282_A

Figure 34. NPS 3 through 6 HPD (Short), HPT (Short) and HPS (Short) Valve

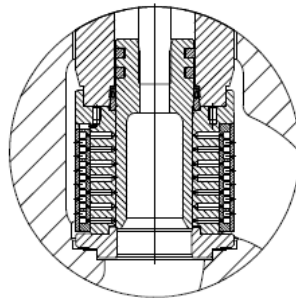


GG66792_D

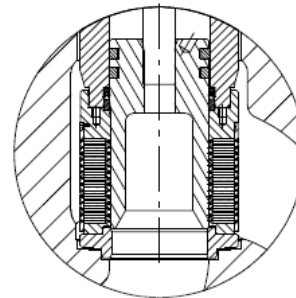
Figure 35. NPS 3 through 6 HPD (Short), HPT (Short) and HPS (Short) Valve - Alternate Configurations



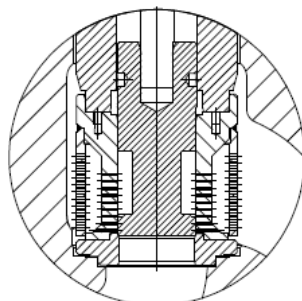
WHISPER III, D3



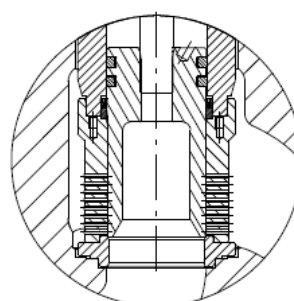
CAVITROL III, 3 STAGE



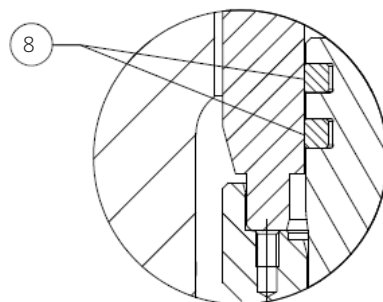
CAVITROL III, 2 STAGE



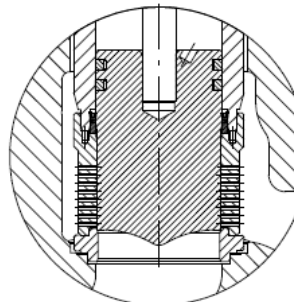
WHISPER III, D3
HPS UNBALANCED PLUG OPTION



DRILLED HOLE, LINEAR



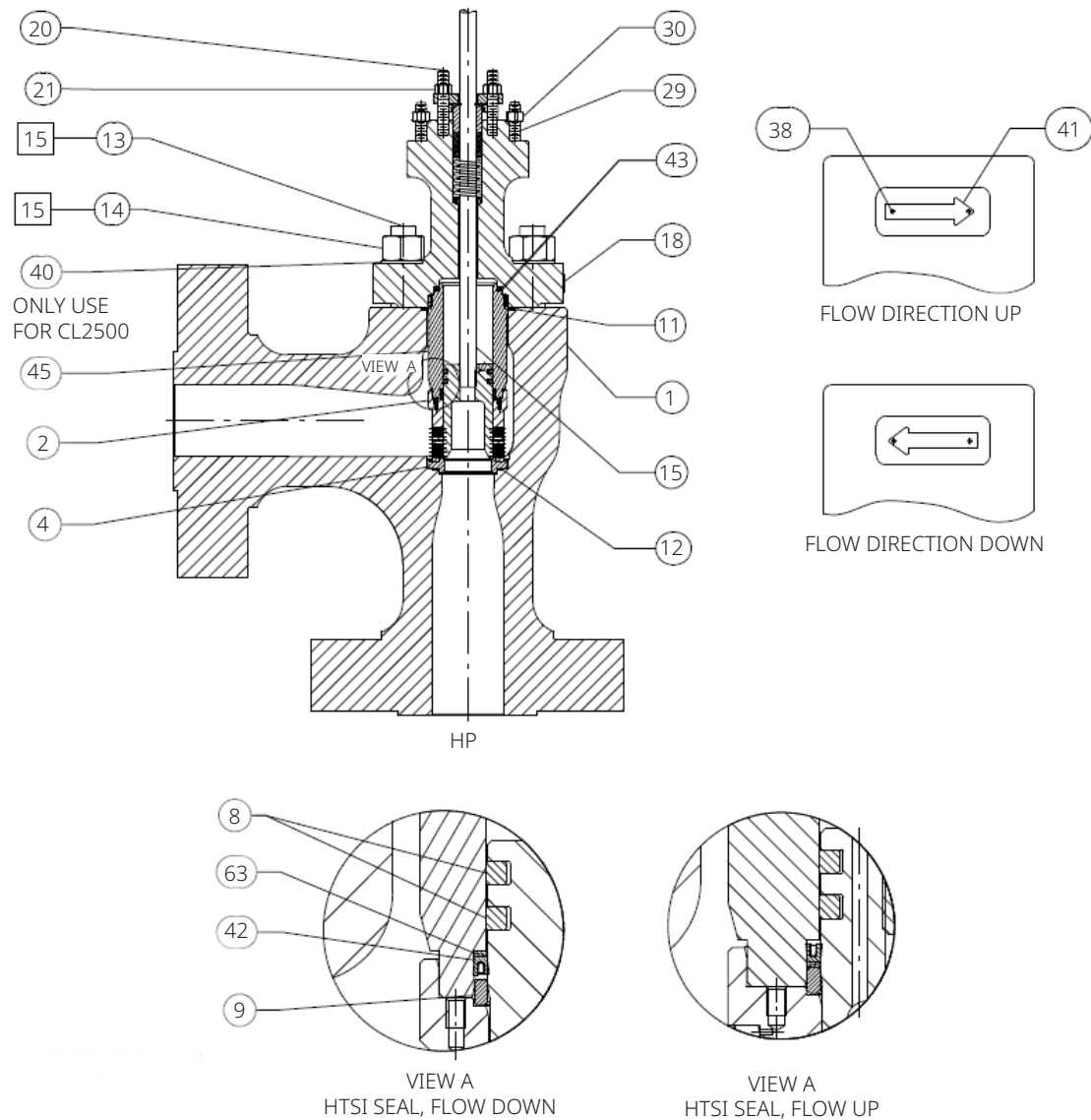
VIEW A
HPD, PISTON RING ONLY



WHISPER III WITH CONTOUR PLUG
ONLY USE FOR CL900/CL1500

GG66792_D

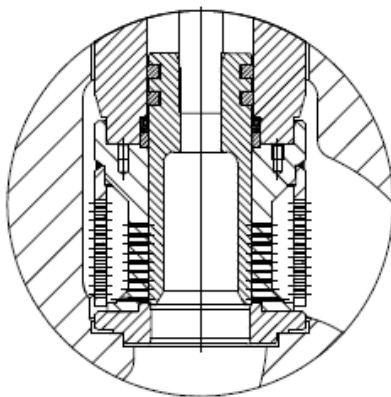
Figure 36. NPS 6 and 8 HPAD and HPAT Valve



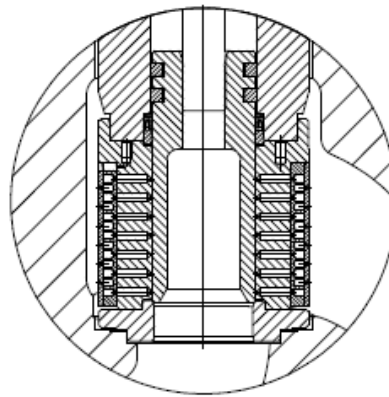
□ APPLY LUB
PARTS NOT SHOWN 16, 17, 44

GG59686

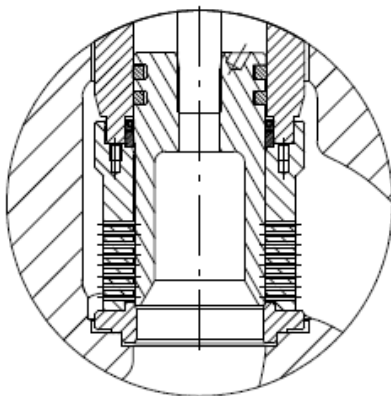
Figure 37. NPS 6 and 8 HPAD and HPAT Valve - Alternate Configurations



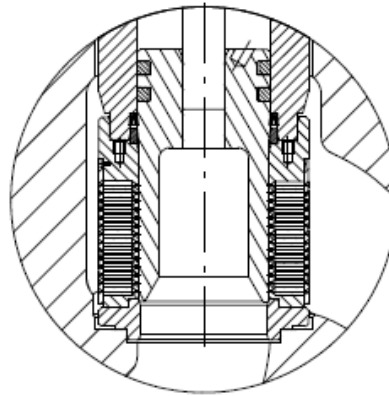
WHISPER III, D3



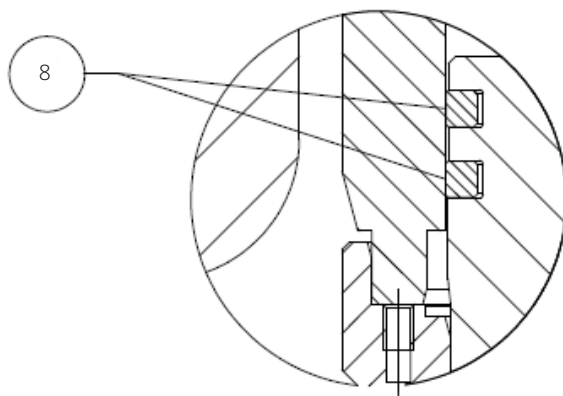
CAVITROL III, 3 STAGE



DRILLED HOLE, LINEAR



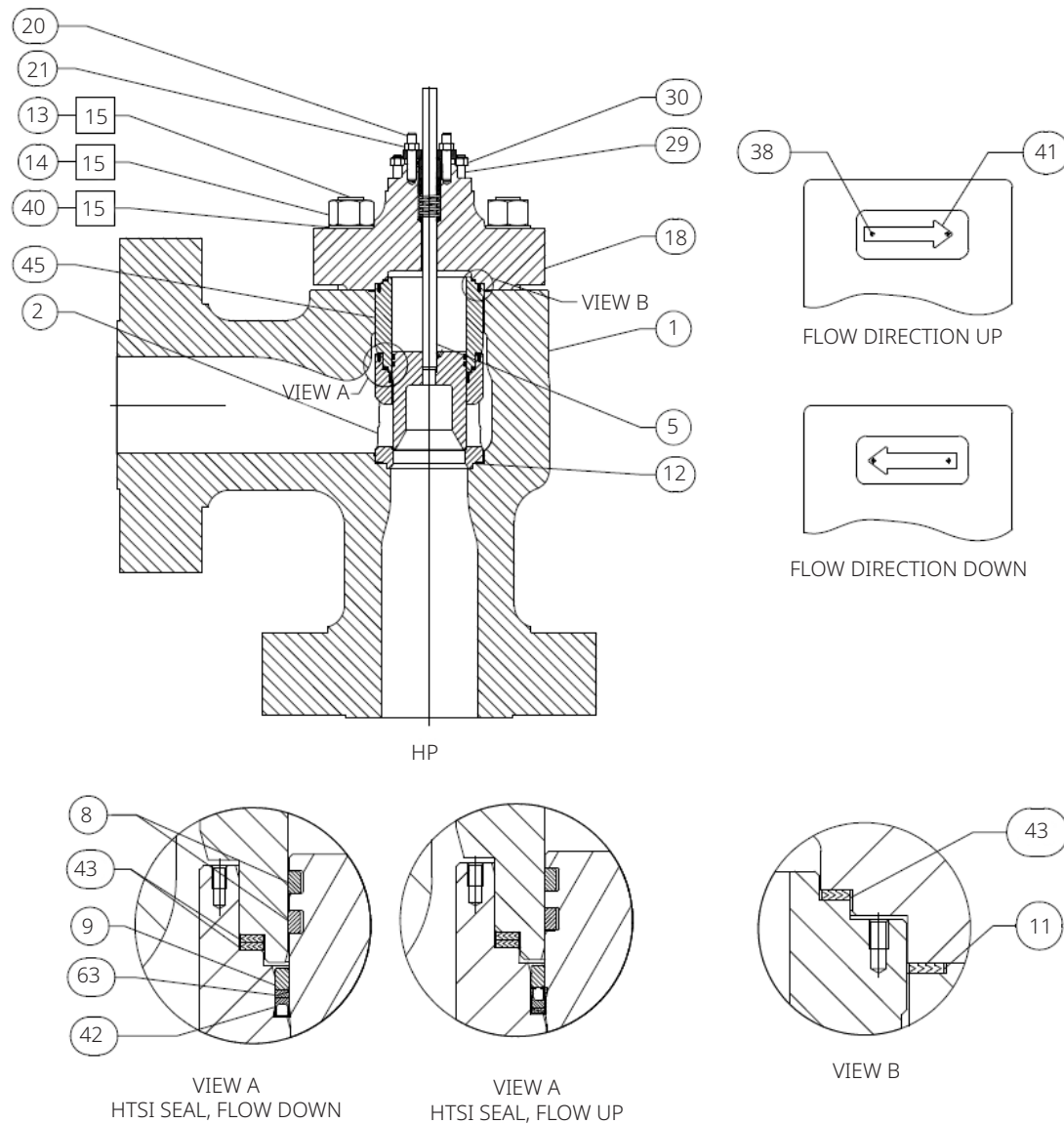
CAVITROL III, 2 STAGE



HPD, PISTON RING ONLY

GG59686

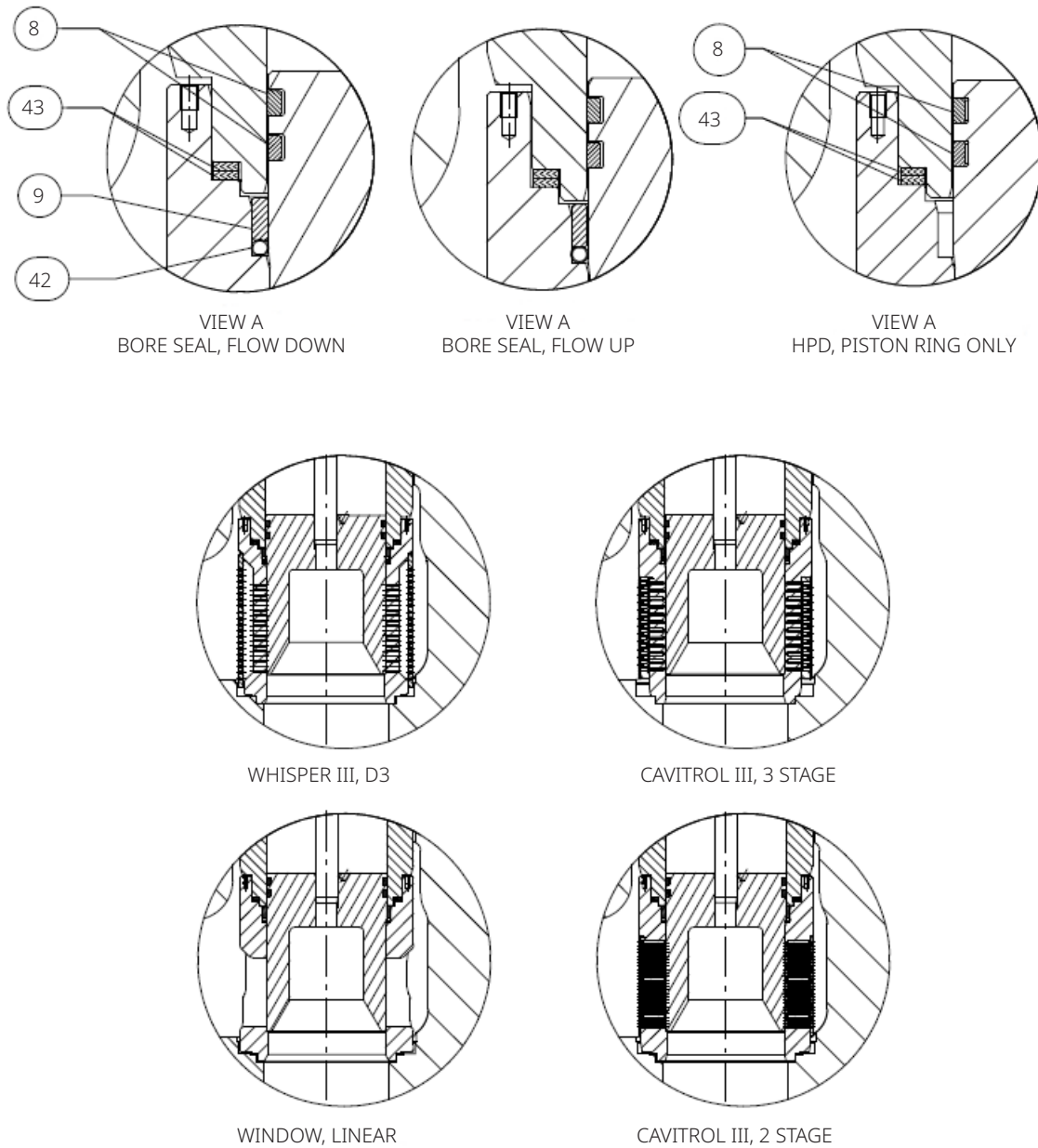
Figure 38. NPS 12 HPAD and HPAT Valve



□ APPLY LUB
PARTS NOT SHOWN 16, 17, 44

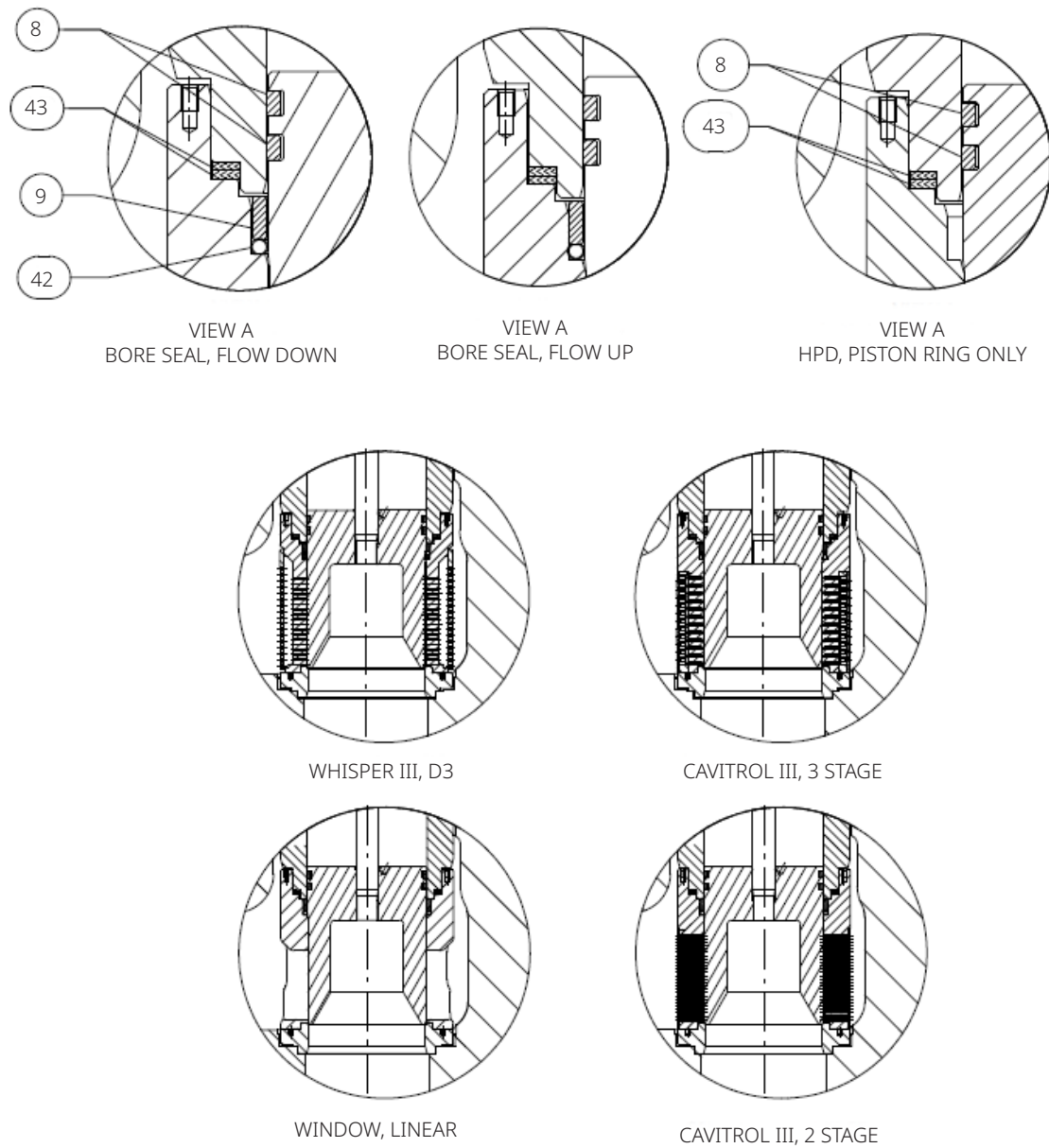
GG59688_C

Figure 39. NPS 12 HPAD and HPAT Valve - Alternate Configurations



GG59688_C

Figure 40. NPS 12 HPAD and HPAT Valve - Separated Seat - Alternate Configurations



GG59687

Section 6: Parts List

NOTE

Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description	Key	Description
1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number and desired material.	24	Spring or Lantern Ring
2*	Cage/Baffle Assy	25	Washer, Special
3	Bonnet Spacer	26*	Packing Box Ring
4*	Seat Ring	27*	Upper Wiper
5*	Valve Plug	28	Follower
6*	Valve Stem	29	Stud Bolt
7*	Pin	30	Hex Nut
8*	Seal Ring/Piston Ring	31	Pipe Plug (optional)
9*	Back Up Ring	31	Lubricator (optional)
10*	Retaining Ring (for NPS 6 and smaller HPT/HPAT only)	31	Lubricator/Isolating Valve (optional)
11*	Bonnet Gasket	32	Yoke Locknut (optional)
12*	Seat Ring Gasket	36	Baffle
13	Stud, Cont Thd	37	Retaining Ring
14	Hex Nut	38	Drive Screw
15	Anti-Seize Lubricant (8 lb / 3.6 Kg can)	39*	Piston Ring
16	Nameplate	40	Washer
17	Wire	41	Flow Arrow
18	Bonnet If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number and desired material.	42*	Soft Seal or Bore seal
19	Packing Flange	43*	Cage Gasket
20	Stud Bolt	44	Nameplate
21	Hex Nut	45	Cage Retainer
22*	Packing Set	63*	Anti-Extrusion Ring
23*	Packing Ring	---	---
*Recommended spare parts			

C-seal Trim (Figure 13)

Key	Description
2*	Cage
4*	Seat Ring
5*	Valve Plug/Retainer
6*	Valve Plug Stem
8*	Piston Ring (2 req'd)
64*	C-seal
*Recommended spare parts	

TSO Trim (Figures 8, 9 and 10)

Key	Description
2*	Cage
4*	Seat Ring
5*	Plug/Stem Assembly
8*	Seal Ring
63*	Anti-Extrusion Ring
9*	Back Up Ring
10*	Retaining Ring
*Recommended spare parts	

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Fisher™ HPS-C and HPT-C Valves

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Figure 1. Fisher HP-C Valve with 657 Actuator



X1367

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for Fisher HPS-C and HPT-C valves. Refer to separate manuals for instructions covering the actuator and accessories.



Do not install, operate, or maintain HPS-C or HPT-C series valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

HPS-C and HPT-C Valves

February 2024

Instruction Manual

D104208X012

Table 1. Specifications

Valve Sizes HPS-C: NPS ■ 1 to 3 (CL900 and CL1500) and ■ 1 to 2 (CL2500) HPT-C: NPS ■ 4 through 12 (CL900 and CL1500)	Material Temperature Capability⁽¹⁾ HPT-C: -198 to 66°C (-325 to 150°F) HPS-C: -198 to 316°C (-325 to 600°F)
End Connection Styles⁽¹⁾ CL900, 1500, and 2500 raised-face and ring type joint flanges per ASME B16.5 Butt weld end connection per ASME B16.25 PN160 and PN250 flanges per EN1092-1	Cryogenic Leak Test per SPE 77/306 Class C (optional)
Maximum Inlet Pressure⁽¹⁾ CL900 and 1500—Valves are consistent with pressure-temperature ratings per ASME B16.34 CL2500—Valves are consistent with pressure-temperature ratings per ASME B16.34	Maximum Actuator Thrust See table 2
Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4 HPT-C and HPS-C: Metal Seat: ■ Class IV is standard ■ Class V air test is optional (test will be at 50 PSID air) ⁽²⁾	Flow Characteristics HPT-C and HPS-C: Equal percentage, linear, and modified equal percentage
	Flow Directions HPT-C: Normally down for linear and equal percentage trims. Flow up for Whisper Trim HPS-C: Normally up
	Approximate Weights See table 3

1. Do not exceed the pressure/temperature limits in this manual and any applicable code limitation.

2. Class V shutoff cannot be performed with water. This residual trapped moisture from testing with water can cause valve and trim damages from the ice crystals formed at below freezing service temperature.

Description

HPS-C has single-port, globe-style control valve with cage-guiding, unbalanced valve plug, and push-down-to-close valve plug action.

HPT-C has single-port, globe-style control valve with cage guiding, balanced valve plug, and push-down-to-close valve plug action.

These valves feature stainless steel construction materials and fabricated or one-piece extension bonnets. HP-C series globe valves are available in short and long face-to-face designs depending on size and pressure class.

Educational Services

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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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HPS-C and HPT-C Valves

February 2024

Specifications

Table 2. Maximum Allowable Actuator Thrust for Standard Style 3 Bonnet Extension Length

VALVE	VALVE SIZE, NPS	STEM DIAMETER		MAXIMUM ALLOWABLE STEM LOAD FOR S20910 STEM MATERIAL	
		mm	Inches	N	lb
HPS-C	1	12.7	1/2	15413	3465
		19.1	3/4	45176	10156
	2	12.7	1/2	16458	3700
		19.1	3/4	46738	10507
		25.4	1	95130	21386
	3	19.1	3/4	48873	10987
		25.4	1	89956	20223
HPT-C with fabricated extension bonnet	4 (long) ⁽¹⁾	19.1	3/4	48055	10803
		25.4	1	89956	20223
	6 (long) ⁽¹⁾	25.4	1	83382	18745
		31.8	1-1/4	139185	31290
	8 (short) ⁽²⁾	25.4	1	83840	18848
		31.8	1-1/4	139741	31415
	10 (short) ⁽²⁾	25.4	1	77662	17459
		31.8	1-1/4	133393	29988
	12 (short) ⁽²⁾	25.4	1	80446	18085
		31.8	1-1/4	136280	30637
HPT-C with one-piece extension bonnet	4 (short) ⁽²⁾	19.1	3/4	46070	10357
		25.4	1	87158	19594
	6 (short) ⁽²⁾	19.1	3/4	43348	9745
		25.4	1	84049	18895
		31.8	1-1/4	139941	31460
	8 (short) ⁽²⁾	25.4	1	86118	19360
		31.8	1-1/4	142014	31926
	10 (short) ⁽²⁾	25.4	1	82595	18568
		31.8	1-1/4	138469	31129
	12 (short) ⁽²⁾	25.4	1	82154	18469
		31.8	1-1/4	138024	31029
		50.8	2	380029	85434

1. (Long) indicates industry standard long face-to-face.
2. (Short) indicates industry standard short face-to-face.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

HPS-C and HPT-C Valves

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Table 3. Approximate Weights (Valve and Bonnet Assemblies)

VALVE	VALVE SIZE, NPS	RATING	END CONNECTION			
			Flange		SWE, BWE	
			kg	lb	kg	lb
HPS-C	1	CL900 and 1500	51	113	48	105
		CL2500	55	120	44	96
	2	CL900 and 1500	81	178	61	135
		CL2500	113	249	84	184
	3	CL900	135	296	---	---
		CL1500	138	304	106	233
HPT-C with fabricated extension bonnet	4 (long) ⁽¹⁾	CL900	240	527	---	---
		CL1500	258	568	211	464
	6 (long) ⁽¹⁾	CL900	521	1147	---	---
		CL1500	567	1248	465	1023
	8 (short) ⁽²⁾	CL900	809	1779	644	1417
		CL1500	999	2198	781	1718
	10 (short) ⁽²⁾	CL900	1087	2392	887	1951
		CL1500	1560	3432	1193	2625
	12 (short) ⁽²⁾	CL900	1349	2967	1044	2297
		CL1500	1953	4296	1425	3134
HPT-C with one-piece extension bonnet	4 (short) ⁽²⁾	CL900	211	465	163	359
		CL1500	264	582	197	434
	6 (short) ⁽²⁾	CL900	398	877	300	661
		CL1500	549	1210	389	858
	8 (short) ⁽²⁾	CL900	725	1598	540	1190
		CL1500	964	2125	698	1539
	10 (short) ⁽²⁾	CL900	1080	2381	833	1836
		CL1500	1574	3470	1115	2458
	12 (short) ⁽²⁾	CL900	1433	3159	1053	2321
		CL1500	2133	4702	1494	3294
1. (Long) indicates industry standard long face-to-face. 2. (Short) indicates industry standard short face-to-face.						

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media. If installing into an existing application, also refer to the warning at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Because some valve body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

⚠ WARNING

Some bonnet flanges have a tapped hole that was used to handle the bonnet during manufacture. Do not use this tapped hole to lift the valve assembly or personal injury may result.

NOTICE

To avoid product damage, inspect the valve before installation for any damage or any foreign material that may have collected in the valve body. Also remove any pipe scale, welding slag, or other foreign material from the pipeline.

1. Before installing the valve, inspect the valve and associated equipment for any damage and any foreign material.
2. Make certain the valve body interior is clean, that pipelines are free of foreign material, and the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.

Note

NPS 8 to 12 CL900 and CL1500 HPT-C valves contain a flow vane in the lower flow passage. This is critical to proper function of the valve and is not a defect.

3. **Gas Service:** The normal method of mounting for gas service is with the actuator vertical above the valve body. However, the control valve assembly may be installed in any orientation unless limited by seismic criteria. Other positions may result in uneven valve plug and cage wear that could result in improper operation. For mounting assistance, consult your [Emerson sales office](#).

NOTICE

To avoid possible damage to the packing, do not allow the installed actuator angle to be so flat as to allow liquid inside the bonnet to come in contact with the packing.

Liquid Service: The preferred method of mounting for liquid service is with the actuator vertical above the valve body. This will allow a vapor layer to form between the liquid and the packing. If there are piping constraints, the actuator can be angled slightly from vertical. However, in no case should the angle be so flat as to allow liquid inside the bonnet to come in contact with the packing. For mounting assistance, consult your [Emerson sales office](#).

4. If insulation is applied, make sure it is applied only to the body/bonnet joint. Do not let the insulation run up the extension bonnet.
5. Use accepted piping and welding practices when installing the valve in the line. For flanged valve bodies, use a suitable gasket between the valve body and pipeline flanges.
6. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.
7. If the valve body was shipped without packing installed in the packing box, install the packing before putting the valve body into service. Refer to instructions given in the Packing Maintenance procedure.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

Valves with ENVIRO-SEAL™ live-loaded packing will not require this initial readjustment. See the Fisher instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section near the end of this manual.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing maintenance and trim maintenance. All maintenance operations may be performed with the valve in the line.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

NOTICE

Follow instructions carefully to avoid damaging the product surfaces, which could result in damage to the product.

Note

The HPS-C/HPT-C valves use spiral-wound gaskets which are crushed to provide their seal. A spiral-wound gasket should never be reused. Whenever a gasket seal is disturbed by removing or shifting parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal because the used gasket may not seal properly.

Packing Maintenance

This section covers PTFE V-ring, double PTFE, and graphite packing used in extension bonnets (figure 2).

Note

If the valve has ENVIRO-SEAL live-loaded packing installed, refer to the instruction manual ENVIRO-SEAL Packing System for Sliding Stem Valves ([D101642X012](#)) for packing instructions. Figure 4 shows typical ENVIRO-SEAL arrangements.

Standard packing key numbers are shown in figure 2. ENVIRO-SEAL packing key numbers are shown in figure 4. Bonnet and valve key numbers are shown in figures 5, 6, 7, and 8.

For spring-loaded single PTFE V-ring packing, the spring (key 24) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 28), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 20), until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed with replacing packing procedures.

If there is undesirable packing leakage with other than spring-loaded packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

If the packing is relatively new and tight on the stem, and if tightening the packing flange nuts does not stop the leakage, it is possible that the valve stem is worn or nicked so that a seal cannot be made. The surface finish of a new valve stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches. If leakage continues, replace the packing by following the numbered steps presented in the replacing packing procedure.

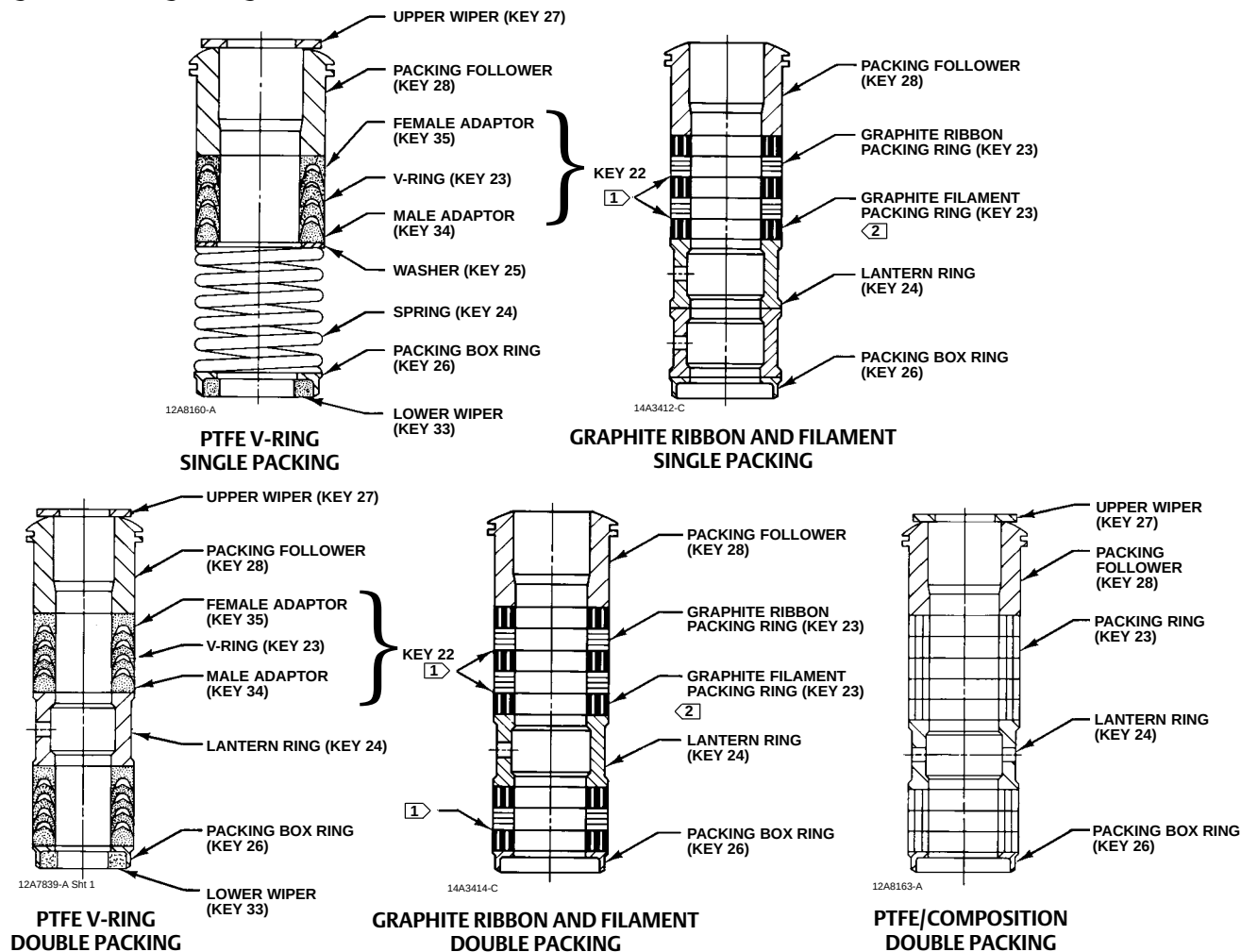
Adding Packing Rings

Key numbers referred to in this procedure are shown in figures 2, 5, and 6 unless otherwise noted.

When using packing with a lantern ring (key 24) it may be possible to add packing rings above the lantern ring as a temporary measure without removing the actuator from the valve body.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the packing flange nuts (key 20) and lift the packing flange, upper wiper, and packing follower (keys 18, 27, and 28) away from the valve body.
3. It may be possible to dig out the old packing rings on top of the lantern ring, but use care to avoid scratching the valve plug stem or packing box wall. Clean all metal parts to remove particles that would prevent the packing from sealing.
4. Remove the stem connector and slip the packing rings over the end of the valve plug stem.
5. Reassemble the packing follower, upper wiper, packing flange, and packing flange nuts (keys 28, 27, 18, and 20).
6. Reconnect the body-actuator stem connection according to the appropriate actuator instruction manual.
7. Tighten the packing flange nuts only far enough to stop leakage under operating conditions. Check for leakage around the packing follower when the valve is being put into service. Retighten the packing flange nuts as required (see table 3).

Figure 2. Packing Arrangements



NOTES:

- 1 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS. USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.
- 2 HAS THE APPEARANCE OF A WOVEN OR BRAIDED RING.

C0747-1

Replacing Packing

⚠ WARNING

Refer to the warning at the beginning of the Maintenance section in this instruction manual.

Key numbers and sequence of assembly of packing parts are shown in figure 2. Bonnet and valve key number locations are shown in figures 5, 6, 7, and 8, unless otherwise noted.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment. Observe the warnings at the start of the Maintenance section.
2. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet. Disconnect the stem connector and remove the actuator from the valve by unscrewing the yoke locknut (key 32) or hex nuts (key 30).

- Loosen the packing flange nuts (key 20) so that the packing is not tight on the valve stem. Remove any travel indicator parts and stem locknuts from the valve stem threads.

⚠ WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next steps.

Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. If the cage sticks to the bonnet, proceed carefully with bonnet removal and support the cage so that it will not fall unexpectedly from the bonnet.

- When lifting the bonnet, be sure the plug and stem assembly (key 4 and 5), cage (key 2), and cage retainer (key 45), if applicable, remain in the valve body. This avoids damage to the seating surfaces as a result of the assembly dropping from the bonnet after being lifted part way out. The parts are also easier to handle separately.

⚠ WARNING

To avoid possible personal injury, review your process shutdown procedures to be sure process pressure is not applied to the valve for the following procedure.

- Hex nuts (key 13) attach the bonnet to the valve body (key 1). Loosen these nuts or cap screws approximately 3 mm (1/8 inch). Then, loosen the body-to-bonnet joint by either rocking the bonnet or prying between the bonnet and valve body. Work with a prying tool around the bonnet until the bonnet loosens.
 - If fluid leaks from the joint, it may indicate that process pressure is applied to the valve. Review your process shutdown procedures, and be sure process pressure is not applied to the valve.
 - If no fluid leaks from the joint, proceed to the next step.
- Unscrew the hex nuts (key 13) and carefully lift the bonnet off the valve stem. If the valve plug and stem assembly starts to lift with the bonnet, use a brass or lead hammer on the end of the stem and tap it back down. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.

Table 4. Recommended Torque for Packing Flange Nuts

STEM DIAMETER		PRESSURE RATING ⁽¹⁾	TORQUE ⁽²⁾			
			N•m		lbf•ft	
mm	Inches		Min	Max	Min	Max
12.7	1/2	CL900	12	18	9	13
		CL1500	15	22	11	16
		CL2500	18	24	13	18
19.1	3/4	CL900	27	41	20	30
		CL1500	34	50	25	37
		CL2500	41	61	30	45
25.4	1	CL900	42	62	31	46
		CL1500	52	77	38	57
		CL2500	61	91	45	67
31.8	1-1/4	CL900	56	83	41	61
		CL1500	68	102	50	75
50.8	2	CL1500	98	146	72	108

1. For intermediate class ratings, use the same torque as the next lower standard class.
2. Lubricate with anti-seize compound.

- If it is necessary to remove and inspect the valve trim, refer to the following Trim Maintenance section.
- Remove the bonnet gasket (key 10) and cover the opening in the valve to protect the gasket surface and prevent foreign material from getting into the valve body cavity.

9. Remove the packing flange nuts, packing flange, upper wiper, and packing follower (keys 20, 18, 27, and 28). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and metal packing parts.

Table 5. Torque for Body-to-Bonnet Bolting Using Anti-Seize Lubricant⁽¹⁾

STUD SIZE	TORQUE	
	N•m	lbf•ft
	B8M, B8M2, S20910 Studs	
3/4	260	190
7/8	370	275
1-1/8	710	525
1-1/4	940	695
1-3/8	1270	935
1-1/2	1650	1220
1-5/8	2130	1570
1-3/4	2670	1970

1. For other lubricants or bolting materials, contact your [Emerson sales office](#) for torques.

10. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs in the packing box surfaces could cause leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
11. If necessary, go to the Trim Maintenance procedures to remove, inspect or replace trim parts. Return to this section when installing the bonnet on the valve body.

Installing the Fabricated Bonnet

1. Remove the covering protecting the valve body cavity and install a new bonnet gasket (key 10), making sure the gasket seating surfaces are clean and smooth. Then slide the bonnet over the stem and onto the stud bolts (key 12).

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) immediately if a discrepancy between actual parts and approved parts is suspected.

2. Lubricate the stud threads and the faces of the hex nuts (key 13) with anti-seize lubricant (not necessary if new factory pre lubricated hex nuts are used). Replace the hex nuts and tighten them finger-tight. Stroke the valve several times to center the trim.

Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 4. When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again

3. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 2. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box.

4. Slide the packing follower, upper wiper, and packing flange (keys 28, 27, and 18) into position. Lubricate the packing flange studs (key 19) and faces of the packing flange nuts (key 20). Install the packing flange nuts.
5. Tightening packing flange nuts (key 20):
 - For spring-loaded PTFE V-ring packing, tighten the packing flange nuts until the shoulder on the packing follower (key 28) contacts the bonnet.
 - For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 3. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 3.
 - For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 3. Then, tighten the remaining nut until the packing flange is level and at a 90 degree angle to the valve stem.
 - For ENVIRO-SEAL live-loaded packing; refer to the Fisher instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)).
6. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

Installing the One-Piece Bonnet

1. Before install bonnet to body, first install bushing spacer (key 46) to bonnet.
2. Install 1/4"-20 eye bolts into the two equally spaced tapped holes on the bottom of bushing spacer. Lift the bushing spacer with eye bolts and put it into the bottom cavity of bonnet, turn the spacer clockwise into bonnet until tight. Afterward, remove the two eye bolts.
3. There are two options to secure bushing spacer.
 - Option 1: Tack weld the bushing spacer to the bonnet using minimal heat. Two welds, 6 mm (1/4-inch) long and 180° apart, are required.
 - Option 2: Use an appropriate tool such as a center punch, stake the threads on the bonnet in one place.
4. The rest of installation procedure refer to step 1 through 6 of Installing the Fabricated Bonnet section.

Trim Maintenance

This procedure describes how the valve trim can be completely disassembled. When inspection or repairs are required, perform only those steps necessary to accomplish the task.

Key number locations are shown in figures 5 and 6 for NPS 1 through 6 (long), and figures 7 and 8 for NPS 4 through 12 (short), unless otherwise noted.

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

To avoid personal injury due to leaking fluids, avoid damaging gasket sealing surfaces. The surface finish of the valve stem (key 5) is critical for making a good packing seal.

NOTICE

The inside surface of the cage (key 2) is critical for tight shutoff and smooth operation of the valve plug. The seating surfaces of the valve plug (key 4) and seat ring (key 3) are critical for proper shutoff. Protect these surfaces accordingly.

Trim Disassembly NPS 1 through 6 (Long)

1. Remove the actuator and the bonnet according to steps 1 through 6 of the Replacing Packing procedures in the Maintenance section.
2. Lift the valve stem and attached valve plug out of the valve body. If the valve plug is to be reused, tape or otherwise protect the valve plug stem and the valve plug seating surface to prevent scratches.
3. Lift out the cage (key 2) and the bonnet gasket (key 10).
4. Remove the seat ring (key 3) and seat ring gasket (key 11).
5. Clean, inspect, and if necessary obtain replacement parts.

Trim Disassembly NPS 4 through 12 (Short)

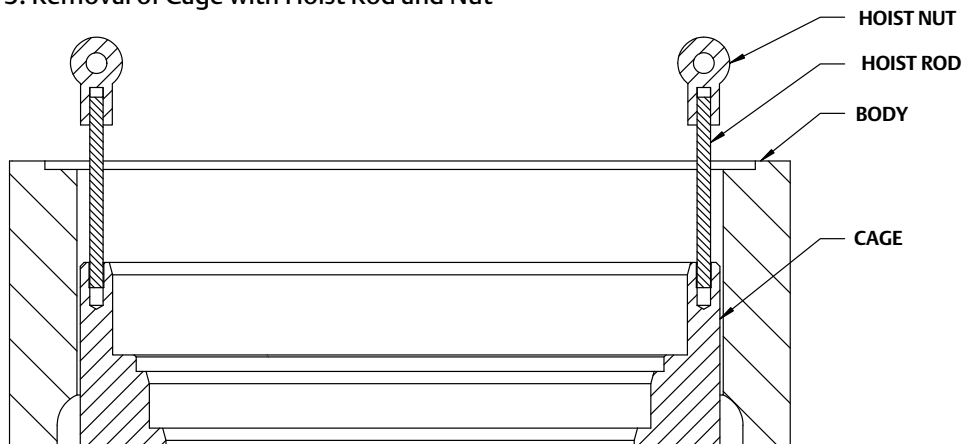
1. Remove the actuator and the bonnet according to steps 1 through 6 of the Replacing Packing procedures in the Maintenance section.
2. Lift the valve stem and attached valve plug out of the valve body. If the valve plug is to be reused, tape or otherwise protect the valve plug stem and the valve plug seating surface to prevent scratches.
3. Lift out the cage retainer (key 45), cage gaskets (key 43), and the bonnet gasket (key 10).

⚠ WARNING

Lifting of the cage must be done with a vertical or straight lift using the equipment shown in figure 3. Lifting at angle may damage the lifting equipment and cause property damage or personal injury.

4. Install threaded rods (about 6 inches long) into the holes on top of the cage vertically. Install hoist rings, nuts or eye bolt on to the threaded rods (see figure 3). Lift out the cage with the hoist nut from the valve body.

Figure 3. Removal of Cage with Hoist Rod and Nut



Note

The cage and cage retainer lifting holes are provided for ease of disassembly. To prevent damage to the cage lifting hole, fully engage the threaded rod into the cage hole, but do not overtighten the hoist rod. It only needs to be hand tight.

If it is hard to lift the cage, a piece of wood and a hammer can be used to strike on the top chamfer of the cage to loosen it from the body or seat ring gasket.

ASTM A193 B7 or comparable threaded rods are required for cage removal. Contact your [Emerson sales office](#) for more information.

5. Remove the seat ring gasket (key 11).
6. Clean, inspect, and if necessary obtain replacement parts.

Valve Plug Maintenance

NOTICE

To avoid the valve plug seal ring (key 7) not sealing properly and affecting valve performance, be careful not to scratch the surfaces of the ring groove on the valve plug or any of the surfaces of the replacement ring.

1. With the valve plug (key 4) removed, according to the disassembly portion of the Trim Maintenance procedure, proceed as follows: For HPS-C valves, proceed to step 5:
2. For HPT-C valves, the spring-loaded seal ring may be removed by first working the retaining ring (key 9) off with a screwdriver. Then carefully slide the metal backup ring (key 8) and seal ring (key 7) off the valve plug (key 4).
3. A spring-loaded seal ring must be installed so that its open side faces toward the valve stem, or toward the seat of the plug depending on flow direction. To install a spring-loaded seal ring, slide the seal ring (key 7) onto the valve plug followed by the metal backup ring (key 8).
4. Then install the retaining ring (key 9) by inserting one end in the groove and, while turning the plug, press the ring into the groove. Again, be careful not to scratch any surfaces of the ring or plug.

NOTICE

To avoid weakening the stem that may cause failure in service, never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem, which will weaken the stem. However, a used valve plug may be reused with a new stem.

5. To replace the valve stem (key 5), drive or drill out the pin (key 6). Unscrew the valve plug from the stem.
6. Screw the new stem into the valve plug. Tighten to the torque value given in table 5. Also, use this table to select the proper drill size. Drill through the stem using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin to lock the assembly.

Trim Assembly NPS 1 through 6 (Long)

Key number locations are shown in figure 5 and 6, unless otherwise noted.

1. Install the seat ring gasket (key 11), and seat ring (key 3).
2. Install the cage (key 2). Any rotational orientation of the cage with respect to the valve body is acceptable.
3. Lower the valve plug (key 4) and stem assembly into the cage. Make sure the seal ring (key 7) is evenly engaged in the entrance chamfer at the top of the cage (key 2) to avoid damaging the ring.
4. Place the gaskets (keys 10) on top of the cage.
5. Mount the bonnet on the valve body and complete assembly using the Replacing Packing procedures in the Maintenance section. Torque guidelines for body-to-bonnet bolting are shown in table 4.
6. If the valve has soft metal-to-metal seats, refer to the Coining Soft Metal-to-Metal Seats section, below.

Trim Assembly NPS 4 through 12 (Short)

Key number locations are shown in figures 7 and 8 unless otherwise noted.

1. Install the seat ring gasket (key 11) in the lower gasket groove in the valve body (key 1), making sure the gasket is centered in the groove and the bottom of the gasket is flush with the mating surface in the body.
2. Install threaded rods (about 6" long) into the holes on top of the cage vertically. Install hoist rings, nuts or eye bolt on to the threaded rods.

Note

The cage and seat ring lifting holes are 1/4"-20. To prevent damage to the cage/seat ring lifting holes, fully engage the threaded rod into the cage/seat ring hole, but do not overtighten the hoist rod. It only needs to be hand tight.

ASTM A193 B7 or comparable threaded rods are required for cage/seat ring installation.

3. Lift the cage (key 2) using the hoist rings on the threaded rods and install the cage into the valve body (see figure 3). Any rotational orientation of the cage with respect to the valve body is acceptable. When installing the cage, take care to lower the cage evenly and ensure the cage will not damage the flat sheet gasket (key 11).
4. For NPS 8 through 12, install quantity-2 cage gaskets (key 43) and make sure the gaskets sit flush on the surface of the groove.
5. Install the cage retainer (key 45) on top of the cage and a single cage gasket (key 43) on top of the cage retainer.
6. Install the bonnet gasket (key 10) into the groove around the valve body trim opening.
7. Lower the valve plug (key 4) and stem assembly through the bore of the cage retainer (key 45) and into the bore of the cage (key 2) and gently rest the plug seating surface against the seating surface in the cage. Make sure the seal ring (key 7) is evenly engaged in the entrance chamfer at the top of the cage retainer (key 45) to avoid damaging the ring.
8. Mount the bonnet on the valve body and complete assembly using the Replacing Packing procedures in the Maintenance section. Torque guidelines for body-to-bonnet bolting are shown in table 4.
9. If the valve has soft metal-to-metal seats, refer to the Coining Soft Metal-to-Metal Seats section.

Note

Be careful to prevent the bonnet from crushing the spiral wound gaskets as the bonnet is lowered on to the valve.

Damaging the gaskets will require that they are replaced.

Table 6. Valve Stem Connection Torque and Drill Size for Pin Hole

VALVE STEM DIAMETER		VALVE STEM CONNECTION TORQUE ⁽¹⁾ (MINIMUM-MAXIMUM)		DRILL SIZE FOR PIN
mm	Inches	N•m	Lbf•ft	Inches
12.7	1/2	81 - 115	60 - 85	1/8
19.1	3/4	237 - 339	175 - 250	3/16
25.4	1	420 - 481	310 - 355	1/4
31.8	1-1/4	827 - 908	610 - 670	1/4
50.8	2	3515-3885	2600 - 2880	3/8

1. Lubricate with anti-seize compound.

Coining Soft Metal-to-Metal Seats

Soft metal-to-metal seat constructions consist of a valve plug with hardfaced CoCr-A seat and a non-hardfaced S31600 seat ring or cage seating surface. For optimum shutoff performance of these constructions, coin seats by stroking the valve plug into the seat ring at least three times with maximum actuator force.

NOTICE

To avoid possible product damage which may affect performance, do not lap soft metal-to-metal seats.

Parts Ordering

Each body-bonnet assembly is assigned a serial number which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly.

Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and to the eleven-character part number for each part required from the following parts kit or parts list information.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Packing Kits

Standard Packing Repair Kits (Non Live-Loaded)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)	50.8 (2) 178 (7)
PTFE (Contains keys 22, 24, 25, 26, 27)	RPACKX00022	RPACKX00032	RPACKX00342	RPACKX00352	Consult sales office
Double PTFE (Contains keys 22, 24, 26, 27)	RPACKX00052	RPACKX00062	RPACKX00362	RPACKX00372	
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring], 24, and 26)	RPACKX00112	RPACKX00122	---	---	Consult sales office
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring], and 26)	---	---	RPACKX00532	RPACKX00542	
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring])	RPACKX00142	RPACKX00152	---	---	Consult sales office

ENVIRO-SEAL Packing Retrofit Kits

Retrofit kits include parts to convert valves with existing standard bonnets to the ENVIRO-SEAL packing box construction. Refer to figure 4 for key numbers for PTFE and Graphite ULF packing.

Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of this packing kit.

ENVIRO-SEAL Packing Retrofit Kits

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)	50.8 (2) 178 (7)
Double PTFE (Contains keys 200, 201, 211, 212, 214, 215, 216, 217, 218, tag, cable tie)	RPACKXRT022	RPACKXRT032	RPACKXRT042	RPACKXRT052	Consult sales office
Graphite ULF (Contains keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 217, tag, cable tie)	RPACKXRT272	RPACKXRT282	RPACKXRT292	RPACKXRT302	
Duplex (Contains keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, cable tie)	RPACKXRT222	RPACKXRT232	RPACKXRT242	RPACKXRT252	

ENVIRO-SEAL Packing Repair Kits

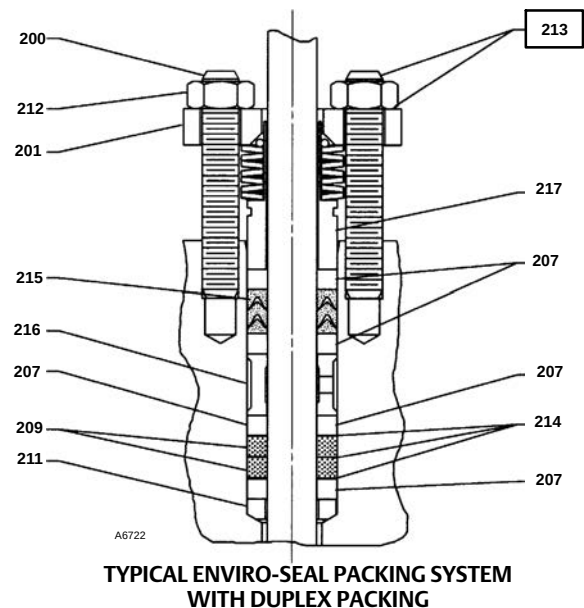
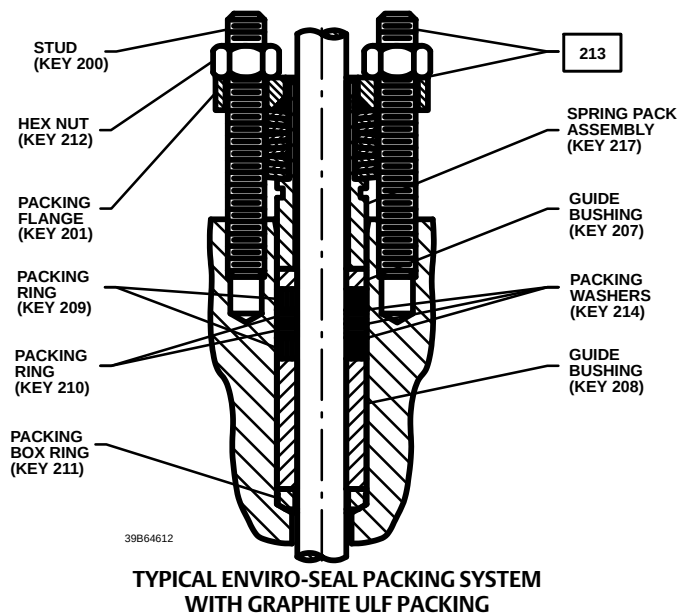
Repair kits include parts to replace the “soft” packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits. Refer to figure 4 for key numbers for PTFE and Graphite ULF packing.

Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances, and design specifications, may adversely alter the performance of this packing kit.

ENVIRO-SEAL Packing Repair Kits

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)	50.8 (2) 178 (7)
Double PTFE (Contains keys 214, 215, & 218)	RPACKX00202	RPACKX00212	RPACKX00222	RPACKX00232	Consult sales office
Graphite ULF (Contains keys 207, 208, 209, 210, and 214)	RPACKX00602	RPACKX00612	RPACKX00622	RPACKX00632	
Duplex (Contains keys 207, 209, 214, and 215)	RPACKX00302	RPACKX00312	RPACKX00322	RPACKX00332	

Figure 4. Enviro-seal Packing



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104208X012

HPS-C and HPT-C Valves

February 2024

Gasket Kit

VALVE RATING	VALVE SIZE, NPS	MATERIAL	
		N06600/Graphite	N07750/Graphite
HPS-C CL1500	1	12B7100X012	12B7100X022
	2	12B7100X032	12B7100X042
	3	12B7100X052	12B7100X062
HPT-C CL1500	4 (long)	12B7100X082	---
	6 (long)	12B7100X112	---
HPS-C CL2500	1	12B7100X152	12B7100X122
	2	12B7100X162	12B7100X132

Gasket Set HPT-C NPS 4 through 12^(1,2)

VALVE RATING	HP GLOBE	MATERIAL		
	Valve Size, NPS	Bonnet Spiral Wound Gasket N06600/Graphite	Cage Spiral Wound Gasket N06600/Graphite	Seat Ring Flat Sheet Gasket S31600/Graphite
CL900	4 (short)	GG62142X012	GG62143X012	GG62144X012
	6 (short)	GG62162X012	GG62163X012	GG62164X012
	8 (short)	GG53667X012	GG53677X012	GG53849X012
	10 (short)	GG53684X012	GG53685X012	GG53852X012
	12 (short)	GG53692X012	GG53693X012	GG53854X012
CL1500	4 (short)	GG62142X012	GG62143X012	GG62144X012
	6 (short)	GG62162X012	GG62163X012	GG62164X012
	8 (short)	GG53678X012	GG53679X012	GG53849X012
	10 (short)	GG53686X012	GG53687X012	GG53852X012
	12 (short)	GG53694X012	GG53695X012	GG53854X012
1. Includes Bonnet Gasket (key 10), Cage Gasket (key 43), and Seat Ring Gasket (key 11). 2. Gaskets should always be replaced as sets, not separately.				

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

HPS-C and HPT-C Valves

February 2024

Instruction Manual

D104208X012

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

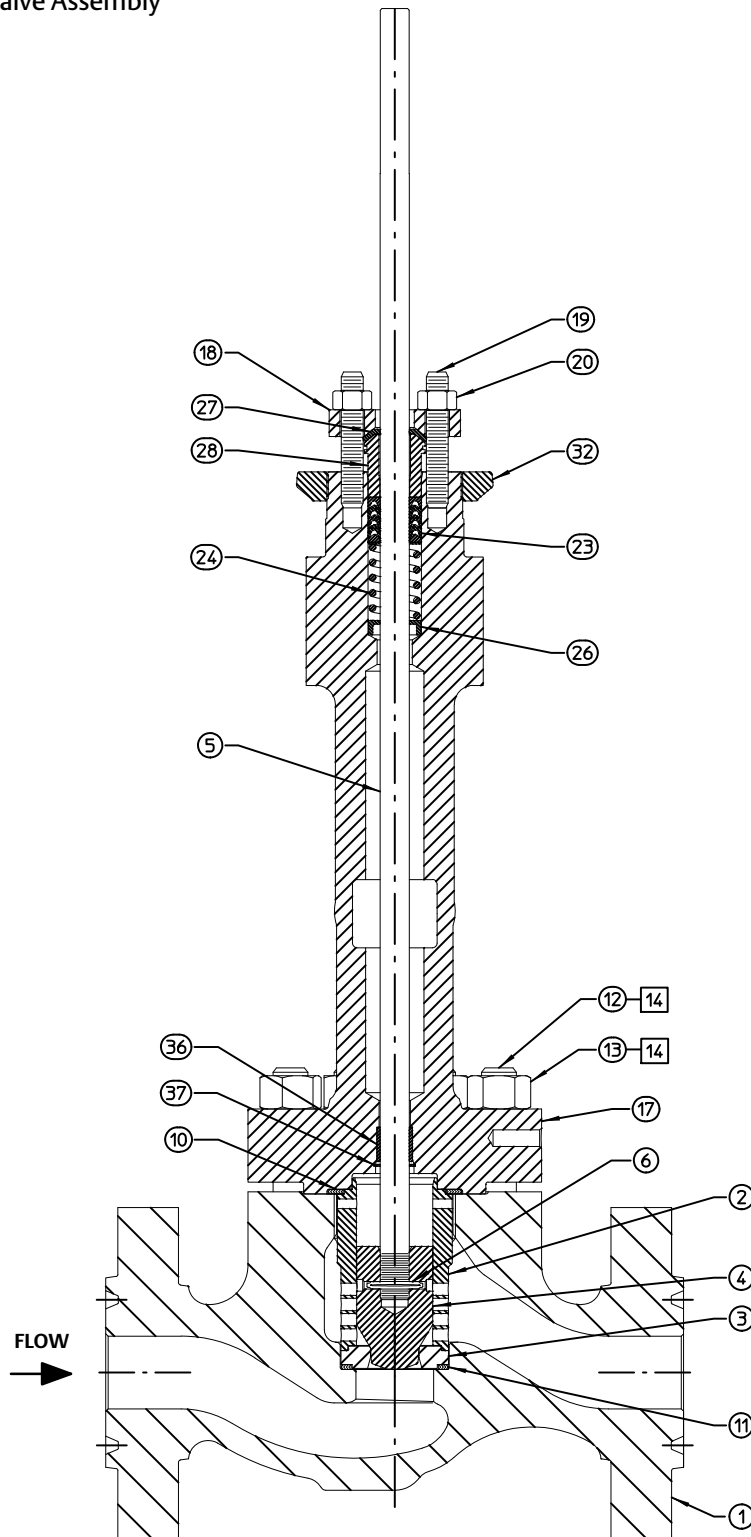
Key	Description
-----	-------------

1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number, and desired material.
2*	Cage
3*	Seat Ring
4*	Valve Plug
5*	Valve Stem
6*	Pin
7*	Seal Ring
8*	Back Up Ring
9*	Retaining Ring (for HPT-C only)
10*	Bonnet Gasket
11*	Seat Ring Gasket
12	Stud
13	Hex Nut
14	Anti-Seize Lubricant
15	Nameplate
16	Wire

Key	Description
-----	-------------

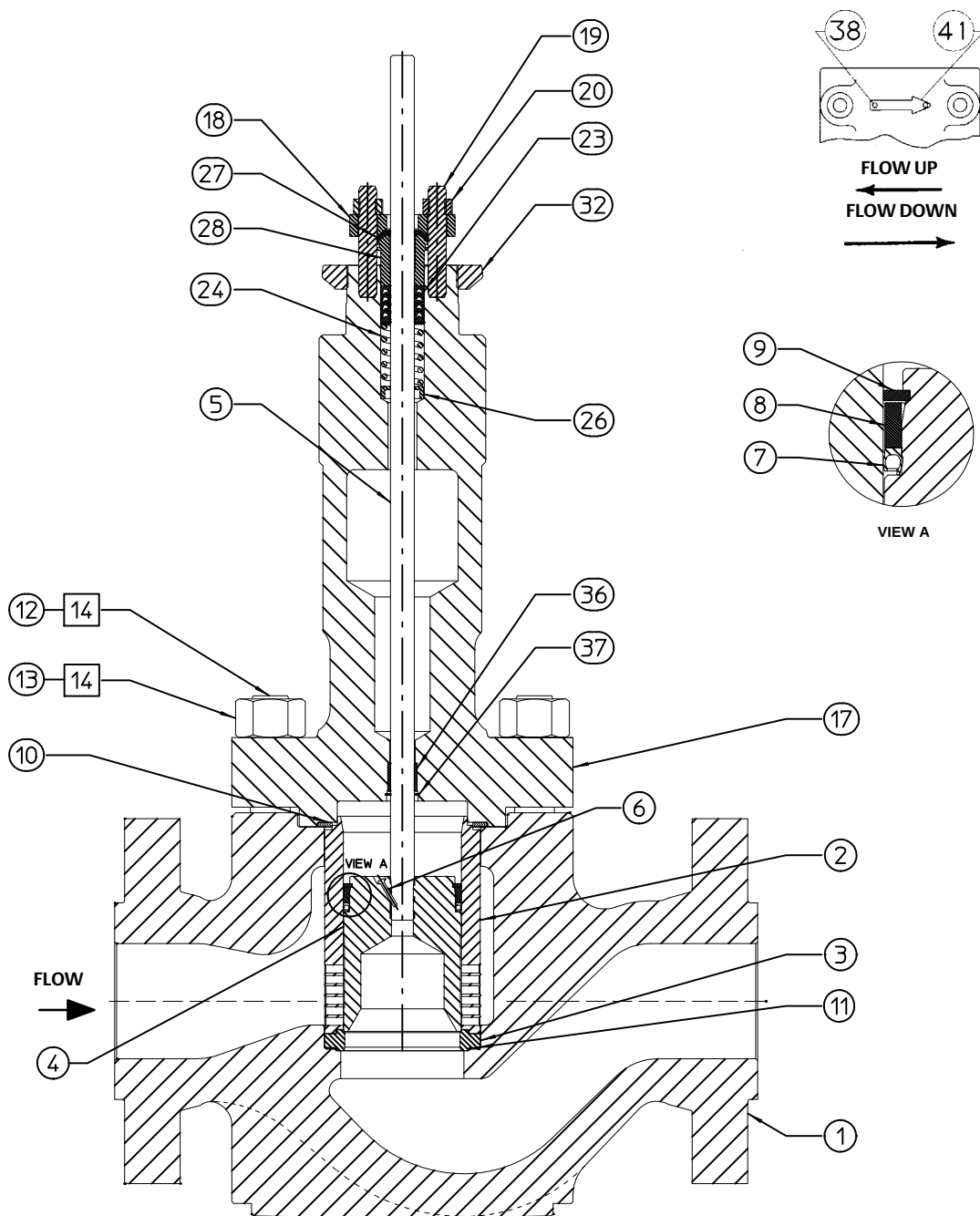
17	Bonnet If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.	
18	Packing Flange	
19	Stud Bolt	
20	Hex Nut	
22*	Packing Set	See Parts Kits
23*	Packing Ring	See Parts Kits
24	Spring or Lantern Ring	See Parts Kits
25	Washer, Special	See Parts Kits
26*	Packing Box Ring	See Parts Kits
27*	Upper Wiper	See Parts Kits
28	Follower	
29	Stud Bolt	
30	Hex Nut	
32	Yoke Locknut	
36	Baffle	
37	Retaining Ring	
38	Drive Screw	
40	Washer	
41	Flow Arrow	
43	Cage Gasket	
44	Nameplate	
45	Cage Retainer	
46	Bushing Spacer	

Figure 5. Fisher HPS-C Valve Assembly



GE87219

Figure 6. Fisher HPT-C Valve Assembly with Fabricated Bonnet NPS 1 through 6 (Long)



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

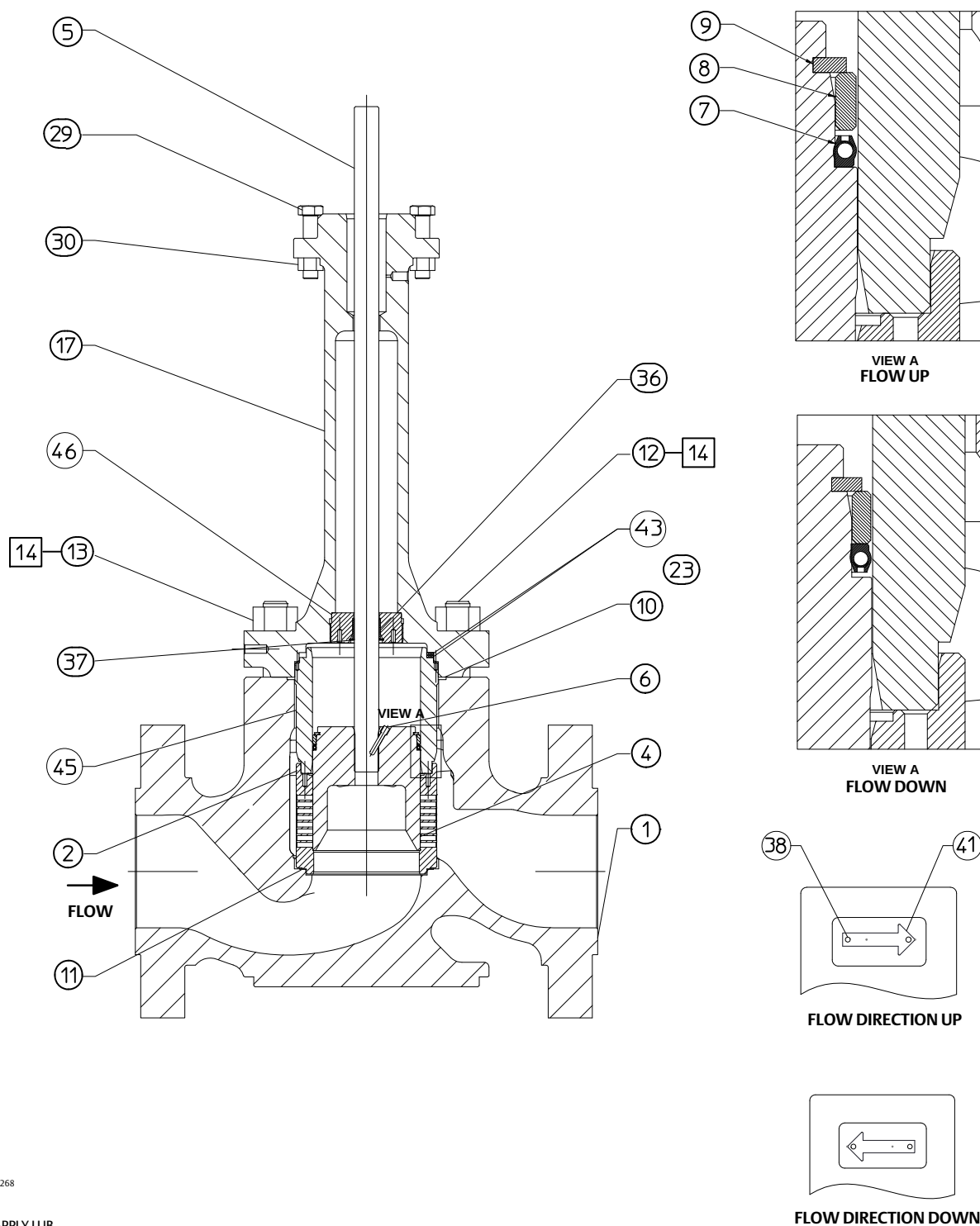
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D104208X012

HPS-C and HPT-C Valves

February 2024

Figure 7. Fisher HPT-C Valve Assembly with One-Piece Bonnet NPS 4 and 6 (Short)



GK03268

□ APPLY LUB

NOTE: PARTS NOT SHOWN: 15, 16, AND 44

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

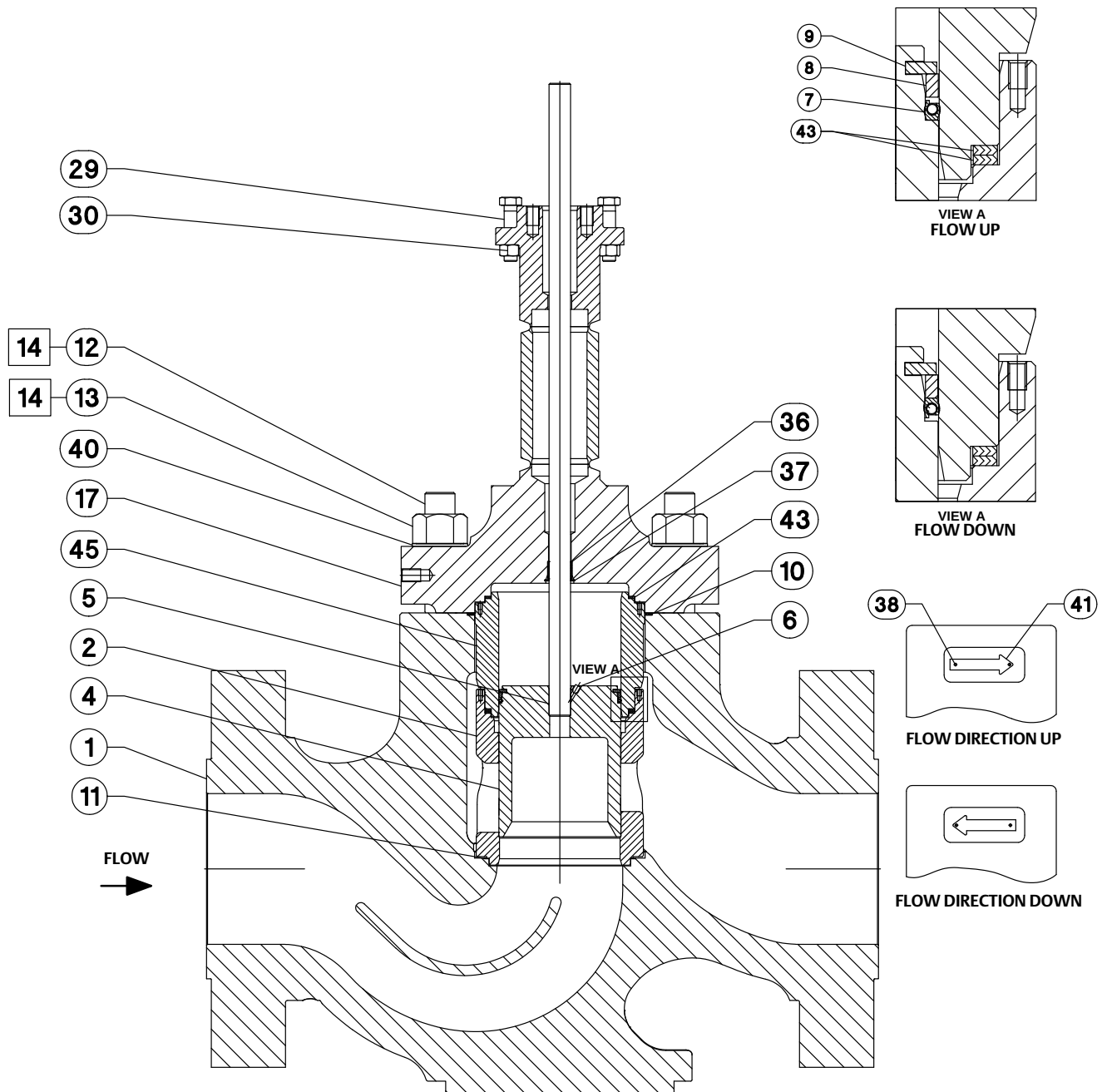
HPS-C and HPT-C Valves

February 2024

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D104208X012

Figure 8. Fisher HPT-C Valve Assembly with Fabricated Bonnet NPS 8 through 12 (Short)



GH10487

□ APPLY LUB

NOTE: PARTS NOT SHOWN: 15, 16, AND 44

ONE-PIECE EXTENSION BONNET OPTION IS ALSO AVAILABLE FOR NPS 8 THROUGH 12 (SHORT) HPT-C VALVES

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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D104208X012

HPS-C and HPT-C Valves

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HPS-C and HPT-C Valves

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HPS-C and HPT-C Valves

February 2024

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

HPS-C and HPT-C Valves

February 2024

Instruction Manual

D104208X012

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Fisher™ IC2 Cryogenic Top-Entry Control Valve



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and parts information for Fisher IC2 valve (see Figure 1). Refer to separate manuals for instructions covering the actuator and accessories.



WARNING



Do not install, operate or maintain IC2 valves without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

1.2 Description

The IC2 is a globe and angle style, single-port, unbalanced valve with integral end connections, body guiding, metal-to-metal seating, quick-change trim and stainless steel and aluminum construction materials.

Figure 1. Typical Fisher IC2 Valve with Extension Bonnet



IC2 GLOBE



IC2 ANGLE STAINLESS STEEL



IC2 ANGLE ALUMINUM

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

IC2 Valve

June 2026

Instruction Manual

D104800X012

Table 1. Specifications

Available Configurations	Material Temperature Capabilities ⁽¹⁾
Single-port, globe and angle style control valve with body guiding, unbalanced valve plug and push-down-to-close valve plug action	-198 to +149°C / -325 to +300°F -254 to +149°C / -425 to +300°F -269 to +149°C / -452 to +300°F ⁽³⁾
Valve Sizes	Flow Coefficients
NPS ■ 1, ■ 1-1/2, ■ 2, ■ 3, ■ 4 and ■ 6	See Catalog 12
End Connection Styles ⁽¹⁾	Port Diameters and Maximum Valve Plug Travels
Butt weld end consistent with ASME B16.25 and SWE consistent with ASME B16.11. For additional options, consult your Emerson sales office .	See Table 3. For additional options consult your Emerson sales office .
Maximum Inlet Pressures ⁽¹⁾	Packing Arrangements
Consistent with CL600 according to ASME B16.34 for maximum bellows pressure drop capabilities see Bellows section.	■ Enhanced ENVIRO-SEAL PTFE ■ Enhanced ENVIRO-SEAL Duplex ■ Enhanced ENVIRO-SEAL Graphite ULF ■ ENVIRO-SEAL IS (ISO-Seal)
Trim Material	See Packing Selection Guidelines for Fisher Sliding-Stem Valves Bulletin (D101986X012) for more information. For additional options, consult your Emerson sales office .
■ 316 SST and Alloy 6	
Shutoff Classifications Per ANSI/FCI 70-2 and IEC 60534-4	Approximate Weights
Metal Seat: ■ Class IV (standard) ■ Class V (optional) ⁽²⁾ ■ Class VI (optional)	Fisher IC2 Globe Valve NPS 1: 26 kg / 57 lb NPS 1-1/2: 39 kg / 86 lb NPS 2: 43 kg / 95 lb NPS 3: 74 kg / 163 lb NPS 4: 122 kg / 269 lb NPS 6: Consult Emerson sales office . Fisher IC2 Angle Body Valve NPS 1: 27 kg / 60 lb NPS 1-1/2: 38 kg / 84 lb NPS 2: 39 kg / 86 lb NPS 3: 75 kg / 165 lb NPS 4: 127 kg / 280 lb NPS 6: Consult Emerson sales office .
Maximum Actuator Thrust	
See Table 2	
Flow Characteristics	
■ Linear ■ Equal Percentage	
Flow Directions	
Up through the seat ring only	
Construction Materials	Additional Options
Body and Bonnet: ■ Stainless Steel (316/CF8M) ■ Aluminum (5083-H112) Body Bolting: ■ SA-193-B8M Class 2 studs with SA194-8M nuts ■ SA193-B8 Class 1 studs with SA194-8 nuts Bellows Seal Assembly: ■ S31603	■ Drip plate ■ Drilled and tapped connection in bonnet for leak off service ■ Displacer
1. Do not exceed the pressure or temperature limits in this manual or any applicable code or standard limitations. 2. Class V shutoff cannot be performed with water. The residual trapped moisture from testing with water can cause valve and trim damage from the ice crystals formed at below freezing service temperatures. 3. Certain restrictions apply. Contact your Emerson sales office for more information.	

Table 2. Maximum Allowable Actuator Thrust for Standard IC2 Bonnet

VALVE SIZE, NPS	STEM DIAMETER		MAXIMUM ALLOWABLE STEM LOAD FOR 316 STRAIN HARDENED STEM MATERIAL	
	mm	in.	N	lb
1	9.5	3/8	9608	2160
	12.7	1/2	17081	3840
1-1/2	9.5	3/8	9608	2160
	12.7	1/2	17081	3840
2	12.7	1/2	17081	3840
	19.1	3/4	38437	8641
3	12.7	1/2	17081	3840
	19.1	3/4	38437	8641
4	12.7	1/2	17081	3700
	19.1	3/4	38437	8641

1.3 Education Services

Emerson Education Services

Phone: 800-338-8158

Email: education@emerson.com

emerson.com/en/final-control/services/valve-training

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in Table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

NOTICE

Before installing the valve, inspect the valve and pipelines for any damage and any foreign material which may cause product damage.

1. Make certain the valve body interior is clean, that pipelines are free of foreign material and that the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.
2. The recommended method of mounting for gas or liquid service is with the actuator vertical above the valve body. The actuator can be mounted 15 degrees or more above the horizontal with the proper supporting structure in place unless limited by seismic criteria. Mounting positions other than actuator vertical above the valve may result in uneven valve plug and guide wear that could result in reduced service life. However, in no case should the angle be so flat as to allow liquid inside the bonnet to come in contact with the packing. For mounting assistance, consult your [Emerson sales office](#).

NOTICE

To avoid possible damage to the packing, do not allow the installed actuator angle to be so flat as to allow liquid inside the bonnet to come in contact with the packing.

3. Use accepted piping and welding practices when installing the valve in the line.
4. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.



WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.

Valves with enhanced ENVIRO-SEAL™ live-loaded packing will not require this initial readjustment. See the Fisher instruction manual titled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) for packing instructions.

Section 3: Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing maintenance and trim and bellows maintenance. All maintenance operations may be performed with the valve in the line.

WARNING

Avoid personal injury or property damage from sudden release of process pressure. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

NOTICE

Follow instructions carefully to avoid damaging the product surfaces.

NOTE

Whenever a gasket seal is disturbed by removing or shifting parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal since the used gasket may not seal properly.

3.1 Packing Maintenance

This section covers packing used in standard IC2 bonnets and bellows bonnets (Figures 2, 3 and 4).

NOTE

If the valve has enhanced ENVIRO-SEAL live-loaded packing installed, refer to the ENVIRO-SEAL Packing System for Sliding Stem Valves Instruction Manual, [D101642X012](#) for packing instructions. Figures 2, 3 and 4 show typical enhanced ENVIRO-SEAL arrangements.

Enhanced ENVIRO-SEAL packing systems are designed for quality performance over extended periods. This longevity allows for packing maintenance to be performed at regularly scheduled plant outages or turnarounds.

Use the following instructions when inspecting or replacing enhanced ENVIRO SEAL packing. Additional information can be found in the ENVIRO-SEAL Sliding-Stem Valves Instruction Manual ([D101642X012](#)).

If changing the packing system material to a different material, such as PTFE to Graphite ULF, it is good practice to review the actuator sizing, as packing friction will change.

NOTICE

To prevent product damage caused by scratching or damaging the packing box wall, take care when removing the old packing parts from the packing box.

Replacing Packing

1. Isolate the control valve from the line pressure.
2. Release pressure and drain process media from both sides of the control valve.
3. If using a power actuator, also shut off all pressure lines to the power actuator and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.
4. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet.
5. Disconnect the stem connector and then remove the actuator from the valve by unscrewing the yoke locknut.
6. Remove any travel indicator parts and stem locknuts from the valve stem threads.
7. Remove the packing nut (key 3, Figures 2, 3 or 4) from bonnet.
8. Remove packing parts from bore using a packing extraction tool and check for damage to valve stem or packing box bore.
9. Install the enhanced ENVIRO-SEAL packing parts into the packing box. Use Figures 2, 3 and 4 to ensure the packing parts and spring pack are assembled in correct order.

10. Install the spring pack assembly with the attached springs, onto the stem, ensuring the Belleville springs are stacked properly and packing box parts are assembled in the correct order (Figures 2, 3 and 4). Packing parts cannot function properly if the Belleville springs or other packing parts are not stacked correctly.
11. Lubricate the packing nut (key 3, Figures 2, 3 or 4) with anti-seize lubricant and install hand tight.

3.2 Tightening Procedures - Packing Nut

1. To achieve maximum benefit from the enhanced ENVIRO-SEAL packing system, the packing nut must compress the Belleville springs to their “target load.” The target load is the point where the Belleville springs are designed for optimum performance, when compressed to 85% of their maximum deflection or nearly flat. (Maximum deflection is when the springs are 100% compressed or completely flat). To obtain the target load of 85% compression of maximum deflection, perform the following:
 - Tighten the packing nut until the Belleville springs are compressed 100% (or completely flat), as detected by a rapid increase in nut torque.
 - For PTFE or Duplex packing, loosen packing flange nut 1/2 turn (180° of rotation).
 - For Graphite ULF packing, loosen packing flange nut 1/4 turn (90° of rotation).

The “target load” of 85% compression has now been reached.

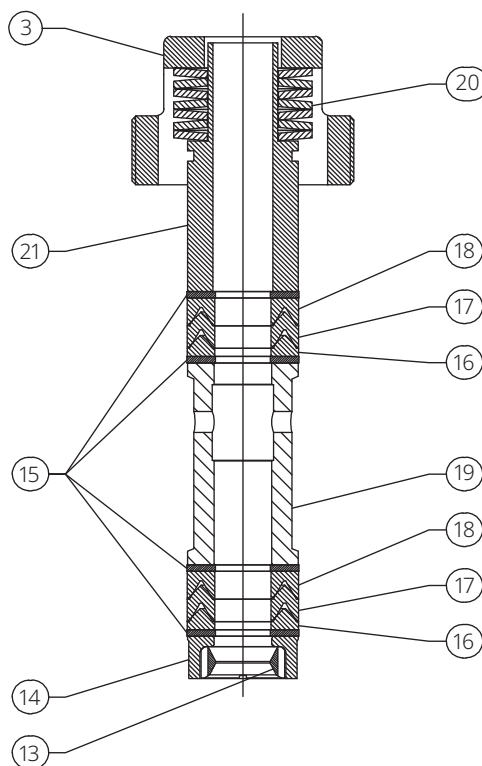
Refer to the appropriate valve and actuator instruction manuals when connecting the valve to the actuator. Under normal conditions, the packing nut should not require retightening.

2. However, when servicing, if the springs do not remain at the target load of 85% compression, retighten the packing box nut according to step 1 above.

3.3 Other Considerations

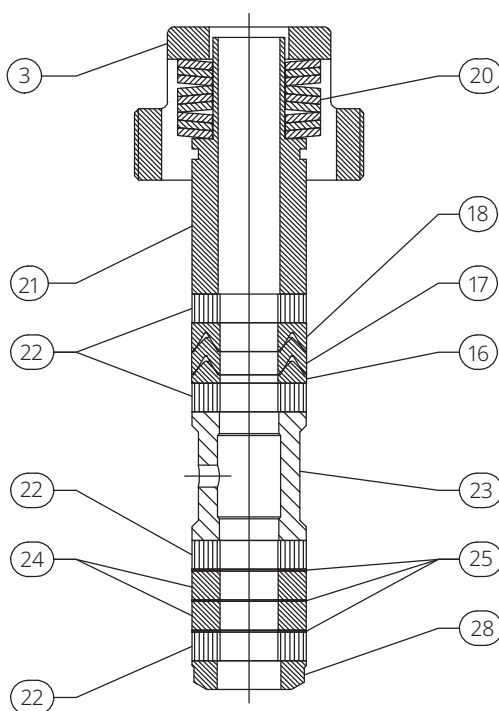
When repacking a valve with enhanced ENVIRO-SEAL packing that has been in service, check the condition of the packing bore after the packing has been removed. A good guideline to use in checking the condition of the packing bore is the 20/20 rule. If less than 20% of the surface area of the bore is pitted and if there are no pits deeper than 0.020 in., then the packing should work as designed. This does not need to be an exact measurement; visual inspection is adequate. If the packing bore does not meet these criteria, the unit should be replaced.

Figure 2. Enhanced ENVIRO-SEAL PTFE Packing Arrangement

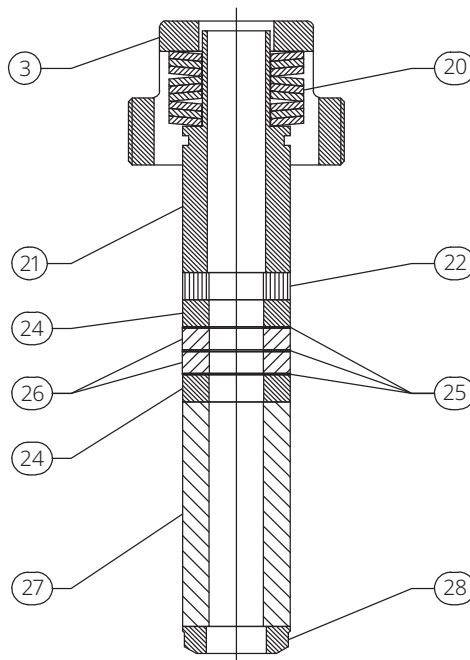


GH10958

Figure 3. Enhanced ENVIRO-SEAL Duplex Packing Arrangement



GH10958

Figure 4. Enhanced ENVIRO-SEAL Graphite ULF Packing Arrangement

GH10958

⚠ WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next steps.

Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet.

To avoid personal injury or damage to the seating surface caused by the valve plug and stem assembly dropping from the bonnet after being lifted out of the valve body, observe the following instructions.

3.4 Bonnet Maintenance

Key number locations are shown in Figure 6, unless noted. This section covers IC2 standard bonnets and bellows bonnets.

1. When lifting a bonnet, temporarily install a valve stem locknut on the valve stem. This locknut will prevent the valve plug and stem assembly from dropping out of the bonnet.

⚠ WARNING

To avoid possible personal injury, review your process shutdown procedures to be sure process pressure is not applied to the valve for the following procedure.

2. Hex nuts (key 13) attach the bonnet to the valve body (key 1). Loosen these nuts or cap screws approximately 3 mm / 1/8 in. Then, loosen the body-to-bonnet joint by either rocking the bonnet or prying between the bonnet and valve body. Work with a prying tool around the bonnet until the bonnet loosens.

Table 3. Body-to-Bonnet Torque Guidelines⁽²⁾

VALVE SIZE, NPS	BOLT TORQUES ⁽¹⁾	
	Bolt Material ⁽²⁾	
	B8	
	N•m	Lbf•ft
1	91	67
1-1/2 or 2	163	120
3	373	275
4	502	370
VALVE SIZE, NPS	B8M ⁽³⁾	
	N•m	Lbf•ft
1	87	64
1-1/2 or 2	163	120
3	373	275
4	502	370

1. Determined from laboratory testing.
 2. Lubricate with anti-seize compound compatible with cryogenic service temperatures. For other lubricants or bolting materials not listed in Table 3, contact your [Emerson sales office](#) for torque information.
 3. SA193-B8M strain hardened.

- If fluid leaks from the joint, it may indicate that process pressure is applied to the valve. Review your process shutdown procedures and be sure process pressure is not applied to the valve.
 - If no fluid leaks from the joint, remove the nuts completely and carefully lift the bonnet off the valve body.
3. Remove the stem locknut. Separate the valve plug and stem from the bonnet and set the parts on a protective surface to prevent damage to gasket or seating surfaces.
 4. Remove the bonnet gasket (key 9) and cover the opening in the valve to protect the gasket surface and prevent foreign material from getting into the valve body cavity.
 5. Remove the packing as described in steps 1 through 8 of the Replacing Packing section. Clean the packing box and metal packing parts.
 6. Inspect the valve stem threads and packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs in the packing box surfaces could cause leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.
 7. If necessary, go to the Trim Maintenance procedures to remove, inspect or replace trim parts. Return to this section when installing the bonnet on the valve body.

Installing the Bonnet

1. Remove the covering protecting the valve body cavity and install a new bonnet gasket (key 9), making sure the gasket seating surfaces are clean and smooth. Then slide the bonnet over the stem and onto the stud bolts (key 12).

NOTE

Proper performance of the bolting procedures in step 12 compresses the bonnet gasket (key 9) to seal the body-to-bonnet joint.

The proper bolting procedures in step 12 include, but are not limited to, ensuring that bolting threads are clean and evenly tightening the cap screws or nuts onto the studs in a crisscross pattern. Tightening one cap screw or nut may loosen an adjacent cap screw or nut. Repeat the crisscross tightening pattern several times until each cap screw or nut is tight and the body-to-bonnet seal is made.

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.



WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

-
2. Lubricate the bolting with anti-seize lubricant and install the bonnet nuts (key 13), using accepted bolting procedures during tightening, so that the body-to-bonnet joint will withstand test pressures and application service conditions. Use the bolt torques in Table 3 as guidelines.
 3. Follow steps 9 through 11 under Replacing Packing procedure section.
 4. Adjust packing by tightening packing nut (key 3, Figures 2, 3 and 4) as described in Tightening Procedures - Packing Nut section.
 5. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

3.5 Trim Maintenance

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

This procedure describes how the valve trim can be completely disassembled. When inspection or repairs are required, perform only those steps necessary to accomplish the task. Observe the Warning at the start of the Maintenance section.

Key number locations are shown in Figure 6, unless otherwise noted.

Trim Disassembly

Key number locations are shown in Figure 6, unless otherwise noted.

1. Remove the actuator and the bonnet according to steps 1 through 9 of the Replacing Packing procedures in the Maintenance section.

⚠ WARNING

To avoid personal injury due to leaking fluids, avoid damaging gasket sealing surfaces. The surface finish of the packing stem (key 10) is critical for making a good packing seal.

The seating surfaces of the valve plug (key 3) and seat ring (key 2) are critical for proper shutoff.

Protect these surfaces accordingly.

Figure 5. Fisher IC2 Valve Stem Torque and Pin Replacement

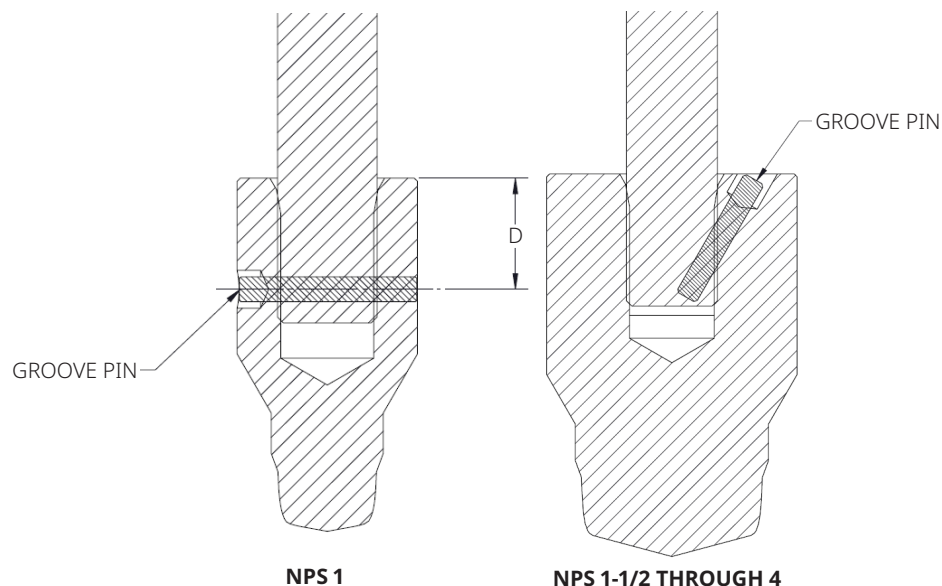


Table 4. Fisher IC2 Valve Stem Torque and Pin Replacement

VALVE STEM DIAMETER		TORQUE, MINIMUM TO MAXIMUM		DRILL SIZE, IN.
mm	in.	N•m	Lbf•ft	
9.5	3/8	40 to 47	25 to 35	3/32
12.7	1/2	81 to 115	60 to 85	1/8
19.1	3/4	238 to 339	175 to 250	3/16
25.4	1	421 to 482	310 to 355	1/4

Perform the following steps to remove the valve trim for standard bonnet constructions:

2. Lift stem stack and bonnet spacer with valve plug attached (keys 10, 7, 6, 3, 4 and 5 in Figure 6) together and gasket (key 9) out of the valve body and set them on a protective surface.
3. To disassemble the bonnet stem, middle stem and pin, drive or drill out the pin (key 14) and unscrew the bonnet stem (key 10) from the middle stem (key 6).
4. Remove displacer (key 5).
5. To disassemble the middle stem, plug stem and pin, drive or drill out the pin (key 16) and unscrew the middle stem (key 6) from the plug stem (key 4).
6. To disassemble the plug stem, plug and pin, drive or drill out the pin (key 17) and unscrew the plug stem (key 4) from the valve plug (key 3).
7. Remove seat ring using seat ring tool.
8. Inspect parts for wear or damage that could prevent proper operation of the valve. Clean, inspect and obtain replacement parts as necessary for reassembly.

Valves with Bellows Assembly

Perform the following steps to remove the valve trim:

1. Lift stem stack and stem/bellows assembly with valve plug attached (keys 10, 7, 6, 3, 4 and 5 in Figure 6) together and gasket (key 9) out of the valve body and set them on a protective surface.
2. Do not remove bonnet stem pin (key 14) due to no space to drill out pin.
3. To disassemble the bellows stem, plug stem and pin: place the stem/bellows assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating or guiding surface. Drive out the pin (key 16). Then unscrew the bellows stem (key 6) from the plug stem (key 4). If the bellows assembly with bonnet stem is to be reused, protect them to prevent damage.

NOTICE

Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

4. Remove displacer (key 5).
5. To disassemble the plug stem, plug and pin, drive or drill out the pin (key 17) and unscrew the plug stem (key 4) from the valve plug (key 3).
6. Remove seat ring (key 2) using seat ring tool.
7. Inspect parts for wear or damage that could prevent proper operation of the valve. Clean, inspect and obtain replacement parts as necessary for reassembly.

Trim Assembly

This procedure assumes that all the trim and associated gaskets were removed from the valve body. If these parts were not all removed, start the assembly procedure at the appropriate step.

NOTICE

To avoid weakening the plug stem or bonnet stem that may cause failure in service, never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem, which will weaken the stem. However, a used valve plug may be reused with a new stem.

Key number locations are shown in Figure 6, unless otherwise noted.

1. Install seat ring using seat ring tool and torque from Table 6.
2. Screw the plug stem (key 4) into the valve plug (key 3). Tighten to the torque value given in Table 6. Refer to Figure 4 to select the proper drill size. Drill through the stem using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin (key 17) to lock the assembly.
3. Slide displacer (key 5) down plug stem (key 4).
4. Screw the middle stem (key 6) into the plug stem (key 4). Tighten to the torque value given in Table 6. Refer to Figure 4 to select the proper drill size. Drill through the stem using one of the holes in the middle stem as a guide. Remove any chips or burrs and drive in a new pin (key 16) to lock the assembly.
5. Screw the middle stem (key 6) into the bonnet stem (key 10). Tighten to the torque value given in Table 6. Refer to Figure 4 to select the proper drill size. Drill through the stem using the hole in the top of the middle stem as a guide. Remove any chips or burrs and drive in a new pin (key 14) to lock the assembly.
6. Mount the bonnet on the valve body and complete reassembly using the Replacing Packing and Installing the Bonnet procedures in the Maintenance section.
7. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

Valves with Bellows Assembly

Perform the following steps to assemble and install the trim

1. Replace and install seat ring using seat ring tool and torque from Table 6.
2. Screw the plug stem (key 4) into the valve plug (key 3). Tighten to the torque valve given in Table 6. Refer to Figure 4 to select the proper drill size. Drill through the stem using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin (key 17) to lock the assembly.
3. Slide displacer (key 5) down plug stem (key 4).
4. If bellows assembly with bonnet stem can be used, proceed as follows:
 - a. Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the bellows stem. Screw the bellows stem (key 6) into the plug stem (key 4), which include bellows assembly and bonnet stem. Tighten to the torque valve given in Table 6. Refer to Figure 4 to select the proper drill size. Drill through the stem using one of the holes in the bellows stem as a guide. Remove any chips or burrs and drive in a new pin (key 16) to lock the assembly.
5. If bellows assembly with bonnet stem cannot be used, proceed as follows:
 - a. Screw a new bonnet stem (key 10) into bellows stem (key 6). Tighten to the torque valve given in Table 6. Refer to Figure 4 to select the proper drill size. Drill through the stem using the hole in the top of the middle stem as a guide. Remove any chips or burrs and drive in a new pin (key 14) to lock the assembly.
 - b. Slide bellows stem into bellows assembly and weld them together according to stem and bellows welding drawings.
 - c. To assembly bellows assembly and plug stem, as described in above step 4a.

NOTICE

When installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

6. Place a new gasket (key 9) on the shoulder of body, slide stem stack into body and then put another new gasket (key 9).
7. Mount the bonnet on the valve body and complete reassembly using the Replacing Packing and Installing the Bonnet procedures in the Maintenance section.
8. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

3.6 Bellows Maintenance

Key number locations are shown in Figure 6, unless otherwise noted.

Replacing a Non-Bellows Valve with a Bellows Assembly

1. Remove the actuator, bonnet assembly as described in the Replacing Packing section (steps 1 through 10).
2. Remove the stem stack assemblies as described in the Valve Trim Disassembly Valves without Bellows Assembly section (steps 1 through 7).
3. To install the new bellows/stem assembly, perform the Valve Trim Assembly Valves with Bellows Assembly Section (steps 1 through 6).
4. To install the new bellows bonnet and packing as described in the Replacing Packing and Installing the Bonnet procedures in the Maintenance section.
5. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

Replacing an Installed Bellows Assembly Valve

1. Remove the actuator, bonnet assembly as described in the Replacing Packing section (steps 1 through 10).
2. Remove the stem stack and bellows/stem assemblies as described in the Valve Trim Disassembly Valves with Bellows Assembly section (steps 1 through 7).
3. To install the new bellows/stem assembly, perform the Valve Trim Assembly Valves with Bellows Assembly Section (steps 1 through 6).
4. Inspect the bellows bonnet. Replace, if necessary.
5. Mount the bonnet on the valve body and complete reassembly using the Replacing Packing and Installing the Bonnet procedures in the Maintenance section.
6. Mount the actuator on the valve assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

Purging Bellows Bonnet

The bellows bonnet has been designed so that it can be purged or leak tested. Refer to Figure 6 for an illustration of a bellows bonnet and perform the following steps for purging or leak testing.

1. Remove the pipe plugs (key 18).
2. Connect a purging fluid to one of the pipe plug connections.
3. Install appropriate piping or tubing in the other pipe plug connection to pipe away the purging fluid or to make a connection to an analyzer for leak testing.
4. When purging or leak testing has been completed, remove the piping or tubing and reinstall the pipe plugs (key 18).

Section 4: Parts

4.1 Parts Ordering

Each body-bonnet assembly is assigned a serial number which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly.

Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and to the eleven-character part number for each part required from the following parts kit or parts list information.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

4.2 Parts Kits

Gasket Kits

Includes key 9.

Table 5. Gasket Kits

Valve Size, NPS	Kit Part Number
1	RGASKETXJ02
1-1/2	
2	
3	RGASKETXJ12
4	

Table 6. Seat Ring Tool Kits and Seat Ring Installation Torque⁽¹⁾

Valve Size, NPS	Kit Part Number	TORQUE	
		N•m	lbf•ft
1	GK14147X022	244	180
1-1/2	GK14197X022	485	658
2	GK14197X032		
3	GK14207X022	1245	918
4	GK14210X022	2195	1619

1. Use LOX-8 for lubrication of seat ring threads.

4.3 Parts List

NOTE

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson sales office.

Enhanced ENVIRO-SEAL Packing Assembly

Table 7. Enhanced ENVIRO-SEAL Packing Assembly (Figures 2, 3 and 4)

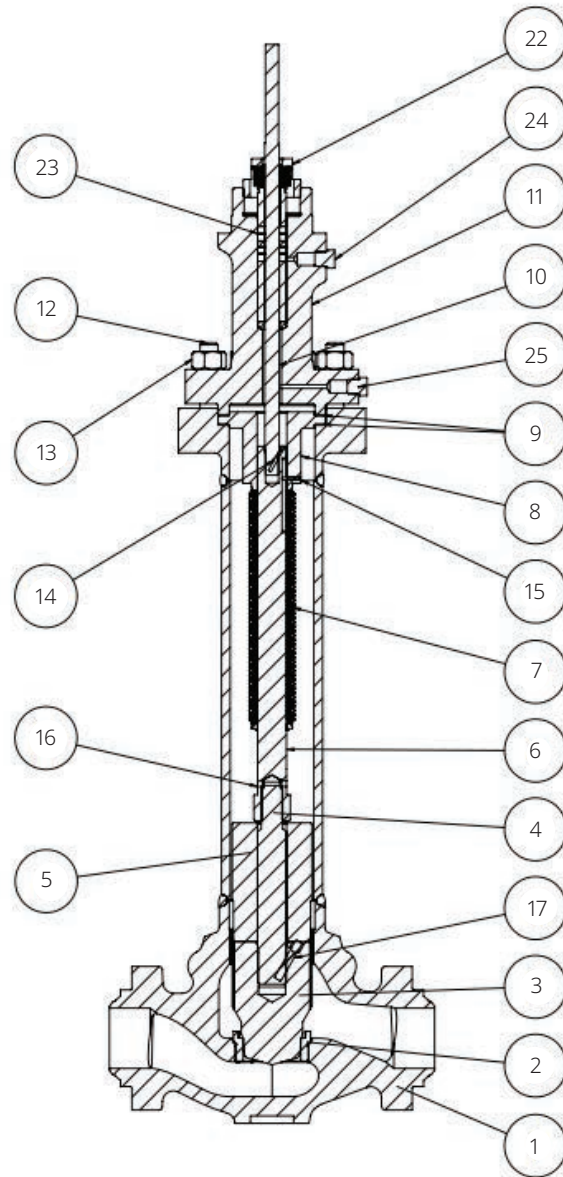
Key	Description	Key	Description
3*	Packing nut	21*	Packing follower
13*	Packing lower wiper	22*	Guide bushing
14*	Packing box ring	23*	Lantern ring
15*	Anti-extrusion washer	24*	Packing ring
16*	Packing ring, Male adaptor	25*	Packing washer
17*	Packing ring	26*	Packing ring
18*	Packing ring, Female adaptor	27*	Guide bushing
19*	Lantern ring	28*	Packing box ring
20*	Belleville spring	---	---
*Recommended spare parts.			

Valve Body Parts

Table 8. Valve Body Parts (Figure 6)

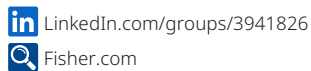
Key	Description	Key	Description
1	Body If you need a body as a replacement part, order by valve size, serial number and desired material.	11	Bonnet or bellows bonnet
2	Seat ring	12	Bonnet stud
3*	Plug	13	Bonnet nut
4*	Plug stem	14	Bonnet stem to middle/Bellows stem pin
5	Displacer	15	Anti-rotation pin
6	Middle/Bellows stem	16	Middle/Bellows stem to plug stem pin
7	Bellows assembly	17*	Plug stem pin
8	Bellows flange/Bonnet spacer	22	Packing nut
9	Bellows flange/Bonnet spacer gaskets	23	Packing
10	Bonnet stem	24	Pipe plug
		25	Pipe plug
*Recommended spare parts.			

Figure 6. Fisher IC2 Valve Assembly



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS



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Fisher™ Large ET/EWT and ED/EWD Valves NPS 12 through 30

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Figure 1. Fisher NPS 12 Valve with Piston Actuator and FIELDVUE™ DVC6200 Digital Valve Controller



X0237-1

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 12 through 30 Fisher ET/EWT and ED/EWD valves, through CL600 ratings.

Refer to separate manuals for instructions covering the actuator and accessories.



Do not install, operate, or maintain ET/EWT or ED/EWD valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Educational Services

For information on available courses for Fisher Large ET/EWT and ED/EWD valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Description

Fisher NPS 12 through 30 CL150 through CL600 ET/EWT and ED/EWD series control valves are used for either throttling or on/off control of a wide variety of liquids and gasses.

ET/EWT series valves utilize a hanging cage and a seat ring that is threaded into the cage. These valves have two spring loaded seal rings, one between the cage and plug and another between the seat ring and valve body, which provide up to a Class V standard shutoff. They are used for low to medium temperature applications between -46°C (-50°F) and 232°C (450°F). This temperature range can be extended to 316°C (600°F) for non-oxidizing service and to 260°C (500°F) for oxidizing service by using the High Temperature (HTS1) seal.

The temperature range of the ET/EWT series can be extended to cryogenic temperatures as low as -198° (-325°F) with the ET-C and EWT-C specialized versions of these valves. The specialized valves feature unique trim, seals, and a longer extension bonnet to tolerate the extreme cold.

ED/EWD series valves utilize a hanging cage and a seat ring that is bolted into the body. These valves have two graphite piston rings between the cage and plug, which provide up to a Class IV standard shutoff. They are used for high temperature applications between 316°C (600°F) and 593°C (1100°F). Shutoff can be improved to Class V by using the Bore seal.

A range of severe service trims are available for noise abatement or cavitation control. Noise abatement trims help with aerodynamic noise attenuation in gas services and feature a Whisper Trim III or WhisperFlo cage. Cavitation control trims help prevent the damaging effects of liquid cavitation and include either a Cavitrol III cage (for services without entrained particulate) or Dirty Service Trim (DST) set (for services with entrained particulate).

Specifications

Typical specifications for these valves are shown in table 1.

Table 1. Specifications

Valve Sizes ED, ET, and ET-C: ■ NPS 12, ■ 14, ■ 16, ■ 18, ■ 20, and ■ 30 EWD, EWT, and EWT-C⁽²⁾: ■ NPS 16x12, ■ 20x16, ■ 24x16, and ■ 24x20 End Connection Styles Flanged: CL150, 300, and 600 raised-face or ring-type joint flanges per ASME B16.5. NPS 30 valve size has series A or B flanges, per ASME B16.47 Buttwelding: All ASME B16.25 schedules through schedule 120 that are compatible with the ASME B16.34 valve body rating For other end connections, contact your Emerson sales office for details. Maximum Inlet Pressure⁽¹⁾ Flanged: Consistent with CL150, 300, and 600 pressure-temperature ratings per ASME B16.34 Buttwelding: Consistent with CL600 pressure-temperature ratings per ASME B16.34 Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4 ET, ET-C, EWT, and EWT-C: Standard: Class V Optional (for all cages except Cavitrol III): Class IV ED and EWD: Standard: Class IV Optional: Class V	Flow Characteristics Standard Cages: ■ Linear or ■ Equal percentage Whisper Trim III and WhisperFlo Cages: Linear Cavitrol III Cages: Linear For other characteristics, contact your Emerson sales office for details. Flow Direction Standard Cages: Down Whisper Trim III and WhisperFlo Cages: Up Cavitrol III Cages: Down Yoke Boss and Stem Diameters ■ 127 mm (5H-inch) diameter yoke boss, with 31.8 mm (1.25 inch) diameter valve stem for all valves except NPS 30 ■ 179 mm (7-inch) diameter yoke boss, with 50.8 mm (2 inch) diameter valve stem for NPS 30 valve Bonnet Style ED, EWD, ET, and EWT: Style 1 extension ET-C and EWT-C: Style 3 extension Approximate Weights See table 2
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1. Do not exceed the pressure or temperature limits in this manual, on the equipment nameplate, and any applicable code limitations.

2. Size designations are "end connection size" x "nominal trim size".

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Large ET and ED Valves

February 2022

Instruction Manual

D103553X012

Table 2. Approximate Weights

VALVE SIZE, NPS	PRESSURE CLASS	END CONNECTION TYPE	APPROXIMATE WEIGHT							
			ED/EWD and ET/EWT				ET-C/EWT-C			
			Short Neck ⁽²⁾		Long Neck ⁽²⁾		Short Neck ⁽²⁾		Long Neck ⁽²⁾	
			Kg	Lb	Kg	Lb	Kg	Lb	Kg	Lb
12	CL150-300	Flanged	950	2100	1090	2400	982	2170	1122	2470
	CL600	Flanged	1270	2800	1410	3100	1302	2870	1442	3170
		Buttwelding	1130	2500	1270	2800	1162	2570	1302	2870
14	CL150-300	Flanged	1130	2500	1230	2700	1162	2570	1262	2770
	CL600	Flanged	1410	3100	1590	3500	1442	3170	1622	3570
		Buttwelding	1180	2600	1360	3000	1212	2670	1392	3070
16x12	CL150-300	Flanged	1320	2900	1450	3200	1352	2970	1482	3270
	CL600	Flanged	1680	3700	1810	4000	1712	3770	1842	4070
		Buttwelding	1410	3100	1540	3400	1442	3170	1572	3470
16	CL150-300	Flanged	1720	3800	2040	4500	1752	3870	2072	4570
	CL600	Flanged	2310	5100	2590	5700	2342	5170	2622	5770
		Buttwelding	2090	4600	2360	5200	2122	4670	2392	5270
18	CL150-300	Flanged	2310	5100	2500	5500	2342	5170	2532	5570
	CL600	Flanged	2900	6400	3130	6900	2932	6470	3162	6970
		Buttwelding	2540	5600	2770	6100	2572	5670	2802	6170
20x16	CL150-300	Flanged	2500	5500	2680	5900	2532	5570	2712	5970
	CL600	Flanged	3180	7000	3360	7400	3212	7070	3392	7470
		Buttwelding	2770	6100	2990	6600	2802	6170	3022	6670
24x16	CL150-300	Flanged	3360	7400	3810	8400	3392	7470	3842	8470
	CL600	Flanged	4260	9400	4810	10600	4292	9470	4842	10670
		Buttwelding	3770	8300	4220	9300	3802	8370	4252	9370
20	CL150-300	Flanged	4122	9088	4526	9978	(1)	(1)	(1)	(1)
	600	Flanged	4736	10442	5112	11269	(1)	(1)	(1)	(1)
		Buttwelding	4583	10104	4808	10600	(1)	(1)	(1)	(1)
24x20	CL150-300	Flanged	5507	12140	5856	12910	(1)	(1)	(1)	(1)
	600	Flanged	6796	14982	7172	15811	(1)	(1)	(1)	(1)
		Buttwelding	6327	13949	6549	14437	(1)	(1)	(1)	(1)
30	CL150-300	Flanged	7390	16300	8350	18400	7535	16620	18545	18720
	CL600	Flanged	9544	21040	10038	22130	(1)	(1)	(1)	(1)
		Buttwelding	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)

1. Contact your [Emerson sales office](#) for these weights.

2. Dependent on valve travel, refer to product bulletin 51.1:ET/ED (Large) ([D103554X012](#)) for addition details.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by the sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some valve body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

Before installing the valve, inspect the valve and pipelines for any damage and any foreign material which may cause product damage.

1. Before installing the valve, inspect the valve and associated equipment for any damage and any foreign material.
2. Make certain that the valve body interior is clean, that pipelines are free of foreign material, and the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.
3. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven valve plug and cage wear and improper operation. Support the actuator if it is not installed in the vertical position. For more information, consult your Emerson sales office.
4. Use accepted piping and welding practices when installing the valve in the line. For flanged valves, use a suitable gasket between the valve and pipeline flanges.

CAUTION

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. In general, if post weld heat treating is to be performed, all trim parts should be removed. Contact your Emerson sales office for additional information.

5. With a leak-off bonnet construction, remove the pipe plugs (key 46) to hook up the leak-off piping. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
6. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valves with ENVIRO-SEAL™ live-loaded packing or HIGH-SEAL ULF live-loaded packing will not require this initial readjustment. See the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves ([D101642X012](#)) or HIGH-SEAL ULF Live-Loaded Packing System ([D101453X012](#)) (as appropriate) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the Parts Kits section.

Maintenance

Unless otherwise noted, refer to the following figures for key numbers: figure 5: ED/EWD Valves, figure 6: ET/EWT Valves, figure 7: ET/EWT Valves with HTS1 Seals, or figure 8: ET-C/EWT-C Valves.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance, and trim maintenance. All maintenance operations may be performed with the valve in the line.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal because the used gasket might not seal properly.

Packing Lubrication

Note

ENVIRO-SEAL and HIGH-SEAL packing do not require lubrication.

⚠ WARNING

To avoid personal injury or property damage resulting from fire or explosion, do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F).

If a lubricator or lubricator/isolating valve is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the pipe plug (key 46). Use a good quality silicon-base lubricant. To operate the lubricator, simply turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except open the isolating valve before turning the cap screw and then close the isolating valve after lubrication is completed.

Packing Maintenance

Note

For valves with ENVIRO-SEAL packing, see the Fisher instruction manual, ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#), for packing instructions.

For valves with HIGH-SEAL packing, see the Fisher instruction manual, HIGH-SEAL ULF Live-Loaded Packing System, [D101453X012](#), for packing instructions.

For spring-loaded single PTFE V-ring packing, the spring (key 8, figure 2) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13, figure 2), check to be sure the shoulder on the packing follower is touching the bonnet (key 35). If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5) until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the Replacing Packing section.

If there is undesirable packing leakage with other than spring-loaded packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

If the packing is relatively new and tight on the valve stem (key 2B) and if tightening the packing flange nuts does not stop the leakage, it is possible that the valve stem is worn or nicked so that a seal cannot be made. The surface finish of a new valve stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

Replacing Packing

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator, and use lock-out procedures to prevent injury while you work on the equipment.
2. Remove the actuator from the valve body by following the appropriate Actuator Removal procedure from the actuator instruction manual.
3. Loosen the packing flange nuts (key 5) so that the packing is not tight on the valve stem (key 2B). Remove any travel indicator parts and locknuts from the valve stem threads.

WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet.

CAUTION

Avoid damage to the seating surfaces caused by the valve plug and stem assembly dropping from the bonnet after being lifted part way out. When lifting the bonnet, temporarily install a locknut on the valve stem. This locknut will prevent the valve plug and stem assembly (key 2) from dropping out of the bonnet.

If the cage (key 3) starts to lift with the bonnet, tap it with a plastic mallet, or other soft material, to be sure it stays in the valve body.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

4. Hex nuts (key 16) attach the bonnet (key 35) to the valve body. Loosen these nuts or cap screws approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, remove the nuts completely and carefully lift the bonnet.
5. Remove the locknut from the valve stem and separate the valve plug and stem assembly from the bonnet. Set the parts on a protective surface to prevent damage to gasket or seating surfaces.
6. Remove the bonnet gasket (key 11) and cover the opening in the valve to protect the gasket surface and prevent foreign material from getting into the valve body cavity.

CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to prevent foreign material from getting into the valve body cavity.

7. Remove the packing flange nuts (key 5), packing flange (key 37), upper wiper (key 12, figure 2), and packing follower (key 13, figure 2). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.
8. Inspect the valve stem threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts by following the appropriate steps in the Trim Maintenance section.
9. Remove the cover protecting the valve body cavity.
10. Install a new bonnet gasket (key 11), making sure the gasket seating surfaces are clean and smooth. Place the valve plug and stem assembly into the valve body, making sure it is properly centered on the seat ring (key 9). Also make sure the valve plug (key 2A) sealing parts are evenly engaged by the chamfer in the top inside diameter of the cage (key 3) to avoid damaging the parts. Then slide the bonnet over the valve stem (key 2B) and onto the studs (key 15).

Note

Proper performance of the bolting procedures in step 11 compresses the bonnet and cage gaskets (key 11) enough to seal the body-to-bonnet joint.

The proper bolting procedures in step 11 include--but are not limited to--ensuring that bolting threads are clean and evenly tightening the hex nuts onto the studs in a crisscross pattern. Tightening one nut may loosen an adjacent nut. Repeat the crisscross tightening pattern several times until each nut is tight and the body-to-bonnet seal is made.

Studs and hex nuts should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your [Emerson sales office](#) if a discrepancy between actual parts and approved parts is suspected.

11. Lubricate the studs (key 15) and install hex nuts (key 16), using accepted bolting procedures during tightening, so that the body-to-bonnet joint will withstand test pressures and application service conditions. Use the bolt torques in table 4 as guidelines.
12. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 2. Place a smooth-edged pipe over the valve stem, and gently tap each soft packing part into the packing box one piece at a time, being sure that air is not trapped between adjacent soft parts.
13. Slide the packing follower (key 13, figure 2), upper wiper (key 12, figure 2), and packing flange (key 37) into position. Lubricate the packing flange studs (key 4) and the faces of the packing flange nuts (key 5). Replace the packing flange nuts.
14. For spring-loaded PTFE V-ring packing, tighten the packing flange nuts until the shoulder on the packing follower (key 13, figure 2) contacts the bonnet.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 3. Then, loosen the packing flange nuts and retighten them to the recommended minimum torque shown in table 3.

For other packing types, tighten the packing flange nuts alternately in small, equal increments until one of the nuts reaches the minimum recommended torque shown in table 3. Then, tighten the remaining flange nut until the packing flange (key 3, figure 2) is at a 90-degree angle to the valve stem.

15. Mount the actuator on the valve assembly, and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

Trim Maintenance

WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

Disassembly

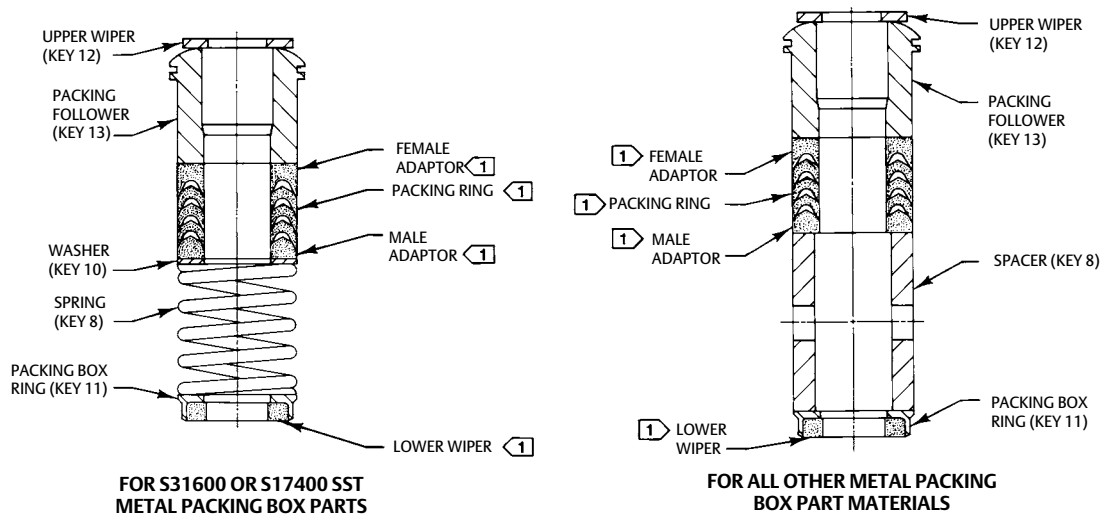
1. Complete steps 1 through 5 of the Replace Packing section to remove the actuator, bonnet, and plug and stem from the valve body. Remove the bonnet gasket (key 11).

WARNING

To avoid personal injury due to leaking fluid, avoid damaging gasket sealing surfaces. The surface finish of the valve stem (key 2B) is critical for making a good packing seal. The inside surface of the cage (key 3) is critical for smooth operation of the valve plug. The seating surfaces of the valve plug (key 2A) and seat ring (key 9) are critical for proper shutoff. Unless inspection reveals otherwise, assume all these parts are in good condition and protect them accordingly.

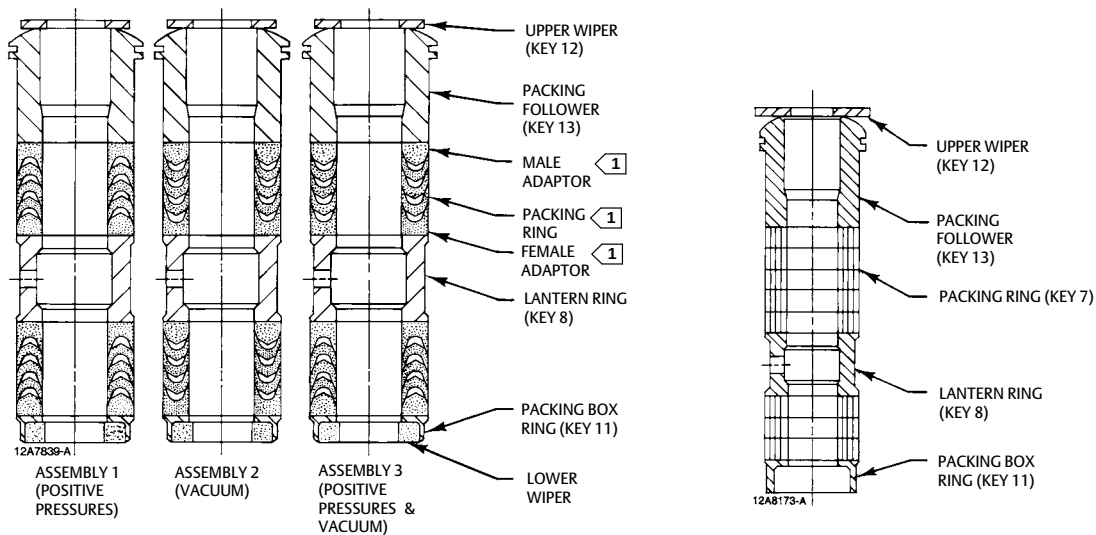
2. Packing parts can be removed if desired. Replace these parts as described in the Replace Packing section.
3. Install 3/8"-16 UNC-2A eye bolts with a minimum threaded length of 13 mm (0.5 inches) into the tapped holes in the top of the cage (key 3) and carefully lift it out of the valve body. For ET/EWT valves, the seat ring (key 9) will be removed with the cage as an assembly due to the seat ring being screwed into the bottom of the cage and secured with tack welds. If the cage is stuck in the valve, use a rubber mallet to strike the exposed portion of the cage at several points around its circumference. Set the part(s) on a protective surface to prevent damage to gasket or seating surfaces.
4. Remove the cage gasket (key 11).
5. Proceed as appropriate:

Figure 2. Typical Packing



12A7837-A

PTFE V-RING SINGLE ARRANGEMENTS



12A7839-A

12A8173-A

31.8 and 50.8 mm
(1-1/4 and 2 INCH) STEM

PTFE V-RING DOUBLE ARRANGEMENTS

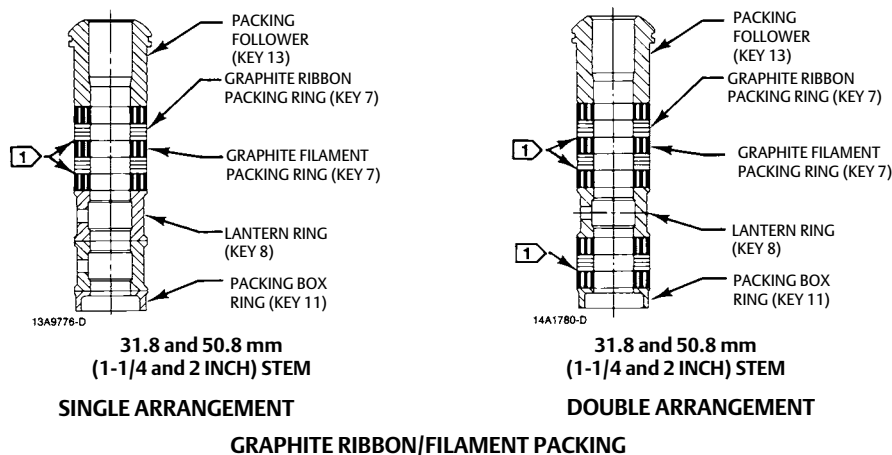
31.8 and 50.8 mm
(1-1/4 and 2 INCH) STEM

PTFE/COMPOSITION ARRANGEMENT

NOTE:
1) PACKING SET (KEY 6) (2 REQUIRED FOR DOUBLE ARRANGEMENTS)

B2398

Figure 2. Typical Packing (Continued)



NOTE:
 1 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS:
 USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

A6060

Table 3. Packing Flange Nut Torque for Packing Without a Spring

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE-TYPE PACKING				PTFE-TYPE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
			N•m	Lbf•ft	N•m	Lbf•ft	N•m	Lbf•ft	N•m	Lbf•ft
31.8	1-1/4	CL150 & 300	33	24.3	49	36.1	16	11.8	25	18.4
		CL600	45	33.2	67	49.4	21	15.5	33	24.3
50.8	2	CL300	43	32	65	48	20	15	31	23
		CL600	61	45	91	67	27	20	41	30

Table 4. Body-to-Bonnet Bolt Torque

BOLT SIZE, INCH	THREADS PER INCH	BOLTING TORQUE ⁽¹⁾	
		N•m	Lbf•ft
1-1/4	8	990	730
1-1/2	8	1750	1290
1-3/4	8	2806	2070
2	8	4244	3130

1. Torque values listed apply to the following stud and nut materials lubricated with Lubriplate MAG-1.

- SA-193-B7 studs with SA-194-2H nuts
- SA-193-B7M studs with SA-194-2HM nuts
- SA-193-B16 studs with SA-194-7 nuts
- SA-193-B8M Class 2 studs with SA-194-8M nuts
- SA-193-B8M2 Class 2B studs with SA-194-8M nuts
- N07718 HT studs with N07718 HT chrome coat nuts
- SA-453 Gr 660A studs with SA-453 Gr 660A nuts
- SA479 S20910 chrome coat studs with SA479 S20910 nuts

For ET/EWT Valves, using the below procedure, disassemble the seat ring from the cage:

- Grind or file off the two tack welds that prevent the seat ring from unscrewing from the cage.
- Install 3/8"-16 UNC-2A bolts or cap screws into the two equally spaced tapped holes in the bottom of the seat ring. These bolts or cap screws will need to have a minimum of 0.5 inches of thread engagement and the length will be determined by the pry bar diameter used in this step.
- Using a pry bar to pry against the cap screws, turn the seat ring counter-clockwise to unscrew it from the cage.

- d. Set the seat ring on a protective surface taking care not to damage the seat ring seal ring (key 223).

For ED/EWD and ET-C/EWT-C Valves, using the below procedure, disassemble the seat ring from the valve body:

- a. Unscrew the seat ring cap screws (key 49).
 - b. Install 3/8"-16 eye bolts with a minimum threaded length of 0.5 inches into the two equally spaced tapped holes in the top of the seat ring (key 9).
 - c. Carefully lift the seat ring out of the valve body using the eye bolts as lifting points.
 - d. Set the seat ring on a protective surface.
 - e. Remove the seat ring gasket (key 13) from the valve body.
6. Cover the opening in the valve to protect the gasket surface and prevent foreign material from getting into the valve body cavity. Inspect parts for wear and damage which would prevent proper operation of the valve. If the cage requires replacement take note that for ET/EWT valves a replacement is available individually (key 3 only) or as a cage and seat ring assembly (key 3 and 9). The valve plug and seat ring, along with their respective sealing parts, will be inspected in the Valve Plug and Seat Ring maintenance procedures.

Valve Plug Maintenance

With the valve plug and stem assembly (key 2) removed according to the Disassembly procedure, proceed as appropriate:

CAUTION

Be careful not to scratch the surfaces of the seal ring grooves in the valve plug (key 2A) or any surfaces of the replacement parts.

For ET/EWT Valves

1. Carefully pry or cut out the plug seal ring (key 28) from its groove in the valve plug (key 2A). Discard the old plug seal ring.
2. Inspect the valve plug (key 2A) and stem (key 2B) for nicks, scratches, or other damage that would prevent proper operation of the valve. If replacement of either is necessary, replace as a complete valve plug and stem assembly (key 2).

CAUTION

To avoid damaging the seal ring, slowly and gently stretch it for the following procedure. Avoid jerking sharply on the ring.

3. Install the replacement plug seal ring (key 28) with the open side facing the top or bottom of the valve plug, depending on flow direction. The open side of the seal ring should face up (toward the actuator) in flow-up installations and down in flow-down installations.

To install the seal ring on the valve plug, first lubricate it with a general purpose silicone-base lubricant. Then gently stretch the seal ring and work it over the top edge of the valve plug. The PTFE material in the seal ring must be permitted time to cold-flow during the stretching procedure, so avoid jerking sharply on the ring. Stretching the seal

ring over the valve plug may make it seem unduly loose when in the groove, but it will contract to its original size after insertion into the cage.

For ET/EWT Valves Equipped with HTS1 Seals

1. Carefully pry the plug retaining ring (key 27) from its groove in the valve plug (key 2A). Then remove the plug seal ring (key 28), backup ring (key 29), and anti-extrusion ring (key 63). Inspect the retaining ring and backup ring for damage and replace as needed. Discard the old plug seal ring and anti-extrusion ring.
2. Inspect the valve plug (key 2A) and stem (key 2B) for nicks, scratches, or other damage that would prevent proper operation of the valve. If replacement of either is necessary, replace as a complete valve plug and stem assembly (key 2).
3. Install the replacement plug seal ring (key 28) and anti-extrusion ring (key 63) with the open side of the seal ring facing the top or bottom of the valve plug, depending on flow direction. The open side of the seal ring should face up (toward the actuator) in flow-up installations and down in flow-down installations. Make sure the anti-extrusion ring is adjacent to the closed side of the seal ring. Then install the plug backup ring (key 29) and retaining ring (key 27).

To install the parts on the valve plug, first lubricate each with a general purpose silicone-base lubricant. Then gently slide each over the top edge of the valve plug.

For ET-C/EWT-C Valves

1. Carefully pry the plug retaining ring (key 27) from its groove in the valve plug (key 2A). Then remove the plug seal ring (key 28) and backup ring (key 29). Inspect the retaining ring and backup ring for damage and replace as needed. Discard the old plug seal ring.
2. Inspect the valve plug (key 2A) and stem (key 2B) for nicks, scratches, or other damage that would prevent proper operation of the valve. If replacement of either is necessary, replace as a complete valve plug and stem assembly (key 2).
3. Install the replacement plug seal ring (key 28) with the open side of the seal ring facing the top or bottom of the valve plug, depending on flow direction. The open side of the seal ring should face up (toward the actuator) in flow-up installations and down in flow-down installations. Then install the plug backup ring (key 29) and retaining ring (key 27).

To install the parts on the valve plug, first lubricate each with a general purpose silicone-base lubricant. Then gently slide each over the top edge of the valve plug.

For ED/EWD Valves

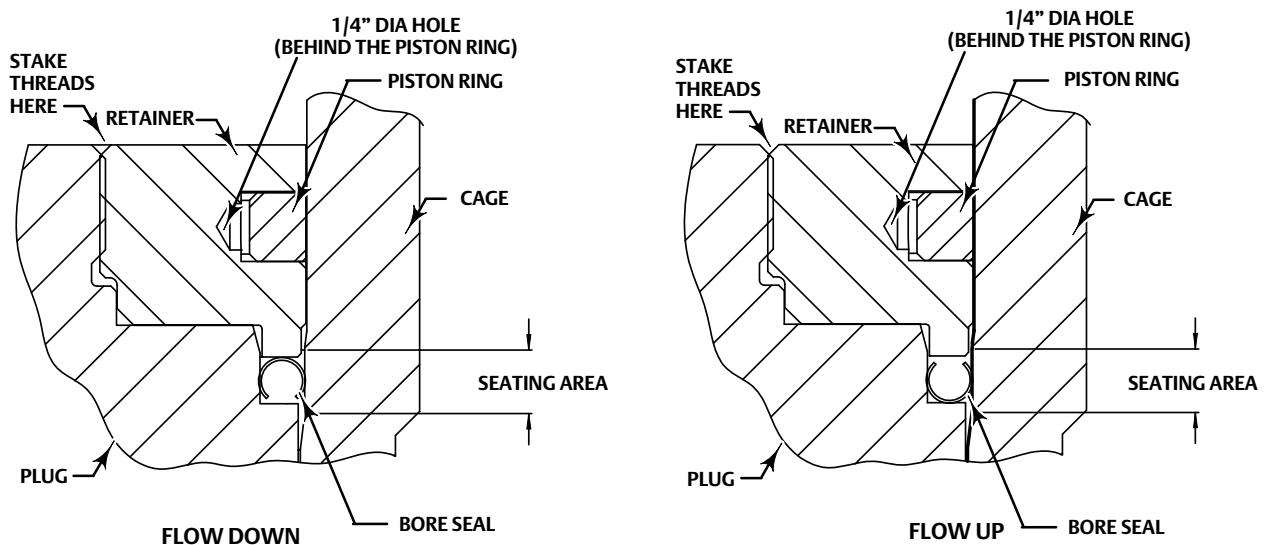
1. Remove and discard the piston rings (key 6). The rings can be easily removed since each is in two pieces.
2. Inspect the valve plug (key 2A) and stem (key 2B) for nicks, scratches, or other damage that would prevent proper operation of the valve. If replacement of either is necessary replace as a complete valve plug and stem assembly (key 2).
3. Each new piston ring (key 6) is furnished as a complete ring, and each must be broken into two approximately equal portions. Do this by placing the ring on edge on a smooth, hard surface and striking the ring squarely with a hammer.
4. Install the replacement piston ring(s) into the groove(s) in the valve plug (key 2A). Be sure to match the broken ends when installing the ring sections in the groove(s).

For ED/EWD Valves Equipped with the Bore Seal

1. Remove and discard the piston ring (key 6). The ring can be easily removed since it is in two pieces. Also inspect the bore seal (key 64) and retainer (key 2C) for nicks, scratches, or other damage that would prevent proper operation of the valve. If replacement of the bore seal is necessary complete steps 2 – 12, otherwise proceed directly to step 13.
2. Referring to figure 3, locate the staked thread on top of the valve plug (key 2A). The staked thread secures the retainer (key 2C). Use a drill with a 1/8 inch bit to drill out the staked area of the thread. Drill approximately 1/8 inch into the metal to remove the staking.

3. Referring to figure 3, locate the 1/4-inch diameter hole in the groove where the piston ring was installed.
4. Select an appropriate tool such as a punch and place the tip of the tool into the hole with the body of the tool held tangent to the outside diameter of the retainer. Strike the tool with a hammer to rotate the retainer and free it from the valve plug. Remove the retainer from the valve plug.
5. Use an appropriate tool such as a flat-blade screwdriver to pry the bore seal (key 64) off the valve plug. Use caution to avoid scratches or other damage to the seating surfaces where the bore seal makes contact with the valve plug (see figure 3).

Figure 3. Fisher ED/EWD Valve Equipped with the Bore Seal



6. Apply a suitable high-temperature lubricant to the inside diameter of the bore seal. Also, lubricate the outside diameter of the valve plug where the bore seal must be pressed into the proper seating position (see figure 3).
7. Referring to figure 3, orient the bore seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the bore seal must face up in a valve with flow-up construction.
 - The open interior of the bore seal must face down in a valve with flow-down construction.
8. Place the bore seal over the top of the valve plug. The retainer will help guide the bore seal down onto the valve plug. Do not force the bore seal over the valve plug. For flow down constructions, skip to step 10.
9. An installation tool (see figure 4 and table 5) must be inserted into the bore seal prior to using the retainer to guide it down the valve plug.
10. Apply a suitable high-temperature lubricant to the threads on the valve plug. Then, place the retainer onto the valve plug and tighten the retainer using an appropriate tool such as a strap wrench. For flow-down constructions, skip to step 12.
11. Remove the retainer and then the installation tool. Place the retainer back onto the valve plug and tighten the retainer using an appropriate tool such as a strap wrench.
12. Using an appropriate tool such as a center punch, stake the threads on top of the valve plug in one place to secure the retainer (see figure 3).
13. Inspect the valve plug (key 2A) and stem (key 2B) for nicks, scratches, or other damage that would prevent proper operation of the valve. If replacement of either is necessary replace as a complete valve plug and stem assembly (key 2).

14. Each new piston ring (key 6) is furnished as a complete ring, and each must be broken into two approximately equal portions. Do this by placing the ring on edge on a smooth, hard surface and striking the ring squarely with a hammer.
15. Install the piston ring into the groove in the retainer (key 2C). Be sure to match the broken ends when installing the ring sections in the groove.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the Bore Seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop across the valve, this force will adequately drive the valve plug to the seat ring, thus giving the Bore Seal a predetermined permanent set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Seat Ring Maintenance

With the seat ring (key 9) removed, according to the Disassembly procedure, proceed as appropriate:

CAUTION

Be careful not to scratch the surfaces of the seating surface or groove in the seat ring or the surfaces of the replacement parts.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

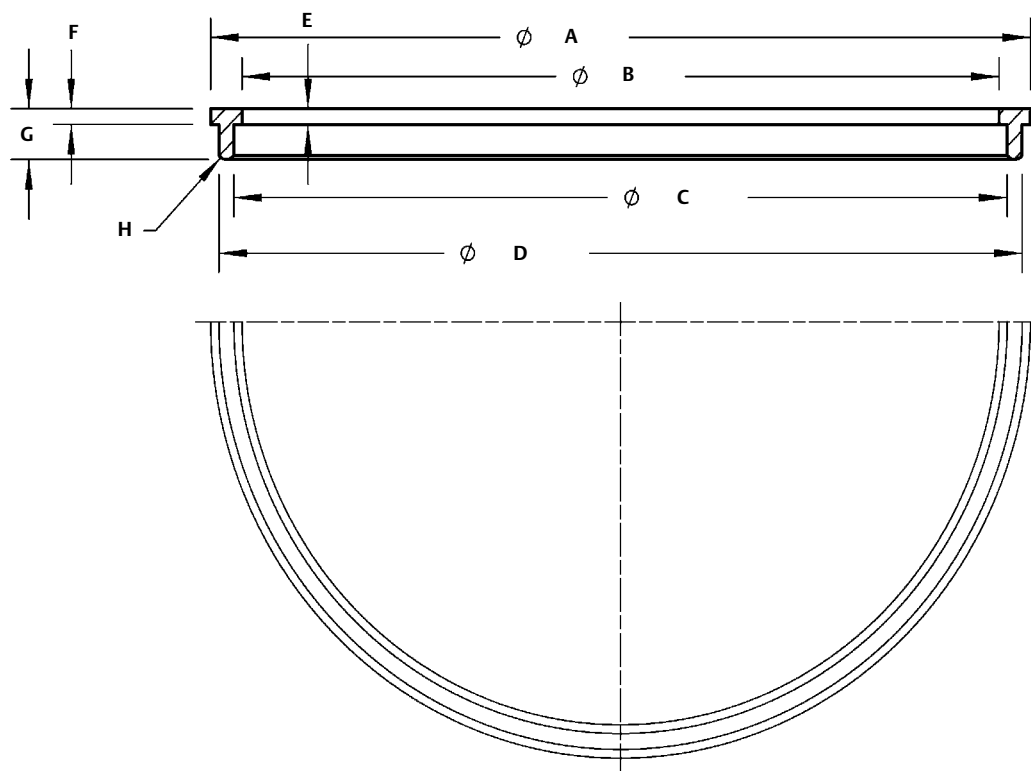
Large ET and ED Valves

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Figure 4. Bore Seal Installation Tool



GE22109-A

Table 5. Bore Seal Installation Tool Dimensions

VALVE PORT SIZE, INCH	Dimensions, Inches (See Figure 4)								Tool Part Number
	A	B	C	D	E	F	G	H	
10.00	10.12	9.7	9.80-9.82	10.00-10.02	0.10	0.10	0.32	R.06	GE17914X012
11.00	12.59	12.17	12.27-12.29	12.49-12.47	0.10	0.10	0.32	R.07	GE18183X012
14.75	14.84	14.424-14.416	14.516-14.536	14.736-14.716	0.10	0.10	0.32	R.05	GE34073X012
18.25	18.35	17.925-17.935	18.030-18.050	18.230-18.250	0.10	0.10	0.32	R.06	GG43649X012
24.00	(1)								(1)

1. Contact your [Emerson sales office](#) for this tool and dimensions.

For ET/EWT Valves

1. Carefully pry or cut out the seat ring seal ring (key 223) from its groove in the seat ring (key 9). Discard the old seat ring seal ring.
2. Then inspect the seat ring (key 9) for nicks, scratches, or other damage that would prevent proper operation of the valve. Replace the seat ring if necessary. A replacement seat ring is available individually (key 9 only) or as a seat ring and cage assembly (key 9 and 3). If replacing individually proceed to step 3, otherwise proceed directly to step 7.
3. Make sure the bolts or cap screws that were installed in the seat ring during the Disassembly procedure are still installed.
4. Orient the cage (key 3) and seat ring so that the threads on each are facing one another for assembly. The bottom of the cage should be facing the top of the seat ring.
5. Using a pry bar to pry against the bolts or cap screws, turn the seat ring clockwise into the cage until tight. Afterwards remove the two bolts or cap screws.

6. Tack weld the seat ring to the cage using minimal heat. Two welds, 6 mm (1/4-inch) long and 180 degrees apart, are required.

CAUTION

To avoid damaging the seal ring, slowly and gently stretch it for the following procedure. Avoid jerking sharply on the ring.

7. Install the replacement seat ring seal ring (key 223) with the open side facing the top or bottom of the seat ring, depending on flow direction. The open side of the seal ring should face down (toward the bottom of the valve body) in flow-up installations and up in flow-down installations.

To install the seal ring on the seat ring, first lubricate it with a general purpose silicone-base lubricant. Then gently stretch the seal ring and work it over the bottom edge of the seat ring. The PTFE material in the seal ring must be permitted time to cold-flow during the stretching procedure, so avoid jerking sharply on the ring. Stretching the seal ring over the seat ring may make it seem unduly loose when in the groove, but it will contract to its original size after insertion into the valve body.

For ET/EWT Valves Equipped with HTS1 Seals

1. Carefully pry the seat ring retaining ring (key 221) from its groove in the seat ring (key 9). Then remove the seat ring seal ring (key 223), backup ring (key 220), and anti-extrusion ring (key 219). Inspect the retaining ring and backup ring for damage and replace as needed. Discard the old seat ring seal ring and anti-extrusion ring.
2. Then inspect the seat ring (key 9) for nicks, scratches, or other damage that would prevent proper operation of the valve. Replace the seat ring if necessary. A replacement seat ring is available individually (key 9 only) or as a seat ring and cage assembly (key 9 and 3). If replacing individually proceed to step 3, otherwise proceed directly to step 7.
3. Make sure the bolts or cap screws that were installed in the seat ring during the Disassembly procedure are still installed.
4. Orient the cage and seat ring so that the threads on each are facing one another for assembly. The bottom of the cage should be facing the top of the seat ring.
5. Using a pry bar to pry against the bolts or cap screws, turn the seat ring clockwise into the cage until tight. Afterwards remove the two bolts or cap screws.
6. Tack weld the seat ring to the cage using minimal heat. Two welds, 6 mm (1/4-inch) long and 180 degrees apart, are required.
7. Install the replacement seat ring seal ring (key 223) and anti-extrusion ring (key 219) with the open side of the seal ring facing the top or bottom of the seat ring, depending on flow direction. The open side of the seal ring should face down (toward the bottom of the valve body) in flow-up installations and up in flow-down installations. Make sure the anti-extrusion ring is adjacent to closed side of the seal ring. Then install the seat ring backup ring (key 220) and retaining ring (key 221).

To install the parts on the seat ring, first lubricate each with a general purpose silicone-base lubricant. Then gently slide each over the bottom edge of the seat ring.

For ET/EWT Valves Equipped with Grid Seat Ring

1. Please contact your [Emerson sales office](#) or refer to FGS12A38 for grid seat ring lifting methods during seat ring/cage assembly process. Other procedures except lifting the grid seat ring still stay the same as standard seat ring.

For ED/EWD and ET-C/EWT-C Valves

1. Inspect the seat ring (key 9) for nicks, scratches, or other damage that would prevent proper operation of the valve. Replace if necessary.

Bore Seal Retrofit

Note

Additional actuator thrust is required for a valve equipped with the bore seal. When installing the bore seal in an existing valve, contact your [Emerson sales office](#) for assistance in determining new actuator thrust requirements.

The bore seal retrofit will require a new valve plug and stem assembly (key 2), bore seal (key 64), and piston ring (key 6). The following steps will guide you in the assembly of these parts. Final installation into the valve body will be per the Assembly procedure.

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the new trim parts while assembling the individual parts and during installation in the valve body.

1. Apply a suitable high-temperature lubricant to the inside diameter of the bore seal. Also, lubricate the outside diameter of the valve plug where the bore seal must be pressed into the proper seating position (see figure 3).
2. Referring to figure 3, orient the bore seal for correct sealing action based on the process fluid flow direction through the valve.
 - The open interior of the bore seal must face up in a valve with flow-up construction.
 - The open interior of the bore seal must face down in a valve with flow-down construction.
3. Place the bore seal over the top of the valve plug. The retainer will help guide the bore seal down onto the valve plug. Do not force the bore seal over the plug. For flow-down constructions, skip to step 5.
4. An installation tool (see figure 4 and table 5) must be inserted into the bore seal prior to using the retainer to guide it down the valve plug.
5. Apply a suitable high-temperature lubricant to the threads on the valve plug. Then, place the retainer onto the valve plug and tighten the retainer using an appropriate tool such as a strap wrench. For flow-down constructions, skip to step 7.
6. Remove the retainer and then the installation tool. Place the retainer back onto the valve plug and tighten the retainer using an appropriate tool such as a strap wrench.
7. Using an appropriate tool such as a center punch, stake the threads on top of the valve plug in one place to secure the retainer (see figure 3).
8. Each new piston ring (key 6) is furnished as a complete ring, and each must be broken into two approximately equal portions. Do this by placing the ring on edge on a smooth, hard surface and striking the ring squarely with a hammer.
9. Install the piston ring into the groove in the retainer (key 2C). Be sure to match the broken ends when installing the ring sections in the groove.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the Bore Seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop across the valve, this force will adequately drive the valve plug to the seat ring, giving the Bore Seal a predetermined permanent set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

Assembly

After completing Packing Maintenance and/or Trim Maintenance procedures, the following steps will guide you through reassembly of the valve.

For ED/EWD and ET-C/EWT-C Valves only

1. Remove the cover protecting the valve body cavity.
2. Install a new seat ring gasket (key 13) into the valve body. Make sure the eye bolts that were installed in the seat ring (key 9) during the Disassembly procedure are still installed. Then using the eye bolts as lifting points, carefully lower the seat ring into the valve body. Make sure that the cap screw holes in the seat ring are lined up with their mating holes in the valve body. Remove the two eye bolts from the seat ring.

CAUTION

Uneven tightening of the cap screws (key 49) will result in the seat ring seating surface being askew from the valve plug seating surface, thereby preventing the valve from attaining its rated shutoff class. This is especially critical in ED/EWD valves equipped with the bore seal. If after assembly the rated shutoff class is not attained your [Emerson sales office](#) can provide further assistance.

3. Secure the seat ring to the valve body using the cap screws (key 49). Tighten the cap screws in a criss-cross pattern working up to the final torque in four equal increments as specified in table 6.
4. Install a new cage gasket (key 11) into the valve body.
5. Make sure the eye bolts that were installed in the cage (key 3) or cage assembly during the Disassembly procedure are still installed. Then using the eye bolts as lifting points, carefully lower the cage into the valve body. Any rotational orientation of the cage with respect to the valve is acceptable.
6. Complete reassembly according to steps 10 through 15 of the Replace Packing section.

Table 6. Seat Ring Cap Screw Torque

VALVE SIZE, NPS	FIRST INCREMENT		SECOND INCREMENT		THIRD INCREMENT		FOURTH INCREMENT FINAL TORQUE	
	N • m	Lbf • ft	N • m	Lbf • ft	N • m	Lbf • ft	N • m	Lbf • ft
12, 14, and 16x12	9.75	7	19.5	14	29.25	21	39	28
16, 18, 20x16, 24x16, 20, 24x20, and 30	23	17	46	34	69	51	92	68

For ET/EWT Valves only

1. Remove the cover protecting the valve body cavity.
2. Install a new cage gasket (key 11) into the valve body.
3. Make sure the eye bolts that were installed in the cage (key 3) or cage assembly during the Disassembly procedure are still installed. Then using the eye bolts as lifting points, carefully lower the cage into the valve body. Any rotational orientation of the cage with respect to the valve is acceptable. Use care to avoid damaging the seat ring seal ring (key 223) while handling the heavy parts. To help insert the cage assembly into the valve, lubricate the outside diameter of the seat ring seal ring with general purpose silicone-base lubricant.
4. Complete reassembly according to steps 10 through 15 of the Replace Packing section.

Parts Ordering

Each body-bonnet assembly is assigned a serial number, which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Seal Ring and Piston Ring Kits

Repair kits include parts to replace the seal rings and piston rings for the valve plug and seat ring.

Valve Size, NPS	Port Diameter, mm (Inch)	ED/EWD Valves		ET/EWT Valves		
		Standard (includes key 6)	With Bore Seal (includes key 6)	Standard (includes keys 28 and 223)	With HTS1 Seals (includes keys 28, 63, 223, and 219)	ET-C/EWT-C (includes key 28)
12, 14, 16x12	254 (10)	RSEALX00012	Consult factory	RSEALX00042	RSEALX00062	RSEALX00082
	279 (11)	RSEALX00022	RSEALX00032	RSEALX00052	RSEALX00072	RSEALX00092
16, 18, 20x16, 24x16	375 (14.75)	RSEALX00102	RSEALX00112	RSEALX00122	RSEALX00142	RSEALX00162
	413 (16.25)	---	---	RSEALX00132	RSEALX00152	---
20, 24x20	18.25	RSEALX00192	RSEALX00202	RSEALX00212	RSEALX00232	RSEALX00252
	19.75	---	---	RSEALX00222	RSEALX00242	---
30	610 (24)	Consult factory	Consult factory	RSEALX00172	Consult factory	Consult factory
	660 (26)	---	---	RSEALX00182	Consult factory	---

Gasket Kits

Valve Size, NPS	Pressure Class	Valve Travel, mm (Inch)	ED/EWD and ET-C/EWT-C Valves (includes keys 11 and 13)	ET/EWT Valves (includes key 11)
12, 14, 16x12	CL150-600	All	RGASKETXE62	RGASKETXE92
16, 18, 20x16, 24x16	CL150-600	less than 378 (14.88)	RGASKETXE72	RGASKETXF12
20x16	CL150-600	378 (14.88)	RGASKETXE82	RGASKETXF22
20, 24x20	CL150-600	203 (8.00), 276 (10.88), 378 (14.88)	RGASKETXF42	RGASKETXF62
24x20	CL150-600	429 (16.88)	RGASKETXF52	RGASKETXF72
30	CL150-300	All	Consult factory	RGASKETXF32
	CL600			RGASKETXH12

Standard Packing Kits (Non Live-Loaded)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	31.8 (1-1/4) 127 (5H)	50.8 (2) 178 (7)
Single PTFE (Contains keys 6, 8, 10, 11, and 12)	RPACKX00352	Consult factory
Double PTFE (Contains keys 6, 8, 11, and 12)	RPACKX00372	Consult factory
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], and 11)	RPACKX00542	RPACKX00552

ENVIRO-SEAL Packing Kits

Repair kits include parts to replace the “soft” packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits. For part numbers of individual components, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, D101642X012. PTFE repair kits include keys 214, 215, and 218. Graphite ULF repair kits include keys 207, 208, 209, 210, and 214. Duplex repair kits include keys 207, 209, 214, and 215.

Retrofit kits include parts to convert valves to the ENVIRO-SEAL packing box construction. For part numbers of individual components, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, D101642X012. PTFE kits include keys 200, 201, 211, 212, 214, 215, 217, 218, tag, and cable tie. Graphite ULF kits include keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 216, 217, tag, and cable tie. Duplex kits include keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, and cable tie.

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	REPAIR KIT		RETROFIT KIT	
	31.8 (1-1/4) 127 (5H)	50.8 (2) 178 (7)	31.8 (1-1/4) 127 (5H)	50.8 (2) 178 (7)
ENVIRO-SEAL Double PTFE	RPACKX00232	Consult factory	RPACKXRT052	Consult factory
ENVIRO-SEAL Graphite ULF	RPACKX00632	Consult factory	RPACKXRT302	Consult factory
ENVIRO-SEAL Duplex	RPACKX00332	Consult factory	RPACKXRT252	Consult factory

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

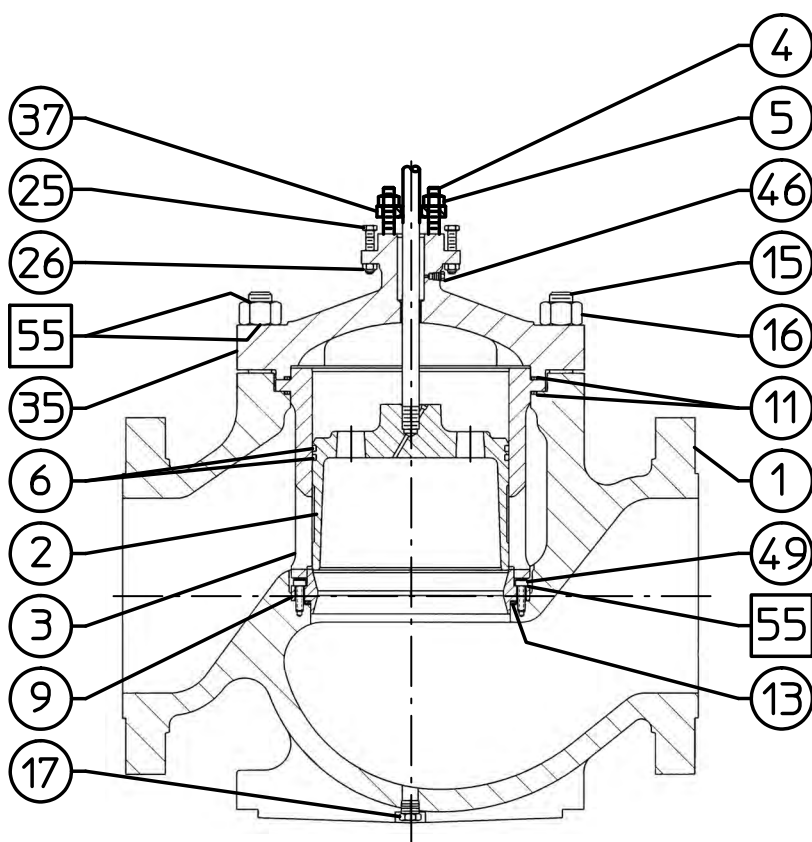
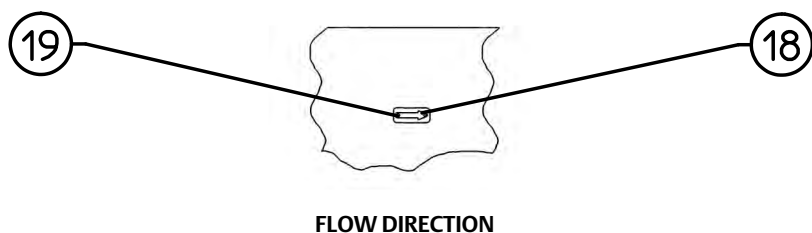
Valve Body (figures 5 through 8)

Key	Description	
1	Valve Body	
2*	Valve Plug and Stem Assembly	
2A	Valve Plug	
2B	Valve Stem	
2C	Retainer	
3*	Cage	
4	Packing Flange Stud	
5	Packing Flange Nut	
6*	Piston Ring	see parts kit
9*	Seat Ring	
11*	Cage or Bonnet Gasket	see parts kit
13*	Seat Ring Gasket	see parts kit
15	Stud	
16	Hex Nut	
17	Drain Plug	
18	Flow Arrow	
19	Drive Screw	
25	Actuator to Bonnet Cap Screw	
26	Actuator to Bonnet Nut	
27*	Plug Retaining Ring	
28*	Plug Seal Ring	see parts kit
29*	Plug Backup Ring	
31	Lubricator or Lubricator/Isolating Valve	
35	Bonnet	
37	Packing Flange	
46	Pipe Plug	
49	Cap Screw	
53	Nameplate	
55	Lubricant	
63*	Plug Anti-Extrusion Ring	see parts kit
64*	Bore Seal	
223*	Seat Ring Seal Ring	see parts kit
220*	Seat Ring Back-up Ring	
219*	Seat Ring Anti-Extrusion Ring	see parts kit
221*	Seat Ring Retaining Ring	

Packing (figure 2)

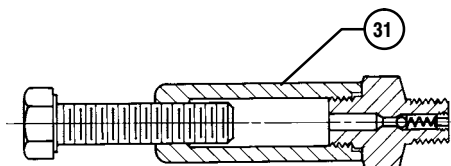
	PTFE V-Ring Single Packing	
6*	Packing Set	see parts kit
8	Spring	
10	Special Washer	
11*	Packing Box Ring	see parts kit
12*	Upper Wiper	see parts kit
13	Packing Follower	
	PTFE V-Ring Double Packing	
6*	Packing Set	see parts kit
8	Lantern Ring	
11*	Packing Box Ring	see parts kit
12*	Upper Wiper	see parts kit
13	Packing Follower	
	PTFE/Composition Packing	
7*	Packing Set	
8	Lantern Ring	
11*	Packing Box Ring	
12*	Upper Wiper	
13	Packing Follower	
	Graphite Ribbon/Filament Single or Double Packing	
7*	Packing Ring, Graphite Ribbon	see parts kit
7*	Packing Ring, Graphite Filament	see parts kit
8	Lantern Ring	
11*	Packing Box Ring	see parts kit
13	Packing Follower	
	ENVIRO-SEAL Packing	
	See Instruction Manual D101642X012	

Figure 5. Typical Fisher ED/EWD Valve



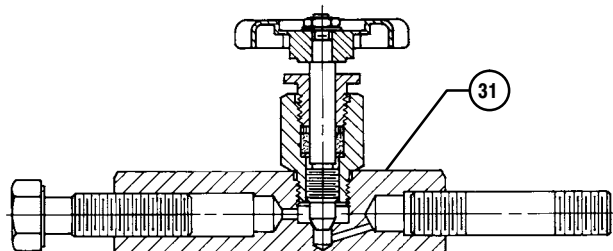
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☐ APPLY LUBRICANT



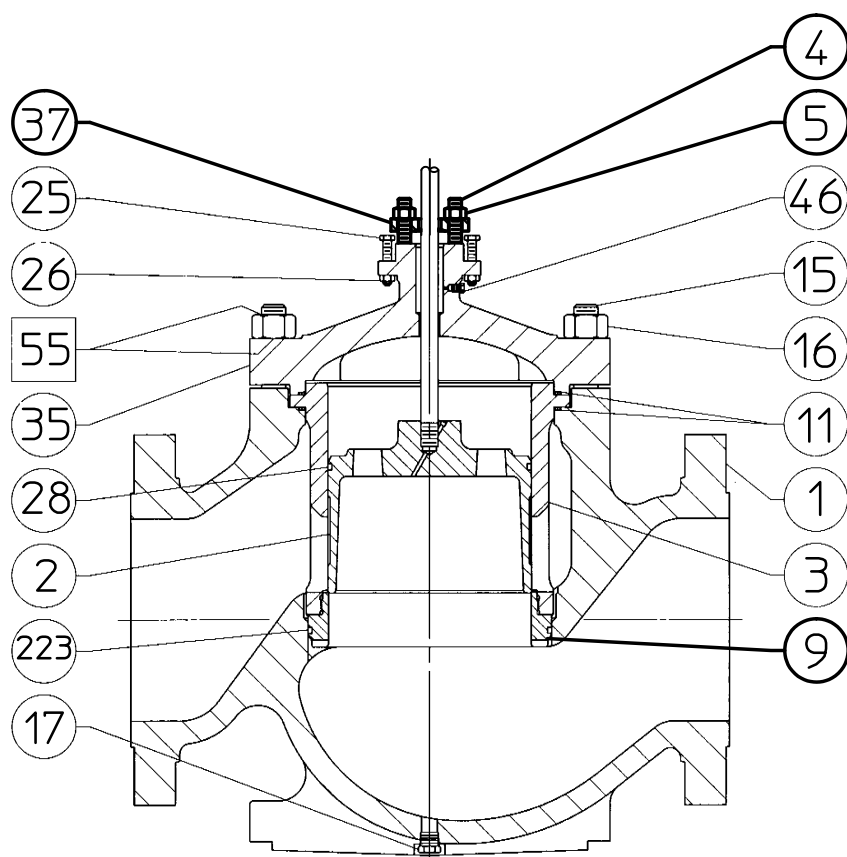
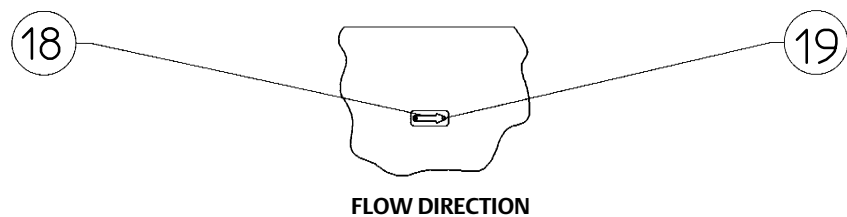
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OPTIONAL LUBRICATOR



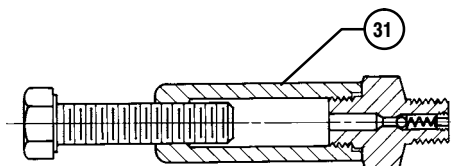
OPTIONAL LUBRICATOR/ISOLATING VALVE

Figure 6. Typical Fisher ET/EWT Valve



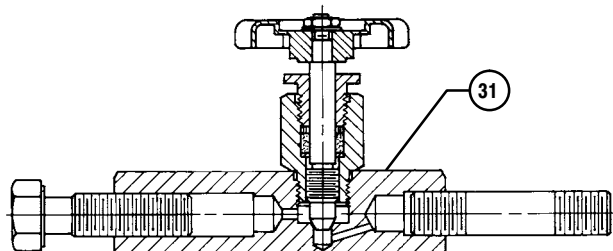
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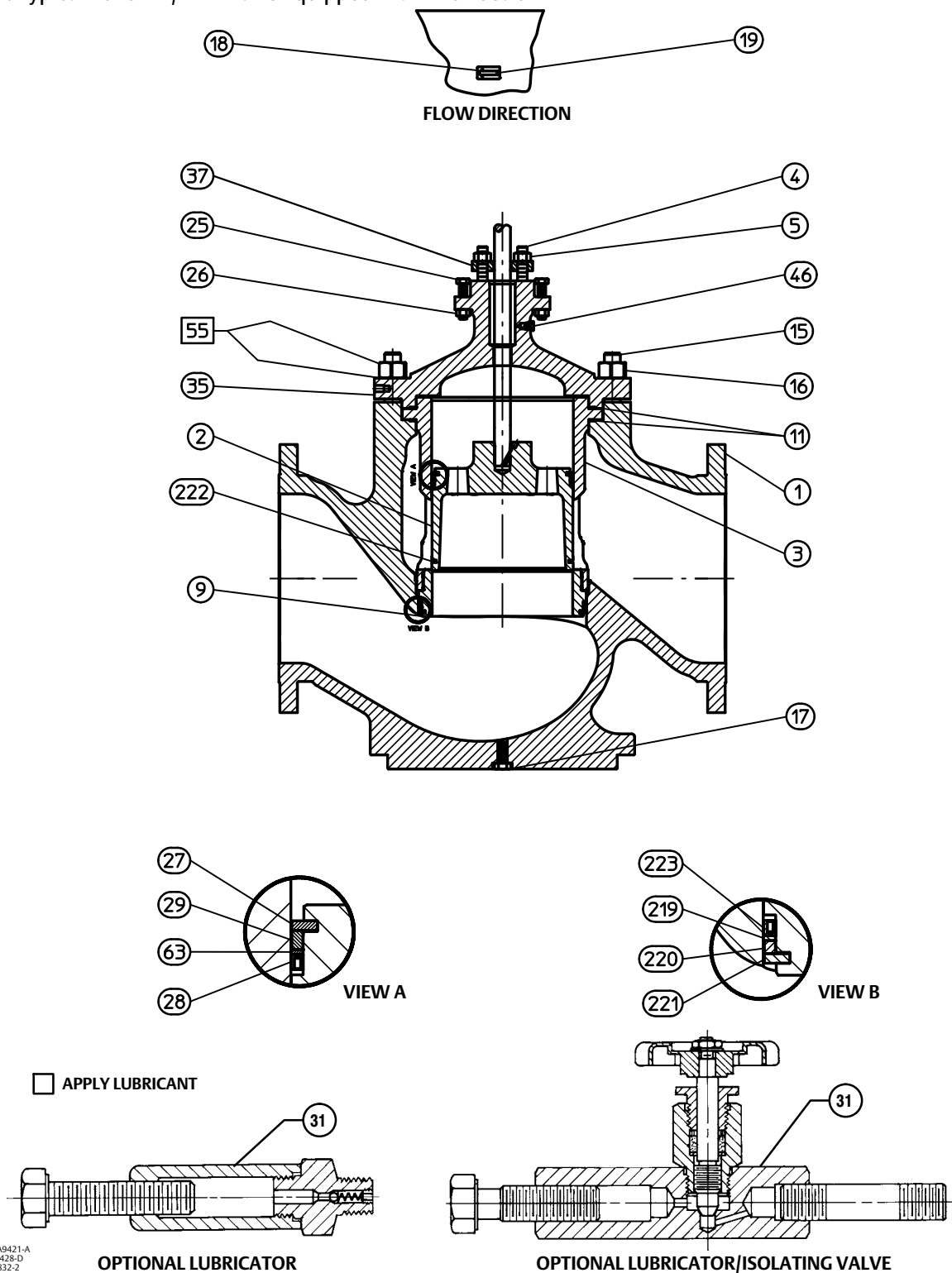
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OPTIONAL LUBRICATOR



OPTIONAL LUBRICATOR/ISOLATING VALVE

Figure 7. Typical Fisher ET/EWT Valve Equipped with HTS1 Seals



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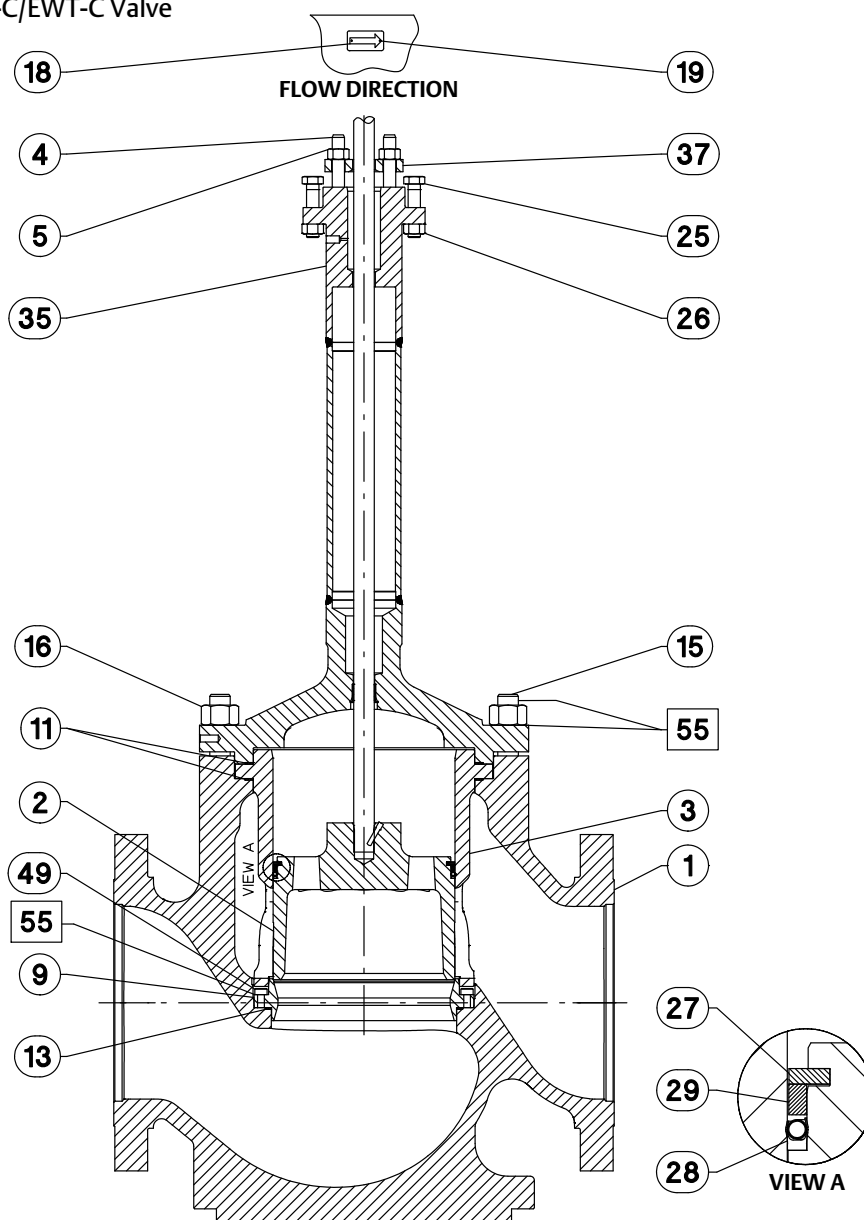
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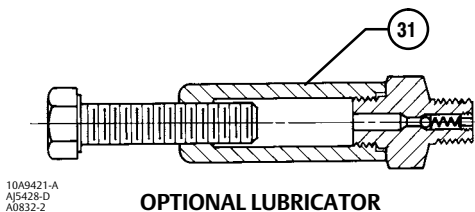
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Figure 8. Typical Fisher ET-C/EWT-C Valve



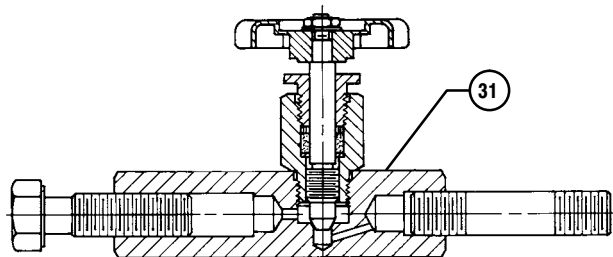
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☐ APPLY LUBRICANT



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OPTIONAL LUBRICATOR



OPTIONAL LUBRICATOR/ISOLATING VALVE

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Introduction

The product covered in this document is no longer in production. This document, which includes the latest published version of the instruction manual, is made available to provide updates of newer safety procedures. Be sure to follow the safety procedures in this supplement as well as the specific instructions in the included instruction manual.

Part numbers in the included instruction manual should not be relied on to order replacement parts. For replacement parts, contact your [Emerson sales office](#).

For more than 30 years, Fisher products have been manufactured with asbestos-free components. The included manual might mention asbestos containing parts. Since 1988, any gasket or packing which may have contained some asbestos, has been replaced by a suitable non-asbestos material. Replacement parts in other materials are available from your sales office.

Safety Instructions

Please read these safety warnings, cautions, and instructions carefully before using the product.



These instructions cannot cover every installation and situation. Do not install, operate, or maintain this product without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson sales office before proceeding.

Specifications

This product was intended for a specific range of service conditions--pressure, pressure drop, process and ambient temperature, temperature variations, process fluid, and possibly other specifications. **Do not expose the product to service conditions or variables other than those for which the product was intended.** If you are not sure what these conditions or variables are, contact your [Emerson sales office](#) for assistance. Provide the product serial number and all other pertinent information that you have available.

Inspection and Maintenance Schedules

All products must be inspected periodically and maintained as needed. The schedule for inspection can only be determined based on the severity of your service conditions. Your installation might also be subject to inspection schedules set by applicable governmental codes and regulations, industry standards, company standards, or plant standards.

In order to avoid increasing dust explosion risk, periodically clean dust deposits from all equipment.

When equipment is installed in a hazardous area location (potentially explosive atmosphere), prevent sparks by proper tool selection and avoiding other types of impact energy.

Parts Ordering

Whenever ordering parts for older products, always specify the serial number of the product and provide all other pertinent information that you can, such as product size, part material, age of the product, and general service conditions. If you have modified the product since it was originally purchased, include that information with your request.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher product, because they may void your warranty, might adversely affect the performance of the product, and could cause personal injury and property damage.

Installation

⚠ WARNING

- Personal injury or equipment damage caused by sudden release of pressure or bursting of parts may result if the valve assembly is installed where service conditions could exceed the limits given in the applicable product literature, the limits on the appropriate nameplates, or the mating pipe flange rating. Use pressure-relieving devices as required by government or relevant industry codes and good engineering practices. If you cannot determine the ratings and limits for this product, contact your [Emerson sales office](#) before proceeding.
- To avoid personal injury, always wear protective gloves, clothing, and eyewear when performing any installation operations.
- To avoid personal injury or property damage, use proper lifting and rigging practices while lifting, installing or removing the valve assembly. Be sure to use lifting and rigging equipment properly sized and selected for the weight and configuration of the valve assembly or component being lifted.
- Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.
- Many rotary shaft valves are not necessarily grounded to the pipeline when installed in a flammable, hazardous, oxygen service, or explosive atmospheres. An explosion is possible, due to the discharge of static electricity from the valve components. To avoid personal injury or property damage, make sure that the valve is grounded to the pipeline before placing the control valve assembly into service. Use and maintain alternate shaft-to-body bonding, such as a shaft-to-body bonding strap assembly.
- Rotary shaft valves are designed and intended for installation between flanges. Personal injury or property damage may result from improper installation. To avoid personal injury or property damage caused by the sudden release of pressure or bursting of parts, do not use or install rotary shaft valves (including single lug constructions) for dead-end service.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- If installing into an existing application, also refer to the WARNING in the Maintenance section.
- When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. To avoid possible personal injury and because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson sales office.

CAUTION

- Ensure that the valve and adjacent pipelines are free of foreign material that could damage the valve seating surfaces.

Maintenance

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Always wear protective gloves, clothing, and eyewear.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure.
- Do not remove the actuator while the valve is pressurized.
- Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring pre-compression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box might contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids might spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug. Cautiously remove parts so that fluid escapes slowly and safely.
- Many valve parts that are moving can injure you by pinching, cutting, or shearing. To help prevent such injury, stay clear of any moving part.
- Never apply pressure to a partially assembled valve.
- To avoid personal injury or property damage caused by uncontrolled movement of a valve bonnet, loosen the bonnet by following these instructions: Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. Loosen bonnet nuts approximately 3 mm (0.125 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed with bonnet removal.
- As you remove parts, such as valve shafts, other parts, such as disks can fall from the valve body or suddenly move to another position in the valve. To avoid injury from falling or moving parts, be sure to support parts and be sure they are in a stable position as you disassemble the valve.
- Personal injury could result from packing leakage. Do not scratch the drive shaft or packing box wall while removing packing parts.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

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Fisher™ Lever-Lock Handlever Actuators for POSI-SEAL™ A81 Rotary Valves

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Figure 1. Fisher Lever-Lock Handlever Actuator Mounted on Valve



W9585

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher Lever-Lock handlever actuator (figure 1). Refer to separate instruction manuals for information covering the control valves.

Do not install, operate, or maintain a Lever-Lock actuator without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The Lever-Lock handlever is used for reliable manual operation of DN 50 through 150 (NPS 2 through 6) Fisher A81 high-performance butterfly valves. Spring-loading secures the handlever in the notched quadrant plate (figure 2), allowing the valve disk to be locked in intermediate positions. Additionally, the handlever can be locked with a user-supplied padlock with 4.8 to 5.2 mm (3/16 to 13/64 inch) shackle to prevent accidental or unauthorized adjustment (see figures 3 and 4).

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Lever-Lock Handlever Actuator

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Table 1. Specifications

Lever-Lock Handlever Actuator Sizes See table 2	Handlever Length Maximum of 432 mm (17 inches). See figure 2 and table 4
Valve Compatibility Mounts on A81 valves per table 2	Construction Materials Handle, quadrant plate, lever, and mounting bracket are all steel materials. Spring, set screws, and fasteners are stainless steel
Maximum torque Output See table 3	Dimension and Approximate Weights See figure 2 and table 4

1. The pressure/temperature limits in this manual, and any applicable code or standard limitation, should not be exceeded.

Table 2. Fisher A81 Valve / Lever-Lock Handlever Compatibility

HANDLEVER ACTUATOR SIZE	VALVE SIZE		SHAFT SIZE		SQUARE SIZE
	DN	NPS	mm	Inches	mm
I	50	2	12.7	1/2	9
	80	3	15.9	5/8	11
II	100	4	19.1	3/4	14
	150	6	25.4	1	17

Table 3. Maximum Allowable Torques and Handlever Force Requirements

VALVE DISK POSITION	MAXIMUM TORQUE				HANDLEVER FORCE REQUIRED	
	Size I		Size II			
	N•m	In•Lb	N•m	In•Lb	N	Lbf
0 Degrees (Breakout Torque)	119	1050	164	1450	423	95
All Other Angles (Dynamic Torque)	47	420	70	620	178	40

Installation

The Lever-Lock handlever actuator is normally shipped mounted on the valve at the factory. If the handlever was ordered separately, install the handlever on the valve by following the instructions in this section.

WARNING

Sudden or unexpected movement of the handle can result from unbalanced flow forces. Firmly grip the handlever and ensure stable footing when operating the handlever to avoid personal injury or property damage.

Installing the Handlever

Orientation

Mount the Lever-Lock bracket assembly, less the handle, to the valve body. The handle is perpendicular to the pipeline when the valve is in the shut position. Rotation of the lever/valve shaft in the counter-clockwise direction will open the valve. Attach the Lever-Lock Handlever actuator to the valve in this orientation but do not fully tighten (torque) the bracket to valve bolting until after the zeroing process below.

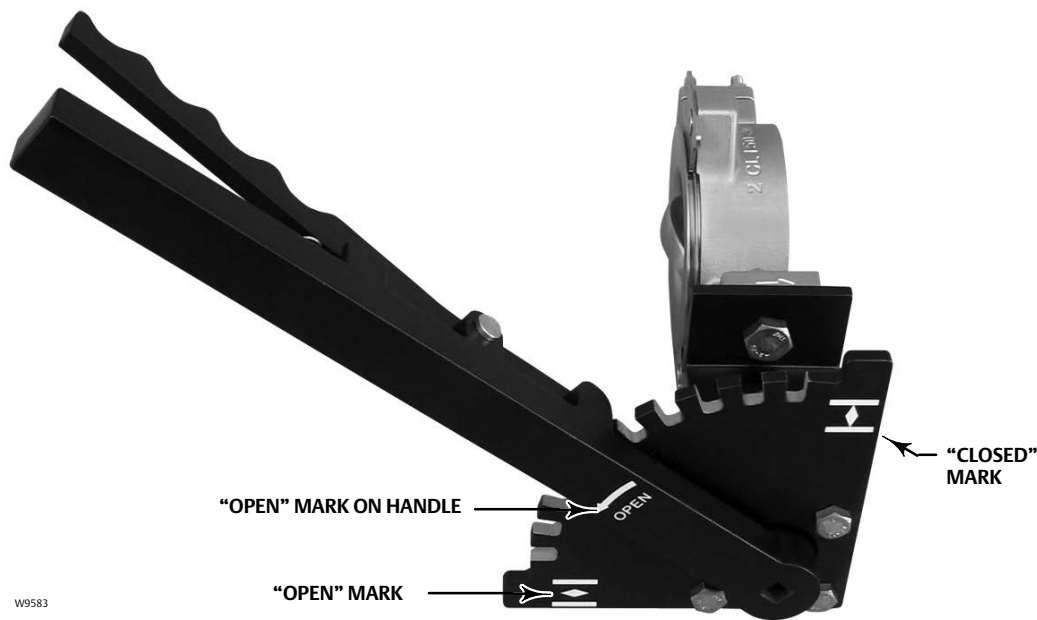
Handle assembly

Place the handle and lever assembly on the valve shaft with the valve closed. Squeeze the lever to compress the spring, position the lever over the notch indicating the closed position, and slide the square cutout portion of the handle over the valve shaft as far as it will go. Maintain at least a 0.8 mm (1/32 inch) gap between the handle and the plate, so the handle doesn't rub on the plate during operation. Torque the two hex socket set screws against the shaft to 2.7 N•m (24 in•lbf).

Zeroing

After tightening the set screws, check the orientation of the disk relative to the body seal retainer. Place a straight edge on the seal retainer which spans the valve opening. Visually check to ensure there is equal space (within 0.8 mm [1/32 inch]) between this straight edge and the top and bottom of the disk to ensure the valve is fully engaged in the seal. To adjust this position, rotate the bracket within the clearance of the mounting bolt holes between the valve body and bracket. Once there is equal distance between the disk and the straight edge, tighten the mounting bolts to 115 N•m (88 ft•lbf). After tightening, recheck disk position at shutoff to ensure nothing shifted during the tightening process.

Figure 2. Fisher Lever-Lock Handlever Actuator for A81 Valve (Open/Closed Marks)



Maintenance

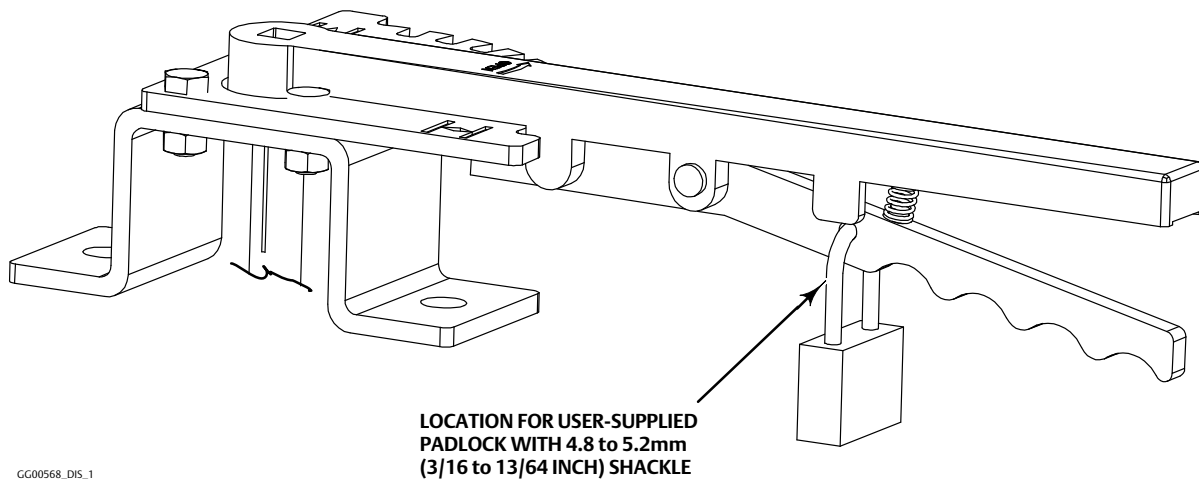
Handlever parts are subject to normal wear/corrosion and must be inspected and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

⚠ WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from either side of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Figure 3. Fisher Lever-Lock Handlever Actuator for A81 Valve (Showing Padlock Location)



GG00568_DIS_1

Ordering Replacements

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, always mention the valve serial number. It is recommended that complete assemblies are considered for replacements to ensure the latest version of the product is supplied.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

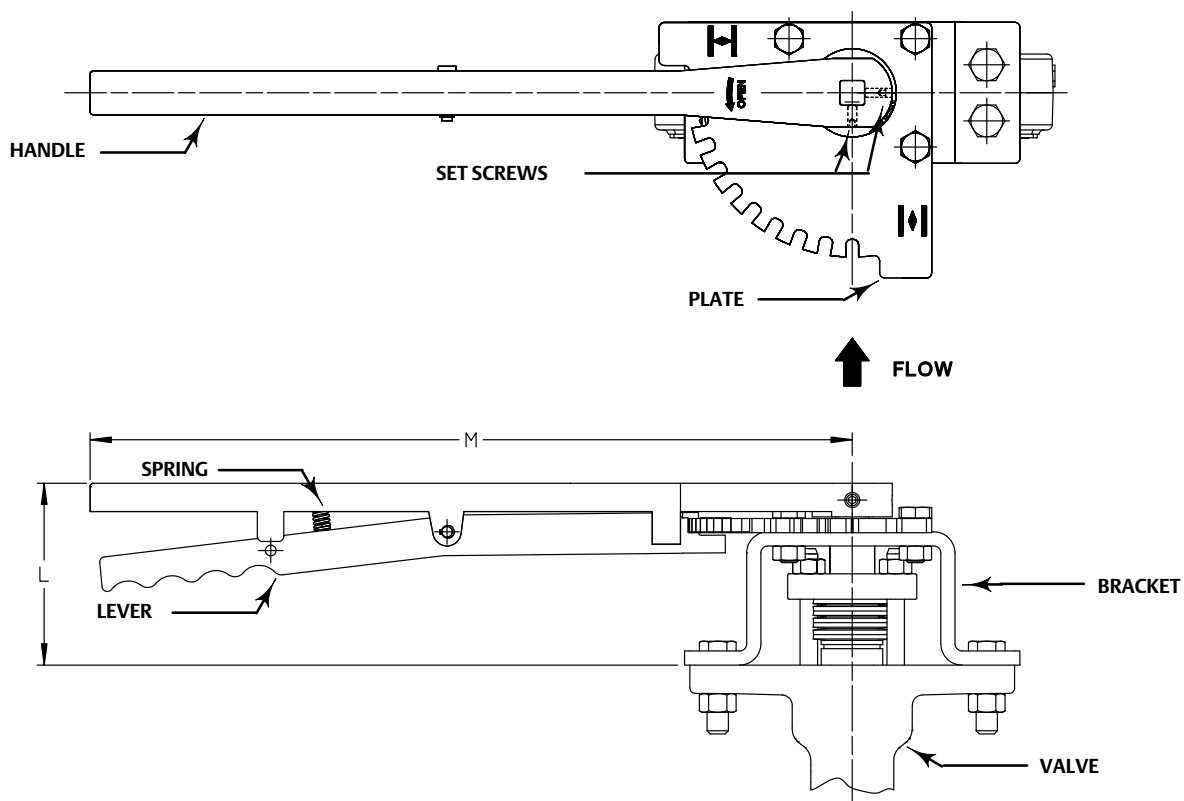
Lever-Lock Handlever Actuator

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Figure 4. Fisher Lever-Lock Handlever Actuator for A81 Valve (fully closed valve position shown)



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Table 4. Dimensions and Weights

VALVE SIZE		M		L		WEIGHT	
DN	NPS	mm	Inch	mm	Inch	kg	lbs
50	2	315	12.4	85	3.35	2.72	3
80	3	315	12.4	85	3.35	2.72	3
100	4	432	17.0	103	4.06	3.63	4
150	6	432	17.0	103	4.06	3.63	4

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Fisher™ NotchFlo™ DST Control Valve

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Figure 1. Fisher NotchFlo DST Control Valve



W9050-2

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher NotchFlo DST control valve. Refer to separate manuals for instructions covering the actuator, positioner, and accessories.



Do not install, operate, or maintain NotchFlo DST valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The NotchFlo DST globe (figure 1) and angle valves have metal seats, cage guiding, quick change trim, and push-down-to-close valve plug action. All available valve sizes and pressure ratings use balanced valve plugs with the exception of CL900 and CL1500 (NPS 1 and 1-1/2 valves) which use an unbalanced valve plug. To provide a seal between the cage and a balanced valve plug, the balanced valve plugs use a pressure-assisted spring-loaded seal ring.

A properly sized NotchFlo DST valve with 3-, 4-, or 6-stage dirty service anti-cavitation trim (figure 2) offers excellent control of high pressure drop liquids with entrained solids, while avoiding the damaging effects of cavitation and erosive solids.

Table 1. Specifications

Available Valves CL600 3-Stage: Level C only CL900 and CL1500 ≤ NPS 4, 4-Stage: Levels A, B, and C⁽¹⁾ CL1500 ≥ NPS 6, 4-Stage: Level C only CL1500 6-Stage: Level C only CL2500 6-Stage: Level C only End Connection Styles and Ratings⁽²⁾ Flanged: Consistent with CL600, 900, 1500, and 2500 per ASME B16.34 Socket Welding: Consistent with CL600, 900, 1500, and 2500 per ASME B16.34 Buttwelding: Consistent with CL600, 900, 1500, and 2500 per ASME B16.34 Also see table 2	Shutoff Classification Class V: $[5 \times 10^{-12} \text{ m}^3/\text{sec}/\text{bar}/\text{mm}$ of port diameter (0.0005 mL/min/psid/in) of water at service pressure drop] per ANSI/FCI 70-2 and IEC 60534-4 Flow Characteristic Linear Flow Direction Flow up Approximate Weights See table 2
---	---

1. Levels A, B, and C provide for varied pressure drops and capacity.

2. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

Figure 2. Fisher NotchFlo DST Trim



W8538-1

NotchFlo DST control valves utilize a high resistance, multi-stage, axial flow path (or passage) where fluid flow is parallel to the axis of the plug and cage.

Pressure reduction occurs throughout the length of the plug; thus individual stages aren't exposed to the full pressure differential. Therefore, trim life is enhanced.

NotchFlo DST trim utilizes a series of notched flow restrictions and expansions to control the pressure drop of the fluid. The amount of pressure drop per stage is controlled to prevent cavitation problems and minimize erosion issues.

Flow passage configuration provided by the multi-stage plug and cage design make the NotchFlo DST valves well-suited for applications involving fluids with entrained particles. This is a potentially serious problem for other anti-cavitation valve designs which are subject to clogged flow passages. Design of the trim allows for high rangeability.

Specifications

Specifications for NotchFlo DST valves are shown in table 1.

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NotchFlo DST Valve

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Table 2. Approximate Weights (Valve and Bonnet Assemblies)

VALVE DESIGN	VALVE SIZE, NPS	PRESSURE RATING	KILOGRAMS		POUNDS	
			Flanged	Socket Weld ⁽¹⁾ , Butt Weld, Screwed ⁽²⁾	Flanged	Socket Weld ⁽¹⁾ , Butt Weld, Screwed ⁽²⁾
3-Stage Angle Valves	1	CL600	20	---	44	---
	2		42	---	93	---
	3		86	---	190	---
	4		140	---	315	---
	6		300	---	660	---
	8		605	---	1340	---
3-Stage Globe Valves	1	CL600	20	15	45	35
	2		40	30	90	70
	3		70	50	155	110
	4		120	80	265	175
	6		275	230	610	510
	8		510	445	1130	980
4-Stage Angle Valves	1	CL900 and CL1500	50	40	110	90
	1-1/2		55	45	120	95
	2		95	95	210	210
	3		185	---	405	---
	4		285	---	625	---
	6		560	---	1230	---
	8		1260	---	2770	---
4-Stage Cast Angle Valves	1	CL900 and CL1500	40	32	88	71
	1-1/2		43	35	95	77
	2		75	57	165	126
	3		148	118	326	260
	4		243	200	536	441
	6		523	443	1153	977
	8		1062	920	2342	2029
4-Stage Globe Valves	1	CL900 and CL1500	58	42	128	93
	1-1/2		75	48	165	106
	2		95	85	210	185
	3		185	140	405	310
	4		340	280	750	620

-continued-

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

NotchFlo DST Valve

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Table 2. Approximate Weights (Valve and Bonnet Assemblies) (cont.)

VALVE DESIGN	VALVE SIZE, NPS	PRESSURE RATING	KILOGRAMS		POUNDS	
			Flanged	Socket Weld ⁽¹⁾ , Butt Weld, Screwed ⁽²⁾	Flanged	Socket Weld ⁽¹⁾ , Butt Weld, Screwed ⁽²⁾
6-Stage Angle Valves	1	CL2500	64	67	140	148
	2		180	170	405	375
	3		500	473	1110	1043
	4		465	433	1025	955
	6		1060	1030	2330	2271
6-Stage Cast Angle Valves	1	CL2500	50	42	110	93
	2		135	108	298	238
	3		352	293	776	646
	4		385	300	849	662
	6		921	692	2031	1526
6-Stage Globe Valves	1	CL1500	47	43	103	94
	2		98	84	217	186
	3		354	307	781	677
	4		406	386	896	852
	6		975	866	2149	1909
	1	CL2500	53	---	117	---
	2		130	---	287	---
	3		321	---	708	---
	4		427	---	942	---
	6		1026	---	2262	---

1. SWE available on NPS 1, 1-1/2, and 2 only.

2. Screwed end available on NPS 1 and 2 CL600 only.

Educational Services

For information on available courses for Fisher NotchFlo DST valves, as well as a variety of other products, contact:

Emerson Automation Solutions
 Educational Services - Registration
 Phone: 1-641-754-3771 or 1-800-338-8158
 E-mail: education@emerson.com
 emerson.com/fishervalvetraining

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

Some bonnet flanges have a tapped hole that was used to handle the bonnet during manufacture. Since this tapped hole was not designed or intended to support the weight of the valve/bonnet assembly, do not use this tapped hole to lift the valve assembly or personal injury may result from the assembly falling.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first checking with your [Emerson sales office](#).

1. Before installing the valve, inspect it to ensure that the valve body cavity is free of foreign material.
2. Clean out all pipelines to remove scale, welding slag, and other foreign materials before installing the valve.
3. Flow through the valve must be in the direction indicated by the flow arrow, which is cast on or attached to the valve body.
4. Use accepted piping practices when installing the valve in the pipeline. For flanged valve bodies, use a suitable gasket between the body and pipeline flanges.
5. Install a three-valve bypass around the valve if continuous operation is required during maintenance.
6. If the actuator and valve body are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.
7. If the valve body was shipped without packing installed in the packing box, install the packing before putting the valve body into service. Refer to instructions given in the Packing Maintenance procedure.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Maintenance

Refer to figure 10 through 19.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing maintenance and trim maintenance. All maintenance operations may be performed with the valve in the line.

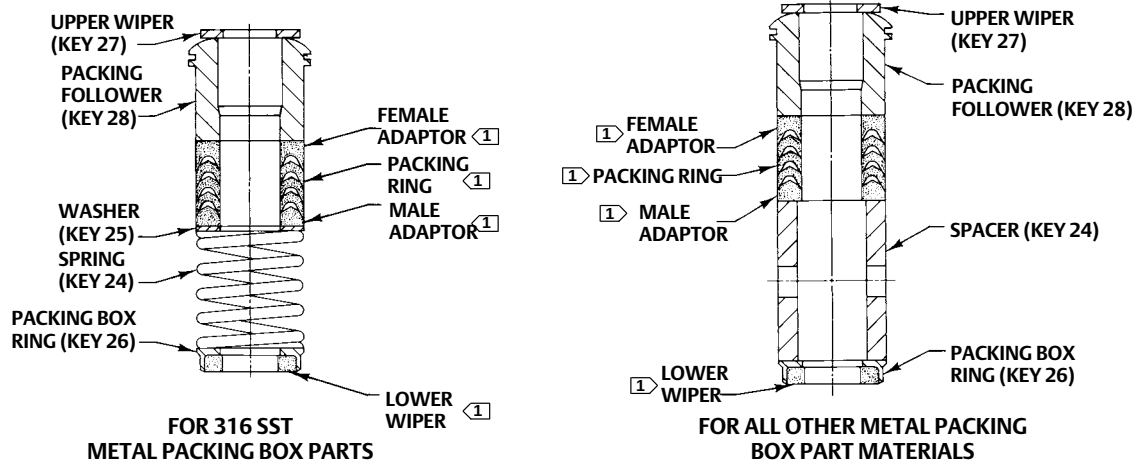
⚠ WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.

- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Figure 3. PTFE V-Ring Packing Arrangements for Plain and Extension Bonnets



NOTE:
 ① MALE ADAPTOR, PACKING RING, FEMALE ADAPTOR, AND LOWER WIPER ARE PART OF PACKING SET (KEY 22).
 2 REQ'D FOR DOUBLE ARRANGEMENTS, EXCEPT LOWER WIPER.

SINGLE ARRANGEMENTS

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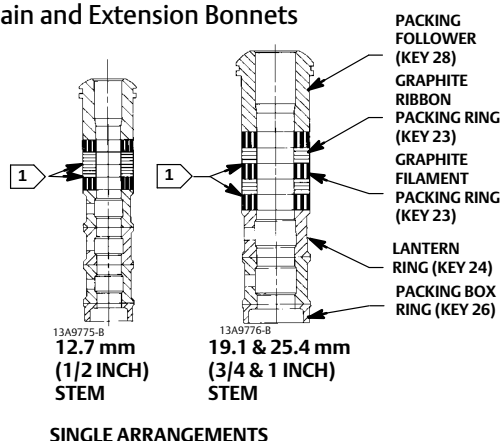
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NotchFlo DST Valve

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Figure 4. Detail of Graphite Ribbon/Filament Packing for Plain and Extension Bonnets



NOTE:
1 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS;
USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

Figure 5. Detail of Graphite ULF Packing for Plain Bonnets

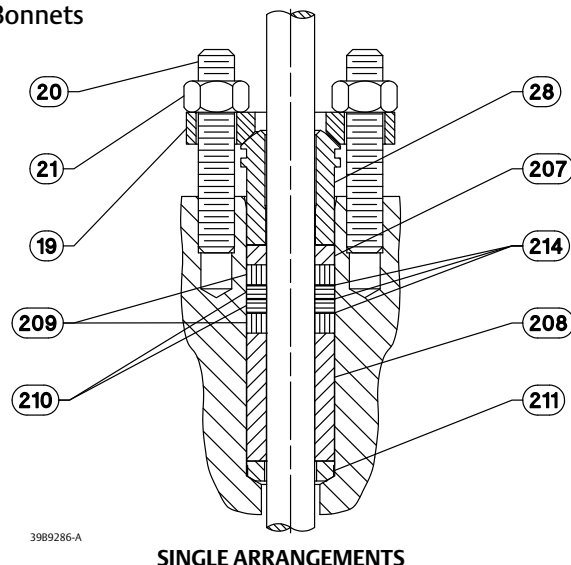


Table 3. CL600 Recommended Torque for Packing Flange Nuts (non live-loaded)

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE TYPE PACKING				PTFE TYPE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
mm	Inches		N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in
12.7	1/2	CL600	9	81	14	122	4	39	7	58
19.1	3/4	CL600	21	182	31	274	10	87	15	131
25.4	1	CL600	35	310	53	466	17	149	25	223

Table 4. CL900, 1500, and 2500 Recommended Torque for Packing Flange Nuts (non live-loaded)

VALVE STEM DIAMETER		PRESSURE RATING	TORQUE			
			N•m		lbf•ft	
mm	Inches		Min	Max	Min	Max
12.7	1/2	CL900	12	18	9	13
		CL1500	15	22	11	16
		CL2500	18	24	13	18
19.1	3/4	CL900	27	41	20	30
		CL1500	34	50	25	37
		CL2500	41	61	30	45
25.4	1	CL900	42	62	31	46
		CL1500	52	77	38	57
		CL2500	61	91	45	67
31.8	1-1/4	CL900	56	83	41	61
		CL1500	68	102	50	75

CAUTION

The NotchFlo DST valve uses spiral-wound gaskets which are crushed to provide their seal. A spiral-wound gasket should never be reused. Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket must be installed upon reassembly. This is necessary to ensure a good gasket seal, since the used gasket will not seal properly.

The spiral-wound gaskets are of special design. Failure to use genuine Fisher replacement parts may result in valve damage and/or failure.

Packing Maintenance

Key numbers refer to figure 3 for PTFE V-ring packing and to figure 4 and 5 for graphite ribbon/filament and graphite ULF packing, unless otherwise indicated.

⚠ WARNING

To avoid personal injury or equipment damage resulting from packing leakage, inspect the valve plug stem and packing box wall for nicks or scratches while performing the following procedures.

Use care to avoid damaging these surfaces.

For spring-loaded single PTFE V-ring packing, the spring (key 24) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 28), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 21, figure 10 through 19) until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the Replacing Packing procedure.

Table 5. Torque for Body-to-Bonnet Bolting Using Anti-Seize Lubricant for CL600 Fisher NotchFlo DST Valves

VALVE RATING	VALVE SIZE, NPS	BOLT TORQUES ^(1,4)			
		SA193-B7, SA193-B8M Class 2 ⁽³⁾		SA193-B8M Class 1 ⁽²⁾	
		N•m	Lbf•ft	N•m	Lbf•ft
CL600	1	122	90	61	45
	2	91	67	43	32
	3	163	120	84	62
	4	258	190	149	110
	6	712	525	---	---
	8	522	385	---	---
1. Determined from laboratory tests. 2. SA193-B8M annealed. 3. SA193-B8M strain hardened. 4. For other materials and torques contact your Emerson sales office .					

Table 6. Torque for Body-to-Bonnet Bolting Using Anti-Seize Lubricant for CL900 and CL1500, Fisher NotchFlo DST Valves

VALVE RATING	TRIM	VALVE SIZE, NPS	BOLT TORQUES ^(1,4)			
			SA193-B7, SA193-B8M Class 2 ⁽³⁾		SA193-B8M Class 1 ⁽²⁾	
			N•m	Lbf•ft	N•m	Lbf•ft
CL900 & 1500	4-stage	1 or 1-1/2	258	190	149	110
		2	373	275	237	175
		3	712	525	509	375
		4	942	695	705	520
		6	2671	1970	---	---
		8	2671	1970	---	---
CL1500	6-stage	1	258	190	149	110
		2	373	275	237	175
		3	2129	1570	---	---
		4	2671	1970	---	---
		6	2671	1970	---	---
1. Determined from laboratory tests. 2. SA193-B8M annealed. 3. SA193-B8M strain hardened. 4. For other materials and torques contact your Emerson sales office .						

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D103211X012

NotchFlo DST Valve

August 2020

Table 7. Torque for Body-to-Bonnet Bolting Using Anti-Seize Lubricant for CL2500 Fisher NotchFlo DST Valves

VALVE RATING	VALVE SIZE	BOLT TORQUES ^(1,2)	
		SA193-B7, SA193-B7M	
	NPS	N•m	lbf•ft
CL2500	1	373	275
	2	712	525
	3	2129	1570
	4	2671	1970
	6	2671	1970
1. Determined from laboratory tests. 2. For other materials and torques contact your Emerson sales office.			

Table 8. Valve Stem Connection Torque and Hole Size for Pin

VALVE STEM DIAMETER		TORQUE, MINIMUM TO MAXIMUM		HOLE SIZE	
mm	Inches	N•m	Lbf•ft	mm	Inch
12.7	1/2	81-115	60-85	3.20 - 3.25	0.126 - 0.128
19.1	3/4	237-339	175-250	4.80 - 4.88	0.189 - 0.192
25.4	1	420-481	310-355	6.38 - 6.45	0.251 - 0.254
31.8	1-1/4	827-908	610-670	6.38 - 6.45	0.251 - 0.254

If there is undesirable packing leakage with other than spring-loaded PTFE V-ring packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts (key 21, figure 10 through 19) to at least the minimum recommended torque in table 3 or 4. However, do not exceed the maximum recommended torque in table 3 or 4, or excessive friction may result. If leakage continues, replace the packing by following the numbered steps presented in the Replacing Packing procedure.

If the packing is relatively new and tight on the valve plug stem, and if tightening the packing flange nuts does not stop the leakage, it is possible that the stem is worn or nicked so that a seal cannot be made. The surface finish of a new stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. While replacing the packing according to the Replacing Packing procedure, inspect the valve plug stem and packing box wall for nicks or scratches.

Adding Packing Rings

⚠ WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

To avoid personal injury or equipment damage resulting from packing leakage, inspect the valve plug stem and packing box wall for nicks or scratches while performing the following procedures. Use care to avoid damaging these surfaces.

Key numbers referred to in this procedure are shown in figures 10 through 19, unless otherwise indicated.

When using packing with a lantern ring (key 24) it may be possible to add packing rings above the lantern ring as a temporary measure without removing the actuator from the valve body.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the packing flange nuts (key 21) and lift the packing flange, upper wiper, and packing follower (keys 19, 27, and 28) away from the valve body.
3. It may be possible to dig out the old packing rings on top of the lantern ring, but use care to avoid scratching the valve plug stem or packing box wall. Clean all metal parts to remove particles that would prevent the packing from sealing.

4. Remove the stem connector and slip the packing rings over the end of the valve plug stem.
5. Reassemble the packing follower, upper wiper, packing flange, and packing flange nuts (keys 28, 27, 19, and 21).
6. Reconnect the body-actuator stem connection according to the appropriate actuator instruction manual.
7. Tighten the packing flange nuts only far enough to stop leakage under operating conditions. Check for leakage around the packing follower when the valve is being put into service. Retighten the packing flange nuts as required (see table 3 or 4).

Replacing Packing

WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

To avoid personal injury or equipment damage resulting from packing leakage, inspect the valve plug stem and packing box wall for nicks or scratches while performing the following procedures. Use care to avoid damaging these surfaces.

Key numbers referred to in this procedure are shown in figures 10 through 19, unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the cap screws in the stem connector, and separate the two halves of the stem connector. Then exhaust all actuator pressure, if any was applied, and disconnect the actuator supply and any leakoff piping.
3. Remove either the yoke locknut (key 32) or the hex nuts (key 30), and remove the actuator from the bonnet (key 18).
4. Loosen the packing flange nuts (key 21) so that the packing (keys 22, 23, 209, or 210, figures 3, 4, or 5) is not tight on the valve plug stem (key 6). Remove any travel indicator disk and stem locknuts from the valve plug stem threads.

CAUTION

When lifting the bonnet (key 18), be sure that the valve plug and stem assembly (keys 5 and 6) remains on the seat ring (key 4). This avoids damage to the seating surfaces as a result of the assembly dropping from the bonnet after being lifted part way out. The parts are also easier to handle separately.

Use care to avoid damaging gasket sealing surfaces.

WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. If the cage sticks to the bonnet, proceed carefully with bonnet removal and support the cage so that it will not fall unexpectedly from the bonnet.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

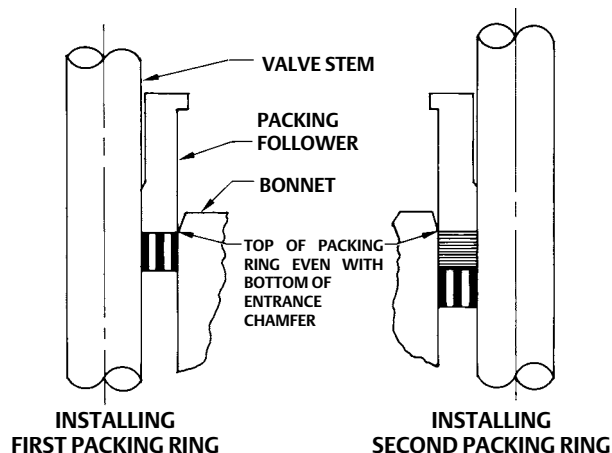
5. Hex nuts (key 14) attach the bonnet to the valve body. Loosen these nuts approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed to the next step. If fluid leaks from the joint, the process pressure was not relieved from the valve as noted in the Warning at the beginning of the Maintenance section in this manual.
6. Unscrew the hex nuts (key 14) and carefully lift the bonnet off the valve stem. If the valve plug and stem assembly starts to lift with the bonnet, use a brass or lead hammer on the end of the stem and tap it back down. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.
7. Remove the valve plug (key 5), bonnet gasket (key 11), cage (key 2), cage gaskets (if applicable) (key 65), seat ring (key 4), and the seat ring gasket(s) (key 12).

CAUTION

Inspect the seat ring, cage, bonnet, and body gasket surfaces. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm (0.003 inch) in height (the thickness of a human hair) can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, because they will prevent the gaskets from sealing properly.

8. Clean all gasket surfaces with a good wire brush. Clean in the same direction as the surface serrations, not across them.
9. Cover the opening in the valve body to protect the gasket surface and to prevent foreign material from getting into the valve body cavity.
10. Remove the packing flange nuts (key 21), packing flange (key 19), upper wiper (key 27), and packing follower (key 28). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall.
11. Clean the packing box and the following metal packing parts: packing follower, packing box ring (key 26), spring or lantern ring (key 24), and, for single arrangements of PTFE V-ring packing only, special washer (key 25).
12. Inspect the valve stem threads for any sharp edges that might cut the packing. A whetstone or emery cloth may be used to smooth the threads if necessary.
13. Remove the protective covering from the valve body cavity, and install the seat ring and cage using new seat ring gasket(s) (key 12), bonnet gasket (key 11), and cage gaskets (if applicable) (key 65). Install the plug, then slide the bonnet over the stem and onto the studs (key 13).

Figure 6. Installing Graphite Ribbon/Filament Packing Rings One at a Time



A2207-2

Note

The prelubricated hex nuts (key 14) referred to in step 14 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 14 include--but are not limited to--ensuring that the bonnet stud threads are clean, and that the hex nuts are evenly tightened to the specified torque values.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in tables 5, 6, and 7 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended on CL900, CL1500, and CL2500 valves. When operating temperature has been reached, perform this torquing procedure once again on CL600 valves.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

14. Lubricate the stud threads and the faces of the hex nuts (key 14) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Install the hex nuts and tighten them finger-tight. Stroke the valve several times to center the trim. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in tables 5, 6, and 7.

When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

Note

When installing packing rings, prevent entrapping air between the rings. Add the rings one at a time without forcing them below the chamfer of the packing box entrance chamber. As each successive ring is added, the stack should not be pushed down more than the thickness of the added ring (figure 6).

15. Install new packing and the metal packing box parts according to the appropriate arrangement in figures 3, 4, or 5. If desired, packing parts may be pre-lubricated with a silicon base grease for easier installation. Slip a smooth-edged pipe over the valve stem, and gently tap each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.

16. Slide the packing follower, wiper, and packing flange into position. Lubricate the packing flange studs (key 20) and the faces of the packing flange nuts (key 21). Install the packing flange nuts.

For the spring-loaded PTFE V-ring packing shown in figure 3, tighten the packing flange nuts until the shoulder on the packing follower (key 28) contacts the bonnet.

Note

Lubrication is not recommended on graphite packing.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 3 or 4. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 3 or 4.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 3 or 4. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

17. Mount the actuator on the valve body assembly, and reconnect the actuator and valve plug stems according to the procedures in the appropriate actuator instruction manual.

Trim Removal

Key numbers referenced in this procedure are shown in figures 10 through 19, except where indicated.

1. Remove the actuator and bonnet by following steps 1 through 6 of the replacing packing procedure. Observe all warnings and cautions in that procedure.
2. Lift the valve stem and attached valve plug out of the valve body. If the valve plug is to be reused, tape or otherwise protect the valve plug stem and the valve plug seating surface to prevent scratches.
3. Lift out the cage (key 2), the bonnet gasket (key 11), and (if applicable) the cage gaskets (key 65).
4. Remove the seat ring (key 4) and the seat ring gasket(s) (key 12).
5. Inspect the parts for wear or damage and replace if needed.
6. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

Valve Plug Maintenance

Key numbers used in this procedure are shown in figures 10 through 19, except where indicated.

1. With the valve plug (key 5) removed according to the trim removal procedure, proceed as appropriate:

For the NPS 1 and 1-1/2 CL900 or 1500 and NPS 1 CL2500 NotchFlo DST valves, proceed to step 2.

For all other NotchFlo DST valves, work the retaining ring (key 10) off the valve plug with a screwdriver. Carefully slide the backup ring, seal ring, and anti-extrusion rings (keys 9, 8, and 63) off the valve plug.

2. To replace the valve plug stem (key 6), drive out the pin (key 7), and unscrew the stem from the valve plug.

CAUTION

Never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem. This weakens the stem and may cause the stem to fail in service. If a new valve plug is required, always order a valve plug, stem, and pin as an assembly. Specify the correct part number of each of the three parts, but state that the parts are being ordered as an assembly.

A used valve plug may be reused with a new stem.

3. Thread the new stem into the valve plug and tighten it to the appropriate torque value given in table 8. Using the valve plug pin hole as a guide, drill the pin hole through the stem. Refer to table 8 for drill sizes.
4. Drive in the pin to lock the assembly.
5. If it is necessary to lap the seating surfaces, complete the lapping seats procedure before installing the seal ring. The Trim Replacement procedure provides seal ring installation instructions and valve reassembly instructions.

Lapping Seats

Key numbers referenced in this procedure are shown in figures 10 through 19, except where indicated.

With metal-seat constructions, lapping seating surfaces of the valve plug and seat ring (keys 5 and 4) can improve shutoff. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Note

NotchFlo DST valves use spiral-wound gaskets. These gaskets provide their seal by being crushed and therefore should never be reused. This includes reusing a gasket after the lapping procedure has been performed.

An “old” gasket can be used to lap the seat, however the gasket must be replaced with a new gasket.

To preserve the effects of lapping, do not change either the position of the seat ring in the valve body cavity or the position of the cage on the seat ring after lapping the seating surfaces. When the parts are removed for cleaning and replacement of the “old” gaskets, return them to the original positions.

Use the following procedure to lap the seating surfaces.

1. Install the following parts according to the instructions presented in the trim replacement procedure: “old” seat ring gasket(s) (key 12), seat ring (key 4), cage (key 2), “old” bonnet gasket(key 11), and (if applicable) the “old” cage gaskets (key 65).
2. Proceed as appropriate:

For a NotchFlo DST balanced valve, install the valve plug and stem assembly (keys 5 and 6)--without seal ring (key 8)--into the cage.

For a NotchFlo DST unbalanced valve, install the valve plug and stem assembly (keys 5 and 6) into the cage.

3. Install the bonnet (key 18) over the valve stem, and secure the bonnet with four of the hex nuts (key 14).
4. Attach a handle, such as a piece of strap iron secured by stem locknuts, to the valve stem. Rotate the handle alternately in each direction to lap the seats.
5. After lapping, disassemble as necessary (you may mark the position of the seat ring and cage with a soft tip marker). Clean the seating surfaces, replace the gaskets, reassemble (taking care to return the seat ring and cage to their original positions), and test for shutoff. Repeat the lapping procedure if necessary.

Trim Replacement

⚠ WARNING

Observe the warning at the start of the Maintenance section.

After all trim maintenance has been completed, reassemble the valve body by following the numbered steps below. Be certain that all gasketed surfaces have been well cleaned. Key numbers referenced in this procedure are shown in figures 10 through 19, except where indicated.

CAUTION

Inspect the seat ring, cage, bonnet, and body gasket surfaces. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm (0.003 inches) in height (the thickness of a human hair) can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, since they will prevent the gaskets from sealing properly.

1. Install the seat ring gasket (key 12) into the valve body. Install the seat ring (key 4).
2. For CL600, CL900, CL1500 4-Stage ≤ NPS 4, CL1500 6-Stage ≤ NPS 3 and CL2500 ≤ NPS 3 valves, install the second seat ring gasket (key 12) onto the seat ring.
For CL1500 4-Stage ≥ NPS 6, install the first cage gasket (key 65) onto the seat ring.
For CL1500 6-Stage ≥ NPS4 and CL2500 ≥ NPS 4 valves, install the gasket (key 68) onto the seat ring.
3. Install the cage.
4. For a NotchFlo DST balanced valve, install the anti-extrusion rings (key 63) onto the valve plug (key 5). Install the seal ring (key 8) onto the valve plug (key 5). Install the ring with the open side facing the valve plug stem end of the valve plug for flow-up applications (view A of figures 10 through 19). Slide the backup ring (key 9) onto the valve plug. Secure with the retaining ring (key 10).
5. Install the valve plug into the cage.
6. Install the bonnet gasket (key 11). For CL1500 4-Stage ≥ NPS 6, CL1500 6-Stage ≥ NPS4 and CL2500 ≥ NPS4 valves, install the second cage gasket (key 65) onto the cage.
7. Install the bonnet over the valve stem and onto the valve body.

Note

The prelubricated hex nuts (key 14) referred to in step 8 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 8 include--but are not limited to--ensuring that the bonnet stud threads are clean, and that the hex nuts are evenly tightened to the specified torque values.

Table 9. Actuator Groups by Type Number

Group 1 71 & 90 mm (2-13/16 and 3-9/16 Inch) Yoke Boss	Group 100 127 mm (5-Inch) Yoke Boss
585C 657 & 667 1008	585C 657
	Group 101 127 mm (5-Inch) Yoke Boss
	667

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in tables 5, 6, and 7 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended on CL900, CL1500, and CL2500 valves. When operating temperature has been reached, perform this torquing procedure once again on CL600 valves.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

8. Lubricate the stud threads and the faces of the hex nuts (key 14) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Install the hex nuts, but do not tighten them. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 5, 6, or 7. When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.
9. Install new packing and packing box parts per steps 15 and 16 of the Replacing Packing procedure. Be certain to observe the note given prior to step 15 of that procedure.
10. Mount the actuator by following the procedures in the actuator instruction manual. Check for packing leakage as the valve is being put into service. Retorque the packing flange nuts as required. See tables 3 and 4.

Parts Ordering

Each valve body-bonnet assembly is assigned a serial number which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, reference the valve serial number to obtain the correct eleven-character part number for each part; the following Parts Kit and Parts List is for information only.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Standard Packing Repair Kits (Non Live-Loaded)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
PTFE (Contains keys 22, 24, 25, 26, 27)	RPACKX00022	RPACKX00032	RPACKX00342	RPACKX00352
Double PTFE (Contains keys 22, 24, 26, 27)	RPACKX00052	RPACKX00062	RPACKX00362	RPACKX00372
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring], 24, and 26)	RPACKX00112	RPACKX00122	---	---
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring], and 26)	---	---	RPACKX00532	RPACKX00542
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring])	RPACKX00142	RPACKX00152	---	---

ENVIRO-SEAL™ Packing Retrofit Kits

Retrofit kits include parts to convert valves with existing standard bonnets to the ENVIRO-SEAL packing box construction.

Refer to figure 7 for key numbers for PTFE packing, to figure 8 for key numbers for Graphite ULF packing, and to figure 9 for key numbers for duplex packing.

PTFE kits include keys 200, 201, 211, 212, 214, 215, 217, 218, tag, and cable tie. Graphite ULF kits include keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 216, 217, tag, and cable tie. Duplex kits include keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, and cable tie.

Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances, and design specifications may adversely alter the performance of this packing kit.

For part numbers of individual components in the ENVIRO-SEAL packing kits, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#).

ENVIRO-SEAL Packing Retrofit Kits

PACKING MATERIAL	STEM DIAMETER AND YOKE BOSS DIAMETER, mm (INCH)			
	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
Double PTFE	RPACKXRT022	RPACKXRT032	RPACKXRT042	RPACKXRT052
Graphite ULF	RPACKXRT272	RPACKXRT282	RPACKXRT292	RPACKXRT302
Duplex	RPACKXRT222	RPACKXRT232	RPACKXRT242	RPACKXRT252

ENVIRO-SEAL Packing Repair Kits

Repair kits include parts to replace the “soft” packing materials in valves that already have ENVIRO-SEAL packing arrangements installed or in valves that have been upgraded with ENVIRO-SEAL retrofit kits.

Refer to figure 7 for key numbers for PTFE packing, to figure 8 for key numbers for Graphite ULF packing, and to figure 9 for key numbers for duplex packing.

PTFE repair kits include keys 214, 215, and 218. Graphite ULF repair kits include keys 207, 208, 209, 210, and 214. Duplex repair kits include keys 207, 209, 214, and 215.

Stems and packing box constructions that do not meet Fisher stem finish specifications, dimensional tolerances, and design specifications may adversely alter the performance of this packing kit.

For part numbers of individual components in the ENVIRO-SEAL packing kits, refer to instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves, [D101642X012](#).

ENVIRO-SEAL Packing Repair Kits

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
Double PTFE (Contains keys 214, 215, & 218)	RPACKX00202	RPACKX00212	RPACKX00222	RPACKX00232
Graphite ULF (Contains keys 207, 208, 209, 210, and 214)	RPACKX00602	RPACKX00612	RPACKX00622	RPACKX00632
Duplex (Contains keys 207, 209, 214, and 215)	RPACKX00302	RPACKX00312	RPACKX00322	RPACKX00332

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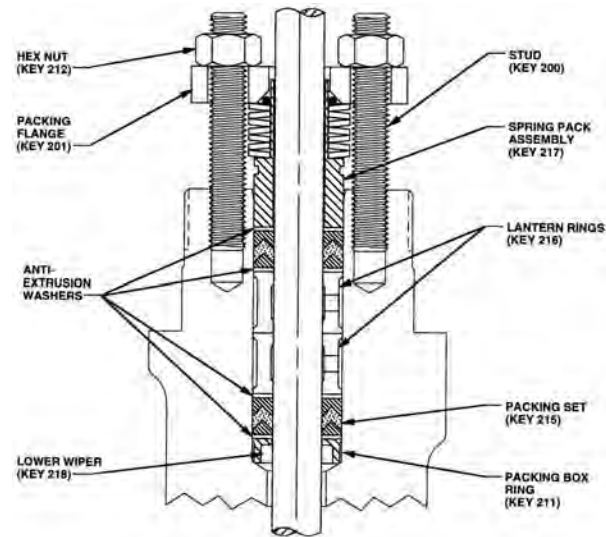
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Gasket Kits

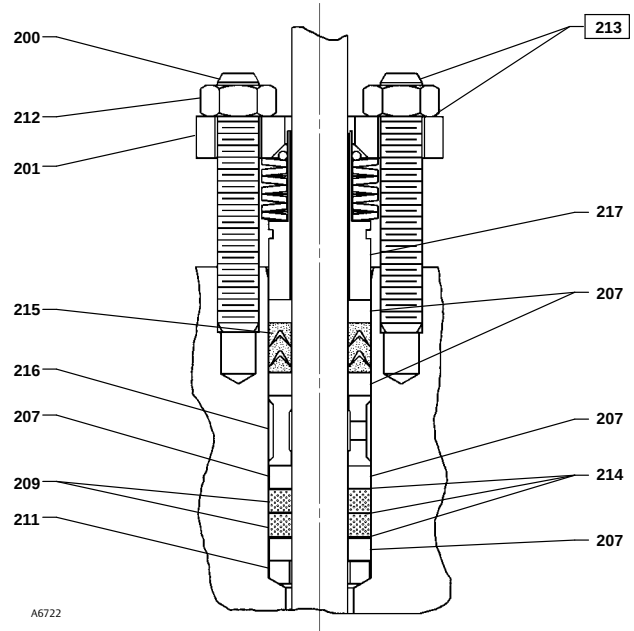
Rating	Valve Size, NPS	Key Number	Part Number	Rating	Valve Size, NPS	Key Number	Part Number		
CL300/CL600	1	Set	RGASKETXC72	CL1500 (6-stage)	1	Set	RGASKETXD42		
		11	1R2859X0042			11	12B6757X012		
		12	12B6758X012 (qty 2)			12	12B6758X012 (qty 2)		
CL300/CL600	2	Set	RGASKETXC82	CL1500 (6-stage)	2	Set	RGASKETXD52		
		11	1R3299X0042			11	12B6756X012		
		12	1R309999442 (qty 2)			12	12B6755X012 (qty 2)		
CL300/CL600	3	Set	RGASKETXC92	CL1500 (6-stage)	3	Set	RGASKETXE32		
		11	1R3484X0042			11	GG03231X012		
		12	1R384599442 (qty 2)			12	GG03232X012 (qty 2)		
CL300/CL600	4	Set	RGASKETXD12	CL1500 (6-stage)	4	Set	RGASKETXE42		
		11	1R3724X0042			11	GE26454X012		
		12	1L8270X0012 (qty 2)			12	GE26456X012		
CL300/CL600	6	Set	RGASKETXD22	CL1500 (6-stage)	4	65	10B5309X012 (qty 2)		
		12	GG04987X012			68	18A8275X012		
		65	GG01635X012 (qty 2)			CL1500 (6-stage)	6	Set	RGASKETXE52
CL300/CL600	8	Set	RGASKETXD32	CL1500 (6-stage)	6			11	GE26179X012
		11	1U5081X0052					12	GE26181X012
		12	1U508599442 (qty 2)			65	1P3680X0012 (qty 3)		
		65	1U508599442			68	GG14893X012		
		67	16A1942X012			Set	RGASKETXE12		
CL900/CL1500	1	Set	RGASKETXD42	CL2500	1	11	12B9359X042		
		11	12B6757X012			12	12B9360X052 (qty 2)		
		12	12B6758X012 (qty 2)			Set	RGASKETXE22		
CL900/CL1500	1-1/2	Set	RGASKETXD42	CL2500	2	11	12B4274X042		
		11	12B6757X012			12	12B4275X042 (qty 2)		
		12	12B6758X012 (qty 2)			Set	RGASKETXE32		
CL900/CL1500	2	Set	RGASKETXD52	CL2500	3	11	GG03231X012		
		11	12B6756X012			12	GG03232X012 (qty 2)		
		12	12B6755X012 (qty 2)			Set	RGASKETXE42		
CL900/CL1500	3	Set	RGASKETXD62	CL2500	4	11	GE26454X012		
		11	12B6027X012			12	GE26456X012		
		12	12B6030X012 (qty 2)			65	10B5309X012 (qty 2)		
CL900/CL1500	4	Set	RGASKETXD72	CL2500	4	68	18A8275X012		
		11	12B9350X012			Set	RGASKETXE52		
		12	12B9351X012 (qty 2)			11	GE26179X012		
CL900/CL1500	6	Set	RGASKETXD82	CL2500	6	12	GE26181X012		
		11	GE26041X012			65	1P3680X0012 (qty 3)		
		12	GE26043X012			68	GG14893X012		
		65	GE26042X012 (qty 2)						
CL900/CL1500	8	Set	RGASKETXD92						
		11	GE25826X012						
		12	GE25828X012						
		65	GE25827X012 (qty 3)						

Figure 7. Typical ENVIRO-SEAL Packing System with PTFE Packing



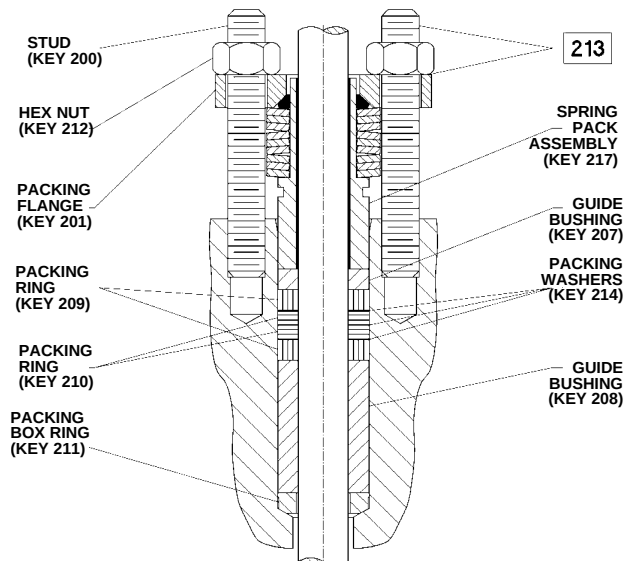
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Figure 9. Typical ENVIRO-SEAL Packing System with Duplex Packing



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Figure 8. Typical ENVIRO-SEAL Packing System with Graphite ULF Packing



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Parts List

Numerous available combinations of valve parts make selection of some parts difficult; when ordering valve parts for which a part number is not listed, provide the valve serial number with the order, permitting proper selection of replacement parts to be made at the factory.

Note

For part numbers not shown, contact your [Emerson sales office](#).

Key Description

- 1 Valve Body
If you need a valve body as a replacement part, order by valve size, serial number, and desired material.
- 2* Cage
- 4* Seat Ring
- 5* Valve Plug or Plug/Stem Assembly
- 6* Valve Stem
- 7* Pin
- 8* Seal Ring
- 9* Back Up Ring
- 10* Retaining Ring
- 11* Bonnet Gasket
- 12* Seat Ring Gasket
- 13 Stud, Cont Thd
- 14 Hex Nut
- 15 Anti-Seize Lubricant

Key Description

- 16 Nameplate (not shown)
- 17 Wire (not shown)
- 18 Bonnet---
- If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.
- 19 Packing Flange
- 20 Stud Bolt
- 21 Hex Nut
- 22* Packing Set
- 23* Packing Ring
- 24 Spring or Lantern Ring
- 25 Washer, Special
- 26* Packing Box Ring
- 27* Upper Wiper
- 28 Follower
- 29 Stud Bolt
- 30 Hex Nut
- 32 Yoke Locknut
- 38 Drive Screw
- 41 Flow Arrow
- 63* Anti-Extrusion Ring
- 65* Cage Gasket
- 66* Carbon Steel Washer
- 68 Gasket

Figure 10. Fisher NotchFlo DST CL600 Balanced Globe Valve Assembly (NPS 1 through 8)

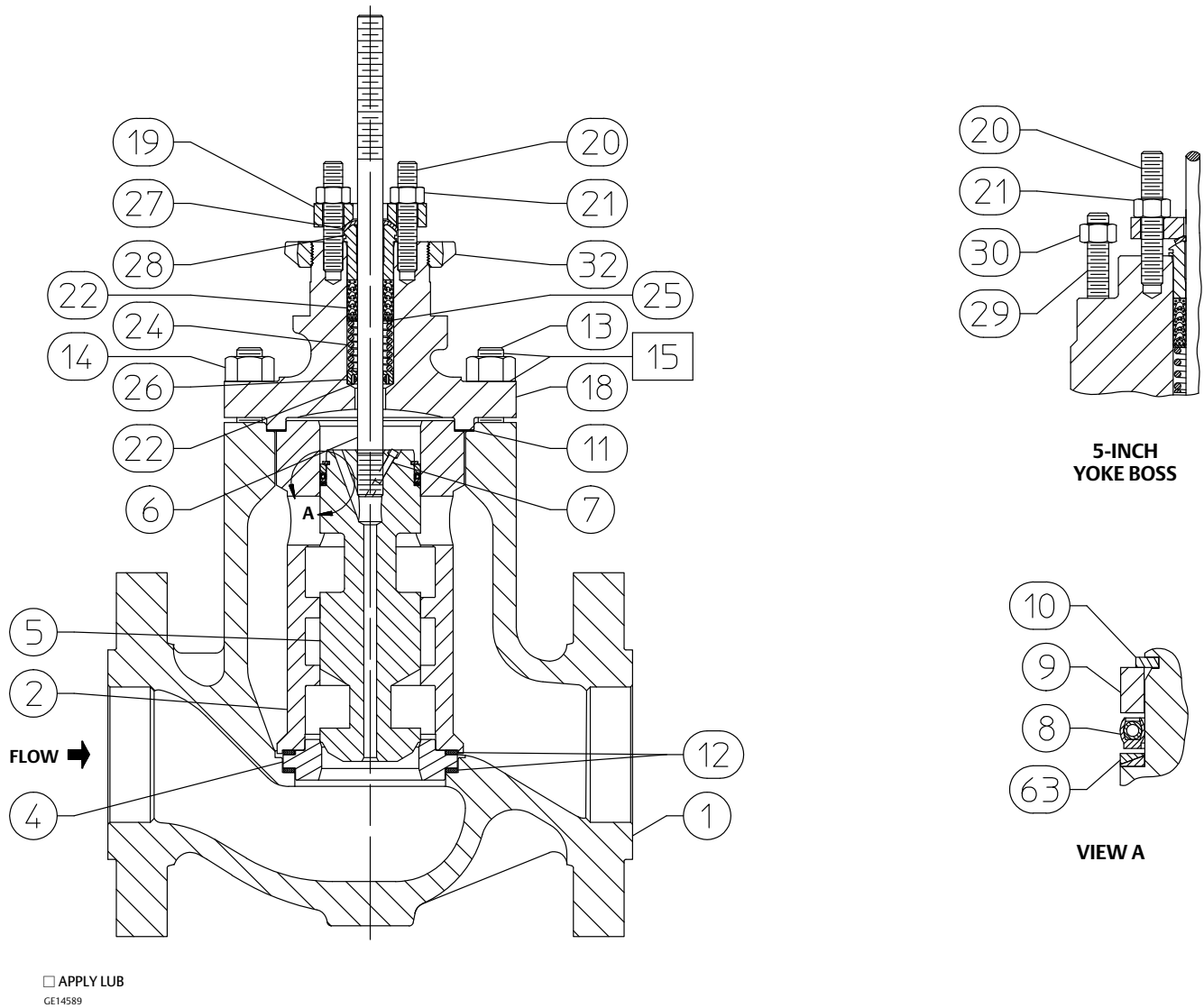
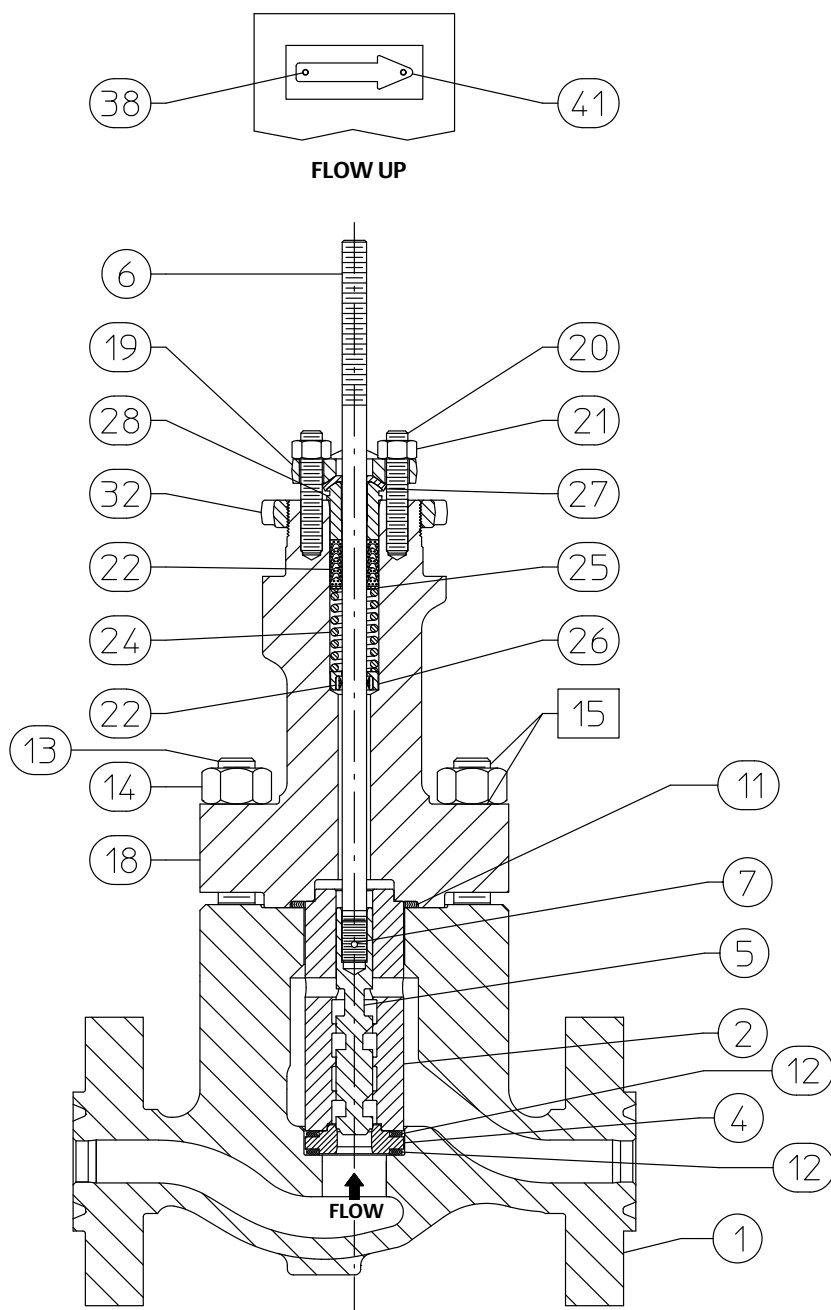


Figure 11. Fisher NotchFlo DST CL900 and 1500 Unbalanced Globe Valve Assembly (NPS 1 to 1-1/2)



□ APPLY LUB
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Figure 12. Fisher NotchFlo DST CL900 and 1500 Balanced Globe Valve Assembly (NPS 2 through 4)

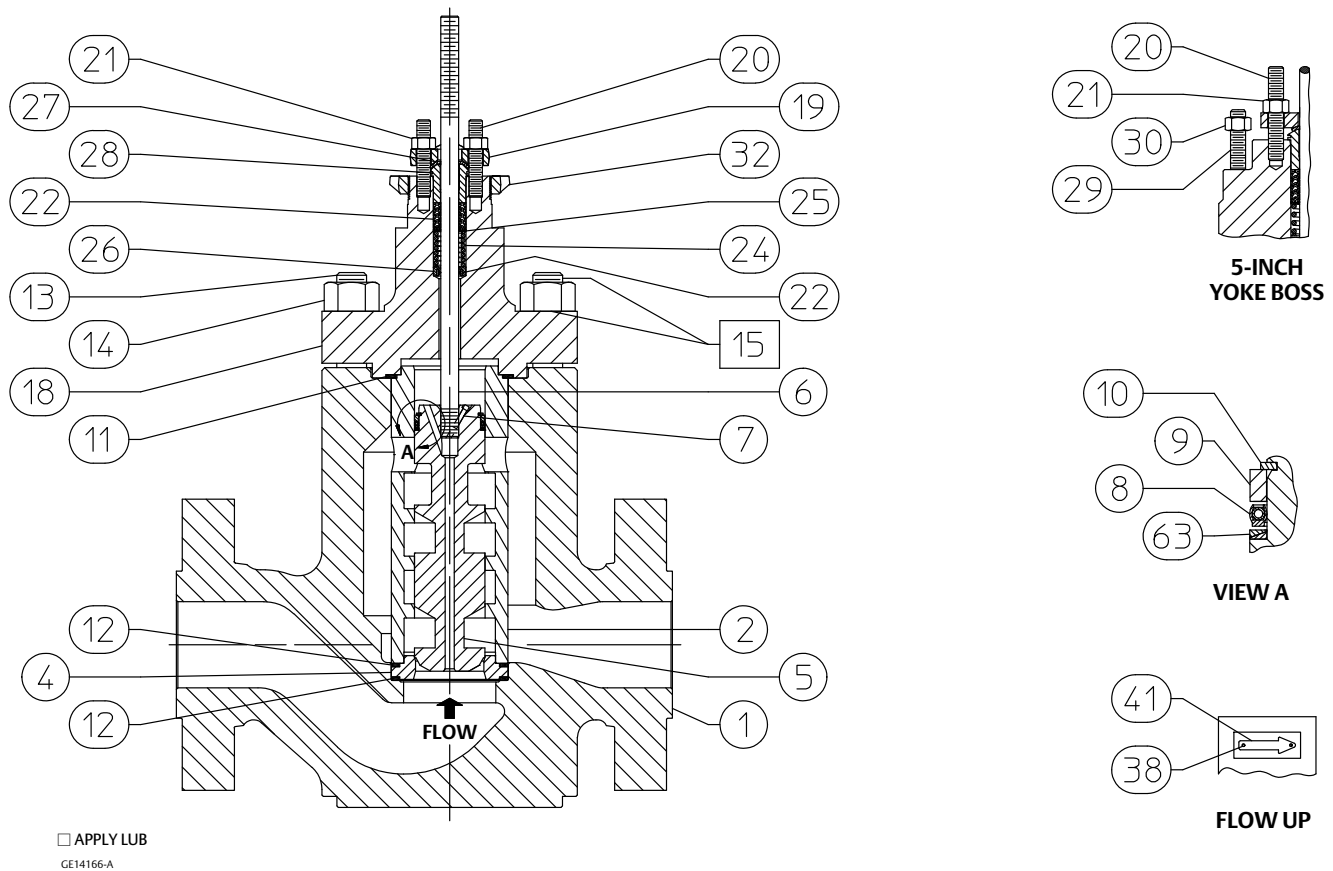
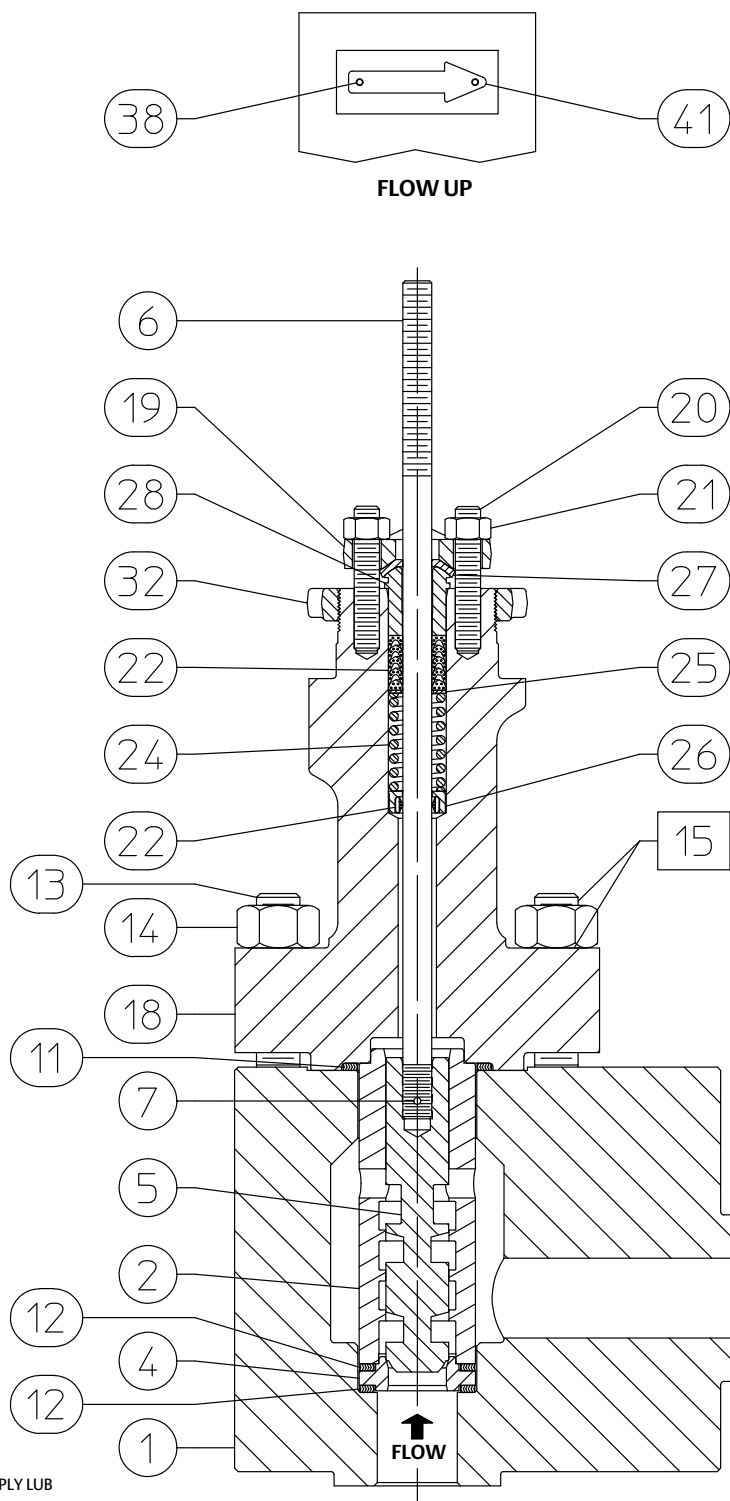
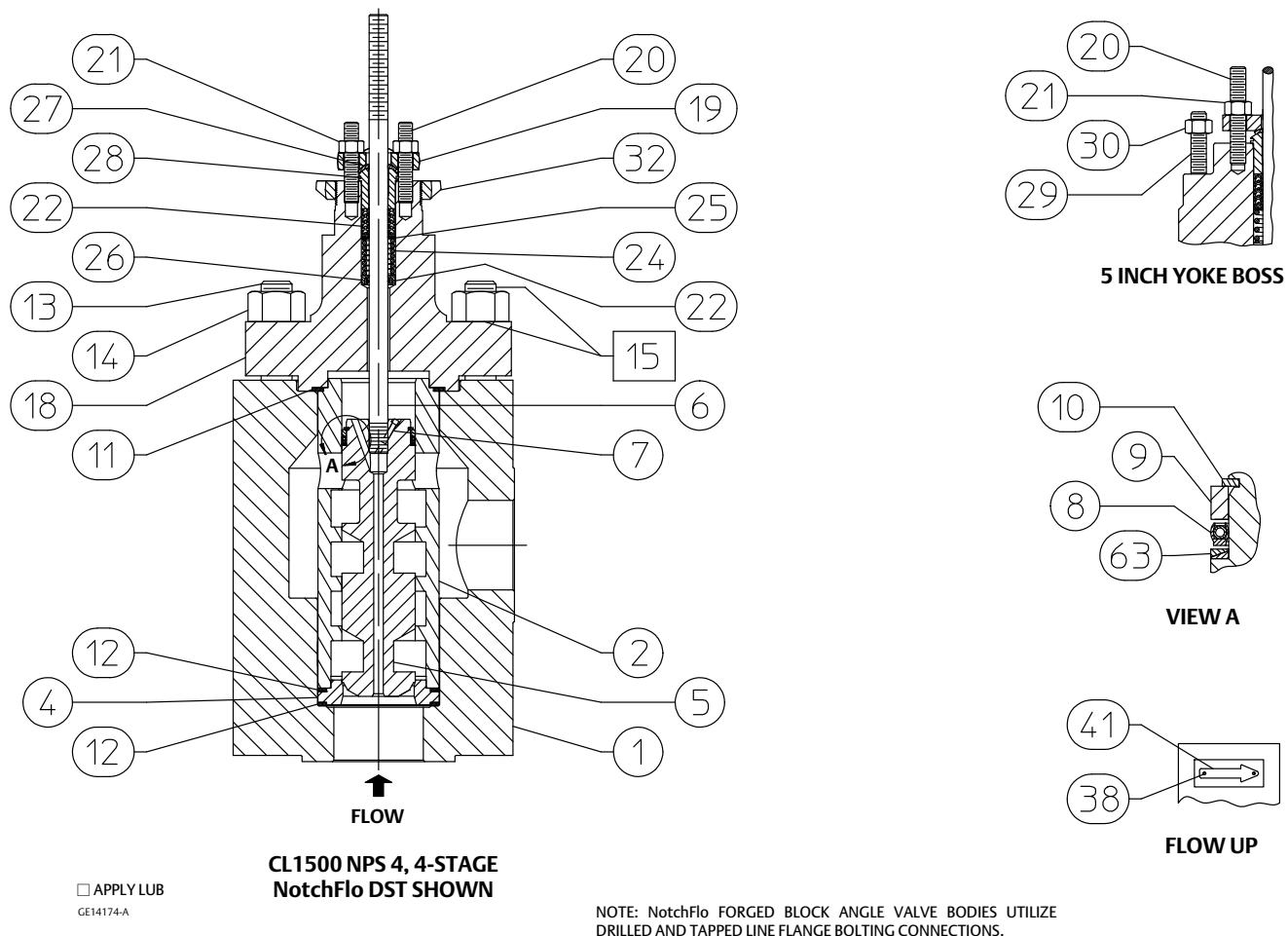


Figure 13. Fisher NotchFlo DST CL900 and 1500 Unbalanced Angle Valve Assembly (NPS 1 to 1-1/2)



NOTE: NotchFlo FORGED BLOCK ANGLE VALVE BODIES UTILIZE DRILLED AND TAPPED LINE FLANGE BOLTING CONNECTIONS.

Figure 14. Fisher NotchFlo DST CL900 and 1500 Balanced Angle Valve Assembly (NPS 2 through 4) and CL600 Balanced Angle Valve Assembly (NPS 1 through 8)



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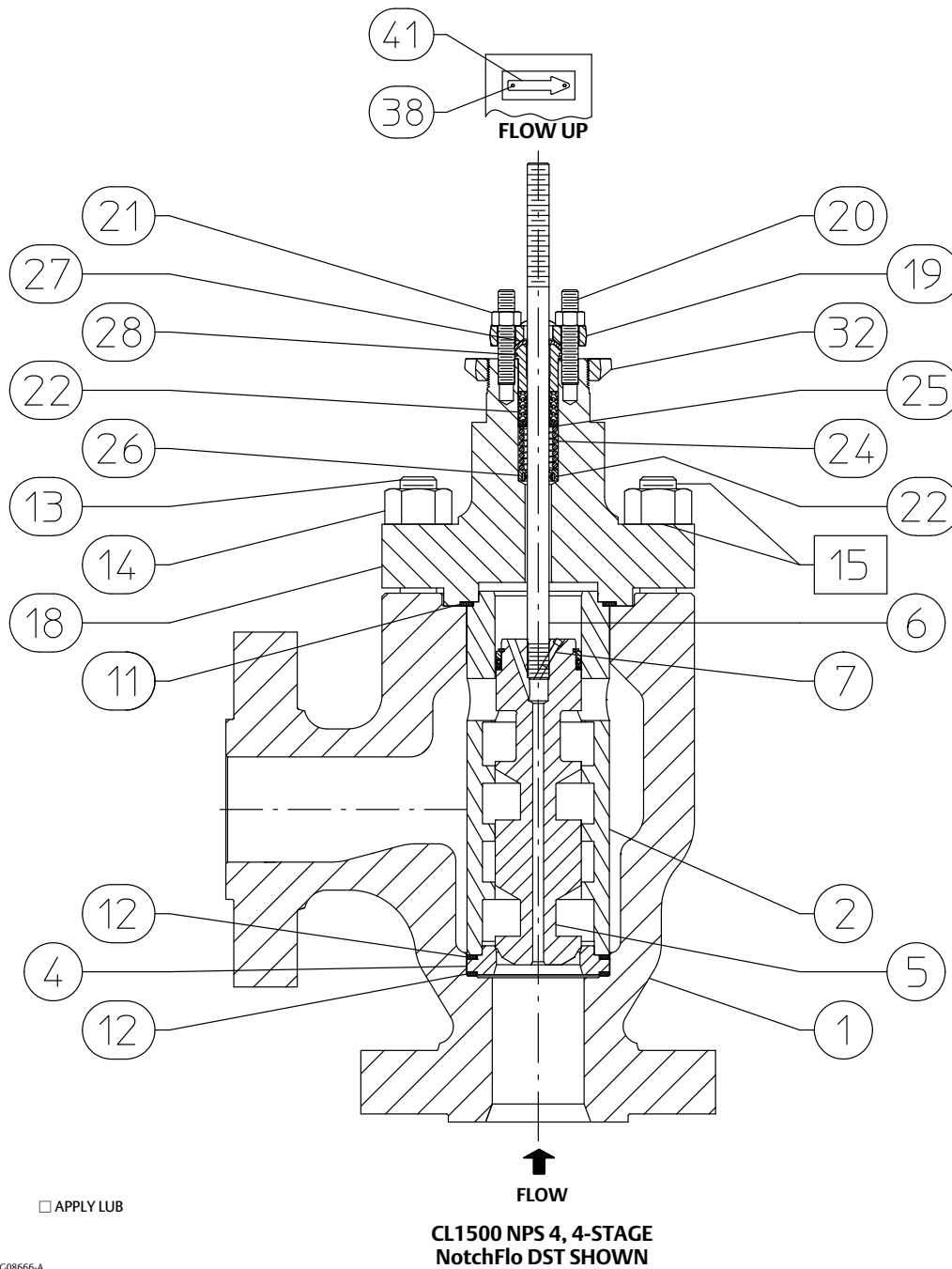
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Table 10. Block Forged Valve Body Line Bolting

Valve Size, NPS	Rating	Bolt Information	Depth of Thread	Quantity (Inclusive of Inlet and Outlet Flange)
1	CL300/600	5/8-11 UNC-2B	0.94	8
2		5/8-11 UNC-2B	0.94	16
3		3/4-10 UNC-2B	1.13	16
4	CL600	7/8-9 UNC-2B	1.32	16
	CL300	3/4-10 UNC-2B	1.13	16
6	CL600	1-8 UN-2B	1.5	24
	CL300	3/4-10 UNC-2B	1.23	24
8	CL600	1 1/8-8 UN-2B	1.69	24
	CL300	7/8-9 UNC-2B	1.31	24
1	CL900/1500	7/8-9 UNC-2B	1.31	8
1-1/2		1-8 UNC-2B	1.5	8
2		7/8-9 UNC-2B	1.31	16
3	CL900	7/8-9 UNC-2B	1.31	16
	CL1500	1 1/8-8 UN-2B	1.69	16
4	CL900	1 1/8-8 UN-2B	1.41	2
		1 1/8-8 UN-2B	1.69	14
	CL1500	1 1/4-8 UN-2B	1.45	4
		1 1/4-8 UN-2B	1.50	4
		1 1/4-8 UN-2B	1.88	8
6	CL1500	1 3/8-8 UN-2B	1.72	6
		1 3/8-8 UN-2B	2.06	18
8	CL1500	1 5/8-8 UN-2B	1.8	2
		1 5/8-8 UN-2B	2.44	22
1	CL2500	7/8-9 UNC-2B	1.31	8
2	CL2500	1-8 UNC-2B	1.5	16
3	CL2500	1 1/4-8 UN-2B	1.87	16
4	CL2500	1 1/2-8 UN-2B	1.65	2
		1 1/2-8 UN-2B	2.25	6
		1 1/2-8 UN-2B	2.13	8
6	CL2500	2-8 UN-2B	2.5	2
		2-8 UN-2B	3	6
		2-8 UN-2B	2.65	8

Figure 15. Fisher NotchFlo DST CL1500 Cast Angle Valve Assembly (NPS 1 through 8)



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Figure 16. Fisher NotchFlo DST CL1500 ≥ NPS 6 Balanced Angle Valve Assembly

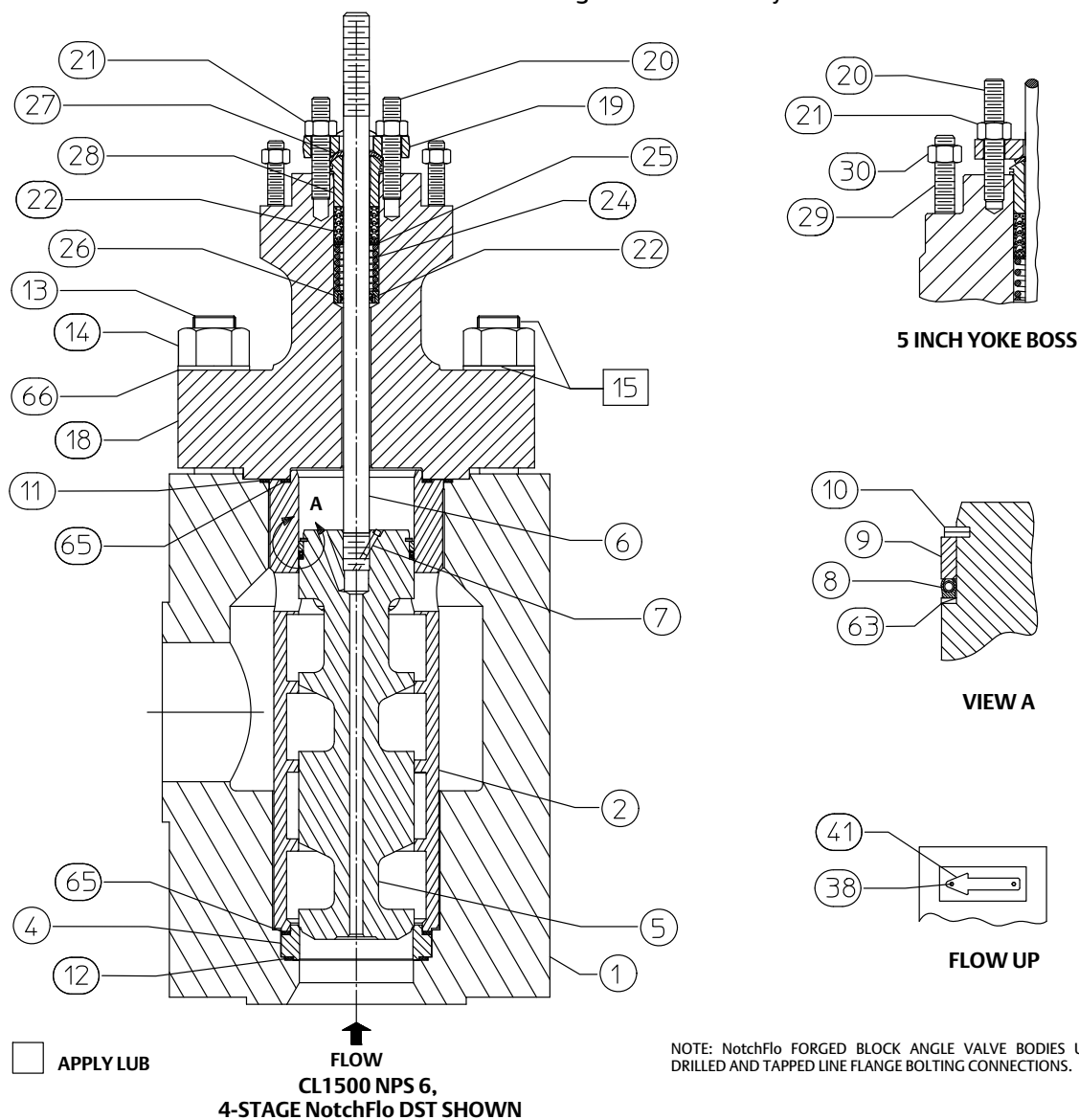


Figure 17. Fisher NotchFlo DST CL2500 6-Stage Unbalanced Angle Valve Assembly (NPS 1)

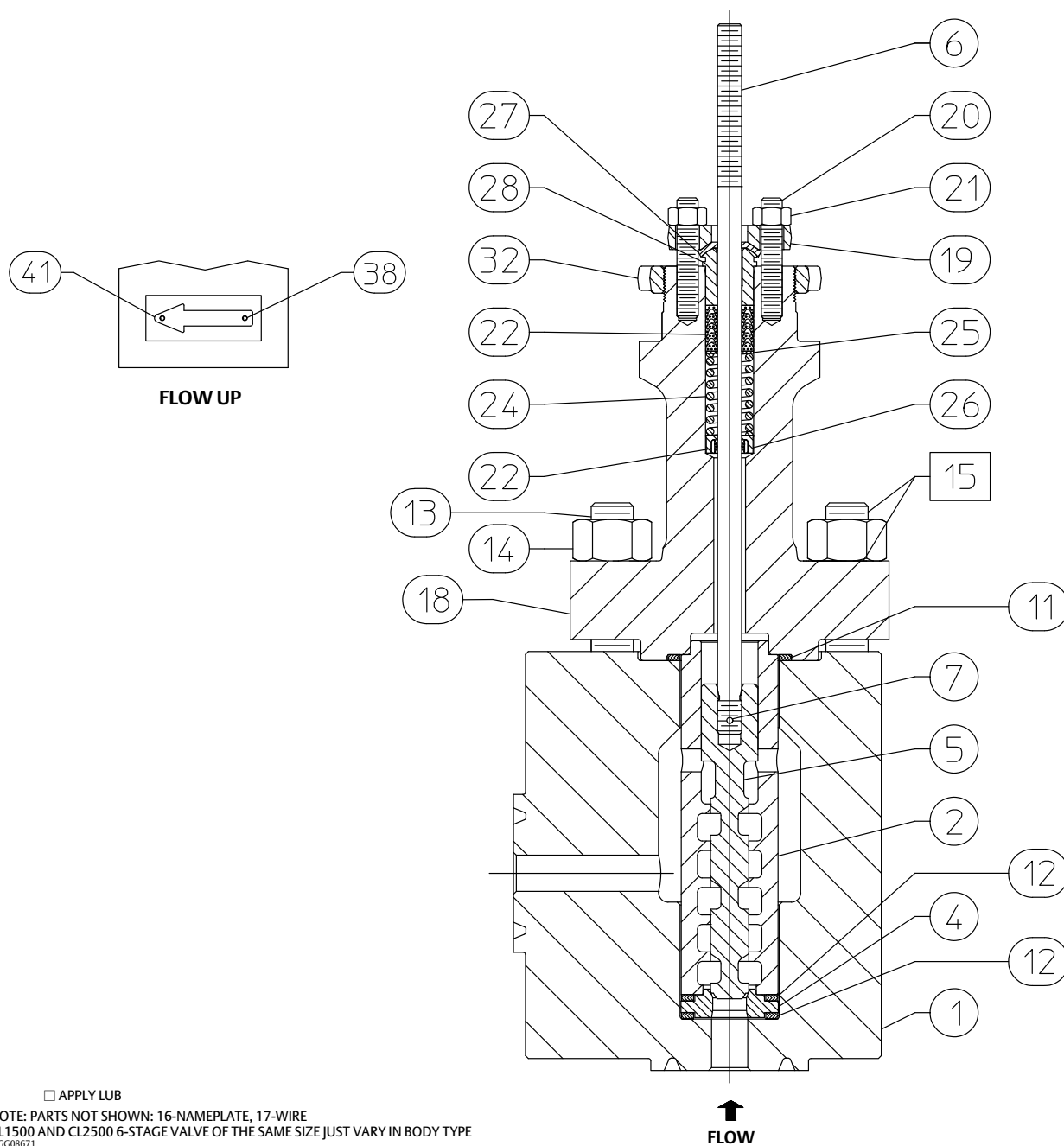
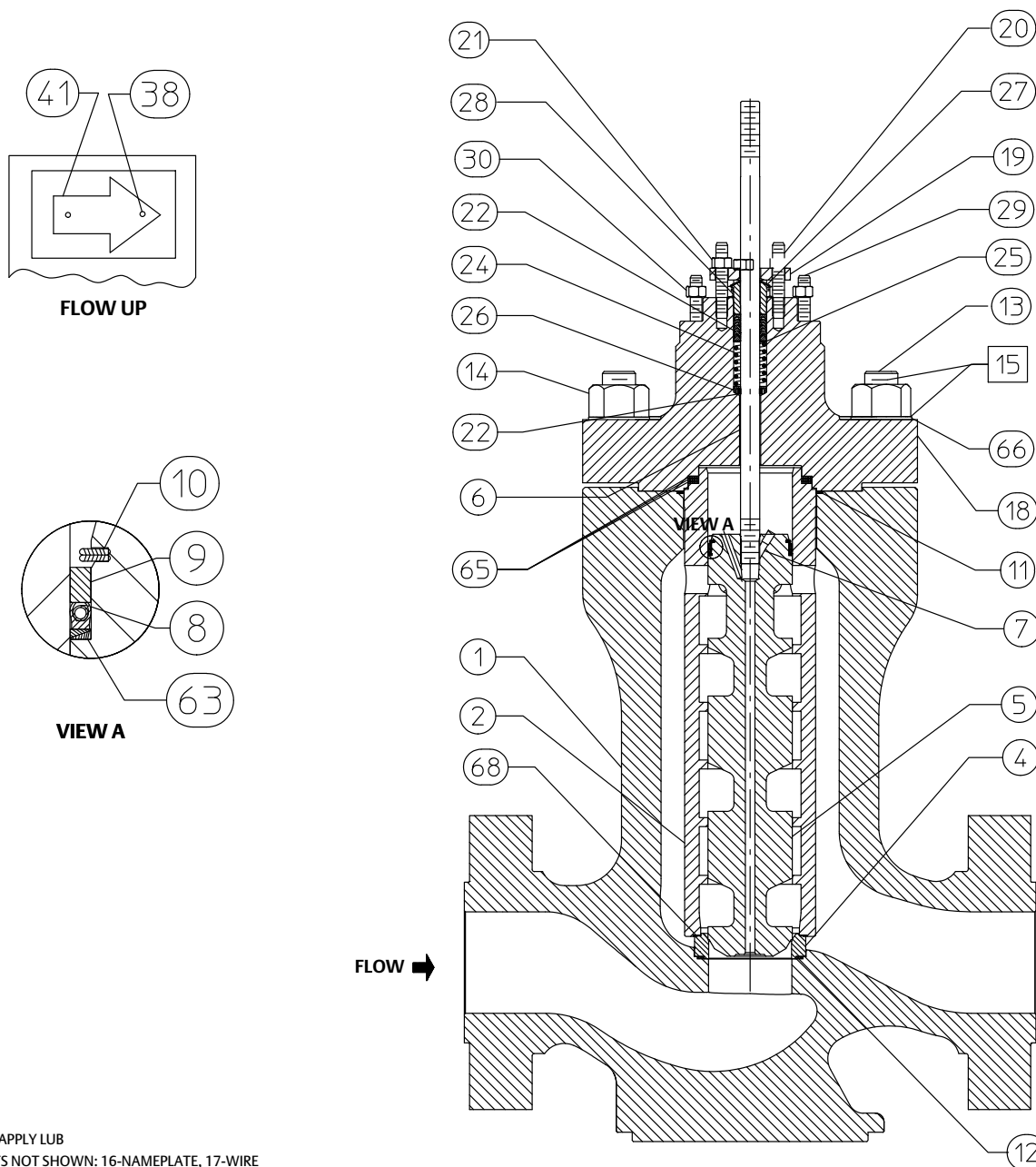


Figure 18. Fisher NotchFlo DST CL1500 and CL2500 6-Stage Globe Valve Assembly (NPS 4 and 6)

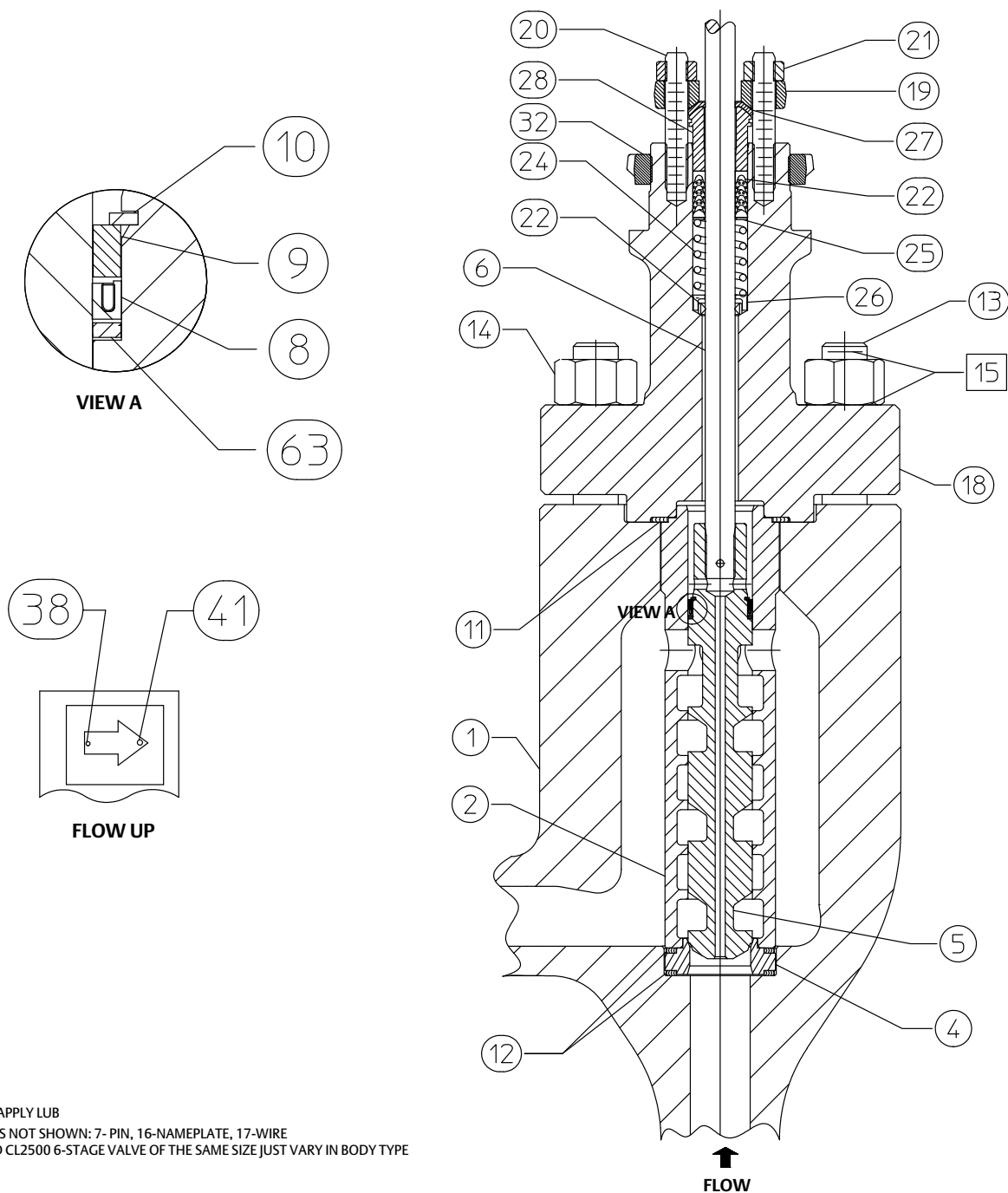


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NOTE: PARTS NOT SHOWN: 16-NAMEPLATE, 17-WIRE
CL1500 AND CL2500 6-STAGE VALVE OF THE SAME SIZE JUST VARY IN BODY TYPE

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Figure 19. Fisher NotchFlo DST CL2500 6-Stage Cast Angle Valve Assembly (NPS 2 and 3)



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Fisher™ NPS 8 CHP Control Valve

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Figure 1. Fisher CHP NPS 8 Control Valve



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher CHP control valve. Refer to separate manuals for instructions covering the actuator, positioner, and accessories.

Do not install, operate, or maintain CHP valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Table 1. Specifications

Size/Pressure Class/Body Materials NPS 8 / CL2500 / WCC, WC9 Maximum Inlet Pressure and Temperature⁽¹⁾ Consistent with ASME B16.34 except CHPT PEEK anti-extrusion seal ring construction. Maximum temperature limit is 380°C (716°F). End Connection Style Buttweld Ends : All butt welding end schedules per ASME B16.25 Bonnet and Body-to-Bonnet Bolting Plain Bonnet: 5 inch H Yoke Boss Studs: Steel A 193-B7/NCF2 Nuts: Steel A 194-2H/NCF2	Flow Coefficient Maximum Cv: 514 Km: 0.74 Fl: 0.86 Modified Equal Percentage Flow Direction Flow down and up Stem Diameter 1-1/4 inch VSC (Valve Stem Connection) Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4⁽²⁾ CHPT: Class IV (standard), Class V (optional) CHPD: Class V with Bore seal (standard) Weight Estimated Valve Body and Bonnet Assemblies 810 kg Please consult Singapore SD&S for any queries
---	---

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

2. For Boiler feedwater application, proper use of a block valve during closing of the control valve is recommended to minimize control valve trim damage.

Description

The CHP globe valve (figure 1) has a metal seat, cage guiding, quick change trim, and push-down-to-close valve plug action. The valve uses a balanced valve plug. To provide a seal between the cage and a balanced valve plug, the balanced valve plug uses a PEEK (Poly Ether Ether Ketone) anti-extrusion ring with a pressure-assisted spring-loaded seal ring.

Educational Services

For information on available courses for the Fisher CHP valve, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Specifications

Specifications for the CHP valves are shown in table 1.

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or property damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Because some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first checking with your [Emerson sales office](#) or Local Business Partner.

1. Before installing the valve, inspect it to ensure that the valve body cavity is free of foreign material.
2. Clean out all pipelines to remove scale, welding slag, and other foreign materials before installing the valve.
3. Flow through the valve must be in the direction indicated by the flow arrow, which is attached to the valve body.
4. Use accepted piping practices when installing the valve in the pipeline.
5. Install a three-valve bypass around the valve if continuous operation is required during maintenance.
6. If the actuator and valve body are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.
7. If the valve body was shipped without packing installed in the packing box, install the packing before putting the valve body into service. Refer to instructions given in the Packing Maintenance procedure.

WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Lifting Guidelines

CAUTION

Care must be taken when lifting the valve/actuator assembly to ensure the accessories and tubing are not damaged in the process. The entire assembly with accessories weighs approximately 1500 kg (3310 lb). Make sure to use appropriate lifting straps/hoist rings capable of lifting this weight.

⚠ WARNING

Avoid personal injury or damage caused by uncontrolled movement or dropping of the assembly valve:

- Swivel hoist rings are sized to lift only the valve and actuator. Do not attached piping or other structures to the valve and actuator assembly when lifting swivel hoist rings.
- Take appropriate precautions to avoid unbalanced loading which may result in sudden swinging or movement of the assembled unit, including additional lifting and/or support methods when necessary.
- Do not use eyebolts when lifting the valve or valve actuator assembly due to variable loading angles inherent to valve maintenance and installation.
- Failure to utilize safe lifting practices may result in equipment damage and/or personal injury.

Lifting Valve/Actuator Assembly

To lift the assembly, insert swivel hoist rings (recommend 3/4-10 UNC) into the four lifting hole locations on the outside diameter of the bonnet flange. The lifting point must be high enough away from the top of the accessory mountings to prevent damage to accessories or piping. When lifting the valve and actuator assembly, a strap around the actuator may be required to ensure lifting stability. Lifting the assembly without using the hoist rings is not preferred.

Lifting Bonnet Only

To lift the bonnet, insert swivel hoist rings (recommend 3/4-10 UNC) into the four lifting hole locations on the outside diameter of the bonnet flange. Use proper length, or adjustable chains to ensure the bonnet and valve body mating surfaces remain parallel when hoisted.

Maintenance

Refer to figure 4.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing maintenance and trim maintenance. All maintenance operations may be performed with the valve in the line.

⚠ WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.

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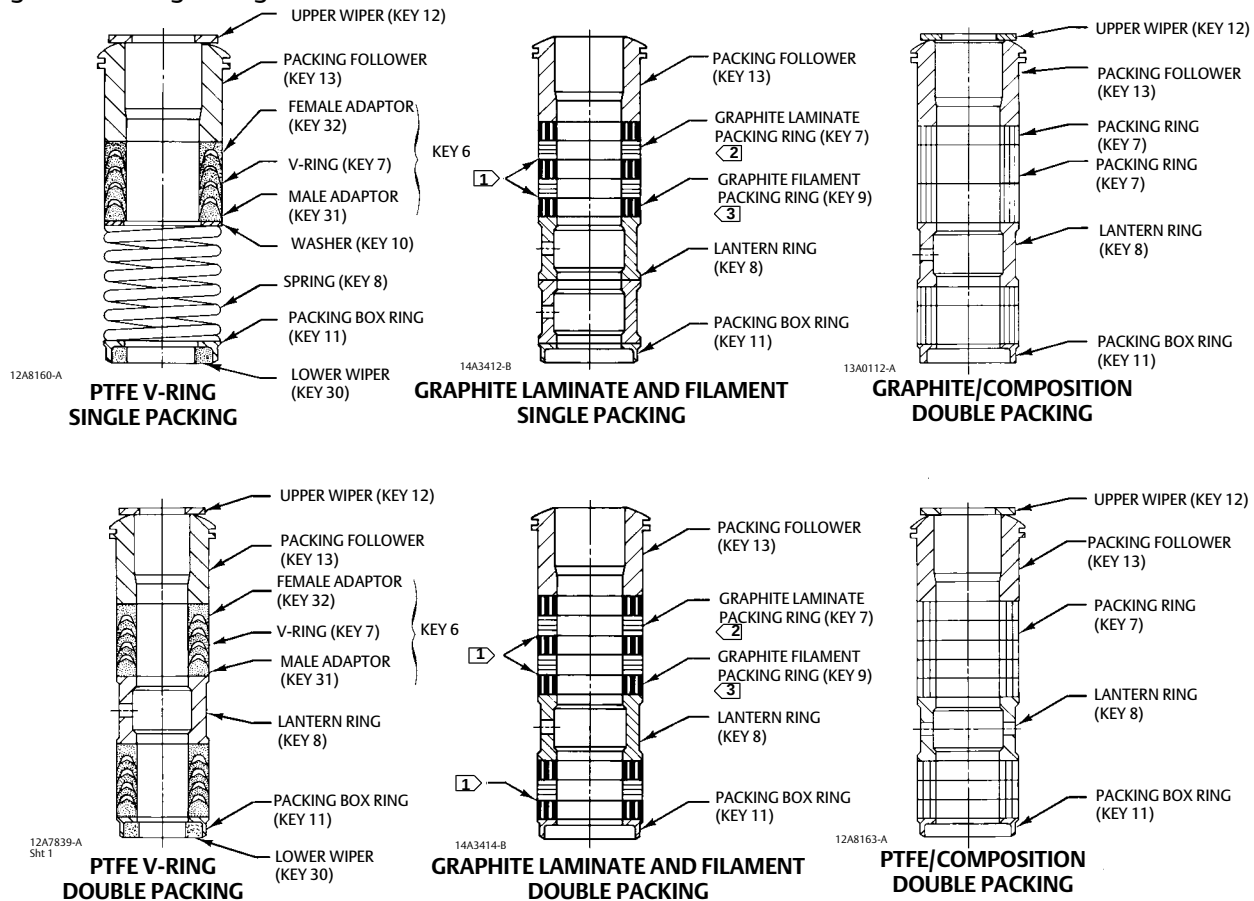
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- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Figure 2. Packing Arrangements



PACKING ARRANGEMENTS FOR 31.8 mm (1-1/4 INCH) VALVE STEMS

- NOTES:
- [1] 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS. USE ONLY ONE BELOW EACH GRAPHITE LAMINATE RING.

- [2] HAS THE APPEARANCE OF FLAT WASHERS PRESSED TOGETHER.
- [3] HAS THE APPEARANCE OF A WOVEN OR BRAIDED RING.

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Table 2. CL2500 Recommended Torque for Packing Flange Nuts (non live-loaded)

VALVE STEM DIAMETER		PRESSURE RATING	TORQUE			
			N•m		lbf•ft	
mm	Inches		Min	Max	Min	Max
31.8	1-1/4	CL2500	81	122	60	90

Table 3. Torque for Body-to-Bonnet Bolting Using Anti-Seize Lubricant

VALVE RATING	BOLT TORQUES	
	SA193-B7, B16	
	N•m	lbf•ft
CL2500	4240	3130

Table 4. Valve Stem Connection Torque and Hole Size for Pin

VALVE STEM DIAMETER		TORQUE, MINIMUM TO MAXIMUM		HOLE SIZE ⁽¹⁾	
mm	Inches	N•m	Lbf•ft	mm	Inch
31.8	1-1/4	735-993	544-736	6.38-6.45	0.251-0.254

1. VSC (Valve Stem Connection) size is 1 1/4-inch.

CAUTION

The CHP valve uses spiral-wound gaskets which are crushed to provide their seal. A spiral-wound gasket should never be reused. Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket must be installed upon reassembly. This is necessary to ensure a good gasket seal, since the used gasket will not seal properly.

The spiral-wound gaskets are of special design. Failure to use genuine Fisher replacement parts may result in valve damage and/or failure.

Packing Maintenance

Key numbers refer to figure 2 for PTFE V-ring packing and graphite ribbon/filament, unless otherwise indicated.

⚠ WARNING

To avoid personal injury or equipment damage resulting from packing leakage, inspect the valve plug stem and packing box wall for nicks or scratches while performing the following procedures. Use care to avoid damaging these surfaces.

For spring-loaded single PTFE V-ring packing, the spring maintains a sealing force on the packing. If leakage is noted around the packing follower, check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the Replacing Packing procedure.

If there is undesirable packing leakage with other than spring-loaded PTFE V-ring packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts to at least the minimum recommended torque in table 2. However, do not exceed the maximum recommended torque in table 2 or excessive friction may result. If leakage continues, replace the packing by following the numbered steps presented in the Replacing Packing procedure.

If the packing is relatively new and tight on the valve plug stem, and if tightening the packing flange nuts does not stop the leakage, it is possible that the stem is worn or nicked so that a seal cannot be made. The surface finish of a new stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. While replacing the packing according to the Replacing Packing procedure, inspect the valve plug stem and packing box wall for nicks or scratches.

Adding Packing Rings

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

To avoid personal injury or equipment damage resulting from packing leakage, inspect the valve plug stem and packing box wall for nicks or scratches while performing the following procedures.

Use care to avoid damaging these surfaces.

Key numbers referred to in this procedure are shown in figure 4, unless otherwise indicated.

When using packing with a lantern ring it may be possible to add packing rings above the lantern ring as a temporary measure without removing the actuator from the valve body.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the packing flange nuts and lift the packing flange, upper wiper, and packing follower away from the valve body.
3. It may be possible to dig out the old packing rings on top of the lantern ring, but use care to avoid scratching the valve plug stem or packing box wall. Clean all metal parts to remove particles that would prevent the packing from sealing.
4. Remove the stem connector and slip the packing rings over the end of the valve plug stem.
5. Reassemble the packing follower, upper wiper, packing flange, and packing flange nuts.
6. Reconnect the body-actuator stem connection according to the appropriate actuator instruction manual.
7. Tighten the packing flange nuts only far enough to stop leakage under operating conditions. Check for leakage around the packing follower when the valve is being put into service. Retighten the packing flange nuts as required (see table 2).

Replacing Packing

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

To avoid personal injury or equipment damage resulting from packing leakage, inspect the valve plug stem and packing box wall for nicks or scratches while performing the following procedures.

Use care to avoid damaging these surfaces.

Key numbers referred to in this procedure are shown in figure 4, unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the cap screws in the stem connector, and separate the two halves of the stem connector. Then exhaust all actuator pressure, if any was applied, and disconnect the actuator supply and any leakoff piping.
3. Remove the hex nuts (key 11), and remove the actuator from the bonnet (key 14).
4. Loosen the packing flange nuts so that the packing is not tight on the valve plug stem (key 4). Remove the stem locknuts from the valve plug stem threads.

CAUTION

When lifting the bonnet (key 14), be sure that the valve plug and stem assembly (keys 3 and 4) remains on the seat ring (key 7). This avoids damage to the seating surfaces as a result of the assembly dropping from the bonnet after being lifted part way out. The parts are also easier to handle separately. Use care to avoid damaging gasket sealing surfaces.

⚠ WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. If the cage sticks to the bonnet, proceed carefully with bonnet removal and support the cage so that it will not fall unexpectedly from the bonnet.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

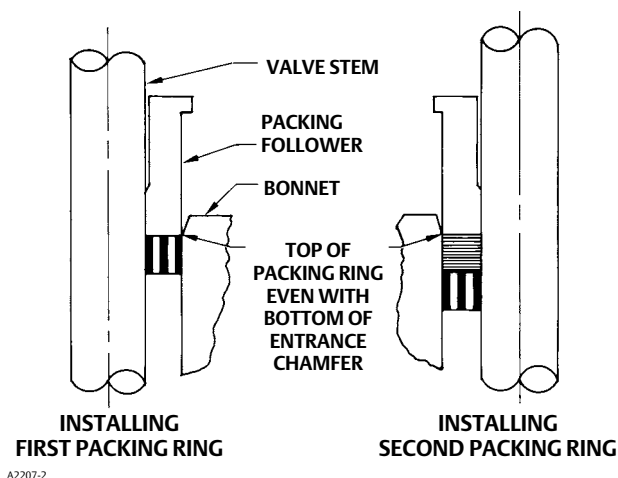
5. Hex nuts (key 12) attach the bonnet to the valve body. Loosen these nuts approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed to the next step. If fluid leaks from the joint, the process pressure was not relieved from the valve as noted in the Warning at the beginning of the Maintenance section in this manual.
6. Unscrew the hex nuts (key 12) and carefully lift the bonnet off the valve stem. If the valve plug and stem assembly starts to lift with the bonnet, use a brass or lead hammer on the end of the stem and tap it back down. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.
7. Remove the valve plug (key 3), bonnet gasket (key 16) and three cage gaskets (key 15), seat ring (key 2), and the seat ring gasket (key 17).

CAUTION

Inspect the seat ring, cage, bonnet, and body gasket surfaces. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm (0.003 inch) in height (the thickness of a human hair) can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, as they will prevent the gaskets from sealing properly.

8. Clean all gasket surfaces with a good wire brush. Clean in the same direction as the surface serrations, not across them.
9. Cover the opening in the valve body to protect the gasket surface and to prevent foreign material from getting into the valve body cavity.
10. Remove the packing flange nuts, packing flange, upper wiper, and packing follower. Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall.
11. Clean the packing box and the following metal packing parts: packing follower, packing box ring, spring or lantern ring, and, for single arrangements of PTFE V-ring packing only, special washer.
12. Inspect the valve stem threads for any sharp edges that might cut the packing. A whetstone or emery cloth may be used to smooth the threads if necessary.
13. Remove the protective covering from the valve body cavity, and install the seat ring and cage using a new seat ring gasket (key 17), bonnet gasket (key 16) and three cage gaskets (key 15). Install the plug, then slide the bonnet over the stem and onto the studs (key 11).

Figure 3. Installing Graphite Ribbon/Filament Packing Rings One at a Time



Note

The prelubricated hex nuts (key 12) referred to in step 14 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 14 include -- but are not limited to -- ensuring that the bonnet stud threads are clean, and that the hex nuts are evenly tightened to the specified torque values.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 3 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure. Hot torquing is not recommended.

14. Lubricate the stud threads and the faces of the hex nuts (key 12) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Install the hex nuts and tighten them finger-tight. Stroke the valve several times to center the trim. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 3.

When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

Note

When installing packing rings, prevent entrapping air between the rings. Add the rings one at a time without forcing them below the chamfer of the packing box entrance chamber. As each successive ring is added, the stack should not be pushed down more than the thickness of the added ring (figure 3).

15. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 2. If desired, packing parts may be pre-lubricated with a silicon base grease for easier installation. Slip a smooth-edged pipe over the valve stem, and gently tap each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.
16. Slide the packing follower, wiper, and packing flange into position. Lubricate the packing flange studs and the faces of the packing flange nuts. Install the packing flange nuts.

For the spring-loaded PTFE V-ring packing shown in figure 2, tighten the packing flange nuts until the shoulder on the packing follower contacts the bonnet.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 2. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 2.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 2. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

17. Mount the actuator on the valve body assembly, and reconnect the actuator and valve plug stems according to the procedures in the appropriate actuator instruction manual.

Trim Removal

Note

Avoid personal injury by supporting the valve properly while removing the trim or while servicing the trim or internal body.

Key numbers referenced in this procedure are shown in figure 4, except where indicated.

1. Remove the actuator and bonnet by following steps 1 through 6 of the replacing packing procedure. Observe all warnings and cautions in that procedure.
2. Lift the valve stem and attached valve plug out of the valve body. If the valve plug is to be reused, tape or otherwise protect the valve plug stem and the valve plug seating surface to prevent scratches.
3. Lift out the cage (key 2) and the bonnet gasket (key 16) and three cage gaskets (key 15).
4. Remove the seat ring (key 6) and the seat ring gasket (key 17).
5. Inspect the parts for wear or damage and replace if needed.
6. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

Valve Plug Maintenance

Key numbers used in this procedure are shown in figure 4, except where indicated.

1. With the valve plug (key 3) removed according to the trim removal procedure, proceed as appropriate:

For the CHPT valve, work the retaining ring (key 9) off the valve plug with a screwdriver. Carefully slide the backup ring, anti-extrusion rings (keys 8 and 10), and seal ring (key 7) off the valve plug.

2. To replace the valve plug stem (key 4), drive out the pin (key 5), and unscrew the stem from the valve plug.

CAUTION

Never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem. This weakens the stem and may cause the stem to fail in service. If a new valve plug is required, always order a valve plug, stem, and pin as an assembly. Specify the correct part number of each of the three parts, but state that the parts are being ordered as an assembly. A used valve plug may be reused with a new stem.

3. Thread the new stem into the valve plug and tighten it to the appropriate torque value given in table 4. Using the valve plug pin hole as a guide, drill the pin hole through the stem. Refer to table 4 for drill sizes.

4. Drive in the pin to lock the assembly.
5. If it is necessary to lap the seating surfaces, complete the lapping seats procedure before installing the seal ring. The Trim Replacement procedure provides seal ring installation instructions and valve reassembly instructions.

Lapping Seats

Key numbers referenced in this procedure are shown in figure 4, except where indicated.

With metal-seat constructions, lapping seating surfaces of the valve plug and seat ring (keys 3 and 6) can improve shutoff. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Note

The CHP valve uses spiral-wound gaskets. These gaskets provide their seal by being crushed and therefore should never be reused. This includes reusing a gasket after the lapping procedure has been performed.

An “old” gasket can be used to lap the seat, however the gasket must be replaced with a new gasket.

To preserve the effects of lapping, do not change either the position of the seat ring in the valve body cavity or the position of the cage on the seat ring after lapping the seating surfaces. When the parts are removed for cleaning and replacement of the “old” gaskets, return them to the original positions.

Use the following procedure to lap the seating surfaces.

1. Install the following parts according to the instructions presented in the trim replacement procedure: “old” seat ring gasket (key 17), seat ring (key 6), cage (key 2) and “old” bonnet gasket (key 16) and three cage gaskets (key 15).
2. Install the valve plug and stem assembly (keys 3 and 4) into the cage.
3. Install the bonnet (key 14) over the valve stem, and secure the bonnet with four of the hex nuts (key 12).
4. Attach a handle, such as a piece of strap iron secured by stem locknuts, to the valve stem. Rotate the handle alternately in each direction to lap the seats.
5. After lapping, disassemble as necessary (you may mark the position of the seat ring and cage with a soft tip marker). Clean the seating surfaces, replace the gaskets, reassemble (taking care to return the seat ring and cage to their original positions), and test for shutoff. Repeat the lapping procedure if necessary.

Trim Replacement

WARNING

Observe the warning at the start of the Maintenance section.

After all trim maintenance has been completed, reassemble the valve body by following the numbered steps below. Be certain that all gasketed surfaces have been well cleaned. Key numbers referenced in this procedure are shown in figure 4, except where indicated.

CAUTION

Inspect the seat ring, cage, bonnet, and body gasket surfaces. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm (0.003 inches) in height (the thickness of a human hair)

can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, because they will prevent the gaskets from sealing properly.

1. Install the seat ring gasket (key 17) into the valve body. Install the seat ring (key 6).
2. Install the cage (key 2).
3. Install the seal ring (key 7) onto the valve plug (key 3). Install the anti-extrusion rings (key 10) onto the valve plug (key 3). Install the ring with the open side facing the seat end of the valve plug for flow-down applications (view A of figure 4). Slide the backup ring (key 8) onto the valve plug. Secure with the retaining ring (key 9).
4. Install the valve plug into the cage.
5. Install the bonnet gasket (key 16) and three cage gaskets (key 15).
6. Install the bonnet over the valve stem and onto the valve body.

Note

The prelubricated hex nuts (key 12) referred to in step 7 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 7 include -- but are not limited to -- ensuring that the bonnet stud threads are clean, and that the hex nuts are evenly tightened to the specified torque values.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 3 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure. Hot torquing is not recommended.

7. Lubricate the stud threads and the faces of the hex nuts (key 12) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Install the hex nuts, but do not tighten them. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 3. When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.
8. Install new packing and packing box parts per steps 15 and 16 of the Replacing Packing procedure. Be certain to observe the note given prior to step 15 of that procedure.
9. Mount the actuator by following the procedures in the actuator instruction manual. Check for packing leakage as the valve is being put into service. Retorque the packing flange nuts as required. See table 2.

Parts Ordering

Each valve body-bonnet assembly is assigned a serial number which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) or Local Business Partner for technical assistance. When ordering replacement parts, reference the valve serial number to obtain the correct eleven-character part number for each part; the following Parts Kit and Parts List is for information only.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kit

Standard Packing Repair Kits (Non Live-Loaded)

Stem Diameter, mm (Inches)	Yoke Boss Diameter, mm (Inches)	Kits Packing Material	
		Single PTFE Graphite	Single PTFE Graphite
31.8 (1-1/4)	127 (5H)	RPACKX00352	RPACKX00542

Parts List

Numerous available combinations of valve parts make selection of some parts difficult; when ordering valve parts for which a part number is not listed, provide the valve serial number with the order, permitting proper selection of replacement parts to be made at the factory.

Note

Contact your [Emerson sales office](#) or Local Business Partner for Part Ordering information.

Valve Assembly (figures 4 and 5)

Key	Description
1	Valve Body
2*	Cage
3*	Valve Plug
4*	Valve Stem
5*	Pin
6*	Seat Ring
7*	Seal Ring
8*	Back Up Ring
9*	Retaining Ring
10*	Anti-Extrusion Ring
11	Stud, Cont Thd
12	Hex Nut
13	Carbon Steel Washer
14	Bonnet
15*	Cage Gasket
16*	Bonnet Gasket
17*	Seat Ring Gasket
18*	Piston Ring
19*	Bore-Seal
20	Flow Arrow
21	Drive Screw
22	Anti-Seize Lubricant
23	Nameplate (not shown)
24	Wire (not shown)

Bonnet Assembly (figure 6)

Key	Description
1	Bonnet
2	Packing Flange
3	Packing Flange Stud 127 mm (5-H-inch) yoke boss diameter (2 req'd)
4	Packing Flange Nut 127mm (5H-inch) yoke boss diameter (2 req'd)
5*	Packing Set
6*	Packing Ring
7	Spring or Lantern Ring
8*	Packing Ring
9	Washer
10*	Packing Box Ring
11*	Upper Wiper, felt
12	Packing Follower, 316 stainless steel
13	Actuator Mounting Stud, steel (8 req'd)
14	Hex Nut, steel (8 req'd)
15*	Lower Wiper, PTFE
16*	Male Adapter, PTFE
17*	Female Adapter, PTFE/glass

Figure 4. Fisher NPS 8 CHP

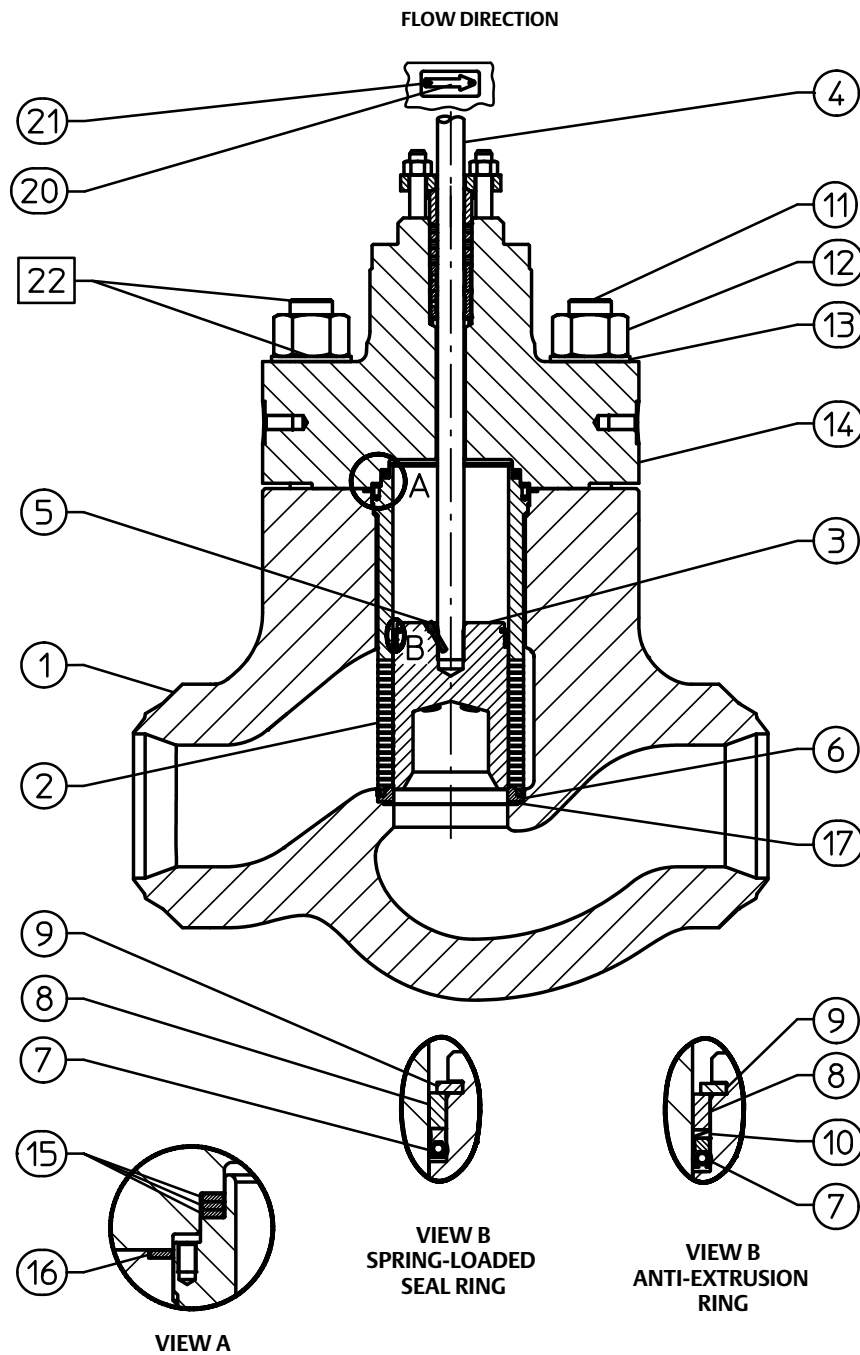
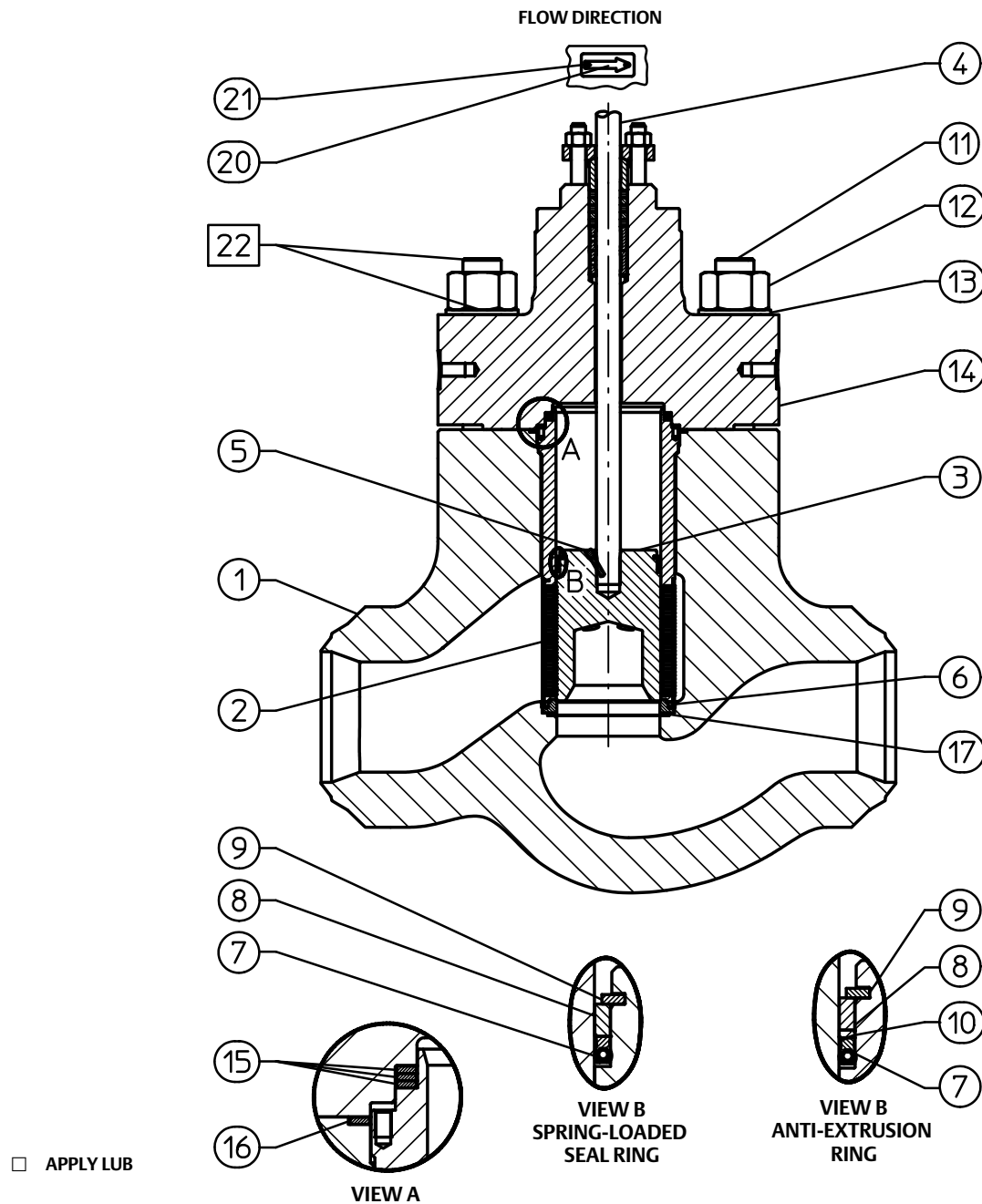
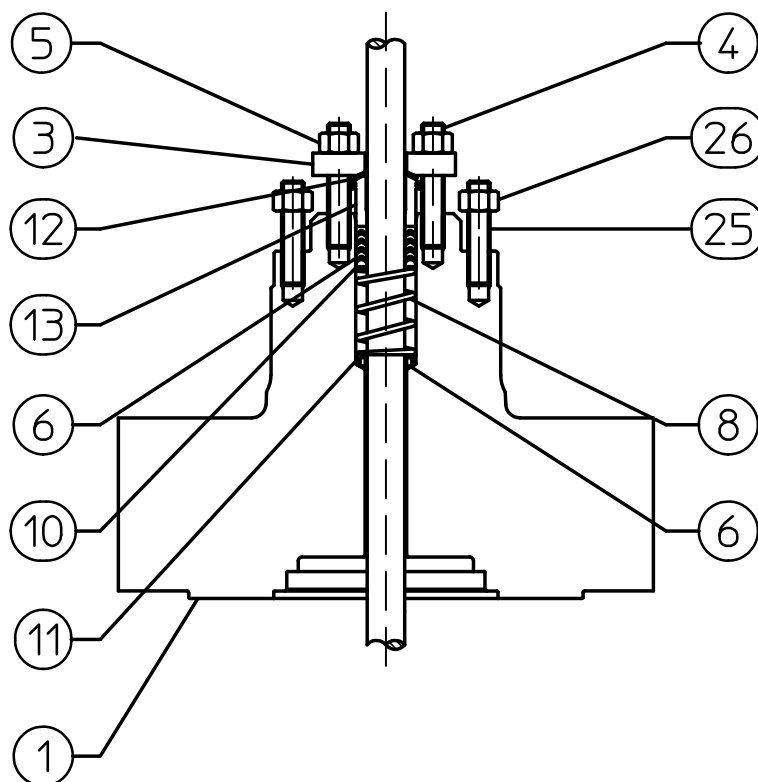


Figure 5. Fisher NPS 8 CHP with Cavitrol III 2-Stage Cage



GG42131

Figure 6. Fisher 5H Yoke Boss Bonnet Assembly



GG44633

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104197X012

NPS 8 CHP Valve

June 2017

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Fisher™ RSS Lined Globe Valve

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Figure 1. Fisher RSS Valve with 667 Actuator and FIELDVUE™ DVC6200 Digital Valve Controller



W9164-2

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 1 through NPS 4 Fisher RSS lined globe valves. Refer to separate manuals for instructions covering the actuator, positioner, and accessories.

Description

The RSS lined globe-style valve (figure 1) has pure-modified PTFE trim parts, push-down-to-close action, and positive shutoff. This valve is intended for applications involving severely corrosive and toxic flowing media, and is well-suited for pure media applications, as well. The RSS valve body provides an economical alternative to alloy valve bodies in a wide variety of applications.



Do not install, operate, or maintain an RSS valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications
Valve Sizes

NPS ■ 1, ■ 1-1/2, ■ 2, ■ 3, and ■ 4

Face-To-Face and Flange Compatibility

VALVE SIZE, NPS	DUCTILE IRON	
	Raised-Face Flange	
	CL150	
	Face-To-Face	
	ASME ⁽¹⁾	EN ⁽²⁾
1	X	X
1-1/2	X	X
2	X	X
3	X	X
4	X	X

1. For ANSI/ISA face-to-face dimensions, see figure 9.

2. For EN face-to-face dimensions, see figure 9.

Maximum Inlet Pressures and Temperatures⁽¹⁾

See table 2

Downstream/Outlet Pressure Ratings⁽¹⁾

See figures 3 and 4

Shutoff Classification

Class VI per ANSI/FCI 70-2 and IEC 60534-4

Application Limits

Liquid Service: For cavitating applications, contact your [Emerson sales office](#)

Gas Service: Velocity $\leq$ 0.33 MACH

Temperature Capabilities

Positive Pressure Service: -29 to 180°C (-20 to 360°F)

Vacuum Service: -29 to 180°C (-20 to 360°F)

Standard Flow Characteristic/Valve Plug Style

Equal percentage

Flow Direction

Up through the seat ring (see figure 7)

Packing Arrangement

Braided PTFE rings

Dimensions and Weights

See figure 9

1. The pressure or temperature limits in this manual, and any applicable standard limitations should not be exceeded.

Table 2. Maximum Allowable Inlet Pressures and Temperatures

TEMPERATURE, °C	PRESSURE, BAR	TEMPERATURE, °F	PRESSURE, PSIG
	Ductile Iron		Ductile Iron
-29 to 38	19.7	-20 to 100	285
93	17.9	200	260
149	15.9	300	230
180	14.8	360	215

Educational Services

Emerson Educational Services

Phone: 1-800-338-8158

E-mail: education@emerson.com

emerson.com/mytraining

Specifications

Specifications for the RSS valve are shown in table 1. If the valve is shipped with the actuator, some of the valve specifications are on the valve nameplate, which is attached to the actuator. If the valve is shipped without the actuator, the valve nameplate is wired to the valve.

Installation

WARNING

Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure can result if the valve is installed where service conditions could exceed the limits given on the nameplate or in table 1 or 2, or figure 3 or 4. To avoid such injury or damage, use pressure-limiting or pressure-relieving devices to prevent service conditions from exceeding these limits.

Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the valve configuration and construction materials are selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Since some valve body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

CAUTION

Before installing the valve, inspect it to be certain that the valve cavity is free of foreign material. Use extra care in handling to avoid damage to the exposed lining on the flanges. Clean out all pipelines to remove scale, welding slag, and any other foreign materials that could cause erosion of the valve body lining.

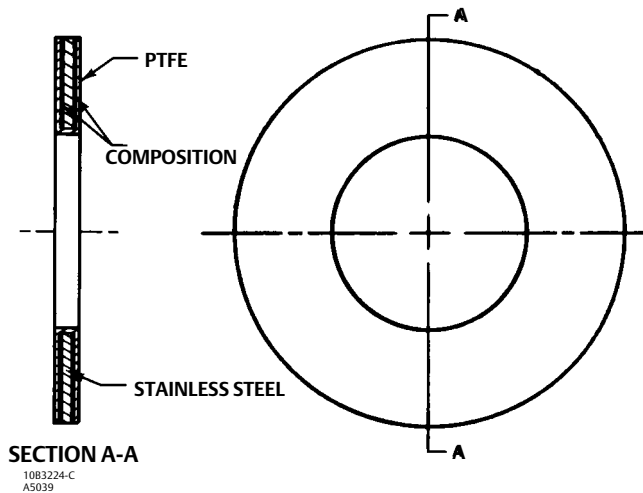
Use accepted piping practices when installing the valve in the pipeline. To minimize valve damage caused by expansion of PTFE lined pipe, use a line flange gasket (figure 2). This gasket evenly distributes the piping loads across the valve flange face and minimizes the potential for cutting or indenting the lined face on the valve flange.

1. The control valve assembly should be installed in a horizontal pipeline with the valve stem in a vertical position. Before installing in any other orientation, consult your [Emerson sales office](#).
Flow through the valve must be in the direction indicated by the arrow cast on the valve (figure 7).
2. With a leak-off bonnet construction, remove the pipe plug (key 20, not shown) and install the leak-off piping into the tapping in the bonnet (key 2, figure 10).
3. If continuous operation is required during inspection or maintenance, install a three-way bypass around the control valve assembly.
4. For a valve used with a fail-closed actuator, remove the shim (key 24, not shown) from between the bonnet and the travel stop. Discard the shim.
5. If the actuator and valve are shipped separately, refer to the appropriate actuator instruction manual for the actuator mounting procedure.

Note

Bench sets for Fisher 657 and 667 actuators must be adjusted after installation on the RSS valve. The heavy duty bellows on the RSS valve has a significant spring rate that must be included in the bench set for proper operation.

Figure 2. Typical Line Flange Gasket (Key 17)



Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing and trim replacement. All these maintenance operations may be performed with the valve in the line.

⚠ WARNING

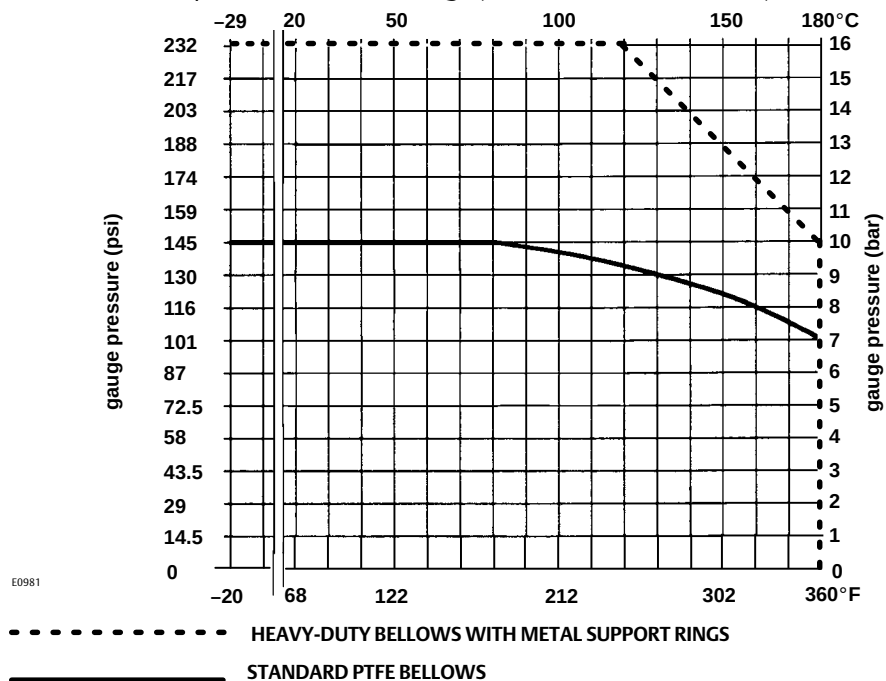
Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

Note

Whenever a line flange gasket (figure 2) seal is disturbed by removing the valve from the line, install a new gasket on reassembly. This is necessary to ensure a good gasket seal.

Figure 3. Downstream/Outlet Pressure Ratings (Positive Pressure Service)



NOTE: THE LINER DOES NOT LIMIT THE DOWNSTREAM PRESSURE RATING IN POSITIVE PRESSURE SERVICES.

Figure 4. Downstream/Outlet Pressure Ratings (Vacuum Service)

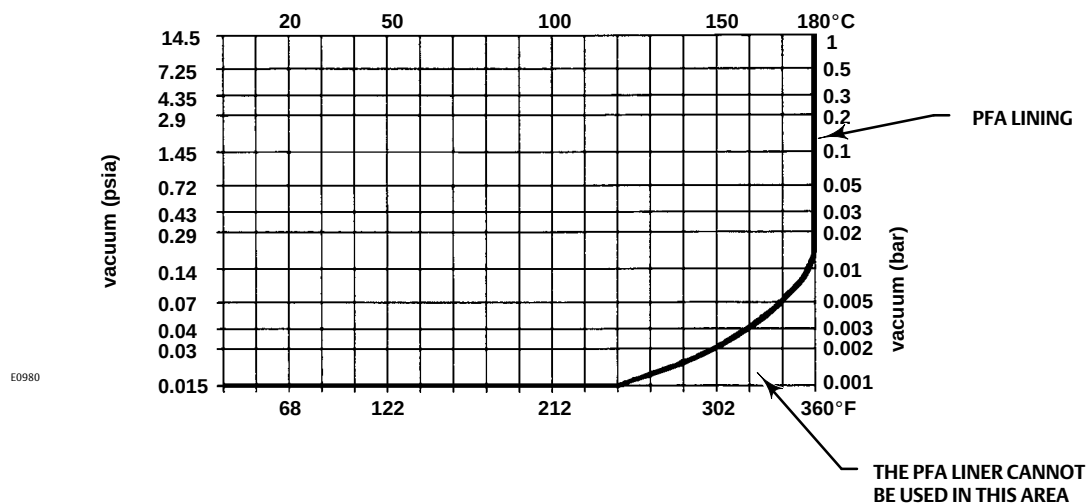
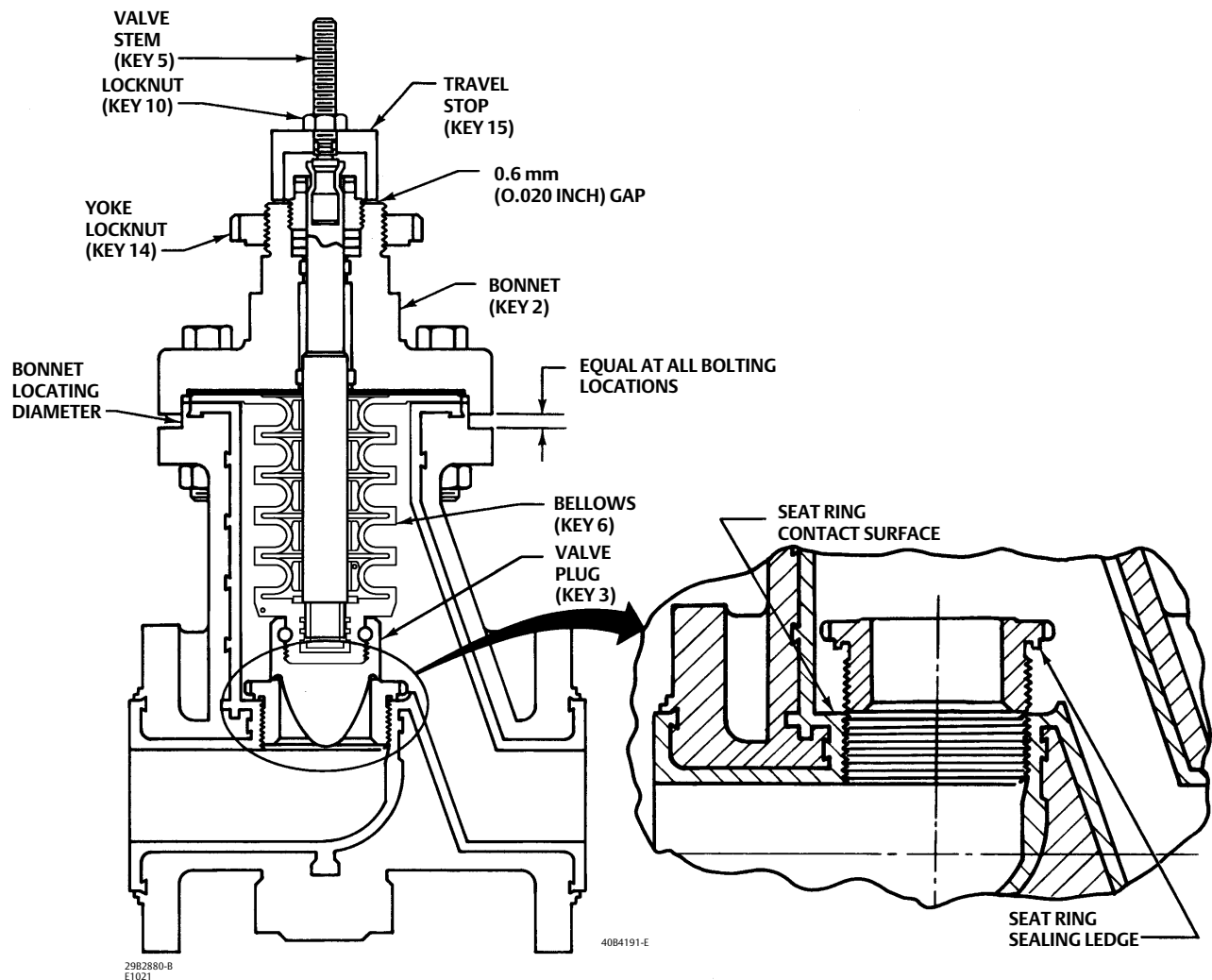


Figure 5. Bonnet, Travel Stop, and Seat Ring Installation Detail



Packing Maintenance

Key numbers are shown in figure 10.

The packing consists of braided packing rings (key 13). The packing box is only a safety measure in case of a leak through the bellows (key 6). Therefore, the packing follower (key 11) is tightened to 1.13 N•m (10 lbf•in) of torque and then loosened one half turn. To detect a leak through the bellows (key 6), the bonnet (key 2) can be provided with a connection for leak-off piping.

Replacing Packing and Bushing Inserts

Key numbers are shown in figure 10.

1. Isolate the control valve from the line pressure. Release pressure from both sides of the valve and drain the process media from both sides of the valve.
2. Exhaust all actuator pressure, and disconnect the operating lines from the actuator and any leak-off piping from the bonnet (key 2). Disconnect the actuator stem connector, and then remove the actuator from the valve by unscrewing the yoke locknut (key 14).
3. Remove any travel indicator parts, the locknut (key 10), and the travel stop (key 16) from the valve stem (key 5) threads.

CAUTION

Follow the procedures as described in the next steps to prevent damage to the bonnet sealing surface and to prevent packing box leakage.

4. Remove the packing follower (key 11). Unscrew the cap screws (key 7) and hex nuts (key 8) that secure the bonnet (key 2) to the valve (key 1). Then, carefully lift the bonnet off and set it on a protective surface to prevent damage to the bonnet sealing surface. If the valve stem, bellows, and valve plug (keys 5, 6, and 3) come out with the bonnet, remove these parts from the bonnet.
5. Remove bushing inserts, packing rings, and packing box ring (keys 13, 12, 28, and 29).
6. Clean the packing box, packing box ring, and packing follower.
7. Inspect the valve stem and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could damage new packing or cause packing box leakage. If the surface condition cannot be improved by light sanding, replace the damaged parts.
8. Install bushing inserts (keys 28 and 29).
9. Install the bonnet (key 2) over the valve stem (key 5). Slide the bonnet down until it properly engages the bonnet locating diameter (figure 5) of the valve.

Note

In order to ensure accurate positioning of the valve plug (key 3) and seat ring (key 4), clearance between the valve and bonnet at all bolting locations (figure 5) must be equal and approximately 2.0 mm (0.080 inches) for NPS 1 through 4 valves. Be sure to measure the clearance in the next step.

10. Tighten the cap screws and hex nuts (keys 7 and 8) in a crisscross pattern to a maximum torque value of 50 N•m (37 lbf•ft). To ensure accurate positioning of the valve plug (key 3) into the seat ring (key 4), check the gap between the valve and bonnet with a feeler gauge (figure 5). At all bolting locations, the gap must be equal and approximately 2.0 mm (0.080 inches) for NPS 1 through 4 valves. In order to keep the gap equal, the individual bolts may have to be tightened to different torque levels.

Note

Due to the cold flowing tendency of the valve liner, this procedure should be repeated upon installation and after the first thermal cycle of the valve.

11. Install the packing rings, packing box ring, and packing follower (keys 13, 12, and 11) over the valve stem. Tighten the packing follower to 1.13 N•m (10 lbf•in) of torque to ensure the packing rings are seated. After the packing rings are seated, loosen the packing follower one half turn.
12. Manually press the valve stem (key 5) into the valve until the valve plug contacts the seat ring.

CAUTION

Improper adjustment in step 13 might cause damage to trim parts. Perform this step carefully.

13. Thread the travel stop (key 16) onto the valve stem until there is a 0.5 mm (0.020 inch) gap between the bottom surface of the travel stop legs and the top of the bonnet (figure 5).
14. Thread the locknut (key 10) onto the stem and tighten it against the travel stop.
15. Mount the actuator and secure it with the yoke locknut (key 14). Connect the actuator stem and valve stem according to the procedure in the appropriate actuator instruction manual.

Figure 6. Typical Locking Rope Installation



W9165-1

WITH LOCKING ROPE PARTIALLY REMOVED



W9166-1

WITH LOCKING ROPE INSTALLED

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RSS Valve

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Instruction Manual

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Figure 7. Fisher RSS Valve Body Shown with Tool Used to Remove or Install Seat Ring



Table 3. Seat Ring Tool Dimensions

VALVE SIZE, NPS	DIMENSIONS (MILLIMETERS)						
	A(ø)	B(ø)	C(ø)	D	E	F	G
1	<u>36.9</u> 37.2	<u>47.2</u> 47.5	<u>54.8</u> 55.6	6.4	4.8	<u>7.9</u> 7.6	190
1-1/2	<u>54.0</u> 54.2	<u>63.9</u> 64.1	<u>71.8</u> 72.6	7.1	5.6	<u>7.9</u> 7.6	222
2	<u>65.1</u> 65.3	<u>76.2</u> 76.5	<u>83.7</u> 84.5	7.1	5.6	<u>7.9</u> 7.6	222
3	<u>91.3</u> 91.5	<u>103.7</u> 104.2	<u>111.9</u> 112.7	7.1	5.6	<u>7.9</u> 7.6	300
4	<u>105.9</u> 106.2	<u>118.2</u> 118.5	<u>126.2</u> 127.0	7.1	5.6	<u>7.9</u> 7.6	300

VALVE SIZE, NPS	DIMENSIONS (INCHES)						
	A(ø)	B(ø)	C(ø)	D	E	F	G
1	<u>1.45</u> 1.46	<u>1.86</u> 1.87	<u>2.16</u> 2.19	1/4	3/16	<u>0.31</u> 0.30	7-1/2
1-1/2	<u>2.13</u> 2.14	<u>2.52</u> 2.53	<u>2.83</u> 2.86	9/32	7/32	<u>0.31</u> 0.30	8-3/4
2	<u>2.56</u> 2.57	<u>3.00</u> 3.01	<u>3.30</u> 3.33	9/32	7/32	<u>0.31</u> 0.30	8-3/4
3	<u>3.59</u> 3.60	<u>4.09</u> 4.10	<u>4.41</u> 4.44	9/32	7/32	<u>0.31</u> 0.30	11-7/8
4	<u>4.17</u> 4.18	<u>4.66</u> 4.67	<u>4.97</u> 5.00	9/32	7/32	<u>0.31</u> 0.30	11-7/8

Figure 8. Seat Ring Tool

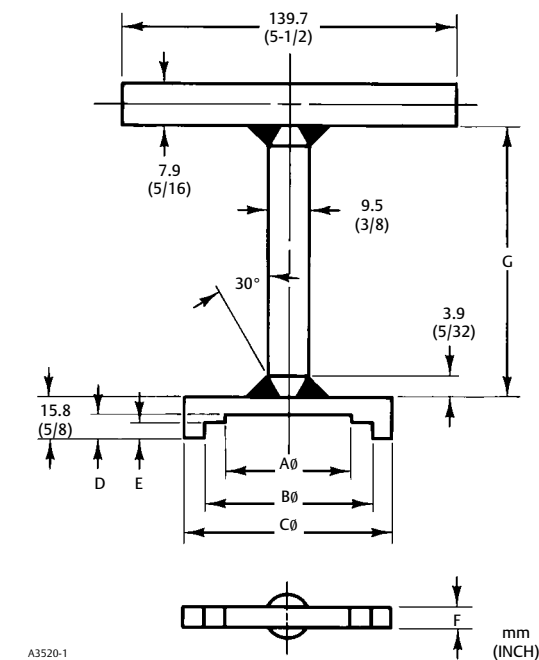


Table 4. Recommended Seat Ring Torque

Valve Size, NPS	Newton Meters	Pound-Force Inches	Pound-Force Feet
1	8	71	---
1-1/2	23	---	17
2	30	---	22
3	50	---	37
4	50	---	37

Trim Maintenance

Key numbers are shown in figure 10.

Disassembly

1. Remove the actuator and the bonnet as described in steps 1 through 4 of the Replacing Packing and Bushing Inserts section.
2. Inspect parts for wear or damage that would prevent proper operation of the valve.
3. To replace the bellows (key 6), unscrew the valve stem (key 5) in a counterclockwise rotation. Install the valve stem into the new bellows with a clockwise rotation by hand. Do not overtighten.
4. To remove the valve plug (key 3), use pliers to remove the locking rope (key 9) that locks the valve plug to the bellows (key 6) as shown in figure 6. Then unscrew the plug from the bellows.

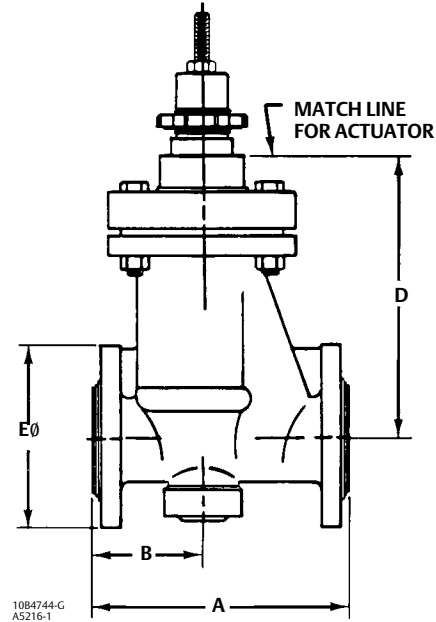
Note

To avoid cold flow of the valve liner and deforming of the valve body seat ring threads and seat ring contact surfaces, promptly install a replacement seat ring according to step 1 of the Assembly procedures.

5. To remove the seat ring (key 4), use the seat ring tool (figure 7 or 8) that can be ordered from the Parts List section or made according to the dimensions in figure 8 and table 3. To avoid cold flow of the valve liner and deforming of the valve body seat ring threads and seat ring contact surfaces, promptly install a replacement seat ring according to step 1 of the Assembly procedures.

Figure 9. Dimensions and Weights

ANSI/ISA CL150 FACE-TO-FACE DIMENSIONS MATING WITH CL150 FLANGES					
Valve Size	Dimensions				Approximate Weight
	A	B	D	EØ	
NPS	mm				kg
1	184.0	83.0	185.0	108.0	10
1-1/2	222.0	97.0	225.0	127.0	17
2	254.0	107.0	230.0	152.4	20
3	298.0	121.0	340.0	190.5	39
4	350.0	176.0	350.0	220.0	42
NPS	Inches				Pounds
1	7.25	3.27	7.28	4.25	23
1-1/2	8.75	3.82	8.86	5.00	36
2	10.00	4.21	9.06	6.00	43
3	11.75	4.76	13.39	7.50	86
4	13.78	6.94	13.78	8.66	92



Assembly

CAUTION

To avoid damage to the seat ring sealing surface and/or threads in the valve body liner, make or order the seat ring tool shown in figures 7 and 8. Installing the seat ring using other tools might cause permanent damage to the seat ring sealing surface and/or threads allowing excessive leakage of the valve.

1. Install the seat ring (key 4) with the seat ring tool (figure 7 or 8) that can be ordered from the Parts List or made according to the dimensions in table 3 and figure 8. Tighten the seat ring until contact is felt between the sealing ledge of the seat ring and its mating surface in the valve (figure 5). At this point, tighten the seat ring one quarter turn or to the torque values listed in table 4.
2. To install the valve plug (key 3), screw the valve plug onto the bellows and insert the locking rope with pliers (figure 6).
3. Install the assembled valve plug, bellows, and valve stem (keys 3, 6, and 5). For metal bellows, install the gasket (key 27).
4. Install the bonnet according to steps 9 and 10 of the Replacing Packing and Bushing Inserts procedure.
5. Tighten the packing follower (key 11) to 1.13 N•m (10 lbf•in) of torque to ensure the packing rings are seated. After the packing rings are seated loosen the packing follower one half turn.
6. Perform steps 12 through 15 of the Replacing Packing and Bushing Inserts section.

Parts Ordering

Each valve body-bonnet assembly is assigned a serial number, which can be found on the valve nameplate. Refer to this serial number when contacting your [Emerson sales office](#) for technical assistance. If the valve is shipped with the actuator, the valve nameplate is attached to the actuator. If the valve is shipped without the actuator, the valve nameplate is wired to the valve. When ordering replacement parts, refer to this serial number and to the part number from the following Parts List.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

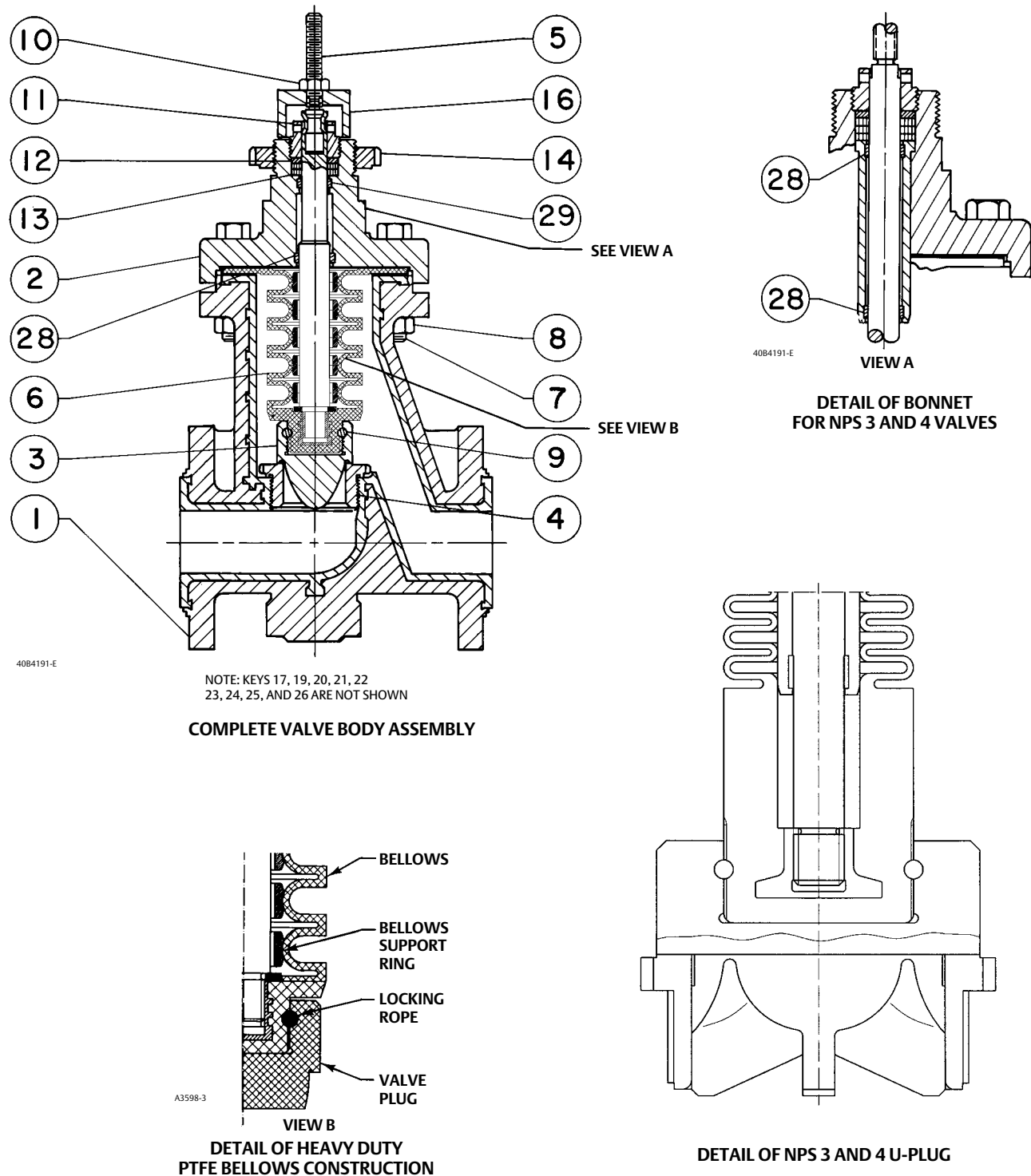
Note

Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description
1	Valve Body or Valve Body/Ring Assembly If you need a valve body as a replacement part, order by valve size, serial number, and desired material
2	Bonnet/Bushing Assembly If you need a bonnet/bushing assembly as a replacement part, order by valve size and stem diameter, serial number, and desired material
3*	Valve Plug
4*	Seat Ring
5*	Valve Stem
6*	Bellows
7	Cap Screw
7	Stud
8	Hex Nut
9*	Locking Rope

Key	Description
10	Locknut
11	Packing Follower
12*	Packing Box Ring
13*	Packing Ring
14	Yoke Locknut
16	Travel Stop
17*	Line Flange Gasket (for use only if specified, see figure 2),
18	Line Flange Cap Screws (for NPS 2 use only)
20	Pipe Plug (for use w/tapped bonnet only--not shown)
21	Seat Ring Tool (for use only if specified--see figure 7 or 8)
22	Nameplate Seal & Wire (not shown)
24*	Shim (for use only w/fail-to-close actuator during shipping)
25	Identification Plate (not shown)
26	Drive Screw
28*	Bushing Insert
29*	Bushing Insert

Figure 10. Fisher RSS Valve Assembly



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RSS Valve

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Fisher™ SS-138B and SS-252B Rotary Ball Valves

Introduction

This special instruction manual is an addendum to the Fisher Vee-Ball™ V150, V200, and V300 Rotary Control Valves NPS 1 through 12 Instruction Manual ([D101554X012](#)). Observe all **Warnings**, **Cautions**, and **Notes** provided in the instruction manual. A copy of the manual is attached to this special instruction manual for your reference.

Scope

This special instruction manual provides the assembly, disassembly, and parts information of the seal shims and seal assembly for the SS-252B, and of the seal shims and flow ring construction for the SS-138B. For other procedures, refer to the Fisher Vee-Ball V150, V200, and V300 Rotary Control Valves NPS 1 through 12 Instruction Manual (D101554X012).

Do not install, operate, or maintain SS-138B and SS-252B rotary ball valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The SS-138B valve, a modified V200 or V300, has a metal flow ring construction with a V-notch ball adjusted by shimming to the center of the valve body cavity to hold the flow ring 0.254 to 0.508 mm (0.010 to 0.020 inch) away from the ball.

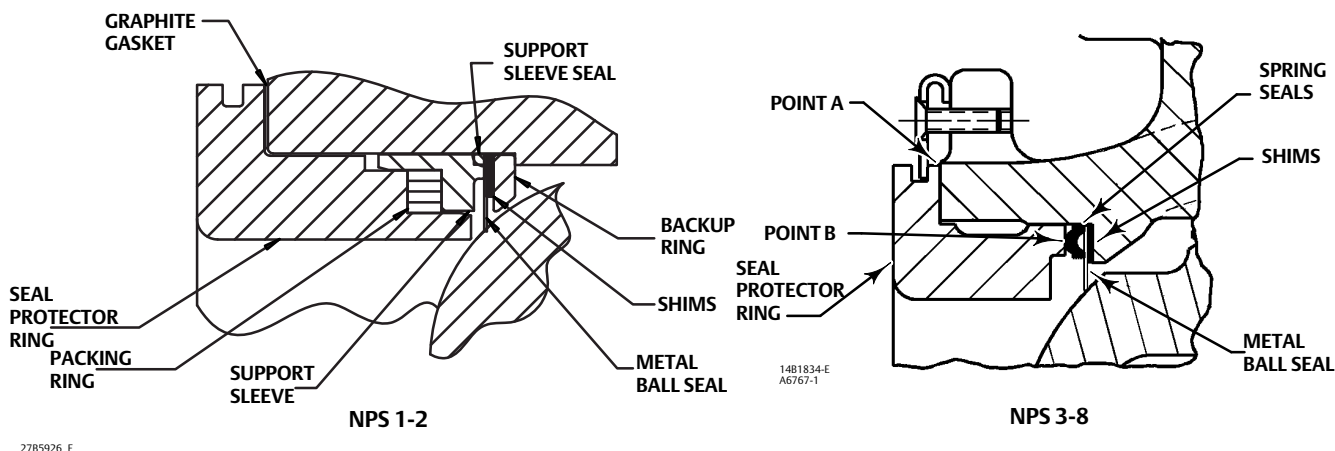
The SS-252B valve, a modified V300, has a stellite metal seal with a V-notch ball adjusted by shimming to the center of the valve body cavity to obtain zero ball seal deflection. The maximum allowable leakage rates (scfh) for this valve are 400 for NPS 2, 500 for NPS 3, 800 for NPS 4, and 1100 for NPS 6.

Educational Services

For information on available courses for Fisher SS-138B and SS-252B rotary ball valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Figure 1. Detail of Fisher SS-252B Metal Seal with Multiple Springs



Assembly of Metal Ball Seal with Multiple Spring Seals for SS-252B

⚠ WARNING

When the actuator is removed from the valve, the Vee-Ball/shaft assembly may suddenly rotate, resulting in personal injury. To avoid injury, carefully rotate the ball to the bottom of the valve body cavity. Make sure the ball will not rotate.

1. Install the seal shims in the valve, and install the seal on top of the seal shims. Add or remove shims under the seal as necessary to obtain zero ball seal deflection.

Note

Zero ball seal deflection is the point at which the addition of one 0.13 millimeter (0.005-inch) thick shim causes contact between the ball and ball seal to be broken. Hold the parts tightly together when determining zero deflection, or improper zero deflection might result.

2. Add five spring seals on top of the metal seal, then install the seal protector ring.

Note

Make the following measurement before compressing the spring seals for the first time.

3. Measure the distance at point "A" (figure 1 in this special manual) between the seal protector ring and the valve body.
 - a. Add a spring seal at point "B" if the measurement is less than 0.635 mm (0.025 inch) at point "A".
 - b. If necessary, add additional spring seals at point "B" until the measurement is 0.635 to 1.27 mm (0.025 to 0.050 inch).

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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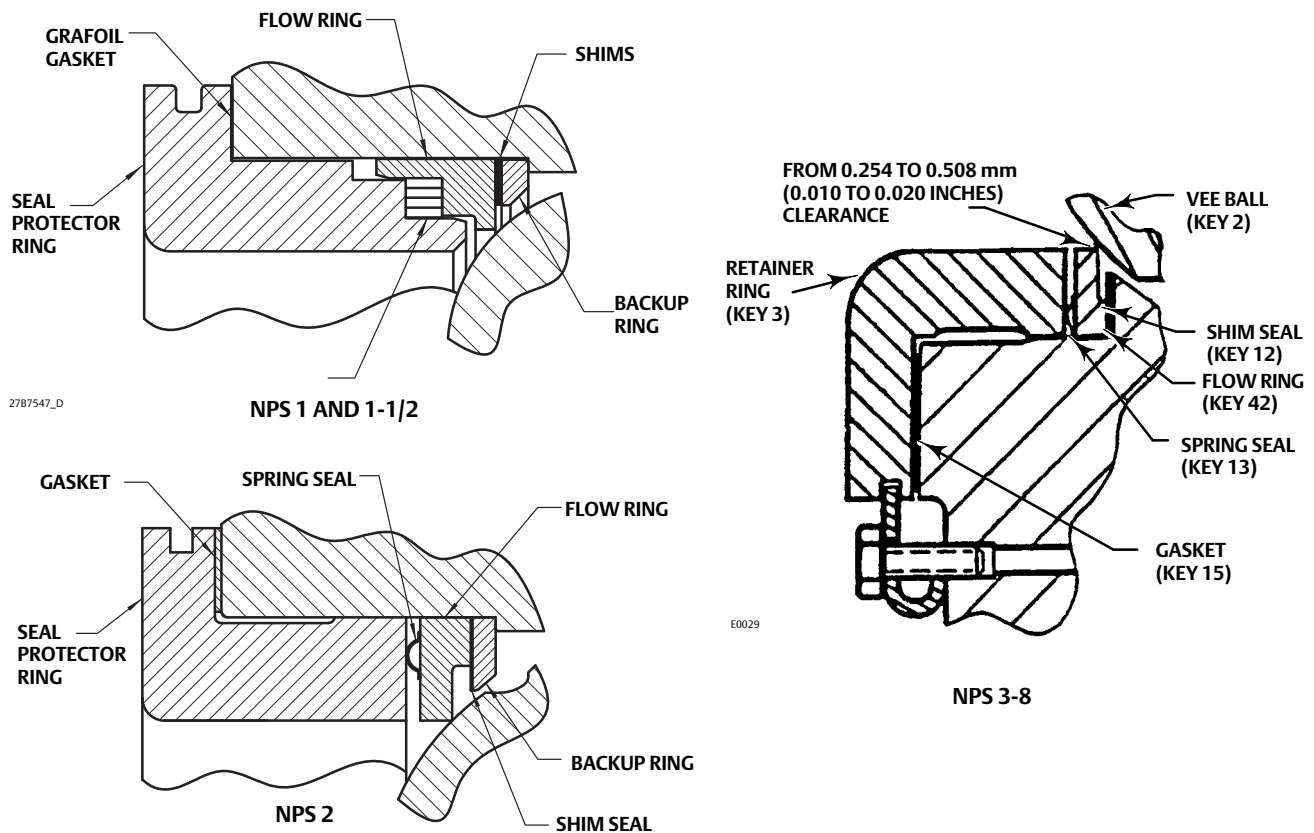
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SS-138B and SS-252B Valves

April 2019

4. Remove the seal protector ring, and add the flexible graphite gasket between the valve body and seal protector ring.
5. Install the seal protector clips, or washers, and seal protector screws (keys 21 and 22) to secure the seal protector ring to the valve body.
6. Refer to the Fisher Vee-Ball V150, V200, and V300 NPS 1 through 12 Instruction Manual ([D101554X012](#)) to continue the reassembly of the valve.

Figure 2. Fisher SS-138B Seal Details



Removing the Flow Ring Construction for SS-138B

⚠ WARNING

When the actuator is removed from the valve, the Vee-Ball/shaft assembly may suddenly rotate, resulting in personal injury. To avoid injury, carefully rotate the ball to the bottom of the valve body cavity. Make sure the ball will not rotate.

Please observe all the Warnings, Cautions, and Notes in the Maintenance section of the Fisher Vee-Ball V150, V200, and V300 Instruction Manual ([D101554X012](#)).

1. Isolate the control valve from the line pressure, release pressure and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure/power lines to the power actuator and release all pressure from the actuator.
2. If not already accomplished, remove the line bolting, remove the valve from the pipeline, and place the actuator/valve assembly on a protected flat surface with the seal protector ring facing up. Provide a method of rotating the ball to the open position.
3. Remove the cap screws and spring clips (keys 21 and 22) that hold the retainer ring (key 3) in place. Carefully lift the ring out of the valve body.
4. Remove the spring seal, flow ring, and shim seals (keys 13, 42, and 12). Check all parts for damage and replace parts, if necessary.
5. If no further disassembly is required, continue with the assembly steps below.

Replacing the Flow Ring Construction for SS-138B

⚠ WARNING

When the actuator is removed from the valve, the Vee-Ball/shaft assembly may suddenly rotate, resulting in personal injury. To avoid injury, carefully rotate the ball to the bottom of the valve body cavity. Make sure the ball will not rotate.

1. If not already accomplished, place the valve/actuator assembly on a protected surface with the flow ring side facing up. Provide a means of rotating the ball to the closed position.
2. Install 12 seal shims (key 12) at the seal ledge (see figure 3).
3. Install the flow ring (key 42), making certain it is centered and does not contact the ball.
4. Secure with the retainer ring (key 3) with cap screws and retainer clip (keys 21 and 22) and tighten the cap screws. Measure the clearance between the flow ring and the ball with a wire gauge.
5. Add or subtract seal shims until obtaining the minimum clearance between the ball and flow ring. The clearance should be between 0.254 to 0.508 mm (0.010 to 0.020 inch)

Installing the Bearing Shims

The bearing shims should be installed after the drive shaft and ball have been installed. Please observe all the **Warnings, Cautions, and Notes** in the Replacing the Ball Seal portion of the Maintenance section of the Fisher Vee-Ball V150, V200, and V300 Instruction Manual ([D101554X012](#)).

1. Insert the follower shaft into the ball ear only until it reaches the far side of the ball ear.
2. Install one shim (key 43) between the thrust washer (applicable for NPS 1, 1-1/2, and 2) and the ball ear right where the follower shaft will exit the ball.
3. Push the follower shaft through the shim and into the bearing, making sure to line up the taper key holes.

Repeat this process until ball movement is less than 0.10 mm (0.004 inch) (within one shim).

Parts List

The following list only covers the seal assembly for these valves. For all other parts please refer to the Fisher Vee-Ball V150, V200, and V300 Instruction Manual ([D101554X012](#)).

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

		Key	Description
Note			
Contact your Emerson sales office for Part Ordering information.			
Key	Description		
2	Ball	12*	Shim Seal (12 req'd) (unless otherwise noted) (10 req'd for NPS 1 and 1-1/2)
3	Protector Ring	13*	Spring Seal (1 req'd for SS-138B, NPS 2-8) (5 req'd for SS-252B, NPS 3-8)
6	Drive Shaft	21	Seal Protector Screw (2 req'd)
7*	Groove Pin	22	Seal Protector Clip (2 req'd)
9	Follower Shaft	23	Actuator Mounting Screw
11*	Ball Seal	24	Actuator Mounting Nut
		26	Manufacturers Tag
		42	Flow Ring
		43	Bearing Shim (12 req'd)
		48	Ball / Shaft Assembly

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

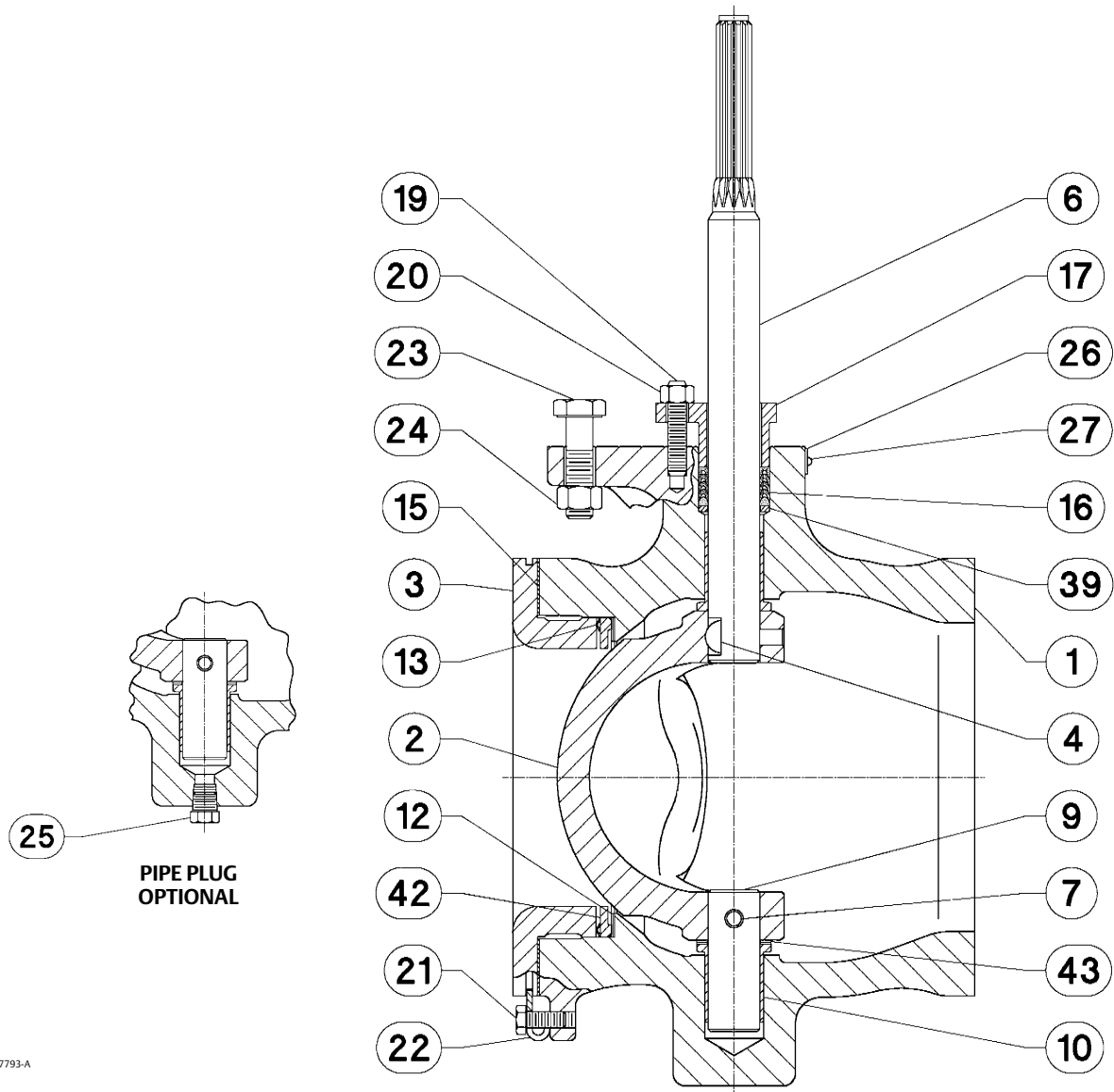
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SS-138B and SS-252B Valves

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Figure 3. Fisher SS-138B Valve Assembly (Details Are Typical for SS-252B Also, Except for Seal Area)



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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

SS-138B and SS-252B Valves

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Fisher™ SS-263 Volume Booster

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Figure 1. Fisher SS-263 Volume Booster



X0206-1

Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for the SS-263 volume booster (figure 1). Refer to separate instruction manuals for information regarding the valve body, actuator, and other accessories.



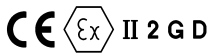
Do not install, operate, or maintain an SS-263 volume booster without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The SS-263 volume booster is used exclusively in Fisher Optimized Digital Valve (ODV) packages. The booster amplifies the output signal from the FIELDVUE™ digital valve controller to increase the stroking speed of pneumatic actuators. It has fixed deadband and incorporates soft-seat construction for use with the Fisher 377 Trip Valve.

The booster features dynamically stabilized trim and integral bypass restriction for use with the digital valve controller. The SS-263 volume booster delivers high-volume output for fast stroking speeds when responding to large input signal changes. However, it also delivers smooth, stable, low-volume output when responding to small input signal changes. This allows stable, accurate throttling control which is often necessary during the startup or commissioning of process control equipment.

Table 1. Specifications

Port Diameters Supply Port: 19 mm (0.75 inch) Exhaust Port: 19 mm (0.75 inch) Input Signal Positioner output Maximum Input Signal Pressure 10.3 bar (150 psig) Input to Output Pressure Ratio Fixed at 1 to 1 Supply Pressure Ranges⁽¹⁾ Maximum pressure must not exceed 10.3 bar (150 psig) Operative Temperature Limits⁽¹⁾ -40 to 71°C (-40 to 160°F) Maximum Flow Coefficients Supply: 9.5 Cv Exhaust: 9.5 Cv C1: 35 Xt: 0.77 Connections Input Signal: 1/4 NPT Supply: 1 NPT Output: 1 NPT or 1-1/4 NPT⁽²⁾	Hazardous Area Classification Complies with the requirements of ATEX Group II Category 2 Gas and Dust  Ex h IIC Tx Gb Ex h IIIC Tx Db Maximum surface temperature depends on operating conditions Gas: T6...T2 Dust: T85...T208 Meets Customs Union technical regulation TP TC 012/2011 for Groups II/III Category 2 equipment  Safety Instrumented System Classification SIL3 capable - certified by exida Consulting LLC Declaration of SEP Fisher Controls International LLC declares this product to be in compliance with Article 4 paragraph 3 of the PED Directive 2014 / 68 / EU. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance. However, the product <i>may</i> bear the CE marking to indicate compliance with <i>other</i> applicable European Community Directives. Approximate Weight Aluminum: 3.6 kg (8 lbs) Stainless Steel: 10.8 kg (24 lbs)
---	---

NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 - Process Instrument Terminology

1. The pressure/temperature limits in this document, and any applicable code or standard limitation should not be exceeded.

2. Consult factory for additional sizes.

Educational Services

For information on available courses for Fisher SS-263 volume booster, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Specifications

Specifications for the SS-263 volume booster are listed in table 1. Information for an individual unit as it comes from the factory appears on the nameplate (figure 2).

Figure 2. Example Nameplate

TYPE SS-263		Fisher Controls International LLC	
DATE		MATERIAL	
MAX SUPPLY		PRESS UNITS	
		SUP PORT	
		EXH PORT	

Installation

⚠ WARNING

Always wear protective clothing, gloves, and eyewear when performing any installation procedures to avoid personal injury.

System damage may result if a volume booster is installed in a way that it can be physically damaged.

Personal injury or system damage may result when service conditions exceed booster or other equipment ratings. Exceeding the pressure specifications in table 1 may cause leakage, parts damage, or personal injury due to bursting of pressure-containing parts or explosion of accumulated gas.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

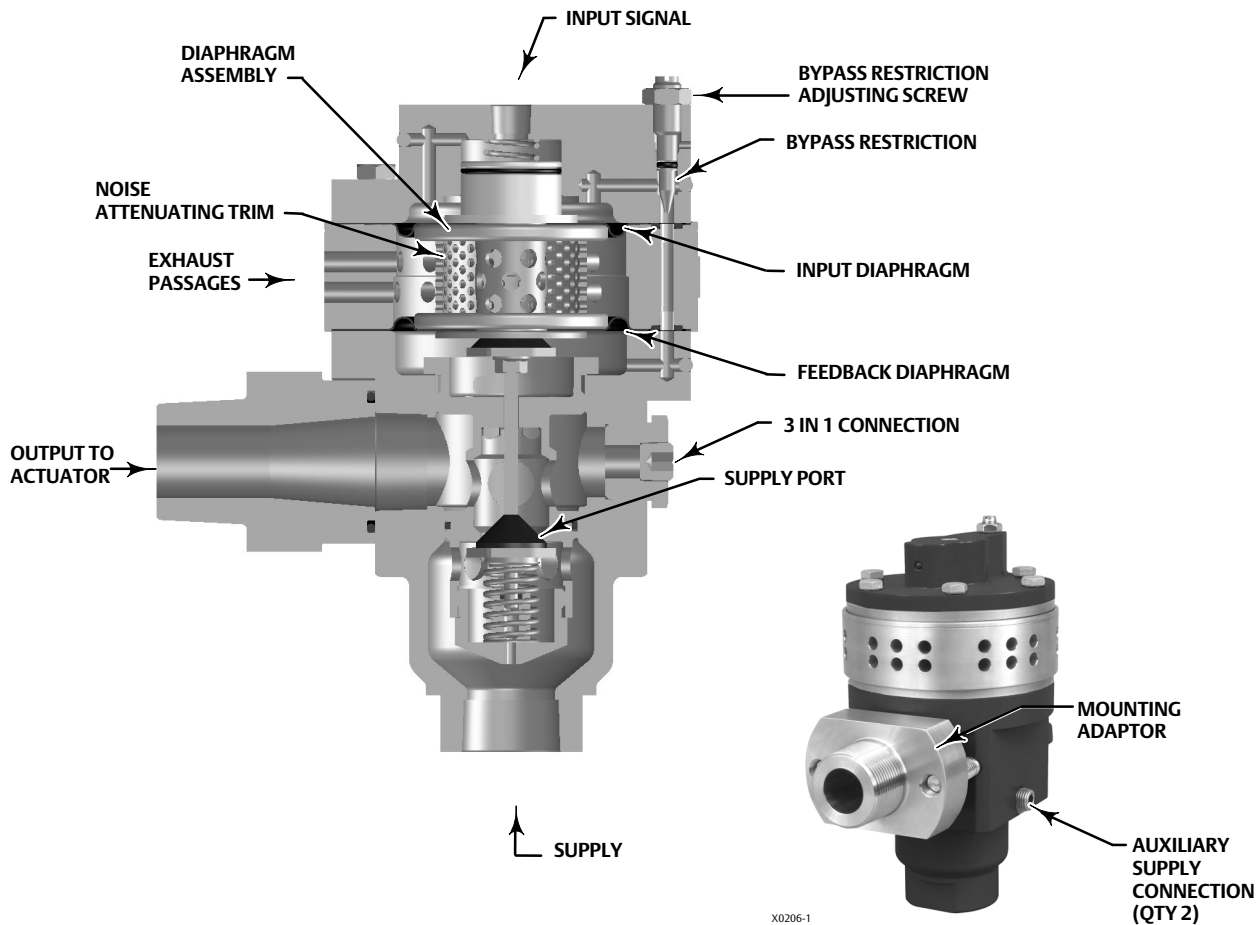
Note

Do not use separate pressure supplies for the volume booster and associated positioner.

The volume booster may not exhaust immediately upon loss of a separate pressure supply. However, if the system is in a transient state at the time of pressure supply loss or if changes to the booster's input signal are sufficient to overcome the deadband, the booster will exhaust.

A high-capacity regulator is required to provide sufficient capacity to supply both components. A high-capacity filter should be installed in the supply line to the regulator.

Figure 3. Volume Booster Sectional View



Mounting

The volume booster is mounted to the actuator using the provided mounting adaptor (figure 3) that attaches to the top or bottom of the piston cylinder using a 1 NPT or 1-1/4 NPT connection and to the SS-263 using a flange-type connection. For mounting to an ATI piston actuator, a 1-1/4 NPT pipe elbow (key 34) is installed between the mounting adaptor and piston cylinder. Mounting of the SS-263 to the actuator is typically performed at the factory; however the following instructions can be used to mount the SS-263 to a Fisher 785C, 685, or ATI piston actuator.

Mounting to a Fisher 785C Piston Actuator

1. Apply a suitable thread sealant to the threads of the mounting adaptor (key 29) and thread into the appropriate 1 NPT or 1-1/4 NPT connection port on the actuator with or without pipe elbow.
2. Install O-ring (key 30) into the groove in the mounting adaptor (key 29).
3. Using studs (key 31), lock washers (key 33) and hex nuts (key 32) mount the SS-263 onto the actuator. Tighten hex nuts (key 32) to 68 N • m (50 ft • lbs).

Mounting to a Fisher 685 Piston Actuator

1. Apply a suitable thread sealant to the threads of the mounting adaptor (key 29) and thread into the appropriate 1 NPT or 1-1/4 NPT connection port on the actuator.
2. Install O-ring (key 30) into the groove in the mounting adaptor (key 29).
3. Using studs (key 31), lock washers (key 33) and hex nuts (key 32) mount the SS-263 onto the actuator. Tighten hex nuts (key 32) to 68 N • m (50 ft • lbs).

Mounting to an ATI Piston Actuator

1. Apply a suitable thread sealant to the threads of the 1-1/4 NPT pipe elbow (key 34) and thread into the appropriate 1-1/4 NPT connection port on the actuator.
2. Apply a suitable thread sealant to the threads of the mounting adaptor (key 29) and thread into the 1-1/4 NPT pipe elbow (key 34).
3. Install O-ring (key 30) into the groove in the mounting adaptor (key 29).
4. Using studs (key 31), lock washers (key 33) and hex nuts (key 32) mount the SS-263 onto the actuator. Tighten hex nuts (key 32) to 68 N • m (50 ft • lbs).

Pressure Connections

The input signal connection is 1/4 NPT, the supply connection is 1 NPT, and the output connection is 1 NPT or 1-1/4 NPT depending on application. Ensure that the piping is of proper size to meet the capacity demands of the booster and that the actuator is equipped with properly sized input connections.

The SS-263 includes two 1/4 NPT auxiliary supply connections that allow additional accessories, such as a Fisher 377 trip valve, to be connected to supply pressure. The 3 in 1 connection provides either a 1/4 NPT diagnostic connection, 1/4 NPT actuator bypass assembly connection (for use on an actuator with a handwheel), or a 3/4 NPT dump valve connection. Consult the appropriate actuator instruction manual for the assembly of the actuator bypass connection.

Supply Pressure

Supply pressure must be filtered clean dry air or noncorrosive gas.

⚠ WARNING

If a flammable or hazardous gas is to be used as the supply pressure medium, personal injury, property damage or equipment damage could result from fire or explosion of accumulated gas or from contact with hazardous gas. The volume booster has no provision for piping away the vented exhaust gas. Therefore, do not use flammable or otherwise hazardous gas as a supply medium unless the unit is in a well-ventilated area and all ignition sources have been removed.

Exhaust Passages

Exhaust to the atmosphere is through exhaust passages located on the perimeter of the diaphragm spacer assembly. Keep the exhaust passages free of any obstructions or foreign materials that might clog them.

Operating Information

Proper installation of the SS-263 and adjustment of the bypass restriction and tuning of the digital valve controller are required for stable actuator performance. Installation and adjustments are typically performed at the factory.

Retain original piping configuration when replacing an SS-263 volume booster that was originally installed at the factory.

To calibrate and tune the volume booster, turn the bypass restriction adjusting screw (figure 3) two turns counterclockwise from the fully closed position. With the actuator in operation, slowly turn the restriction clockwise until the booster operates in response to large changes in the input signal, yet allows small changes to move the actuator without initiating booster operation. When additional capacity is required, multiple boosters can be used in parallel. The minimum required adjustment for each bypass restriction adjustment screw is 1/6 turn, regardless of configuration.

Principle of Operation

Refer to figure 3.

Because of the restriction, large input signal changes register on the booster input diaphragm sooner than in the actuator. A large, sudden change in the input signal causes a pressure differential to exist between the input signal and the feedback diaphragm of the booster. When this occurs, the diaphragms move to open either the supply port or the exhaust port, whichever action is required to reduce the pressure differential. The port remains open until the difference between the booster input and output pressures returns to within the deadband limits of the booster.

With the bypass restriction adjusted for stable operation, signals having small magnitude and rate changes pass through the bypass restriction and into the actuator without initiating booster operation. Both the supply and exhaust ports remain closed, allowing the output of the digital valve controller to act directly on the actuator piston.

Maintenance

WARNING

Always wear protective clothing, gloves, and eyewear when performing any maintenance procedures to avoid personal injury.

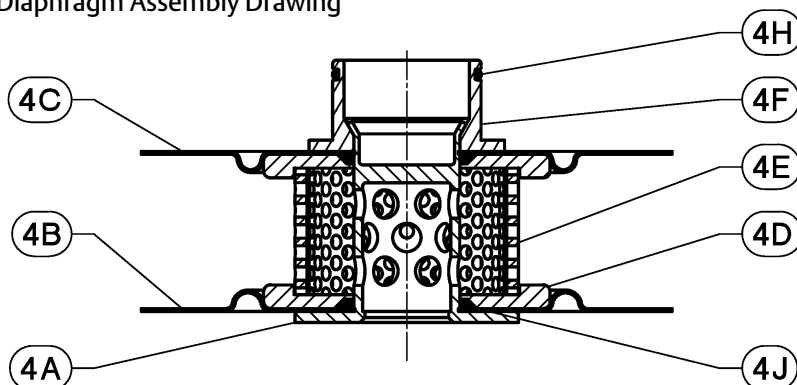
Maintenance requires taking the volume booster out of service periodically. To avoid personal injury or equipment damage, disconnect or bypass any pressure lines to the booster, and vent any pressure locked in the unit before you begin maintenance.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Diaphragm Assembly Replacement

Key numbers refer to figures 4 and 6.

Figure 4. Diaphragm Assembly Drawing



1. Remove the six cap screws (key 10) from the perimeter of the spring case assembly (key 3), and lift off the assembly, taking care you do not lose the upper spring (key 6).
2. Remove the diaphragm assembly (key 4) and diaphragm spacer assembly (key 2) as a unit. The two small O-rings (key 22) will stay attached to the diaphragm spacer assembly (key 2).
3. Separate the diaphragm assembly (key 4) from the diaphragm spacer assembly (key 2). Inspect the upper diaphragm (key 4C) and the lower diaphragm (key 4B) for damage and replace if necessary.

Note

The diaphragms are not individually replaceable, but must be ordered as a diaphragm assembly (key 4).

4. Replace the two O-rings (key 22).
5. Carefully install the diaphragm assembly (key 4) into the diaphragm spacer assembly (key 2) by folding the upper diaphragm (key 4C) inward. Rotate the diaphragm assembly (key 4) until the oversized hole in each diaphragm aligns with the flow passage in the diaphragm spacer assembly (key 2).
6. Install the diaphragm assembly (key 4) and the diaphragm spacer assembly (key 2) onto the body (key 1) while making sure the lower diaphragm (key 4B) is flat and not folded or pinched. Orient the parts to form the bypass restriction passage as shown in figure 6.
7. Apply lubricant (key 18) to the O-ring (4H) and the outside diameter of the spring seat (4F).
8. Install the upper spring (key 6) and the spring case assembly (key 3) on the upper diaphragm (key 4C).

CAUTION

To avoid damage to the diaphragms, do not overtighten the screws.

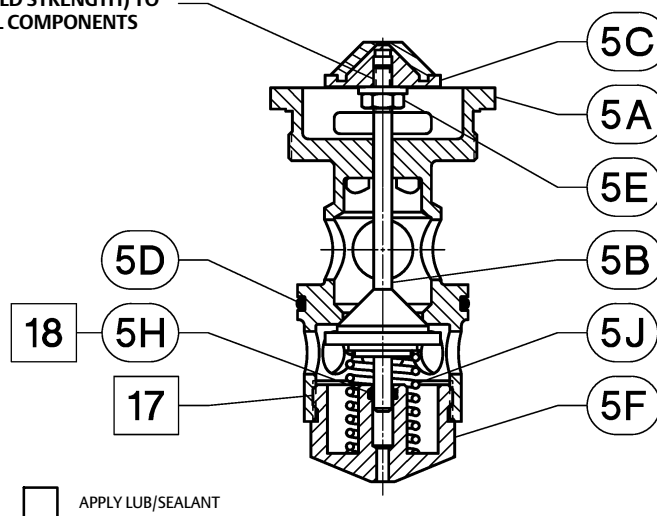
9. Replace the six cap screws (key 10) and tighten them in a crisscross manner using multiple patterns working up to a final torque of 15.8 N • m (140 lbf • in).

Valve Assembly Replacement

For key numbers refer to figures 5 and 6.

Figure 5. Valve Assembly Drawing

APPLY THREAD LOCKING ADHESIVE (MILD STRENGTH) TO
THREAD WHEN REPLACING INDIVIDUAL COMPONENTS



CE476000-A

APPLY LUB/SEALANT

1. Remove the six cap screws (key 10) from the perimeter of the spring case assembly (key 3), and lift off the assembly, taking care you do not lose the upper spring (key 6).
2. Remove the diaphragm assembly (key 4) and diaphragm spacer assembly (key 2) as a unit. The two small O-rings (key 22) will stay attached to the diaphragm spacer assembly (key 2).
3. Unscrew the valve assembly (key 5) from the body, using the 2-inch hex located on the seat ring (key 5A).
4. If you are replacing a complete valve assembly (key 5), proceed to step 10.
5. If you are replacing an upper valve (key 5C) and a lower valve and stem (key 5B), loosen the hex nut (key 5E), and remove the upper valve. Remove the hex nut (key 5E). Remove the lower guide (key 5F) and the lower spring (key 5J). Remove the lower valve and stem (key 5B) from the seat ring (key 5A).
6. Insert the replacement lower valve and stem (key 5B) into the seat ring (key 5A) and install the hex nut (key 5E) on the stem.
7. Replace the O-ring (key 5H) and apply lubricant (key 18) to both the O-ring (key 5H) and the guide bore of the lower guide (key 5F).
8. Install the lower spring (key 5J) and the lower guide (key 5F). Tighten to 61 N•m (45 lbf•ft).
9. Apply threadlock adhesive (mild strength) or equivalent to the threads of the lower valve and stem (key 5B) and install the upper valve (key 5C). Tighten the hex nut (key 5E) to 4.5 N•m (40 lbf•in) with the lower surface of the upper valve (key 5C) aligned with the upper surface of the seat ring (key 5A) as shown in figure 5.
10. Apply lubricant (key 18) to the O-ring (key 5D) and apply sealant (key 17) to the thread of the seat ring (key 5A).
11. Install the valve assembly (key 5) into the body (key 1). Torque to 102 N•m (75 lbf•ft).
12. Replace the O-rings (key 22).
13. Install the diaphragm assembly (key 4) and the diaphragm spacer assembly (key 2) onto the body (key 1) while making sure the lower diaphragm (key 4B) is flat and not folded or pinched. Orient the parts to form the bypass restriction passage as shown in figure 6.

14. Apply lubricant (key 18) to the O-ring (4H) and the outside diameter of the spring seat (4F).
15. Install the upper spring (key 6) and the spring case assembly (key 3) on the upper diaphragm (key 4C).

CAUTION

To avoid damage to the diaphragms, do not overtighten the screws.

16. Replace the six cap screws (key 10) and tighten them in a crisscross manner using multiple patterns working up to a final torque of 15.8 N • m (140 lbf • in).

Parts Ordering

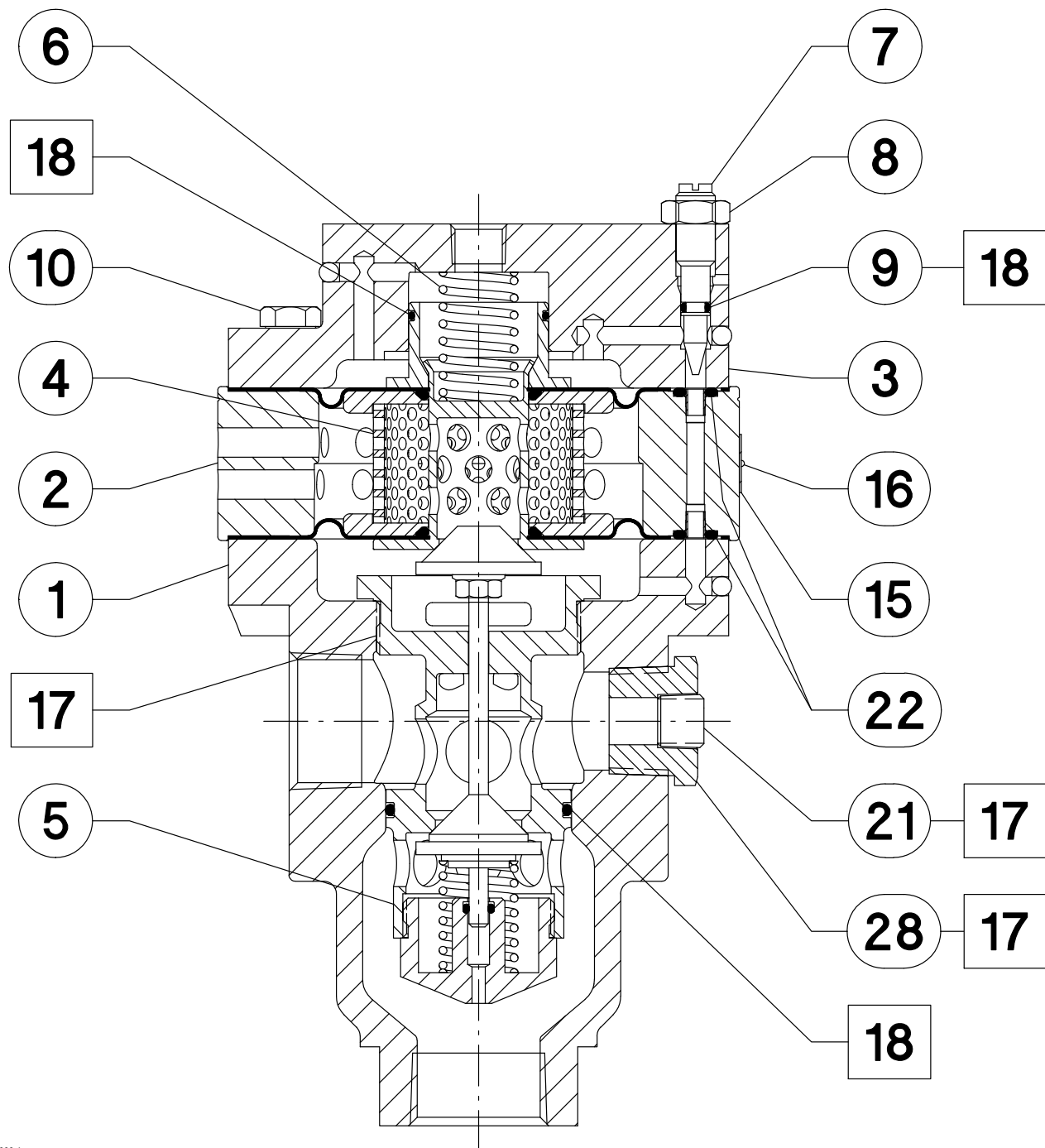
Whenever corresponding with your [Emerson sales office](#) about this equipment, mention the serial number of the valve assembly. This serial number can be found on the actuator nameplate. It may also be helpful to mention the date and other information on the volume booster nameplate as shown in figure 2.

When ordering replacement parts, state the complete eleven-digit part number of each part required as found in the following parts list.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher instrument, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

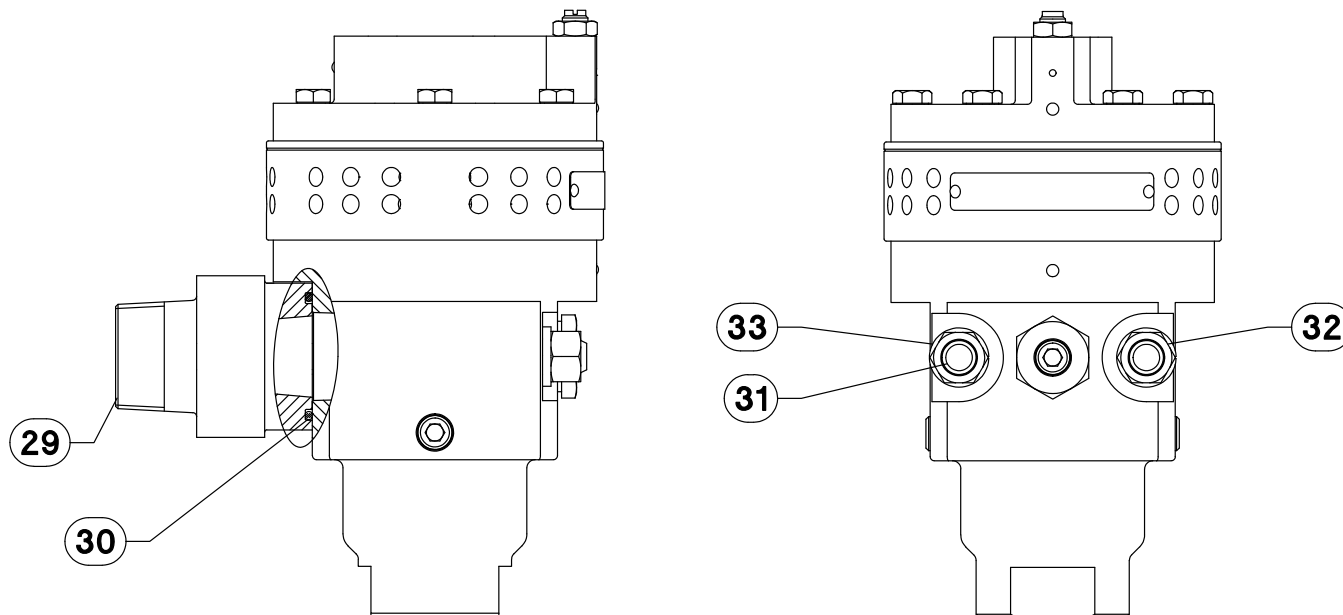
Figure 6. Volume Booster Assembly Drawing



GE49000-A

☐ APPLY LUB/SEALANT

Figure 7. Volume Booster Assembly with Mounting Adaptor



GE56173-A

Parts Kits

Table 2. Parts Kits

Description	Key Number Included in Kit	Part Number
Diaphragm Assembly Kit (key 4)	4A, 4B, 4C, 4D (qty 2), 4E, 4F, 4H, 4J (qty 2)	RSS263X0012
O-Ring Kit	5D, 5H, 9, 22 (qty 2), 30	RSS263X0022

Parts List (figures 4, 5, 6, and 7)

Note

For part numbers not shown, contact your [Emerson sales office](#).

Key	Description	Part Number	Key	Description	Part Number
1	Body Assembly, Aluminum		5D*	O-Ring	see parts kit
2	Diaphragm Spacer Assembly, Aluminum		5E	Flange Hex Nut	
3	Spring Case Assembly, Aluminum		5F	Lower Guide	
4*	Diaphragm Assembly, Aluminum/Nitrile/Nylon	see parts kit	5H*	O-Ring	see parts kit
4A	Orifice	see parts kit	5J	Lower Spring	
4B	Lower Diaphragm	see parts kit	6	Upper Spring	
4C	Upper Diaphragm	see parts kit	7	Restriction	
4D	Diaphragm Plate (2 req'd)	see parts kit	8	Hex Nut	
4E	Exhaust Diffuser	see parts kit	9*	O-Ring	see parts kit
4F	Spring Seat	see parts kit	10	Cap Screw	
4H	O-ring	see parts kit	15	Nameplate	
4J	O-ring (2 req'd)	see parts kit	16	Drivescrew	
5*	Valve Assembly, Brass/Nitrile	GE47600X012	17	Sealant, anti-seize	
5A	Seat Ring		18	Lubricant, silicone based	
5B*	Lower Valve and Stem Assembly	GE47594X012	21	Pipe Plug	
5C*	Upper Valve	1V198470972	22*	O-Ring	see parts kit
			28	Hex Pipe Bushing	
			29	Mounting Adaptor	
			30*	O-ring	see parts kit
			31	Stud (2 req'd)	
			32	Hex Nut (2 req'd)	
			33	Lock Washer (2 req'd)	
			34	1-1/4 NPT Pipe Elbow	

*Recommended spare parts

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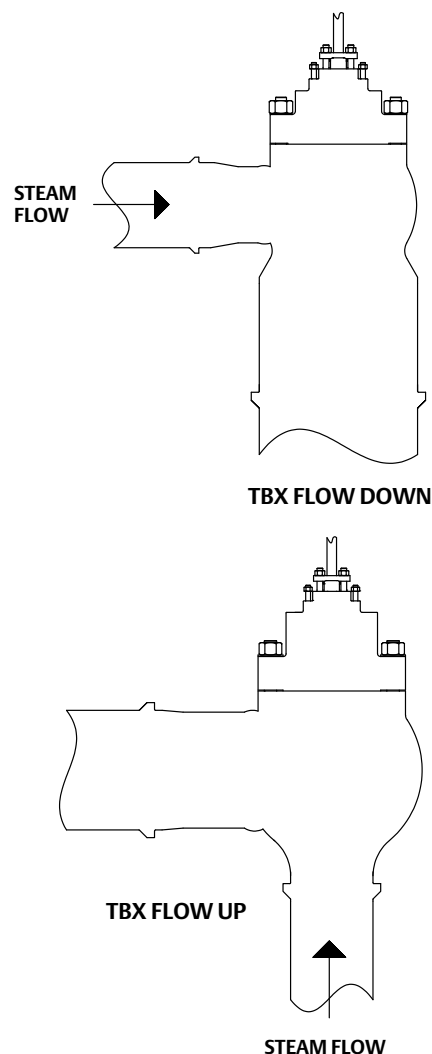


Fisher™ TBX Blowdown Fixture

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Figure 1. Fisher TBX Constructions



Introduction

Scope of Manual

This instruction manual includes installation and operation information for the Fisher TBX Blowdown Fixture for flow up and flow down TBX valves. Piping blowdown is very important to successful plant startup and trouble free operation. The plan for piping blowdown should be undertaken by professionals familiar with all aspects of blowdown operation. This manual is not intended to cover all details required for successful piping system cleaning.

Some instructions are different between the TBX flow up and TBX flow down valve constructions. Figure 1 can be used to help identify which instructions apply. Inlet steam flow is perpendicular to the valve stem and actuator on a TBX flow down and parallel to the valve stem and actuator on a TBX flow up.

Key numbers identified for valve disassembly are shown in the specific valve instruction manual. Refer to separate instruction manuals for instructions covering the exact valve, actuator, and accessories associated with the blowdown fixture.

Do not install, operate, or maintain a TBX Blowdown Fixture without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The TBX Blowdown Fixture provides a convenient way to clean piping upstream of the valve while taking care not to damage internal valve parts.

Educational Services

For information on available courses for the Fisher TBX Blowdown Fixture, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Principle of Operation

The Blowdown Fixture replaces the valve plug and cage and allows steam flow from the upstream piping to be directed through the valve body and out the valve outlet and downstream piping.

Maintenance

WARNING

To avoid personal injury or property damage from release of pressurized process media, ensure that the system is completely depressurized and appropriate safety measures have been taken prior to carrying out any of the following maintenance procedures. Only trained competent individuals with the proper equipment should attempt to disassemble and install a Blowdown Fixture, and reassemble a TBX valve.

- Do not remove the actuator from the desuperheater while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.

- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valve Disassembly

The following valve disassembly steps are intended as a quick reference only. Refer to the TBX instruction manual, [D103172X012](#), for key numbers and further detail regarding valve disassembly.

Actuator Removal

The following actuator disassembly steps are intended as a quick reference only. Refer to the appropriate actuator instruction manual for further detail on actuator removal.

1. Release the actuator seat load by either manually stroking the valve or applying the appropriate instrument signal. The stem connector may be removed once the plug is off of the valve seat.
2. If an instrument signal has been used to stroke the plug off the seat, remove the signal only after removing the stem connector.
3. Isolate and disconnect the operating lines from the actuator.
4. Loosen the yoke fasteners and remove the actuator from the valve.

Packing Box

Unbolt the packing stud nuts, (key 68), and remove the packing flange (key 66) and packing follower, (key 65) (reference the appropriate instruction manual for key numbers). Remove as much packing as possible from the packing box.

CAUTION

Extreme care should be taken to avoid scratching the stem or the packing box.

Bonnet and Trim

1. Loosen the bonnet stud nuts, (key 55) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the bonnet studs, which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

2. Remove the bonnet (key 6) from the valve with uni-axial pull. If the bonnet seems to bind in the valve body, check the alignment of the hoist or pulling mechanism. Deviation from an axial pull of the parts may result in galling or bending of the stem (key 23). The bonnet may be lightly tapped back into alignment with a soft face mallet. The stem and plug should be pushed back into the valve body while the bonnet is being removed. Once the bonnet is removed, dislodge any remaining packing rings from the packing box.

CAUTION

Do not attempt to overpower any binding, as damage to the guide surfaces may result.

3. Remove the packing ring (key 63) from the bottom of the packing box. Lightly sand the inside of the packing box with 60 or 80 grit paper to remove any adherent packing material. Final cleanup should be made with 160 grit or finer paper.
4. Inspect the bonnet guiding surfaces and gasket mating surfaces. Light damage on the guiding surface may be repaired with an emery cloth or other suitable material. Damage to the gasket mating surface may require bonnet replacement to avoid leakage.
5. Remove the plug assembly (key 22, 23, and 53) as a single unit by grasping the valve stem (key 23) and pulling the assembly from the body cavity. The plug assembly contains sensitive guiding and sealing surfaces on its outside diameter and care must be taken in its handling. The plug should be temporarily stored on a clean wooden or cloth surface.
6. Remove the cage (key 21) from the valve body. Remove and discard the upper and lower cage gaskets (key 43). Reference the TBX valve instruction manual for guidance in performing this disassembly. The cage contains sensitive guiding surfaces on its outside diameter and care must be taken during handling. The cage should be temporarily stored on a clean wooden or cloth surface.
7. Clean and inspect the guiding and sealing surfaces of the plug assembly. For balanced plug designs, inspect the piston ring (key 45) and Bore Seal ring (key 46) for signs of excess wear or damage and replace if necessary. The piston ring is a two piece design with an outer seal ring and an inner expander ring. The outer ring diameter should be expanded beyond the diameter of the plug in its free state. It can be shifted within its groove to inspect for uneven wear around its circumference. The piston ring should require some compression when installing the plug into the cage. Lack of required compression indicates that the piston ring has worn or relaxed and should be replaced. Vertical marks in the axial orientation also indicates wear that requires replacement of the ring. The Bore Seal ring has a C-shaped cross section with the open portion of the C-shape facing the stem side of the plug for flow-up designs and the open portion of the C-shape facing the seating surface of the plug for flow-down designs. Any uneven marks around the circumference of the ring or any flattening of the ring shape at its outside diameter are indications of wear and require replacement. Contact your [Emerson sales office](#) or Local Business Partner for Bore Seal ring replacement.
8. Clean and inspect the inside diameter surfaces of the cage. The entire length of the cage inside diameter is either a sealing and/or guiding surface and any measurable wear requires that the cage be replaced.
9. **Flow up construction only:** The seat ring remains retained inside the valve body. Clean and inspect the angled seating surface. Any detectable damage around the circumference of the seating surface is an indication of wear and requires reconditioning to ensure seating performance. Contact your Emerson sales office or Local Business Partner for specific instructions on reconditioning the seating surface.
10. **Flow down construction only:** The bolted seat ring and lower cage must be removed. Loosen the seat ring bolts, (key 76) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the seat ring studs, which may cause binding. Individual bolts should not be completely loosened while the remaining bolts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs. Reference the TBX instruction manual ([D103172X012](#)) for instructions on removing the bolted seat ring and lower cage (key 79). Discard lower cage gaskets (key 75). The bolted seat ring and lower cage contain sensitive guiding and gasket surfaces on its outside diameter and care must be taken in their handling. The seat ring and lower cage should be temporarily stored on a clean wooden or cloth surface.

11. Remove all used gaskets and foreign matter from the interior of the valve and from the inlet and outlet openings. Remove any foreign matter that may be in the valve trim. Inspect all valve body guiding and sealing surfaces for any signs of wear.

Visual Inspection

Visually inspect the interior of the valve for abnormal wear, signs of erosion, or scoring if the valve has been in service. All scores and scratches should be removed by grinding or filing to remove any interference of the clearance zones between the internal bores and the mating parts. The affected area should be sanded with 100 grit or finer paper. Do not attempt to completely remove the score, only the interference should be removed and sanded.

The gasket surfaces of the valve body and bonnet should be inspected to verify that they are not damaged and are free of imbedded gasket material.

Installation of the Blowdown Plug

Inspect the valve to ensure that all parts and gaskets have been removed and the valve body is free from foreign debris. For TBX flow up constructions, lubricate the inside and outside of the seat lip and the upper valve body bore and counterbore. For TBX flow down constructions, lubricate the lower body bore where the bolted seat and lower cage guide are located and the upper valve body bore and counterbore. Install the trim as noted below and illustrated in the Blowdown Fixture drawings, figures 2, 3, and 4.

1. Place the lower cage gasket (key 43) into the valve body.
2. Insert the Blowdown Plug (key 3) into the valve body, making sure that the gasket remains properly placed. Note that the Blowdown Plug must extend to and engage with the seat ring. If there is any question regarding the proper seating of the Blowdown Plug inside the valve body, the following measurements can be taken for confirmation. Measure the thickness of the Blowdown Plug flange at its largest diameter. Measure the depth of the mating counterbore where the Blowdown Plug flange engages into the valve body. When assembled with a new cage gasket, the resulting depth from the top of the valve body to the top of the Blowdown Plug flange should be the difference in these two measured values, minus an additional 0.045 inch to allow for the uncompressed gasket.
3. Flow down construction only: Insert the Blowdown Plug (key 3) into the valve body, making sure the gasket remains properly placed.

Table 1. Recommended Bonnet Stud Torque⁽¹⁾

Bolt Size, Inch	Threads Per Inch	Recommended Bolt Torque, lbf•ft ⁽²⁾
1	8	405
1-1/8	8	550
1-1/4	8	730
1-3/8	8	980
1-1/2	8	1290
1-5/8	8	1650
1-3/4	8	2070
1-7/8	8	2560
2	8	3130
2-1/4	8	4490

1. Torque values for lubricated threads.
2. Torques for studs with heavy hex nuts.

4. Place the upper cage gasket (key 43) on top of the flange of the Blowdown Plug.
5. Lubricate the bonnet studs (key 54) and lower the bonnet (key 6) onto the valve body, making sure that the upper cage gasket remains in the gasket containment groove.
6. Lubricate and tighten the bonnet fasteners as recommended in the TBX valve instruction manual. Torque values are also shown in table 1 of this document.

CAUTION

Failure to comply with good body-to-bonnet bolting practices and the torque values shown in table 1 or in the appropriate valve instruction manual may result in damage to the valve.

Piping Blowdown with the Blowdown Fixture Installed

WARNING

To avoid personal injury or property damage from blown out debris, take appropriate measures to stay clear of the outlet of the blowdown piping during the following procedure.

Note

The following steps are not intended to be complete instructions for performing a proper system blowdown. They are intended only to address the basic issues required for proper piping blowdown.

1. Perform piping blowdown according to plant startup procedures. Normal blowdown procedures should incorporate piping velocities in excess of those anticipated during maximum system operation. Piping should be blown down until two subsequent checks of a target placed at the outlet of the blowdown piping indicate that all debris has been removed from the piping.
2. At the completion of the blowdown procedure, secure and depressurize the system.

Disassembly of the Blowdown Fixture

1. Loosen the bonnet nuts, (key 55) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the bonnet flange studs which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

2. Remove the bonnet (key 6) from the valve with uni-axial pull. If the bonnet seems to bind in the valve body, check the alignment of the hoist or pulling mechanism. Deviation from an axial pull of the parts may result in galling or bending of the stem.

CAUTION

Do not attempt to over-power any binding, as damage to the guide surfaces may result.

3. Remove and discard the upper cage gasket (key 43).
4. Remove the Blowdown Plug (key 3) from the valve body cavity using the integral eyebolt holes in the blowdown plug.
5. Remove and discard the lower cage gasket (key 43).

CAUTION

To avoid compromising the service life of the TBX valve body and/or trim, do not reuse the Blowdown Fixture gaskets for valve reassembly.

Cleaning

After removal of the Blowdown Plug, the interior of the valve body should be rinsed with clean water or repeatedly wiped with clean towels until the surfaces are clean to the touch. All internal parts should be cleaned prior to reassembly.

Reassembly

Refer to the TBX valve instruction manual for guidance in reassembling the valve.

Ordering Information

Information required to order a TBX Blowdown Fixture.

- Valve Serial Number
- Valve Tag Number
- Customer Order Number
- Valve Model Number

Blowdown Fixture Design Conditions

- Flushing Fluid
- Flushing Fluid Pressure
- Flushing Fluid Temperature
- Material (carbon steel unless otherwise specified)

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 2. Fisher TBX Flow Up Welded Seat Ring Blowdown Fixture

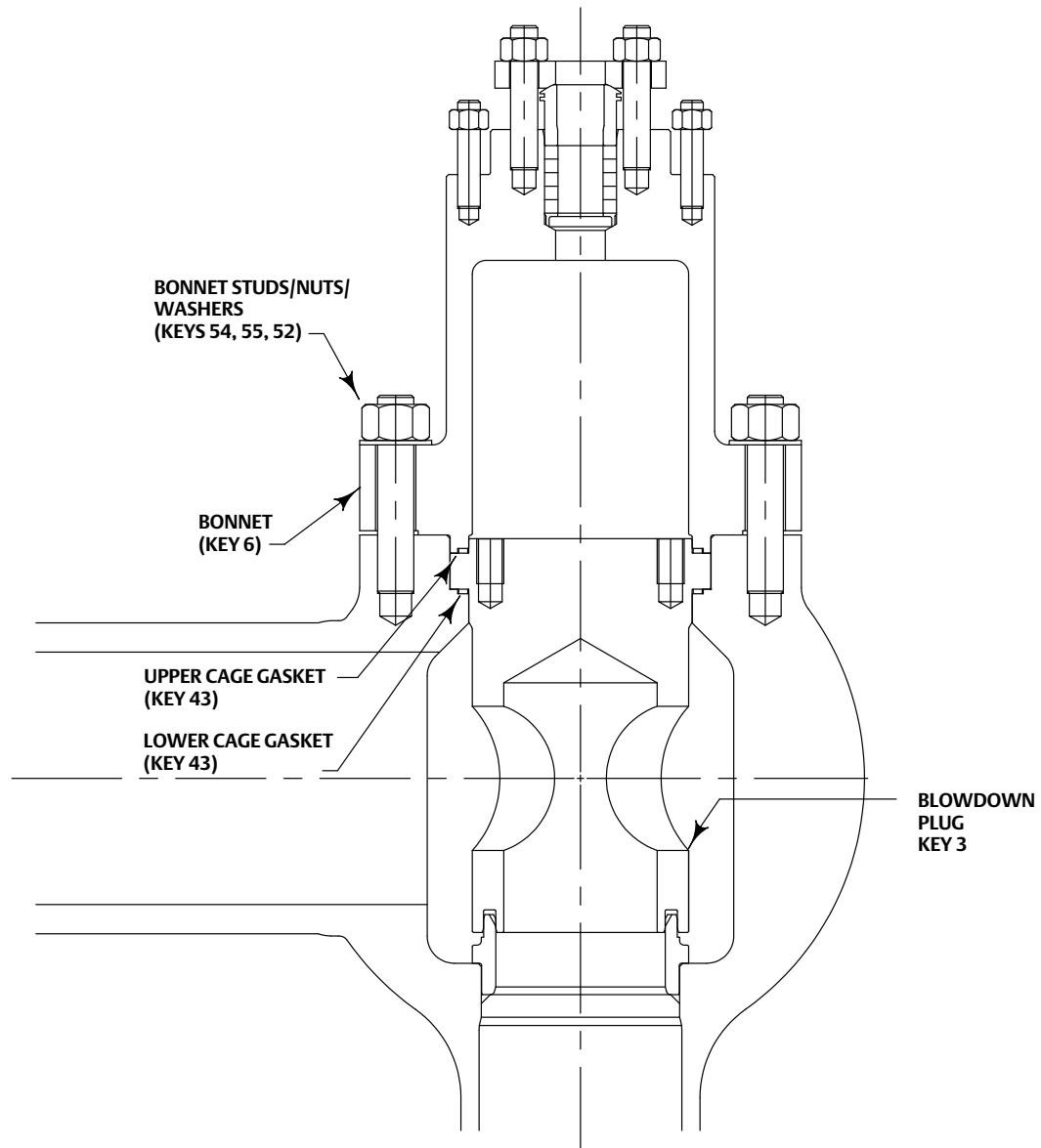


Figure 3. Fisher TBX Flow Up Bolted Seat Ring Blowdown Fixture

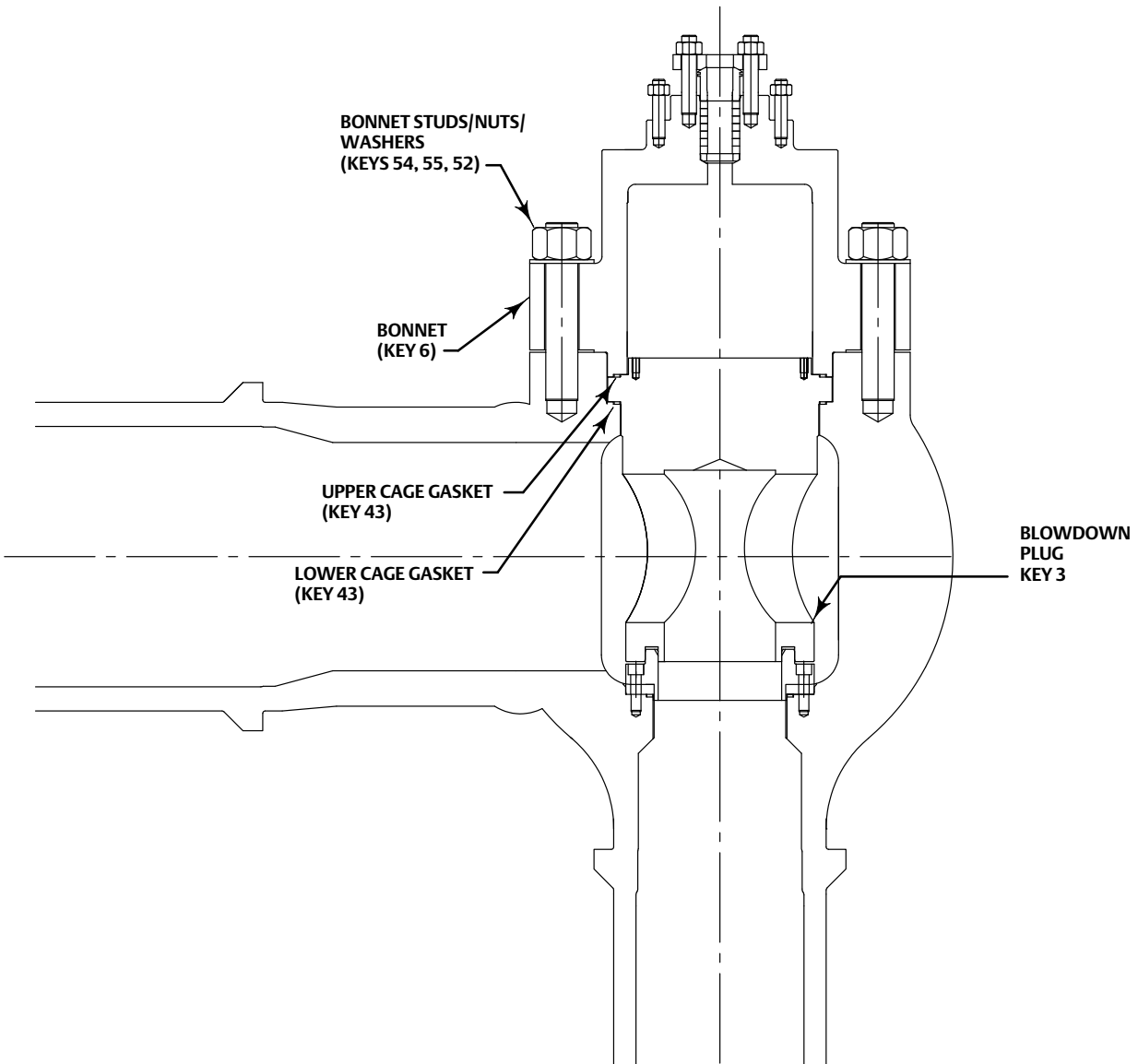
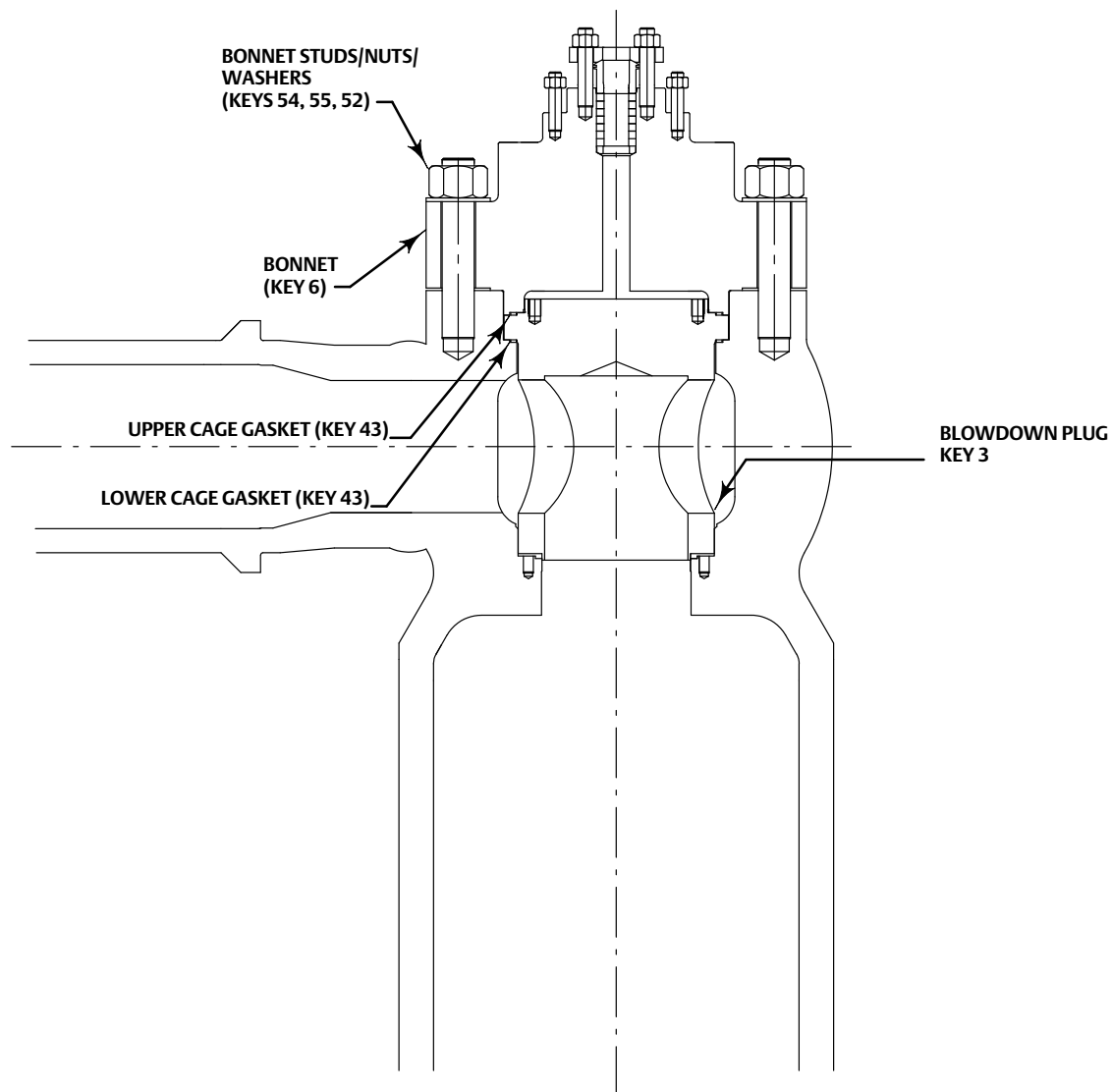


Figure 4. Fisher TBX Flow Down Blowdown Fixture



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D103207X012

TBX Blowdown Fixture

June 2017

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

TBX Blowdown Fixture

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Instruction Manual

D103207X012

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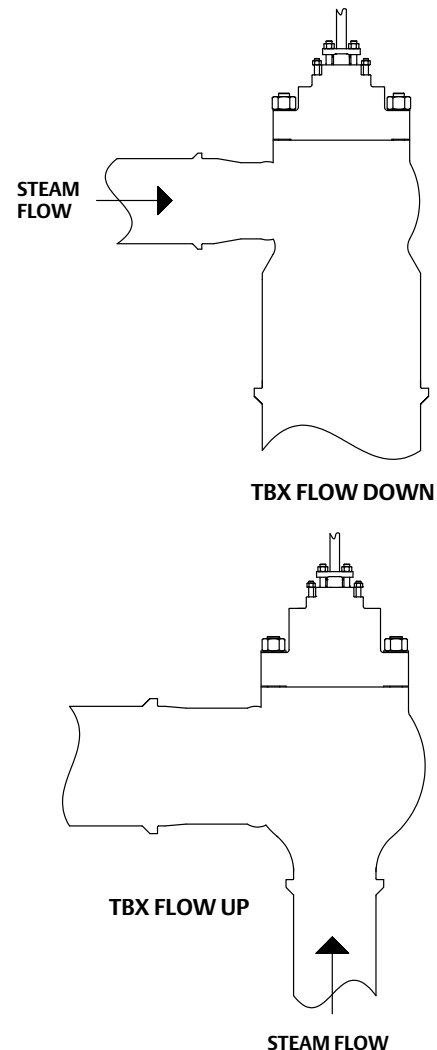


Fisher™ TBX Blowout Fixture

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Figure 1. Fisher TBX Constructions



Introduction

Scope of Manual

This instruction manual includes installation and operation information for the Fisher TBX Blowout Fixture for flow up and flow down TBX valves. Piping blowdown is very important to successful plant startup and trouble free operation. The plan for piping blowdown should be undertaken by professionals familiar with all aspects of blowdown operation. This manual is not intended to cover all details required for successful piping system cleaning.

Some instructions are different between the TBX flow up and TBX flow down valve constructions. Figure 1 can be used to help identify which instructions apply. Steam flow is perpendicular to the valve stem and actuator on a TBX flow down and parallel to the valve stem and actuator on a TBX flow up.

Key numbers identified for valve disassembly are shown in the specific valve instruction manual. Refer to separate instruction manuals for instructions covering the exact valve, actuator, and accessories associated with the blowout fixture.

Do not install, operate, or maintain a TBX Blowout Fixture without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The TBX Blowout Fixture provides a convenient way to clean piping upstream of the valve while taking care not to damage internal valve parts.

Educational Services

For information on available courses for the Fisher TBX Blowout Fixture, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Principle of Operation

The Blowout Fixture replaces the valve cage and plug, as well as the valve bonnet. The fixture allows steam flow from the inlet or outlet piping to be directed through the valve, out the blowout fixture, and through temporary piping.

Maintenance

WARNING

To avoid personal injury or property damage from the release of pressurized process media, ensure that the system is completely depressurized and appropriate safety measures have been taken prior to carrying out any of the following procedures. Only trained competent individuals with the proper equipment should attempt to disassemble and install a Blowout Fixture, and reassemble a TBX valve.

- Do not remove the actuator from the desuperheater while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valve Disassembly

The following valve disassembly steps are intended as a quick reference only. Refer to the TBX instruction manual, D103172X012, for key numbers and further detail regarding valve disassembly.

Actuator Removal

The following actuator disassembly steps are intended as a quick reference only. Refer to the appropriate actuator instruction manual for further detail regarding actuator removal.

1. Release the actuator seat load by either manually stroking the valve or applying the appropriate instrument signal. The stem connector may be removed once the plug is off of the valve seat.
2. If an instrument signal has been used to stroke the plug off the seat, remove the signal only after removing the stem connector.
3. Isolate and disconnect the operating lines from the actuator.
4. Loosen the yoke fasteners, as appropriate, and remove the actuator from the valve.

Packing Box

Unbolt the packing stud nuts, (key 68), and remove the packing flange (key 66) and packing follower, (key 65) (reference the appropriate instruction manual for key numbers). Remove as much packing as possible from the packing box.

CAUTION

Extreme care should be taken to avoid scratching the stem or the packing box.

Bonnet and Trim

1. Loosen the bonnet stud nuts, (key 55) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the bonnet studs which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

2. Remove the bonnet (key 6) from the valve with uni-axial pull. If the bonnet seems to bind in the valve body, check the alignment of the hoist or pulling mechanism. Deviation from an axial pull of the parts may result in galling or bending of the stem (key 23).

CAUTION

Do not attempt to over-power any binding, as damage to the guide surfaces may result.

The bonnet may be lightly tapped back into alignment with a soft face mallet. The stem and plug should be pushed back into the valve body while the bonnet is being removed. Once the bonnet is removed, dislodge any remaining packing rings from the packing box.

3. Remove the packing ring (key 63) from the bottom of the packing box. Lightly sand the inside of the packing box with 60 or 80 grit paper to remove any adherent packing material. Final cleanup should be made with 160 grit or higher paper.
4. Inspect the bonnet guiding surfaces and gasket mating surfaces. Light damage on the guiding surface may be repaired with an emery cloth or other suitable material. Damage to the gasket mating surface may require bonnet replacement to avoid leakage.
5. Remove the plug assembly (key 22, 23, and 53) as a single unit by grasping the valve stem (key 23) and pulling the assembly from the body cavity. The plug assembly contains sensitive guiding and sealing surfaces on its outside diameter and care must be taken in its handling. The plug should be temporarily stored on a clean wooden or cloth surface.
6. Remove the cage (key 21) from the valve body. Remove and discard the upper and lower cage gaskets (key 43). Reference the TBX valve instruction manual for guidance in performing this disassembly. The cage contains sensitive guiding surfaces on its outside diameter and care must be taken during handling. The cage should be temporarily stored on a clean wooden or cloth surface.
7. Clean and inspect the guiding and sealing surfaces of the plug assembly. For balanced plug designs, inspect the piston ring (key 45) and Bore Seal ring (key 46) for signs of excess wear or damage and replace if necessary. The piston ring is a two piece design with an outer seal ring and an inner expander ring. The outer ring diameter should

be expanded beyond the diameter of the plug in its free state. It can be shifted within its groove to inspect for uneven wear around its circumference. The piston ring should require some compression when installing the plug into the cage. Lack of required compression indicates that the piston ring has worn or relaxed and should be replaced. Vertical marks in the axial orientation also indicates wear that requires replacement of the ring. The Bore Seal ring has a C-shaped cross section with the open portion of the C-shape facing the stem side of the plug for flow-up designs and the open portion of the C-shape facing the seating surface of the plug for flow-down designs. Any uneven marks around the circumference of the ring or any flattening of the ring shape at its outside diameter are indications of wear and require replacement. Contact your [Emerson sales office](#) or Local Business Partner for Bore Seal ring replacement.

8. Clean and inspect the inside diameter surfaces of the cage. The entire length of the cage inside diameter is either a sealing and/or guiding surface and any measurable wear requires that the cage be replaced.
9. **Flow up construction only:** The seat ring remains retained inside the valve body regardless if it is bolted or welded. Clean and inspect the angled seating surface. Any detectable damage around the circumference of the seating surface is an indication of wear and requires reconditioning to ensure seating performance. Contact your Emerson sales office or Local Business Partner for specific instructions on reconditioning the seating surface.
10. **Flow down construction only:** The bolted seat ring and lower cage must be removed. Loosen the seat ring bolts, (key 76) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the seat ring studs, which may cause binding. Individual bolts should not be completely loosened while the remaining bolts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs. Reference the TBX instruction manual (D103172X012) for instructions on removing the bolted seat ring and lower cage (key 79). Discard the lower cage gaskets (key 75). The bolted seat ring and lower cage contain sensitive guiding and gasket surfaces on its outside diameter and care must be taken in their handling. The seat ring and lower cage should be temporarily stored on a clean wooden or cloth surface.
11. Remove all used gaskets and foreign matter from the interior of the valve and from the inlet and outlet openings. Remove any foreign matter that may be in the valve body or trim. Inspect all valve body guiding and sealing surfaces for any signs of wear.

Visual Inspection

Visually inspect the interior of the valve for abnormal wear, signs of erosion, or scoring if the valve has been in service. All scores and scratches should be removed by grinding or filing to remove any interference of the clearance zones between the internal bores and the mating parts. The affected area should be sanded with 100 grit or finer paper. Do not attempt to completely remove the score, only the interference should be removed and sanded.

The gasket surfaces of the valve body and bonnet should be inspected to verify that they are not damaged and are free of imbedded gasket material.

Table 1. Recommended Bonnet Bolt Torque

Bolt Size, Inch	Threads per Inch	Recommended Bolt Torque, lbf•ft ⁽¹⁾
1	8	405
1-1/8	8	550
1-1/4	8	730
1-3/8	8	980
1-1/2	8	1290
1-5/8	8	1650
1-3/4	8	2070
1-7/8	8	2560
2	8	3130
2-1/4	8	4490

1. Torques for studs with heavy hex nuts.

Installation of the Blowout Fixture

Inspect the valve to ensure that all parts and gaskets have been removed and the valve body is free from foreign debris. For TBX flow up constructions, lubricate the inside and outside of the seat lip and the upper valve body bore and counterbore. For TBX flow down constructions, lubricate the lower body bore where the bolted seat and lower cage guide and the upper valve body bore and counterbore. Install the trim as noted below and illustrated in the Blowout Fixture drawings, figures 2-13.

1. Place the lower cage gasket (key 43) in the valve body.
2. **Flow up construction only:** Insert the blowout plug (key 5) in the valve body making sure that the gasket remains properly placed. Note that the Blowout Plug must extend to and engage with the seat ring. If there is any question regarding the proper seating of the Blowout Plug inside the valve body, the following measurements can be taken for confirmation. Measure the thickness of the Blowout Plug flange at its largest diameter. Measure the depth of the mating counterbore where the Blowout Plug flange engages into the valve body. When assembled with a new cage gasket, the resulting depth from the top of the valve body to the top of the Blowout Plug flange should be the difference in these two measured values, minus an additional 0.045 inch to allow for the uncompressed gasket.
3. **Flow down construction only:** Insert the Blowout Plug (key 4 or 5) into the valve body, making sure that the gasket remains properly placed.
4. Place the upper cage gasket (key 43) on top of the Blowout Plug flange.
5. Lubricate the bonnet studs (key 54) and lower the blowout bonnet (key 10) onto the valve body, making sure that the upper cage gasket remains located in the gasket containment groove.
6. Lubricate and tighten the bonnet fasteners as recommended in the TBX valve instruction manual. Torque values are also shown in table 1 of this document.

CAUTION

Failure to comply with good body-to-bonnet bolting practices and the torque values shown in table 1 or in the appropriate valve instruction manual may result in damage to the valve.

Piping Blowdown with the Blowout Fixture Installed

⚠ WARNING

To avoid personal injury or property damage from sudden release of process pressure or bursting of parts, do not exceed the pressure class rating of the blowout fixture when performing the piping blowdown.

Note

The following steps are not intended to be complete instructions for performing a proper system blowdown. They are intended only to address the basic issues required for proper piping blowdown.

1. Connect temporary piping to the Blowout Bonnet connection taking care not to impose excessive piping loads on the valve-to-bonnet connection.
2. Perform piping blowdown according to plant startup procedures. Normal blowdown procedures should incorporate piping velocities in excess of those anticipated during maximum system operation. Piping should be blown down until two subsequent checks of a target placed at the outlet of the blowdown piping indicate that all debris has been removed from the piping.

3. At the completion of the blowdown procedure, secure and depressurize the system.

Disassembly of the Blowout Fixture

1. Disconnect the temporary piping connection from the Blowout Bonnet.
2. Loosen the Blowout Bonnet nuts, (key 55) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the bonnet flange studs which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

3. Remove the Blowout Bonnet (key 10) from the valve with uni-axial pull. If the Blowout Bonnet seems to bind in the valve body, check the alignment of the hoist or pulling mechanism. Deviation from an axial pull of the parts may result in galling or bending of the stem.

CAUTION

Do not attempt to over-power any binding, as damage to the guide surfaces may result.

4. Remove and discard the upper cage gasket (key 43).
5. Remove the Blowout Plug (key 5) from the valve body cavity using the integral eyebolt holes in the Blowout Plug.
6. Remove and discard the lower cage gasket (key 43).

CAUTION

To avoid compromising the service life of the TBX valve body and/or trim, do not reuse the Blowout Fixture gaskets for valve reassembly.

Cleaning

After removal of the blowout trim, the interior of the valve body should be rinsed with clean water or repeatedly wiped with clean towels until the surfaces are clean to the touch. All internal parts should be thoroughly cleaned prior to reassembly of the valve.

Reassembly

Refer to the TBX valve instruction manual for guidance in reassembling the valve.

Ordering Information for Flanged Fixture

Information required for specifying and ordering the TBX Blowout Fixture. See figures 2 and 3.

Valve Information

- Valve Serial Number
- Valve Tag Number
- Customer Order Number
- Valve Model Number

Blow Fixture Design Conditions

- Flushing Fluid
- Flushing Fluid Pressure
- Flushing Fluid Temperature
- Material (carbon steel unless otherwise noted)
- Blow Fixture Pressure Class: CL300 (this is the default class if not otherwise specified)

Ordering Information for BWE Fixture

Information required for specifying and ordering the TBX Blowout Fixture. See figures 4 and 5.

Valve Information

- Valve Serial Number
- Valve Tag Number
- Customer Order Number
- Valve Model Number

Blow Fixture Design Conditions

- Flushing Fluid
- Flushing Fluid Pressure
- Flushing Fluid Temperature
- Material (carbon steel unless otherwise noted)
- Blow Fixture Pressure Class: CL300 (this is the default class if not otherwise specified)
- Blow Fixture Outlet Pipe Schedule (Schedule XS unless otherwise noted)

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 2. Fisher TBX Flow Up Welded Seat Ring Flanged Outlet-to-Bonnet Blowout Fixture (Blows Debris from the Outlet)

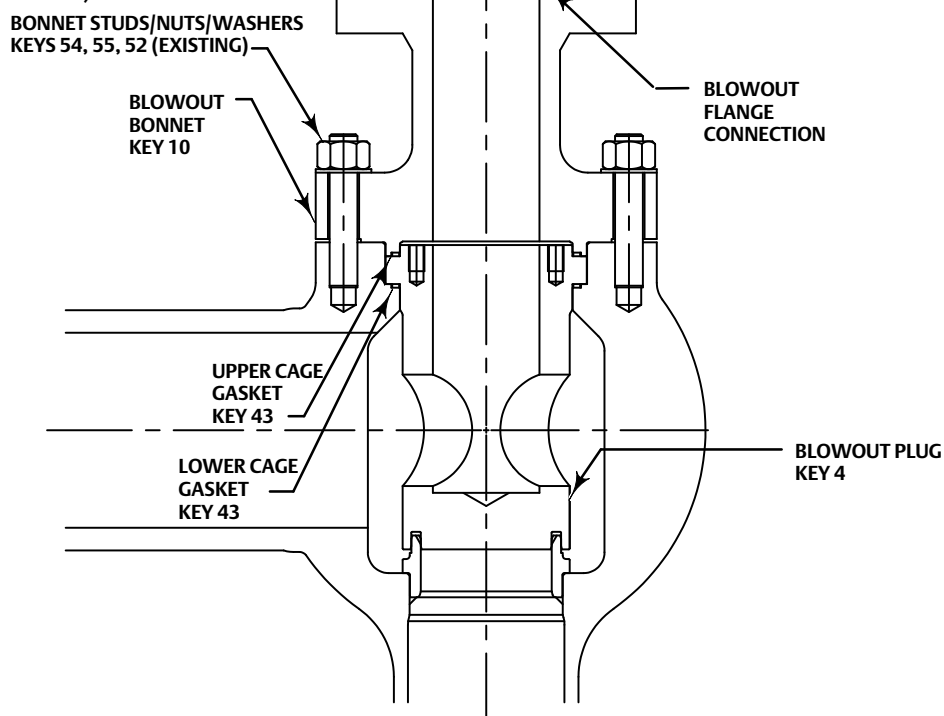


Figure 3. Fisher TBX Flow Up Welded Seat Ring Flanged Inlet-to-Bonnet Blowout Fixture (Blows Debris from the Inlet)

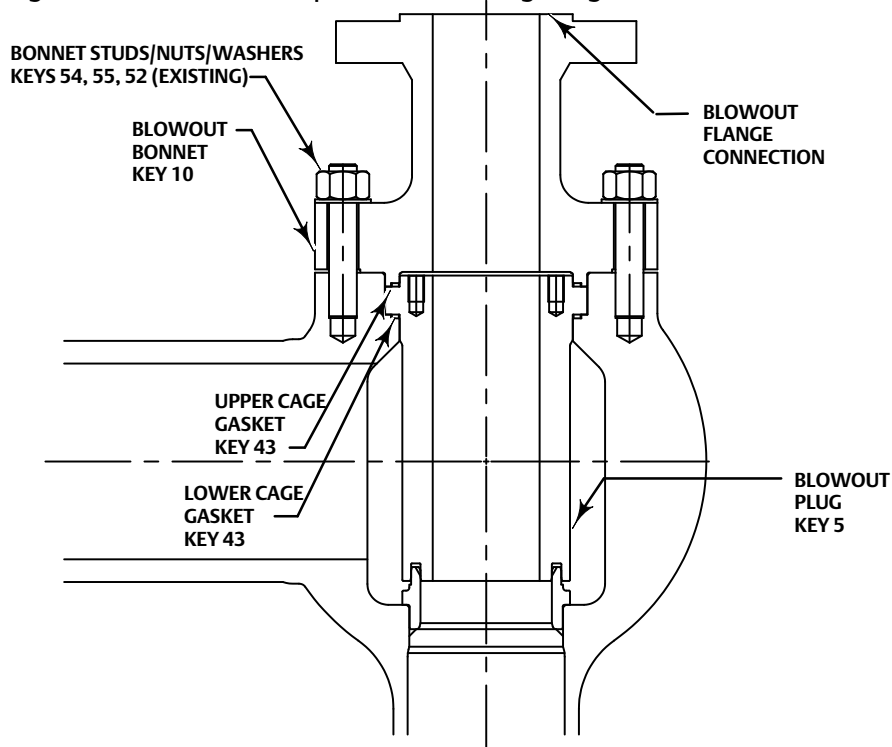


Figure 4. Fisher TBX Flow Up Welded Seat Ring BWE Inlet-to-Bonnet Fixture (Blows Debris from the Inlet)

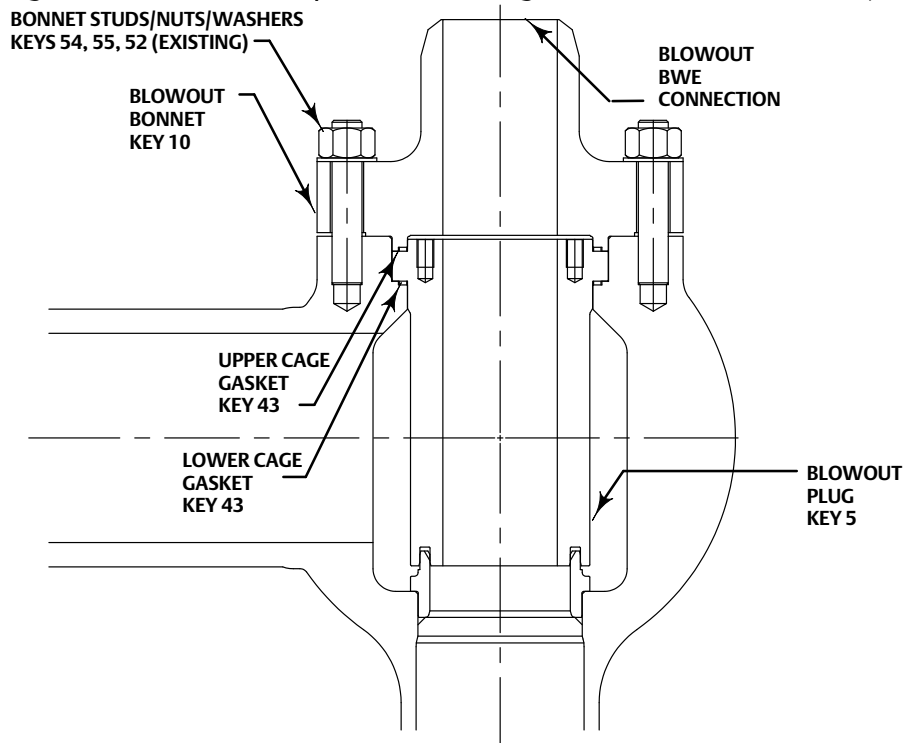


Figure 5. Fisher TBX Flow Up Welded Seat Ring BWE Outlet-to-Bonnet Fixture (Blows Debris from the Outlet)

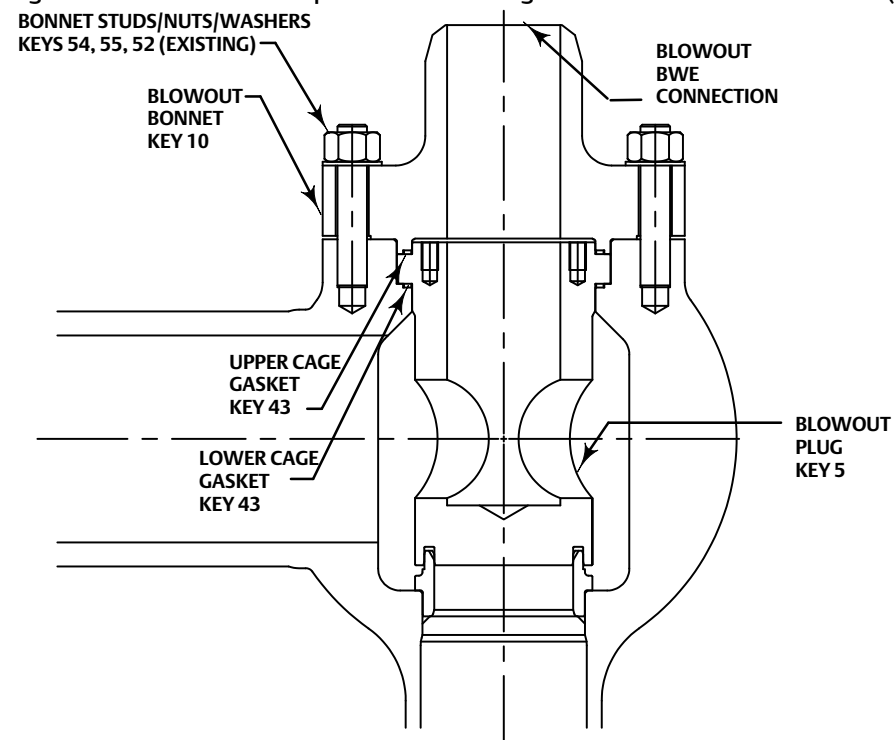


Figure 6. Fisher TBX Flow Up Bolted Seat Ring Flanged Outlet-to-Bonnet Blowout Fixture (Blows Debris from the Outlet)

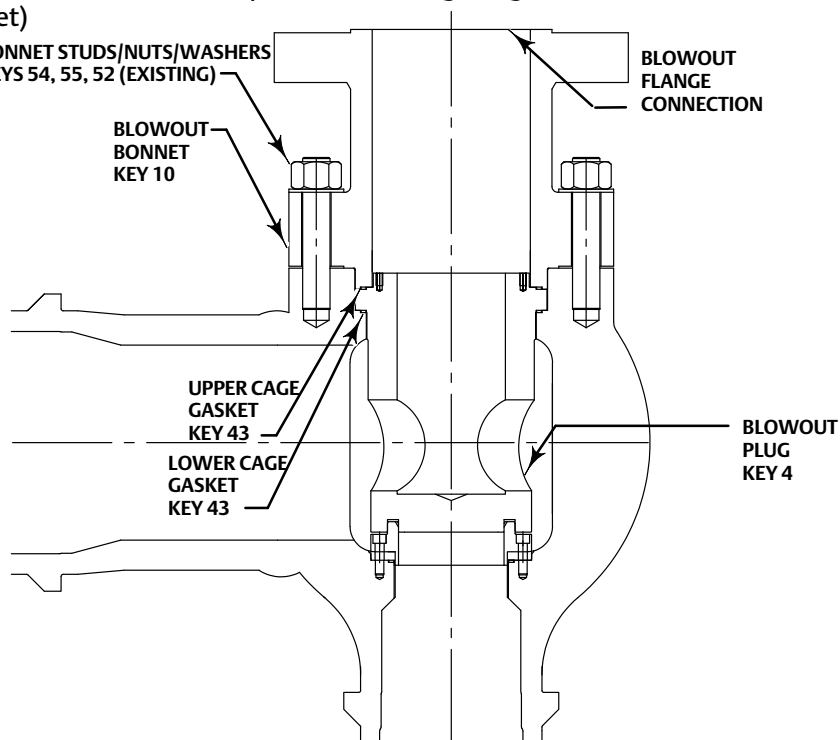


Figure 7. Fisher TBX Flow Up Bolted Seat Ring Flanged Inlet-to-Bonnet Blowout Fixture (Blows Debris from the Inlet)

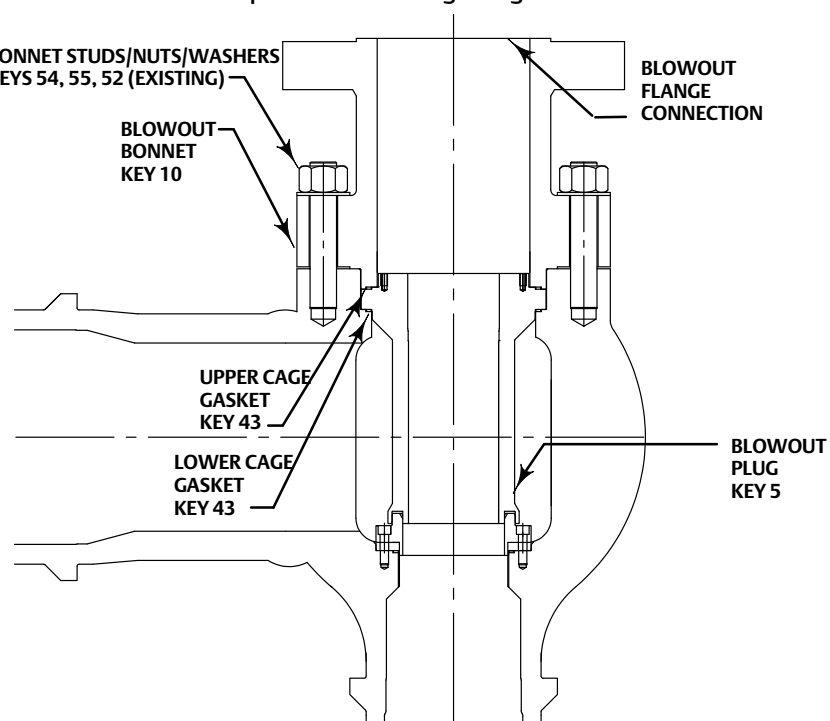


Figure 8. Fisher TBX Flow Up Bolted Seat Ring BWE Outlet-to-Bonnet Fixture (Blows Debris from the Outlet)

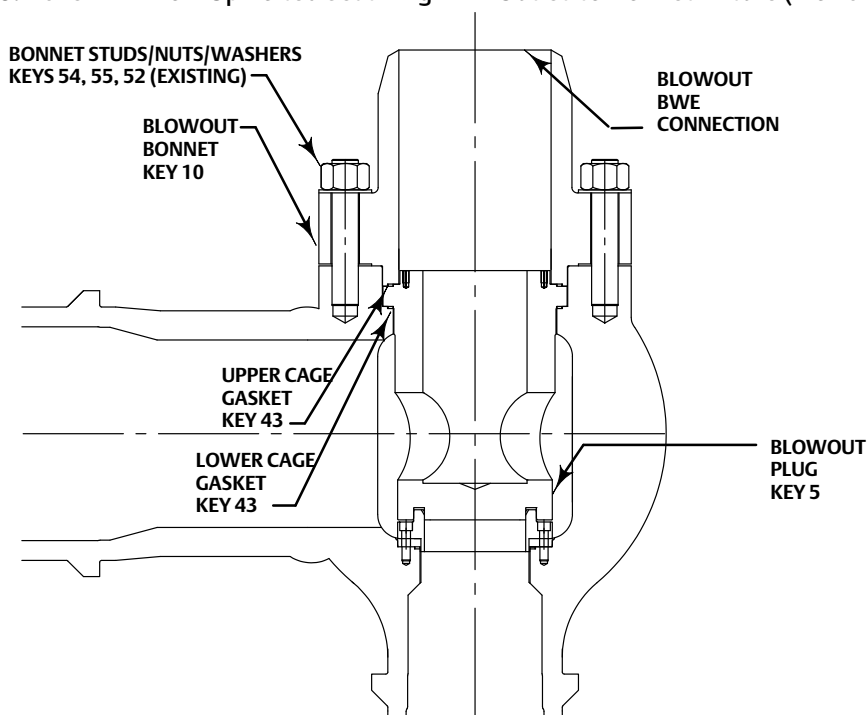


Figure 9. Fisher TBX Flow Up Bolted Seat Ring BWE Inlet-to-Bonnet Fixture (Blows Debris from the Inlet)

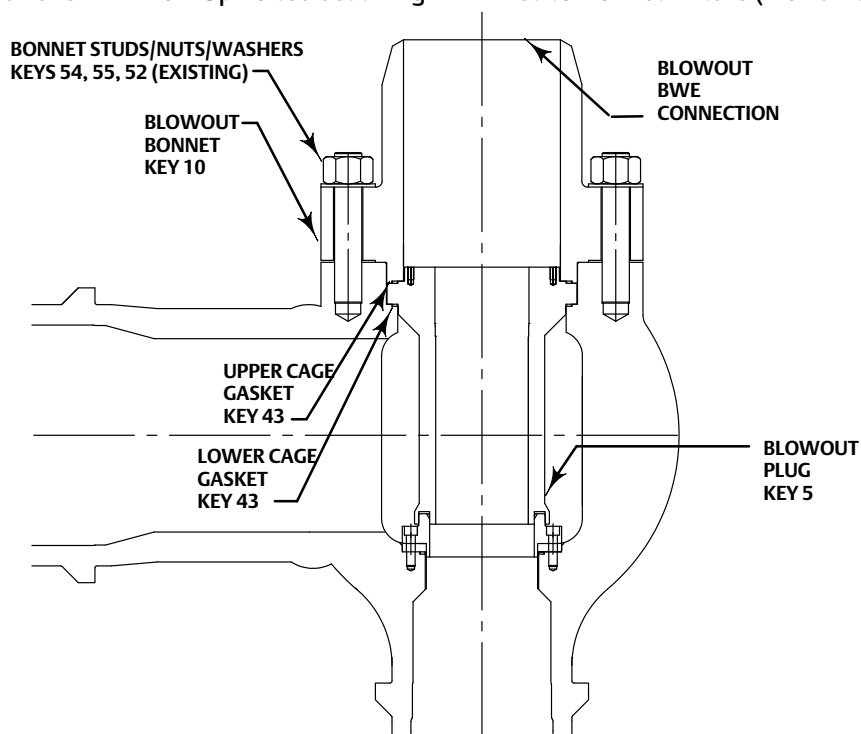


Figure 10. Fisher TBX Flow Down Flanged Outlet-to-Bonnet Blowout Fixture (Blows Debris from the Outlet)

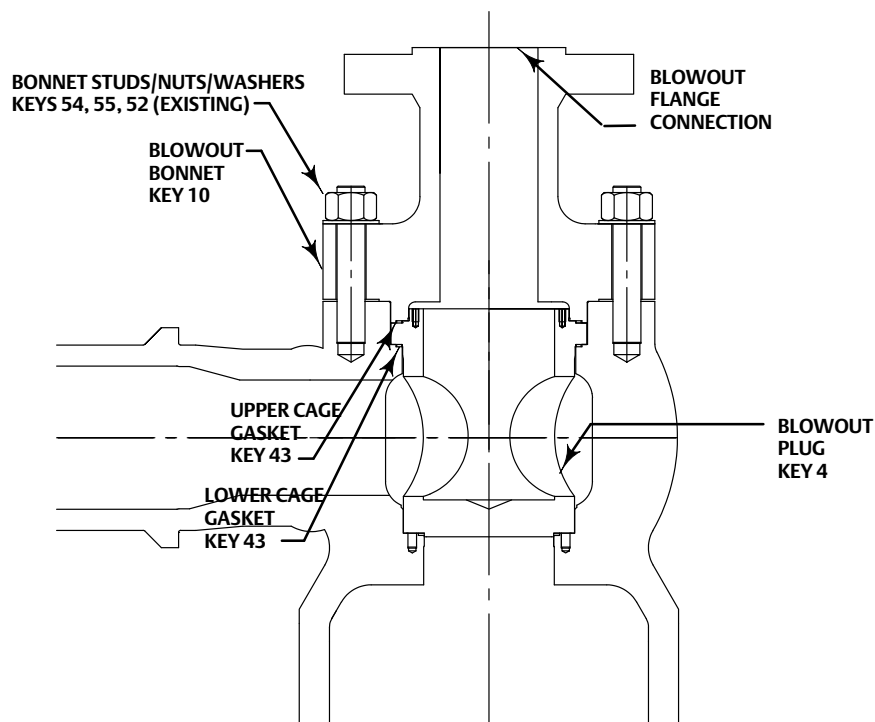


Figure 11. Fisher TBX Flow Down Flanged Inlet-to-Bonnet Blowout Fixture (Blows Debris from the Inlet)

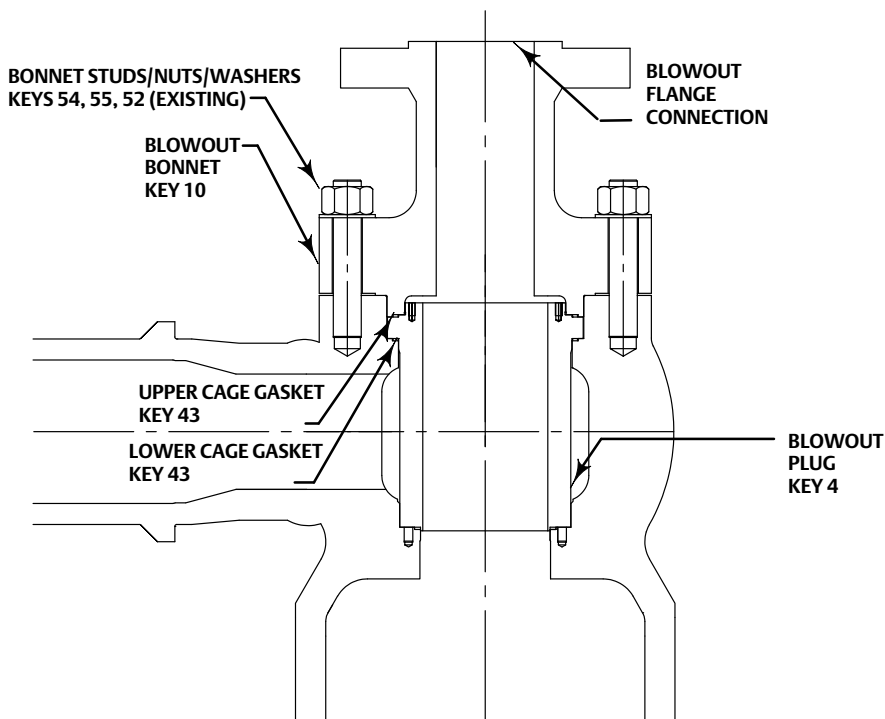


Figure 12. Fisher TBX Flow Down BWE Outlet-to-Bonnet Fixture (Blows Debris from the Outlet)

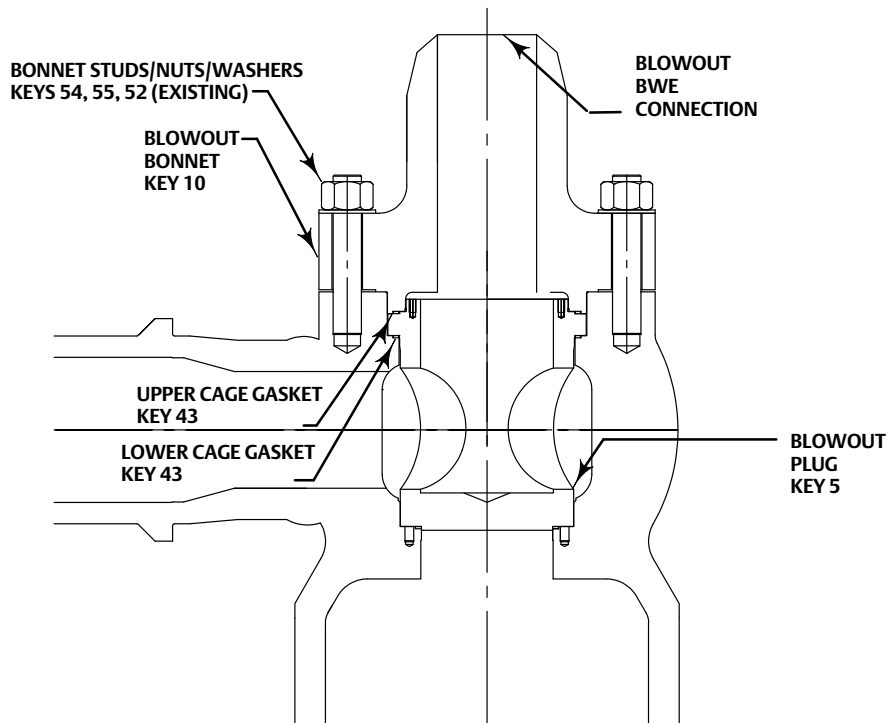
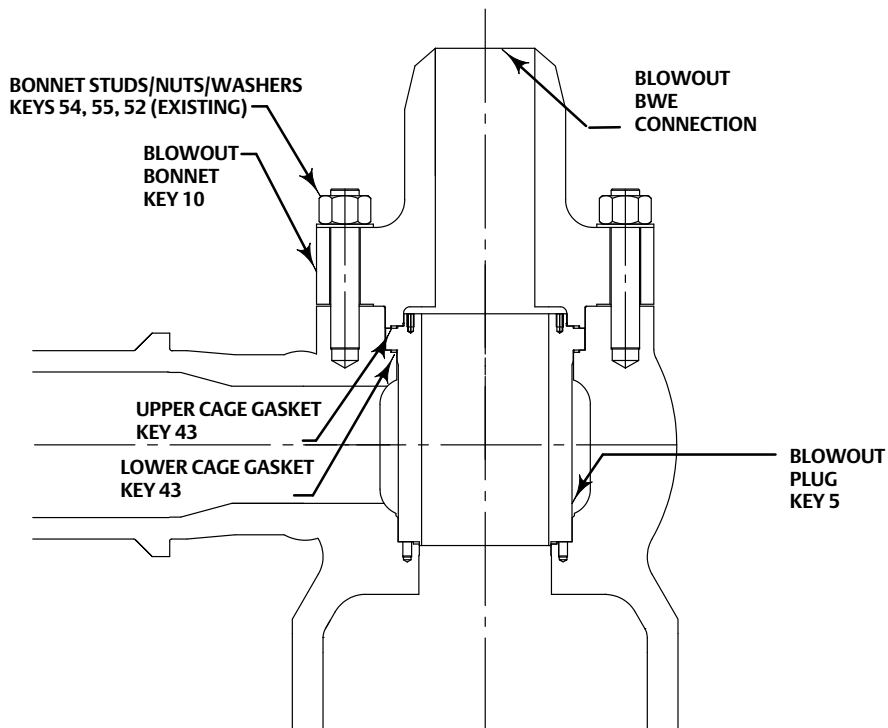


Figure 13. Fisher TBX Flow Down BWE Inlet-to-Bonnet Fixture (Blows Debris from the Inlet)



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

TBX Blowout Fixture

July 2017

Instruction Manual

D103206X012

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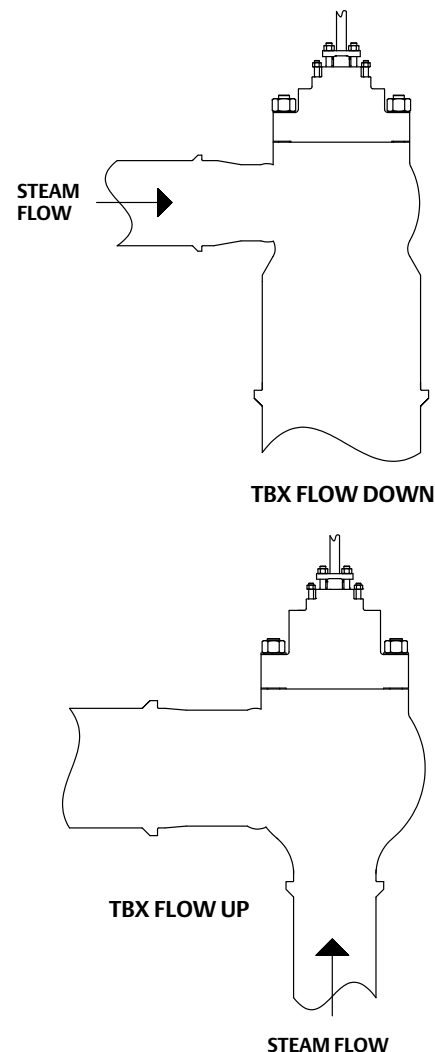


Fisher™ TBX Hydro-Plug Fixture

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Figure 1. Fisher TBX Constructions



Introduction

Scope of Manual

This instruction manual includes installation and operation information for the Fisher TBX Hydro-Plug Fixture for flow up and flow down TBX valves. The TBX Hydro-Plug Fixture can be very useful in establishing hydro test boundaries since most TBX valves are split class valves. This manual is not intended to cover all details required for successful hydro testing.

Some instructions are different between the TBX flow up and TBX flow down valve constructions. Figure 1 can be used to help identify which instructions apply. Inlet steam flow is perpendicular to the valve stem and actuator on a TBX flow down and parallel to the valve stem and actuator on a TBX flow up.

Key numbers identified for valve disassembly are shown in the specific valve instruction manual. Refer to separate instruction manuals for instructions covering the exact valve, actuator, and accessories associated with the Hydro-Plug.

Do not install, operate, or maintain a TBX Hydro-Plug Fixture without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The TBX Hydro-Plug fixture provides a convenient way to establish hydrotest boundaries associated with using a split class valve typical of the TBX. The Hydro-Plug fixture is intended to be used so that the upstream piping can be tested at the required pressure for body and inlet piping pressure class without overpressurizing the lower pressure class outlet and outlet piping.

Educational Services

For information on available courses for the Fisher TBX Hydro-Plug Fixture, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Principle of Operation

The Hydro-Plug replaces the valve plug and cage and allows pressurization of the valve inlet, valve body, and inlet piping to the appropriate hydro pressure without overpressurizing the lower pressure class valve outlet and outlet piping.

CAUTION

The Hydro-Plug Fixture employs a rubber O-ring to create a positive seal at the valve seat. The sealing integrity of this O-ring will be compromised if the Hydro-Plug is installed when welding the valve body inline, or during welding preheat or post weld heat treatment.

Maintenance

⚠ WARNING

To avoid personal injury or property damage from pressurized escape of process media, ensure that the system is completely depressurized and appropriate safety measures have been taken prior to carrying out any of the following

procedures. Only trained competent individuals with the proper equipment should attempt to disassemble and install a Hydro-Plug Fixture, and reassemble a TBX valve.

- Do not remove the actuator from the desuperheater while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valve Disassembly

The following valve disassembly steps are intended as a quick reference only. Refer to the TBX instruction manual, [D103172X012](#), for further detail regarding valve disassembly.

Actuator Removal

The following actuator disassembly steps are intended as a quick reference only. Refer to the appropriate actuator instruction manual for further detail regarding actuator removal.

1. Release the actuator seat load by either manually stroking the valve or applying the appropriate instrument signal. The stem connector may be removed once the plug is off the valve seat.
2. If an instrument signal has been used to stroke the plug off the seat, remove the signal only after removing the stem connector.
3. Isolate and disconnect the operating lines from the actuator.
4. Loosen the yoke locknut or the fasteners and remove the actuator from the valve.

Packing Box

Unbolt the packing stud nuts, (key 68), and remove the packing flange (key 66) and packing follower, (key 65) (reference appropriate instruction manual for key numbers). Remove as much packing as possible from the packing box.

CAUTION

Extreme care should be taken to avoid scratching the stem or the packing box.

Bonnet and Trim

1. Loosen the bonnet stud nuts (key 55), using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the bonnet studs which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

2. Remove the bonnet (key 6) from the valve with uni-axial pull. If the bonnet seems to bind in the valve body, check the alignment of the hoist or pulling mechanism. Deviation from an axial pull of the parts may result in galling or bending of the stem (key 23).

CAUTION

Do not attempt to over-power any binding, as damage to the guide surfaces may result.

The bonnet may be lightly tapped back into alignment with a soft face mallet. The stem and plug should be pushed back into the valve body while the bonnet is being removed. Once the bonnet is removed, dislodge any remaining packing rings from the packing box.

3. Remove the packing ring (key 63) from the bottom of the packing box. Lightly sand the inside of the packing box with 60 or 80 grit paper to remove any adherent packing material. Final cleanup should be made with 160 grit or higher paper.
4. Inspect the bonnet guiding surfaces and gasket mating surfaces. Light damage on the guiding surface may be repaired with an emery cloth or other suitable material. Damage to the gasket mating surface may require bonnet replacement to avoid leakage.
5. Remove the plug assembly (key 22, 23, and 53) as a single unit by grasping the valve stem (key 23) and pulling the assembly from the body cavity. The plug assembly contains sensitive guiding and sealing surfaces on its outside diameter and care must be taken in its handling. The plug should be temporarily stored on a clean wooden or cloth surface.
6. Remove the cage (key 21) from the valve body. Remove and discard the upper and lower cage gaskets (key 43). Reference the TBX valve instruction manual for guidance in performing this disassembly. The cage contains sensitive guiding surfaces on its outside diameter and care must be taken during handling. The cage should be temporarily stored on a clean wooden or cloth surface.
7. Clean and inspect the guiding and sealing surfaces of the plug assembly. For balanced plug designs, inspect the piston ring (key 45) and Bore Seal ring (key 46) for signs of excess wear or damage and replace if necessary. The piston ring is a two piece design with an outer seal ring and an inner expander ring. The outer ring diameter should be expanded beyond the diameter of the plug in its free state. It can be shifted within its groove to inspect for uneven wear around its circumference. The piston ring should require some compression when installing the plug into the cage. Lack of required compression indicates that the piston ring has worn or relaxed and should be replaced. Vertical marks in the axial orientation also indicates wear that requires replacement of the ring. The Bore Seal ring has a C-shaped cross section with the open portion of the C-shape facing the stem side of the plug for flow-up designs and the open portion of the C-shape facing the seating surface of the plug for flow-down designs. Any uneven marks around the circumference of the ring or any flattening of the ring shape at its outside diameter are indications of wear and require replacement. Contact your [Emerson sales office](#) or Local Business Partner for Bore Seal ring replacement.

Table 1. Recommended Bonnet Bolt Torque

Bolt Size, Inch	Threads per Inch	Recommended Bolt Torque, lbf•ft ⁽¹⁾
1	8	405
1-1/8	8	550
1-1/4	8	730
1-3/8	8	980
1-1/2	8	1290
1-5/8	8	1650
1-3/4	8	2070
1-7/8	8	2560
2	8	3130
2-1/4	8	4490

1. Torques for studs with heavy hex nuts.

8. Clean and inspect the inside diameter surfaces of the cage. The entire length of the cage inside diameter is either a sealing and/or guiding surface and any measurable wear requires that the cage be replaced.
9. **Flow up construction only:** The seat ring remains retained inside the valve body. Clean and inspect the angled seating surface. Any detectable damage around the circumference of the seating surface is an indication of wear and requires reconditioning to ensure seating performance. Contact your [Emerson sales office](#) or Local Business Partner for specific instructions on reconditioning the seating surface.
10. **Flow down construction only:** The bolted seat ring and lower cage must be removed. Loosen the seat ring bolts, (key 76) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the seat ring studs, which may cause binding. Individual bolts should not be completely loosened while the remaining bolts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs. Reference the TBX instruction manual ([D103172X012](#)) for instructions on removing the bolted seat ring and lower cage (key 79). Discard lower cage gaskets (key 75). The bolted seat ring and lower cage contain sensitive guiding and gasket surfaces on its outside diameter and care must be taken in their handling. The seat ring and lower cage should be temporarily stored on a clean wooden or cloth surface.
11. Remove all used gaskets and foreign matter from the interior of the valve and from the inlet and outlet openings. Remove any foreign matter that may be in the valve trim. Inspect all valve body guiding and sealing surfaces for any signs of wear.

Visual Inspection

Visually inspect the interior of the valve for abnormal wear, signs of erosion, or scoring if the valve has been in service. All scores and scratches should be removed by grinding or filing to remove any interference of the clearance zones between the internal bores and the mating parts. The affected area should be sanded with 100 grit or finer paper. Do not attempt to completely remove the score, only the interference should be removed and sanded.

The gasket surfaces of the valve body and bonnet should be inspected to verify that they are not damaged and are free of imbedded gasket material.

Installation of the Hydro-Plug

Inspect the valve to ensure that all parts and gaskets have been removed and the valve body is free from foreign debris. For TBX flow up constructions, lubricate the inside and outside of the seat lip and the upper valve body bore and counterbore. For TBX flow down constructions, lubricate the lower body bore where the bolted seat and lower cage guide are located and the upper valve body bore and counterbore. Install the trim as noted below and illustrated in the Hydro-Plug Fixture drawings, (figures 2 to 4).

1. Place the lower cage gasket (key 43) in the valve body.
2. Insert the Hydro-Plug (key 2) in the valve body, making sure that the gasket remains properly placed. Note that the Hydro-Plug must extend to and engage with the seat ring. If there is any question regarding the proper seating of

the Hydro-Plug inside the valve body, the following measurements can be taken for confirmation. Measure the thickness of the Hydro-Plug flange at its largest diameter. Measure the depth of the mating counterbore where the Hydro-Plug flange engages into the valve body. When assembled with a new cage gasket, the resulting depth from the top of the valve body to the top of the Hydro-Plug flange should be the difference in these two measured valves, minus an additional 0.045 inch to allow for the uncompressed gasket.

3. **Flow down construction only:** Insert the Hydro-Plug (key 2) into the valve body, making sure that the gasket remains properly placed.
4. Place the upper cage gasket (key 43) on the Hydro-Plug.
5. Lubricate the bonnet studs (key 54) and lower the bonnet (key 6) onto the valve body, making sure that the upper cage gasket remains in the gasket containment groove.
6. Lubricate and tighten the bonnet fasteners as recommended in the appropriate valve instruction manual. Torque values are also shown in table 1 of this document.

CAUTION

Failure to comply with good body-to-bonnet bolting practices and the torque values shown in table 1 or in the appropriate valve instruction manual may result in damage to the valve.

Piping Hydro Test with Hydro-Plug Fixture Installed

⚠ WARNING

To avoid personal injury or property damage from pressurized escape of process media, ensure that the system is completely depressurized and appropriate safety measures have been taken prior to carrying out any of the following procedures. Only trained competent individuals with the proper equipment should attempt to perform the following procedure.

- **Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

Note

The following steps are not intended to be complete instructions for performing a safe and complete hydrotest. They are intended only to address the basic issues required for hydrotesting.

1. Establish hydrotest boundaries to ensure that all required components are tested without overpressurizing the lower pressure class piping and components. After following all safety precautions and venting the system of air, raise the system to the required hydrotest pressure.
2. At the completion of the hydrotest procedure, secure and depressurize the system.

Disassembly of the Hydro-Plug Fixture

1. Loosen the bonnet nuts, (key 55) using an even and opposing pattern (for example, if the first nut loosened is at the 1 o'clock position, the next nut to be loosened would be at the 7 o'clock position). This will prevent uneven loading of the bonnet flange studs which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

2. Remove the bonnet (key 6) from the valve with uni-axial pull. If the bonnet seems to bind in the valve body, check the alignment of the hoist or pulling mechanism. Deviation from an axial pull of the parts may result in galling or bending of the stem.

CAUTION

Do not attempt to over-power any binding, as damage to the guide surfaces may result.

3. Remove and discard the upper cage gasket (key 43).
4. Remove the Hydro-Plug (key 2) from the valve body cavity using the integral eyebolt holes in the Hydro-Plug.
5. Remove and discard the lower cage gasket (key 43).

CAUTION

To avoid compromising the service life of the TBX valve body and/or trim, do not reuse the blowout gaskets for valve reassembly.

Cleaning

After removal of the hydro-plug, the interior of the valve body should be rinsed with clean water or repeatedly wiped with clean towels until the surfaces are clean to the touch. All internal parts should be cleaned prior to reassembly.

Reassembly

Refer to the appropriate valve instruction manual for guidance in reassembling the valve.

Ordering Information for Hydro-Plug Fixture

Information required for specifying and ordering the TBX Hydro-Plug Fixture.

Valve Information

- Valve Serial Number
- Valve Tag Number
- Customer Order Number
- Valve Model Number
- Material (carbon steel unless otherwise specified)

Figure 2. Fisher TBX Flow Up Welded Seat Ring Hydro-Plug

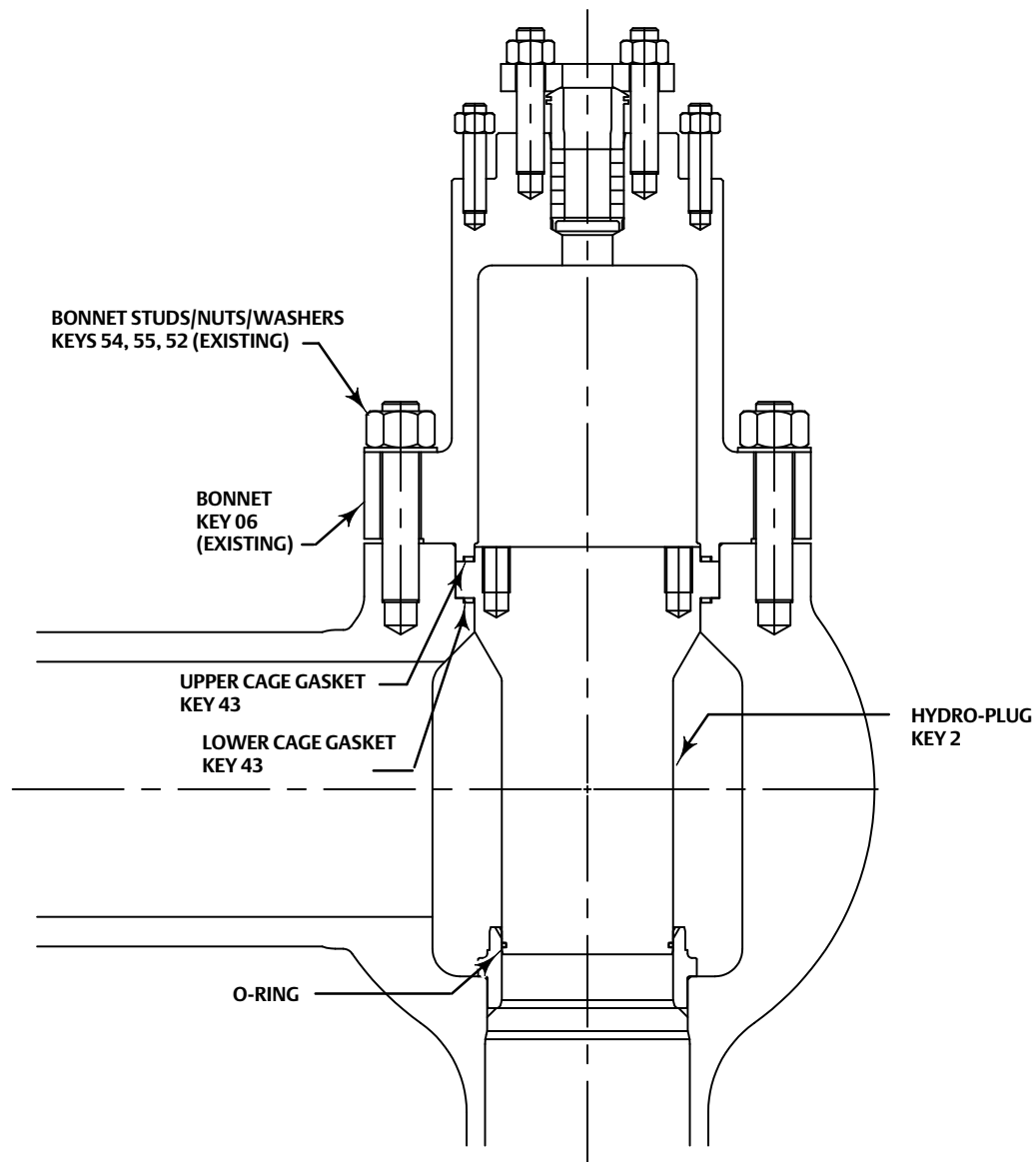


Figure 3. Fisher TBX Flow Up Bolted Seat Ring Hydro-Plug

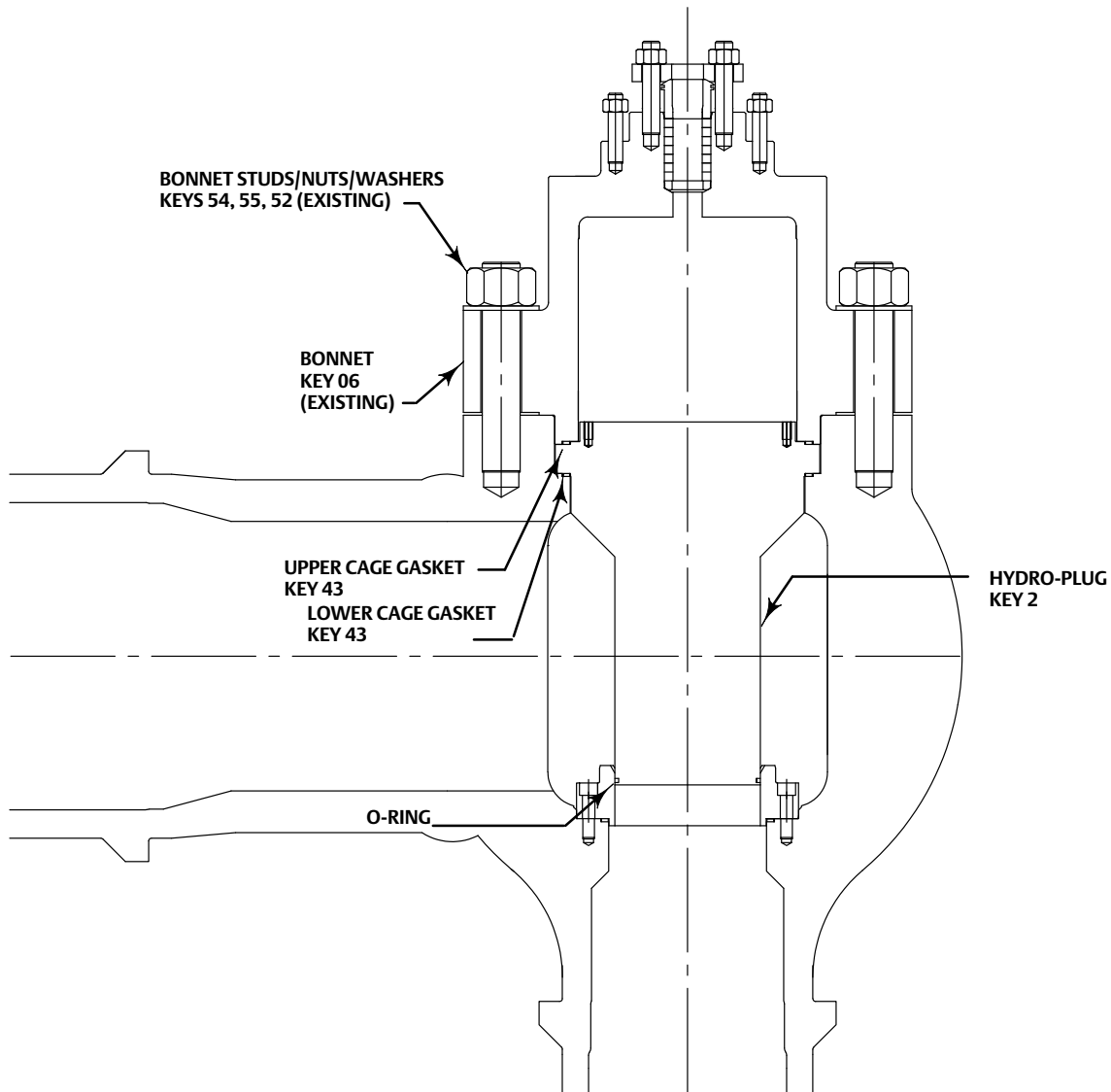
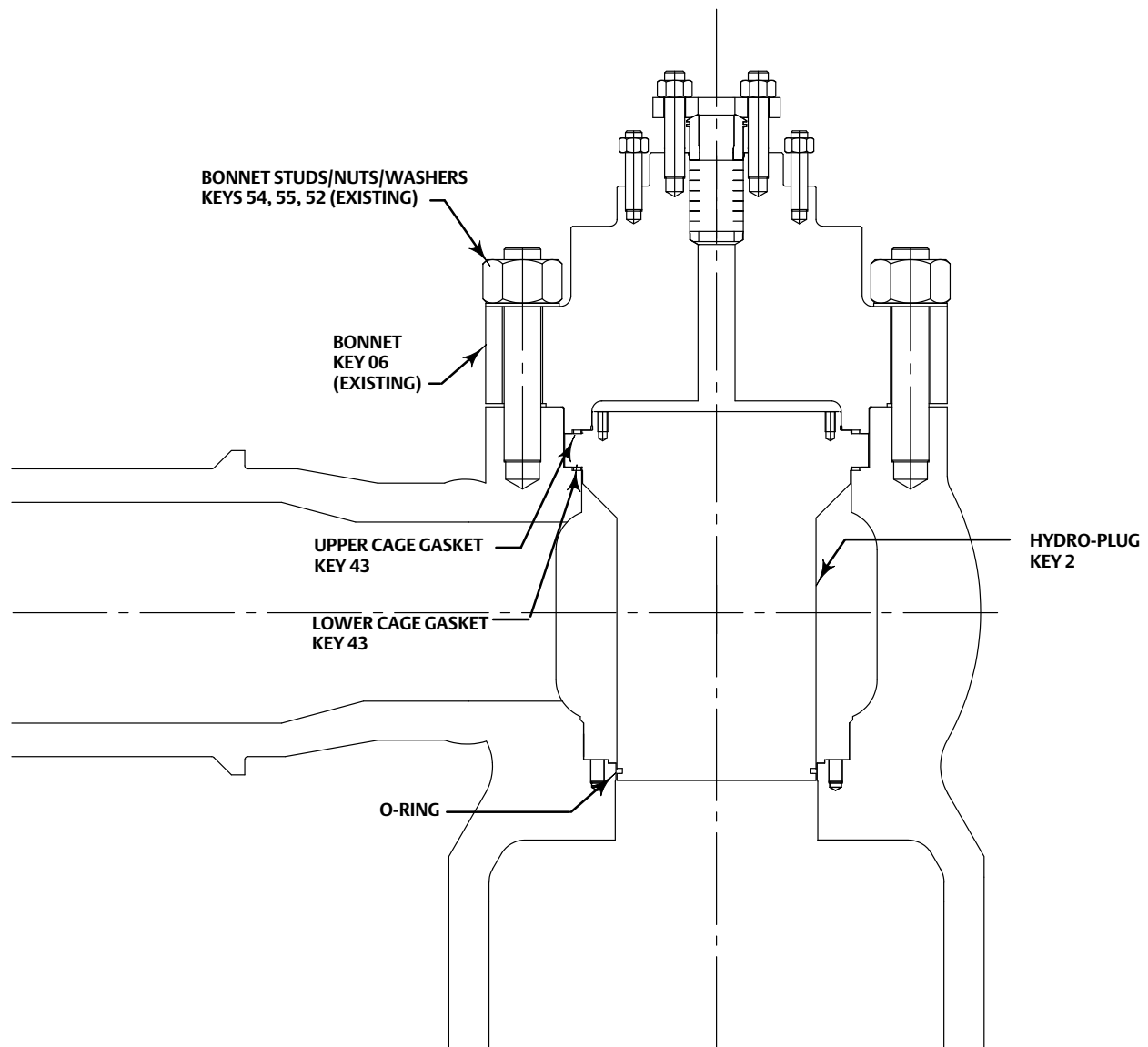


Figure 4. Fisher TBX Flow Down Hydro-Plug



⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

TBX Hydro-Plug Fixture

July 2017

Instruction Manual

D103208X012

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Fisher™ TBX Steam Conditioning Valve



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, maintenance and operation information for the Fisher TBX control valve. Refer to separate instruction manuals for instructions covering the actuator and accessories.

WARNING



Do not install, operate or maintain a TBX valve without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

1.2 Education Services

Emerson Education Services
Phone: 800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Figure 1. Fisher TBX Steam Conditioning Valve



X0165

1.3 Description

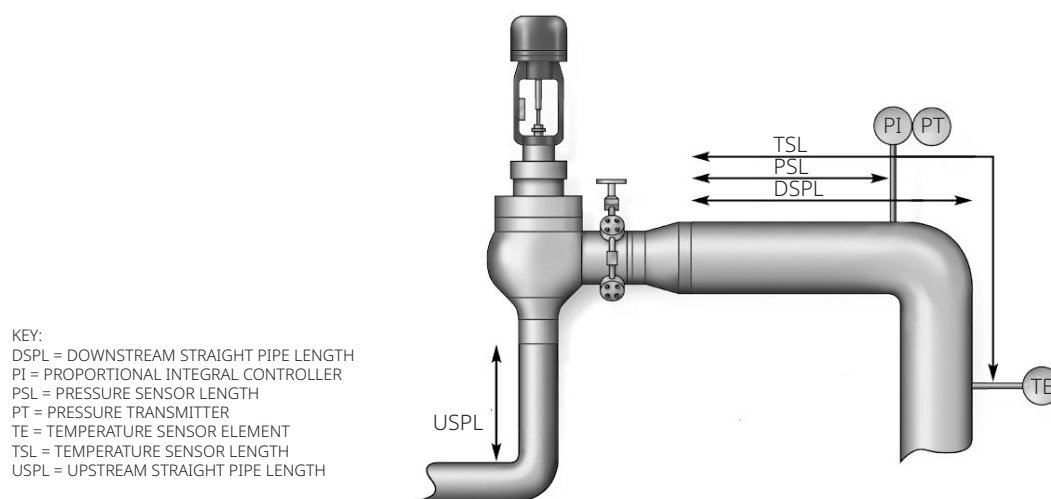
The TBX Steam Conditioning Valve (see Figure 1) provides a convenient and efficient way to reduce steam pressure and temperature within a single device. Typical installations include steam backpressure control, turbine bypass, boiler start-up service, auxiliary steam letdown for drying rolls, kettles, equipment drives, plant heating and other loads requiring dependable and accurate control of steam pressure and temperature.

The TBX Steam Conditioning Valve (Figure 1) is designed to handle the most severe applications in today's cycling power plants as well as provide precise pressure and temperature control for process applications. The TBX incorporates over 20 years of steam conditioning experience and product development. The valve body is designed with the latest finite element analysis (FEA) and computational fluid dynamics (CFD) tools to optimize performance and reliability for demanding steam systems.

The TBX is a flow-up or flow-down design providing the ultimate combination of performance and maintainability. The flow-down TBX incorporates Emerson's low noise Whisper Trim III technology. The flow-up TBX incorporates the same Whisper Trim III technology as the flow-down design, but can also be outfitted with WhisperFlo Trim technology. The simplified trim configuration is thermally compensated to handle the rapid changes in temperatures expected during a turbine trip.

Water atomization and vaporization are key elements in any steam conditioning application. The TBX incorporates a spraywater manifold consisting of variable geometry Type AF nozzles producing a spray pattern suitable for high rangeability applications. These nozzles are strategically placed to achieve complete mixing and quick vaporization at all flowing conditions. Years of research in spray atomization and vaporization were key to optimizing the water injection system. Extensive use of CFD analysis, in addition to field performance feedback, was used to validate spray system enhancements.

Figure 2. Typical Fisher TBX Installation



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D103172X012

TBX Valve

August 2025

Table 1. Specifications for Standard Designs (Physical Specifications)

End Connection Sizes ⁽¹⁾	Construction Materials (continued)
Valve Inlet: NPS 4 through 24 Valve Outlet: NPS 8 through 60	Bonnet Bolting ■ SA193 Grade B7 ■ SA193 Grade B16 ■ SB637 N07718
End Connection Types	Seat Ring Welded Seat Ring (flow-up only) ■ Steel with Alloy 6 ■ 2-1/4 Cr-1 Mo with Alloy 6 ■ 9 Cr-1 Mo-V with Alloy 6 ■ 9 Cr-2 W-V with Alloy 6 Bolted Seat Ring ■ 2-1/4 Cr-1 Mo with Alloy 6 and N07718 Bolting ■ N06625 with Alloy 6 and N07718 Bolting ■ N07718 with Alloy 6 and N07718 Bolting
Valve Configuration	Plug: Control Plug ■ 2-1/4 Cr-1 Mo with Alloy 6 Guiding Surfaces ■ 9 Cr-1 Mo-V with Alloy 6 Guiding Surfaces
Valve Body Ratings ⁽²⁾⁽⁴⁾	Stem ■ SA479 Type S20910 ■ N07718
ASME: CL150 to CL2500	Cage: Control Cage ■ 2-1/4 Cr-1 Mo Nitrided ■ 9 Cr-1 Mo-V Nitrided ■ S41000 Cage with F22 Retainer⁽⁵⁾ ■ S41000 Cage with F91 Retainer⁽⁵⁾ Lower Cage (flow-down only) ■ 2-1/4 Cr-1 Mo Nitrided ■ 9 Cr-1 Mo-V Nitrided
Bonnet Type	Piston Rings ■ Alloy 6B with N07750 Expander
Bolted	Bore Seal ■ N07718
Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4	Gaskets ■ Bonnet: N07750/Graphite ■ All Others: N06600/Graphite
Standard: Class V Optional: Class IV	Packing ■ Graphite/Flexible Graphite
Flow Characteristics ⁽³⁾	Nozzles ■ S41000 Stainless steel ■ N07718
Whisper Trim™ III: Linear WhisperFlo™ (flow-up only): Linear	
Flow Direction	
Whisper Trim III: Flow-up or down WhisperFlo: Flow-up	
Construction Materials	
Body/Bonnet ■ SA105 Carbon steel ■ SA182 Grade F22 (2-1/4 Cr-1 Mo) ■ SA182 Grade F91 (9 Cr-1 Mo-V) ■ SA182 Grade F92 (9 Cr-2 W-V)	

1. Consult your [Emerson sales office](#) for additional options.
2. Not all valve sizes are available in all valve body ratings.
3. Contact your [Emerson sales office](#) for other flow characteristics.
4. Intermediate classes above CL2500 are available upon request. Consult your [Emerson sales office](#) for additional information. PN pressure ratings available per pressure requirements of EN1092-1.
5. Whisperflo constructions only.

Section 2: Installation

WARNING

Always wear protective gloves, clothing and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the TBX valve is installed where service conditions could exceed the limits of the pressure rating noted on the nameplate. To avoid such injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

WARNING

This valve is intended for a specific range of service conditions (see Table 1). Applying different conditions to the valve could result in parts damage, malfunction of the valve or loss of control of the process. Do not expose this valve to service conditions or variables other than those for which this valve is intended. If you are not sure what these conditions are, you should contact Emerson for more complete specifications. Provide the product serial number (shown on the nameplate) and all other pertinent information.

NOTICE

Check that the TBX valve is properly orientated with respect to the flow direction of the valve (either flow-up or flow-down). Incorrect installation can result in damage to the valve and poor performance.

1. Before installation, all piping upstream of the valve must be blown clean so that no loose materials such as welding slag, dirt or other foreign matter, are left in the pipe. Use care to keep foreign matter out of the line openings while preparing the valve installation.
2. If possible, before fitting in the line, connect the actuator to a temporary air supply and operate to verify positioning. Disconnect the instrument lines (if applicable).

WARNING

Do not lift the valve by its actuator yoke or cooler manifold piping. Lifting lugs attached to the actuator must not be used to lift the complete valve assembly unless clearly marked as being rated to support the complete valve assembly weight. Personal injury or damage to equipment could occur if the valve is improperly lifted into place.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Only personnel trained in proper lifting and rigging practices shall perform valve/actuator assembly lifting, rigging and installation. Because each lift will be unique, the method of lifting the valve assembly, the correct location for attaching and lifting the valve assembly and what the valve assembly will do when lifted shall be considered for each lift.

Lifting and rigging equipment used to lift, install or remove a valve assembly or component must be properly selected and sized for the weight and configuration of the valve assembly or component being lifted. The weight of the complete valve assembly, including attached accessories, must be taken in consideration for this purpose. The lifting and rigging equipment must be properly maintained and inspected for damage before each use.

Lifting lugs or other lifting equipment attached to the valve or actuator must never be used to lift or support the weight of attached piping.

If the TBX is equipped with butt weld ends, the valve body must be supported using a lifting sling or other method that does not place a load or force onto the finished surface of the butt weld ends. The TBX does not have a stable resting condition. The valve inlet and outlet must be fully supported until fully welded (butt weld end connections) or bolted (flanged end connections) into the piping.

NOTICE

Care must be taken when lifting the valve/actuator assembly to ensure all accessories and tubing are not damaged in the process. Accessories and tubing may need to be removed prior to lifting to prevent damage and properly reinstalled before use. Protect valve flange faces, butt weld ends and other connection surfaces from damage during lifting.

3. Arrange lifting slings or other lifting and rigging equipment appropriate for the valve weight and configuration around the main valve body to safely lift the valve to the pipe opening.

WARNING

Do not expose the valve to undue stresses by installing it in bent pipes or flanges. Personal injury and equipment damage could result from flange sealing failure due to improper installation.

4. **Flanged Connections**—Lubricate the flange connection bolts with a high temperature thread lubricant. Install flange gaskets and connection bolts per accepted practices and tighten securely.
5. **Welded Connections**—Welding procedures should be in accordance with the applicable codes and the base materials. For preheat, welding electrodes and postweld heat treatment, refer to the applicable codes and practices applicable for the specific facility. Materials are specified on the customer specification sheet. Emerson recommends the valve be disassembled for welding, however if the valve inlet and outlet connections are to be welded with the valve assembled, the valve plug should be maintained off the valve seat during all associated operations. If the valve is to be welded by Shielded Metal Arc Welding (SMAW) process, the valve must be disassembled for welding to ensure that any weld slag is removed from the valve.

NOTICE

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal parts is possible. In general, if post weld heat treating is to be performed, all trim parts and nozzles should be removed. Contact your Emerson sales office for additional information.

6. Remove the spraywater control valve and flush the cooling water line until all debris is removed from the line prior to connecting it to the TBX valve. Use only clean sources of cooling water to reduce the possibility of nozzle clogging. A strainer should be installed in the water line as close to the TBX valve as possible. To determine appropriate mesh size, refer to valve sizing and specification document or contact your [Emerson sales office](#). Review strainer manufacturer's pressure drop curves to determine appropriate strainer body size. You may need to use a strainer that is larger than the water line size.



WARNING

Failure to use a strainer could result in nozzle clogging and subsequent property damage or loss. Uncontrolled temperatures resulting from clogged nozzles may result in equipment or process temperature limits being exceeded. Exceeding system temperature limits could result in property damage or personal injury.

7. A length of straight pipe is required downstream of the TBX valve to ensure complete vaporization of cooling water. An example of a typical installation appears in Figure 2. Consult the TBX cooler sizing sheet for the required distance of straight pipe. This is unique for each application and is supplied by Emerson.
8. Typically, a temperature sensor should be mounted a minimum distance of 9.1 m / 30 feet downstream of the TBX valve. This distance will vary depending on a number of factors including steam velocity and percentage of spraywater. Consult the cooler sizing sheet provided with the unit for this temperature sensor distance. The steam line should not have any branch lines dividing the steam flow between the TBX valve and the temperature sensor. If you have any questions, contact your [Emerson sales office](#).

9. A typical installation is illustrated in Figure 2. A pressure transmitter senses the pressure downstream (or upstream in backpressure control applications). The pressure controller sends a signal to the actuator positioner opening or closing the TBX valve as required to maintain pressure. A rising stem opens the TBX valve to allow additional steam flow. A temperature sensor (TE) measures changes in temperature and a temperature transmitter (TT) transmits the signal to the temperature control device. The output signal from the controller is sent to the positioner on the cooling water (spraywater) control valve (SWCV). The positioner's output signal strokes the SWCV open, increasing water pressure on the nozzles. Increasing water pressure upstream of the nozzles increases water flow through the nozzles.

NOTICE

Pneumatic lines (where applicable) should be thoroughly blown clean with dry air before connection. Check to make sure wiring connections are made per the equipment manufacturer's instructions and in accordance with local, regional and national codes.

10. If foreign debris has been introduced into the valve or upstream piping during installation, it must be removed prior to using the valve for the first time. A Blowout or Blowdown tool can be purchased to match the TBX valve and facilitate piping blowdown without removal of the valve from the line. Contact your Emerson sales office for pricing and availability of fixtures. Review Fisher instruction manuals, TBX Blowout Fixture (D103206X012) and Fisher Blowdown Fixture (D103207X012) prior to use.
11. After cleanliness of the piping system has been assured, connect instrumentation and power supply to the TBX valve actuator and associated equipment.
12. Monitor the TBX valve as the system is brought on line. Some visible vapors may be seen as the lubricants are heated. If you see any steam leaks after startup, follow isolation and disassembly procedures and disassemble the valve and replace the gaskets (key 43). If the packing box leaks, tighten hex nuts (key 68). If leakage continues, replace the packing (key 64). Be sure to properly isolate the TBX valve prior to disassembly of valve or packing.



WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Section 3: Maintenance

It is recommended that diagnostic tests be performed on the valve 3 to 6 months prior to scheduled maintenance shutdowns. Complete valve disassembly is recommended if tests performed on the valve indicate leakage, sticking or substandard operation. If diagnostics indicate normal valve operation, complete disassembly and inspection of the TBX is recommended during every other regularly scheduled outage or after 24 to 36 months, whichever comes first. Table 2 identifies the recommended inspection tips and diagnostics that can be performed with corresponding repair and replacement information.



WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D103172X012

TBX Valve

August 2025

Table 2. Inspection Summary

Key	Part Description	Inspection Tips and Diagnostics	Repair	Replacement
1	Valve Body	Inspect for erosion, thermal fatigue and other damage.	Consult your local Emerson Service Center for a recommendation on necessary weld repair or replacement if damage exists.	
6	Bonnet	Inspect gasket surfaces for damage that could indicate gasket leakage. Inspect packing box to ensure no galling, scoring or particulate is present.	If damage exists consult your local Emerson Service Center for a recommendation on necessary weld repair or replacement.	
20	Nozzle Body Flange	Inspect gasket surfaces for damage that could indicate gasket leakage when spray nozzles are replaced.	Replacement only	As needed
21	Cage	Inspect cage bore for excessive wear, galling damage, particulate damage and flow passage damage or clogging.	Consult your local Emerson Service Center for a recommendation on necessary repair or replacement if damage exists.	As needed for optimal performance
22	Plug	Inspect for seat erosion, excessive wear, galling damage and particulate damage, paying close attention to the seating and guiding surfaces.	Re-cutting/machining of seating surfaces can be performed by your local Emerson Service Center.	As needed for optimal performance
23, 53	Stem and Stem Pin	Inspect stem for dings, scoring and galling. Inspect valve stem connection for tightness.	Valve stem connection can be repaired by your local Emerson Service Center.	As needed
24	Seat	Inspect for seat erosion, particulate damage, galling and proper bolt torque (if applicable, refer to Table 5).	Re-cutting/machining of seating surfaces can be performed by your local Emerson Service Center.	As needed to maintain proper shutoff
25	Plug Retainer	Inspect for excessive wear, galling and other damage.	Repair can be performed by your local Emerson Service Center.	As needed
30	Spray Nozzle	Refer to Nozzle Maintenance Section.		Replacement every 24 to 36 months for optimal performance
37	Nozzle Sleeve	Inspect for particulate or magnetite buildup when spray nozzles are replaced.	Clean if necessary.	As needed
43, 47, 48, 75	All Gaskets	Every valve disassembly requires replacement of gaskets.	Replacement only	Every valve disassembly

- continued -

Table 2. Inspection Summary (continued)

Key	Part Description	Inspection Tips and Diagnostics	Repair	Replacement
45	Piston Ring	Inspect for particulate buildup, scoring and excessive wear. Ensure piston ring is free to expand and contract in the groove.	Replacement only	As needed
46	Bore Seal Ring	Inspect for excessive wear, galling, signs of leakage and other damage.	Replacement only	Every 36 months for optimal performance
63	Packing Box Ring	Inspect for scoring, galling and other damage.	Replacement only	As needed
64	Packing Set	Every valve disassembly requires replacement of the packing set.	Replacement only	Every valve disassembly
65	Packing Follower	Inspect for scoring, galling and other damage.	Replacement only	As needed
66	Packing Flange	Inspect for scoring, galling and other damage.	Replacement only	As needed

3.1 Servicing

Shut off water and steam flow and vent all system pressure before breaking any pressure boundaries.

WARNING

Residual system pressure may be released during the following steps if the system was improperly isolated or vented. Use extreme care to prevent personal injury while loosening any fasteners in the pressure boundary.

3.2 Removal of Valve Bonnet and Trim

1. For ANSI/FCI 70-2 Class V constructions, stroke the actuator to unseat the plug and bore seal from the bore seal landing. Slowly bleed the actuator until there is no remaining air pressure. The plug will settle to a resting position while not being fully seated. This will allow for an easier disassembly.
2. Disconnect all external connections to the positioner and actuator and remove the actuator from the valve. Consult the actuator manufacturer's documentation for assistance in actuator removal.

3. Loosen and remove the hex nuts (key 68) along with the packing follower (key 65). If possible, remove packing set (key 64) from the packing box.
4. Loosen bonnet stud nuts (key 55) using an even pattern to avoid uneven expansion of the gaskets. Remove the entire bonnet assembly (key 6), pulling evenly in line with the valve stem (key 23) centerline. Uneven bonnet removal can result in galling or bending of the valve stem. If difficulty is encountered in removing the bonnet, check the bonnet for alignment and straighten the bonnet before making further attempts to remove it from the valve body.



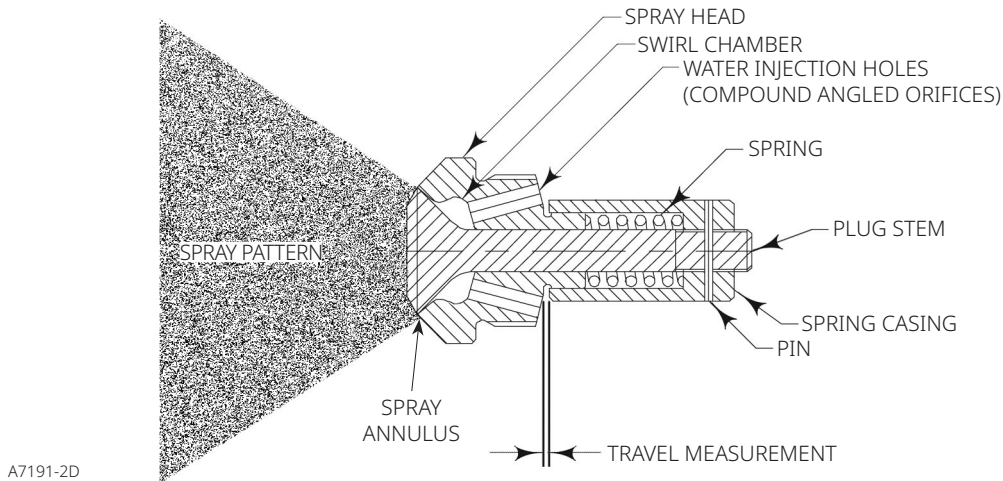
WARNING

The bonnet must be handled with care while being removed from the body. Damage to the bonnet can result in gasket leakage while the valve is in service. Protect the bonnet by placing it on clean cloth or wood while the valve is disassembled.

5. Dislodge any remaining packing (key 64) from the packing box and discard. Remove the packing box ring (key 63) from the bottom of the packing box. Inspect all parts: packing box, packing box ring (key 63), packing follower (key 65), valve stem (key 23), hex nuts (key 68) and studs (key 69) for signs of wear. Replace parts that are damaged or show excessive wear.
6. Inspect the bonnet guiding surfaces and gasket mating surfaces. Light damage on the guiding surface may be repaired with an emery cloth or other suitable material. Damage to the gasket mating surface may require bonnet replacement to avoid leakage.
7. Remove the plug assembly (flow-up and flow-down: keys 22, 23, 25 and 53) as a single unit by lifting the valve stem (key 23) with appropriate rigging and lifting equipment and pulling the assembly from the body cavity. The plug assembly contains sensitive guiding and sealing surfaces on its outside diameter and care must be taken in its handling. Protect the plug by placing it on clean cloth or wood while the valve is disassembled.
8. Flow-Up Construction only: If the TBX has a magnetite catcher (key 79) and excess magnetite buildup is present, remove the magnetite catcher located in the bore of the plug (key 22) by cutting the tackwelds at the base of the part and unscrewing from the plug. Clean as necessary to remove magnetite buildup.
9. Remove the cage (key 21) from the valve body. Remove and discard two (2) cage gaskets (key 43). Reference Figures 11, 12 and 13 for guidance in performing this disassembly. The cage contains sensitive guiding surfaces on its inside and outside diameter and care must be taken during handling. Protect the cage by placing it on clean cloth or wood while the valve is disassembled.

10. ANSI/FCI 70-2 Class V constructions only: Clean and inspect the guiding and sealing surfaces of the plug assembly. Inspect the piston ring (key 45) and Bore Seal ring (key 46) for signs of excess wear or damage and replace if necessary. The piston ring is a two-piece design with an outer seal ring and an inner expander ring. The outer ring diameter should be expanded beyond the diameter of the plug in its free state. It can be shifted within its groove to inspect for uneven wear around its circumference. The piston ring should require some compression when installing the plug into the cage. Lack of required compression indicates that the piston ring has worn or relaxed and should be replaced. Vertical marks in the axial orientation also indicate wear that requires replacement of the ring. The Bore Seal ring has a C-shaped cross section. The open portion of the C-shape faces the stem side of the plug on flow-up valves. The open portion of the C-shape faces the seating surface of the plug on flow-down valves. See Figure 5 for proper orientation. Any uneven marks around the circumference of the ring or any flattening of the ring shape at its outside diameter are indications of wear and require replacement. Contact your [Emerson sales office](#) for Bore Seal ring replacement.

- ANSI/FCI 70-2 Class IV constructions only: Clean and inspect the guiding and sealing surfaces of the plug assembly. Inspect the two piston rings (key 45) for signs of wear or damage and replace if necessary. The piston ring is a two piece design with an outer seal ring and an inner expander ring. The outer ring diameter should be expanded beyond the diameter of the plug in its free state. It can be shifted within its groove to inspect for uneven wear around its circumference. The piston ring should require some compression when installing the plug into the cage. Lack of required compression indicates that the piston ring has worn or relaxed and should be replaced. Vertical marks in the axial orientation also indicate wear that requires replacement of the ring.
11. Clean and inspect the cage bore for excessive wear. The entire length of the cage bore is either a sealing and/or guiding surface and any measurable wear requires that the cage be replaced.
 12. Welded seat rings remain retained inside the valve body. Clean and inspect the seating surface. Any detectable damage around the circumference of the seating surface is an indication of wear and requires reconditioning to ensure seating performance. Contact your [Emerson sales office](#) for specific instructions on reconditioning the seating surface. If the TBX has a bolted seat ring, remove the cap screws (key 76) and discard the gasket(s) (key 75) that sit between the valve body and seat ring. Inspect cap screws for damage and excessive wear; replace as necessary.
 13. Flow-down construction only. Remove the lower cage (key 78); reference Figure 11 for guidance in performing this disassembly. The cage contains sensitive guiding surfaces on its inside and outside diameter and care must be taken during handling. Protect the cage by placing it on clean cloth or wood while the valve is disassembled.
 14. Remove all used gaskets and foreign material from the interior of the valve and from the inlet and outlet openings. Remove any foreign material that may be in the valve body or trim. Inspect all valve body guiding and sealing surfaces for any signs of wear.
 15. If the valve has been in service, visually inspect the interior of the valve for abnormal wear, erosion or thermal fatigue. The gasket surfaces of the valve body and bonnet should be inspected to verify that they are not damaged and are free of imbedded gasket material. All scratches should be removed by grinding or filing to remove any interference of the clearance zones between the internal bores and the mating parts. All signs of thermal fatigue should be carefully evaluated to determine if repair or replacement is necessary. Your local Emerson Service Center can help determine the severity of damage, if present and recommend a course of action.

Figure 3. Fisher AF Nozzle Cross Section

3.3 Nozzle Maintenance and Replacement

When subjected to normal operating conditions, it is possible that wear, blockage and/or weld fatigue will occur to the valve body or nozzle assembly. During regularly scheduled maintenance, visually inspect the nozzles for wear and blockage. Your local Emerson Service Center can help to determine the extent of weld fatigue and the correct course of action. Poor performing nozzles or nozzle failure is typically caused by wear, corrosion, erosion and/or blockage.

The following instruction will help to determine if any of these problems are present and provide a recommended course of action for each.

NOTE

For optimal performance, nozzles should be inspected every 18 to 24 months and replaced every 24 to 36 months.

1. OPTIONAL: Figure 3 shows the spray pattern that will need to be present during operation of the AF nozzles. Testing can be performed by attaching the existing or an alternate, similar pressure, water line to the spray water input connection. If this spray pattern is not present, replacement is recommended.
2. Loosen and remove the nozzle body flange stud nuts (key 58) and washers (key 59). Then, remove the nozzle body flange (key 20). Inspect the nozzle body flange gasket surfaces for damage. If damage is present replacement is necessary.
3. Remove the nozzle sleeve (key 37) with attached spray nozzle (key 30), nozzle sleeve gasket (key 47) and nozzle body flange gasket (key 48). Inspect the nozzle sleeve for particulate or magnetite buildup and clean if necessary.

4. Inspect the spray annulus surface, the area between the plug stem and spray head, for excessive wear, erosion/corrosion or blockage due to particulate. Wear is defined as any nicks, cuts or gouges on or immediately around the spray annulus. Erosion/corrosion is defined as any form of rust or erosion of the metal on the plug stem or spray head. Blockages are defined when small particulate becomes trapped between the plug stem and spray head or spring casing and spray head. Replacement of the nozzle is recommended if any of the preceding problems are present.
5. Grind off the tack welds holding the nozzle (key 30) in place. Apply a penetrant type thread lubricant and allow to soak prior to unscrewing the nozzle. Using the provided flats on the side of the spray head, unscrew the nozzle from the nozzle sleeve (key 37).
6. Grind excess tack weld material off both the nozzle (key 30) and nozzle sleeve (key 37).
7. In the absence of external forces, the nozzle must be fully closed. If the nozzle is not fully closed, it will need to be replaced.
8. Inspect the water injection holes for reduced or non-circular shape due to erosion. Every hole must be the same size and shape. If any are oversized or non-circular in shape, the nozzle will need to be replaced.
9. Inspect the interior of the water injection holes for buildup of particulate or magnetite. Nozzle replacement will be needed if any buildup is present.

NOTE

Complete disassembly of the nozzle is strongly discouraged, due to individual spare parts not being available.

10. OPTIONAL: To further check the nozzle for buildup of particulate or magnetite, the nozzle can be disassembled. If disassembled, take great care not to damage the sharp edges of the spray annulus on the plug stem and the sprayhead, as this will greatly affect the spray pattern. Do not compress a removed spring by hand or with a tool, as compression beyond its normal operating range will damage the spring.

To disassemble the nozzle, first remove the pin using a small punch and unscrew the spring casing from the plug stem. The nozzle can be reassembled by following a reverse order of disassembly, taking care to line the hole in the plug stem up with the hole in the spring casing, then pressing the pin back into place through the two parts.

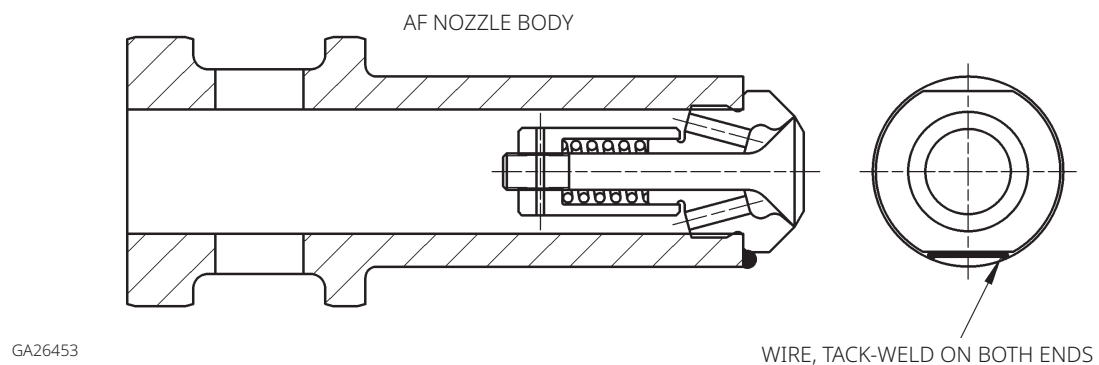
11. The internal spring may relax over time and not provide the tensile force required to shut off and control flow. If the nozzle spring is suspected of being too relaxed, then the nozzle should be replaced.
12. The travel can be determined by using a feeler gauge to measure the distance between the spray head near the water injection ports to the side of the spring casing, as outlined in Figure 3. This measurement must match the factory set plug stem travel for the corresponding nozzle type as shown in Table 3.

Table 3. AF Nozzle Specifications

NOZZLE TYPE	PLUG TRAVEL, IN.
AF7	0.014
AF10	0.028
AF14	0.029
AF17	0.034
AF20	0.036
AF24	0.042
AF28	0.048
AF32	0.056
AF35	0.065
AF40	0.063
AF44	0.069

13. Inspect nozzle threads for damage and clean if needed. If damage is present, nozzle replacement will be necessary.
14. Rinse both the nozzle (key 30) and nozzle sleeve (key 37) to remove particulate.
15. Screw nozzle into the nozzle sleeve (key 37) and tighten just until the spray head is flat and tight against the nozzle sleeve.
16. Tack-weld a small piece of welding wire onto the nozzle sleeve (key 37) next to either of the spray head flats to prevent rotation during service; refer to Figure 4. Maintain low heat to prevent distortion of the nozzle.

Figure 4. Spray Nozzle Tack Weld Location



17. Reassemble in the following order: nozzle sleeve gasket (key 47), nozzle body flange gasket (key 48), spray nozzle/sleeve assembly (keys 30 and 37), nozzle body flange (key 20), washers (key 59) and stud nuts (key 58). It is required to replace the nozzle sleeve gasket (key 47) and nozzle body flange gasket (key 48) with new gaskets each time the nozzle body flange (key 20) is removed.

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

**WARNING**

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

18. Lubricate the nozzle body studs (key 57) and all surfaces the studs and nuts come into contact with. Tighten the nozzle body flange nuts (key 58) in a uniform, multistage cross pattern. You may need to torque multiple times at each torque to ensure that the nozzle body flange is torqued evenly. Required nozzle body flange bolting torque can be found in Table 4.

Table 4. Recommended Nozzle Body Flange Bolting Torque with Nickel Anti-Seize Lubricant⁽¹⁾

BOLT SIZE	THREADS PER INCH	LUBRICATION	RECOMMENDED BOLT TORQUE ⁽²⁾	
In.			N·m	Lbf·ft
5/8	11	Nickel Anti-Seize	163	120
3/4	10		258	190
7/8	9		373	275
1	8		522	385
1-1/8	8		712	525
1-1/4	8		942	695
1-3/8	8		1268	935
1-1/2	8		1654	1220
1. For other lubricants, contact your Emerson sales office for recommended bolt torque.				
2. Torques for lubricated studs with heavy hex nuts.				

3.4 Valve Assembly

1. Cleaning—Make certain that all interior surfaces of the valve body and bonnet (including the packing box) are clean and free of dirt, including the inlet and outlet openings. All surfaces of the valve interior that receive mating parts should be given special attention when cleaning. All sliding fit surfaces should be coated with a copper-based high temperature anti-seize lubricant prior to reassembly. Refer to Figures 11, 12 and 13 for reference.

If the TBX has a bolted seat ring or is flow-down orientation, proceed with steps 2 through 4; otherwise, proceed directly to step 5.

- Place one gasket (key 75) into the valve body. If the TBX is a flow-up construction: Install the seat ring (key 24) onto this gasket surface. If the TBX is a flow-down construction: install the lower cage (key 78) onto the gasket surface, ensuring the bolt holes in the cage flange are positioned with the bolt holes in the valve body. Then place another gasket (key 75) onto the diameter of the lower cage and install the seat ring (key 24) onto this second gasket surface.

NOTE

Horizontal actuator only: TBX valves positioned in the process pipeline with a horizontal actuator/trim may require special attention to ensure that the spiral wound gaskets are maintained in the proper location during the valve assembly procedures without falling out of the gasket groove. A gasket manufacturer recommends spray adhesive 3M #77 Super Spray Adhesive to temporarily hold gaskets in place until they are fully contained by the TBX valve body and trim components. Please note special spiral wound gasket-positioning techniques may be recommended. To use the adhesive, lightly spray the gasket groove that the gasket will be installed in. Also lightly spray one side of the spiral wound gasket that will be contacting the previously coated gasket groove. Let the spray adhesive set for one minute and then lightly press the spiral wound gasket into the gasket groove.

Other Considerations: Ensure the spiral wound gasket is located in the correct location when contact is made. Trying to remove the gasket after contact will damage the gasket by pulling out or removing the soft filler/facing material. If the gasket is incorrectly positioned after applying the spray adhesive it must be removed and discarded. The gasket groove will then need to be cleaned and a new gasket will need to be installed.

- Lubricate the seat ring cap screws (key 76) and all surfaces that contact the screws, including the valve body and seat ring.
- Torque the cap screws in a crisscross pattern, using no more than 1/4 of the specified torque as indicated in Table 5. Repeat the crisscross pattern, working up to the specified torque in 1/4 increments until the final torque is achieved. Wait a minimum of 1 minute to allow for gasket/screw relaxation and recheck the torque, adjusting as necessary.

Table 5. TBX (Flow-Up and Flow-Down) Bolted Seat Ring Torque with Nickel Anti-Seize Lubricant⁽¹⁾

BOLT SIZE	THREADS PER INCH	LUBRICATION	RECOMMENDED BOLT TORQUE	
In.			N·m	Lbf·ft
3/8	16	Nickel Anti-Seize	38	28
7/16	14		60	44
1/2	13		87	64
5/8	11		156	115
1. For other lubricants, contact your Emerson sales office for recommended bolt torque.				

- Install one cage gasket (key 43) into the groove in the valve body. If the valve has a horizontal stem orientation, ensure that the gasket remains in the groove and does not get pinched during cage installation.

NOTE

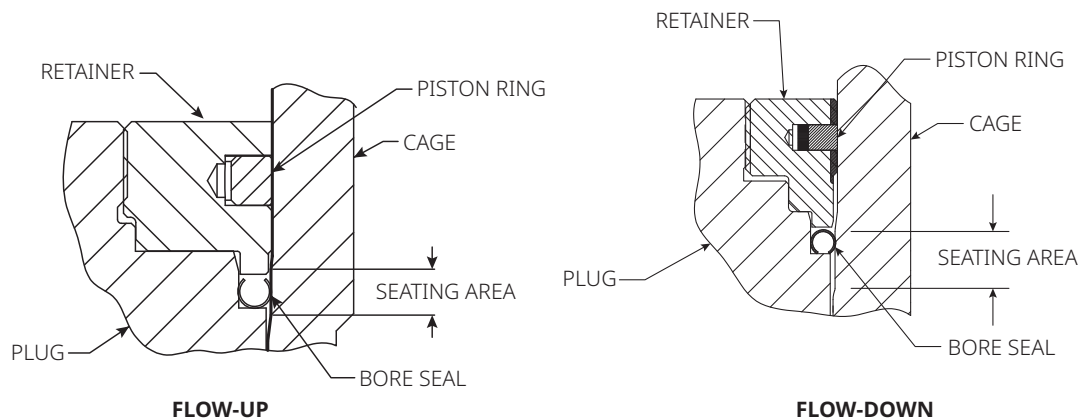
Horizontal actuator only: Follow the note in Step 2 above to ensure the gasket are in the proper location during valve assembly.

6. Lubricate the inside of the cage as completely as possible. Insert the lubricated cage (key 21) into the valve body. Ensure the lower cage diameter slides over the outside diameter of the seat ring. If there is any question regarding the proper seating of the cage inside the valve body, the following measurements can be taken for confirmation. Measure the thickness of the cage flange at its largest diameter. Measure the depth of the mating counterbore where the cage flange engages into the valve body. When assembled with a new cage gasket, the resulting depth from the top of the valve body to the top of the cage flange should be the difference in these two measured values, minus an additional 0.045 in. to allow for the uncompressed gasket.
7. Flow-Up Construction only: If applicable, install the magnetite catcher (key 79) by threading into the bore of the plug (key 22). Apply four tackwelds equally spaced along the circumference of the plug to prevent rotation during service.

If the TBX is an ANSI/FCI 702 Class V construction, proceed with steps 8 to 15; otherwise proceed directly to step 16 for Class IV constructions.

8. The plug assembly includes a plug (key 22), stem (key 23), stem pin (key 53), retainer (key 25), piston ring (key 45) and Bore Seal ring (key 46). Lubricate the plug assembly at all raised outside diameter surfaces and lubricate the piston ring(s) and Bore Seal ring.
9. Orient the Bore Seal for correct sealing action based on the process fluid flow direction through the valve, refer to Figure 5 to complete this step.

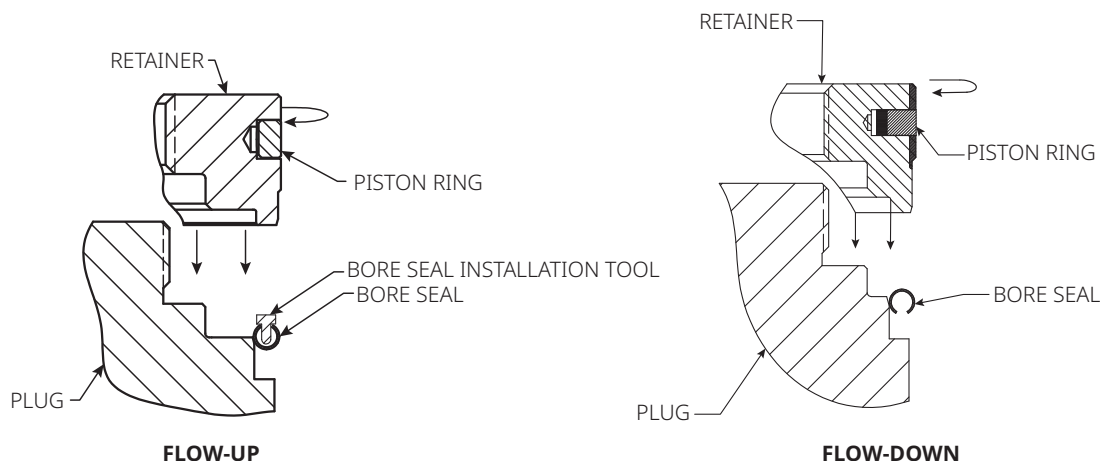
Figure 5. Fisher Bore Seal Construction



10. Place the Bore Seal plug seal over the top of the valve plug. The retainer will help guide the Bore Seal down onto the plug. Do not force the Bore Seal over the plug (Figure 6).
11. For the Flow-up design, the Bore Seal installation tool (Figure 10) must be inserted into the Bore Seal prior to using the retainer to guide it down the plug.
12. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the Bore Seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
13. If applicable, remove the retainer and then the installation tool. Place the Bore Seal retainer back onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.

14. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place to secure the Bore Seal retainer.

Figure 6. Retainer Guiding Fisher Bore Seal Onto the Plug



15. Install the lubricated plug assembly into the cage. The piston ring(s) should require some radial compression to collapse into the cage diameter. Do not use a metallic tool to create this piston ring compression as this could damage the outer sealing diameter of the ring. The plug(s) should slide into the cage(s) smoothly with little effort until the Bore Seal ring reaches its mating cage diameter. The extra load required to seat the Bore Seal trim seal will be applied during actuator set up.
16. ANSI/FCI 702 Class IV constructions only: The plug assembly includes a plug (key 22), stem (key 23), stem pin (key 53) and two piston rings (key 45). Lubricate the plug assembly at all raised outside diameter surfaces and lubricate the piston rings. Install the lubricated plug assembly into the cage. The piston rings should require some radial compression to collapse into the cage diameter(s). Do not use a metallic tool to create this piston ring compression, as this could damage the outer sealing diameter of the ring. The plug(s) should slide into the cage(s) smoothly with little effort. Refer to Figures 7 and 9.
17. Install the second cage gasket (key 43) over the cage boss where it will be self-centering for the mating bonnet groove.

NOTE

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

18. Apply appropriate high-temperature anti-seize lubricant to the bonnet studs (key 54) and screw them into the valve body. Back the studs out 1/2 to 1 turns after bottoming the stud in the valve body.
19. Lubricate the bonnet locating surfaces and carefully install the bonnet (key 6). Use care to avoid bending the stem.
20. Install bonnet stud washers (key 52) and nuts (key 55) and hand tighten.
21. Tighten the bonnet nuts (key 55) in a uniform, multistage cross pattern. Monitor the distance between the bonnet and body and keep it even to ensure that the bonnet is being torqued evenly. It is recommended that torquing be performed in a minimum of four torque levels until the final torque level is achieved. You may need to torque multiple times at each torque level to ensure that the bonnet is torqued evenly. Required torque can be found in Table 6 for the appropriate body/bonnet bolting material. After final torquing, ensure there is an even gap and that the metal-to-metal contact between the valve body and bonnet is achieved around the entire circumference of the body-bonnet joint.

Table 6. Recommended Body/Bonnet Bolting Torque with Nickel Anti-Seize Lubricant⁽¹⁾

BOLT SIZE	THREADS PER INCH	LUBRICATION	RECOMMENDED BOLT TORQUE ⁽²⁾	
In.			N·m	Lbf·ft
1	8	Nickel Anti-Seize	522	385
1-1/8			712	525
1-1/4			942	695
1-3/8			1268	935
1-1/2			1654	1220
1-5/8			2129	1570
1-3/4			2671	1970
1-7/8			3308	2440
2			4027	2970
2-1/4			5776	4260

1. For other lubricants, contact your [Emerson sales office](#) for recommended bolt torque.

2. Torques for lubricated studs with heavy hex nuts.

22. After the body/bonnet studs have been torqued to the required level, check the plug movement to ensure that the plug still moves freely.
23. Recheck cleanliness of the packing box. Insert the packing box ring (key 63) over the stem and into the packing box. Measure the depth of the packing box before and after ring insertion to be certain that it has traveled to the bottom of the packing box. Insert packing rings (key 64), after lubricating with high temperature grease, into the packing box and staggering the gaps on adjacent rings. The packing follower (key 65) can be used to ensure that each packing ring is pushed down before installing the next packing ring.

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24. After all packing rings are installed, thoroughly lubricate the studs (key 69) and insert the packing follower (key 65) and the packing flange (key 66). Tighten the hex nuts (key 68) tight enough to block leakage but not so tight that stem travel is hindered. Consult Table 7, Recommended Packing Nut Torque for recommended torque levels. Evenly tighten the nuts to the maximum level, then loosen and retighten to the minimum torque level. After operating, further tightening may be required to prevent leakage.
25. Install the actuator on the valve in accordance with manufacturer's standard procedure. If this is an ANSI/FCI 702 Class V construction, the plug assembly will require an additional load and travel to seat the Bore Seal ring (refer to Figures 8 and 9 for details). After calibration of the actuator, the valve should be ready to return to service.

Table 7. Recommended Packing Nut Torque with Anti-Seize Lubricant

STEM DIAMETER In.	ASME PRESSURE RATING	MAXIMUM TORQUE		MINIMUM TORQUE	
		N·m	Lbf·ft	N·m	Lbf·ft
1-1/4	CL300	49	36	33	24
	CL600	67	49	45	33
	CL900	83	61	56	41
	CL1500	102	75	68	50
	CL2500	122	90	82	60
2	CL300	65	48	59	43
	CL600	91	67	83	61
	CL900	120	88	109	80
	CL1500	147	108	133	98
	CL2500	170	125	156	115

Figure 7. Fisher TBX Flow-Up Class IV Construction

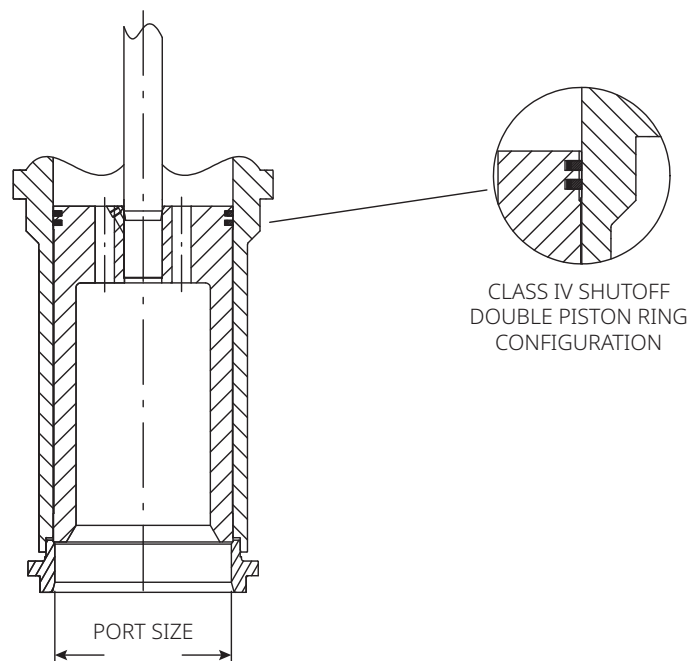
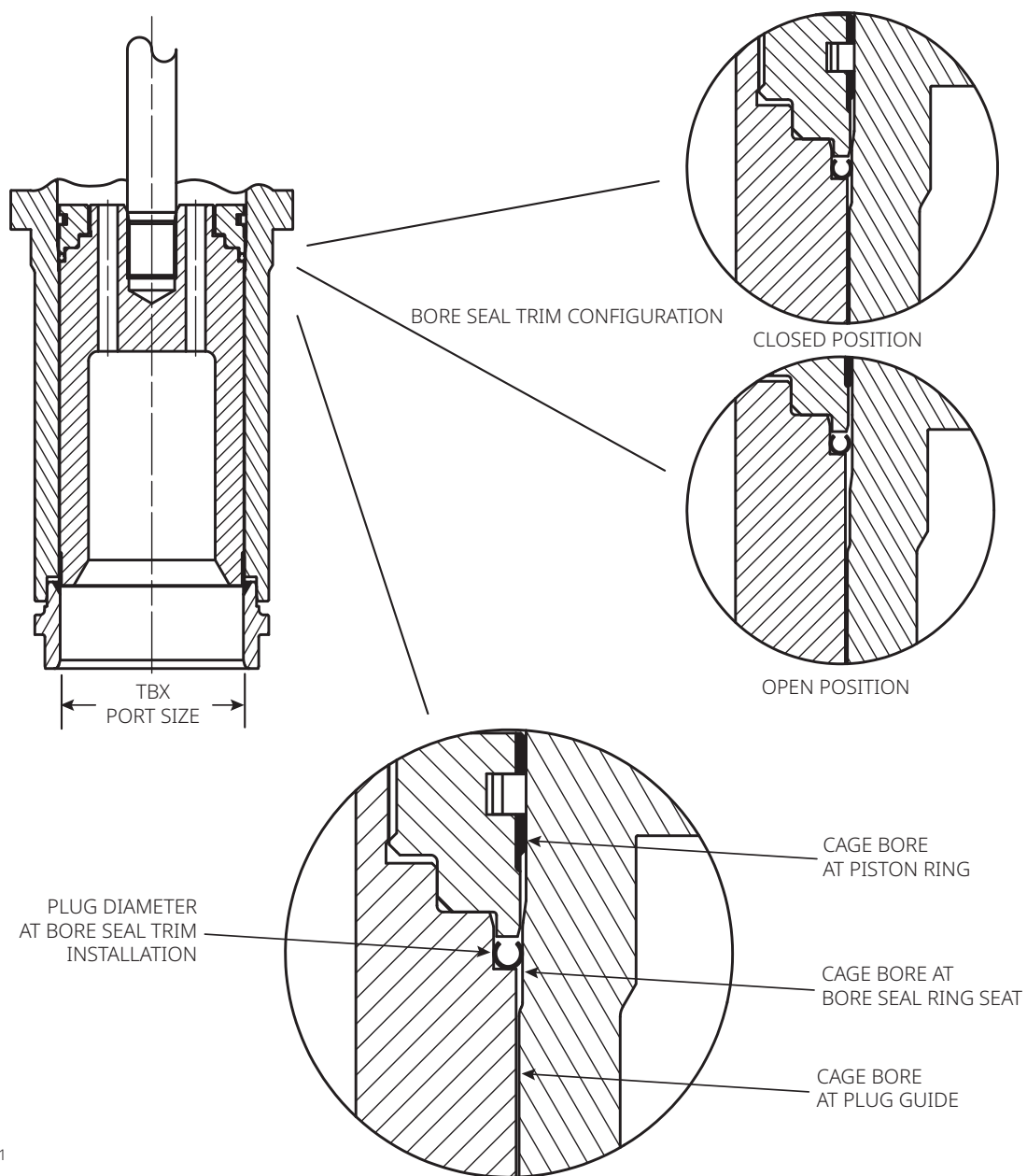
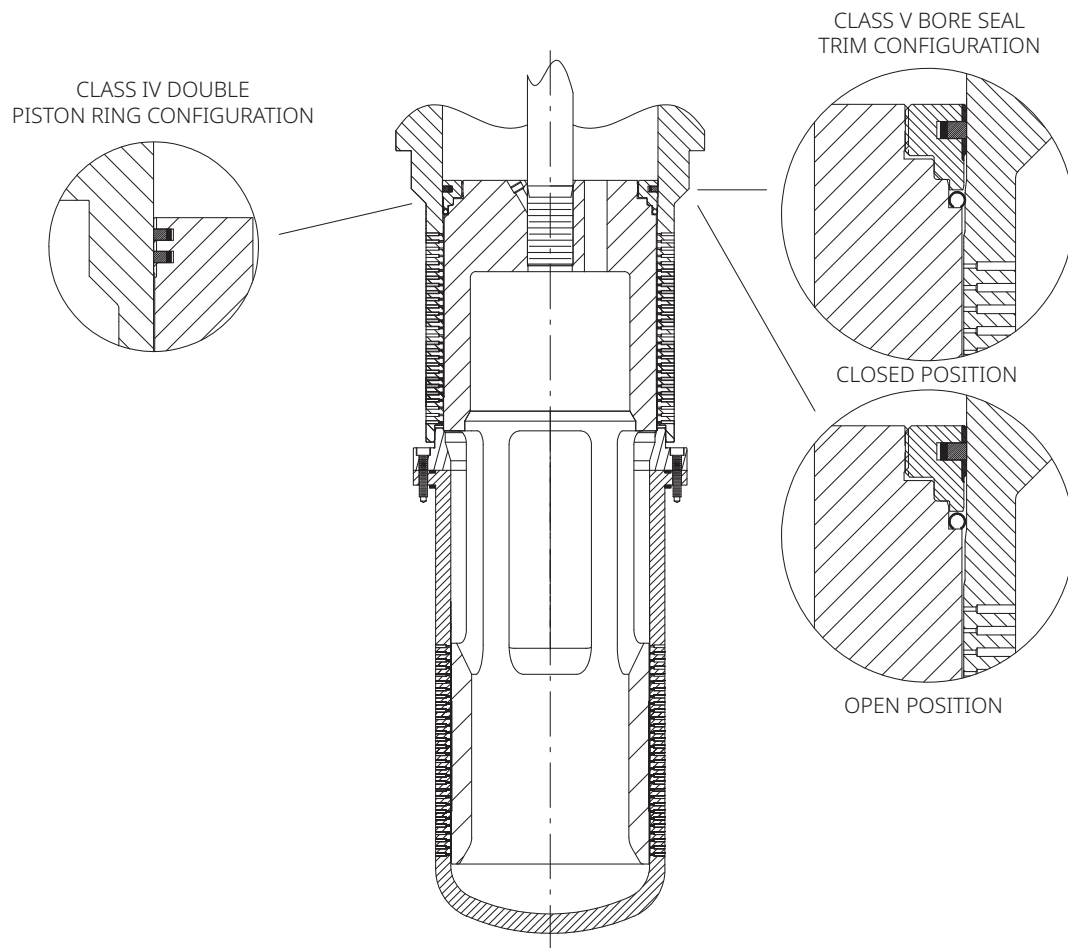


Figure 8. Fisher TBX Flow-Up Class V Construction



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Figure 9. Fisher TBX Flow-Down Construction



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

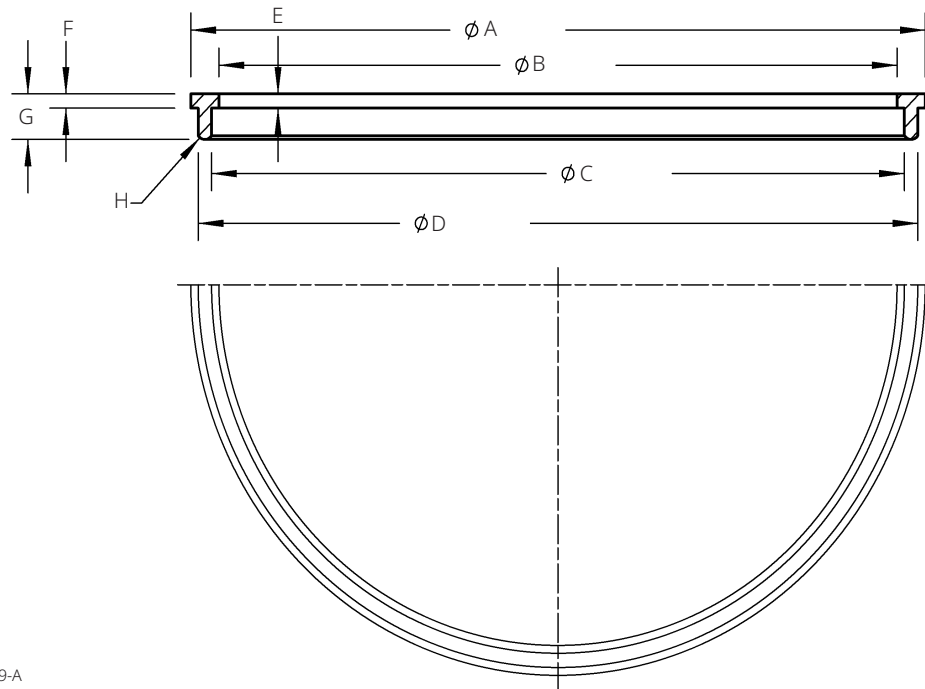
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Figure 10. Bore Seal Installation Tool (Flow-Up Only)



GE22109-A

Table 8. Bore Seal Installation Tool Dimensions (Flow-Up Only)

VALVE PORT SIZE, IN.	DIMENSIONS, IN. (SEE FIGURE 10)								TOOL PART NUMBER
	A	B	C	D	E	F	G	H	
3.4375	(1)								N/A
4.28	(1)								N/A
4.70	4.77	4.35	4.45 to 4.47	4.67 to 4.65	0.10	1.10	0.32	R.06	GE18267X012
5.375	5.49	5.07	5.17 to 5.19	5.39 to 5.37	0.10	0.10	0.32	R.06	GE22109X012
6.25	6.34	5.92	6.02 to 6.04	6.24 to 6.22	0.10	0.10	0.32	R.06	GE18266X012
7.00	7.11	6.69	6.79 to 6.81	7.01 to 6.99	0.09	0.10	0.32	R.06	GE18264X012
7.62	7.76	7.34	7.44 to 7.46	7.66 to 7.64	0.10	0.10	0.32	R.06	GE18263X012
8.00	(1)								N/A
9.20	9.39	8.97	9.07 to 9.09	9.29 to 9.27	0.10	0.10	0.32	R.06	GE17916X012
10.00	10.12	9.7	9.80 to 9.82	10.02 to 10.00	0.10	0.10	0.32	R.06	GE17914X012
11.00	(1)								N/A
11.20	11.35	10.93	11.015 to 11.025	11.265 to 11.255	0.10	0.10	0.32	R.07	GE17905X012
13.75	(1)								N/A
14.75	14.84	14.424 to 14.416	14.516 to 14.536	14.736 to 14.716	0.1	0.1	0.32	R.05	GE34073X012
16.70	(1)								N/A
18.25	(1)								N/A
19.9375	(1)								N/A

1. For sizes, contact your [Emerson sales office](#).

Section 4: Parts

4.1 Parts Ordering

Each TBX valve is assigned a serial number that can be found on the bonnet flange. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and key numbers for each part required. The key numbers in the Parts List and the assembly drawing in Figures 11, 12 and 13 can be used to help in part identification.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

4.2 Parts List

NOTE

Contact your [Emerson sales office](#) for part numbers.

Key	Description	Key	Description
1	Body	54	Bonnet Stud
6	Bonnet	55	Bonnet Stud Nut
20	Nozzle Body Flange	57	Nozzle Body Flange Stud
21*	Control Cage	58	Nozzle Body Flange Stud Nut
22*	Control Plug	59	Nozzle Body Flange Washer
23*	Stem	60	Actuator Stud
24	Seat	61	Actuator Stud Nut
25	Plug Retainer	63*	Packing Box Ring
30*	Spray Nozzle	64*	Packing Set
37	Nozzle Sleeve	65*	Packing Follower
43*	Cage Gasket, 2 req'd	66*	Packing Flange
45*	Piston Ring	68*	Hex Nut
46*	Bore Seal ring	69*	Stud
47*	Nozzle Sleeve Gasket	75*	Gasket
48*	Nozzle Body Flange Gasket	76*	Seat Ring Cap Screws
52	Bonnet Stud Washer	78*	Lower Cage
53*	Stem Pin	79	Magnetite Catcher (not shown)
*Recommended spare parts			

Figure 11. Fisher Flow-Down TBX Assembly with Bolted Seat Ring

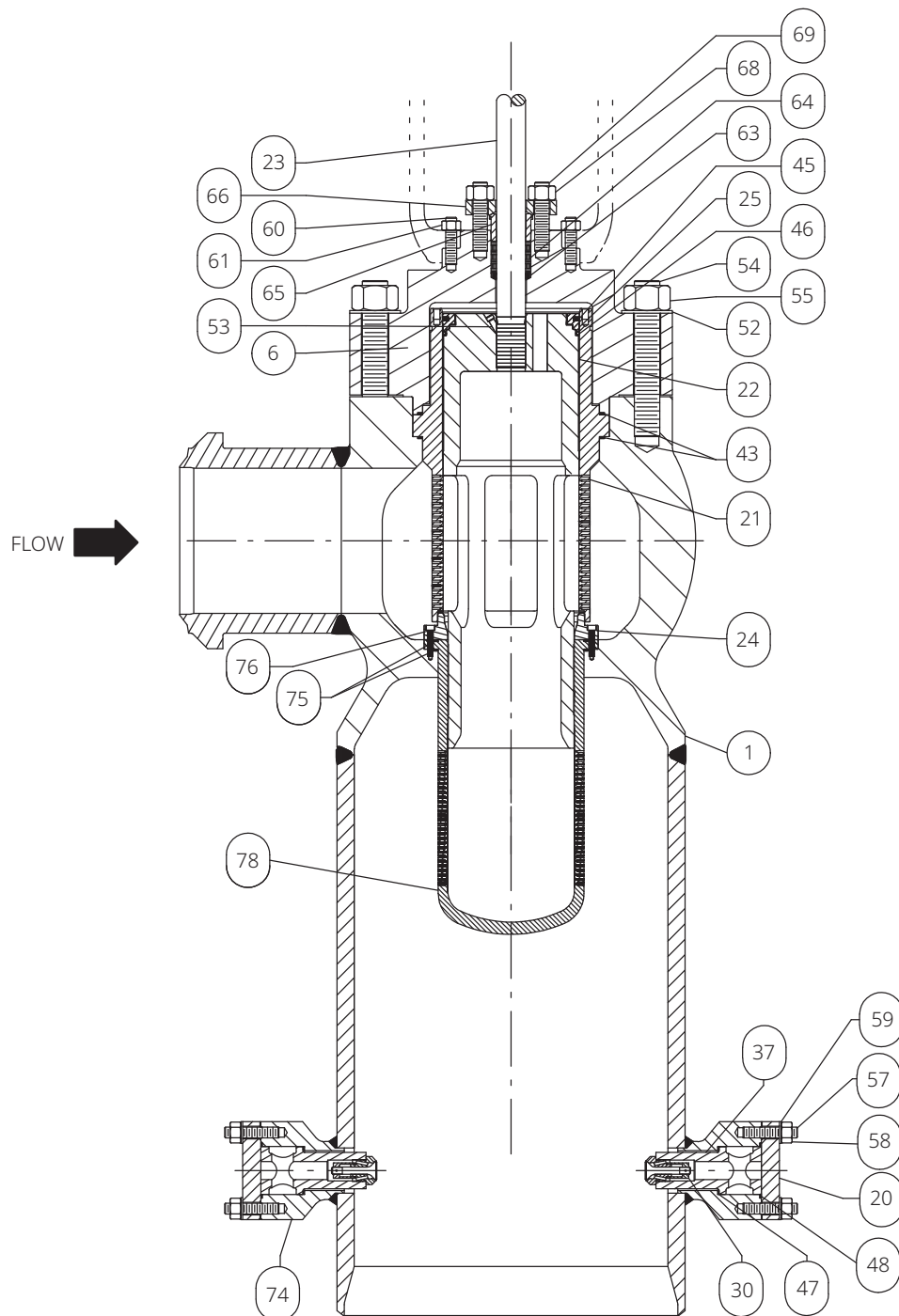


Figure 12. Fisher Flow-Up TBX Assembly with Bolted Seat Ring

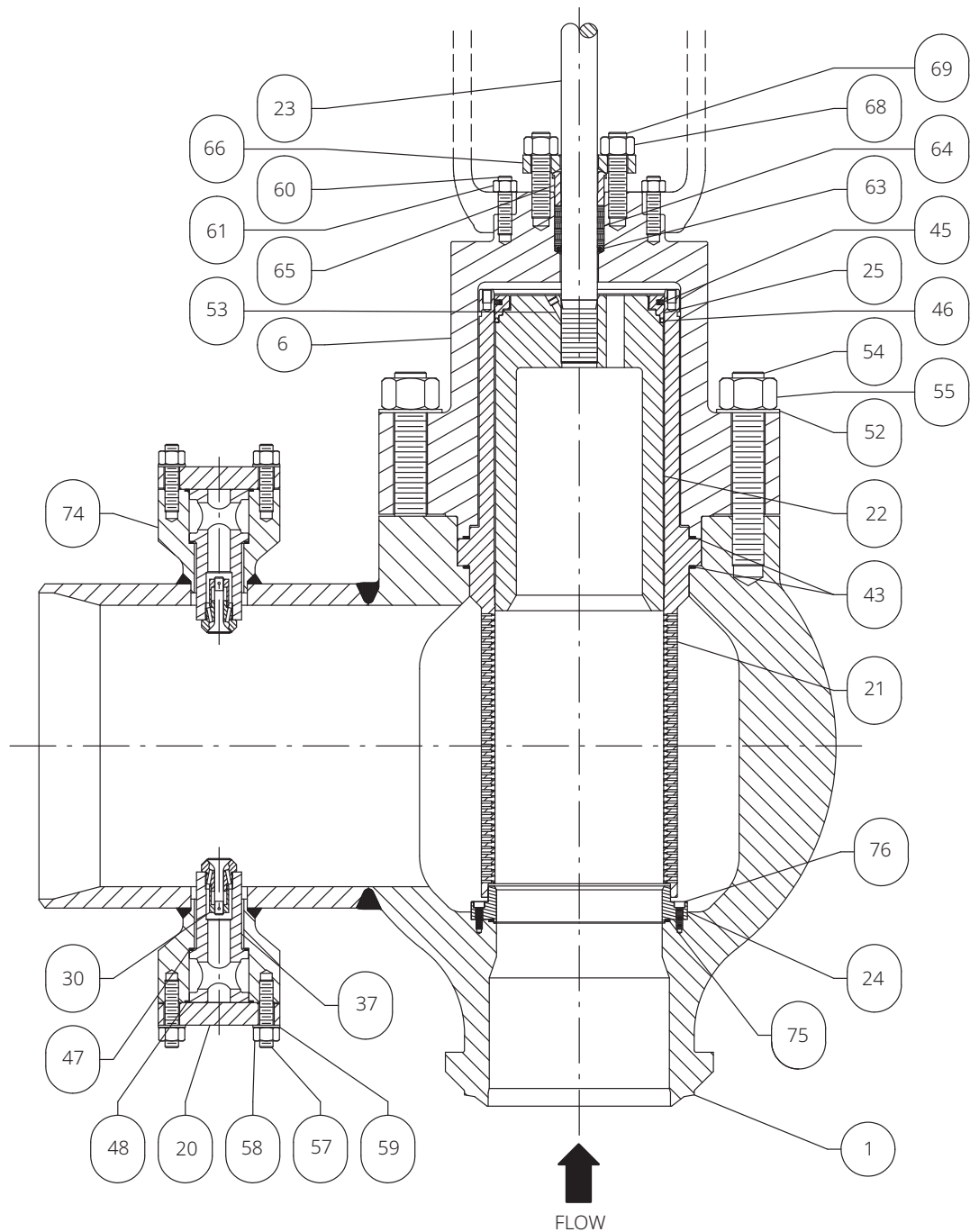
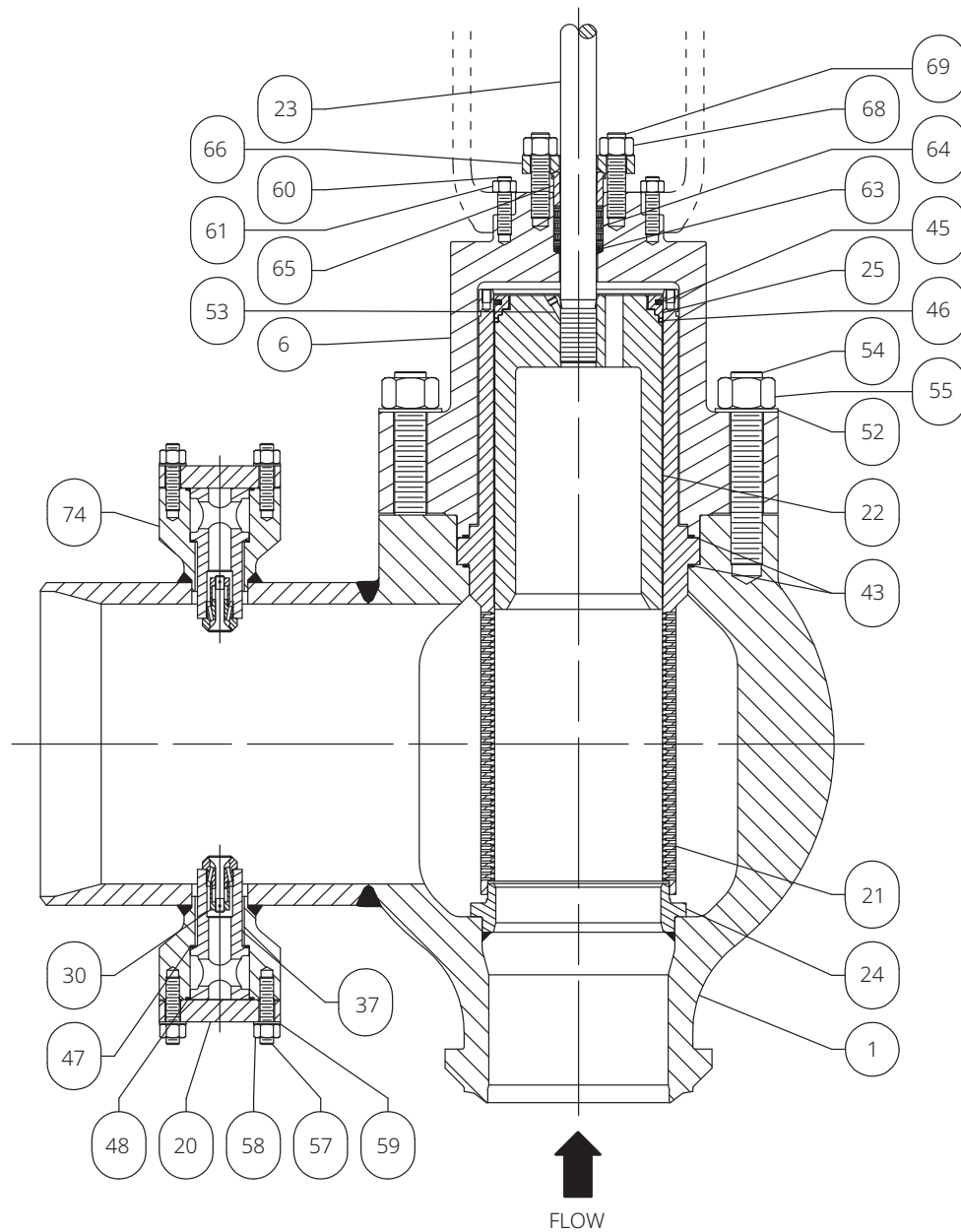


Figure 13. Fisher Flow-Up TBX Assembly with Welded Seat Ring



GE12463-A

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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FISHER™



Fisher™ TBX-P Steam Pressure Control Valve

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Figure 1. Fisher TBX-P Steam Pressure Control Valve



X1715

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and operation information for the Fisher TBX control valve. Refer to separate instruction manuals for instructions covering the actuator and accessories.



Do not install, operate, or maintain a TBX-P valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications for Standard Designs (Physical Specifications)

End Connection Sizes⁽¹⁾ Valve Inlet: NPS 4 through NPS 24 Valve Outlet: NPS 8 through NPS 60 End Connection Types ■ ASME Buttweld (all sizes) ■ ASME Raised Face Flanges (all sizes) ■ ASME Ring Type Joint Flanges (all sizes) Valve Configuration Angle Pattern (flow up or flow down) Valve Body Ratings⁽²⁾⁽⁴⁾ ASME: CL150 - CL2500 Bonnet Type Bolted Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4 Standard: Class V Optional: Class IV Flow Characteristics⁽³⁾ Whisper Trim™ III: Linear WhisperFlo™ (flow up only): Linear Flow Direction Whisper Trim III: Flow up or down WhisperFlo: Flow up Construction Materials Body/Bonnet ■ SA105 Carbon Steel ■ SA182 Grade F22 (2.25Cr-1 Mo) ■ SA182 Grade F91 (9Cr-1 Mo-V) ■ SA182 Grade F92 (Cr-2 W-V)	Bonnet Bolting ■ SA193 Grade B7 ■ SA193 Grade B16 ■ N07718 Seat Ring <i>Welded Seat Ring (flow up only)</i> ■ Carbon Steel with Alloy 6 ■ 2.25Cr-1 Mo with Alloy 6 ■ 9Cr-1 Mo-V with Alloy 6 ■ 9Cr-2 W-V with Alloy 6 <i>Bolted Seat Ring</i> ■ 2.25Cr-1 Mo with Alloy 6 and N07718 Bolting ■ N06625 with Alloy 6 and N07718 Bolting ■ N07718 with Alloy 6 and N07718 Bolting Plug: <i>Control Plug</i> SA182 Grade F22 (2.25Cr-1 Mo) with Alloy 6 Guiding Surfaces SA182 Grade F91 (9Cr-1 Mo-V) with Alloy 6 Guiding Surfaces Stem ■ SA479 Type S20910 ■ N07718 Cage: <i>Control Cage</i> ■ 2.25Cr-1 Mo Nitrided ■ 9Cr-1 Mo-V Nitrided ■ S41000 Cage with 2.25Cr-1 Mo Retainer⁽⁵⁾ ■ S41000 Cage with 9Cr-1 Mo-V Retainer⁽⁵⁾ <i>Lower Cage (flow down only)</i> ■ 2.25Cr-1 Mo Nitrided ■ 9Cr-1 Mo-V Nitrided Piston Rings Alloy 6B with N07750 Expander Bore Seal N07718 Gaskets <i>Bonnet:</i> N07718/Graphite <i>All Others:</i> N06600/Graphite Packing Graphite/Flexible Graphite
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1. Consult your [Emerson sales office](#) for additional options.

2. Not all valve sizes are available in all valve body ratings.

3. Contact your Emerson sales office for other flow characteristics.

4. Intermediate classes above CL2500 available upon request. Consult your Emerson sales office for additional information. PN pressure ratings available per pressure requirements of EN1092-1.

5. WhisperFlo constructions only.

Educational Services

For information on available courses for the Fisher TBX-P steam pressure control valve, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

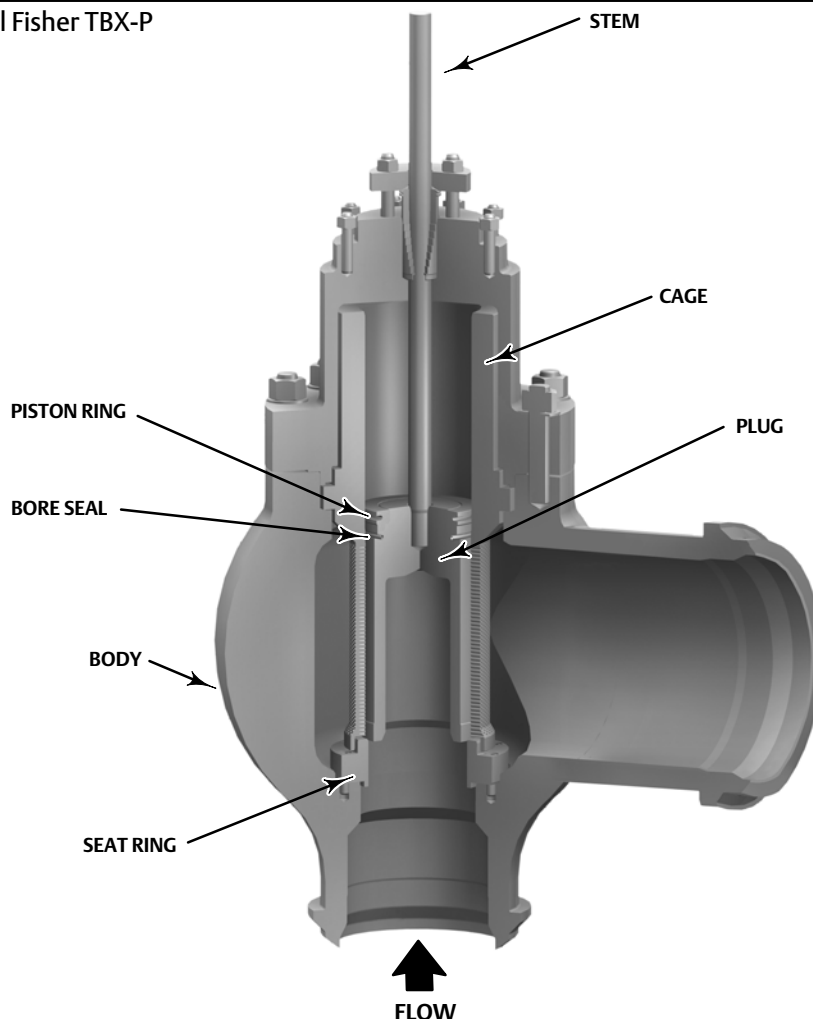
Description

TBX-P steam pressure control valves (see figure 1) are balanced-plug angle valves that are custom built for each application. Typical installations include steam pressure control, vent to atmosphere, auxiliary steam and other applications requiring dependable and accurate control of steam pressure.

The TBX-P steam pressure control valve (see figure 1) is designed to handle the most severe applications in today's cycling power plants as well as provide precise pressure control for process applications. The TBX-P incorporates more than 30 years of steam pressure control experience and product development. The valve body is designed with the latest finite element analysis (FEA) and computational fluid dynamics (CFD) tools to optimize performance and reliability for demanding steam systems.

The TBX-P is a flow up or flow down design providing the ultimate combination of performance and maintainability. The flow down TBX-P incorporates Emerson's low noise Whisper Trim III technology. The flow up TBX-P incorporates the same Whisper Trim III technology as the flow down design, but can also be outfitted with WhisperFlo Trim technology.

Figure 2. Typical Fisher TBX-P



Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the TBX-P valve is installed where service conditions could exceed the limits of the pressure rating noted on the nameplate. To avoid such injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

This valve is intended for a specific range of service conditions (see table 1). Applying different conditions to the valve could result in parts damage, malfunction of the valve, or loss of control of the process. *Do not expose this valve to service conditions or variables other than those for which this valve is intended.* If you are not sure what these conditions are, you should contact Emerson for more complete specifications. Provide the product serial number (shown on the nameplate) and all other pertinent information.

Check that the TBX-P valve is properly orientated with respect to the flow direction of the valve (either flow up or flow down). Incorrect installation can result in damage to the valve and poor performance.

1. Before installation, all piping upstream of the valve must be blown clean so that no loose materials such as welding slag, dirt or other foreign matter, are left in the pipe. Use care to keep foreign matter out of the line openings while preparing the valve installation.
2. If possible, before fitting in the line, connect the actuator to a temporary air supply and operate to verify positioning. Disconnect the instrument lines (if applicable).

⚠ WARNING

Do not lift the valve by its actuator yoke. Lifting lugs attached to the actuator must not be used to lift the complete valve assembly unless clearly marked as being rated to support the complete valve assembly weight. Personal injury or damage to equipment could occur if the valve is improperly lifted into place.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Only personnel trained in proper lifting and rigging practices shall perform valve/actuator assembly lifting, rigging and installation. Because each lift will be unique, the method of lifting the valve assembly, the correct location for attaching and lifting the valve assembly, and what the valve assembly will do when lifted shall be considered for each lift.

Lifting and rigging equipment used to lift, install or remove a valve assembly or component must be properly selected and sized for the weight and configuration of the valve assembly or component being lifted. The weight of the complete valve assembly, including attached accessories, must be taken in consideration for this purpose. The lifting and rigging equipment must be properly maintained and inspected for damage before each use.

Lifting lugs or other lifting equipment attached to the valve or actuator must never be used to lift or support the weight of attached piping.

If the TBX-P is equipped with butt weld ends, the valve body must be supported using a lifting sling or other method that does not place a load or force onto the finished surface of the butt weld ends. The TBX-P does not have a stable resting condition. The valve inlet and outlet must be fully supported until fully welded (butt weld end connections) or bolted (flanged end connections) into the piping.

CAUTION

Care must be taken when lifting the valve/actuator assembly to ensure all accessories and tubing are not damaged in the process. Accessories and tubing may need to be removed prior to lifting to prevent damage and properly reinstalled before use. Protect valve flange faces, butt weld ends, and other connection surfaces from damage during lifting.

3. Arrange lifting slings, or other lifting and rigging equipment appropriate for the valve weight and configuration to safely lift the valve to the pipe opening.

⚠ WARNING

Do not expose the valve to undue stresses by installing it in bent pipes or flanges. Personal injury and equipment damage could result from flange sealing failure due to improper installation.

4. **Flanged Connections**—Lubricate the flange connection bolts with a high temperature thread lubricant. Install flange gaskets and connection bolts per accepted practices and tighten securely.
5. **Welded Connections**—Welding procedures should be in accordance with the applicable codes and the base materials. For preheat, welding electrodes, and postweld heat treatment, refer to the applicable codes and practices applicable for the specific facility. Materials are specified on the customer specification sheet. Emerson recommends the valve be disassembled for welding, however if the valve inlet and outlet connections are to be welded with the valve assembled, the valve plug should be maintained off the valve seat during all associated operations. If the valve is to be welded by SMAW process, the valve must be disassembled for welding to ensure that any weld slag is removed from the valve.

CAUTION

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal parts is possible. In general, if post weld heat treating is to be performed, all trim parts should be removed. Contact your [Emerson sales office](#) for additional information.

Pneumatic lines (where applicable) should be thoroughly blown clean with dry air before connection. Check electronic lines for correct connection.

6. If foreign debris has been introduced into the valve or upstream piping during installation, it must be removed prior to using the valve for the first time. A blowout or blowdown tool can be purchased to match the TBX-P valve and facilitate piping blowdown without removal of the valve from the line. Contact your Emerson sales office for pricing and availability of fixtures. Review Fisher instruction manuals, TBX-P Blowout Fixture ([D103206X012](#)) and Fisher Blowdown Fixture ([D103207X012](#)) prior to use.
7. After cleanliness of the piping system has been assured, connect instrumentation and power supply to the TBX-P valve actuator and associated equipment.
8. Monitor the TBX-P valve as the system is brought online. Some visible vapors may be seen while the lubricants are heated. If you see any steam leaks after startup, follow isolation and disassembly procedures and disassemble the valve and replace the gaskets (key 43). If the packing box leaks, tighten hex nuts (key 68). If leakage continues, replace the packing (key 64). Be sure to properly isolate the TBX-P valve prior to disassembly of valve or packing.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened prior to shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Maintenance

It is recommended that diagnostic tests be performed on the valve 3 to 6 months prior to scheduled maintenance shutdowns. Complete valve disassembly is recommended if tests performed on the valve indicate leakage, sticking, or substandard operation. If diagnostics indicate normal valve operation, complete disassembly and inspection of the TBX-P is recommended during every other regularly scheduled outage or after 24 to 36 months, whichever comes first. Table 2 identifies the recommended inspection tips and diagnostics that can be performed with corresponding repair and replacement information.

Table 2. Inspection Summary

Key	Part Description	Inspection Tips and Diagnostics	Repair	Replacement
1	Valve Body	Inspect for erosion, thermal fatigue, and other damage.	Consult your local Emerson Service Center for a recommendation on necessary weld repair or replacement if damage exists.	
6	Bonnet	Inspect gasket surfaces for damage that could indicate gasket leakage. Inspect packing box to ensure no galling, scoring, or particulate is present.	If damage exists consult your local Emerson Service Center for a recommendation on necessary weld repair or replacement.	
21	Cage	Inspect cage bore for excessive wear, galling damage, particulate damage, and flow passage damage or clogging.	Consult your local Emerson Service Center for a recommendation on necessary repair or replacement if damage exists.	As needed for optimal performance
22	Plug	Inspect for seat erosion, excessive wear, galling damage, and particulate damage, paying close attention to the seating and guiding surfaces.	Re-cutting/machining of seating surfaces can be performed by your local Emerson Service Center.	As needed for optimal performance
23, 53	Stem and Stem Pin	Inspect stem for dings, scoring, and galling. Inspect valve stem connection for tightness.	Valve stem connection can be repaired by your local Emerson Service Center.	As needed
24	Seat	Inspect for seat erosion, particulate damage, galling, and proper bolt torque (if applicable, refer to table 3).	Re-cutting/machining of seating surfaces can be performed by your local Emerson Service Center.	As needed to maintain proper shutoff
25	Plug Retainer	Inspect for excessive wear, galling, and other damage.	Repair can be performed by your local Emerson Service Center.	As needed
43, 75	All Gaskets	Every valve disassembly requires replacement of gaskets.	Replacement Only	Every valve disassembly
45	Piston Ring	Inspect for particulate buildup, scoring, and excessive wear. Ensure piston ring is free to expand and contract in the groove.	Replacement Only	As needed
46	Bore Seal Ring	Inspect for excessive wear, galling, signs of leakage, and other damage.	Replacement Only	Every 36 months for optimal performance
63	Packing Box Ring	Inspect for scoring, galling, and other damage.	Replacement Only	As needed
64	Packing Set	Every valve disassembly requires replacement of the packing set.	Replacement Only	Every valve disassembly
65	Packing Follower	Inspect for scoring, galling, and other damage.	Replacement Only	As needed
66	Packing Flange	Inspect for scoring, galling, and other damage.	Replacement Only	As needed

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Servicing

Shut off steam flow and vent all system pressure before breaking any pressure boundaries.

⚠ WARNING

Residual system pressure may be released during the following steps if the system was improperly isolated or vented.

Use extreme care to prevent personal injury while loosening any fasteners in the pressure boundary.

Removal of Valve Bonnet and Trim

1. Disconnect all external connections to the positioner and actuator and remove the actuator from the valve. Consult the actuator manufacturer's documentation for assistance in actuator removal.
2. Loosen and remove the hex nuts (key 68) along with the packing follower (key 65). If possible, remove packing set (key 64) from the packing box.
3. Loosen bonnet stud nuts (key 55) using an even pattern to avoid uneven expansion of the gaskets. Remove the entire bonnet assembly (key 6), pulling evenly in line with the valve stem (key 23) centerline. Uneven bonnet removal can result in galling or bending of the valve stem. If difficulty is encountered in removing the bonnet, check the bonnet for alignment and straighten the bonnet before making further attempts to remove it from the valve body.

CAUTION

The bonnet must be handled with care while being removed from the body. Damage to the bonnet can result in gasket leakage while the valve is in service.

Protect the bonnet by placing it on clean cloth or wood while the valve is disassembled.

4. Dislodge any remaining packing (key 64) from the packing box and discard. Remove the packing box ring (key 63) from the bottom of the packing box. Inspect all parts: packing box, packing box ring (key 63), packing follower (key 65), valve stem (key 23), hex nuts (key 68) and studs (key 69) for signs of wear. Replace parts that are damaged or show excessive wear.
5. Inspect the bonnet guiding surfaces and gasket mating surfaces. Light damage on the guiding surface may be repaired with an emery cloth or other suitable material. Damage to the gasket mating surface may require bonnet replacement to avoid leakage.
6. Remove the plug assembly (flow up and flow down: keys 22, 23, 25, and 53) as a single unit by lifting the valve stem (key 23) with appropriate rigging and lifting equipment and pulling the assembly from the body cavity. The plug assembly contains sensitive guiding and sealing surfaces on its outside diameter and care must be taken in its handling. Protect the plug by placing it on clean cloth or wood while the valve is disassembled.
7. **Flow Up Construction only:** If the TBX-P has a magnetite catcher (key 79) and excess magnetite buildup is present, remove the magnetite catcher located in the bore of the plug (key 22) by cutting the tackwelds at the base of the part and unscrewing from the plug. Clean as necessary to remove magnetite buildup.
8. Remove the cage (key 21) from the valve body. Remove and discard two (2) cage gaskets (key 43). Reference figures 9, 10, and 11 for guidance in performing this disassembly. The cage contains sensitive guiding surfaces on its inside and outside diameter and care must be taken during handling. Protect the cage by placing it on clean cloth or wood while the valve is disassembled.
9. **ANSI/FCI 70-2 Class V constructions only:** Clean and inspect the guiding and sealing surfaces of the plug assembly. Inspect the piston ring (key 45) and Bore Seal ring (key 46) for signs of excess wear or damage and replace if necessary. The piston ring is a two-piece design with an outer seal ring and an inner expander ring. The outer ring diameter should be expanded beyond the diameter of the plug in its free state. It can be shifted within its groove to inspect for uneven wear around its circumference. The piston ring should require some compression when installing the plug into the cage. Lack of required compression indicates that the piston ring has worn or relaxed and should be replaced. Vertical marks in the axial orientation also indicate wear that requires replacement of the ring. The Bore Seal ring has a C-shaped cross section. The open portion of the C-shape faces the stem side of the plug on flow up valves. The open portion of the C-shape faces the seating surface of the plug for flow down valves. See figure 3 for proper orientation. Any uneven marks around the circumference of the ring or any flattening of the ring shape at its outside diameter are indications of wear and require replacement. Contact your [Emerson sales office](#) for Bore Seal ring replacement.

ANSI/FCI 70-2 Class IV constructions only: Clean and inspect the guiding and sealing surfaces of the plug assembly. Inspect the two piston rings (key 45) for signs of wear or damage and replace if necessary. The piston ring is a two piece design with an outer seal ring and an inner expander ring. The outer ring diameter should be expanded beyond the diameter of the plug in its free state. It can be shifted within its groove to inspect for uneven wear around its circumference. The piston ring should require some compression when installing the plug into the cage. Lack of required compression indicates that the piston ring has worn or relaxed and should be replaced. Vertical marks in the axial orientation also indicate wear that requires replacement of the ring.

10. Clean and inspect the cage bore for excessive wear. The entire length of the cage bore is either a sealing and/or guiding surface and any measurable wear requires that the cage be replaced.
11. Welded seat rings remain retained inside the valve body. Clean and inspect the seating surface. Any detectable damage around the circumference of the seating surface is an indication of wear and requires reconditioning to ensure seating performance. Contact your Emerson sales office for specific instructions on reconditioning the seating surface. If the TBX-P has a bolted seat ring, remove the cap screws (key 76) and discard the gasket(s) (key 75) that sit between the valve body and seat ring. Inspect cap screws for damage and excessive wear; replace as necessary.

12. **Flow down construction only.** Remove the lower cage (key 78); reference figure 9 for guidance in performing this disassembly. The cage contains sensitive guiding surfaces on its inside and outside diameter and care must be taken during handling. Protect the cage by placing it on clean cloth or wood while the valve is disassembled.
13. Remove all used gaskets and foreign material from the interior of the valve and from the inlet and outlet openings. Remove any foreign material that may be in the valve body or trim. Inspect all valve body guiding and sealing surfaces for any signs of wear.
14. If the valve has been in service, visually inspect the interior of the valve for abnormal wear, erosion, or thermal fatigue. The gasket surfaces of the valve body and bonnet should be inspected to verify that they are not damaged and are free of imbedded gasket material. All scratches should be removed by grinding or filing to remove any interference of the clearance zones between the internal bores and the mating parts. All signs of thermal fatigue should be carefully evaluated to determine if repair or replacement is necessary. Your local Emerson Service Center can help determine the severity of damage, if present, and recommend a course of action.

Valve Assembly

1. **Cleaning**--Make certain that all interior surfaces of the valve body and bonnet (including the packing box) are clean and free of dirt, including the inlet and outlet openings. All surfaces of the valve interior that receive mating parts should be given special attention when cleaning. All sliding fit surfaces should be coated with a copper-based high temperature anti-seize lubricant prior to reassembly. Refer to figures 9, 10, and 11 for reference.

If the TBX-P has a bolted seat ring or is flow down orientation, proceed with steps 2 through 4; otherwise, proceed directly to step 5.

2. Place one gasket (key 75) into the valve body. **If the TBX-P is a flow up construction:** Install the seat ring (key 24) onto this gasket surface. **If the TBX-P is a flow down construction:** Install the lower cage (key 78) onto the gasket surface ensuring the bolt holes in the cage flange are positioned with the bolt holes in the valve body. Then place another gasket (key 75) onto the diameter of the lower cage, and install the seat ring (key 24) onto this second gasket surface.

Note

Horizontal actuator only: TBX-P valves positioned in the process pipeline with a horizontal actuator/trim may require special attention to ensure that the spiral wound gaskets are maintained in the proper location during the valve assembly procedures without falling out of the gasket groove. A gasket manufacturer recommends spray adhesive 3M #77 Super Spray Adhesive to temporarily hold gaskets in place until they are fully contained by the TBX-P valve body and trim components. Please note special spiral wound gasket-positioning techniques may be recommended. To use the adhesive, lightly spray the gasket groove that the gasket will be installed in. Also lightly spray one side of the spiral wound gasket that will be contacting the previously coated gasket groove. Let the spray adhesive set for one minute and then lightly press the spiral wound gasket into the gasket groove.

Other Considerations: Ensure the spiral wound gasket is located in the correct location when contact is made. Trying to remove the gasket after contact will damage the gasket by pulling out or removing the soft filler/facing material. If the gasket is incorrectly positioned after applying the spray adhesive it must be removed and discarded. The gasket groove will then need to be cleaned and a new gasket will need to be installed.

3. Lubricate the seat ring cap screws (key 76) and all surfaces that contact the screws, including the valve body and seat ring.
4. Torque the cap screws in a crisscross pattern, using no more than 1/4 of the specified torque as indicated in table 3. Repeat the crisscross pattern, working up to the specified torque in 1/4 increments until the final torque is achieved. Wait a minimum of 1 minute to allow for gasket/screw relaxation and recheck the torque, adjusting as necessary.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D10455X012

TBX-P Valve

August 2020

Table 3. TBX-P (Flow Up and Flow Down) Bolted Seat Ring Torque with Nickel Anti-Seize Lubricant⁽¹⁾

CAP SCREW SIZE, Inch	THREADS PER INCH	LUBRICATION	RECOMMENDED BOLT TORQUE	
			N • m	lbf • ft
3/8	16	Nickel Anti-Seize	41	30
1/2	13		91	67
5/8	11		163	120

1. For other lubricants, contact your [Emerson sales office](#) for recommended bolt torque.

5. Install one cage gasket (key 43) into the groove in the valve body. If the valve has a horizontal stem orientation, ensure that the gasket remains in the groove and does not get pinched during cage installation.

Note

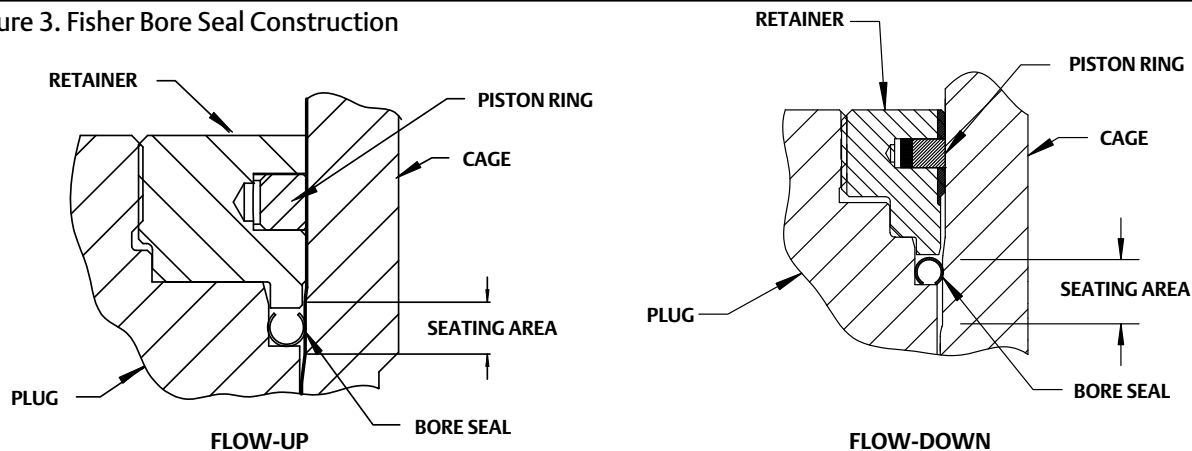
Horizontal actuator only: Follow the note in step 2 above to ensure the gaskets are in the proper location during valve assembly.

6. Lubricate the inside of the cage as completely as possible. Insert the lubricated cage (key 21) into the valve body. Ensure the lower cage diameter slides over the outside diameter of the seat ring. If there is any question regarding the proper seating of the cage inside the valve body, the following measurements can be taken for confirmation. Measure the thickness of the cage flange at its largest diameter. Measure the depth of the mating counterbore where the cage flange engages into the valve body. When assembled with a new cage gasket, the resulting depth from the top of the valve body to the top of the cage flange should be the difference in these two measured values, minus an additional 0.045 inches to allow for the uncompressed gasket.
7. **Flow Up Construction only:** If applicable, install the magnetite catcher (key 79) by threading into the bore of the plug (key 22). Apply four tackwelds equally spaced along the circumference of the plug to prevent rotation during service.

If the TBX-P is an ANSI/FCI 70-2 Class V construction, proceed with steps 8 through 15; otherwise proceed directly to step 16 for Class IV constructions.

8. The plug assembly includes a plug (key 22), stem (key 23), stem pin (key 53), retainer (key 25), piston ring (key 45) and Bore Seal ring (key 46). Lubricate the plug assembly at all raised outside diameter surfaces and lubricate the piston ring(s) and Bore Seal ring.
9. Orient the Bore Seal for correct sealing action based on the process fluid flow direction through the valve, refer to figure 3 to complete this step.

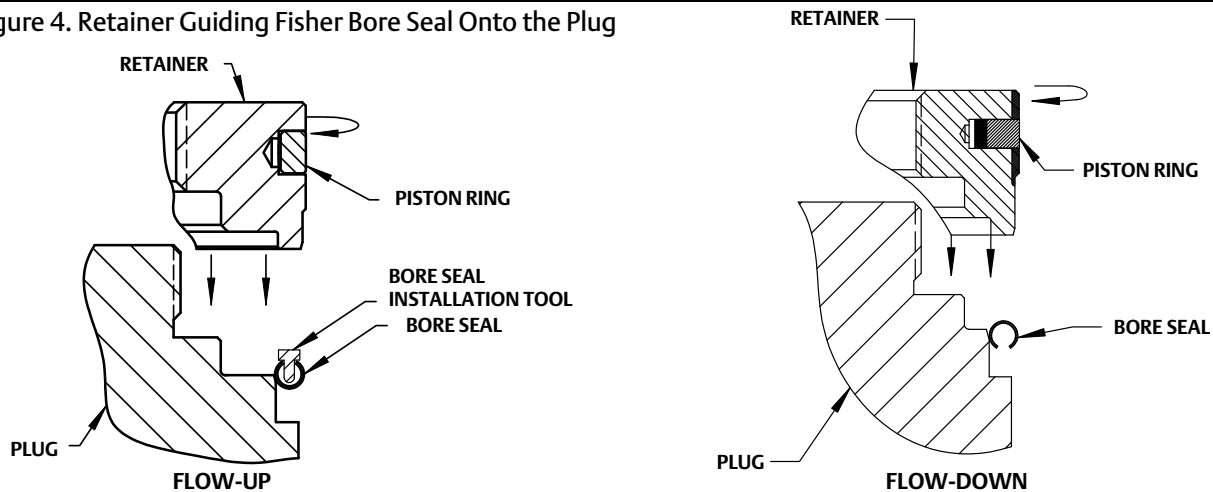
Figure 3. Fisher Bore Seal Construction



10. Place the Bore Seal plug seal over the top of the valve plug. The retainer will help guide the Bore Seal down onto the plug. Do not force the Bore Seal over the plug (figure 4).

11. For the Flow-up design, the Bore Seal installation tool (figure 8) must be inserted into the Bore Seal prior to using the retainer to guide it down the plug.
12. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the Bore Seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
13. If applicable, remove the retainer and then the installation tool. Place the Bore Seal retainer back onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.
14. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place to secure the Bore Seal retainer.

Figure 4. Retainer Guiding Fisher Bore Seal Onto the Plug



15. Install the lubricated plug assembly into the cage. The piston ring(s) should require some radial compression to collapse into the cage diameter. Do not use a metallic tool to create this piston ring compression as this could damage the outer sealing diameter of the ring. The plug(s) should slide into the cage(s) smoothly with little effort until the Bore Seal ring reaches its mating cage diameter. The extra load required to seat the Bore Seal trim seal will be applied during actuator set up.
16. ANSI/FCI 70-2 Class IV constructions only: The plug assembly includes a plug (key 22), stem (key 23), stem pin (key 53), and two piston rings (key 45). Lubricate the plug assembly at all raised outside diameter surfaces and lubricate the piston rings. Install the lubricated plug assembly into the cage. The piston rings should require some radial compression to collapse into the cage diameter(s). Do not use a metallic tool to create this piston ring compression, as this could damage the outer sealing diameter of the ring. The plug(s) should slide into the cage(s) smoothly with little effort. Refer to figures 5 and 7.
17. Install the second cage gasket (key 43) over the cage boss where it will be self-centering for the mating bonnet groove.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

18. Apply appropriate high-temperature anti-seize lubricant to the bonnet studs (key 54) and screw them into the valve body. Back the studs out 1/2 to 1 turns after bottoming the stud in the valve body.
19. Lubricate the bonnet locating surfaces and carefully install the bonnet (key 6). Use care to avoid bending the stem.
20. Install bonnet stud washers (key 52) and nuts (key 55) and hand tighten.
21. Tighten the bonnet nuts (key 55) in a uniform, multistage cross pattern. Monitor the distance between the bonnet and body and keep it even to ensure that the bonnet is being torqued evenly. It is recommended that torquing be performed in a minimum of four torque levels until the final torque level is achieved. You may need to torque multiple times at each torque level to ensure that the bonnet is torqued evenly. Required torque can be found in table 4. After final torquing, ensure there is an even gap and that the metal-to-metal contact between the valve body and bonnet is achieved around the entire circumference of the body-bonnet joint.

Table 4. Recommended Body/Bonnet Bolting Torque with Nickel Anti-Seize Lubricant⁽¹⁾

BOLT SIZE, Inch	THREADS PER INCH	LUBRICATION	RECOMMENDED BOLT TORQUE ⁽²⁾	
			N•m	Lbf•ft
1	8	Nickel Anti-Seize	522	385
1-1/8			712	525
1-1/4			942	695
1-3/8			1268	935
1-1/2			1654	1220
1-5/8			2129	1570
1-3/4			2671	1970
1-7/8			3308	2440
2			4027	2970
2-1/4			5776	4260

1. For other lubricants, contact your [Emerson sales office](#) for recommended bolt torque.
2. Torques for lubricated studs with heavy hex nuts.

22. After the body/bonnet studs have been torqued to the required level, check the plug movement to ensure that the plug still moves freely.
23. Recheck cleanliness of the packing box. Insert the packing box ring (key 63) over the stem and into the packing box. Measure the depth of the packing box before and after ring insertion to be certain that it has traveled to the bottom of the packing box. Insert packing rings (key 64), after lubricating with high temperature grease, into the packing box and staggering the gaps on adjacent rings. The packing follower (key 65) can be used to ensure that each packing ring is pushed down before installing the next packing ring.
24. After all packing rings are installed, thoroughly lubricate the studs (key 69) and insert the packing follower (key 65) and the packing flange (key 66). Tighten the hex nuts (key 68) tight enough to block leakage but not so tight that stem travel is hindered. Consult table 5, Recommended Packing Nut Torque for recommended torque levels. Evenly tighten the nuts to the maximum level, then loosen and retighten to the minimum torque level. After operating, further tightening may be required to prevent leakage.
25. Install the actuator on the valve in accordance with manufacturer's standard procedure. If this is an ANSI/FCI 70-2 Class V construction, the plug assembly will require an additional load and travel to seat the Bore Seal ring (refer to figures 6 and 7 for details). After calibration of the actuator, the valve should be ready to return to service.

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Table 5. Recommended Packing Nut Torque with Anti-Seize Lubricant

STEM DIAMETER Inch	ASME PRESSURE RATING	MAXIMUM TORQUE		MINIMUM TORQUE	
		N•m	Lbf•ft	N•m	Lbf•ft
1-1/4	CL300	49	36	33	24
	CL600	67	49	45	33
	CL900	83	61	56	41
	CL1500	102	75	68	50
	CL2500	122	90	82	60
2	CL300	65	48	59	43
	CL600	91	67	83	61
	CL900	120	88	109	80
	CL1500	147	108	133	98
	CL2500	170	125	156	115

Figure 5. Fisher TBX-P Flow Up Class IV Construction

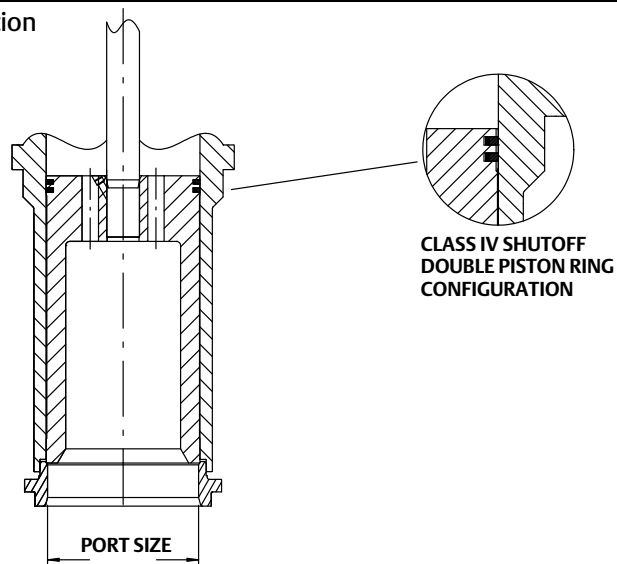
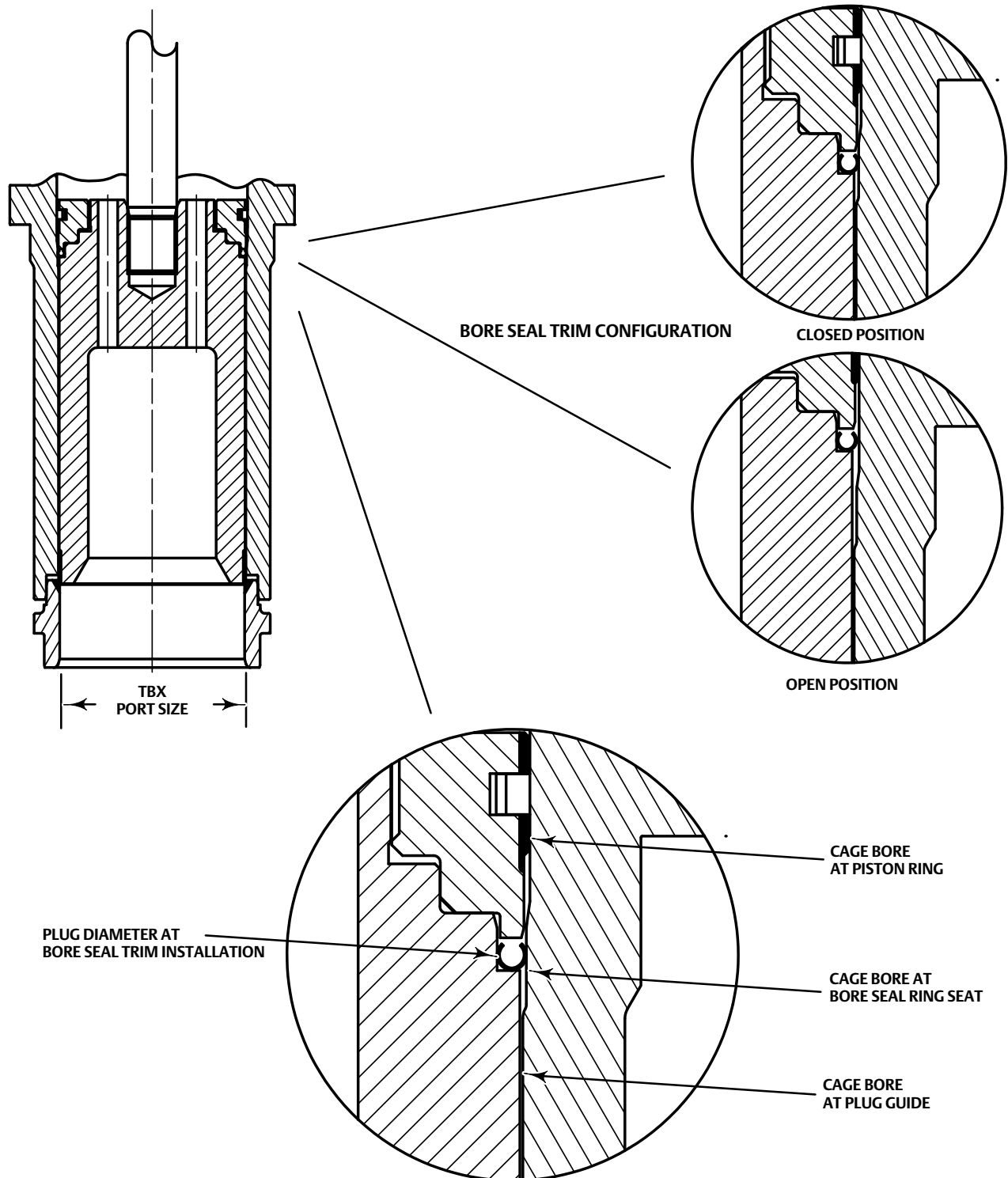
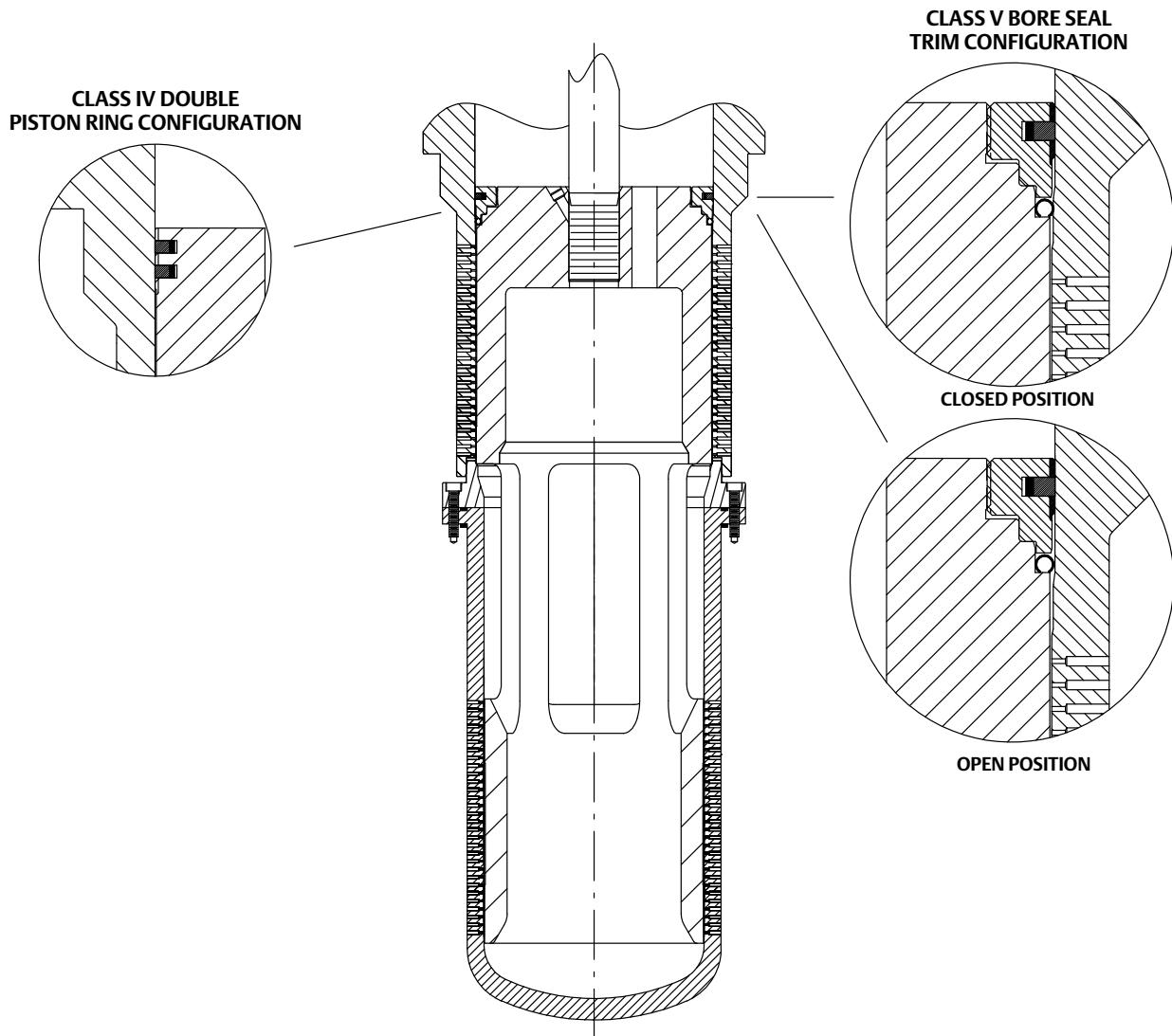


Figure 6. Fisher TBX-P Flow Up Class V Construction



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Figure 7. Fisher TBX-P Flow Down Construction



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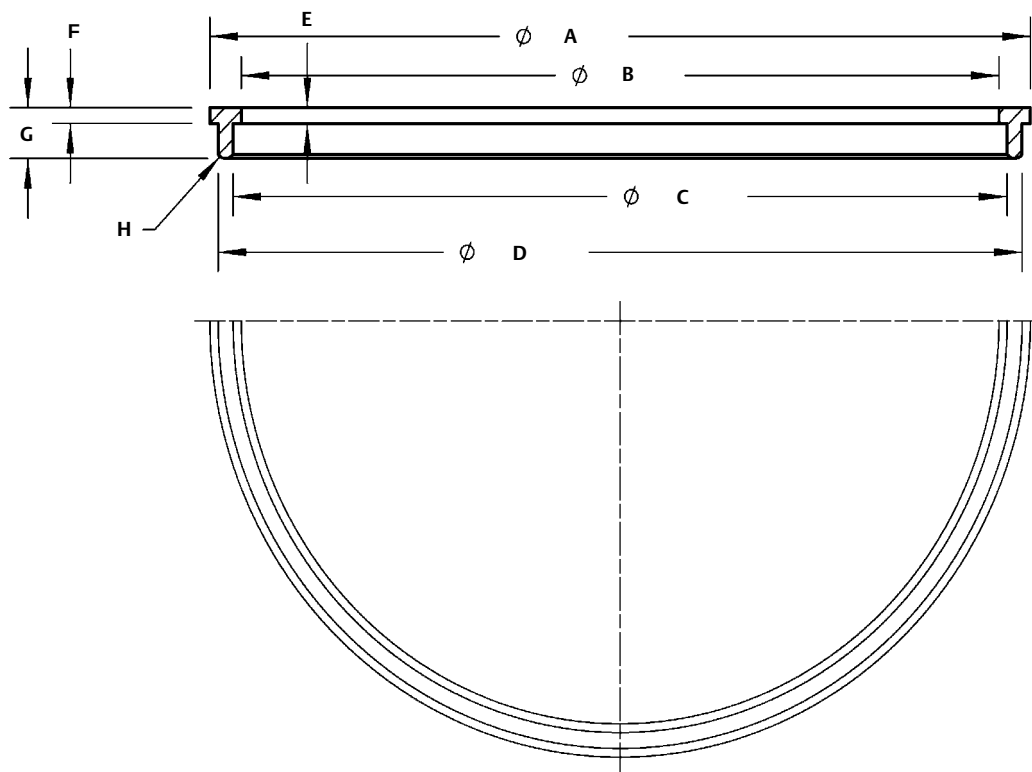
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Figure 8. Bore Seal Installation Tool (Flow Up Only)



GE22109-A

Table 6. Bore Seal Installation Tool Dimensions (Flow Up Only)

VALVE PORT SIZE, INCH	Dimensions, Inches (See Figure 8)								Tool Part Number
	A	B	C	D	E	F	G	H	
3.4375	(1)								n/a
4.28	(1)								n/a
4.70	4.77	4.35	4.45-4.47	4.67-4.65	0.10	1.10	0.32	R.06	GE18267X012
5.375	5.49	5.07	5.17-5.19	5.39-5.37	0.10	0.10	0.32	R.06	GE22109X012
6.25	6.34	5.92	6.02-6.04	6.24-6.22	0.10	0.10	0.32	R.06	GE18266X012
7.00	7.11	6.69	6.79-6.81	7.01-6.99	0.09	0.10	0.32	R.06	GE18264X012
7.62	7.76	7.34	7.44-7.46	7.66-7.64	0.10	0.10	0.32	R.06	GE18263X012
8.00	(1)								n/a
9.20	9.39	8.97	9.07-9.09	9.29-9.27	0.10	0.10	0.32	R.06	GE17916X012
10.00	10.12	9.7	9.80-9.82	10.02-10.00	0.10	0.10	0.32	R.06	GE17914X012
11.00	(1)								n/a
11.20	11.35	10.93	11.015-11.025	11.265-11.255	0.10	0.10	0.32	R.07	GE17905X012
13.75	(1)								n/a
14.75	14.84	14.424-14.416	14.516-14.536	14.736-14.716	0.1	0.1	0.32	R.05	GE34073X012
16.70	(1)								n/a
18.25	(1)								n/a
19.9375	(1)								n/a

1. For sizes contact your [Emerson sales office](#).

Parts Ordering

Each TBX-P valve is assigned a serial number that can be found on the bonnet flange. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and key numbers for each part required. The key numbers in the Parts List and the assembly drawing in figures 9, 10, and 11 can be used to help in part identification.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your [Emerson sales office](#) for part numbers.

Key	Description
1	Body
6	Bonnet
21*	Control Cage
22*	Control Plug
23*	Stem
24	Seat
25	Plug Retainer

Key	Description
43*	Cage Gasket, 2 req'd
45*	Piston Ring
46*	Bore Seal ring
52	Bonnet Stud Washer
53*	Stem Pin
54	Bonnet Stud
55	Bonnet Stud Nut
60	Actuator Stud
61	Actuator Stud Nut
63*	Packing Box Ring
64*	Packing Set
65*	Packing Follower
66*	Packing Flange
68*	Hex Nut
69*	Stud
75*	Gasket
76*	Seat Ring Cap Screws
78*	Lower Cage
79	Magnetite Catcher (not shown)

Figure 9. Fisher Flow Down TBX-P Assembly with Bolted Seat Ring

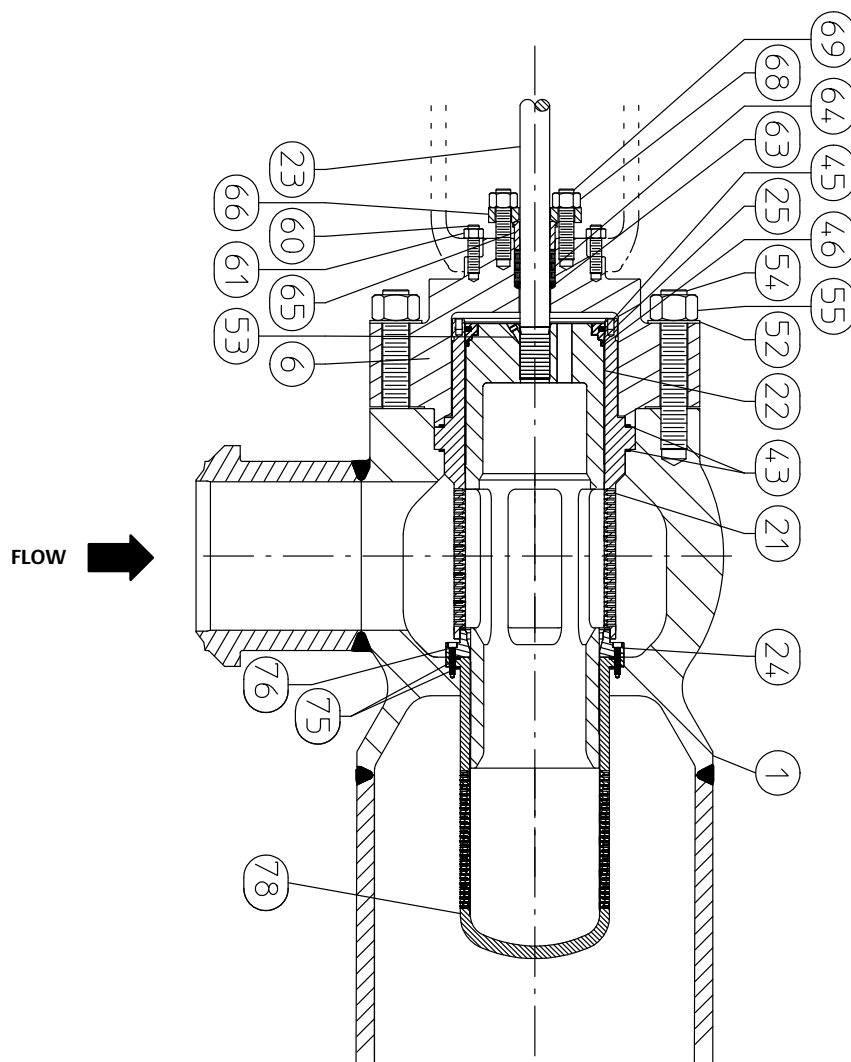


Figure 10. Fisher Flow Up TBX-P Assembly with Bolted Seat Ring

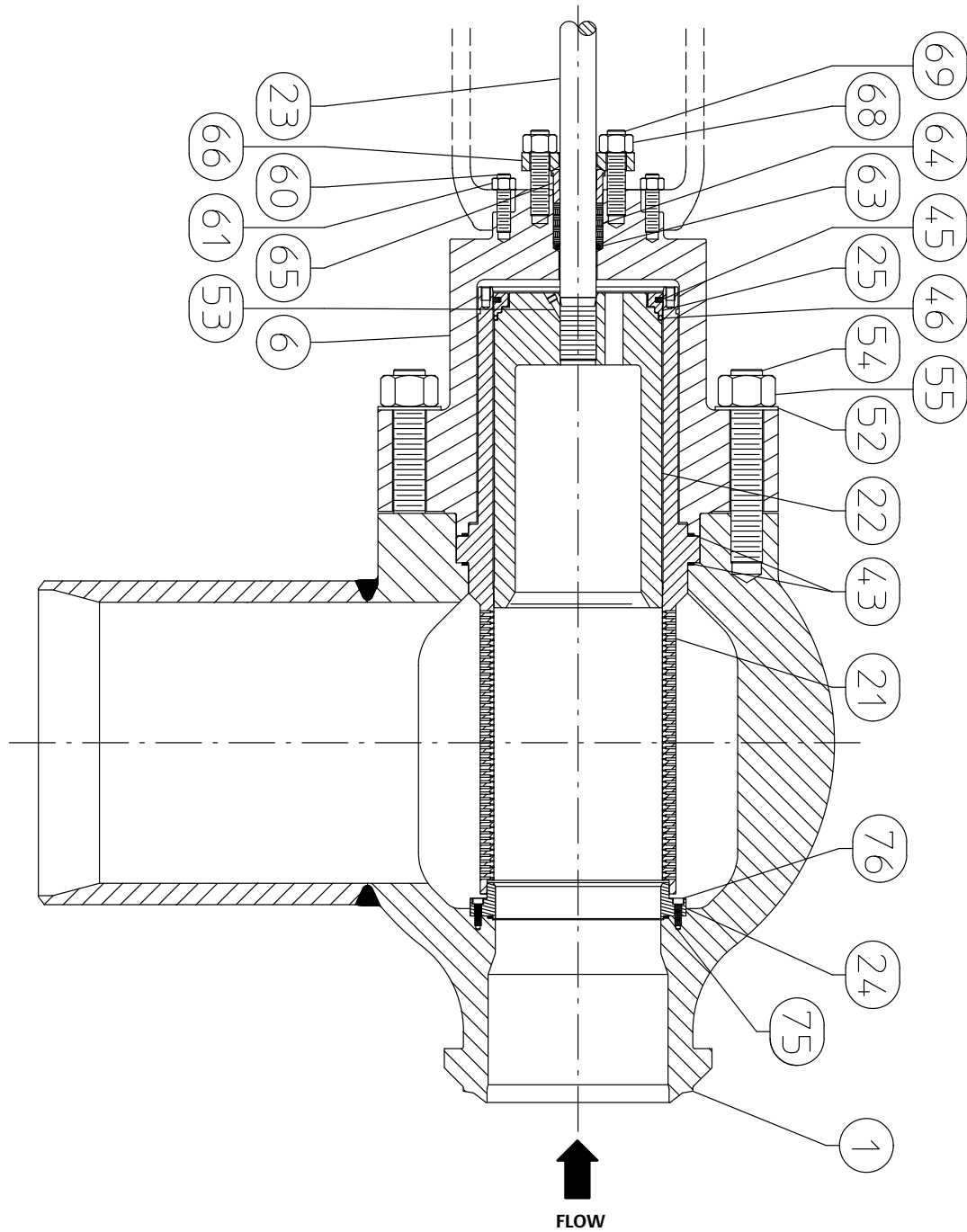
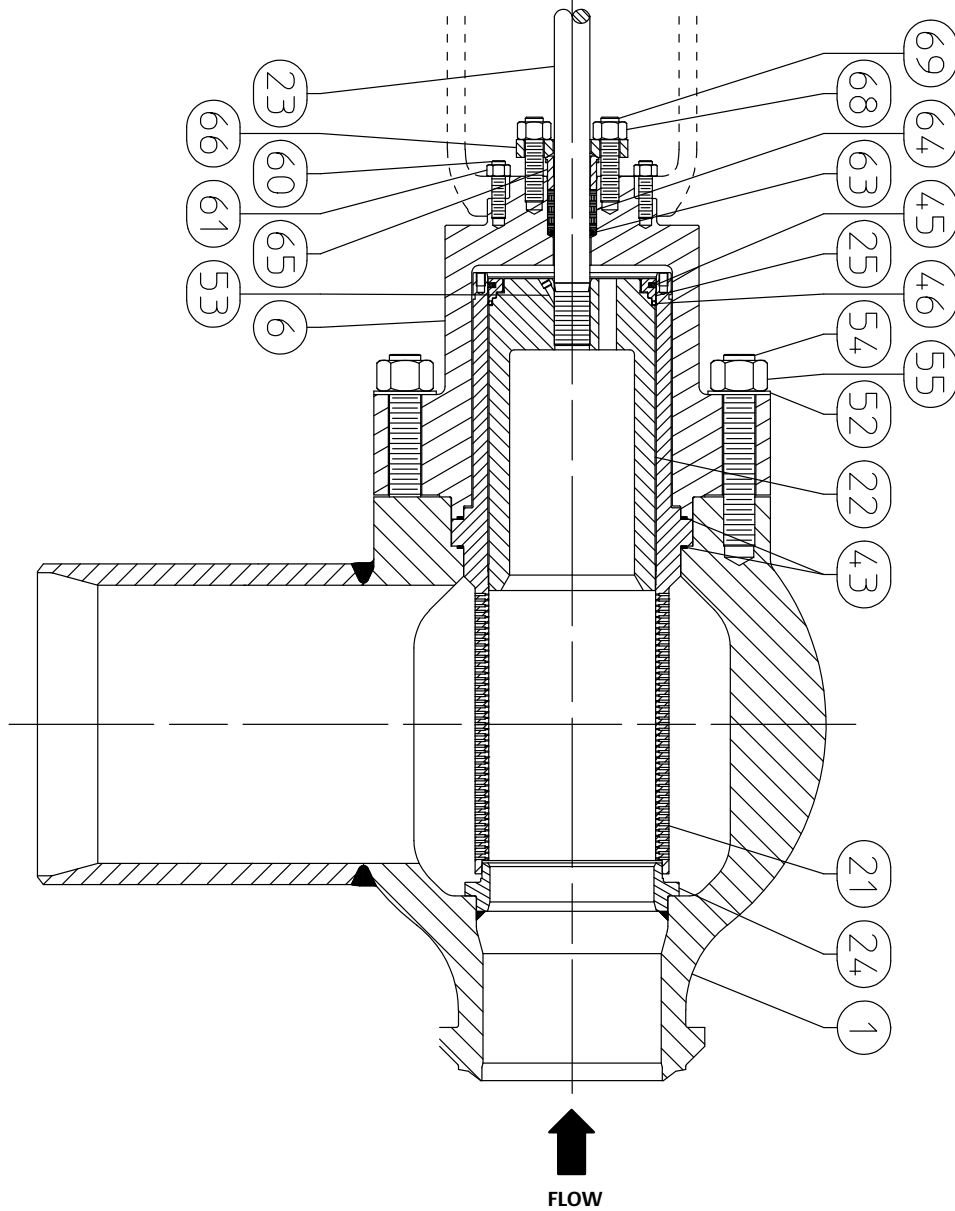


Figure 11. Fisher Flow Up TBX-P Assembly with Welded Seat Ring



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Fisher™ TBX-T Desuperheater

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Figure 1. Fisher TBX-T Desuperheater



X0162

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and operation information for the Fisher TBX-T desuperheater. Refer to separate instruction manuals for instructions covering the actuator and accessories.



Do not install, operate, or maintain a TBX-T desuperheater without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

Water atomization and vaporization are key elements in any steam conditioning application. The TBX-T design incorporates a spraywater manifold of variable geometry AF nozzles that produce an optimized spray pattern over a wide operating range. These nozzles are strategically placed to achieve optimal mixing and quick vaporization at all flowing conditions. Years of research in spray atomization and vaporization were key to optimizing the water injection system. Extensive use of CFD analysis, in addition to field performance feedback, was used to validate spray system enhancements.

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Table 1. Specifications for Standard Designs (Physical Specifications)

Steam Line Connection Sizes⁽¹⁾⁽³⁾ NPS 8 through NPS 60 (DN200 through DN1500) Steam Line Connection Types ■ ASME Buttweld (all sizes) ■ ASME Raised Face Flanges (all sizes) ■ ASME Ring Type Joint Flanges (all sizes) Construction Materials Steam Pipe: ■ SA105 carbon steel, ■ SA182 Grade F22 (2-1/4 Cr-1 Mo) ■ SA182 Grade F91 (9 Cr-1 Mo-V) ■ SA182 Grade F92 (9 Cr-2 W-V) Nozzles: ■ S41000 stainless steel ■ N07718 nickel alloy Gaskets: ■ N06600/Graphite Bolting: ■ SA193 Grade B7, ■ SA193 Grade B16, ■ N07718	Spraywater Connection⁽¹⁾⁽³⁾ ■ NPS 1 through NPS 4 ■ ASME Raised Face Flange (all sizes) ■ ASME Ring Type Joint Flange (all sizes) ■ ASME Buttweld (all sizes) ■ ASME Socket Weld ■ ASME CL150 to CL2500⁽⁴⁾ Maximum Inlet Pressures⁽¹⁾ Consistent with applicable pressure-temperature ratings per ASME B16.34 Spraywater Pressure Required⁽²⁾ 3.5 to 35 bar (50 to 500 psi) greater than steam line pressure
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1. Do not exceed the pressure or temperature limits in this instruction manual, nor any applicable code or standard limitations.

2. A function of required turndown and equipment selection.

3. Contact your [Emerson sales office](#) for additional options.

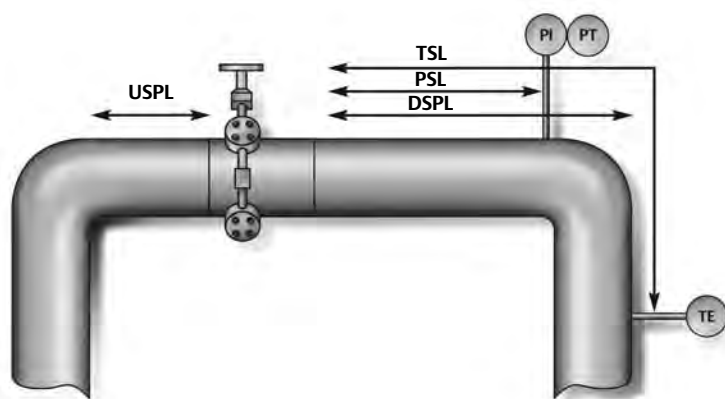
4. Intermediate rating above CL2500 available upon request. PN pressure ratings available per requirements of EN 1092-1. Consult your Emerson sales office for additional information.

Educational Services

For information on available courses for Fisher TBX-T desuperheaters, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Figure 2. Typical Fisher TBX Installation



KEY:
 DSPL = DOWNSTREAM STRAIGHT PIPE LENGTH
 PI = PROPORTIONAL INTEGRAL CONTROLLER
 PSL = PRESSURE SENSOR LENGTH
 PT = PRESSURE TRANSMITTER
 TE = TEMPERATURE SENSOR ELEMENT
 TSL = TEMPERATURE SENSOR LENGTH
 USPL = UPSTREAM STRAIGHT PIPE LENGTH

X0355

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the TBX-T desuperheater is installed where service conditions could exceed the limits of the pressure rating noted on the nameplate. To avoid such injury or damage, provide a relief valve for over pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the desuperheater configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and fluid conditions. Do not apply any other conditions to the desuperheater without first contacting your local [Emerson sales office](#).

1. Before installation, all piping upstream of the desuperheater must be blown clean so that no loose materials such as welding slag, dirt or other foreign matter, are left in the pipe. Use care to keep foreign matter out of the line openings while preparing the desuperheater installation.

⚠ WARNING

Do not lift the desuperheater by its cooler manifold piping. Personal injury or damage to equipment could occur if the desuperheater is improperly lifted into place.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Only personnel trained in proper lifting and rigging practices shall perform desuperheater assembly lifting, rigging and installation. Because each lift will be unique, the method of lifting the desuperheater assembly, the correct location for attaching and lifting the desuperheater assembly, and what the desuperheater assembly will do when lifted shall be considered for each lift.

Lifting and rigging equipment used to lift, install or remove a desuperheater assembly or component must be properly selected and sized for the weight and configuration of the desuperheater assembly or component being lifted. The weight of the complete desuperheater assembly, including attached accessories, must be taken in consideration for this purpose. The lifting and rigging equipment must be properly maintained and inspected for damage before each use.

Lifting lugs or other lifting equipment attached to the desuperheater must never be used to lift or support the weight of attached piping.

If the TBX-T is equipped with butt weld ends, the desuperheater body must be supported using a lifting sling or other method that does not place a load or force onto the finished surface of the butt weld ends. The TBX-T does not have a stable resting condition. The desuperheater inlet and outlet must be fully supported until fully welded (butt weld end connections) or bolted (flanged end connections) into the piping.

2. Arrange lifting slings, or other lifting and rigging equipment appropriate for the desuperheater weight and configuration, around the main steam pipe to safely lift the TBX-T to the pipe opening.

⚠ WARNING

Do not expose the TBX-T to undue stresses by installing it in bent pipes or flanges. Personal injury and equipment damage could result from flange sealing failure due to improper installation.

3. Flanged Connections—Lubricate the flange connection bolts with a high temperature thread lubricant. Install flange gaskets and connection bolts per accepted practices and tighten securely.
4. Welded Connections—Welding procedures should be in accordance with the applicable codes and the base materials. For preheat, welding electrodes, and post weld heat treatment, refer to the applicable codes and practices applicable for the specific facility. Materials are specified on the customer specification sheet.

CAUTION

Depending on desuperheater body materials used, post weld heat treating may be required. If so, damage to internal parts is possible. In general, if post weld heat treating is to be performed, all nozzles should be removed. Contact your [Emerson sales office](#) for additional information.

5. Remove the spraywater control valve and flush the cooling water line until all debris is removed from the line prior to connecting it to the TBX-T desuperheater. Use only clean sources of cooling water to reduce the possibility of nozzle clogging. A strainer should be installed in the water line as close to the TBX-T desuperheater as possible. To determine appropriate mesh size, refer to desuperheater sizing and specification document, or contact your Emerson sales office. Review strainer manufacturer's pressure drop curves to determine appropriate strainer body size. You may need to use a strainer that is larger than the water line size.

⚠ WARNING

Failure to use a strainer could result in nozzle clogging and subsequent property damage or loss. Uncontrolled temperatures resulting from clogged nozzles may result in equipment or process temperature limits being exceeded. Exceeding system temperature limits could result in property damage or personal injury.

6. A length of straight pipe is required downstream of the TBX-T desuperheater to ensure complete vaporization of cooling water. An example of a typical installation appears in figure 2. Consult the TBX-T cooler sizing sheet for the required distance of straight pipe. This is unique for each application and is supplied by Emerson Automation Solutions.
7. Typically, a temperature sensor should be mounted a minimum distance of 9.1 m (30 feet) downstream of the TBX-T desuperheater. This distance will vary depending on a number of factors including steam velocity and percentage of spraywater. Consult the TBX-T cooler sizing sheet provided with the unit for this temperature sensor distance. The steam line should not have any branch lines dividing the steam flow between the TBX-T desuperheater and the temperature sensor. If you have any questions, contact your local [Emerson sales office](#).
8. A typical installation is illustrated in figure 2. A temperature sensor (TE) measures changes in temperature and a temperature transmitter (TT) transmits the signal to the temperature control device. The output signal from the controller is sent to the positioner on the cooling water (spraywater) control valve (SWCV). The positioner's output signal strokes the SWCV open, increasing water pressure on the nozzles. Increasing water pressure upstream of the nozzles increases water flow through the nozzles.

CAUTION

Pneumatic lines (where applicable) should be thoroughly blown clean with dry air before connection. Check to make sure wiring connections are made per the equipment manufacturer's instructions and in accordance with local, regional, and national codes.

Maintenance

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Use bypass valves or completely shut off the process to isolate the desuperheater from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the desuperheater.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Servicing

Table 2. Inspection Summary

Key	Part Description	Inspection Tips and Diagnostics	Repair	Replacement
1	Steam Pipe (not replacement part)	Inspect for erosion, thermal fatigue, and other damage.	Consult your local Emerson Service Center for a recommendation on necessary weld repair or replacement	
2	Nozzle Body (not replacement part)	Inspect for erosion, thermal fatigue, and other damage.	Consult your local Emerson Service Center for a recommendation on necessary weld repair or replacement	
3	Nozzle Sleeve	Inspect for particulate or magnetite buildup when spray nozzles are replaced.	Clean if necessary.	As needed
7	Nozzle Body Flange	Inspect gasket surfaces for damage that could indicate gasket leakage when spray nozzles are replaced.	Replacement Only	As needed
10	Spray Nozzle	Refer to Nozzle Maintenance Section.		Replacement every 24-36 months for optimal performance

Nozzle Maintenance and Replacement

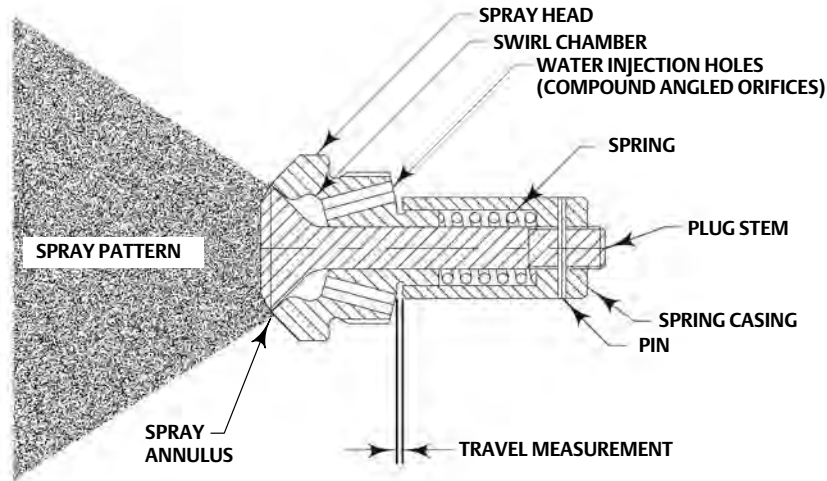
When subjected to normal operating conditions, it is possible that wear, blockage, and/or weld fatigue will occur to the nozzle assembly. During regularly scheduled maintenance, visually inspect the nozzles for wear and blockage. Your local Emerson Service Center can help to determine the extent of weld fatigue and the correct course of action. Poor performing nozzles or nozzle failure is typically caused by wear, corrosion, erosion, and/or blockage. The following instruction will help to determine if any of these problems are present and provide a recommended course of action for each.

Note

For optimal performance, nozzles should be inspected every 18-24 months and replaced every 24-36 months.

1. **OPTIONAL:** Figure 3 shows the spray pattern that will need to be present during operation of the AF nozzles. Testing can be performed by attaching the existing or an alternate, similar pressure, water line to the spray water input connection. If this spray pattern is not present, replacement is recommended.

Figure 3. Fisher AF Nozzle Cross Section



A7191-2D

2. Loosen and remove the nozzle body flange stud nuts (key 6) and washers (key 4). Then, remove the nozzle body flange (key 7). Inspect the nozzle body flange gasket surfaces for damage. If damage is present replacement is necessary.
3. Remove the nozzle sleeve (key 3) with attached spray nozzle (key 10), nozzle sleeve gasket (key 9), and nozzle body flange gasket (key 8). Inspect the nozzle sleeve for particulate or magnetite buildup and clean if necessary.
4. Inspect the spray annulus surface, the area between the plug stem and spray head, for excessive wear, erosion/corrosion, or blockage due to particulate. Wear is defined as any nicks, cuts, or gouges on or immediately around the spray annulus. Erosion/corrosion is defined as any form of rust or erosion of the metal on the plug stem or spray head. Blockages are defined when small particulate becomes trapped between the plug stem and spray head or spring casing and spray head. Replacement of the nozzle is recommended if any of the preceding problems are present.
5. Grind off the tack welds holding the nozzle (key 10) in place. Apply a penetrant type thread lubricant and allow to soak prior to unscrewing the nozzle. Using the provided flats on the side of the spray head, unscrew the nozzle from the nozzle sleeve (key 3).
6. Grind excess tack weld material off both the nozzle (key 10) and nozzle sleeve (key 3).
7. In the absence of external forces, the nozzle must be fully closed. If the nozzle is not fully closed, it will need to be replaced.
8. Inspect the water injection holes for reduced or non-circular shape due to erosion. Every hole must be the same size and shape. If any are over-sized or non-circular in shape, the nozzle will need to be replaced.
9. Inspect the interior of the water injection holes for buildup of particulate or magnetite. Nozzle replacement will be needed if any buildup is present.

Note

Complete disassembly of the nozzle is strongly discouraged, due to individual spare parts not being available.

10. **OPTIONAL:** To further check the nozzle for buildup of particulate or magnetite, the nozzle can be disassembled. If disassembled, take great care not to damage the sharp edges of the spray annulus on the plug stem and the

sprayhead, as this will greatly affect the spray pattern. Do not compress a removed spring by hand or with a tool, as compression beyond its normal operating range will damage the spring.

To disassemble the nozzle, first remove the pin using a small drill bit as a punch, and unscrew the spring casing from the plug stem. The nozzle can be reassembled by following a reverse order of disassembly, taking care to line the hole in the plug stem up with the hole in the spring casing, then pressing the pin back into place through the two parts.

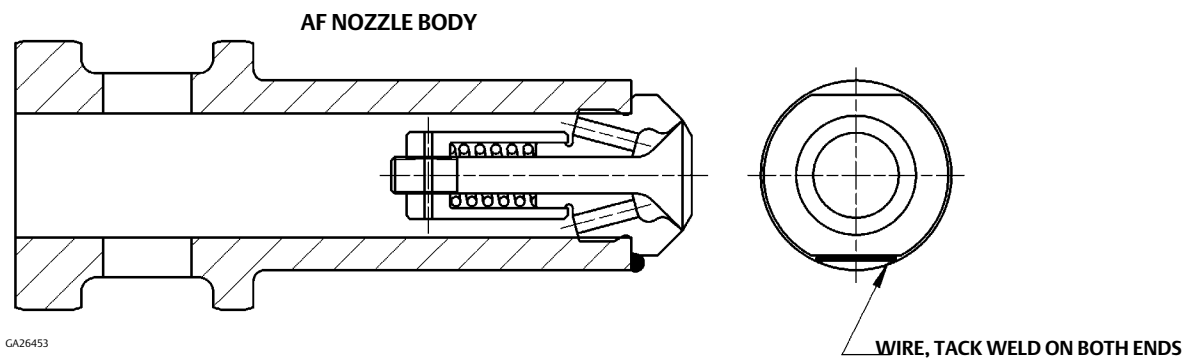
11. The internal spring may relax over time and not provide the tensile force required to shut off and control flow. If the nozzle spring is suspected of being too relaxed, then the nozzle should be replaced.
12. The travel can be determined by using a feeler gauge to measure the distance between the spray head near the water injection ports to the side of the spring casing, as outlined in figure 3. This measurement must match the factory set plug stem travel for the corresponding nozzle type as shown in table 3.

Table 3. AF Nozzle Specifications

NOZZLE TYPE	PLUG TRAVEL, INCHES
AF7	0.014
AF10	0.028
AF14	0.029
AF17	0.034
AF20	0.036
AF24	0.042
AF28	0.048
AF32	0.056
AF35	0.065
AF40	0.063
AF44	0.069

13. Inspect nozzle threads for damage and clean if needed. If damage is present, nozzle replacement will be necessary.
14. Rinse both the nozzle (key 10) and nozzle sleeve (key 3) to remove particulate.
15. Screw nozzle into the nozzle sleeve (key 3) and tighten just until the spray head is flat and tight against the nozzle sleeve.
16. Tack-weld a small piece of welding wire onto the nozzle sleeve (key 3) next to either of the spray head flats to prevent rotation during service; refer to figure 4. Maintain low heat to prevent distortion of the nozzle.

Figure 4. Spray Nozzle Tack Weld Location



17. Reassemble in the following order: nozzle sleeve gasket (key 9), nozzle body flange gasket (key 8), spray nozzle/sleeve assembly, nozzle body flange (key 7), washers (key 4), and stud nuts (key 6). It is recommended that the nozzle sleeve gasket and nozzle body flange gasket be replaced with new ones.

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18. Torque nozzle body flange nuts as indicated in table 4.

Table 4. Recommended Nozzle Body Flange Bolting Torque with Nickel Anti-Seize Lubricant⁽¹⁾

BOLT SIZE, INCH	THREADS PER INCH	LUBRICATION	RECOMMENDED BOLT TORQUE ⁽²⁾	
			N•m	Lbf•ft
5/8	11	Nickel Anti-Seize	163	120
3/4	10		258	190
7/8	9		373	275
1	8		522	385
1-1/8			712	525
1-1/4			942	695
1-3/8			1268	935
1-1/2			1654	1220
1. For other lubricants, contact your Emerson sales office for recommended bolt torque. 2. Torques for lubricated studs with heavy hex nuts.				

Parts Ordering

Each TBX-T desuperheater is assigned a serial number. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering replacement parts, refer to the serial number and key numbers for each part required. The key numbers in the Parts List and the assembly drawing in figure 5 can be used to help in part identification.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher desuperheater, because they may void your warranty, might adversely affect the performance of the desuperheater, and could cause personal injury and property damage.

Parts List

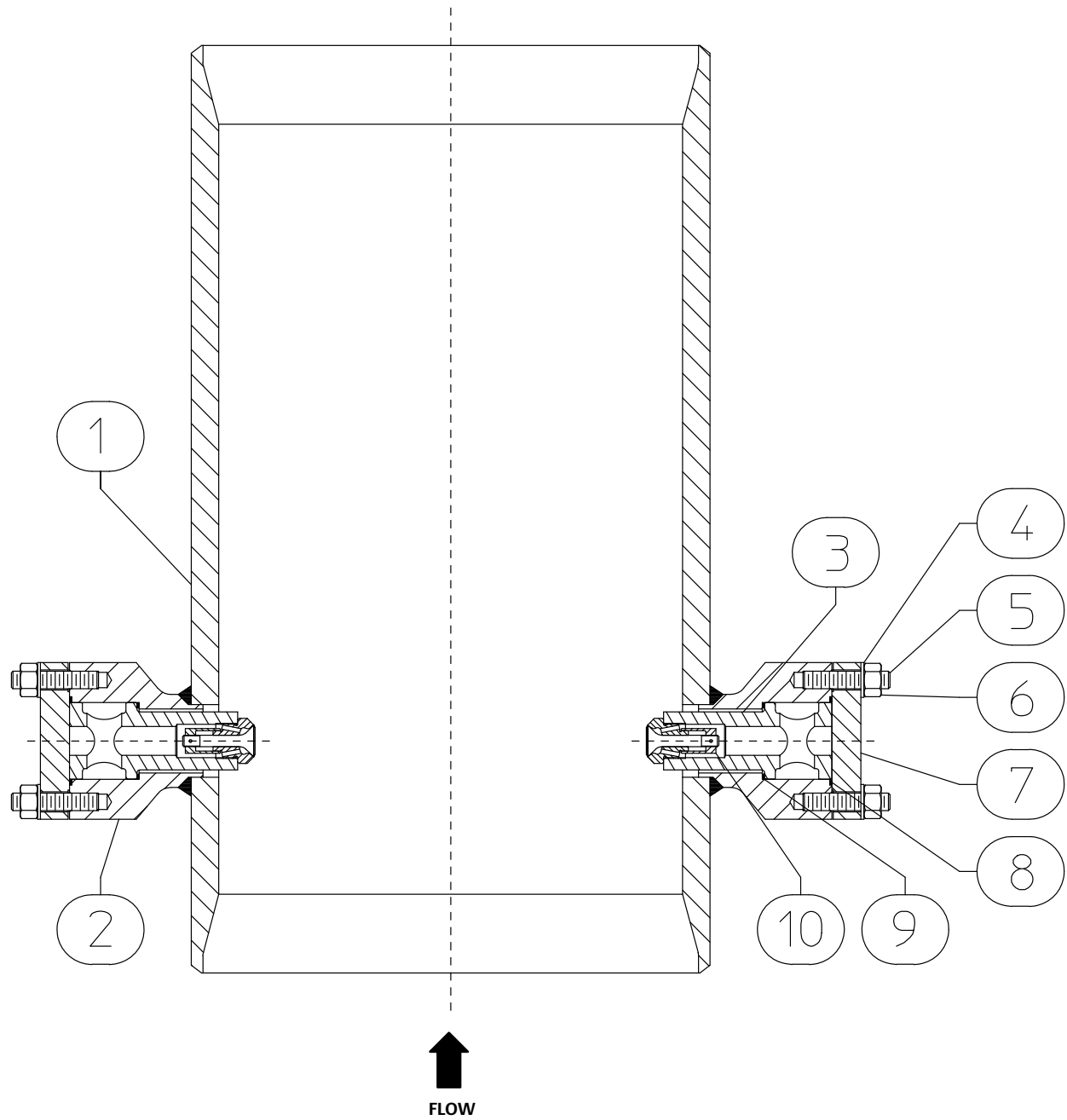
Note

Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description
1	Steam Pipe
2	Nozzle Body
3	Nozzle Sleeve
4	Nozzle Body Flange Washer

Key	Description
5	Nozzle Body Flange Stud
6	Nozzle Body Flange Stud Nut
7	Nozzle Body Flange
8*	Nozzle Body Flange Gasket
9*	Nozzle Sleeve Gasket
10*	Spray Nozzle

Figure 5. Fisher TBX-T Desuperheater



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Fisher™ V150E Expanded Outlet Vee-Ball™ Control Valve

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Figure 1. Fisher V150E Expanded Outlet Vee-Ball Valve with 2052 Actuator and FIELDVUE™ DVC6200 Digital Valve Controller



W9915

Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for the Fisher Vee-Ball V150E rotary control valve (see figure 1).

For information on ENVIRO-SEAL™ packing, see the ENVIRO-SEAL Packing System for Rotary Valves instruction manual, [D101643X012](#). Refer to separate manuals for information concerning the actuator, positioner and accessories.

Do not install, operate, or maintain a V150E valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

V150E Vee-Ball valves (figure 1) with a V-notch ball are used in throttling service. The V150E valve is a raised-face flanged construction. The splined valve shaft connects to a variety of Fisher rotary-shaft actuators.

Table 1. Specifications

Valve Sizes and End Connection Styles DN ■ 80x100, ■ 100x150, ■ 150x200, ■ 200x250, ■ 250x300 and NPS ■ 3x4, ■ 4x6, ■ 6x8, ■ 8x10, ■ 10x12 flanged valves that mate with ■ PN 10/16, ■ JIS 10K, or ■ CL150 raised-face flanges (see table 2)	Actuator Mounting Standard valve construction is for right-hand mounting, as viewed from upstream end of valve with the shaft horizontal. Actuator can be mounted in any of four quadrants. Left-hand actuator mounting is available upon request
Dimensions See table 6 for dimensions	Valve/Actuator Action With compact 2052 spring and diaphragm or Fisher 1061 piston rotary actuator, the valve is field-reversible between PDTc or PDTO: push-down-to-close (extending actuator rod closes valve) and push-down-to-open (extending actuator rod opens valve)
Standard Flow Direction Forward (into the convex face of the V-notch ball)	Approximate Weight See table 6
Maximum Ball Rotation 90 degrees	
Orientation Valve shaft must be horizontal when installed in a horizontal or vertical pipeline	

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

Table 2. Valve Body Material, End Connections, and Ratings

VALVE DESIGN	VALVE BODY MATERIAL	VALVE SIZE	FLANGE END CONNECTIONS
V150E	CG8M	DN 80x100, 100x150, 150x200, 200x250, 250x300	Compatible with PN 10/16 or JIS 10K raised-face flanges
		NPS 3x4, 4x6, 6x8, 8x10, 10x12	Compatible with CL150 raised-face flanges

Specifications

Specifications for these valves are shown in table 1 and in bulletin 51.3:V150E, V150E Expanded Outlet Vee-Ball Control Valve ([D103429X012](#)).

Installation

Installation steps are provided in this section for V150E valves. Key numbers in installation procedures are shown in figure 10 unless otherwise indicated.

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed either the valve body rating or the mating pipe flange joint rating. To avoid such injury or damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. To avoid possible personal injury and because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#) or Local Business Partner.

⚠ WARNING

The valve drive shaft is not necessarily grounded to the pipeline when installed. Personal injury or property damage could result from an explosion caused by a discharge of static electricity from valve components if the process fluid or the atmosphere around the valve is flammable. If the atmosphere around the valve or the process fluid is flammable, electrically bond the drive shaft to the valve.

Note

Standard PTFE packing is composed of a partially conductive carbon-filled PTFE female adaptor with PTFE V-ring packing. Standard graphite packing is composed of all conductive graphite ribbon packing. Alternate shaft-to-valve body bonding is available for hazardous service areas where the standard packing is not sufficient to bond the shaft to the valve (see the following step).

Attach the optional bonding strap assembly (key 131, figure 2) to the valve drive shaft (key 6) with the clamp (key 130, figure 2) and connect the other end of the bonding strap assembly to the valve body with the cap screw (key 23).

1. If the valve is to be stored before installation, protect the flange mating surfaces and keep the valve body cavity dry and free of foreign material.
2. Install a three-valve bypass around the control valve assembly if continuous operation will be necessary during inspection and maintenance of the valve.
3. The valve is normally shipped as part of a control valve assembly, with an actuator mounted on the valve. If the valve and actuator have been purchased separately or if the actuator has been removed, mount the actuator according to the Actuator Mounting section and the appropriate actuator instruction manual.
4. Standard flow direction is with the smaller diameter flange end facing upstream.
5. Install the valve in a horizontal or vertical pipeline with the drive shaft in a horizontal position.

CAUTION

Do not allow the valve to be installed in the pipeline with the drive shaft in the vertical position because of excessive wear to valve component parts.

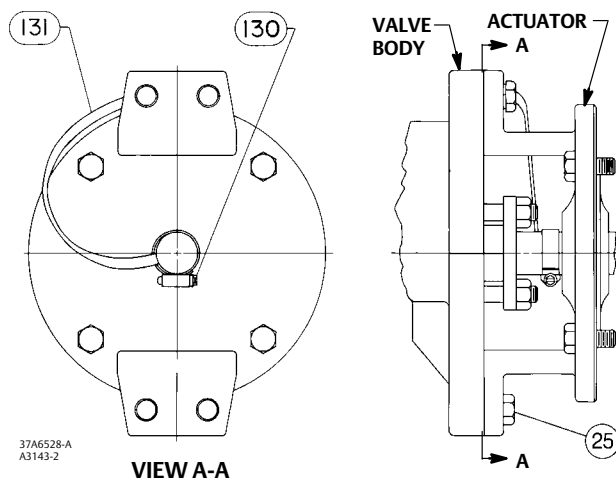
6. The actuator can be right- or left-hand mounted with the shaft in a horizontal orientation as shown in figure 1. If necessary, refer to the appropriate actuator instruction manual for actuator installation and adjustment procedures.

CAUTION

Ensure the valve and adjacent pipelines are free of foreign material that could damage the valve seating surfaces.

7. Be certain the valve and adjacent pipelines are free of any foreign material that could damage the valve seating surfaces.
8. Be sure the pipeline flanges are in line with each other.

Figure 2. Optional Shaft-to-Body Bonding Strap Assembly



Installing V150E Valves

1. Install the V150E valve using standard length flange studs and nuts, appropriate for the inlet and outlet ends of the valve as dictated by the size and rating of the flange, to connect the valve flanges to the pipeline flanges.
2. Lubricate the studs with anti-seize lubricant.
3. Insert flat-sheet line flange gaskets (or spiral-wound gaskets with compression-controlling center rings) that are compatible with the flowing media.
4. Connect pressure lines to the actuator as indicated in the actuator instruction manual. When an auxiliary manual actuator is used with a power actuator, install a bypass valve on the power actuator (if one is not supplied) for use during manual operation.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If the valve has ENVIRO-SEAL live-loaded packing installed, this initial re-adjustment will probably not be required. See ENVIRO-SEAL Packing System for Rotary Valves instruction manual, [D101643X012](#), for packing instructions.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

Key numbers in this procedure are shown in figure 10, unless otherwise noted.

⚠ WARNING

The Vee-ball closes with a shearing, cutting motion, which could result in personal injury. To avoid injury, keep hands, tools, and other objects away from the Vee-ball while stroking the valve.

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- The valve packing area may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Packing Maintenance

Key numbers in this procedure are shown in figure 10, unless otherwise noted. A detailed view of the packing is also shown in figure 3.

If the valve is equipped with the ENVIRO-SEAL Packing System, refer to:

- the separate ENVIRO-SEAL Packing System for Rotary Valves instruction manual, [D101643X012](#), for maintenance instructions, and
- the Parts List section of this manual for retrofit kits, parts kits, and individual parts.

If the packing is relatively new and tight on the drive shaft (key 6), and if tightening the packing follower nuts does not stop leakage, it is possible that the drive shaft is worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches on the packing box wall. Inspect the drive shaft and packing box wall for nicks or scratches while performing the following procedure.

Replacing Packing

When using this procedure, it is recommended that the actuator **not** be removed from the valve while the valve is still in the pipeline or between flanges. Valve/actuator adjustments must be made with the valve out of the pipeline. Refer to the Determining Closed Position portion of the Actuator Mounting section.

Disassembly

⚠ WARNING

Observe the steps in the **WARNING** at the beginning of the Maintenance section.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines to the power actuator, release pressure from the actuator, and disconnect the pressure lines from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you are working on the equipment.
2. Remove line bolting, remove the control valve from the pipeline, and place the valve/actuator assembly on a flat surface with the inlet facing up.
3. Remove the actuator cover. Take note of the orientation of the actuator with respect to the valve body and the lever orientation with respect to the valve drive shaft (see figure 9).

⚠ WARNING

When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, with a shearing, cutting motion, which could result in personal injury. To avoid injury, carefully rotate the ball to a stable position after the actuator is removed.

CAUTION

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever or actuator off the valve shaft. Driving the lever or actuator off the valve shaft could damage the ball, seal, and valve.

If necessary, use a puller to remove the lever or actuator from the valve shaft. It is okay to tap the puller screw lightly to loosen lever or actuator, but hitting the screw with excessive force could damage the ball, seal, and valve.

4. Loosen the clamped lever, remove the actuator mounting screws and nuts (keys 23 and 24), and remove the actuator. (If necessary, refer to the actuator instruction manual for assistance.)
5. If applicable, remove the bonding strap assembly before attempting to remove the packing (see figure 2).
6. Remove the packing follower nuts and packing follower (keys 17 and 20). For alloy packing constructions, the packing follower (key 17) and a separate packing flange (key 40) must be removed if present.

If the valve is equipped with the ENVIRO-SEAL packing system, refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual, [D101643X012](#), for disassembly.

⚠ WARNING

Personal injury could result from packing leakage. Do not scratch the drive shaft or packing box wall while removing packing parts in the following procedure.

7. Remove the packing parts (see figure 3, keys 16, 17, 35, and 39 depending on construction) using a formed wire hook with a sharp end. Pierce the rings with the sharp end of the hook in order to remove them. Do not scratch the

drive shaft or packing box wall; scratching these surfaces could cause leakage. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing.

Assembly

If the valve is equipped with the ENVIRO-SEAL packing system, refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual, [D101643X012](#), for assembly.

1. To help ensure correct centering of the Vee-ball (key 2) on the seal (key 11), make sure the ball is closed while you install or tighten new packing. Insert a screwdriver, pry bar, or similar tool between the lower ear of the ball and the valve body. Use the pry to move the ball tightly against the bearing on the actuator side of the valve (see figure 4). Keep the ball in that position until you have completed packing installation and adjustment.
2. Install the new packing parts using the parts sequence shown in figure 3. Install the packing follower (key 17).
3. Secure the packing follower with the packing follower nuts (key 20). Tighten the nuts far enough to stop leakage under operating conditions.

Note

If the valve is equipped with a bonding strap assembly (figure 2), re-install the assembly.

4. Reconnect the actuator and lever in accordance with the orientations that were noted in step 3 of the disassembly procedures. If necessary, use figure 9 to identify the correct index marks.
5. Refer to the appropriate actuator instruction manual to complete actuator assembly and adjustment.
6. When the control valve is in operation, check the packing follower for leakage and retighten the packing follower nuts (key 20) as necessary.

Replacing the HD Ball Seal

Perform this procedure if the control valve is not shutting off properly or if seal inspection or replacement is necessary.

The valve / actuator assembly must be removed from the pipeline and the actuator must be removed from the valve to replace the ball seal. Key numbers are shown in figure 13 unless otherwise indicated. Ball Seal assembly details (with key numbers) are also shown in figure 5.

WARNING

Perform the steps in the **WARNING** at the beginning of the Maintenance section of this manual.

Removing the HD seal

1. Remove line bolting, remove the control valve from the pipeline, remove the actuator (as discussed in the packing section), and place the valve body on a flat work surface.
 - a. For NPS 3x4 and 4x6 valves, the ball must be removed to access the seal. See the Bearing and Ball Maintenance Disassembly section on page 12 in this manual. Then return to this procedure and continue with the next steps.

Figure 3. Packing Arrangements

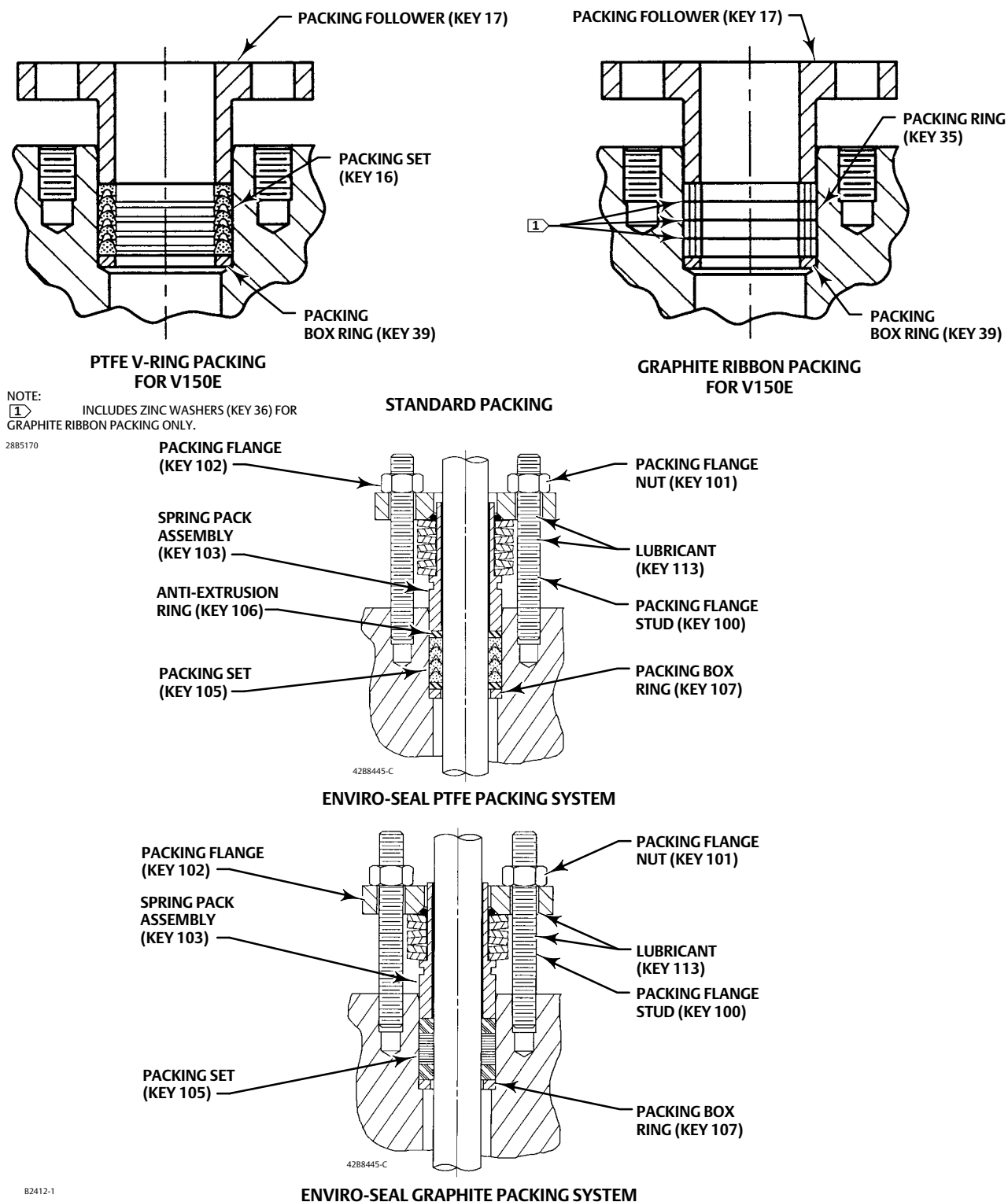
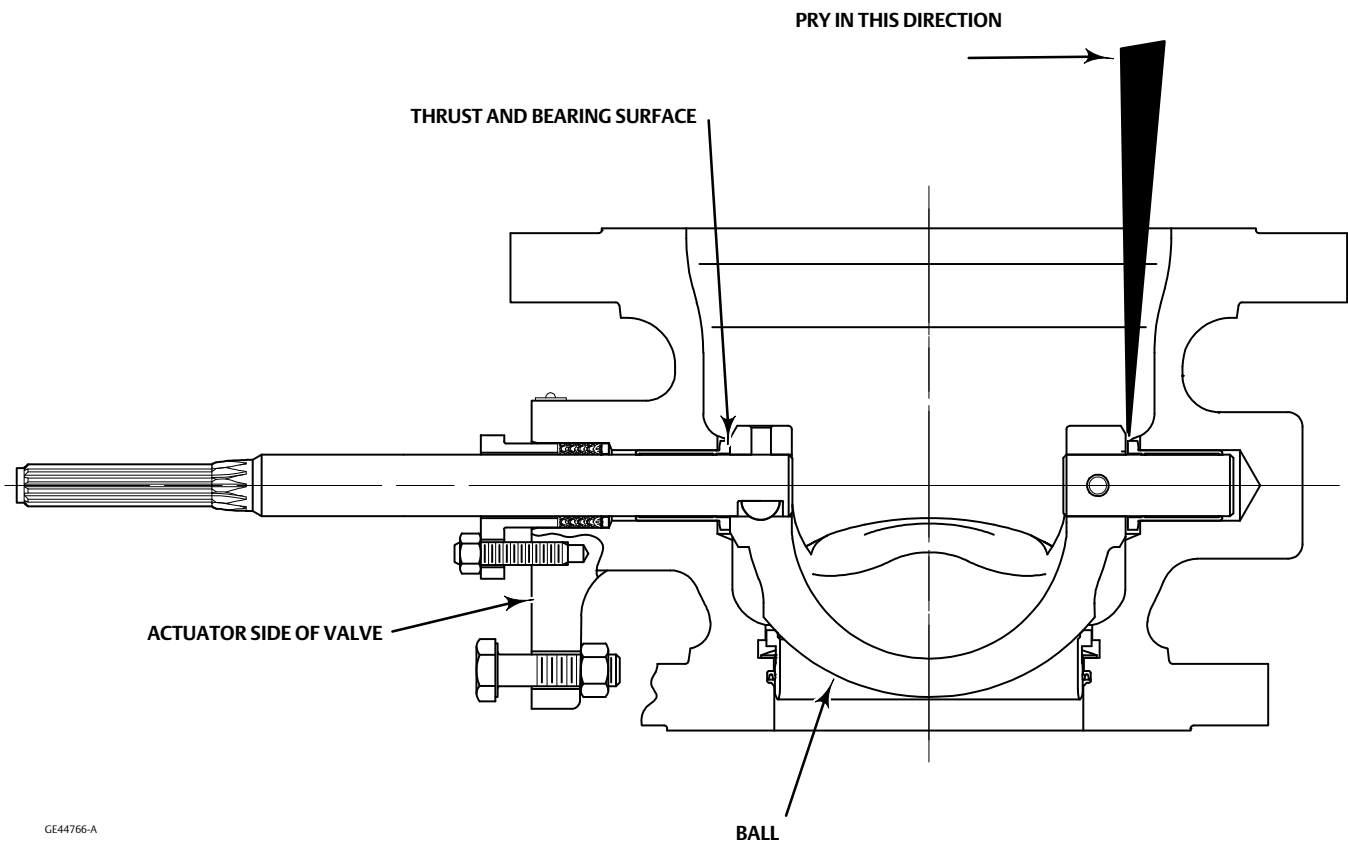


Figure 4. Typical Fisher V150E Valve Showing Pry Bar



- b. For NPS 6x8 and larger valves, the HD seal can be removed through the outlet end of the valve with the ball installed. Carefully rotate the ball past the 90 degree open position until it is no longer in contact with the HD seal.

CAUTION

Due to the ball shape, take care when you rotate either the front skirted edge or the circular back edge of the ball out of the HD seal, as the seal could be damaged.

2. With the inlet side of the valve facing up, push the HD metal seal (key 11) into the valve body (key 1).

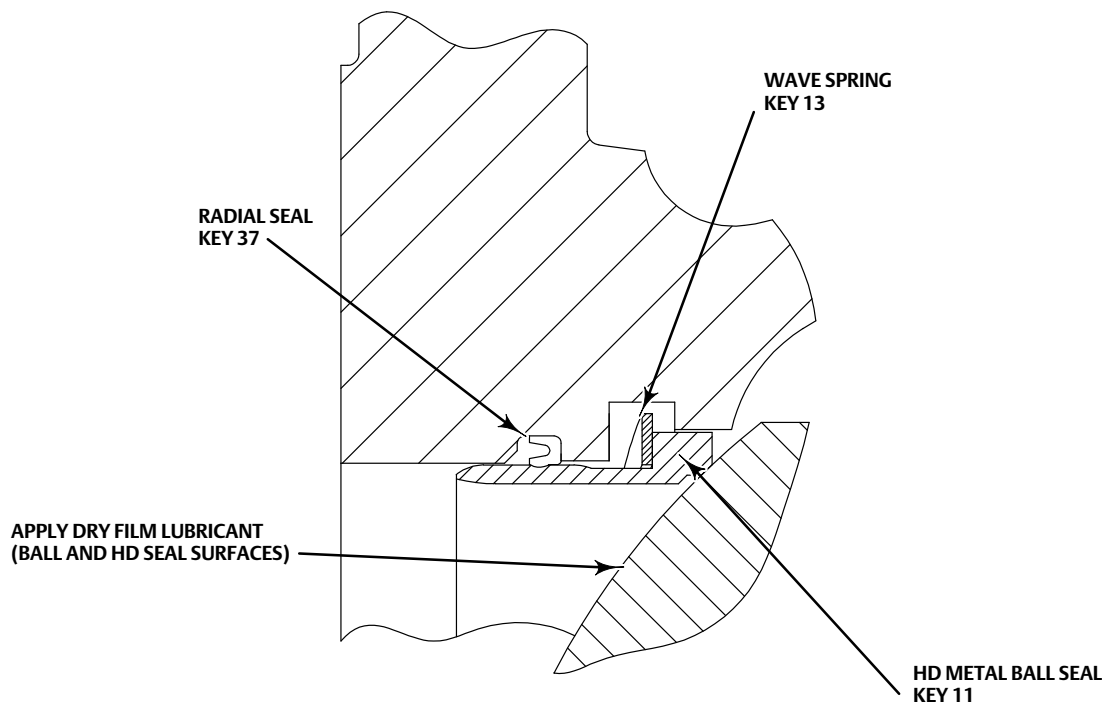
CAUTION

Exercise care to avoid damaging components in the following procedure.

- It might be necessary to remove the HD metal seal by carefully tapping it with a soft punch and hammer. Take care not to damage the valve body.

- If the seal is difficult to push out, it is recommended that a seal removal plate be used to press the HD metal seal out of the valve body. Refer to figure 6 for dimensions of the seal removal plate.

Figure 5. Ball Seal Assembly



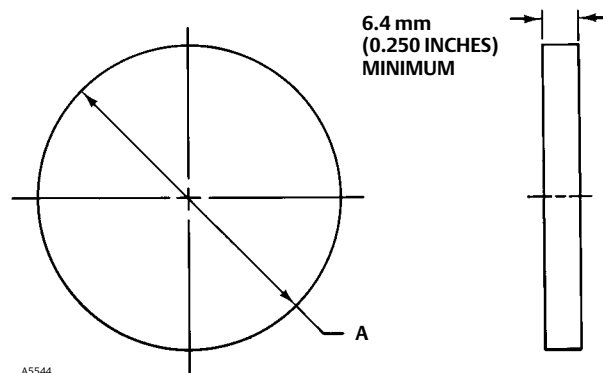
3. The seal can be removed through the outlet end of the valve. In NPS 6x8 and larger valves there is room to manipulate the seal around the ball and remove it from the outlet end. Remove the wave spring (key 13), and the radial seal (key 37).
4. If replacement of the ball, shafts (keys 6 or 9), or bearings (key 10) is needed, proceed to the Bearing and Ball Maintenance procedure. If only the seal is to be replaced, proceed to the Installing HD Metal Seals section.

⚠ WARNING

The Vee-Ball closes with a shearing, cutting motion, which could result in personal injury. To avoid injury or property damage, keep hands, tools, and other objects away from the Vee-Ball while stroking the valve.

Figure 6. HD Seal Removal Plate Dimensions

VALVE SIZE, NPS	DIMENSION A	
	Minimum-Maximum, mm	Minimum-Maximum, Inches
3x4	75.9-76.2	2.990-3.000
4x6	95.0-95.3	3.740-3.750
6x8	126.7-127.0	4.990-5.000
8x10	158.5-158.8	6.240-6.250
10x12	212.5-212.7	8.365-8.375



Installing HD metal seals

Refer to figures 6, and 13 for key number locations during seal installation.

Thoroughly clean all parts that are to be reused and obtain replacement parts. Be sure that all sealing surfaces are in good condition without scratches or wear. Place the valve body on a flat surface with the inlet side of the valve facing up.

1. Lubricate the radial seal (key 37) and install into the appropriate groove in the valve body, making sure the open side of the radial seal faces away from the ball.
2. Install the wave spring (key 13) into the appropriate groove in the valve body.
3. **HD Metal Seal Lubrication** will assist with break-in of the HD metal seals and with assembly. It is required that both the ball surface and seal be lubricated with dry film lubricant or equivalent moly disulfide.
4. Position the valve body on a flat surface with the outlet side of the valve facing up.
 - a. On all sizes without the ball installed, the HD seal can be installed by pushing the HD seal past the wave spring and radial seal, making sure the HD metal seal remains level. Following this, install the remaining trim components as explained under the Bearing and Ball Maintenance section and specifically the Assembly heading on page 13.
 - b. On NPS 6x8 and larger valves, if the ball is still installed, rotate the ball past the 90 degree open position and hold it there while you install the HD metal seal (key 11) into the valve body. Push the HD seal past the wave spring and radial seal, making sure the HD metal seal remains level.
5. Use the pry to move the ball tightly against the bearing on the actuator side of the valve to help ensure correct side-to-side centering of the ball (key 2) on the seal (key 11). See figure 4.
6. Be sure that the HD seal is fully installed in the valve. Carefully rotate the ball to engage the HD seal while applying force across the middle of the seal to compress the wave spring until the ball is fully engaged. Be cautious during this process, knowing that excessive force may damage the ball. Keep the ball in the engaged position going forward.
7. Continue to check the ball's position and re-center if necessary during actuator mounting and packing adjustments.

Bearing and Ball Maintenance

⚠ WARNING

Before performing the steps in this section, observe the **WARNING** at the beginning of the Maintenance section on page 5.

Procedures for disassembly and assembly of the bearings and ball cannot be accomplished until the shaft and valve packing are removed from the valve. Refer to the Replacing Packing procedures to remove the actuator, and to remove the packing flange and packing follower from the valve. When the packing disassembly steps are complete, return to this section.

Disassembly

⚠ WARNING

When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, with a shearing, cutting motion, which could result in personal injury. To avoid injury, carefully rotate the ball to a stable position at the bottom of the valve body cavity. Make sure the ball will not rotate.

Key numbers in this procedure are shown in figures 5 and 10, unless otherwise indicated.

1. A taper key (key 4) is used to connect the ball and drive shaft.
2. Carefully rotate the ball to the open position after the actuator is disconnected. Make sure the ball will not rotate (see warning above). Provide support for the ball during the following disassembly.
3. Working from the small end of the groove pin (key 7), use a pin punch to drive the groove pin out of the ball ear and follower shaft.

For tack welded taper keys, driving the taper key out of the ball ear will shear the tack welding.

4. Locate the small end of the taper key (key 4). Using a pin punch on the smaller end of the taper key, drive it out of the ball (key 2) and drive shaft (key 6). Note: driving the taper key in the wrong direction will tighten it.
5. Pull the drive shaft (key 6) out of the actuator side of the valve body.

CAUTION

Exercise care to avoid damaging components in the following procedure.

6. The ball will be free to move when both shafts are removed. Make sure the sealing surface of the ball is not damaged while removing the follower shaft.
7. Use a piece of continuous threaded rod as a removal rod when moving the follower shaft (key 9) into the center of the ball. Refer to table 3 for a description of the size threaded rod needed. The length of the rod should allow easy working room from the valve body.

Table 3. Continuous Threaded Rod

Valve Size, NPS	Threaded Rod Thread Size	Thread Depth in Follower Shaft, Inches
3x4	1/4-20	0.5
4x6	1/4-20	0.5
6x8	1/4-20	0.5
8x10	5/16-18	0.62
10x12	5/16-18	0.62

8. Carefully remove the follower shaft and ball (key 2) from the outlet end of the valve body.
9. The bearings are not pressed in, so they can be removed with minimal force. Be careful not to damage the machined surfaces of the bearing bore if prying is required.
10. For HD seal removal, follow the steps outlined under Removing HD Seal on page 7.

Assembly

1. Inspect all sealing surfaces to ensure they are in good condition and without scratches or wear.
2. Install the HD ball seal. See Installing the HD Seal on page 12, and follow steps 1 – 4. Then return to this procedure and continue with the next steps.
3. Install the replacement bearings (key 10) by hand. The bearing flanged end should touch the valve body.
4. **Installing the Vee-Ball:**

Lubrication will assist with break-in of the HD metal seals and with assembly. It is required that both the ball surface and seal be lubricated with dry film lubricant or equivalent moly disulfide.

⚠ WARNING

The ball might be damaged if it is allowed to fall into the valve body. To avoid personal injury or damage to the sealing surfaces, support the ball to prevent it from falling into or out of the valve body cavity.

Place the valve body on a table or bench with the inlet side down and carefully install the ball into the valve body cavity from the outlet end.

When installing the ball (key 2) into the valve body assembly, firmly support the ball while installing the shafts in the following steps.

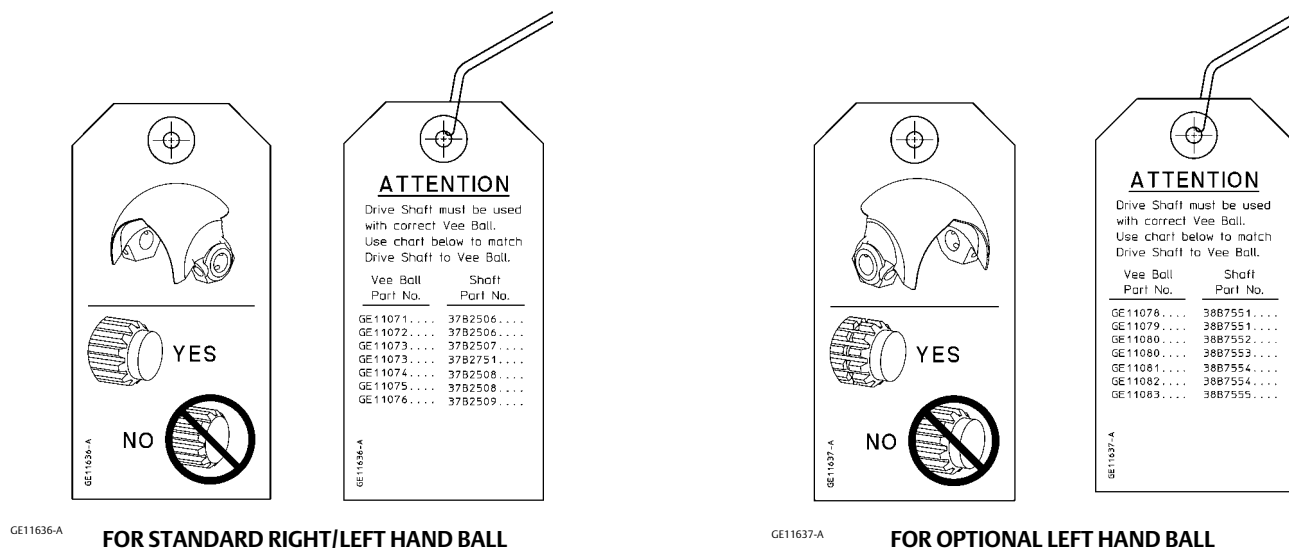
5. **Installing the follower shaft (key 9):**
 - **For NPS 3x4 valves:** The follower shaft (key 9) should already have been inserted into the ball ear before the ball was put into the valve body. With the ball rotated open and not in contact with the HD seal, insert the follower shaft (key 9) into the valve body bearing (key 10).
 - **For NPS 4x6 and larger valves:** With the ball rotated open and not in contact with the HD seal, insert the follower shaft (key 9) through the ball, and into the valve body bearing (key 10).
6. Align the hole in the follower shaft with the holes in the ball. Insert the small end of the groove pin (key 7) into the hole in the ball and into the follower shaft. The pin will hold the parts in place while the drive shaft (key 6) is being installed.
7. **Installing the Drive Shaft:**

CAUTION

The drive shaft must be used with the correct Vee-Ball. Refer to the tag (see figure 7) attached to the Vee-Ball and to the drive shaft.

Failure to use the correct Vee-Ball/ shaft combination may result in the ball not being in the position indicated by the slash mark on the end of the shaft. If the ball is not properly aligned with the slash mark, the valve will not function correctly and seal damage may result.

Figure 7. Informational Tag



Installing the Taper Key

Current standard construction materials for all valves require the taper key (key 4, figure 9) to be tack welded in place after properly seating, using the following procedure. Use standard welding preparations when preparing parts for reassembly.

CAUTION

Make sure the drive shaft is free of oil or grease, otherwise the taper pin or taper key will not seat properly. Failure to properly set the taper pin or taper key could result in it coming loose while in service. Loosening of the taper key in service could result in improper valve function and equipment damage.

- Install the drive shaft (key 6) into the valve body through the ball and into the ball.
- Insert the taper key (key 4) into ball and drive shaft (keys 2 and 6) as shown in figure 8. The taper key inserts with the flat side of the key facing the drive shaft (key 6).
- Using a flat end punch, drive the groove pin (key 7) into the ball ear and follower shaft until it is flat with the ball ear surface. Stake both ends of the pin hole with a center punch to ensure the groove pin does not come out.
- Using a flat end punch, drive the taper key (key 4) into the ball ear and drive shaft (key 6) until solid, heavy contact is obtained between the key and shaft.
- Measure the position of the taper key head.
- Drive the taper key in further using the minimum distance shown in table 4.
- Inspect the ball/shaft taper key connection to verify that the taper key spans the entire shaft flat width. If not, the taper key must be driven in further until this condition is satisfied. However, do not exceed the maximum depths shown in table 5.

Note

All valve taper keys are tack welded, except titanium.

15. When the above conditions are met, tack weld the taper key (key 4) to the ball ear on the head end of the key (see figures 8 and 10). Use a:
 - 1/8 inch diameter weld on NPS 3x4, 4x6, 6x8 valves,
 - 3/16 inch diameter weld on NPS 8x10 and 10x12 valves
16. Use the pry to move the ball tightly against the bearing on the actuator side of the valve to help ensure correct side-to-side centering of the ball (key 2) on the seal (key 11). See figure 4.
17. Be sure that the HD seal is fully installed in the valve. Carefully rotate the ball to engage the HD seal while applying force across the middle of the seal to compress the wave spring until the ball is fully engaged. Be cautious during this process, knowing that excessive force may damage the ball. Keep the ball in the engaged position going forward.
18. Continue to check the ball's position and re-center if necessary during actuator mounting and packing adjustments.

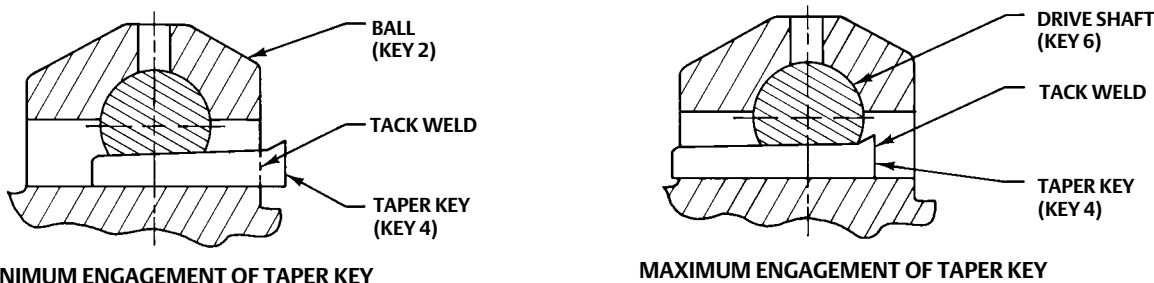
For all constructions: Refer to Packing Maintenance, and other procedures as necessary to complete the assembly of the valve.

Actuator Mounting

Use the appropriate actuator instruction manual, this section of this manual, and figure 9 of this manual when mounting the actuator or changing actuator styles and positions.

1. To help ensure correct centering of the Vee-Ball (key 2) on the seal (key 11), be sure the ball is closed when mounting the actuator (for applications other than Spring Return Fail-Open).
2. Clean the valve shaft and actuator lever splines to be sure the actuator lever will slide on easily. Only drive the lever in if absolutely necessary.
3. Carefully wedge the ball solidly against the actuator-side bearing, using a screwdriver or similar tool inserted between the lower ear of the ball and the valve body. This will center the ball. See figure 4.

Figure 8. Taper Key Installation



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A6035-1

Table 4. Taper Key Minimum Depth

Valve Size, NPS	Minimum Depth To Drive Taper Key After Initial Solid Contact, mm (Inches)
3x4, 4x6, 6x8	4.8 (0.188)
8x10, 10x12	5.6 (0.219)

Table 5. Taper Key Maximum Depth

Valve Size, NPS	Maximum Depth To Drive Taper Key After Initial Solid Contact, mm (Inches)
3x4, 4x6	7.1 (0.281)
6x8	7.9 (0.312)
8x10, 10x12	9.5 (0.375)

4. Keep the wedge in place while installing the lever, if necessary. Remove the wedge after you have clamped the actuator lever on the valve shaft and have connected the lever to the actuator piston rod or diaphragm rod.

Determining Mounting Position

The actuator can be either right or left-hand mounted, with the actuator on the right or left side when viewed from upstream (see figure 9).

The Series B Vee-Ball has one V-notch. For **right-hand mounting (standard)**, the ball will be in the top of the valve body when the valve is open and the shaft is horizontal. In this position the ball rotates CCW to Close. For **left-hand mounting (standard)**, the ball will be in the bottom of the valve body when the valve is open and the shaft is horizontal. In this position the ball rotates CCW to Close. An optional ball for **left-hand mounting**, which rotates into the top of the valve body when the shaft is horizontal, is also available. In this position the ball rotates CW to Close.

Determining Closed Position

1. The valve must be removed from the line to check the position of the ball.

⚠ WARNING

The Vee-Ball closes with a shearing, cutting motion. To avoid personal injury, keep hands, tools, and other objects away from the ball while stroking the valve.

2. Rotate the ball to the closed position.
3. Position the ball in the proper location
 - When viewed from the valve body inlet, the ball is in the proper position when the flat spot on the top of the ball is exactly in the center of the seal package.

Make a copy of the centering template in figure 13 out of a suitable stiff material. Place the centering template in the opening at the seal (See figure 12). Find the center of the template and make sure the spot on the ball is centered directly below it.

4. Adjust the actuator as described in the appropriate actuator instruction manual until the ball is centered in the closed position. A line is stamped on the actuator end of the drive shaft (see figure 9) to indicate the ball position.

Use the appropriate actuator instruction manual and figure 9 of this manual when mounting the actuator or changing actuator styles and positions.

Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your [Emerson sales office](#) or Local Business Partner regarding spare parts or technical information. When ordering replacement parts, also specify the complete 11-character part number from the parts kits or parts list information.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

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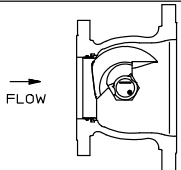
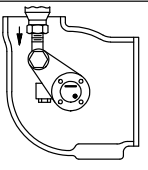
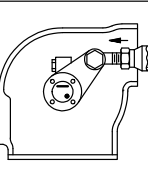
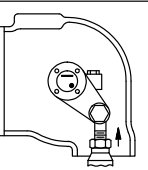
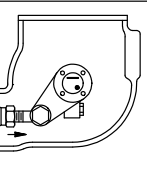
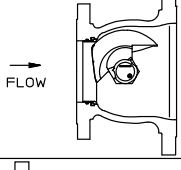
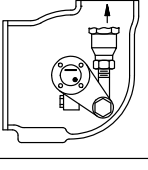
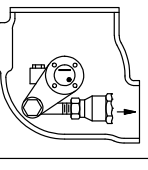
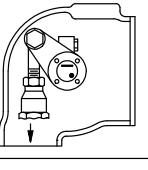
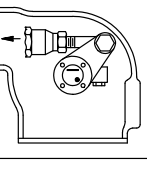
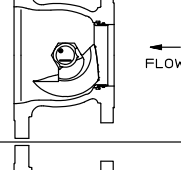
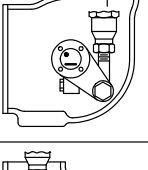
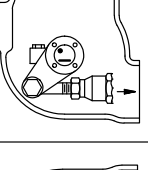
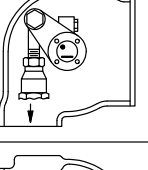
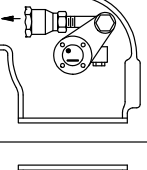
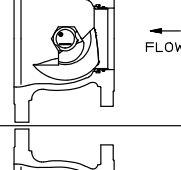
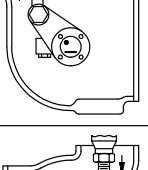
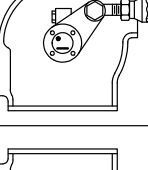
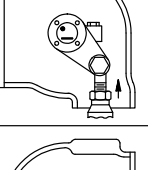
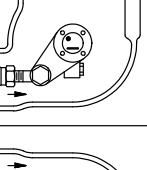
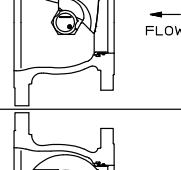
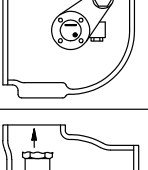
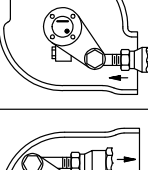
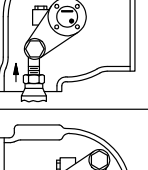
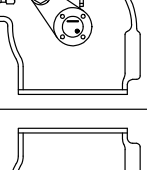
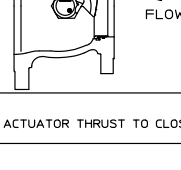
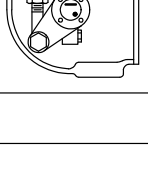
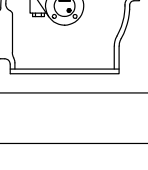
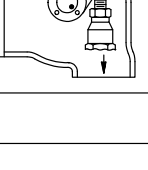
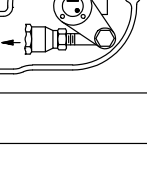
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V150E Valve

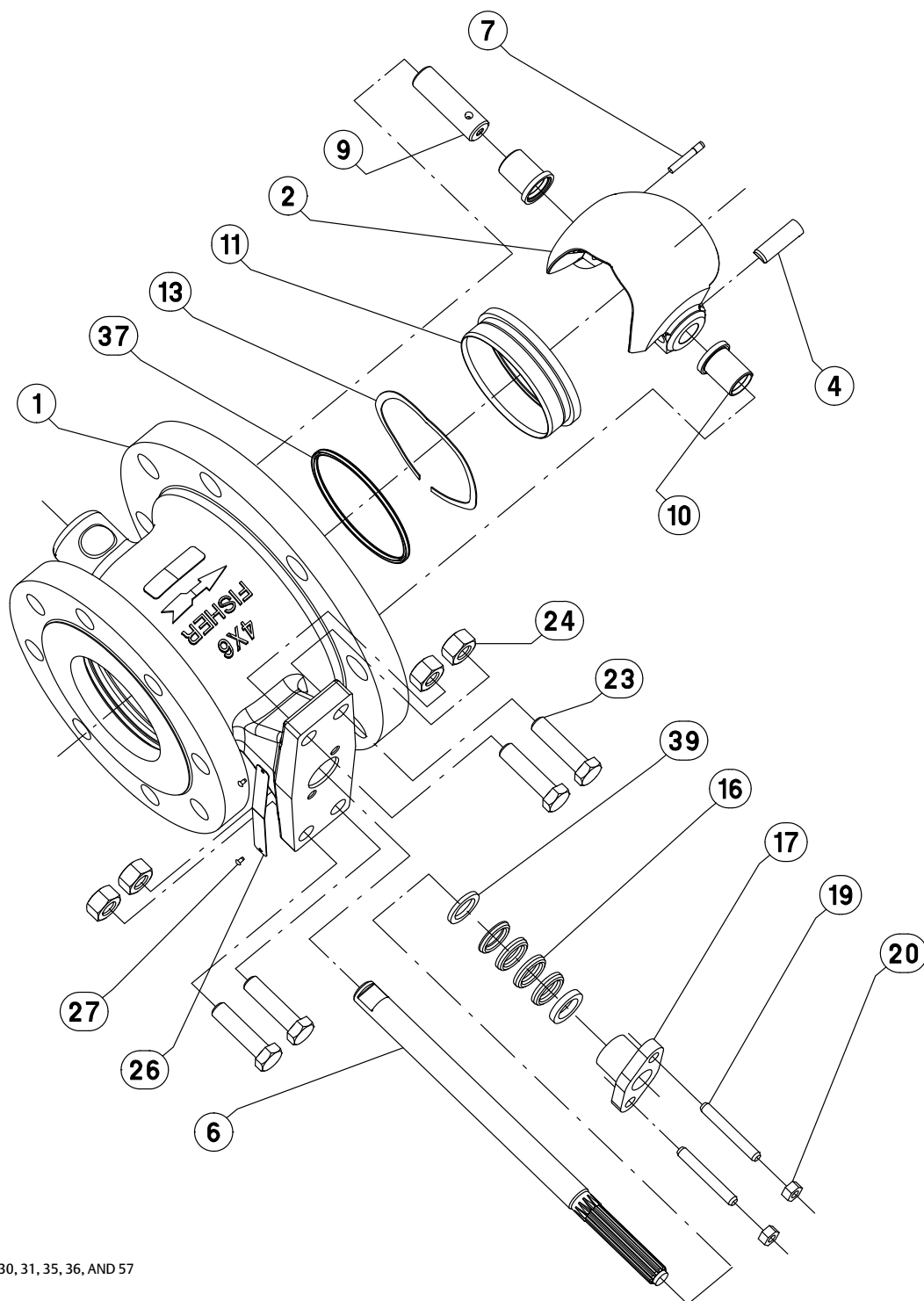
July 2017

Figure 9. Index Marks for Actuator Lever Orientation

ACTUATOR		VALVE OPEN	ACTUATOR POSITION			
MOUNTING	STYLE		1	2	3	4
(STANDARD) RIGHT-HAND	STYLE A PUSH DOWN TO CLOSE					
	STYLE B PUSH DOWN TO OPEN					
(STANDARD) LEFT-HAND	STYLE C PUSH DOWN TO OPEN					
	STYLE D PUSH DOWN TO CLOSE					
(OPTIONAL) LEFT-HAND	STYLE C PUSH DOWN TO CLOSE					
	STYLE D PUSH DOWN TO OPEN					
NOTES: 1. ARROW ON LEVER INDICATES DIRECTION OF ACTUATOR THRUST TO CLOSE VALVE.						

GG08274-A

Figure 10. Exploded View, Fisher V150E



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PARTS NOT SHOWN: KEY 30, 31, 35, 36, AND 57

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

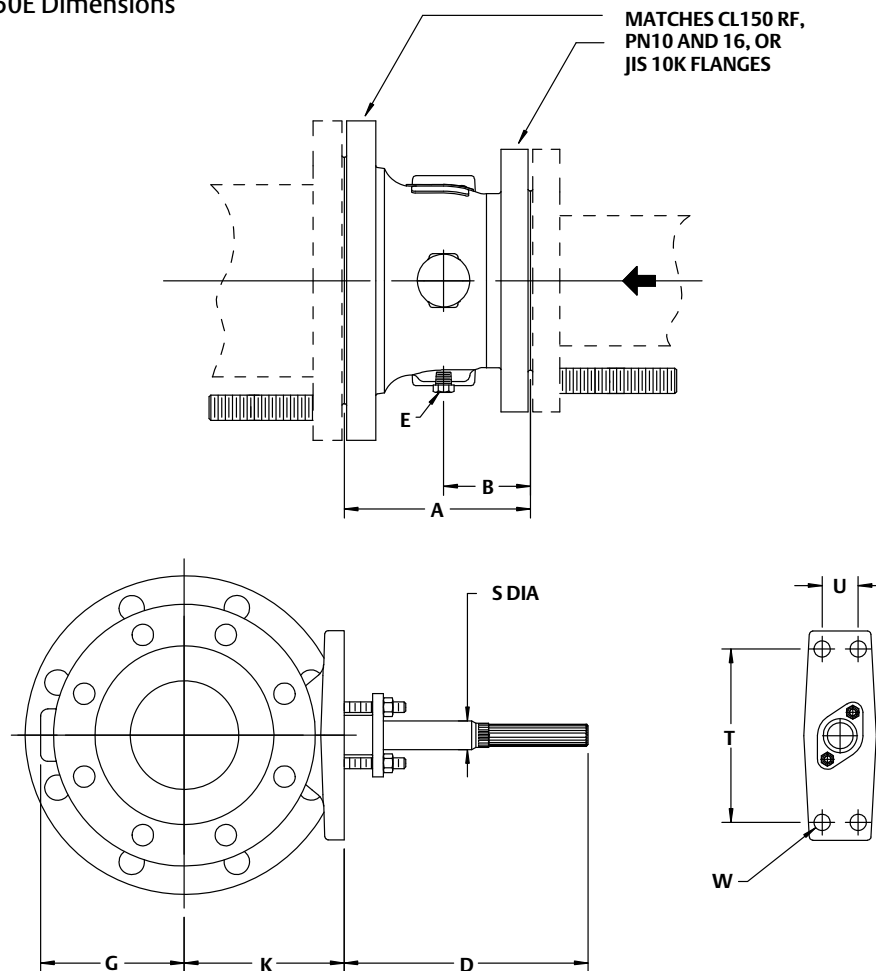
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Figure 11. Fisher V150E Dimensions



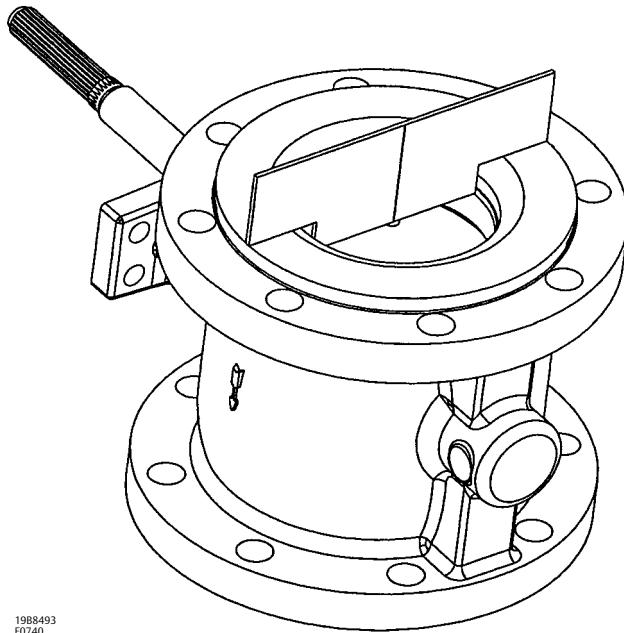
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Table 6. Fisher V150E Dimensions (see figure 11)

DN ⁽¹⁾	mm										APPROXIMATE WEIGHT
	A	B	D	G	K	SØ	T	U	W	E (optional)	kg
80x100	165	82	214	111	130	19.1	152	31.8	14.2	1/2 NPT	26
100x150	163	76	214	127	141	19.1	152	31.8	14.2	1/2 NPT	28
150x200	207	101	214	154	164	25.4	152	31.8	17.5	1/2 NPT	46
200x250	248	123.5	208	189	232	31.8	235	46	17.5	3/4 NPT	87
250x300	297	147	208	216	260	31.8	235	46	17.5	3/4 NPT	123
NPS ⁽¹⁾	Inch										APPROXIMATE WEIGHT
	A	B	D	G	K	SØ	T	U	W	E (optional)	lbs
3x4	6.50	3.23	8.43	4.37	5.12	0.75	5.98	1.25	0.56	1/2 NPT	58
4x6	6.42	2.99	8.43	5.00	5.55	0.75	5.98	1.25	0.56	1/2 NPT	61
6x8	8.15	3.98	8.43	6.06	6.46	1.00	5.98	1.25	0.69	1/2 NPT	100
8x10	9.76	4.86	8.19	7.44	9.13	1.25	9.25	1.81	0.69	3/4 NPT	192
10x12	11.69	5.79	8.19	8.50	10.24	1.25	9.25	1.81	0.69	3/4 NPT	271

1. Valve Inlet size x Outlet size

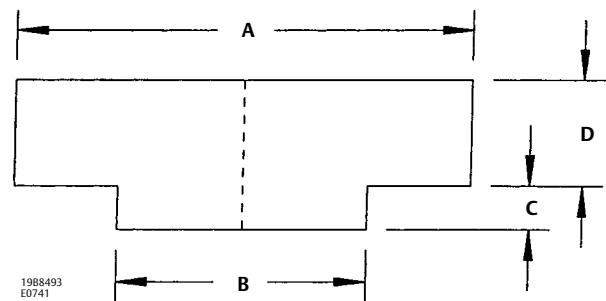
Figure 12. Centering Template in Use



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Figure 13. Centering Template Dimensions

VALVE SIZE	A	B	C	D
DN	mm			
80x100	127	63	24	38
100x150	157	82	36	44
150x200	216	117	21	51
200x250	270	139	12	57
250x300	324	203	2	60
NPS	Inches			
3x4	5.00	2.50	0.94	1.50
4x6	6.19	3.25	1.42	1.75
6x8	8.50	4.62	0.82	2.00
8x10	10.62	5.50	0.48	2.25
10x12	12.75	8.00	0.09	2.38



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Retrofit Kits for ENVIRO-SEAL Packing

Retrofit kits include parts to convert existing V150E valves with shallow (single packing depth) packing box to the ENVIRO-SEAL packing box construction. Retrofit kits include single PTFE packing. See following table.

ENVIRO-SEAL Packing Retrofit Kits

SHAFT DIAMETER ⁽¹⁾		PART NUMBER	
mm	Inches	Single PTFE	Graphite
19.1	3/4	RRTYXRT0032	RRTYXRT0332
25.4	1	RRTYXRT0052	RRTYXRT0352
31.8	1-1/4	RRTYXRT0062	RRTYXRT0362
Parts Included in Kit			
Key	Description	Quantity	
100	Packing stud	2	2
101	Packing nut	2	2
102	Packing flange	1	1
103	Spring pack assembly	1	1
105	Packing set	1	1
106	Anti-extrusion washer	2	---
107	Packing box ring ⁽²⁾	1	1
---	Tag	1	1
---	Tie Cable	1	1

1. Diameter through the packing box.
2. Not required for all sizes of V150E with 1-1/4 inch diameter shafts.

Repair Kits for ENVIRO-SEAL Packing

Repair kits include valves parts for shallow (single packing depth) for ENVIRO-SEAL packing box construction. Repair kits include single PTFE or graphite packing. See following table.

ENVIRO-SEAL Packing Repair Kits

SHAFT DIAMETER ⁽¹⁾		PART NUMBER	
mm	Inches	PTFE	Graphite
19.1	3/4	RRTYX000032	13B8816X052
25.4	1	RRTYX000052	13B8816X092
31.8	1-1/4	RRTYX000062	13B8816X112
Parts Included in Kit			
Key	Description	Quantity	
105	Packing set	1	1
106	Anti-extrusion washer	2	...(2)

1. Diameter through the packing box.
2. Included in key 105.

Parts List

Note

Part numbers are shown for recommended spares only. For other part numbers, contact your [Emerson sales office](#) or Local Business Partner.

Common Parts (figure 10)

Key	Description	Part Number
1	If you need a valve body as a replacement part, order by valve size, serial number, and desired valve body material. Contact your Emerson sales office or Local Business Partner for assistance.	
2	Ball	
4*	Taper Key	
	R30006 (cobalt alloy 6 casting)	
	NPS 3x4 and 4x6	12B9530X012
	NPS 6x8	12B9531X012
	NPS 8x10 and 10x12	12B9532X012
6	Drive Shaft	
7*	Groove Pin	
	S31600 (316 Stainless Steel)	
	NPS 3x4 and 4x6	18A6135X012
	NPS 6x8	18A6138X012
	NPS 8x10	11B0738X012
	NPS 10x12	11B8596X012
9	Follower Shaft	
10*	Bearing (2 req'd)	
	PEEK/PTFE	
	NPS 3x4 and 4x6	17B7142X012
	NPS 6x8	27B7136X012
	NPS 8x10 and 10x12	27B7775X012
11*	Ball Seal	
	HD (Heavy-Duty) Metal	
	R30006 (cobalt alloy 6 casting)	
	NPS 3x4	34B4766X032
	NPS 4x6	34B4767X032
	NPS 6x8	34B4768X032
	NPS 8x10	34B4769X032
	NPS 10x12	34B3365X032

Key	Description	Part Number
13*	Wave Spring, N07750	
	NPS 3x4	24B4760X012
	NPS 4x6	24B4761X012
	NPS 6x8	24B4762X012
	NPS 8x10	24B4763X012
	NPS 10x12	22B4509X012
16*	Packing Set, PTFE and carbon-filled PTFE V-ring	
	NPS 3x4 and 4x6	12A8995X022
	NPS 6x8	12A8832X022
	NPS 8x10 and 10x12	12A8951X022
17	Packing Follower	
19	Packing Follower Stud	
20	Packing Follower Nut	
23	Actuator Mounting Screw	
24	Actuator Mounting Nut	
25	Pipe Plug (optional)	
	S31600	
	NPS 3x4, 4x6, and 6x8	1A369235072
	NPS 8x10 and 10x12	1A771535072
26	Identification Nameplate	18B2294X012
27	Drive Screw	
28	Flow Arrow	
30	Nameplate	
31	Nameplate Wire	
37*	Radial Seal, PTFE/CG	
	NPS 3x4	18B0264X012
	NPS 4x6	28B0265X012
	NPS 6x8	28B0266X012
	NPS 8x10	28B0267X012
	NPS 10x12	28B0268X012
39*	Packing Box Ring	
	S31600	
	NPS 3x4 and 4x6	16A6084X012
	NPS 6x8	16A6085X012
	NPS 8x10 and 10x12	16A6086X012
130	Clamp	
131	Bonding Strap Assembly	

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ENVIRO-SEAL Packing System (Parts in all Vee-Ball Valves) (figure 3)

Key	Description	Part Number	Key	Description	Part Number
100	Packing Flange Stud		107 *	Packing Box Ring	
101	Packing Flange Nut			W/single and double PTFE packing	
102	Packing Flange			NPS 3x4 and 4x6	16A6084X012
103	Spring Pack Assembly			NPS 6x8	16A6085X012
105 *	Packing Set		108 *	Packing Ring (2 req'd)	
	W/single PTFE packing			W/double PTFE packing	
	NPS 3x4	12B7414X012		NPS 3x4 and 4x6	12A8992X022
	NPS 4x6	12B7414X012		NPS 6x8	12A8831X022
	NPS 6x8	12B7438X012		NPS 8x10 and 10x12	12A8953X022
	NPS 8x10 and 10x12	12B7450X012	109 *	Anti-Extrusion Ring (2 req'd)	
106 *	Anti-Extrusion Ring (2 req'd)			NPS 3x4 and 4x6 PTFE packing	12B7422X012
	W/single and double PTFE packing			NPS 6x8 PTFE packing	12B7446X012
	NPS 3x4 and 4x6	12B7418X012		NPS 8x10 and 10x12 PTFE packing	12B7458X012
	NPS 6x8	12B7442X012	110	Lantern Ring	
	NPS 8x10 and 10x12	12B7454X012	111	Tag	
			112	Tie Cable	
			113	Lubricant, anti-seize (not furnished with packing system)	

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Fisher™ Slurry Vee-Ball™ V150S and V300S Control Valve NPS 3 through 12

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Figure 1. Fisher Slurry Vee-Ball Control Valve



X0186-1

Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for Fisher Slurry Vee-Ball V150S and V300S rotary control valves, NPS 3 through 12 (see figure 1).

Refer to separate manuals for information concerning the actuator, positioner and accessories.



Do not install, operate, or maintain V150S or V300S valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

Valve Sizes NPS ■ 3, ■ 4, ■ 6, ■ 8, ■ 10, and ■ 12 End Connection V150S: CL150 Raised-face flange V300S: CL300 Raised-face flange Shutoff Classification Construction does not provide tight shutoff. Nominal gap between ball and flow ring seat is 0.035 inch for high chrome iron construction and 0.015 inch for ceramic insert construction. Construction Materials Standard Construction: See table 2 Flow Direction Reverse flow recommended (into concave face of ball, out through the flow ring)	Valve Installation Shaft axis shall be horizontal Actuator Mounting Right-hand or left-hand, as viewed from upstream end of valve Maximum Ball Rotation 90 degrees Valve/Actuator Action Standard ball rotation is clockwise (CW) to close with right hand mount actuator. Left hand mount actuator with counterclockwise (CCW) to close ball action is optional. For horizontal pipe run and horizontal shaft orientation, it is recommended the ball rotate to the top of valve body upon opening. With diaphragm or piston rotary actuator and splined shaft, the valve is field-reversible between push-down-to-close or push-down-to-open: ■ PDTC (extending actuator rod closes valve) and ■ PDTO (extending actuator rod opens valve)
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Educational Services

For information on available courses for the Fisher Slurry Vee-Ball valve, as well as a variety of other products, contact:

Emerson Automation Solutions
 Educational Services - Registration
 Phone: 1-641-754-3771 or 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/fishervalvetraining

Description

The Slurry Vee-Ball valve shown in figure 1 mates with CL150 or CL300 raised face flanges. Rugged construction, highly wear-resistant trim materials, and an unrestricted straight through flow path make the design ideal for controlling the most abrasive of slurries.

A shaft with a choice of drive connections will allow a variety of power operated actuators and valve positioners or controllers to be used.

The design is particularly effective in minimizing erosive damage to the adjoining pipework, thereby providing greater operational safety and service life when compared with other valve types.

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Table 2. Standard Construction Materials

Part	Material	MATERIAL TEMPERATURE CAPABILITY			
		°C		°F	
		Minimum	Maximum	Minimum	Maximum
Valve Body	Carbon Steel ASME SA216 WCC	-29	427	-20	800
Body Liner	High Chrome Iron (HCl) ASTM A532 Class III Type A	-29	427	-20	800
V-Notch Ball	High Chrome Iron ASTM A532 Class III Type A	-29	427	-20	800
	Ceramic (optional)	-29	427	-20	800
Flow Ring	High Chrome Iron ASTM A532 Class III Type A	-29	427	-20	800
	HCl with Ceramic Insert (optional)	-29	230	-20	450
Flow Ring Retainer	Carbon Steel ASME SA105	-29	427	-20	800
Bearing Shroud	High Chrome Iron ASTM A532 Class III Type A	-29	427	-20	800
Bearing	S44004	-29	427	-20	800
Drive Shaft	S17400	-29	427	-20	800
Follower Shaft	S17400	-29	427	-20	800
Shaft Pins	S42000	-29	427	-20	800
Gaskets	Graphite SST Laminate	-198	538	-325	1000
Packing Set	PTFE V-ring	-46	230	-50	450
	Graphite	-198	538	-325	1000
Packing Box Ring and Follower	S31600	-198	538	-325	1000
Studs	B8M Class 2	-45	538	-50	1000
Nuts	S31600	-45	538	-50	1000
Retainer Screws and Clips	S31600	-45	538	-50	1000
Spring	S30400	-29	427	-20	800
Plug	S41000	-45	538	-50	1000

Figure 2. Flange Stud Length for Seal Protector End

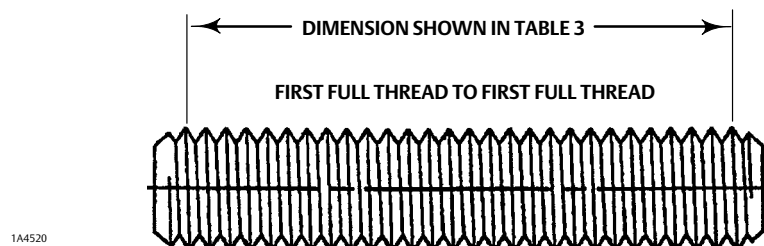


Table 3. Flange Stud Lengths Required for Flow Ring End of Fisher V150S Valves

VALVE SIZE, NPS	V150S		V300S	
	mm	Inches	mm	Inches
3	95	3.75	121	4.75
4	108	4.25	217	5
6	114	4.50	140	5.5
8	183	7.19	215	8.44
10	222	8.72	260	10.22
12	256	10.10	301	11.85

Specifications

Specifications for these valves are shown in table 1 and in Fisher Bulletin 51.3:V150S Slurry Vee-Ball V150S and V300S Rotary Control Valves ([D103154X012](#)).

Installation

WARNING

Safe work practices should be followed when handling the valve and actuator.

Some types of ceramic trim, including PSZ, can create a spark under certain conditions when an edge of one ceramic part is struck against a second ceramic part with enough force. Do not use ceramic trim where the process fluid has volatile or combustible properties.

The valve drive shaft is not necessarily grounded to the pipeline when installed. Personal injury or property damage could result from an explosion caused by a discharge of static electricity from valve components if the process fluid or the atmosphere around the valve is flammable. If the valve is installed in a hazardous area, electrically bond the drive shaft to the valve.

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed either the valve body rating or the mating pipe flange joint rating. To avoid such injury or damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.

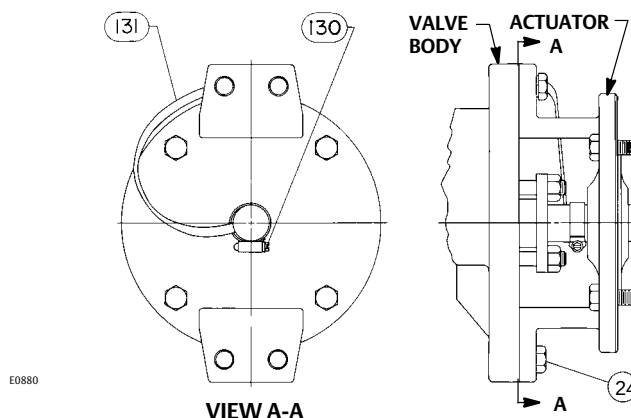
Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

Figure 3. Optional Shaft-to-Body Bonding Strap Assembly



1. Install the valve in the direction of the flow arrow fitted to the valve body.
2. Install the valve with the shaft axis in the horizontal position.
3. If required, fit a bonding strap assembly (key 131) to the drive shaft (key 8) with the clamp, (key 130, figure 3) and connect the other end of the bonding strap assembly to the valve body with actuator mounting cap screw.
4. If the valve and actuator have been purchased separately or if the actuator has been removed, mount the actuator according to the Actuator Mounting section and the appropriate actuator instruction manual.
5. The actuator can be right- or left-hand mounted with the shaft in a horizontal orientation as shown in figure 1. If necessary, refer to the appropriate actuator instruction manual for actuator installation and adjustment procedures.

Table 4. Fisher V150S Dimensions

VALVE SIZE	V150S DIMENSIONS ⁽¹⁾										
	A	B	D	G	K	M ⁽²⁾	N ⁽²⁾	S Diameter	T	U	W
DN	mm										
80	165	80.0	235	140	130	104	98.0	19.1	152	31.8	14.2
100	194	102	214	152	140	117	98.0	19.1	152	31.8	14.2
150	230	111	214	175	164	124	112	25.4	152	31.8	14.2
200	304	184	208	220	231	195	124	31.8	235	46.0	17.5
250	385	235	208	250	261	235	132	31.8	235	46.0	17.5
300	455	291	208	300	304	270	132	38.1	235	46.0	17.5
NPS	Inch										
3	6.49	3.15	9.26	5.51	5.12	4.11	3.86	0.75	6.00	1.25	0.56
4	7.62	4.02	8.44	5.98	5.53	4.61	3.86	0.75	6.00	1.25	0.56
6	9.06	4.38	8.44	6.89	6.45	4.90	4.40	1.00	6.00	1.25	0.56
8	11.96	7.25	8.19	8.66	9.11	7.68	4.90	1.25	9.25	1.81	0.69
10	15.16	9.26	8.18	9.84	10.26	9.25	5.19	1.25	9.25	1.81	0.69
12	17.91	11.47	8.18	11.81	11.97	10.63	5.19	1.50	9.25	1.81	0.69

1. Stud length associated with clearance dimension "M" is longer than standard length specified in ANSI B16.5.
2. Clearance necessary to remove flange bolts.

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Table 5. Fisher V300S Dimensions

VALVE SIZE	V300S DIMENSIONS										
	A	B	D	G	K	M ⁽¹⁾	N ⁽¹⁾	S Diameter	T	U	W
DN	mm										
80	165	80.0	235	140	130	127	121	19.1	152	31.8	14.2
100	194	102	214	152	140	146	127	19.1	152	31.8	14.2
150	230	111	214	175	164	152	140	25.4	152	31.8	14.2
200	304	184	208	220	231	223	152	31.8	235	46.0	17.5
250	385	235	208	250	261	276	137	31.8	235	46.0	17.5
300	455	291	208	300	304	324	186	38.1	235	46.0	17.5
NPS	Inch										
3	6.49	3.15	9.26	5.51	5.12	5	4.75	0.75	6.00	1.25	0.56
4	7.62	4.02	8.44	5.98	5.53	5.75	5	0.75	6.00	1.25	0.56
6	9.06	4.38	8.44	6.89	6.45	6	5.5	1.00	6.00	1.25	0.56
8	11.96	7.25	8.19	8.66	9.11	8.78	6	1.25	9.25	1.81	0.69
10	15.16	9.26	8.18	9.84	10.26	10.87	6.81	1.25	9.25	1.81	0.69
12	17.91	11.47	8.18	11.81	11.97	12.75	7.31	1.50	9.25	1.81	0.69

1. Clearance necessary to remove flange bolts.

Figure 4. Fisher Slurry Vee-Ball Dimensions (see table 4 and 5)

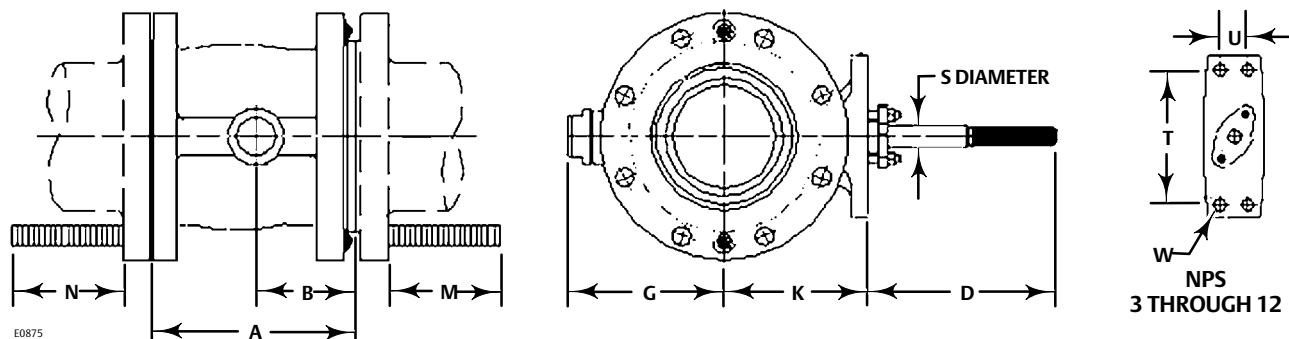
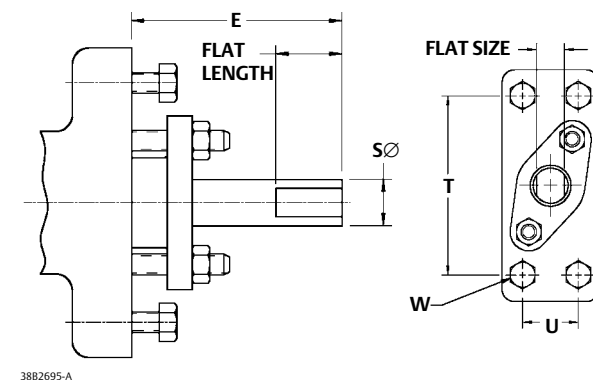


Table 6. Fisher Slurry Vee-Ball Dimensions for Double D Shaft Drive

VALVE SIZE	E	S(1)	FLAT LENGTH	T	U	W
DN	mm					
80	83	19.0	25.4	95	25	see below
100	83	19.0	25.4	95	25	
150	83	25.4	25.4	95	25	
200	83	31.8	25.4	133	38	
250	89	31.8	25.4	133	38	
300	89	38.1	38.1	133	38	
NPS	Inch					
3	3.25	3/4	1.0	3.75	1.0	1/2-13
4	3.25	3/4	1.0	3.75	1.0	1/2-13
6	3.25	1	1.0	3.75	1.0	1/2-13
8	3.25	1-1/4	1.0	5.25	1.5	5/8-11
10	3.5	1-1/4	1.0	5.25	1.5	5/8-11
12	3.5	1-1/2	1.5	5.25	1.5	5/8-11

1. This nominal valve shaft diameter is the shaft diameter through the packing box. Use this diameter when selecting Fisher actuators.

Figure 5. Fisher Slurry Vee-Ball Dimensions for Double D Shaft Drive (see table 6)



Maintenance

⚠ WARNING

The V-notch ball closes with a shearing, cutting motion, which could result in personal injury. To avoid injury, keep hands, tools, and other objects away from the V-notch ball while stroking the valve.

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- The valve packing area may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Packing Maintenance

1. It is recommended that the valve be removed from the line when replacing packing to allow correct set up of the actuator after actuator removal.
2. Remove the packing follower nuts and packing follower (keys 18 and 16).
3. Remove the packing parts (see figure 4 and keys 15 and 14) using a purposed designed packing extraction tool to avoid damaging the packing box bore and shaft surfaces.

4. Install the new packing parts using the sequence shown in figure 4. Fit the packing follower (key 16). Fit nuts (key 18).
5. Tighten the packing nuts to compress the packing to seal for operating conditions. At the same time push the ball and shroud on the drive end against the valve body inside location face to center the ball. This can be done by using a lever (wood) against the inside ball lug face and the valve body liner inlet.

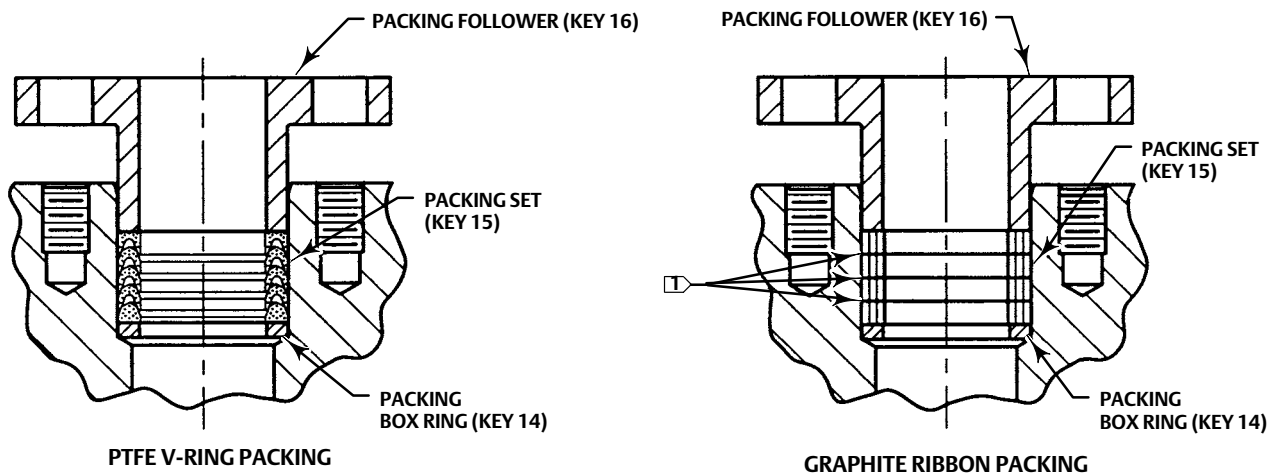
Disassembly

⚠ WARNING

Observe the steps in the WARNING at the beginning of the Maintenance section.

Reference figures 9 and 10.

Figure 6. Packing Arrangements



NOTE:

1 Includes zinc washers for graphite ribbon packing only.

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STANDARD PACKING

CAUTION

Trim parts are made from brittle material, handle with care to avoid chipping or breakage.

1. Remove the actuator cover (where applicable). Take note of the orientation of the actuator with respect to the valve body and the lever orientation with respect to the valve drive shaft.
2. Remove the actuator.
3. Remove the flow ring retainer screws, clips and flow ring retainer (keys 22, 23, and 5).
4. Knock or press out the flow ring (key 4).

5. Position the ball to allow access to the shaft pins. Use a modified parallel pin punch (figure 7) to to knock out the shaft pins, (key 10) through the shaft and ball lugs.

Note

The punch dimensions should be as per table 7 to avoid damaging the ball and shaft. The hole diameter in the ball is larger than the hole in the shaft and the punch needs to be centrally located with the pin.

6. Remove packing follower (key 16). Remove plug (key 20) and spring (key 19).
7. Knock or press each shaft (key 9) out through the ball and the bearings (key 7).
8. Remove ball (key 3) and shrouds (key 6).
9. Knock, press, or pull out bearings (key 7).
10. Knock or press out body liner (key 2).
11. Remove packing (key 15).

For service applications involving scale formation that sets up and “freezes” mating parts, supplementary recommendations for disassembly can be provided by your [Emerson sales office](#).

Assembly

WARNING

Observe the steps in the WARNING at the beginning of the Maintenance section.

Reference figures 9 and 10.

CAUTION

Trim parts are made from brittle material, handle with care to avoid chipping or breakage.

1. Clean all surfaces of the parts to be used. Ensure all mating surfaces are in good condition and free from scratches and dents. Replace worn parts. Fit new gaskets (key 13 and 21) and packing (key 15).
2. Position the valve body with flow arrow uppermost.
3. Fit the valve body liner (key 2) into the valve body, aligning cross-holes with shaft bore axis.
4. Fit the bearings (key 7) through the valve body liner into the valve body.
5. Place bearing shrouds (key 6) over the bearings and through the valve body liner to contact faces in the valve body bore.
6. Orientate the ball (key 3) so that the lug with the location slot will be on the non-drive side of the valve body, that is opposite from the actuator. Place the ball on a wad of rag to rest in the bottom of the valve body with the lugs uppermost. Fit the drive shaft (key 8) through the bearing on the drive side and into the hexagon hole of the ball, aligning the holes for the shaft pins. With a splined shaft, the indicator line on the splined shaft end should be on the ball side to indicate the ball “seat location.” Fit the follower shaft (key 9).
7. Fit the shaft pins (key 10) through the ball and into the shaft using a pin punch (figure 7). Position the pins approximately centrally about the shaft axis.

8. Next install the packing. Fit the studs (key 17), packing box ring (key 14), packing set (key 15), packing follower (key 16), and nuts (key 18). Adjust the packing tightness for use.
9. Before fitting the flow ring, tap the end of the bearing on the drive end to ensure that the ball/shroud assembly is hard against the valve body inner recess location on the drive end.
10. Next fit the flow ring.
 - a. For one piece High Chrome Iron flow ring (key 4), fit into the valve body and valve body liner. Fit the gasket, (key 13) and flow ring retainer (key 5). Secure with retainer screws (key 22) and clips (key 23). Check that the ball rotates freely.
 - b. For flow ring with ceramic insert, position the valve body on the valve body liner flange face with the ball secured and facing upwards. Make sure the flow ring insert type (key 28) and flow ring insert (key 29) are clean and free of grease and oil. Apply a bead of Loctite™ 620 around the smaller outside diameter of the ceramic insert and push the insert into the flow ring. Place shims on the upper ball face (recommended thickness 0.015 inch) and lower the flow ring assembly into place. Secure with retainer, screws and clips. Push the insert down onto the shims and allow the adhesive to set.
11. Coat thread of non-drive end body plug with Loctite 567 and fit gasket (key 21), spring (key 19), and plug (key 20) to body. Tighten plug by hand until gasket contact is achieved. Continue to tighten body plug an additional 1/4-turn from gasket contact.

For service applications involving scale formation that sets up and “freezes” mating parts, supplementary recommendations for assembly can be provided by your [Emerson sales office](#).

Actuator Mounting

Use the appropriate actuator instruction manual, this section of this manual, and figure 8 of this manual when mounting the actuator or changing actuator styles and positions.

1. To help ensure correct centering of the V-notch ball (key 3) on the flow ring (key 4 or 28/29), be sure the ball is closed when mounting the actuator (for applications other than Spring Return Fail-Open).

Figure 7. Pin Punch

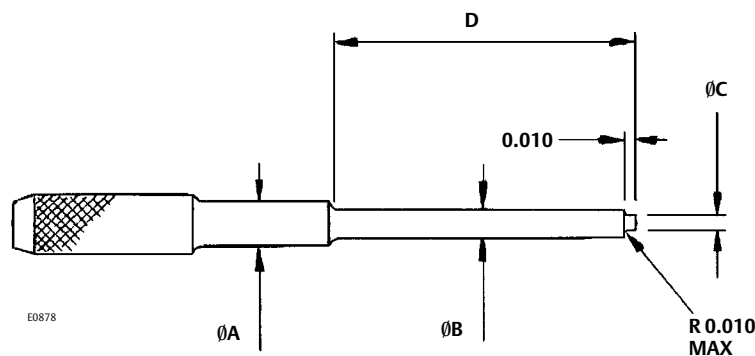


Table 7. Pin Punch Dimensions

Valve Size, NPS	Ball Pin Hole Ø	Shaft Pin Hole Ø	A Min	B Max	C Max	D Min
3 and 4	0.19	0.16	0.25	0.15	0.085	1.45
6	0.22	0.19	0.25	0.18	0.105	1.85
8 and 10	0.28	0.25	0.38	0.24	0.135	2.2
12	0.28	0.25	0.38	0.24	0.135	2.6

2. Clean the valve shaft and actuator lever splines to be sure the actuator lever will slide on easily. Only drive the lever in if absolutely necessary.
3. Carefully wedge the ball solidly against the actuator-side bearing to center the ball.
4. Keep the wedge in place while installing the lever, if necessary. Remove the wedge after you have clamped the actuator lever on the valve shaft and have connected the lever to the actuator piston rod or diaphragm rod.

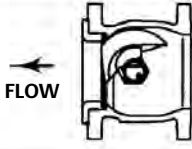
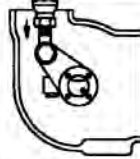
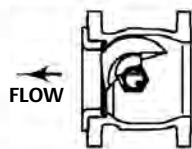
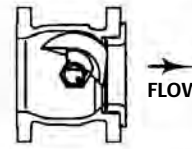
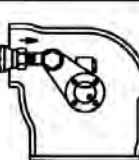
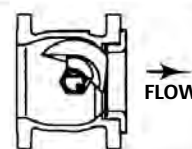
Determining Mounting Position for Spline Shaft/Lever Type

The actuator can be either right or left-hand mounted, with the actuator on the right or left side when viewed from upstream (see figure 8).

For **right-hand mounting (standard)**, the ball will be in the top of the valve body when the valve is open and the shaft is horizontal. In this position the ball rotates CW to Close.

For **left-hand mounting**, the ball will be in the top of the valve body when the valve is open and the shaft is horizontal. In this position the ball rotates CCW to Close.

Figure 8. Index Marks for Actuator Lever Orientation for NPS 3 through 12 Valves

ACTUATOR		VALVE OPEN	ACTUATOR POSITION			
MOUNTING	STYLE		1	2	3	4
(OPTIONAL) LEFT-HAND	STYLE D PUSH DOWN TO CLOSE					
	STYLE C PUSH DOWN TO OPEN					
(STANDARD) RIGHT-HAND	STYLE B PUSH DOWN TO CLOSE					
	STYLE A PUSH DOWN TO OPEN					
NOTE: 1. Arrow on lever indicates direction of actuator thrust to close valve.						

Determining Closed Position

1. The valve must be removed from the line to check the position of the ball.

⚠ WARNING

The V-notch ball closes with a shearing, cutting motion. To avoid personal injury, keep hands, tools, and other objects away from the ball while stroking the valve.

2. Rotate the ball to the closed position.
3. Position the ball in the proper location.
4. The ball is in its closed position when the Vee plane of the ball, (opposite the convex side) is parallel to the liner end flange face of the valve body. Measure to check. Adjust the actuator linkage or travel stops to position.

CAUTION

To extend operating life of the V-notch ball, always ensure the V-notch ball rotates into the top of the valve body to open.

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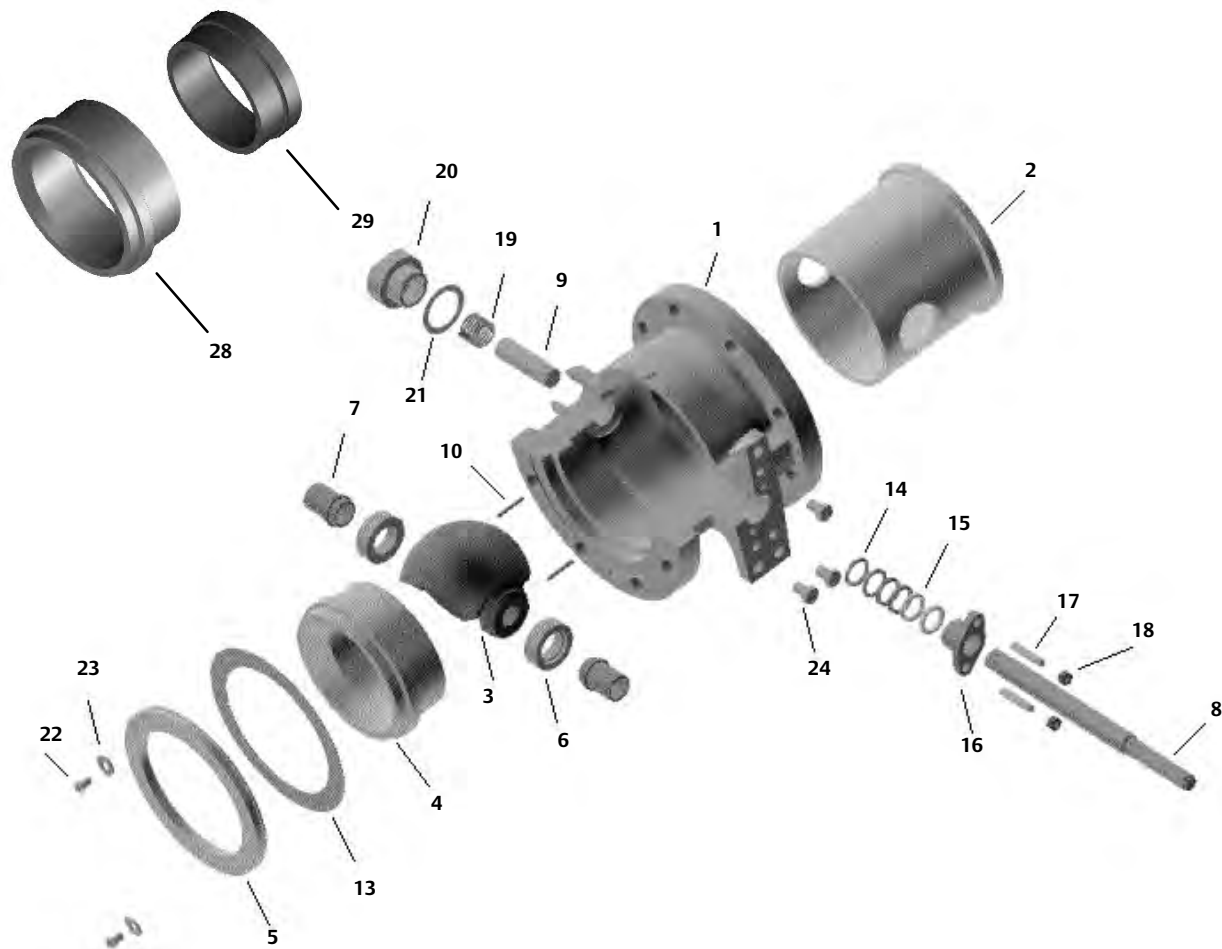
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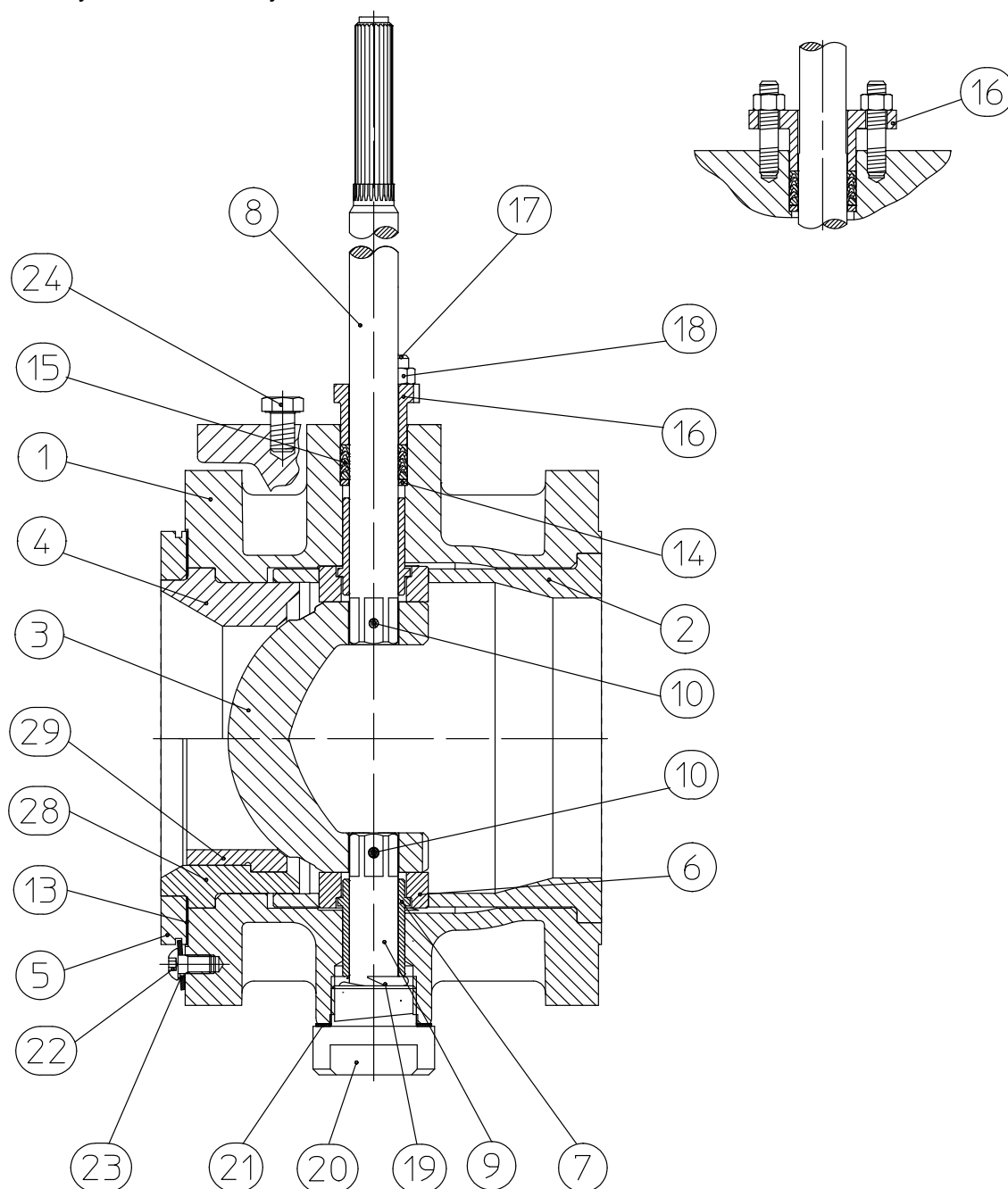
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Figure 9. Exploded View, Fisher Slurry Vee-Ball NPS 3 through 12
(Including Alternative Ceramic Insert Construction, Keys 28 and 29)



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Figure 10. Fisher Slurry Vee-Ball Assembly



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Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your [Emerson sales office](#) regarding spare parts or technical information. When ordering replacement parts, also specify the complete 11-character part number from the parts kits.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your Emerson sales office for Part Ordering information.

Common Parts (figures 9 and 10)

Key Description

- 1 If you need a valve body as a replacement part, order by valve size, serial number, and desired valve body material.
- 2* Valve Body Liner
- 3* V-notch Ball
- 4* Flow Ring
- 5 Flow Ring Retainer
- 6* Bearing Shroud (2 req'd)
- 7* Bearing (2 req'd)
- 8 Drive Shaft Spline
- 8 Drive Shaft
- 9 Follower Shaft
- 10* Shaft Pin (2 req'd)

Key Description

- 13* Gasket
- 14* Packing Box Ring
- 15* Packing Set
- 16 Packing Follower
- 17 Stud (2 req'd)
- 18 Nut (2 req'd)
- 19 Spring
- 20 Plug
- 21* Gasket
- 22 Retainer Screw (2 req'd)
- 23 Retainer Clip (2 req'd)
- 24 Actuator Mounting Screw (4 req'd)
- 25 Nameplate
- 26 Drive Screw (4 req'd)
- 27 Flow Arrow
- 28 Flow Ring Insert
- 29 Flow Ring Insert
- 130 Clamp
- 131 Bearing Clamp Assembly

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Fisher™ V250 Ball Valve

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Figure 1. Fisher V250 Ball Valve with 1061 Actuator



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Introduction

Scope of Manual

This instruction manual provides installation, maintenance, and parts ordering information for NPS 4 through 24 Fisher V250 valves (figure 1) that mate with ASME flanges. Other instruction manuals provide information covering the actuator and accessories.

Do not install, operate, or maintain a V250 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The V250 valve is a flangeless rotary control valve used for high pressure, throttling or on-off control of liquid or gas applications (see figure 1). These valves operate on a rotary motion input through a splined valve-shaft/actuator-shaft connection for use with power or manual handwheel actuators. The single seal, dual seal, and flow ring constructions are covered in this instruction manual.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

V250 Valve

November 2020

Instruction Manual

D100422X012

Table 1. Specifications

Valve Sizes and End Connection Styles NPS 4 through 24 flangeless valves retained by line flange bolts and designed to fit between ASME raised-face or ring-type joint flanges. See table 2 for valves that install between ASME flanges Maximum Inlet Pressure⁽¹⁾ Consistent with applicable pressure-temperature ratings listed in table 2 Maximum Allowable Shutoff Pressure Drop^(1,2,3) Single-Seal and Dual-Seal Construction: 155 bar (2250 psi) at 38°C (100°F) and 103 bar (1500 psi) at 82°C (180°F) except where further limited by the pressure-temperature rating of the valve body Flow Ring Construction: Limited by the pressure-temperature rating of the valve body Seal Material Temperature Capability⁽¹⁾ Single-Seal and Dual-Seal Construction: -46 to 82°C (-50 to 180°F) with LCC or stainless steel valve bodies Flow Ring Construction with Nitrile O-Rings: -46 to 93°C (-50 to 200°F) with LCC steel and stainless steel valve bodies Flow Ring Construction with Fluorocarbon O-Rings: -46 to 204°C (-50 to 400°F) with LCC steel and stainless steel valve bodies	Flow Characteristic Modified equal percentage Flow Direction Forward Flow: Single seal construction is standard for forward flow (see figure 4) Bidirectional Flow: Flow ring construction can be used for either forward or reverse flow (see figure 5) Bidirectional Shutoff: Dual seal construction is required to provide shutoff for bidirectional flow (see figure 12) Shutoff Classification Single Seal and Dual Seal Constructions: 0.0001% of maximum valve capacity (less than 1% of Class IV, ANSI/FCI 70-2) Flow Ring Construction: 1% of maximum valve capacity Maximum Ball Rotation 90 degrees Actuator Mounting Right-hand or left-hand mounted as viewed from the valve body inlet for forward flow Approximate Weights See table 3
--	---

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

2. Maximum allowable shutoff pressure drops are further limited for the following constructions. The NPS 12 with S20910 drive shaft is limited to 128 bar (1862 psi) from -46 to 59°C (-50 to 139°F) and to 103 bar (1490 psi) at 93°C (200°F). The NPS 16 with 17-4PH steel, with 2-1/2 inch splined drive shaft is limited to 69 bar (1000 psi), and with the S20910, 2-1/2 inch splined drive shaft is limited to 55 bar (795 psi) at all service temperatures. The NPS 24 with S20910 drive shaft is limited to 92 bar (1336 psi) at all service temperatures.

3. NPS 20 CL900 and NPS 24 CL900 flow ring is limited to 1500 psi.

Table 2. Pressure Rating and Flange Compatibility

Valve Size, NPS	Inlet Pressure Capability	ASME Flange Compatibility
4	Consistent with CL600 or 900 (ASME B16.34)	CL600 or 900 raised face or ring-type joint flange (ASME B16.5)
6		
8		
10		
12		
16	Consistent with CL600 (ASME B16.34)	CL600 raised face or ring-type joint flange (ASME B16.5)
20	Consistent with CL600 or 900 (ASME B16.34)	CL600 or 900 raised face or ring-type joint flange (ASME B16.5)
24		

Table 3. Approximate Weights

VALVE SIZE, NPS	WEIGHT	
	Kilograms	Pounds
4	73	160
6	132	290
8	222	490
10	345	760
12	431	950
16	771	1700
20 (CL600)	1814	4000
20 (CL900)	2045	4500
24	2404	5300

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given on the valve and actuator nameplates. Use pressure-relieving devices as required by accepted industry, local, state, or federal codes, and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

Avoid personal injury or property damage caused by uncontrolled movement or dropping of the valve assembly.

Hoist rings are sized to lift only the valve and actuator. Do not use hoist rings to lift the valve if piping or other structures are added.

Rig the lift to use two hoist rings and take appropriate precautions to avoid unbalanced loading which may result in sudden swinging or movement of the assembled unit, including additional lifting and/or support methods when necessary.

Failure to utilize safe lifting practices may result in equipment damage and/or personal injury.

1. If the valve will be placed in storage prior to installation, protect the flanges and keep the inside of the valve dry and clear of foreign material.
2. Install a three-valve bypass around the control valve assembly if continuous operation will be necessary during inspection and maintenance of the valve.
3. Inspect the valve body for damage and be certain that the valve body cavity is free of foreign material.
4. Be certain that adjacent pipelines are free of any foreign material, such as pipe scale or welding slag, that could damage the valve body seating surfaces.
5. A V250 valve is normally shipped as part of a control valve assembly, with a power or manual handwheel actuator mounted on the valve. If the valve and actuator have been purchased separately or if the actuator has been

removed for maintenance, mount the actuator according to the actuator mounting procedure and adjust actuator travel before inserting the valve into the pipeline. This allows necessary measurements to be made during the actuator adjustment process.

The actuator can be either right-or left-hand mounted, as viewed from the valve body inlet, in any of the positions shown in figure 10. Refer to the Actuator Mounting procedure in this manual and to the actuator instruction manual for mounting and adjusting instructions before proceeding.

6. Before installing the valve, make sure the flow through the valve matches the flow direction arrow on the valve. Failure to do so can damage the seal in a valve with a single seal construction.

For bidirectional flow, install the valve so the highest pressure flow matches the flow direction arrow on the valve. Install the V250 valve in any position, but the recommended orientation is in a horizontal pipeline with the shaft positioned horizontally and the ball closing in the downward direction.

CAUTION

To avoid damage to the ball sealing surface, rotate the ball to the fully open position before installing the valve between the pipeline flanges.

7. With the ball in the fully open position, install line flange gaskets and insert the valve between the pipeline flanges. Use standard composition gaskets, or other flat sheet gaskets compatible with the flow media, between the valve and the pipeline flanges. Spiral wound gaskets without compression controlling centering rings are not recommended.

CAUTION

Uneven tightening of line bolts may cause uneven wear of the ball surface, leakage downstream or to atmosphere, or uneven flange gasket alignment. Tighten line bolts evenly when installing the valve.

8. Center the valve in the line by making sure the mating flanges are aligned. Secure the valve in the line with the cap screws (keys 33 and 34, figures 11 and 12), line bolts (key 35, not shown), and hex nuts (key 44, not shown). Required clearances for installation of the long line bolt studs and the required engagement length for the cap screws are shown in figure 2. When tightening the cap screws and line bolts, use accepted bolting procedures. Lubricate the studs or bolts and tighten the nuts in a crisscross sequence to ensure proper alignment of the valve with the flanges.
9. For hazardous atmosphere or oxygen service valves, read the following WARNING, and perform the instruction provided in the WARNING and provide the bonding strap assembly mentioned in step 10 below if the valve is used in a hazardous application.

⚠ WARNING

The V250 is not necessarily grounded to the pipeline when installed. If the process fluid or the atmosphere around the valve is flammable, personal injury or property damage could result from an explosion caused by a discharge of static electricity from the valve components. If the valve is installed in a hazardous area, electrically bond the drive shaft to the valve.

Note

The packing is composed of all conductive packing rings (graphite ribbon packing) to electrically bond the shaft to the valve for hazardous area service or non-conductive PTFE packing rings. For oxygen service applications, perform the following step.

Figure 2. Flange Bolt Lengths

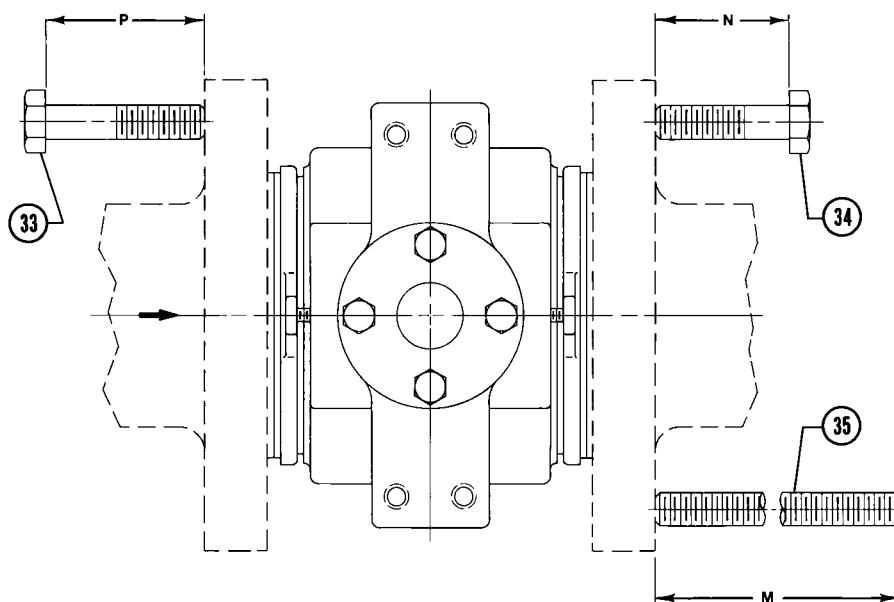
VALVE SIZE, NPS	CL600 BOLTING DIMENSIONS					
	Raised Face Flanges			Ring Type Joint Flanges		
	P	N	M ⁽¹⁾	P	N	M ⁽¹⁾
mm						
4	---	---	343	---	---	343
6	118	118	413	124	124	413
8	140	137	445	143	140	451
10	159	162	527	165	165	527
12	178	152	584	178	165	584
16	197	197	660	203	203	673
20	254	254	---	254	254	---
24	330	330	---	343	343	---
Inch						
4	---	---	13.50	---	---	14.50
6	4.63	4.63	16.25	4.88	4.88	16.25
8	5.50	5.38	17.50	5.63	5.50	17.75
10	6.25	6.38	20.75	6.50	6.50	20.75
12	7.00	6.00	23.00	7.00	6.50	23.00
16	7.75	7.75	26.00	8.00	8.00	26.50
20	10.00	10.00	---	10.00	10.00	---
24	13.00	13.00	---	13.50	13.50	---

1. These bolts may be installed from either end of the valve.

VALVE SIZE, NPS	CL900 BOLTING DIMENSIONS					
	Raised Face Flanges			Ring Type Joint Flanges		
	P	N	M ⁽¹⁾	P	N	M ⁽¹⁾
mm						
4	124	124	375	124	130	375
6	127	127	445	127	133	445
8	152	149	483	152	156	483
10	168	171	546	168	175	546
12	184	168	610	184	191	610
20 ⁽²⁾	---	---	420	---	---	420
Inch						
4	4.88	4.88	14.75	4.88	5.13	14.75
6	5.00	5.00	17.50	5.00	5.25	17.50
8	6.00	5.88	19.00	6.00	6.13	19.00
10	6.63	6.75	21.5	6.63	6.88	22.00
12	7.25	6.63	24	7.25	7.50	24.00
20 ⁽²⁾	---	---	16.5	---	---	16.5

1. These bolts may be installed from either end of the valve.

2. For NPS 20 size, only studs and nuts are used. See the M dimension.



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- Attach the bonding strap assembly (key 41, figure 3) to the shaft with the clamp (key 40, figure 3), and connect the other end of the bonding strap assembly to the valve with the machine screw (key 43, figure 3).
- Connect pressure lines to the actuator as indicated in the actuator instruction manual. When a manual actuator is used with a power actuator, install a bypass valve on the power actuator (if not already supplied) for use during manual operation.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are presented in this section for replacing the shaft seals, the ball seal or flow ring, the drive and follower shafts, the ball and bushing, and the valve outlet gasket.

Key number locations are shown in figure 11 for single seal and flow ring constructions, and in figure 12 for dual seal constructions.

⚠ WARNING

Personal injury or property damage can result due to a sudden release of pressure or process fluid if the pipe plug (key 42, figure 12) is removed while the valve is pressurized. To avoid such injury or damage, remove the pipe plug only when the control valve is isolated from the pressure system, or provide a hand valve to control relief of internal valve pressure to avoid personal injury or property damage.

A V250 valve with a dual seal construction contains a pipe plug port (key 42, figure 12) on the underside of the valve. This port can be used to relieve internal valve pressure for testing seal integrity when in the pipeline.

If the pipe plug port is to be used for testing seal integrity when the valve is in the pipeline, the plug should be replaced with a hand valve to allow controlled relief of valve pressure during seal leak rate testing.

⚠ WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from either side of the valve.
- For dual seal valve constructions, remove pressure and drain the valve interior by removing the pipe plug (key 42).
- Vent the power actuator loading pressure.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Replacing the Follower Shaft Seal

Both the follower and drive shaft seals should be replaced at the same time. Key number locations are shown in figure 11 or 12.

Note

The valve shaft's sealing surfaces are critical in obtaining a good seal. If the valve shafts are scratched, nicked or worn, replace or repair the valve shaft before installing new shaft seals.

Both seal rings, drive end and follower end, should be replaced at the same time.

1. Isolate the control valve from the line pressure, release pressure from both sides of valve, and drain the process media from both sides of the valve. For dual seal valve constructions, remove pressure and drain the valve interior cavity. Shut off and disconnect all lines from the power actuator.

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

CAUTION

When removing the actuator in the following step, use a wheel puller to separate the actuator parts from the valve shaft. Failure to do this could cause damage to the actuator parts and the drive shaft.

2. Remove the cap screws (key 29) from the actuator mounting yoke and, while referring to the actuator instruction manual for assistance, remove the actuator. For oxygen service and hazardous area applications, remove the clamp and bonding strap assembly (keys 40 and 41, figure 3).
3. Install the new backup ring and shaft seal in the seal carrier. Be sure to install the backup ring on the correct side (see figure 4).
4. Replace the seal carrier and secure it with the hex nuts (key 8). Be careful not to damage the shaft seal or O-ring during replacement of the seal carrier.
5. Mount the actuator to the valve while referring to the Actuator Mounting section of this instruction manual and to the appropriate actuator instruction manual. If appropriate, install or replace the bonding strap assembly and the clamp (key 41 and 40, figure 3).

Replacing Ball Seal or Flow Ring

Perform this procedure if the control valve is not shutting off properly (that is, leaking downstream). This procedure does not require removing the actuator from the valve. In addition to being shown in figures 11 and 12, key numbers are shown in figure 5 for the ball seal constructions and in figure 6 for the flow ring construction.

Removal

1. Isolate the control valve from the line pressure, release pressure from both sides of valve, and drain the process media from both sides of the valve. For dual seal valve constructions, remove pressure and drain the valve interior cavity. Shut off and disconnect all lines from the power actuator.

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

The ball (key 2) closes with a shearing motion. To avoid personal injury, keep hands, tools, and other objects away from the ball while stroking the valve.

CAUTION

Damage to the ball (key 2) may occur if the ball is not in the fully open position while the valve is being removed from the pipeline. If necessary, pressure the actuator temporarily to retain the ball in the open position while removing the valve from the pipeline.

2. With the ball in the fully open position, unscrew the line bolts and remove the valve from the pipeline.
3. Unscrew the cap screws (key 15, figures 11 and 12 only) and remove the seal protector ring (key 14) or the flow ring (key 14) from the inlet end of the valve. Then remove the O-ring (key 13), the ball seal (key 11), and the shim seals (key 10). The flow ring construction will have no ball seal. For a dual seal construction, repeat this procedure on the other end of the valve.
4. Thoroughly clean all metal surfaces. Check all parts for damage, and replace damaged parts with new parts if necessary.

Figure 4. Ball Seal Detail

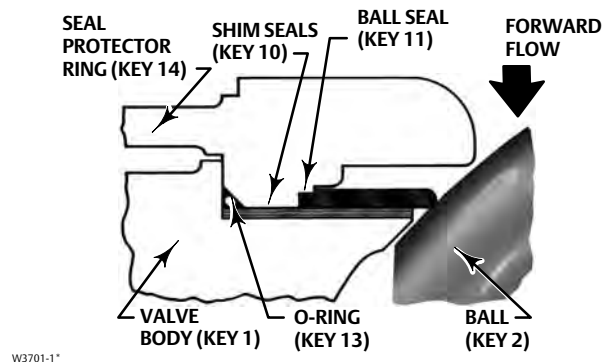


Figure 5. Flow Ring Detail

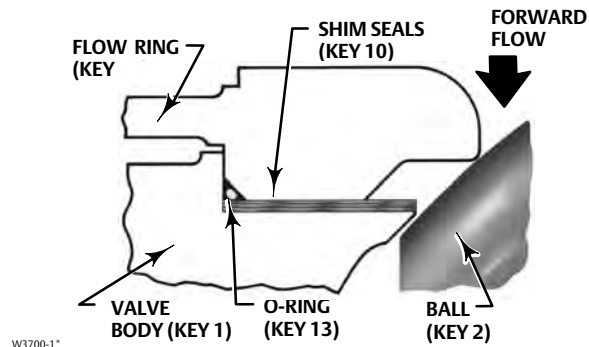
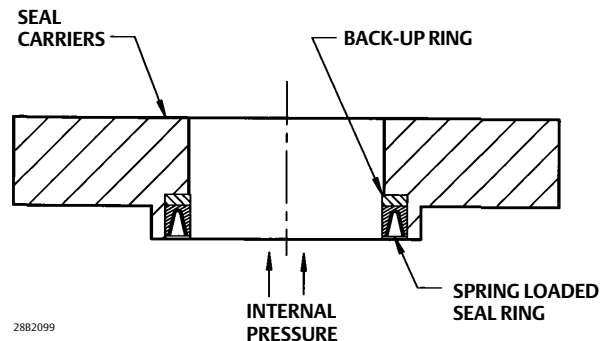


Figure 6. Seal & Backup Ring Assembly



5. Proceed to the appropriate Installation procedure to install the removed parts.

Installation of Single or Dual Ball Seal

1. Check the seal surface of the valve (key 1) for scratches that may prevent the shim seals (key 10) from sealing off internal valve pressures.
2. Rotate the ball (key 2) to the closed position as indicated by the travel indicator scale (key 37, figures 10 and 11 only).
3. Place the appropriate number of shim seals into the valve:
 - For NPS 4 through 10 valves, insert up to 6 shim seals into the valve.
 - For NPS 12 through 24 valves, insert up to 7 shim seals into the valve.
4. Inspect the sealing surface of the ball seal (key 11) for possible damage. Then place the ball seal on top of the shim seals with any nicks or scratches facing away from the ball.
5. Add or remove the 0.25 mm (0.010 inch) thick shim seals to the valve until the ball seal firmly contacts the ball sealing surface (i.e., without rocking) when pressed tightly against the shim seal assembly.
6. Temporarily remove the ball seal, and remove 3 shim seals.
7. Replace the ball seal, and then place the O-ring (key 13) into the valve.
8. With the ball seal centered on the ball, install the seal protector ring (key 14) and secure it to the valve with the cap screws (key 15).
9. For dual seal constructions, repeat this procedure on the other end of the valve.

Installation of Flow Ring

1. Check the seal surface of the valve (key 1) for scratches that may prevent the shim seals (key 10) from sealing off internal valve pressures.
2. Rotate the ball (key 2) to the closed position as indicated by the indicator scale (key 37, figure 11 only).
3. Place the appropriate number of shim seals into the valve:
 - For NPS 4 through 10 valves, insert 6 shim seals into the valve.
 - For NPS 12 through 24 valves, insert 7 shim seals into the valve.
4. Making certain the flow ring (key 14) is centered and does not contact the ball, secure the flow ring to the valve with the cap screws (key 15).

5. Measure the clearance between the flow ring and the ball with a wire gauge. Add or subtract shim seals until the minimum clearance is 0.38 mm (0.015 inches) for valves used for forward flow and 0.76 mm (0.030 inches) for reverse flow.
6. Once minimum clearance is obtained, temporarily remove the flow ring.
7. Insert the O-ring (key 13) into the valve, and secure the flow ring to the valve with the cap screws (key 15).

Installing Live-Loaded PTFE Packing

These steps refer only to the Live Loaded PTFE Packing. Key number locations are shown in figures 11, 12, and 13.

Note

The valve shaft's packing surfaces are critical in obtaining a good seal. If the valve shafts are scratched, nicked or worn, replace or repair the valve shaft before installing the Live Loaded PTFE Packing parts. Both seal rings, drive end and follower end, should be replaced at the same time.

1. Remove the hex nuts (key 8) from the seal carrier (key 17 on the drive shaft end and key 3 on the follower shaft end). Remove the spacer (key 22). On NPS 4, 12, and 24 valves, the stud bolt (key 4) will need to be removed. The drive pin (key 28) needs to be removed from the outboard end of the valve body.
2. Replace the seal carrier and spacer with the new packing box (key 17 or 3). To keep the ball properly centered inside the valve body, the bushing spacer shims may need to be added or removed (see the Replacing Drive Shaft, Follower Shaft, Ball, Bushings, and Valve Outlet Gasket -- Assembly section).
3. Secure the packing box with hex nuts (key 8), for NPS 6, 8, 10, 16, or 20 valves, or socket head cap screw (key 4), for NPS 4, 12, or 24 valves. Lubricate the hex nuts or cap screws and tighten them. Be careful not to damage the O-ring during installation of the packing box.
4. Install the packing box studs (key 100).

Note

The Belleville springs must be stacked properly and packing box parts must be assembled in the correct order, if the packing parts are to function properly.

5. Install the packing ring, female and male adaptors, anti-extrusion rings, and packing box rings (keys 105, 106, and 107). Be sure to install the packing rings in the order and quantity shown in figure 13.
6. Install the spring pack assembly (key 103 or 104), which includes the Belleville springs, packing follower, and O-ring. The O-ring is a non-functional part used to retain the packing springs during assembly.
7. Install the packing flange (key 102) on the shaft. Then lubricate and install the packing nuts (key 101), hand tightening them. Apply lubricant to the stud threads, internal nut threads and contacting face of the nut. Packing flanges with flats on the sides may need to be oriented with the mounting bracket so the flange will fit between the legs of the bracket.
8. To obtain optimum maximum benefit from the packing system, tighten the packing flange nuts and compress the Belleville springs to their Target Load. The Belleville springs are designed to provide optimum performance at their Target Load, 85% of their maximum deflection/compression.

To obtain the Target Load compression, tighten the packing flange nuts alternately and evenly, keeping the packing flange parallel with the valve flange, until the Belleville springs are compressed 100%. Then loosen each packing flange nut one half turn (180° of rotation).

Replacing Drive Shaft, Follower Shaft, Ball, Bushings, and Valve Outlet Gasket

This procedure is to be performed to replace the valve ball, the drive shaft, and the follower shaft, if the ball does not rotate in response to rotation of the actuator end of the drive shaft, or if there is leakage around the outlet gasket.

Disassembly

CAUTION

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever off the valve shaft. Driving the actuator lever off the valve shaft could move the ball (key 2) from the centered position, causing damage to the ball, the ball seal (key 11), and the valve (key 1).

Use care when removing the actuator lever and, if necessary, use a wheel puller to remove the lever or actuator from the valve shaft. It is okay to tap the wheel puller screw lightly to loosen the lever or actuator, but hitting the screw with excessive force could also damage the valve.

1. Remove the cap screws (key 29) from the actuator mounting yoke and, while referring to the actuator instruction manual for assistance, remove the actuator. If appropriate, remove the clamp and bonding strap assembly (key 40 and 41, figure 3).
2. Remove either the seal protector ring (key 14) or the flow ring (key 14) from the inlet end of the valve assembly by following steps 1, 2, and 3 of the Replacing Ball Seal or Flow Ring section. For dual seal constructions, note that this procedure should be repeated on the outlet end of the valve.
3. Proceed as appropriate: For single seal constructions and flow ring constructions (figure 11 only), remove the cap screws (key 15). Then, remove the valve outlet (key 5) and gasket (key 12).

Note

Perform the following step with the inlet end of the valve assembly facing upward and with the ball (key 2) in the fully open position.

4. Remove the hex nuts (key 8) from the follower shaft (key 7) side of the valve. Then remove the seal carrier (key 3). Inspect and replace the seal (key 16) and O-ring (key 23) if necessary.

Note

During the following step, it may be necessary to apply heat to the retainer screw (key 32) to disengage the thread locking adhesive (high strength) (key 30) that holds the retainer screw in place.

5. Remove the retainer screw (key 32).
6. Using a soft-faced hammer to prevent damaging the end of the follower shaft (key 7), drive the follower shaft into the flow bore of the ball just enough so that the split ring (key 31) can be removed. Then remove the split ring.

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Table 4. Shaft Retainer and Retainer Screw Torques

VALVE SIZE, NPS	N•m		Lbf•Ft	
	Shaft Retainer (Key 25)	Retainer Screw (Key 32)	Shaft Retainer (Key 25)	Retainer Screw (Key 32)
4	136	27	100	20
6	759	27	560	20
8	1390	41	1025	30
10	1760	41	1295	30
12	2390	68	1760	50
16	3830	68	2825	50
20	6660	68	4910	50
24	12300	68	9075	50

7. Remove the follower shaft (key 7), the spacer (key 22), the bushing spacer shims (key 18), the bushing (key 20), the thrust washer (key 19), and the thrust spacer (key 21) from the valve.
8. Insert a ball support post (see figure 7) into the follower shaft (key 7) bore of the valve. Use of the ball support post will ensure that the ball sealing surfaces will not get damaged as the shaft retainer (key 25) is being removed. Position the ball support post so that the ball will be supported firmly inside the valve body cavity during the performance of the next three steps.

Note

During the following step, it may be necessary to apply heat to the shaft retainer (key 25) to disengage the thread locking adhesive (high strength) (key 30) that holds the shaft retainer in place.

9. Remove the shaft retainer (key 25) and the washer (key 24).
10. Remove the hex nuts (key 8) from the drive shaft (key 6) side of the valve. Then remove the seal carrier (key 17). Inspect and replace the seal (key 16) and O-Ring (key 23) if necessary.
11. With the ball firmly supported, remove the drive shaft (key 6) and attached parts out of the valve. Attached parts will include the spacer (key 22), the bushing spacer shims (key 18), the bushing (key 20), the thrust washer (key 19), and the thrust spacer (key 21).
12. While maintaining firm support of the ball (key 2), proceed as follows:
 - a. First, remove the ball support post through the follower shaft bore of the valve.
 - b. Then, while being careful not to damage the sealing surfaces of the ball, remove the ball through the outlet end of the valve.
13. Inspect and, if necessary, replace all parts. Then, proceed to the assembly procedure below.

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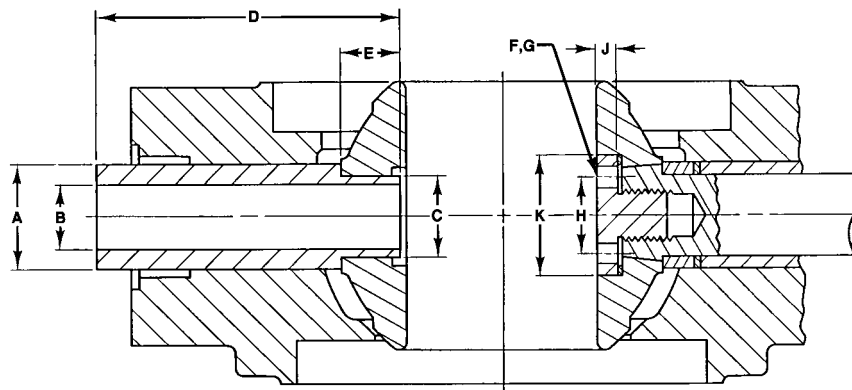
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D100422X012

Figure 7. Ball Support Post Dimensions

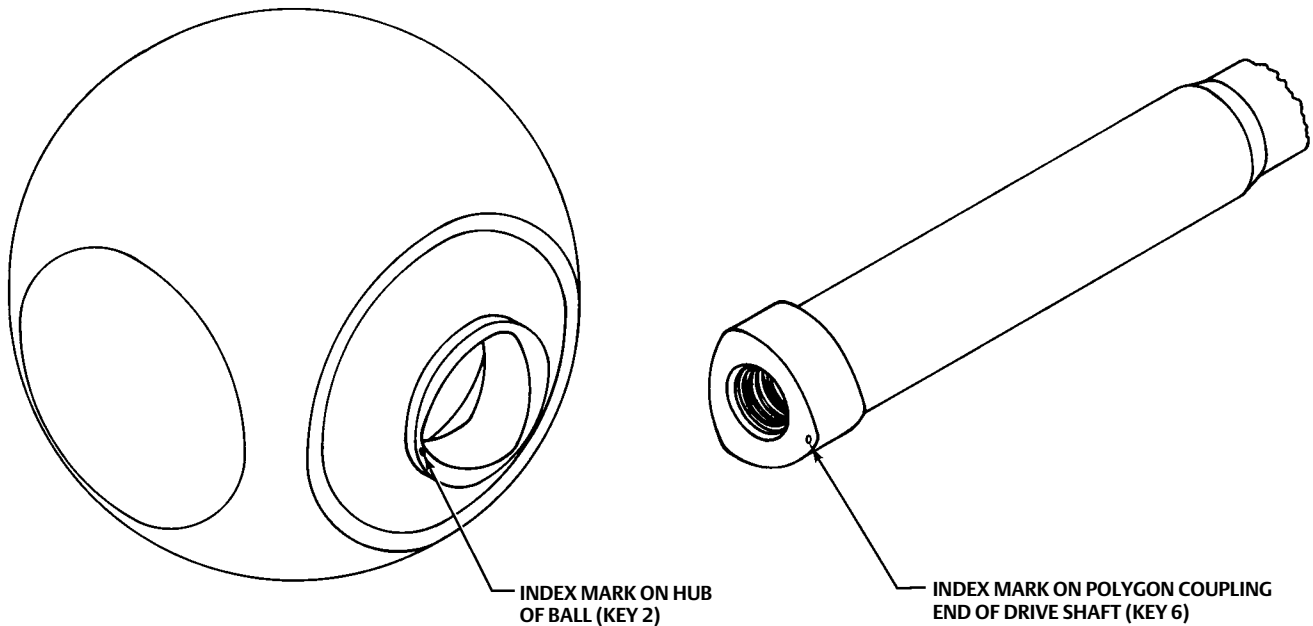
VALVE SIZE NPS	A(1)	B	C(1)	D	E	F(2)	G(1)	H	J	K
mm										
4	41.02	23.83	31.62	146.1	22.23	4	8.69	30.18	7.95	46.05
	40.77		31.37				9.04			
6	63.25	41.28	50.67	165.1	25.40	4	13.39	46.02	11.13	68.28
	62.99		50.42				13.89			
8	75.95	50.80	63.37	215.9	34.93	4	16.56	55.58	12.70	85.73
	75.69		63.12				17.07			
10	85.47	53.98	69.72	215.9	44.45	4	16.56	55.58	15.88	87.33
	85.22		69.47				17.07			
12	91.82	60.33	76.07	228.6	50.80	4	19.74	65.07	14.30	100.03
	91.57		75.82				20.35			
16	126.7	82.55	101.3	292.1	66.68	4	26.04	93.68	19.05	138.13
	126.4		101.0				26.70			
20	152.1	104.8	126.7	336.6	85.73	4	26.04	93.68	23.83	163.53
	151.8		126.4				26.70			
24	180.6	127.0	152.1	368.3	92.08	4	32.39	136.53	25.40	195.28
	180.2		151.8				33.05			
Inches										
4	1.615	0.938	1.245	5.750	0.875	4	0.342	1.188	0.313	1.813
	1.605		1.235				0.356			
6	2.490	1.625	1.995	6.500	1.000	4	0.527	1.812	0.438	2.688
	2.480		1.985				0.547			
8	2.990	2.000	2.495	8.500	1.375	4	0.652	2.188	0.500	3.375
	2.980		2.485				0.672			
10	3.365	2.125	2.745	8.500	1.750	4	0.652	2.188	0.625	3.438
	3.355		2.735				0.672			
12	3.615	2.375	2.995	9.000	2.000	4	0.777	2.562	0.563	3.938
	3.605		2.985				0.801			
16	4.990	3.250	3.990	11.500	2.625	4	1.025	3.688	0.750	5.438
	4.975		3.975				1.051			
20	5.990	4.125	4.990	13.250	3.375	4	1.025	3.688	0.938	6.438
	5.975		4.975				1.051			
24	7.110	5.000	5.990	14.500	3.625	4	1.275	5.375	1.000	7.688
	7.095		5.975				1.301			
1. Tolerances for the A and C dimensions are indicated by showing maximum and minimum dimensions. 2. Numbers of holes in port.										

1. Tolerances for the A and C dimensions are indicated by showing maximum and minimum dimensions.
2. Numbers of holes in port.



39A1059-B
A3141-1

Figure 8. Index Marks on Drive Shaft and Ball



79BA08073-A
B1793

Assembly

1. Position the ball (key 2) so that it is firmly supported inside the valve (key 1). Insert a ball support post (see figure 7) into the follower shaft (key 7) bore of the valve. Position the ball support post so that the ball will be supported firmly inside the valve body cavity while performing steps 2 through 5.

CAUTION

Damage to the valve assembly and downstream equipment could occur if the shaft retainer (key 25) should become disengaged from the drive shaft (key 6) during operation of a V250 control valve assembly. To prevent such damage, make sure that the internal threads in the Polygon coupling end of the drive shaft and the external threads of the shaft retainer are cleaned thoroughly before applying thread locking adhesive (high strength) (key 30) as described in step 5 of this assembly procedure.

2. Insert the drive shaft (key 6) into the drive shaft side of the valve and ball assembly. When inserting the drive shaft, make sure that the index mark on the Polygon coupling end of the drive shaft is aligned with the index mark on the hub of the ball. Refer to figure 8 for the location of these index marks.
3. Install the thrust spacer (key 21) into the drive shaft side of the valve and position it so that it is in contact with the ball hub. Then, install the thrust washer (key 19) and the bushing (key 20).
4. Insert the washer (key 24) into the ball. Lubricate the exposed surface of the washer with a good quality grease or lubricant.

CAUTION

Improper tightening of the shaft retainer (key 25) could allow the shaft retainer to become disengaged from the drive shaft (key 6) during operation of a V250 control valve assembly. This could cause damage to the valve assembly and downstream

equipment. To prevent such damage, make sure that the shaft retainer is tightened to the appropriate torque value listed in table 4.

5. Apply thread locking adhesive (high strength) (key 30) to the threads of the shaft retainer (key 25). Then, install the shaft retainer into the inside end of the drive shaft. Tighten the shaft retainer to the torque value listed in table 4.

CAUTION

Damage to the valve assembly and downstream equipment could occur if the retainer screw (key 32) should become disengaged from the follower shaft (key 7) during operation of a V250 control valve assembly. To prevent such damage, make sure that the internal threads in the inside end of the follower shaft and the external threads of the retainer screw are cleaned thoroughly before applying thread locking adhesive (high strength) (key 30) as described in step 8 of this assembly procedure.

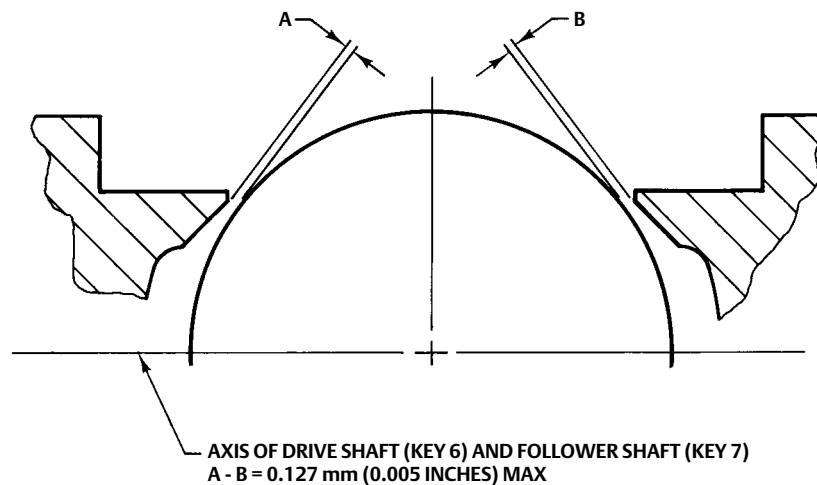
6. While maintaining firm support of the ball (key 2), remove the ball support post through the follower shaft bore of the valve. Then install the follower shaft into the valve. When installing the follower shaft, make sure that the drilled hole containing the two pins (key 9) is aligned with the two notches machined on the inside surface of the ball hub.
7. Temporarily position the follower shaft so that it protrudes slightly into the flow bore of the ball. Place the split ring (key 31) on the end of the follower shaft. Then, return the follower shaft to its original position.

CAUTION

Improper tightening of the retainer screw (key 32) could allow the retainer screw to become disengaged from the follower shaft (key 7) during operation of a V250 control valve assembly. This could cause damage to the valve assembly and downstream equipment. To prevent such damage, make sure that the retainer screw is tightened to the appropriate torque value listed in table 4.

8. Apply thread locking adhesive (high strength) (key 30) to the threads of the retainer screw. Then, install the retainer screw into the inside end of the follower shaft until it is at least flush with the end surface of the follower shaft. Make sure that the drilled hole containing the two pins (key 9) is still aligned with the two notches machined on the inside surface of the ball hub. Tighten the retainer screw to the torque value listed in table 4.
9. Install the thrust spacer (key 21) into the follower shaft side of the valve and position it so that it is in contact with the ball hub. Then, install the thrust washer (key 19) and the bushing (key 20).
10. Center the ball inside the valve along the axis of both the drive shaft and the follower shaft. The maximum deviation in measurement between the valve and ball from one side to the other should be no more than 0.005 inches (0.127 mm) as shown in figure 9.
11. In order to maintain proper centering of the ball inside the valve, the bushing spacer shims (key 18) must be installed in the following manner:
 - a. For the **drive shaft** side of the valve, install several bushing spacer shims around the drive shaft and into the valve.
 - b. Then, temporarily install the spacer (key 22) and the seal carrier (key 17).
 - c. Repeat this process, but add only one more bushing spacer shim into the valve each time, until contact between the seal carrier and the valve is broken.
 - d. Then, remove one bushing spacer shim and secure the spacer and seal carrier to the valve with the hex nuts (key 8). Be careful not to damage the seal (key 16) or O-ring (key 23) during replacement of the seal carrier.

Figure 9. Proper Alignment for Centering the Ball



- a. For the follower shaft side of the valve, install several bushing spacer shims around the follower shaft and into the valve.
 - b. Then, temporarily install the spacer (key 22) and the seal carrier (key 3).
 - c. Repeat this process, but add only one more bushing spacer shim into the valve each time, until contact between the seal carrier and the valve is broken.
 - d. Then, remove one bushing spacer shim and secure the spacer and seal carrier to the valve with the hex nuts (key 8). Be careful not to damage the seal (key 16) or O-ring (key 23) during replacement of the seal carrier.
12. Install the seal protector ring (key 14, figure 5) or the flow ring (key 14, figure 6) and all remaining parts by following the appropriate procedures presented in the Ball Seal and Flow Ring Maintenance section.
 13. For NPS 20 CL900 and NPS 24 CL900 valves, lifting hoist rings are provided. If the safety hoist rings were removed, replace them and torque them to 312 N•m (230 lbf•ft).
 14. Mount the actuator to the valve while referring to the actuator mounting section of this instruction manual and to the appropriate actuator instruction manual. If appropriate, replace the bonding strap assembly and the clamp (key 41 and 40, figure 4).
 15. Install the valve into the pipeline by referring to the Installation section of this instruction manual.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

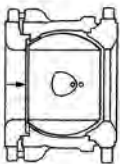
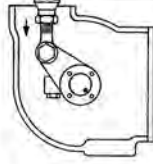
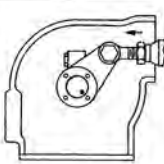
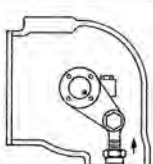
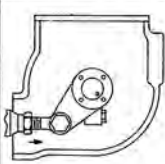
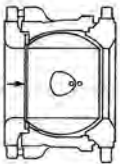
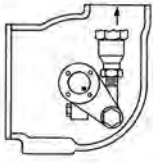
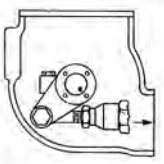
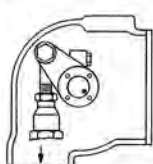
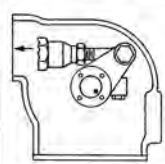
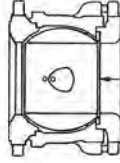
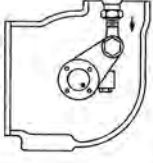
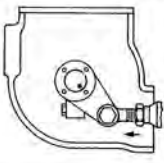
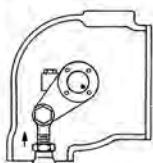
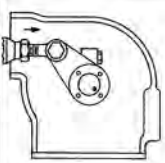
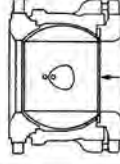
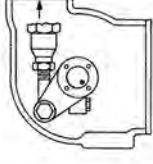
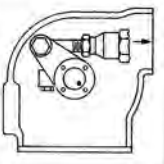
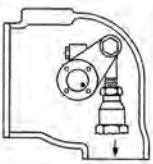
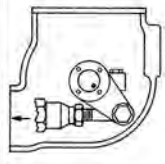
V250 Valve

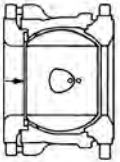
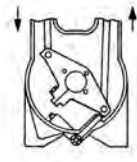
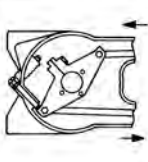
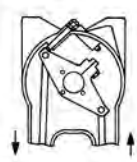
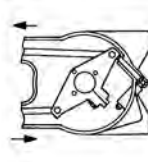
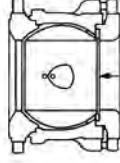
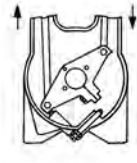
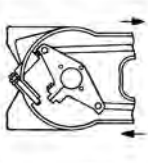
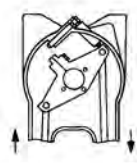
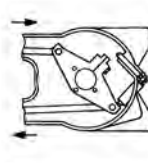
November 2020

Instruction Manual

D100422X012

Figure 10. Index Marks for Actuator Mounting

NPS 4 TO 12 V250 MOUNTING						
ACTUATOR		VALVE OPEN	ACTUATOR POSITION			
MOUNTING	STYLE		1	2	3	4
RIGHT-HAND	STYLE A (PDTC)					
	STYLE B (PDTO)					
LEFT-HAND	STYLE C (PDTC)					
	STYLE D (PDTO)					

NPS 16 TO 24 V250 MOUNTING						
ACTUATOR		VALVE OPEN	ACTUATOR POSITION			
MOUNTING	STYLE		1	2	3	4
RIGHT-HAND	STYLE A					
LEFT-HAND	STYLE C					

NOTES:

1. ARROW ON LEVER INDICATES DIRECTION OF ACTUATOR THRUST TO CLOSE VALVE.

2. PDTC—PUSH DOWN TO CLOSE; PDTO—PUSH DOWN TO OPEN.

3. THE NPS 16 TO 24 V250 MOUNTING CHART APPLIES TO VALVES USED WITH 1069 ACTUATORS ONLY.

48A8905-B
48A8827-A

Actuator Mounting

Use the appropriate actuator instruction manual and figure 10 of this instruction manual when changing actuator styles and positions. The actuator may be either right- or left-hand mounted. Figure 10 shows the correct lever/shaft orientation for both left-hand mounting and right-hand mounting configurations.

Travel Adjustment

Actuator travel adjustment can be performed with the valve either in or out of the pipeline. Key numbers referenced in the following procedures are shown in figure 11 for single seal and flow ring constructions and in figure 12 for dual seal constructions.

For valve assemblies in the pipeline:

1. Rotate the ball (key 2) to either the open or closed position as indicated by the travel indicator scale (key 37) on the outboard end of the valve.
2. Adjust the actuator as described in the appropriate actuator instruction manual until the arrow stamped on the end of the follower shaft (key 7) is fully aligned with the open or closed position on the travel indicator scale.

For valve assemblies out of the pipeline, proceed as follows:

1. Rotate the ball to the fully open position. The fully open position is achieved when the inside surface of the ball bore (key 2) is completely square with the line flange gasket surface of the seal protector ring (key 14) or flow ring (key 14).
2. Adjust the actuator as described in the appropriate actuator instruction manual until the inside surface of the ball bore is at right angles to the line flange gasket surface of the seal protector ring or flow ring.
3. Adjust the travel indicator scale (key 37) until the arrow stamped on the end of the follower shaft (key 7) is fully aligned with the open position.

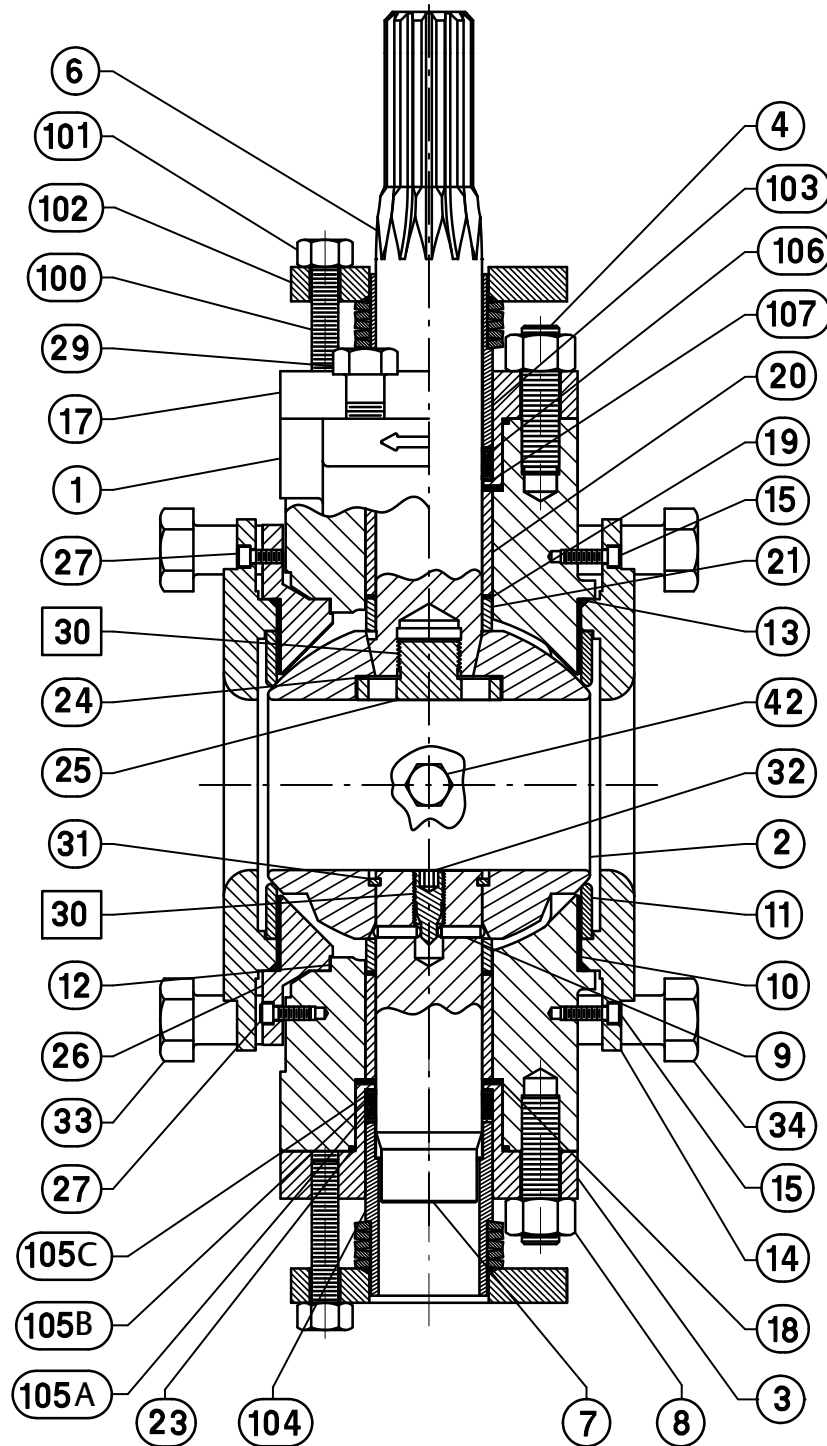
Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

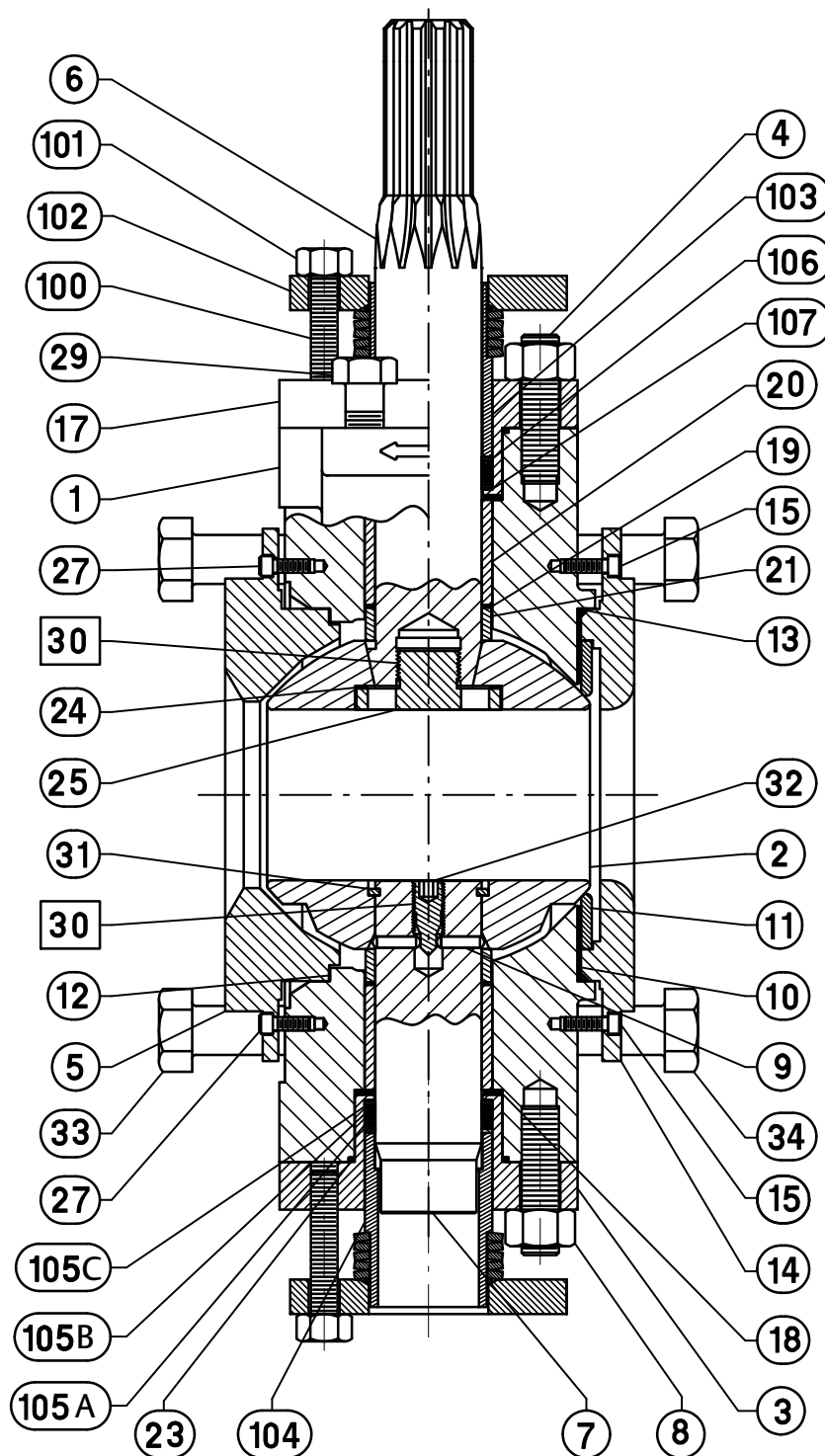
Figure 11. Fisher V250 Valve Assembly with Dual Seal Construction



NOTE:
1. KEY NUMBERS 35, 38, 39, AND 44 ARE NOT SHOWN.
□ APPLY AN ADHESIVE

GE84944

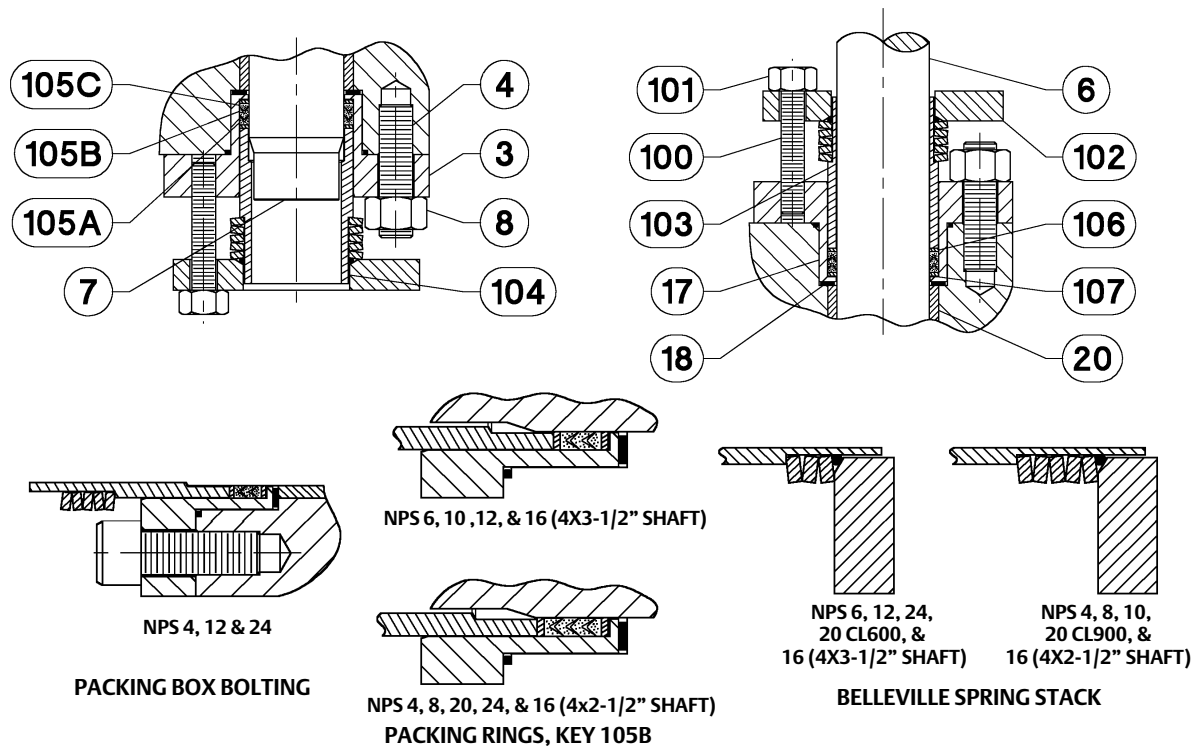
Figure 12. Fisher V250 Valve Assembly with Single Seal Construction



NOTE:
1. KEY NUMBERS 35, 38, 39, AND 44 ARE NOT SHOWN.
□ APPLY AN ADHESIVE

GE88081

Figure 13. Live Loaded Packing Assembly



3783095-F

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

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V250 Valve

November 2020

Parts Kits

Live-Loaded PTFE Packing kits

VALVE SIZE, NPS	KIT PART NUMBER
4	37B3095X142
6	37B3095X102
8	37B3095X062
10	37B3095X042
12	37B3095X182
16	37B3095X132
20	37B3095X082
24	37B3095X162

Part kits include keys 10, 11, 12, 13, 16, 18, 19, and 23 (see following table)

VALVE SIZE, NPS	KIT PART NUMBER		
	Single Seal	Dual Seal	Flow Ring
4	RV250X00412	RV250X00422	RV250X00432
6	RV250X00612	RV250X00622	RV250X00632
8	RV250X00812	RV250X00822	RV250X00832
10	RV250X01012	RV250X01022	RV250X01032
12	RV250X01212	RV250X01222	RV250X01232
16	RV250X01612	RV250X01622	RV250X01632
20	RV250X02012	RV250X02022	RV250X02032
24	RV250X02412	RV250X02422	RV250X02432

KEY NUMBER	DESCRIPTION	QUANTITY IN KIT		
		Single Seal	Dual Seal	Flow Ring
Key 10	Shim seal	2	4	2
Key 11	Ball seal	1	2	---
Key 12	Gasket	1	1	1
Key 13	O-ring	1	2	1
Key 16	Seal ring	2	2	2
Key 18	Bushing spacer shim	4	4	4
Key 19	Washer	2	2	2
Key 23	O-ring	2	2	2

Parts List

Note

Contact your [Emerson sales office](#) for part ordering information.

Key Description

1	Valve Body
	If you need a valve body as a replacement part, order by valve size and trim diameter, serial number, and desired material.
2	Ball
3	Packing Box
4	Stud Bolt
5	Valve Outlet (for single ball seal & flow ring constructions only, none req'd for dual ball seal construction)
6	Drive Shaft
7	Follower Shaft
8	Hex Nut
9	Pin
10*	Shim Seal (a maximum of 14 req'd for any construction)
11*	Ball Seal (1 req'd for single ball seal construction; 2 req'd for dual ball seal construction; none req'd for flow ring construction)
12*	Gasket
13*	O-Ring (1 req'd for single ball seal & flow ring constructions; 2 req'd for dual ball seal construction)
14	Seal Protector Ring
15	Cap Screw
16*	Shaft Seal Kit (1 req'd) (includes 2 seals and backup rings)
17	Packing Box
18*	Bushing Spacer Shim
19*	Thrust Washer (2 req'd)
20*	Bushing (2 req'd)

Key Description

21	Thrust Spacer
22	Spacer
23*	O-Ring (2 req'd)
24	Washer
25	Shaft Retainer
26	Adaptor Ring
27	Cap Screw
28	Drive Pin
29	Cap Screw
30	Thread Locking Adhesive (High Strength) (not furnished with valve)
31	Split Ring
32	Retainer Screw
33	Cap Screw
34	Cap Screw
35	Line Bolt (see figure 2)
36	Drive Screw
37	Indicator Scale
38	Nameplate (use when actuator is not furnished; not shown)
40	Clamp (see figure 3)
41	Bonding Strap Assembly (see figure 3)
42	Pipe Plug
43	Machine Screw (see figure 3)
44	Hex Nut
100	Packing Flange Stud
101	Hex Nut
102	Packing Flange
103	Spring Packing, Drive End
104	Spring Packing, Follower End
105A*	Packing Female Adaptor (2 req'd)
105B*	Packing Ring
105C*	Packing Male Adaptor (2 req'd)
106*	Anti-Extrusion Ring (4 req'd)
107*	Packing Box Ring (2 req'd)

*Recommended spare parts

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Fisher™ V260 and V270 Buried Service

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Figure 1. Fisher Buried Service with V260 Valve



X2061

Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for the Fisher V260 and V270 Buried Service (see figure 1). Refer to separate manuals for information concerning the valve, actuator, positioner, and accessories.



Do not install, operate, or maintain a V260 or V270 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The Fisher V260 and V270 Buried Service construction incorporates a shaft extension from the actuator to valve designed only to transfer the torque required to operate the valve. When installed the Buried Service construction can provide up to a -25 dBA noise reduction with no impact on flow.

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Specifications

Valve Body Size and End Connection Styles

V260: NPS ■ 6, ■ 8, ■ 10, ■ 12, ■ 16, ■ 20, and ■ 24 flanged valves with CL150, CL300, or CL600 raised-face flanges compatible with ASME B16.5

V270: NPS ■ 6, ■ 8, ■ 10, ■ 12, ■ 14, ■ 16, ■ 20, and ■ 24 flanged valves with CL150, CL300, or CL600 raised-face flanges compatible with ASME B16.5

Maximum Inlet Pressures and Temperatures⁽¹⁾

V260: Consistent with CL150, CL300 or CL600 pressure-temperature ratings per ASME B16.34

V270: Consistent with CL150, CL300 or CL600 pressure-temperature ratings per ASME B16.34. Allowable Temperature Range: -40 to 82°C (-40 to 180°F)

Flow Characteristic

See V260 bulletin ([D102352X012](#)) and V270 bulletin ([D104178X012](#))

Flow and Shutoff Direction

See V260 bulletin (D102352X012) and V270 bulletin (D104178X012)

Flow Coefficients

See Fisher Catalog 12

Shutoff Classification

See V260 bulletin (D102352X012) and V270 bulletin (D104178X012)

Seal Material

V260: ■ Standard: POM (polyoxymethylene) -29 to 82°C (-20 to 180°F) ■ Optional: PTFE/PEEK⁽²⁾ -73 to 260°C (-100 to 500°F)

V270: ■ Standard: POM (polyoxymethylene)

Maximum Ball Rotation

90°

Packing Arrangements

Enhanced ENVIRO-SEAL™ packing system provides improved sealing, guiding, and transmission of loading force to control liquid and gas emissions

Approximate Weight

See table 2 and 3

1. The pressure-temperature limits in this instruction manual and any applicable standard or code limitation for valve should not be exceeded.

2. POM stands for polyoxymethylene

Table 1. Standard Materials of Construction

Part ⁽¹⁾	Material
Packing Box Housing	Carbon Steel
Actuator Mounting Pad	Carbon Steel
Extension Housing Pipe	ASME SA106 Grade B
Bottom Plate	Carbon Steel
Actuator Adapter	Alloy Steel AISI G43400
Extension Pipe	ASME SA106 Grade B
Shaft Adapter	Alloy Steel AISI G43400
Adaptor Plate	Carbon Steel
Thrust Bearing	316 SST Nitrided
O-Ring	Nitrile
Pipe Plug	Carbon Steel
Mounting Bolting	SAE Grade 5/NCF3

1. For valve parts, refer to V260 bulletin (D102352X012) and V270 bulletin (D104178X012).

Educational Services

Emerson Educational Services
Phone: 1-800-338-8158
E-mail: education@emerson.com
emerson.com/mytraining

Installation

WARNING

- To avoid personal injury, always wear protective gloves, clothing, and eyewear when performing any installation operations.
- To avoid personal injury or property damage resulting from the bursting of pressure retaining parts, be certain the service conditions do not exceed the limits given in this manual.
- To avoid personal injury or property damage that can result from the sudden release of process pressure if valve or mating pipe flange pressure ratings are exceeded, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.
- To avoid personal injury or property damage caused by tipping of the valve, do not transport, store, or maintain the valve and extension assembly in the vertical orientation.

WARNING

- Failure to utilize safe lifting and rigging practices could result in property damage and personal injury or death.
- All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Only personnel trained in proper lifting and rigging practices shall perform valve/actuator assembly lifting, rigging and installation. Because each lift will be unique, the method of lifting the valve assembly, the correct location for attaching and lifting the valve assembly, and what the valve assembly will do when lifted shall be considered for each lift.
- Lifting and rigging equipment used to lift, install or remove a valve assembly or component must be properly selected and sized for the weight and configuration of the valve assembly or component being lifted. The weight of the complete valve assembly, including attached accessories, must be taken in consideration for this purpose. The lifting and rigging equipment must be properly maintained and inspected for damage before each use.
- If the valve is supplied with an actuator or handwheel, do not use the actuator or handwheel to lift the complete valve assembly. Lifting lugs attached to the actuator must not be used to lift the complete valve assembly unless clearly marked as being rated to support the complete valve assembly weight.
- Hoist rings or other lifting equipment attached to the valve or actuator must never be used to lift or support the weight of attached piping.

NOTICE

Care must be taken when lifting the valve/actuator assembly to ensure all accessories and tubing are not damaged in the process. Accessories and tubing may need to be removed prior to lifting to prevent damage and properly reinstalled before use. Protect valve flange faces and other connection surfaces from damage during lifting.

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Table 2. V260 Buried Service Extension Assembly (with Standard 8-Foot Extension) Approximate Weights

VALVE SIZE, NPS	CLASS	KEYWAY DIAMETER	APPROXIMATE WEIGHT with Bettis Actuator, kg				
			G1	G2	G3	G4	G5
6	150-600	5/8	536	541	531	557	---
8	150-600	5/8	663	668	659	684	---
10	150-600	1/4	937	942	1008	1021	---
12	150-600	1/4	1149	1154	1219	1232	1282
16	150-600	3/4	---	2716	2900	2930	2895
20	150-600	1/4	---	---	4724	4754	4719
24	150	3/4	---	---	5758	5787	5753
	300	3/4	---	---	6167	6196	6162
	600	4	---	---	7501	7578	7542
VALVE SIZE, NPS	CLASS	KEYWAY DIAMETER	APPROXIMATE WEIGHT with Bettis Actuator, lb				
			G1	G2	G3	G4	G5
6	150-600	5/8	1181	1193	1172	1228	---
8	150-600	5/8	1462	1474	1453	1509	---
10	150-600	1/4	2065	2077	2223	2250	---
12	150-600	1/4	2531	2543	2687	2714	2825
16	150-600	3/4	---	5987	6394	6459	6383
20	150-600	1/4	---	---	10414	10481	10403
24	150	3/4	---	---	12694	12760	12683
	300	3/4	---	---	13594	13660	13583
	600	4	---	---	16538	16706	16628

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Table 3. V270 Buried Service Extension Assembly (with Standard 8-Foot Extension) Approximate Weights

VALVE SIZE, NPS	CLASS	KEYWAY DIAMETER	APPROXIMATE WEIGHT with Bettis Actuator, kg					
			G1	G2	G3	G4	G5	
6	150	5/8	397	402	392	418	---	
	300		417	422	412	438		
	600		507	512	502	528		
8	150	5/8	528	533	523	549	---	
	300		573	578	568	594		
	600		688	693	683	709		
10	150	1/4	666	671	739	751	---	
	300		731	736	804	816		
	600		981	986	1054	1066		
12	150	1/4	877	883	948	961	1011	
	300		1002	1008	1073	1086	1136	
	600		1282	1288	1353	1366	1416	
14	150	3/4	---	1277	1490	1520	1485	
	300			1297	1510	1540	1505	
	600			1597	1810	1840	1805	
16	150	3/4	---	1504	1714	1744	1709	
	300			1684	1894	1925	1889	
	600			2154	2364	2395	2359	
20	150	3/4	---	2467	2673	2704	2668	
	300	1/4		2802	3008	3039	3003	
	600			3672	3878	3909	3873	
24	150	3/4	---	---	3795	3825	3789	
	300	1/2			4694	4772	4737	
	600	4			6189	6267	6232	
VALVE SIZE, NPS	CLASS	KEYWAY DIAMETER	APPROXIMATE WEIGHT with Bettis Actuator, lb					
			G1	G2	G3	G4	G5	
6	150	5/8	875	887	865	922	---	
	300		919	931	909	966		
	600		1117	1129	1107	1164		
8	150	5/8	1163	1175	1153	1210	---	
	300		1263	1275	1253	1310		
	600		1516	1528	1506	1563		
10	150	1/4	1468	1480	1629	1655	---	
	300		1611	1623	1772	1798		
	600		2162	2174	2323	2349		
12	150	1/4	1934	1946	2091	2118	2229	
	300		2210	2222	2367	2394	2505	
	600		2827	2839	2984	3011	3122	
14	150	3/4	---	2816	3285	3352	3274	
	300			2860	3329	3396	3318	
	600			3521	3990	4057	3979	
16	150	3/4	---	3316	3779	3846	3768	
	300			3713	4176	4244	4165	
	600			4749	5212	5281	5201	
20	150	3/4	---	---	5438	5893	5960	5882
	300	1/4			6177	6632	6699	6621
	600				8095	8550	8617	8539
24	150	3/4	---	---	8366	8432	8354	
	300	1/2			10348	10521	10443	
	600	4			13644	13817	13739	

Key number locations are shown in figures 5 and 6, unless otherwise noted. Throughout this manual, the component key number will be identified for clarity.

1. For the valve assembly, please reference Instruction Manual for V260 ([D102178X012](#)) or V270 ([D104297X012](#)). After valve assembly, orient the valve body with the shaft horizontal and key positioned toward the top of the shaft. Secure the body for further assembly. Lubricate and install the O-ring (key 63) on packing box housing. Take care to ensure it will not get pinched when assembled. Install the shaft key onto the valve shaft.
2. Attach the stem extension housing assembly (key 60) to mounting pad on the packing box housing of the valve assembly. Apply lubricant and install thrust bearing (key 65) into position. Fasten stem extension housing to packing box housing cap screws with washers (key 61 and 62) according to the torque values as shown in table 4 and 5.

Note

Standard Fisher live-loaded PTFE packing is composed of partially conductive packing rings (carbon-filled PTFE male and female adaptors) to electrically bond the drive shaft to the valve body. For hazardous area service, an alternate shaft-to-body bonding strap is also available by using the following step (see figure 2).

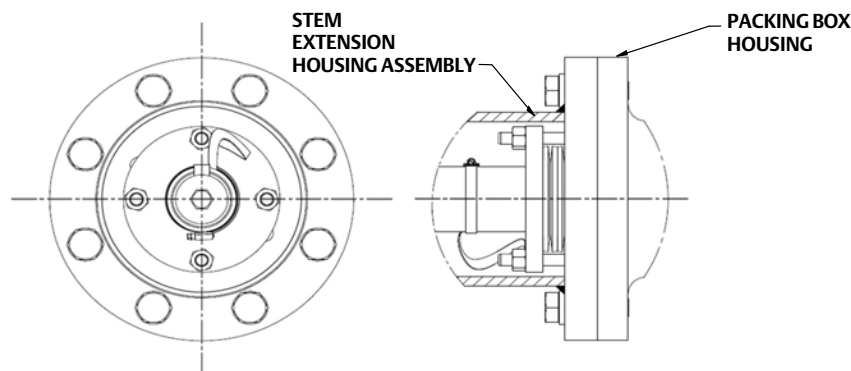
3. For hazardous area applications where redundant shaft-to-body grounding is preferred, before installing the stem extension housing assembly, attach the optional bonding strap assembly to the valve drive shaft with the clamp and connect the other end of the bonding strap assembly to the packing studs to connect with valve body as shown in figure 2.
4. Lubricate and install O-ring (key 68) into the O-ring groove on actuator adaptor end of stem extension assembly (key 64). Continue to install the stem extension assembly until it is seated against the thrust bearing. Apply lubricant to the thrust bearing (key 65) surface and insert the stem extension assembly into stem extension housing assembly (key 60). Slide the shaft into the shaft adapter on the end of stem extension assembly (key 64), take care to maintain the keyway alignment and to not damage the thrust bearing.
5. Rotate the stem extension assembly (key 64) watching the ball to ensure the keyway was aligned and seated properly.

NOTICE

Be certain the valve and adjacent pipelines are free of any foreign material that could damage the valve sealing surfaces.

6. Provide appropriate flange gaskets, and place the valve in the pipeline. Tighten flange bolting in a star pattern to ensure the flange gaskets are compressed evenly.
7. Attach actuator as described in Actuator Mounting section and applicable actuator instruction manual.

Figure 2. Optional Shaft-to-Body Bonding Strap Assembly



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Actuator Mounting

After the stem extension assembly (key 64) is installed, insert actuator key (key 69) into key slot into the actuator end of stem extension assembly. Connect with Bettis actuator, fasten cap screws and washers (key 66 and 67) according to the torque values listed in table 4 and 5.

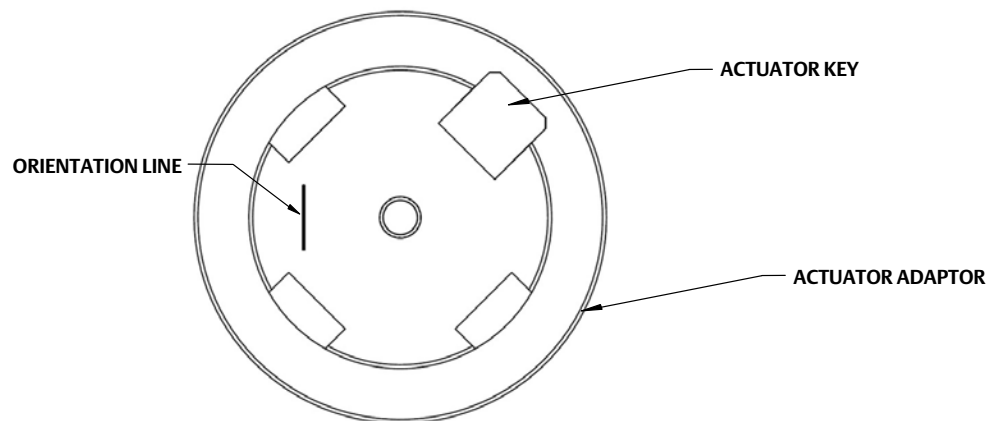
Some designs require adaptor plates to match different Bettis actuators. When adaptor plates are required, attach the adaptor plate to the actuator first, and then fasten adaptor plate/actuator assembly onto the extension housing assembly (key 60).

Two different venting plugs need to be installed after above steps completed. Apply pipe thread sealant to the threads of the Y602-12 vent assembly (key 70) and to the lower pipe plugs (key 71). Pay attention to install the Y602-12 vent assembly (key 70) on the actuator side and oriented to make the opening face downward, and vent plug (key 71) on valve body side. The Y602-12 vent assembly need be above the ground after extension assembly/valve assembly buried.

Determining Closed Position

1. To confirm proper actuator adjustment visually check the position of the ball.
2. Adjust the actuator linkage or travel stops as described in the actuator instruction manual so that at the end of stroke, the valve ball bore diameter in the full open (100%) position is in alignment and centered within the upstream and downstream valve seal inside diameters. The actuator linkage or travel stops should be adjusted so that the full closed (0%) valve position is precisely 90 degrees from the visually verified 100% open position. (See figure 3.)

Figure 3. Orientation Line Details



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Table 4. Torque Values without Adaptor Plate

Valve Size, NPS	Class	Bettis Actuator	STEM Extension Housing to Actuator				STEM Extension Housing to Packing Box Housing						
			Screw Size, in	Torque		Bolting Material	Screw Size, in	Torque		Bolting Material			
				N • m	ft • lbf			N • m	ft • lbf				
6	150-600	G1	see table 5	see table 5	see table 5	see table 5	3/4	258	190	SAE GR5			
		G2											
		G3	5/8	163	120	SAE GR5							
		G4	3/4	258	190								
8	150-600	G1	see table 5	see table 5	see table 5	see table 5					1	536	395
		G2											
		G3	5/8	163	120	SAE GR5							
		G4	3/4	258	190								
10	150-600	G1	see table 5	see table 5	see table 5	see table 5	1	536	395				
		G2											
		G3	5/8	163	120	SAE GR5							
		G4	3/4	258	190								
		G5	1	536	395								
12	150-600	G1	see table 5	see table 5	see table 5	see table 5					1-1/4	942	695
		G2											
		G3	5/8	163	120	SAE GR5							
		G4	3/4	258	190								
		G5	1	536	395								
14	150-600	G2	see table 5	see table 5	see table 5	see table 5	1	536	395				
		G3											
		G4											
		G5	1	536	395	SAE GR5							
16	150-600	G2	see table 5	see table 5	see table 5	see table 5	1	536	395				
		G3					1-1/4	942	695				
		G4											
		G5	1	536	395	SAE GR5							
20	150-600	G2	see table 5	see table 5	see table 5	see table 5	1	536	395				
		G3					1-1/4	942	695				
		G4											
		G5	1	536	395	SAE GR5							
24	150	G2	see table 5	see table 5	see table 5	see table 5	1-1/4	942	695				
		G3											
		G4											
		G5	1	536	395	SAE GR5							
	300-600	G3	see table 5	see table 5	see table 5	see table 5							
		G4											
		G5	1	536	395	SAE GR5							

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Table 5. Torque Values with Adaptor Plate

VALVE SIZE, NPS	CLASS	BETTIS ACTUATOR	STEM EXTENSION HOUSING TO ACTUATOR PLATE				ADAPTOR PLATE TO ACTUATOR						
			Screw Size, in	Torque		Bolting Material	Screw Size, in	Torque		Bolting Material			
				N • m	ft • lbf			N • m	ft • lbf				
6	150-600	G1	5/8	163	120	SAE GR5	5/8	163	120	SAE GR5			
		G2					3/4	258	190				
8	150-600	G1					5/8	163	120		5/8	163	120
		G2					3/4	258	190		3/4	258	190
10	150-600	G1					5/8	163	120		5/8	163	120
		G2					3/4	258	190		3/4	258	190
12	150-600	G1					5/8	163	120		5/8	163	120
		G2					3/4	258	190		3/4	258	190
14	150-600	G2					3/4	258	190		3/4	258	190
		G3	3/4	258	190		5/8	163	120				
		G4	1	536	395		3/4	258	190				
		G2	5/8	163	120		3/4	258	190				
16	150-600	G2	5/8	163	120		3/4	258	190				
		G3	3/4	258	190		5/8	163	120				
		G4	1	536	395		3/4	258	190				
20	150-600	G2	5/8	163	120		3/4	258	190				
		G3	3/4	258	190		5/8	163	120				
		G4	1	536	395		3/4	258	190				
24	150	G2	5/8	163	120		3/4	258	190				
		G3	3/4	258	190		5/8	163	120				
		G4	1	536	395		3/4	258	190				
	300-600	G3	3/4	258	190		5/8	163	120				
		G4	1	536	395		3/4	258	190				
		G2	5/8	163	120		3/4	258	190				

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

⚠ WARNING

Avoid personal injury or equipment damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Do not loosen any pressure retaining bolting while the valve is still pressurized. For V270, this includes the body to tailpiece nuts (key 21), packing box housing screws (key 10), packing nuts (key 36) or pipe plugs (keys 23 and 28). For V260, this includes the body hex nut (key 19), packing box housing nut (key 23), packing nuts (key 101) and pipe plug (key 25).
- Avoid injury by keeping hands, tools, and other objects away from the ball while stroking the valve.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Check the actuator cannot suddenly open or close the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- A tip over hazard exists for the valve/actuator assembly. Ensure the valve/actuator assembly is properly secured and always supported to prevent falling or rolling which may cause injury or property damage.
- Use lock-out/tag-out best practices and procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box housing may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Packing Maintenance

Refer to figure 4 for details of the enhanced ENVIRO-SEAL PTFE packing. All maintenance operations in this section may be performed on an unpressurized valve that is still installed inline and before extension assembly installed.

Note

For additional information on the live-loaded packing system refer to the enhanced ENVIRO-SEAL Packing System Instruction Manual ([D101643X012](#)).

Stopping Leakage

Optimum performance of the enhanced ENVIRO-SEAL PTFE packing system is obtained when the Belleville springs are compressed to the required “target load.” The target load is the point where the springs are compressed to 85% of their maximum deflection.

Under normal conditions, the packing nuts should not require re-tightening. However, when servicing, if the springs do not remain at the target load of 85% compression, retighten the packing box nuts per the following:

1. Tighten the packing flange nuts alternately and evenly, keeping the packing flange parallel with the valve flange (see figure 4) until the Belleville springs are compressed 100% (or completely flat).

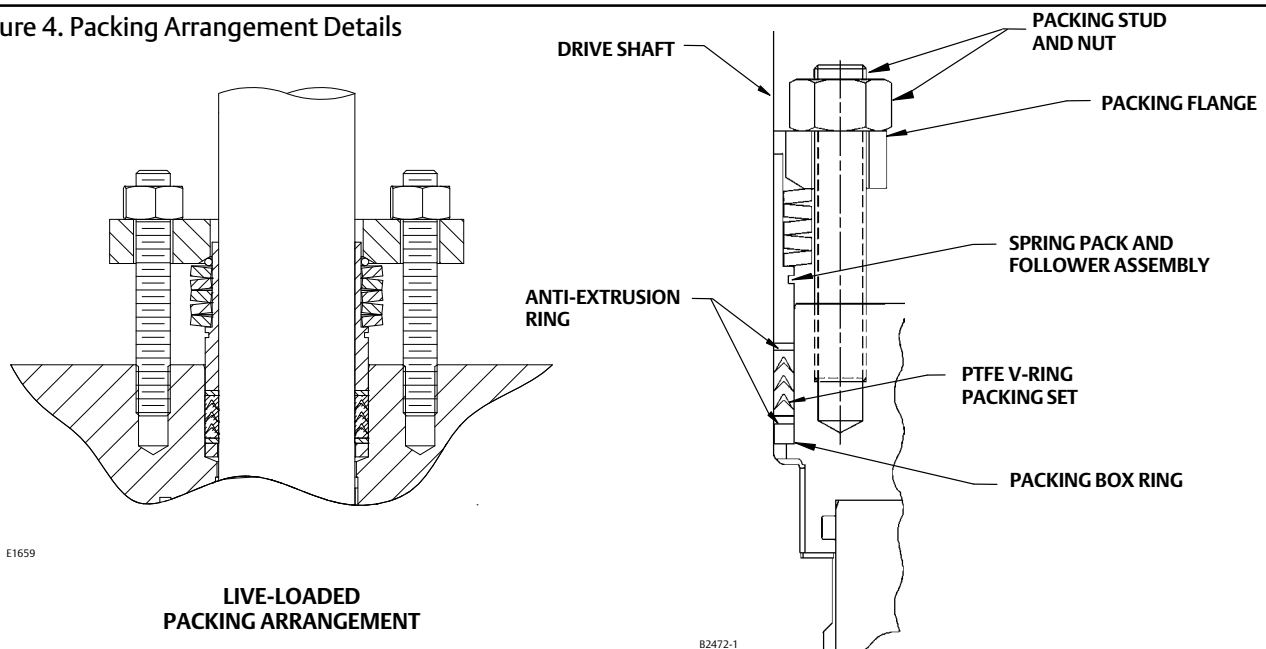
- a. For PTFE packing, loosen each packing flange nut one half turn (180° of rotation).
2. The target load of 85% compression has now been reached. If leakage continues, replace the packing components and inspect the packing box housing bore and valve drive shaft for damage as described in the following procedures.

Replacing Packing

Replacing the packing requires bleeding off the system and removing the actuator and stem extension assembly and housing from the valve. It is not necessary to remove the valve from the pipeline to adjust or replace packing, but for buried service, the stem extension assembly and housing must also be removed.

Refer to figure 4 which identifies the V270 packing components by key number.

Figure 4. Packing Arrangement Details



Packing Disassembly

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines (or other power source) to the power actuator, release pressure from the actuator, and disconnect the pressure lines from the actuator. Use lockout/tagout procedures to be sure that the above measures stay in effect while disassembling the equipment.

⚠ WARNING

- See the **WARNING** at the beginning of the Maintenance section for more information before removing the valve from the pipeline.
- Use proper lifting and rigging practices while moving the valve or valve/actuator assembly.

2. Remove line bolting, remove the control valve from the pipeline, and place the actuator/extension assembly/valve assembly on a flat surface. Position and secure the valve assembly with the shaft in the horizontal orientation.
3. To assist with future reassembly, note and mark the orientation of the actuator with respect to the extension assembly and the coupler orientation with respect to the stem extension assembly (key 64).
4. Refer to the appropriate actuator instruction manual for info on removal.
5. Remove the actuator mounting screws while properly supporting the actuator then separate the actuator from the stem extension assembly. For Fail-Open actuators, the actuator will need to be pressurized to move the valve ball to the closed position until the actuator is completely removed from the extension assembly.
6. Refer to figure 3, make the orientation line vertical to make the key position upward. Remove the extension assembly from the valve packing box housing.
7. If necessary, remove the bonding strap assembly, shown in figure 2 from the valve before removing the packing parts.
8. Remove the packing follower nuts, packing flange, and spring pack and packing follower.
9. Remove the packing parts:
 - a. If the packing box housing is mounted on the valve: Remove the packing rings from the packing box housing with an appropriate tool. Do not scratch the drive shaft or packing gland bore. Scratching these surfaces could cause leakage. Clean, inspect, and obtain replacement parts as necessary for reassembly. Examine the drive shaft and packing gland bore for any signs of damage that may prevent proper sealing.
 - b. If the packing box housing is separated from the valve (refer to V270 Instruction Manual ([D104297X012](#)) for disassembly instructions): Remove the drive shaft from the packing box housing. With the drive shaft removed, remove all internal packing parts. Clean, inspect, and obtain replacement parts as necessary for reassembly. Examine the drive shaft and packing gland bore for any signs of damage that may prevent proper sealing.

Packing Assembly

For additional information on the live-loaded packing system refer to the enhanced ENVIRO-SEAL Packing System Instruction Manual ([D101643X012](#)).

1. If the packing housing box is removed from the valve, Refer to the appropriate valve instruction manual to reinstall the drive shaft and packing box housing assembly on the valve.
2. Place the new packing components over the drive shaft and slide each into the packing box housing until properly seated at the bottom of the packing gland. Use the parts sequence shown in figure 4 and verify the Belleville springs are in the correct configuration.
3. Secure the spring pack and packing follower assembly and packing flange with the packing nuts.
4. Tighten the packing flange nuts alternately and evenly, keeping the packing flange parallel with the valve flange, until the Belleville springs are compressed 100% (or completely flat).
 - a. For PTFE packing, loosen each packing flange nut one half turn (180° of rotation).
5. If necessary, install the bonding strap assembly shown in figure 2.
6. Use the steps provided in the Installation section to install the extension assembly, and use the steps provided in the Actuator Mounting section to install the actuator. For actuator travel adjustments, refer to the appropriate actuator instruction manual.
7. When the control valve is in operation, the vent assembly (key 70) can be checked for any signs of packing leakage.

Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your [Emerson sales office](#) regarding spare parts or technical information. When ordering replacement parts, also specify the part name and desired material.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description
-----	-------------

60	Stem Extension Housing Assembly
61	Hex Head Screw Cap
62	Lock Washer
63	O-Ring

Key	Description
-----	-------------

64	Stem Extension Assembly
65	Thrust Bearing
66	Hex Head Screw Cap
67	Lock Washer
68	O-Ring
69	Actuator Key
70	Vent
71	Pipe Plug
72	Adaptor Plate
73	Hex Socket Screw Cap
74	Lock Washer

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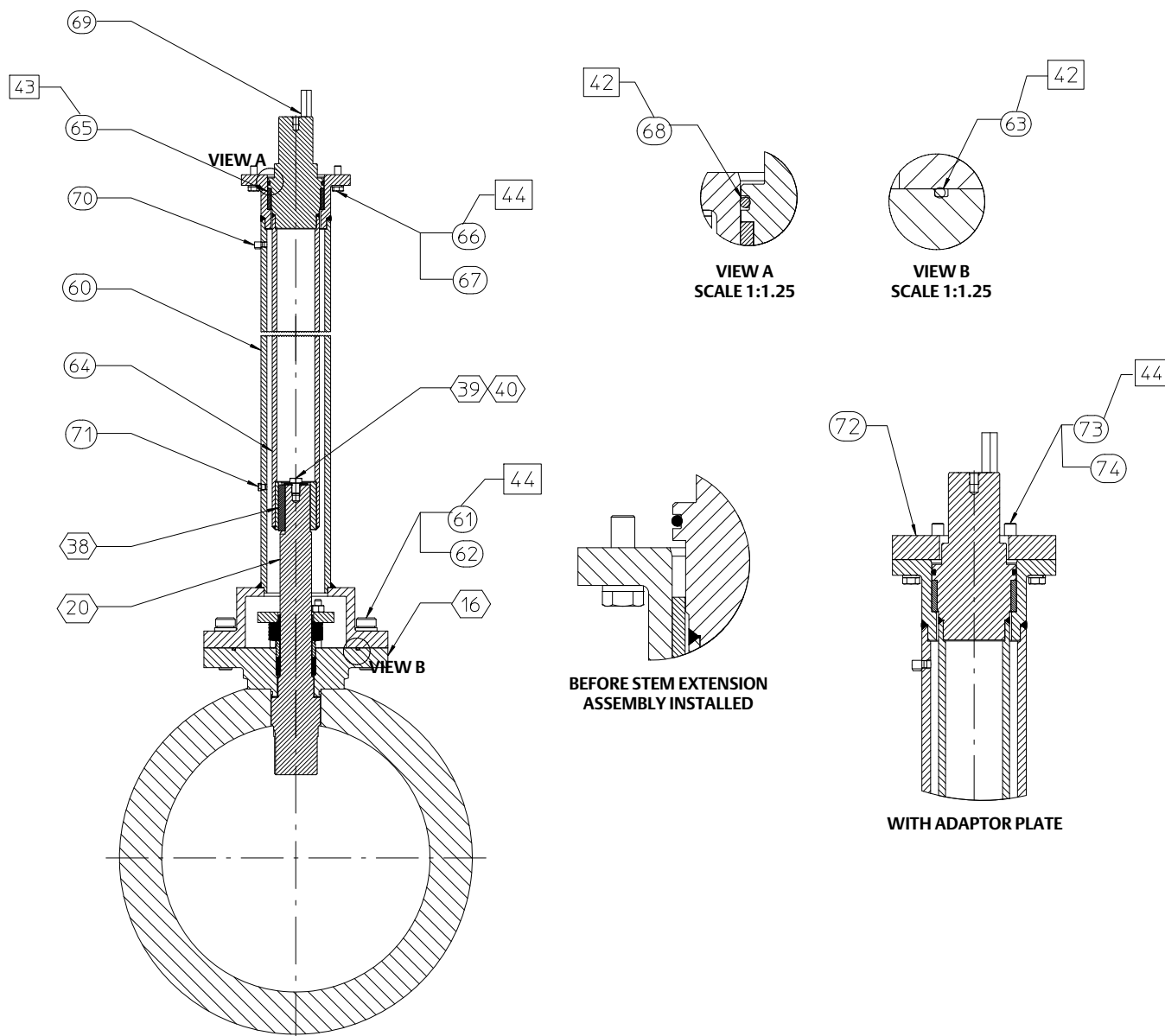
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Figure 5. Fisher V260 Buried Service Assembly



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NOTE:

- APPLY LUBRICANT AND SEE V260 INSTRUCTION MANUAL ([D102178X012](#))
- SEE V260 INSTRUCTION MANUAL ([D102178X012](#))

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

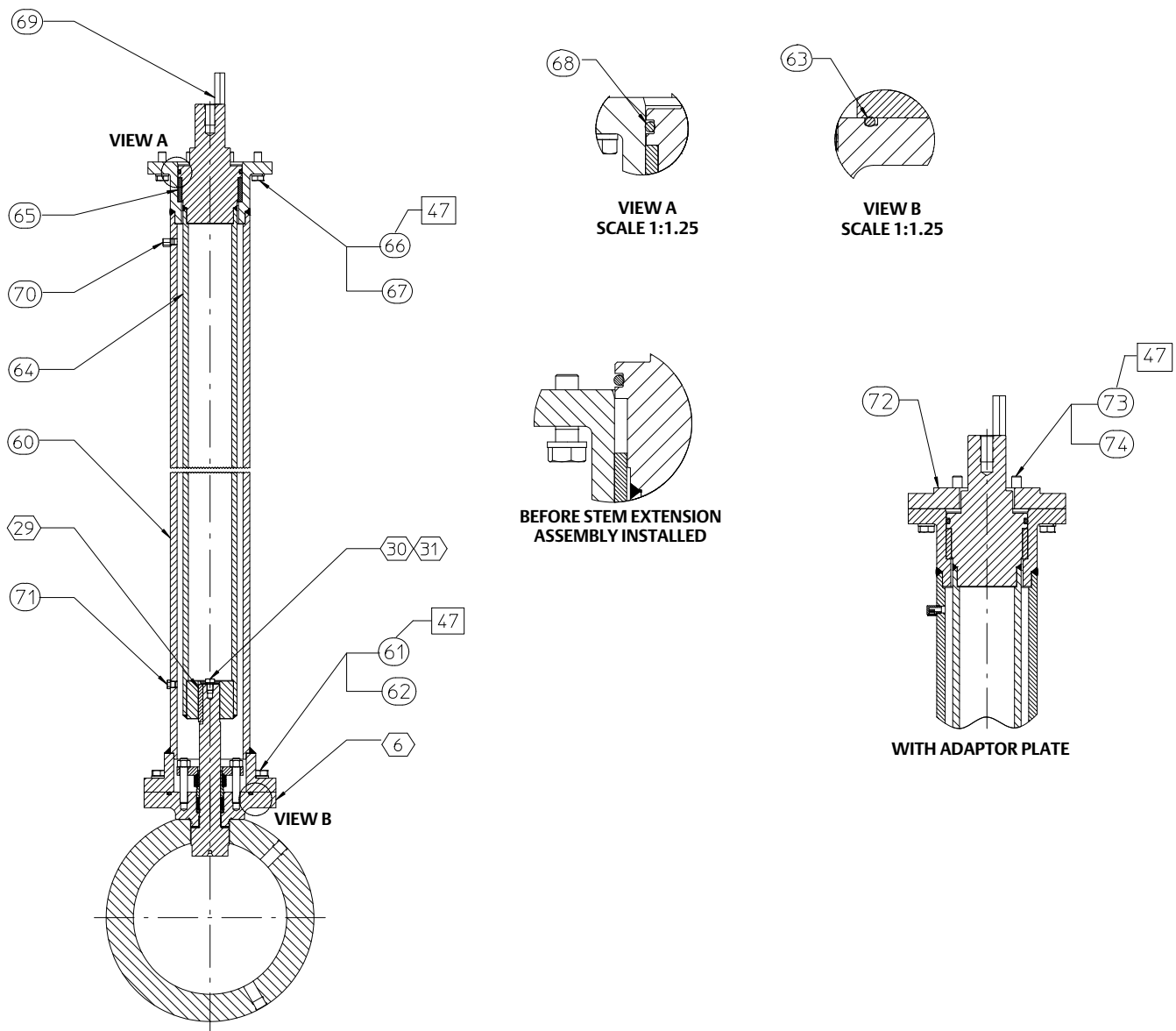
Instruction Manual

D104783X012

Buried Service

October 2024

Figure 6. Fisher V270 Buried Service Assembly



GG87627

NOTE:

- APPLY LUBRICANT AND SEE V270 INSTRUCTION MANUAL ([D104297X012](#))
- ◇ SEE V270 INSTRUCTION MANUAL (D104297X012)

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Instruction Manual

D104783X012

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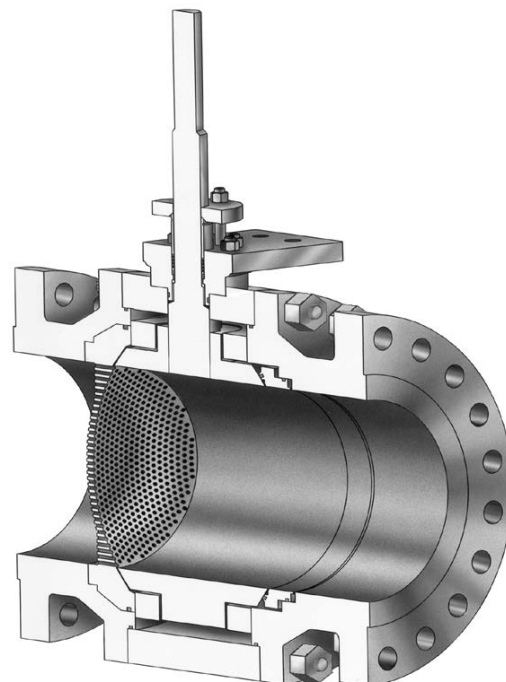


Fisher™ V260 Rotary Pipeline Ball Valve

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Figure 1. Fisher V260 Sectional View



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Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for the Fisher V260 control valve. Refer to separate manuals for information concerning the actuator, positioner, and accessories (see figure 1).

Do not install, operate, or maintain a V260 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

V260 throttling ball valves are available in single-seal, double block-and-bleed, dual-seal, and bidirectional flow constructions with or without attenuators. Valves with dome-style attenuators combine the efficiency of a rotary valve with the noise reducing capability of a special trim (figure 4). Valves without attenuators present little or no restriction to flow at full travel.

Table 1. Specifications

Valve Body Size and End Connection Styles⁽¹⁾ NPS 6, 8, 10, 12, 16, 20, and 24 flanged valves with CL150, CL300, and CL600 raised-face or ring-type joint flanges compatible with ASME B16.5. See table 2 for face-to-face dimensions. Consult factory for other pressure ratings. Maximum Inlet Pressures and Temperatures⁽¹⁾ Consistent with CL150, CL300, and CL600 pressure-temperature ratings per ASME B16.34 Maximum Allowable Shutoff Pressure Drop⁽¹⁾ For Single-Seal and Dual-Seal Construction: (Except where further limited by the pressure-temperature rating of valve body material) For LF2 valve body material: CL150: 19.6 bar (285 psi) at 38°C (100°F) CL300: 51 bar (740 psi) at 38°C (100°F) CL600: 103 bar (1480 psi) at 38°C (100°F) Seal Material and Temperature Capability⁽¹⁾ ■ POM⁽²⁾ (Standard) -29 to 82°C (-20 to 180°F) ■ PTFE/PEEK⁽²⁾⁽³⁾ (Optional) -29 to 93°C (-20 to 200°F) Flow Characteristic Modified equal percentage	Flow and Shutoff Direction Unidirectional flow for Fisher V260 is forward flow. Seal is upstream. ■ Single Seal Constructions: Should be used for unidirectional flow and unidirectional shutoff only. ■ Dual Seal Constructions: V260A and V260C may be used for unidirectional or bidirectional flow. V260B should be used for unidirectional flow only for most effective anti-cavitation protection. Bidirectional shutoff requires the dual seal construction. Shutoff Classification (per ANSI/FCI 70-2 and IEC 60534-4) Single-Seal Composition Constructions: Class IV, optional Class VI Dual-Seal Composition Constructions: Class IV, optional Class VI Maximum Ball Rotation 90 degrees Actuator Mounting Right-hand or left-hand mounted as viewed from the valve inlet for forward flow Approximate Weight See table 2
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1. The pressure-temperature limits in this instruction manual and any applicable standard or code limitation for valve should not be exceeded.

2. POM stands for polyoxymethylene, PTFE stands for polytetrafluorethylene, and PEEK stands for poly-ether-ether-ketone.

3. Temperature limits of PTFE/PEEK is limited due to standard nitrile O-ring. Contact your [Emerson sales office](#) for higher temperature options, up to 232°C (450°F).

Educational Services

For information on available courses for Fisher V260 valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

⚠ WARNING

- To avoid personal injury, always wear protective gloves, clothing, and eyewear when performing any installation operations.
- To avoid personal injury or property damage resulting from the bursting of pressure retaining parts, be certain the service conditions do not exceed the limits given in this manual.
- To avoid personal injury or property damage that can result from the sudden release of process pressure if valve or mating pipe flange pressure ratings are exceeded, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.
- Service conditions are limited for valve and trim material combinations. Do not apply any other service condition to the valve without first contacting your [Emerson sales office](#).
- Personal injury could result from packing leakage. The valve packing was tightened before shipment however, the packing might require some readjustment to meet specific service conditions.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.
- To avoid personal injury or property damage, a minimum of two swivel hoists must be used when lifting NPS 24 CL600 assemblies.

Table 2. Face-to-Face Dimensions and Approximate Weights

VALVE SIZE, NPS (CL600 ⁽¹⁾)	FACE-TO-FACE DIMENSIONS	APPROXIMATE WEIGHT
	mm	kg
6	559	311
8	661	424
10	788	653
12	840	882
16	990.6	2472
20	1144	4313
24	1397	7257
	Inches	lbs
6	22	686
8	26.04	975
10	31.04	1550
12	33.07	2025
16	39	5450
20	47	9500
24	55	16000

1. For CL150 and CL300 valves, face-to-face dimensions are the same as CL600 valves.

Key number locations are shown in figure 6, unless otherwise noted.

1. Install a three-valve bypass around the control valve assembly if continuous operation will be necessary during inspection and maintenance of the valve.
2. The valve is normally shipped as part of a control valve assembly, with an actuator mounted on the valve. The valve/actuator assembly is adjusted at the factory before the unit is shipped.

If the valve or actuator has been purchased separately or if the actuator has been removed, mount the actuator according to the Actuator Mounting section and the appropriate actuator instruction manual. Make any necessary

adjustments on the bench before installing the valve in the pipeline. With the valve in the pipeline, you cannot see the exact position of the ball to determine the fully open or closed positions.

3. Standard flow direction is shown in figure 6. If possible, install the valve in a horizontal pipeline with the drive shaft horizontal. The actuator can be right- or left-hand mounted in any of the positions shown in the actuator instruction manual. If necessary, refer to the appropriate actuator instruction manual for installation and adjustment procedures.
4. Be certain the valve and adjacent pipelines are free of any foreign material that could damage the valve sealing surfaces. Impurities or entrained solids in the process fluid could plug the passages in the trim. If the process fluid is not clean, install a filter upstream to keep the pipeline free of impurities or entrained solids.
5. Provide appropriate flange gaskets, and place the valve in the pipeline. Tighten flange bolting in a criss-cross sequence to ensure the flange gaskets are loaded evenly.

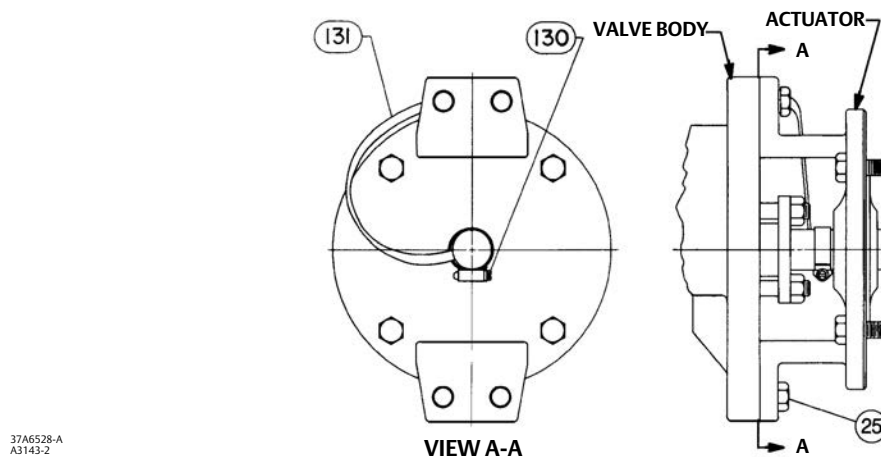
Note

Standard Fisher V260 valve packings (key 105) are composed of:

- Conductive packing ring (graphite ribbon packing), or
- Partially conductive packing rings (For example: a carbon-filled PTFE female adaptor with PTFE V-ring packing or a graphite-composition packing ring with PTFE/composition packing ring)

In order to electrically bond the drive shaft to the valve body for hazardous area service, an alternate shaft-to-body bonding strap can be provided by using the following step.

Figure 2. Optional Shaft-to-Body Bonding Strap Assembly



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6. For hazardous applications, attach the optional bonding strap assembly (key 131) to the valve drive shaft (key 6) with the clamp (key 130) and connect the other end of the bonding strap assembly to the valve body with the mounting cap screw as shown in figure 2.
7. Connect pressure lines to the actuator as indicated in the actuator instruction manual. When an auxiliary manual actuator is used with a power actuator, install a bypass valve on the power actuator (if one is not supplied) for use during manual operation.
8. If the valve has ENVIRO-SEAL™ live-loaded packing installed, an initial re-adjustment may not be required, depending on your application. See the Fisher instruction manual titled ENVIRO-SEAL Packing System for Rotary Valves ([D101643X012](#)) for packing instructions and adjustments (see figure 3).

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

Key numbers are shown in figure 6, unless otherwise noted.

⚠ WARNING

Avoid personal injury or equipment damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Dual-seal valve constructions can retain pressure and process fluid even after process pressure has been removed from both sides of the valve. Relieve this pressure before disassembling or removing the valve from the line. Take additional care if the process fluid is hot, flammable, caustic, or hazardous.
- Carefully secure the valve in an upright position. The roundness of the flanges and valve body allow it to easily roll from side-to-side. The combined weight of the valve/actuator assembly could cause injury or property damage when falling to the side.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Avoid injury by keeping hands, tools, and other objects away from the ball while stroking the valve.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- To avoid personal injury or property damage, a minimum of two swivel hoists must be used when lifting NPS 24 CL600 assemblies.

Packing Maintenance

Note

For the ENVIRO-SEAL Packing System, refer to the separate ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)), for maintenance instructions.

Stopping Leakage

For standard PTFE V-ring packing, leakage around the packing follower may be stopped by tightening the packing follower nuts.

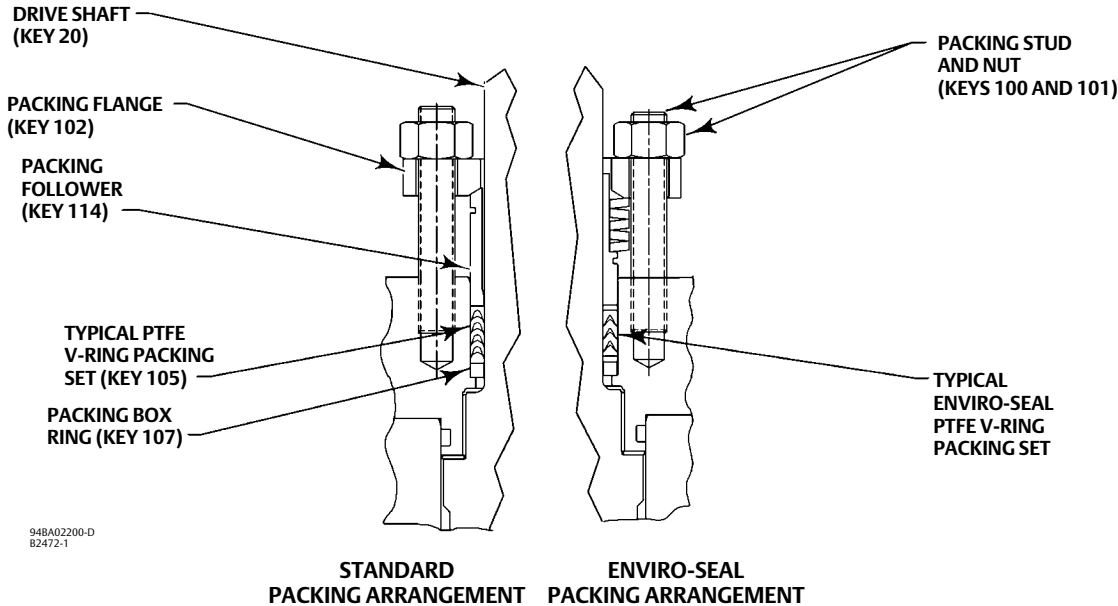
If the packing is relatively new and tight on the drive shaft, and if tightening the packing follower nuts does not stop the leakage, the drive shaft may be worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches on the packing box wall. Inspect the drive shaft and packing box wall for nicks or scratches while performing the following procedure.

Replacing Packing

Replacing the packing requires bleeding off the system and removing the actuator from the valve. Valve/actuator adjustments cannot be made correctly without observing the fully open or closed position of the ball (key 11). It is not

necessary to remove the valve from the pipeline, if care is taken to note the position and alignment of the lever and shaft and to not disturb the turnbuckle position.

Figure 3. Packing Arrangement Details



Disassembly

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines (or other power source) to the power actuator, release pressure from the actuator, and disconnect the pressure lines from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

⚠ WARNING

See the **WARNING** at the beginning of the Maintenance section for more information before removing the valve from the pipeline.

2. Remove line bolting, remove the control valve from the pipeline, and place the actuator/valve assembly on a flat surface.
3. Remove the actuator cover. Note and mark the orientation of the actuator with respect to the valve body and the lever orientation with respect to the valve drive shaft, to assist with reassembly.
4. Loosen the lever locking device cap screw. Loosening the lever turnbuckle adjustment is not necessary during disassembly. When remounting the actuator, the turnbuckle will be used for actuator adjustments.
5. Removing the actuator from the valve:
 - a. Remove the actuator mounting screws, bolts, or nuts.

CAUTION

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever or actuator off the valve shaft. Driving the lever or actuator off the valve shaft could damage the ball, seal(s), and valve.

If necessary, use a wheel puller to remove the lever or actuator from the valve shaft. Tap the wheel puller screw lightly to loosen the lever or actuator. Do not hit the screw with excessive force. Using excessive force could damage the ball, seal(s), and valve.

- b. Slide the lever along the valve shaft while removing the actuator from the valve.
6. If necessary, remove the bonding strap assembly, shown in figure 2, from the valve before attempting to remove the packing box parts.
7. Remove the packing follower nuts, packing flange, and packing follower (keys 101, 102, and 114, figure 3).
8. Remove the packing parts:
 - a. If the packing housing (key 16) is mounted on the valve: Use a formed wire hook with a sharp end to pierce the packing rings, and pull the rings out of the packing box. Do not scratch the drive shaft or packing box wall. Scratching these surfaces could cause leakage. Clean, inspect, and obtain replacement parts as necessary for reassembly.
 - b. If the packing housing is removed from the valve: Remove the drive shaft (key 20) from the packing housing. With the drive shaft removed, remove all internal parts. Clean, inspect, and obtain replacement parts as necessary for reassembly.

The packing sets (key 105) listed in the parts list do not include any metal parts. Either clean and reuse metal packing parts or obtain replacements by ordering them individually.

Assembly

If the valve is equipped with the ENVIRO-SEAL packing system, refer to the ENVIRO-SEAL Packing System Rotary Valves instruction manual ([D101643X012](#)) for assembly.

1. If the packing housing assembly (key 16) is removed from the valve, use the valve assembly steps to reinstall the drive shaft (key 20) and packing housing assembly on the valve.
2. For standard packing arrangements, install the new packing parts using the parts sequence shown in figure 3.
3. Secure the packing follower and packing flange with the packing nuts (keys 114, 102, and 101). Tighten the nuts far enough to stop leakage during operating conditions.
4. If necessary, install the bonding strap assembly shown in figure 2.
5. Use the steps provided in the Actuator Mounting section to install the actuator on the valve. For actuator travel adjustments, refer to the appropriate actuator instruction manual.
6. When the control valve is installed in the pipeline and in operation, check around the packing follower for leakage and retighten the packing nuts as necessary.

Seal Ring Maintenance

Disassembly

⚠ WARNING

For valves with dual-seals, fluid and/or a hazardous material may be trapped under pressure in the valve body cavity. To avoid personal injury, relieve the pressure, and drain any remaining fluid or hazardous material from the valve body cavity. If necessary, disassemble the valve in a safe area for cleaning.

See the WARNING at the beginning of the Maintenance section for more information before removing the valve from the pipeline.

Disassemble the valve only to the extent necessary to accomplish the needed inspection and repairs. For some repairs (for example, the trim parts only) complete disassembly of the valve is not necessary. Follow the disassembly procedures to the point necessary to accomplish the repair, then skip to the appropriate assembly steps to complete the reassembly of the valve. Always clean and protect sealing surfaces from damage.

Mark parts as necessary to allow them to be returned to the same position as removed. For example: Be sure to return the tailpiece to the same end of the valve from which it was removed. Also, the seal assembly within the tailpiece should be returned to the same tailpiece from which it was removed. The bearing plates should be marked and reinstalled on the ball in the same position as they were, when removed.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines to the power actuator, release pressure from the actuator, and disconnect the pressure lines from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove line bolting, remove the control valve from the pipeline, and clean all valve surfaces. Place the actuator/valve assembly on a flat working surface.
3. Mark parts as necessary to allow them to be returned to the same position during re-assembly.
4. Perform the procedure in the Packing Maintenance section to remove the actuator from the valve. When valve maintenance is complete, refer to the Mounting Actuator procedure at the end of the Maintenance section to re-install the actuator on the valve.
5. Provide a clean soft working surface to protect the tailpiece-flange sealing surface.
 - a. If the valve does not have an attenuator dome, lift the valve and place it on its side with either tailpiece flange resting on the flat surface. Be sure the valve is in a stable, upright position before releasing the hoist connection.
 - b. If the valve has a single attenuator dome, it is best to position the valve body so the tailpiece with the dome is in the down position. Be sure the valve is stable, in an upward position before releasing the hoist connection.

Note

If the packing is in good condition, it is possible to remove and replace the seal assembly, or dome assembly without removing the packing box assembly. However, the packing assembly must be removed to remove the ball (key 11) from the valve body.

6. Remove the packing housing nuts (key 23). Remove the packing housing assembly from the valve. The assembly includes all the packing box parts, drive shaft, O-ring seals, bearing, and other parts.
7. Remove the nuts from the studs (keys 19 and 3) to remove the tailpiece/valve connection. (Refer to figure 6).

Note

While lifting the tailpiece (key 2 or 6) from the valve body, check to see if the seal assembly is lifting with the tailpiece. (Note: Some valve constructions do not have a seal assembly installed in the tailpiece.) If it is, slide something between the ball and tailpiece to protect the ball in case the seal assembly falls out of the tailpiece.

8. If the valve has dual attenuator domes, tap the dome to loosen it from the top tailpiece before the top tailpiece is lifted from the valve body.
9. Turn the tailpiece over so the seal assembly is facing up, and place it on a clean soft surface with the flange face down.
10. For NPS 6, from the tailpiece assembly or from the valve, remove the seal assembly (key 9), wave spring (key 8), retaining ring (key 41), and o-ring seal (key 7). Clean and protect all sealing surfaces.

For NPS 8 through 24, from the tailpiece assembly or from the valve, remove the seal assembly, wave spring, and O-ring seal (keys 8 and 7). Clean and protect all sealing surfaces.

⚠ WARNING

In the next step, be sure to secure the bearing plates on the ball to prevent them from falling. When lifting the ball, the bearing plates may slide-off the ball trunnions which may cause personal injury or property damage.

11. Turn the ball (key 11) to the closed position. Use a nylon sling through the ball bore to lift the ball out of the valve body. Lift the ball and set it on a clean soft surface.
12. Remove the two bearing plates and thrust washers (key 4 and 30) from the ball (key 11). Inspect the bearing in the bearing plates and thrust washers (keys 29 and 30). If necessary, remove and replace the bearings (key 29).
13. Evenly loosen the hex nuts from the studs on the lower tailpiece (key 2 or 6). Remove the valve body from the tailpiece.
14. Remove from the tailpiece assembly, the dome assembly and/or the seal assembly, wave spring, and O-ring seal. Clean and protect all sealing surfaces.

Assembly

Be sure to replace valve parts in the same position that they were removed. Use the following suggested sequence to reassemble the valve.

Note

Clean and protect all sealing surfaces from damage while installing parts. Lubricate parts when necessary as an aid for installing parts, and to help protect sealing surfaces.

Key number locations are shown in figure 6.

1. Place the tailpiece (key 2 or 6), pipe flange end down on a clean soft surface with the seal assembly or attenuator dome cavity facing up.
2. Lubricate (key 42) and install the O-rings (key 12) on both tailpieces.

For characterized domes, install the grooved end of the dome groove pin (key 33) into the tailpiece, as far as it will go. Use only a light tapping force, taking care not to bend the pin. This groove pin will prevent the attenuator dome from rotating with respect to the tailpiece.

3. Install the inlet end attenuator dome (key 28 or 10) into the tailpiece (key 6). Use the lifting lugs in the two threaded holes for ease of handling.

For characterized attenuators, align the pin hole in the dome with the groove pin (key 33) placed in the tailpiece in step 3. High Density attenuators don't require this orientation.

4. For NPS 6 dual seal V260A or V260B constructions, install the the retaining ring (key 41) into the tailpiece (key 6). Take care not to damage the sealing surface of the tailpiece.

For NPS 8 through 24 dual seal V260A or V260B constructions, lubricate (key 42) and install the O-ring (key 15) on the dome spacer (key 13). If a dual dome is being assembled, install the dome spacer into the tailpiece, using the two threaded holes as lifting lugs.

5. Apply thread locking adhesive (key 45) to and install the two cap screws (key 36) that hold the washers (key 37) which help retain the dome or dome spacer (if applicable) in the tailpiece.

For constructions with dual dome and/or dual seals, lubricate (key 42) and install the O-ring (key 7) in the groove on the inlet seal (key 9). Install the wave spring (key 8) over the end of the seal. Install the seal assembly O-ring (key 7) between the dome spacer and the dome (key 10).

Note

Verify that the ball opens into the dome windows last. (See figure 5)

If not, remove the dome and tailpiece and turn it 180 degrees to allow the windows to open last.

6. Install the grooved end of the groove pins (key 5) into the bearing plates (key 4) as far as they will go. Use only a light tapping force, taking care not to bend the pins.
7. Apply dry film lubrication (key 43) between the trunnion surfaces on the ball and the trunnion bearings.
8. Install new bearings (key 29) in the bearing plates (key 4).

WARNING

In the next step, be sure to secure the bearing plates on the ball to prevent them from falling. When lifting the ball, the bearing plates may slide off the ball trunnions which may cause personal injury or property damage.

9. Lift the ball with a nylon sling through the bore and turn the ball until the port and trunnions are horizontal.
10. Slide one ball thrust washer (key 30) onto each side of the ball trunnions, and install a bearing plate (key 4) on each side of the ball trunnions.
11. Carefully lower the ball and bearing plates onto the lower (inlet) tailpiece taking care not to damage the ball surface.
While lowering the ball, guide the groove pins in the bearing plates into their proper location in the tailpiece. To determine the proper location for Right Hand Mounting, turn the splined trunnion so that it is on your right hand side when the attenuator dome is in front of you and the bottom of the valve is nearest you.
12. Install the grooved end of the groove pin (key 18) into the valve body, as far as it will go. Use only a light tapping force, taking care not to bend the pin. Apply lubricant (key 44) and install the body studs (key 3) in the valve body and install two swivel hoists for lifting the valve body.
13. Lift the valve body, using the swivel hoists, so it is centered over the ball and bearing plates. Be sure the shaft hole is aligned with the splined trunnion on the ball. When lowering the valve body, take care not to damage the ball. Guide the groove pins in the valve body into their proper location in the tailpiece.
14. Install the hex nuts (key 19) on the studs (key 3) and hand-tighten them.
15. Lubricate (key 42) and install the O-ring (key 14) on the packing housing (key 16). Install the shaft bearing (key 32) in the packing box housing.
16. Install the packing housing studs (key 22) in the valve body.
17. Apply anti-seize lubricant (key 44) to the large spline on the shaft. Line-up the missing spline tooth with the appropriate space in the ball, and install the drive shaft (key 20) into the ball.
18. Install the shaft thrust washer (key 24) onto the shaft.

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Instruction Manual

D102178X012

V260 Valve

December 2018

19. Install the packing housing (key 16) and nuts (key 23), and tighten them evenly. Orient the length of the packing box housing perpendicular to the bore of the valve body.

⚠ WARNING

Refer to table 3 for bolt torque requirements. Exceeding any torque requirements could damage the valve and impair safe operation.

Table 3. Torque Values

VALVE SIZE, NPS	PRESSURE RATING	VALVE BODY HEX NUT (KEY 19)		MOUNTING FLANGE HEX NUT (KEY 23)	
		N•m	lbf-ft	N•m	lbf-ft
6	CL150	375	277	271	200
	CL300	525	387		
	CL600	710	524		
8	CL150	393	290		
	CL300	549	405		
	CL600	746	550		
10	CL150	549	405		
	CL300	746	550		
	CL600	990	730		
12	CL150	549	405		
	CL300	990	730		
	CL600	990	730		
16	CL150	746	550	746	550
	CL300	1750	1290		
	CL600	1750	1290		
20	CL150	990	730	990	730
	CL300	2237	1650		
	CL600	3470	2560		
24	CL150	1749	1290	990	730
	CL300	3470	2560	990	730
	CL600	6088	4490	1749	1290

20. Assemble the seal and install the second tailpiece using the following steps.

For dual seal and dual dome constructions, it is easier to lay the valve assembly on its side while installing the second tailpiece.

21. For NPS 6 install the dome, retaining ring, and alignment groove pin in the tailpiece.

For NPS 8 through 24 install the dome, dome spacer, and alignment groove pins (if a characterized attenuator is used) in the tailpiece.

22. Lubricate (key 42) and install the seal assembly O-ring (key 7) in the groove of the seal as shown in figure 6.

23. Install the wave spring (key 8) over the end of the seal (key 17 or 9). Note that the spring is not required with the attenuator dome (key 28, figure 6).

24. For single seal constructions, place the seal ring assembly into the tailpiece, taking care not to damage the O-ring (key 7) while sliding it into the tailpiece. Also, be careful to protect all sealing surfaces.

For dual seal constructions, place the seal assembly (key 17) into the dome, dome spacer and tailpiece.

25. Lift the second tailpiece assembly and align it with the valve body studs and pins. Slide the tailpiece onto the studs and bearing plate pins. The groove pins in the valve body should be guided into the pin holes in the tailpiece. Pull it up tightly, taking care not to damage the tailpiece O-ring as it is pulled into the valve body.

26. Install the hex nuts (key 19) on the studs (key 3) and hand-tighten them. Torque all the hex nuts evenly.

⚠ WARNING

Refer to table 3 for bolt torque requirements. Exceeding any torque requirements could damage the valve and impair safe operation.

27. Refer to the Packing Maintenance section to install the packing parts.

Actuator Mounting

Use the appropriate actuator instruction manual when mounting the actuator or changing actuator styles and positions.

Determining Mounting Position

The actuator can be either right- or left-hand mounted.

Note

Right-hand mounting means that the actuator is mounted on the right side of the valve when viewed from the valve inlet.

Left-hand mounting means that the actuator is mounted on the left side of the valve when viewed from the valve inlet.

Right- or left-hand mounting can change the actuator action from push-down-to-close to push-down-to-open, or vice-versa.

Determining Closed Position

1. You must remove the valve from the pipeline to check the position of the ball.
2. Adjust the actuator linkage or travel stops as described in the actuator instruction manual. Adjust the actuator so that the valve ball will be fully open or closed when the actuator is at the end of its stroke, depending on the actuator action selected.

Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your [Emerson sales office](#) regarding spare parts or technical information. When ordering replacement parts, also specify the part name and desired material.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 4. Ball Attenuator Construction Details

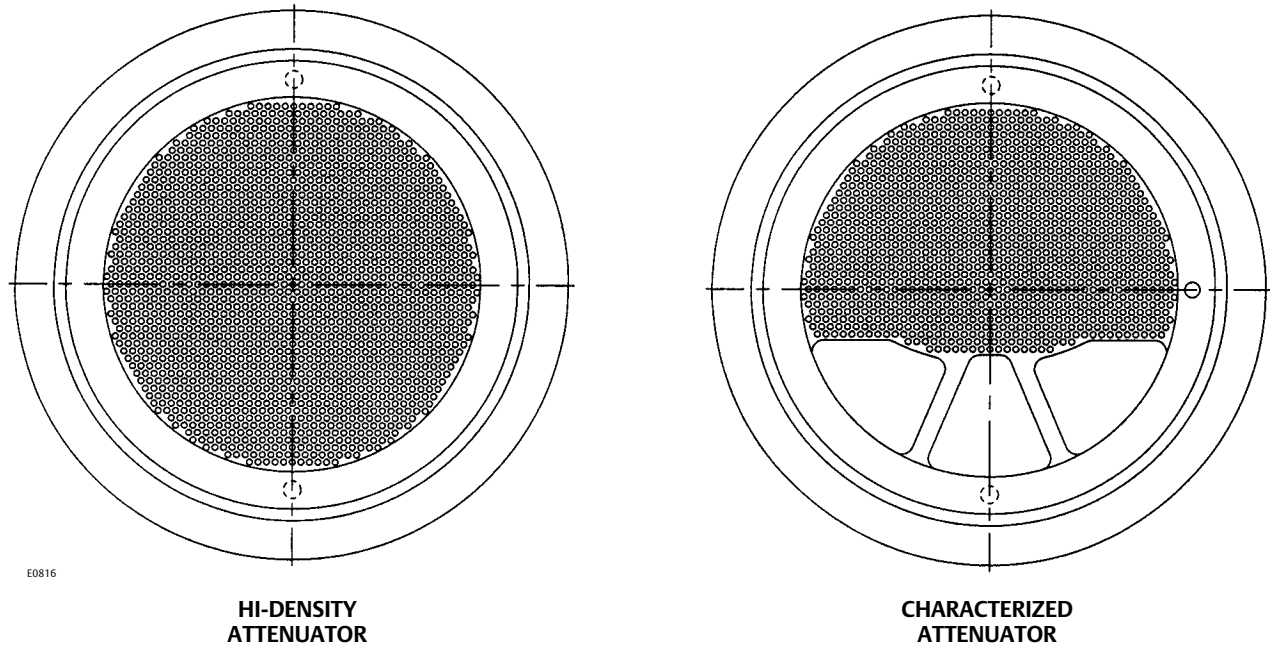
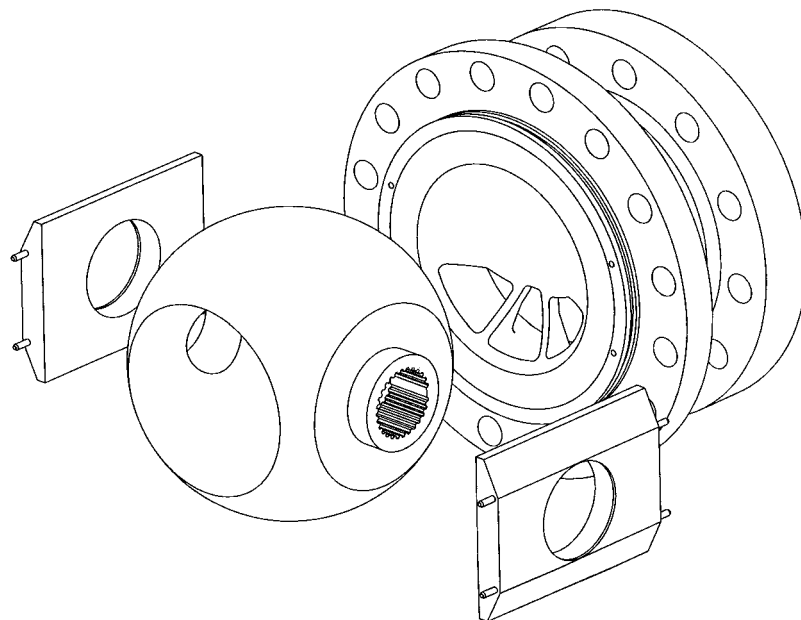


Figure 5. Exploded View of Dome, Ball, Tailpiece and Bearing Plates



Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering Information.

Key	Description
-----	-------------

1	Valve Body If you need a valve body as a replacement part, order the valve size, pressure rating, serial number, and desired material. Contact your Emerson sales office.
2	Inlet Tailpiece
3	Body Stud
4	Bearing Plate (2 req'd)
5	Dowel Pin (8 req'd)
6	Outlet Tailpiece (same as inlet for NPS 6)
7*	Seal Assembly O-ring (1 req'd for single, 2 req'd for dual seal)
8	Wave Spring (1 req'd for single, 2 req'd for dual-seal)
9*	Outlet Seal Assembly (same as inlet for NPS 6)
10	Attenuator Dome for Dual Seal
11	Ball
12*	Tailpiece O-ring (2 req'd)
13	Dome Spacer (NPS 8 through 24)
14*	Packing Box O-ring
15	Dome Spacer O-ring (NPS 8 through 24)
16	Packing Box Housing

Key	Description
-----	-------------

17*	Inlet Seal Assembly
18*	Dowel Pin (4 req'd)
19	Body Hex Nut
20	Drive Shaft
21	Actuator Mounting Cap Screw (4 req'd)
22	Packing Housing Stud, Steel
23	Packing Housing Nut, Steel
24*	Shaft Thrust Washer
25	Pipe Plug (not shown)
26	Flow Arrow
27	Drive Screw, for nameplate
28	Attenuator Dome for Single Seal
29*	Trunnion Bearing (2 req'd)
30*	Ball Thrust Washer (2 req'd)
32*	Shaft Bearing
33	Pin, Attenuator Dome (not shown)
34	Nameplate (not shown)
36	Drive Screw (not shown)
37	Washer (not shown)
38	Square Key (Keyed Shaft only)
39	Flat Washer (Keyed Shaft only)
40	Hex Head Screw Cap (Keyed Shaft only)
41	Retaining Ring (NPS 6)
42	Lubricant, Silicon Grease
43	Lubricant, Dry Film
44	Lubricant, Anti-seize
45	Lubricant, Loctite
100	Packing Stud (2 req'd for NPS 6-12, 4 req'd for NPS 16-24)
101	Packing Nut (2 req'd for NPS 6-12, 4 req'd for NPS 16-24)
102	Packing Flange
105*	Packing Set ENVIRO-SEAL PTFE/Carbon-Filled PTFE Standard PTFE/Carbon Filled PTFE
106	Anti-Extrusion Ring, PTFE
107	Packing Box Ring
116	Clamp (grounding strap assembly)
117	Grounding Strap Assembly

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

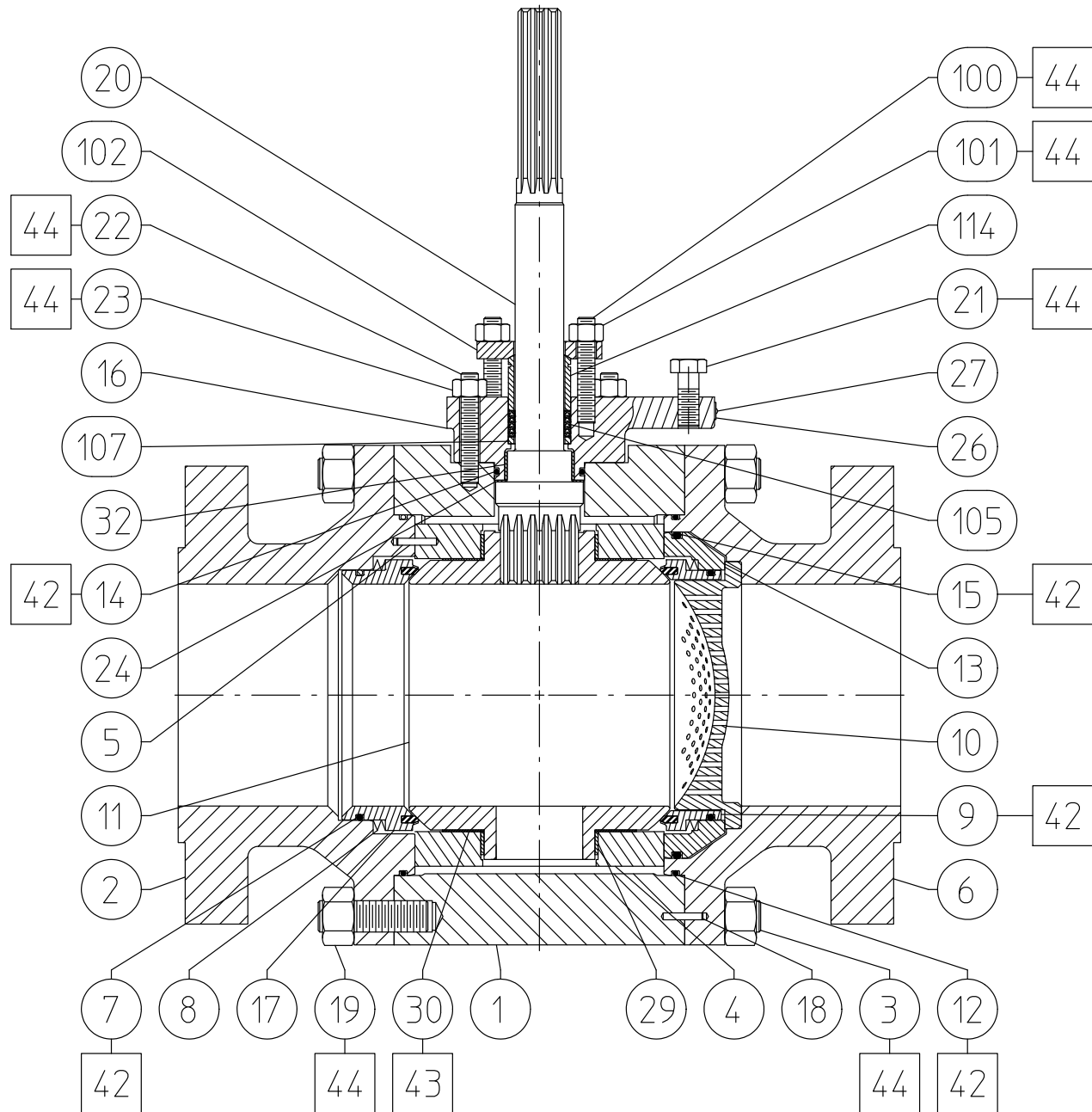
Instruction Manual

D102178X012

V260 Valve

December 2018

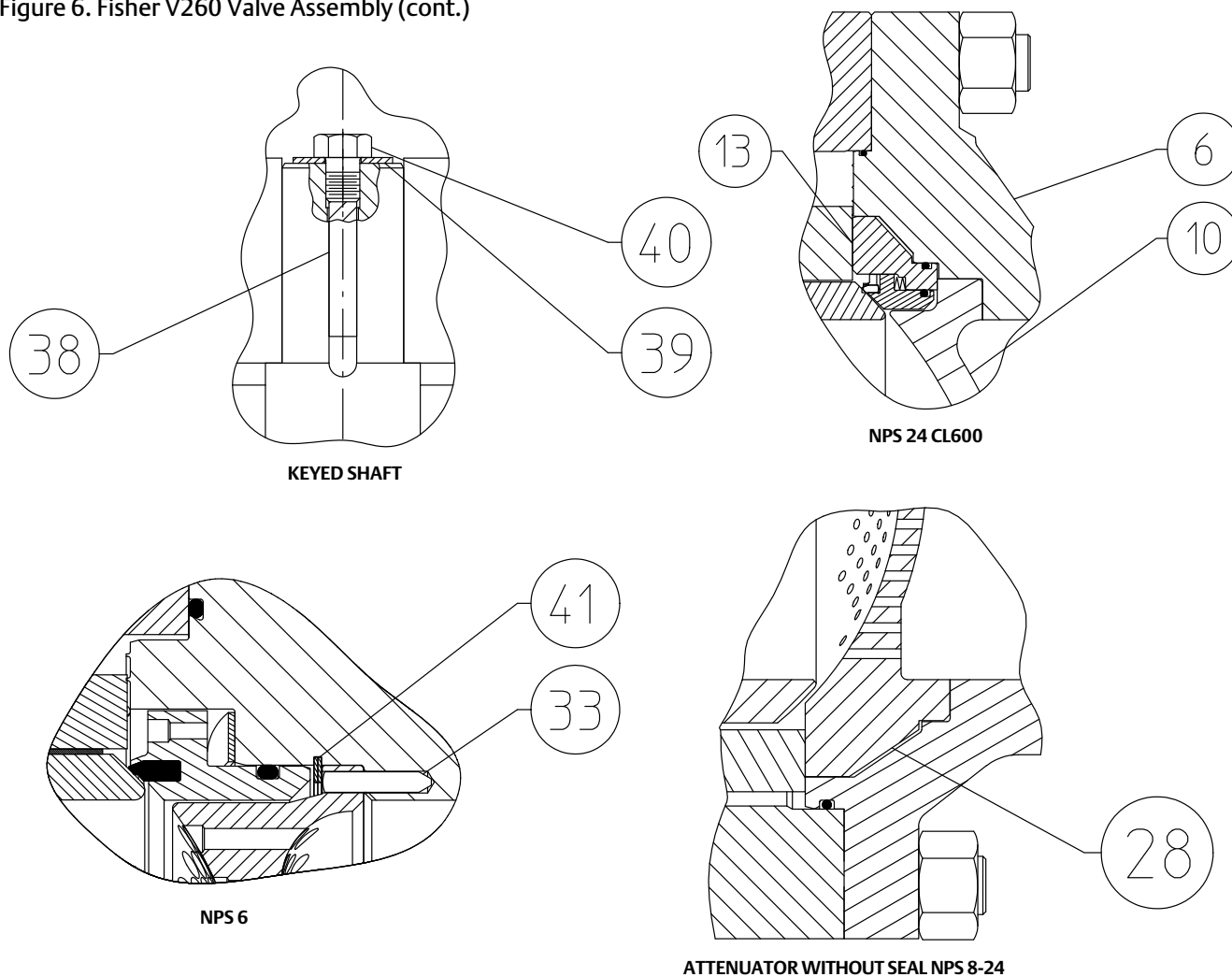
Figure 6. Fisher V260 Valve Assembly



5489811-F

☐ APPLY LUB

Figure 6. Fisher V260 Valve Assembly (cont.)



5489811-F

☐ APPLY LUB

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Fisher™ V280 Full-Bore Ball Control Valve

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Figure 1. Fisher V280 Control Valve



X1611

Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for the Fisher V280 Full-Bore Ball control valve (see figure 1). Refer to separate manuals for information concerning the actuator, positioner, and accessories.

Do not install, operate, or maintain a V280 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The Fisher V280 is a three-piece, trunnion mounted, full-bore control valve designed with features for optimized pressure, flow, and process control. The V280 comes standard as a single-seal construction with optional dual-seal construction allowing for bidirectional flow and double block-and-bleed operation, with or without attenuation. Valve constructions with attenuators combine the efficiency of a rotary valve with the noise reducing capability of a special trim. Valve constructions without attenuators present little or no restriction to flow at full travel. The V280 construction meets ANSI/NACE MR0175/ISO 15156 as standard.

Specifications

Valve Sizes and End Connection Styles

NPS ■ 6, ■ 8, ■ 10, ■ 12, and ■ 16 flanged valve size with CL900 raised-face flanges compatible with ASME B16.5. Consult your [Emerson sales office](#) for other end connection styles

Maximum Inlet Pressure and Temperatures⁽¹⁾

Consistent with CL900 pressure-temperature ratings per ASME B16.34

Maximum Allowable Shutoff Pressure Drop⁽¹⁾

For Single-Seal and Dual-Seal Construction (except where further limited by pressure-temperature rating of the valve body):

CL900: 153.2 bar (2220 psig) at 38°C (100°F)

Shutoff Classifications

Single or Dual-Seal Construction

Class IV standard: ANSI/FCI 70-2 and IEC 65034-4

Class VI optional: ANSI/FCI 70-2 and IEC 65034-4

Flow Characteristic

- Modified linear with single high-density attenuator
- Modified equal percentage with single characterized attenuator
- Modified equal percentage without attenuator

Flow and Shutoff Direction

Unidirectional flow is forward flow. Seal is upstream

Single Seal Construction: Should be used for unidirectional flow and unidirectional shutoff only

Dual Seal Construction: V280 with Aerodome and unattenuated V280 may be used for unidirectional and bidirectional flow

V280 with Hydrodome should be used for unidirectional flow only for effective anti-cavitation protection. Bidirectional shutoff requires dual seal construction

Flow Coefficients

See Fisher [Catalog 12](#)

Seal Material and Temperature Capabilities⁽¹⁾

Standard: POM (polyoxymethylene) -29 to 82°C (-20 to 180°F)

Optional: POM (polyoxymethylene) with Nitrile MoS₂ Impregnated O-rings -46 to 82°C (-50 to 180°F) or PTFE/PEEK⁽²⁾ with fluorocarbon O-rings -23 to 204°C (-10 to 400°F)

Maximum Ball Rotation

90°

Actuator Mounting

Right-hand or left-hand mounted as viewed from the valve inlet from forward flow

Packing Arrangements

PTFE Packing: Standard construction

ENVIRO-SEAL™ Packing: This optional packing system provides improved sealing, guiding, and transmission of loading force to control liquid and gas emissions

Approximate Weights

See table 2

Options

- Double block-and-bleed applications (Dual seal construction is required)
- Two or three-stage Aerodome attenuator, two-stage or three-stage Hydrodome attenuator
- Ring type joint flanges
- Inconel drive shaft
- Keyed shaft
- Nitrile MoS₂ Impregnated O-rings
- S31600 SST ENC ball
- PTFE/PEEK seal insert
- Contact your Emerson sales office for other options

1. The pressure or temperature limits in this bulletin and any applicable standard or code limitation for this valve should not be exceeded.

2. PTFE stands for Polytetrafluoroethylene and PEEK stands for PolyEtherEtherKetone.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104425X012

V280 Valve

August 2019

Table 1. Standard Materials of Construction

Part	Material
Valve Body	LF2 Carbon Steel
Ball	Carbon Steel ENC
Seal	POM with S31600 SST Seal Blank
Drive Shaft	S17400 SST H1150D
Dome Attenuator	S17400 SST
Wave Spring	N07750
Retaining Ring	N07750
Tailpiece	LF2 Carbon Steel
Tailpiece Mounting Bolting	B7M Steel
Bearing Plate	Carbon Steel
Bearings	N04400 with PTFE
Thrust Washer	Carbon filled PTFE
Packing Box Housing	Carbon Steel
Packing	PTFE/Carbon filled PTFE
Packing Bolting	B7M Steel
Packing Follower, Packing Box Ring	Annealed S31600 SST
Groove Pins	S31600
O-Rings	Nitrile
Actuator Mounting Bolting	Steel Grade 5

Table 2. Face-to-Face Dimensions⁽¹⁾ and Approximate Weights

VALVE SIZE, NPS	CLASS	FACE-TO-FACE DIMENSION		APPROXIMATE WEIGHT	
		mm	Inches	kg	lbf
6	900	610	24.00	415	915
8		737	29.00	753	1660
10		838	33.00	1143	2520
12		965	38.00	1823	4020
16		1130	44.50	2885	6360

1. Dimensions per ASME B16.10-2017.

Educational Services

For information on available courses for Fisher V280 valves, as well as a variety of other products, contact:

Emerson Automation Solutions
 Educational Services - Registration
 Phone: 1-641-754-3771 or 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

⚠ WARNING

- To avoid personal injury, always wear protective gloves, clothing, and eyewear when performing any installation operations.
- To avoid personal injury or property damage resulting from the bursting of pressure retaining parts, be certain the service conditions do not exceed the limits given in this manual.
- To avoid personal injury or property damage that can result from the sudden release of process pressure if valve or mating pipe flange pressure ratings are exceeded, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.
- Service conditions are limited for valve and trim material combinations. Do not apply any other service conditions to the valve without first contacting your [Emerson sales office](#).
- Personal injury could result from packing leakage. See the Packing Maintenance section for adjustment information.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.
- Use proper lifting and rigging practices while moving the valve or valve/actuator assembly.

Key number locations are shown in figure 4 unless otherwise noted. Throughout this manual, the component key number will be identified for clarity.

1. Install a three-valve bypass around the control valve assembly if continuous operation will be necessary during inspection and maintenance of the valve.
2. The valve is normally shipped as part of a control valve assembly, with a factory adjusted actuator mounted on the valve. If the valve or actuator has been purchased separately, or if the actuator has been removed, refer to the Actuator Mounting section and the appropriate actuator instruction manual for installation and adjustment procedures.
3. The standard valve construction allows uni-directional flow. If possible, install the valve in a horizontal pipeline with the drive shaft (key 20) horizontal. The actuator can be right- or left-hand mounted in any of the positions shown in the actuator instruction manual.

CAUTION

Be certain the valve and adjacent pipelines are free of any foreign material that could damage the valve sealing surfaces.

Impurities or entrained solids in the process fluid could plug the passages in the trim. If the process fluid is not clean, install a filter upstream to keep the pipeline free of impurities or entrained solids.

4. Provide appropriate flange gaskets, and place the valve in the pipeline. Tighten flange bolting in a star pattern to ensure the flange gaskets are compressed evenly.

Note

Standard Fisher V280 valve packings (key 105) are composed of:

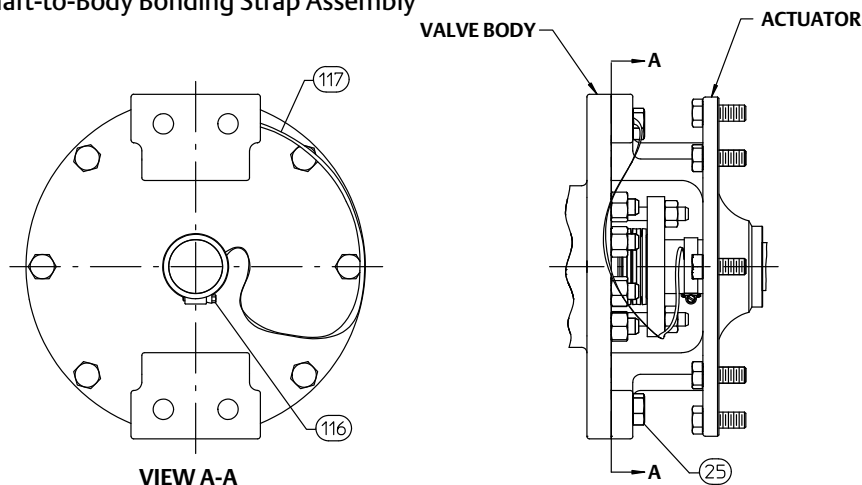
- Conductive packing ring (graphite ribbon packing), or

- Partially conductive packing rings (for example: a carbon-filled PTFE female adaptor with PTFE V-ring packing or a graphite-composition packing ring with a PTFE/composition packing ring).

To electrically bond the drive shaft to the valve body for hazardous area service, an alternate shaft-to-body bonding strap can be provided by using the follow step (see figure 2).

- For hazardous area applications where redundant shaft-to-body grounding is preferred, attach the optional bonding strap assembly (key 117) to the valve drive shaft (key 20) with the clamp (key 116) and connect the other end of the bonding strap assembly to the valve body with the mounting cap screw (key 25) as shown in figure 2.

Figure 2. Optional Shaft-to-Body Bonding Strap Assembly



GH02761

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

⚠ WARNING

Avoid personal injury or equipment damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Do not loosen any pressure retaining bolting while the valve is still pressurized. This includes the body-to-tailpiece nuts (key 18), packing box housing nuts (key 21), packing nuts (key 101) or pipe plug (keys 26).
- Avoid injury by keeping hands, tools, and other objects away from the ball while stroking the valve.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Check that the actuator cannot suddenly open or close the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure, relieve any process pressure from both sides of the valve body, and drain the process media from both sides of the valve.

- **Dual-seal constructions can retain pressure and process fluid even after process pressure has been removed from both sides of the valve. The ball should be partially opened to relieve this pressure before disassembling or removing the valve from the line. Take additional care if the process fluid is hot, flammable, caustic, or hazardous.**
 - **A tip over hazard exists for the valve/actuator assembly. Ensure the valve/actuator assembly is properly secured and always supported to prevent falling or rolling which may cause injury or property damage.**
 - **Use lock-out/tag-out best practices and procedures to be sure that the above measures stay in effect while you work on the equipment.**
 - **The valve packing box housing may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.**
 - **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**
-

Packing Maintenance

Refer to figure 3 for details of the standard PTFE V-ring packing (left) and the ENVIRO-SEAL packing system (right). All maintenance operations in this section may be performed on an unpressurized valve that is still installed inline.

Note

For additional information on the ENVIRO-SEAL packing system refer to the ENVIRO-SEAL Packing System Instruction Manual ([D101643X012](#)).

Stopping Leakage

For standard PTFE V-ring packing, leakage around the packing follower may be stopped by tightening the packing follower nuts. If the packing is relatively new and tight on the drive shaft, and if tightening the packing follower nuts does not stop the leakage, the drive shaft may be worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches on the packing box housing packing gland bore.

For ENVIRO-SEAL packing, optimal performance is obtained when the Belleville springs are compressed to the required target load. The target load is the point where the springs are compressed to 85% of their maximum deflection.

Under normal conditions, the packing nuts should not require re-tightening. However, when servicing, if the springs do not remain at the target load of 85% compression, retighten the packing nuts (key 101) per the following:

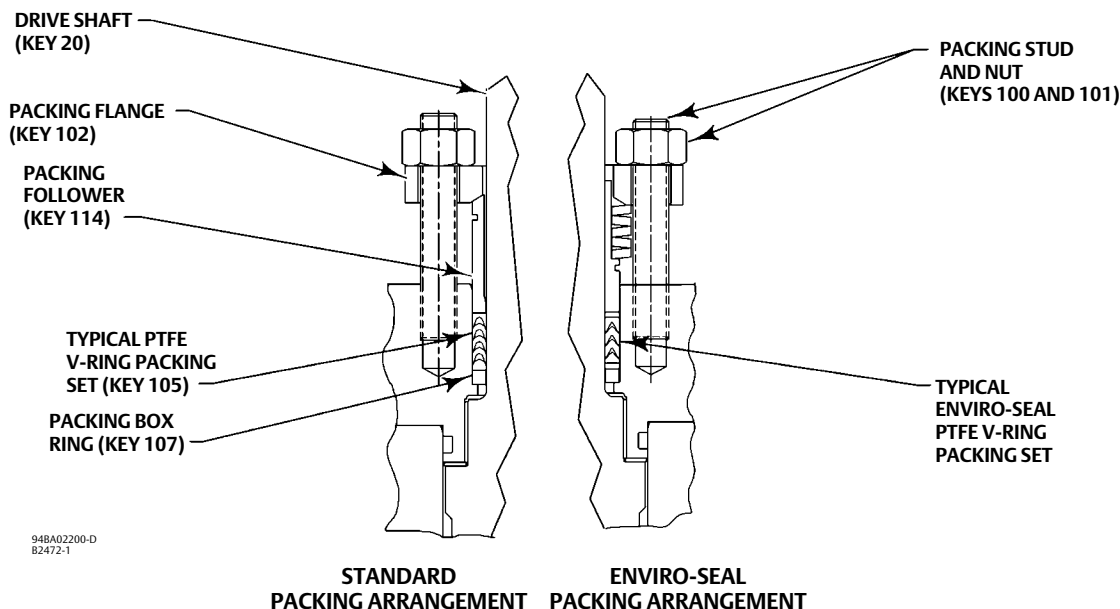
1. Tighten the packing flange nuts (key 101) alternately and evenly, keeping the packing flange parallel with the valve flange (see figure 3), until the Belleville springs are compressed 100% (or completely flat).
 - a. For PTFE packing, loosen each packing flange nut one half turn (180° of rotation).
2. The target load of 85% compression has now been reached. If leakage continues, replace the packing components and inspect the packing box housing, packing gland bore, and valve drive shaft for damage as described in the following procedures.

Replacing Packing

Replacing the packing requires bleeding off the system and removing the actuator from the valve. Valve/actuator adjustments cannot be made correctly without observing the fully open or closed position of the valve ball (key 3). It is not necessary to remove the valve from the pipeline to make adjustments if care is taken to note the position and alignment of the actuator lever and valve shaft and to not disturb the actuator turnbuckle position.

Refer to figure 3 which identifies the V280 packing components by key number (also see the Parts List section of this manual).

Figure 3. Packing Arrangement Details



Packing Disassembly

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines (or other power source) to the power actuator, release pressure from the actuator, and disconnect the pressure lines from the actuator. Use lockout/tagout procedures to be sure that the above measures stay in effect while disassembling the equipment.

⚠ WARNING

- See the **WARNING** at the beginning of the Maintenance section for more information before removing the valve from the pipeline.
- Use proper lifting and rigging practices while moving the valve or valve/actuator assembly.

2. Remove line bolting, remove the control valve from the pipeline, and place the actuator/valve assembly on a flat surface.
3. To assist with future reassembly, note and mark the orientation of the actuator with respect to the valve body and the actuator lever orientation with respect to the valve drive shaft.
4. Refer to the appropriate actuator instruction manual for information on removal.

CAUTION

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever or actuator off the valve drive shaft (key 20). Driving the lever or actuator off the valve drive shaft could damage the ball, seals, and valve.

If necessary, use a wheel puller to remove the lever or actuator from the valve drive shaft. Tap the wheel puller screw lightly to loosen the lever or actuator. Do not hit the screw with excessive force. Using excessive force could damage the ball, seal, and valve.

5. Loosen the actuator lever locking device cap screw. Loosening the lever turnbuckle adjustment is not necessary during disassembly. When remounting the actuator, the turnbuckle will be used for actuator adjustments.
6. Remove the actuator mounting screws, bolts, or nuts while properly supporting the actuator and separate the actuator and mounting bracket from the valve.
7. Slide the lever along the valve drive shaft (key 20) while removing the actuator from the valve.
8. If necessary, remove the bonding strap assembly, shown in figure 2 from the valve before removing the packing parts.
9. Remove the packing follower nuts, packing flange, spring pack (only applicable to ENVIRO-SEAL), and packing follower (keys 101, 102, and 114).
10. Remove the packing parts:
 - a. If the packing box housing (key 6) is mounted on the valve: Use a formed wire hook with a sharp end to pierce the packing rings, and pull the rings out of the packing box housing. Do not scratch the drive shaft or packing gland bore. Scratching these surfaces could cause leakage. Clean, inspect, and obtain replacement parts as necessary for reassembly. Examine the drive shaft and packing gland bore for any signs of damage that may prevent proper sealing.
 - b. If the packing box housing is separated from the valve (refer to Seal Ring Maintenance section of this manual for disassembly instructions): Remove the drive shaft (key 20) from the packing box housing. With the drive shaft removed, remove all internal packing parts. Clean, inspect, and obtain replacement parts as necessary for reassembly. Examine the drive shaft and packing gland bore for any signs of damage that may prevent proper sealing.

Note

Verify that the grounding ball is installed in the drive shaft-to-ball tang interface to guarantee electrical continuity between ball trim and valve drive shaft.

The packing sets (key 105) listed in the parts list do not include any metal parts. Either clean and reuse metal packing parts or obtain replacements by ordering them individually.

Packing Assembly

For additional information on the ENVIRO-SEAL packing system refer to the ENVIRO-SEAL Packing System Instruction Manual ([D101643X012](#)).

If the packing housing box (key 6) is removed from the valve, use the valve assembly steps to reinstall the drive shaft (key 4) and packing box housing assembly on the valve. (Refer to Seal Ring Maintenance section of this manual for additional assembly instructions).

1. Place the new packing components over the valve drive shaft (key 20) and slide each into the packing box housing until properly seated at the bottom of the packing gland bore. Use the parts sequence shown in figure 3 and verify the correct configuration.
2. For standard packing arrangements, secure the packing follower and packing flange with packing nuts (keys 114, 102, and 101). Tighten the packing flange nuts alternately and evenly until leakage has stopped during operating

conditions (only applicable to standard packing), keeping the packing flange parallel with the valve flange (see figure 3).

3. If necessary, install the bonding strap assembly (keys 116 and 117) shown in figure 2.
4. Use the steps provided in the Actuator Mounting section to install the actuator on the valve. For actuator travel adjustments, refer to the appropriate actuator instruction manual.
5. When the control valve is in operation, carefully examine the packing follower region for any signs of leakage.

Seal Ring Maintenance

⚠ WARNING

- See the **WARNING** at the beginning of the Maintenance section for more information before removing the valve from the pipeline.
- Use proper lifting and rigging practices while moving the valve or valve/actuator assembly.

Valve Disassembly

Refer to figure 4 to identify the V280 valve components by key number.

Disassemble the valve only to the extent necessary to accomplish the needed inspection and repairs. For some repairs complete disassembly of the valve is not necessary. Follow the disassembly procedures to the point necessary to accomplish the repair, then skip to the appropriate assembly steps to complete the reassembly of the valve. Always clean and protect sealing surfaces from damage.

Note

It is not necessary to remove the base bracket for maintenance.

Mark parts as necessary to allow them to be returned to the same position and orientation as removed. The tailpiece, for instance, shall be returned to the same end of the valve from which it was removed. The seal assembly shall also be returned to the same tailpiece and in the same orientation from which it was removed.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines to the power actuator, release pressure from the actuator, and disconnect the pressure lines from the actuator. Use lockout/tagout procedures to be sure that the above measures stay in effect while working on the equipment.
2. Remove line bolting, remove the control valve from the pipeline, and clean all valve surfaces. Place the actuator/valve assembly on a flat working surface.
3. Mark parts as necessary to allow them to be returned to the same position during reassembly.
4. Refer to the appropriate actuator instruction manual for information on removal. Loosen the actuator mounting screws, bolts, or nuts while properly supporting the actuator then separate the actuator and mounting bracket from the valve. When valve maintenance is complete, refer to the Mounting Actuator procedure in this manual to reinstall the actuator on the valve.

5. Provide a clean soft working surface to protect the tailpiece-flange serrated surface. Lift the valve and place it on either tailpiece flange face. Be sure the valve is in a stable, upright position before releasing the hoist connection.

Note

If the packing (key 105) is in good condition, it is possible to remove and replace the seal assembly (key 5) without removing the packing box housing assembly. However, the packing box housing assembly must be removed to remove the ball (key 3) from the valve body.

6. Remove the packing box housing nuts (key 21).
7. Remove the packing box housing assembly from the valve. The assembly includes the drive shaft (key 20), O-ring and back-up ring (keys 13 and 16), shaft bearing (key 7), shaft thrust washer (key 11), and all packing parts.

Note

Verify that the grounding ball is installed in the drive shaft-to-ball tang interface to guarantee electrical continuity between ball (key 3) and valve drive shaft (key 20).

8. If it is desired to separate the packing box assembly parts, loosen or remove the packing components and slide the shaft down and out the valve side of the packing box housing. Inspect the drive shaft bushing (key 7) and the thrust washer (key 11). If necessary, replace worn components.
9. Remove the valve body nuts (key 18) from the studs (key 4) on the upper tailpiece and remove the tailpiece (key 2) from the valve body (key 1).

CAUTION

While lifting the tailpiece (key 2) with seal (key 5) from the valve body (key 1), check to see if the seal (key 5) is lifting with the tailpiece. If so, use caution in case the seal falls out and protect the ball and the body sealing surfaces. An additional strap can be employed to ensure the seal is captured in the event it disengages from the tailpiece.

If the valve assembly is resting on the base bracket during disassembly, secure the valve when removing the tailpieces from the body to prevent tipping.

10. Turn the tailpiece assembly over so the seal is facing up and place it on a clean soft surface to protect the flange serrated surface.
11. Remove the seal (key 5) from the tailpiece by using the 1/4-20 UNC jack bolt tappings on the seal flange. This will aid with disengaging the O-ring from the tailpiece seal gland. Be sure to not use any tools that could cause damage to the sealing surface. Note the configuration of the seal O-ring (key 14) and back-up ring (key 15) and the wave spring (key 17). Ensure the bearing plate (key 8) dowel pins (key 23) are accounted for.
12. If the tailpiece has an attenuator dome (key 24), place a flat head screw driver in the removal notch on the retaining ring (key 28) and pry the retaining ring out of the groove. Once the removal notch end of the retaining ring is out of the groove, pull up on the removal notch end to unseat the retaining ring from the groove. Be sure not to scratch the O-ring sealing surface while performing this operation. Clean and protect all sealing surfaces.

⚠ WARNING

When lifting the ball, ensure the bearing plates (key 8) are secure on the ball trunnions to prevent parts from falling which may cause personal injury or property damage.

13. Turn the ball (key 3) to the closed position. Use an approved lifting sling through the ball bore to lift the ball out of the valve body. Lift the ball and set it on a clean soft surface.
14. Remove the two bearing plates (key 8) and thrust washers (key 10) from the ball. Inspect the lined bushing (key 9) in each bearing plate and the thrust washers. If necessary, replace worn components.
15. Evenly loosen the nuts (key 18) from the studs (key 4) on the lower tailpiece and lift the body (key 1) from the tailpiece (key 2).
16. For dual seal constructions, repeat step 11.
17. For dual dome attenuator constructions, repeat step 12.

Valve Assembly

Be sure to replace valve parts in the same position and orientation from which they were removed. Use the following steps to reassemble the valve.

Note

Clean and protect all sealing surfaces from damage while installing parts. Lubricate components when necessary as an aid for installation, and to help protect sealing surfaces.

Refer to figure 4 that identifies the V280 valve components by key number.

During assembly, visually inspect component surfaces that interface with an O-ring or seal for any damage or foreign material that may prevent proper sealing.

1. Place both tailpieces (key 2), flange end down on a clean soft surface with the seal assembly cavity facing up. Use caution to protect the flange end serrated surfaces.
2. For all attenuator dome constructions, lubricate the tailpiece retaining ring groove, attenuator dome counterbore surface, and the surface where the attenuator dome will rest against the tailpiece with an anti-seize lubricant (key 45). This will aid in the disassembly process.
3. For all attenuator dome constructions, install the grooved end of the groove pin (key 27) into the tailpiece as far as it will go. Take care not to bend the pin. This groove pin will prevent the attenuator dome from rotating within the tailpiece.
4. Install the attenuator dome by aligning the pin hole in the attenuator dome with the groove pin (key 27) installed in the bottom of the tailpiece.
5. Install the retaining ring (key 28) into the tailpiece by expanding the coils of the retaining ring and installing one end into the groove. Hold the one end installed into the groove and press down around the perimeter of the retaining ring in a winding fashion until the ring is fully seated into the groove. There should be audible indication of the ring once it has fully seated in the groove. Take care to not damage the sealing surface of the tailpiece.
6. Lubricate (key 33) the tailpiece counterbore above the retaining ring groove where the seal will sit in the tailpiece.
7. On the seal (key 5), install the O-ring (key 14) and back-up ring (key 15) with the back-up ring towards the valve body (see figure 4).
8. Install the wave spring (key 17) into the tailpiece.
9. Lubricate (key 33) the installed O-ring and back-up ring on the seal and insert the seal assembly into the tailpiece counterbore. Maintain axial alignment of the two components as the seal assembly is drawn down into place.

Note

For single or dual characterized attenuator dome constructions, verify that the ball opens into the attenuator dome window(s) last. If not, remove the attenuator dome and tailpiece and rotate 180° to allow the window(s) to open last.

10. Lubricate (key 33) the half-dovetail groove on the tailpiece (key 2) and install the O-rings (key 12) in both tailpieces.
11. If necessary, install the grooved end of the groove pins (key 23) into the bearing plate (key 8) as far as they will go.
12. Install new bushings (key 9) in the bearing plates (key 8) by aligning the split in the bushing towards the longer side of the bearing plate (see figure 4).

⚠ WARNING

When lifting the ball, ensure the bearing plates (key 8) are secure on the ball trunnions to prevent parts from falling which may cause personal injury or property damage.

13. Use an approved lifting sling through the ball bore to lift the ball (key 3). Orient the ball so the port and trunnions are parallel with the ground.
14. Lubricate and install the thrust washers (key 10) and bearing plates on both ball trunnions.
15. Install the ball and bearing plates assembly onto the lower tailpiece. While lowering the ball, guide the groove pins in the bearing plates into their proper location in the tailpiece pin holes.
16. Place the body (key 1) on an appropriate work surface.
17. Install the grooved end of the groove pins (key 22) into the body. Take care to not bend the pins during assembly.
18. If studs (keys 4) were removed from valve body during disassembly, apply anti-seize lubricant (key 45) to the threads of the studs and holes and install in both sides of the body with the material identifier facing outward.
19. Lubricate (key 33) the tailpiece O-ring sealing surface of the body and lower the body over the ball and onto the tailpiece, guiding the body over the ball and aligning the pin holes on the tailpiece with the groove pins (key 22) installed in the body. Make sure that the body shaft bore is aligned to the same side as the tang slot on the ball.
20. Apply anti-seize lubricant (key 45) to the face and threads of the nuts (key 18). Install the nuts on the studs by hand with the material identifier facing outward. Use an appropriate torque device to apply the final torque specification (see table 3).
21. Repeat step 19 before installing the upper tailpiece.
22. Install the upper tailpiece from steps 1 through 10 over the studs (key 4) and pins (key 22) installed in the body.
23. Repeat step 20 once the upper tailpiece has been installed on the body.
24. Insert the drive shaft (key 20) through the body shaft bore to engage the shaft tang with the ball tang slot. Install the shaft thrust washer (key 11) onto the shaft.
25. Install the drive shaft bushing (key 7) in the packing box housing from the end that engages the body.
26. Lubricate (key 33) and install the O-ring (key 13) and back-up ring (key 16) on the packing box housing.
27. Lubricate the packing box housing studs (key 19) with an anti-seize lubricant (key 45) and install in the valve body.
28. After lubricating (key 33) the body shaft bore, position the packing box housing assembly over the drive shaft and slide into place ensuring the O-ring (key 7) properly engages the body shaft bore. Make sure to orient the length of the packing box housing perpendicular to the bore of the valve body (see figure 4).
29. Install the packing components as detailed in the Packing Maintenance section of this manual.
30. Apply anti-seize lubricant to the packing box housing nuts (key 21) and torque to the required specifications (see table 3).
31. For keyed shafts, install the valve shaft key (key 38), flat washer (key 39) and hex head bolt (key 40). The purpose of the washer and hex bolt is to prevent the key from migrating axially out of the keyway in-service.
32. If the base bracket was removed from the body during disassembly, place it on the body flats that correspond with the desired shaft orientation (horizontal or vertical). Lubricate the two socket head cap screws with an anti-seize lubricant (key 45), place a washer (key 41) over each screw, and install into the body. Torque to the required specifications (see table 4).

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33. If the swivel hoist rings (key 35) were removed during disassembly, reinstall the two swivel hoist rings into the body flats that correspond with the desired shaft orientation (horizontal or vertical). Do not lubricate the threads. Torque to the required specifications (see table 4).

Table 3. Bolt Torque Specifications

VALVE SIZE, NPS	CLASS	FASTENER SIZE	VALVE BODY HEAVY HEX NUT TORQUE ⁽¹⁾		FASTENER SIZE	PACKING BOX HOUSING HEAVY HEX NUT TORQUE ⁽¹⁾	
		in	N • m	ft • lbf	in	N • m	ft • lbf
6	900	1-1/4-8	990	730	3/4-10	271	200
8		1-3/8-8	1329	980			
10		1-5/8-8	2235	1650			
12		1-7/8-8	3470	2560	1-1/8-8	746	550
16		2-1/4-8	6090	4490			

1. Fasteners must be lubricated to achieve proper preload.

Table 4. Required Base Bracket and Swivel Hoist Ring Torque Specifications

VALVE SIZE, NPS	FASTENER SIZE, INCH	VALVE BODY HEAVY HEX NUT TORQUE ^(1,2)	
		N • m	ft • lbf
6	3/4-10	136	100
8			
10			
12	1-8	312	230
16			

1. Base bracket fasteners must be lubricated to achieve proper preload.

2. Do not lubricate swivel hoist ring fasteners. If lubricated, consult your [Emerson sales office](#) for additional torque specifications.

Actuator Mounting

Use the appropriate actuator instruction manual for mounting the actuator or changing the actuator position. Attach the actuator mounting bracket to the valve packing box and tighten the mounting bracket fasteners as detailed in table 5.

Table 5. Required Actuator Mounting Bracket-to-Valve Bolt Torque Specifications

VALVE SIZE, NPS	FASTENER SIZE, INCH	SAE J429 GRADE 5/NCF3 ⁽¹⁾	
		N • m	ft • lbf
6	3/4-10	339	250
8	7/8-9	508	375
10			
12	1-1/4-8	1490	1100
16			

1. Fasteners must be lubricated to achieve proper preload.

Determining Closed Position

1. To confirm proper actuator adjustment visually check the position of the ball.
2. Adjust the actuator linkage or travel stops as described in the actuator instruction manual so that at the end of stroke, the valve ball bore diameter in the full open (100%) position is in alignment and centered within the upstream and downstream valve seal inside diameters. The actuator linkage or travel stops should be adjusted so that the full closed (0%) valve position is precisely 90 degrees from the visually verified 100% open position. The valve has a given dead band where the seal is in full contact with the ball, so if the valve position is not precisely 90 degrees from the visually verified 100% open position, leakage past the seal could occur.
3. For reference, two parallel lines are machined on the actuator mounting end of the valve drive shaft (key 20). The lines represent the orientation of the valve ball bore. The ball is in the closed position when the two lines are perpendicular to the pipeline bore.

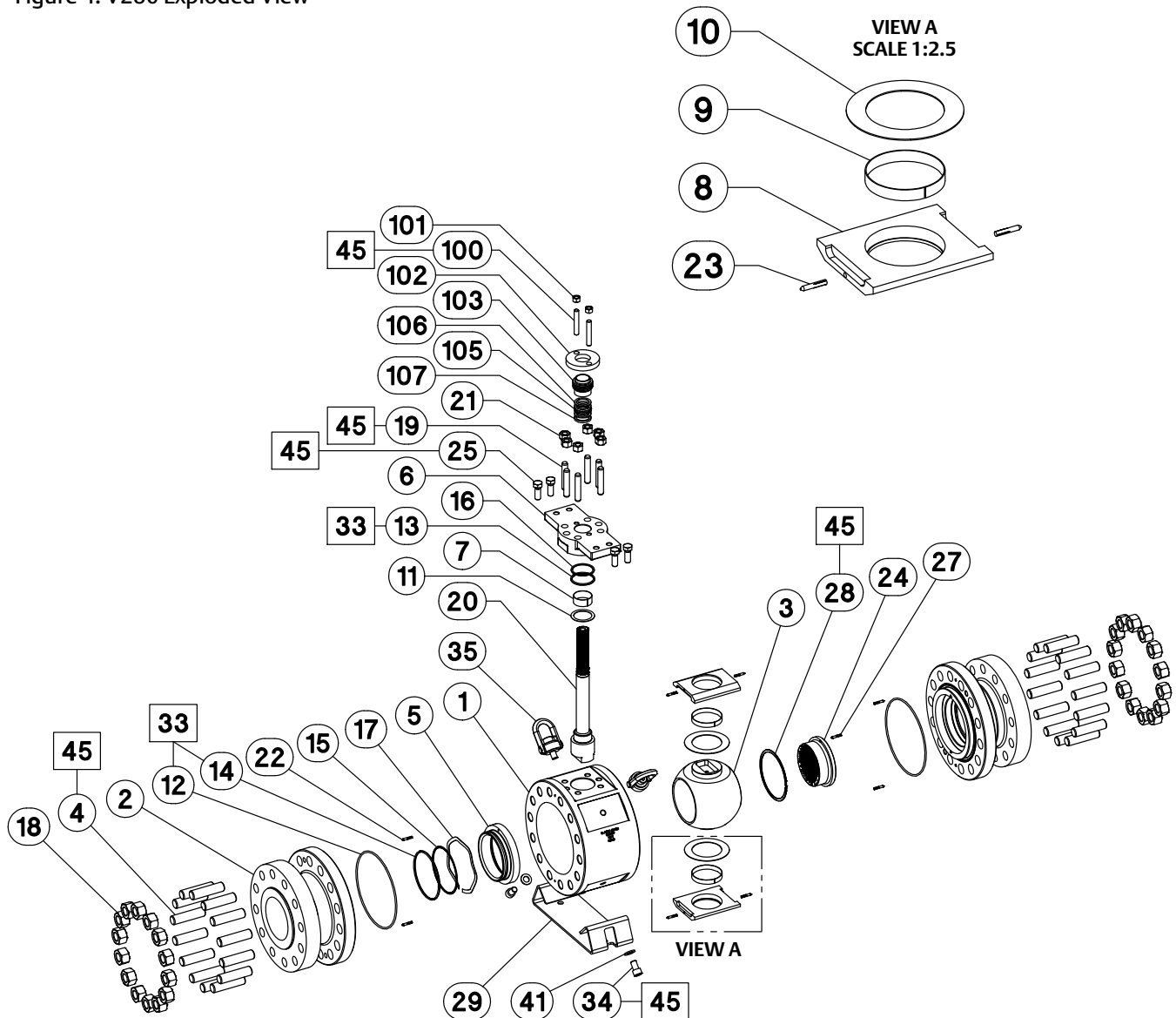
Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your [Emerson sales office](#) regarding spare parts or technical information. When ordering replacement parts, also specify the part name and desired material.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Figure 4. V280 Exploded View



NOTE:

1. KEY NUMBERS 26, 30, 31, 32, 36, 37, 38, 39, 40, 42, 43, 44, 114, 116, 117 ARE NOT SHOWN

□ APPLY LUBRICANT

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Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description
1	Valve Body If you need a valve body as a replacement part, order the valve size, pressure rating, serial number, and desired material.
2	Tailpiece
3	Ball
4	Valve Body Bolt
5*	Seal
6	Packing Box Housing
7*	Shaft Bearing
8	Bearing Plate
9*	Trunnion Bearing (2 req'd)
10*	Ball Thrust Washer (2 req'd)
11*	Shaft Thrust Washer
12*	Tailpiece O-Ring (2 req'd)
13*	Packing Box House O-Ring
14*	Seal O-Ring (1 req'd for single, 2 req'd for dual-seal)
15*	Seal Back-Up Ring (1 req'd for single, 2 req'd for dual-seal)
16*	Packing Box Housing Back-Up Ring
17	Wave Spring (1 req'd for single, 2 req'd for dual-seal)
18	Valve Body Heavy Hex Nut
19	Packing Box Housing Bolt
20	Drive Shaft Assembly
21	Packing Box Housing Heavy Hex Nut

Key	Description
1	Valve Body If you need a valve body as a replacement part, order the valve size, pressure rating, serial number, and desired material.
2	Tailpiece
3	Ball
4	Valve Body Bolt
5*	Seal
6	Packing Box Housing
7*	Shaft Bearing
8	Bearing Plate
9*	Trunnion Bearing (2 req'd)
10*	Ball Thrust Washer (2 req'd)
11*	Shaft Thrust Washer
12*	Tailpiece O-Ring (2 req'd)
13*	Packing Box House O-Ring
14*	Seal O-Ring (1 req'd for single, 2 req'd for dual-seal)
15*	Seal Back-Up Ring (1 req'd for single, 2 req'd for dual-seal)
16*	Packing Box Housing Back-Up Ring
17	Wave Spring (1 req'd for single, 2 req'd for dual-seal)
18	Valve Body Heavy Hex Nut
19	Packing Box Housing Bolt
20	Drive Shaft Assembly
21	Packing Box Housing Heavy Hex Nut

Key	Description
22*	Valve Body Groove Pin
23*	Bearing Plate Groove Pin
24	Attenuator Dome
25	Actuator Mounting Cap Screw (4 req'd)
26	Hex Head Pipe Plug (not shown)
27*	Attenuator Dome Groove Pin
28*	Retaining Ring (1 req'd for single, 2 req'd for dual-seal)
29	Base Bracket
30	Nameplate (not shown)
31	Drive Screw (not shown)
32	Flow Direction Arrow (not shown)
33	Grease Lubricant
34	Socket Head Cap Screw (base bracket only)
35	Swivel Hoist Ring
36	Warning Tag (not shown)
37	Warning Tag Drive Screw (not shown)
38	Square Key (not shown)
39	Flat Washer (not shown)
40	Socket Head Cap Screw (not shown)
41	Flat Washer (base bracket only)
42	NACE Label (not shown)
43	NACE Label Drive Screw (not shown)
44	Thread Plug (not shown)
45	Anti-Seize Lubricant
100	Packing Stud (2 req'd for NPS 6-10, 4 req'd for NPS 12-16)
101	Packing Nut (2 req'd for NPS 6-10, 4 req'd for NPS 12-16)
102	Packing Flange
103	Spring Pack
105*	Packing Set ENVIRO-SEAL, PTFE/Carbon Filled PTFE Standard, PTFE/Carbon Filled PTFE
106	Anti-Extrusion Ring
107	Packing Box Ring
114	Standard Packing Follower (not shown)
116	Clamp (not shown)
117	Ground Strap (not shown)

Key	Description
22*	Valve Body Groove Pin
23*	Bearing Plate Groove Pin
24	Attenuator Dome
25	Actuator Mounting Cap Screw (4 req'd)
26	Hex Head Pipe Plug (not shown)
27*	Attenuator Dome Groove Pin
28*	Retaining Ring (1 req'd for single, 2 req'd for dual-seal)
29	Base Bracket
30	Nameplate (not shown)
31	Drive Screw (not shown)
32	Flow Direction Arrow (not shown)
33	Grease Lubricant
34	Socket Head Cap Screw (base bracket only)
35	Swivel Hoist Ring
36	Warning Tag (not shown)
37	Warning Tag Drive Screw (not shown)
38	Square Key (not shown)
39	Flat Washer (not shown)
40	Socket Head Cap Screw (not shown)
41	Flat Washer (base bracket only)
42	NACE Label (not shown)
43	NACE Label Drive Screw (not shown)
44	Thread Plug (not shown)
45	Anti-Seize Lubricant
100	Packing Stud (2 req'd for NPS 6-10, 4 req'd for NPS 12-16)
101	Packing Nut (2 req'd for NPS 6-10, 4 req'd for NPS 12-16)
102	Packing Flange
103	Spring Pack
105*	Packing Set ENVIRO-SEAL, PTFE/Carbon Filled PTFE Standard, PTFE/Carbon Filled PTFE
106	Anti-Extrusion Ring
107	Packing Box Ring
114	Standard Packing Follower (not shown)
116	Clamp (not shown)
117	Ground Strap (not shown)

*Recommended spare parts

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Fisher™ V500 Rotary Globe Control Valve



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual provides installation, operation, maintenance and parts ordering information for NPS 1 through 12 Fisher V500 eccentric plug rotary control valves. Refer to separate manuals for information concerning the actuator and accessories.

WARNING

 Do not install, operate or maintain a V500 valve without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

1.2 Description

The V500 rotary control valve is a flanged (Figure 1) valve with a self-centering seat, eccentrically rotating plug and splined valve shaft. Suitable for forward or reverse flow use, this valve mates with a variety of actuators to provide throttling or on-off service. Valves mate with CL150, 300 or 600 raised face pipeline flanges.

Figure 1. Fisher V500 Flanged Rotary Control Valve with 1061 Actuator and FIELDVUE™ DVC6200 Digital Valve Controller



W8380-1

Table 1. Specifications

Valve Sizes ⁽¹⁾	Flow Direction
NPS ■ 1, ■ 1-1/2, ■ 2, ■ 3, ■ 4, ■ 6, ■ 8, ■ 10 and ■ 12	■ Reverse Flow (Standard Direction): Past valve plug and through seat ring tends to close the valve, recommended for erosive and general service ■ Forward Flow: Through seat ring and past valve plug; tends to open the valve, recommended for high pressure drop and high cycle service
End Connection Style	Actuator Mounting
■ Raised-face flanges, ■ ring-type joint flanges (ASME B16.5) ■ CL150, ■ CL300 or ■ CL600 Valve bodies with EN flanges also available; consult your Emerson sales office.	■ Left-hand or ■ right-hand as viewed from the upstream side of the valve. See Figure 2.
Maximum Inlet Pressure ⁽²⁾	Valve Plug Rotation
Consistent with applicable ASME B16.34 or EN 12516-1 ratings	Counterclockwise to close (when viewed from actuator side of valve) through 90° of valve plug rotation
Shutoff Classification	Valve/Actuator Action
Class IV per ANSI/FCI 70-2 and IEC 60534-4 (0.01% of valve capacity at full travel), for either flow direction. Leak rates for full and restricted port valves are based on full port capacities. Reduced port valves seat at the full port diameter.	With diaphragm or piston rotary actuator, field-reversible between ■ push-down-to-close (extending actuator rod closes the valve) and ■ push-down-to-open (extending actuator rod opens the valve)
Flow Characteristic	Shaft Diameters ⁽³⁾ and Approximate Weights
Modified linear	See Table 2
1. The valve size shown in this manual refers to Nominal Pipe Size (NPS). 2. The pressure or temperature limits in this manual and any applicable standard limitations should not be exceeded. 3. Shaft diameter and spline end must match available shaft diameter of actuator.	

Section 2: Installation



WARNING

Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given on the appropriate nameplates or the mating pipe flange rating. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

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WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some valve body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

Table 2. Shaft Diameter and Approximate Weights

VALVE SIZE, NPS	SHAFT DIAMETER		APPROXIMATE WEIGHT		
			Flanged		
	Through Valve	At Spline End	CL150	CL300	CL600
	mm		kg		
1	12.7	12.7	5.4	5.9	5.9
1-1/2	15.9	15.9	8.6	9.5	10
2	15.9	15.9	9.5	11	13
3	25.4	25.4	19	24	26
	25.4	19.1			
4	31.8	31.8	36	42	50
6	38.1	38.1	54	69	93
	38.1	31.8			
8	38.1	38.1	79	98	135
10	44.5	44.5	186	213	317
12	53.8	53.8	218	256	370
	53.8	50.8			
	in.		lbs		
1	1/2	1/2	12	13	13
1-1/2	5/8	5/8	19	21	23
2	5/8	5/8	21	25	28
3	1	1	42	52	57
	1	3/4			
4	1-1/4	1-1/4	79	93	111
6	1-1/2	1-1/2	120	152	204
	1-1/2	1-1/4			
8	1-1/2	1-1/2	75	217	298
10	1-3/4	1-3/4	408	468	697
12	2-1/8	2-1/8	478	563	815
	2-1/8	2			

Key numbers in this procedure are shown in Figure 11 (NPS 1 and 1-1/2 valves), Figure 14 (NPS 2 through 8 valves) and Figure 15 (NPS 10 and 12) unless otherwise indicated.

NOTICE

To prevent product damage during storage, keep the valve body cavity dry and clear of foreign material.

1. If the valve is to be stored before installation, protect the flange mating surfaces and keep the valve body cavity dry and clear of foreign material.
2. Install a three-valve bypass around the control valve assembly if continuous operation will be necessary during inspection and maintenance of the valve.
3. A V500 valve is normally shipped as part of a control valve assembly, with a power or manual actuator mounted on the valve. If the valve and actuator have been purchased separately or if the actuator has been removed from the valve, mount the actuator according to the Actuator Mounting procedure. Also, adjust the actuator travel using the Adjusting Actuator Travel procedure before installing the valve. The necessary measurements cannot be made with the valve installed.
4. Before starting the actual installation of the valve, determine the proper installation orientation of the valve plug (key 2) and actuator. Determine the flow direction of the process fluid through the valve. See Figure 2.

NOTICE

Ensure the valve and adjacent pipelines are free of foreign material that could damage the valve seating surfaces.

5. Before installing the valve, make sure the flow direction arrow (key 32) on the valve matches the actual process fluid flow direction through the valve for the application where the valve will be installed.
6. Install the flange gaskets and insert the valve between the mating pipeline flanges. Use flat sheet gaskets compatible with the process media or spiral wound gaskets with compression-controlling center rings.

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Figure 2. Index Marks for Actuator Lever Orientation

ACTUATOR		ACTUATOR POSITION				
MOUNTING	STYLE	VALVE OPEN	1	2	3	4
RIGHT-HAND	STYLE A (PDTC)					
	STYLE B (PDTO)					
LEFT-HAND	STYLE C (PDTO)					
	STYLE D (PDTC)					

NOTES:

1. ARROW ON LEVER INDICATES DIRECTION OF ACTUATOR THRUST TO CLOSE VALVE.

2. PDTC—PUSH DOWN TO CLOSE; PDTO—PUSH DOWN TO OPEN

3. F—FORWARD FLOW; R—REVERSE FLOW

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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

V500 Valve

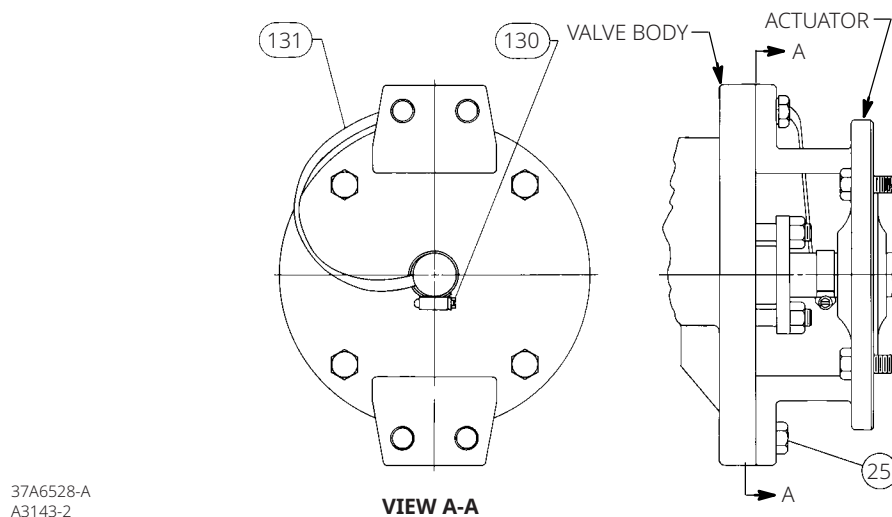
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Table 3. Recommended Line Studs and Nuts

VALVE SIZE	Pressure Rating	Bolt Size	Stud Qty	Nut Qty	Bolt Length	Style
NPS					In.	
1	CL150	1/2-13 UNC	8	16	2.75	II
	CL300	5/8-11 UNC	8	16	3.5	II
	CL600	5/8-11 UNC	6	16	4	II
			2	2	3	III
1-1/2	CL150	1/2-13 UNC	8	16	3	II
	CL300	3/4-10 UNC	8	16	4	II
	CL600	3/4-10 UNC	8	16	4.5	II
2	CL150	5/8-11 UNC	8	16	3.5	II
	CL300	5/8-11 UNC	16	32	3.75	II
	CL600	5/8-11 UNC	8	16	4.5	II
			8	8	3.75	III
3	CL150	5/8-11 UNC	8	16	3.75	II
	CL300	3/4-10 UNC	16	32	4.5	II
	CL600	3/4-10 UNC	12	24	5.25	II
			4	4	4.25	III
4	CL150	5/8-11 UNC	16	32	4	II
	CL300	3/4-10 UNC	16	32	4.75	II
	CL600	7/8- 9 UNC	12	24	6	II
			4	4	5	III
6	CL150	3/4-10 UNC	16	32	4.25	II
	CL300	3/4-10 UNC	24	48	5.25	II
	CL600	1-8 UNC	16	32	7.25	II
			8	8	6	III
8	CL150	3/4-10 UNC	16	32	4.5	II
	CL300	7/8-9 UNC	24	48	5.75	II
	CL600	1-1/8-8 UN	20	40	8	II
			4	4	6.75	III
10	CL150	7/8-9 UNC	24	48	5	II
	CL300	1-8 UNC	32	64	6.75	II
	CL600	1-1/4-8 UN	24	48	9	II
			8	8	6.75	III
12	CL150	7/8-9 UNC	24	48	5	II
	CL300	1-1/8-8 UN	32	64	7.25	II
	CL600	1-1/4-8 UN	32	64	9	II
			8	8	6.75	III

Figure 4. Optional Shaft-to-Body Bonding Strap Assembly**NOTE**

For best shutoff performance and to reduce bearing wear, it is recommended that you install the valve shaft in a horizontal direction. See Figure 1.

2.1 Ceramic Trim

Some types of ceramic trim, including the VTC (very tough ceramic) variety, can create a spark under certain circumstances. When the edge of a ceramic part is struck against a second ceramic part with enough force, a spark can be created.

⚠ WARNING

Avoid personal injury and property damage from ignition of process fluid caused by sparks from ceramic trim. Do not use ceramic trim where the process fluid is unstable or if it is an explosive mixture (such as air and ether).

⚠ WARNING

The valve drive shaft is not necessarily grounded to the pipeline when installed. Personal injury or property damage could result if the process fluid or the atmosphere around the valve is flammable, from an explosion caused by a discharge of static electricity from the valve components. If the valve is installed in a hazardous area, electrically bond the drive shaft to the valve.

1. Prepare to install the line bolts and nuts. Consult Figures 3, 4 and 5 before installing the line bolts and nuts.

NOTE

Standard PTFE packing is composed of a partially conductive carbon-filled PTFE female adaptor with PTFE V-ring packing. Standard graphite packing is composed of all conductive graphite ribbon packing rings. Alternate shaft-to-valve body bonding is available for hazardous service areas where the standard packing is not sufficient to bond the shaft to the valve (see the following step).

2. For hazardous applications, attach the bonding strap assembly (key 131) to the shaft with the clamp (key 130) and connect the other end of bonding strap assembly to the valve body with the cap screw (key 25). See Figure 4.

For all valve bodies, install the line bolts and nuts; then, tighten them using accepted bolting procedures. These procedures include, but are not limited to, lubricating the line bolts and hex nuts and tightening the nuts in a crisscross sequence to ensure proper gasket load.

3. If a purge is desired for the purged bearing construction, remove the pipe plugs (keys 29 and 24) and install the purge lines. Purge pressure should be greater than the pressure within the valve and the purge fluid should be as clean as possible.
4. Connect pressure lines to the actuator as indicated in the actuator instruction manual. When a manual actuator is used with a power actuator, install a bypass valve on the power actuator (if not already supplied) for use during manual operation.



WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If the valve has enhanced ENVIRO-SEAL™ live-loaded packing installed readjustment will probably not be required. See the Emerson Automation Solutions instruction manual entitled ENVIRO-SEAL Packing System for Rotary Valves ([D101643X012](#)) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the Parts Kit section later in this manual.

Section 3: Maintenance

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing area may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.**
- **Check with your process or safety engineer for any other hazards that may be present from exposure to process media.**

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

As used in these instructions, the term “actuator” refers to power actuators (such as pneumatic diaphragm or piston actuators) or manual actuators (such as handwheel or handlever actuators).

3.1 Packing Maintenance

Key numbers are referenced in Figures 11, 13 and 14 unless otherwise indicated.

NOTE

For the ENVIRO-SEAL packing system, refer to the Parts Ordering section for retrofit kits and parts kits (see Figure 15). Refer to the separate ENVIRO-SEAL instruction manual for maintenance instructions.

Standard ENVIRO-SEAL packing systems can be used in vacuum service with packing rings in the standard orientation. It is not necessary to reverse the ENVIRO-SEAL PTFE packing rings.

Stopping Leakage

All maintenance procedures in this section may be performed with the valve body (key 1) in the line.

For packing other than spring-loaded packings, leakage around the packing follower (key 14) can be stopped by tightening the packing flange nuts (key 16). If leakage cannot be stopped in this manner, replace the packing according to the Replacing Packing procedure.

If the packing is relatively new and tight on the valve shaft (key 3) and if tightening the packing nuts does not stop leakage, it is possible that the valve shaft is worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches on the packing box wall. Inspect the shaft and packing box wall for nicks or scratches when performing the following procedures.

Replacing Packing

NOTE

If the valve has enhanced ENVIRO-SEAL live-loaded packing installed, see the separate ENVIRO-SEAL instruction manual.

This procedure may be performed without removing the actuator from the valve body if adding PTFE/composition packing rings as a temporary measure. However, the actuator must be removed if replacing any other kind of packing or if the metal packing parts (keys 14, 17 and, if used, 18) need to be replaced.

Removing the Packing

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

NOTICE

When the actuator is removed from the valve, do not use a hammer or similar tool to drive the lever or actuator off the valve shaft. Driving the lever or actuator off the valve shaft could damage the valve plug, seal and valve.

If necessary, use a wheel puller to remove the lever or actuator from the valve shaft. It is okay to tap the wheel puller screw lightly to loosen the lever or actuator, but hitting the screw with excessive force could damage the valve plug, seal and valve.

2. If necessary, remove the cap screws (key 25) and hex nuts (key 26). Then remove the actuator while referring to the actuator manual for assistance.
3. Remove the packing nuts (key 16). For NPS 1 through 8 remove the packing follower (key 14). For NPS 10 and 12, remove the packing flange (key 45) and then remove the packing follower (key 14).
4. Remove the old packing rings (key 13), packing box ring (key 17) and, if used, the lantern ring (key 18).

⚠ WARNING

Do not scratch the valve shaft or packing box wall. Scratching these surfaces could cause leakage.

5. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing.
6. If necessary, complete the steps in the Replacing the Valve Plug, Shaft and Bearings section and return to the Installing Packing steps below.

Installing Packing

1. Install the new packing rings and packing box ring by stacking the parts as shown in Figure 5. Make sure split rings are arranged so that the splits do not line up to form a leak path. Then slide the stack into the packing box as far as will go while being careful to avoid trapping air among the rings.
2. Install the studs (key 15) and packing follower (key 4) and for NPS 10 and 12, also install the packing flange (key 45). Install the nuts (key 16).

⚠ WARNING

To prevent possible product damage or leakage, make sure the valve plug remains in the closed position when installing new packing parts.

3. Make sure the valve plug is in the closed position when installing new packing parts.
4. Insert a screw driver, pry bar or similar tool between the lower ear of the plug and the valve body (see Figure 6). Use the pry to move the plug tightly against the thrust washer and bearing on the actuator side of the valve. Keep the valve plug in that position until you have completed the packing installation.
5. Tighten packing flange nuts enough to stop leakage under normal conditions.
6. Mount the actuator while referring to the actuator mounting procedures of the actuator instruction manual. You must complete the Adjusting Actuator Travel procedure in this manual before installing the valve in the pipeline, due to the measurements that must be made during the actuator adjustment process.
7. When the control valve is being put back into operation, check the packing follower for leakage and retighten the packing nuts as necessary.

3.2 Replacing Retainer, Seat Ring, Face Seals and Insert

This procedure is to be performed if the control valve is not shutting off properly, if the port diameter is to be changed by installing a different seat ring or if seat ring inspection is necessary. The actuator and valve (key 1) must be removed from the pipeline; however, the actuator may remain mounted during this procedure. The insert is an optional part for most constructions, but is required on the NPS 2, 3 and 4 Globe Face-to-Face design.

A retainer tool is required to remove the retainer (key 5), seat ring (key 4), face seals (key 8) and insert (key 135). If specifically ordered, a tool is supplied with the valve; a tool can also be ordered individually. If desired, a tool can be machined using the dimensions shown in Figure 7.

During assembly, handle the retainer, seat ring, face seals and insert carefully. Critical areas that must be protected are the threads and inner surface of the retainer (key 5), the sealing surfaces of the face seals (key 8), the face seal grooves in the seat ring (key 4), the shutoff surface of the seat ring and the face seal surface in the valve body (key 1) or in the insert.

A new retainer gasket (key 11) and insert gasket (key 134) are required whenever the retainer (key 5) is removed. Other parts in good condition can be reused.

Disassembly of Retainer, Seat Ring, Face Seals and Insert

The insert is an optional part for most constructions, but is required on the NPS 2, 3, and 4 Globe Face-to-Face design. Key numbers are shown in Figures 11, 13 and 14 unless otherwise noted.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove line bolting. Then, remove the control valve from the pipeline and place the valve on a flat surface with the retainer (key 5) facing up.
3. Rotate the valve shaft (key 3) to move the valve plug (key 2) into the open position.

NOTE

The retainer (key 5) was installed at the factory using the torque listed in Table 6.

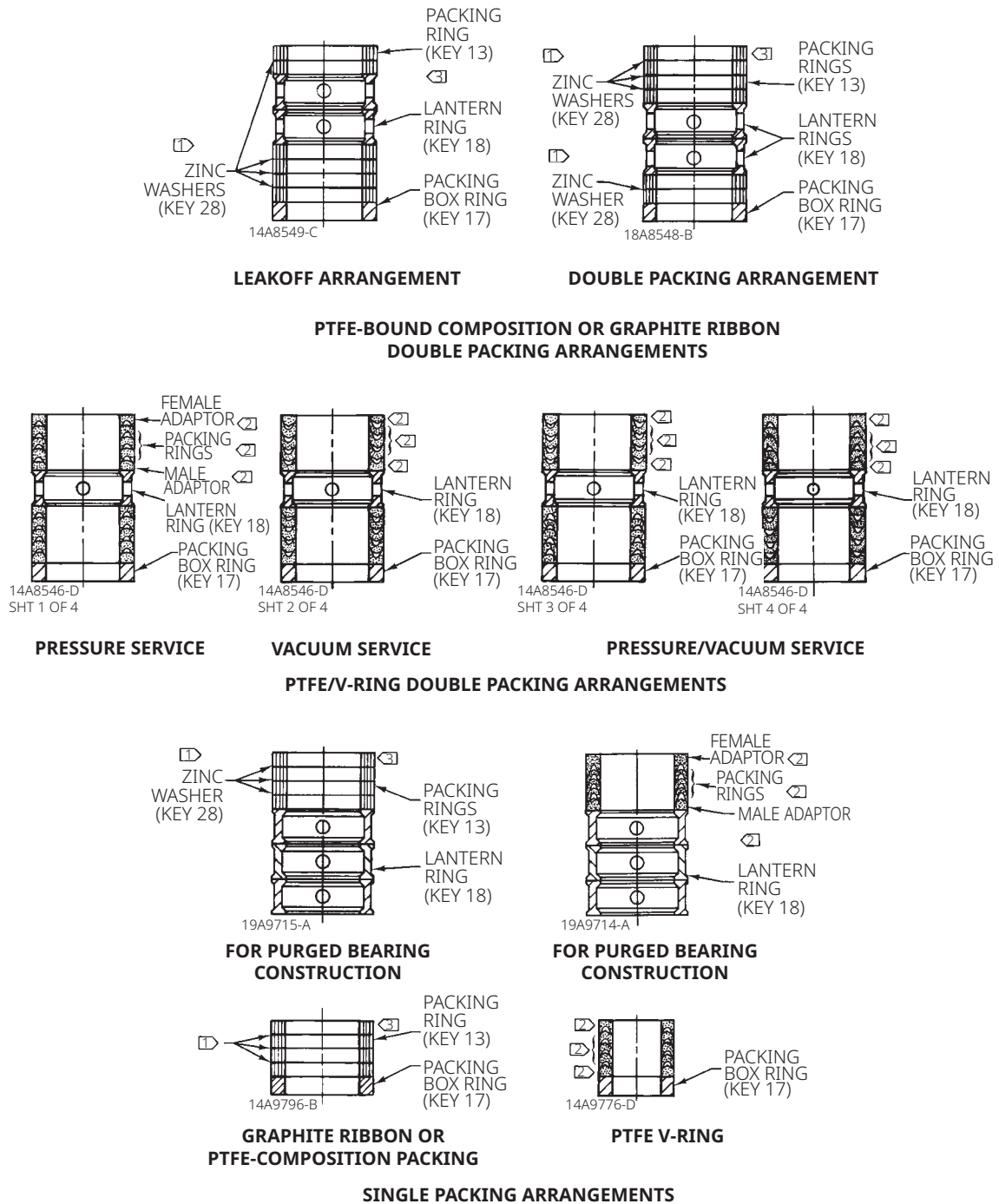
4. Remove the retainer by engaging the retainer tool, attaching an impact wrench or other suitable tool and unscrewing the retainer. Inspect the retainer.

NOTICE

Place the retainer on a protected, flat surface where the threads and inner surface will not be contaminated or damaged.

5. Remove the retainer gasket (key 11). Inspect the gasket surfaces on the valve body (key 1).
6. Lift out the seat ring (key 4), both face seals (key 8), insert (key 135), and insert gasket (key 134). Inspect the parts and place them on a flat, protected surface.
7. Inspect the shutoff surface of the valve plug. If it is worn, nicked or scratched, proceed to the Replacing Valve Plug, Shaft and Bearings procedure. If the parts are in good shape and do not require maintenance, continue to the Assembly procedure.

Figure 5. Packing Arrangements

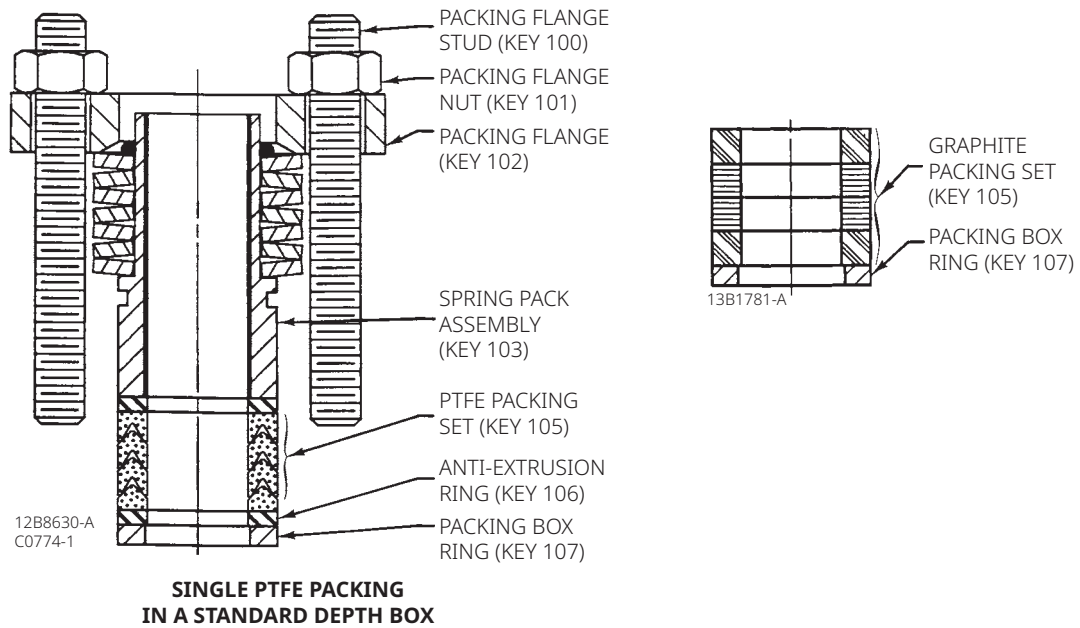


NOTES:

1. INCLUDES ZINC WASHERS (KEY 28) FOR GRAPHITE RIBBON PACKING ONLY.
2. INCLUDED IN PTFE V-RING PACKING SET (KEY 13).
3. FOR ONLY PTFE/BOUND-COMPOSITION PACKING, TOP RING IS CONDUCTIVE GRAPHITE FILAMENT RING.

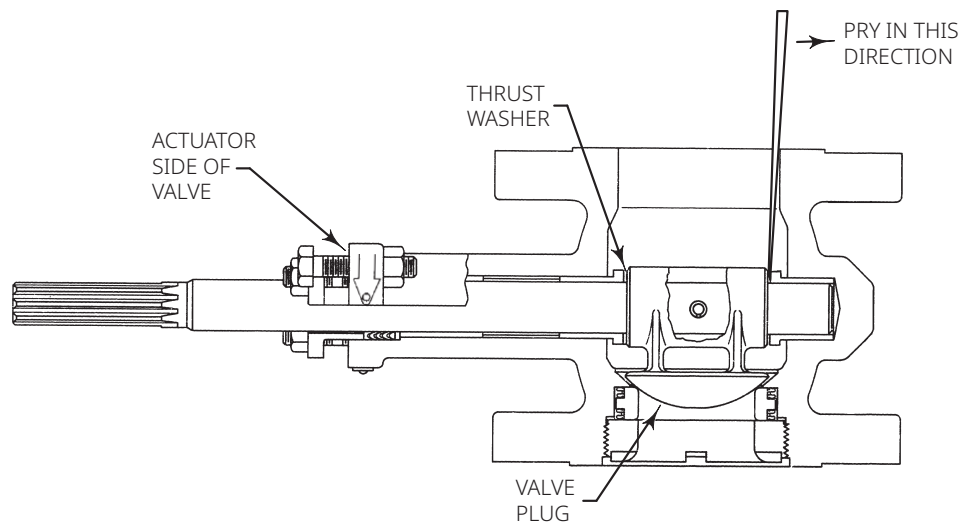
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Figure 5. Packing Arrangements (continued)



PTFE/COMPOSITION OR GRAPHITE ENVIRO-SEAL PACKING ARRANGEMENTS

Figure 6. Pry Bar Use



NOTE:

1. VALVE PLUG SHOULD BE IN THE OPEN POSITION WHEN TIGHTENING THE PACKING FLANGE NUTS (KEY 16).

Table 5. Data for Making Retainer Tool

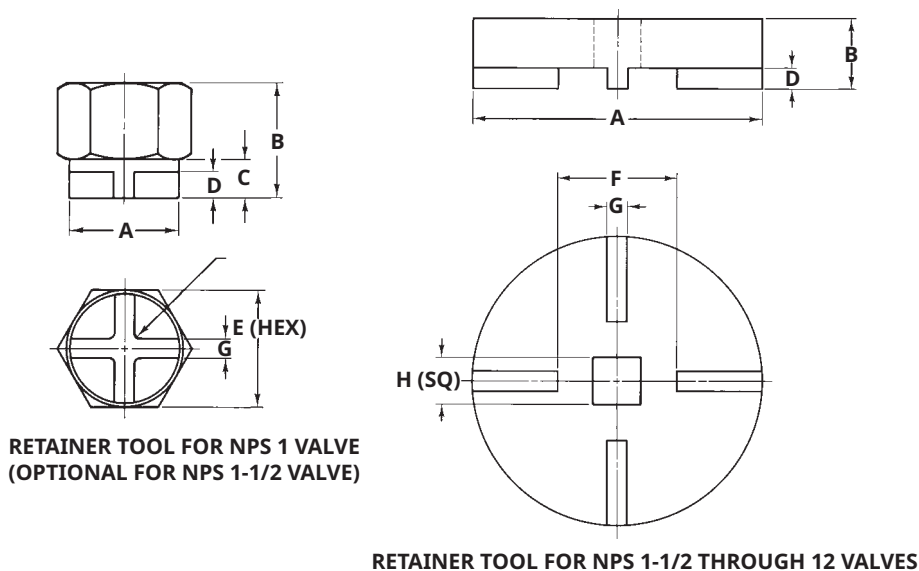
VALVE SIZE, NPS	A	B	C	D	E (HEX)	F	G	H (SQUARE)	A	B	C	D	E (HEX)	F	G	H (SQUARE)
	mm								in.							
1	26.9	28.4	9.7	6.4	28.4	1.5	4.8	---	1.06	1.12	0.38	0.25	1.12	0.06	0.19	---
1-1/2 ⁽¹⁾	36.6	28.4	9.7	6.4	38.1	3.0	4.8	---	1.44	1.12	0.38	0.25	1.50	0.12	0.19	---
1-1/2 ⁽²⁾	36.6	19.1	---	6.4	---	22.4	4.8	12.7	1.44	0.75	---	0.25	---	0.88	0.19	0.50
2	55.6	19.1	---	6.4	---	22.4	4.8	12.7	2.19	0.75	---	0.25	---	0.88	0.19	0.50
3	79.2	33.3	---	7.9	---	41.4	7.9	19.0	3.12	1.31	---	0.31	---	1.62	0.31	0.75
4	104.6	33.3	---	7.9	---	41.4	7.9	25.4	4.12	1.31	---	0.31	---	1.62	0.31	1.00
6	155.4	38.1	---	11.2	---	63.5	11.2	25.4	6.12	1.50	---	0.44	---	2.50	0.44	1.00
8	203.2	50.8	---	11.2	---	101.6	11.2	38.1	8.00	2.00	---	0.44	---	4.00	0.44	1.50
10	241.3	50.8	---	11.2	---	127	19.1	38.1	9.5	2	---	0.44	---	5	0.75	1.5
12	273	50.8	---	11.2	---	127	25.4	38.1	10.75	2	---	0.44	---	5	1	1.5

1. Dimensions for 1-1/2 in. tool made from hex barstock, an optional material.
2. Dimensions for 1-1/2 in. tool made from round barstock.

Table 6. Retainer Torque⁽¹⁾

VALVE SIZE, NPS	RETAINER TORQUE	
	N·m	Lbf·ft
1	140	100
1-1/2	185	135
2	260	190
3	515	380
4	1170	860
6	2305	1700
8	3120	2300
10	4750	3500
12	6100	4500

1. Lubricate with anti-seize lubricant.

Figure 7. Data for Making and Using Retainer Tool (Key 33) (Also See Tables 5 and 6)

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Assembly of Retainer, Seat Ring, Face Seals and Insert

WARNING

Seat ring installation requires that the valve plug (key 2) remain in the open position. To avoid personal injury or damage to tools, valve parts or other items resulting from plug closing, prevent plug travel by using travel stops, manual actuators, constant supply pressure to a pneumatic actuator or other steps as appropriate. When installing the seat ring, keep hands, tools and other objects out of the valve.

1. Apply enough supply pressure to the actuator to open the valve plug or take other steps to hold the valve plug open.
2. Clean the valve body, the retainer threads, the retainer gasket surface and the seat ring sealing surface.
3. Using either face seals (key 8) in good condition or new face seals, place one seal in the seat ring cavity.

Table 7. Assembly Clearance

VALVE SIZE	SEAT RING AND RETAINER CLEARANCE			
	mm		in.	
NPS	Min.	Max.	Min.	Max.
2	0.05	0.17	0.002	0.007
3 to 12	0.08	0.30	0.003	0.012

NOTE

The seat ring (key 4) may have one or two shutoff surfaces. The shutoff surfaces are the narrow, rounded edges of the seat ring bore. Inspect the seat ring and locate the shutoff surfaces before proceeding. Insert the gasket (key 134) and body insert (key 135) into valve body prior to face seal installation.

4. Insert the seat ring into the seat ring cavity with the correct shutoff surface facing the valve plug and shaft. The seat ring will cover the face seal installed in step 3.
5. Place the second face seal on the seat ring.
6. Apply anti-seize lubricant to the gasket surface in the valve body. Install the gasket (key 11), while making certain that for NPS 2 through 12 sizes the concave surface of the gasket is up (hump surface of gasket down).
7. Apply anti-seize lubricant to the threads and bottom of the retainer (key 5). Thread the retainer into the valve body.
8. Refer to Figure 7. With the appropriate torque indicating tool, tighten the retainer to the torque listed in Table 6.
9. A gap between the seat ring (key 4) and retainer (key 5) allows the seat ring to self-center. Applying the proper amount of torque during installation should position the retainer and seat ring properly. However, for NPS 2 through 12 valves, use a feeler gauge to measure between the parts as shown in Figure 14, making certain the necessary clearance exists.

Compare the measured gap to the clearance in Table 7 and proceed as follows:

- If the measured clearance is within table values, proceed to the next step.
- If the measured gap is larger than the maximum, tighten the retainer—apply more torque than that listed in Table 6, if necessary—until the clearance is within maximum and minimum values.
- If the measured clearance is smaller than the minimum, remove the retainer, seat ring and face seals, clean the parts and reassemble so as to obtain the necessary clearance.

10. Perform the Adjusting Actuator Travel procedure and then install the control valve in the pipeline.

3.3 Replacing Valve Plug, Shaft and Bearings

Perform this procedure to replace the valve plug (key 2), expansion pin assembly (keys 9 and 10), shaft (key 3) or bearings (keys 6 and 42). For NPS 12, follower shaft (key 3) and groove pins (key 39) are also the parts need to be replaced. These parts are independently replaceable; for example, installing a new valve plug does not require replacing a reusable valve shaft or expansion pin assembly. Key numbers refer to Figures 11, 13 and 14 unless otherwise indicated.

Disassembly of Valve Plug, Shaft and Bearings

WARNING

To avoid personal injury resulting from contact with edges of the valve plug (key 2) and seat ring (key 4) during plug rotation, stay clear of the plug edges when rotating the plug. To avoid damage to tools, valve parts or other items resulting from valve plug rotation, keep tools and other property away from the edges of the plug.

NOTICE

To avoid increased leakage, increased valve component wear or possible damage to the valve body (key 1), plug (key 2), shafts (keys 3 and 38) and bearings (keys 6 and 42) resulting from a sharp blow to the actuator body or valve parts, use a wheel puller to separate the actuator parts from the valve shaft.

Do not drive the actuator parts off the valve shaft since this could move the valve bearings, shaft and plug away from proper alignment, causing improper seating of the plug. Such misalignment may result in damage to valve components if the valve is returned to service without disassembly and inspection of the valve plug alignment.

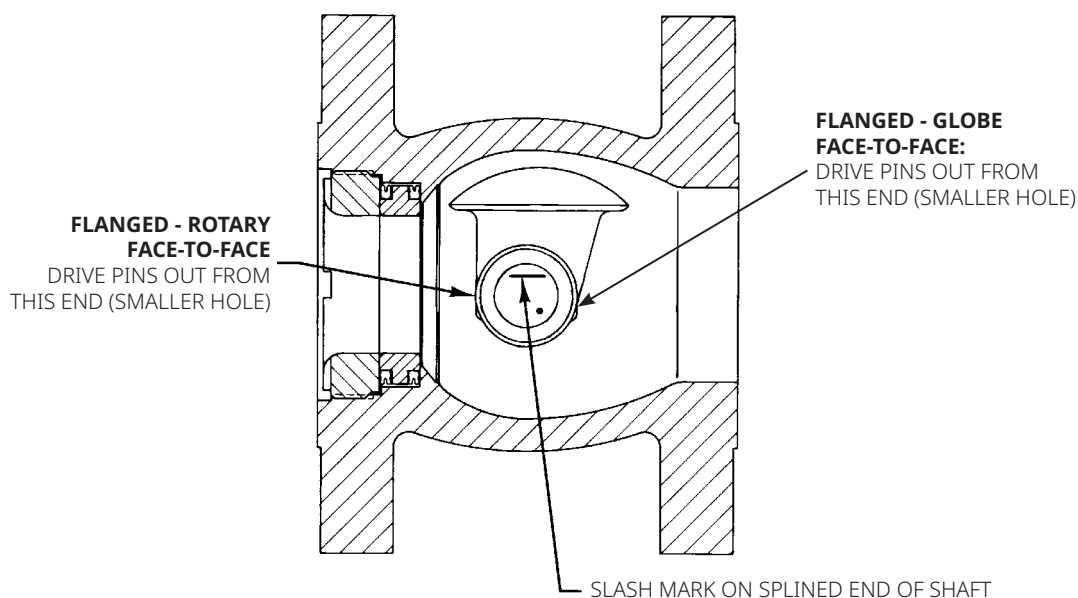
NOTE

Following removal of the valve from the pipeline and partial disassembly, the valve shaft may be used to remove bearings in accordance with the procedure described in step 8.

NOTE

For globe face-to-face NPS 2, 3 and 4, disassembly of retainer, seat ring and insert prior to plug, shaft and bearings disassembly, to make sure plug and bearings can be placed out from retainer side of valve body.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove the actuator cover. Note the actuator orientation with respect to the valve body and the lever orientation with respect to the valve drive shaft (see Figure 2). Remove the lever but do not loosen the actuator turnbuckle adjustment. Remove the actuator mounting screws and nuts and remove the actuator. If necessary, refer to the actuator instruction manual for assistance.
3. With the valve body (key 1) out of the pipeline, loosen the packing nuts (key 16). If the packing is to be reused, do not remove it. However, Emerson recommends that the packing be replaced whenever the drive shaft is removed.
4. Rotate the plug (key 2) to the fully open position.

Figure 8. Detail of Valve Plug for Pin Removal

A3307-1

Table 8. Data for Tapped Hole in Valve Shaft

VALVE SIZE, NPS	SHAFT DIAMETERS				THREAD SIZE, UNC
	Through Valve Body	At Spline End	Through Valve Body	At Spline End	
	mm	mm	in.		
1	12.7	12.7	0.50	0.50	10-24
1-1/2	15.9	15.9	0.62	0.62	1/4-20
2	15.9	12.7	0.62	0.62	10-24
3	25.4	15.9	1.00	1.00	3/8-16
	25.4	25.4	1.00	0.75	5/16-18
4	31.8	19.1	1.25	1.25	3/8-16
6	38.1	38.1	1.50	1.50	1/2-13
	38.1	31.8	1.50	1.25	3/8-16
8	38.1	38.1	1.50	1.50	1/2-13
10	44.5	44.5	1.75	1.75	1/2-13
12	53.8	53.8	2.12	2.12	3/4-10
	53.8	50.8	3.12	2	

5. For NPS 1 through 10, refer to Figure 8. Find the expansion pin (key 9) and the taper pin (key 10) inside of it. These parts are holding the valve plug in position on the shaft. Find the larger hole in the valve plug hub where these pins enter the hub. On the opposite side of the plug hub is a smaller hole where the chamfered end of the expansion pin rests on the inner lip of the hole. Using a pin punch and hammer, strike the chamfered end of the expansion pin through the smaller hole. Remove both pins from the valve plug hub in the direction shown in Figure 8.

Driving the pins in the other direction will tighten the pins.

For NPS 12, drive out two groove pins (key 39) that secure the plug (key 2) to the drive shaft (key 3) and follower shaft (key 38). Remove both pins from the valve plug hub in the direction shown in Figure 8. Driving the pins in the other direction will tighten the pins. Remove the hex nuts (key 44) and then remove the bottom flange (key 40). Thread a bolt into the end of the follower shaft and pull the follower shaft out of the valve. Refer to Table 9 for thread sizes. The bearing (key 6) may come out with the follower shaft.

WARNING

To avoid personal injury or damage to tools, valve parts or other items and plug damage resulting from the valve plug falling from the valve body, support the plug to prevent it from falling as the shaft (key 3) is being removed.

6. Pull the drive shaft (key 3) from the valve body. If the shaft cannot be removed by hand, attach a slide hammer or similar tool to the spline end of the valve shaft. If the shaft has a tapped hole at the spline end of the shaft; refer to Table 8 for thread sizes.
7. Remove the plug and thrust washer (key 12) from the valve body.

NOTE

For NPS 1 through 8, two shaft bearings (key 6) are located inside the valve body on either side of the valve plug. Only one of these two bearings is identified by key 6. The other bearing is located along the valve shaft on the other side of the valve plug. For NPS 10 and 12, there are two shaft bearings. One is identified as key 6 and the other is identified as key 42.

8. If the shaft bearings are to be replaced, remove the packing (key 13).
9. If the bearing closest to the packing (key 6 on NPS 1 through 8 and key 42 on NPS 10 and 12) requires replacement and cannot be removed by hand, press it out using a ram with dimensions given in Figure 9 and Table 9.

NOTICE

Ensure the bearing stop is not moved when pressing out the bearing. Movement may cause the new bearing and valve plug to not be centered with the seal, causing possible leakage or damage of the seal/plug.

Insert the ram through the packing box and press the bearing into the valve body cavity. The bearing stop (key 7) does not need to be removed; take care not to move the bearing stop when pressing out the bearing.

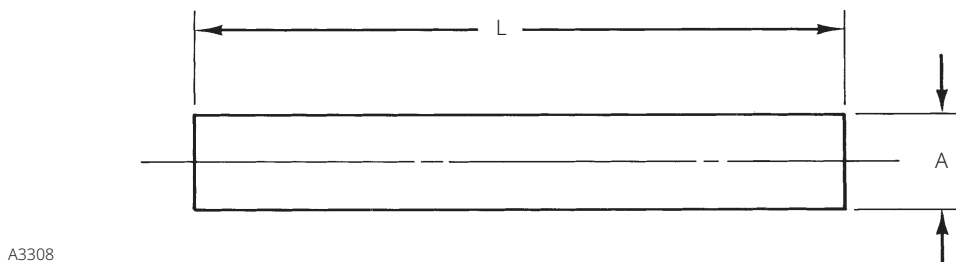
10. For NPS 1 through 8, if the second bearing (key 6) requires replacement and cannot be removed by hand, use one of the following methods:
 - Knock or pry the bearing out or
 - Use the valve shaft as a piston to drive the bearing from the valve body. To accomplish this, first, fill the bearing bore with a heavy grease and then insert the end of the shaft back through the valve body and into the grease-filled bearing. Protect the splined end of the shaft with, for example, a block of wood; then strike the protected end. When the shaft is struck, it will act as a piston, pushing the grease into the bearing bore. The grease will then force the bearing out of the bore and farther along the shaft. Soon, the bearing will be positioned for easy removal.

For NPS 10 and 12, if the bearing (key 6) on the follower shaft requires replacement and cannot be removed by hand, press it out using a ram with dimensions as given in Figure 9 and Table 9. Press the bearing into the valve body cavity.

11. If used, remove the O-rings (keys 19 and 20) from the bearings. Also, for NPS 1 through 8, remove the pipe plug (key 29).

Table 9. Ram Dimensions

VALVE SIZE, NPS	A MAXIMUM MINIMUM		L	
	mm	in.	mm	in.
1	15.1 14.7	.594 .578	114	4.50
1-1/2	18.3 17.9	.719 .703	114	4.50
2	18.3 17.9	.719 .703	127	5.00
3	27.8 27.4	1.094 1.078	165	6.50
4	34.1 33.7	1.344 1.328	165	6.50
6	42.1 41.7	1.656 1.641	197	7.75
8	42.1 41.7	1.656 1.641	229	9.00
10	48.4 48.0	1.905 1.890	229	9.00
12	57.8 57.4	2.275 2.260	260	10.25

Figure 9. Ram Dimension for Bearing Removal (Also See Table 9)

A3308

Assembly of Valve Plug, Shaft and Bearings

NOTE

Before starting to assemble the valve components, place the valve body (key 1) on a flat surface with the retainer (key 5) facing down as shown in Figure 10. This orientation of the valve body allows easier installation of the valve plug.

For globe face-to-face NPS 2, 3 and 4, assembly of plug, shaft and bearings, prior to retainer, seat ring and insert assembly to make sure plug and bearings can be placed into valve body from retainer side of body.

1. Thoroughly clean the parts before assembly.
2. If O-rings (keys 19 and 20) are used, apply a small amount of lubricant to the O-rings so the bearings will easily slide into the valve body. Insert the smaller O-ring (key 20) inside the bearing and the larger O-ring (key 19) around the outside of the bearing.

NOTICE

To avoid damage to O-rings resulting from contact with sharp edges within the bearing holes, use appropriate care when installing the O-rings.

3. Slide the bearings (key 6) and O-rings (keys 19 and 20), if used, into the valve body as shown in Figures 11, 13 and 14.

NOTE

Place the valve body on a flat surface with the retainer (key 5) facing down so that you can look into the valve body cavity. This orientation makes installing the valve plug easier. The retainer should be facing up for globe face-to-face NPS 2, 3 and 4.

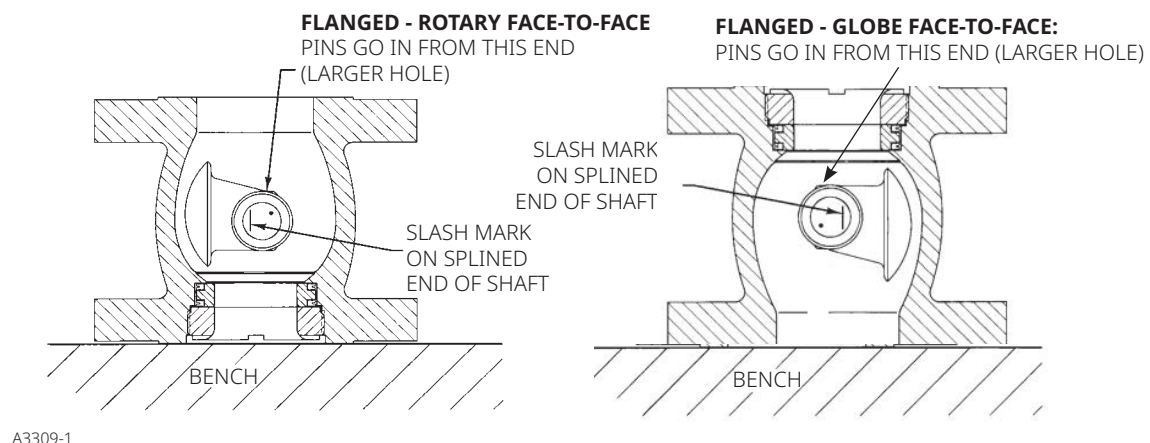
4. Inspect the valve shaft (key 3). Insert the shaft end with the pin hole into the packing box and through the bearings that was previously installed in the packing box in step 3. Stop before the shaft enters the main valve body cavity. Support the end of the shaft that extends out from the valve body.
5. Determine the correct orientation of the valve plug (key 2) required by the specific installation orientation of the valve and the flow direction of the process fluid. See Figure 2.
6. For NPS 1 through 10, inspect the valve plug. Note the location of the larger hole on the valve plug hub. Place the valve plug in the valve body cavity.

For NPS 12, place the plug in the valve body cavity. Slide the follower shaft, splined end first, through the bearing (key 6) that was previously installed in step 3 and into the hub of the plug. Align the groove pin hole in the follower shaft with the hole on the plug hub.

7. For NPS 1 through 10, position the valve plug so the larger hole is facing up, away from the seat ring and retainer (near from the seat ring and retainer for globe face-to-face NPS 2, 3 and 4). The valve plug must also be oriented so the seating surface of the plug is correctly positioned for the specific application as shown by the illustrations in Figure 2.

For NPS 12, determine the correct orientation of the plug (key 2) required by the specific installation orientation of the valve and the flow direction of the process fluid. See Figure 2. The groove pin holes in both the drive shaft (key 3) and the hub of valve plug are offset from center. Make certain the holes will align.

Figure 10. Detail of Valve Plug for Pin Insertion



NOTE

Before proceeding, inspect the valve plug position once again to ensure the correct orientation as described in step 6. If the valve plug is not properly installed, it will not rotate properly and will not shutoff in service.

8. Hold the thrust washer(s) (key 12) between the valve plug (key 2) and the bearing installed next to the packing as shown in Figures 11, 13 and 14.
For NPS 1 through 10, slide the valve shaft (key 3) from the packing box into the valve body through the thrust washer(s) and plug. If the shaft material is S17400, use two 0.7938 mm / 1/32 in. 17-7 PH thrust washers. If the shaft material is S20910, use one 1.587 mm / 1/16 in. alloy 6 thrust washer.

For NPS 12, align the zero mark located on the end of the drive shaft with the zero mark located on the plug hub. Slide the valve drive shaft (key 3) from the packing box housing into the valve body through the thrust washer and into the hub of the plug.
9. Secure the valve plug in the correct open position. Inspect the splined end of the valve shaft and locate the slash mark on the splined end. Rotate the valve shaft until the slash mark is vertical and facing out from the center of the shaft in the same direction as the valve plug seating surface. See Figure 10.

NOTE

When the valve shaft is correctly positioned, the slash mark on the splined end will be parallel with the plug shutoff surface. See Figure 10. If the plug is not properly aligned with the slash mark, the valve will not function correctly.

10. Secure the plug to the shaft (key 3) as follows:

For NPS 1 through 10:

- a. Look into the valve body and find the larger pin hole on one side of the valve plug hub. Find the smaller hole on the opposite side of the hub. These holes should line up with the hole through the shaft (key 3). For NPS 10, refer to Figure 10 for the pins insertion orientation.

NOTE

If the holes in the valve plug hub do not line up with the hole in the shaft, check the slash mark on the splined end of the shaft. Make sure the shaft and plug are properly oriented.

NOTICE

For NPS 1 through 2, use only N10276 expansion and taper pins (keys 9 and 10) with VTC (ceramic) valve plug. With any other pin material, there is danger of the pins expanding and cracking the plug as temperature rises. For that reason, the NPS 1 through 2 VTC valve plugs are sold only as a set that includes N10276 pins. Use only the pins that are furnished with the set.

Components of the VTC valve plug assembly for the NPS 3 through 8 cannot be repaired in the field.

- b. Place the chamfered end of the expansion pin (key 9) into the larger hole in the plug hub (see Figure 11).

NOTICE

To avoid damage to the expansion pin, valve plug or shaft resulting from the application of excessive force on the expansion pin, use appropriate care when driving the expansion pin through the plug hub and shaft. Use the right tool. Do not use excessive force.

- c. For NPS 1 through 8, drive the expansion pin into the larger hole until the chamfered end of the pin reaches the inner lip of the smaller hole on the opposite side of the plug. Closely observe the progress of the pin to avoid striking it after it has reached the lip of the smaller hole. For NPS 10, drive the expansion pin into the pin hole until the expansion pin flange touch the plug hub.
- d. Place the taper pin (key 10) into the open end of the expansion pin. Drive the taper pin into the expansion pin until the pins, plug and shaft are snug. Do not attempt to drive either pin flush with the hub.

For NPS 12, to secure the plug to the follower shaft, align the groove pin hole in the plug hub and the hole on the opposite side of the plug with the groove pin hole through the follower shaft (key 38). Use pin punches to drive in the groove pin until it is flush with the surface of plug hub. Stake both ends of the pin hole in the plug hub to retain the pin during this step. Then to secure the plug to the drive shaft, it should be noticed that the groove pin holes in both the drive shaft (key 3) and the hub of the plug are offset from center and have spline ridges. Make certain in the holes in the plug hub will align with the hole in the drive shaft. Secure the plug to the drive shaft by using pin punches and driving in the groove pin until it is flush with the surface of the plug hub. Make certain that the groove pin goes completely through the drive shaft and into the opposite side of the plug hub.

11. Rotate the plug by hand to check that it rotates properly. If rotation interferes with the valve body, drive out the pins (keys 9 and 10) for NPS 1 through 10 and the groove pin (key 39) for NPS 12. Remove the valve shaft (keys 3 and 38) and repeat this procedure starting with step 4.
12. For NPS 1 through 8, if used, install the pipe plug (key 29). For NPS 10 and 12, install the gasket (key 41), bottom flange (key 40) and then install and tighten the hex nuts (key 44) (reference table below). Make sure the pipe plug (key 29) is installed in the bottom flange. For NPS 10 and 12, lubricate the bottom flange studs (key 43) and hex nuts (key 43) with appropriate anti-seize lubricant. Install the bottom flange studs (key 43), gasket (key 41), bottom flange (key 40) and then install and tighten the hex nuts (key 44) using accepted bolting procedures. See Table 10 for torque values. Make sure the pipe plug (key 29) is installed in the bottom flange if applicable.

Table 10. Bottom Flange Bolting Torque

VALVE SIZE, NPS	TORQUE	
	N-m	Lbf-ft
10	141	104
12	176	130

13. If the seat ring (key 4), face seals (key 8) and retainer (key 5) need to be installed, complete the assembly instructions in the procedure for Replacing Retainer, Seat Ring and Face Seals. If the seat ring has previously been installed, proceed to Adjusting Actuator Travel.

3.4 Adjusting Actuator Travel

Perform this procedure whenever the actuator is removed or disconnected from the valve and whenever the seat ring and retainer (keys 4 and 5) are removed. Actuator travel that is too short will increase shutoff leakage; too much travel will cause excessive plug and seat ring torque.

Any of the Fisher pneumatic (spring-and- diaphragm, piston or spring-return piston), electric, electrohydraulic or manual actuators—or any other operator—must be adjusted for use with a V500 valve so that the valve plug is rotated to the fully closed position. The fully closed position is obtained when a gap of 0.001 in. exists between the seat ring (key 5) and retainer (key 4).

Note that this gap is also measured when assembling the seat ring, retainer and face seals to ensure correct assembly. Measure the gap according to this procedure to ensure proper actuator adjustment. Merely completing the assembly measurement is not sufficient.

Travel for different actuators is adjusted differently (some use turnbuckle assemblies; some use externally adjusted travel stops; others use internal limit switches). Refer to the actuator instruction manual for adjustment instructions.

1. Mount the actuator following the instructions in the actuator instruction manual. Refer to Figure 3 to select actuator mounting style and position and to orient the actuator lever with the valve shaft (key 3).
2. For actuators with clamped levers,

NOTICE

When installing the actuator onto the valve, do not use a hammer or similar tool to drive the lever or actuator onto the valve shaft. Driving the lever or actuator onto the valve shaft could damage the valve plug, seal ring and other valve components.

- Clean the valve shaft splines and actuator lever splines to be sure the actuator lever will slide on easily.
 - Pull the valve shaft (key 3), by hand, toward the packing (key 13). Or,
 - If the lever does not slide easily on the valve shaft, carefully wedge the valve plug solidly against the actuator-side thrust washer using a screwdriver or similar tool in the same direction as the pry bar shown in Figure 6.
3. Clamp the lever to the valve shaft.

NOTICE

Do not apply full actuator signal (pressure or power) to the actuator in the next step. Full signal may wedge the valve plug into the seat ring. Use a regulated signal source and gradually increase the signal to slowly stroke the actuator.

4. Adjust actuator travel and stroke the actuator so that the plug is close to but not contacting the seat ring at full actuator travel. If available on electric actuators, use a manual handwheel to position the plug.
5. Adjust travel, using full actuator signal, until the valve plug contacts the seat ring around its full circumference. This contact self-centers the seat ring on the valve plug.
6. Continue to adjust travel until a gap of 0.001 in. exists between the seat ring and retainer, as shown in Figure 14, at full actuator travel.
7. Refer to the actuator instruction manual to lock the actuator travel adjustment.

3.5 Changing Valve Flow Direction

The V500 valve may be installed in either forward or reverse flow service. Forward flow enters the seat ring first, then flows past the valve plug. If changing flow direction is necessary, release all pressure from the valve and actuator. Remove the control valve assembly from the pipeline and rotate the assembly about the valve shaft to put the retainer end of the valve where the other end was. Refer to the procedure for Changing Actuator Mounting Style if the actuator must be repositioned and refer to the Installation section to install the control valve assembly. Be sure to reposition the flow direction arrow on the valve body.

3.6 Changing Actuator Mounting Style

Refer to Figure 3 of this manual and the actuator instruction manual when changing mounting styles or positions. Right-hand mounting places the actuator on the right side of the valve as viewed from the upstream side of the valve; left-hand mounting places the actuator on the left side of the valve. Remember that the upstream side of the valve inlet is the retainer end of the valve body for forward flow and the other end of the valve body is the upstream side for reverse flow.

Complete the Adjusting Actuator Travel procedure whenever the actuator is removed.

Section 4: Parts

4.1 Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your [Emerson sales office](#). When ordering replacement parts, also specify the part name and desired material.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

4.2 Parts Kits

Repair Kits

Repair kits include recommended spares for standard and sealed bearing constructions.

Table 11. Repair Kits

PARTS INCLUDED IN KITS		QUANTITY IN KIT
Key Number	Description	
9	Expansion pin	1
10	Taper pin	1
11	Retainer gasket	1
19	O-ring (sealed bearing only)	2
20	O-ring (sealed bearing only)	2

Valve Size, NPS	Kit Parts Number
1	RV500X00012
1-1/2	RV500X00022
2	RV500X00032
3	RV500X00042
4	RV500X00052
6	RV500X00062
8	RV500X00072

Repair Kits for ENVIRO-SEAL Packing

Packing boxes in these valves may be deep-drilled. If the valve being repaired has a deep packing box, additional parts are required. Refer to the Packing Maintenance section in this manual.

Table 12. Repair Kits for ENVIRO-SEAL Packing

PARTS INCLUDED IN KITS		QUANTITY IN KIT	
Key Number	Description	PTFE	Graphite
105	Packing Set	1	1
106	Anti-Extrusion Washer	2	-- (1)
1. Included in packing set, key 105.			

Valve Size, NPS	Kit Parts Number
1	RRTYX000012
1-1/2 and 2	RRTYX000022
3	RRTYX000052
4	RRTYX000062
6 and 8	RRTYX000072
10	RRTYX000232
12	RRTYX000252

Retrofit Kits for ENVIRO-SEAL Packing

Retrofit kits include parts to convert existing V500 valves with single depth packing box to the ENVIRO-SEAL packing box construction. Retrofit kits include single PTFE or graphite packing box construction (see following table).

Table 13. Retrofit Kits for ENVIRO-SEAL Packing

PARTS INCLUDED IN KITS		QUANTITY IN KIT	
Key Number	Description	PTFE	Graphite
100	Packing stud	2	2
101	Packing nut	2	2
102	Packing flange	1	1
103	Spring pack assembly	1	1
105	Packing set	1	1
106	Anti-extrusion washer	2	---
107	Packing box ring	1	1

Valve Size, NPS	Kit Parts Number
1	RRTYXRT0012
1-1/2 and 2	RRTYXRT0022
3	RRTYXRT0052
4	RRTYXRT0062
6 and 8	RRTYXRT0072
10	RRTYXRT0682
12	RRTYXRT0722

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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D100423X012

V500 Valve

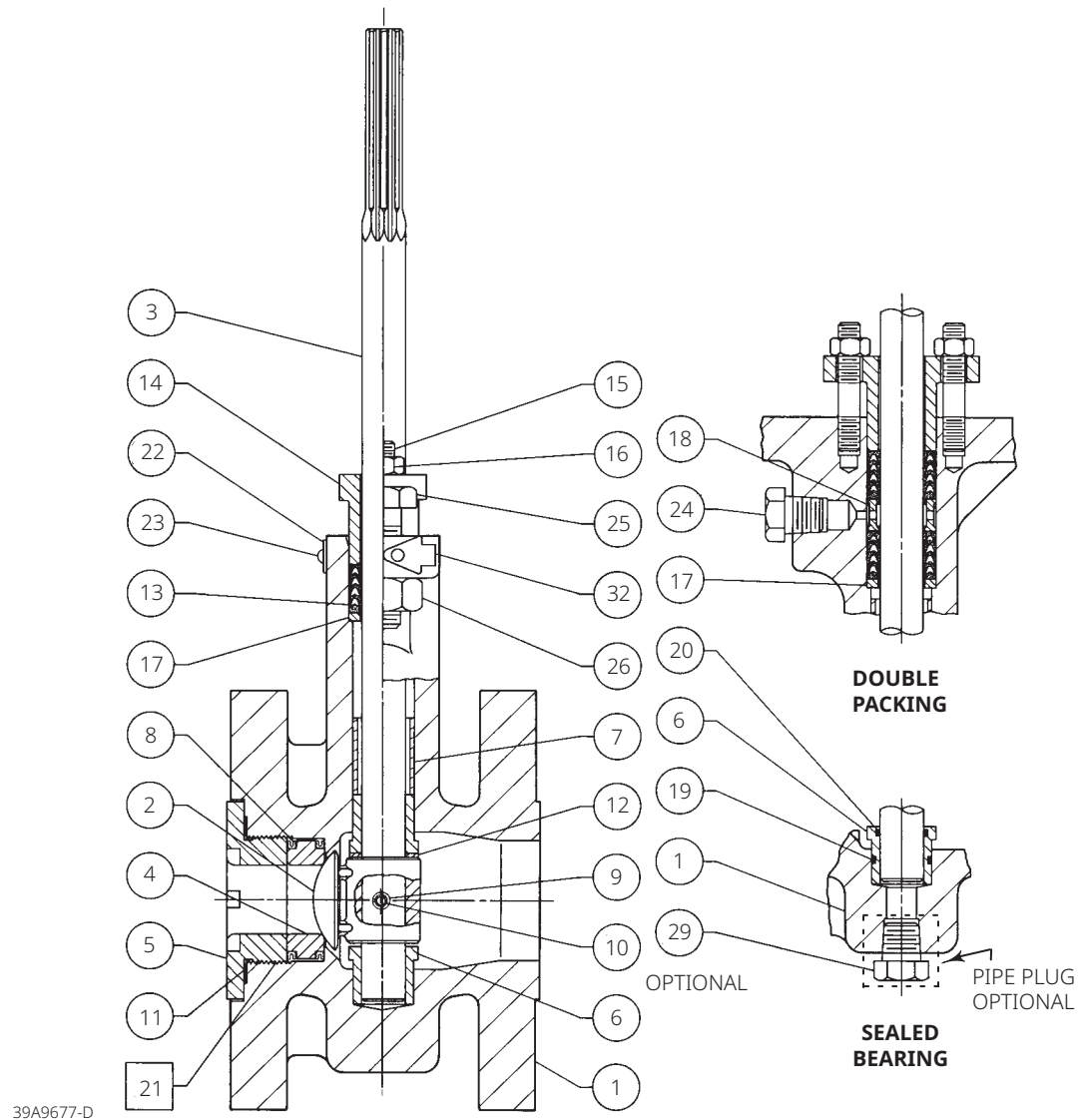
June 2026

Table 14. Explanation of Valve Construction⁽¹⁾

For These Packing and Bearing Constructions	Use These Valve Constructions
Single packing and standard bearings	Standard packing box without end tapping
Single packing and sealed bearings	Standard packing box with end tapping
Double packing and standard bearings	Deep packing box without lube or end tapping
Leakoff packing and standard bearings	Deep packing box with only lube tapping
Double packing and sealed bearings	Deep packing box with only lube tapping
Leakoff packing and sealed bearings	Deep packing box with both lube and end tapping
Purged bearing and single packing for purged bearings	Deep packing box with both lube and end tapping

1. Please contact your [Emerson sales office](#) for more information.

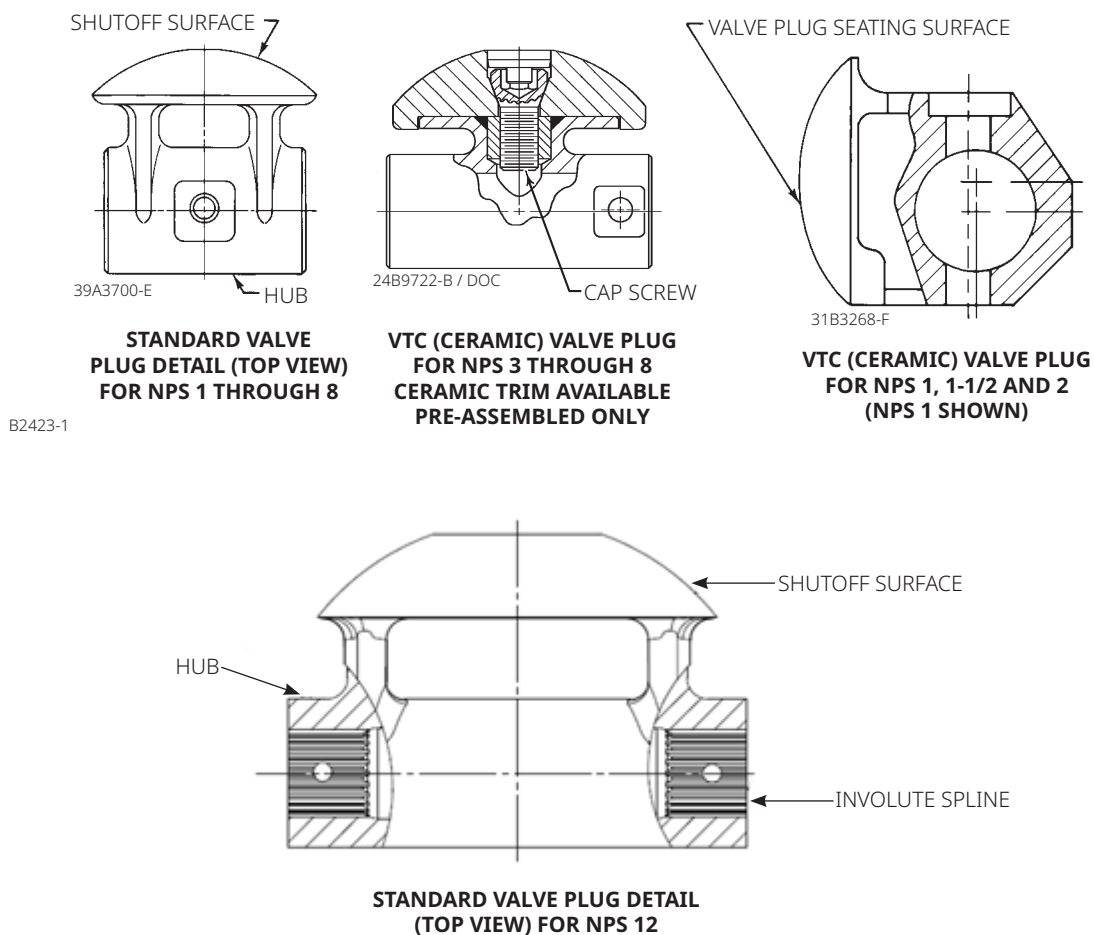
Figure 11. Fisher V500 Rotary Control Flange Valve, NPS 1 and 1-1/2



☐ APPLY LUBRICANT

PARTS NOT SHOWN: 28, 30, 31, 33, 36, 37, 130, 131, 134, AND 135.

Figure 12. Valve Plug Views



4.3 Parts List

NOTE

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson sales office.

Valve Common Parts (Figures 11, 13 and 14)

Table 15. Parts List

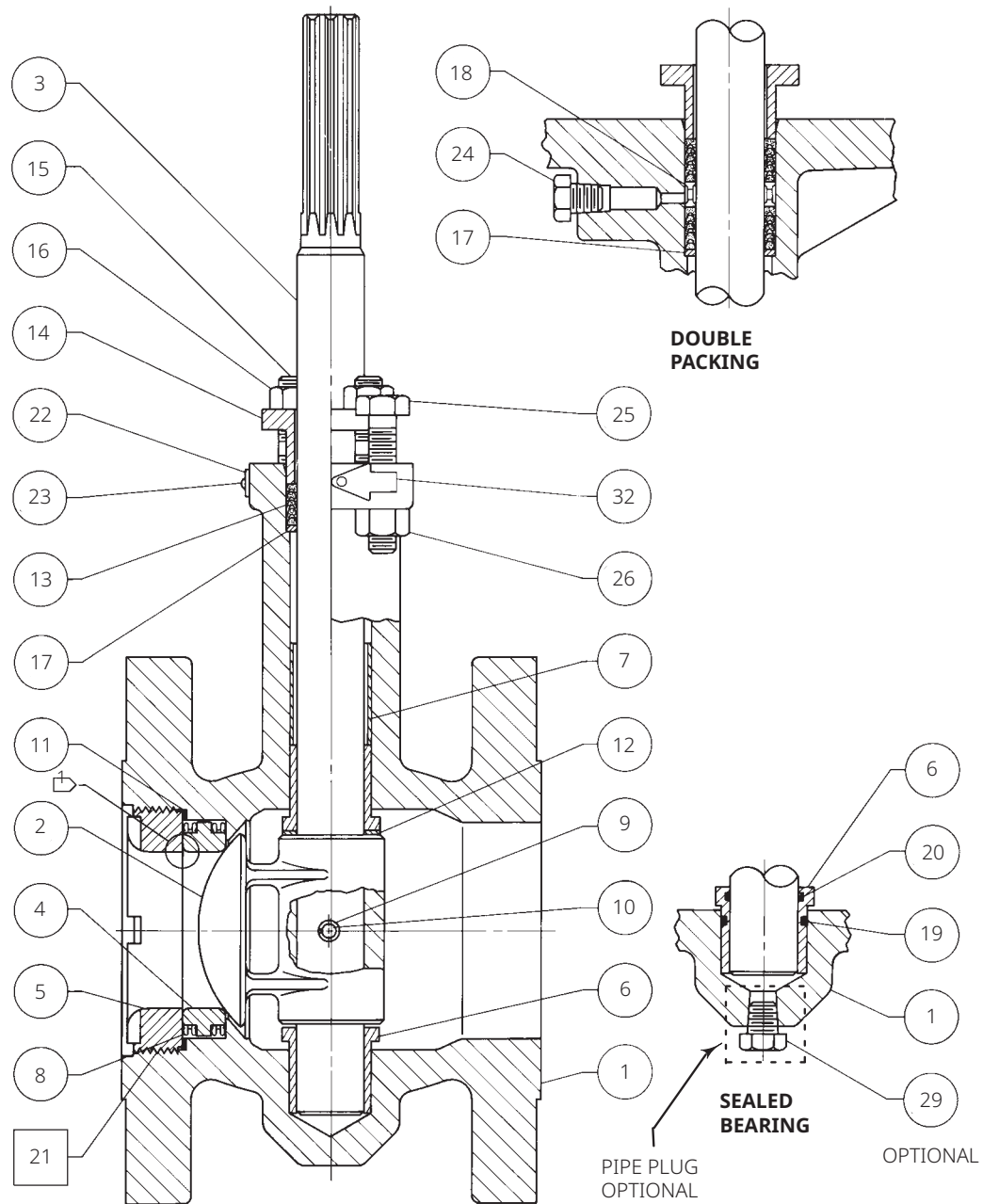
Key	Description	Key	Description
1	Valve body/Bearing assembly If you need a valve body as a replacement part, order by valve size, serial number and desired material.	24	Isolator/Lubricator valve (not shown) Pipe nipple (not shown)
2	Valve plug	25	Cap screw
3	Valve shaft	26	Hex nut
4*	Seat ring	28*	Packing washer (not shown) Single (3 req'd) Double or leakoff (4 req'd)
5	Retainer		
6*	Bearing (2 req'd, NPS 1 through NPS 8; 1 req'd NPS 10 and NPS 12)	29	Pipe plug (for sealed or purged bearing constructions) (Optional)
7	Bearing stop	30	Nameplate (not req'd when actuator is furnished)
8*	Face seal, (2 req'd)	31	Nameplate wire (not req'd when actuator is furnished)
9*	Expansion pin	32	Flow arrow
10*	Taper pin	33	Retainer tool (not shown)
11*	Retainer gasket	36	Line studs (for flangeless valve bodies)
12	Thrust washer ⁽¹⁾	37	Cap screws (for flangeless valve bodies)
13*	Packing set	38*(2)	Follower shaft
14	Packing follower	39 ⁽²⁾	Groove pin
15	Packing flange stud (2 req'd)	40 ⁽²⁾	Bottom flange
16	Packing flange nut (2 req'd)	41*(2)	Gasket
17*	Packing box ring	42*(2)	Drive bearing
18	Lantern ring	43 ⁽²⁾	Stud (for bottom flange bolting)
19	O-ring (for sealed bearing, 2 req'd)	44 ⁽²⁾	Hex nut (for bottom flange bolting)
20*	O-ring (for sealed bearings, 2 req'd)	45 ⁽²⁾	Packing flange
21	Anti-seize lubricant (not furnished with valve)	130	Clamp (req'd w/ nonconductive packing)
22	Nameplate	131	Bonding strap assembly (req'd with nonconductive packing)
23	Drive screw (6 req'd)	134	Gasket (for valve body with insert design, does not include NPS 2)
24	Pipe plug	135	Insert
*Recommended spare parts			
1. A single quantity of the part number is needed – you will receive two thrust washers when you specify 17-7PH.			

Enhanced ENVIRO-SEAL Packing System (Figure 15)

Table 16. Parts List

Key	Description	Key	Description
100	Packing flange stud (2 req'd)	106*	Anti-extrusion ring (2 req'd)
101	Packing flange nut (2 req'd)	107*	Packing box ring
102	Packing flange	108*	Packing ring (2 req'd)
103	Spring pack assembly	109*	Anti-extrusion ring
105*	Packing set	- - -	- - -
*Recommended spare parts			

Figure 13. Fisher V500 Rotary Control Valve, NPS 2, 3, 4, 6 and 8



49A3686-F

☐ APPLY LUB

PARTS NOT SHOWN: 28, 30, 31, 33, 36, 37, 130, 131, 134, AND 135.

1. MEASURE GAP HERE

Figure 14. Fisher V500 Rotary Control Valve, NPS 10 and 12

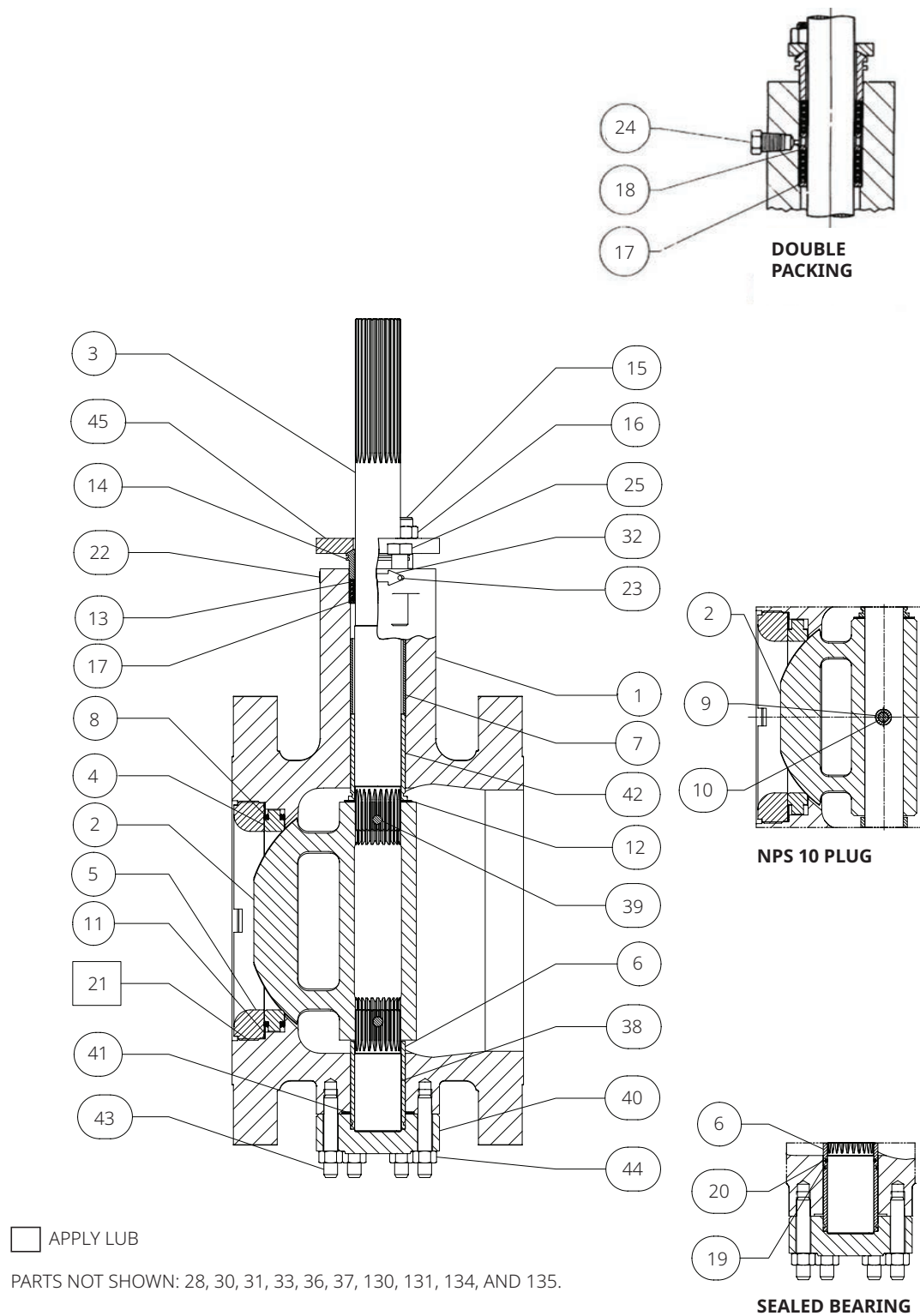
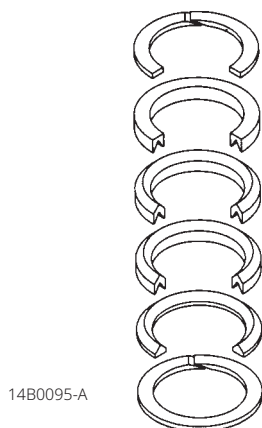
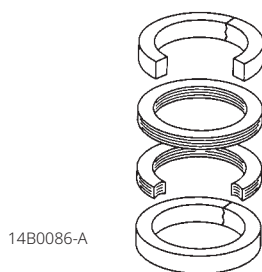


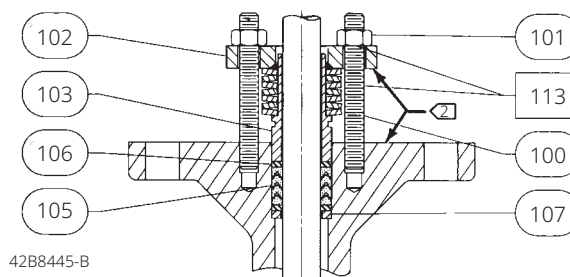
Figure 15. ENVIRO-SEAL Rotary Packing Arrangements with PTFE and Graphite Packing



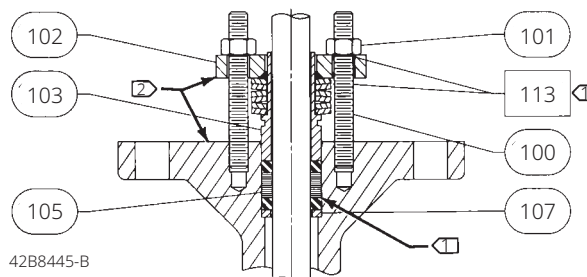
**STACKING ORDER OF
PTFE PACKING RINGS**



**STACKING ORDER OF
GRAPHITE PACKING RINGS**



**SINGLE PTFE PACKING
STANDARD DEPTH BOX**



**GRAPHITE PACKING
STANDARD DEPTH BOX**

NOTES:

1. APPLY LUBRICANT.
2. THESE TWO SURFACES SHOULD REMAIN PARALLEL AS YOU ALTERNATELY AND EVENLY TIGHTEN THE PACKING NUTS (KEY 101).

Appendix A: Flangeless Considerations

The flangeless valve body has been discontinued. This appendix is provided in order to do maintenance and get key information for existing flangeless valve bodies. For flangeless valve bodies make sure the mating line flanges are aligned.

Table A-1. Shaft Diameter and Approximate Weights

VALVE SIZE, NPS	SHAFT DIAMETER		APPROXIMATE WEIGHT		
	Through Valve	At Spline End	Flangeless		
			CL150	CL300	CL600
			mm		
1	12.7	12.7	3.6	3.6	3.6
1-1/2	15.9	15.9	5.4	5.4	5.4
2	15.9	15.9	8.2	8.2	8.2
3	25.4	25.4	16	16	16
	25.4	19.1			
4	31.8	31.8	34	34	34
6	38.1	38.1	50	50	---
	38.1	31.8			
8	38.1	38.1	57	68	---
	in.		lbs		
1	1/2	1/2	8	8	8
1-1/2	5/8	5/8	12	12	12
2	5/8	5/8	18	18	18
3	1	1	35	35	35
	1	3/4			
4	1-1/4	1-1/4	75	75	75
6	1-1/2	1-1/2	110	110	---
	1-1/2	1-1/4			
8	1-1/2	1-1/2	125	150	---

Table A-2. Line Stud (Key 36)⁽¹⁾

R				
Valve Size	Pressure Rating	Qty	Bolt Size	Bolt Length
NPS				In.
6	CL150	6	3/4-10 UNC	5.00
	CL300	6	3/4-10 UNC	5.00
8	CL150	---	---	---
	CL300	4	7/8-9 UNC	5.62

1. Use instead of cap screws.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

V500 Valve

June 2026

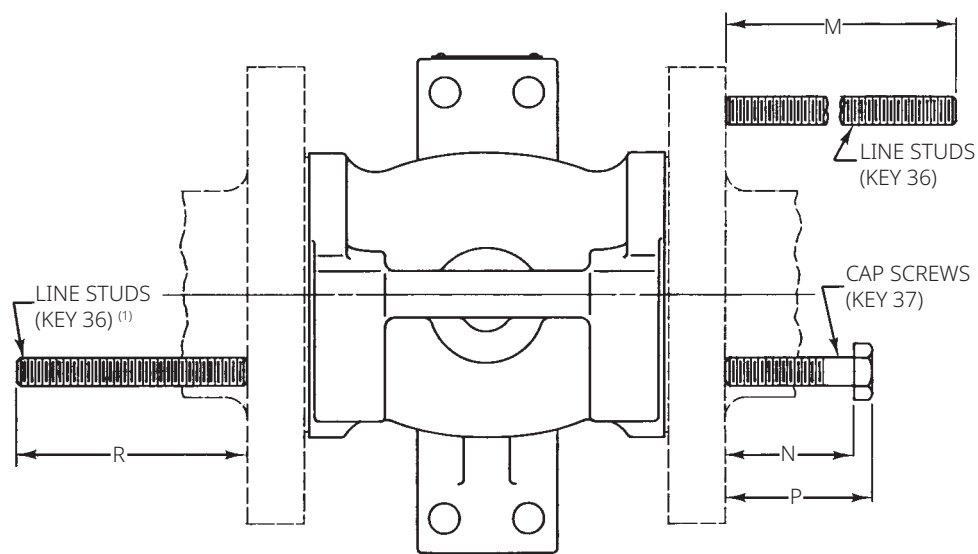
Instruction Manual

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Table A-3. Cap Screw (Key 37)

N					
Valve Size	Pressure Rating	Qty	Bolt Size	Bolt Length	Overall Length
NPS				In.	In.
3	CL150	---	---	---	---
	CL300	4	3/4-10 UNC	2.38	2.88
	CL600	4	3/4-10 UNC	2.38	2.88
4	CL150	4	5/8-11 UNC	2.00	2.44
	CL300	4	3/4-10 UNC	2.38	2.88
	CL600	4	7/8-9 UNC	2.75	3.38

**Figure A-1 Line Bolt Dimensions for Flangeless Valve Bodies
(Also See Tables A2 and A3)**

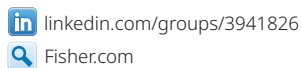


NOTE:
1. USED INSTEAD OF CAP SCREWS.

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FISHER™



Fisher™ Vee-Ball™ V150 and V300 NPS 14 through 24 Rotary Control Valves



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual provides installation, operation, maintenance and parts ordering information for NPS 14, 16, 20, 24x20 and 24 V150 and NPS 14, 16, 20 and 24 V300 rotary control valves. For smaller valves (NPS 1 through 12), refer to the Vee-Ball V150, V200 and V300 Rotary Control Valves NPS 1 through 12 instruction manual (D101554X012). For information on ENVIRO-SEAL™ packing, see the ENVIRO-SEAL Packing System for Rotary Valves instruction manual (D101643X012). Refer to separate manuals concerning the actuator, positioner and mounted accessories.

WARNING



Do not install, operate or maintain V150 and V300 valves without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Figure 1. Fisher Vee-Ball Valves



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

V150 and V300 Valves

July 2025

Instruction Manual

D101957X012

Table 1. Technical Specifications

Valve Sizes and End Connection Styles	Actuator Mounting
V150: NPS 14, 16, 20, 24x20 and 24 with CL150 raised-face flanges as shown in Table 3 V300: NPS 14, 16, 20 and 24 with CL300 raised-face flanges as shown in Table 3	■ Right-hand or ■ left-hand as viewed from the upstream end of the valve. Standard valve construction with standard ball rotation is with right-hand mounting. Optional valve construction with optional ball rotation for left-hand mounting is available upon request.
Maximum Inlet Pressure ⁽¹⁾	Ball Rotation
Consistent with applicable ASME B16.34 or EN 12516-1 ratings	Standard: Ball rotates Counterclockwise to Close (CCW) when viewed from actuator side of valve Optional: Ball rotates Clockwise to Close (CW) Maximum ball rotation is 90 degrees
Standard Flow Direction	Valve/Actuator Action
Forward (into the convex sealing face of the ball)	With diaphragm or piston rotary actuator, field-reversible between push-down-to-close (extending actuator rod closes valve) and push-down-to-open (extending actuator rod opens valve)
1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.	

Table 2. Valve Sizes, Drive Shaft Diameters and Valve Assembly Weights

VALVE SIZE		DRIVE SHAFT DIAMETER		VALVE ASSEMBLY WEIGHT			
mm	NPS	mm	in.	kg		lb	
				V150	V300	V150	V300
350	14	44.5	1-3/4	206	374	545	825
400	16	54.0	2-1/8	333	510	735	1125
		54.0 x 50.8	2-1/8 x 2				
500	20	63.5	2-1/2	524	755	1155	1661
600 ⁽¹⁾	24x20 ⁽¹⁾	63.5	2-1/2	757	- - -	1666	- - -
600	24	76.2	3	965	1308	2122	2877
600 ⁽²⁾	24 ⁽²⁾	76.2	3	798	898	1755	1975
1. NPS 24x20 available only for V150, not for V300 valves. 2. Flangeless NPS 24.							

Table 3. Valve Sizes, End Connection Styles and Ratings⁽¹⁾⁽²⁾

VALVE BODY MATERIAL	FLANGE COMPATIBILITY	RATING	FACE-TO-FACE DIMENSION, mm / in.
WCC or CG8M	CL150 (V150) raised-face	ASME B16.34 CL150	NPS 14 and 16 Valves: ASME B16.10 Short NPS 20 Valves: 508 / 20 NPS 24 and 24x20 Valves: 610 / 24 NPS 24 Flangeless Valves: 508 / 20 NPS 24 Valves: 610 / 24
	CL300 (V300) raised-face	ASME B16.34 CL300	NPS 14 Valves: 38 / 15 NPS 16 Valves: 406 / 16 NPS 20 Valves: 508 / 20 NPS 24 Flangeless Valves: 508 / 20 NPS 24 Valves: 610 / 24
1. Do not exceed the material temperature capabilities or the pressure drop limitations shown in bulletin 51.3: Vee-Ball (D101363X012). 2. The pressure/temperature limits in this manual and any application code limitations, should not be exceeded.			

1.2 Description

The V150 or V300 Vee-Ball valve with a V-notch ball is used in throttling or on-off service. The V150 valve (Figure 1) is a raised-face flanged construction available in CL150. The V300 valve is a raised-face flanged construction available in CL300. The splined valve shaft connects to a variety of rotary actuators.

1.3 Specifications

Specifications for these valves are shown in Table 1 and bulletin 51.3: Vee-Ball Fisher Vee-Ball V150, V200 and V300 Rotary Control Valves ([D101363X012](#)).

1.4 Education Services

Emerson Education Services
Phone: 800-338-8158
Email: education@emerson.com
emerson.com/mytraining

Section 2: Installation

Key numbers are shown in Figure 10, unless otherwise indicated.

WARNING

- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed either the valve body rating or the mating pipe flange joint rating. To avoid such injury or damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Because some valve body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

Install the valve with the drive shaft in the horizontal position as shown in Figure 1.

NOTICE

To maximize seal life, the valve should be installed so the drive shaft will be in the horizontal orientation while in service. Please contact your Emerson sales office for evaluating vertical drive shaft installations.

1. If the valve is to be stored before installation, protect the flange mating surfaces and keep the valve cavity dry and free of foreign material.
2. Install a three-valve bypass around the control valve assembly if continuous operation will be necessary during inspection and maintenance of the valve.
3. Mounting the Actuator:
 - a. The valve is normally shipped as part of a control valve assembly, with the actuator mounted on the valve. The factory makes actuator/valve adjustments before the valve is shipped.
 - b. If the valve and actuator have been purchased separately or if the actuator has been removed, mount the actuator according to the Actuator Mounting section of this manual.
4. Be certain the valve and adjacent pipelines are free of any foreign material that could damage the valve seating surfaces.
5. Be sure the mating line flanges are aligned. Provide standard flat sheet flange gaskets (or spiral wound gaskets with compression-controlling centering rings) that are compatible with the process fluid.

Refer to Figure 2 for required clearance for valve installation and stud length. Lubricate the studs with anti-seize lubricant.

6. Install the valve using studs and nuts to connect the valve flanges to the pipeline flanges. The seal protector ring (key 3) end of the valve requires longer line flange studs than standard (see Figure 2).

Table 4. Required Clearances for Installation of Fisher V150 and V300 Valves

VALVE SIZE, NPS	DIMENSION						
	A ⁽⁵⁾		B ⁽⁵⁾	M ⁽²⁾ (Min.)		N ⁽⁶⁾	
	CL150 ASME B16.10 (Short) ⁽¹⁾	CL300		CL150 ASME B16.10 (Short) ⁽¹⁾	CL300	CL150	CL300
mm							
14	381	381	175	152	197	133	178
16	406	406	178	152	210	133	190
20 ⁽³⁾	508	508	235 ⁽³⁾	178	222	159	203
24x20 ^(3,4)	610	---	235	203	260	191	248
24	610	610	324	203	260	191	248
24 ⁽⁷⁾	508	508	324	686	743	---	---
in.							
14	15.00	15.00	6.88	6.00	7.75	5.25	7.00
16	16.00	16.00	7.00	6.00	8.25	5.25	7.50
20 ⁽³⁾	20.00	20.00	9.25 ⁽³⁾	7.00	8.75	6.25	8.00
24x20 ^(3,4)	24.00	---	9.25	7.50	---	6.75	---
24	24.00	24.00	12.75	8.00	10.25	7.50	9.75
24 ⁽⁷⁾	20.00	20.00	12.75	27.00	29.25	---	---

1. ASME B16.10 (Short) applies to NPS 14 and 16 valves only.

2. Inlet flange stud bolt length is longer than the standard length as specified in ASME B16.5.

3. NPS 20, CL150 valves do not comply with ASME B16.10 (Short).

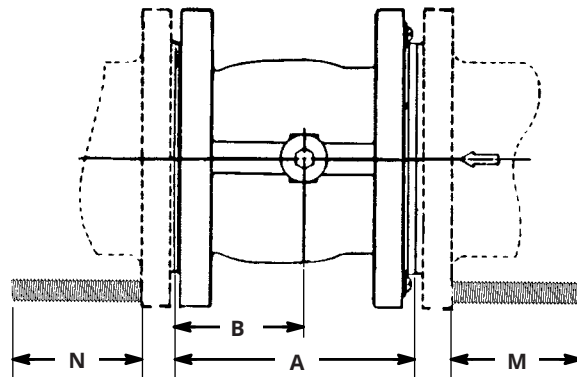
4. Valve body mates with NPS 24 ASME CL150 flanges. Internal based on NPS 20 valve design.

5. If the Cavitrol Hex anti-cavitation trim is installed, the A and B dimension will be 12.7 mm / 1/2-in. longer than the dimension specified.

6. For V150 and V300 valve assemblies with the Cavitrol Hex anti-cavitation trim installed, dimension M bolt length is required for both the inlet and outlet flange ends.

7. For NPS 24 V150 and V300 flangeless option only.

Figure 2. Required Clearances for Installation of Fisher V150 and V300 Valves



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Do not attempt to use standard-length line flange studs for the seal protector end of the valve. Refer to Figure 2 for length of flange studs required.

Install all remaining studs. Tighten the nuts in a criss-cross sequence to ensure the flange gaskets are properly loaded.

⚠ WARNING

The valve drive shaft is not necessarily grounded to the pipeline when installed. Personal injury or property damage could result if the process fluid or the atmosphere around the valve is flammable, from an explosion caused by a discharge of static electricity from the valve components. If the valve is installed in a hazardous area, electrically bond the drive shaft to the valve.

Standard PTFE packing is composed of a partially conductive carbon-filled PTFE female adaptor with PTFE V-ring packing. Standard graphite packing is composed of all conductive graphite ribbon packing rings. Alternate shaft-to-valve body bonding is available for hazardous service areas where the standard packing is not sufficient to bond the shaft to the valve (see the following step and Figure 4).

7. For hazardous applications, attach the optional bonding strap assembly (key 131, Figure 4) to the valve drive shaft (key 6) with the clamp (key 130, Figure 4) and connect the other end of the bonding strap assembly to the valve body with the cap screw (key 23).
8. Connect pressure lines to the actuator as indicated in the actuator instruction manual. When an auxiliary manual actuator is used with a power actuator, install a bypass valve on the power actuator (if one is not supplied) for use during manual operation.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might need some re-adjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If the valve has ENVIRO-SEAL live-loaded packing installed, this initial re-adjustment will probably not be required. Refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual (D101643X012) for packing instructions.

Section 3: Maintenance

Valve parts are subject to normal wear and must be inspected and/or replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

⚠ WARNING

The Vee-ball closes with a cutting motion. To avoid personal injury, keep hands, tools and other objects away from the ball while stroking the valve.

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Make sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- The valve packing area may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

3.1 Packing Maintenance

Key numbers are shown in Figure 10, unless otherwise indicated. A detailed view of the packing is also shown in Figure 3.

If the valve is equipped with the ENVIRO-SEAL Packing System, refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)).

NOTE

For the ENVIRO-SEAL Packing System, refer to the Parts List section for individual parts (see Figure 3). Refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)) for maintenance instructions.

Stopping Leakage

For PTFE V-ring packing, leakage around the packing follower and packing flange (keys 17 and 40) can be stopped by tightening the packing follower nuts (key 20).

If the packing is relatively new and tight on the drive shaft (key 6) and if tightening the packing follower nuts does not stop leakage, it is possible that the drive shaft is worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks, scratches or corrosion on the packing box wall.

If the leakage cannot be stopped by the above steps, the packing must be removed and replaced. Inspect the drive shaft and packing box before installing new packing parts.

Packing Replacement

When replacing the packing, the actuator should not be removed from the valve while the valve is still in the pipeline or between flanges. Valve/actuator adjustments must be made with the valve out of the pipeline.

Disassembly

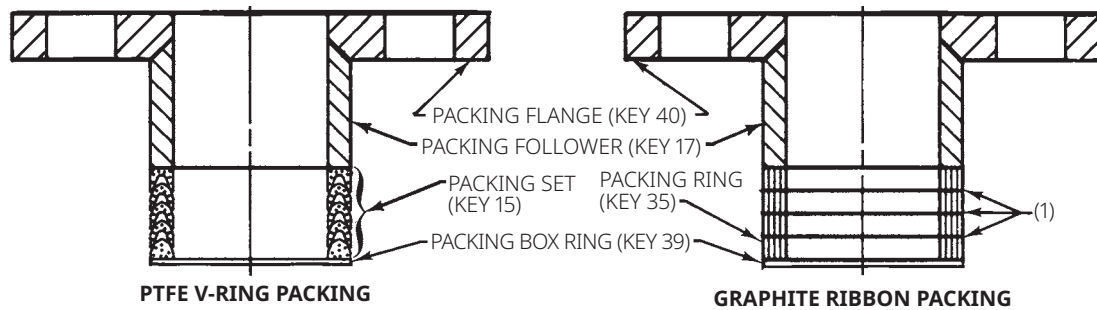
1. Isolate the control valve from the line pressure, release pressure from both sides of the valve and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines to the power actuator, release pressure from the actuator and disconnect the pressure lines from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove line bolting, remove the control valve from the pipeline and place the actuator/valve assembly on a protected flat surface with the seal protector ring facing up.
3. Remove the actuator cover. Note the orientation of the actuator with respect to the valve body and the lever orientation with respect to the valve drive shaft (see Figure 8).



WARNING

When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, resulting in personal injury. To avoid injury, carefully rotate the ball to the stable position after the actuator is removed.

Figure 3. Packing Arrangements

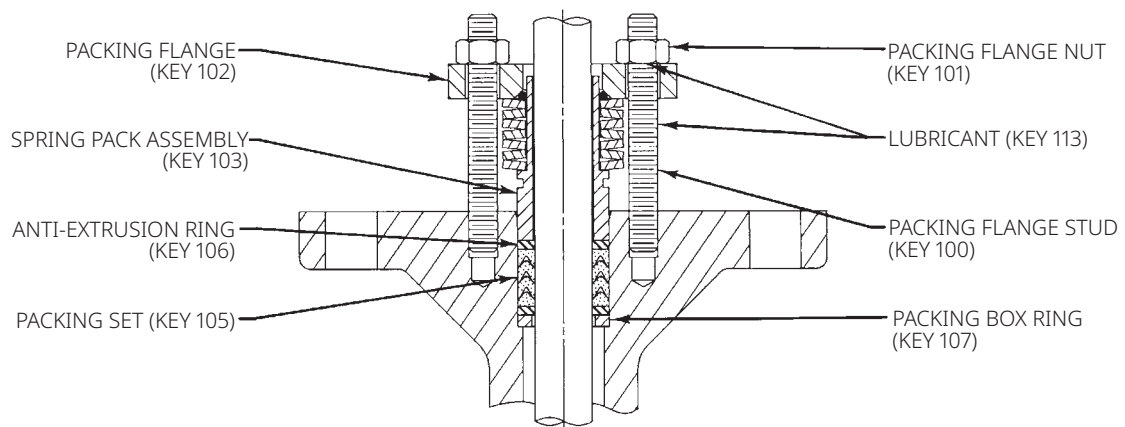


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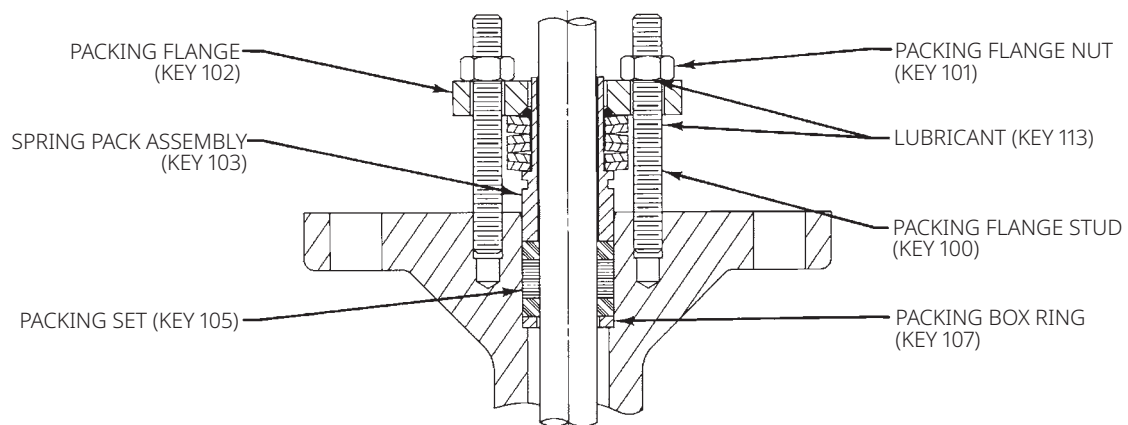
STANDARD PACKING ASSEMBLY

NOTE:

1. INCLUDES ZINC WASHERS (KEY 36) FOR GRAPHITE RIBBON PACKING ONLY.



ENVIRO-SEAL PTFE PACKING SYSTEM



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B2412

ENVIRO-SEAL GRAPHITE PACKING SYSTEM

NOTICE

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever or actuator off the valve shaft. Driving the lever or actuator off the valve shaft could damage the ball, seal and valve.

If necessary, use a wheel puller to remove the lever or actuator from the valve shaft. It is okay to tap the wheel puller screw lightly to loosen the lever or actuator, but hitting the screw with excessive force could damage the ball, seal and valve.

NOTE

Some actuator designs have a bolt inserted in the lever to spread the clamp on the valve spline shaft. Tightening the bolt expands the splined lever connection allowing the valve shaft to be removed.

4. When removing the lever (do not loosen the actuator turnbuckle adjustment), remove the actuator mounting screws and nuts (keys 23 and 24) and remove the actuator. (If necessary, refer to the actuator instruction manual for assistance.)
5. If necessary, remove the bonding strap assembly before attempting to remove the packing (see Figure 4).
6. Remove the packing flange and nuts and packing follower (keys 20, 40 and 17).
If the valve is equipped with the ENVIRO-SEAL packing system, refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual (D101643X012) for disassembly.
7. Remove the packing parts (key 16 packing set includes additional key numbers) by making a formed wire hook with a sharp end. Pierce the rings with the sharp end of the hook in order to remove them. Do not scratch the drive shaft or packing box wall; scratching these surfaces could cause leakage. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing. (Note: Metal packing parts are not provided in the packing set).

Assembly

If the valve is equipped with the ENVIRO-SEAL packing system, refer to the ENVIRO-SEAL Packing System Rotary Valves instruction manual (D101643X012) for assembly.

1. Install the new packing parts using the parts sequence shown in Figure 3.
2. Insert the packing follower and packing flange (keys 17 and 40) and secure them with the packing follower nuts (key 20). Tighten the nuts far enough to stop leakage during operating conditions.

NOTE

If the valve is equipped with a bonding strap assembly (Figure 4), re-install the assembly.

3. Reconnect the actuator and lever in accordance with the orientations that were noted in step 3 of the disassembly procedures. If necessary, use Figure 8 to identify the correct index marks.
4. If necessary, refer to the appropriate actuator instruction manual to complete actuator assembly and adjustment.
5. When the control valve is in operation, check the packing follower for leakage and retighten the packing follower nuts (key 20) as necessary.

3.2 Ball Seal Replacement

Perform this procedure if the control valve is not shutting off properly or if seal inspection is necessary. Remove the actuator/valve assembly from the pipeline.

The actuator may remain mounted on the valve during the ball seal inspection and replacement procedures. Ball seal assembly details (with key numbers) are also shown in Figure 5. Upon inspection, if it is found that the ball, drive shaft or bearings need to be replaced, use this procedure to remove the ball seal. Then, proceed to the Bearing and Ball Maintenance procedures to replace the ball, bearings or shafts. Then return to this procedure and begin with the assembly steps in the Ball Seal Replacement section.

During disassembly and re-assembly procedures, handle the seal protector ring, seal and other parts (keys 3, 11, 13 and 37) carefully to prevent damage. A new gasket (key 15) is required whenever the seal protector ring (key 3) is removed.

NOTICE

Due to the Vee-ball shape, take care to never rotate either the front skirted edge of the ball or the circular back edge of the ball through the ball seal at any time. The seal could be damaged.

The flow ring construction does not use a seal (key 11), radial seal (key 37) or wave spring (key 13). Use this procedure to remove the seal protector ring for flow ring constructions, but disregard any instructions calling for the seal and other seal parts.

Disassembly

WARNING

If the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, resulting in personal injury. To avoid injury, carefully rotate the ball to the stable position after the actuator is removed. If necessary, lock the ball in a specific position when directed by the following steps.

Key numbers are shown in Figure 10, unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator and release all pressure from the actuator.
2. Remove line bolting, remove the control valve/actuator assembly from the pipeline and place the valve on a protected flat surface with the seal protector ring facing up. Carefully rotate the ball to the open position.

NOTE

Lifting bolt holes are provided in the seal retainer or flow ring to assist in its removal from the valve body.

3. Remove the retainer screws (key 21). Carefully remove the seal protector ring and gasket (keys 3 and 15). (For flow ring constructions, go to step 4.)
 - a. For valves with composition seal, remove the seal (key 11) from the valve body (key 1).
 - b. For valves with HD metal seal, once the protector ring has been removed from the valve, push the metal seal (key 11) out of the seal protector ring (key 3). Remove the radial seal (key 37). Inspect, clean or obtain replacement parts as necessary.

It might be necessary to remove the HD metal seal by carefully tapping it with a soft punch and hammer. Take care not to damage the seal protector ring surfaces.
4. Inspect, clean or obtain replacement parts as necessary. Inspect the gasket and sealing surfaces on the valve body (key 1), ball (key 2), ball seal (key 11) and seal protector ring (key 3) for damage.
5. If a replacement ball, drive and follower shafts or bearings (keys 2, 6, 9 and 10) are needed, proceed to the Bearing and Ball Maintenance procedure for disassembly and assembly procedures. If only the seal is to be replaced, proceed to the assembly procedure below.

Assembly

Refer to Figure 5 for part and key number locations during seal installation.

1. Thoroughly clean all parts that are to be re-used or obtain replacement parts. Be sure that all sealing surfaces are in good condition without scratches or wear. If the valve has been installed between line flanges and the flange studs and nuts have been tightened, always replace the gasket (key 15).

If you have not already done so, lift the valve and place it with the outlet flange face flat on the protected working surface. Use the lever from the actuator or provide some other safe method to rotate the ball into the closed position. The inlet flange face should be up and the ball approximately centered within the opening.
2. Make sure the ball cannot rotate during seal assembly procedures (read the Warning on page 11).
3. For valves with composition ball seals:
 - Install the composition seal (key 11) into the valve body.
 - Install the gasket (key 15) on the valve body.
 - Install the seal protector ring (key 3) into the valve body. (Go to step 6 below.)
4. For valves with HD metal seals:
 - Lubricate with Mag Lub or an equivalent lubricant and install the radial seal (key 37) into the appropriate groove in the seal protector ring making sure the open side of the radial seal faces away from the ball.
 - Install the wave spring (key 13) on the seal protector ring (key 3).
 - Install the HD metal seal (key 11) into the seal protector ring (key 3), past the radial seal. While pushing it past the radial seal, make sure the HD metal seal is level.
 - To assist with break-in of the HD metal seals, it is recommended that the ball and seal be lubricated. Apply dry film lubricant to the seat of the HD metal seal (key 11) and to the face of the ball.

NOTE

During break-in, if the Vee-Ball rotation is not smooth, it may be necessary to tighten the packing slightly to dampen any tendency for stick-slip motion of the ball and seal assembly.

5. Install the HD metal ball seal/seal protector ring assembly into the valve body (key 1). Go to step 6 below.
6. Install the retaining screws (key 21) that secure the seal protector ring (key 3) to the valve body (key 1). Tighten the screws (key 21).
7. If necessary, refer to the Packing Maintenance procedures to install the packing. Install the actuator using the Actuator Mounting procedures or to the appropriate actuator instruction manual.

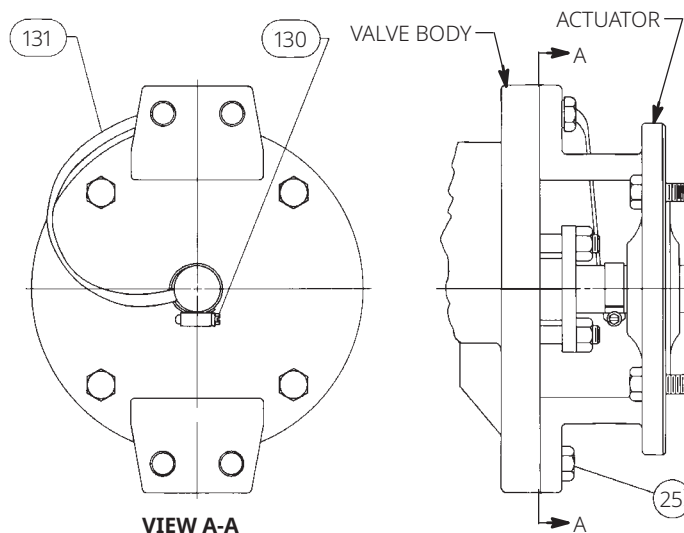
3.3 Bearing and Ball Maintenance

Procedures for disassembly and assembly of the bearings and ball cannot be accomplished until the ball seal and valve packing are loosened.

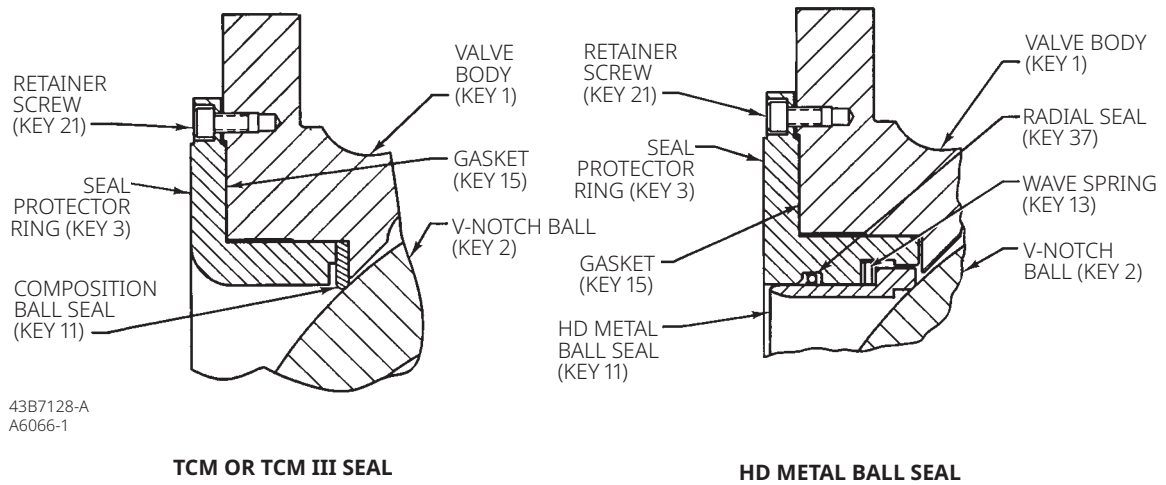
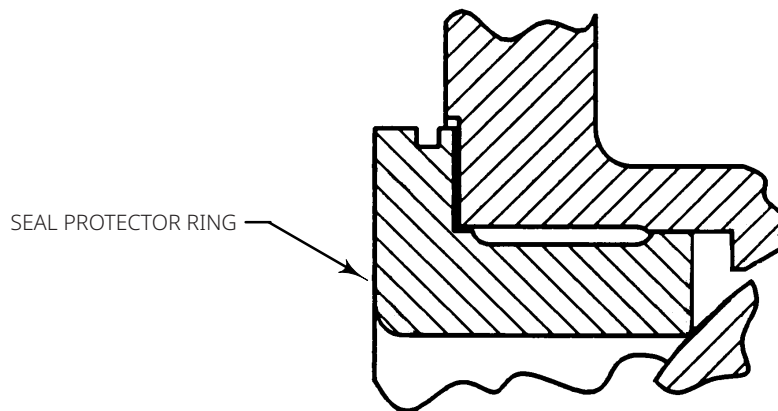
- Refer to the Packing Maintenance procedures to remove the actuator.
- Refer to the Ball Seal Replacement procedures to remove the seal from the valve.
- Install an “eye” bolt into the threaded hole within the ball cavity (see Figure 10).
(Note: The eye bolt provides a method for lifting and controlling the rotation of the ball during the following procedures. (Read the following Warning.)
- When ball seal disassembly steps are complete, return to this section.

If you have not already done so, place the valve on a flat protected working surface with the seal side down, prior to removing and installing the ball and bearings. Key numbers in this procedure are shown in Figure 10, unless otherwise indicated.

Figure 4. Optional Shaft-to-Body Bonding Strap Assembly



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A3143-2/IL

Figure 5. Ball Seal Assembly Detail**Figure 6. Flow Ring Construction**

E0849

Disassembly



WARNING

When the actuator is removed from the valve, the ball may suddenly rotate, resulting in personal injury. To avoid injury, carefully rotate the ball to a stable position.

Once the drive and follower shafts have been removed from the valve body, the ball may fall out of or into the valve body. To avoid personal injury or damage to the sealing surfaces of the ball, provide a hoist to support the ball to prevent it from falling as the shafts are being removed.

1. Carefully lift the valve and set it on the edge of the flanges so the ball is in the open position and in the down position. (Note: The weight of the ball should turn it into the open position.) Block the drive end of the valve body to hold the shaft in a horizontal position.
2. Drive the pins (key 7) out of the drive shaft and out of the follower shaft (keys 6 and 9).
Both pins are tack welded to the ball ears. To remove a pin, insert a pin punch into the open hole, opposite the tack welded side and break the tack weld while driving the pin out.
3. Carefully lift the valve and place the valve on the working surface with the seal side down (read the Warning on page 14).
Because of the weight of the ball, it should rotate so the contoured sealing surface of the ball is resting on the surface.
4. Remove the flange nuts (key 47), the bottom flange (key 44) and gasket (key 45) from the valve. Use a hoist to lift valve body slightly.
Make sure the sealing surface of the ball is not damaged while removing the follower shaft (key 9).
5. Push the follower shaft (key 9) into the center of the ball. For valves with metal bearings, remove the thrust washer (key 38).
6. Pull the drive shaft (key 6) out of the actuator side of the valve body. For valves with metal bearings, remove the thrust washer (key 38).
7. Removing the bearings (key 10):
 - a. For PEEK bearings, remove the bearings by hand. If the bearings are tight in the valve body, pull or drive them out with a slight pressure.
 - b. For metal bearings, use a press and ram to remove the drive shaft bearings out of the valve body. Refer to Figure 7 for ram dimensions.
 - To remove the follower shaft bearing from the bottom flange (key 44), use a blind-hole bearing puller similar to CG2545AB, which is made by Snap-on Tools. If you do not have such a tool, you can machine the bearing out of the bottom flange.

NOTE

For proper shutoff performance, the ball and seal require the bearing (key 10) to be positioned correctly. If you removed the bearings (key 10), be sure to locate the new bearings as shown in Figure 7.

8. Thoroughly clean all surfaces of parts that are to be re-used or obtain replacement parts. Upon reassembly, the pins needs to be tack welded to the ball ears. Remove excess weld material, if the parts are to be used during re-assembly.

Assembly

1. Inspect all sealing surfaces to ensure they are in good condition and without scratches or wear. Thoroughly clean all parts and make sure they are free of oil or grease.
2. Installing bearings (key 10):
 - a. For PEEK bearings, install the drop-in bearings by hand. The bearing flanged end should touch the drive shaft bearing support surface (see Figure 10). Also, install the bearing (key 10) into the bottom flange (key 44). The bearing flange should touch the surface of the bottom flange.

For NPS 24 V150 and V300 valve constructions, the PEEK bearings are flangeless and can be dropped in by hand.

- b. For metal bearings (key 10):
 - For the valve body, use a press and ram to install the bearings. Refer to Figure 7 for dimensions and tolerances of the ram and bearings.
 - Press the bearing in until it is flush with the valve body (key 1).

The acceptable tolerance for bearing location is: flush with the valve body to 1.5 mm / 0.06 in. inside the bearing bore. That is, the bearings should not protrude into the flow cavity of the valve.

- Press the bearing into the bottom flange, using the same tolerances shown for bearing installation into the valve body.



WARNING

The ball might be damaged if it is allowed to fall into the valve body. To avoid personal injury or damage to the sealing surfaces, support the ball to prevent it from falling into the valve body cavity.

3. Installing the ball, drive and follower shafts (keys 2, 6 and 9):
 - If you have not already done so, place the valve body (key 1) on a flat protected working surface with the seal side flat on the working surface.
 - In the the next step, make sure the splined ear of the ball is aligned with the packing box side of the valve body.

NOTICE

The ball might be damaged if it is allowed to hit the flange edge or interior of the valve cavity while it is being lowered into the valve body.

- Using the "eye" bolt in the center of the ball cavity, lift the ball above the valve. Carefully, start lowering the ball, splined ear first, down into the valve body through the outlet flange. When the ball ear enters the valve body, it needs to be misaligned with the drive shaft bearing support.

As the ball clears the outlet opening, turn and rotate the ball as necessary to align the splined ball ear with the drive shaft bearing support (see Figure 10).

Allow the ball to come to rest on the contoured sealing surface of the ball on the protected surface.

4. Carefully lift the valve body until the drive shaft (key 6) can be inserted through valve shaft bore and bearing (key 10) and into the drive shaft/splined ear of the the ball.

NOTE

1. See note 1, Figure 10.
 2. For valves with metal bearings and the NPS 24 flangeless PEEK bearings, hold the thrust washer (key 38, Figure 10) in place before inserting the drive shaft.
-

Make sure that the "O" mark on the shaft aligns with the "O" mark on the ball ear, within the ball cavity. Insert the drive shaft (key 6) into the ball. If the "O" marks are aligned correctly, the drive shaft pin (key 7) should slide through the ball ear and drive shaft.

- With the valve body still lifted, align the ball follower shaft bore with the opening in the valve body for the lower flange (key 44). [Note: For valves with metal bearings and the NPS 24 flangeless PEEK bearings, hold the thrust washer (key 38, Figure 10) in place before inserting the follower shaft.] While aligning the pin holes, insert the follower shaft into the ball.
- Place the gasket (key 45) in position on the bottom flange (key 44). Insert the bottom flange into the valve body, onto the follower shaft and thread the bottom flange nuts (key 47) onto the studs (key 46). Hand tighten the nuts.

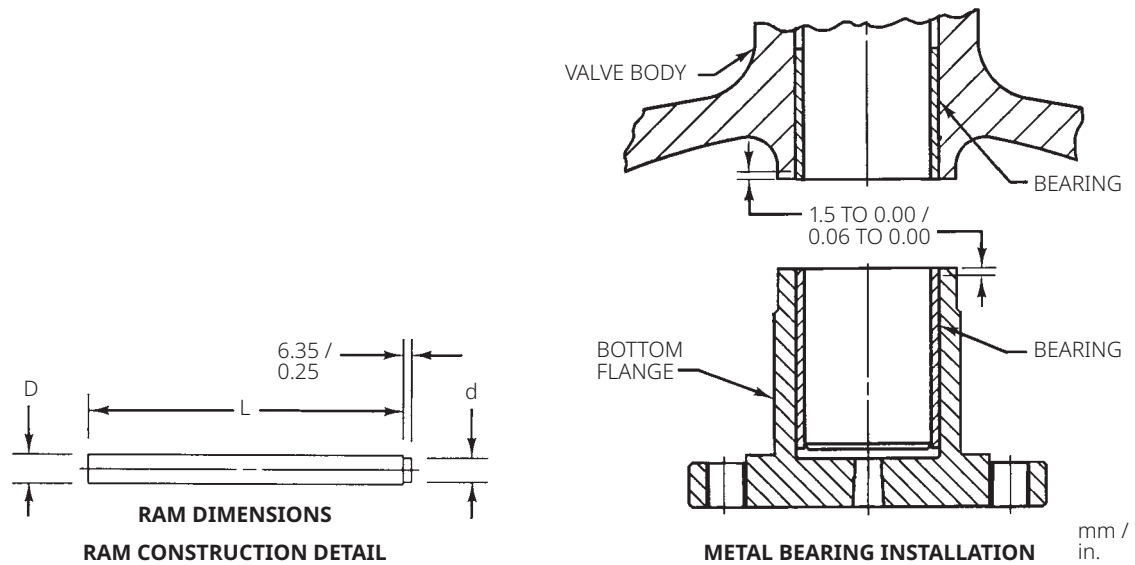
5. Installing the pins (key 7):

NOTICE

The ball might be damaged if it is allowed to hit the flange edge or interior of the valve cavity while it is being lowered into the valve body.

- Lift the valve and place it on the edge of both flanges. Make sure the ball is in its open position and in the lower half of the valve cavity. Block the packing box side of the valve so the drive shaft is horizontal.

Figure 7. Ram Construction and Bearing Installation



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A6062-1

Table 5. Bearing Ram Dimensions

VALVE SIZE, NPS	RAM LENGTH		RAM DIAMETER			
	L		D		d	
	mm	in.	mm	in.	mm	in.
14	172	6.75	51.30	2.02	44.45	1.75
			51.05	2.01	44.20	1.74
16	178	7.00	60.96	2.40	53.91	2.125
			60.71	2.39	53.72	2.115
20 and 24x20	216	8.50	70.35	2.77	63.50	2.50
			70.10	2.76	63.25	2.49
24	254	10	85.34	3.36	76.20	3.00
			85.09	3.35	75.95	2.99

- Insert the pin (key 7) into the ball ear and follower shaft until it is flat with the ball ear surface. (Note: the pin does not extend the full width of the ball ear.
- Refer to the Packing Replacement procedures and install the packing parts as described in that section. Slightly tighten the packing nuts (key 20).

- Using a pry bar, insert the bar between the ball ear and the follower shaft side of the valve body. Move the ball tightly towards the packing box side of the valve body and against the bearing flange or thrust washer. The ball should be centered within the seal cavity.
- Again, insert the bar between the ball ear and the follower shaft side of the valve body. While holding the ball in place, tighten the packing box nuts (key 20).

If the ball is not held in place while tightening the packing box nuts, the ball will move to an off-center position.

6. Welding the pins (key 7):

NOTE

When welding the pins to the ball ears, use a compatible filler rod material. For CG8M (317 stainless steel) balls use 317L (most preferred), 316L or 309L (least preferred) filler rod.

Tack weld both pins (key 7) to the ball ears with a 10 mm / 3/8-in. diameter weld.
(Note: Good weld penetration is required on both the pin and ball ear.)

7. Tighten the bottom flange nuts using the following torque values:

Table 6. Torque Nut Values

VALVE SIZE, NPS	VALVE	STUD SIZE	QUANTITY	TORQUE	
				N•m	ft•lbs
14	V150	1/2-13	6	102	75
	V300	5/8-11		176	130
16	V150	9/16-12		141	104
	V300	5/8-11		176	130
20	V150	5/8-11		176	130
	V300	3/4-10		258	190
24	V150	7/8-9		373	275
	V300	7/8-9		373	275

8. Lift the valve and place it with the outlet flange face flat on the protected working surface. Use the lever from the actuator or provide some other safe method to rotate the ball into the closed position. The inlet flange face should be up to allow the installation of the ball seal. The ball should be centered within the valve opening.
9. Refer to the Ball Seal Replacement procedures to install the ball seal and seal protector ring.

3.4 Cavitrol Hex Replacement

Disassembly

WARNING

Observe the steps in the WARNING at the beginning of the Maintenance section.

1. Isolate the control valve from line pressure, drain the process media from both sides of the valve and remove the control valve/actuator assembly from the pipeline as described in the Ball Seal Replacement section.
2. Place the valve on a protected flat surface with the body outlet flange facing up.
3. Remove the four fasteners (key 67) securing the Cavitrol Hex trim to the valve body.

WARNING

To avoid personal injury or property damage, do not use the four threaded lifting holes provided in the Cavitrol Hex trim to lift the complete valve assembly. The four threaded holes are sized for lifting only the Cavitrol Hex trim.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Lifting and rigging equipment used to lift, install or remove the Cavitrol Hex trim must be properly selected and sized for the weight of the component. The weights of the Cavitrol Hex trim are provided in Table 7.

4. Install hoist rings or other appropriate lifting equipment into the four 3/8 in.-16 threaded holes provided in the Cavitrol Hex trim flange.
5. Remove the Cavitrol Hex trim and place on a protected flat surface.
6. Remove gasket (key 65) from the valve body outlet flange.

Assembly

The Cavitrol Hex anti-cavitation trim (key 64) is available for the NPS 14, 16 and 20, V150 and V300 flanged, raised-face, body constructions. To retrofit the Cavitrol Hex to an existing valve assembly, special body machining is required. Four threaded holes must be added to the valve body outlet flange. Contact your [Emerson sales office](#) for retrofit information.

NOTE

The Cavitrol Hex anti-cavitation trim will add 12.7 mm / 1/2-in. to the face to face dimension of the valve. Refer to Table 4 of this manual for information on required flange stud length.

1. The Cavitrol Hex anti-cavitation trim (key 64) is to be installed last, after the Vee-Ball valve body assembly is complete. The recommended valve orientation for assembly is with the body outlet flange facing up.
2. Ensure the ball is in the open position.
3. Place the gasket (key 65) over the body outlet flange serrated surface as illustrated in Figure 11.
4. Install hoist rings or other appropriate lifting equipment into the four 3/8 in.-16 threaded holes in the Cavitrol Hex flange.

Table 7. Fisher Cavitrol Hex Dimensions and Weight

VALVE SIZE	FLANGE THICKNESS C (ADD TO OVERALL FACE-TO-FACE DIMENSION)		WEIGHT	
NPS	mm	in.	kg	lbs
14	12.7	0.5	44.1	97.3
16	12.7	0.5	63.5	139.9
20	12.7	0.5	111.2	245.1

5. Insert the Cavitrol Hex anti-cavitation trim into the valve, ensuring the holes in the body outlet flange align with the holes in the trim flange. Remove lifting equipment used to install Cavitrol Hex trim.
6. Install four fasteners (key 67) and adequately tighten to secure the trim to the valve assembly.

3.5 Whisper NXV Trim Installation

To install the Whisper NXV or retrofit into an existing valve, special welding is required. Please contact your [Emerson sales office](#) for service information.

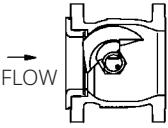
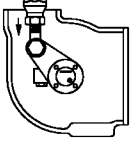
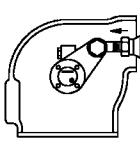
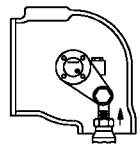
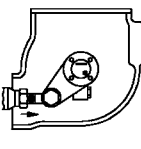
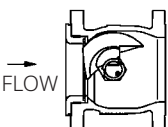
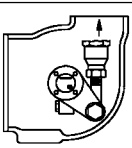
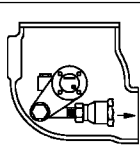
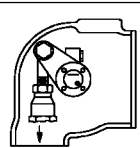
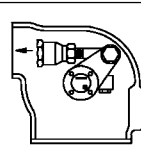
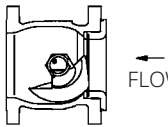
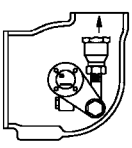
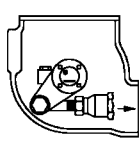
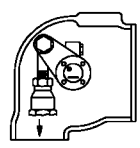
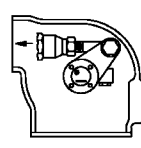
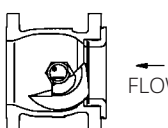
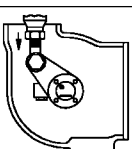
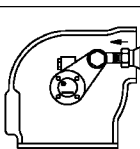
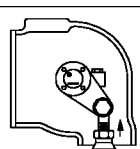
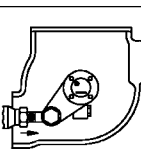
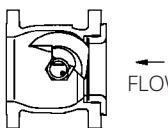
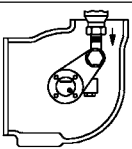
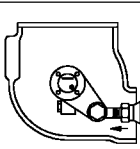
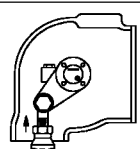
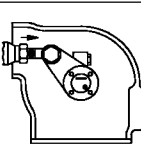
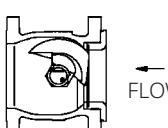
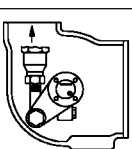
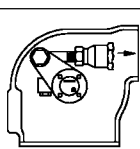
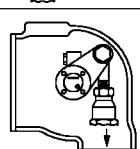
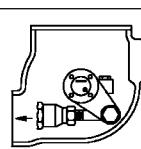
3.6 Whisper NXV Trim Maintenance

For NPS 14 and 16 valves with Whisper NXV Trim, the Whisper Trim Attenuator requires special removal processes to be separated from the ball. Contact your [Emerson sales office](#) for more information.

NOTICE

The Whisper NXV Trim attenuator is only compatible with CG8M, CF3M or CF8M ball materials. Use of non-compatible ball materials with the S31603 (316L) Whisper NXV Trim may result in insufficient weld strength leading to damage to the valve seal, attenuator and other valve components and interfere with proper valve operation.

Figure 8. Index Mark for Actuator Lever Orientation

ACTUATOR		VALVE OPEN	ACTUATOR POSITION			
MOUNTING	STYLE		1	2	3	4
(STANDARD) RIGHT-HAND	STYLE A PUSH DOWN TO CLOSE					
	STYLE B PUSH DOWN TO OPEN					
(STANDARD) LEFT-HAND	STYLE C PUSH DOWN TO OPEN					
	STYLE D PUSH DOWN TO CLOSE					
(OPTIONAL) LEFT-HAND	STYLE C PUSH DOWN TO CLOSE					
	STYLE D PUSH DOWN TO OPEN					
NOTE: 1. ARROW ON LEVER INDICATES DIRECTION OF ACTUATOR THRUST TO CLOSE VALVE.						

3.7 Actuator Mounting

Standard flow direction is with the seal protector ring (key 3) facing upstream. Install the valve with the drive shaft horizontal and the ball closing in the downward direction (see Figure 8).

⚠ WARNING

The Vee-ball (key 2, Figure 10) closes with a cutting motion. To avoid personal injury, keep hands, tools and other objects away from the ball while stroking the valve.

Actuator travel must be adjusted before installing the valve in the pipeline because it is not possible to accurately determine the closed position once the valve is in the line.

The actuator can be right or left-hand mounted in any of four positions as shown in Figure 8.

NOTE

Right-hand mounting—Actuator is on the right side of the valve when viewed from the valve inlet.

Left-hand mounting—Actuator is on the left side of the valve when viewed from the valve inlet.

However, when changing the valve from right to left-hand mounting or vice versa, a different valve drive shaft and ball are required. If a new shaft and ball are required, refer to the Bearing and Ball Maintenance section and the Parts List in this manual.

NOTE

If necessary, it is possible to mount the valve in the left-hand position with the ball rotating to the top of the valve. This will require a non-standard ball. The ball rotates clockwise to close. Refer to Figure 8 or contact your [Emerson sales office](#) for assistance.

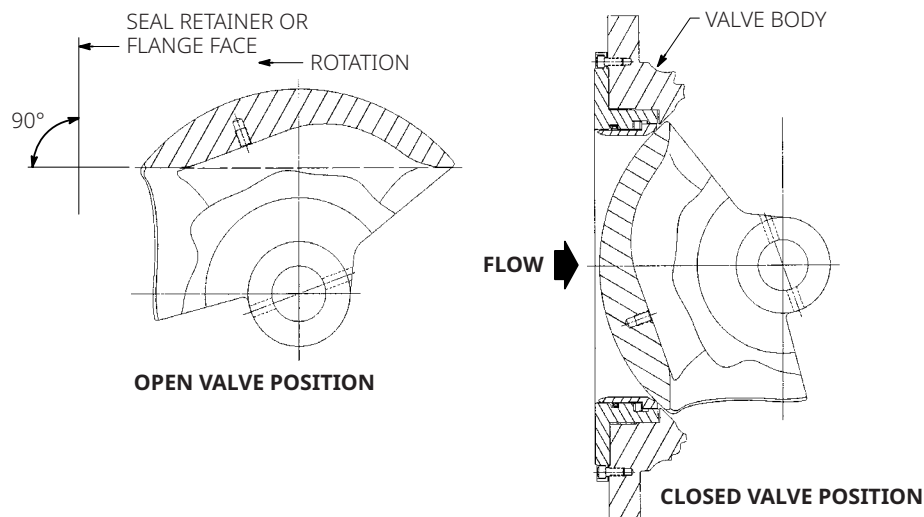
Determining Open Position

The valve must be removed from the pipeline to check the position of the ball.

1. Rotate the ball to the open position. The open position of the ball is shown in Figure 9.
2. Adjust the actuator linkage until the open position is obtained using the appropriate actuator instruction manual procedures.
3. Stroke the valve to the closed position.

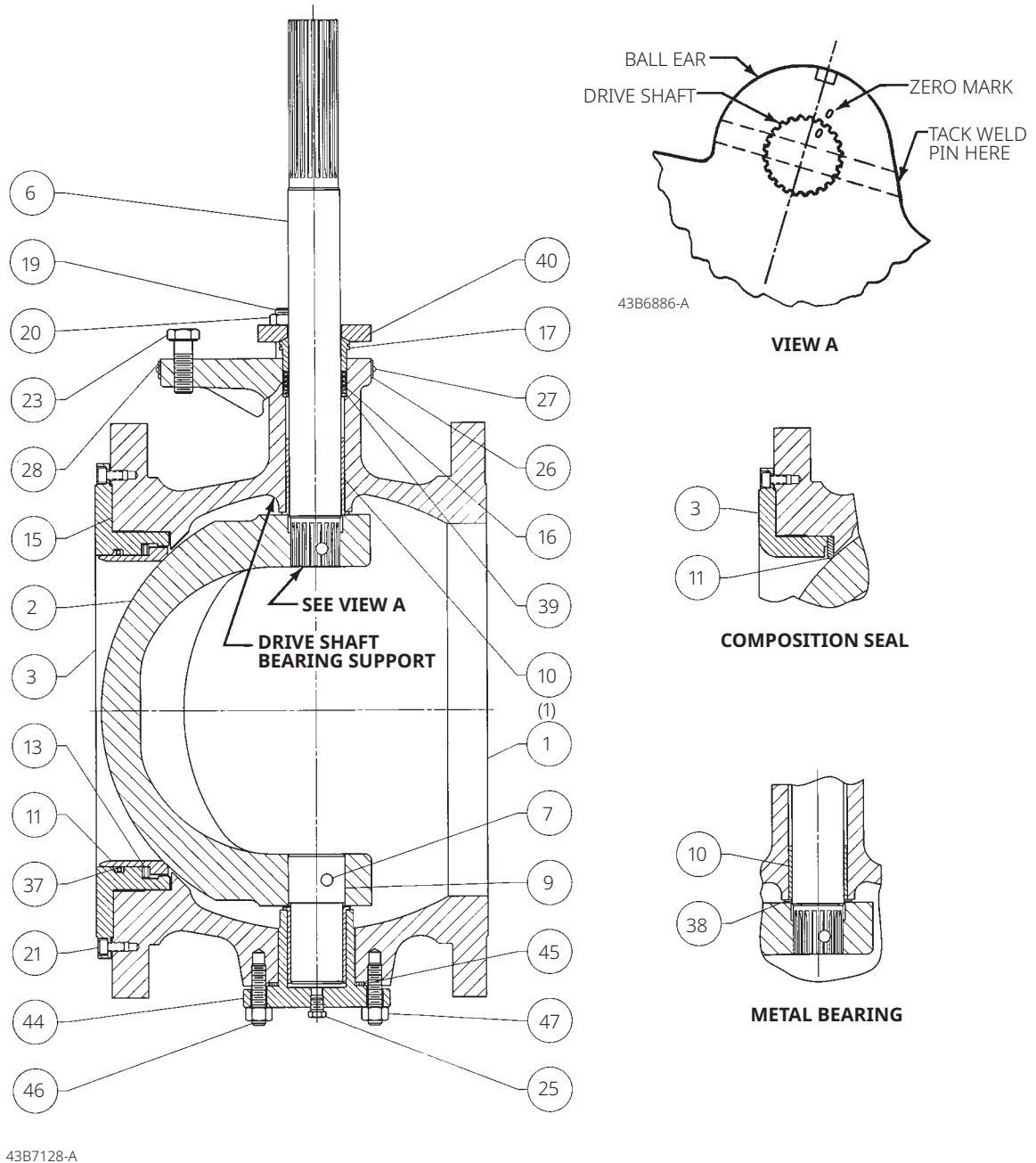
Make sure the actuator does not stroke the ball more than 90 degrees when rotating to the closed position (see Figure 9).

Figure 9. Determining the Ball Position



A6065

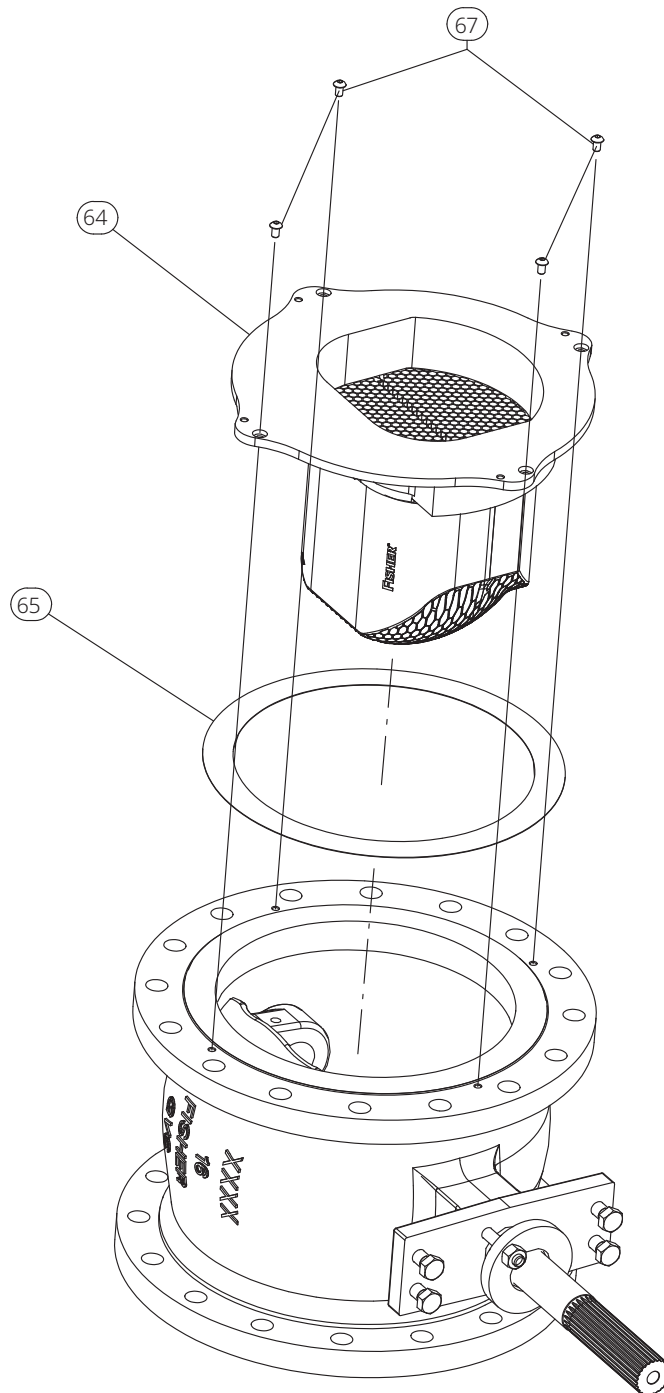
Figure 10. Fisher V150 and V300 Valve Assembly



NOTES:

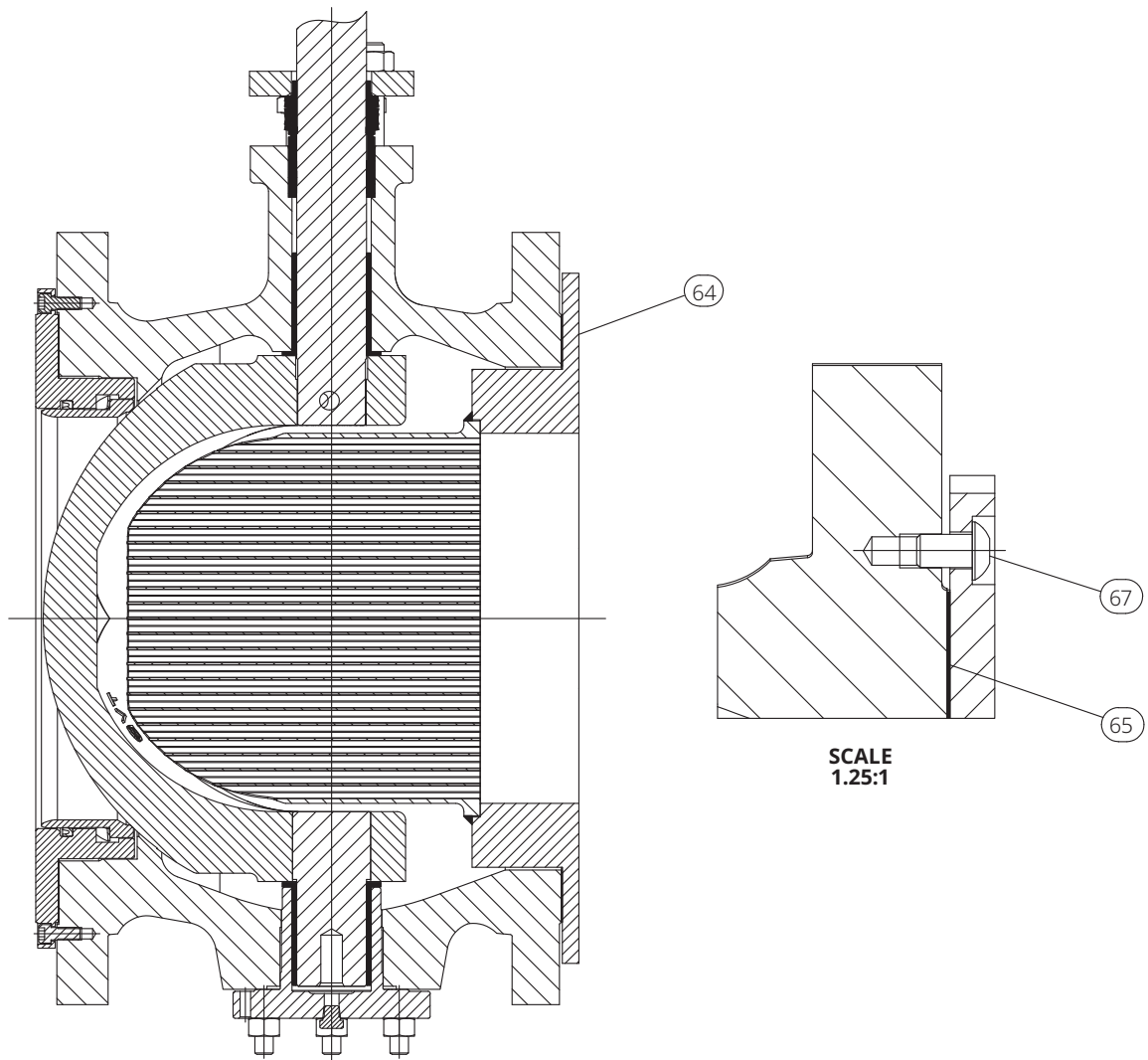
1. THE V-NOTCH BALL EXTENDS TO THIS POINT WHEN ROTATED 180 DEGREES AWAY FROM THE CLOSED POSITION.
SEE BEARING AND V-NOTCH BALL ASSEMBLY PROCEDURES.
2. KEYS 24, 30, 31, 35 AND 36 ARE NOT SHOWN.

Figure 11. Fisher V150 with Cavitrol Hex Explosion View



GH12081

Figure 12. Fisher V150 with Cavitrol Hex Valve Assembly



GH12150

Section 4: Parts

4.1 Parts Kits

Cavitrol Hex Retrofit Kit

Kit includes the Cavitrol Hex (key 64), gasket (key 65) and fasteners (key 67). Kits are available for the NPS 14, 16 and 20 V150 and V300 flanged, raised-face body constructions. To retrofit the Cavitrol Hex anti-cavitation trim to an existing valve assembly, special body machining is required. Contact your [Emerson sales office](#) for retrofit information.

Valve Size, NPS	Material	Kit Part Number
14	S31603	RCAVHEX0102
16		RCAVHEX0122
20		RCAVHEX0142
14	R31233	RCAVHEX0112
16		RCAVHEX0132
20		RCAVHEX0152

4.2 Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your [Emerson sales office](#) regarding spare parts or technical information.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve and could cause personal injury and property damage.

4.3 Parts List

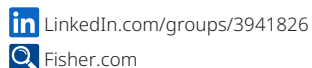
Key	Description	Key	Description
1	Valve body assembly If a part number is required, contact your Emerson sales office .	25	Pipe plug
2*	Ball	26	Identification nameplate
3	Seal protector ring	27	Drive screw
6*	Drive shaft	28	Flow arrow (2 req'd)
7*	Pin (2 req'd)	30	Body size/serial number nameplate
9*	Follower shaft	31	Nameplate wire (not shown)
10*	Bearing (2 req'd)	35*	Packing ring (4 req'd)
11*	Ball seal	36*	Packing washer (Use with Graphite ribbon packing, 3 req'd)
13*	Wave spring Use with HD metal seal	37*	Radial seal Use with HD metal ball seal
15*	Gasket	38	Thrust washer (4 req'd)
16*	Packing set, set includes PTFE V-ring packing with one Carbon-filled conductive ring, male adapter and female adapter	39*	Packing box ring
17	Packing follower	40	Packing flange
19	Packing follower stud (2 req'd)	44	Bottom flange
20	Packing follower nut (2 req'd)	45*	Gasket
21	Retainer screw (used with B8M)	46	Bottom flange stud (6 req'd)
23	Actuator mounting screw (4 req'd)	47	Hex nut (6 req'd)
24	Actuator mounting nut (4 req'd)	64	Cavitrol hex
		65	Gasket
		67	Screw
*Recommended spare parts			

ENVIRO-SEAL Packing System (Figure 3)

Key	Description	Key	Description
100	Packing flange stud	106*	Anti-extrusion ring (2 req'd)
101	Packing flange nut	107*	Packing box ring
102	Packing flange	111	Tag
103	Spring pack assembly	112	Tie cable
105*	Packing set	113	Lubricant
*Recommended spare parts			

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS



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FISHER™



Fisher™ Vee-Ball™ V150, V200, and V300 Rotary Control Valves NPS 1 through 12

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Figure 1. Fisher Vee-Ball with 2052 Actuator and FIELDVUE™ DVC6200 Digital Valve Controller



X0187-1

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Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for the Fisher Vee-Ball V150 (NPS 1 through 12), V200 (NPS 1 through 10), and V300 (NPS 1 through 12) rotary control valves (see figure 1). NPS 3 through 12 valves without an Rotary Attenuator currently in production are referred to as Series B (for more information on this distinction see Appendix A).

For larger valves (NPS 14, 16, and 20), refer to a separate instruction manual. For information on ENVIRO-SEAL™ packing, see the ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)). Refer to separate manuals for information concerning the actuator, positioner and accessories.



Do not install, operate, or maintain Vee-Ball valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Vee-Ball Valves

April 2024

Instruction Manual

D101554X012

Table 1. Specifications

Valve Sizes See table 2	Actuator Mounting ■ Right-hand, standard or ■ left-hand, optional, as viewed from upstream end of valve (see figure 23 and the Actuator Mounting section)
Valve End Connection Styles V150: Flanged valves that mate with CL150 raised-face flanges and EN 1092-1 Type B raised-face and Type F Recess V200: Flangeless (all sizes) and flanged valves that mate with CL600 raised-face flanges (NPS 2-8) V300: Flanged valves that mate with CL300 raised-face flanges and EN 1092-1 Type B raised-face and Type F Recess	Maximum Ball Rotation Standard: Ball rotates counterclockwise to close when viewed from actuator side of valve Optional: Ball rotates clockwise to close Ball rotation is 90 degrees
Maximum Inlet Pressure⁽¹⁾ Consistent with applicable ASME B16.34 or EN 12516-1 ratings	Valve/Actuator Action With diaphragm or piston rotary actuator, field-reversible between: ■ push-down-to-close (extending actuator rod closes valve) and ■ push-down-to-open (extending actuator rod opens valve.) See actuator manual for details
Standard Flow Direction Forward (into the convex face of the Vee-ball)	

1. The pressure/temperature limits in this manual, and any applicable code or standard limitation, should not be exceeded.

Description

The V150, V200, and V300 Vee-Ball valves (figure 1) with a V-notch ball are used in throttling or on-off service. The V200 is a flangeless construction. The V150 and V300 valves are raised-face flanged constructions. The splined valve shaft of all these valves connect to a variety of rotary-shaft actuators.

Specifications

Specifications for these valves are shown in table 1 and in the Fisher Vee-Ball V150, V200, and V300 Rotary Control Valves Bulletin 51.3:Vee-Ball ([D101363X012](#)).

Educational Services

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E-mail: education@emerson.com
emerson.com/mytraining

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D101554X012

Vee-Ball Valves

April 2024

Table 2. Valve Body Materials, End Connections, and Ratings

VALVE DESIGN	VALVE BODY MATERIAL	SIZE	RATINGS
		NPS / DN	ASME / PN
V150	WCC	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12, 14, 16, 20, 24x20 ⁽⁵⁾	CL150
	WCC / 1.0619 ⁽¹⁾	DN 80, 100, 150	PN 10-16
		DN 200, 250, 300	PN 10 or PN 16
	LCC	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12	CL150
		DN 80, 100, 150	PN 10-16
		DN 200, 250, 300	PN 10 or PN 16
	CF3M ⁽²⁾	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12	CL150
	CF3M/1.4409 ⁽¹⁾	DN 80, 100, 150	PN 10-16
		DN 200, 250, 300	PN 10 or PN 16
	CG8M	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12, 14, 16, 20, 24x20 ⁽⁵⁾	CL150
	CW2M	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12	
	M35-2	NPS 1, 1-1/2, 2, 3, 4, 6, 8	
	CD3MN ⁽³⁾	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12	
	CD3MWCuN ⁽³⁾	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12	
	CK3MCuN	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12	
V200 ⁽⁴⁾	WCC, LCC, CG8M, or CF3M ⁽²⁾	NPS 1, 1-1/2, 2	CL150/300/600 flangeless
		NPS 3, 4	CL150 and CL300/600 flangeless
		NPS 6, 8	CL150/300 and CL600 flangeless
		NPS 10	CL150/300/600 flangeless
	WCC, LCC, or CG8M	NPS 2, 3, 4, 6, 8, 10	CL600
	CW2M, M35-2, or CK3MCuN	NPS 1, 1-1/2, 2, 3, 4, 6, 8	CL150/300/600 flangeless
	CK3MCuN	NPS 10	CL150 flangeless
V300	WCC	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12, 14, 16, 20	CL300
	WCC / 1.0619 ⁽¹⁾	DN 25, 40, 50	PN 10-40
		DN 80, 100, 150	PN 25-40
		DN 200, 250, 300	PN 25 or PN 40
	LCC	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12	CL300
		DN 25, 40, 50	PN 10-40
		DN 80, 100, 150	PN 25-40
		DN 200, 250, 300	PN 25 or PN 40
	CF3M ⁽²⁾	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12	CL300
	CF3M/1.4409 ⁽¹⁾	DN 25, 40, 50	PN 10-40
		DN 80, 100, 150	PN 25-40
		DN 200, 250, 300	PN 25 or PN 40
	CG8M	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12, 14, 16, 20	CL300
	CW2M	NPS 1, 1-1/2, 2, 3, 4, 6, 8	
	M35-2	NPS 1, 1-1/2, 2, 3, 4, 6, 8	
	CD3MN ⁽³⁾	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12	
	CD3MWCuN ⁽³⁾	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12	
	CK3MCuN	NPS 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12	

1. WCC and EN Std 1.0619 are dual certified. CF3M and EN SST 1.4409 are dual certified.
 2. CF3M is a standard offering in Europe and Asia Pacific.
 3. NORSOK compliant materials available upon request.
 4. Flangeless V200 assemblies mate with raised-face flanges.
 5. Valve body mates with NPS 24 ASME CL150 flanges. Internal based on NPS 20 valve design.

Installation

Separate installation steps are provided in this section for V150 and V300 flanged valves, V200 flangeless valves. Key numbers in installation procedures are shown in figures 24, 25, and 26 unless otherwise indicated.

Some types of ceramic trim, including VTC, can create a spark under certain conditions. If an edge of a ceramic part is struck against a second ceramic part with enough force, it can produce a spark.

⚠ WARNING

Avoid personal injury and property damage from ignition of process fluid caused by sparks from ceramic trim. Do not use ceramic trim where the process fluid is unstable or if it is an explosive mixture (such as ether and air).

⚠ WARNING

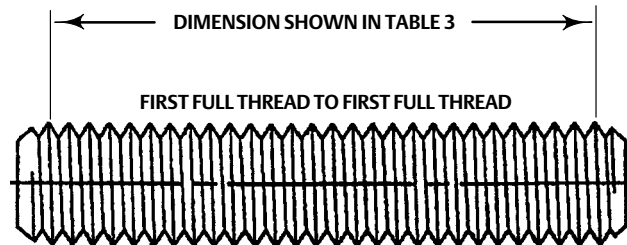
Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed either the valve body rating or the mating pipe flange joint rating. To avoid such injury or damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Figure 2. Flange Stud Length for Seal Protector End



1A4520

Table 3. Flange Stud Lengths Required for Seal Protector Ring End of Fisher V150, V200, and V300 Valves

VALVE SIZE		V150 ⁽²⁾				V200 ⁽¹⁾		V300 ⁽²⁾	
		ANSI/ISA 575.08.02 Face-to-Face		ASME B16.10 Short Face-to-Face		ANSI/ISA 575.08.02 Face-to-Face		ANSI/ISA 575.08.02 Face-to-Face	
DN	NPS	mm	Inches	mm	Inches	mm	Inches	mm	Inches
25	1	70	2.75	95	3.75	---	---	89	3.50
40	1-1/2	83	3.25	127	5.00	---	---	102	4.00
50	2	95	3.75	146	5.75	121	4.75	95	3.75
80	3	95	3.75	133	5.25	140	5.50	121	4.75
100	4	108	4.25	146	5.75	165	6.50	127	5.00
150	6	114	4.50	152	6.00	197	7.75	140	5.50
200	8	121	4.75	171	6.75	216	8.50	152	6.00
250	10	133	5.25	165	6.50	---	---	171	6.75
300	12	140	5.50	159	6.25	---	---	184	7.25

1. For the flanged V200, the same bolt lengths are used for both the inlet and outlet flange ends because the studs for threaded flange holes are double nutted. If the Cavitrol Hex anti-cavitation trim is installed, the required outlet flange bolt length will be 1/2" longer than the Dimension specified in the table above. See Vee-Ball bulletin ([D101363X012](#)).

2. For V150 and V300 valve assemblies with the Cavitrol Hex anti-cavitation trim installed, the same bolt lengths are used for both the inlet and outlet flange ends.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. To avoid possible personal injury and because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

⚠ WARNING

The valve drive shaft is not necessarily grounded to the pipeline when installed. Personal injury or property damage could result from an explosion caused by a discharge of static electricity from valve components if the process fluid or the atmosphere around the valve is flammable. If the atmosphere around the valve or the process fluid is flammable, electrically bond the drive shaft to the valve.

Note

Standard PTFE packing is composed of a partially conductive carbon-filled PTFE female adaptor with PTFE V-ring packing. Standard graphite packing is composed of all conductive graphite ribbon packing. Alternate shaft-to-valve body bonding is available for hazardous service areas where the standard packing is not sufficient to bond the shaft to the valve (see the following step).

Attach the optional bonding strap assembly (key 131, figure 3) to the valve drive shaft (key 6) with the clamp (key 130, figure 3) and connect the other end of the bonding strap assembly to the valve body with the cap screw (key 23).

1. If the valve is to be stored before installation, protect the flange mating surfaces and keep the valve body cavity dry and free of foreign material.
2. Install a three-valve bypass around the control valve assembly if continuous operation will be necessary during inspection and maintenance of the valve.
3. The valve is normally shipped as part of a control valve assembly, with an actuator mounted on the valve. If the valve and actuator have been purchased separately or if the actuator has been removed, mount the actuator according to the Actuator Mounting section and the appropriate actuator instruction manual.
4. Standard flow direction is with the seal protector ring (key 3) facing upstream.
5. Install the valve in a horizontal or vertical pipeline with the drive shaft in a horizontal position.

NOTICE

To maximize seal life, the valve should be installed so the drive shaft will be in the horizontal orientation while in service. Please contact your Emerson sales office for evaluating vertical drive shaft installations.

6. The actuator can be right- or left-hand mounted with the shaft in a horizontal orientation as shown in figure 1. If necessary, refer to the appropriate actuator instruction manual for actuator installation and adjustment procedures.

NOTICE

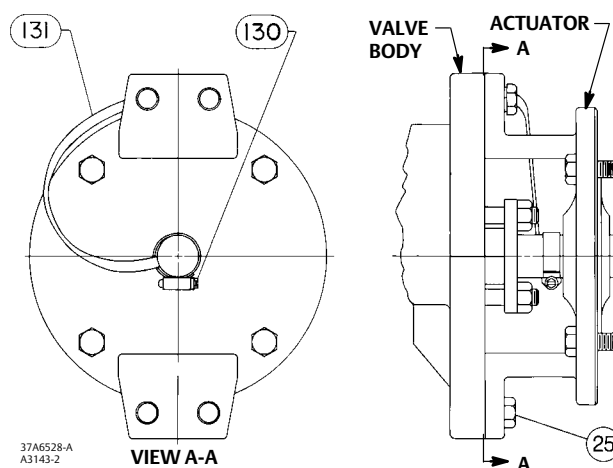
Ensure the valve and adjacent pipelines are free of foreign material that could damage the valve seating surfaces.

7. Be certain the valve and adjacent pipelines are free of any foreign material that could damage the valve sealing surfaces.
8. Be sure the pipeline flanges are in line with each other.

Installing V150, V300, and Flanged V200 Valves

1. Install the V150 and V300 valve using studs (keys 32 and 33, not shown) and nuts to connect the valve flanges to the pipeline flanges. The seal protector ring (key 3) end of the valve requires longer line flange studs (key 32) than standard. Do not use standard-length line flange studs for the seal protector ring end of the valve. The seal protector ring end of the valve for the DN25/NPS 1 constructions will have threaded flange holes due to insufficient nut clearance.

Figure 3. Optional Shaft-to-Body Bonding Strap Assembly



2. See table 3 and figure 2 for length of studs for the seal protector ring end of V150 and V300 valves. Lubricate the studs with anti-seize lubricant.
3. Insert flat-sheet line flange gaskets (or spiral-wound gaskets with compression-controlling center rings) that are compatible with the flowing media.
4. Connect pressure lines to the actuator as indicated in the actuator instruction manual. When an auxiliary manual actuator is used with a power actuator, install a bypass valve on the power actuator (if one is not supplied) for use during manual operation.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If the valve has ENVIRO-SEAL live-loaded packing installed, this initial re-adjustment will probably not be required. See ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)) for packing instructions.

Installing V200 Valves

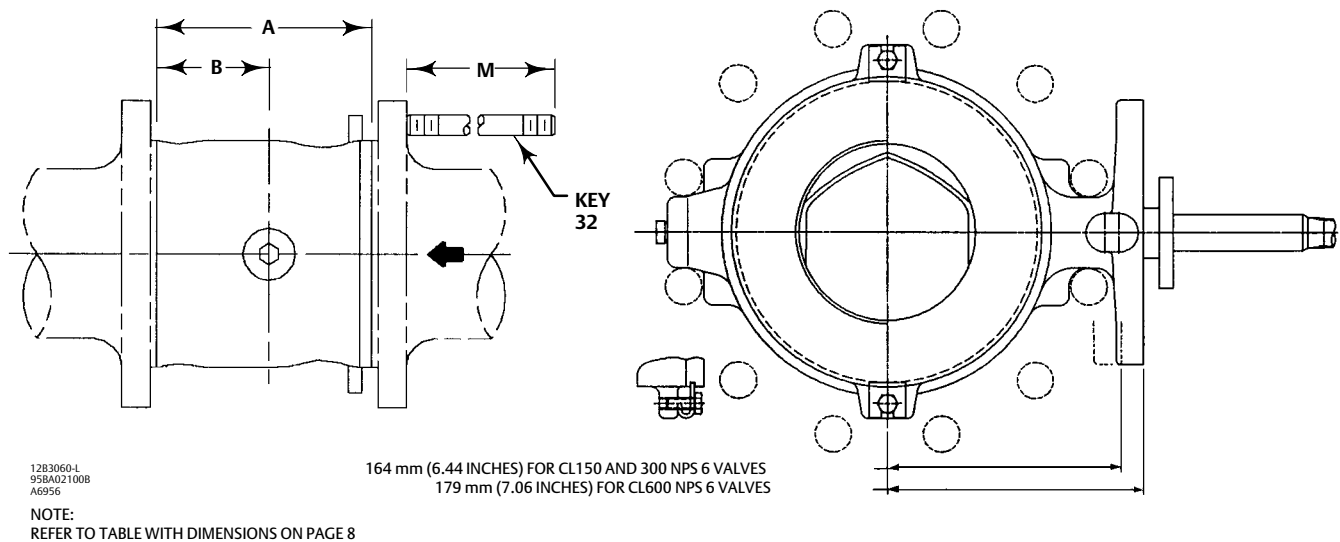
Stud length dimensions are shown in figure 4 for the seal protector ring end of the valve. For V200, CL600, the dimension from the center line of the valve bore to the mounting flange face is larger than a CL150 or 300 valve.

1. Install the V200 valve using long studs (key 32, figure 4) to connect the two pipeline flanges. Refer to figure 4 for the size of studs required. Lubricate the studs with anti-seize lubricant.
2. Install two studs in the flanges before you place the valve in the line. Place the two studs so they will contact the line-centering notches at the bottom of the valve body.
3. Insert flat-sheet line flange gaskets (or spiral-wound gaskets with compression-controlling center rings) that are compatible with the process fluid.
4. Place the valve on the two studs. Install all remaining studs. Measure carefully to be sure the valve is centered on the pipeline flanges and tighten the flange stud nuts. Tighten the nuts in a criss-cross sequence to be sure the flange gaskets are properly torqued.
5. Connect pressure lines to the actuator as indicated in the actuator instruction manual. When an auxiliary manual actuator is used with a power actuator, install a bypass valve on the power actuator (if one is not supplied) for use during manual operation.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Figure 4. Fisher V200 Dimensions and Required Clearances for Installation



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Vee-Ball Valves

April 2024

Instruction Manual

D101554X012

V200 VALVE SIZE, NPS	DIMENSION						
	A		B	M			
	Standard ANSI/ISA S75.08.02 ⁽¹⁾	CL150 ASME B16.10 ⁽²⁾ Short (Optional)		Standard CL150 ANSI/ISA S75.08.02 ⁽¹⁾	CL150 ASME B16.10 ⁽²⁾ Short (Optional)	CL300	CL600
mm							
1	102	127	58	176	202	202	202
1-1/2	114	165	64	189	240	224	224
2	124	178	57	211	268	237	237
3	165	203	87	254	286	279	286
4	194	229	92	286	321	305	343
6	229	267	119	343	381	362	423
8	243	292	119	343	394	387	426
10	297	330	151	419	451	---	---
Inches							
1	4.00	5.00	2.29	6.94	7.94	7.94	7.94
1-1/2	4.50	6.50	2.50	7.44	9.44	8.81	8.81
2	4.88	7.00	2.25	8.31	10.56	9.31	9.31
3	6.50	8.00	3.44	10.00	11.25	11.00	11.25
4	7.62	9.00	3.62	11.25	12.62	12.00	13.50
6	9.00	10.50	4.69	13.50	15.00	14.25	16.25
8	9.56	11.50	4.69	13.50	15.50	15.25	16.75
10	11.69	13.00	5.94	16.50	17.75	---	---

1. IEC 534-3-2 face-to-face dimensions are equivalent to ANSI/ISA S75.08.02 face-to-face dimensions.

2. 150 pound class only.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

Key numbers in this procedure are shown in figures 24, 25, and 26, unless otherwise noted.

⚠ WARNING

The Vee-ball closes with a shearing, cutting motion, which could result in personal injury. To avoid injury, keep hands, tools, and other objects away from the Vee-ball while stroking the valve.

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- The valve packing area may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Packing Maintenance

Key numbers in this procedure are shown in figures 24, 25, and 26, unless otherwise noted. A detailed view of the packing is also shown in figure 5.

If the valve is equipped with the ENVIRO-SEAL Packing System, refer to:

- the separate ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)) for maintenance instructions, and
- the Parts List section of this manual for retrofit kits, parts kits, and individual parts.

If the packing is relatively new and tight on the drive shaft (key 6), and if tightening the packing follower nuts does not stop leakage, it is possible that the drive shaft is worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches on the packing box wall. Inspect the drive shaft and packing box wall for nicks or scratches while performing the following procedure.

Replacing Packing

When using this procedure, it is recommended that the actuator **not** be removed from the valve while the valve is still in the pipeline or between flanges. Valve/actuator adjustments must be made with the valve out of the pipeline. Refer to the Determining Closed Position portion of the Actuator Mounting section.

Disassembly

WARNING

Observe the steps in the **WARNING** at the beginning of the Maintenance section.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines to the power actuator, release pressure from the actuator, and disconnect the pressure lines from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you are working on the equipment.
2. Remove line bolting, remove the control valve from the pipeline, and place the valve/actuator assembly on a flat surface with the seal protector ring facing up.
3. Remove the actuator cover. Take note of the orientation of the actuator with respect to the valve body and the lever orientation with respect to the valve drive shaft (see figure 6).

WARNING

When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, with a shearing, cutting motion, which could result in personal injury. To avoid injury, carefully rotate the ball to a stable position after the actuator is removed.

NOTICE

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever or actuator off the valve shaft. Driving the lever or actuator off the valve shaft could damage the ball, seal, and valve. If necessary, use a puller to remove the lever or actuator from the valve shaft. It is okay to tap the puller screw lightly to loosen lever or actuator, but hitting the screw with excessive force could damage the ball, seal, and valve.

4. Remove the clamped lever (do not loosen the actuator turnbuckle adjustment), remove the actuator mounting screws and nuts (keys 23 and 24), and remove the actuator. (If necessary, refer to the actuator instruction manual for assistance.)

5. If applicable, remove the bonding strap assembly before attempting to remove the packing (see figure 3).
6. Remove the packing follower nuts and packing follower (keys 17 and 20). For alloy packing constructions, the packing follower (key 17) and a separate packing flange (key 40) must be removed if present.

If the valve is equipped with the ENVIRO-SEAL packing system, refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)) for disassembly.

WARNING

Personal injury could result from packing leakage. Do not scratch the drive shaft or packing box wall while removing packing parts in the following procedure.

7. Remove the packing parts (see figure 5, keys 16, 17, 35, and 39 depending on construction) using a formed wire hook with a sharp end. Pierce the rings with the sharp end of the hook in order to remove them. Do not scratch the drive shaft or packing box wall; scratching these surfaces could cause leakage. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing.

Assembly

If the valve is equipped with the ENVIRO-SEAL packing system, refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)) for assembly.

Series B only

1. For NPS 8, 10, and 12 valves, install the packing spacer (key 34) if it has been removed.
2. To help ensure correct centering of the Vee-ball (key 2) on the seal (key 11), make sure the ball is closed while you install or tighten new packing. Insert a screwdriver, pry bar, or similar tool between the lower ear of the ball and the valve body. Use the pry to move the ball tightly against the bearing on the actuator side of the valve (see figure 6). Keep the ball in that position until you have completed packing installation and adjustment.
3. Install the new packing parts using the parts sequence shown in figure 5. Install the packing follower (key 17). Alloy constructions have a packing follower (key 17) and a separate packing flange (key 40) that must be replaced.
4. Secure the packing follower with the packing follower nuts (key 20). Tighten the nuts far enough to stop leakage under operating conditions.

Handle the seal protector ring, seal, and other parts carefully to prevent damage. A new gasket (key 15) is required whenever the seal protector ring (key 3) (figure 11) is removed.

Flow ring construction does not use a seal, shims, or spring seal. Use this procedure to remove the seal protector ring from flow ring constructions, but disregard any instructions calling for the seal, shims, or spring seal.

Note

If the valve is equipped with a bonding strap assembly (figure 3), re-install the assembly.

5. Reconnect the actuator and lever in accordance with the orientations that were noted in step 3 of the disassembly procedures. If necessary, use figure 23 to identify the correct index marks.
6. Refer to the appropriate actuator instruction manual to complete actuator assembly and adjustment.
7. When the control valve is in operation, check the packing follower for leakage and retighten the packing follower nuts (key 20) as necessary.

Replacing the Ball Seal

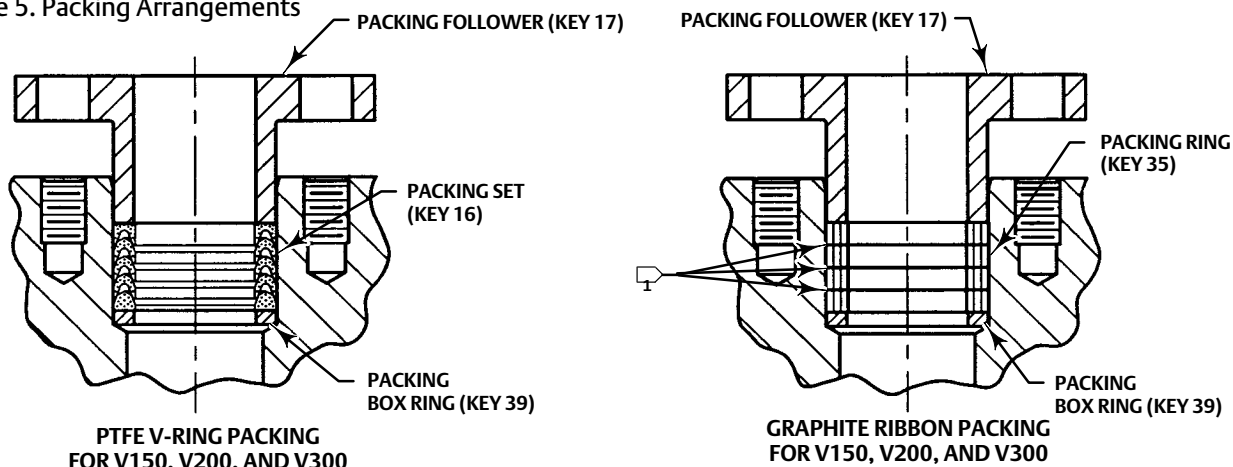
Disassembly

Perform this procedure if the control valve is not shutting off properly or if seal inspection is necessary. If you find upon inspection that the ball, shaft, or bearings need to be replaced, use this procedure to remove the ball seal. Then, proceed to the Bearing and Ball Maintenance procedures. Then, return to this procedure and begin with the assembly of the ball seal steps.

While the actuator/valve assembly must be removed from the pipeline, the actuator may remain mounted on the valve as you replace the ball seal.

Key numbers are shown in figures 24, 25, and 26, unless otherwise indicated. Ball Seal assembly details (with key numbers) are also shown in figures 8, 9, and 10.

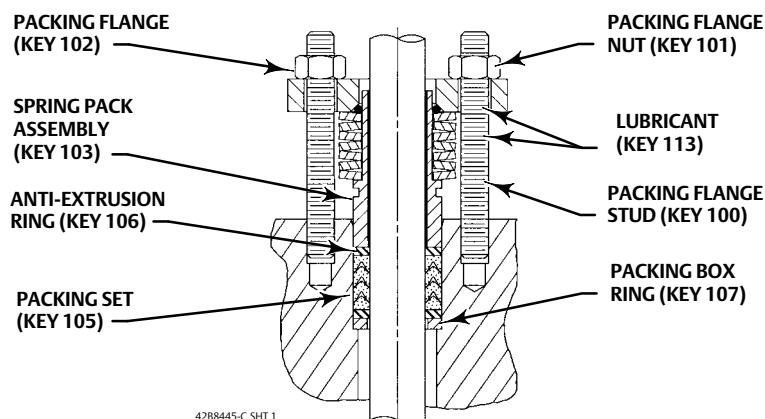
Figure 5. Packing Arrangements



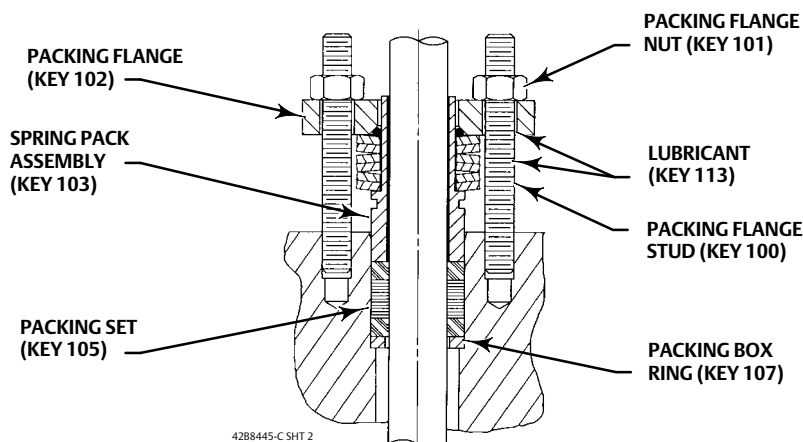
NOTE:
① INCLUDES ZINC WASHERS (KEY 36) FOR
GRAPHITE RIBBON PACKING ONLY.

2885170

STANDARD PACKING



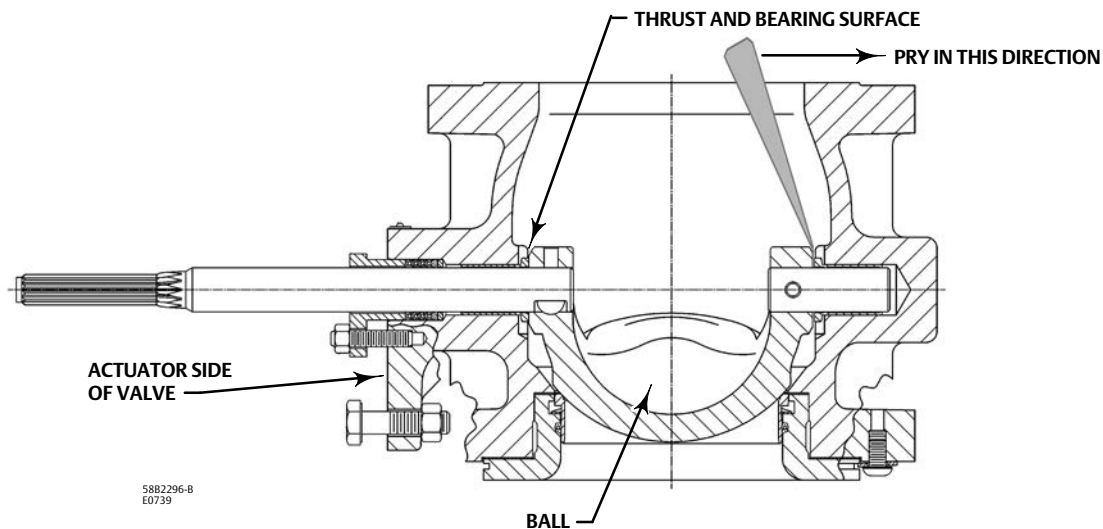
ENVIRO-SEAL PTFE PACKING SYSTEM



ENVIRO-SEAL GRAPHITE PACKING SYSTEM

B2412-1

Figure 6. Typical Vee-Ball Valve Showing Pry Bar



⚠ WARNING

Perform the steps in the **WARNING** at the beginning of the Maintenance section of this manual.

1. Remove line bolting, remove the control valve from the pipeline, and place the valve on a flat surface with the seal protector ring facing up. Carefully rotate the ball to the open position.
2. Remove protector ring screws and washers (keys 21 and 22). Carefully remove the seal protector ring and gasket (keys 3 and 15). (For flow ring constructions, go to step 4.)
 - a. For a Fisher TCM seal, remove the seal (key 11) from the valve body. For NPS 1, 1-1/2, and 2 valves, also remove the backup ring (key 14, figure 8) from the valve body.
 - b. For a flat metal seal, remove the spring seal, seal, and shims (keys 13, 11, and 12). (Note: It may be necessary to re-use some of the original shims when reassembling the flat metal seal.)
 - c. For an HD ball seal or a high temperature HD ball seal, once the protector ring has been removed from the valve, push the metal seal (key 11) out of the seal protector ring (key 3). Remove the wave spring (key 13), and on the HD metal seal, the radial seal (key 37).

Note

The high temperature HD ball seal also has a piston ring (key 133) that will need to be removed. It will be in two pieces for the NPS 1, 1-1/2 and 2 valves, and one piece with a break in it for the NPS 3 through 12 valves.

NOTICE

Exercise care to avoid damaging components in the following procedure.

- It might be necessary to remove the HD seal by carefully tapping it with a soft punch and hammer. Take care not to damage the seal protector ring.
 - NPS 3 through 12 valves, if the seal is difficult to push out, it is recommended that a seal removal plate be used to press the HD seal out of the seal protector ring. Refer to figure 12 for dimensions of the seal removal plate.
 - NPS 10 and 12 valves with a Rotary Attenuator only: Remove the retaining ring (key 41) in the seal protector ring. This retaining ring is an octagonal-shaped support wire. To remove the retaining ring, find one of the free ends of the ring. Use a screwdriver or similar tool to pry inward and upward until the ring is removed.
3. Inspect the gasket and sealing surfaces on the valve body (key 1 or 1A), the seal protector ring (key 3), Vee-Ball (key 2), and the retaining ring (key 41 for NPS 10 and 12 valves with a Rotary Attenuator only). Be sure the sealing surfaces are not damaged.
 4. If replacement of the ball, shafts (keys 6 or 9), or bearings (key 10) is needed, proceed to the Bearing and Ball Maintenance procedure. If only the seal is to be replaced, proceed to the Assembly steps below.

Assembly

Refer to figures 8, 9, and 10 for key number locations during seal installation. Valve key number locations are shown in figures 24, 25, and 26.

1. Thoroughly clean all parts that are to be re-used and obtain replacement parts. Be sure that all sealing surfaces are in good condition without scratches or wear. If the valve has been installed between line flanges and the flange studs and nuts have been tightened, always replace the gasket (key 15) with a new gasket.
2. To help ensure correct side-to-side centering of the ball (key 2) on the seal (key 11), make sure the ball is closed while you install the seal or flow ring and seal protector ring. Insert a screwdriver, pry bar, or similar tool between the lower ear of the ball and the valve body (see figure 6).
3. Use the pry to move the ball tightly against the bearing on the actuator side of the valve. Be careful, excessive force may damage the ball. Keep the ball in that position until you have completed seal or flow ring installation. Check the ball's position periodically, and re-center if necessary, during lever assembly and packing adjustments.

⚠ WARNING

The Vee-Ball closes with a shearing, cutting motion, which could result in personal injury. To avoid injury or property damage, keep hands, tools, and other objects away from the Vee-Ball while stroking the valve.

4. Install the seal.

NOTICE

Due to the Vee-ball shape, take care to never completely rotate either the front skirted edge or the circular back edge of the ball out of the ball seal as the seal could be damaged.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

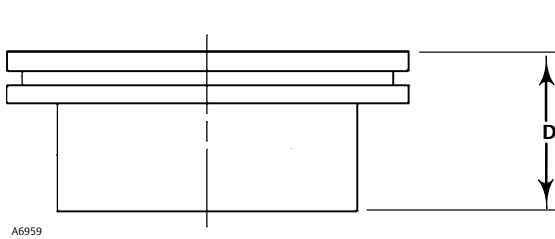
Instruction Manual

D101554X012

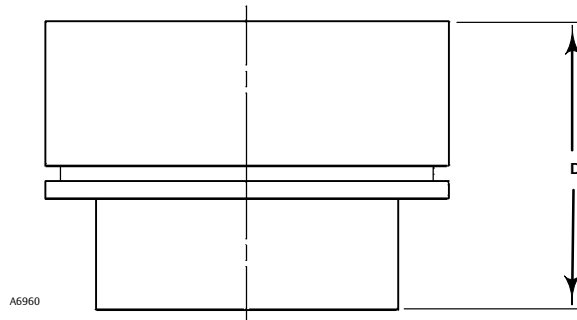
Vee-Ball Valves

April 2024

Figure 7. NPS 1 and 1-1/2 Seal Protector Ring Measurements



ANSI/ISA S75.08.02 FACE-TO-FACE VALVE



CL150 ASME B16.10 (SHORT) FACE-TO-FACE VALVE

Valve Size, DN	Valve Size, NPS	Construction ⁽¹⁾	TCM Seal "D"	HD Seal "D"	Flow Ring "D"
mm					
25	1	New	37.6	44.7	39.6
		Old	25.1	33.0	26.9
40	1-1/2	New	39.1	44.5	40.9
		Old	27.4	32.8	29.2
Inches					
25	1	New	1.48	1.76	1.56
		Old	0.99	1.30	1.06
40	1-1/2	New	1.54	1.75	1.61
		Old	1.08	1.29	1.15

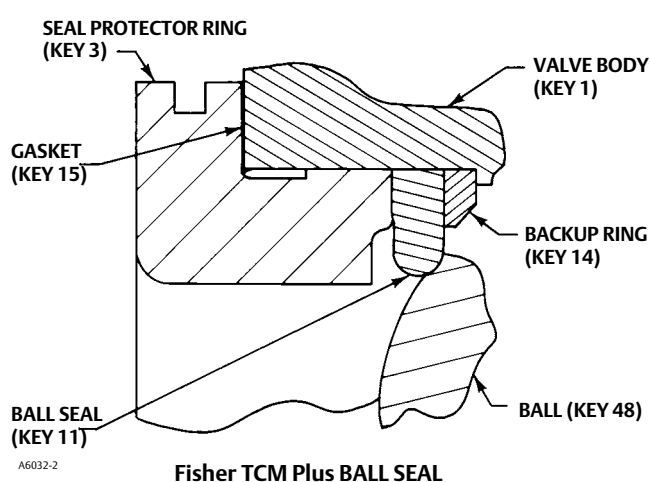
1. See the Note on page 14 of this Instruction Manual.

1. See the Note on page 14 of this Instruction Manual.

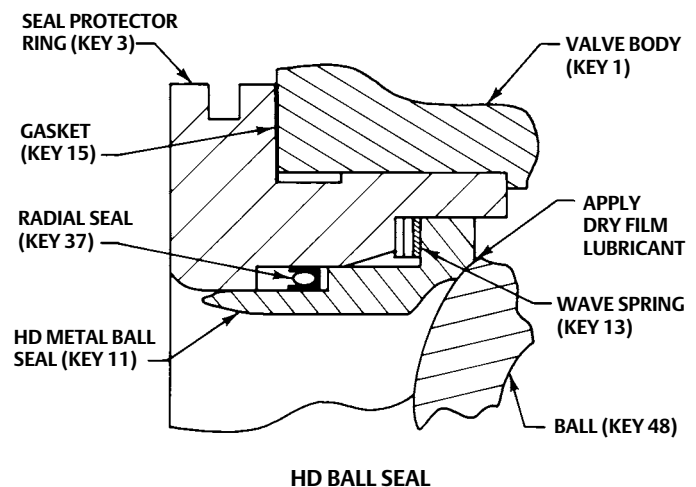
Valve Size, NPS	Construction ⁽¹⁾	TCM Seal "D"	HD Seal "D"	Flow Ring "D"
mm				
1	New	63.0	70.1	65.0
	Old	50.5	58.4	52.3
1-1/2	New	89.9	95.3	91.7
	Old	78.2	83.6	80.0
Inches				
1	New	2.48	2.76	2.56
	Old	1.99	2.30	2.06
1-1/2	New	3.54	3.75	3.61
	Old	3.08	3.29	3.15

1. See the Note on page 14 of this Instruction Manual.

Figure 8. Ball Seal Assembly for NPS 1, 1-1/2, and 2 Valves



Fisher TCM Plus BALL SEAL



HD BALL SEAL

Figure 9. Ball Seal Assembly for NPS 3 through 12 Valves

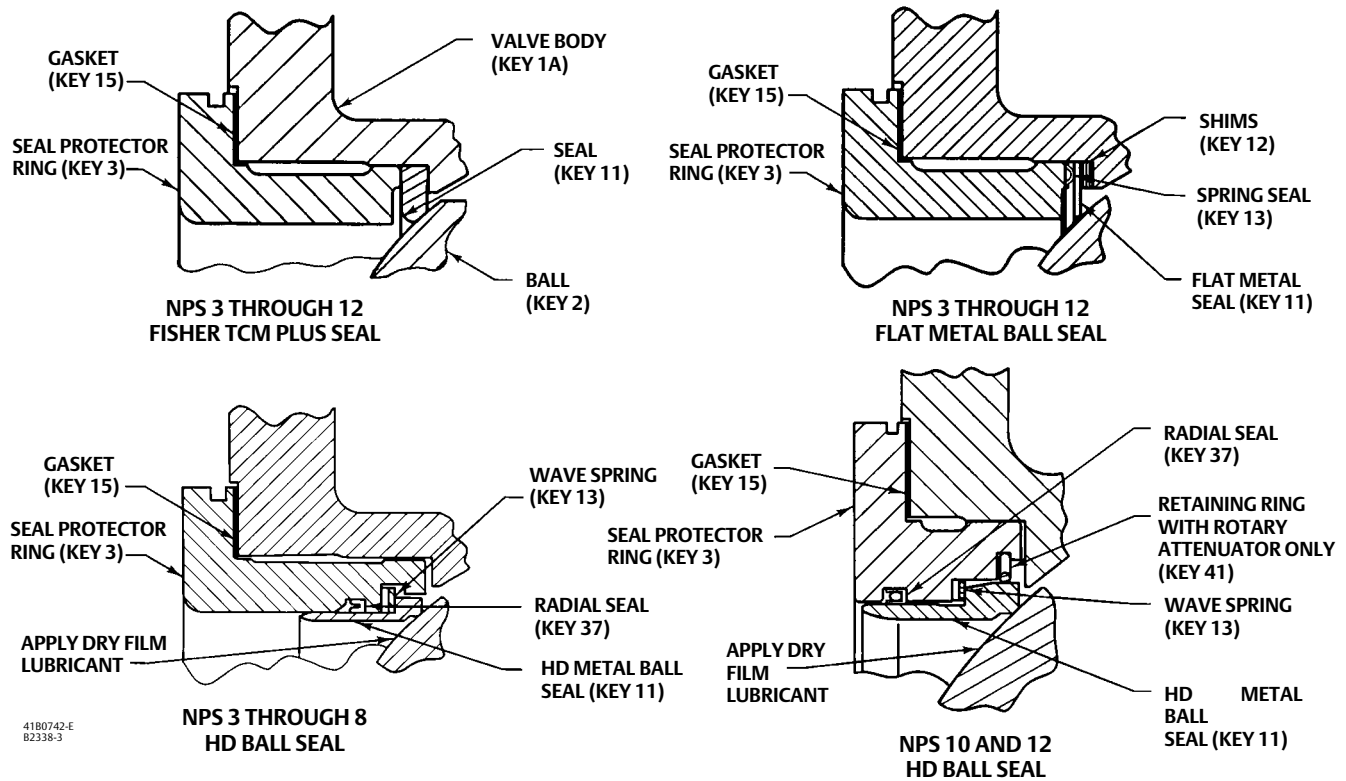


Figure 10. High Temperature HD Ball Seal Details

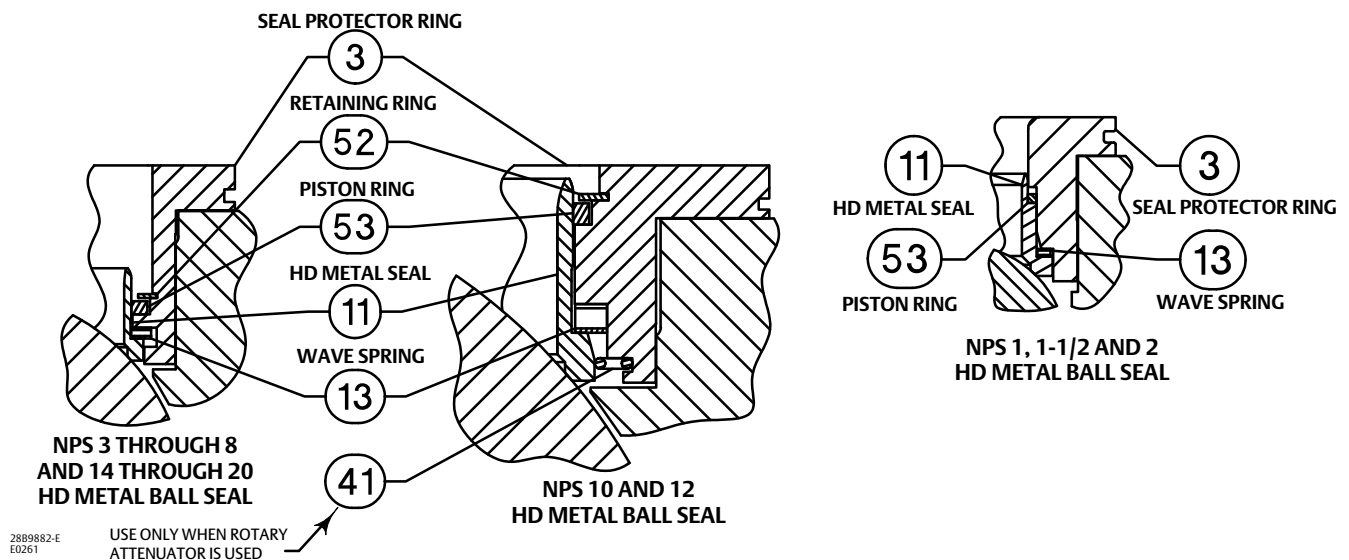


Figure 11. Seal Protector Ring

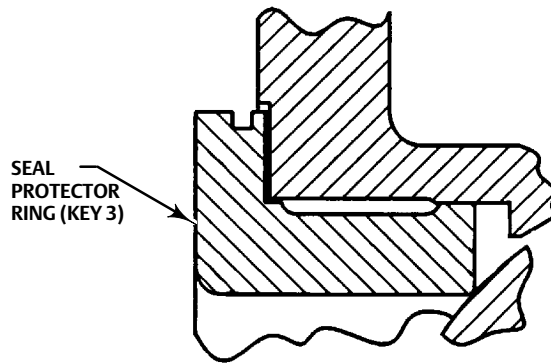
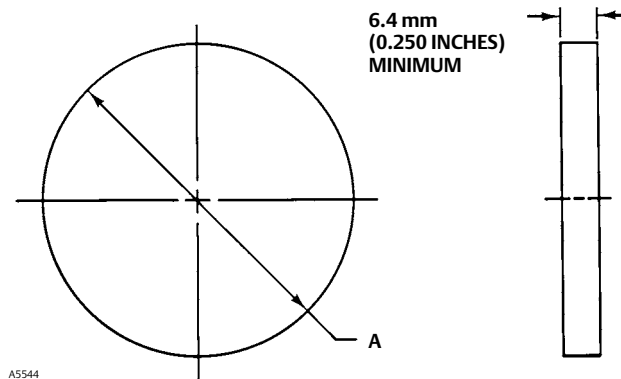


Figure 12. HD Seal Removal Plate Dimensions



VALVE SIZE		DIMENSION A	
DN	NPS	Minimum-Maximum, mm	Minimum-Maximum, Inches
80	3	75.9-76.2	2.990-3.000
100	4	95.0-95.3	3.740-3.750
150	6	126.7-127.0	4.990-5.000
200	8	158.5-158.8	6.240-6.250
250	10	212.5-212.7	8.365-8.375
300	12	263.3-263.5	10.365-10.375

Installing Fisher TCM Plus or Extra ball seals:

- a. NPS 1, 1-1/2, and 2 valves: Install the backup ring (key 14). Install the Fisher TCM seal (key 11) into the valve body. Refer to figure 7.
 - Install the gasket (key 15) on the valve body.
 - Install the seal protector ring (key 3) into the valve body. Now go to step 5 in this procedure.
- b. NPS 3 through 12 valves: Install the Fisher TCM seal (key 11) into the valve body.
 - Install the gasket (key 15) on the valve body.
 - Install the seal protector ring (key 3) into the valve body. Now go to step 5 in this procedure.

Installing flat metal seals:

- a. Install 12 shims in the valve and install the flat metal seal on top of the shims.
- b. Install the spring seal (key 13) on the flat metal seal (key 11) with the convex side of the spring seal facing the ball.
- c. Install the seal protector ring, and install the protector ring screws and washers (keys 21 and 22). Tighten the screws.
- d. Add or remove shims under the ball seal as necessary to obtain zero ball seal deflection as accurately as possible.

Note

Zero ball seal deflection for a flat metal seal is the point at which the addition of one 0.13 mm (0.005 inch) thick shim causes contact between the ball and ball seal to be broken. Hold the parts tightly together when determining zero deflection, or improper zero deflection might result.

- e. After zero deflection is reached, remove the seal protector ring, spring seal, seal and 4 shims. Final assembly of the control valve should not exceed a maximum of 9 shims for zero deflection. If more than 9 shims are required, contact your [Emerson sales office](#).
- f. Install the gasket (key 15) on the valve body.
- g. Install the seal protector ring (key 3) into the valve body. Now go to step 5 in this procedure.

Installing HD ball seals:

Note

The older and newer designs of the NPS 1 and 1-1/2 seal protector ring are functionally the same, but are different lengths and not interchangeable. All NPS 1 and 1-1/2 sizes of V150 and V300 valves are the newer design. The change in seal protector ring length occurred in the 1992/1993 timeframe and affects NPS 1 and 1-1/2 V200 valves only. To determine whether you have the older or newer design, measure the length of the seal protector ring (key 3, figure 26) from its pipeline flange mating surface to its opposite end. Compare your measurement to those listed in figure 7.

- a. **For NPS 1 and 1-1/2 valves:** The older and newer designs of the NPS 1 and 1-1/2 seal protector rings are functionally the same, but are different lengths and not interchangeable. Refer to figure 7 for protector ring dimensions.
 - Install the wave spring (key 13) onto the ball seal.
 - Lubricate and install the radial seal (key 37) onto the ball seal (key 11). Make sure the open side of the radial seal faces away from the ball.
 - Push the ball seal assembly into the seal protector ring (key 3).
 - Go to step 5 in this procedure.

b. For all NPS 3 through 8 valves and NPS 10 and 12 valves without Rotary Attenuator:

- Lubricate and install the radial seal (key 37) into the appropriate groove in the seal protector ring making sure the open side of the radial seal faces away from the ball.
- Install the wave spring (key 13) into the seal protector ring (key 3).
- Install the HD seal (key 11) into the seal protector ring (key 3), past the radial seal. While pushing it past the radial seal, make sure the HD seal is level. Go to step 5 in this procedure.

c. For NPS 10 and 12 valves with Rotary Attenuator:

- Lubricate the radial seal with lithium grease and install the radial seal (key 37) into the appropriate groove in the seal protector ring making sure the open side of the radial seal faces away from the ball.
- Install the wave spring (key 13) into the seal protector ring (key 3).
- To install the retaining ring (key 41), find one of the free ends of the ring. Insert the free end into the groove in the seal protector ring. Work around the ring, pressing it into the groove until the ring is completely in its groove.
- Install the HD seal (key 11) into the seal protector ring (key 3), past the radial seal. While pushing it past the radial seal, make sure the HD seal is level.
- The HD seal uses a retaining ring (key 41) for NPS 10 and 12 valves only. This retaining ring is an octagonal-shaped support wire. Go to step 5 in this procedure.

Installing high temperature HD ball seals:

a. For NPS 1, 1-1/2 and 2 valves: The older and newer designs of the NPS 1 and 1-1/2 seal protector rings are functionally the same, but are different lengths and not interchangeable. All part numbers in this manual are for the newer design. Refer to figure 7 for ring dimensions.

- Place the wave spring (key 13) on top of the HD seal (key 11).
- Break the piston ring (key 133) into two approximately equal pieces either by placing the ring over a pencil or similar object and applying pressure down-wards on the ring until the ring snaps. Be sure to match the broken ends together as you install it on the HD seal (key 11).
- Lay the HD seal (key 11) down on a flat surface and push the seal protector ring (key 3) into place. Make sure the seal is level. Go to step 5 in this procedure.

b. For NPS 3 through 8 valves:

- Place the piston ring (key 133) and retaining ring (key 132) into the appropriate groove in the seal protector ring (key 3). The piston ring has one break in it; do **not** break it further.
- Install the wave spring (key 13) into the seal protector ring (key 3).
- Lay the HD seal (key 11) down on a flat surface and push the seal protector ring (key 3) past the piston ring (key 133) and into place. Make sure the seal is level. Go to step 5 in this procedure.

c. For NPS 10 and 12 valves:

- Place the piston ring (key 133) and retaining ring (key 132) into the appropriate groove in the seal protector ring (key 3). The piston ring has one break in it; do not break it further.
 - Install the wave spring (key 13) into the seal protector ring (key 3).
 - If the valve has a Rotary Attenuator, install the retaining ring (key 41). The octagonal shaped support wire ring has two free ends. Place one of the free ends into the groove in the seal protector ring. Then starting at the inserted end, press the rest of the ring into the groove completely.
 - Lay the HD seal (key 11) down on a flat surface and push the seal protector ring (key 3) past the piston ring (key 133) and into place. Make sure the seal is level. Go to step 5 in this procedure.
5. Install a replacement gasket (key 15) on the valve body (key 1 or 1A). Install the HD ball seal/seal protector ring assembly into the valve body (key 1 or 1A).
 6. Install washers (or clips), and screws that clamp the seal protector ring to the valve body [keys 3, 21, and 22; the V200 valve uses clips (key 22) in place of washers].
 7. If necessary, refer to the Packing Maintenance procedures to install the packing. Install the actuator using the Actuator Mounting procedures or to the appropriate actuator instruction manual.

HD Ball Seal Lubrication

To assist with break-in of the HD seals, it is recommended that the ball and seal be lubricated with dry film lubricant or equivalent moly disulfide.

Bearing and Ball Maintenance

⚠ WARNING

Before performing the steps in this section, observe the WARNING at the beginning of the Maintenance section on page 8.

DN 80 - 300 (NPS 3 through 12) Valves

Procedures for disassembly and assembly of the bearings and ball cannot be accomplished until the ball seal and valve packing are removed from the valve.

Refer to the Replacing Packing procedures to remove the actuator, and to remove the packing flange and packing follower from the valve. When the packing disassembly steps are complete, return to this section.

Refer to the Replacing the Ball Seal procedures to remove the ball seal from the valve.

Table 4. Continuous Threaded Rod

Valve Size, DN	Valve Size, NPS	Threaded Rod Thread Size	Thread Depth in Follower Shaft
80	3	0.25-20	0.5
100	4	0.25-20	0.5
150	6	0.25-20	0.5
200	8	0.3125-18	0.62
250	10	0.3125-18	0.62
300	12	0.3125-18	0.94

Disassembly

⚠ WARNING

When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, with a shearing, cutting motion, which could result in personal injury. To avoid injury, carefully rotate the ball to a stable position at the bottom of the valve body cavity. Make sure the ball will not rotate.

Key numbers in this procedure are shown in figures 24, 25, and 26, unless otherwise indicated.

1. A taper key (key 4, figures 14, 24, 25 and 32) is used to connect the ball and drive shaft in NPS 3 through 12 valves.
2. Carefully rotate the ball to the open position after the actuator is disconnected. Make sure the ball will not rotate (see warning above). Provide support for the ball during the following disassembly.
3. Working from the small end of the groove pin (key 7), use a pin punch to drive the groove pin out of the ball ear and follower shaft.

Welded Taper Key Replacement

For tack welded taper keys, driving the taper key out of the ball ear will shear the tack welding.

4. Locate the small end of the taper key (key 4, see figures 14, 24, 25 and 32). Using a pin punch on the smaller end of the taper key, drive it out of the ball (key 2) and drive shaft (key 6). Note: driving the taper key in the wrong direction will tighten it.
5. Pull the drive shaft (key 6) out of the actuator side of the valve body.

NOTICE

Exercise care to avoid damaging components in the following procedure.

6. The ball will be free to move when both shafts are removed. Make sure the sealing surface of the ball is not damaged while removing the follower shaft.
 - a. Unscrew the pipe plug (key 25) if one is installed. Use a punch to drive the follower shaft (key 9) into the center of the ball.
 - b. If a pipe plug is not installed, use a piece of continuous threaded rod as a removal rod when moving the follower shaft (key 9) into the center of the ball. Refer to the table 4 for a description of the size threaded rod needed. The length of the rod should allow easy working room from the valve body.
7. Carefully remove the follower shaft and ball (key 2) from the valve body.

Rotary Attenuator Maintenance

For NPS 4 valves with attenuator, remove the ball/attenuator through the inlet of the valve. Taking hold of the follower shaft ear on the ball/attenuator, you must position the scalloped edge of the attenuator against the valve bore opening and then pivot, or roll, the ball/attenuator out of the valve body (see figure 18).

For NPS 6, 8, 10, and 12 valves with attenuator, remove the ball/attenuator through the outlet of the valve by carefully turning and manipulating the ball. The NPS 6, 8, 10, or 12 ball/attenuator will not come straight out of the valve body.

Whisper NXV Trim Maintenance

For NPS 4, 6, 8, 10, and 12 valves with Whisper NXV Trim, the Whisper Trim Attenuator requires special removal processes to be separated from the ball. Contact your [Emerson sales office](#) for more information.

8. Remove the bearings (key 10) by hand. If the bearings are tight in the valve body, then pull or drive them out with a slight pressure.
 - To remove the follower shaft bearings, use a blind-hole bearing puller. If you do not have such a tool, you can machine the bearing out.
9. Thoroughly clean surfaces of all parts that are to be re-used or obtain replacement parts.

Assembly

1. Inspect all sealing surfaces to ensure they are in good condition and without scratches or wear.
2. Install the replacement bearings (key 10) by hand. The bearing flanged end should touch the valve body.
3. **Installing the Vee-Ball:** Ensure the ball part number matches up with the appropriate seal type as shown in the key 2 ball table in the parts list section of this instruction manual.

⚠ WARNING

The ball might be damaged if it is allowed to fall into the valve body. To avoid personal injury or damage to the sealing surfaces, support the ball to prevent it from falling into or out of the valve body cavity.

Note

For ease of assembly, the follower shaft (key 9) should be inserted into the ball before installing the ball in the following applications:

- NPS 3 valve without ball/Rotary Attenuator
- NPS 4 through 12 valves with ball/Rotary Attenuator.

Carefully install the ball into the valve body cavity.

- **For Vee-Ball with Rotary Attenuator (NPS 4 through 12 valves),** carefully install the ball into the valve body cavity. For NPS 4 valves, install the ball/attenuator through the inlet of the valve. For NPS 6, 8, 10, and 12 valves, install the ball/attenuator through the outlet of the valve. Taking hold of the follower shaft ear on the ball/attenuator, you must position the scalloped edge of the attenuator against the valve bore opening and then carefully pivot, or roll, the ball/attenuator into the valve body (see figure 18).
- **For Vee-Ball with Whisper NXV Trim (NPS 4 through 12 valves),** installation of new Whisper NXV trim and reinstallation of previously removed trim requires special welding processes. Contact your [Emerson sales office](#) for more information.

NOTICE

The Whisper NXV Trim array is only compatible with CG8M, CF3M, or CF8M ball materials.

Use of non-compatible ball materials with the S31603 (316L) Whisper NXV Trim may result in insufficient weld strength leading to damage to the valve seal, array and other valve components and interfere with proper valve operation.

After you have installed the ball (key 2) into the valve body assembly, firmly support the ball while installing the shafts.

4. Installing the follower shaft (key 9):

- **For NPS 3 valves:** The follower shaft (key 9) should already have been inserted into the ball before the ball was put into the valve body. Insert the follower shaft (key 9) into the valve body bearing (key 10).

- For NPS 4 and larger valves: Insert the follower shaft (key 9) through the ball, and into the valve body bearing (key 10).
- For NPS 4 through 12 valves with ball/Rotary Attenuator: The follower shaft (key 9) should already have been inserted into the ball/attenuator before the ball was put into the valve body. Insert the follower shaft (key 9) into the valve body bearing (key 10).

Then for all sizes, align the hole in the follower shaft with the holes in the ball. Insert the small end of the groove pin (key 7) into the hole in the ball and into the follower shaft. The pin will hold the parts in place while the drive shaft (key 6) is being installed.

Table 5. Taper Key Minimum Depth

Valve Size, DN	Valve Size, NPS	Minimum Depth To Drive Taper Key After Initial Solid Contact, mm (Inches)
80, 100, 150	3, 4, 6	4.8 (0.188)
200, 250, 300	8, 10, 12	5.6 (0.219)

Table 6. Taper Key Maximum Depth

Valve Size, DN	Valve Size, NPS	Maximum Depth To Drive Taper Key After Initial Solid Contact, mm (Inches)
80, 100	3, 4	7.1 (0.281)
150	6	7.9 (0.312)
200, 250	8, 10	9.5 (0.375)
300	12	10.3 (0.406)

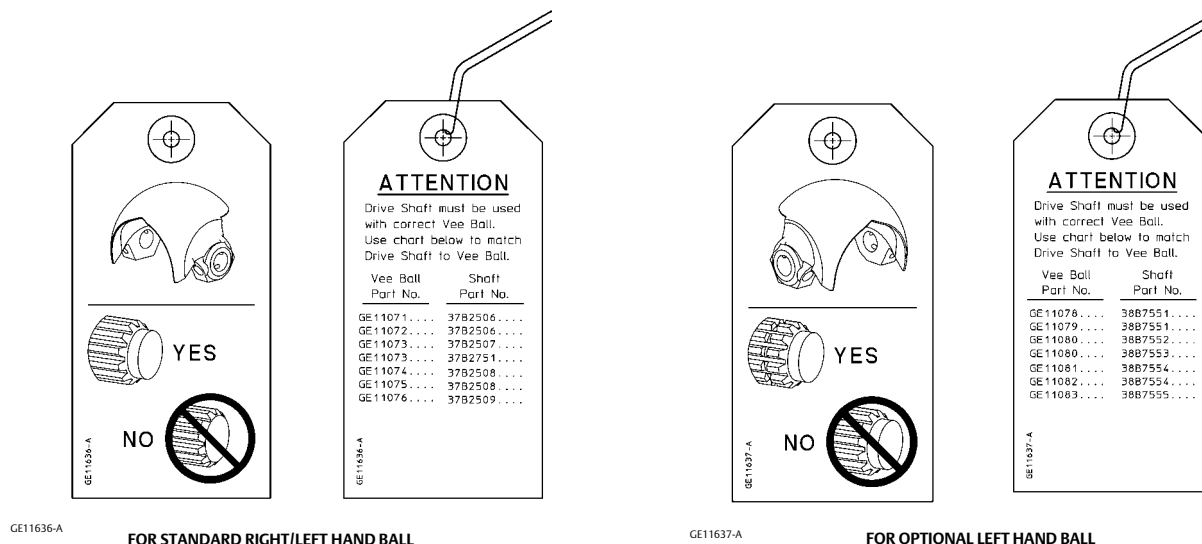
5. Installing the Drive Shaft:

NOTICE

The drive shaft must be used with the correct Vee-Ball. Refer to the tag (see figure 13) attached to the Vee-Ball and to the drive shaft.

Failure to use the correct Vee-Ball/shaft combination may result in the ball not being in the position indicated by the slash mark on the end of the shaft. If the ball is not properly aligned with the slash mark, the valve will not function correctly and seal damage may result.

Figure 13. Informational Tag



NOTICE

Make sure the drive shaft is free of oil or grease, otherwise the taper pin or taper key will not seat properly. Failure to properly set the taper pin or taper key could result in it coming loose while in service. Loosening of the taper key in service could result in improper valve function and equipment damage.

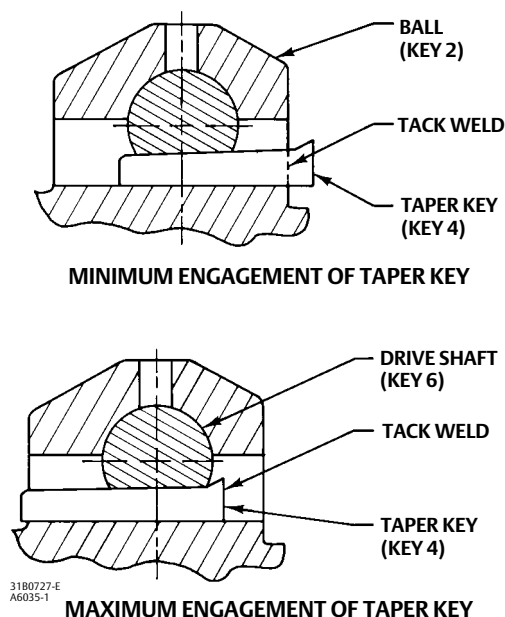
- a. Insert the drive shaft into the valve body bearing (key 10), and into the ball ear. Align the hole in the drive shaft with the holes in the ball.
- b. Insert the taper key into the ball and drive shaft as shown in figure 14.
 - Installing the Taper Key

Current standard construction materials for all NPS 3 through 12 valves require the taper key (key 4, figure 14) to be tack welded in place **after** properly seating, using the following procedure. Use standard welding preparations when preparing parts for reassembly.

NOTICE

Make sure the drive shaft (key 6) is free of oil or grease, otherwise the taper key will not seat properly. Failure to properly set the taper pin or taper key could result in it coming loose while in service. Loosening of the taper key in service could result in improper valve function and equipment damage.

Figure 14. Taper Key Installation



6. Install the drive shaft (key 6) into the valve body through the ball and into the lower bearing.
7. Insert the taper key (key 4) into ball and drive shaft (keys 2 and 6) as shown in figure 14. The taper key inserts, with the flat side of the key, facing the drive shaft (key 6).

8. Using a flat end punch, drive the groove pin (key 7) into the ball ear and follower shaft until it is flat with the ball ear surface. Stake both ends of the pin hole with a center punch to ensure the groove pin does not come out.
9. Using a flat end punch, drive the taper key (key 4) into the ball ear and drive shaft (key 6) until solid, heavy contact is obtained between the key and shaft.
10. Measure the position of the taper key head.
11. Drive the taper key in further using the minimum distance shown in table 5.
12. Inspect the ball/shaft taper key connection to verify that the taper key spans the entire shaft flat width. If not, the taper key must be driven in further until this condition is satisfied. However, do not exceed the maximum depths shown in table 6.

Note

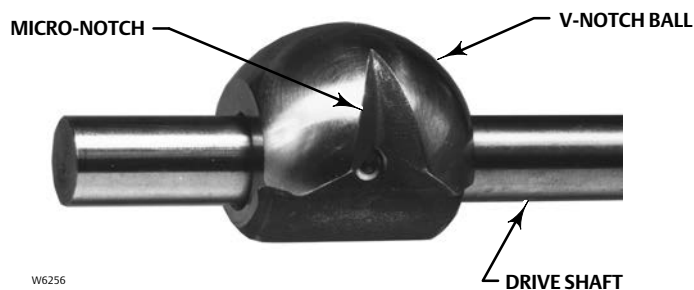
All valve taper keys are tack welded, except titanium.

13. When the above conditions are met, tack weld the taper key (key 4) to the ball ear on the head end of the key (see figures 24 and 25).

Use a:

- 1/8 inch diameter weld on NPS 3 through 6 valves,
- 3/16 inch diameter weld on NPS 8 through 10 valves, and
- 1/4 inch diameter weld on NPS 12 valves.

Figure 15. Typical Metal Micro-Notch Ball and Drive Shaft



For all constructions: Refer to Replacing the Ball Seal, Packing Maintenance, and other procedures as necessary to complete the assembly of the valve.

DN 25 through 50 (NPS 1 through 2) Valves

Procedures for disassembly and assembly of the bearings and ball cannot be accomplished until the ball seal and valve packing are removed from the valve.

Refer to the Replacing Packing procedures to remove the actuator, and to remove the packing flange and packing follower from the valve. When the packing disassembly steps are complete, return to this section.

Refer to the Replacing the Ball Seal procedures to remove the ball seal from the valve.

Disassembly

⚠ WARNING

When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, with a shearing, cutting motion, which could result in personal injury. To avoid injury, carefully rotate the ball to a stable position at the bottom of the valve body cavity. Make sure the ball will not rotate.

Key numbers in this procedure are shown in figures 24, 25, and 26, unless otherwise indicated.

1. A taper pin (key 4, figure 20) is used in the NPS 1, 1-1/2, and 2 valves, and in the NPS 1 Metal Micro-Notch valve (figure 21).
2. Ceramic Micro Notch ball constructions: A screw (key 4, figure 22) is used to attach the ball to the drive shaft.

NOTICE

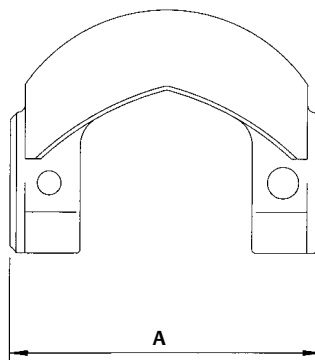
Exercise care to avoid damaging components in the following procedure.

- a. The parts are held together with a screw and an adhesive. Remove the screw (key 4) and separate the drive shaft from the ball. In some cases, a small amount of heat can be applied to help loosen the adhesive. However, excessive heat may damage other valve component parts.
- b. Once the shafts have been removed from the valve body, the ball may fall. To avoid personal injury or damage to the sealing surfaces, provide support for the ball to prevent it from falling as the shaft(s) are being removed.

Table 7. Continuous Threaded Rod

Valve Size, DN	Valve Size, NPS	Threaded Rod Thread Size	Thread Depth in Follower Shaft
25	1	1/4-20	0.5
40	1.5	1/4-20	0.5
50	2	1/4-20	0.5

Figure 16. Dimensions of Ball in Ball / Shaft Assembly



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D101554X012

Vee-Ball Valves

April 2024

VALVE SIZE		A			
		NEW - WITHOUT THRUST WASHER		OLD - WITH THRUST WASHER	
DN	NPS	mm	Inches	mm	Inches
25	1	32.9	1.29	31.8	1.25
40	1.5	48.6	1.91	47.7	1.88
50	2	64.5	2.54	63.4	2.50

3. Carefully rotate the ball to the open position after the actuator is disconnected. Make sure the ball will not rotate (see warning above). Provide support for the ball during the following disassembly.
4. Unscrew the pipe plug (key 25). (The pipe plug is optional and may not be available.)
5. Working from the small end of the groove pin (key 7), use a pin punch to drive the groove pin out of the ball ear and follower shaft.

Note

All NPS 1 Micro-Notch constructions use a one piece shaft. They do not have a follower shaft.

6. Locate the small end of the taper key (key 4, figure 14). Using a pin punch on the smaller end of the taper key, drive it out of the ball (key 2) and drive shaft (key 6). Note: driving the taper key in the wrong direction will tighten it.
7. Pull the drive shaft (key 6) out of the actuator side of the valve body.

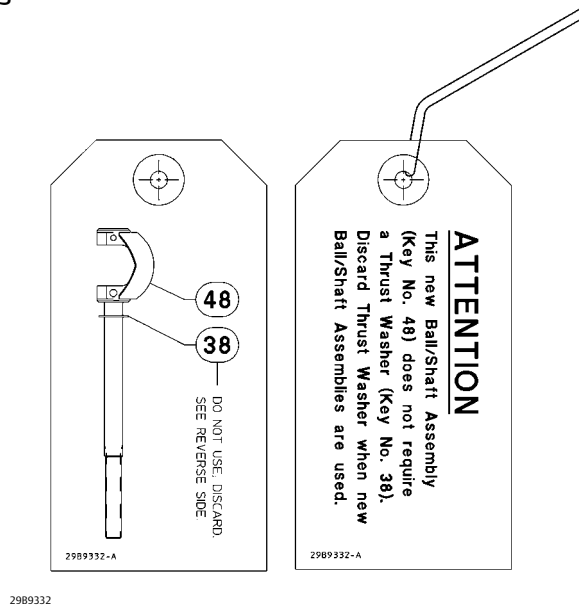
Note

The new ball/shaft assembly (key 48) does not require a thrust washer (key 38) in valves ordered after November 01, 2001.

Discard the thrust washer in valves ordered prior to this date when new ball/shaft assemblies are used as spare parts.

Figure 17 shows the informational tag that is attached with the new ball/shaft assembly when shipped as a spare part. Refer to figure 16 for dimensions of the ball in the ball/shaft assembly.

Figure 17. Informational Tag



NOTICE

Exercise care to avoid damaging components in the following procedure.

8. Make sure the sealing surface of the ball is not damaged while removing the follower shaft.
 - a. If a pipe plug (key 25) is installed, use a punch to drive the follower shaft (key 9) into the center of the ball.
 - b. If a pipe plug is not installed, use a piece of continuous threaded rod as a removal rod when moving the follower shaft (key 9) into the center of the ball. Refer to the table 7 shown below for a description of the size threaded rod needed. The length of the rod should allow easy working room from the valve body.
9. Remove the ball (key 2) by carefully removing the follower shaft and ball from the valve body.
10. Remove the bearings (key 10) by hand. If the bearings are tight in the valve body, then pull or drive them out with a slight pressure.
11. Thoroughly clean surfaces of all parts that are to be re-used or obtain replacement parts.

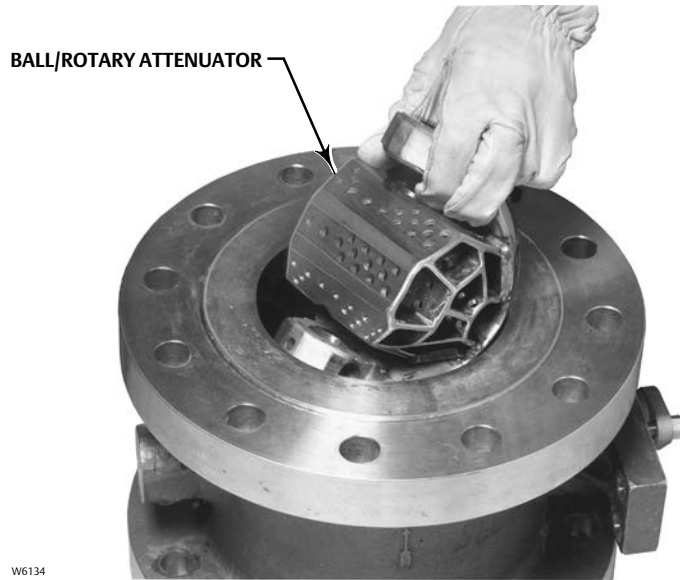
Assembly

1. Inspect all sealing surfaces to ensure they are in good condition and without scratches or wear.
2. Install bearings (key 10) by hand. The bearing flanged end should touch the body.
3. Installing the ball (key 2):

⚠ WARNING

The Vee-Ball might be damaged if it is allowed to fall into the valve body. To avoid personal injury or damage to the sealing surfaces, support the ball to prevent it from falling into or out of the valve body cavity.

Figure 18. Ball/Rotary Attenuator Installation and Removal Method



Note

For ease of assembly, the follower shaft (key 9) should be inserted into the ball before installing the ball in an NPS 3 valve without ball/Rotary Attenuator

Carefully install the ball into the valve body cavity.

After you have installed the ball (key 2) into the valve body assembly, firmly support the ball while installing the shafts.

4. Installing the follower shaft (key 9):

- For NPS 1 through 2 valves: The follower shaft (key 9) should already have been inserted into the ball before the ball was put into the valve body. Insert the follower shaft (key 9) into the valve body bearing (key 10).

Note

All NPS 1 Micro-Notch constructions use a one piece shaft. They do not have a follower shaft.

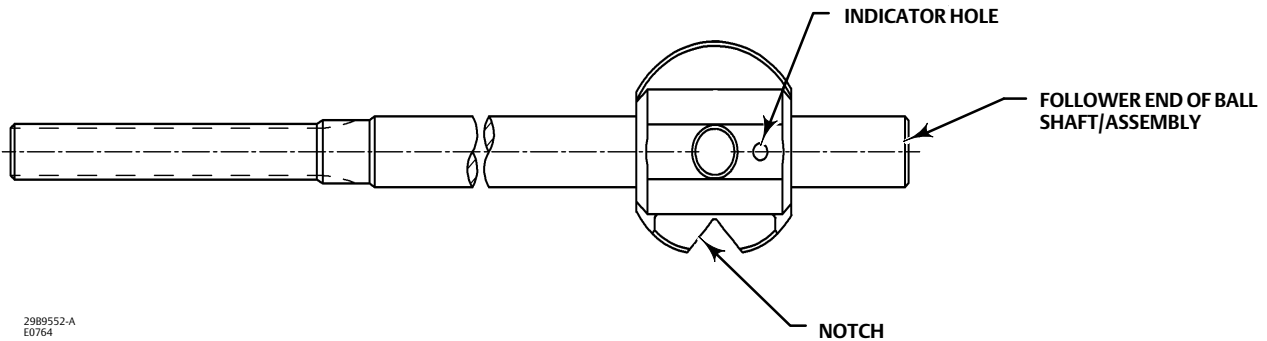
5. Installing the Drive Shaft for Valves with Taper Pins

NOTICE

The drive shaft must be used with the correct Vee-Ball. Refer to the tag (see figure 13) attached to the Vee-Ball and to the drive shaft.

Failure to use the correct Vee-Ball/ shaft combination may result in the ball not being in the position indicated by the slash mark on the end of the shaft. If the ball is not properly aligned with the slash mark, the valve will not function correctly and seal damage may result.

Figure 19. Location of Indicator Hole in Micro-Notch Vee-Balls



NOTICE

Make sure the drive shaft is free of oil or grease, otherwise the taper pin will not seat properly. Failure to properly set the taper pin or taper key could result in it coming loose while in service. Loosening of the taper key in service could result in improper valve function and equipment damage.

6. Insert the drive shaft into the valve body bearing (key 10), and into the ball ear (or ball, for Micro-Notch constructions). Align the hole in the drive shaft with the holes in the ball.

Note

There is an indicator hole drilled in all Micro-Notch balls. This indicator hole must be oriented closest to the follower end of the ball/shaft assembly. See figure 19.

7. Insert the taper pin into the ball and drive shaft as shown in figures 20 and 21. The small end of the taper pin must be inserted into the larger hole side of the ball ear (or ball, for Micro-Notch constructions), and into the large hole side of the drive shaft.

Note

The taper pin will not fit correctly if inserted in the wrong direction through the ball ear (or ball, for Micro-Notch constructions) or through the drive shaft. Make sure the drive shaft and ball ear (or ball, for Micro-Notch constructions) are in the correct orientation for installing the pin.

- Installing Taper Pins in NPS 1, 1-1/2, and 2 Valves

Note

For NPS 1, 1-1/2, and 2 valves, the taper pins (figure 20) do not require welding.

Using a flat-end punch, drive the taper pin into the ball ear (or ball, for Micro-Notch constructions) and drive shaft until solid heavy contact is felt. Make sure the taper pin spans the width of the ball.

Using a flat end punch, drive the groove pin (key 7) into the ball and follower shaft until it is flat with the ball surface.

Installing the Drive Shaft in VTC Ceramic Vee-Ball Valves

NOTICE

The drive shaft must be used with the correct Vee-Ball. Refer to the tag (see figure 13) attached to the Vee-Ball and to the drive shaft.

Failure to use the correct Vee-Ball/ shaft combination may result in the ball not being in the position indicated by the slash mark on the end of the shaft. If the ball is not properly aligned with the slash mark, the valve will not function correctly and seal damage may result.

Figure 20. Taper Pin Installation for Fisher V150, V200, and V300 NPS 1, 1-1/2, and 2 Valves

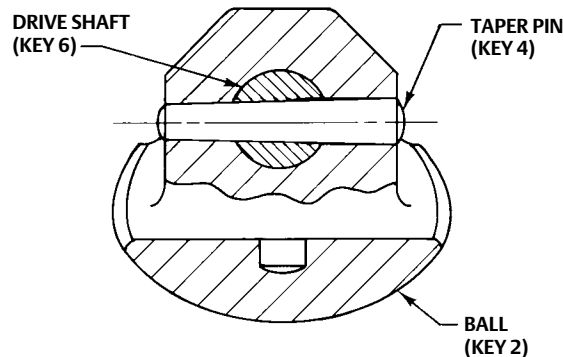
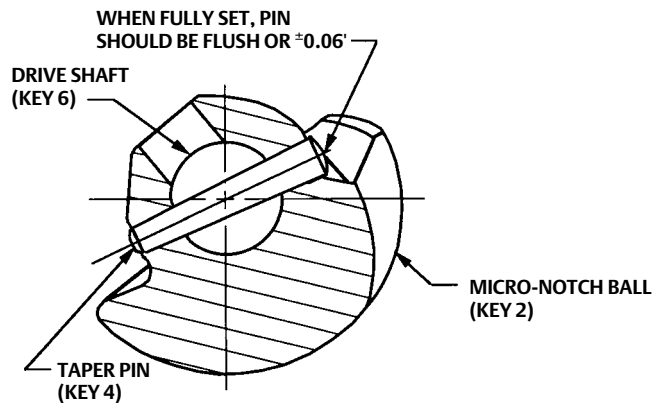
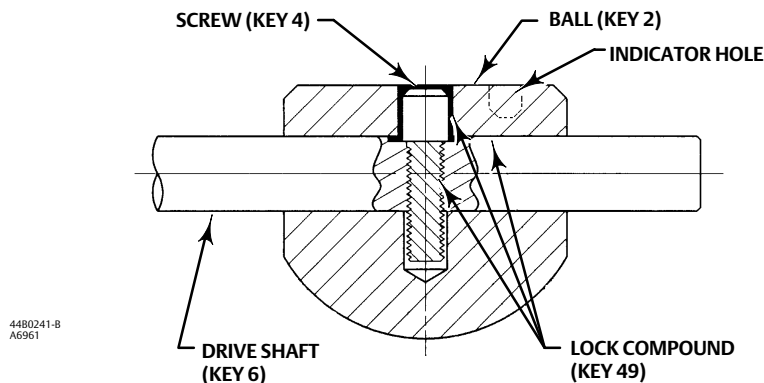


Figure 21. Taper Pin Installation for Fisher V150, V200, and V300 NPS 1 Valves with Micro-Notch Ball Construction



Valves with NPS 1 ceramic micro-notch balls use a screw with a threaded valve shaft to connect the ball to the shaft. An adhesive is used to lock the screw in the valve shaft (keys 4 and 6, figure 22).

Figure 22. Screw Installation for Fisher V150, V200, and V300 NPS 1 Valves with VTC Ceramic Micro-Notch Ball Construction



Note

There is an indicator hole drilled in all Micro-Notch balls. The orientation of this hole in the ceramic Vee-Ball is to the right of the screw in the ball, and must be located closest to the follower end of the ball/shaft assembly. See figures 19 and 22.

⚠ WARNING

Avoid personal injury and property damage from ignition of process fluid caused by sparks from ceramic trim.

Do not use ceramic trim where the process fluid is unstable or if it is an explosive mixture (such as ether and air).

Within the valve body:

8. The threaded hole in the shaft, the screw and screw clearance hole in the ball must be free of oil and grease before applying an activator.
9. Apply Loctite® Depend® Activator 7387 to threaded hole, screw and ball clearance hole. Assemble the ball onto the shaft while aligning threaded shaft hole within the ball clearance hole.
10. The flat on the shaft must be oriented so that the head of the cap screw seats on the flat.
11. Apply 5 drops of Loctite Depend 330 into the hole in the ball.
12. Thread the screw into the shaft tightening it to 9.2 N•m (81 in•lbs) torque. Remove excess adhesive, Allow four hours to cure fully before continuing with assembly.

For all constructions: Refer to Replacing the Ball Seal, Packing Maintenance, and other procedures as necessary to complete the assembly of the valve.

Cavitrol Hex Installation

The Cavitrol Hex anti-cavitation trim (key 64) is available for the NPS 4 through 12, V150, V300, and V200 flanged, raised-face body constructions. To retrofit the Cavitrol Hex to an existing valve assembly, special body machining is required. Two threaded holes must be added to the valve body outlet flange. Contact your [Emerson sales office](#) for retrofit information.

Note

The Cavitrol Hex anti-cavitation trim will add 0.5 inch to the face to face dimension of the valve. Refer to table 3 of this manual for information on required flange stud length.

Assembly

1. The Cavitrol Hex anti-cavitation trim (key 64) is to be installed last, after the Vee-Ball valve body assembly is complete. The recommended valve orientation for assembly is with the body outlet flange facing up.
2. Ensure the ball is in the open position.
3. Place the gasket (key 65) over the body outlet flange serrated surface as illustrated in figure 28.
4. Insert the Cavitrol Hex anti-cavitation trim into the valve, ensuring the holes in the body outlet flange align with the holes in the trim flange.
5. Install two fasteners (key 21) and adequately tighten to secure the trim to the valve assembly.

Actuator Mounting

Use the appropriate actuator instruction manual, this section of this manual, and figure 23 of this manual when mounting the actuator or changing actuator styles and positions.

1. To help ensure correct centering of the Vee-Ball (key 2) on the seal (key 11), be sure the ball is closed when mounting the actuator (for applications other than Spring Return Fail-Open).
2. Clean the valve shaft and actuator lever splines to be sure the actuator lever will slide on easily. Only drive the lever in if absolutely necessary.
3. Carefully wedge the ball solidly against the actuator-side bearing, using a screwdriver or similar tool inserted between the lower ear of the ball and the valve body. This will center the ball. See figure 6.
4. Keep the wedge in place while installing the lever, if necessary. Remove the wedge after you have clamped the actuator lever on the valve shaft and have connected the lever to the actuator piston rod or diaphragm rod.

Determining Mounting Position

The actuator can be either right or left-hand mounted, with the actuator on the right or left side when viewed from upstream (see figure 23).

The Series B Vee-Ball, NPS 4 through 12 with Rotary Attenuator, and the NPS 1 micro-notch Vee-Ball have one V-notch. For **right-hand mounting (standard)**, the ball will be in the top of the valve body when the valve is open and the shaft is horizontal. In this position the ball rotates CCW to Close. For **left-hand mounting (standard)**, the ball will be in the bottom of the valve body when the valve is open and the shaft is horizontal. In this position the ball rotates CCW to Close. An optional ball for **left-hand mounting**, which rotates into the top of the valve body when the shaft is horizontal, is also available. In this position the ball rotates CW to Close.

The NPS 1 through 2 has two notches, and can be rotated in either direction.

Determining Closed Position

1. The valve must be removed from the line to check the position of the ball.

⚠ WARNING

The Vee-Ball closes with a shearing, cutting motion. To avoid personal injury, keep hands, tools, and other objects away from the ball while stroking the valve.

2. Rotate the ball to the closed position.
3. Position the ball in the proper location

For Series B:

- When viewed from the valve body inlet, the ball is in the proper position when the flat spot on the top of the ball is exactly in the center of the seal package.

Make a copy of the centering template in figure 27 out of a suitable stiff material. Place the centering template in the opening at the seal (See figure 27). Find the center of the template and make sure the spot on the ball is centered directly below it.

For NPS 1, 1-1/2, and 2 valves: Follow one of the procedures below:

- When viewed from the valve body inlet, the ball is in the proper position when both V-notches of the ball are centered between the machined diameter of the ledge that supports the seal.
 - If the ball has a spot machined on the top, align that spot to the exact center of the seal cavity.
4. Adjust the actuator linkage as described in the appropriate actuator instruction manual until the ball is centered in the closed position. A line is stamped on the actuator end of the drive shaft (see figure 23) to indicate the ball position.

Use the appropriate actuator instruction manual and figure 23 of this manual when mounting the actuator or changing actuator styles and positions.

The Micro-Notch ball closed position is approximately 5 degrees closed from the first point of flow. This establishes the zero degree position for the ball.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

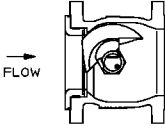
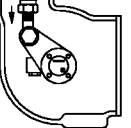
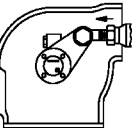
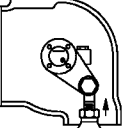
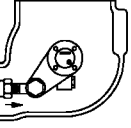
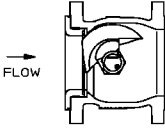
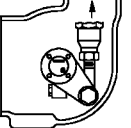
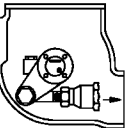
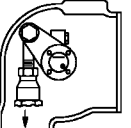
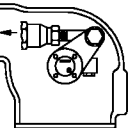
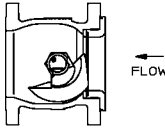
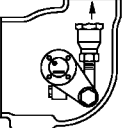
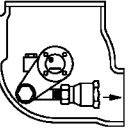
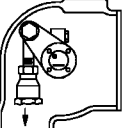
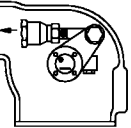
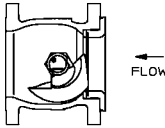
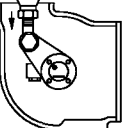
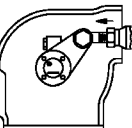
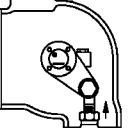
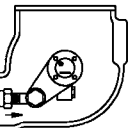
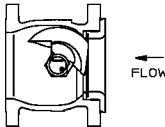
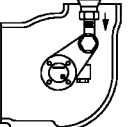
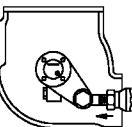
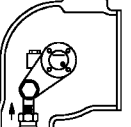
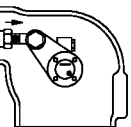
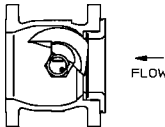
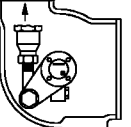
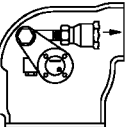
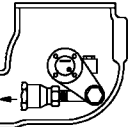
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Figure 23. Index Marks for Actuator Lever Orientation for NPS 1 through 12 Valves with or without Attenuation Devices

ACTUATOR		VALVE OPEN	ACTUATOR POSITION			
MOUNTING	STYLE		1	2	3	4
(STANDARD) RIGHT-HAND	STYLE A PUSH DOWN TO CLOSE					
	STYLE B PUSH DOWN TO OPEN					
(STANDARD) LEFT-HAND	STYLE C PUSH DOWN TO OPEN					
	STYLE D PUSH DOWN TO CLOSE					
(OPTIONAL) ⁽²⁾ LEFT-HAND	STYLE C PUSH DOWN TO CLOSE					
	STYLE D PUSH DOWN TO OPEN					
NOTE: 1. ARROW ON LEVER INDICATES DIRECTION OF ACTUATOR THRUST TO CLOSE VALVE. 2. THE OPTIONAL LEFT-HAND ORIENTATION IS NOT AVAILABLE FOR MICRO-NOTCH VEE-BALLS.						

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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

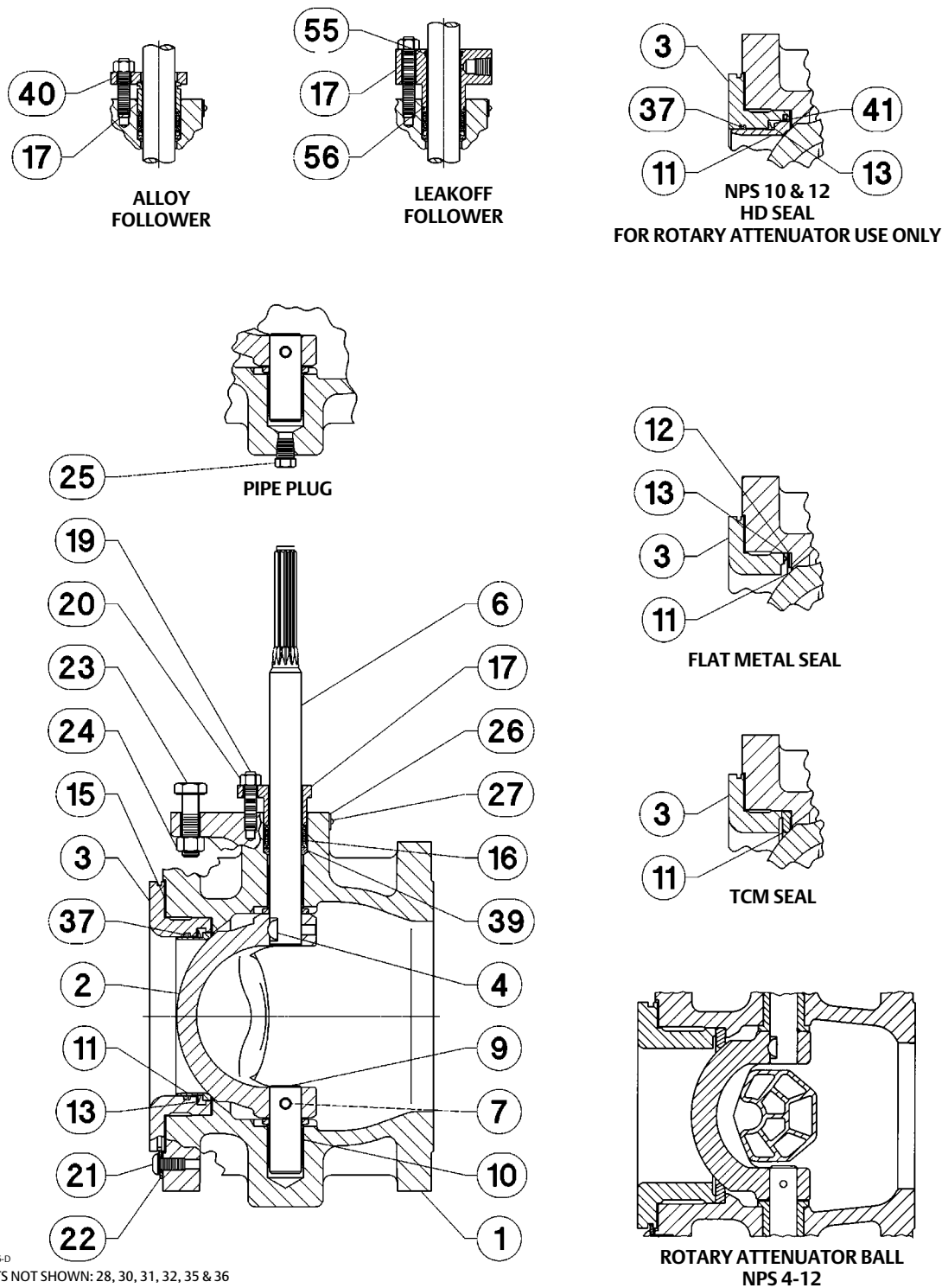
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Figure 24. Fisher V150 or V300 (NPS 3 - 12) or Flanged V200 (NPS 3 - 8) Valve Assembly
(Details are typical for V200 Flangeless valve body)



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Figure 25. Exploded View, Fisher V150 and V300 (NPS 3 - 12) and Flanged V200 (NPS 3-8) without Attenuation Device Assembly

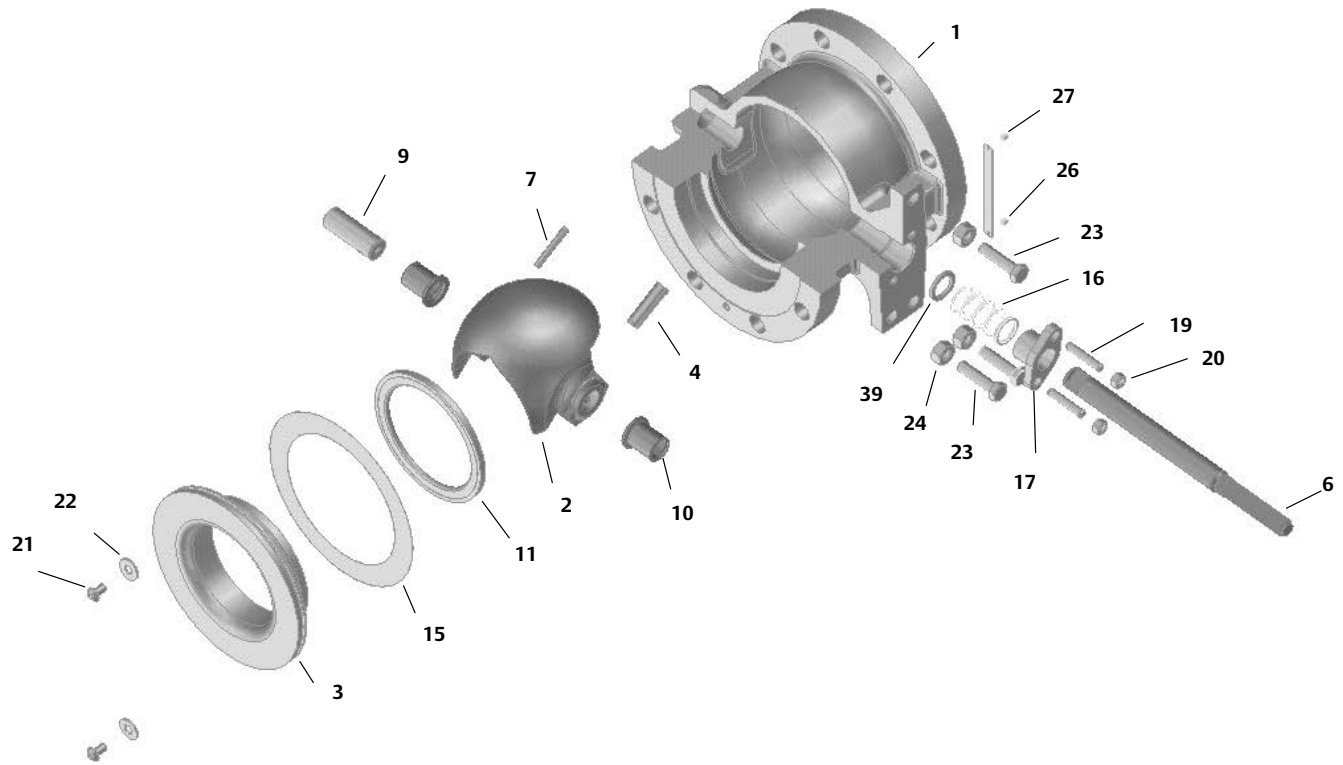
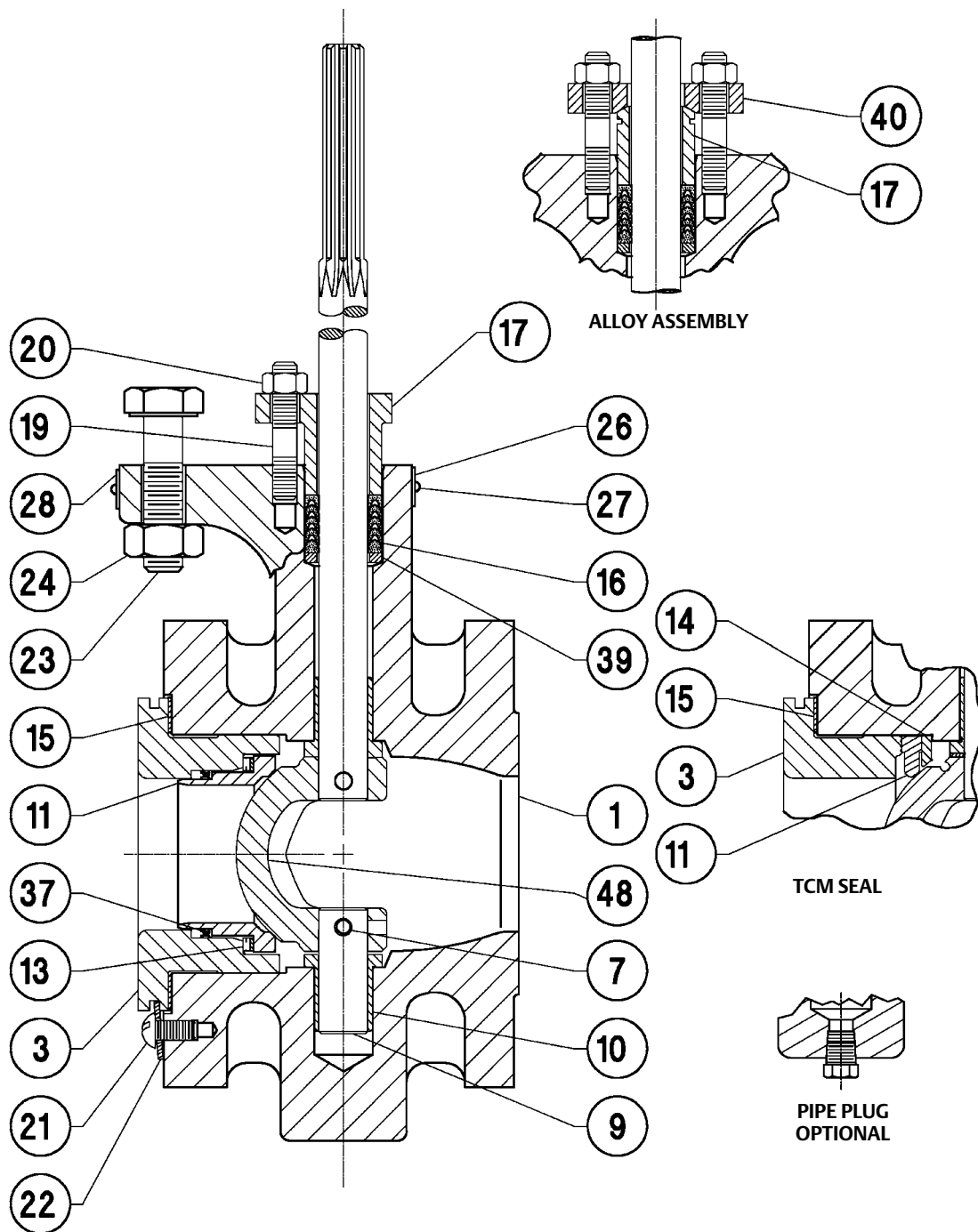


Figure 26. Fisher V150 or V300 (NPS 1, 1-1/2, and 2) and Flanged V200 (NPS 2) Valve Assembly
(Details are typical for Flangeless V200)



NOTE:
PARTS NOT SHOWN: 30, 31, 32, 33, 35 & 36
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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

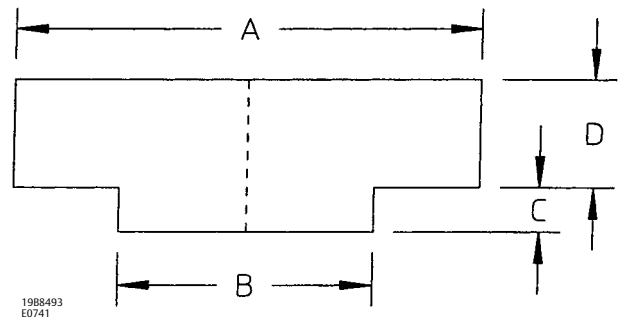
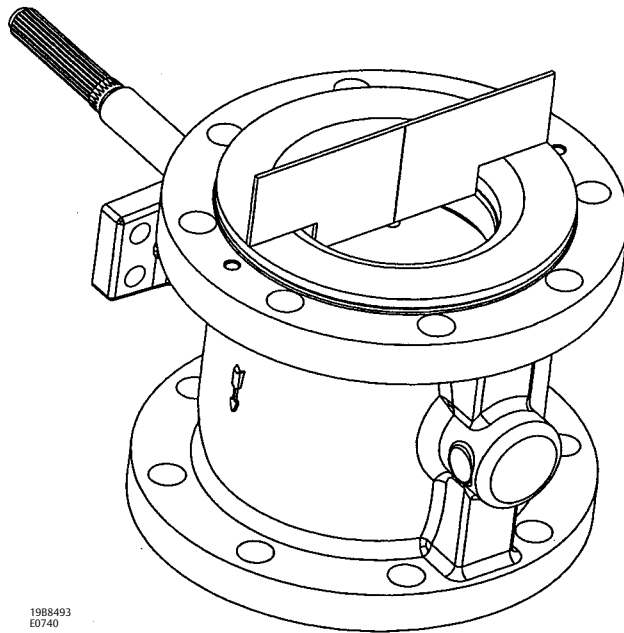
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Figure 27. Centering Template in Use and Template Dimensions



VALVE SIZE, DN	VALVE SIZE, NPS	A (FOR ASME VALVES)	A (FOR DIN VALVES)	B ⁽¹⁾	C ⁽¹⁾ (ANSI/ISA S75.08.02)	C (ASME B16.10 Short ⁽²⁾)	D ⁽¹⁾
mm							
25	1	63	68	19	35	61	25
40	1-1/2	82	88	28	34	85	25
50	2	102	102	38	31	85	25
80	3	127	138	63	24	62	38
100	4	157	157	82	36	71	44
150	6	216	212	117	21	59	51
200	8	270	268	139	12	61	57
250	10	324	320	203	2	35	60
300	12	381	378	254	2	20	63
Inches							
25	1	2.50	2.68	0.75	1.40	2.40	1.00
40	1-1/2	3.25	3.46	1.12	1.34	3.34	1.00
50	2	4.02	4.02	1.50	1.22	3.34	1.00
80	3	5.00	4.55	2.50	0.94	2.44	1.50
100	4	6.19	6.19	3.25	1.42	2.80	1.75
150	6	8.50	8.35	4.62	0.82	2.32	2.00
200	8	10.62	10.55	5.50	0.48	2.42	2.25
250	10	12.75	12.60	8.00	0.09	1.40	2.38
300	12	15.00	14.88	10.00	0.09	0.78	2.50
1. These dimensions are the same for ASME and DIN valves. 2. Note that ASME B16.10 Short dimensions are actually longer than ANSI/ISA S75.08.02 dimensions.							

Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your [Emerson sales office](#) regarding spare parts or technical information. When ordering replacement parts, also specify the key number, part name, and desired material using the parts list.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they will void your warranty, might adversely affect the performance of the valve, and could give rise to personal injury and property damage.

Note

For the NPS 2 V150 valve, this manual covers valves with serial numbers 12551183 and higher. Always reference the serial number of your valve when corresponding with your Emerson sales office.

Parts Kits

Retrofit Kits for ENVIRO-SEAL Packing

Retrofit kits include parts to convert existing V150, V200 and V300 valves with shallow (single packing depth) packing box to the ENVIRO-SEAL packing box construction. Retrofit kits include single PTFE packing. See following table.

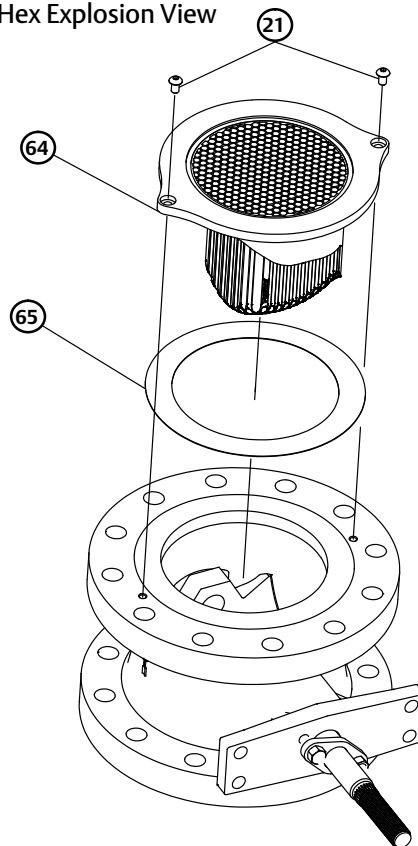
ENVIRO-SEAL Packing Retrofit Kits

SHAFT DIAMETER ⁽¹⁾		PART NUMBER	
mm	Inches	Single PTFE	Graphite
12.7	1/2	RRTYXRT0012	RRTYXRT0312
15.9	5/8	RRTYXRT0022	RRTYXRT0322
19.1	3/4	RRTYXRT0032	RRTYXRT0332
25.4	1	RRTYXRT0052	RRTYXRT0352
31.8	1-1/4	RRTYXRT0062	RRTYXRT0362
38.1	1-1/2	RRTYXRT0072	RRTYXRT0372
PARTS INCLUDED IN KIT		QUANTITY	
Key	Description		
100	Packing stud	2	2
101	Packing nut	2	2
102	Packing flange	1	1
103	Spring pack assembly	1	1
105	Packing set	1	1
106	Anti-extrusion washer	2	---
107	Packing box ring ⁽²⁾	1	1
---	Tag	1	1
---	Tie Cable	1	1

1. Diameter through the packing box.

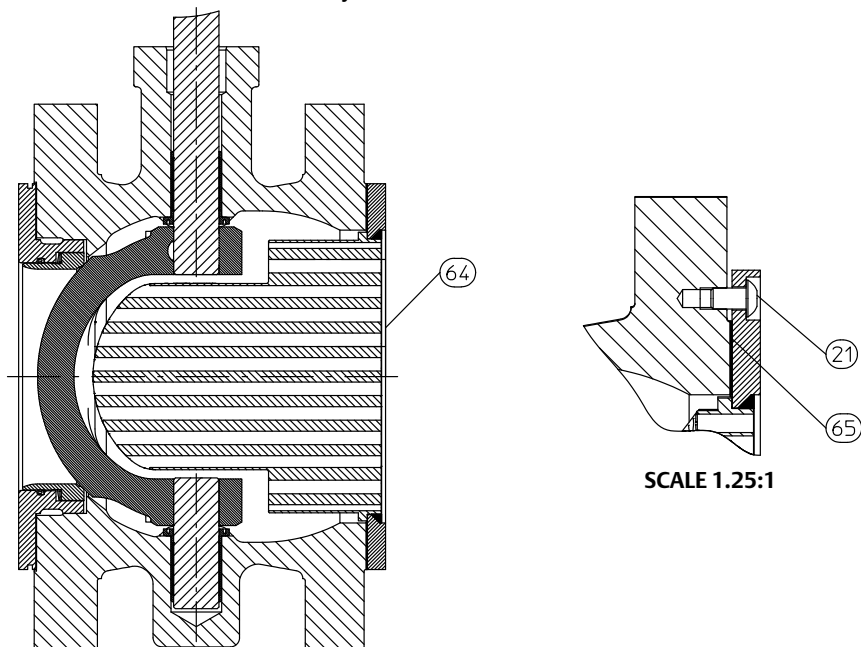
2. Not required for all sizes of V150 and V200 or for V300 with 1-1/4 or 1-1/2 inch diameter shafts.

Figure 28. Fisher V300 with Cavitrol Hex Explosion View



GE96725

Figure 29. Fisher V300 with Cavitrol Hex Assembly View



GE96724

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Repair Kits for ENVIRO-SEAL Packing

Repair kits include valves parts for shallow (single packing depth) for ENVIRO-SEAL packing box construction. Repair kits include single PTFE or graphite packing. See following table.

ENVIRO-SEAL Packing Repair Kits

SHAFT DIAMETER ⁽¹⁾		PART NUMBER	
mm	Inches	PTFE	Graphite
12.7	1/2	RRTYX000012	13B8816X012
15.9	5/8	RRTYX000022	13B8816X032
19.1	3/4	RRTYX000032	13B8816X052
25.4	1	RRTYX000052	13B8816X092
31.8	1-1/4	RRTYX000062	13B8816X112
38.1	1-1/2	RRTYX000072	13B8816X142
Parts Included in Kit			
Key	Description	Quantity	
105	Packing set	1	1
106	Anti-extrusion washer	2	--- ⁽²⁾
1. Diameter through the packing box. 2. Included in key 105.			

Repair Kits for Ball Seals

Seal repair kits include recommended spare parts for Fisher TCM Plus, S31600 stainless steel, CF10SMnN, or CD7MCuN ball seal constructions. The following table indicates the repair kit part number and the quantity of parts included in the kit.

Fisher V150, V200, and V300 Repair Kits

VALVE SIZE		KIT PART NUMBER			
		Ball Seal Material			
DN	NPS	TCM Plus	---	Alloy 6	CD7MCuN (Alloy 255 Duplex SST)
25	1	RV150X00CA2	---	RV150XHDAA2	RV150XHDCA2
40	1-1/2	RV150X00CB2	---	RV150XHDA2	RV150XHDCB2
VALVE SIZE		Ball Seal Material			
DN	NPS	TCM Plus	S31600 (316 SST)	CF10SMnN	CD7MCuN (Alloy 255 Duplex SST)
50	2 ⁽¹⁾	RV150X00C12	RV150X00M12	RV150X0HD12	RV150XHDC12
50	2 ⁽²⁾	RV150X00C82	---	RV150X0HD82	RV150XHDC82
80	3	RV150X00C22	RV150X00M22	RV150X0HD22	RV150XHDC22
100	4	RV150X00C32	RV150X00M32	RV150X0HD32	RV150XHDC32
150	6	RV150X00C42	RV150X00M42	RV150X0HD42	RV150XHDC42
200	8	RV150X00C52	RV150X00M52	RV150X0HD52	RV150XHDC52
250	10	RV150X00C62	RV150X00M62	RV150X0HD62	RV150XHDC62
300	12	RV150X00C72	RV150X00M72	RV150X0HD72	RV150XHDC72
Parts Included in Kit		Quantity in Kit			
Key No.	Description				
11	Ball seal	1	1	1	1
12	Shim seal ⁽³⁾	---	4	---	---
13	Spring seal	---	1	---	---
13	Wave spring	---	---	1	1
15	Gasket	1	1	1	1
37	Radial seal	---	---	1	1
21	Retainer screw	2 or 4 ⁽⁴⁾	2 or 4 ⁽⁴⁾	2 or 4 ⁽⁴⁾	2 or 4 ⁽⁴⁾
22	Retainer washer	2 or 4 ⁽⁴⁾	2 or 4 ⁽⁴⁾	2 or 4 ⁽⁴⁾	2 or 4 ⁽⁴⁾
1. V150's only for serial numbers below 12551183. 2. V150's for serial numbers 12551183 and above. All V200's and V300's. 3. Fewer shim seals are furnished in the parts kits than are used in the original construction of the valve. Most original shim seals can be reused. 4. A quantity of 2 is supplied for NPS 2 through 8 valves, and a quantity of 4 is supplied for NPS 10 and 12 valves.					

Cavitrol Hex Retrofit Kit

Kit includes the Cavitrol Hex (key 64), gasket (key 65), and fasteners (key 21). Kits are available for the NPS 4 through 12 V150, V300, and V200 flanged, raised-face body constructions. To retrofit the Cavitrol Hex anti-cavitation trim to an existing valve assembly, special body machining is required. Two threaded holes must be added to the valve body outlet flange. Contact your [Emerson sales office](#) for retrofit information.

Fisher V150, V200⁽¹⁾, and V300 Cavitrol Hex Kits

VALVE SIZE, NPS	KIT PART NUMBER	
	Material	
	S31603 (316L)	R31233 (Ultimet)
4	RCAVHEX0002	RCAVHEX0012
6	RCAVHEX0022	RCAVHEX0032
8	RCAVHEX0042	RCAVHEX0052
10	RCAVHEX0062	RCAVHEX0072
12	RCAVHEX0082	RCAVHEX0092
1. V200 raised face flanged body.		

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Common Parts (figures 24, 25 & 26)

Key	Description
1	If you need a valve body as a replacement part, order by valve size, serial number, and desired valve body material. Contact your Emerson sales office for assistance.
2*	Ball
2*	Ball w/ Rotary Attenuator
3	Seal Protector Ring
4*	Taper Key
6*	Drive Shaft
6*	Drive Shaft w/ Rotary Attenuator
7*	Groove Pin
9*	Follower Shaft
9*	Follower Shaft w/ Rotary Attenuator
10*	Bearing (2 req'd)
11*	Ball Seal
12*	Shim Seal (12 req'd) Use w/flat metal seal only
13*	Spring Seal Use w/ flat metal seal only
13*	Wave Spring use w/ HD Metal Seal only
14	Backup Ring (Composition seal only)
15*	Gasket
16*	Packing Set
17	Packing Follower w/integral flange
17	Packing Follower w/o integral flange
19	Packing Follower Stud
20	Packing Follower Nut
21	Seal Protector Screw
22	Seal Protector Clip
23	Actuator Mounting Screw
24	Actuator Mounting Nut
25	Pipe Plug (Optional) (not shown)

Key	Description
26	Identification Nameplate
27	Drive Screw
28	Flow Arrow
30	Nameplate
31	Nameplate Wire (not shown)
32	Line Flange Stud
33	Line Flange Stud
34	Spacer
35*	Packing Ring (4 req'd)
36*	Packing Washer
37*	Radial Seal Use w/HD Metal Seal
39*	Packing Box Ring
40	Packing Flange
41	Retaining Ring
48*	Ball-Shaft Assembly
64	Cavitrol Hex
65	Gasket
130	Clamp
131	Bonding Strap Assembly

ENVIRO-SEAL Packing System (Parts in all Type Vee-Ball Valves) (figure 5)

Key	Description
100	Packing Flange Stud
101	Packing Flange Nut
102	Packing Flange
103	Spring Pack Assembly
105*	Packing Set
106*	Anti-Extrusion Ring (2 req'd)
107*	Packing Box Ring
108*	Packing Ring (2 req'd)
109*	Anti-Extrusion Ring (2 req'd)
110	Lantern Ring
111	Tag
112	Tie Cable
113	Lubricant, anti-seize (not furnished with packing system)

Appendix A Instructions for Non-Series B

The Series B changes affected only the NPS 3 through 12 valves without attenuators. To determine if a Vee-Ball valve is Series B, you will need to examine several of the internal parts. Compare the distinctive skirted V-notch outline of the forward side and the circular edge on the reverse side of the Series B design ball to the V-notch on both sides of the non-series B design ball. Then look for bushings. The lack of bushings indicates the valve body is Series B.

All Vee-Ball valves NPS 3 through 12 produced before the Series B design changes use the Specifications table, the Installation, Maintenance, Packing Maintenance, Replacing Packing, and Replacing the Ball Seal instructions found elsewhere in this manual. Bearing and Vee-Ball Maintenance and Actuator Mounting instructions for these valves may be found below.

Maintenance

WARNING

The Vee-ball closes with a shearing, cutting motion, which could result in personal injury. To avoid injury, keep hands, tools, and other objects away from the Vee-ball while stroking the valve.

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- The valve packing area may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Procedures for disassembly and assembly of the bearings and ball cannot be accomplished until the ball seal and valve packing are removed from the valve.

1. Refer to the Replacing Packing procedures to remove the actuator, and to remove the packing flange and packing follower from the valve. When the packing disassembly steps are complete, return to this section.
2. Refer to the Replacing the Ball Seal procedures to remove the ball seal from the valve.

Disassembly

WARNING

When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, with a shearing, cutting motion, which could result in personal injury. To avoid injury, carefully rotate the ball to a stable position. Make sure the ball will not rotate.

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Key numbers in this procedure are shown in figures 24, 26, and 32, unless otherwise indicated. A taper key (key 4, figure 14) is used in NPS 3 through 12 Non-Series B valves.

3. Carefully rotate the ball to the open position after the actuator is disconnected. Make sure the ball will not rotate (see warning above). Provide support for the ball during the following disassembly.
4. Unscrew the pipe plug (key 25). (With newer valve constructions, the pipe plug is optional and may not be available.)
5. Working from the small end of the groove pin (key 7), use a pin punch to drive the groove pin out of the ball ear and follower shaft.

For tack welded taper keys, driving the taper key out of the ball ear will shear the tack welding.

6. Locate the small end of the taper key (key 4, see figure 14). Using a pin punch on the smaller end of the taper key, drive it out of the ball (key 2) and drive shaft (key 6). Note: driving the taper key in the wrong direction will tighten it.
7. Pull the drive shaft (key 6) out of the actuator side of the valve body.
8. Make sure the sealing surface of the ball is not damaged while removing the follower shaft.
 - a. If a pipe plug (key 25) is installed, use a punch to drive the follower shaft (key 9) into the center of the ball.
 - b. If a pipe plug is not installed, use a piece of continuous threaded rod as a removal rod when moving the follower shaft (key 9) into the center of the V-notch ball. Refer to the table 8 for a description of the size threaded rod needed. The length of the rod should allow easy working room from the valve body.
9. Remove the ball (key 2) by carefully removing the follower shaft and ball from the valve body.
10. Remove the packing box spacer (key 34) for NPS 8, 10, and 12 valves.
11. Removing the bearings (key 10):
 - a. For **composition bearings**, remove the bearings by hand. If the bearings are tight in the valve body, then pull or drive them out with a slight pressure. Allow the bushings (key 5 or 8) to remain in the valve body.

Table 8. Continuous Threaded Rod

Valve Size, NPS	Threaded Rod Thread Size	Thread Depth in Follower Shaft
3	1/4-20	0.5
4	1/4-20	0.5
6	1/4-20	0.5
8	5/16-18	0.62
10	5/16-18	0.62
12	5/16-18	0.94

- b. For **metal bearings**, use a press and ram to remove the drive shaft bearings out of the valve body. Refer to figures 30 and 31 ram dimensions. The bushings (key 5 or 8) will normally remain in the valve body.

To remove the follower shaft bearings, use a blind-hole bearing puller. If you do not have such a tool, you can machine the bearing out.

Note

For proper shutoff performance, the ball and seal require the bearing (key 10) to be positioned correctly. If you removed the bearings (key 10), be sure to locate the new bearings as shown in figures 30 and 31.

12. Thoroughly clean surfaces of all parts that are to be re-used or obtain replacement parts.

Assembly

1. Inspect all sealing surfaces to ensure they are in good condition and without scratches or wear.
2. Installing bearings (key 10):
 - a. For composition bearings, install the bearings by hand. The bearing flanged end should touch the bushing (key 5 or 8).
 - b. For metal bearings:
 - Use a press and ram to install the bearings (key 10). Refer to figures 30 and 31.
 - Press the bearings in until each bearing is flush with the bushing (key 5 or 8). The acceptable tolerance for bearing location is: flush with the bushing to 1.52 mm (0.060 inches) inside the bushing. That is, the bearings should not protrude into the flow cavity of the valve, and they should not be more than 1.52 mm (0.060 inches) inside the bushing.
 - Take care not to change the position of the bushings (key 5 or 8) when pressing in new bearings (key 10), otherwise the ball will not center in the valve body and seal.
3. Installing the Vee-Ball (key 2):

WARNING

The Vee-Ball might be damaged if it is allowed to fall into the valve body. To avoid personal injury or damage to the sealing surfaces, support the ball to prevent it from falling into or out of the valve body cavity.

Note

For ease of assembly, the follower shaft (key 9) should be inserted into the ball before installing the ball in an NPS 3 valve without ball/Rotary Attenuator.

Carefully install the ball into the valve body cavity.

After you have installed the ball (key 2) into the valve body assembly, firmly support the ball while installing the shafts.

4. Installing the follower shaft (key 9):

- For NPS 3 valves: The follower shaft (key 9) should already have been inserted into the ball before the ball was put into the valve body. Insert the follower shaft (key 9) into the valve body bearing (key 10).
- For NPS 4 and larger valves without Rotary Attenuator: Insert the follower shaft (key 9) through the ball, and into the valve body bearing (key 10).

Then for all sizes, align the hole in the follower shaft with the holes in the ball. Insert the small end of the groove pin (key 7) into the hole in the ball and into the follower shaft. The pin will hold the parts in place while the drive shaft (key 6) is being installed.

5. Insert the drive shaft (key 6) into the valve body bearing (key 10), and into the ball ear. Align the hole in the drive shaft with the holes in the ball.

NOTICE

The drive shaft must be used with the correct Vee-Ball. Refer to the tag (see figure 13) attached to the Vee-Ball and to the drive shaft.

Failure to use the correct Vee-Ball/ shaft combination may result in the ball not being in the position indicated by the slash mark on the end of the shaft. If the ball is not properly aligned with the slash mark, the valve will not function correctly and seal damage may result.

6. Installing the Taper Key (key 4):

Current standard construction materials for all NPS 3 through 12 valves require the taper key (key 4, figure 14) to be tack welded in place using the following procedure. Use standard welding preparations when preparing parts for reassembly.

NOTICE

Make sure the drive shaft (key 6) is free of oil or grease, otherwise the taper key will not seat properly. Failure to properly set the taper pin or taper key could result in it coming loose while in service. Loosening of the taper key in service could result in improper valve function and equipment damage.

1. Install the drive shaft (key 6) into the valve body through the ball and into the lower bearing.
2. Insert the taper key (key 4) into ball and drive shaft (keys 2 and 6) as shown in figure 14. The taper key inserts, with the flat side of the key, facing the drive shaft (key 6).
3. Using a flat end punch, drive the groove pin (key 7) into the ball ear and follower shaft until it is flat with the ball ear surface.
4. Using a flat end punch, drive the taper key (key 4) into the ball ear and drive shaft (key 6) until solid, heavy contact is obtained between the key and shaft.
5. Measure the position of the taper key head.
6. Drive the taper key in further using the minimum distance shown in table 8.

Table 9. Taper Key Minimum Depth

VALVE SIZE, NPS	MINIMUM DEPTH TO DRIVE TAPER KEY AFTER INITIAL SOLID CONTACT, mm (INCHES)
3, 4, 6	4.8 (0.188)
8, 10, 12	5.6 (0.219)

Table 10. Taper Key Maximum Depth

VALVE SIZE, NPS	MAXIMUM DEPTH TO DRIVE TAPER KEY AFTER INITIAL SOLID CONTACT, mm (INCHES)
3, 4	7.1 (0.281)
6	7.9 (0.312)
8, 10	9.5 (0.375)
12	10.3 (0.406)

7. Inspect the ball/shaft taper key connection to verify that the taper key spans the entire shaft flat width. If not, the taper key must be driven in further until this condition is satisfied. However, do not exceed the maximum depths shown in table 9.

Note

When welding standard valves that have a CG8M (317 SST) or CF3M (316L SST) ball, use 309 or 309L filler rod material.

Alloy valve taper keys are normally not welded.

8. When the above conditions are met, tack weld the taper key (key 4) to the ball ear on the head end of the key (see figure 26). Use a:

- 1/8 inch diameter weld on NPS 3 through 6 valves,
- 3/16 inch diameter weld on NPS 8 through 10 valves, and
- 1/4 inch diameter weld on NPS 12 valves.

For all constructions: Refer to Replacing the Ball Seal, Packing Maintenance, and other procedures as necessary to complete the assembly of the valve.

Actuator Mounting

Use the appropriate actuator instruction manual and figure 23 of this manual when mounting the actuator or changing actuator styles and positions.

To help ensure correct centering of the ball (key 2) on the seal (key 11), be sure the ball is closed when mounting the actuator. Do not use a hammer or other tool to drive the actuator lever onto the valve shaft.

Clean the valve shaft and actuator lever splines to be sure the actuator lever will slide on easily. If the lever does not slide on easily, carefully wedge the ball solidly against the actuator-side bearing using a screwdriver or similar tool inserted between the lower ear of the ball and the valve body.

Keep the wedge in place while installing the lever, but again, do not drive on the lever. Remove the wedge after you have clamped the actuator lever on the valve shaft and connected the lever to the actuator piston rod or diaphragm rod.

Determining Mounting Position

The actuator can be either right or left-hand mounted.

Note

Right-hand mounting—Actuator is on the right side of the valve when viewed from valve inlet.

Left-hand mounting—Actuator is on the left side of the valve when viewed from valve inlet.

The preferred location of the ball is in the top of the valve body when the valve is open. To convert from right to left hand-mounting, turn the valve to position the actuator mounting pad on the left and rotate the ball to the top of the valve.

The number one V-notch controls flow on right-hand mounting. Turn the valve 180 degrees, and rotate the ball to the top of the valve to obtain left-hand mounting. The number two V-notch controls flow for this construction. See figure 33.

Determining Closed Position

1. The valve must be removed from the line to check the position of the ball.

WARNING

The ball closes with a shearing, cutting motion. To avoid personal injury, keep hands, tools, and other objects away from the ball while stroking the valve.

2. Rotate the ball to the closed position.
3. Follow one of the procedures below:
 - When viewed from the valve body inlet, the ball is in the proper position when both V-notches of the ball are centered between the machined diameter of the ledge that supports the seal.
 - If the ball has a spot machined on the top, align that spot to the exact center of the seal cavity.
4. Adjust the actuator linkage as described in the appropriate actuator instruction manual until the condition described in step 3 exists. A line is stamped on the actuator end of the drive shaft (see figure 23) to indicate the ball position.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they will void your warranty, might adversely affect the performance of the valve, and could give rise to personal injury and property damage.

Non-Series B Design Parts (figure 32)

Note

Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description
2	Ball
2	Ball with Rotary Attenuator (RH mtg in Common parts section)
6	Drive Shaft
9	Follower Shaft
10*	Bearing (2 req'd)

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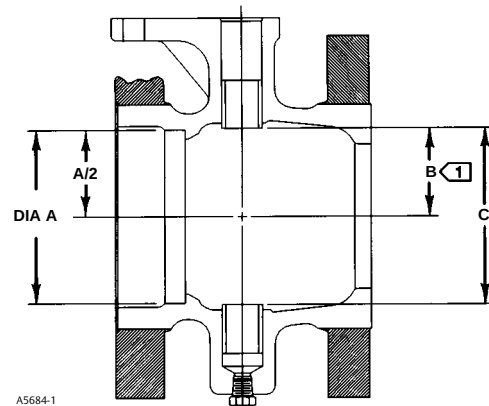
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VALVE SIZE, NPS	BEARING RAM DIMENSIONS								BUSHING RAM DIMENSIONS					
	Ram Lengths				Ram Diameters				Ram Diameters					
	L		M		D		d		D		Long Ram d		Short Ram d	
	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches
3 & 4	201.42 MIN	7.930 MIN ⁽¹⁾	95.25 MIN	3.750 MIN	22.86 22.61	0.900 0.890	19.05 18.80	0.750 0.740	28.19 27.94	1.110 1.100	19.05 18.80	0.750 0.740	22.86 22.61	0.900 0.890
6	247.65 MIN	9.750 MIN	95.25 MIN	3.750 MIN	29.21 28.96	1.150 1.140	25.40 25.15	1.000 0.990	34.54 34.29	1.360 1.350	25.40 25.15	1.000 0.990	29.21 28.96	1.150 1.140
8	338.75 MIN	13.310 MIN	139.70 MIN	5.500 MIN	35.56 35.31	1.400 1.390	31.75 31.50	1.250 1.240	40.89 40.64	1.610 1.600	31.75 31.50	1.250 1.240	35.56 35.31	1.400 1.390
10	396.75 MIN	15.620 MIN	139.70 MIN	5.500 MIN	35.56 35.31	1.400 1.390	31.75 31.50	1.250 1.240	40.89 40.64	1.610 1.600	31.75 31.50	1.250 1.240	35.56 35.31	1.400 1.390
12	476.25 MIN	18.750 MIN	152.40 MIN	6.000 MIN	41.91 41.66	1.650 1.640	38.10 37.85	1.500 1.490	50.42 50.17	1.985 1.975	38.10 37.85	1.500 1.490	41.91 41.66	1.650 1.640

1. MIN = Minimum.

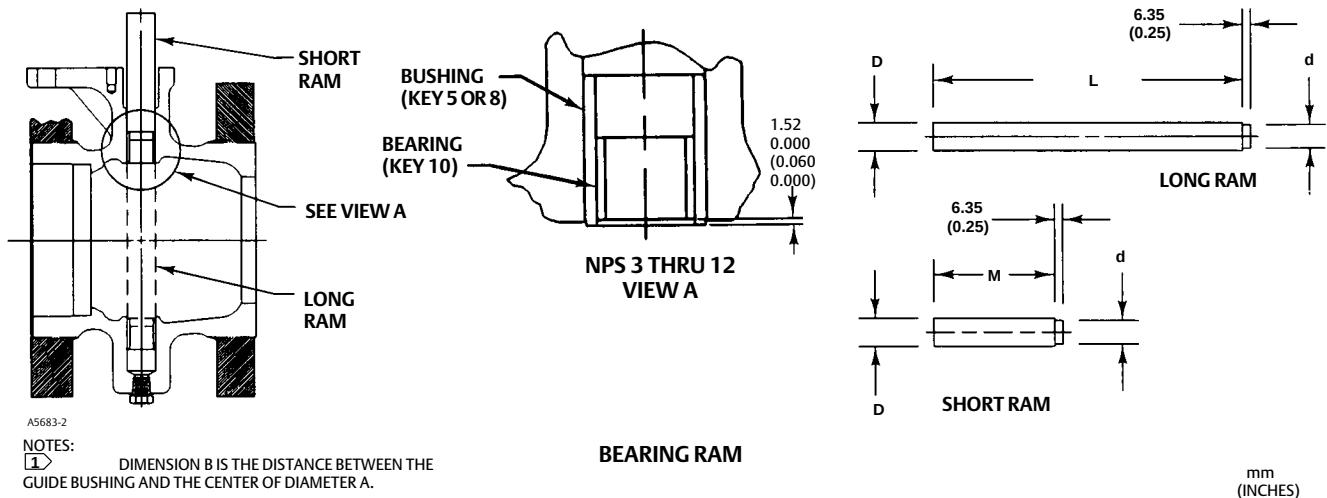
VALVE SIZE, NPS	DIMENSION			
	B	C	B	C
	Millimeters		Inches	
3	48.26 50.04	100.38 100.63	1.960 1.970	3.952 3.962
4	60.10 60.35	121.01 121.26	2.366 2.376	4.764 4.774
6	83.59 83.85	168.00 168.25	3.291 3.301	6.614 6.624
8	106.20 106.45	213.21 213.46	4.181 4.191	8.394 8.404
10	135.33 135.59	271.48 271.73	5.328 5.338	10.688 10.698
12	169.67 169.93	340.16 340.41	6.680 6.690	13.392 13.402

Figure 30. Bushing Location



BUSHING (KEY 5) LOCATION

Figure 31. Metal Bearing Ram Location



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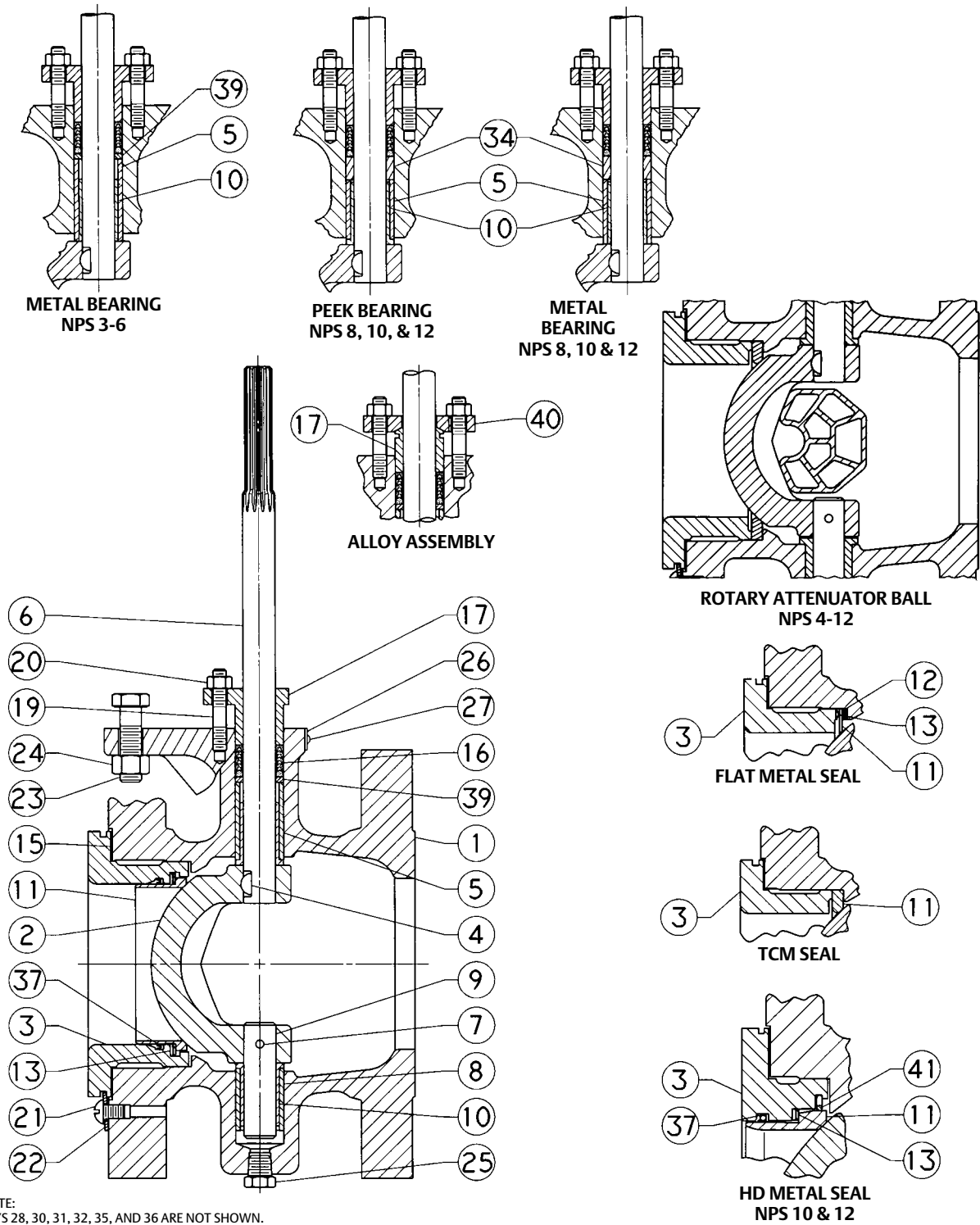
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Figure 32. Fisher V150 and V300 Non-Series B Valve Assembly (NPS 3- 12)
(Details are typical for V200 Valves except V200 does not have flanges)



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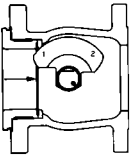
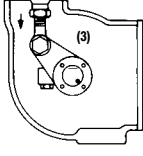
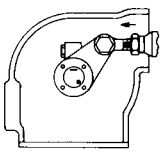
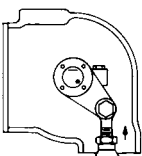
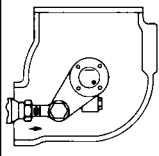
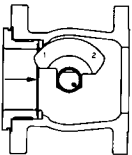
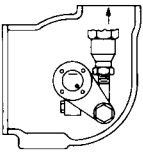
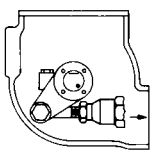
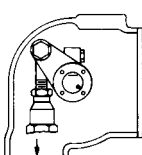
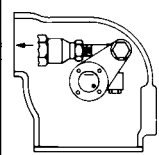
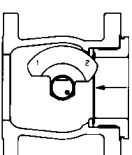
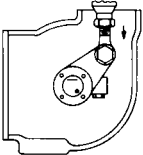
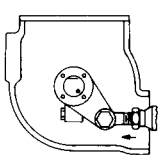
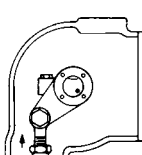
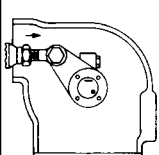
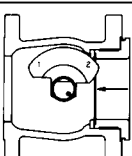
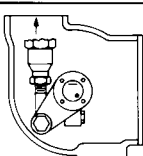
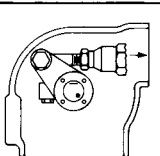
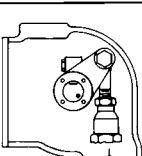
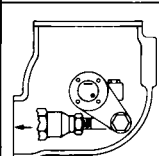
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Figure 33. Index Marks for Actuator Lever Orientation for Non-Series B Valves

ACTUATOR		VALVE OPEN	ACTUATOR POSITION			
MOUNTING	STYLE		1	2	3	4
RIGHT-HAND ⁽¹⁾	STYLE A (PDTC) ⁽²⁾	FLOW 				
	STYLE B (PDTO) ⁽²⁾	FLOW 				
LEFT-HAND ⁽¹⁾	STYLE C (PDTC) ⁽²⁾	 FLOW				
	STYLE D (PDTO) ⁽²⁾	 FLOW				
1. Right-hand mounting controls with v notch no. 1; Left-hand mounting controls with v notch no. 2 2. PDTC-push down to close; PDTO-push down to open 3. Arrow on lever indicates direction of actuator thrust to close valve						

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Fisher™ Vee-Ball™ V200U Rotary Control Valve DN 25 through 250 (NPS 1 through 10)

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Figure 1. Fisher V200U Flangeless Vee-Ball with Bettis™ RPE Actuator and FIELDVUE™ DVC2000 Digital Valve Controller



Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for the Fisher Vee-Ball Flangeless V200U rotary control valve sizes DN 25 through DN 250 (NPS 1 through NPS 10) (see figure 1).

For information on ENVIRO-SEAL™ packing, see the ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)). Refer to separate manuals for information concerning the actuator, positioner and accessories.



Do not install, operate, or maintain Vee-Ball valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

Valve Sizes See table 2 Valve End Connection Styles Flangeless (all sizes) ■ mates EN1092-1 PN10-40 Type B raised-face flanges (see table 2) ■ mates with ASME B16.5 CL150/CL300 raised-face flanges (see table 2) Maximum Inlet Pressure⁽¹⁾ Consistent with applicable EN 12516-1 or ASME B16.34 ratings Standard Flow Direction Forward (into the convex face of the Vee-Ball) Dimensions See table 4 Actuator Mounting ■ Right-hand, standard or ■ left-hand, optional, as viewed from the valve inlet (see figure 10 and the Actuator Mounting section)	Standard: Ball rotates counterclockwise to close when viewed from actuator side of valve Optional: Ball rotates clockwise to close Ball rotation is 90 degrees Valve/Actuator Action For right-hand mount actuator, the standard ball design and actuator action is counter-clockwise to close (CCW). The ball will rotate to the top of the valve body when open for a horizontal pipe run with the valve shaft positioned horizontal. ■ Left-hand actuator mounting with CCW action is an option. Left-hand actuator mounting with a special clockwise to close (CW) ball design and actuator action is also available to allow the ball to rotate to the top of the valve body for a horizontal pipe run with the valve shaft positioned horizontal. With diaphragm or piston rotary actuator, field-reversible between: ■ push-down-to-close (PDTC) (extending actuator rod closes valve) and ■ push-down-to-open (PDTO) (extending actuator rod opens valve.) Approximate Weight See table 3
--	--

1. The pressure/temperature limits in this manual, and any applicable code or standard limitation, should not be exceeded.

Description

The V200U Vee-Ball valves (figure 1) with a V-notch ball are used in throttling or on-off service. The V200U is a flangeless construction capable of interfacing with EN 1092-1 Type B or ASME B16.5 raised face flanges. The splined or square drive shaft connects to a variety of rotary-shaft actuator options.

Specifications

Specifications for these valves are shown in table 1 and in the Fisher V200U Vee-Ball Rotary Control Valves Bulletin 51.3:V200U (D104550X012).

Educational Services

For information on available courses for Fisher Vee-Ball valves, as well as a variety of other products, contact:

Emerson Automation Solutions
 Educational Services - Registration
 Phone: 1-641-754-3771 or 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/fishervalvetraining

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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D104548X012

V200U Valve

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Table 2. Valve Body Materials, End Connections, and Ratings

VALVE BODY MATERIAL	VALVE SIZE, DN	VALVE SIZE, NPS	FLANGELESS VALVE END CONNECTION COMPATIBILITY					
			ASME B16.5		EN1092-1			
			Raised Face Flange		Type B Raised Face Flange			
			CL150	CL300	PN10	PN16	PN25	PN40
EN 1.4408/CF8M	25	1	X	X	X	X	X	X
	40	1-1/2	X	X	X	X	X	X
	50	2	X	X	X	X	X	X
	80	3	X	X	X	X	X	X
	100	4	X	X	X	X	X	X
	150	6	X	X	X	X	X	X
	200	8	X	X	X	X	X	X
	250	10	X	X	X	X	X	X

Table 3. V200U Approximate Weights

VALVE SIZE		RATING	WEIGHT	
DN	NPS		kg	lbs
25	1	CL150 and 300	3	7
		PN10-40		
40	1-1/2	CL150 and 300	5	10
		PN10-40		
50	2	CL150 and 300	6	13
		PN10-40		
80	3	CL150	8	18
		CL300	10	22
		PN10-40	9	19
100	4	CL150 and 300	13	28
		PN10/16	12	26
		PN25/40	13	28
150	6	CL150 and 300	27	58
		PN10-40		
200	8	CL150 and 300	49	109
		PN10/16		
		PN25/40		
250	10	CL150	64	140
		CL300	102	225
		PN10/16	64	140
		PN25/40	71	156

Installation

Installation steps are provided in this section for V200U valves. Key numbers in installation procedures are shown in figure 16, 17, and 18 unless otherwise indicated.

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed either the valve body rating or the mating pipe flange joint rating. To avoid such injury or damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. To avoid possible personal injury and because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

⚠ WARNING

The valve drive shaft is not necessarily grounded to the pipeline when installed. Personal injury or property damage could result from an explosion caused by a discharge of static electricity from valve components if the process fluid or the atmosphere around the valve is flammable. If the atmosphere around the valve or the process fluid is flammable, electrically bond the drive shaft to the valve.

Note

Standard PTFE packing is composed of a partially conductive carbon-filled PTFE female adaptor with PTFE V-ring packing. Standard graphite packing is composed of all conductive graphite ribbon packing. Alternate shaft-to-valve body bonding is available for hazardous service areas where the standard packing is not sufficient to bond the shaft to the valve (see the following step).

Attach the optional bonding strap assembly (key 131, figure 2) to the valve drive shaft (key 6) with the clamp (key 130, figure 2) and connect the other end of the bonding strap assembly to the valve body with the cap screw (key 23).

1. If the valve is to be stored before installation, protect the flange mating surfaces and keep the valve body cavity dry and free of foreign material.
2. Install a three-valve bypass around the control valve assembly if continuous operation will be necessary during inspection and maintenance of the valve.
3. The valve is normally shipped as part of a control valve assembly, with an actuator mounted on the valve. If the valve and actuator have been purchased separately or if the actuator has been removed, mount the actuator according to the Actuator Mounting section and the appropriate actuator instruction manual.

4. Standard flow direction is forward (fluid flows into the convex face of the V-notch ball).
5. Install the valve in a horizontal or vertical pipeline with the drive shaft in a horizontal position.

CAUTION

Do not allow the valve to be installed in the pipeline with the drive shaft in the vertical position because of excessive wear to valve component parts.

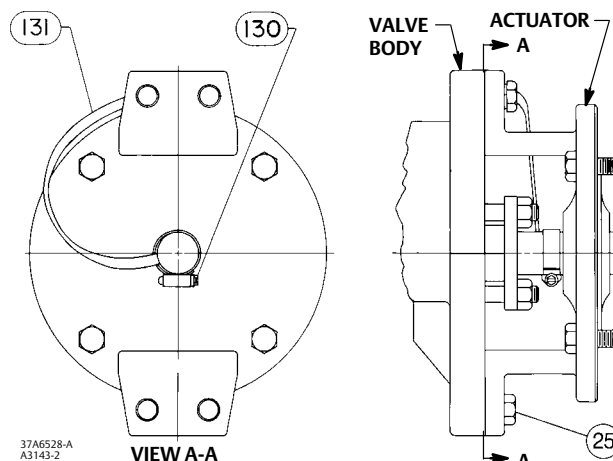
6. The actuator can be right- or left-hand mounted with the shaft in a horizontal orientation as shown in figure 1. If necessary, refer to the appropriate actuator instruction manual for actuator installation and adjustment procedures.

CAUTION

Ensure the valve and adjacent pipelines are free of foreign material that could damage the valve seating surfaces.

7. Be certain the valve and adjacent pipelines are free of any foreign material that could damage the valve sealing surfaces.
8. Be sure the pipeline flanges are in line with each other.

Figure 2. Optional Shaft-to-Body Bonding Strap Assembly



Installing V200U Valves

1. To avoid potential interference with the valve outlet end pipe flange, the V200U ball should be in the closed position prior to installation. Install the V200U valve using long studs to connect the two pipeline flanges. Refer to figure 3 for the length of studs required based on the mating pipeline flange pressure class. Lubricate the studs with anti-seize lubricant.

CAUTION

For DN 100, 200, and 250 (NPS 4, 8, and 10), damage to the ball (key 2) could occur if the downstream piping interferes with the ball rotation. Prior to installing the valve body between adjacent flanges, reference dimension P in table 4 and measure carefully to ensure the ball will rotate without interference.

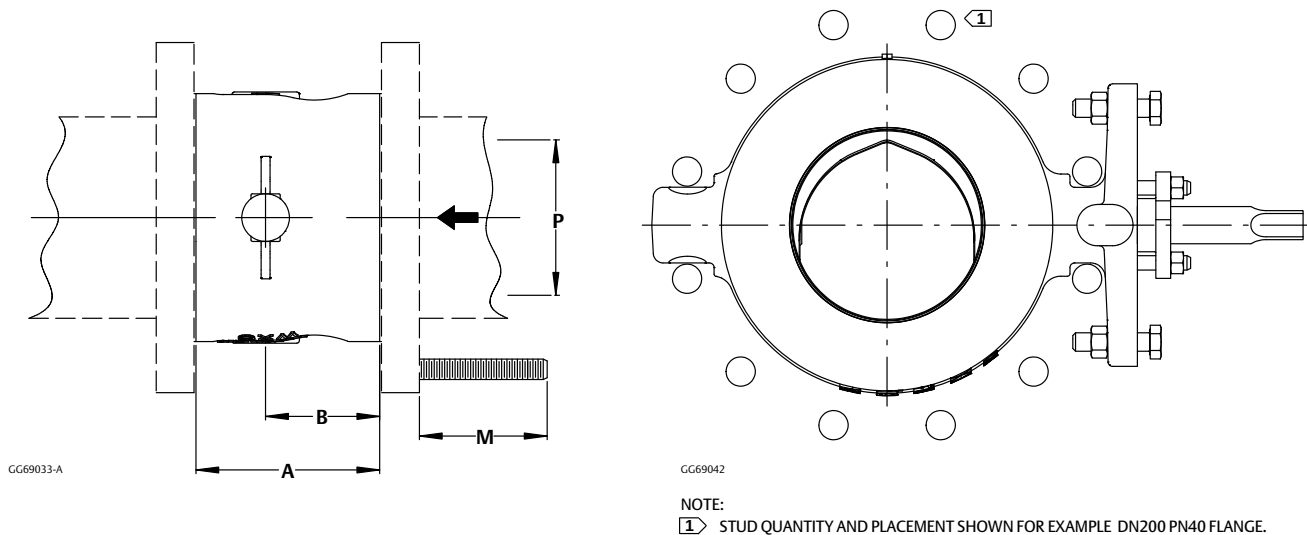
2. Install two studs in the flanges before you place the valve in the line. Place the two studs so they will contact the line-centering features at the bottom of the valve body.
3. Insert appropriate flange gaskets that are compatible with the process fluid.
4. Place the valve on the two studs. Install all remaining studs. Measure carefully to be sure the valve is centered on the pipeline flanges, and tighten the flange stud nuts. Tighten the nuts in a criss-cross sequence to be sure the flange gaskets are properly torqued.
5. Connect pressure lines to the actuator as indicated in the actuator instruction manual. When an auxiliary manual actuator is used with a power actuator, install a bypass valve on the power actuator (if one is not supplied) for use during manual operation.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If the valve has ENVIRO-SEAL live-loaded packing installed, this initial re-adjustment will probably not be required. See ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)) for packing instructions.

Figure 3. Fisher V200U Dimensions and Required Clearances for Installation



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V200U Valve

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Table 4. Fisher V200U Dimensions and Required Clearances for Installation

VALVE SIZE, DN	VALVE SIZE, NPS	DIMENSION									
		A	B	M ⁽¹⁾				p ⁽²⁾			
				PN 10/16	PN 25/40	CL150	CL300	PN 10/16	PN 25/40	CL150	CL300
				mm							
25	1	50	32	150	150	121	134	---	---	---	---
40	1-1/2	60	37	175	175	140	159	---	---	---	---
50	2	75	46	200	200	166	172	---	---	---	---
80	3	100	59	225	240	204	216	---	---	---	---
100	4	116	68	250	270	223	242	103	104	99	99
150	6	160	89	310	340	274	299	---	---	---	---
200	8	200	124	355	405	324	356	188	190	188	188
250	10	240	147	410	470	375	413 ⁽³⁾	253	253	242	237
Inches											
25	1	1.97	1.25	5.91	5.91	4.75	5.25	---	---	---	---
40	1-1/2	2.36	1.47	6.89	6.89	5.5	6.25	---	---	---	---
50	2	2.95	1.82	7.88	7.88	6.5	6.75	---	---	---	---
80	3	3.94	2.34	8.86	9.45	8.00	8.50	---	---	---	---
100	4	4.58	2.67	9.85	10.63	8.75	9.50	4.06	4.09	3.90	3.90
150	6	6.30	3.52	12.21	13.39	10.75	11.75	---	---	---	---
200	8	7.87	4.89	13.98	15.95	12.75	14.00	7.40	7.48	7.40	7.40
250	10	9.45	5.78	16.15	18.51	14.75	16.25 ⁽³⁾	9.96	9.96	9.53	9.33

1. Clearance necessary to remove the bolt.
2. Minimum internal diameter of the mating pipe or flange required for Vee-Ball clearance.
3. The NPS 10 CL300 construction requires 4 bolts per side (8 total) to be installed in blind, tapped holes on the valve body. The M value for these 1 – 8 UNC fasteners is 140 mm (5.5 inch).

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

Key numbers in this procedure are shown in figures 16, 17, and 18 unless otherwise noted.

⚠ WARNING

The Vee-Ball closes with a shearing, cutting motion, which could result in personal injury. To avoid injury, keep hands, tools, and other objects away from the Vee-Ball while stroking the valve.

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- The valve packing area may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Packing Maintenance

Key numbers in this procedure are shown in figures 16, 17, and 18 unless otherwise noted. A detailed view of the packing is also shown in figure 4.

If the valve is equipped with the ENVIRO-SEAL Packing System, refer to:

- The separate ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)) for maintenance instructions, and
- The Parts List section of this manual for retrofit kits, parts kits, and individual parts.

If the packing is relatively new and tight on the drive shaft (key 6), and if tightening the packing follower nuts does not stop leakage, it is possible that the drive shaft is worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches on the packing box wall. Inspect the drive shaft and packing box wall for nicks or scratches while performing the following procedure.

Replacing Packing

When using this procedure, it is recommended that the actuator **not** be removed from the valve while the valve is still in the pipeline or between flanges. Valve/actuator adjustments must be made with the valve out of the pipeline. Refer to the Determining Closed Position portion of the Actuator Mounting section.

Disassembly

⚠ WARNING

Observe the steps in the WARNING at the beginning of the Maintenance section.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines to the power actuator, release pressure from the actuator, and disconnect the pressure lines from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you are working on the equipment.
2. To avoid potential interference with the valve outlet end pipe flange, the V200U ball should be in the closed position prior to removal.
3. Remove line bolting, remove the control valve from the pipeline, and place the valve/actuator assembly on a flat surface with the seal protector ring facing up.
4. Remove the actuator cover. Take note of the orientation of the actuator with respect to the valve body and the lever orientation with respect to the valve drive shaft (see figure 14) for Fisher actuation.

⚠ WARNING

When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, with a shearing, cutting motion, which could result in personal injury. To avoid injury, carefully rotate the ball to a stable position at the bottom of the valve body cavity. Make sure the ball will not rotate.

CAUTION

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever or actuator off the valve shaft. Driving the lever or actuator off the valve shaft could damage the ball, seal, and valve.

If necessary, use a puller to remove the lever or actuator from the valve shaft. It is okay to tap the puller screw lightly to loosen lever or actuator, but hitting the screw with excessive force could damage the ball, seal, and valve.

5. Remove the clamped lever (do not loosen the actuator turnbuckle adjustment), remove the actuator mounting screws and nuts (keys 23 and 24), and remove the actuator. (If necessary, refer to the actuator instruction manual for assistance.)
6. If applicable, remove the bonding strap assembly before attempting to remove the packing (see figure 2).
7. Remove the packing follower nuts and packing follower (keys 17 and 20). For alloy packing constructions, the packing follower (key 17) and a separate packing flange (key 40) must be removed if present.

If the valve is equipped with the ENVIRO-SEAL packing system, refer to the ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)) for disassembly.

⚠ WARNING

Personal injury could result from packing leakage. Do not scratch the drive shaft or packing box wall while removing packing parts in the following procedure.

8. Remove the packing parts (see figure 4, keys 16, 17, 35, and 39 depending on construction) using a formed wire hook with a sharp end. Pierce the rings with the sharp end of the hook in order to remove them. Do not scratch the drive shaft or packing box wall; scratching these surfaces could cause leakage. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing.

Assembly

If the valve is equipped with the ENVIRO-SEAL packing system, refer to the ENVIRO-SEAL Packing System for Rotary Valves Instruction Manual ([D101643X012](#)) for assembly.

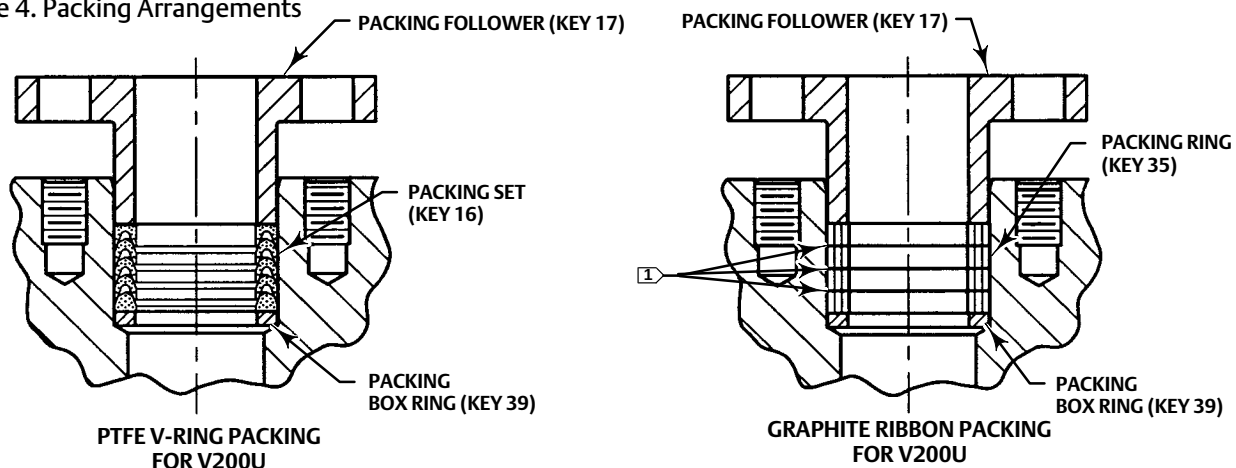
1. To help ensure correct centering of the Vee-Ball (key 2) on the seal (key 11), make sure the ball is closed while you install or tighten new packing. Insert a screwdriver, pry bar, or similar tool between the lower ear of the ball and the valve body. Use the pry to move the ball tightly against the bearing on the actuator side of the valve (see figure 5). Keep the ball in that position until you have completed packing installation and adjustment.
2. Install the new packing parts using the parts sequence shown in figure 4. Install the packing follower (key 17).
3. Secure the packing follower with the packing follower nuts (key 20). Tighten the nuts far enough to stop leakage under operating conditions.

Note

If the valve is equipped with a bonding strap assembly (figure 2), re-install the assembly.

4. Reconnect the actuator and lever in accordance with the orientations that were noted in step 3 of the disassembly procedures. If necessary, use figure 10 to identify the correct index marks.
5. Refer to the appropriate actuator instruction manual to complete actuator assembly and adjustment.
6. When the control valve is in operation, check the packing follower for leakage and re-tighten the packing follower nuts (key 20) as necessary.

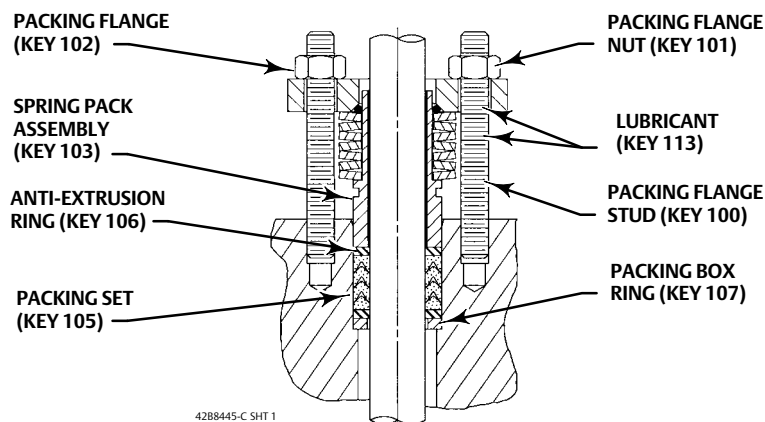
Figure 4. Packing Arrangements



NOTE:
 1 INCLUDES ZINC WASHERS (KEY 36) FOR
 GRAPHITE RIBBON PACKING ONLY.

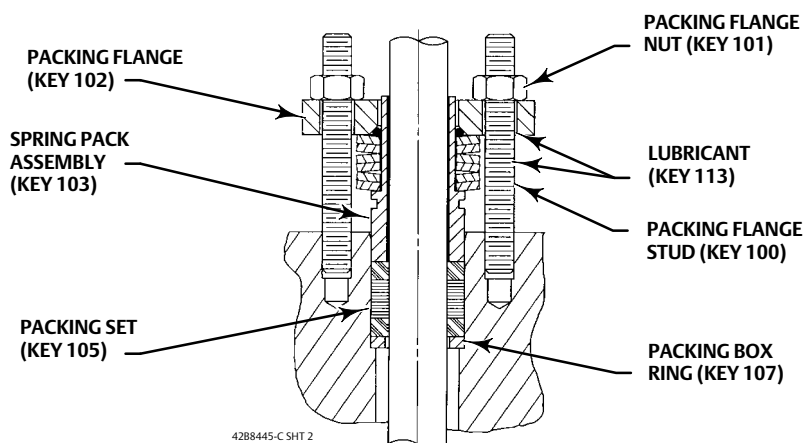
28B5170

STANDARD PACKING



42B8445-C SHT 1

ENVIRO-SEAL PTFE PACKING SYSTEM

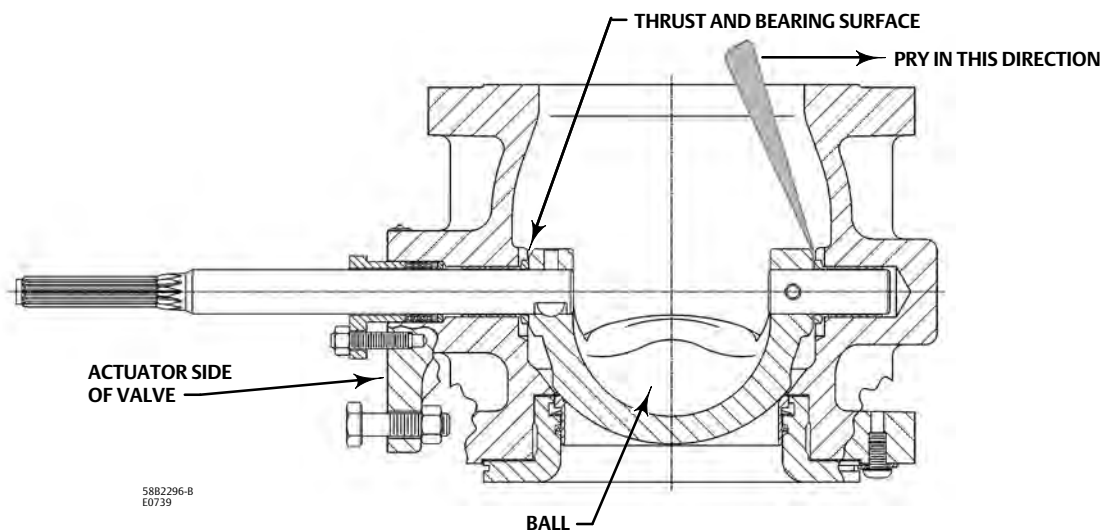


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42B8445-C SHT 2

ENVIRO-SEAL GRAPHITE PACKING SYSTEM

Figure 5. Typical Vee-Ball Valve Showing Pry Bar

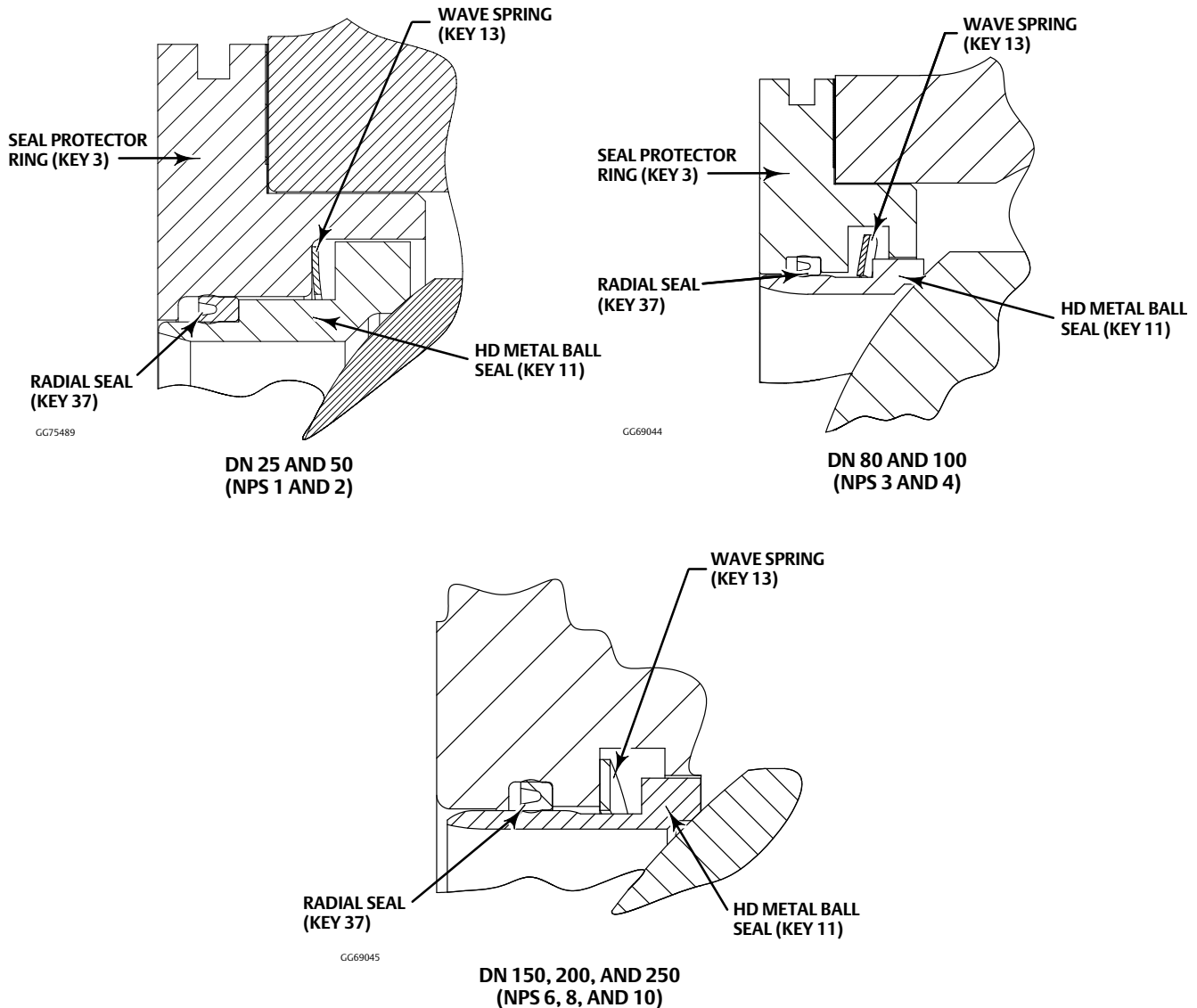


Replacing the HD Ball Seal

Perform this procedure if the control valve is not shutting off properly or if seal inspection is necessary.

The valve / actuator assembly must be removed from the pipeline. To avoid potential interference with the valve outlet end pipe flange, the V200U ball should be in the closed position prior to removal. For DN 25 through 100 (NPS 1 through 4), the actuator may remain mounted on the valve for ball seal replacement. For DN 150 through 250 (NPS 6 through 10), the actuator must be removed from the valve to replace the ball seal. Key numbers are shown in figures 16, 17, and 18 unless otherwise indicated. Ball Seal assembly details (with key numbers) are also shown in figure 6.

Figure 6. Ball Seal Design



⚠ WARNING

Perform the steps in the **WARNING** at the beginning of the Maintenance section of this manual.

Removing the HD Seal

1. Remove line bolting, remove the control valve from the pipeline, remove the actuator (as discussed in the packing section), and place the valve body on a flat work surface.
 - a. For DN 25 through 100 (NPS 1 through 4), remove protector ring screws and washers (keys 21 and 22). Carefully remove the seal protector ring (keys 3) and gasket (keys 15).

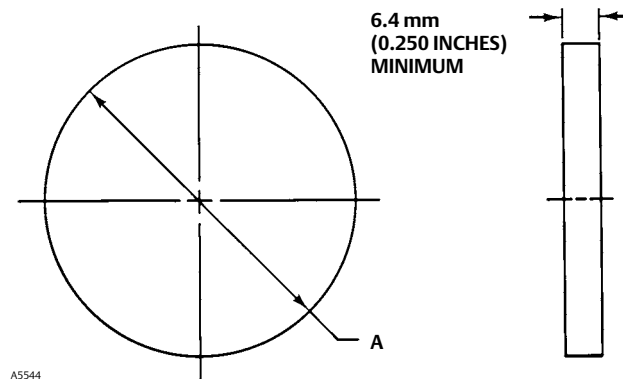
- b. For DN 150, 200, and 250 (NPS 6, 8, and 10), the ball must be removed to access the seal. See the Bearing and Ball Maintenance Disassembly section of this manual. Then return to this procedure and continue with the next steps.
2. Remove HD seal from related component.
 - c. For DN 25 through 100 (NPS 1 through 4), once the protector ring (key 3) has been removed from the valve, push the metal seal (key 11) out of the seal protector ring (key 3). Remove the wave spring (key 13) and the radial seal (key 37).
 - d. For DN 150, 200, and 250 (NPS 6, 8, and 10), with the inlet side of the valve facing up, push the HD metal seal (key 11) into the valve body (key 1). Remove the wave spring (key 13) and the radial seal (key 37).

CAUTION

Exercise care to avoid damaging components in the following procedure.

- It might be necessary to remove the HD metal seal by carefully tapping it with a soft punch and hammer. Take care not to damage the seal protector ring and valve body.
- For DN 80 through 250 (NPS 3 through 10) valves, if the seal is difficult to push out, it is recommended that a seal removal plate be used to press the HD metal seal out of the valve body. Refer to figure 7 for dimensions of the seal removal plate.

Figure 7. HD Seal Removal Plate Dimensions



VALVE SIZE		DIMENSION A	
DN	NPS	Minimum-Maximum, mm	Minimum-Maximum, Inches
80	3	75.9-76.2	2.990-3.000
100	4	95.0-95.3	3.740-3.750
150	6	126.7-127.0	4.990-5.000
200	8	158.5-158.8	6.240-6.250
250	10	212.5-212.7	8.365-8.375

3. If replacement of the ball, shafts (keys 6 or 9), or bearings (key 10) is needed, proceed to the Bearing and Ball Maintenance procedure. If only the seal is to be replaced, proceed to the Installing HD Metal Seals section.

Installing HD Metal Seals

Refer to figures 6, 16, 17, and 18 for key number locations during seal installation.

Thoroughly clean all parts that are to be re-used and obtain replacement parts. Be sure that all sealing surfaces are in good condition without scratches or wear. If the valve has been installed between line flanges and the flange studs and nuts have been tightened, always replace the gasket (key 15) with a new gasket.

1. For DN 25 through 100 (NPS 1 through 4), before installing HD metal seals, ensure ball (key 2) is installed into valve body. Ball should be in closed position while you install the seal and seal protector ring. Insert a screwdriver, pry bar, or similar tool between the lower ear of the ball and the valve body (see figure 5).
2. Use the pry to move the ball tightly against the bearing on the actuator side of the valve. Be careful, excessive force may damage the ball. Keep the ball in that position until you have completed seal or flow ring installation. Check the ball's position periodically, and re-center if necessary, during lever assembly and packing adjustments. See figure 5.

⚠ WARNING

The Vee-Ball closes with a shearing, cutting motion, which could result in personal injury. To avoid injury or property damage, keep hands, tools, and other objects away from the Vee-Ball while stroking the valve.

3. Install the HD Seal.

a. For DN 25, 40 and 50 (NPS 1, 1-1/2, and 2):

- Install the wave spring (key 13) into the seal protector ring (key 3).
- Lubricate and install the radial seal (key 37) onto the ball seal (key 11). Make sure the open side of the radial seal faces away from the ball.
- Push the ball seal assembly into the seal protector ring (key 3).
- Install a replacement gasket (key 15) on the valve body (key 1). Install the HD ball seal/seal protector ring assembly into the valve body (key 1).
- Install clips and screws that clamp the seal protector ring to the valve body (keys 3, 21, and 22).
- If necessary, refer to the Packing Maintenance procedures to install the packing. Install the actuator using the Actuator Mounting procedures or to the appropriate actuator instruction manual.

b. For DN 80 and 100 (NPS 3 and 4):

- Install the wave spring (key 13) into the seal protector ring (key 3).
- Install the HD seal (key 11) into the seal protector ring (key 3), past the radial seal. While pushing it past the radial seal, make sure the HD seal is level.
- Install a replacement gasket (key 15) on the valve body (key 1). Install the HD ball seal/seal protector ring assembly into the valve body (key 1).
- Install clips and screws that clamp the seal protector ring to the valve body (keys 3, 21, and 22).
- If necessary, refer to the Packing Maintenance procedures to install the packing. Install the actuator using the Actuator Mounting procedures or to the appropriate actuator instruction manual.

- c. For DN 150, 200, and 250 (NPS 6, 8, and 10), position the valve body on a flat surface with the outlet side of the valve facing up.
- Lubricate the radial seal (key 37) and install into the appropriate groove in the valve body, making sure the open side of the radial seal faces away from the ball.
 - Install the wave spring (key 13) into the appropriate groove in the valve body.
 - The HD seal can be installed by pushing the HD seal past the wave spring and radial seal, making sure the HD metal seal remains level. Following this, install the remaining trim components as explained under the Bearing and Ball Maintenance Assembly section of this manual.
 - Use the pry bar or similar tool to move the ball tightly against the bearing on the actuator side of the valve to help ensure correct side-to-side centering of the ball (key 2) on the seal (key 11). See figure 5.
 - Be sure that the HD seal is fully installed in the valve. Carefully rotate the ball to engage the HD seal while applying force across the middle of the seal to compress the wave spring until the ball is fully engaged. Be cautious during this process, knowing that excessive force may damage the ball. Keep the ball in the engaged position going forward.
 - Continue to check the ball's position and re-center if necessary during actuator mounting and packing adjustments.

HD Ball Seal Lubrication

To assist with break-in of the HD seals, it is required that the ball and seal be lubricated with dry film lubricant or equivalent moly disulfide.

Bearing and Ball Maintenance

⚠ WARNING

Before performing the steps in this section, observe the **WARNING** at the beginning of the Maintenance section of this manual.

For DN 80 through 250 (NPS 3 through 10):

Procedures for disassembly and assembly of the bearings and ball cannot be accomplished until the shaft and valve packing are removed from the valve.

Refer to the Replacing Packing procedures to remove the actuator, and to remove the packing flange and packing follower from the valve. When the packing disassembly steps are complete, return to this section.

Disassembly

⚠ WARNING

When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, with a shearing, cutting motion, which could result in personal injury. To avoid injury, carefully rotate the ball to a stable position at the bottom of the valve body cavity. Make sure the ball will not rotate.

Key numbers in this procedure are shown in figures 6, 17, and 18, unless otherwise indicated.

1. For DN 80 and 100 (NPS 3 and 4), seal protector ring (key 3) and HD seal (key 5) should be removed first, refers to procedure of Removing HD Seal on page 12. For DN 150, 200, and 250 (NPS 6, 8, and 10), HD seal will be removed after ball (key 2) is removed in this procedure.
2. A taper key (key 4) is used to connect the ball and drive shaft in DN 80 through 250 (NPS 3 through 10) valves.
3. Carefully rotate the ball to the open position after the actuator is disconnected. Make sure the ball will not rotate (see warning above). Provide support for the ball during the following disassembly.
4. Working from the small end of the groove pin (key 7), use a pin punch to drive the groove pin out of the ball ear and follower shaft.

For tack welded taper keys, driving the taper key out of the ball ear will shear the tack welding.

5. Locate the small end of the taper key (key 4). Using a pin punch on the smaller end of the taper key, drive it out of the ball (key 2) and drive shaft (key 6). Note: driving the taper key in the wrong direction will tighten it.
6. Pull the drive shaft (key 6) out of the actuator side of the valve body.

CAUTION

Exercise care to avoid damaging components in the following procedure.

7. The ball will be free to move when both shafts are removed. Make sure the sealing surface of the ball is not damaged while removing the follower shaft.
8. Use a piece of continuous threaded rod as a removal rod when moving the follower shaft (key 9) into the center of the ball. Refer to table 5 for a description of the size threaded rod needed. The length of the rod should allow easy working room from the valve body.

Table 5. Continuous Threaded Rod

Valve Size, DN	Valve Size, NPS	Threaded Rod Thread Size	Thread Depth in Follower Shaft, Inch
80	3	1/4-20	0.5
100	4	1/4-20	0.5
150	6	1/4-20	0.5
200	8	5/16-18	0.62
250	10	5/16-18	0.62

9. Carefully remove the follower shaft.
10. For DN 80 and 100 (NPS 3 and 4), the ball (key 2) should be removed from the inlet opening of the valve body. Lift the ball to clear the bearings (key 10). Engage the ball drive shaft side ear with the body as shown in figure 8 and carefully lift the ball by the follower side ear to remove.

For DN 150, 200, and 250 (NPS 6, 8, and 10), the ball (key 2) should be removed from the outlet opening of the valve body. Lift the ball to clear the bearings (key 10). Engage the ball drive shaft side ear with the body as shown in figure 9 and carefully lift the ball by the follower side ear to remove.

11. The bearings are not pressed in, so they can be removed with minimal force. Be careful not to damage the machined surfaces of the bearing bore if prying is required.

For HD seal removal, follow the steps outlined under Removing HD Seal of this manual.

Figure 8. DN 25 and 100 (NPS 1 through 4) Ball Removal

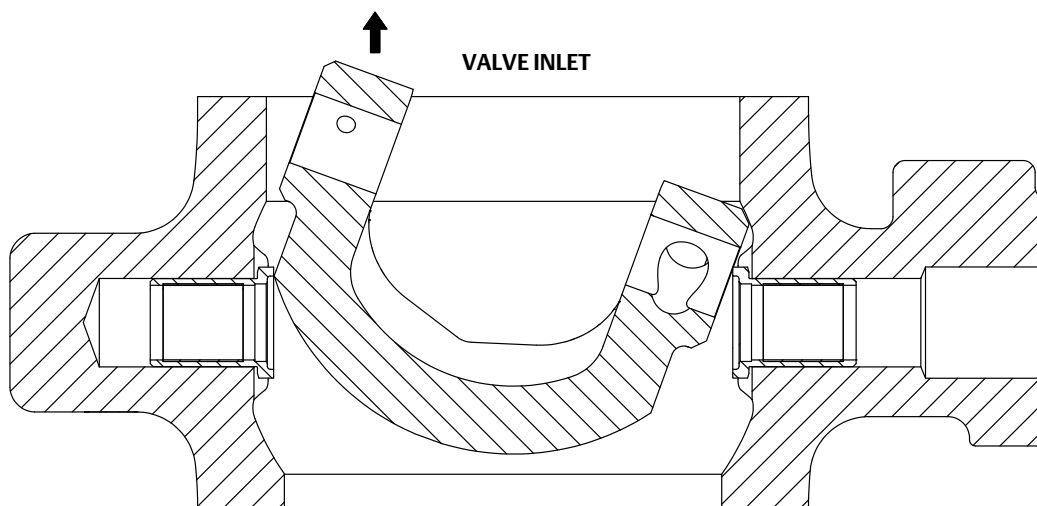
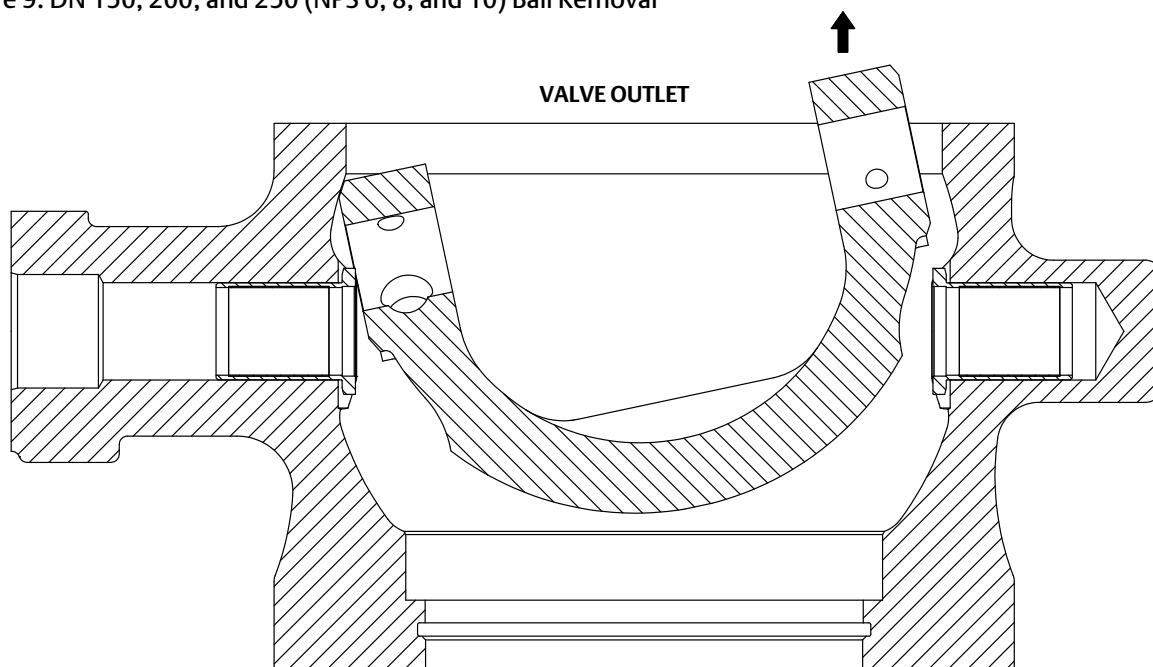


Figure 9. DN 150, 200, and 250 (NPS 6, 8, and 10) Ball Removal



Assembly

1. Inspect all sealing surfaces to ensure they are in good condition and without scratches or wear.

For DN 150, 200, and 250 (NPS 6, 8, and 10), install the HD ball seal. See Installing the HD Seal of this manual and follow steps 1 through 4. Then return to this procedure and continue with the next steps.

2. Install the replacement bearings (key 10) by hand. The bearing flanged end should touch the valve body.

3. **Installing the Vee-Ball:** Lubrication will assist with break-in of the HD metal seals and with assembly. It is required that both the ball surface and seal be lubricated with dry film lubricant or equivalent moly disulfide.

⚠ WARNING

The ball might be damaged if it is allowed to fall into the valve body. To avoid personal injury or damage to the sealing surfaces, support the ball to prevent it from falling into or out of the valve body cavity.

Place the valve body on a table or bench.

- For DN 80 and 100 (NPS 3 and 4), the ball (key 2) should be installed from the inlet opening of the valve body. The follower shaft (key 9) should be inserted into the ball before the ball is installed. Engage the ball drive shaft side ear with the body as shown in figure 8 then lower the follower side ball ear into the body and position the ball between the bearings.
 - For DN 150, 200, and 250 (NPS 6, 8, and 10), the ball (key 2) should be installed from the outlet opening of the valve body. Engage the ball drive shaft side ear with the body as shown in figure 9 then lower the follower side ball ear into the body and position the ball between the bearings.
4. **Installing the Follower Shaft (key 9):**
 - For DN 80 and 100 (NPS 3 and 4), the follower shaft (key 9) should already have been inserted into the ball before the ball was put into the valve body. Insert the follower shaft (key 9) into the valve body bearing (key 10).
 - For DN 150, 200, and 250 (NPS 6, 8, and 10), with the ball rotated open and not in contact with the HD seal, insert the follower shaft (key 9) through the ball, and into the valve body bearing (key 10).
 5. Align the hole in the follower shaft with the holes in the ball. Insert the small end of the groove pin (key 7) into the hole in the ball and into the follower shaft. The pin will hold the parts in place while the drive shaft (key 6) is being installed.
 6. **Installing the Drive Shaft (key 6):**

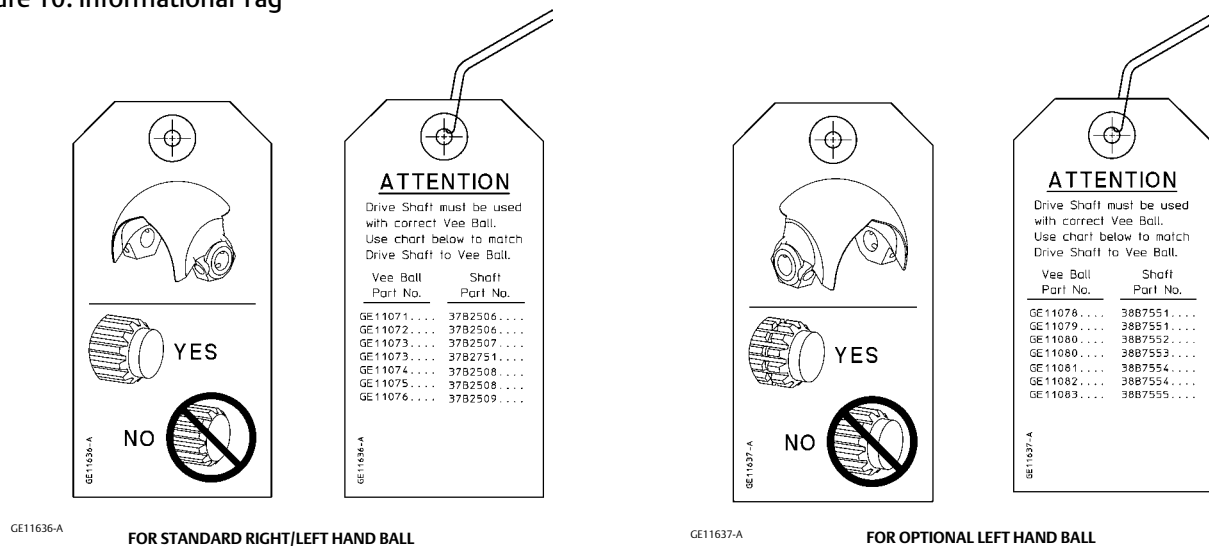
CAUTION

The drive shaft must be used with the correct Vee-Ball. Refer to the tag (see figure 10) attached to the Vee-Ball and to the drive shaft.

Failure to use the correct Vee-Ball/shaft combination may result in the ball not being in the position indicated by the slash mark on the end of the shaft. If the ball is not properly aligned with the slash mark, the valve will not function correctly and seal damage may result.

Make sure the drive shaft is free of oil or grease, otherwise the taper pin or taper key will not seat properly. Failure to properly set the taper pin or taper key could result in it coming loose while in service. Loosening of the taper key in service could result in improper valve function and equipment damage.

Figure 10. Informational Tag



7. Install the drive shaft (key 6) into the valve body through the valve body bearing and into the ball.
8. Insert the taper key (key 4) into ball and drive shaft (keys 2 and 6) as shown in figure 11. The taper key inserts with the flat side of the key facing the drive shaft (key 6).
9. Using a flat end punch, drive the groove pin (key 7) into the ball ear and follower shaft until it is flat with the ball ear surface. Stake both ends of the pin hole with a center punch to ensure the groove pin does not come out.
10. Using a flat end punch, drive the taper key (key 4) into the ball ear and drive shaft (key 6) until solid, heavy contact is obtained between the key and shaft.
11. Measure the position of the taper key head.
12. Drive the taper key in further using the minimum distance shown in table 6.
13. Inspect the ball/shaft taper key connection to verify that the taper key spans the entire shaft flat width. If not, the taper key must be driven in further until this condition is satisfied. However, do not exceed the maximum depths shown in table 7.

Note

All valve taper keys are tack welded, except titanium.

14. When the above conditions are met, tack weld the taper key (key 4) to the ball ear on the head end of the key (see figures 17 and 18). Use a:
 - 1/8-inch diameter weld on DN 80, 100, and 150 (NPS 3, 4, and 6) valves
 - 3/16-inch diameter weld on DN 200 and 250 (NPS 8 and 10) valves
15. Use the pry bar or similar tool to move the ball tightly against the bearing on the actuator side of the valve to help ensure correct side-to-side centering of the ball (key 2) on the seal (key 11). See figure 5.
16. Be sure that the HD seal is fully installed in the valve. Carefully rotate the ball to engage the HD seal while applying force across the middle of the seal to compress the wave spring until the ball is fully engaged. Be cautious during this process, knowing that excessive force may damage the ball. Keep the ball in the engaged position going forward.

17. Continue to check the ball's position and re-center if necessary during actuator mounting and packing adjustments.

For all constructions, refer to Packing Maintenance, and other procedures as necessary to complete the assembly of the valve.

Figure 11. Taper Key Installation

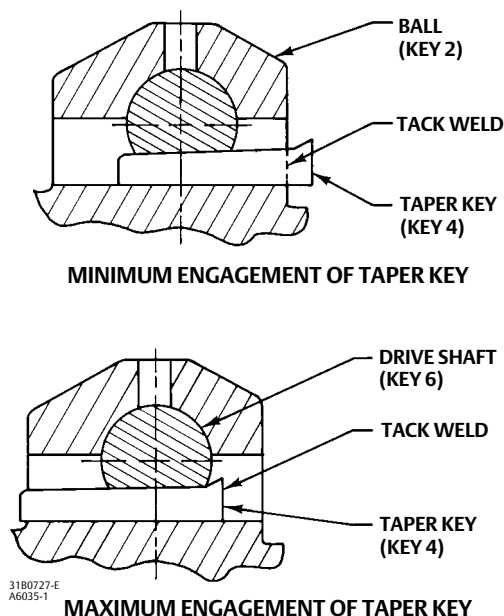


Table 6. Taper Key Minimum Depth

Valve Size, DN	Valve Size, NPS	Minimum Depth To Drive Taper Key After Initial Solid Contact, mm (Inches)
80, 100, 150	3, 4, 6	4.8 (0.188)
200, 250,	8, 10,	5.6 (0.219)

Table 7. Taper Key Maximum Depth

Valve Size, DN	Valve Size, NPS	Maximum Depth To Drive Taper Key After Initial Solid Contact, mm (Inches)
80, 100	3, 4	7.1 (0.281)
150	6	7.9 (0.312)
200, 250	8, 10	9.5 (0.375)

DN 25 through 50 (NPS 1 through 2) Valves

Procedures for disassembly and assembly of the bearings and ball cannot be accomplished until the ball seal and valve packing are removed from the valve.

Refer to the Replacing Packing procedures to remove the actuator, and to remove the packing flange and packing follower from the valve. When the packing disassembly steps are complete, return to this section.

Refer to the Replacing the Ball Seal procedures to remove the ball seal from the valve.

Disassembly

⚠ WARNING

When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, with a shearing, cutting motion, which could result in personal injury. To avoid injury, carefully rotate the ball to a stable position at the bottom of the valve body cavity. Make sure the ball will not rotate.

Key numbers in this procedure are shown in figures 6 and 16 unless otherwise indicated.

1. A taper pin (key 4) is used in the DN 25, 40, and 50 (NPS 1, 1-1/2, and 2) valves.

CAUTION

Exercise care to avoid damaging components in the following procedure.

Table 8. Continuous Threaded Rod

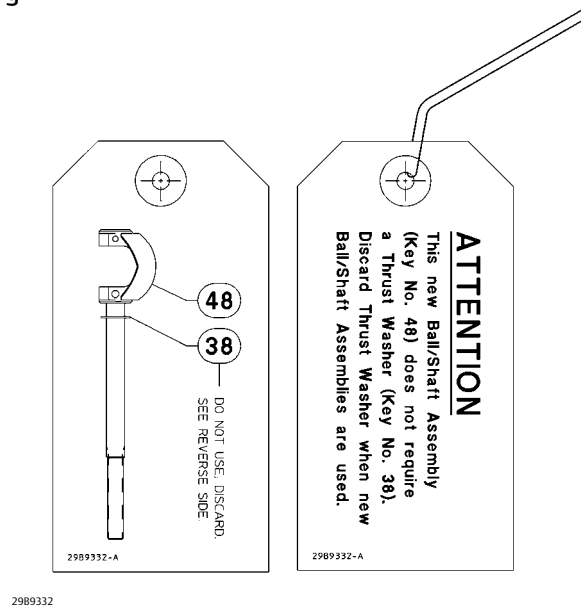
Valve Size, DN	Valve Size, NPS	Threaded Rod Thread Size	Thread Depth in Follower Shaft
25	1	1/4-20	0.5
40	1.5	1/4-20	0.5
50	2	1/4-20	0.5

2. Carefully rotate the ball to the open position after the actuator is disconnected. Make sure the ball will not rotate (see warning above). Provide support for the ball during the following disassembly.
3. Working from the small end of the groove pin (key 7), use a pin punch to drive the groove pin out of the ball ear and follower shaft.
4. Locate the small end of the taper pin (key 4, figure 11). Using a pin punch on the smaller end of the taper pin, drive it out of the ball (key 2) and drive shaft (key 6). Note: driving the taper key in the wrong direction will tighten it.
5. Pull the drive shaft (key 6) out of the actuator side of the valve body.

Note

Figure 17 shows the informational tag that is attached with the new ball/shaft assembly when shipped as a spare part.

Figure 12. Informational Tag



CAUTION

Exercise care to avoid damaging components in the following procedure.

6. Make sure the sealing surface of the ball is not damaged while removing the follower shaft.
 - a. Use a piece of continuous threaded rod as a removal rod when moving the follower shaft (key 9) into the center of the ball. Refer to the table 8 for a description of the size threaded rod needed. The length of the rod should allow easy working room from the valve body.
7. Remove the ball (key 2) by carefully removing the follower shaft and ball from the valve body. See figures 8 and 9.
8. Remove the bearings (key 10) by hand. If the bearings are tight in the valve body, then pull or drive them out with a slight pressure.
9. Thoroughly clean surfaces of all parts that are to be re-used or obtain replacement parts.

Assembly

1. Inspect all sealing surfaces to ensure they are in good condition and without scratches or wear.
2. Install bearings (key 10) by hand. The bearing flanged end should touch the body.
3. Installing the ball (key 2):

⚠ WARNING

The Vee-Ball might be damaged if it is allowed to fall into the valve body. To avoid personal injury or damage to the sealing surfaces, support the ball to prevent it from falling into or out of the valve body cavity.

Carefully install the ball into the valve body cavity.

After you have installed the ball (key 2) into the valve body assembly, firmly support the ball while installing the shafts.

4. Installing the follower shaft (key 9):

- For DN 25 through 50 (NPS 1 through 2) valves: The follower shaft (key 9) should already have been inserted into the ball before the ball was put into the valve body. Insert the follower shaft (key 9) into the valve body bearing (key 10).

5. Installing the Drive Shaft for Valves with Taper Pins

CAUTION

Make sure the drive shaft is free of oil or grease, otherwise the taper pin will not seat properly. Failure to properly set the taper pin or taper key could result in it coming loose while in service. Loosening of the taper key in service could result in improper valve function and equipment damage.

6. Insert the drive shaft into the valve body bearing (key 10), and into the ball ear . Align the hole in the drive shaft with the holes in the ball.
7. Insert the taper pin into the ball and drive shaft as shown in figure 13. The small end of the taper pin must be inserted into the larger hole side of the ball ear, and into the large hole side of the drive shaft.

Note

The taper pin will not fit correctly if inserted in the wrong direction through the ball ear or through the drive shaft. Make sure the drive shaft and ball ear are in the correct orientation for installing the pin.

- Installing Taper Pins in DN 25, 40, and 50 (NPS 1, 1-1/2, and 2) Valves

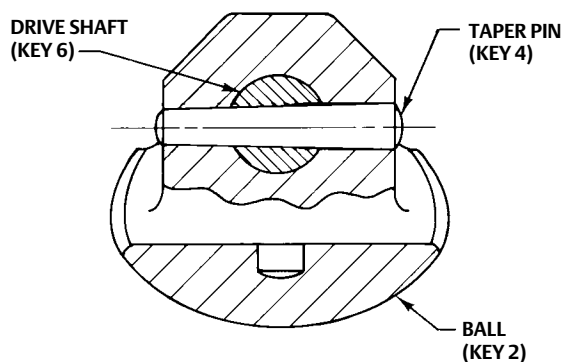
Note

For DN 25, 40, and 50 (NPS 1, 1-1/2, and 2) valves, the taper pins (figure 13) do not require welding.

Using a flat-end punch, drive the taper pin into the ball ear and drive shaft until solid heavy contact is felt. Make sure the taper pin spans the width of the ball.

Using a flat end punch, drive the groove pin (key 7) into the ball and follower shaft until it is flat with the ball surface.

Figure 13. Taper Pin Installation



A6033-1

Actuator Mounting

Use the appropriate actuator instruction manual, this section of this manual, and figure 14 of this manual when mounting the actuator or changing actuator styles and positions.

1. To help ensure correct centering of the Vee-Ball (key 2) on the seal (key 11), be sure the ball is closed when mounting the actuator (for applications other than Spring Return Fail-Open).
2. Clean the valve shaft and actuator lever splines to be sure the actuator lever will slide on easily. Only drive the lever in if absolutely necessary.
3. Carefully wedge the ball solidly against the actuator-side bearing, using a pry bar or similar tool inserted between the lower ear of the ball and the valve body. This will center the ball. See figure 5.
4. Keep the wedge in place while installing the lever, if necessary. Remove the wedge after you have clamped the actuator lever on the valve shaft and have connected the lever to the actuator piston rod or diaphragm rod.

Determining Mounting Position

The actuator can be either right or left-hand mounted, with the actuator on the right or left side when viewed from upstream (see figure 14).

The Series B Vee-Ball has one V-notch. For **right-hand mounting (standard)**, the ball will be in the top of the valve body when the valve is open and the shaft is horizontal. In this position the ball rotates CCW to Close. For **left-hand mounting (standard)**, the ball will be in the bottom of the valve body when the valve is open and the shaft is horizontal. In this position the ball rotates CCW to Close. An optional ball for **left-hand mounting**, which rotates into the top of the valve body when the shaft is horizontal, is also available. In this position the ball rotates CW to Close.

(DN 25 and 50) NPS 1 through 2 has two notches and can be rotated in either direction.

Determining Closed Position

1. The valve must be removed from the line to check the position of the ball.

WARNING

The Vee-Ball closes with a shearing, cutting motion. To avoid personal injury, keep hands, tools, and other objects away from the ball while stroking the valve.

2. Rotate the ball to the closed position.
3. Position the ball in the proper location:

For Series B: When viewed from the valve body inlet, the ball is in the proper position when the flat spot on the top of the ball is exactly in the center of the seal package.

Make a copy of the centering template in figure 15 out of a suitable stiff material. Place the centering template in the opening at the seal (see figure 15). Find the center of the template and make sure the spot on the ball is centered directly below it.

For DN 25, 40, and 50 (NPS 1, 1-1/2, and 2) valves: Follow one of the following procedures:

- When viewed from the valve body inlet, the ball is in the proper position when both V notches of the ball are centered between the machined diameter of the ledge that supports the seal.
- If the ball has a spot machined on the top, align that spot to the exact center of the seal cavity.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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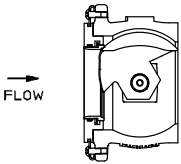
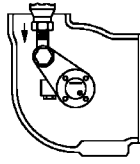
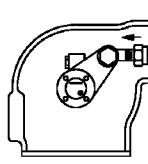
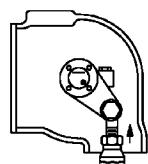
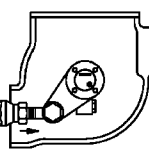
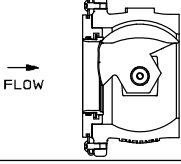
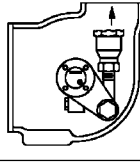
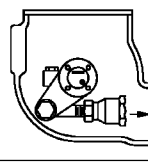
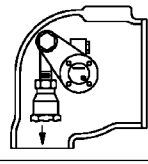
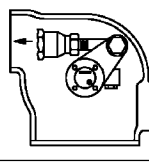
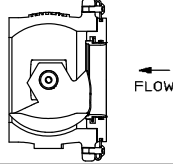
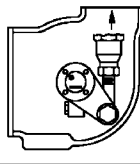
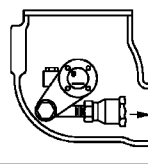
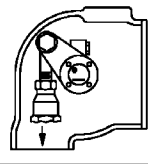
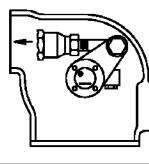
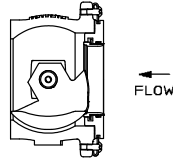
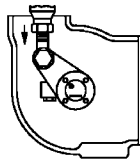
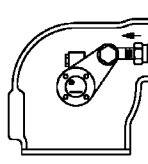
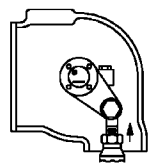
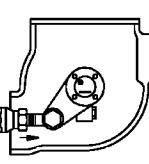
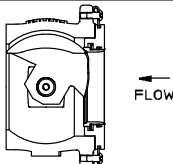
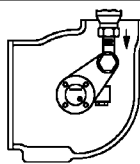
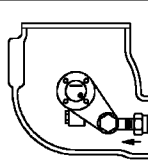
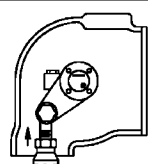
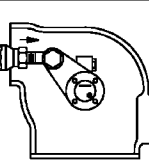
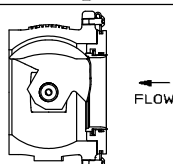
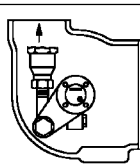
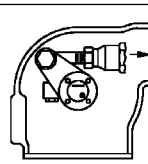
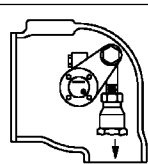
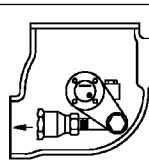
V200U Valve

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- Adjust the actuator as described in the appropriate actuator instruction manual until the ball is centered in the closed position. A line is stamped on the actuator end of the drive shaft (see figure 14) to indicate the ball position.

Use the appropriate actuator instruction manual and figure 14 when mounting the actuator or changing actuator styles and positions.

Figure 14. V200U Index Marks for Actuator Lever Orientation

ACTUATOR		VALVE OPEN	ACTUATOR POSITION			
MOUNTING	STYLE		1	2	3	4
(STANDARD) RIGHT-HAND BALL ROTATES COUNTER-CLOCKWISE TO CLOSE	STYLE A PUSH DOWN TO CLOSE					
	STYLE B PUSH DOWN TO OPEN					
(STANDARD) LEFT-HAND BALL ROTATES COUNTER-CLOCKWISE TO CLOSE	STYLE C PUSH DOWN TO OPEN					
	STYLE D PUSH DOWN TO CLOSE					
(OPTIONAL) LEFT-HAND BALL ROTATES CLOCKWISE TO CLOSE	STYLE C (2) PUSH DOWN TO CLOSE					
	STYLE D PUSH DOWN TO OPEN					
NOTE: 1. ARROW ON LEVER INDICATES DIRECTION OF ACTUATOR THRUST TO CLOSE VALVE. 2. THE OPTIONAL LEFT-HAND ORIENTATION IS NOT AVAILABLE FOR MICRO-NOTCH VEE-BALLS.						

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FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

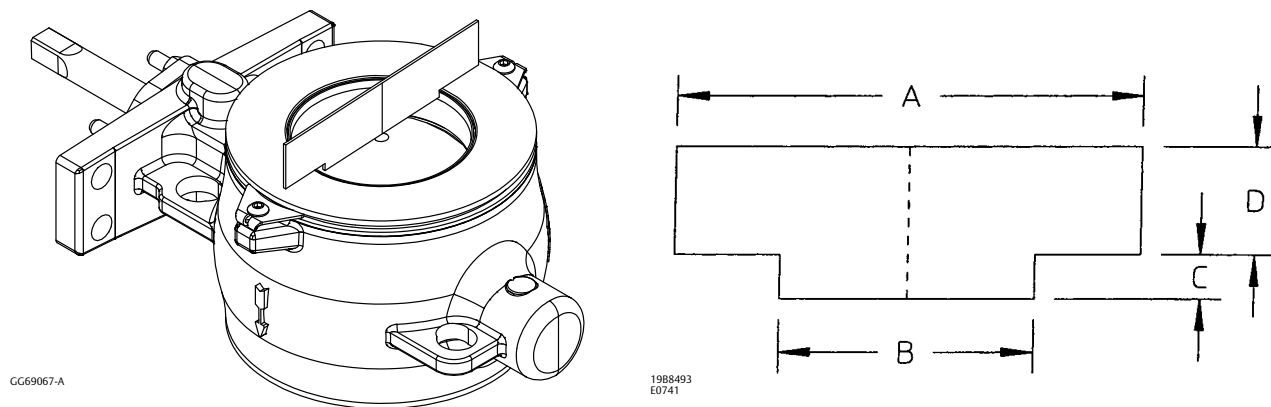
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Figure 15. Centering Template in Use and Template Dimensions



VALVE SIZE, DN	VALVE SIZE, NPS	A	B ⁽¹⁾	C	D ⁽¹⁾
mm					
25	1	63	19	11	25
40	1-1/2	82	28	9	25
50	2	102	38	11	25
80	3	127	63	5	38
100	4	157	82	3	44
150	6	216	117	2	51
200	8	270	139	13	57
250	10	324	203	3	60
Inches					
25	1	2.50	0.75	0.43	1.00
40	1-1/2	3.25	1.12	0.35	1.00
50	2	4.02	1.50	0.43	1.00
80	3	5.00	2.50	0.20	1.50
100	4	6.19	3.25	0.12	1.75
150	6	8.50	4.62	0.08	2.00
200	8	10.62	5.50	0.51	2.25
250	10	12.75	8.00	0.12	2.38

1. These dimensions are the same for ASME and DIN valves.

Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your [Emerson sales office](#) regarding spare parts or technical information. When ordering replacement parts, also specify the key number, part name, and desired material using the parts list.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they will void your warranty, might adversely affect the performance of the valve, and could give rise to personal injury and property damage.

Retrofit Kits for ENVIRO-SEAL Packing

Retrofit kits include parts to convert existing V200U valves with shallow (single packing depth) packing box to the ENVIRO-SEAL packing box construction. Retrofit kits include single PTFE packing. See following table.

ENVIRO-SEAL Packing Retrofit Kits

SHAFT DIAMETER ⁽¹⁾		PART NUMBER	
mm	Inches	Single PTFE	Graphite
12.7	1/2	RRTYXRT0012	RRTYXRT0312
15.9	5/8	RRTYXRT0022	RRTYXRT0322
19.1	3/4	RRTYXRT0032	RRTYXRT0332
25.4	1	RRTYXRT0052	RRTYXRT0352
31.8	1-1/4	RRTYXRT0062	RRTYXRT0362
		Parts Included in Kit	
Key	Description	Quantity	
100	Packing stud	2	2
101	Packing nut	2	2
102	Packing flange	1	1
103	Spring pack assembly	1	1
105	Packing set	1	1
106	Anti-extrusion washer	2	---
107	Packing box ring ⁽²⁾	1	1
---	Tag	1	1
---	Tie Cable	1	1

1. Diameter through the packing box.

2. Not required for all sizes of V150E with 1-1/4 inch diameter shafts.

Repair Kits for ENVIRO-SEAL Packing

Repair kits include valves parts for shallow (single packing depth) for ENVIRO-SEAL packing box construction. Repair kits include single PTFE or graphite packing. See following table.

ENVIRO-SEAL Packing Repair Kits

SHAFT DIAMETER ⁽¹⁾		PART NUMBER	
mm	Inches	PTFE	Graphite
12.7	1/2	RRTYX000012	13B8816X012
15.9	5/8	RRTYX000022	13B8816X032
19.1	3/4	RRTYX000032	13B8816X052
25.4	1	RRTYX000052	13B8816X092
31.8	1-1/4	RRTYX000062	13B8816X112
Parts Included in Kit			
Key	Description	Quantity	
105	Packing set	1	1
106	Anti-extrusion washer	2	--- ⁽²⁾

1. Diameter through the packing box.

2. Included in key 105.

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

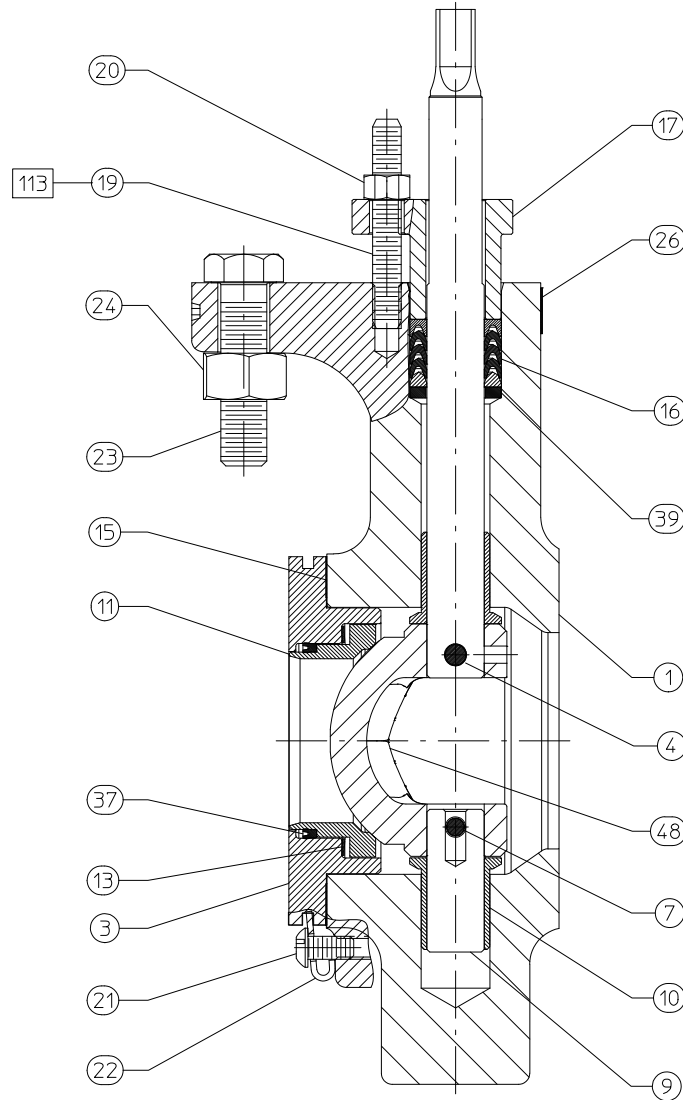
Common Parts (figures 16, 17, and 18)

Key	Description
1	If you need a valve body as a replacement part, order by valve size, serial number, and desired valve body material. Contact your Emerson sales office for assistance.
2*	Ball
3	Seal Protector Ring, DN 25 through 100 (NPS 1 through 4)
4*	Taper Key/Taper Pin
6*	Drive Shaft
7*	Groove Pin
9*	Follower Shaft
10*	Bearing (2 req'd)
11*	Ball Seal
13*	Wave Spring
15*	Gasket
16*	Packing Set
17	Packing Follower
19	Packing Follower Stud
20	Packing Follower Nut
21	Seal Protector Ring Screw, DN 25 through 100 (NPS 1 through 4)
22	Seal Protector Ring Clip, DN 25 through 100 (NPS 1 through 4)
23	Actuator Mounting Screw
24	Actuator Mounting Nut
26	Identification Nameplate
27	Drive Screw
28	Flow Arrow
30	Nameplate
31	Nameplate Wire (not shown)
37*	Radial Seal
39*	Packing Box Ring
40	Packing Flange
41	Retaining Ring
130	Clamp
131	Bonding Strap Assembly

ENVIRO-SEAL Packing System (Parts in all Type Vee-Ball Valves) (figure 4)

Key	Description
100	Packing Flange Stud
101	Packing Flange Nut
102	Packing Flange
103	Spring Pack Assembly
105*	Packing Set
106*	Anti-Extrusion Ring (2 req'd)
107*	Packing Box Ring
108*	Packing Ring (2 req'd)
109*	Anti-Extrusion Ring (2 req'd)
110	Lantern Ring
111	Tag
112	Tie Cable
113	Lubricant, anti-seize (not furnished with packing system)

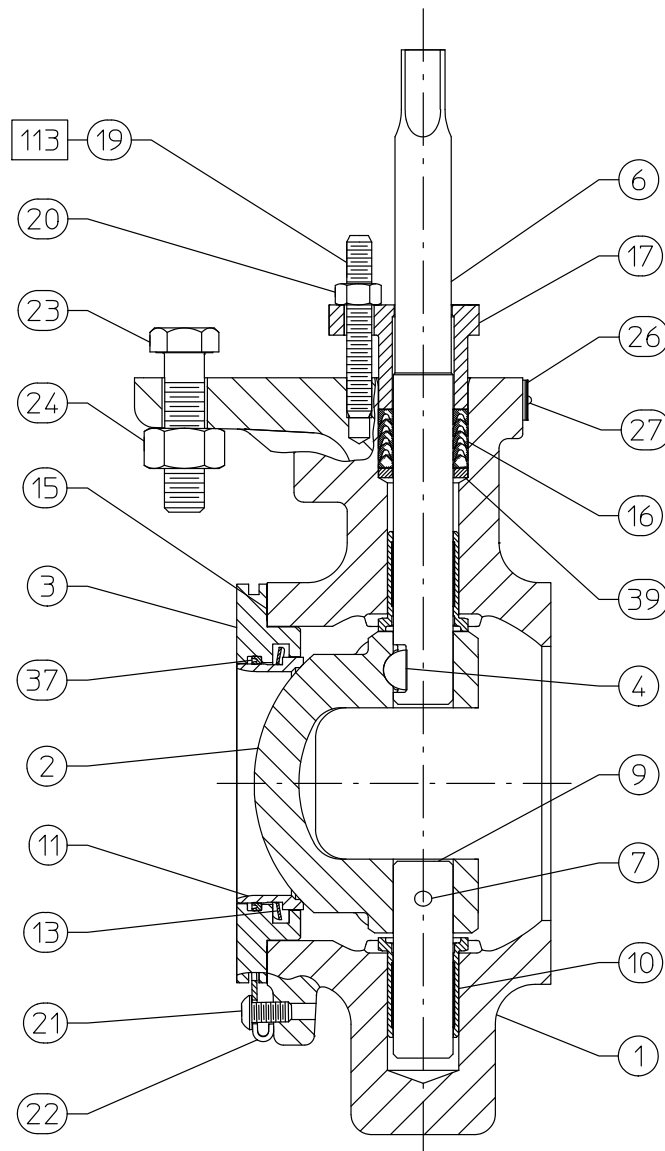
Figure 16. Fisher V200U DN 25, 40, and 50 (NPS 1, 1-1/2, and 2) Cross Sectional View



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NOTE:
KEYS 27, 28, 30, 31, 32, 35, 36, 51, 53 AND 62 ARE NOT SHOWN.

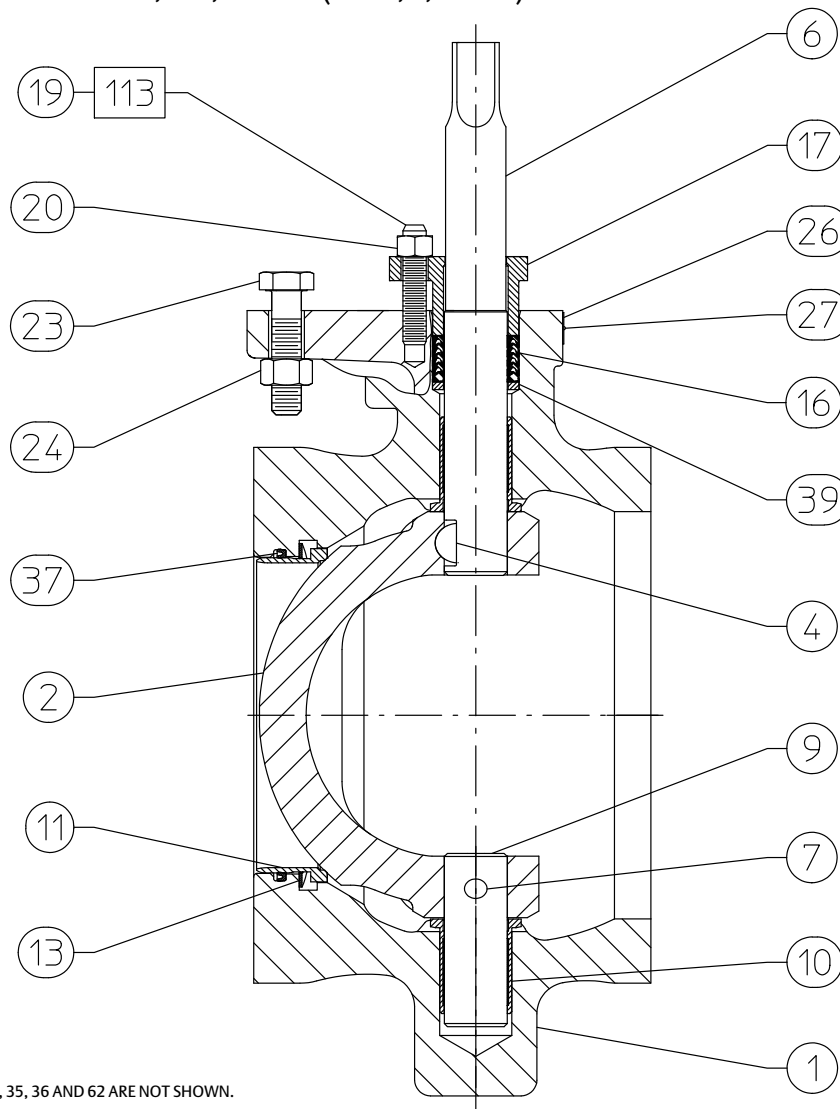
Figure 17. Fisher V200U DN 80 and 100 (NPS 3 and 4) Cross Sectional View



CG67035

NOTE:
KEYS 28, 30, 31, 32, 35, 36 AND 62 ARE NOT SHOWN.

Figure 18. Fisher V200U DN 150, 200, and 250 (NPS 6, 8, and 10) Cross Sectional View



GG67091

NOTE:
KEYS 28, 30, 31, 32, 35, 36 AND 62 ARE NOT SHOWN.

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Fisher™ Yarway™ AT-18/28, AT-38/48, and TempLow 4300 Desuperheater

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Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and operation information for the Fisher Yarway AT-18/28, AT-38/48, and TempLow 4300 variable orifice desuperheaters. Refer to separate instruction manuals for information on the actuator and accessories.

Figure 1. Fisher Yarway Desuperheaters



Table 1. Specifications

Available Types Forged Design: Yarway AT-18/Yarway AT-28, Fabricated Design: Yarway AT-38/Yarway AT-48, Cast Design: Yarway TempLow 4300 series Common Characteristics: ■ Desuperheaters with ASME flange connections are designed according to ASME B16.34 – Valves Flanged, Threaded, and Welding End ■ Desuperheaters with EN flange connections are designed in accordance with EN12516 – Industrial Valves-Shell Design Strength Body Style and Flow Direction Angle Body and Flow Down Configurations⁽¹⁾ and Valve Size: See table 1 and figures 10, 11, and 12 End Connections Styles^(1,2) See table 1 Maximum Inlet Pressure and Temperature⁽¹⁾⁽²⁾ Consistent with ASME B16.34 and EN1092-1, unless limited by maximum pressure drop or material temperature capabilities Pressure Drop⁽¹⁾ Min pressure drop depends on nozzle selection (1 or 2 bar) 1 to 59 Bar: A to D_x nozzles in S41000 stainless steel 2 to 59 Bar: E to K nozzles in S41000 stainless steel 60 to 100 Bar: Alloy 6 material nozzle Pressure Drop Limitation: 100 Bar⁽³⁾	Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4 Standard: Class V Flow Coefficients See Yarway AT-18/28, AT-38/48 and TempLow 4300 Insertion Style Desuperheater Bulletin (D104714X012) Packing Arrangements Single Graphite Nozzle Material Selection See Yarway AT-18/28, AT-38/48 and TempLow 4300 Insertion Style Desuperheater Bulletin (D104714X012) Material Temperature Capabilities⁽¹⁾ See table 2 Approximate Weight See table 3 Maximum Water Flow Capacity in Continuous Service Yarway AT-18 and AT-38: 25 m³/hr (110GPM) Yarway AT-28 and AT-48: 50 m³/hr (220GPM) Yarway TempLow 4300: 25 m³/hr (110GPM)
--	--

1. Do not exceed the pressure or temperature limits in the Yarway AT-18/28, AT-38/48 and TempLow 4300 Insertion Style Desuperheater Bulletin (D104714X012) nor any applicable code or standard limitations.

2. EN (or other valve body material) ratings and end connections can usually be supplied; consult your [Emerson sales office](#).

3. Consult your Emerson sales office for additional product options when maximum pressure drop exceeds 100 bar.



Do not install, operate, or maintain a Yarway AT-18/28, AT-38/48, and TempLow 4300 Desuperheater without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson sales office before proceeding.

Description

The Yarway AT-18/28 is a heavy duty A.T.-temp desuperheater with a forged body construction is specially designed for use on medium to high-pressure steam applications. The design is adaptable to various boiler codes and material specifications. The piston and stem are nitrided to give long life and galling resistance. Piston rings are specially hardened and subsequently nitrided and are provided with a special liquid tight slot. These rings offer running properties and enable controllable C_v (K_v) values as low as 0.005 C_v (0.0043 K_v).

The Yarway 38/48 is a standard duty A.T.-temp desuperheater is developed for use on low to medium pressure applications. The fabricated construction makes it easily adaptable to meet various boiler codes and material specifications. The unit can also be used as a liquid into gas injector for which high grade alloy such as stainless steel is often used. The vital trim components are similar to those used in Yarway AT-18/28 heavy duty A.T.-temp desuperheaters.

The Yarway TempLow 4300 desuperheater comes in standard constructions. The cast body mounts through a 3-inch flange in the steam line and is available in a wide variety of characteristics. Water pressure 3.5 to 100 bar (50 to 1450 psi) above steam pressure is employed to generate thin-film, conical sprays which are injected into the steam flow through a series of vortex spray nozzles. The fine spray evaporates rapidly in the steam, thereby minimizing the tendency for spray water to accumulate in the line.

Educational Services

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Principle of Operation

Fisher Yarway AT-18/28, AT-38/48, and TempLow 4300 Desuperheaters can be used in many applications to efficiently reduce the temperature of superheated steam to the desired set point. These desuperheaters are of insertion style with angle body design and integrated spray water control. General applications are:

- Cooling of process steam or gas
- Boiler superheater attemperator
- Boiler reheater attemperator
- Auxiliary steam desuperheating (e.g. steam let down stations)

The Fisher Yarway AT-18/28, AT-38/48, and TempLow 4300 Desuperheaters regulate the amount of injection water by varying the number of open injection spray nozzles. This enables the water pressure at the nozzles to remain constant, independent of the number of injection nozzles in operation. This results in a near uniform spray over the entire operating range. Control of the nozzle opening is achieved by the positioning of a piston which is operated directly by an actuator mounted on the desuperheater. Because of this feature, a separate spraywater control valve is not required.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Yarway Desuperheaters

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Instruction Manual

D104773X012

Table 1. Yarway Available Valve Connections

TYPE	STEAM FLANGE SIZE			WATER FLANGE SIZE ⁽¹⁾			STEAM PIPE SIZE
	NPS	ASME B16.5 Ratings	Connection ⁽²⁾	NPS	ASME B16.5 Ratings	Connection ⁽²⁾	NPS
AT-18	3	CL600-2500	RF, RTJ	1, 1-1/2, 2	CL600-2500	RF, RTJ	6-48
AT-28	4	CL600-2500	RF, RTJ	1-1/2, 2, 3	CL600-2500	RF, RTJ	8-48
AT-38	3	CL150-1500	RF, RTJ	1, 1-1/2, 2	CL150-1500	RF, RTJ	6-48
AT-48	4	CL150-1500	RF, RTJ	1-1/2, 2, 3	CL150-1500	RF, RTJ	8-48
TempLow 4300	3	CL150-1500	RF, RTJ	1	CL150-1500	RF, RTJ	6-16
	DN	EN1092-1 Ratings	Connection ⁽²⁾	DN	EN1092-1 Ratings	Connection ⁽²⁾	DN
AT-18	80	PN100-400	Type B1, B2 (RF)	25, 40, 50	PN100-400	Type B1, B2 (RF)	150-1200
AT-28	100	PN100-400	Type B1, B2 (RF)	40, 50, 80	PN100-400	Type B1, B2 (RF)	200-1200
AT-38	80	PN10-250	Type B1, B2 (RF)	25, 40, 50	PN10-250	Type B1, B2 (RF)	150-1200
AT-48	100	PN10-250	Type B1, B2 (RF)	40, 50, 80	PN10-250	Type B1, B2 (RF)	200-1200

1. Water flange class rating must be equal or greater to the body flange class rating.
2. End connection style abbreviations: RF-Raised Face, RTJ-Ring Type Joint.

Table 2. Yarway AT and TempLow 4300 Shell Temperature

TYPE ⁽³⁾	BODY FLANGE MATERIAL ⁽¹⁾	OPERATING TEMPERATURE	
		°C	°F
AT-38/48	SA105	-29 to 427	-20 to 800
	F11	-29 to 538	-20 to 1000
	304 SST		
	316 SST		
	SA105/1.0460 ⁽²⁾	-29 to 427	-20 to 800
	1.7335	-29 to 538	-20 to 1000
AT-18/28	F22	-29 to 593	-20 to 1100
	F91		
	F347H		
	1.7383		
	1.4903		
	1.4550		
TempLow 4300	WC6	-29 to 538	-20 to 1000

1. For availability of materials other than those listed, consult your [Emerson sales office](#).
2. SA105 / 1.0460 material is available for PED.
3. CL150 terminates at 538°C (1000°F).

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Yarway Desuperheaters

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Table 3. Yarway AT and Templo 4300 Weights

TYPE	ASME PRESSURE RATING	WEIGHT	
		kg	lb
AT-18	CL600	50	110
	CL900	64	140
	CL1500	68	150
	CL2500	88	195
	PN100/160	52	115
	PN250	60	135
	PN320	70	155
AT-28	PN400	84	190
	CL600	80	180
	CL900	88	195
	CL1500	106	235
	CL2500	144	315
	PN100/160	80	180
	PN250	96	210
AT-38	PN320	120	265
	PN400	152	335
	CL150	28	60
	CL300	30	65
	CL600	32	70
	CL900	44	95
	CL1500	50	110
	PN10/16	26	60
	PN25/40	28	60
	PN63	32	70
	PN100	34	75
AT-48	PN160	36	80
	PN250	44	95
	CL150	46	105
	CL300	52	115
	CL600	60	130
	CL900	70	155
	CL1500	74	165
	PN10/16	44	95
	PN25/40	46	100
	PN63	50	110
	PN100	56	125
Templo 4300	PN160	60	130
	PN250	70	155
	CL150	39	86
	CL300	43	95
	CL600	45	100
	CL900	53	116
	CL1500	60	132

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the desuperheater is installed where service conditions could exceed the limits given in table 1 or on the nameplate. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the desuperheater configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and fluid conditions. Do not apply any other conditions to the desuperheater without first contacting your [Emerson sales office](#)

System Considerations

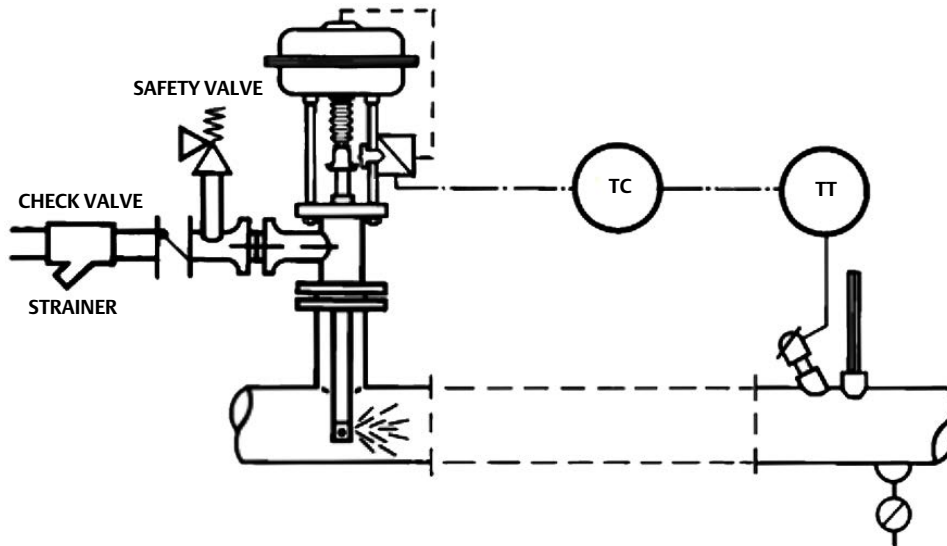
Note

The desuperheater water supply should be of good quality, clean and filtered – for example, boiler feed water – and should have a constant pressure as specified in the order documents. Each water supply line should be protected with its own individual strainer, Emerson recommends a strainer with a mesh size of approximately 100 mu (400 mu upon request) in the water supply line to protect the Desuperheater from clogging.

- Where there are positive shut-off components in the water supply, including electric actuators, then a safety relief valve of an approved type should be fitted.
- A straight run of pipe is required downstream of the desuperheater to ensure complete vaporization of the cooling water. Consult the desuperheater sizing sheet for installation recommendations, including the recommended straight pipe distance required.
- A temperature sensor should be mounted in accordance with the manufacturer's instructions. The recommended distance from the desuperheater to the temperature sensor changes with the velocity and percentage of spraywater required. Consult the desuperheater sizing sheet for installation recommendations, including the recommended distance required before the temperature sensor.
- Allow no branching out from the steam line, to divide or to add to the steam flow, between the temperature sensor and the desuperheater.

A typical control loop is illustrated in figure 2. A temperature sensor generates a signal (pneumatic or digital) through a transmitter. This signal is transmitted to the positioner on the desuperheater. The positioner output signal is piped to the actuator, which strokes the desuperheater governing the amount of spraywater flow.

Figure 2. Typical Control Loop with the Yarway Desuperheater



Preliminary Checks

1. Check that the information on the documentation, identification plate, and tag number complies with the order specification.
2. Check the desuperheater, actuator and accessories for any visible damage.
3. Remove the desuperheater carefully from its packaging, lifting by appropriately positioned straps around the body.

⚠ WARNING

To prevent personal injury and damage to equipment, do not use the water inlet connection, yoke, actuator or any of its accessories for lifting.

4. Leave the flange covers in place during transportation, until ready to install in the piping.

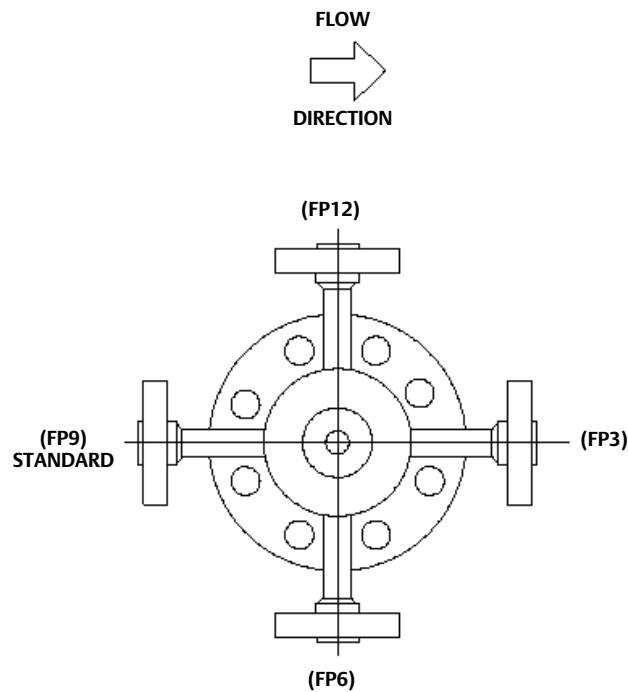
Mounting Considerations

⚠ WARNING

Personal injury could result from packing leakage. Packing was tightened prior to shipment. However, some readjustment will be required to meet specific service conditions.

- When installing the desuperheater, use gaskets and bolting material in accordance with the relevant piping code.
- Place the gasket onto the mounting flange and carefully insert the nozzle into the branch pipe.
- Ensure that the spray cylinder is pointed in the direction of the steam flow before tightening the mounting bolts. Reference figure 3 for water flange positions.

Figure 3. Yarway Desuperheater Water Flange Positions



Note

The desuperheater should be free of forces, moments, and torques.

- The desuperheater is provided with a lower body length, as specified in the general arrangement drawing and the mounting branch for the steam pipework must be manufactured to suit.
- The length of the T-dimension in figure 4, should be such that, the centerline of the spray cylinder is located on the centerline of the steam pipe (figure 6).
- The mounting branch should be NPS 3 (DN 80) or NPS 4 (DN 100) nominal bore, maximum pipe schedule 160 for clearance purposes (check the applicable power piping code).

Figure 4. Yarway Desuperheater T Dimension

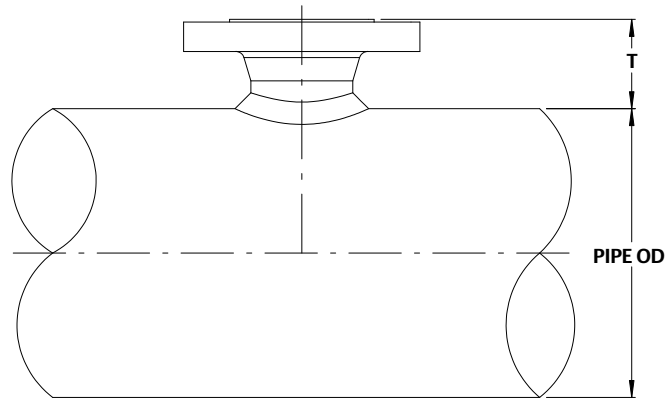
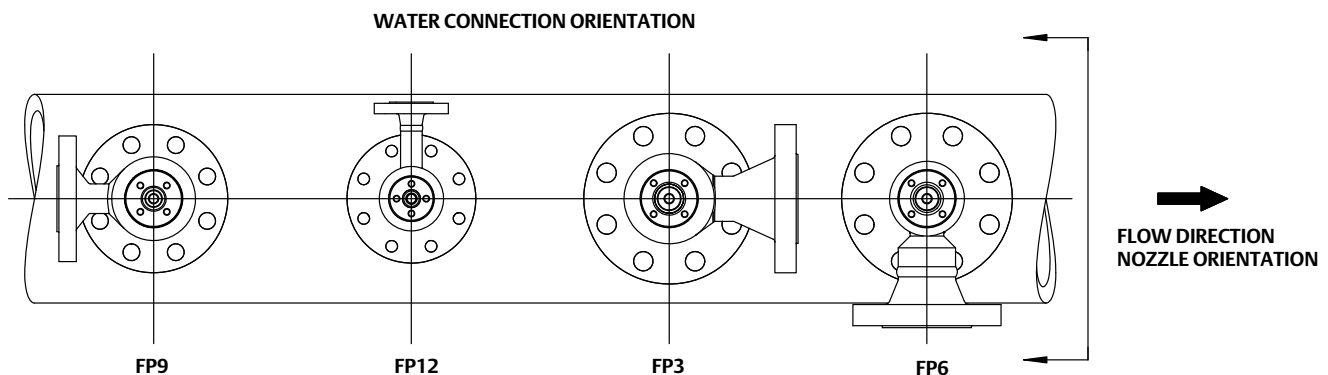


Figure 5. Yarway Desuperheater Mounting Orientations



- The "vertical-up" position is preferred for the valve stem and actuator.
- Consult actuator documentation for assistance in actuator assembly.
- Installation may be in vertical or horizontal, but the direction of water injection should always be with the steam flow.
- The desuperheater may be mounted at 90° to the steam pipe, for all steam flow orientations, but avoid installation in the vertically downwards position, wherever possible.

Note

Horizontal oriented desuperheater must be installed with a support for weight compensation. Consideration must be given to supporting the actuator.

Maintenance

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the desuperheater.
- Use bypass valves or completely shut off the process to isolate the desuperheater from process pressure. Relieve process pressure from both sides of the desuperheater. Drain the process media from both sides of the desuperheater.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Nozzle Maintenance

Note

The spray cylinder is an assembly. Do not completely disassemble the individual nozzles.

Inspection Considerations

When subjected to normal operating conditions, thermal cycling does occur and temperature differentials at the desuperheater are usually the highest in the plant, it is possible that wear, blockage, and/or weld fatigue will occur to the desuperheater body or nozzle assembly.

- Wear is defined as any nicks, cuts, or gouges.
- Erosion/corrosion is defined as any form of rust or erosion of the metal on the nozzle.
- Blockages are defined as small particulate trapped within the nozzle.
- Weld fatigue is defined as appearance of cracks.

Spray cylinder (key 1), fastener ring (key 4), piston/stem assembly (key 3) and piston rings (key 2) are to be considered wear parts. During regularly scheduled maintenance (table 4), visually inspect the desuperheater welds for cracks and inspect nozzles for wear and blockage. Poor performing nozzles or nozzle failure is typically caused by wear, corrosion, erosion, and/or blockage. The following instructions will help to determine if any of these problems are present and provide a recommended course of action for each.

Table 4. Recommended Inspection and Replacement Schedule

Key	Part Name	Recommended Inspection	Recommended Replacement
1	Yarway Spray Cylinder	Inspect after first year of service and once every two years thereafter.	Once every 5 years of service
2	Piston Rings	N/A	Any time the unit is disassembled. Once every 5 years of service
3	Piston/Stem Assembly	N/A	Once every 5 years of service
4	Fastener Ring and Tack Welds	After first year of service	Once every 5 years of service
See Parts List	Packing Components	See Parts List	Any time the unit is disassembled

Inspection Procedure

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

Disassembly Procedure

1. Disconnect all external connections. Consult actuator documentation for assistance in actuator removal.
2. Ensure that there is no residual pressure in either the steam or water lines.
3. Loosen steam flange and water flange bolting, but vent connections before complete removal.
4. The desuperheater may now be removed from the system.
5. Carefully lift the desuperheater using accepted lifting and rigging practices. Follow the lifting warning and instructions provided in the Preliminary Checks section. Ensure all accessories and all sealing surfaces are protected from damage during lifting.
6. Disassemble when in the horizontal position with the body extension section secured.

Disassembly Procedure

1. Mark the body extension (key 5) and the spray cylinder (key 1) with witness marks to ensure proper alignment at reassembly.
2. Grind off the nozzle tack welds. Make sure that the weld is removed sufficiently to allow rotation of the fastener ring (key 4) without damage.
3. Unscrew the fastener ring (key 4).
 - For AT-18/28 and AT-38/48 unscrew the fastener ring counter clockwise.
 - Threading on the body extension is right handed (key 5).
 - For TempLow 4300 unscrew fastener ring clockwise.
 - Threading on the body extension is left handed.

Note

If difficulties are encountered with the removal of the fastener ring (key 4), then the fastener ring may be removed by grinding through at two diametrically opposite points. Do not damage the body and spray cylinder threading.

Spray Cylinder Inspection

1. Inspect the condition of the cylinder internally.

- **Wear** is defined as any nicks, cuts, or gouges of the nozzle, especially in or around the orifice.
- **Erosion/corrosion** is defined as any form of rust or erosion of the metal on the nozzle.
- **Blockages** are defined as small particulate trapped within the nozzle orifice.

If any of the preceding problems are present, replacement of the spray cylinder is recommended. If not, proceed to step 2.

2. Scratches and blemishes may be removed by either polishing or honing. The cylinder bore should not exceed 32 mm (1.25 in) with a maximum eccentricity of 0.25 mm (0.009 in).
3. Debris can be removed from the nozzles by blowing through with compressed air.
4. Inspect the nozzle atomizer outlet holes. These should not show any undue elliptical wear, roughness or damage. If any are over-sized or non circular in shape, the nozzle will need to be replaced.
5. Carefully clean the cylinder threading. Where necessary, dressing with a small file.
6. Inspect seating surface. The seating surface should be clean and free from cuts, gouges or wire drawing. A proper seat shows a narrow concentric lapped seating band.
7. Clean the spray cylinder to remove scale. Thoroughly rinse.

Body Extension Inspection

1. Examine the threading on the body extension. Where necessary, dressing with a small file. If the threading is damaged, then weld repair may be possible. Contact your [Emerson sales office](#) for more information.

Piston and Stem Assembly Inspection

1. Remove the piston and stem (key 3). The piston and stem are always supplied as a complete assembly.
2. Inspect the piston for wear and tear.
3. Replace piston rings (key 2) any time that the unit is disassembled.

Note

Take care not to overstress the piston rings when fitting. The rings are marked 'top' and should always point in the direction of the packing box, for proper functioning.

4. Examine the condition of the stem. Where it runs in the packing box, remove any graphite with a fine grade emery cloth, polishing in the longitudinal direction.
5. The stem disc and seat may be lapped using a lapping compound to repair.

Packing Box Inspection

1. Remove all rings, lantern ring and packing material from the valve body.
2. Clean the packing box carefully, using a rotating wire brush and/or honing device.
3. Inspect the packing box and stem for straightness, wear, scratches, pitting and other abnormalities which would prevent establishment of a good seal around the packing.

4. If a spacer is supplied with this packing or if a spacer was removed from the packing box, make sure it is installed first. If one end of the spacer is chamfered, install chamfered end down so that it sits at bottom of packing box.

Note

Cleanliness of the packing area is vital for proper valve sealing. Do not use grease or lubricants in combination with graphite packing.

Reassembly

Reference installation content where needed in the subsequent sections of this Instruction Manual.

Packing Set Installation

Note

Packing (see Parts List) is supplied as a complete set and rings should be in same order as packaged in the set.

1. Install one ring at a time using a packing driver or gland bushing. Measure the depth of the packing box before and after ring insertion to be certain that it has traveled to the bottom of the packing box. Each ring must be seated individually with a packing driver. Pre-compression of each ring during installation is very important for the tightness of the seal.

NOTICE

Do not use screwdriver or other sharp object to install the packing. This could damage the packing and/or stem. If a packing driver is used, make sure that the diametrical clearances between the inner dimension (ID) of the driver and outer dimension (OD) of the stem and the OD of the driver and ID of the stuffing box do not exceed 0.5 mm (0.020 inch).

2. Stagger the joints (if present) on each successive ring 180° apart.
3. Check packing rings for proper fit. They should be push fit into packing box.

Note

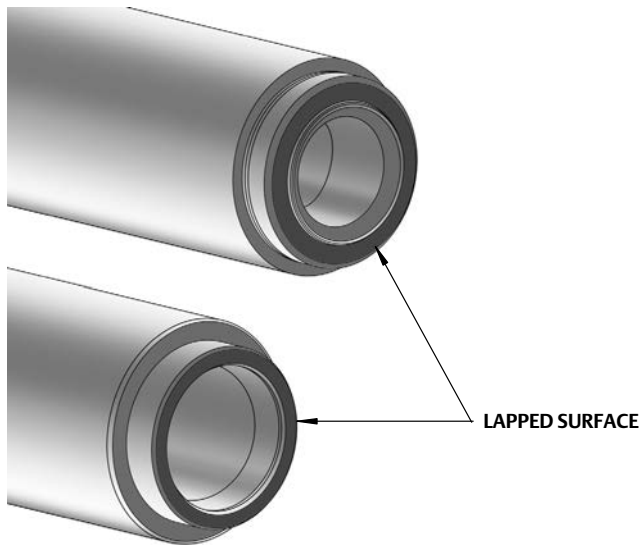
Do not over compress the packing. The amount of compression should be only that which is required to the install the correct number of rings into the stuffing box. Compression of the packing in a partially filled packing box, to make room for the rest of the packing, can be accomplished using the gland bushing and taking up on the gland nuts.

4. After all packing rings are installed, thoroughly lubricate the studs and insert the packing follower and the packing flange (see Parts List).
5. Tighten the hex nuts to 45 N • m

Spray Cylinder Reassembly

1. Apply a thin coating of the lapping compound to the piston rings to prevent scoring. Position the slots in the piston rings (key 2), such that they are at 120° to each other.
2. Lapping spray cylinder (key 1) / seat surfaces (key 5) together. Use a fine grade polishing paste to lap the seating area of cylinder and body extension. The seal is metal to metal so a concentric seat area is vital.

Figure 6. Lapped Surfaces



3. Clean lapped surfaces before mounting.

Note

Always use a new fastener ring.

4. Mount fastener ring on the spray cylinder.
5. Mount fastener ring and spray cylinder on the body.
 - For AT-18/28 and AT-38/48 screw the fastener ring clockwise.
 - Threading on the body extension is right handed (key 5).
 - For TempLow 4300 screw the fastener ring counter-clockwise.
 - Threading on the body extension is left handed.

Note

For a two-column cylinder, the middle of two columns needs to be the centerline of spray cylinder when aligning with the water flange position, (figure 7). For a three-column cylinder, the middle column needs to be the centerline of spray cylinder when aligning with the water flange position.

Figure 7. Two-Column Spray Cylinder

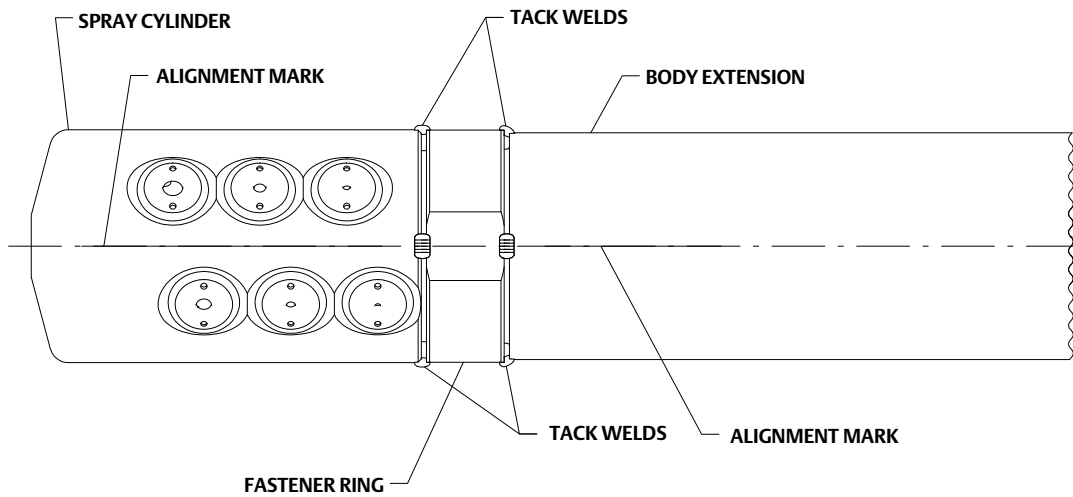
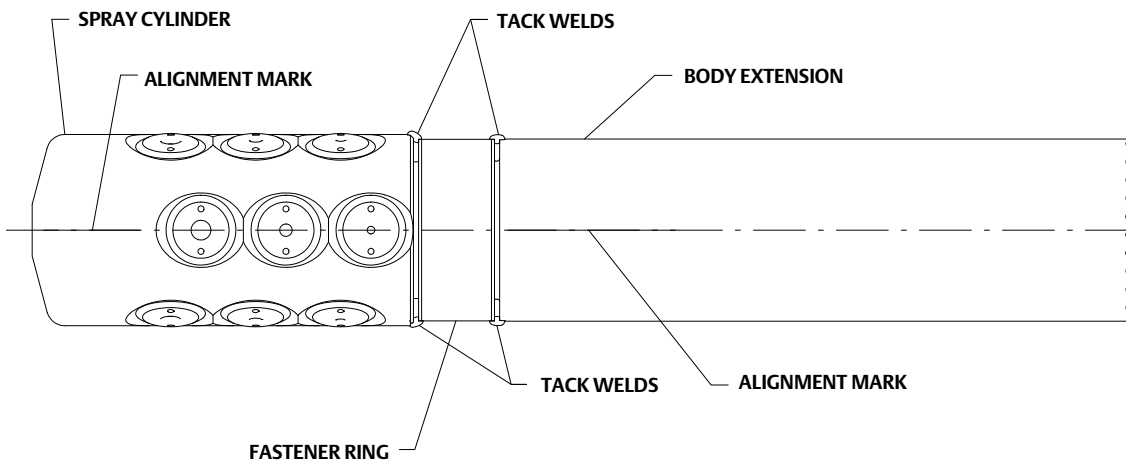
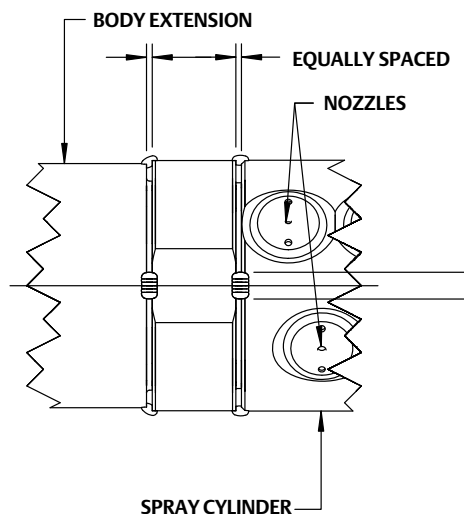


Figure 8. Three-Column Spray Cylinder



6. Center spray cylinder. The gap at both side of fastener ring should be equal. 0.4 mm (1/64 inch) minimum, (figure 9).
7. Align spray cylinder with reference to water flange according to required position in general arrangement drawing, (figure 3 and 5).
8. Once positioned with reference to water flange, align the centerline of the spray cylinder.
9. Tighten fastener ring (key 4).
10. Tackweld between fastener ring and spray cylinder. Tackweld fastener ring and body to prevent unthreading. Place multiple welds around the unit (see figure 9).

Figure 9. Tackweld Details



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Troubleshooting

The following guide (table 2) is a basic first line troubleshooting guide. Contact your [Emerson sales office](#) for assistance if you are unable to resolve your field operation problem.

Table 2. Fisher Yarway AT-18/28, AT-38/48, and TempLow 4300 Desuperheater Troubleshooting

Problem	Reason	Possible Solution
Low temperature	Valve cycling, low system flow, valve throttling too close to seat	Reduce water pressure. Must be steam saturated pressure plus 50 psi
	Controller action reversed	Check system signal sense
	Water pressure too high	Reduce inlet water pressure
	Valve does not shut off	1. Check valve stroke 2. Check Instrument Signal (IS) shutoff point
	Valve seat leakage indicated	Secure system and evaluate seat leakage
High temperature, no control	Water pressure at valve inlet less than specified	1. Open water valve 2. Blow down strainer 3. Check supply pressure
	Air pressure to actuator/positioner	1. Air pressure too low. Adjust to 40-50 psi 2. Clean air set filter 3. Blow down air supply line 4. Check for moisture in instrument air
	Water pressure at valve as specified	1. Check valve stroke 2. Check water temperature 3. Check for valve plugging 4. Check water quality
Hunting or limit cycling	Temperature setpoint too close to saturation pressure temperature	1. Increase temperature (steam superheat) 2. Evaluate and readjust controller action
	Temperature controller tuning not correct	1. Positioner arm link bent, loose or binding
	Valve binding or friction	1. Check packing adjustment (some leakage expected) 2. Check packing gland/stem clearance 3. Use correct original type packing 4. Review positioner calibration 5. Check instrument air supply pressure

Parts Ordering

Each desuperheater is assigned a serial number that can be found on the desuperheater nameplate attached to the body or on a tag attached to the water pipe. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering a replacement parts, refer to the serial number and key number. The key numbers in figure 7, 8, and 9 can be used to help in part identification.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher Yarway desuperheater, because they may void your warranty, might adversely affect the performance of the desuperheater, and could cause personal injury and property damage.

Parts List

Note

Contact your Emerson sales office for Part Ordering information.

AT-38/48 (figure 11)

Key	Description
1*	Spray Cylinder
2*	Piston Rings
3*	Piston / Stem Assembly
4*	Fastener Ring
5	Body Assembly
6	Body Flange
7	Flange Adaptor
8	Water Flange
9	Spacer
10	Body Flange
11*	Packing Set
12	Bolt Stud
13*	Packing Follower
14*	Packing Flange
15*	Yoke Locknut
16	Nord-Lock Washer

AT-18/28 (figure 10)

Key	Description
1*	Spray Cylinder
2*	Piston Rings
3*	Piston / Stem Assembly
4*	Fastener Ring
5	Forging Body
6	Weld Neck Flange
7	Spacer
8	Hex Nut
9*	Packing Set
10	Bolt Stud
11*	Packing Follower
12*	Packing Flange
13*	Yoke Locknut

TempLow 4300 (figure 12)

Key	Description
1*	Spray Cylinder
2*	Piston Rings Set
3*	Piston / Stem Assembly
4*	Fastener Ring
5	Welded Lower Body
6	Upper Body
7	Cap Screw Set
8*	Packing Set
9*	Packing Follower
10*	Packing Flange
11*	Yoke Locknut

Figure 10. Fisher Yarway AT-18/28 Desuperheater Assembly

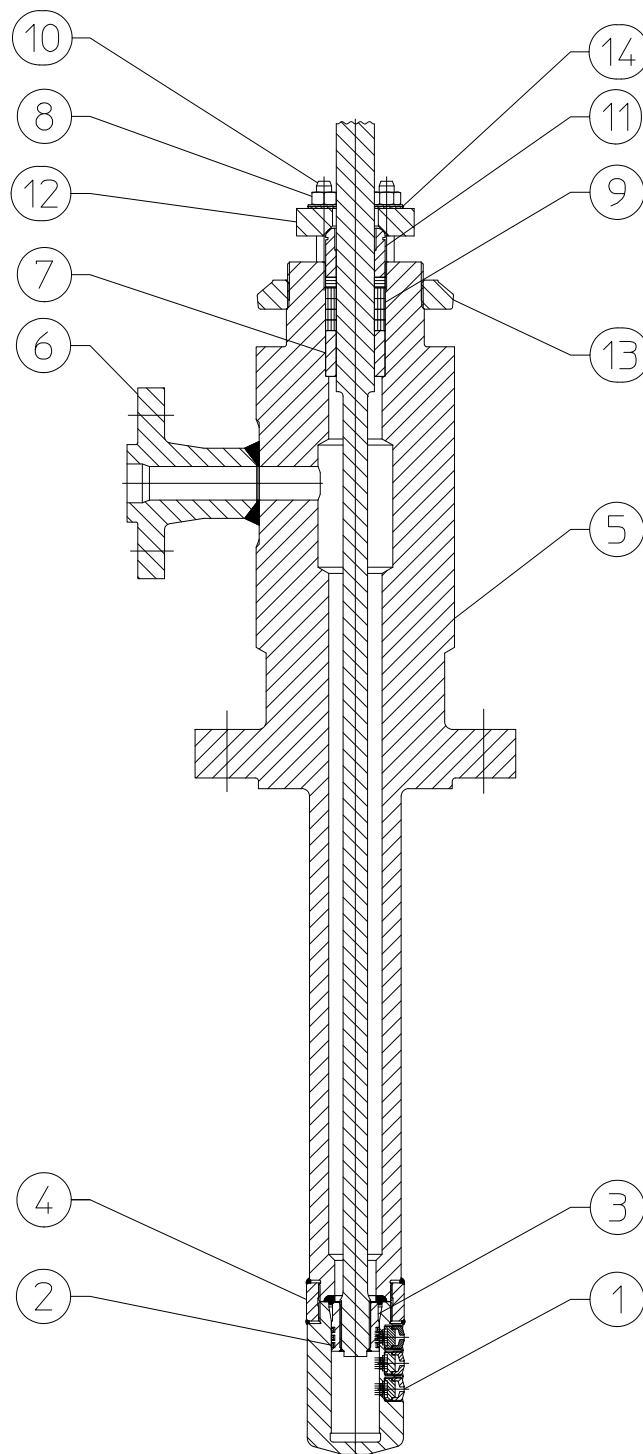


Figure 11. Fisher Yarway AT-38/48 Desuperheater Assembly

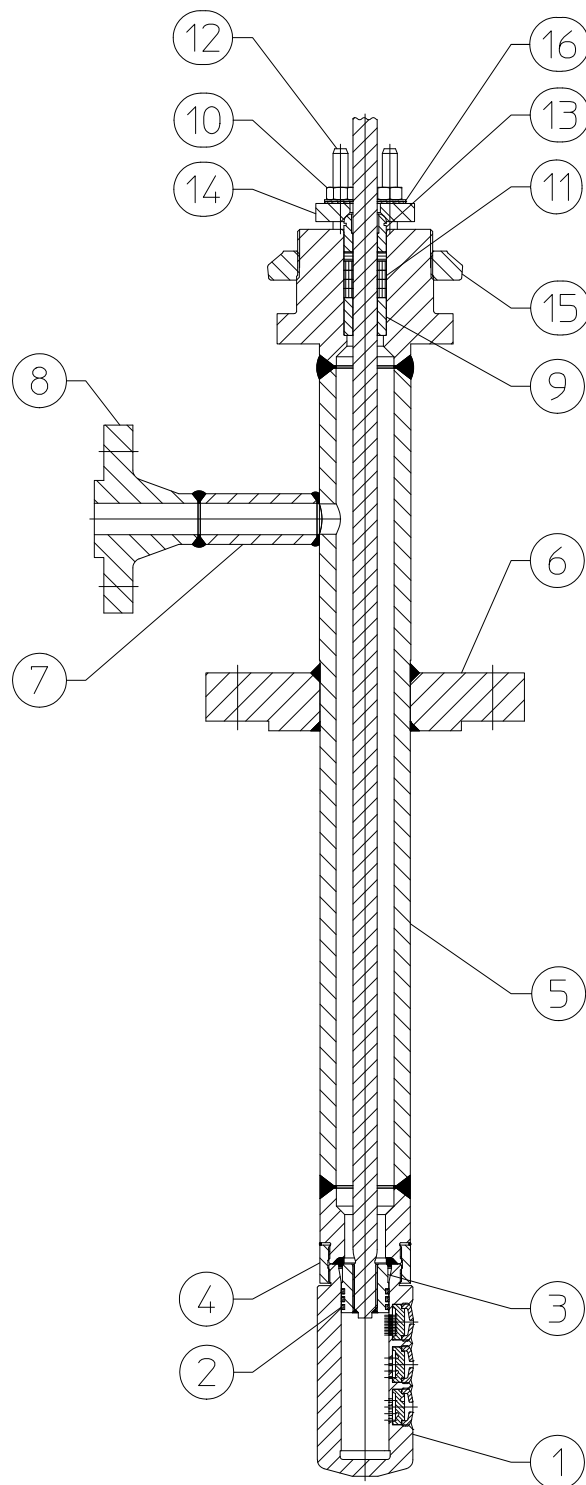
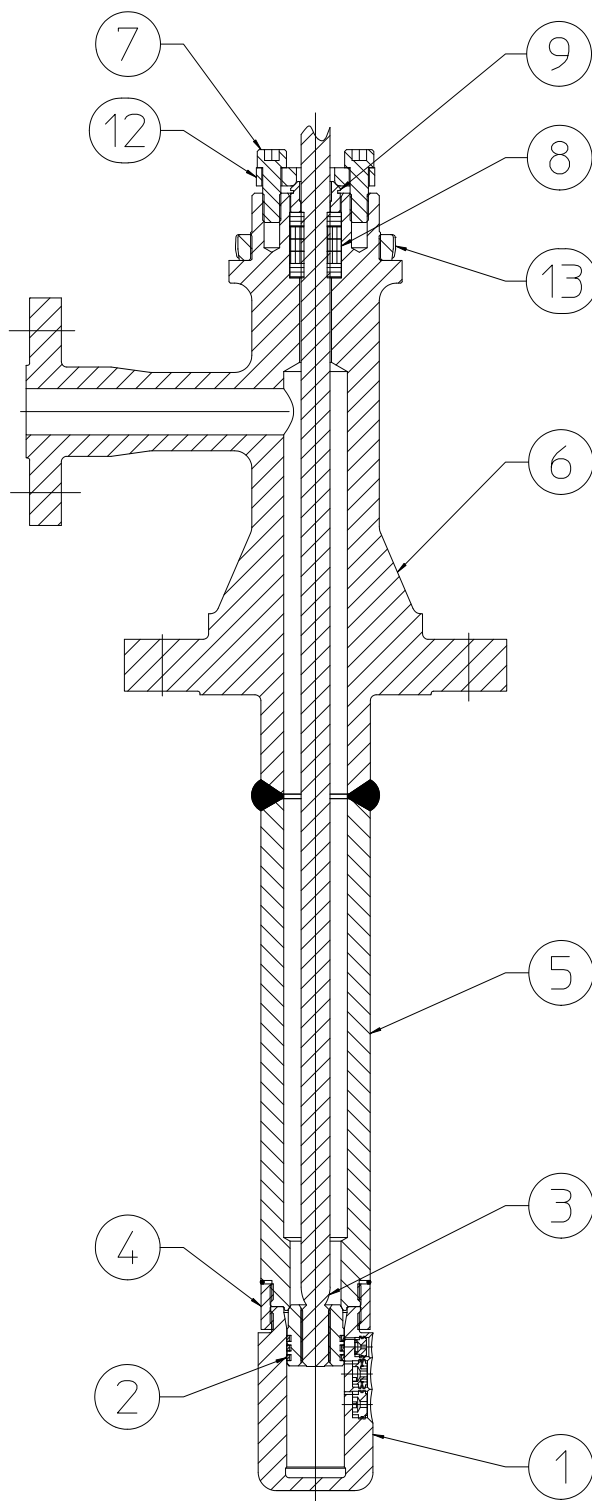


Figure 12. Fisher Yarway TempLow 4300 Desuperheater Assembly



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Yarway Desuperheaters

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Fisher™ Yarway™ AT-25 VenTemp Desuperheater

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Figure 1. Fisher Yarway AT-25 VenTemp Desuperheater



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Introduction

Scope of Manual

This instruction manual includes installation and operation information for the AT-25 Desuperheater.



Do not install, operate, or maintain a AT-25 Desuperheater without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The AT-25 Desuperheater offers efficient desuperheating in steam pipelines of NPS 16 and less. It is designed primarily for use in low-capacity superheated steam systems where the load is fairly constant. By utilizing a spray nozzle assembly that is removable from outside the desuperheater assembly, the AT-25 provides a venturi solution while maintaining a high level of serviceability.

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AT-25 VenTemp Desuperheater

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Table 1. Specifications

Steam Line Connections ■ BWE per ASME B16.25 or DIN 2559 ■ NPS 2 through 16, CL150 to 2500 ■ DN 50 through 400, PN25 to 400 Spraywater Connections ■ RF per ASME B16.5 or Type B per EN 1092-1 ■ NPS 1/2 through 2, CL150 to 2500 ■ DN 15 through 50, PN10 to 400 Maximum Inlet Pressure and Temperature⁽¹⁾ Consistent with applicable pressure-temperature ratings per ASME B16.34 or EN 12516-1	Spraywater Flow Coeffecients ■ Minimum C_v: 0.016 (K_v: 0.014) ■ Maximum C_v: 14.708 (K_v: 12.723) Spraywater Pressure Required 0.4 to 35 bar (6 to 500 psi) greater than steam line pressure – depending on nozzle selection Construction Materials⁽²⁾ ■ SA105, ■ SA182 F11, ■ SA182 F22, ■ SA182 F91, ■ P250GH, ■ 1.7335, and ■ 1.7380
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1. The pressure or temperature limits in the referenced tables and any applicable code or standard limitations should not be exceeded.

2. For availability of materials other than those listed, consult your [Emerson sales office](#).

Educational Services

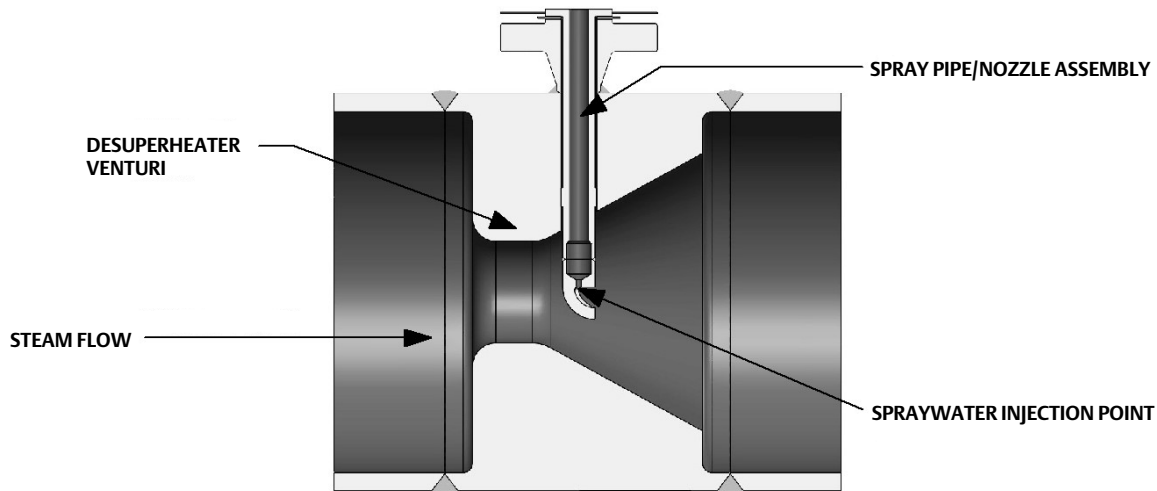
Emerson Educational Services

Phone: 1-800-338-8158

E-mail: education@emerson.com

emerson.com/mytraining

Figure 2. Detail View of the Fisher Yarway AT-25 Desuperheater



Principle of Operation

Superheated steam flowing along the steam line enters the AT-25 Desuperheater throat, increasing its velocity, while reducing its pressure. This change from static to dynamic pressure is utilized to disintegrate the spraywater, injected from the spray nozzle within the venturi region. Directly after the throat area, the venturi profile is interrupted and the flow area drastically increased, resulting in intense turbulence and enhanced mixing of water and steam.

The outlet steam temperature is controlled by regulating the flow of cooling water by means of a conventional control valve. Spraywater flow is throttled as the control valve responds to the signal generated by the temperature control loop. The spraywater enters the desuperheater water connection and then continues into the spray nozzle. As the flow area is reduced, the spraywater accelerates through the injection point. The accelerated flow results in a fine spray for efficient and rapid evaporation.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the AT-25 desuperheater is installed where service conditions could exceed the limits given in table 1 or on the nameplate. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the desuperheater configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and fluid conditions. Do not apply any other conditions to the desuperheater without first contacting your [Emerson sales office](#)

System Considerations

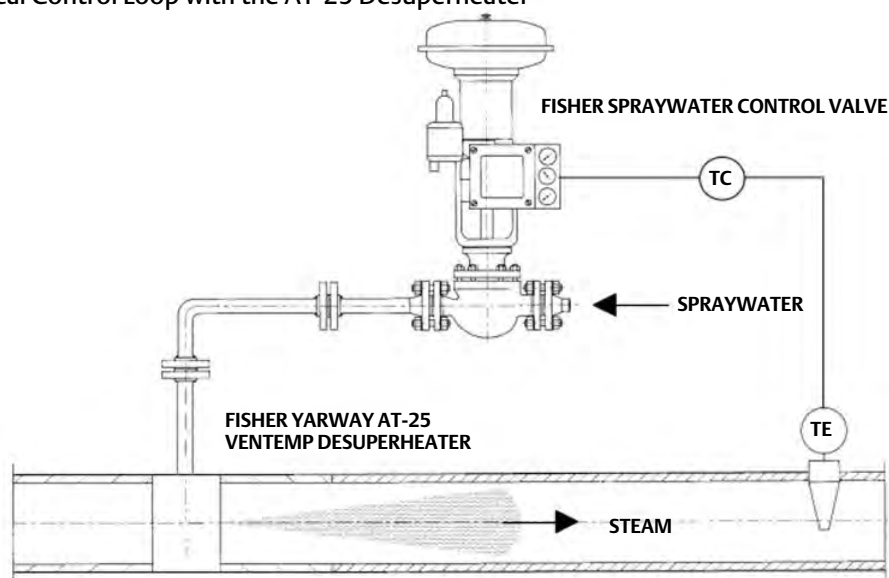
Note

The desuperheater water supply should be of good quality, clean and filtered – for example, boiler feed water – and should have a constant pressure as specified in the order documents. Each water supply line should be protected with its own individual strainer. For nozzle sizes N01 through N03, a mesh size of 40 is recommended. For nozzle sizes N04 and above, a mesh size of 20 is recommended.

- A straight run of pipe is required downstream of the desuperheater to ensure complete vaporization of the cooling water. Consult the desuperheater sizing sheet for installation recommendations, including the recommended straight pipe distance required.
- A temperature sensor should be mounted in accordance with the manufacturer's instructions. The recommended distance from the desuperheater to the temperature sensor changes with the velocity and percentage of spraywater required. Consult the desuperheater sizing sheet for installation recommendations, including the recommended distance required before the temperature sensor.
- Allow no branching out from the steam line, to divide or to add to the steam flow, between the temperature sensor and the desuperheater.

A typical control loop is illustrated in figure 3. A temperature sensor generates a signal (pneumatic or digital) through a transmitter. This signal is transmitted to the positioner on the spraywater control valve. The positioner output signal is piped to the actuator, which strokes the spraywater control valve governing the amount of spraywater flow.

Figure 3. Typical Control Loop with the AT-25 Desuperheater



Preliminary Checks

1. Check that the information on the documentation, identification plate, and tag number complies with the order specification.
2. Remove the AT-25 Desuperheater carefully from its packaging. Do not use the water inlet connection for lifting.
3. Before installation, check the AT-25 Desuperheater for any visible damage. Make sure that the protective covers are removed, and that butt weld ends and flange faces are clean and without blemish. Any damage to the unit should be reported immediately to your [Emerson sales office](#).

Mounting Considerations

- When installing the AT-25 Desuperheater, use gaskets and bolting material in accordance with the relevant piping code.
- To reduce the risk of spray nozzle clogging, it is recommended that the unit be installed with the water connection vertically upward.
- Buttweld AT-25 Desuperheaters should be welded inline using proper weld procedures.
- Post-weld heat treatment should be done with the pipeline filled with an inert gas (oxidation of the vena contracta area may lead to a significantly higher pressure drop over the AT-25 than calculated).
- Flush out the water line before connecting to the AT-25 Desuperheater mounting flange.
- For an installation example, see figure 3.

Note

The AT-25 Desuperheater should be free of forces, movements, and torques.

Maintenance

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
 - Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
 - Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
 - Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
 - Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
-

Servicing

Although the AT-25 desuperheater is a simple design requiring very little maintenance, regular service intervals require removal of the spray nozzle assembly. It may also be necessary to service the unit in the event that the spray nozzle becomes clogged by debris. Prior to removal of the nozzle from the unit, ensure that the necessary gaskets and spare nozzles (if applicable) are available for rebuild if turnaround time for the repair is critical. Do not re-use the graphite gaskets. Review the drawing and specification sheet for clarification. If in doubt as to the construction, advise your [Emerson sales office](#) of the serial number and model number and ask for further clarification.

Service Item	Recommended Service Interval
Spray Nozzle Inspection	Every 18-24 months
Spray Nozzle Replacement	Every 24-36 months

Spray Nozzle Removal

1. Before removing the spray nozzle from the desuperheater, ensure that there is no residual pressure in either the steam or water lines.
2. Loosen the water flange bolts and disconnect the water supply line from the desuperheater water flange, taking care not to damage the water flange and nozzle mounting surfaces.
3. The spray nozzle may now be removed from the desuperheater.
4. Inspect the desuperheater sealing surfaces for damage. Repair if needed.

Note

If there is damage on the gasket surfaces that is too large for field repair, the unit may require replacement.

Spray Nozzle Inspection

1. Inspect the nozzle for excessive wear, erosion/corrosion, and/or blockage due to particulate.
 - Wear is defined as any nicks, cuts, or gouges of the nozzle, especially in or around the orifice.
 - Erosion/corrosion is defined as any form of rust or erosion of the metal on the nozzle.
 - Blockages are defined as small particulate trapped within the nozzle orifice.

If any of the preceding problems are present, replacement of the nozzle is recommended. If not, proceed to step 2.

2. Thoroughly flush the nozzle after inspection.

Spray Nozzle Installation

1. Verify that all flange and nozzle gasket mating surfaces are clean and free of damage.

Note

If there is damage on the gasket surfaces that is too large for field repair, the unit may require replacement.

2. Install a new gasket at the surface between the desuperheater water flange and the nozzle mating surface.

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3. Insert the spray nozzle with the spray direction pointed in the downstream flow direction.
4. Install a new gasket at the surface between the nozzle mating surface and the water supply line flange.
5. Reconnect the water line flange connection. Use a high temperature nickel compound on the flange bolting.
6. After ensuring that the desuperheater is properly installed in the pipeline, the unit may be returned to service. The desuperheater should be monitored as the unit is brought online to ensure that there are no leaks in the connections.

Troubleshooting

The following guide (table 2) is a basic first line troubleshooting guide. Contact your [Emerson sales office](#) for assistance if you are unable to resolve your field operation problem.

Table 2. Fisher AT-25 VenTemp Desuperheater Troubleshooting

Problem	Possible Solution
Temperature setpoint is not reached	Check water source availability and pressure
	Check nozzle for plugging
	Make sure the set point is not below the saturation temperature
	Check to ensure full actuator stroke is reached
Temperature is below setpoint	Check temperature control loop – reset
	Check nozzle for fouling/poor spray pattern – clean/replace
	Check temperature sensor location – relocate per guidelines
	Tune control system parameters
Water in steam line	Temperature setpoint may be too close to saturation
	Check that steam traps are functioning properly
Water in steam line when steam line isolated	Review piping configuration for downstream tees and elbows
	Check for leakage of spraywater control valve

Parts Ordering

Each AT-25 desuperheater is assigned a serial number that can be found on the desuperheater body or on a tag attached to the water pipe. Refer to the serial number when contacting your [Emerson sales office](#) for technical assistance. When ordering a replacement nozzle, refer to the serial number and key number. The key numbers in Figure 4 can be used to help in part identification.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

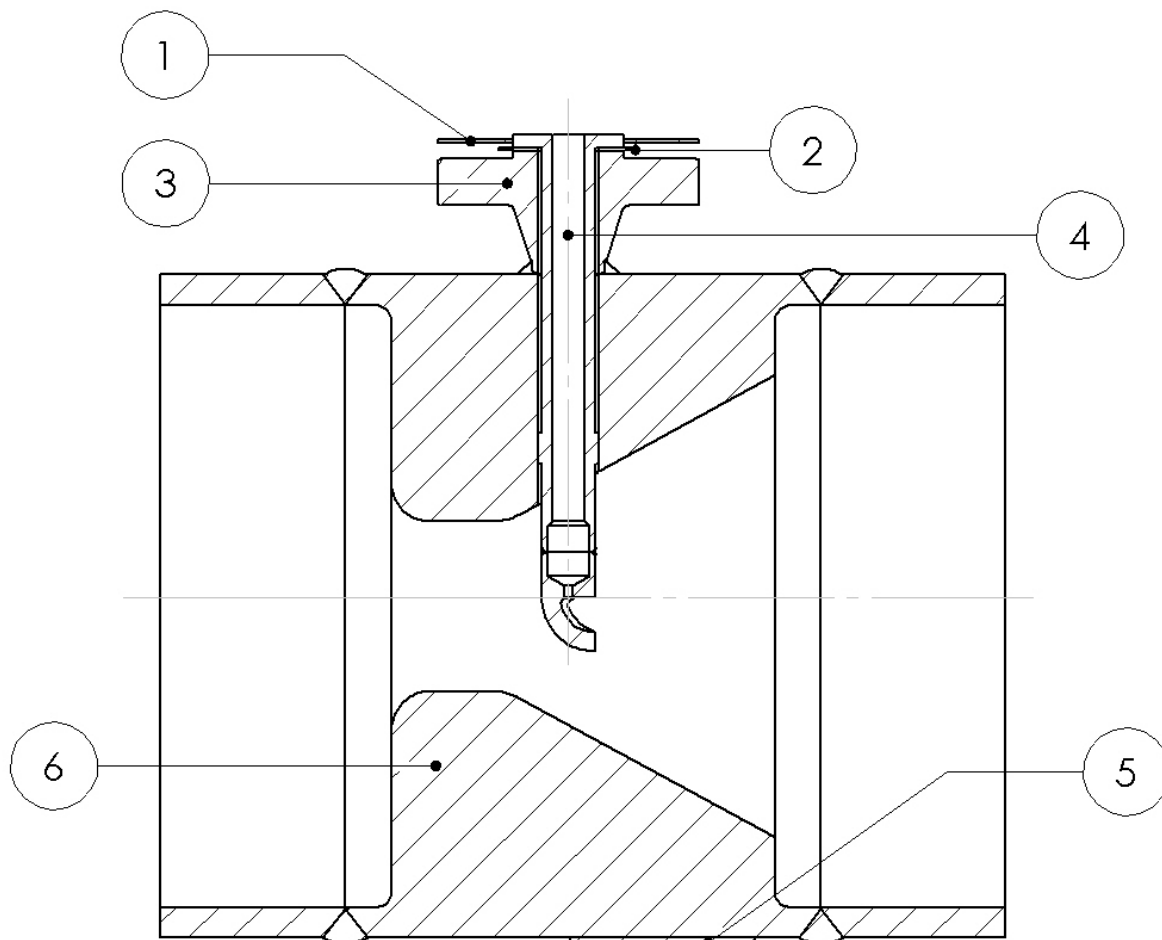
Parts List

Note

Contact your Emerson sales office for Part Ordering information.

Key	Description
1*	Spray Direction Indicator
2*	Gasket
3	Water Flange
4*	Nozzle Pipe Assembly
5	Nameplate
6	Body
	If you need a valve body as a replacement part, order the valve size, Class and desired material. Contact your Emerson sales office.

Figure 4. Fisher Yarway AT-25 VenTemp Valve Assembly



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Fisher™ YD and YS 3-Way Valves

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Figure 1. Fisher YD Valve with 667 Actuator



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Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 1/2 through 8 YD and NPS 1/2 through 6 YS control valves. Refer to separate manuals for instructions covering the actuators and accessories.

Do not install, operate, or maintain YD or YS valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Table 1. Specifications

Valve Sizes, Ratings, and End Connections^(1,2) Cast Iron Valves <i>Flanged:</i> NPS 1-1/2 through 6 CL125 flat-face or CL250 raised-face flanges per ASME B16.1 <i>Screwed:</i> NPS 1-1/2 and 2 consistent with ASME B16.4 Steel and Stainless Steel Valves <i>Flanged:</i> NPS 1 through 8 CL150, 300, and 600 raised-face or ring-type joint flanges per ASME B16.5 <i>Screwed or Socket Welding:</i> NPS 1/2 through 2 consistent with ASME B16.11 <i>Buttwelding:</i> NPS 1 through 8. All available ASME B16.25 schedules that are consistent with ASME B16.34 Also see table 2 Maximum Inlet Pressure⁽¹⁾ Cast Iron Valves <i>Flanged:</i> Consistent with CL125B or 250B per ASME B16.1 <i>Screwed:</i> Consistent with CL250 per ASME B16.4 WCC and Stainless Steel Valves <i>Flanged:</i> Consistent with CL150, 300, and 600⁽³⁾ per ASME B16.34 <i>Screwed or Welding:</i> Consistent with flanged CL600 per ASME B16.34	Do not exceed the pressure, temperature, and pressure drop conditions specified when the valve was ordered. See the Installation section for additional information. Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4 YD <i>Standard Design:</i> Class IV <i>High-Temperature Design:</i> Class II YS <i>Standard Class:</i> Class IV <i>Optional Class:</i> Class V Flow Characteristic Linear Approximate Shipping Weights NPS 1/2, 3/4 Valves: 14 kg (30 pounds) NPS 1 Valves: 18 kg (40 pounds) NPS 1-1/2 Valves: 27 kg (60 pounds) NPS 2 Valves: 39 kg (85 pounds) NPS 2-1/2 Valves: 50 kg (110 pounds) NPS 3 Valves: 68 kg (150 pounds) NPS 4 Valves: 109 kg (240 pounds) NPS 6 Valves: 227 kg (500 pounds) NPS 8 Valves: 447 kg (985 pounds)
--	---

1. EN (or other) ratings and end connections can usually be supplied; consult your [Emerson sales office](#) or Local Business Partner.

2. The pressure or temperature limits in this manual, and any applicable standard limitations, should not be exceeded.

3. Certain bonnet bolting material selections may require a CL600 easy-e valve assembly to be derated. Contact your Emerson sales office or Local Business Partner.

Description

The YD and YS valves are three-way valves for throttling or on-off (flow switching) service with converging (flow mixing) or diverging (flow splitting) flow patterns. YS valves, when used in diverging service, are recommended for on-off applications only. These valves are generally shipped as part of a control valve assembly, having a diaphragm, piston, or manual actuator mounted on them. A typical construction is shown in figure 1.

Specifications

Specifications for the YD and YS valves are shown in table 1. Some specifications appear on the actuator nameplate if the valve is part of a complete control valve assembly.

Educational Services

For information on available courses for Fisher YD and YS valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure might result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#) or Local Business Partner.

Before installing the valve, inspect the valve and pipelines for any damage and any foreign material which may cause product damage.

1. Before installing the valve, inspect it for any shipping damage and for any foreign material in the valve body cavity.
2. Clean out all pipelines to remove pipe scale, chips, welding slag, and other foreign materials.
3. Use accepted piping and welding practices when installing the valve. For flanged valves, use suitable gaskets between the valve and the pipeline flanges.
4. Do not install the valve in a system where the working pressures exceed those specified in the ASME pressure/temperature ratings or those specified by Emerson Automation Solutions.
5. If continuous operation is required during maintenance and inspection, install a conventional three-valve bypass around the valve so that the valve can be isolated.
6. Orient the valve so that flow will be in the direction indicated by the flow arrows.

Note

The common port for the YD is the bottom port as shown on the flow direction plates (key 17) in figure 10. The common port for the YS is the left-hand port as shown on the flow direction plates in figure 9.

CAUTION

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Threaded connections may also loosen. In general, if post weld

heat treating is to be performed, all trim parts should be removed. Contact your [Emerson sales office](#) or Local Business Partner for additional information.

7. YD or YS control valves can be installed in any position, although the recommended position is with the actuator vertical above the valve. For NPS 4 and 6 YS valves, size 80 or larger actuators mounted between 45 degrees above and 45 degrees below horizontal should be supported. If forces other than normal gravitational forces are experienced, such as vibrational forces, smaller size actuators might also need to be supported when they are not in a vertical position. For further information, consult your Emerson sales office or Local Business Partner.

Table 2. Valve Body Sizes and End Connections

VALVES SIZE, NPS	CAST IRON VALVES	STEEL OR STAINLESS STEEL VALVES
1/2, 3/4	---	NPT screwed or socket weld
1	---	NPT screwed; CL150, 300, or 600 raised-face or ring-type joint flanged; butt welding; or socket weld
1-1/2, 2	NPT screwed; CL125 flat-face flanged; or CL250 raised-face flanged	NPT screwed; CL150, 300, or 600 raised-face or ring-type joint flanged; butt welding; or socket weld
2-1/2, 3, 4, 6	CL125 flat-face or CL250 raised-face flanged	CL150, 300, or 600 raised face or ring-type joint flanged; or butt welding
8	---	CL150, 300, or 600 raised face, ring-type joint, or butt welding

WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valves with ENVIRO-SEAL live-loaded packing or HIGH-SEAL live-loaded packing will not require this initial re-adjustment. See the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves or HIGH-SEAL Live-Loaded Packing System (as appropriate) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit subsection near the end of this manual.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for trim maintenance, packing maintenance, and ENVIRO-SEAL bellows seal bonnet replacement. All maintenance operations may be performed with the valve in the line.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.

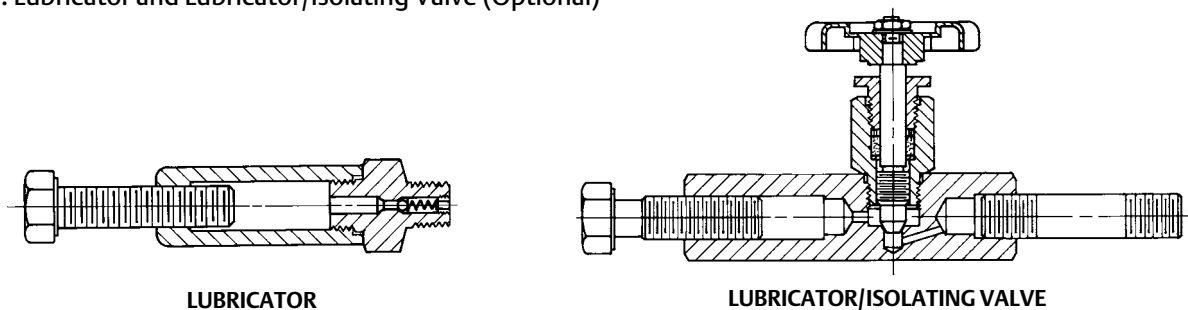
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

CAUTION

Follow instructions carefully to avoid damaging the product surfaces, which could result in damage to the product.

Packing Lubrication

Figure 2. Lubricator and Lubricator/Isolating Valve (Optional)



Note

ENVIRO-SEAL and HIGH-SEAL packing do not require lubrication.

⚠ WARNING

To avoid personal injury or property damage resulting from fire or explosion, do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F).

If a lubricator or lubricator/isolating valve (figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the pipe plug (key 14, figure 13). Use a good quality silicon-base lubricant. Do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F). To operate the lubricator, simply turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except open the isolating valve before turning the cap screw and then close the isolating valve after lubrication is completed.

Packing Maintenance

Note

For valves with ENVIRO-SEAL packing, see the Fisher instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves for packing instructions.

For valves with HIGH-SEAL packing, see the Fisher instruction manual HIGH-SEAL Live-Loaded Packing System for packing instructions.

Packing Replacement

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Table 3. Recommended Torque for Packing Flange Nuts

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE TYPE PACKING				PTFE TYPE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
mm	Inches		N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in
9.5	3/8	CL125, 150	3	27	5	40	1	13	2	19
		CL250, 300	4	36	6	53	2	17	3	26
		CL600	6	49	8	73	3	23	4	35
12.7	1/2	CL125, 150	5	44	8	66	2	21	4	31
		CL250, 300	7	59	10	88	3	28	5	42
		CL600	9	81	14	122	4	39	7	58
19.1	3/4	CL125, 150	11	99	17	149	5	47	8	70
		CL250, 300	15	133	23	199	7	64	11	95
		CL600	21	182	31	274	10	87	15	131
25.4	1	CL300	26	226	38	339	12	108	18	162
		CL600	35	310	53	466	17	149	25	223
31.8	1-1/4	CL300	36	318	54	477	17	152	26	228
		CL600	49	437	74	655	24	209	36	314

The following procedure covers PTFE V-ring packing. A similar procedure can be followed for PTFE/composition packing. However, because PTFE/composition packing comes in split rings, it is possible to replace the rings without removing the actuator from the valve.

Installation of graphite ribbon/filament packing requires special care to avoid trapping air between the rings. Start only one ring at a time without forcing the top of the packing ring below the bottom of the entrance chamfer of the packing box. Thus, when a ring is added, the stack should not be pushed into the cavity more than the thickness of the added ring.

The arrangement of packing box parts is shown in figures 3, 4, 5, 6, and 7. Key numbers used in the following steps are shown in figures 13 and 14.

1. Remove the actuator and bonnet according to steps 1 through 4 of the Disassembly procedure in the Maintenance section on page 7.
2. With the stem and valve plug assembly removed from the bonnet, remove the packing nuts (key 5), packing flange (key 3), wiper ring (key 12), and packing follower (key 13) from the bonnet. The old packing can then be pulled out with a packing hook (take care to avoid scratching the packing box wall) or pushed out using a rod inserted through the bottom of the bonnet.
3. Clean the packing box and all metal parts.
4. Complete maintenance necessary on other parts and install the bonnet on the valve as indicated in the Assembly section (starting on page 12).
5. Install the new packing and associated parts in the sequence shown in figures 3, 4, 5, 6, and 7. Be careful not to damage the packing during installation.
6. Replace the packing flange and packing flange nuts.

For **spring-loaded PTFE V-ring packing**, tighten the packing flange nuts until the shoulder on the packing follower contacts the bonnet.

For **graphite packing**, tighten the packing flange nuts to the maximum recommended torque shown in table 3. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 3.

For **other packing types**, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 3. Then, tighten the remaining flange nut until the packing flange is level and at a 90-degree angle to the valve stem.

For **ENVIRO-SEAL or HIGH-SEAL live-loaded packing**, refer to the note at the beginning of the Packing Maintenance section.

7. Mount the actuator on the bonnet and make up the stem connection according to the procedure given in the appropriate actuator instruction manual.

Trim Maintenance

WARNING

Observe the warning at the start of the Maintenance section.

CAUTION

To avoid damaging parts, do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

Key numbers in the following procedures are shown in figure 10 for standard YD, in figure 11 for high-temperature YD, and in figure 9 for YS, except where indicated.

Disassembly

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve, and drain the process media from both sides of the valve. Remove actuator supply pressure, and use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

⚠ WARNING

See the **WARNING** at the beginning of the Maintenance section for more information.

2. Disconnect the actuator stem connector and remove the locknut (key 15, figure 13) that holds the actuator to the valve. (Valves with a 127 mm (5-inch) yoke boss use cap screws and nuts to secure the actuator on the valve). Then lift the actuator from the valve.

Figure 3. Fisher PTFE V-Ring Packing Arrangements

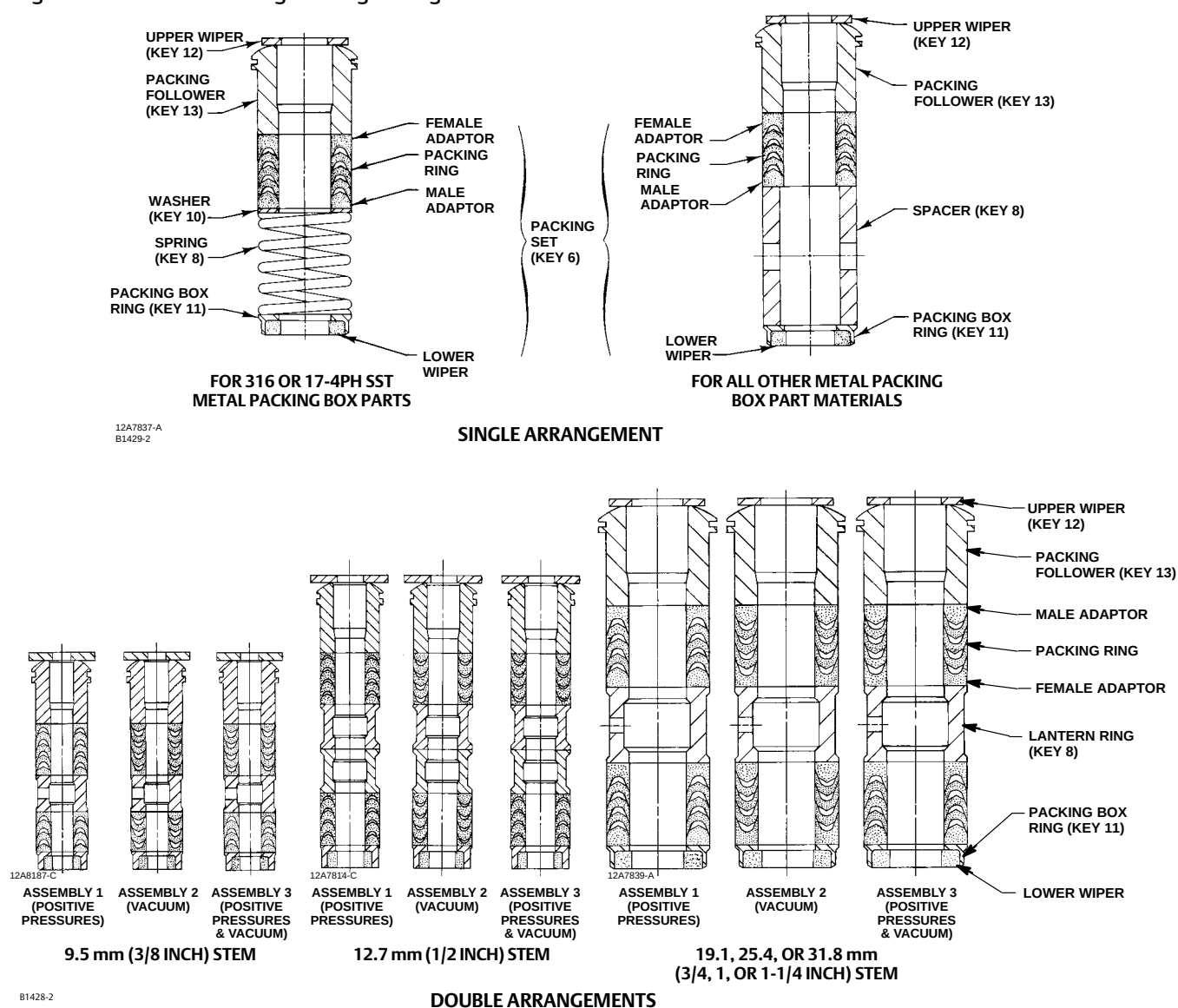
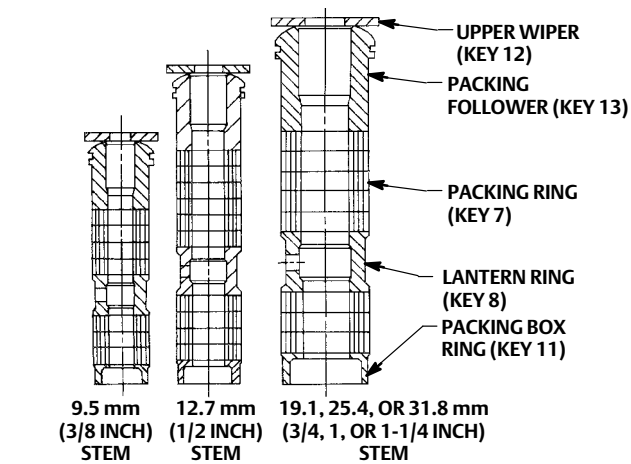
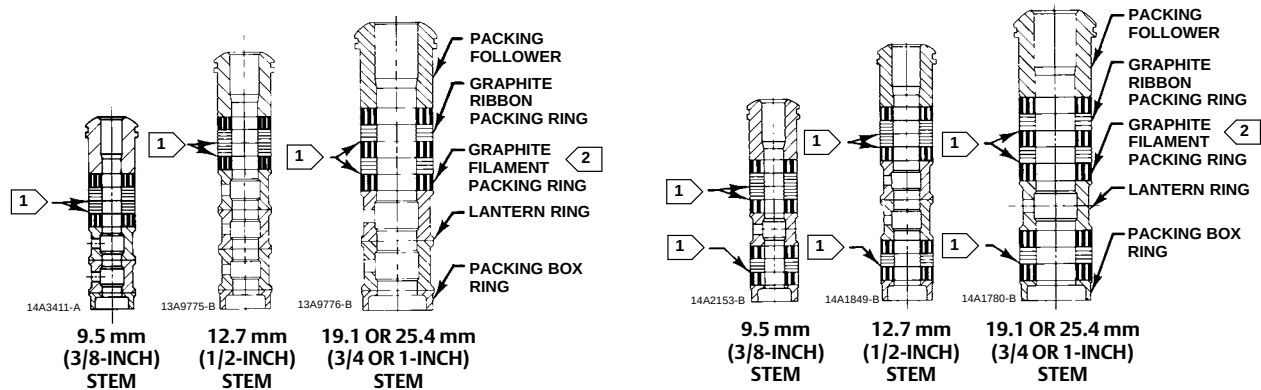


Figure 4. Detail of Fisher PTFE/Composition Packing Arrangements



TYPICAL (DOUBLE) ARRANGEMENTS

Figure 5. Fisher Graphite Ribbon/Filament Packing Arrangements



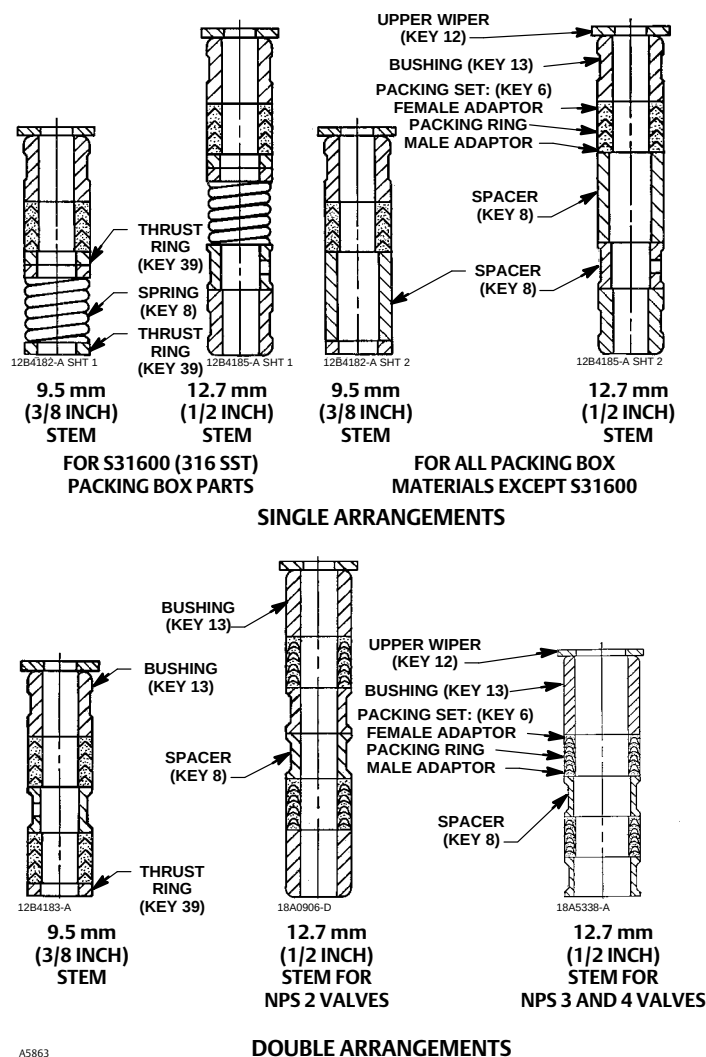
SINGLE PACKING ARRANGEMENT

DOUBLE PACKING ARRANGEMENT

A2438-2

- NOTE:
- 1 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS. USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.
- 2 HAS THE APPEARANCE OF A WOVEN OR BRAIDED RING.

Figure 6. PTFE Packing Arrangements for Use in Fisher ENVIRO-SEAL Bellows Seal Bonnets



3. Remove the nuts (key 16, figures 9 and 10) or cap screws from the bonnet flange.
4. Lift off the bonnet along with the valve plug and stem (keys 2 and 5, figures 9 and 10). Due to the design of the valve, several other trim parts will be drawn out with the valve plug. They are as follows:
 YD (Standard)--The upper cage (key 3A) and associated seals, gaskets, and shim (keys 9, 11, 19, 20A, 20B, and 22).
 YD (High Temperature)--The upper cage (key 3B) and associated gaskets and shim (keys 9, 11, and 22).
 YS--The upper seat (key 7), upper cage (key 3), and associated gaskets and shim (keys 9, 11, and 22).

CAUTION

The exposed portion of the cage provides a guiding surface that must not be damaged during disassembly or maintenance. Damage could affect valve performance. If the cage is stuck in the valve, use a rubber mallet to strike the exposed portion at several points around the circumference.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

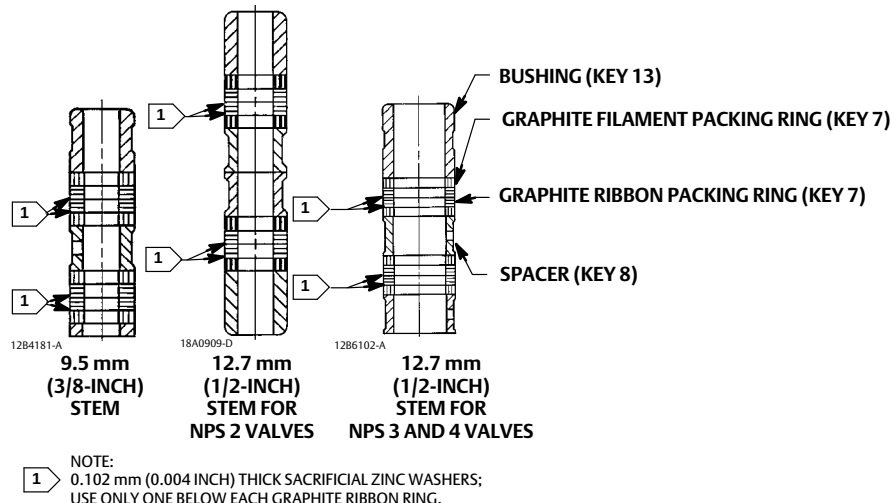
Instruction Manual

D100425X012

YD and YS Valves

July 2017

Figure 7. Double Graphite Ribbon/Filament Arrangements for Use in Fisher ENVIRO-SEAL Bellows Seal Bonnets



A5870

Take proper care not to damage any sealing or seating surfaces as nicks or scratches in these parts might cause leakage.

- Loosen the packing flange nuts (key 5, figures 13 and 14) and draw the valve plug and stem straight out the bottom of the bonnet. Lift all cage and seat parts off the valve plug and stem. If the stem for YD or YS requires replacing, drive the pin (key 6) out and unscrew the stem from the plug.

Table 4. Pin Drill Sizes

VALVE TYPE	VALVE STEM CONNECTION, mm (INCH)	DRILL SIZE, INCHES
YD & YS	9.5 (3/8)	3/32
	12.7 (1/2)	1/8
	19.1 (3/4)	3/16
	25.4 (1)	1/4

Table 5. Recommended Bolt Torques for B7 Body-to-Bonnet Bolting⁽¹⁾

VALVE SIZE, NPS	RECOMMENDED BOLT TORQUE, N•m (Lbf•ft)
1/2, 3/4	129 (95)
1, 1-1/2	129 (95)
2	96 (71)
2-1/2	96 (71)
3	169 (125)
4	271 (200)
6	549 (405)
8(2)	CL150/300: 373 (275) CL600: 522 (385)

1. For other materials, contact your [Emerson sales office](#) or Local Business Partner.
2. For NPS 8 YD valves, the bottom adaptor has shorter bolts than the bonnet, but the bolt torque is the same as the bonnet torque.

- To replace the adaptor (key 24, figure 15) on ENVIRO-SEAL bellows seal bonnets, place the plug stem assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out the pin (key 36, figure 15). Reverse the plug stem assembly in the soft-jaw chuck or vise. Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the valve plug/adaptor assembly (key 24, figure 15) from the valve stem assembly (key 20, figure 15).

CAUTION

Never use an old stem with a new valve plug. The use of an old stem requires drilling a new pin hole through the stem (or adaptor, in case an ENVIRO-SEAL bellows seal bonnet is being used). This drilling weakens the stem or adaptor and may cause failure in service. However, a used valve plug may be reused with a new stem or adaptor.

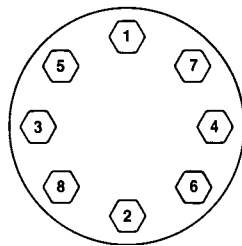
7. The internal parts of the bonnet can now be disassembled, if necessary. For packing replacement, refer to the section entitled Packing Replacement on page 6.
8. *Standard YD Only*—It is recommended that the cage seal (key 19), seal ring (key 20A), and backup ring (key 20B) be replaced upon assembly. These can be removed by prying them out of the upper cage grooves with a screwdriver or a soft-tipped instrument. If a screwdriver is used, take care not to scratch the surfaces of the cage.
9. The remaining trim parts can now be lifted out of the valve. Under severe service conditions, some of these parts might have become stuck to the valve. In this case, it might be necessary to use a seat ring puller to remove these parts. Because there is a slight clearance around the outer circumference of the lower cage (key 4) and seat ring (key 8), it might be possible to remove these by tapping them loose, if interior room permits.

Assembly

YD (Standard)

1. Use new gaskets, seals, and shim (keys 9, 11, 14, 19, 20A, 20B, and 22) on assembly and wipe all sealing surfaces with a clean cloth.
2. For NPS 8 YD, install the bottom flange adaptor (key 24) and gasket (key 9).
3. Install the seat ring gasket (key 14) and place the seat ring (key 8) on top of the gasket.
4. Install the lower cage (key 4) into the valve, being certain that it fits down over the raised portion of the seat ring. The narrow portion of the cage windows should point downward.
5. Slip the O-ring cage seal (key 19) over the bottom of the upper cage (key 3A) and into the cage groove.

Figure 8. Typical Bolting Pattern



A0274-1

6. Press the backup ring (key 20B) and the seal ring (key 20A), respectively, into the inner groove of the upper cage. It might be necessary to bend one side of each of these in slightly to accomplish this. Take care not to distort the rings when doing this.
7. If a new stem (key 5) is to be used, screw the stem into the valve plug (key 2) until it wedges tight at the end of the valve stem thread.

CAUTION

Never use an old stem with a new valve plug. The use of an old stem requires drilling a new pin hole through the stem (or adaptor, in case an ENVIRO-SEAL bellows seal bonnet is being used). This drilling weakens the stem or adaptor and may cause failure in service. However, a used valve plug may be reused with a new stem or adaptor.

Locate the pilot hole in the valve plug and drill the hole through the plug and stem assembly (determine drill size from table 4). Drive in the pin to lock the assembly.

8. For ENVIRO-SEAL bellows seal bonnets, grip the flats of the stem extending out of the top of the bellows shroud with a soft-jaw chuck or other type of vise. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.

CAUTION

To prevent possible damage to the seal ring and cage seal, exercise care in the following procedure.

9. Place the upper cage (key 3A) over the plug assembly, being certain not to damage the seal ring, and lower this entire assembly into the valve. Due to the close fit between the valve body bore and the cage seal, it will be necessary to apply a steady force to the top of the cage for final positioning inside the valve body bore. Take care to ensure that the upper cage slips into the lower cage and the cage seal is not damaged.
10. Place the spiral wound gasket (key 11), shim (key 22), and bonnet gasket (key 9), respectively, over the upper cage.
11. Mount the bonnet onto the valve with the lubricator or pipe plug parallel with the pipeline.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson Automation Solutions representative immediately if a discrepancy between actual parts and approved parts is suspected.

12. Lubricate the valve stud bolts or cap screws (key 15) and install the nuts (key 16) on the bolts using accepted bolting practices. Tighten the nuts to the recommended bolt torques given in table 5. Follow a pattern similar to that shown in figure 8.

Note

It might be necessary to repeat the bolting pattern several times until the bonnet-to-body seal is made, because the tightening of one nut might loosen an adjacent nut. Repeat the pattern until none of the nuts will turn at the recommended torque.

13. Mount the actuator on the bonnet and make up the stem connection according to the procedure given in the appropriate actuator instruction manual.

YD (High Temperature)

1. Use new gaskets, seals, and shim (keys 9, 11, 13, 14, 19, 20, and 22) on assembly and wipe all sealing surfaces with a clean cloth.
2. For NPS 8 YD, install the bottom flange adaptor (key 24) and gasket (key 9).
3. Install the seat ring gasket (key 14) and place the seat ring (key 8) on top of the gasket followed by the spiral wound spring (key 13).
4. Install the lower cage (key 4) into the valve, being certain that it fits down over the raised portion of the seat ring. The narrow portion of the cage windows should point downward.
5. Place one of the retaining ring gaskets (key 19) into the valve.
6. If a new stem (key 5) is to be used, screw the stem into the valve plug (key 2) until it wedges tight at the end of the valve stem thread.

CAUTION

Never use an old stem with a new valve plug. The use of an old stem requires drilling a new pin hole through the stem (or adaptor, in case an ENVIRO-SEAL bellows seal bonnet is being used). This drilling weakens the stem or adaptor and may cause failure in service. However, a used valve plug may be reused with a new stem or adaptor.

Locate the pilot hole in the valve plug and drill the hole through the plug and stem assembly (determine drill size from table 4). Drive in the pin to lock the assembly.

7. For ENVIRO-SEAL bellows seal bonnets, grip the flats of the stem extending out of the top of the bellows shroud with a soft-jaw chuck or other type of vise. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.
8. Place the seal ring retainer (key 3C) into the valve and lower the valve plug assembly into the retainer orifice.
9. Carefully place the seal rings (key 20) over the valve plug, being certain that they rest against the retaining ring. Each of these has a cut through its cross section. These cuts should be oriented 180 degrees apart to ensure a proper seal.
10. Insert the other retaining ring gasket (key 19) on top of the retaining ring.
11. Lower the upper cage (key 3B) into the valve. When properly installed, the raised ring on the bottom of the cage should fit snugly into the groove formed by the seal rings and the retaining ring.
12. Place the spiral wound gasket (key 11), shim (key 22), and bonnet gasket (key 9), respectively, over the upper cage.

13. Mount the bonnet onto the valve with the lubricator or pipe plug parallel with the pipeline.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

14. Lubricate the valve stud bolts (key 15) and install the nuts (key 16) onto the bolts using good bolting practices. Tighten the nuts to the recommended bolt torques given in table 5. A pattern similar to that shown in figure 8 should be followed.

Note

It might be necessary to repeat the bolting pattern several times until the bonnet-to-body seal is made, because the tightening of one nut might loosen an adjacent nut. Repeat the pattern until none of the nuts will turn at the recommended torque.

15. Mount the actuator on the bonnet and make up the stem connection according to the procedure given in the appropriate actuator instruction manual.

YS

1. Use new gaskets and shim (keys 9, 11, 12, 13, 14 and 22) on assembly and wipe all sealing surfaces with a clean cloth.
2. Install the lower seat ring gasket (key 14) and place the lower seat ring (key 8) on top of the gasket followed by the spiral wound spring (key 13).
3. Install the lower cage (key 4) into the valve, being certain that it fits down over the raised portion of the seat ring. The narrow portion of the cage windows should point downward.
4. Place the upper seat ring gasket (key 12) into the valve.
5. If a new stem (key 5) is to be used, screw the stem into the valve plug (key 2) until it wedges tight at the end of the valve stem thread.

CAUTION

Never use an old stem with a new valve plug. The use of an old stem requires drilling a new pin hole through the stem (or adaptor, in case an ENVIRO-SEAL bellows seal bonnet is being used). This drilling weakens the stem or adaptor and may cause failure in service. However, a used valve plug may be reused with a new stem or adaptor.

Locate the pilot hole in the valve plug and drill the hole through the plug and stem assembly (determine drill size from table 4). Drive in the pin to lock the assembly.

6. For ENVIRO-SEAL bellows seal bonnets, grip the flats of the stem extending out of the top of the bellows shroud with a soft-jaw chuck or other type of vise. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.
7. Place the upper seat ring (key 7) and upper cage (key 3), respectively, over the plug and stem assembly, being certain not to scratch any sealing surfaces. Lower this entire assembly into the valve.
8. Place the spiral wound gasket (key 11), shim (key 22), and bonnet gasket (key 9), respectively, over the upper cage.
9. Mount the bonnet onto the valve with the lubricator or pipe plug parallel with the pipeline.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

10. Lubricate the valve stud bolts or cap screws (key 15) and install the nuts (key 16) onto the bolts using good bolting practices. Tighten the nuts to the recommended bolt torques given in table 5. A pattern similar to that shown in figure 8 should be followed.

Note

It might be necessary to repeat the bolting pattern several times until the bonnet-to-body seal is made, because the tightening of one nut might loosen an adjacent nut. Repeat the pattern until none of the nuts will turn at the recommended torque.

11. Mount the actuator onto the bonnet and make up the stem connection according to the procedure given in the appropriate actuator instruction manual.

ENVIRO-SEAL Bellows Seal Bonnet

Replacing a Plain or Extension Bonnet with an ENVIRO-SEAL Bellows Seal Bonnet (Stem/Bellows Assembly)

1. Remove the actuator and bonnet according to steps 1 through 4 of the Disassembly procedure in the Maintenance section on page 7.
2. With care, remove the valve plug and stem assembly from the valve. If necessary, also lift out the cage.

CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to protect the sealing surfaces and to prevent foreign material from getting into the valve body cavity.

3. Remove and discard the existing bonnet gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

Note

The ENVIRO-SEAL stem/bellows assembly for YD and YS valves is available only with a threaded and drilled plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed.

4. Inspect the existing valve plug. If the plug is in good condition, it can be reused with the new ENVIRO-SEAL stem/bellows assembly. To remove the existing valve plug from the stem, first, place the existing plug stem assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 8).
5. Reverse the plug stem assembly in the soft-jaw chuck or vise. Grip the valve stem in an appropriate place and unscrew the existing plug from the valve stem.

CAUTION

When installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

Note

The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

6. To attach the valve plug to the stem of the new ENVIRO-SEAL stem/bellows assembly, first attach the plug to the adaptor (key 24). Locate the adaptor. Notice that a hole has not been drilled in the threads where the plug screws onto the adaptor. Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor. Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Select the proper size of drill bit and drill through the adaptor using the hole in the valve plug as a guide. Remove any metal chips or burrs and drive in a new pin to lock the plug/adaptor assembly together.
8. Attach the plug/adaptor assembly to the ENVIRO-SEAL stem/bellows assembly by first securing the stem/bellows assembly in a soft-jaw chuck or other type of vise so that the jaws of the chuck or vise grip the flats of the stem extending out of the top of the bellows shroud. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.
9. Inspect the seat ring (key 9) and soft seat parts (keys 21, 22, and 23); replace, if necessary.
10. Place a new gasket (key 10) into the valve in place of the bonnet gasket. Install the new stem/bellows assembly with valve plug/adaptor by placing it into the valve on top of the new bellows gasket.

11. Place a new gasket (key 22) over the stem/bellows assembly. Place the new ENVIRO-SEAL bonnet over the stem/bellows assembly.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

12. Properly lubricate the bonnet stud bolts. Install and tighten the bonnet hex nuts to the proper torque.
13. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 17 or 18.
14. Install the packing flange. Properly lubricate the packing flange stud bolts and the faces of the packing flange nuts.

For **graphite packing**, tighten the packing flange nuts to the maximum recommended torque shown in table 6. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 6.

For **other packing types**, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 6. Then, tighten the remaining flange nut until the packing flange is level and at a 90-degree angle to the valve stem.

15. Install travel indicator parts and stem locknuts; mount the actuator onto the valve according to the procedure in the appropriate actuator instruction manual.

Replacement of an Installed ENVIRO-SEAL Bellows Seal Bonnet (Stem/Bellows Assembly)

1. Remove the actuator and bonnet according to steps 1 through 4 of the Disassembly procedure in the Maintenance section on page 7.

CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to protect the sealing surfaces and to prevent foreign material from getting into the valve body cavity.

2. Carefully remove the ENVIRO-SEAL stem/bellows assembly. If necessary, also lift out the cage. Remove and discard the existing bonnet gasket and bellows gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

CAUTION

The ENVIRO-SEAL stem/bellows assembly for YD and YS valves is available only with a threaded and drilled plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug

can be installed. If the existing valve plug is reused, and the adaptor is in good condition, it may also be reused. However, never reuse an old adaptor with a new valve plug. Using an old adaptor with a new valve plug requires drilling a new pin hole in the adaptor. This drilling weakens the adaptor and may cause failure in service. However, a used valve plug may be reused with a new adaptor.

3. Inspect the existing valve plug and adaptor. If they are in good condition, they can be reused with the new stem/bellows assembly and they do not need to be separated.

CAUTION

When removing/installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

Note

The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

4. If the valve plug and adaptor are not in good condition and must be replaced, first remove the valve plug/adaptor assembly from the stem/bellows assembly; then remove the valve plug from the adaptor. First, place the stem/bellows assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 6, figure 9, 10, or 11. Drive out the pin (key 36, figure 15).

Table 6. Recommended Torque for Fisher ENVIRO-SEAL Bellows Seal Packing Flange Nuts

VALVE SIZE, NPS	VALVE STEM DIAMETER THROUGH PACKING	MINIMUM TORQUE		MAXIMUM TORQUE	
		N•m	Lbf•in	N•m	Lbf•in
1/2 - 2	1/2	3	24	5	48
3 - 4	1	7	60	10	84

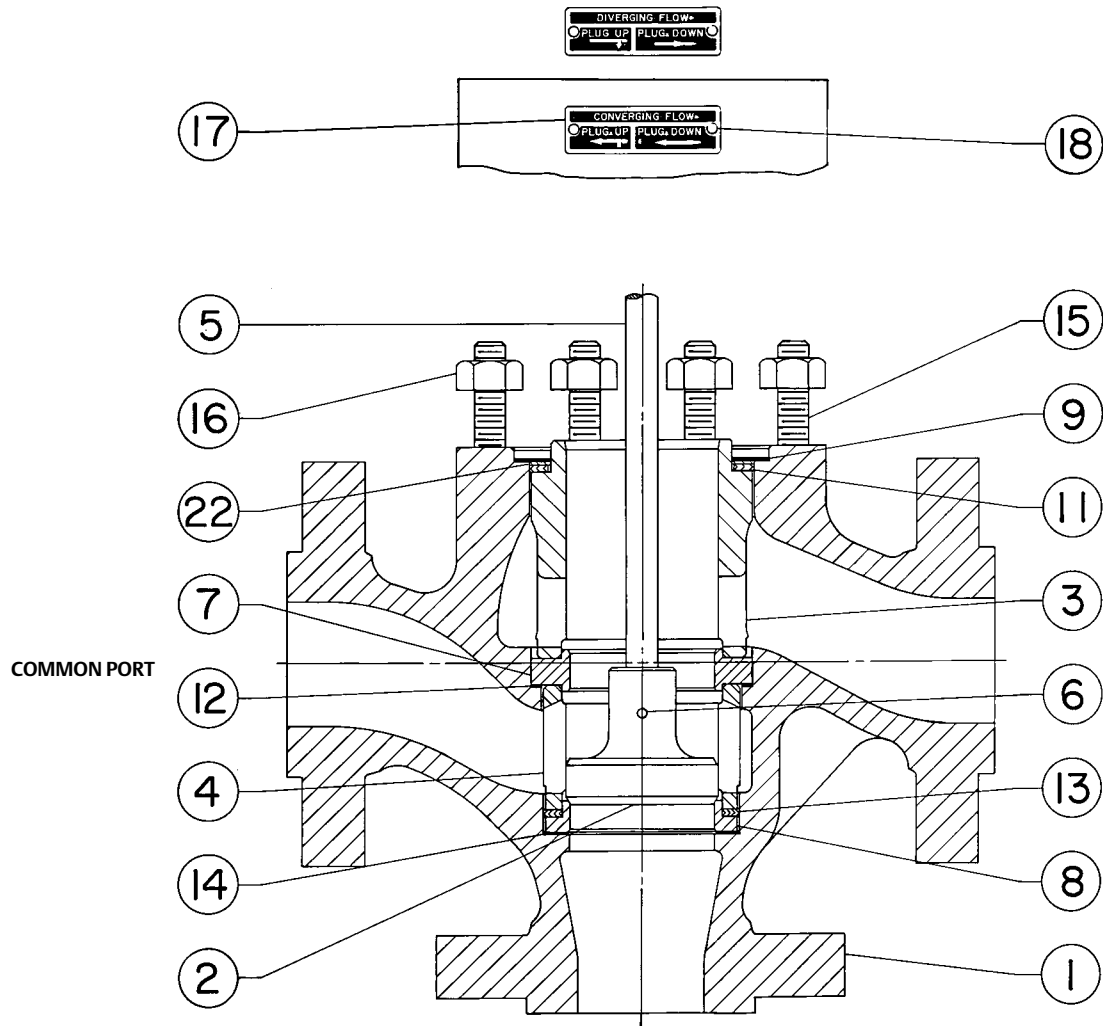
5. Reverse the stem/bellows and plug/adaptor assembly in the soft-jaw chuck or vise. Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the plug/adaptor assembly from the stem/bellows assembly. Unscrew the valve plug from the adaptor.
6. To attach either the existing valve plug or a new one to the stem of the new ENVIRO-SEAL stem/bellows assembly, first attach the plug to the adaptor (if the valve plug was removed from the adaptor) as follows:
 - Locate the adaptor. Notice that a hole has not been drilled in the threads where the plug screws onto the adaptor.
 - Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor.
 - Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Complete the installation by following steps 7 through 9 and steps 12 through 15 of the ENVIRO-SEAL Bellows Seal Bonnet installation instructions given above.

Purging the ENVIRO-SEAL Bellows Seal Bonnet

The ENVIRO-SEAL bellows seal bonnet can be purged or leak tested. Refer to figure 15 for an illustration of an ENVIRO-SEAL bellows seal bonnet, and perform the following steps for purging or leak testing.

1. Remove the two diametrically opposed pipe plugs (key 16).
2. Connect a purging fluid to one of the pipe plug connections.
3. Install appropriate piping or tubing in the other pipe plug connection to pipe away the purging fluid or to make a connection to an analyzer for leak testing.

Figure 9. Fisher YS Valve



30A3554-D

Figure 10. Fisher YD Valve (Standard)

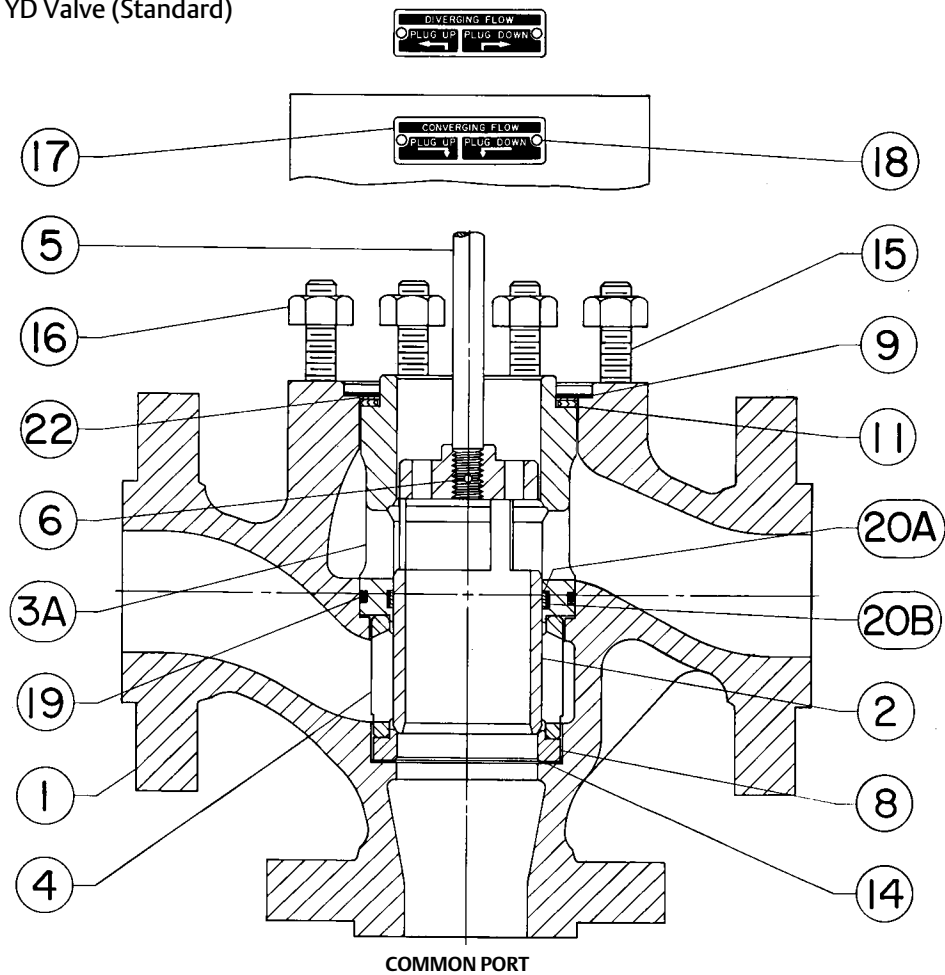


Figure 11. Fisher YD Valve (High Temperature)

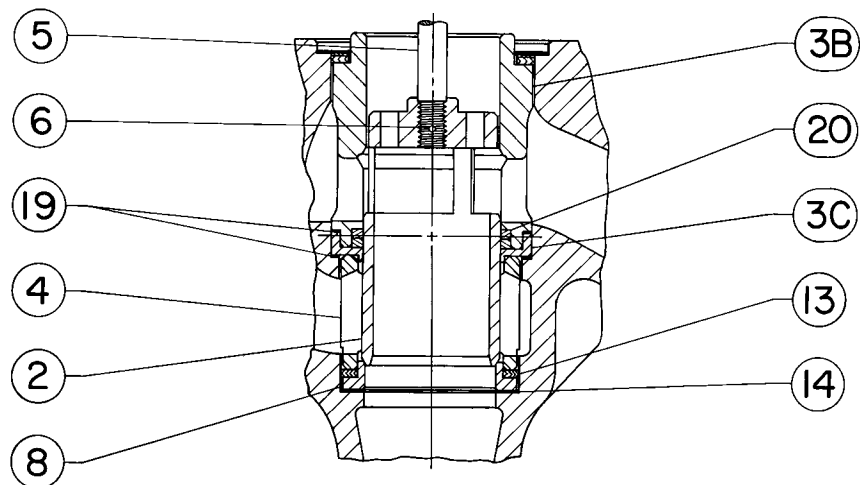
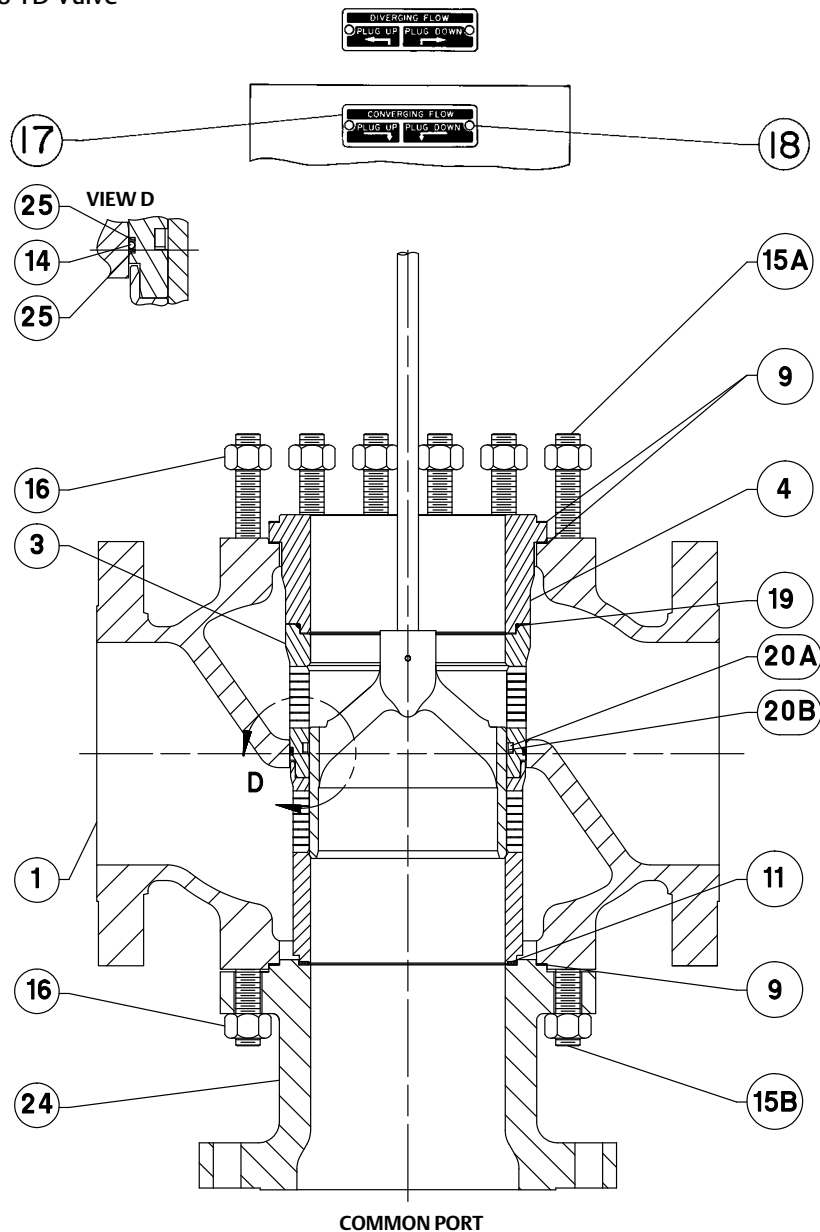


Figure 12. Fisher NPS 8 YD Valve



54B9114-A

Figure 13. Fisher Standard Bonnet

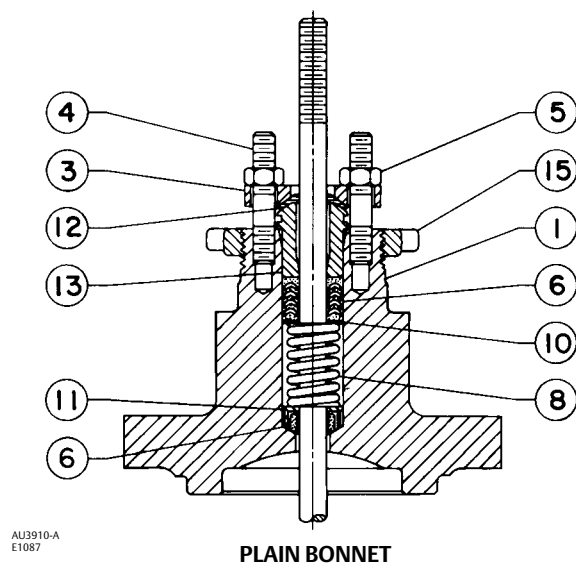
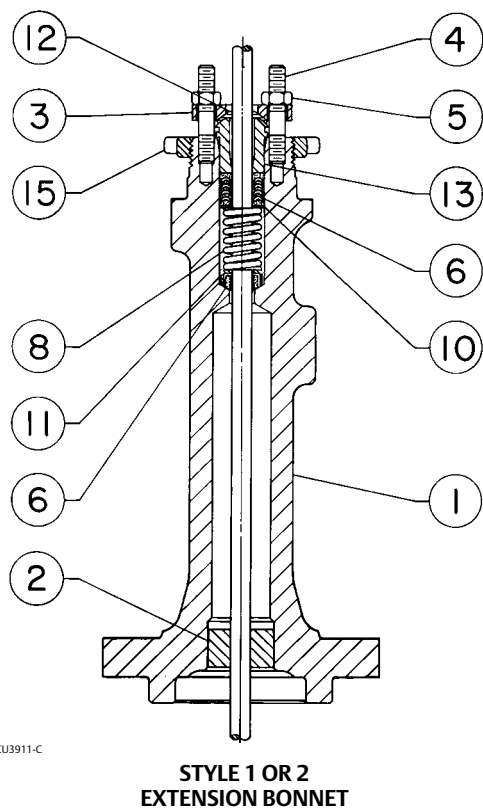
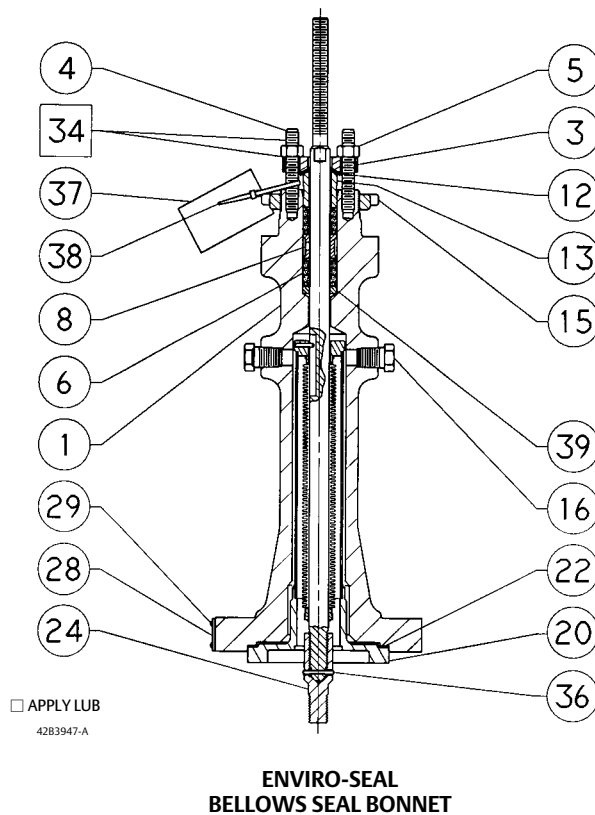


Figure 14. Fisher Extension Bonnet



CU3911-C

Figure 15. Fisher ENVIRO-SEAL Bellows Seal Bonnet



Parts Ordering

Each valve is assigned a serial number which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Always refer to the serial number when corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment. When ordering replacement parts, also state the complete eleven-character part number for each part required from the following parts list.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Standard Packing Repair Kits (Non Live-Loaded)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)
PTFE (Contains keys 6, 8, 10, 11, and 12)	RPACKX00012	RPACKX00022	RPACKX00032	RPACKX00342
Double PTFE (Contains keys 6, 8, 11, and 12)	RPACKX00042	RPACKX00052	RPACKX00062	RPACKX00362
PTFE/Composition (Contains keys 7, 8, 11, and 12)	RPACKX00072	RPACKX00082	RPACKX00092	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00102	RPACKX00112	RPACKX00122	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], and 11)	---	---	---	RPACKX00532
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring])	RPACKX00132	RPACKX00142	RPACKX00152	---
Double Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00162	RPACKX00172	RPACKX00182	---

Packing Kits (ENVIRO-SEAL) Repair

PACKING MATERIAL	STEM DIAMETER AND YOKE BOSS DIAMETER, mm (INCH)			
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)
Double PTFE (contains keys 214, 215, & 218)	RPACKX00192	RPACKX00202	RPACKX00212	RPACKX00222
Graphite ULF (contains keys 207, 208, 209, 210, and 214)	RPACKX00592	RPACKX00602	RPACKX00612	RPACKX00622

Packing Kits (ENVIRO-SEAL) Retrofit

PACKING MATERIAL	STEM DIAMETER AND YOKE BOSS DIAMETER, mm (INCH)			
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)
Double PTFE (contains keys 200, 201, 211, 212, 214, 215, 217, and 218)	RPACKXRT012	RPACKXRT022	RPACKXRT032	RPACKXRT042
Graphite ULF (contains keys 200, 201, 207, 208, 209, 210, 211, 212, 214, and 217)	RPACKXRT262	RPACKXRT272	RPACKXRT282	RPACKXRT292

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YD and YS Valves

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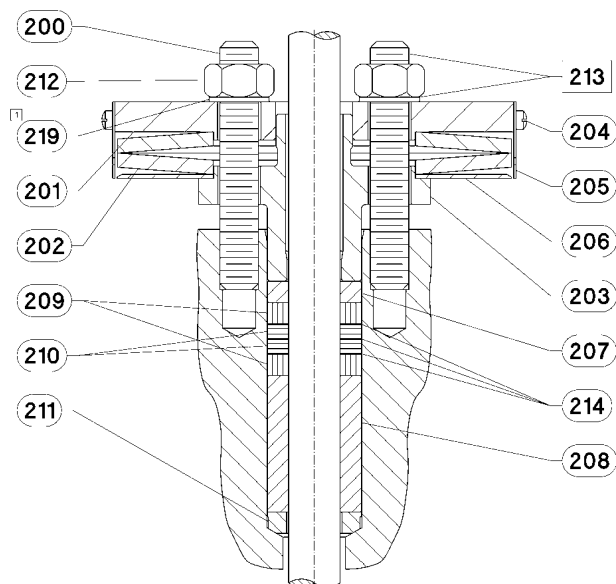
Gasket Kits

Gasket Kits

VALVE SIZE, NPS	YD (Includes keys 9, 11, 14, and 22)	YS (Includes keys 9, 11, 12, 13, 14, and 22)
	Part Number	Part Number
NPS 1/2 to 1-1/2 NPS 2 to 2-1/2 NPS 3 NPS 4 NPS 6	RGASKETXB62 RGASKETXB72 RGASKETXB82 RGASKETXB92 RGASKETXC12	RGASKETXC22 RGASKETXC32 RGASKETXC42 RGASKETXC52 RGASKETXC62

Valve Size, NPS	Key Number	YD Part Number	YS Part Number
1/2 through 1-1/2	Set	RGASKETXB62	RGASKETXC22
	9	1R2859X0042	1R2859X0042
	11	1R286099442	1R286099442
	12	---	10A3326X052
	13	---	10A3325X062
	14	10A3327X052	10A3327X052
	22	16A1936X012	16A1936X012
2 through 2-1/2	Set	RGASKETXB72	RGASKETXC32
	9	1R3299X0042	1R3299X0042
	11	1R329799442	1R329799442
	12	---	10A3384X042
	13	---	10A3383X042
	14	10A3385X042	10A3385X042
	22	16A1938X012	16A1938X012
3	Set	RGASKETXB82	RGASKETXC42
	9	1R3484X0042	1R3484X0042
	11	1R348299442	1R348299442
	12	---	10A3437X062
	13	---	10A3436X042
	14	10A3438X062	10A3438X062
	22	16A1940X012	16A1940X012
4	Set	RGASKETXB92	RGASKETXC52
	9	1R3724X0042	1R3724X0042
	11	1R372299442	1R372299442
	12	---	10A3479X052
	13	---	10A3478X052
	14	10A3480X052	10A3480X052
	22	16A1941X012	16A1941X012
6	Set	RGASKETXC12	RGASKETXC62
	9	1U5081X0052	1U5081X0052
	11	1U508599442	1U508599442
	12	---	10A3525X042
	13	---	10A3524X022
	14	11A9521X052	11A9521X052
	22	16A1942X012	16A1942X012

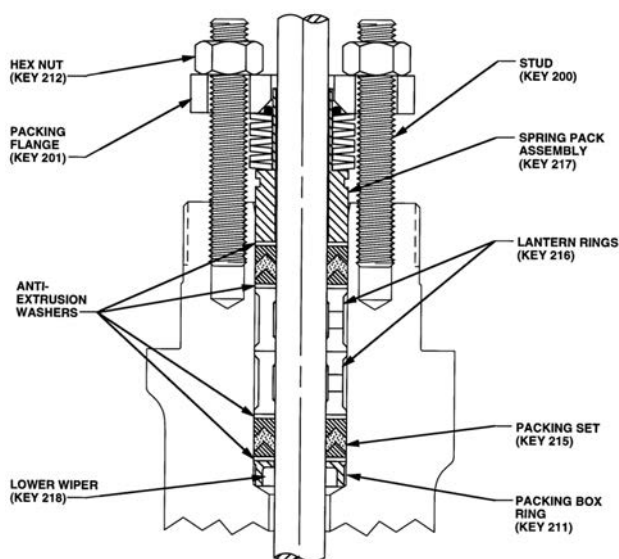
Figure 16. Typical Fisher HIGH-SEAL Graphite ULF Packing System



1. FIND NUMBER 219 NOT REQUIRED WITH 3/8 INCH STEM

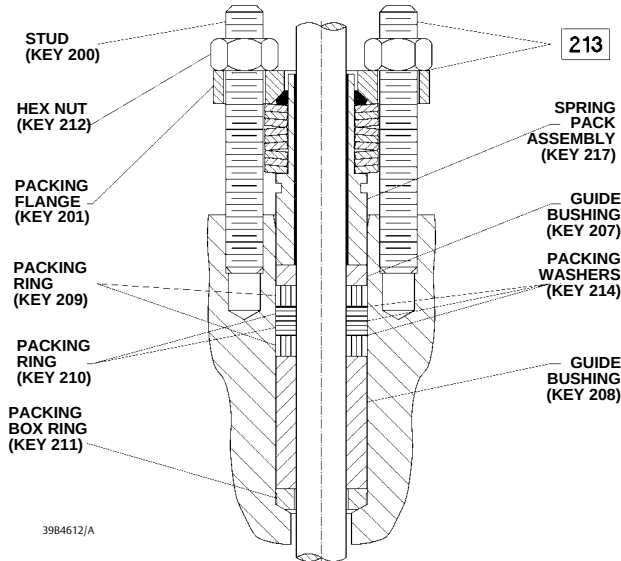
3984153-A

Figure 17. Typical Fisher ENVIRO-SEAL Packing System with PTFE Packing



A6297-1

Figure 18. Typical Fisher ENVIRO-SEAL Packing System with Graphite ULF Packing



3984612/A

Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your [Emerson sales office](#) or Local Business Partner.

Note

Part numbers for most key numbers are listed in tables which follow.

YD and YS Valve

Key	Description	Part Number
1	If you need a valve body as a replacement part, order by valve size, serial number, and desired material	
17	Flow Direction Plate, SST	
18	Drive Screw, SST (4 req'd)	
21	Nameplate	
23	Wire	

Bonnet for YD and YS

1	Bonnet	
	If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.	
14	Pipe Plug	
16	Pipe Plug (Used With Tapped Extension Bonnet Only) (not shown)	
27	Pipe Nipple (Used with Lubr./Iso. Valve)	

*Recommended spare parts

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Keys 2*, 5*, and 6* Valve Plug and Stem Assembly for Plain Bonnet

VALVE SIZE, NPS	STEM DIAMETER & VSC SIZE		YD STANDARD		YD HIGH TEMPERATURE		YS	
	mm	Inches	CB7Cu-1 (17-4PH SST)	CF8M (316 SST)	CB7Cu-1 (17-4PH SST)	CF8M (316 SST)	S41600 (416 SST)	S31600 (316 SST)
1/2 to 1-1/2	9.5 12.7	3/8 1/2	10A3315X032 ---	10A3315X052 ---	---	---	10A3317X202 10A9499X092	10A3317X072 ---
2 and 2-1/2	12.7	1/2	20A3369X052	20A3369X122	21A5078X032	---	10A3373X242	10A3373X232
3	12.7 19.1	1/2 3/4	20A3422X102 ---	20A3422X072 ---	---	---	10A3427X052 10A3428X102	10A3427X112 ---
4	12.7	1/2	20A3464X092	20A3464X072	---	---	20A3469X102	---
6	19.1	3/4	20A3507X092	20A3507X112	21A5073X062	---	20A3511X092	20A3511X082

Key 2* Valve Plug

VALVE SIZE, NPS	VALVE STEM CONNECTION		YD STANDARD		YD HIGH-TEMPERATURE	
	mm	Inch	CB7Cu-1 (17-4 PH SST)	CF8M (316 SST)	CB7Cu-1 (17-4 PH SST)	CF8M (316 SST)
1/2 to 1-1/2	9.5	3/8	10A3315X012	10A3315X022	11A5077X012	---
2 & 2-1/2	12.7	1/2	20A3369X012	20A3369X022	21A5078X012	21A5078X022
3	12.7 19.1	1/2 3/4	20A3422X092 20A3423X052	20A3422X022 ---	21A5071X042 21A5072X052	21A5071X022 ---
4	12.7 19.1	1/2 3/4	20A3464X082 20A3465X042	20A3464X022 20A3465X022	21A5076X042 21A5075X042	21A5076X022 21A5075X022
6	19.1 25.4	3/4 1	20A3507X042 20A3508X042	20A3507X022 ---	21A5073X052 21A5074X042	21A5073X022 ---

Key 2* Valve Plug (cont.)

VALVE SIZE, NPS	VALVE STEM CONNECTION		YS	
	mm	Inch	S41600 (416 SST)	S31600 (316 SST)
1/2 to 1-1/2	9.5 12.7	3/8 1/2	10A3317X012 10A9499X012	10A3317X022 10A9499X022
2 & 2-1/2	12.7 19.1	1/2 3/4	10A3373X012 ---	10A3373X022 10A3374X022
3	12.7 19.1	1/2 3/4	10A3427X012 10A3428X012	10A3427X022 10A3428X022
4	12.7 19.1	1/2 3/4	20A3469X012 20A3470X012	20A3469X022 20A3470X022
6	19.1 25.4	3/4 1	20A3511X012 20A3512X012	20A3511X022 20A3512X022

Keys 3* & 3A* Upper Cage (YS and Standard YD Only)

VALVE SIZE, NPS	KEY 3, UPPER CAGE (YS)		KEY 3A, UPPER CAGE (YD STANDARD)	
	CB7Cu-1 (17-4PH SST)	CF8M (316 SST), ENC	CB7Cu-1 (17-4PH SST)	CF8M (316 SST), ENC
1/2 - 1-1/2 2, 2-1/2	29A7516X012 2U223433272	29A7516X022 2U740448932	20A3363X012 20A3376X012	30A3319X022 30A3377X012
3 4 6	2U231833272 2U236033272 2U506333272	2U740648932 2U740748932 2U806948932	20A3431X012 20A3473X012 20A3516X012	30A3432X012 30A3474X012 30A3517X012

Keys 3B*, 3C*, & 4* Upper Cage and Retaining Ring (High Temp. YD Only) and Lower Cage

VALVE SIZE, NPS	KEY 3B, UPPER CAGE (YD HIGH TEMPERATURE)		KEY 3C, RETAINING RING (YD HIGH TEMPERATURE)		KEY 4, LOWER CAGE (ALL TRIM STYLES)	
	CB7Cu-1 (17-4PH SST)	CF8M (316 SST), ENC	S41600 (416 SST)	CF8M (316 SST)	CB7Cu-1 (17-4PH SST)	CF8M (316 SST), ENC
1/2 - 1-1/2 2, 2-1/2	20A3320X012 20A3378X012	---	10A3337X012 10A3394X012	---	20A3323X012 20A3381X012	20A3324X012 20A3382X012
3 4 6	20A3546X012 20A3548X012 20A3518X012	30A3547X012 30A3549X012 30A3519X012	10A3448X012 10A3490X012 10A3536X012	10A3348X022 10A3490X012 10A3536X022	20A3434X012 20A3476X012 20A3522X012	20A3435X012 20A3477X012 20A3523X012

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Key 5* Valve Plug Stem

VALVE SIZE, NPS	STEM SIZE		VALVE STEM CONNECTION		YD, S31600 (316 SST)		YS, S31600 (316 SST)	
	mm	Inch	mm	Inch	Standard Bonnet	Style 1 Ext. Bonnet	Standard Bonnet	Style 1 Ext. Bonnet
For Use With Group 1 Actuators⁽¹⁾								
1/2 thru 1-1/2	9.5	3/8	9.5	3/8	10A8823X312	1U217735162	10A8823X292	10A3539X012
	12.7	1/2	9.5 12.7	3/8 1/2	1U530935162 ---	---	---	---
2, 2-1/2	12.7	1/2	12.7	1/2	10A3541X012	10A3540X012	1N821035162	1U218035162
	19.1	3/4	12.7 19.1	1/2 3/4	---	---	---	---
3	12.7	1/2	12.7	1/2	1U230535162	1U230635162	1U217935162	1U7965X0012
	19.1	3/4	19.1	3/4	1U230835162	---	1K5878X0012	---
4	12.7	1/2	12.7	1/2	1K586935162	1U230635162	1U230635162	1U294035162
	19.1	3/4	19.1	3/4	1K587735162	---	1K896535162	1P669735162
6	19.1	3/4	19.1	3/4	1L996435162	1U507135162	1U507135162	1P669735162
For Use With Group 100 Actuators⁽¹⁾								
6	25.4	1	25.4	1	---	---	1K928935162	---
For Use With Group 101 Actuators⁽¹⁾								
6	25.4	1	25.4	1	---	---	1K744735162	---

1. Actuator Groups 1, 100, and 101 are defined on the following page.

Actuator Groups

GROUP 1 54, 71, 90 mm (2-1/8, 2-13/16 & 3-9/16 INCH) YOKE BOSS	GROUP 100 127 mm (5-Inch) YOKE BOSS
585C Series 1B 644 & 645 655 657 & 667—Except 102 mm (4-Inch) Travel, Size 70 1008—Except 51 mm (2-Inch) Travel, 90 mm (3-9/16 Inch) Yoke Boss	585C Series 657 1008—51 mm (2-Inch) only
	Group 101 127 mm (5-Inch) Yoke Boss
	667

Key 6* Pin, 316 SST

VALVE SIZE, NPS	VALVE STEM CONNECTION		YD	YS
	mm	Inch		
1/2 to 1-1/2	9.5	3/8	1P730438992	1P730438992
	12.7	1/2	---	1B627035072
2 & 2-1/2	12.7	1/2	1B599635072	1B599635072
	19.1	3/4	---	1R7386X0012
3	12.7	1/2	1B599635072	1B599635072
	19.1	3/4	1R7386X0012	1R7386X0012
4	12.7	1/2	1D545735072	1D545735072
	19.1	3/4	1D5458X0012	1D5458X0012
6	19.1	3/4	1B600735072	1L302335072
	25.4	1	1R655435072	---

Keys 7* & 8* Upper and Lower Seat Rings

VALVE SIZE, NPS	KEY 7, UPPER SEAT RING		KEY 8, LOWER SEAT RING			
	YS		YD Standard		YD High Temperature and YS	
	S41600 (416 SST)	S31600 (316 SST)	S41600 (416 SST)	CF8M (316 SST)	S41600 (416 SST)	CF8M (316 SST)
1/2, 3/4, 1, 1-1/2	10A3336X012	10A3336X022	10A3335X012	10A3335X022	10A3334X012	10A3334X022
2, 2-1/2	---	10A3393X022	10A3392X012	10A3392X022	10A3391X012	10A3391X022
3	10A3447X012	10A3447X022	10A3446X012	10A3446X022	10A3445X012	10A3445X022
4	10A3489X012	10A3489X022	10A3488X012	10A3488X022	10A3487X012	10A3487X022
6	10A3535X012	10A3535X022	11A9076X012	11A9076X022	10A3533X012	10A3533X022

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D100425X012

YD and YS Valves

July 2017

Key 9* Bonnet Gasket and Key 22* Shim

VALVE SIZE, NPS	KEY 9 (YD & YS)	KEY 22 (YD & YS)
	FGM (Graphite/S31600)	S31600 (316 SST)
1/2 - 1-1/2	1R2859X0042	16A1936X012
2, 2-1/2 3	1R3299X0042 1R3484X0042	16A1938X012 16A1940X012
4 6	1R3724X0042 1U5081X0052	16A1941X012 16A1942X012

Key 11* Spiral Wound Gasket and Key 13* Spiral Wound Spring

VALVE SIZE, NPS	KEY 11 (YD & YS)	KEY 13 (YS ONLY)
	N06600 and Graphite Laminate	N06600 and Graphite Laminate
	To 593°C (1100°F)	To 593°C (1100°F)
1/2 - 1-1/2	1R286099442	10A3325X062
2, 2-1/2 3	1R329799442 1R348299442	10A3383X042 10A3436X042
4 6	1R372299442 1U508599442	10A3478X052 10A3524X022 ⁽¹⁾

1. N06600 material only.

Key 12* Upper Seat Ring Gasket and Key 14* Lower Seat Ring Gasket

VALVE SIZE, NPS	KEY 12 (YS ONLY)	KEY 14 (YD & YS)
	FGM (Graphite/S31600)	FGM (Graphite/S31600)
1/2 - 1-1/2	10A3326X052	10A3327X052
2, 2-1/2 3	10A3384X042 10A3437X062	10A3385X042 10A3438X062
4 6	10A3479X052 10A3525X042	10A3480X052 11A9521X052

Key 19* O-Ring or Gasket (YD Only)

VALVE SIZE, NPS	O-RING (YD STANDARD)			RETAINING RING GASKET (YD HIGH TEMPERATURE) (2 REQ'D)
	Nitrile ⁽¹⁾ -29 to 93°C (-20 to 200°F)	Fluorocarbon ⁽²⁾ -18 to 204°C (0 to 400°F)	Ethylene-Propylene -40 to 232°C (-40 to 450°F)	FGM (Graphite/S31600)
1/2, 3/4, 1, 1-1/2	10A3328X012	10A3330X012	10A3329X022	10A3326X052
2, 2-1/2 3	1V3269X0012 14A5688X012	1V3269X0042 14A5688X022	1V3269X0062 14A5688X082	10A3384X042 10A3437X062
4 6	10A3481X012 1V3350X0022	10A3483X012 1V3350X0012	10A3482X022 1V3350X0042	10A3479X052 10A3525X042

1. For hydrocarbon service to 71°C (160°F).
2. -18 to 38°C (0° to 100°F) for H₂O service.

Keys 20*, 20A*, & 20B* Seals (YD Only)

VALVE SIZE, NPS	YD (STANDARD)				YD (HIGH TEMPERATURE)
	Key 20A Seal Ring	Key 20B Back Up Ring			Key 20 Valve Plug Seal
	PTFE	Nitrile ⁽¹⁾ -29 to 93°C (-20 to 200°F)	Fluorocarbon ⁽²⁾ -18 to 204°C (0 to 400°F)	Ethylene Propylene -40 to 232°C (-40 to 450°F)	Graphite (2 req'd)
1/2, 3/4, 1, 1-1/2	10A3331X012	10A3332X022	10A3332X032	10A3332X042	10A3333X012
2, 2-1/2 3	10A3388X012 10A3442X012	10A3389X022 10A3443X022	10A3389X032 10A3443X032	10A3389X052 10A3443X072	10A3390X012 10A3444X012
4 6	10A3484X012 10A3530X012	10A3485X022 10A3531X022	10A3485X032 10A3531X032	10A3485X042 10A3531X052	10A3486X012 10A3532X012

1. For hydrocarbon service to 71°C (160°F).
2. -18 to 38°C (0° to 100°F) for H₂O service.

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Keys 3, 4, 9, 11, 14, and 19 (NPS 8 YD Only)

PLUG/ CAGE / STEM KEY 3		CAGE RETAINER KEY 4	GASKET, QTY 3, KEY 9	SPIRAL WOUND GASKET, KEY 11		O-RING KEY 14	O-RING KEY 19
Low Temperature	High Temperature			Low Temperature, Qty 1	High Temperature, Qty 2	Low Temperature	Low Temperature
27B4290X012	27B4290X022	34B9111X012	1C2515X0052	10B5412X032	10B5412X032	1H8623X0022	1D2692X0022

Keys 20, 20A, 20B, 24, and 25 (NPS 8 YD Only)

BACK-UP RING, KEY 20A	SEAL RING, KEY 20B	SEAL RING, QTY 3, KEY 20	FLANGE ADAPTOR, KEY 24		BACK-UP RING, QTY 2, KEY 25	GASKET, QTY 2, KEY 25
Low Temperature	Low Temperature	High Temperature	Low Temperature	High Temperature	Low Temperature	High Temperature
10A3531X032	10A3530X012	10A3532X012	CL300: 34B6974X012 CL600: 37B9811X012	CL300: 34B6974X012 CL600: ---	12A54898X012	10A3525X042

Keys 6*, 7*, 8, and 10 Packing Box Parts

DESCRIPTION		KEY NUMBER	STEM DIAMETER, mm (INCHES)			
			9.5 (3/8)	12.7 (1/2)	19.1 (3/4)	25.4 (1)
PTFE V-Ring Packing	Single packing set, PTFE (1 req'd for single, 2 req'd for double)	6	1R290001012	1R290201012	1R290401012	1R290601012
	Spring, stainless steel (for single only)	8	1F125437012	1F125537012	1F125637012	1D582937012
	Lantern Ring, stainless steel (for double only)	8	1F364135072	1J962335072	0N028435072	0U099735072
	Quantity required	Double	---	1	2	1
	Special washer, stainless steel (for single only)	10	1F125236042	1F125136042	1F125036042	1H982236042
PTFE/ Composition Packing	Packing Ring, PTFE/Composition	7	1F3370X0012	1E319001042	1E319101042	1D7518X0012
	Quantity required	Double	---	7	10	8
	Lantern Ring, stainless steel (1 required for double)	8	1F364135072	1J962335072	0N028435072	0U099735072
Graphite Ribbon/ Packing	Packing Ring, graphite filament	7	1F3370X0322	1E3190X0222	1E3191X0282	1D7518X0132
	Quantity required	Single Double	---	2 4	3 5	3 5
	Packing ring, graphite ribbon	7	1V3160X0022	1V3802X0022	1V2396X0022	1U6768X0022
	Quantity required	Single Double	---	2 3	2 3	2 3
	Lantern ring, S31600 (316 SST)	8	1F364135702	1J962335072	0N028435072	0U099735072
	Quantity required	Single Double	---	2 1	3 2	2 1

ENVIRO-SEAL Bellows Seal Parts

Key	Description	Part Number	Key	Description	Part Number
1	Bonnet/ENVIRO-SEAL bellows seal bonnet If you need a bonnet or an ENVIRO-SEAL bellows seal bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.			stem (2 req'd for double packing) PTFE for NPS 3 and 4 with 12.7 mm (1/2 inch) stem (2 req'd for double packing)	12A9016X012
3	ENVIRO-SEAL bellows seal packing flange		7*	ENVIRO-SEAL bellows seal packing ring for low chloride graphite ribbon/filament packing arrangement	12A8832X012
4	ENVIRO-SEAL bellows seal stud bolt			Ribbon packing ring for 9.5 mm (3/8 inch) and NPS 2 with 12.7 mm (1/2 inch) stem (4 req'd)	18A0908X012
5	ENVIRO-SEAL bellows seal hex nut			Filament packing ring for 9.5 mm (3/8 inch) and NPS 2 with 12.7 mm (1/2 inch) stem (4 req'd)	1P3905X0172
6*	ENVIRO-SEAL bellows seal packing set PTFE for 9.5 mm (3/8 inch) stem (1 req'd for single packing, 2 req'd for double packing) PTFE for NPS 2 with 12.7 mm (1/2 inch)	12A9016X012		Ribbon packing ring for NPS 3 and 4 with 12.7 mm (1/2 inch) stem (4 req'd)	18A0918X012

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Key	Description	Part Number	Key	Description	Part Number
	Filament packing ring for NPS 3 and 4 with 12.7 mm (1/2 inch) stem (4 req'd)	14A0915X042		NPS 1 w/ 9.5 mm (3/8 inch) stem	32B4224X012
8	ENVIRO-SEAL bellows seal spring			NPS 1-1/2 w/ 9.5 mm (3/8 inch) stem	32B4225X012
8	ENVIRO-SEAL bellows seal spacer			NPS 2 w/ 12.7 mm (1/2 inch) stem	32B4226X012
12*	ENVIRO-SEAL bellows seal upper wiper			NPS 3 w/ 12.7 mm (1/2 inch) stem	32B4227X012
	For 9.5 mm (3/8 inch) and NPS 2 with 12.7 mm (1/2 inch) stem	18A0868X012		NPS 4 w/ 12.7 mm (1/2 inch) stem	32B4228X012
	For NPS 3 and 4 with 12.7 mm (1/2 inch) stem	18A0870X012		N06022 trim mat'l, N06022 bellows mat'l	
13*	ENVIRO-SEAL bellows seal bushing			NPS 1 w/ 9.5 mm (3/8 inch) stem	32B4224X022
	For 9.5 mm (3/8 inch) stem (1 req'd), for NPS 2 with 12.7 mm (1/2 inch) stem (2 req'd)			NPS 1-1/2 w/ 9.5 mm (3/8 inch) stem	32B4225X022
	S31600/PTFE	18A0820X012		NPS 2 w/ 12.7 mm (1/2 inch) stem	32B4226X022
	R30006	18A0819X012		NPS 3 w/ 12.7 mm (1/2 inch) stem	32B4227X022
	S31600/Cr Coated	11B1155X012		NPS 4 w/ 12.7 mm (1/2 inch) stem	32B4228X022
	For NPS 3 and 4 with 12.7 mm (1/2 inch) stem (1 req'd)			2 Ply Bellows	
	S31600/PTFE	18A0824X012		S31600 trim mat'l, N06625 bellows mat'l	
	R30006	18A0823X012		NPS 1 w/ 9.5 mm (3/8 inch) stem	32B4224X032
	S31600/Cr Coated	11B1157X012		NPS 1-1/2 w/ 9.5 mm (3/8 inch) stem	32B4225X032
13*	ENVIRO-SEAL bellows seal bushing/liner			NPS 2 w/ 12.7 mm (1/2 inch) stem	32B4226X032
	For 9.5 mm (3/8 inch) stem (1 req'd), for NPS 2 with 12.7 mm (1/2 inch) stem (2 req'd)			NPS 3 w/ 12.7 mm (1/2 inch) stem	32B4227X032
	N10276 bushing, PTFE/glass liner	12B2713X012		NPS 4 w/ 12.7 mm (1/2 inch) stem	32B4228X032
	N10276 bushing, PTFE/carbon liner	12B2713X042		N06022 trim mat'l, N06022 bellows mat'l	
	For NPS 3 and 4 with 12.7 mm (1/2 inch) stem (1 req'd)			NPS 1 w/ 9.5 mm (3/8 inch) stem	32B4224X042
	N10276 bushing, PTFE/glass liner	12B2715X012		NPS 1-1/2 w/ 9.5 mm (3/8 inch) stem	32B4225X042
	N10276 bushing, PTFE/carbon liner	12B2715X042		NPS 2 w/ 12.7 mm (1/2 inch) stem	32B4226X042
15	ENVIRO-SEAL bellows seal Locknut			NPS 3 w/ 12.7 mm (1/2 inch) stem	32B4227X042
16	ENVIRO-SEAL bellows seal pipe plug (2 req'd)			NPS 4 w/ 12.7 mm (1/2 inch) stem	32B4228X042
20*	ENVIRO-SEAL bellows seal stem/bellows assembly		22*	ENVIRO-SEAL bellows seal bonnet gasket (graphite laminate)	
	1 Ply Bellows			NPS 1/2 through 1	12B6316X022
	S31600 trim mat'l, N06625 bellows mat'l			NPS 1-1/2	12B6317X022
				NPS 2	12B6318X022
				NPS 3	12B6319X022
				NPS 4	12B6320X022
			24	ENVIRO-SEAL bellows seal adaptor	
			28	ENVIRO-SEAL bellows seal nameplate, warning	
			29	ENVIRO-SEAL bellows seal drive screw (2 req'd)	
			36*	ENVIRO-SEAL bellows seal pin	12B3951X012
			37	ENVIRO-SEAL bellows seal warning tag	
			38	ENVIRO-SEAL bellows seal tie	
			39	ENVIRO-SEAL bellows seal thrust ring	

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YD and YS Valves

July 2017

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D100425X012

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Fisher™ Z500 Severe Service Ball Valves (Obsolete)

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Introduction

The product covered in this document is no longer in production. This document, which includes the latest published version of the instruction manual, is made available to provide updates of newer safety procedures. Be sure to follow the safety procedures in this supplement as well as the specific instructions in the included instruction manual.

Part numbers in the included instruction manual should not be relied on to order replacement parts. For replacement parts, contact your [Emerson sales office](#).

For more than 30 years, Fisher products have been manufactured with asbestos-free components. The included manual might mention asbestos containing parts. Since 1988, any gasket or packing which may have contained some asbestos, has been replaced by a suitable non-asbestos material. Replacement parts in other materials are available from your sales office.

Safety Instructions

Please read these safety warnings, cautions, and instructions carefully before using the product.



These instructions cannot cover every installation and situation. Do not install, operate, or maintain this product without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. **To avoid personal injury or property damage it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your Emerson sales office before proceeding.

Specifications

This product was intended for a specific range of service conditions--pressure, pressure drop, process and ambient temperature, temperature variations, process fluid, and possibly other specifications. **Do not expose the product to service conditions or variables other than those for which the product was intended.** If you are not sure what these conditions or variables are, contact your [Emerson sales office](#) for assistance. Provide the product serial number and all other pertinent information that you have available.

Inspection and Maintenance Schedules

All products must be inspected periodically and maintained as needed. The schedule for inspection can only be determined based on the severity of your service conditions. Your installation might also be subject to inspection schedules set by applicable governmental codes and regulations, industry standards, company standards, or plant standards.

In order to avoid increasing dust explosion risk, periodically clean dust deposits from all equipment.

When equipment is installed in a hazardous area location (potentially explosive atmosphere), prevent sparks by proper tool selection and avoiding other types of impact energy.

Parts Ordering

Whenever ordering parts for older products, always specify the serial number of the product and provide all other pertinent information that you can, such as product size, part material, age of the product, and general service conditions. If you have modified the product since it was originally purchased, include that information with your request.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher product, because they may void your warranty, might adversely affect the performance of the product, and could cause personal injury and property damage.

Installation

⚠ WARNING

- Personal injury or equipment damage caused by sudden release of pressure or bursting of parts may result if the valve assembly is installed where service conditions could exceed the limits given in the applicable product literature, the limits on the appropriate nameplates, or the mating pipe flange rating. Use pressure-relieving devices as required by government or relevant industry codes and good engineering practices. If you cannot determine the ratings and limits for this product, contact your [Emerson sales office](#) before proceeding.
- To avoid personal injury, always wear protective gloves, clothing, and eyewear when performing any installation operations.
- To avoid personal injury or property damage, use proper lifting and rigging practices while lifting, installing or removing the valve assembly. Be sure to use lifting and rigging equipment properly sized and selected for the weight and configuration of the valve assembly or component being lifted.
- Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.
- Many rotary shaft valves are not necessarily grounded to the pipeline when installed in a flammable, hazardous, oxygen service, or explosive atmospheres. An explosion is possible, due to the discharge of static electricity from the valve components. To avoid personal injury or property damage, make sure that the valve is grounded to the pipeline before placing the control valve assembly into service. Use and maintain alternate shaft-to-body bonding, such as a shaft-to-body bonding strap assembly.
- Rotary shaft valves are designed and intended for installation between flanges. Personal injury or property damage may result from improper installation. To avoid personal injury or property damage caused by the sudden release of pressure or bursting of parts, do not use or install rotary shaft valves (including single lug constructions) for dead-end service.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- If installing into an existing application, also refer to the WARNING in the Maintenance section.
- When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. To avoid possible personal injury and because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson sales office.

CAUTION

- Ensure that the valve and adjacent pipelines are free of foreign material that could damage the valve seating surfaces.

Maintenance

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Always wear protective gloves, clothing, and eyewear.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure.
- Do not remove the actuator while the valve is pressurized.
- Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring pre-compression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box might contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids might spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug. Cautiously remove parts so that fluid escapes slowly and safely.
- Many valve parts that are moving can injure you by pinching, cutting, or shearing. To help prevent such injury, stay clear of any moving part.
- Never apply pressure to a partially assembled valve.
- To avoid personal injury or property damage caused by uncontrolled movement of a valve bonnet, loosen the bonnet by following these instructions: Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. Loosen bonnet nuts approximately 3 mm (0.125 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed with bonnet removal.
- As you remove parts, such as valve shafts, other parts, such as disks can fall from the valve body or suddenly move to another position in the valve. To avoid injury from falling or moving parts, be sure to support parts and be sure they are in a stable position as you disassemble the valve.
- Personal injury could result from packing leakage. Do not scratch the drive shaft or packing box wall while removing packing parts.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

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Fisher™ Z500 Severe Service Ball Valves

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Figure 1. Fisher Z500 Severe Service Ball Valve



X1243

Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for the Fisher Z500 Severe Service Ball Valve (see figure 1).

Do not install, operate, or maintain Z500 valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The Z500 severe service ball valve is a split body bolted design, full or reduced port, with a blowout proof shaft. It can be lever operated, gear operated, or actuated. The Z500 severe service ball valve line is a simplistic two-piece floating ball design with integral metal seat meant to provide tight metal seating shutoff in high temperature, high pressure, corrosive, and erosive applications across all industries.

Specifications

Specifications for these valves are shown in table 1.

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Z500 Valve

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Table 1. Specifications

Valve Sizes Z500: NPS 1/2, 3/4, 1, 1-1/2, 2, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 26, 28, 30 and, 36 Maximum Working Pressures⁽¹⁾ Consistent with applicable pressure-temperature ratings in table 4 per ASME B16.34, but do not exceed the material temperature capabilities shown below Shutoff Classification⁽¹⁾ Z500: Valves are tested to API 598 in the preferred flow direction. Class V type B per FCI 70-2 in reverse flow in bi-directional design (Must be specified). For other shutoff requirements, please contact your Emerson sales office or Local Business Partner. Construction Materials See tables 2 and 3 Temperature Capabilities⁽¹⁾ Welded and Threaded Ends: Carbon Steel, -462°C (-800°F); F22, 538°C (1000°F); F91, 649°C (1200°F); F316, 538°C (1000°F); F316H, 760°C (1400°F) Flanged End Connections: Carbon Steel, -351°C (-600°F); F22, 427°C (800°F); F91, 538°C (1000°F); F316, 538°C (1000°F) Lower Limits: Carbon steel: -29°C (-20°F), Stainless steel: -40°C (-40°F)	Packing Constructions Carbon Steel Valve Bodies: Wire reinforced graphite packing, AISI 4130 nitrided packing gland Stainless Steel: N06600 wire-reinforced graphite packing, S31600 nitrided packing gland Standard Flow Direction Preferred Flow Direction: Preferred flow for optimal sealing is forward into the integral seat Flow Coefficients Contact your Emerson sales office or Local Business Partner Maximum Ball Rotation 90 degrees Actuator Mounting The preferred mounting orientation is vertical. Other orientations are acceptable Approximate Weight Contact your Emerson sales office or Local Business Partner Options Reduced port, Expanded outlet, Scraper seats, HVOF coating options, Bi-directional sealing, High cycle constructions, Lockouts, Spray and fused coatings
---	---

1. The pressure/temperature limits in this manual, and any applicable code or standard limitation, should not be exceeded.

Table 2. Standard Construction Materials for NPS 1/2 through 36 Valves

PART	VALVE BODY AND END ADAPTER MATERIAL			
	Carbon Steel	F22	F91	F316, F316H
Ball ⁽¹⁾	S41000	S41000	S41000	S31600
Upstream seat ⁽¹⁾	S41000	S41000	S41000	S31600
Seat Holder ⁽²⁾	S41000	S41000	S41000	S31600
Body gasket	S17400	N07718	N07718	S66286
Spring	N07718 or S17400 ⁽³⁾	N07718	N07718	S66286
Packing	Flexible graphite with wire-reinforced braided graphite and stainless steel washers			
Shaft	S17400 Nitrided	N07718 Nitrided	N07718 Nitrided	S66286 Nitrided
Shaft adapter	AISI 4130 Nitrided, 4140 Nitrided			
Coatings	HVOF Chrome Carbide (standard), HVOF Tungsten Carbide, Spray and Fused Nickel-Boron			

1. Part is coated (HVOF chrome carbide standard)
2. Seat holder is standard on welded and threaded end connections in 0.65, 1.15, 1.5, and 2 inch bores only. Bidirectional option must be specified for all other constructions.
3. N07718 spring for 2 inch bore and below. S17400 spring for 3 inch bore and above.

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Z500 Valve

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Table 3. Spray and Fused Coating Standard Construction Materials⁽¹⁾

PART	VALVE BODY AND END ADAPTER MATERIAL			
	Carbon Steel	F22	F91	F316, F316H
Ball and Upstream Seat ⁽²⁾	F22			S31600
1. Seat holder is standard on welded and threaded end connections in 0.65, 1.15, 1.5, and 2 inch bores only. Bidirectional option must be specified for all other constructions. 2. Part is coated.				

Table 4. Valve Body Materials, End Connections, and Ratings

Ratings	Bore (inches)	Size, NPS	End Connection	Valve Body Materials ⁽¹⁾
CL150 through 1500	0.65	1/2	Buttweld, Socketweld, FNPT, RF, RTJ	Carbon Steel, F22, F91, F316, and F316H
		3/4		
		1		
		1-1/2		
	1.15	1		
		1-1/2		
		2		
		2-1/2		
	1.5	1-1/2		
		2		
		2-1/2		
		3		
	2	2	Buttweld, Socketweld, FNPT, RF, RTJ	
		2-1/2	Buttweld, RF, RTJ	
		3		
		4		
	3	3		
		4		
		6		
	4	4		
		6		
	6	6		
		8		
	8	8	RF, RTJ	
		10		
	10	10		
	12	12		
14	14			
16	16			
18	18			
20	20			
24	24			
26	26			
28	28			
30	30			
36	36			

-continued-

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Z500 Valve

July 2018

Instruction Manual

D103803X012

Table 4. Valve Body Materials, End Connections, and Ratings (continued)

Ratings	Bore (inches)	Size, NPS	End Connection	Valve Body Materials ⁽¹⁾
CL2500	0.65	1/2	Buttweld, Socketweld, FNPT, RF, RTJ	Carbon Steel, F22, F91, F316, and F316H
		3/4		
		1		
		1-1/2		
	1.15	1		
		1-1/2		
		2		
		2-1/2		
	1.5	1-1/2		
		2		
		2-1/2		
		3		
	2	2	Buttweld, Socketweld, FNPT, RF, RTJ	
		2-1/2		
		3	Buttweld, RF, RTJ	
		4		
	3	3		
		4		
		6		
	4	4		
6				
6	6			
	8			
8	8	RF, RTJ		
	10			
CL3200	0.65	1/2	Buttweld, Socketweld	Carbon Steel, F22, F91, F316, and F316H
		3/4		
		1		
	1.15	1		
		1-1/2		
		2		
	1.5	1-1/2		
		2		
2-1/2				
CL4500	0.65	1/2	Buttweld, Socketweld	Carbon Steel, F22, F91, F316, and F316H
		3/4		
		1		
	1.15	1		
		1-1/2		
		2		
	1.5	1-1/2		
		2		
2-1/2				

1. Valve bodies machined from forgings or forged bar.

1. Valve bodies machined from forgings or forged bar.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed either the valve body rating or the mating pipe flange joint rating. To avoid such injury or damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. To avoid possible personal injury and because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#) or Local Business Partner.

⚠ WARNING

The valve drive shaft is grounded to the pipeline via graphite packing. If the process fluid or atmosphere around the valve is flammable, this electrical bonding (graphite packing) must be used to avoid personal injury or property damage as a result of an explosion caused by a discharge of static electricity from valve components.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

When a valve is shipped bare shaft:

- a. Valve is shipped in the open position with exposed shaft
- b. Valve will include two shaft keys.

When a valve is shipped with mounting kit only:

- a. Valve will ship in the in open position
- b. Valve will have the mounting finger-tight to the valve
- c. Customer shall ensure proper mounting of the actuator

- d. Customer shall ensure valve shaft has not been pushed or forced down into the valve
- e. Customer shall ensure no binding occurs when mounting the actuator
 - i. Customer shall ensure the correct alignment is done when mounting the actuator
 - ii. No hammering or forcing down of the shaft adapter is allowed
- f. Customer shall ensure all bolts are torqued down appropriately
- g. Customer shall ensure the actuator mounting surface is completely flush with the mounting bracket. For additional information on actuator mounting, refer to the Actuator Mounting section in this instruction manual on page 14.
- h. Customer shall ensure the mounting can allow for or can accommodate expansion of the shaft or adapter at high temperatures. See table 7.

When a valve is shipped with actuator:

- a. Valve will be shipped in the required fail position
 - b. All bolting will be torqued as required
 - c. Emerson recommends that the customer not remove the actuator for final installation in the line
1. Inspect the valve prior to installation into the piping system to ensure there is no shipping damage. End protectors and shipping materials must be removed to allow a complete inspection.
 2. Inspect the actuator, if included, for damage and then cycle the valve with the actuator from open (the normal shipping position) to closed to open to ensure proper functioning.

CAUTION

Make sure the valve is installed in the correct orientation. Put the high pressure side (body side) on the upstream side. The arrow on the valve should point from the high pressure to low pressure side when the valve is closed. The valve could be damaged if installed incorrectly.

Weld End Valves

⚠ WARNING

Emerson Automation Solutions is not responsible for improper installation or inspection of any valve which falls outside the criteria presented in this instruction manual. Requests for additional information on unique situations should be directed to your [Emerson sales office](#) or Local Business Partner.

CAUTION

Weld fill between the valve and pipe should never be used to correct for improper pipe installation length or misalignment. Additional welding beyond what is required may cause the valve to reach higher temperatures and have a larger heat-affected zone, which can cause permanent damage to the valve or its components.

For additional information, refer to ASME Boiler and Pressure Vessel Code Section IX.

Procedure

Initial Preparation

1. Ensure the valve is in the fully open position so that vital sealing areas of the ball are not exposed to weld spatter.
2. Never make arc strikes on the valve body or end adapter except inside the groove intended for butt welding or inside the corner of the joint for socket welding. Arc strikes made on areas which are not intended to be welded can cause a localized increase in hardness and micro-cracks, and can otherwise compromise the intended mechanical properties of the material.
3. Attach the welding ground strap to the side of the valve being welded.
4. Install the valve into the piping system prior to welding in order to minimize piping loads. Orient the valve with the shaft vertical, if possible, and install the piping such that pipe loads are minimized on the valve.
5. Weld the valve into the line using welders and procedures fully qualified per ASME Boiler and Pressure Vessel Code Section IX.
6. Ensure that the valve body temperature always remains below 427°C (800°F).

Post-Weld Heat Treatment

CAUTION

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal parts is possible. Do not place the entire valve in a stress relief furnace, or cover the entire valve with stress relieving blankets, as this could damage the valve. Contact your [Emerson sales office](#) or Local Business Partner for additional information.

1. Weld the valve into the line using qualified welders and procedures per Section IX of the ASME Boiler and Pressure Vessel Code. If specific procedures are required, contact your Emerson sales office or Local Business Partner for written guidance based on pipe and valve materials.
2. Apply post weld heat treat in accordance with valve material and code requirements. Only local post weld heat treat on each end of the valve must be used.

Final Inspection after Post-Weld Heat Treatment

After post weld heat treat, verify valve body studs and packing studs are tight.

CAUTION

Before cycling the valve in the line, make sure the line is clean of weld slag and other debris that could damage the valve. Cycle the valve after installation to ensure proper functioning.

1. Cycle the valve to verify proper operation. Ensure that the torque required to cycle the valve has remained within acceptable limits.
2. Verify that the body and packing bolting are tightened to the correct torque per tables 5 and 6.
3. Install proper insulation as required for insulated piping systems.

Operation

1. No routine maintenance or lubrication is required. No tightening of body studs should be necessary. Packing bolting may be retightened if a shaft packing leak is noted during operation.

2. Actuators supplied with the valve may require maintenance per the actuator manufacturer's recommendations. For valves supplied with gears, the grease in the gearbox might need to be cleaned out and replaced periodically. Use only high temperature grease recommended for gearboxes.
3. Metal-seated ball valves have high torques. Consult your [Emerson sales office](#) or Local Business Partner for more information.
4. Valves operate clockwise to close and counterclockwise to open. Gears and actuators are marked with arrows and symbols to show valve position and operating direction. Lever operated valves have an integral lockplate so that only the correct operating direction is possible. The lockplate has the "O" for open and the "C" for closed marked to show proper position. The lever is always aligned with the ball bore for positive proof of ball position. Gears and actuators have adjustable stops for proper ball positioning.
5. The ball is mated to the end adapter seat. The top of the shaft is marked to show the proper orientation of the lapped side of the ball.
6. This valve should be either normally open or normally closed. Throttling with this valve is not recommended for extended periods. Throttling for brief periods during startup or shutdown is allowed.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- The valve packing area may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

1. If valve maintenance is required, contact your [Emerson sales office](#) or Local Business Partner.

Troubleshooting

Operation

- **Shaft adapter/actuator may be misaligned--** Remove actuator and shaft adapter, then reassemble per assembly procedures for actuators.
- **Over-tightened shaft packing--** Loosen packing to hand tight, cycle valve and retighten per procedures following torque table 6.
- **Inadequate air supply--** Increase air supply or install larger solenoid or quick exhaust valve. Refer to actuator manufacturer's specifications.

Valve will not Rotate

- **Valve body ID or bore is clogged--** Flush or clean valve ID and try to cycle valve.
- **Actuator is not operating correctly or has failed--** Replace or repair actuator and try to cycle valve.
- **Shaft keys have sheared--** Remove shaft adapter and determine why keys sheared, insert new keys, reassemble and try to cycle valve.

Valve Shaft Packing Leaking

- **Packing flange bolting is loose--** Tighten packing bolting. See Packing Replacement section, step 7 on page 14 of this instruction manual.
- **Packing is damaged or improperly installed--** Depressurize valve, remove old packing and replace with new assembly per assembly instruction steps 3 to 5.
- **Actuator misalignment--** Check for actuator misalignment.

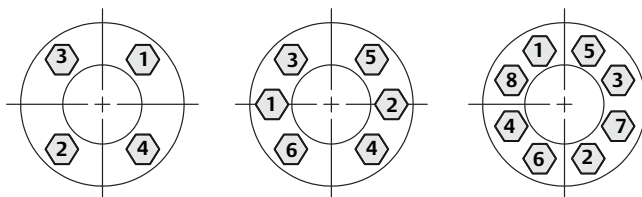
Valve Body Gasket Leaking

- **Body bolting is loose--** Tighten body bolting per table 5 and figure 2.
- **Body gasket damaged--** Contact your [Emerson sales office](#) or Local Business Partner.

Table 5. Body-to-End Adapter Bolt Torque and Bracket-to-Body Bolt Torque Values

STUD SIZE (mm)	RECOMMENDED TORQUE (ft • lbf) ⁽¹⁾			RECOMMENDED TORQUE (in • lbf) ⁽¹⁾			RECOMMENDED TORQUE (N • m) ⁽¹⁾		
	B7M (σ y = 80Ksi)	B7 / B16 (σ y = 100Ksi)	B8M CL1 (σ y = 30Ksi)	B7M	B7/B16	B8M CL1	B7M	B7/B16	B8M CL1
1/4 - 20 UNC	7.6	8.9	4	91	107	48	10	12	5
5/16 - 18 UNC	15.5	17.8	8	186	214	96	21	24	11
3/8 - 16 UNC	27.3	31	13.9	328	372	167	37	42	19
7/16 - 14 UNC	43	50	22	516	600	264	58	68	30
1/2 - 13 UNC	66	71	33	792	852	396	89	96	45
9/16 - 12 UNC	95	95	47	1140	1140	564	129	129	64
5/8 - 11 UNC	125	125	65	1500	1500	780	169	169	88
3/4 - 10 UNC	200	200	115	2400	2400	1380	271	271	156
7/8 - 9 UNC	290	290	180	3480	3480	2160	393	393	244
1 - 8 UNC	405	405	270	4860	4860	3240	549	549	366
1 1/8 - 8 UN	550	550	290	6600	6600	3480	746	746	393
1 1/4 - 8 UN	730	730	545	8760	8760	6540	990	990	739
1 3/8 - 8 UN	980	980	735	11760	11760	8820	1329	1329	997
1 1/2 - 8 UN	1290	1290	965	15480	15480	11580	1749	1749	1308
1 5/8 - 8 UN	1650	1650	1235	19800	19800	14820	2237	2237	1674
1 3/4 - 8 UN	2070	2070	1550	24840	24840	18600	2807	2807	2102
1 7/8 - 8 UN	2560	2560	1920	30720	30720	23040	3471	3471	2603
2 - 8 UN	3130	3130	2340	37560	37560	28080	4244	4244	3173

1. Torque recommendations provided require lubrication of stud and nut with a Lithium Polymer Grease. Use of other lubricants may change torque recommendation. Contact your [Emerson sales office](#) or Local Business Partner if other bolting materials are used.

Figure 2. Bolting Tightening Pattern


Valve Leaking through Ball or Seating Area

- Valve body ID or bore is clogged-- Flush or clean valve ID and try to cycle valve.
- Valve is not fully closed-- Close valve, taking care not to over torque.
- Actuator travel stops are not set correctly-- Set stops and cycle, checking for leaks.
- Seat or Ball is damaged-- Contact your Emerson sales office or Local Business Partner for repair.
- Belleville spring is collapsed — Contact your Emerson sales office or Local Business Partner for repair.

Note

If you need additional trouble-shooting assistance, please contact your Emerson sales office or Local Business Partner.

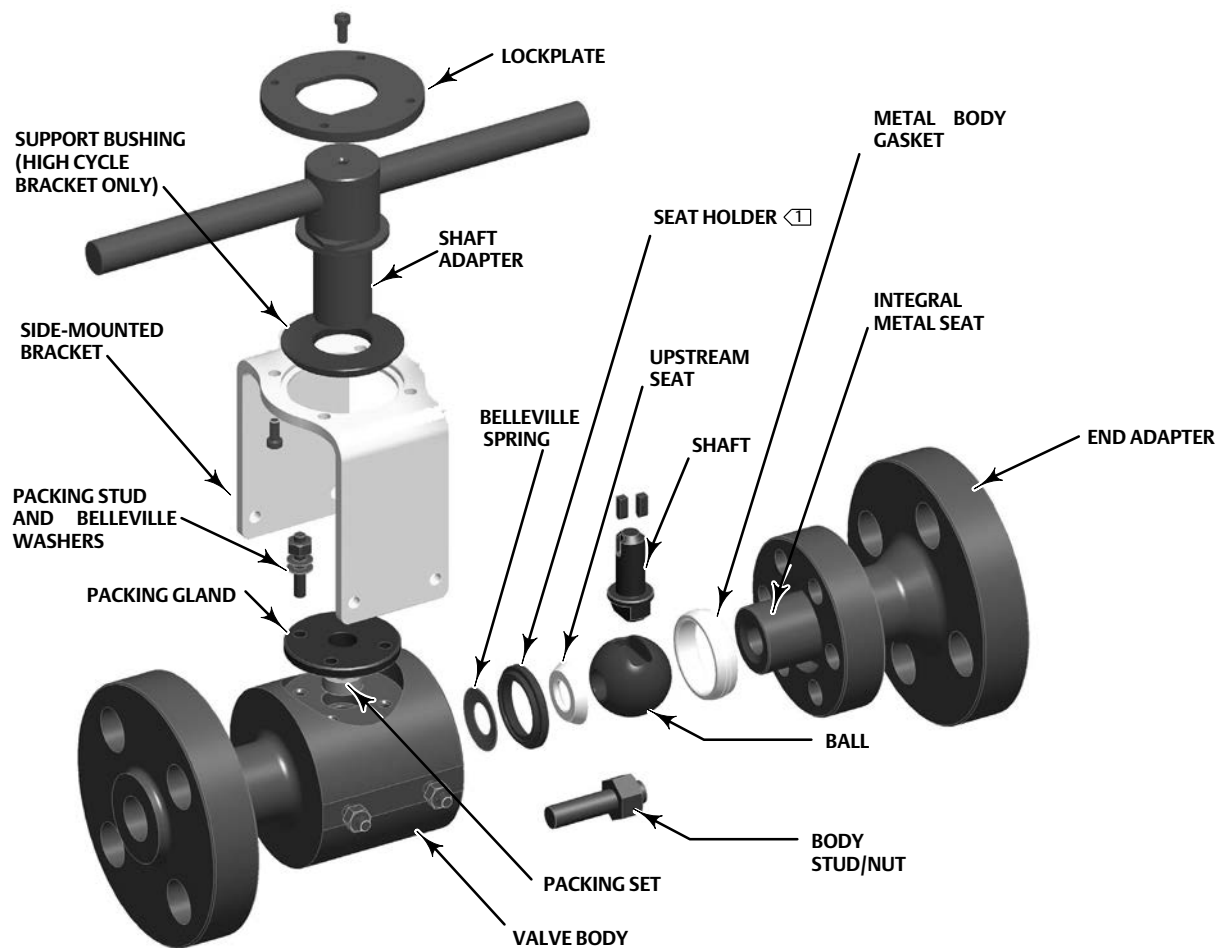
Packing Replacement

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
 - Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
 - Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
 - Vent the power actuator loading pressure and relieve any actuator spring precompression.
 - Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
 - Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
 - The valve packing area may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
 - Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
-

Figure 3. Z500 Construction Features



X1207

Note:

□ Seat holder is standard on welded and threaded end connections in 0.65, 1.15, 1.5, and 2 inch bores only. Bidirectional option must be specified for all other constructions.

1. Loosen the packing studs.
 2. Remove the packing rings from the packing box, being careful not to damage the packing box.
 3. Inspect the clean packing box to ensure all surfaces are clean and undamaged.
 4. Insert the zero clearance washer. Use the packing flange to press the washer into position.
 5. Insert the bottom end ring of the shaft packing. Use the packing flange to press the bottom end ring into position.
 6. Insert the die formed rings. Use the packing flange to press the ring into position.
-

Figure 4. Assembly Steps

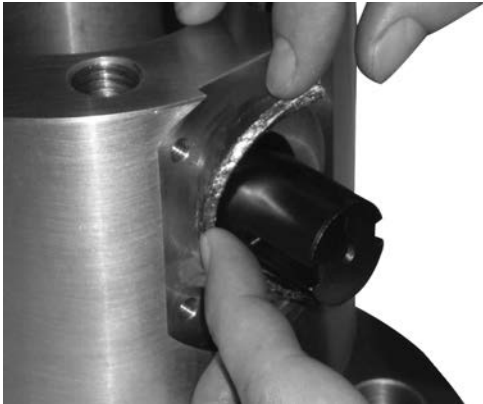


Figure 5. Insert Top End Ring



7. Insert the top end ring of shaft packing. Use the packing flange to press the top end ring into position.

Figure 6. Use Packing Flange



8. Bolt up the packing flange. Use Belleville washers in the same orientation as removed. Contact your [Emerson sales office](#) or Local Business Partner for additional information. Make sure that the markings on the studs and nuts are facing out. Tighten the nuts in a star pattern (figure 2). Tighten the nuts with applicable torque (table 6).

Figure 7. Bolt Up the Packing Flange



Actuator Mounting

CAUTION

Never use a hammer or excessive force to install the shaft adapter on the valve. Improper installation can cause permanent damage to the valve.

1. Mount the shaft adapter on top of the shaft with the two keys. Make sure it fits onto the shaft easily without hammering.
2. Position the mounting bracket onto the body. Use anti-seize lubricant on the bracket studs and nuts. Make sure the markings on the studs and nuts are facing out. Leave the nuts.

Figure 8. Mount the Shaft Adapter



Figure 9. Position the Mounting Bracket



-
3. Place the actuator on top of the mounting bracket and shaft adapter, in the fail position. Make sure the actuator is properly aligned with the shaft adapter. If not, loosen the mounting bracket to assure proper alignment and retighten the mounting bracket. Use anti-seize lubricant on the actuator studs and nuts. Ensure the markings on the studs and nuts are facing out. Ensure the mounting can allow or can accommodate expansion of the shaft or adapter at high temperature. Reference table 7.
 4. Tighten the actuator and mounting bracket studs to the applicable torque after everything is aligned properly.
 5. Install the actuator hand wheel, if present, with key and retention plate. Install the indicator plate on top of the actuator.

Figure 10. Place the Actuator on Top of the Mounting Bracket

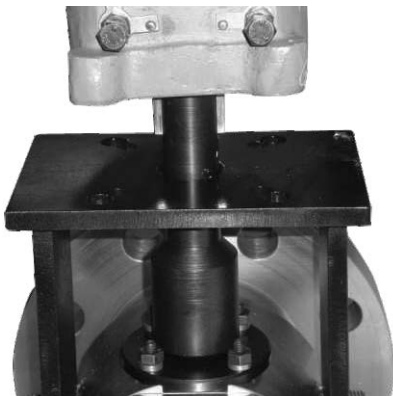
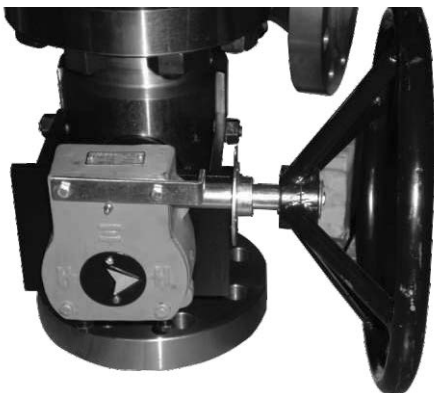


Figure 11. Install the Handwheel



Hand Lever

6. Position the mounting bracket onto the body. Use anti-seize lubricant on the bracket studs and nuts. Make sure the markings on the studs and nuts are facing out. Leave the nuts finger tight.
7. Insert the support bushing into the allotted slot of the mounting bracket.
8. Mount the shaft adapter on top of the shaft with the two keys. Make sure it fits onto the shaft easily without hammering. Make sure the mark is facing the lapped side of the ball/end adapter.

Figure 12. Shaft Adapter



-
9. Place the lock plate on top of the mounting bracket. Note the orientation of the open “O” and closed “C” markings.

Figure 13. Lock Plate



-
10. Thread on the socket head cap screws, using anti-seize lubricant, from the underside of the mounting bracket.
11. Tighten the mounting bracket and lockplate bolting to the applicable torque after everything is aligned properly.

Figure 14. Handlever Assembly



-
12. Insert the lever through the hole on the shaft adapter. Thread in the set screw on top of the shaft adapter to hold the lever in place.

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Z500 Valve

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Table 6. Packing Flange Bolt Torque Values

BOLT SIZE		RECOMMENDED TORQUE		
mm	Inch	lbf•ft	lbf•in	N•m
6	1/4	4	50	6
8	5/16	6	75	8
10	3/8	8	100	11
11	7/16	15	180	20
13	1/2	21	250	28
16	5/8	38	450	50
19	3/4	58	700	79
22	7/8	100	1200	135
25	1	150	1800	203

Table 7. Assembly Stand Off

NOMINAL BORE SIZE ⁽¹⁾		STANDOFF - MINIMUM		STANDOFF - MAXIMUM	
mm	Inch	mm	Inch	mm	Inch
17	0.65	0.38	0.015	0.89	0.035
29	1.15	0.38	0.015	0.89	0.035
38	1.5	0.38	0.015	0.89	0.035
51	2	0.38	0.015	0.89	0.035
76	3	0.64	0.025	1.14	0.045
102	4	0.89	0.035	1.40	0.055
152	6	1.02	0.040	1.52	0.060
203	8	1.27	0.050	1.78	0.070
254	10	1.52	0.060	2.03	0.080
305	12	1.78	0.070	2.54	0.100
356	14	2.92	0.115	3.68	0.145
406	16	3.43	0.135	4.19	0.165
457	18	2.67	0.105	3.43	0.135

1. Contact your [Emerson sales office](#) or Local Business Partner for additional sizes.

Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your [Emerson sales office](#) or Local Business Partner regarding spare parts or technical information.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they will void your warranty, might adversely affect the performance of the valve, and could give rise to personal injury and property damage.

Parts List

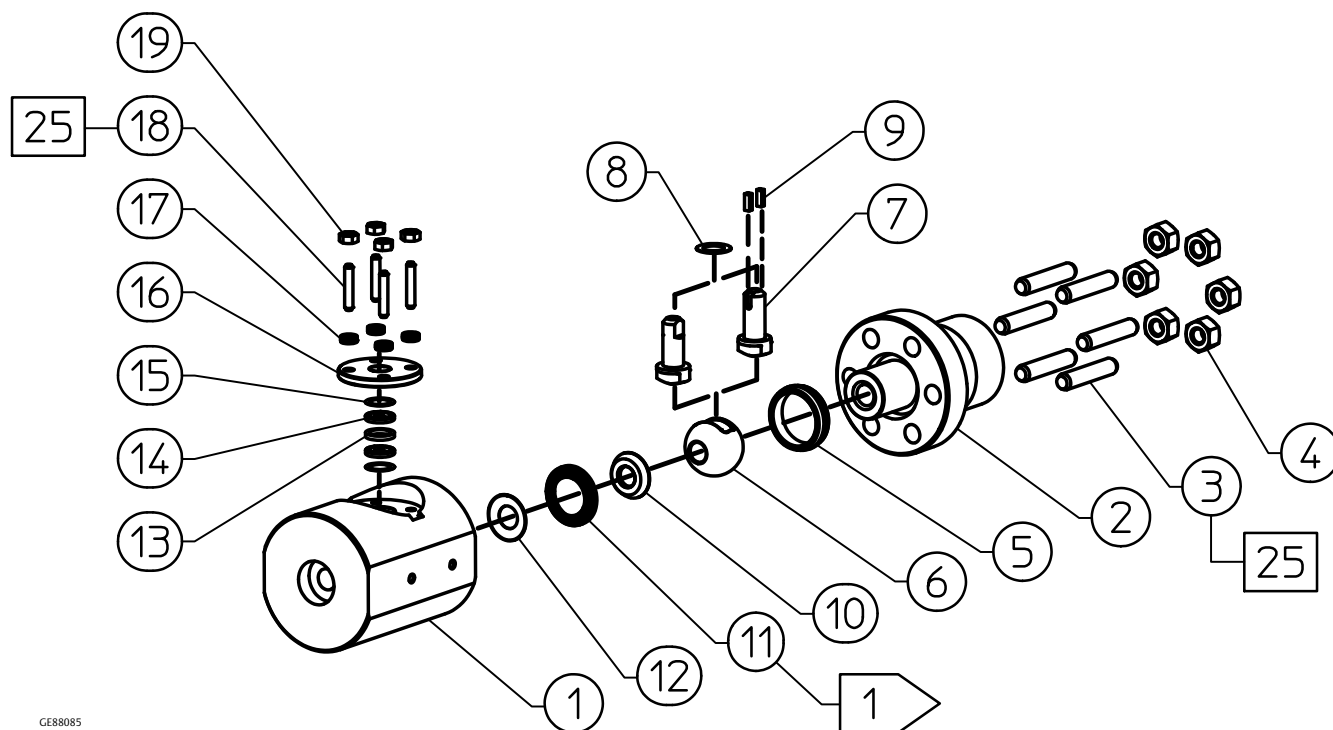
Note

Contact your Emerson sales office or Local Business Partner for part number information.

Key	Description
1	If you need a valve body as a replacement part, order by valve size, serial number, and desired valve body material. Contact your Emerson Automation Solutions sales office for assistance.
2	End Adapter
3	Body Bolts
4	Body Nuts
5*	Valve Body Gasket
6	Ball

Key	Description
7	Shaft
8	Thrust Washer
9	Shaft Key
10	Upstream Seat
11	Seat Holder for Bidirectional Shutoff
12	Belleville Spring
13*	Shaft Packing
14*	Shaft Packing
15*	Shaft Packing
16	Packing Gland
17	Belleville Washer
18	Packing Bolts
19	Packing Nuts

Figure 15. Fisher Z500 Valve Assembly



GE88085

□ APPLY LUB

① OPTIONAL: 11

PARTS NOT SHOWN: KEY 20, 21, 22, 23, 24, 26, and 27

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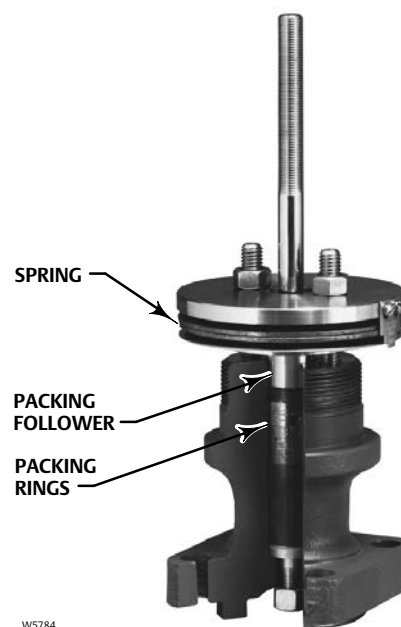


HIGH-SEAL ULF Live-Loaded Packing System

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Spring Selection	3
Installation	3
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Retrofit Parts	7
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Figure 1. HIGH-SEAL ULF Live-Loaded Packing System



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for HIGH-SEAL ULF live-loaded packing systems (see figure 1). These systems are available for sliding-stem valves with 9.5, 12.7, 19.1, 25.4, 31.8 and 50.8 mm (3/8, 1/2, 3/4, 1, 1-1/4, and 2-inch) stem diameters. Refer to separate manuals for instructions covering valves and actuators. For rotary valve applications, contact your [Emerson sales office](#) or Local Business Partner or refer to your rotary valve instruction manual.

Do not install, operate, or maintain HIGH-SEAL ULF live-loaded packing systems without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all

safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

HIGH-SEAL ULF live-loaded packing systems combine the excellent sealing performance of the ENVIRO-SEAL Graphite ULF packing set with the high-performance of the HIGH-SEAL spring pack. The long-travel HIGH-SEAL Belleville springs accurately compensate for any packing consolidation or wear, keeping the packing stress nearly constant over the life of the packing set.

The HIGH-SEAL load scales ensure accurate initial packing adjustment and provide positive visual indication of the packing stress at any time. It is recommended that new packing sets be adjusted to the MAX level.

HIGH-SEAL ULF packing systems are intended for more-severe applications with pressure limits up to 290 bar (4200 psig), except for 9.5 mm (3/8 inch) stem size, which is restricted to 110 bar (1600 psig). If your application exceeds these limits, consult your Emerson sales office or Local Business Partner. For ratings on packing systems, refer to 59.1:062 Packing Selection Guidelines For Sliding Stem Valves ([D101986X012](#)). However, do not exceed the pressure/temperature limits of the valve. If the piping and valve are insulated, do not allow insulation to extend above the yoke boss surface, covering the HIGH-SEAL ULF packing arrangement. Keep the HIGH-SEAL ULF packing arrangement exposed to ambient air conditions.

Table 1. Packing Friction with HIGH-SEAL Graphite ULF Packing

VALVE STEM DIAMETER		HIGH-SEAL GRAPHITE ULF PACKING
mm	Inches	
Newtons		
9.5	3/8	935
12.7	1/2	1250
15.9	5/8	1680
19.1	3/4	2350
25.4	1	3740
31.8	1-1/4	4800
50.8	2	6000
Pounds (Force)		
9.5	3/8	210
12.7	1/2	230
15.9	5/8	380
19.1	3/4	530
25.4	1	840
31.8	1-1/4	1100
50.8	2	1350

The flange, Belleville springs, stud bolts and nuts, packing follower, and packing arrangement are an integral part of the HIGH-SEAL ULF system (see figure 6). For maximum packing life and to operate within the friction specified in table 1, do not interchange any other packing parts with the parts in the HIGH-SEAL ULF system.

⚠ WARNING

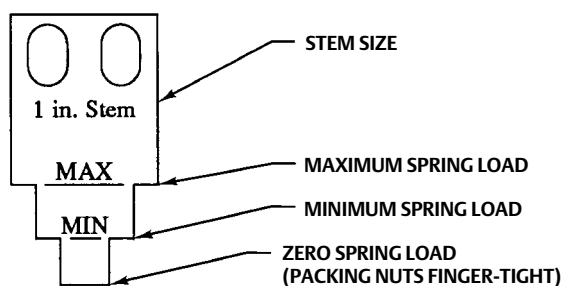
HIGH-SEAL ULF live-loaded packing systems are intended for a specific range of pressure, temperature and other service conditions. The valves for which these packing systems are available are also intended for a specific range of pressure, temperature and other service conditions. Do not expose the packing system or the valve to service conditions or variables other than those for which the packing system and valve are intended. If you are not sure what these conditions are, contact your Emerson sales office or Local Business Partner. Provide the product serial number (shown on the nameplate) and all other pertinent information. Applying different conditions could result in parts damage, malfunction of the valve or loss of control of the process, and could also result in personal injury or property damage.

Spring Selection

The Belleville springs for HIGH-SEAL ULF systems are rated by stem size (see table 1). Available materials for the Belleville springs are S17700 (17-7 PH stainless steel) and N07718.

It is important to match the appropriate load scale (see figure 2) to the stem size of the valve. Stem size is stamped on the load scale.

Figure 2. Typical Load Scale



A4990-2

Installation

HIGH-SEAL ULF packing systems are designed for quality performance over extended periods. This longevity allows packing maintenance to be performed as it should be, at regularly scheduled plant outages or turn-arounds.

⚠ WARNING

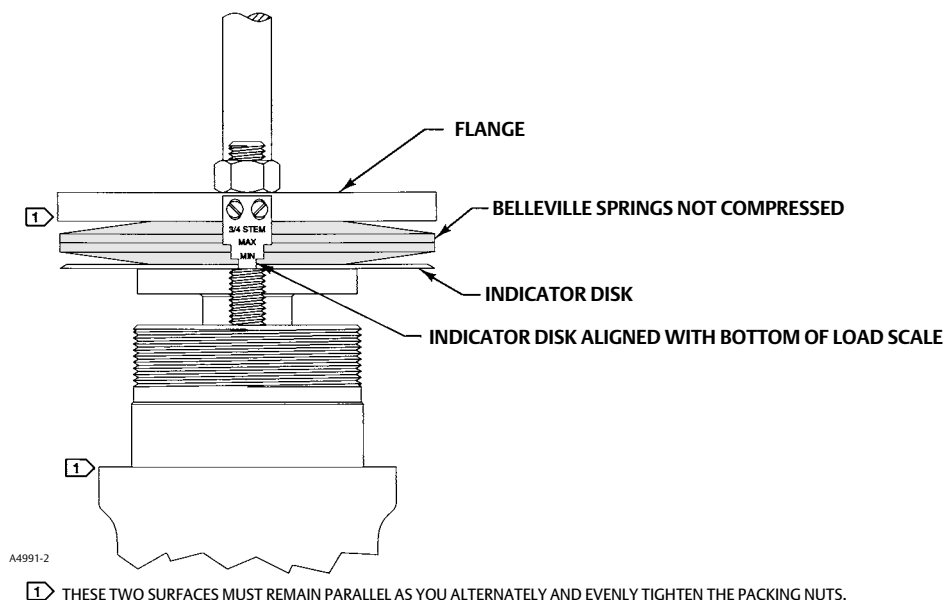
Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If the valve is in service, isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment. Refer to instructions in the appropriate valve and actuator instruction manuals.

If you are installing the HIGH-SEAL ULF packing system in a valve that is still connected to an actuator, it will be necessary to disconnect the valve from the actuator to provide sufficient space to install the packing assembly. Refer to appropriate valve and actuator instruction manuals. Remove old packing parts from the packing box by using the valve instruction manual procedures.

Figure 3. HIGH-SEAL ULF Packing Assembly Showing the Load Properly Adjusted for Decompressed Springs



The valve stem condition is critical to packing sealing performance and life. As-new surface finish ($0.1 \mu\text{m}$ [$4 \mu\text{in}$] R_a max) is recommended for best performance. Refer to the appropriate valve instruction manual for instructions on replacing the valve stem.

Check the condition of the packing bore after you have removed the packing. An easy method for cleaning debris and minor imperfections from the bore is to use a brake cylinder hone attached to an electric drill. This method will do a good job of cleaning the packing bore without changing the dimension of the bore.

Inspect the packing bore size and surface finish. If the packing bore is worn, pitted, damaged, or oversized more than 0.010 inch, replace the valve bonnet or have your Emerson Automation Solutions Service Center repair it.

Key number locations are shown in figure 6.

1. If a retrofit kit is being installed in place of the original packing, remove existing packing studs from the valve, and replace them with the longer studs (key 200).
2. Install the packing arrangement into the valve packing box.

Note

Be sure to install the packing rings in the sequence shown in figure 6. Identify parts by color or by the number stamped on the part.

- For valves with 9.5 mm (3/8 inch) valve stems, do not install the packing follower (key 203) at this time. (Note: the yoke boss will not slide over the packing follower. The packing follower must be installed while lowering the actuator yoke onto the valve.)
 - For valves with 12.5 mm (1/2 inch) or larger stem diameters, install the packing follower (key 203).
3. Refer to the appropriate valve and actuator instruction manuals when connecting the valve to the actuator. While lowering the actuator yoke onto the valve, install the packing follower [for a 9.5 mm (3/8 inch) valve stem size], indicator disk, springs, and flange (keys 203, 206, 202, and 201).

Figure 4. Load Scale Indicating Minimum Spring Compression

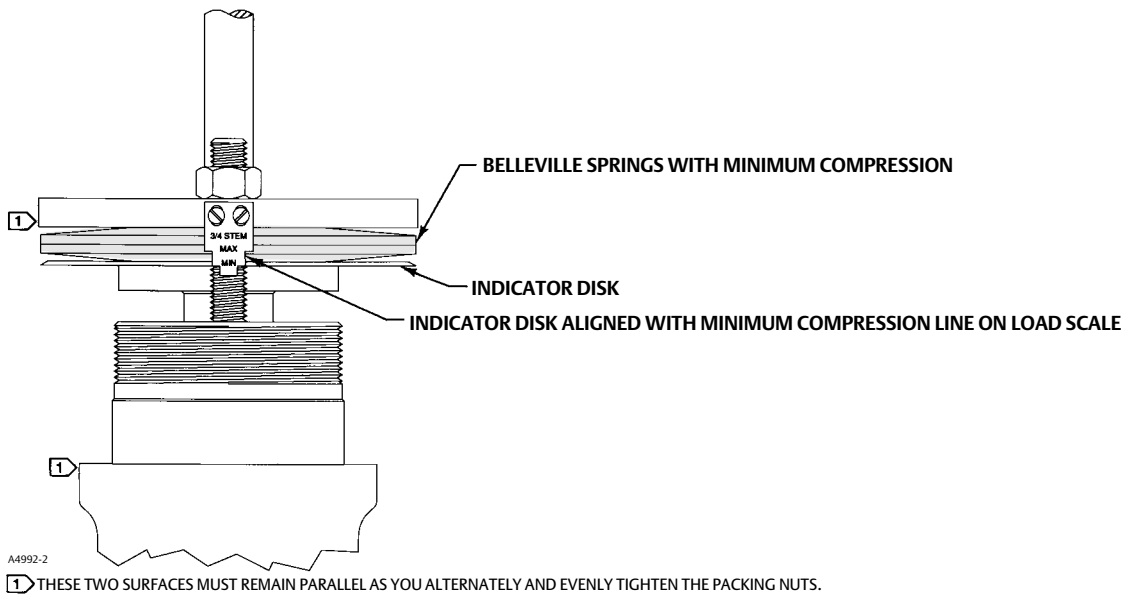
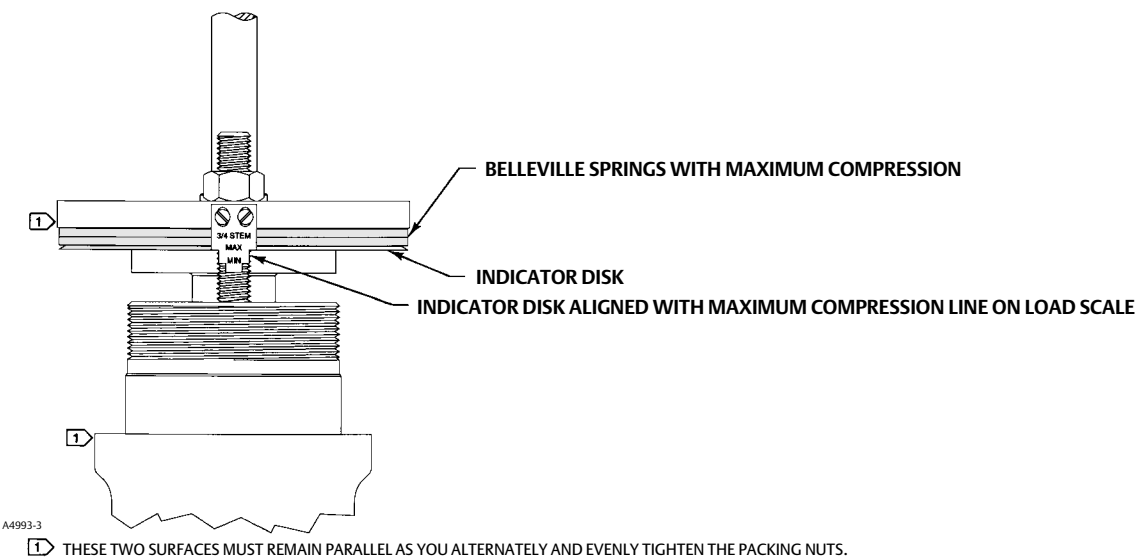


Figure 5. Load Scale Indicating Maximum Spring Compression



4. Place the packing follower against the packing as shown in figure 6.
5. Place the indicator disk (key 206) and the first Belleville spring (key 202) while guiding them onto the packing follower (key 203). Make certain the cone-shaped side of the Belleville spring is towards the indicator disk as shown in figure 3.
6. Place the second Belleville spring (key 202) with the coned-shaped side toward the flange (key 201); see figure 3. Position the flange on top of the spring, making sure the second spring fits into its guide in the flange.

CAUTION

Keep the packing follower and flange centered on the valve stem. If any metal part makes contact with the stem, it can cause damage to the stem surface. Vertical scratches or nicks on the stem surface can cause excessive leakage from the packing.

7. Lubricate the packing nuts with anti-seize lubricant and tighten them hand-tight.
8. The load scale (figure 2) is used to indicate compression on the Belleville springs. Position the load scale (key 205) by slightly loosening the mounting screws (key 204). Align the bottom edge of the load scale with the indicator disk and retighten the screws. Figure 3 illustrates the load scale properly adjusted before the nuts have been tightened and with the Belleville springs not compressed.
9. Tighten the packing nuts while observing the two load scales (key 205) to make sure the flange (key 201) is tightened evenly. Figure 4 indicates minimum spring compression with the indicator disk aligned with the minimum compression line on the load scale. Be sure to keep the follower centered on the stem while tightening the nuts. Tighten the nuts alternately and evenly, keeping the flange parallel with the valve (see figures 4 and 5), until the indicator disk aligns with the maximum compression line on the load scales, as shown in figure 5.
10. The packing is now properly loaded and the packing nuts do not need to be retightened unless the indicator begins to approach the minimum compression line (see figure 4). After the valve has been in service for awhile, visually check the load scale to determine loading. Under normal conditions, the packing nuts should not require retightening for the life of the packing.

Parts Ordering

Each valve assembly is assigned a serial number that can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your [Emerson sales office](#) or Local Business Partner for technical assistance. When ordering replacement parts, refer to the serial number and to the 11-character part number for each part required from the following parts list.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Retrofit Parts

Retrofit parts meet requirements to convert existing Fisher A, CAV4, E, EH, HP, YD, and YS valves to the HIGH-SEAL ULF packing box construction.

⚠ WARNING

Stems and packing box constructions that do not meet Emerson Automation Solutions stem finish specifications, dimensional tolerances, and design specifications may adversely alter the performance of this packing retrofit, resulting in personal injury or property damage.

HIGH-SEAL Retrofit Kits

STEM SIZE DIAMETER, mm (Inch)	YOKE BOSS DIAMETER, mm (Inch)	RETROFIT KITS	
		S17700 Springs	N07718 Springs
9.5 (3/8)	54 (2-1/8)	RPACKXRT312	RPACKXRT322
12.7 (1/2)	71 (2-13/16)	RPACKXRT332	RPACKXRT342
19.1 (3/4)	90 (3-9/16)	RPACKXRT352	RPACKXRT362
25.4 (1)	127 (5)	RPACKXRT372	RPACKXRT382
31.8 (1-1/4)	127 (5, 5H)	RPACKXRT392	RPACKXRT402
50.8 (2)	177.8 (7)	Consult your Emerson sales office or Local Business Partner ⁽¹⁾	
1. The 50.8 mm (2-inch) stem will typically require a longer actuator yoke to clear the HIGH-SEAL packing studs (key 200).			

Parts Included in Retrofit Kits

KEY NUMBER	DESCRIPTION	QUANTITY	
		For 9.5, 12.7, 19.2, 25.4, & 31.8 mm Stems (3/8, 1/2, 3/4, 1, & 1-1/4 Inch Stems)	For 50.8 mm Stems (2-Inch Stems)
		ULF	
200	Packing Stud	2	3
201	Packing Flange	1	1
202	Belleville Spring	2	2
203	Packing Follower	1	1
204	Screw	4	6
205	Load Scale	2	3
206	Indicator Disk	1	1
207	Bushing	1	1
208	Bushing	1	1
209	Packing Ring	2	2
210	Packing Ring	2	2
211	Packing Box Ring	1	1
212	Packing Nut	2	3
214	Packing Washer	3	3
219	Washer (not required on 9.5 mm [3/8 inch] stem)	2	3

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HIGH-SEAL Live-Loaded Packing

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D101453X012

Parts List

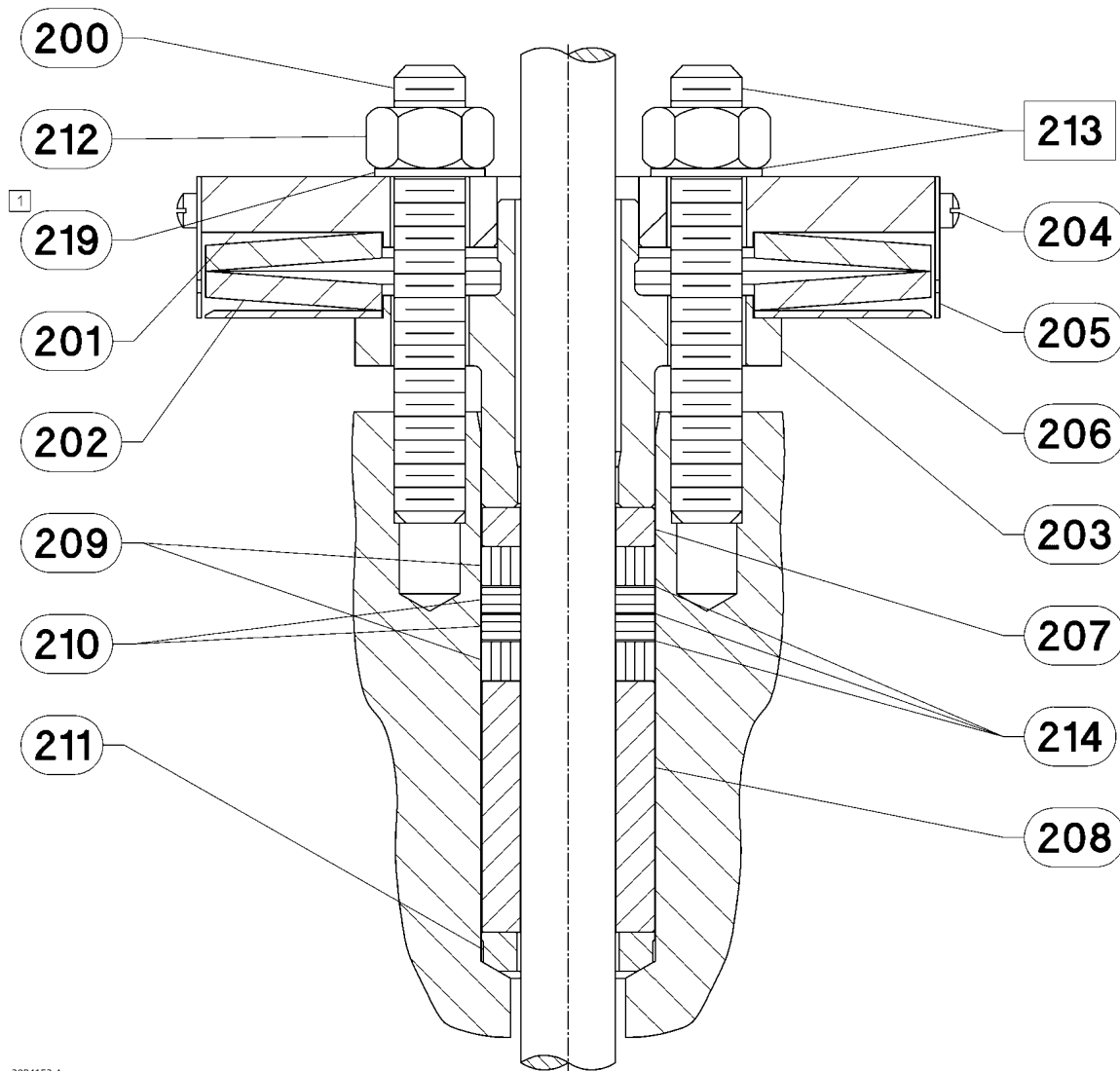
Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your [Emerson sales office](#) or Local Business Partner.

Key	Description	Part Number
200	Stud	
201	Flange	
202	Spring	See Spring Identification and Dimensions table
203	Packing Follower	

Key	Description	Part Number
204	Screw	
205	Load Scale	
206	Indicator Disk	
207*	Bushing	See following table
208*	Bushing	See following table
209*	Packing Ring	See following table
210*	Packing Ring	See following table
211*	Packing Box Ring	See following table
212	Nut	
213	Anti-seize lubricant (not furnished with unit) (not shown)	
214*	Packing Washer	See following table
219	Washer	

Figure 6. HIGH-SEAL Graphite ULF Packing Assembly



39B4153-A

1. FIND NUMBER 219 NOT REQUIRED WITH 3/8 INCH STEM

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For 9.5, 12.7 and 19.1 mm (3/8, 1/2 and 3/4 Inch) Stems with ULF Packing

KEY NO.	QTY	DESCRIPTION	MATERIAL	PART NUMBER		
				9.5 mm (3/8 inch) Stem, 54 mm (2-1/8 inch) Yoke Boss	12.7 mm (1/2 inch) Stem, 71 mm (2-13/16 inch) Yoke Boss	19.1 mm (3/4 inch) Stem, 90 mm (3-9/16 inch) Yoke Boss
207*	1	Bushing	Carbon	12B5780X012	12B5782X012	12B5784X012
208*	1	Bushing	Carbon	19B2882X012	19B2883X012	19B2889X012
209*	2	Packing ring	Carbon/graphite composite	12B5798X012	12B5799X012	12B5800X012
210*	2	Packing ring (packing ribbon)	Graphite/zinc	14B7519X012	14B7498X012	14B7520X012
211*	1	Packing box ring	S31600	12B5774X012	12B5775X012	12B5776X012
214*	3	Packing washer	PTFE	12B6936X012	12B6937X012	12B6938X012

*Recommended spare part.

Spring Identification and Dimensions

SPRING	SPRING DIMENSIONS											
	Valve Stem Diameter		Valve Stem Diameter		Valve Stem Diameter		Valve Stem Diameter		Valve Stem Diameter		Valve Stem Diameter	
	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches
	9.5	3/8	12.7	1/2	19.1	3/4	25.4	1	31.8	1-1/4	50.8	2
Inside Dia	47.6	1.875	60.3	2.375	74.6	2.938	96.8	3.813	103.2	4.063	138	5.438
Outside Dia	98.4	3.875	111.1	4.375	146.1	5.75	206.4	8.125	206.4	8.125	225	8.875
Thickness	2.4	0.094	4.0	0.156	5.2	0.203	6.7	0.266	7.1	0.281	8.3	0.328

For 25.4, 38.1, and 50.8 mm (1, 1-1/4 and 2-inch) Stems with ULF Packing

KEY NO.	QTY		DESCRIPTION	MATERIAL	PART NUMBER		
	For 25.4 & 38.1 mm (1 & 1-1/4 Inch) Stems	For 50.8 mm (2 Inch) Stems			25.4 mm (1-inch) Stem, 127 mm (5-Inch) Yoke Boss	31.8 mm (1-1/4 Inch) Stem, 127 mm (5-Inch) Yoke Boss	50.8 mm (2-Inch) Stem, 178 mm (7-Inch) Yoke Boss
207*	1	1	Bushing (black w/white color code)	Carbon	12B5786X012	12B5788X012	12B5790X012
208*	1	1	Bushing (black)	Carbon	19B2891X012	19B4141X012	19B4143X012
209*	2	2	Packing ring	Carbon/graphite composite	12B5801X012	12B5802X012	12B5803X012
210*	2	2	Packing ring (packing ribbon)	Graphite/zinc	14B7521X012	14B7522X012	17B3077X012
211*	1	1	Packing box ring	S31600	12B5777X012	12B5778X012	12B5779X012
214*	3	3	Packing washer	PTFE	12B6939X012	12B6940X012	19B4144X012

*Recommended spare part.

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Fisher™ HP Control Valve Startup Trim for NPS 8 and Larger

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Figure 1. Fisher HP Control Valve with 585C Actuator and FIELDVUE™ DVC6200 Digital Valve Controller



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Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Fisher HP Control Valve Startup Trim for NPS 8 and larger.

Do not install, operate, or maintain HP valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The Fisher HP Startup Trim kits are available for NPS 8 and larger sizes and include options for hydro testing, flushing, and chemical cleaning of the system. The hydro kit is intended to be used so that the upstream piping can be tested at the required pressure for body and inlet piping pressure class without over pressurizing any attached lower pressure class piping or equipment downstream. The flushing kit allows for pipes to be cleaned upstream and downstream of the valve by allowing dirt, scale, or debris to pass through the valve without causing damage to the valve trim used in normal operation. The chemical cleaning kit is used when cleaning the pipeline with a low velocity, chemical flush of the pipeline.

Educational Services

For information on available courses for Fisher HP and HPA valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Valve Installation

Observe all installation warnings, cautions and notes provided in the Fisher HP and HPA Control Valve Instruction Manual ([D101634X012](#)). Follow the instructions provided in the Fisher HP and HPA Control Valve Instruction Manual for valve assembly installation

Maintenance

WARNING

Avoid personal injury or property damage from sudden release of pressure or uncontrolled process fluid. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any spring precompression.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Trim Removal

Observe all maintenance warnings, cautions and notes in the Fisher HP and HPA Control Valve Instruction Manual ([D101634X012](#)). Follow the Trim Removal instructions provided in the Fisher HP and HPA Control Valve Instruction Manual. See figure 5 for the HP assembly drawing

Installation of Startup Trim Kits

Inspect the valve to ensure all parts and gaskets have been removed and the valve body is free from foreign debris. Inspect all parts for defects and cleanliness; remove any burrs on metal valve components. Visually inspect the interior of the valve for abnormal wear, signs of erosion, or scoring if the valve has been in service. Inspect the gasket surfaces of the valve body, bonnet, and trim to verify they are not damaged and are free of imbedded gasket material.

Installation of Flushing and Hydro Trim Kits

1. Install the seat ring flat sheet gasket (key 12) in the lower gasket groove in the valve body (key 1), making sure the gasket is centered in the groove and the bottom of the gasket is flush with the mating surface in the body. See figure 4.
2. For Flushing Trim: Install eyebolt (3/8-16 UNC-2B) in to the hole on the top of the cage (key 2), as shown in figure 2. Then proceed with step 3, lifting the cage using the eyebolt.

For Hydro Trim: Install threaded rods (1/4-20 UNC-2B) in to the holes on the top of the cage (key 2). Install hoist rings, nuts or eye bolt on to the threaded rod, as shown in figure 3. Then proceed with step 3, lifting the cage using the hoist rings on the threaded rods inserted in the top of the cage

Figure 2. Installation of Flushing Cage with Eyebolt

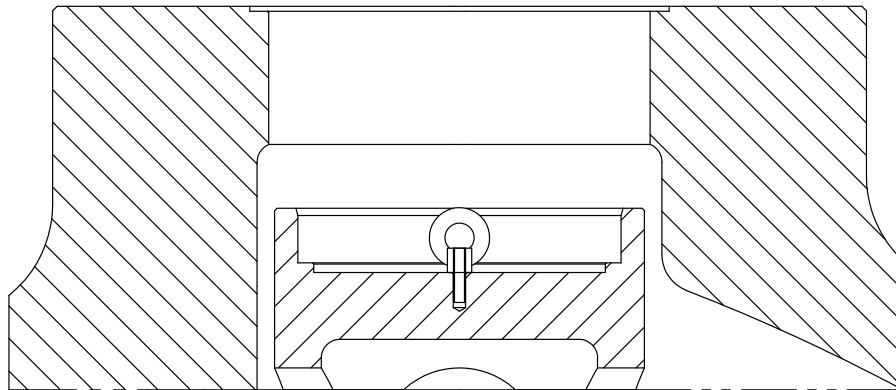
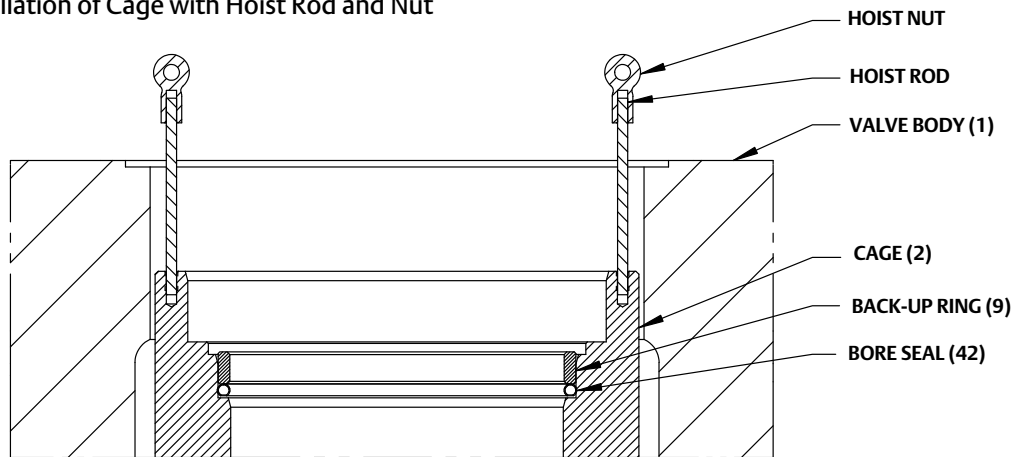


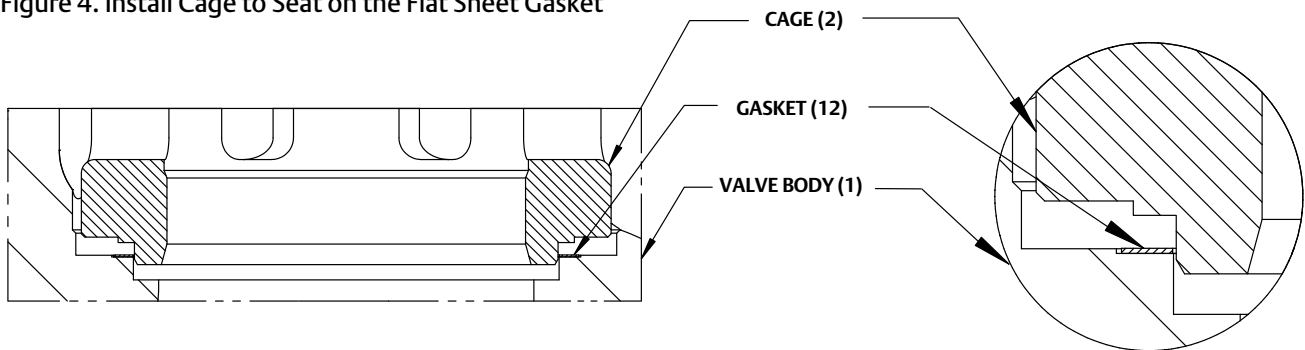
Figure 3. Installation of Cage with Hoist Rod and Nut



GH02761

3. Install the cage (key 2) into the valve body. When installing the cage (key 2), take care to lower the cage evenly and ensure that cage (key 2) will not damage the flat sheet gasket (key 12) during installation. See figures 4 and 5.

Figure 4. Install Cage to Seat on the Flat Sheet Gasket



4. Install three-cage spiral wound gasket (key 43) in the gasket groove on top of the cage (key 2), making sure the gaskets sit flush on the surface of the groove. See figure 5.
5. Install the bonnet spiral wound gasket (key 11) in the gasket groove on top of the body (key 1), making sure the gasket sits flush on the surface of the groove.
6. Threaded surfaces of the studs (key 13), faces of the nuts (key 14), washers (key 40) and nut seating surface on the bonnet (key 18) should be lubricated with nickel-based anti-seize lubricant prior to assembly.

Note

Take care not to introduce lubricant between the washer and the bonnet surface.

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HP Control Valve Startup Trim

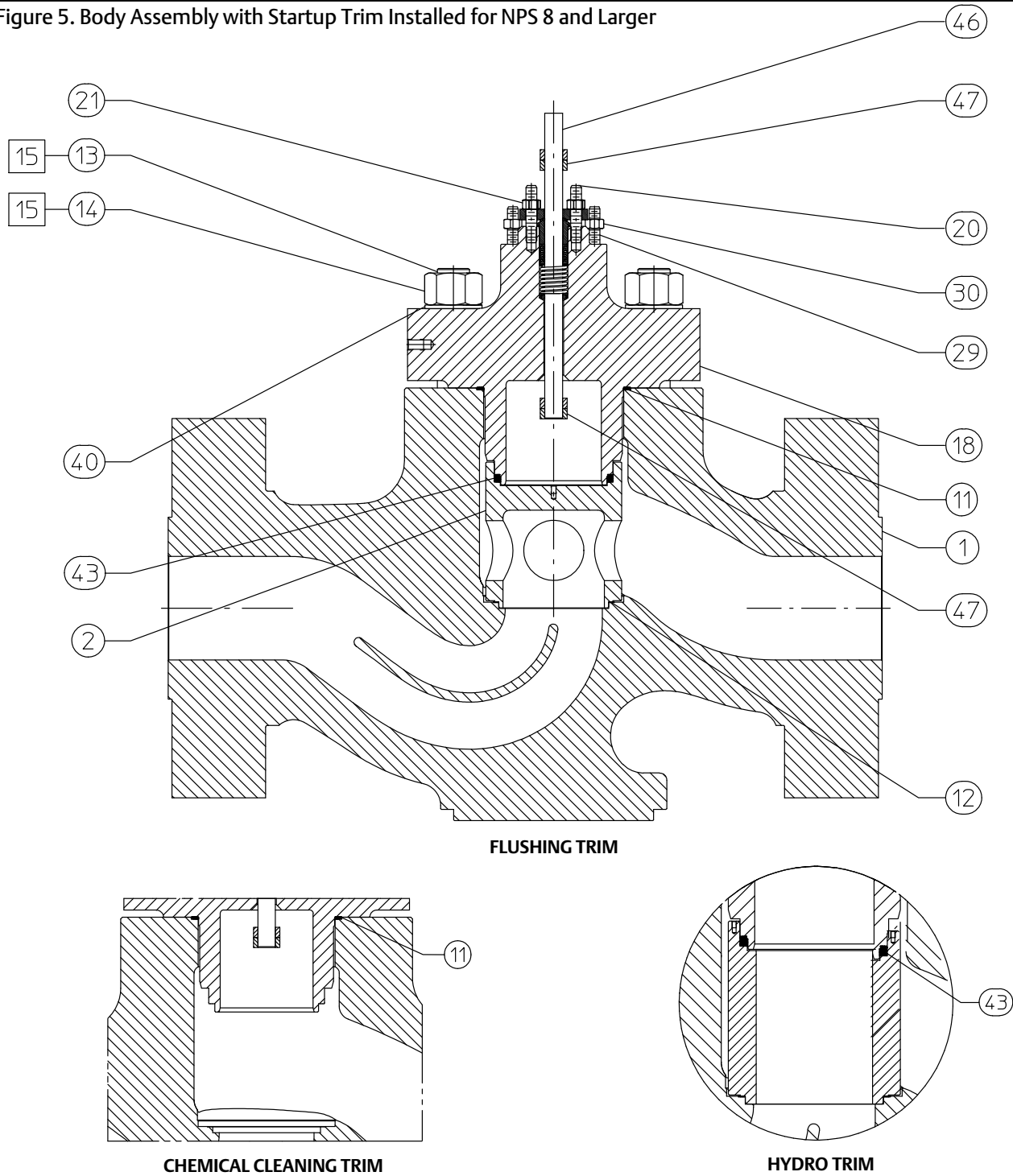
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7. Apply nickel-based anti-seize lubricant to stem (key 46) and two jam nuts (key 47). Lock nuts together by threading in opposite directions. See table 1 for recommended jam nut (key 47) torque values.
8. Install the stem/nut assembly (key 46, key 47) into the bonnet (key 18) such that the side with the two locked nuts is opposite of the packing box bore and will be inside the body cavity when fully installed.

Table 1. Recommended Nut Torque for Hex Jam Nuts (Key 47)

VALVE SIZE, NPS	STEM SIZE	NOMINAL TORQUE	
		N • m	ft • lbf
All	1	380	280
	1-1/4	750	550
	2	3025	2230

Figure 5. Body Assembly with Startup Trim Installed for NPS 8 and Larger



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9. Install packing per Fisher HP and HPA Control Valve Instruction Manual ([D101634X012](#)).
10. Apply nickel-based anti-seize lubricant and install two jam nuts (key 47) onto the side of the stem (key 46) extruding from the packing box. Snug the nuts together, see table 1 for recommended jam nut (key 47) torque values. These will be removed after flushing/hydro testing.
11. Lower the bonnet (key 18) and stem/nut assembly (key 46, key 47) over the bonnet studs (key 13) and onto the valve body (key 1), making sure the bonnet (key 18) skirt will not damage the bonnet spiral wound gasket (key 11), or the three-cage spiral wound gaskets (key 43). When lowering the bonnet (key 18) into the body (key 1), take care to ensure that the bottom diameter guides properly with the cage (key 2) and the outside diameter of bonnet guides properly with body (key 1).

Note

The bonnet might not sit flush on the bonnet gasket until the bolts are completely tightened. Once tightened properly, the bonnet will contact metal-to-metal with the valve body.

For bolt sizes larger than 1-1/2 inch, install washers (key 40) over the bonnet studs, taking care not to introduce lubricant between the washer and the bonnet surface. Lubricant should be present between the seating surface of the bonnet stud nut and the washer. Turn the nuts (key 14) onto the studs (key 13) until hand tight.

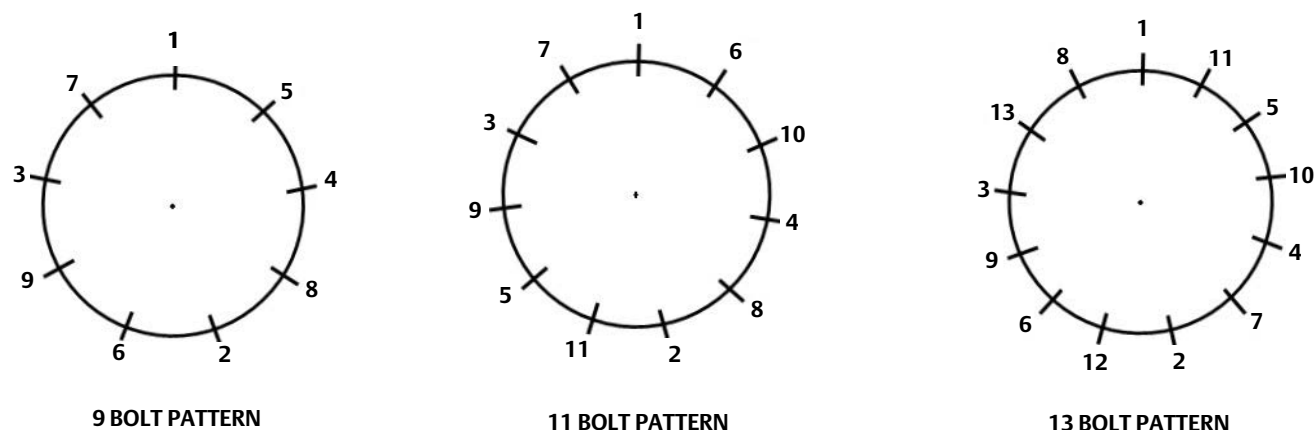
12. Torque bonnet nuts (key 14) in a crisscross pattern with no more than 1/4 of the nominal torque specified in table 2. When all nuts are tightened to that torque, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat the above until all nuts are tightened to the specified nominal torque value. If any nut still turns at the final torque, tighten every nut to the final torque again. For odd number of bolts, tighten the bonnet nuts following the pattern shown in figure 6.

Table 2. Recommended Bolt Torque for Alloy Steel Bolting Using Anti-Seize Lubricant (Keys 13 and 14)⁽¹⁾

STUD SIZE	NOMINAL TORQUE	
	Bolting Materials	
	B7, B16, B8M2, BD, S20910, N07718, and 660 Studs	
	N • m	ft • lbf
1-3/8	1270	935
1-1/2	1650	1220
1-5/8	2130	1570
1-3/4	2670	1970
2	4030	2970
2-1/4	5780	4260
2-1/2	7990	5890

1. For other bolting materials or lubricants, contact your [Emerson sales office](#) for torque information.

Figure 6. Nut Tightening Pattern



Installation of Chemical Cleaning Trim Kit

1. Install the bonnet spiral wound gasket (key 11) in the gasket groove on top of the body (key 1), making sure the gasket sits flush on the surface of the groove.
2. Threaded surfaces of the studs (key 13), faces of the nuts (key 14), washers (key 40) and nut seating surfaces on the bonnet (key 18) should be lubricated with nickel-based anti-seize lubricant prior to assembly.

Note

Take care not to introduce lubricant between the washer and the bonnet surface.

3. Apply nickel-based anti-seize lubricant to stem (key 46) and two jam nuts (key 47). Lock nuts together by threading in opposite directions. See table 1 for recommended jam nut (key 47) torque values.
4. Install the stem/nut assembly (key 46, key 47) into the bonnet (key 18) such that the side with the two jam nuts (key 47) is opposite of the packing box bore and will be inside the body when fully assembled.
5. Install packing per Fisher HP and HPA Control Valve Instruction Manual ([D101634X012](#)).
6. Apply nickel-based anti-seize lubricant and install two jam nuts (key 47) onto the side of the stem (key 46) extruding from the packing box. Snug the nuts together, see table 1 for recommended jam nut (key 47) torque values. These will be removed after chemical cleaning operation.
7. Lower the bonnet (key 18) and stem/nut assembly (key 46, key 47) over the bonnet studs (key 13) and onto the valve body (key 1), making sure the bonnet (key 18) skirt will not damage the bonnet spiral wound gasket (key 11) during assembly. When lowering the bonnet (key 18) in to the body (key 1), take care to ensure that the outside diameter of the bonnet guides properly with body (key 1).

Note

The bonnet might not sit flush on the bonnet gasket until the bolts are completely tightened. Once tightened properly, the bonnet will contact metal-to-metal with the valve body.

For bolt size larger than 1-1/2 inch, install washers (key 40) over the bonnet studs, taking care not to introduce lubricant between the washer and the bonnet surface. Lubricant should be present between the seating surface of the bonnet stud nut and the washer. Turn the nuts (key 14) onto the studs (key 13) until hand tight.

8. Torque bonnet nuts (key 14) in a crisscross pattern with no more than 1/4 of the nominal torque specified in table 2. When all nuts are tightened to that torque, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat the above until all nuts are tightened to the specified nominal torque value. If any nut still turns at the final torque, tighten every nut to the final torque again. For odd number of bolts, tighten the bonnet nuts following the pattern shown in figure 6.

Disassembly of Startup Trim Kits

Disassembly of Flushing and Hydro Trim Kits

1. Loosen the bonnet nuts (key 14), using an even and opposing pattern, as specified in figure 6. This will prevent uneven loading of the bonnet flange studs which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

2. Remove the bonnet from the valve by pulling straight up. If the bonnet seems to bind in the valve body, check the alignment of the hoist or rigging equipment. Ensure that the bonnet is lifted straight off the body to prevent parts damage.
3. Remove two jam nuts (key 47) from the side of the stem (key 46) extruding from the packing box.
4. Remove packing per Fisher HP and HPA Control Valve Instruction Manual ([D101634X012](#)).
5. Remove the stem/nut assembly (key 46, key 47).
6. Remove and discard the bonnet spiral wound gasket (key 11).
7. Remove and discard the three-cage spiral wound gaskets (key 43).
8. **For Flushing Trim:** Install eyebolt (3/8-16 UNC-2B) in to the hole on the top of the cage (key 2), as shown in figure 2. Then proceed with step 8.
For Hydro Trim: Install threaded rods (1/4-20 UNC-2B) in to the holes on the top of the cage (key 2). Install hoist rings, nuts or eye bolts on to the threaded rod, as shown in figure 3. Then proceed with step 8.
9. Remove the cage (key 2) from the valve body cavity.
10. Remove and discard the seat ring flat sheet gasket (key 12).

Disassembly of Chemical Cleaning Trim Kits

1. Loosen the bonnet nuts (key 14), using an even and opposing pattern, as specified in figure 6. This will prevent uneven loading of the bonnet flange studs which may cause binding.

Individual nuts should not be completely loosened while the remaining nuts are tight. It is suggested that at least two stages of loosening be used to avoid overloading the last few remaining studs.

2. Remove the bonnet from the valve by pulling straight up. If the bonnet seems to bind in the valve body, check the alignment of the hoist or rigging equipment. Ensure that the bonnet is lifted straight off the body to prevent parts damage.
3. Remove two jam nuts (key 47) from the side of the stem (key 46) extruding from the packing box.
4. Remove packing per Fisher HP and HPA Control Valve Instruction Manual ([D101634X012](#)).
5. Remove the stem/nut assembly (key 46, key 47).
6. Remove and discard the bonnet spiral wound gasket (key 11).

Cleaning

After removal of the chemical trim, the interior of the valve body and all internal parts should be properly cleaned prior to reassembly.

Trim Replacement and Valve Reassembly

After removal of the Startup Trim and proper cleaning, reassemble the valve by following the Trim Replacement instructions provided in the Fisher HP and HPA Control Valve Instruction Manual (D101634X012).

Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your [Emerson sales office](#) regarding spare parts or technical information. When ordering replacement parts, also specify the part name and desired material.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104480X012

HP Control Valve Startup Trim

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HP Control Valve Startup Trim

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KALREZ™ Packing System for Fisher™ Rotary-Shaft Valves

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Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for KALREZ valve stem packing (KVSP) systems. These systems are available for Fisher rotary valves with 12.7 through 38.1 mm (1/2 through 1-1/2 inch) shaft diameters. The system can be used with many rotary valves, as shown in table 1. Refer to appropriate valve and actuator instruction manuals for necessary information relating to the disassembly and assembly of the valve and actuator.

Do not install, operate, or maintain a KALREZ packing system without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

See table 1 for valve designs and shaft diameters where KALREZ packing systems can be applied.

Emerson Automation Solutions offers KALREZ packing systems that you can easily install into your existing valves or that you can purchase with new valves. The KVSP 500 Series uses Vespe^l™ CR-6100 backup rings and KALREZ seal rings.

The external live-loading provides a constant load over the life of the packing material, which reduces the need for packing box adjustment and maintenance.

Installation

Use these instructions to install KALREZ packing in valves that have standard packing, or when inspecting or replacing KALREZ packing.

Table 2 lists part numbers for KALREZ packing sets only. When retrofitting valves to KALREZ packing, contact your Emerson Automation Solutions sales office for information on additional parts needed.

Table 1. Specifications

Applicable Valve Designs A41, 8510, 8510B (single arrangements only), 8550, and 8560 valves; V100, V150, V200, V300 and V500 Vee-Ball™ valves; and CV500 Cam-Vee-Ball valves. See table 2	(1/2, 5/8, 3/4, 7/8, 1, 1-1/4 and 1-1/2 inches). See table 2
Applicable Shaft Diameters <i>Vee-Ball and Eccentric Disc Valves:</i> ■ 12.7, ■ 15.9, ■ 19.1, ■ 22.2, ■ 25.4, ■ 31.8, and ■ 38.1 mm	Pressures and Temperatures⁽¹⁾ Maximum Application Temperature 260°C (500°F) Maximum Application Pressure Pressure is limited to the maximum valve rating
1. The pressure/temperature limits in this manual, in the valve literature, and any applicable code or standard limitation should not be exceeded.	

Removing the Actuator

WARNING

Avoid personal injury from sudden release of process pressure or uncontrolled movement of parts. Before performing any installation operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

You must remove the actuator from the valve when you install KALREZ packing systems. To allow proper readjustment of the Vee-Ball, eccentric disc, or valve disc position, it is recommended that you remove the valve from the pipeline. Refer to appropriate valve and actuator instruction manuals.

WARNING

Avoid personal injury or equipment damage from uncontrolled movement of parts. If a spring-return actuator is used, be sure the actuator spring is resting on its travel stop. If something is obstructing shaft rotation, it is possible that disconnecting the shaft connector will allow the spring to force the actuator to the end of its rotation. Refer to the appropriate valve and actuator instruction manuals to remove the actuator.

Figure 1. KALREZ Packing Arrangements

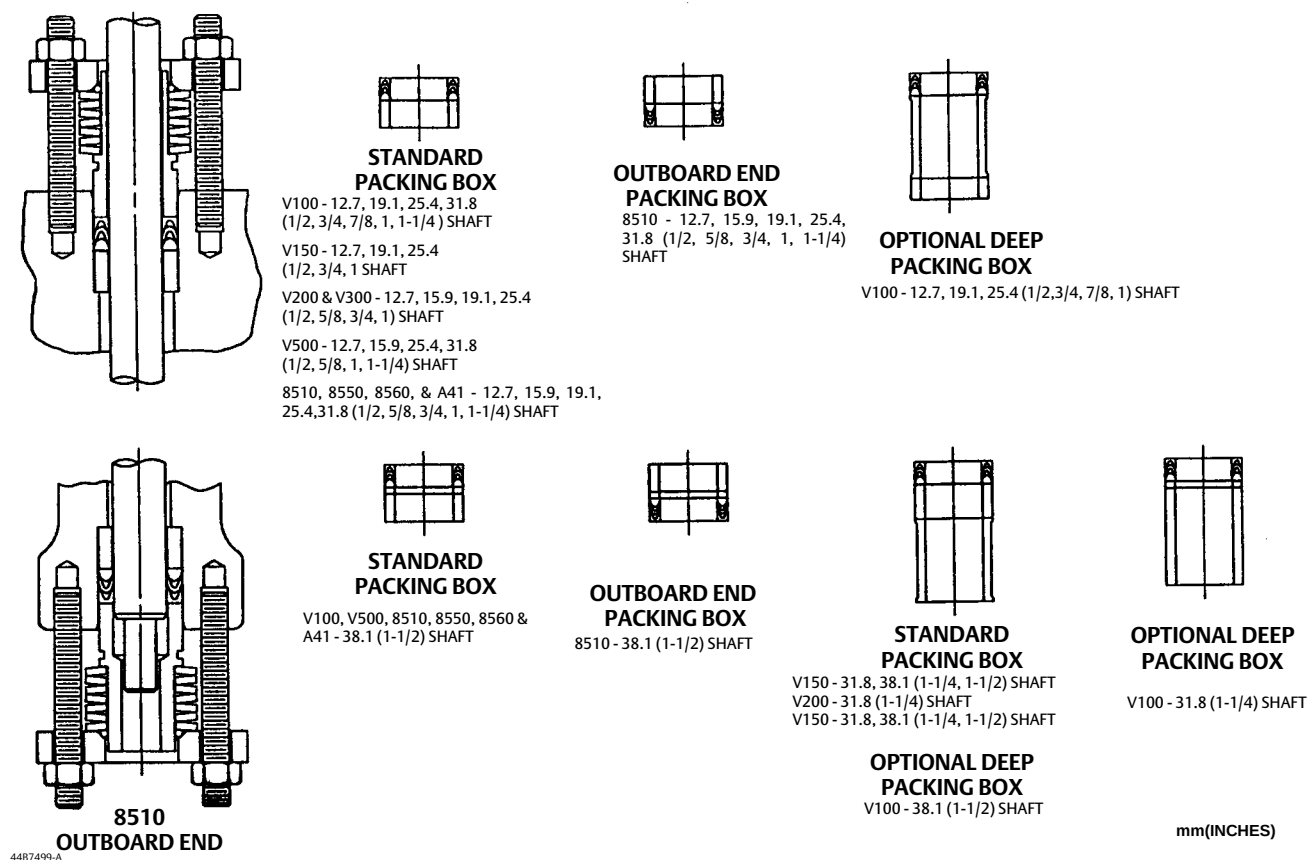
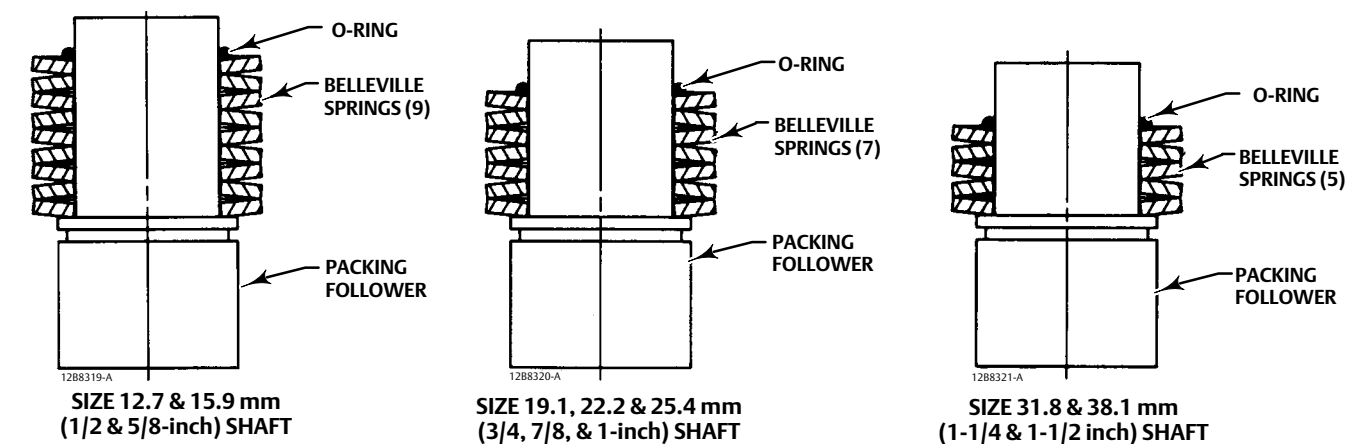


Figure 2. Belleville Spring Stacking Order



Installing a KALREZ Packing System

Refer to figure 1.

Note

When installing a KALREZ packing system into an insulated valve, do not cover the Belleville packing springs with insulation.

CAUTION

Use caution when removing existing internal packing parts. Do not scratch, nick, or dent the valve shaft.

Note

The valve shaft surface condition is critical in obtaining a good seal. If the valve shaft surface is scratched, nicked, or worn, replace the valve shaft before installing the KALREZ Packing System.

1. Remove old packing parts from the packing box by using the valve instruction manual procedures. Refer to the appropriate valve instruction manual to replace the valve shaft and valve parts.
 2. If the piping and valve are insulated, do not allow the insulation to cover the KALREZ Belleville springs.
 3. If you are converting an existing valve to this packing, remove existing packing box studs from the valve body, and replace them with longer studs (as required).
-

Note

KVSP packing systems should be installed as a complete set, NOT AS INDIVIDUAL PIECES OR COMPONENTS.

Note

Ensure that the Belleville springs are stacked properly (see figure 2) and packing box parts are assembled in the correct order (see figure 1). Packing parts cannot function properly if the Belleville springs or other packing parts are not stacked correctly.

4. All kits include a single use packet of KRYTOX™ GPL 206 high performance fluorinated grease to maximize service life and ease of assembly. KRYTOX lubricants are chemically inert to the chemicals regulated under the U.S. Clean Air Act, non-reactive to gaseous and liquid oxygen and chlorine services, with chemical compatibility consistent with KALREZ and the KVSP Systems.
5. Apply the KRYTOX lubricant **liberally** to both the I.D. (inner diameter) and O.D. (outer diameter) surfaces of each KVSP component before installing. All exposed surfaces of the packing assembly should be fully covered.
6. With the shaft in place in the valve, install the packing parts into the valve packing box. Carefully slide the packing down the shaft while being careful not to force the packing and damage it on the shaft spline. Use figures 1 and 2 to ensure that the packing parts and spring pack are assembled in the correct order.
7. Be careful NOT to position the KVSP packing system adjacent to any lubrication holes in the packing box which could compromise its sealing performance.

Tightening Procedures

A modified tightening procedure is recommended for live-loading the KVSP System to help ensure the correct loading force is used during the life of the packing and to help avoid any overcompression of the packing. This procedure also creates open space within the spring set that allows dynamic movement of the packing system to compensate for any volumetric changes that occur during thermal cycling.

Note

The following tightening procedure will change the final loading force to about 1/2 of a fully compressed disc spring.

1. Hand tighten the gland nuts on the Belleville disc springs and measure the uncompressed or free height.
2. Fully compress the Belleville disc springs alternately and evenly to the flat condition. The flat condition will be evident by a sharp increase in the applied nut torque. Note that there may appear to be space left between the springs; this is due to friction between the springs. Measure the compressed height.
3. Back off the disc spring deflection by 1/3 or 33% of the difference between (1) the free, uncompressed spring height and (2) the fully compressed spring height.
4. The KVSP Systems are designed so the components move together during service to eliminate free space within the packing system. This is part of the system's design and will occur automatically during service without further adjustment from normal mechanical and thermal cycling. The resulting working height is then established half way between (1) the free, uncompressed height and (2) the fully compressed position; this also provides approximately 50% of the load force available from the fully compressed disc spring. This new set position helps give the system an ideal and balanced load, allowing for expansion and contraction due to temperature variations in the process and maximizing the service life.

Other Considerations

When retrofitting an existing packing system or repacking a valve with KALREZ packing that has been in service, check the condition of the packing bore after you have removed the packing. An easy method for cleaning debris and minor imperfections from the bore is to use a brake cylinder hone attached to an electric drill. This method will do a good job of cleaning the packing bore without changing the dimension of the bore.

When you have completed this exercise, a good guideline to use in checking the condition of the packing bore is the 20/20 rule. If less than 20% of the surface area of the bore is pitted and if there are no pits deeper than 0.020 inch, then your packing should work fine. This does not need to be an exact measurement; visual inspection is adequate. If the packing bore does not meet this criteria, however, you should replace the valve.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Table 2. Rotary KALREZ Applications and Packing Set Part Numbers

Valve	Valve Size, NPs	Shaft Diameter		KVSP-500 PACKING SET Part Number
		mm	Inches	
V100 (std or deep packing box) V150 V200 V500 8510 8510 (outboard end) 8550 8560 (CL150) A41 (CL150)	1, 1-1/2, 2 2 1 1 2 2 2 3 3	12.7	1/2	24B6255X012
V200 V300 V500 8510 8510 (outboard end) 8550 8560 (CL150) 8560 (CL300) A41 (CL150) A41 (CL300)	1-1/2, 2 2 1-1/2, 2 3 3 3 4 3 4 3	15.9	5/8	24B6255X022
V100 (std or deep packing box) V150, V200, V300 8510 8510 (outboard end) 8550 8560 (CL150) 8560 (CL300) A41 (CL150) A41 (CL300)	3 3, 4 4 4 4 6 4 6 4	19.1	3/4	24B6255X032
V100 V100 (deep packing box)	4 4	22.2	7/8	24B6255X042
V100 (std or deep packing box) V150, V200, V300 V500 CV500 8510 8510 (outboard end) 8550 8560 (CL150) 8560 (CL300) A41 (CL150) A41 (CL300)	6 6 3 3 6 6 6 8 4 8 4	25.4	1	24B6255X052
V100 (std or deep packing box) V150, V200, V300 V500 CV500 8510 8510 (outboard end) 8550 8560 (CL150) 8560 (CL300) A41 (CL150) A41 (CL300)	8, 10, 12 8, 10 4 4 8, 10 8, 10 8, 10 10 8 10 8	31.8	1-1/4	24B6255X062
V100 (std or deep packing box) V150, V300 V500 CV500 8510 8510 (outboard end) 8550 8560 (CL150) 8560 (CL300) A41 (CL150) A41 (CL300)	12 12 6, 8 6, 8 12 12 12 12 10 12 10	38.1	1-1/2	24B6255X072

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⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

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KALREZ™ Packing System for Fisher™ Sliding-Stem Valves

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Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for KALREZ valve stem packing (KVSP) systems. These systems are available for Fisher sliding-stem valves with 9.5, 12.7, 19.1, 25.4, and 31.8 mm (3/8, 1/2, 3/4, 1, and 1-1/4 inch) diameter stems. The system can be used with many sliding-stem valves as shown in the Applications section of the Specifications. Refer to appropriate valve and actuator instruction manuals for necessary information relating to the disassembly and assembly of the valve and actuator.

Do not install, operate, or maintain KALREZ packing systems without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

Emerson Automation Solutions offers KALREZ packing systems that you can easily install into your existing valves or that you can purchase with new valves. The KVSP 500 Series uses Vespel™ CR-6100 backup rings and KALREZ seal rings. The KVSP Fire-Safe Series uses Vespel CR-6100 backup rings, KALREZ seal rings, and a die-formed flexible graphite ring located on top of the KALREZ packing set.

These packing systems help seal your process to conserve valuable fluids, and help protect the environment against the emission of toxic or polluting liquids and gases. The external live-loading provides a constant load over the life of the packing material, which reduces your need for packing box adjustment and maintenance.

If the piping and valve are insulated, do not allow insulation to extend above the yoke boss surface, covering the KALREZ packing arrangement. Keep the KALREZ packing arrangement exposed to ambient air conditions.

Table 1. Specifications

Applicable Valve Designs	Pressures and Temperatures ⁽²⁾
Fisher valves using CL125 through 600, ■ A, ■ easy-e™ valves (for example, EAT, EZ, ETR, EWD, etc.), ■ EH, ■ HP, ■ YD, and ■ YS⁽¹⁾ Applications Valve Stem Diameters: ■ 9.5, ■ 12.7, ■ 19.1, ■ 25.4, and ■ 31.8 mm (3/8, 1/2, 3/4, 1, and 1-1/4 inches)	Maximum Application Temperature <i>KVSP 500 Series: 260°C (500°F)</i> <i>KVSP Fire-Safe Series: 260°C (500°F)</i> Maximum Application Pressure <i>For Environmental Service: 31 bar (450 psig)</i> <i>For Non-Environmental Service: Pressure is limited to the maximum valve rating</i> Also see bulletin 59.1:062, Packing Selection Guidelines for Sliding-Stem Valves
1. For availability of a KALREZ packing system with a specific valve, contact your Emerson sales office or Local Business Partner. 2. The pressure/temperature limits in this manual, in the valve literature, and any applicable code or standard limitation, should not be exceeded.	

Installation and Maintenance

Use these instructions to install KALREZ packing in valves that have standard packing or when inspecting or replacing KALREZ packing.

⚠ WARNING

Avoid personal injury from sudden release of process pressure or uncontrolled movement of parts. Before performing any installation or maintenance operations:

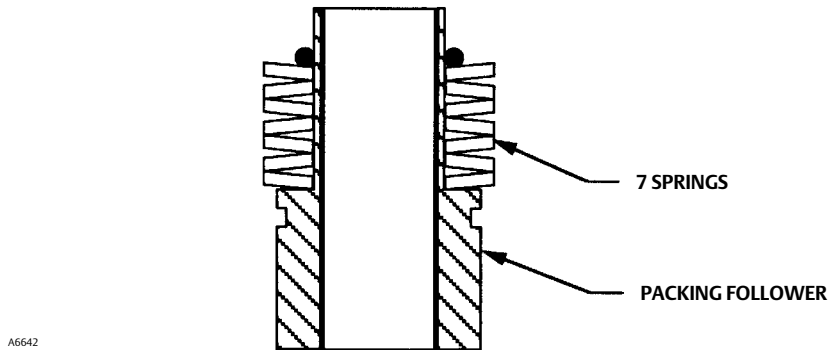
- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If you are installing the packing system in a valve that is still connected to an actuator, remove the actuator from the valve to provide sufficient space to install the packing assembly. If a spring-return actuator is used, it is possible that disconnecting the stem connector will allow the spring to force the actuator to the end of its travel. Be sure the actuator spring is resting on its travel stop. Refer to the appropriate valve and actuator instruction manuals to remove the actuator.

Carefully remove the old packing parts from the packing box by using the valve instruction manual procedures. Both the valve stem surface condition and the packing bore are critical in obtaining a good seal. If the valve stem surface is

scratched, nicked, or worn, replace the valve stem before installing the KALREZ Packing System. Check the condition of the packing bore and clean or hone it out, as necessary. Refer to the appropriate valve instruction manual to replace the valve stem.

Figure 1. Belleville Spring Stacking Order



For key number locations refer to figure 3. Then proceed as follows:

1. The original packing flange studs used for standard packing arrangements should be long enough to accommodate the KALREZ packing parts. If you determine that the existing studs and nuts should be replaced however, due to their condition, replace them with new studs and nuts (keys 200 and 212).
2. Complete all valve maintenance before installing the KALREZ packing system into the bonnet.
3. Be careful NOT to position the KVSP packing system adjacent to any lubrication holes in the bonnet which could compromise its sealing performance.

Note

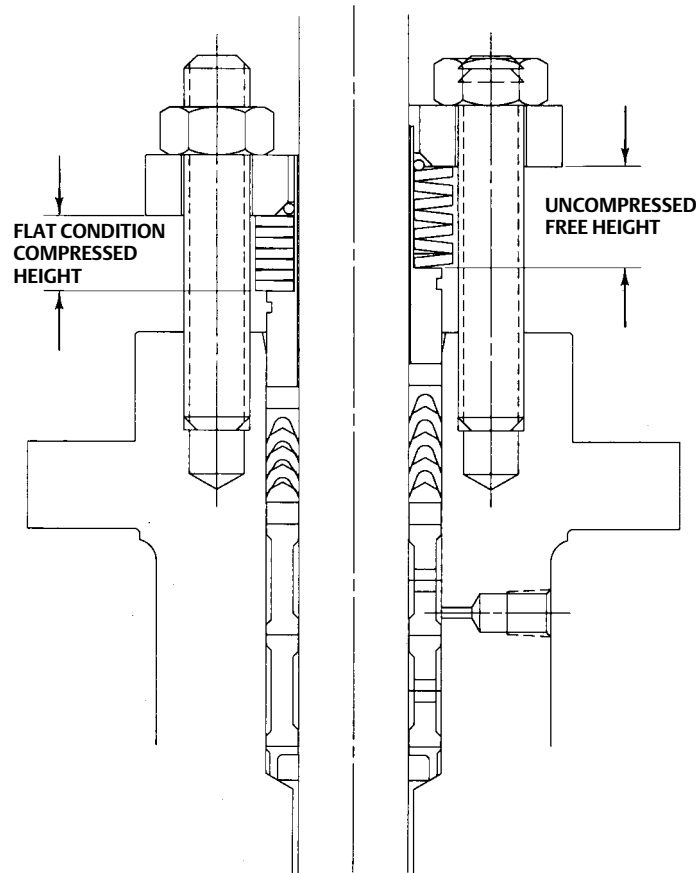
Ensure that the Belleville springs are stacked properly (see figure 1) and packing box parts are assembled in the correct order (see figure 3). Packing parts cannot function properly if the Belleville springs or other packing parts are not stacked correctly.

4. KVSP packing systems should be installed as a complete set, NOT AS INDIVIDUAL PIECES OR COMPONENTS.
5. All kits include a single use packet of KRYTOX™ GPL 206 high performance fluorinated grease to maximize service life and ease of assembly. KRYTOX lubricants are chemically inert to the chemicals regulated under the U.S. Clean Air Act, non-reactive to gaseous and liquid oxygen and chlorine services, with chemical compatibility consistent with KALREZ and the KVSP Systems.
6. Apply the KRYTOX lubricant **liberally** to both the I.D. and O.D. surfaces of each packing set component (key 215) before installing. All exposed surfaces of the packing assembly should be fully covered.
7. Carefully slide the packing down the stem while being careful not to force the packing and damage it on the stem threads. Use figure 3 to ensure that the packing parts and spring pack are assembled in the correct order.

Tightening Procedures

A modified tightening procedure is recommended for live-loading the KVSP System to ensure the correct loading force is used during the life of the packing and to avoid any overcompression of the packing. This procedure also creates open space within the spring set that allows dynamic movement of the packing system to compensate for any volumetric changes that occur during thermal cycling.

Figure 2. KVSP System Tightening Procedure



The following tightening procedure will change the final loading force to about 1/2 of a fully compressed disk spring.

1. Hand tighten the gland nuts on the Belleville disk springs and measure the uncompressed or free height as shown in figure 2.
2. Fully compress the Belleville disk springs alternately and evenly to the flat condition. The flat condition will be evident by a sharp increase in the applied nut torque. Note that there may appear to be space left between the springs; this is due to friction between the springs. Measure the compressed height. See figure 2.
3. Back off the disk spring load by 1/3 or 33% of the difference between (1) the free spring height and (2) the fully compressed spring height.

Other Considerations

When retrofitting an existing packing system or repacking a valve with KALREZ packing that has been in service, check the condition of the packing bore after you have removed the packing. An easy method for cleaning debris and minor imperfections from the bore is to use a brake cylinder hone attached to an electric drill. This method will do a good job of cleaning the packing bore without changing the dimension of the bore.

If any visible pits or defects remain in the packing bore, the bonnet should be replaced.

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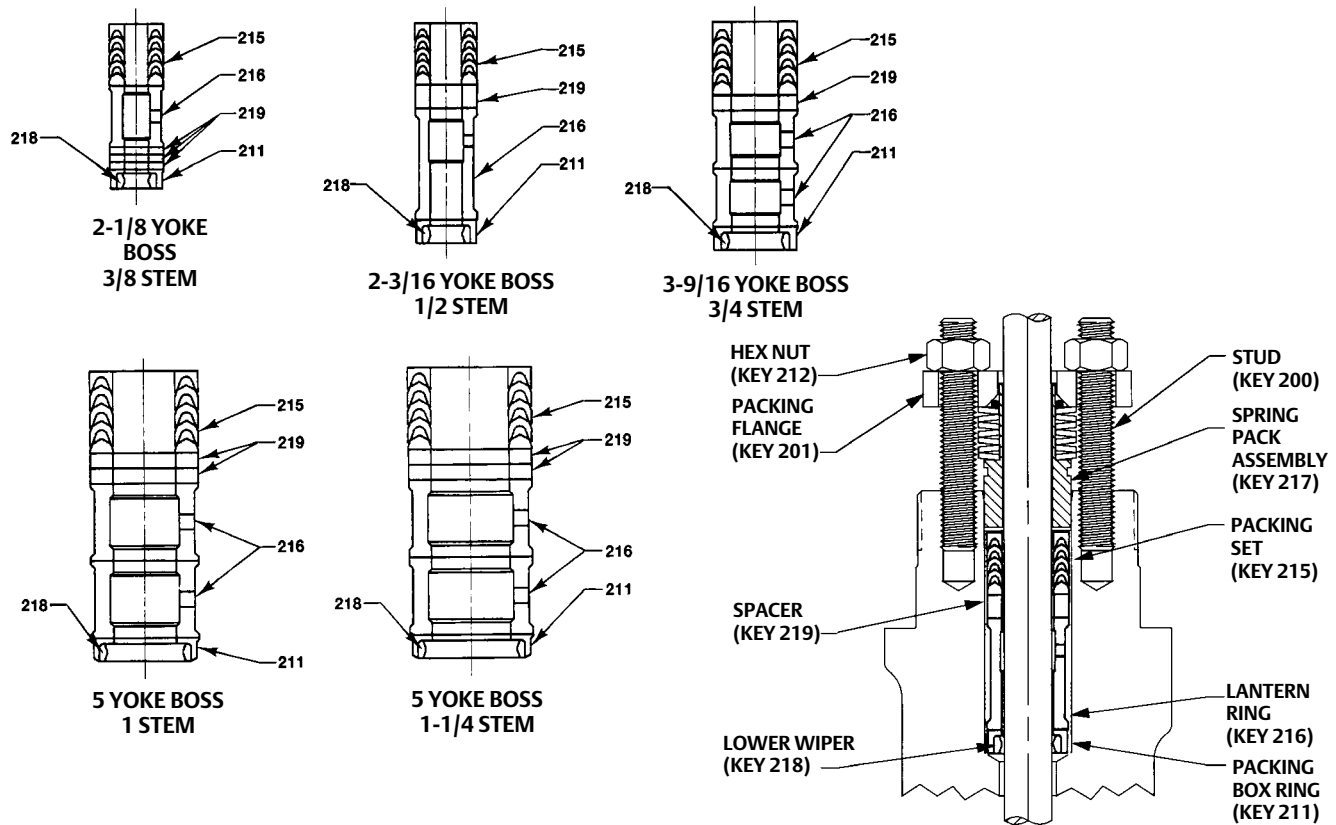
KALREZ System - Sliding-Stem Valves

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easy-e Packing (see figure 3)

KEY NUMBER	DESCRIPTION	STEM SIZE, mm (INCHES)									
		9.5 (3/8)		12.7 (1/2)		19.1 (3/4)		25.4 (1)		31.8 (1-1/4)	
		PN	Qty	PN	Qty	PN	Qty	PN	Qty	PN	Qty
200	Stud, SA-193-CL 2 (B8M), Strain Hardened	1E944135222	2	1E944435222	2	1E944935222	2	0V002535222	2	0W08693522 2	2
201	Packing Flange, S31600 (316 SST)	12B6923X012	1	12B6924X012	1	12B6925X012	1	12B6654X012	1	12B6680X012	1
211*	Packing Box Ring, S31600	1J873135072	1	1J873235072	1	1J873335072	1	1J873435072	1	1J873535072	1
212	Packing Nut SA-194-8M Strain Hardened S31600	1E944035252	2	1E944535252	2	1E944635252	2	1A343335252	2	1A368135252	2
213	Anti-Seize Lubricant	Not furnished with packing. Use anti-seize lubricant purchased from any supplier.									
215*	Packing Set, KALREZ/Vespel CR-6100	24B7042X012	1	24B7042X022	1	24B7042X032	1	24B7042X042	1	24B7042X052	1
215*	Packing Set, Fire-Safe	24B7043X012	1	24B7043X022	1	24B7043X032	1	24B7043X042	1	24B7043X052	1
216	Lantern Ring, S31600	22B6943X012	1	22B6944X012	1	0N028435072	2	0U099735072	2	0W08713507 2	2
217	Spring Pack Assembly S31600/N07718	12B6921X062	1	12B6921X072	1	12B6921X082	1	12B6921X092	1	12B6921X102	1
218*	Lower Wiper, PTFE	1J872106992	1	1J872206992	1	1J872306992	1	1J872406992	1	1J872506992	1
219	Spacer, S31600	14B7044X012	3 ⁽¹⁾	14B7045X012	1 ⁽²⁾	14B7046X012	1 ⁽²⁾	14B7047X012	2 ⁽¹⁾	14B7056X012	2 ⁽¹⁾
* Recommended spare part. 1. Quantity equals 1 for Fire-Safe. 2. Not used with Fire-Safe.											

Figure 3. KALREZ Packing Assembly for easy-e Valves



34B7261-A
A6297/G1
B2460

Parts Ordering

Each valve assembly is assigned a serial number that can be found on the valve body. Refer to this serial number when contacting your [Emerson sales office](#) or Local Business Partner for technical assistance. When ordering replacement parts, refer to this serial number and to the part description and part number from the following parts list. When ordering replacement parts, refer to the serial number and to the 11-character part number for each part required from the following parts list.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

KALREZ System - Sliding-Stem Valves

July 2017

Instruction Manual

D102136X012

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M Series Manual Handwheel Gear Actuator

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Introduction

Scope of Manual

This instruction manual includes installation, operation, maintenance, and parts ordering information for M Series manual handwheel gear actuators. Refer to separate manuals for instructions covering the valves used with these actuators.

Do not install, operate, or maintain an M Series handwheel gear actuator without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

M Series handwheel gear actuators (figure 1) are totally enclosed, weatherproof, worm gear actuators for reliable manual operation with Fisher A11, A31A and A41 High Performance Butterfly Valves. The M actuator consists of a body housing, cover, worm gear, input shaft, and handwheel. The housing is grease packed.

Specifications

Specifications for the M Series manual handwheel gear actuators are shown in table 1.

Table 1. Specifications

Actuator Sizes See tables 2, 3 and 4 Valve Compatibility ■ Accepts A11 valve square-end shafts from 10.3 to 34.9 mm (13/32 to 1-3/8 inches), keyed shafts from 38.1 to 44.5 mm (1-1/2 to 1-3/4 inches)⁽¹⁾ ■ Accepts A31A valve keyed shafts from 44.5 to 57.2 mm (1-3/4 to 2-1/4 inches) ■ Accepts A41 valve Double D shafts from 12.7 to 44.5 mm (1/2 to 1-3/4 inches) Maximum Torque Output See Bulletin 22.2:M Handwheel Rotation Clockwise handwheel rotation closes the valve (produces clockwise rotation of the valve shaft)	Construction Materials Housing and Cover: Cast iron Worm: Steel Worm Gear: Manganese Bronze Input Shaft: Steel (303 SST on request) Handwheel: Cast Iron Mounting Positions See figure 2 Dimensions and Approximate Weights See Bulletin 22.2:M Options ■ Locking plates with padlock for fixed positioning ■ Stops are typically set every 10°, but can be special ordered with stops set up to 45° from both ends ■ Handwheel extensions
---	---

1. As an option, CL600 NPS 10 (with 1-1/2 inch keyed shaft) and NPS 12 (with 1-3/4 inch shaft) A11 valves require a keyed connection if being used with size 9KE or 10KE-6 actuators.

Figure 1. M Series Handwheel Gear Actuator



W4715-1

Installation

⚠ WARNING

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the actuator where service conditions could exceed the limits given in this manual or on the appropriate nameplates. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

The M Series gear actuator is normally mounted on a valve at the factory. However, the actuator can be field mounted; it can be mounted in any position on the A11 or A31A and it can be mounted in positions 1 and 3 on the A41, as shown in figure 2. Make clearance considerations before mounting the actuator to determine the most suitable mounting position.

The M Series actuator has a direct stab-on design. Simply insert the valve shaft into the broached area of the body housing. Then attach the mounting bracket to the actuator, using the torques listed in table 5, and attach the mounting bracket to the valve.

Table 2. M Series Gear Actuator for A11 (CL600)

VALVE SIZE, NPS	VALVE SHAFT SIZE, INCHES	MAXIMUM RECOMMENDED TORQUE ⁽¹⁾		ACTUATOR SIZE	HANDWHEEL DIAMETER, INCHES	RIM FORCE ⁽²⁾		NUMBER OF TURNS TO CLOSE ⁽³⁾	MAXIMUM TORQUE RATING OF ACTUATOR	
		n•m	lb•in			n	lb		N•m	Lbf•in
3	13/32	113	1,000 ⁽⁴⁾	1KE	12	80	18	9.5	452	4,000
4	5/8	303	2,690 ⁽⁴⁾	1KE	12	209	47	9.5	452	4,000
6	7/8	643	5,700	2KE	12	445	100	9.5	678	6,000
		765	6,780 ⁽⁴⁾	5KE		400	90	12.5	904	8,000
8	1	643	5,700	2KE	12	445	100	9.5	678	6,000
		846	7,500	5KE	12	445	100	12.5	904	8,000
		1349	11,960 ⁽⁴⁾	7KE	18	436	98	13.5	2,260	20,000
10	1-3/8	1354	12,000	7KE	18	440	99	13.5	2,260	20,000
	1-1/2	2144	19,000	9KE	24	440	99	16	3,390	30,000
	1-1/2	3520	31,160 ⁽⁴⁾	10KE-6	18	214	48	72	8,474	75,000
12	1-3/8	1354	12,000	7KE	18	440	99	13.5	2,260	20,000
	1-3/4	2144	19,000	9KE	24	440	99	16	3,390	30,000
	1-3/4	3520	31,160 ⁽⁴⁾	10KE-6	18	214	48	72	8,474	75,000

1. Maximum recommended torque for the valve/actuator combination is based on valve shaft rating, actuator rating and rim force.
2. Rim force required to produce maximum recommended torque.
3. This column shows the number of times the handwheel must be turned to close the valve 90 degrees.
4. Shaft rating of the A11 valve.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

M Series Actuator

February 2019

Instruction Manual

D500237X012

Table 3. M Series Gear Actuator for A31A

VALVE SIZE, NPS	VALVE SHAFT SIZE, INCHES	MAXIMUM RECOMMENDED TORQUE ⁽¹⁾		ACTUATOR SIZE	HANDWHEEL DIAMETER, INCHES	RIM FORCE ⁽²⁾		NUMBER OF TURNS TO CLOSE ⁽³⁾	MAXIMUM TORQUE RATING OF ACTUATOR	
		n•m	lb•in			n	lb		N•m	Lbf•in
CL150										
14	1-3/16	644	5,700	2KE	12	445	100	9.5	271	6,000
		847	7,500	5KE	12	445	100	12.5	904	8,000
		1287	11,390 ⁽⁴⁾	7KE	18	418	94	13.5	2,260	20,000
16	1-1/4	644	5,700	2KE	12	445	100	9.5	271	6,000
		847	7,500	5KE	12	445	100	12.5	904	8,000
		1,579	13,970 ⁽⁴⁾	7KE	18	512	115	13.5	2,260	20,000
18	1-1/2	1356	12,000	7KE	18	440	99	13.5	2,260	20,000
		2188	19,370 ⁽⁴⁾	9KE	24	449	101	16	3,390	30,000
		2188	19,370	10KE-6	18	133	30	72	8,474	75,000
20	1-3/4	1356	12,000	7KE	18	440	99	13.5	2,260	20,000
		2147	19,000	9KE	24	440	99	16	3,390	30,000
		2555	22,620 ⁽⁴⁾	10KE-6	18	156	35	72	8,474	75,000
24	2-1/4	2147	19,000	9KE	24	440	99	16	3,390	30,000
		8,474	75,000	10KE-6	18	516	116	72	8,474	75,000
CL300										
14	1-3/4	1356	12,000	7KE	18	440	99	13.5	2,260	20,000
		2555	22,620 ⁽⁴⁾	9KE	24	525	118	16	3,390	30,000
16	1-3/4	1356	12,000	7KE	18	440	99	13.5	2,260	20,000
		2555	22,620 ⁽⁴⁾	9KE	24	525	118	16	3,390	30,000
18	2-1/4	2147	19,000	9KE	24	440	99	16	3,390	30,000
		6,985	61,830 ⁽⁴⁾	10KE-6	18	423	95	72	8,474	75,000
20	2-3/4	2147	19,000	9KE	24	440	99	16	3,390	30,000
		8474	75,000	10KE-6	18	516	116	72	8,474	75,000
24	2-3/4	8474	75,000	10KE-6	18	516	116	72	8,474	75,000
1. Maximum recommended torque for the valve/actuator combination is based on valve shaft rating, actuator rating and rim force. 2. Rim force required to produce Maximum recommended torque. 3. This column shows the number of times the handwheel must be turned to close the valve 90 degrees. 4. Shaft rating of the A31A valve.										

Table 4. M Series Gear Actuator for A41

VALVE SHAFT SIZE, INCHES	ACTUATOR SIZE	SHAFT RATING		HANDWHEEL DIAMETER, INCHES	RIM FORCE ⁽¹⁾		NUMBER OF TURNS TO CLOSE ⁽²⁾	MAXIMUM TORQUE RATING OF ACTUATOR	
		n•m	lb•in		n	lb		N•m	Lbf•in
1/2	0KE/D1	58	515	8	441	21	6	271	2,400
5/8	0KE/D2	138	1,230	8	227	51			
3/4	0KE/D3	240	2,120	8	391	88			
1	2KE/D4	468	4,140	12	325	73	9.5	678	6,000
1-1/4	6KE/D5	1,110	9,820	24	365	82	10	1,356	12,000
1-1/2	6KE/D6	1,356	12,000	24	445	100			
1-3/4	9KE/D7	2,658	23,520	36	365	82	16	3,390	30,000
1. Rim force required to produce shaft rating torque. 2. This column shows the number of times the handwheel must be turned to close the valve 90 degrees.									

Table 5. M Series Mounting Plate to Gearbox

Type M Actuator	Bolt Size	Bolt Torque n•m	Bolt Torque lb•f
A11 and A31A Compatible			
1KE	1/2	91	67
2KE	1/2	91	67
5KE	1/2	91	67
7KE	5/8	163	120
9KE	5/8	163	120
10KE-6	5/8	163	120
A41 Compatible			
0KE/D1	5/16	22	16.5
0KE/D2	5/16	22	16.5
0KE/D3	5/16	22	16.5
2KE/D4	3/8	39	29
6KE/D5	3/8	39	29
6KE/D6	5/8	163	120
9KE/D7	3/4	258	190

Operation

After the actuator and control valve assembly are installed, the manual actuator is ready for operation.

CAUTION

Applying too much torque to the actuator and valve parts could cause damage to the parts. To avoid such damage, do not exceed the rim force listed in table 2, 3 and 4 or any other torque limitation of internal valve parts. Also, do not use wrenches or other devices on the handwheel or handwheel shaft to increase operating force.

Maintenance

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If the rim force required to rotate the handwheel exceeds the rim force listed in table 2, 3, or 4, check for the following conditions:

- Insufficient lubrication
- Seized actuator parts
- Excessive pressure drop across the valve
- Obstruction to the valve disk rotation

If the manual actuator does not seem to control the process fluid, the worm or drive sleeve gear teeth may be broken, the handwheel pin may be sheared, or the valve parts may be broken. Purchase a replacement manual actuator if necessary. Refer to the valve instruction manual if valve maintenance is needed.

Lubrication

The interior parts of the M Series actuator should be lubricated on a regular schedule with a quality gear lubricant. The interior parts should also be lubricated whenever difficulty in handwheel rotation indicates a need for lubrication.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve.
2. Remove the cap screws that secure the gearbox cover plate and remove the gearbox cover plate.
3. Coat the worm, the drive sleeve gear teeth, and the bearing surfaces of the gearbox housing and worm with a quality gear lubricant.
4. Replace the cover plate and cap screws using the bolt torques listed in table 5.
5. Replace the manual actuator on the valve. Adjust the actuator travel stop to limit the open and closed positions of the valve disk following the steps in the appropriate valve instruction manual.

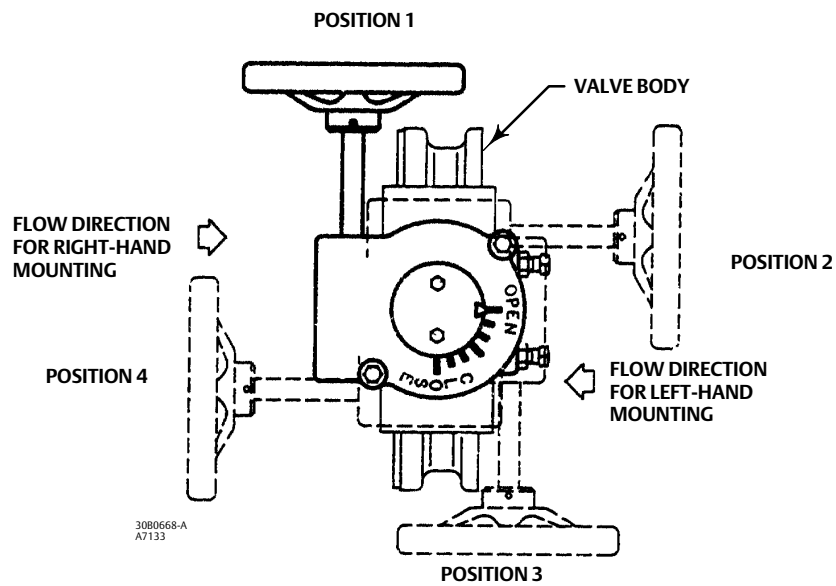
Parts Ordering

When corresponding with your [Emerson sales office](#) indicate the size of the M Series actuator. The size is stamped on the gearbox. You should also provide the serial number of the valve.

WARNING

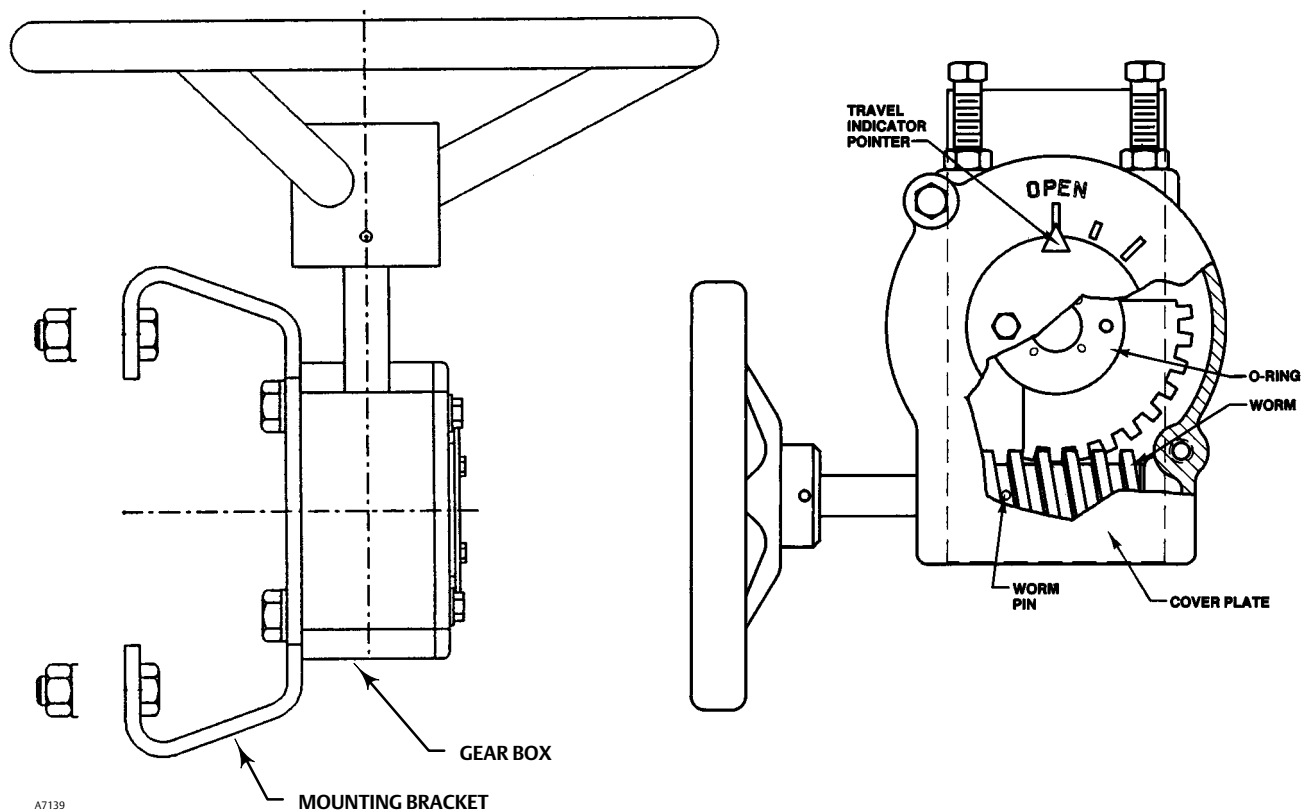
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Figure 2. Available Mounting Positions



NOTE:
ONLY POSITIONS 1 AND 3 ARE APPLICABLE TO A41.

Figure 3. Typical M Series Assembly



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Service Instructions for Fisher™ 1068 Rotary Vane Actuator

This instruction manual was prepared by Kinetrol.

Do not install, operate or maintain this product without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance.



To avoid personal injury or property damage it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings.

If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Fisher 1068 Rotary Vane Actuator



X1591

SPRING RETURN



X1590

DOUBLE ACTING

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations. Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

⚠ WARNING

To avoid personal injury and parts damage, do not apply pressure that exceeds the Maximum Operating Pressure of 7 bar (100 psig). Use pressure-limiting or pressure-relieving devices to prevent the Operating Pressure from exceeding this value.

Actuator Mounting

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Safely vent the power actuator loading pressure.
- Use lock-out procedures to be sure the above measures stay in effect with you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, even with the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings.
- Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

NOTICE

When adjusting the travel stop for the closed position of the valve ball or disk, refer to the appropriate valve instruction manual for detailed procedures. Undertravel or overtravel at the closed position may result in poor valve performance and/or damage to the equipment.

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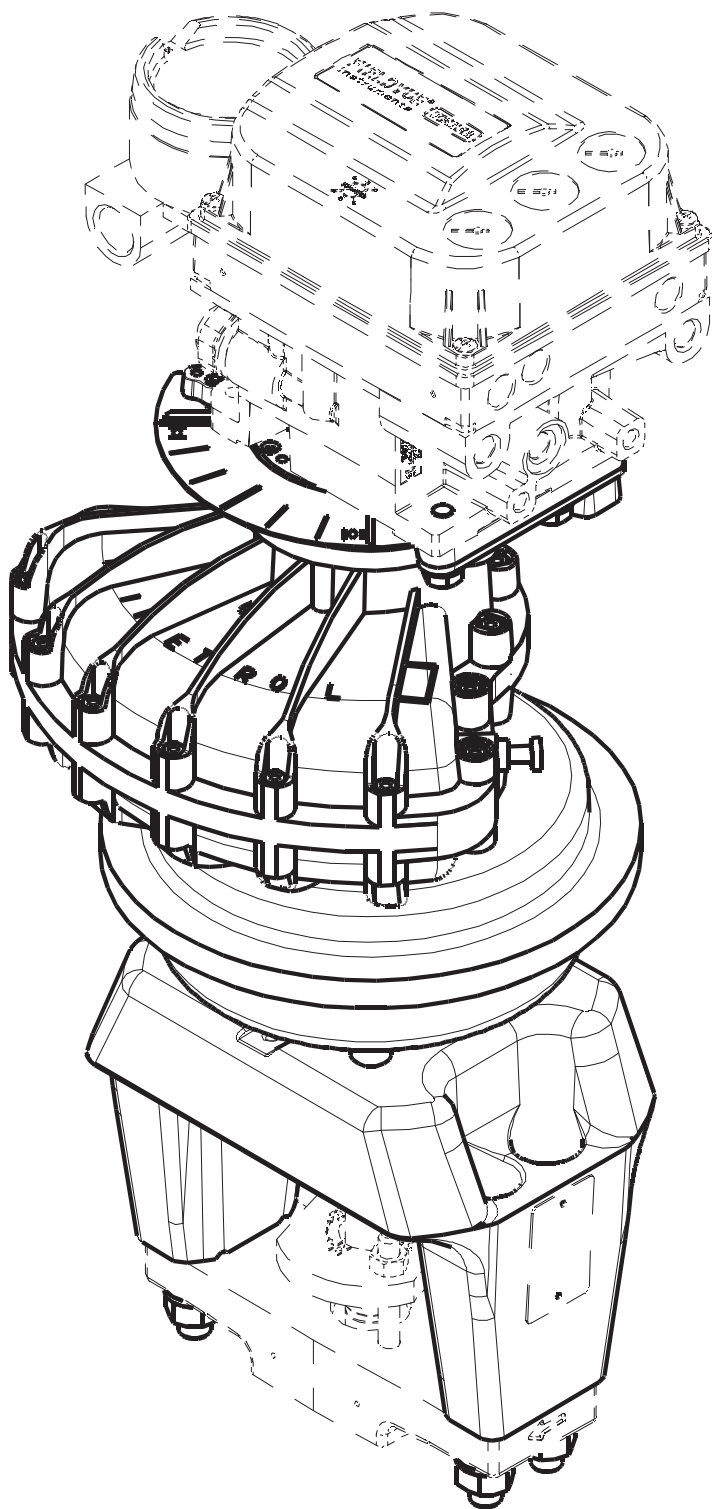
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ROTARY 1/4 TURN PNEUMATIC ACTUATORS

Suitable for use in safe area and hazardous gas/dust atmospheres (ATEX)



Issue
G

Signed
D.G.W

Date
08-01-20

KINETROL Trading Estate Farnham Surrey England

Doc.No. TD202

Page 1 of 18

ROTARY 1/4 TURN PNEUMATIC ACTUATORS

Suitable for use in safe area and hazardous gas/dust atmospheres (ATEX)

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ROTARY 1/4 TURN PNEUMATIC ACTUATORS

Suitable for use in safe area and hazardous gas/dust atmospheres (ATEX)

Section 1: Rotary 1/4 turn actuator / double acting & spring return models.

1.1 General Actuators & Spring Returns

1.1.1 Mounting Holes sizes

Table 1: Actuator (ANSI Threads)

Model	Number of Holes	ANSI Thread	Depth of Thread	PCD
7i	4	5/16-18 UNC	0.63"	2.00"
8i	4	5/16-18 UNC	0.63"	2.76"
9i	4	3/8-16 UNC	0.79"	2.56"
10i	4	3/8-16 UNC	0.63"	4.02"
12i	4	1/2-13 UNC	0.94"	3.06"
14i	4	5/8-11 UNC	1.12"	3.89"
15i	4	5/8-11 UNC	1.12"	5.51"

Table 2: Spring Return (ANSI Threads)

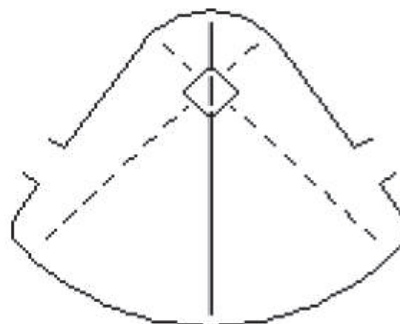
Model	Number of Holes	ANSI Thread	Depth of Thread	PCD
5i	4	5/16-18 UNC	0.51"	2.76"
7i	4	5/16-18 UNC	0.51"	2.76"
8i	4	5/16-18 UNC	0.63"	2.76"
9i	4	3/8-16 UNC	0.63"	4.02"
10i	4	3/8-16 UNC	0.63"	4.02"
12i	4	3/8-16 UNC	0.63"	4.02"
14i	4	1/2-13 UNC	0.94"	4.92"
15i	4	5/8-11 UNC	1.12"	5.51"

1.1.2 Mounting

Actuator / spring and driven unit must be correctly aligned, i.e. actuator vane / spring coupling and driven unit must be able to move in same direction from end stop when coupled together.

Figure 1.

Vane shown in mid-travel position.
 Identifying groove in top of output drive square shows position of vane.



ROTARY 1/4 TURN PNEUMATIC ACTUATORS

Suitable for use in safe area and hazardous gas/dust atmospheres (ATEX)

Note: Position of output shaft when vane at mid-travel position.

- 1) Take particular care in aligning model 5i actuator, 6-hole mounting means 30° misalignment possible if flange has 60° error and coupling 90° error.
- 2) There must be no end load on actuator drive shaft.
- 3) Check clearance between actuator and driven unit drive shaft, allowing for coupling to be used.
- 4) Care must be taken to ensure concentricity between actuator or spring return drive shaft and driven unit shaft.
- 5) Actuator can be mounted in any plane.
- 6) When side loading of actuator shaft is unavoidable, ensure load does not exceed guide lines given in Kinetrol Technical data sheet TD28.

1.1.3 Drive Coupling

- 1) Square hole drive coupling supplied for double acting actuators and anti-backlash drive coupling supplied with spring return actuators both in stainless steel.
- 2) In order to prevent rubbing and wear on the actuator / spring mount face, the actuator square should engage as deeply as reasonably practical into the coupling. However, a minimum gap of 0.5mm (0.02") between the coupling face and actuator / spring mount face should be maintained.

1.1.4 Air/Gas Supply

- 1) Operating air pressure should not exceed 7 bar (100 psi).
- 2) Supply medium must be clean, dry, oil-free, and non-corrosive and meet the requirements of ISA standard 7.0.01 or ISO 8573-1. Severe personal injury or property damage may occur from an uncontrolled process if the instrument supply medium is not clean, dry, oil-free, and non-corrosive. While use and regular maintenance of a filter that removes particles larger than 40 micrometers in diameter will suffice in most applications, further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimised.
- 3) Plastic or other non-conductive tubing should not be used if unit is ATEX.
- 4) The actuator can be driven by a hazardous gas as long as the gas is not corrosive (e.g. natural gas "sweet" and not "sour" gas is used).
- 5) The actuator shall not be operated with flammable gas/air mixtures.
- 6) Air can be passed to the actuator from three different sets of air ports:
 - a) Through the side holes.
 - b) Through the two holes at the rear of the actuator by fitting a Namur adaptor.
 - c) Through the two holes in the top flange of the actuator.

ROTARY 1/4 TURN PNEUMATIC ACTUATORS

Suitable for use in safe area and hazardous gas/dust atmospheres (ATEX)

1.1.5 Operation

- 1) External stops are strongly recommended when actuator is operating a mechanism with cantilevered load. However, Kinetrol technical data sheet, TD37, can be used to ensure load inertia and travel speed remain within allowable limits.
- 2) Positioner end of drive shaft may be used for visual position indication, when indicator arrow fitted.
- 3) Spring units can only be fitted to the driven (square) end of the actuator.
- 4) Ambient operating temperature range of actuator and spring is -40°C to 80°C as standard and -54°C to 60°C with low temperature seals.
 Special care should be taken to ensure that heat conducted from, for example, a hot valve, does not increase the temperature above these limits.
 Refer to Kinetrol for guidance.
- 5) Ensure environmental conditions, such as corrosive environments, are compatible with the materials of construction and protective finishes (Kinetrol technical data sheet TD14 refers). If unsure, contact Kinetrol.
 Excessive corrosion of the actuator and spring may cause it to fail in service.
- 6) The maximum rubbing speed of any component within the actuator and spring return unit must not exceed 4m/s for Cat 2.
 See table below for minimum operating travel times:
- 7) Do not allow dust layers to build up on the apparatus.

Table 3: Minimum Actuator operating travel times

Model	Category 2 operating time for 90° travel (sec)
5i	0.027
7i	0.036
8i	0.042
9i	0.046
10i	0.047
12i	0.060
14i	0.081
15i	0.091

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Suitable for use in safe area and hazardous gas/dust atmospheres (ATEX)

1.1.6 Maintenance

- 1) Actuator maintenance is limited to replacement of seals when wear affects actuator performance.
- 2) Seal life will vary according to application, conditions of cycle frequency, temperature, condition of air supply, etc.
- 3) Detailed seal replacement instructions in next section.
- 4) Spring return units are not user serviceable and therefore no spare parts are available other than complete units, baseplate gasket / O-ring seals and keeper plates for safe spring removal.

1.1.7 Recommended Spare Parts

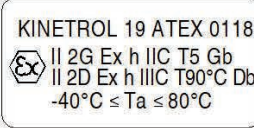
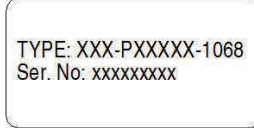
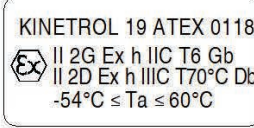
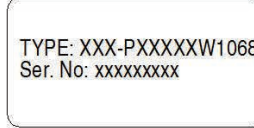
- 1) Standard seal kits, available for each actuator model, consist of the following:
 - 2 off vane seal - 2 off expander - 2 off shaft seal
 - Plus all necessary O-rings, screws, nuts and grease for all sizes.
 In addition, a tube of sealant will be required to seal case halves.

Table 4: Standard seal kit spare part ordering codes

Model	Act Seal Kit P/N	Vane P/N	Baseplate Seal P/N
5i	R1068KTX012	R1068KTX132	R1068KTX262
7i	R1068KTX022	R1068KTX142	R1068KTX272
8i	R1068KTX032	R1068KTX152	R1068KTX282
9i	R1068KTX042	R1068KTX162	R1068KTX292
10i	R1068KTX052	R1068KTX172	R1068KTX302
12i	R1068KTX062	R1068KTX182	R1068KTX312
14i	R1068KTX072	R1068KTX192	R1068KTX322
15i	R1068KTX082	R1068KTX202	R1068KTX332

1.1.8 Labelling

- 1) All Kinetrol actuators and spring return units that are approved for use in areas where explosives, dust and gases are present, are marked with the following labels:

			
STANDARD ACTUATOR		LOW TEMPERATURE ACTUATOR	

- 2) Ensure that the details on the label such as the ambient temperature range is suitable for the application. Also ensure that any other equipment fitted to the actuator and spring return unit (e.g. valve or positioner) does not restrict the use within the parameters shown on the above labels.

ROTARY 1/4 TURN PNEUMATIC ACTUATORS

Suitable for use in safe area and hazardous gas/dust atmospheres (ATEX)

1.1.9 Adjustment

1) Kinetrol Actuators come as standard with adjustable end stops.

Table 5: Standard stroke adjustments available

Models	Adjustment range available
5i/7i/8i/9i/14i/15i	10°
10i/12i	11°

2) Greater adjustment range possible with non-standard stops.
 Contact Kinetrol for details.

1.2 Actuator Seal Replacement Instructions

1.2.1 Dismantling Actuator

- 1) DISMANTLING ACTUATOR (see exploded view Figure 3)
 CAUTION: Before dismantling, check there are no burrs on square drive shafts. If there are, remove to avoid damage to bearings and shaft seals during removal of case halves. In the case of spring return actuators, remove spring unit (according to section 1.3.1) before opening actuator case. Ancillary equipment such as DVC mount plate / Yoke / coupling etc, will also need to be removed before dismantling actuator.
- 2) All models: loosen, but do not remove, all case screws.
- 3) Separate case halves by connecting air to inlet port and apply pressure to drive them apart. Procedure is safe although the separation is audible, ear defenders are recommended.
 Pull off one case half.
 CAUTION: Do NOT hammer diecast castings or shaft end. It will damage internal sealing surfaces.
- 4) Clean both case halves removing silicone rubber sealant.
 Clean joint surfaces of case flange with surgical spirit.
- 5) Replace and lubricate shaft seals.
- 6) Undo vane nuts and bolts and remove old expanders and seals from vane. Take care not to damage side plates.
- 7) Clean vane.

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1.2.2 Re-assembling vane

- 1) Check vane for any obvious defects and make sure it is free of burrs, then place vane face down on a bench or hold in a vice.
- 2) Fit Side plate Infill Insert into Side plates (7i only). Push hex headed bolts with plain washer through side plate, expander (teeth facing towards head of bolt) and seal (base of seal away from bolt head).
- 3) After checking that expander and seal are the right way round - expander has vane shaped hole, seal has shaft centre line marked.
- 4) While holding up side plate, expander and seal, apply a low strength anaerobic adhesive to bolt thread such as Loctite 222.
- 5) Thread first few threads of each bolt into vane.
- 6) Screw bolts down and tighten to torques given in table 6.
- 7) Turn vane over then fit seal, expander and side plate over end of bolts. Check orientation as before.
- 8) Screw nuts down thread.
- 9) Hold head of bolt with a spanner, torque up nuts to torque specified in table 6.

Table 6: Vane bolt and nut Tightening Torques

Model	Tightening Torque	
5i	8lbf.ins	0.90 Nm
7i	8lbf.ins	0.90 Nm
8i	20lbf.ins	2.26 Nm
9i	20lbf.ins	2.26 Nm
10i	15lbf.ins	1.70 Nm
12i	30lbf.ins	3.39 Nm
14i	30lbf.ins	3.39 Nm
15i	30lbf.ins	3.39 Nm

1.2.3 Re-assembling Actuator

- 1) Coat bearing bushes and inside both case halves with molybdenum disulphide grease or grease supplied by Kinetrol (usually as part of seal kit).
- 2) Lightly and evenly coat joint face on each case half with instant gasket sealant available from Kinetrol or Silastic 732 RTV sealant obtainable from ironmongers, etc. may be used as a substitute.
CAUTION: EXCESS SEALANT, if extruded inside case, WILL IMPAIR OPERATION OF SEALS.
 Remove all excess sealant especially from inside edge.
- 3) Insert vane into one case half, turning it to ease square on drive shaft through shaft seal. Watch that lip seals at ends of vane easily work down into case without damage.
- 4) Fit remaining case half on top of the other, turning it to ease positioner shaft through shaft seal.
- 5) **CAUTION:** Check that lip seals are not trapped at case joint face. Ensure minimal time delay to closing of case once sealant has been applied.
- 6) Tighten case bolts to torques given in table 7.

ROTARY 1/4 TURN PNEUMATIC ACTUATORS

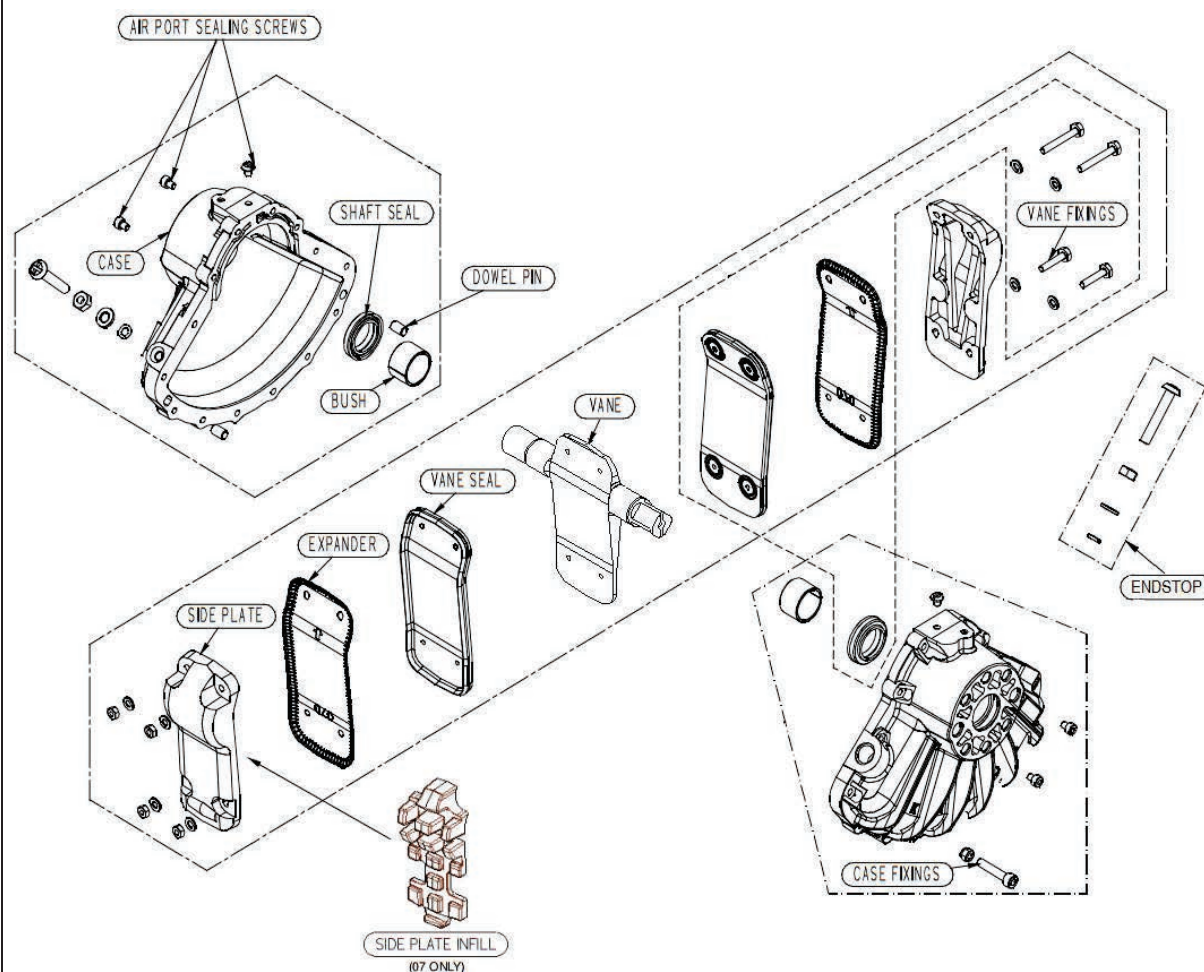
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Table 7: Case bolt Tightening Torques

Model	Tightening Torque	
5i	20lbf.ins	2.26 Nm
7i	20lbf.ins	2.26 Nm
8i	60lbf.ins	6.78 Nm
9i	60lbf.ins	6.78 Nm
10i	80lbf.ins	8.96 Nm
12i	100lbf.ins	11.3 Nm
14i	120lbf.ins	13.6 Nm
15i	225lbf.ins	25.4 Nm

- 7) Rotate vane manually to check movement and wipe away sealant extruded internally.
- 8) Allow setting time for sealant before applying test air pressure.

Figure 3. Exploded view of typical actuator



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1.3 Spring Return Units

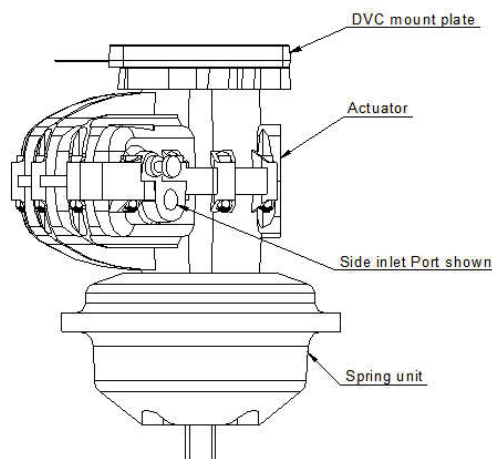
1.3.1 Removal of spring return unit

- 1) **WARNING** – the wound-up steel springs are storing a large amount of energy which, if suddenly released, can be dangerous.
- 2) A keeper plate strong enough to take full spring torque must be fitted in order to remove S/R unit without releasing spring tension.
- 3) Keeper plates and screws available from Kinetrol.
 Refer to table 8 for spare part order Numbers.

Table 8: Keeper plate ordering codes

Model	Part Number
5i	GE98028X012
7i	GE98028X022
8i	GE98028X032
9i	GE98028X042
10i	GE98028X052
12i	GE98028X062
14i	GE98028X072
15i	GE98028X082

Figure 4. Typical spring return actuator



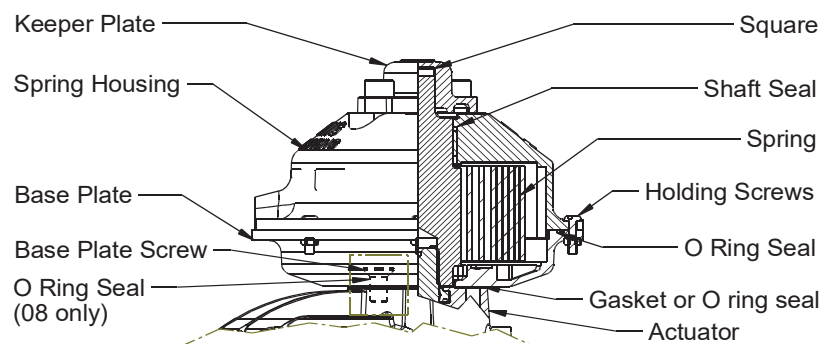
- 4) If the spring return actuator is installed as shown in figure 4, it will first be necessary to invert the assembly before removing or refitting the spring unit. (as shown in figure 5)

ROTARY 1/4 TURN PNEUMATIC ACTUATORS

Suitable for use in safe area and hazardous gas/dust atmospheres (ATEX)

- 5) Connect air line via pressure regulating valve to actuator air inlet.
Note DVC connecting port to be plugged.
- 6) Place keeper plate over square shaft protruding from S/R unit.
- 7) Increase air pressure slowly until actuator vane turns to mid-travel position.
(See Figure 1 of actuator section.)
- 8) Keeper plate holes will then line up with threaded holes in spring housing.
- 9) Insert all screws through keeper plate holes and tighten to lock keeper plate in position. Disconnect air supply.
- 10) Separate spring housing from base plate by removing holding screws. Then remove spring housing.
- 11) If necessary to gain access to actuator case fixing screws also remove base plate by removing base plate screws. Take care with gasket / O-ring between base plate and actuator. (Service actuator as required per Seal Replacement Instructions section 1.2).

Figure 5. Spring return unit section view



1.3.2 Re-fitting of Spring unit

- 1) If necessary replace base plate after replacing gasket or O-ring as appropriate.
Refer to table 4 for spare part order numbers. Ensure the 4 countersunk base plate fixing screws are all fitted with O-rings (8i models only).
- 2) Ensure actuator vane is in mid-travel position.
- 3) Locate spring housing on drive shaft, rotate it to line up holding screw holes with base plate and replace holding screws.
- 4) Connect air line via pressure regulating valve to actuator air inlet.
- 5) Adjust air pressure until it balances the spring tension.
- 6) Loosen keeper plate screws. If air pressure is correct balancing spring tension will not bind. If binding, adjust air pressure until balanced.
- 7) Remove keeper plate completely.
- 8) Disconnect air supply.

ROTARY 1/4 TURN PNEUMATIC ACTUATORS

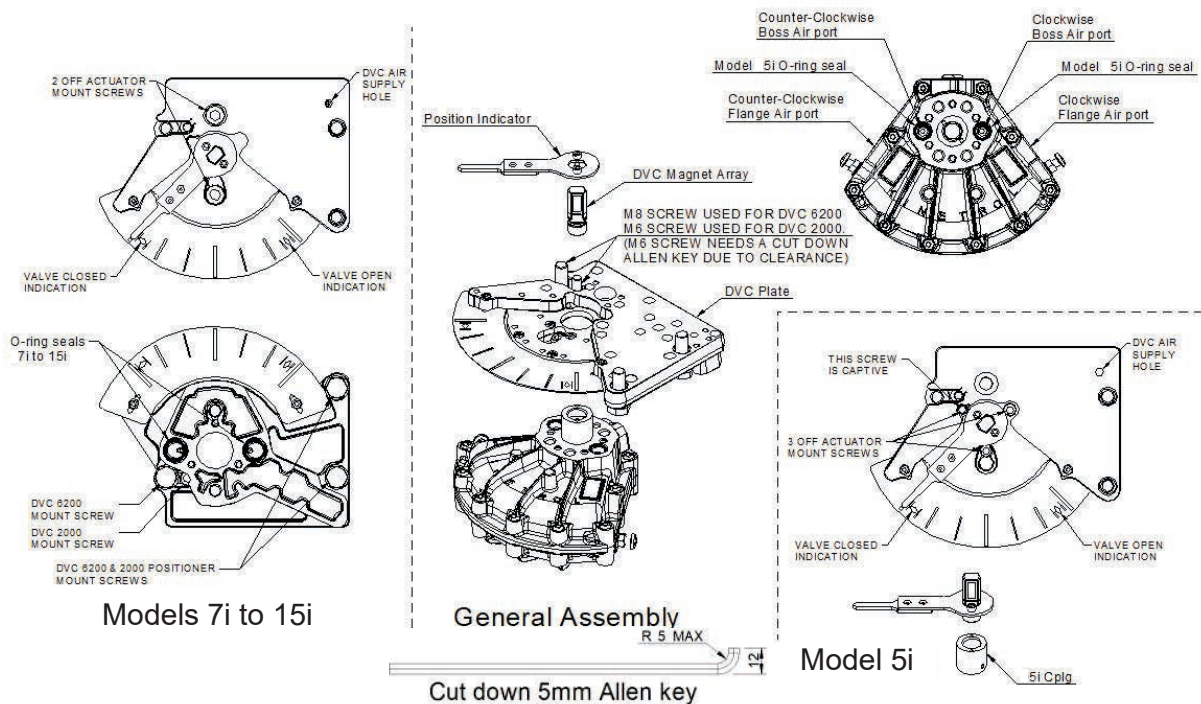
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Section 2: Accessory mount for Fisher DVC2000 & DVC6200 Positioners

2.1.1 Mount kit for Fisher DVC Positioners

- a) The Fisher DVC2000 & DVC6200 positioners can be direct mounted to actuator models 5i to 15i via a DVC mount kit.
- b) Two variants of the DVC mount kit are available one which fits to the model 05i actuator and another which fits to the 7i to 15i size actuators.
- c) Note, models 12i, 14i and 15i require an additional accessory mount plate (supplied with actuator as standard).

Figure 6. General arrangement of the DVC mount kit.



- d) Fitting DVC mount kit to Spring return actuator:
 Note: model 5i (only) has a separate coupling fastened to the shorter output square (supplied with actuator as standard) for the DVC array to fit into.
 - First remove one of the boss air port screws (according to the desired direction of travel).
 - Fit O-ring seals as shown in figure 6, apply a small amount of grease to seals to hold in place while fitting DVC plate to actuator.
 - Fit DVC magnet array into actuator round shaft.
 - Fit position indicator over magnet array and secure onto actuator shaft using screws provided.
 - Valve open/closed indication plate can be reversed.
- e) If fitting to a Double acting actuator first follow section 2.1.1d then remove the opposing flange air port blanking plug, this will need to be externally piped to the DVC positioner.
- f) Note all fasteners are to be chemically locked using Loctite 222 or equivalent.

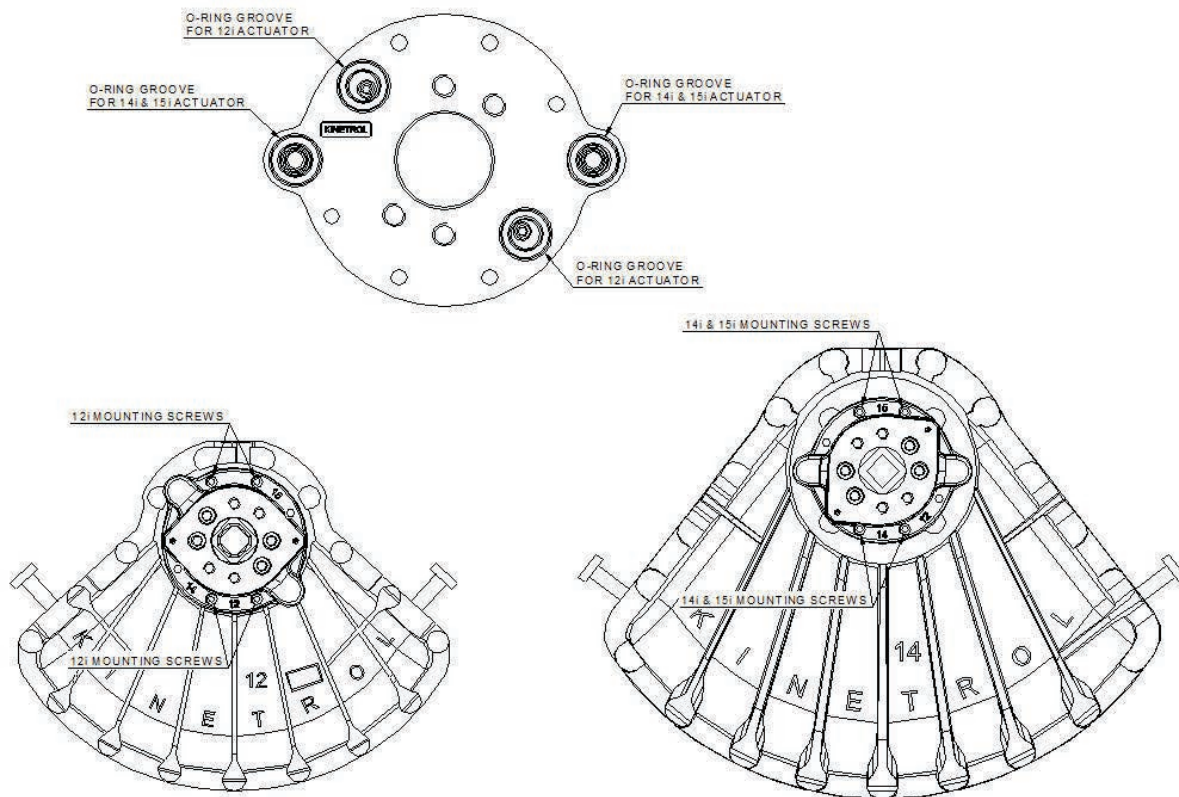
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2.1.2 Accessory mount for size 12i, 14i & 15i actuators

- a) To mount the DVC mount kit to actuator models 12i to 15i an accessory plate first needs to be fitted to the actuator (supplied pre-fitted to spring return actuators and loose within coupling kit for double acting actuators).

Figure 7. Accessory plate for actuator models 12i to 15i



- b) O-rings seals are fitted in grooves as shown in figure 7.
 c) Plate fits to actuators in different orientations as shown in figure 7.
 d) DVC mount kit direct mounts to the accessory plate as per figure 6.

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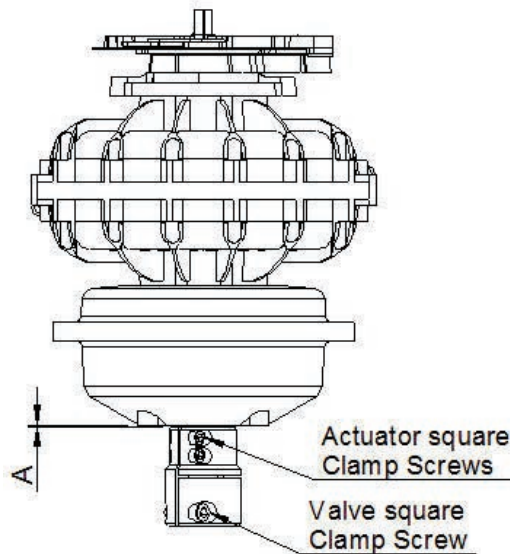
Section 3: Installation of Valve Yokes and anti-backlash couplings

3.1.1 Fitting anti-backlash couplings to Spring Return actuators

A range of anti-backlash couplings are available to direct couple to Fisher valves. A complete list of available options can be seen in table 11.

Note: Double acting actuators are fitted with solid couplings a complete list of available options can be seen in table 12.

Figure 8. Anti-backlash coupling fitted to Spring return actuator



- a) Fit coupling to spring return actuator leaving approx 0.5mm (0.02") gap between coupling face and spring mount face as shown on figure 8 dimension "A".
- b) Apply a low strength anaerobic adhesive to actuator square clamp screw threads such as Loctite 222 and torque up screw / screws to value given in table 9.
- c) Double acting actuators do not use anti-backlash couplings due to clearance constraints a range of standard through square couplings are available.

Table 9. Anti-backlash coupling clamp screw tightening torques

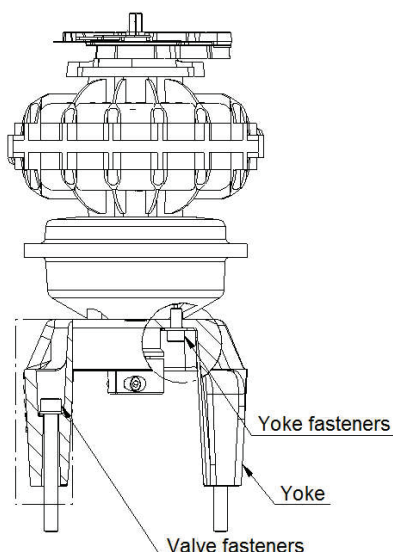
Screw size	Tightening Torque	
M6	156 lbf.ins	17.6 Nm
M8	372 lbf.ins	42 Nm
M10	797 lbf.ins	90 Nm
M12	1416 lbf.ins	160 Nm

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3.1.2 Mounting Yokes to Actuators & Spring Returns

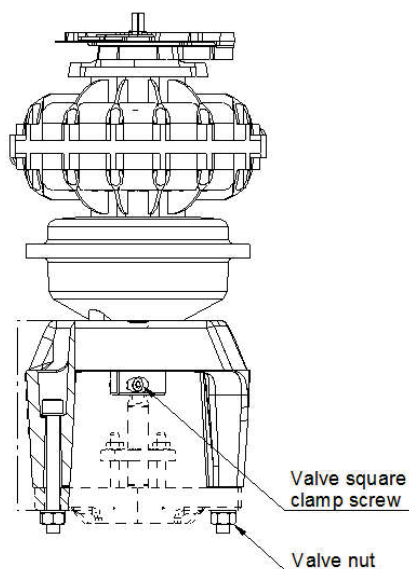
Figure 9. Yoke fitted to Spring return actuator



- a) First fit valve fasteners into yoke before fitting yoke to double acting / spring return actuator (some sizes lack the clearance to fit after).
- b) Apply a low strength anaerobic adhesive to yoke fastener screw threads such as Loctite 222 and torque up screws, consult TD111 for tightening torques.
- c) Note washers may not be supplied for some yoke and valve fasteners due to space constraints.

3.1.3 Mounting yokes to valves

Figure 10. Valve fitted to Spring return actuator



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- a) Ensure valve opening and closing direction matches the opening and closing direction of the double acting / spring return actuator.
- b) Do not apply any end loading to actuator output drive, and ensure the actuator output drive and valve square are concentric to each other.
- c) If possible for optimal setting and to reduce any misalignment between actuator drive and valve square, the unit should be assembled in mid position.
- d) The unit should be assembled in the vertical position as shown in figure 9 with the valve securely held in place.
- e) Apply a low strength anaerobic adhesive to valve fastener screw threads.
- f) Fit actuator assembly as shown in figure 10 to valve taking care to centrally locate anti-backlash coupling onto valve square and loosely tighten valve fasteners.
- g) Apply a low strength anaerobic adhesive to valve square clamp screw threads and torque up screw / screws to value given in table 9.
- h) Now torque up valves fasteners, see table 10 for tightening torques.

Table 10. Valve Fastener tightening torques

Yoke Size	Tightening Torque	
Yoke 1	920 lbf.ins	104 Nm
Yoke 2	920 lbf.ins	104Nm
Yoke 3	1770 lbf.ins	200 Nm

- i) Now operate assembly open and closed a few times to check correct function and look for any alignment issues.

3.1.4 Disassembly of Valve Yokes and anti-backlash couplings.

Follow stages 3.1.1 to 3.1.3 but in reverse order.

Warning – Any fasteners including anti-backlash coupling clamp screws, removed or loosened during disassembly, must be replaced with new ones of the same grade, original fasteners must NOT be re-used.

ROTARY 1/4 TURN PNEUMATIC ACTUATORS

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Table 11. Spring return actuator anti-backlash couplings

Actuator Size	Part description	Shaft Diameter	Part Number
5i	Anti-Backlash Coupling (9mm)	1/2"	GE97906X012
	Anti-Backlash Coupling (11mm)	5/8"	GE97906X022
7i	Anti-Backlash Coupling (9mm)	1/2"	GE97906X032
	Anti-Backlash Coupling (11mm)	5/8"	GE97906X042
	Anti-Backlash Coupling (14mm)	3/4"	GE97906X052
	Anti-Backlash Coupling (19mm)	1"	GE97906X062
8i	Anti-Backlash Coupling (9mm)	1/2"	GE97906X072
	Anti-Backlash Coupling (11mm)	5/8"	GE97906X082
	Anti-Backlash Coupling (14mm)	3/4"	GE97906X092
	Anti-Backlash Coupling (19mm)	1"	GE97906X102
	Anti-Backlash Coupling (22mm)	1-1/4"	GE97906X112
	Anti-Backlash Coupling (27mm)	1-1/2"	GE97906X122
9i	Anti-Backlash Coupling (9mm)	1/2"	GE97906X132
	Anti-Backlash Coupling (11mm)	5/8"	GE97906X142
	Anti-Backlash Coupling (14mm)	3/4"	GE97906X152
	Anti-Backlash Coupling (19mm)	1"	GE97906X162
	Anti-Backlash Coupling (22mm)	1-1/4"	GE97906X172
	Anti-Backlash Coupling (27mm)	1-1/2"	GE97906X182
10i	Anti-Backlash Coupling (9mm)	1/2"	GE97906X192
	Anti-Backlash Coupling (11mm)	5/8"	GE97906X202
	Anti-Backlash Coupling (14mm)	3/4"	GE97906X212
	Anti-Backlash Coupling (19mm)	1"	GE97906X222
	Anti-Backlash Coupling (22mm)	1-1/4"	GE97906X232
	Anti-Backlash Coupling (27mm)	1-1/2"	GE97906X242
12i	Anti-Backlash Coupling (14mm)	3/4"	GE97906X252
	Anti-Backlash Coupling (19mm)	1"	GE97906X262
	Anti-Backlash Coupling (22mm)	1-1/4"	GE97906X272
	Anti-Backlash Coupling (27mm)	1-1/2"	GE97906X282
14i	Anti-Backlash Coupling (14mm)	3/4"	GE97906X292
	Anti-Backlash Coupling (19mm)	1"	GE97906X302
	Anti-Backlash Coupling (22mm)	1-1/4"	GE97906X312
	Anti-Backlash Coupling (27mm)	1-1/2"	GE97906X322
15i	Anti-Backlash Coupling (22mm)	1-1/4"	GE97906X332
	Anti-Backlash Coupling (27mm)	1-1/2"	GE97906X342

- a) Couplings designed to suit Fisher 8580, 8590, V150, V200, V300, V500 and CV500 valves.
b) Value in parentheses is the valve square size.

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Suitable for use in safe area and hazardous gas/dust atmospheres (ATEX)

Table 12. Double acting actuator solid couplings

Actuator Size	Part description	Shaft Diameter	Part Number
7i	Solid Coupling (9mm)	1/2"	GE97906X352
	Solid Coupling (11mm)	5/8"	GE97906X362
8i	Solid Coupling (9mm)	1/2"	GE97906X372
	Solid Coupling (11mm)	5/8"	GE97906X382
	Solid Coupling (14mm)	3/4"	GE97906X392
	Solid Coupling (19mm)	1"	GE97906X402
	Solid Coupling (22mm)	1-1/4"	GE97906X412
9i	Solid Coupling (14mm)	3/4"	GE97906X422
	Solid Coupling (19mm)	1"	GE97906X432
	Solid Coupling (22mm)	1-1/4"	GE97906X442
10i	Solid Coupling (14mm)	3/4"	GE97906X452
	Solid Coupling (19mm)	1"	GE97906X462
	Solid Coupling (22mm)	1-1/4"	GE97906X472
	Solid Coupling (27mm)	1-1/2"	GE97906X482
12i	Solid Coupling (19mm)	1"	GE97906X492
	Solid Coupling (22mm)	1-1/4"	GE97906X502
	Solid Coupling (27mm)	1-1/2"	GE97906X512
14i	Solid Coupling (19mm)	1"	GE97906X522
	Solid Coupling (22mm)	1-1/4"	GE97906X532
	Solid Coupling (27mm)	1-1/2"	GE97906X542
15i	Solid Coupling (22mm)	1-1/4"	GE97906X552
	Solid Coupling (27mm)	1-1/2"	GE97906X562

- a) Couplings designed to suit Fisher 8580, 8590, V150, V200, V300, V500 and CV500 valves.
b) Value in parentheses is the valve square size.

Service Instructions for Fisher™ Digital Isolation™ Triple Offset Valve (TOV) Solution

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Component Instruction and Maintenance Manuals ..	2
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Educational Services	4
Parts Ordering	4

Figure 1. Fisher Digital Isolation TOV Solution



X1550

Introduction

Fisher Digital Isolation Solutions leverage Emerson's automation expertise with time-tested products to provide a complete and dependable isolation valve solution for your most critical isolation, SIS, and ESD valve applications.

Scope of Manual

This instruction manual includes the web links for product specifications, installation and maintenance instructions for each component.

Do not install, operate or maintain this product without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Component Specifications

For product specifications click on the following web link ([TOV Specs](#)) where you will find the technical specifications documents for the components used on Fisher Digital Isolation Solutions products.

Component Instruction and Maintenance manuals

For Component Instruction and Maintenance manuals click on the following links ([ASCO](#), [TopWorx](#), [DVC6200 SIS](#), [BETTIS](#)) where you will find the documents for the components used on Fisher Digital Isolation Solutions.

If a paper copy of component specifications or Instruction/Maintenance manuals is required please consult your Emerson sales office.

WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to provide safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Actuator Mounting Bracket-to-Valve Bolt Torque

SA 193-B7/zinc plated

Fastener Size	N • m	Ft • lb
5/16"	30	22
3/8"	53	39
7/16"	84	62
1/2"	130	96
9/16"	176	130
5/8"	230	170
3/4"	380	280
1"	786	580
1-1/4"	1424	1050

SA193 Grade B8 CL2

Fastener Size	N • m	Ft • lb
5/16"	19	14
3/8"	35	26
7/16"	56	41
1/2"	85	63
9/16"	123	91
5/8"	163	120
3/4"	258	190
1"	536	395
1-1/4"	969	715

SA 193-B7/zinc plated

Fastener Size	N • m	Ft • lb
M10	69	51
M12	116	86
M16	241	178
M20	413	305
M24	656	484
M30	1164	859

SA193 Grade B8 CL2

Fastener Size	N • m	Ft • lb
M10	48	35
M12	80	59
M16	165	122
M20	284	209
M24	451	333
M30	800	590

Lubrication should always be used with the SA 193-B8 Class 2 bolt material to prevent galling.

Educational Services

For information on available courses for Fisher Digital Isolation products, as well as a variety of other products, contact: Emerson Automation Solutions

Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Part Ordering

Each Fisher Digital Isolation package has a unique Fisher serial number. When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number.

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Fisher™ Digital Isolation™ NL Trunnion Mounted Ball Valve (TMBV) (Obsolete Product)

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Specifications	2
Inspection and Maintenance Schedules	2
Parts Ordering	2
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Introduction

The product covered in this document is no longer in production. This document, which includes the latest published version of the instruction manual, is made available to provide updates of newer safety procedures. Be sure to follow the safety procedures in this supplement as well as the specific instructions in the included instruction manual.

Part numbers in the included instruction manual should not be relied on to order replacement parts. For replacement parts, contact your [Emerson sales office](#).

For more than 30 years, Fisher products have been manufactured with asbestos-free components. The included manual might mention asbestos containing parts. Since 1988, any gasket or packing which may have contained some asbestos, has been replaced by a suitable non-asbestos material. Replacement parts in other materials are available from your sales office.

Safety Instructions

Please read these safety warnings, cautions, and instructions carefully before using the product.

These instructions cannot cover every installation and situation. Do not install, operate, or maintain this product without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson sales office before proceeding.

Specifications

This product was intended for a specific range of service conditions--pressure, pressure drop, process and ambient temperature, temperature variations, process fluid, and possibly other specifications. **Do not expose the product to service conditions or variables other than those for which the product was intended.** If you are not sure what these conditions or variables are, contact your [Emerson sales office](#) for assistance. Provide the product serial number and all other pertinent information that you have available.

Inspection and Maintenance Schedules

All products must be inspected periodically and maintained as needed. The schedule for inspection can only be determined based on the severity of your service conditions. Your installation might also be subject to inspection schedules set by applicable governmental codes and regulations, industry standards, company standards, or plant standards.

In order to avoid increasing dust explosion risk, periodically clean dust deposits from all equipment.

When equipment is installed in a hazardous area location (potentially explosive atmosphere), prevent sparks by proper tool selection and avoiding other types of impact energy.

Parts Ordering

Whenever ordering parts for older products, always specify the serial number of the product and provide all other pertinent information that you can, such as product size, part material, age of the product, and general service conditions. If you have modified the product since it was originally purchased, include that information with your request.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher product, because they may void your warranty, might adversely affect the performance of the product, and could cause personal injury and property damage.

Installation

⚠ WARNING

- Personal injury or equipment damage caused by sudden release of pressure or bursting of parts may result if the valve assembly is installed where service conditions could exceed the limits given in the applicable product literature, the limits on the appropriate nameplates, or the mating pipe flange rating. Use pressure-relieving devices as required by government or relevant industry codes and good engineering practices. If you cannot determine the ratings and limits for this product, contact your [Emerson sales office](#) before proceeding.
- To avoid personal injury, always wear protective gloves, clothing, and eyewear when performing any installation operations.
- To avoid personal injury or property damage, use proper lifting and rigging practices while lifting, installing or removing the valve assembly. Be sure to use lifting and rigging equipment properly sized and selected for the weight and configuration of the valve assembly or component being lifted.
- Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.
- Many rotary shaft valves are not necessarily grounded to the pipeline when installed in a flammable, hazardous, oxygen service, or explosive atmospheres. An explosion is possible, due to the discharge of static electricity from the valve components. To avoid personal injury or property damage, make sure that the valve is grounded to the pipeline before placing the control valve assembly into service. Use and maintain alternate shaft-to-body bonding, such as a shaft-to-body bonding strap assembly.
- Rotary shaft valves are designed and intended for installation between flanges. Personal injury or property damage may result from improper installation. To avoid personal injury or property damage caused by the sudden release of pressure or bursting of parts, do not use or install rotary shaft valves (including single lug constructions) for dead-end service.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- If installing into an existing application, also refer to the WARNING in the Maintenance section.
- When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. To avoid possible personal injury and because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson sales office.

CAUTION

- Ensure that the valve and adjacent pipelines are free of foreign material that could damage the valve seating surfaces.

Maintenance

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Always wear protective gloves, clothing, and eyewear.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure.
- Do not remove the actuator while the valve is pressurized.
- Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring pre-compression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box might contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids might spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug. Cautiously remove parts so that fluid escapes slowly and safely.
- Many valve parts that are moving can injure you by pinching, cutting, or shearing. To help prevent such injury, stay clear of any moving part.
- Never apply pressure to a partially assembled valve.
- To avoid personal injury or property damage caused by uncontrolled movement of a valve bonnet, loosen the bonnet by following these instructions: Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. Loosen bonnet nuts approximately 3 mm (0.125 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed with bonnet removal.
- As you remove parts, such as valve shafts, other parts, such as disks can fall from the valve body or suddenly move to another position in the valve. To avoid injury from falling or moving parts, be sure to support parts and be sure they are in a stable position as you disassemble the valve.
- Personal injury could result from packing leakage. Do not scratch the drive shaft or packing box wall while removing packing parts.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

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Service Instructions for Fisher™ Digital Isolation™ Trunnion Mounted Ball Valve (TMBV) Solution

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Figure 1. Fisher Digital Isolation TMBV Solution



X1507

Introduction

Fisher Digital Isolation Solutions leverage Emerson's automation expertise with time-tested products to provide a complete and dependable isolation valve solution for your most critical isolation, SIS, and ESD valve applications.

Scope of Manual

This instruction manual includes the web links for product specifications, installation and maintenance instructions for each component.

Do not install, operate or maintain this product without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Component Specifications

For product specifications click on the following web link ([TMBV Specs](#)) where you will find the technical specifications documents for the components used on Fisher Digital Isolation Solutions products.

Component Instruction and Maintenance manuals

For Component Instruction and Maintenance manuals click on the following links ([ASCO](#), [TopWorx](#), [DVC6200 SIS](#), [BETTIS](#)) where you will find the documents for the components used on Fisher Digital Isolation Solutions.

If a paper copy of component specifications or Instruction/Maintenance manuals is required please consult your Emerson Sales office.

WARNING

Avoid personal injury and property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.
- Depending on the actuator construction, it will be necessary to manage the pneumatic actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to provide safe removal of the actuator from the valve.
- Use lock-out procedures to be sure the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Actuator Mounting Bracket-to-Valve Bolt Torque

SA 193-B7/zinc plated

Fastener Size	N • m	Ft • lb
5/16"	30	22
3/8"	53	39
7/16"	84	62
1/2"	130	96
9/16"	176	130
5/8"	230	170
3/4"	380	280
1"	786	580
1-1/4"	1424	1050

SA193 Grade B8 CL2

Fastener Size	N • m	Ft • lb
5/16"	19	14
3/8"	35	26
7/16"	56	41
1/2"	85	63
9/16"	123	91
5/8"	163	120
3/4"	258	190
1"	536	395
1-1/4"	969	715

SA 193-B7/zinc plated

Fastener Size	N • m	Ft • lb
M10	69	51
M12	116	86
M16	241	178
M20	413	305
M24	656	484
M30	1164	859

SA193 Grade B8 CL2

Fastener Size	N • m	Ft • lb
M10	48	35
M12	80	59
M16	165	122
M20	284	209
M24	451	333
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Lubrication should always be used with the SA 193-B8 Class 2 bolt material to prevent galling.

Educational Services

For information on available courses for Fisher Digital Isolation products, as well as a variety of other products, contact: Emerson Automation Solutions

Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Part Ordering

Each Fisher Digital Isolation package has a unique Fisher serial number. When corresponding with your [Emerson sales office](#) about this equipment, always mention the valve serial number.

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Service Manual for Multiport Flow Selector™ Valve

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Figure 1. Fisher Multiport Flow Selector Valve



X1398

Introduction

Scope of Manual

This instruction manual includes installation, operation, and maintenance information for the Multiport Flow Selector.



Do not install, operate, or maintain a Multiport Flow Selector without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

The Multiport Flow Selector offers an efficient solution for oil well testing. This valve has eight inlets, one test outlet, and one group outlet. Eight pipe lines can be connected to this valve and allows continuous flow while sampling/testing individual oil wells.

Educational Services

For information on available courses for the Multiport Flow Selector valve, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104239X012

Multiport Flow Selector

April 2022

Specifications

The Multiport Flow Selector specifications are given in tables 1 through 5.

Table 1. Valve Specifications NPS 2x4 and 3x6

SPECIFICATIONS	VALVE SIZE							
	2 x 4			3 x 6				
ASME Class Rating ⁽¹⁾	CL300	CL600	CL900	CL150	CL300	CL600	CL900	CL1500
Weight, kg (lb)	91 (200)	91 (200)	363 (800)	553 (1220)	630 (1390)	658 (1450)	680 (1500)	968 (2135)
Inlet Ports	NPS 2			NPS 3				
Test Outlet Port	NPS 2			NPS 3				
Group Outlet Port	NPS 4			NPS 6				
End Connections	Raised-face flanges (ASME B16.5) or threaded connections for NPS 2x4 constructions only							
Temperature Range ⁽²⁾	-1 to 204°C (30 to 400°F)							
Shutoff	Class IV per ANSI/FCI70-2 and IEC 60534-4							
1. The pressure/temperature limits in this instruction manual and any applicable standard or code limitation should not be exceeded. 2. Standard O-ring material established upper and lower temperature limits.								

Table 2. Valve Specifications NPS 4x8, 4x10, and 6x16

SPECIFICATIONS	VALVE SIZE							
	4 x 8			4x10	6 x 16			
ASME Class Rating	CL300	CL600	CL900	CL1500	CL300	CL600	CL900	CL1500
Weight, kg (lb)	959 (2115)	975 (2150)	1134 (2500)	1742 (3840)	1810 (3990)	2018 (4450)	3590 (7915)	5343 (11780)
Inlet Ports	NPS 4			NPS 4	NPS 6			
Test Outlet Port	NPS 4			NPS 4	NPS 6			
Group Outlet Port	NPS 8			NPS 10	NPS 16			
End Connections	Mates with raised-face flanges per ASME B16.5							
Temperature Range ⁽¹⁾	-1 to 204°C (30 to 400°F)							
Shutoff	Class IV per ANSI/FCI70-2 and IEC 60534-4							
1. The pressure/temperature limits in this instruction manual and any applicable standard or code limitation should not be exceeded. 2. Standard O-ring material established upper and lower temperature limits.								

Table 3. Actuator Specifications

SPECIFICATIONS	VALVE SIZE AND ASME CLASS RATING				
	NPS 2 x 4 CL300/600/900	NPS 3 x 6 CL150/300/ 600/900/1500	NPS 4 x 8 CL300/600/900	NPS 4 x 10 CL1500	NPS 6 x 16 CL300/600/ 900/1500
Max Torque Output, N • m (ft • lbf)	203 (150)	881 (650)	1085 (800)	1085 (800)	2034 (1500)
Actuator Speed, RPM	1.0	0.5-1.0	0.5-1.0	0.5-1.0	0.3-0.5
Actuator Weight, kg (lb)	82 (180)				
Plug Position Accuracy	± 1°				

Installation

Minimum Tools Required

A torque wrench, socket wrench, and Allen head wrenches are required to install the Multiport Flow Selector Valve and actuator assembly.

Table 4. Socket Size for Multiport Bonnet Studs and Nuts

VALVE SIZE, NPS	ASME CLASS RATING	SOCKET SIZE (in)
2 x 4	CL300	1-5/8
	CL600	
	CL900	
3 x 6	CL150	2
	CL300	
	CL600	
	CL900	
	CL1500	2-3/8
4 x 8	CL300	2-3/16
	CL600	
	CL900	
4 x 10	CL1500	2-3/4
6 x 16	CL300	2-9/16
	CL600	
	CL900	3-1/8
	CL1500	3-7/8

Other socket sizes (inch) required: 7/16, 1/2, 9/16, 3/4, 7/8, and 1-1/8.

Allen key sizes (inch) required: 5/32, and 1/4

Table 5. Wrench Sizes (Inch) for Multiport Inlet and Outlet Flanges

FLANGE SIZE, NPS	ASME CLASS RATING				
	CL150	CL300	CL600	CL900	CL1500
2	---	1-1/16	1-1/16	1-7/16	---
3	1-1/16	1-1/4	1-1/4	1-7/16	1-13/16
4	---	1-1/4	1-7/16	1-13/16	2
6	1-1/4	1-1/4	1-5/8	1-13/16	2-3/16
8	---	1-7/16	1-13/16	2-3/16	---
10	---	---	---	---	2-15/16
16	---	2	2-3/8	2-9/16	3-7/8

WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Avoid personal injury and property damage by keeping hands, tools, and other objects away from the plug while operating the valve.

Observe all WARNING decals and tags.

Key numbers in this procedure are shown in figure 2 and 3 unless otherwise indicated.

Before installing the unit, observe all warning tags and:

1. Check for external physical damage.
2. Check for any visible leakage of gear oil from the Multiport Electric Actuator (MPA).
3. Visually inspect the inside of the Multiport through the group outlet port checking for damage, rust, and/or debris.
4. Verify the voltage requirement of the MPA (AC/DC) and connect power supply and signal circuits to test the operation of the electric actuator and plug. Check for proper plug alignment at each port.
5. Inspect connecting pipelines to be certain they are free of foreign material such as pipe scale or weld slag that could damage the sealing surfaces of the Multiport Flow Selector valve.
6. Provide appropriate flange gaskets and install them between the pipe flanges and valve body flanges. Tighten flange bolting in a star pattern to ensure uniform compression of the gaskets.

Note

To prevent seal damage when hydrotesting external piping, position the plug midway between two inlet ports in order to equalize pressure between the plug and valve body.

The Multiport Flow Selector plug/port alignment is factory adjusted when supplied with an actuator and should not require further adjustment.

Field Technician Commissioning Activities

Refer to the Multiport Actuator (MPA) O&M Manual — Supplied by Bettis ([MPA-400-0711](#)). See page 19 for detailed commissioning activities.

CAUTION

Replace pipe plug with breather before operating unit. The valve body may be pressurized from hydrostatic testing. Do not remove any bolts or flanges for inspection until after the unit has been depressurized.

Circuit boards are susceptible to damage from static discharge when touched. Ensure that you ground yourself before touching the knobs on the electric actuator.

Reinstallation of the Actuator Assembly

1. Using a manual wrench, rotate the plug (key 2) a few revolutions to verify it turns freely. Initial effort required to rotate the plug could be high if the plug has not been rotated for an extended period of time.
2. Secure the actuator mounting bracket (key 43) to the bonnet using two cap screws (key 44), two travel indicator studs (key 54), and four lock washers (key 56). For the NPS 2x4 construction, secure the lower plate to the bonnet using two cap screws, two travel indicator studs and nuts, and four lock washers.

Regardless of size, apply an anti-seize lubricant (key 40) to the threaded portion of the fasteners. The cap screws should be spaced 180 degrees apart from one another and 90 degrees apart from the travel indicator studs.
3. Secure the travel indicator plate to the travel indicator studs by tightening two cap screws (key 55). Proper assembly has occurred if the lock washers have been placed between the travel indicator studs and travel indicator plate and if flat washers (key 57) have been placed between the cap screws and travel indicator plate. For the 2x4 construction, place travel indicator spacers over the travel indicator studs and secure the travel indicator plate

down by tightening the nuts. Proper assembly has occurred if there are flat washers between the travel indicator spacers and travel indicator plate and travel indicator plate and nuts.

Regardless of size, an anti-seize lubricant (key 40) shall be applied to the threaded portion of the fasteners and nuts.

4. To complete the assembly of the mounting kit for the NPS 2x4 construction, thread four spacer studs into the lower plate and secure the upper plate to the spacer studs using four cap screws. Proper assembly has occurred if there are lock washers between the lower plate and spacer studs and spacer studs and upper plate. An anti-seize lubricant (key 40) shall be applied to the threaded portion of the studs and fasteners.
5. Apply grease (key 41) to the surfaces on the key slot(s) found on the shaft coupler (key 47). Insert key(s) (key 48) into the shaft coupler key slot(s). Insert the shaft coupler with key(s) into the bottom of the Multiport Electric Actuator and hold in place by hand.
6. Slowly lower the actuator with shaft coupler (key 47) onto the mounting bracket (key 43). Align the shaft coupler with the square end of the plug (key 2). Position the shaft coupler such that the reference mark on the square end of the plug remains visible between the flats of the shaft coupler. This reference mark indicates the location of the seal assembly relative to the inlet ports of the body.
7. Attach the actuator to the mounting bracket (key 43) using four cap screws (key 45) and four lock washers (key 46). Tighten these fasteners finger tight only.
8. Apply an anti-seize lubricant (key 40) to the travel indicator holder (key 49) and thread on the jam nut (key 51), as well as the travel indicator pointer (key 50) and nut (key 52). Thread this assembly into the shaft coupler (key 47). The travel indicator pointer shall be on the same side as the reference mark found on the square end of the plug and shall be positioned such that it will not contact any parts of the travel indicator assembly while rotating.
9. Using the electric actuator, rotate the plug (key 2) a few revolutions to establish proper alignment between the shaft coupler (key 47) and plug. Visually check for any binding and adjust the position of the actuator as necessary. Once the proper alignment has been established, secure the actuator to the mounting bracket (key 43) by tightening the cap screws (key 46).

Home Port Calibration

Refer to the Multiport Electric Actuator (MPA) O&M Manual — Supplied by Bettis ([MPA-400-0711](#)) for detailed instructions on how to calibrate the home port position.

Multiport Electric Actuator Set Up

Refer to the Multiport Electric Actuator (MPA) O&M Manual — Supplied by Bettis ([MPA-400-0711](#)) for detailed instruction on:

1. Disabling port positions
2. Controller address
3. Control room MODBUS RTU operation
4. Installation and use of MPA software on laptop/PC

Maintenance

Refer to figure 2 and 3, typical Multiport assembly and mounting drawings.

⚠ WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly rotate the plug.
- Use bypass valves or completely shut off the process to isolate the Multiport from process pressure. Relieve process pressure from all parts of the valve. Drain the process media from all sides of the Multiport.
- Use lockout procedures to be sure the above measures stay in effect while you work on the equipment.
- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
- The tapered roller bearing area may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when separating the bonnet from the plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

The Multiport Flow Selector valve is shipped completely greased and lubricated. Routine maintenance of this valve is recommended, especially if it has been stored for an extended amount of time. Maintenance steps include:

1. Keeping the tapered roller bearing (key 3) greased. A high temperature silicone grease (key 39) can be injected into the bearing housing through the lube fitting (key 28).
2. Confirming proper alignment between the plug and inlet ports.
 - Verify the correct placement of the travel indicator pointer (key 50) onto the coupler (key 47).
 - Align the plug (key 2) with one of the inlet ports. Confirm the travel indicator pointer is in alignment with the selected inlet port.
3. Visual inspection of the seal insert (key 12). The sealing surface of this insert should be smooth and completely intact.
 - If the seal insert needs to be replaced, replace all o-rings (key 5, 7, 14, 20, 25, and 26), backup rings (key 6, 8, 15, and 21), rod seal (key 4), plug bushing (key 9), and wiper seals (key 24).
4. Rotate the plug (key 2) one complete revolution using the electric actuator to confirm the assembly is functioning properly. Check the local display unit on the electric actuator for any alarm codes.

Disassembly

Review warnings found in the Maintenance section of this manual.

Refer to figures 2 and 3 when disassembling the Multiport Flow Selector.

Note

The bonnet can be removed with the Multiport Electric Actuator still attached. If this is done, ensure proper orientation has been maintained between the actuator and valve body once the bonnet has been re-installed onto the valve body. If this orientation has not been maintained, recalibration of the actuator is required. One way to ensure proper orientation has been maintained is to place alignment marks between the plug (key 2) and coupler (key 47) prior to removal of the bonnet (key 19).

1. Rotate the plug (key 2) to any unused inlet port. Remove the blind flange from this inlet port to gain access to the seal assembly. Once the adjustment tool has been secured to the seal adjuster (key 18), rotate this tool clockwise until it stops. This action unloads the wave springs (key 11, 17) and removes the forces generated between the seal insert (key 12), valve body (key 1) and scraper (key 12)/valve body (key 1).
2. Remove the nuts (key 32) from the bonnet (key 19), lifting lugs (key 33), and the studs (key 31) from the body (key 31). Thread eye bolts into the jack screws holes provided in the bonnet. Raise the bonnet vertically until it clears the plug (key 2) and move it to the side.
3. Remove the plug (key 2) from the valve body (key 1). The seal components should still be installed inside of the plug.
4. Remove the seal assembly from the plug (key 2) using the adjustment tool as follows:
 - Once the adjustment tool has been inserted into the seal adjuster (key 18) and secured, rotate the tool counterclockwise until the seal adjuster disengages from the final thread on the plug.
 - With the adjustment tool still secured to the seal adjuster (key 18), pull it out of the plug. All components that make up the seal assembly are now outside of the plug.
5. Carefully remove the bearing cup (key 3) from the bonnet (key 19).
6. Inspect all components for damage. Replace any damaged parts and reassemble by following the Assembly procedure in this manual.

Assembly

Refer to figures 2 and 3 when assembling the Multiport Flow Selector.

Ensure all parts are clean and in good condition before assembling the Multiport Flow Selector. Refer to figure 2 to determine which components require lubrication.

Body (Key 1)

1. Visually inspect all internal and external surfaces and threads.
2. Install the plug bushing (key 9) into the lower section of the body.

Plug (Key 2)

1. Install the lower plug O-ring (key 8), with the correct number of backup rings (key 7). For ASME rated CL150, 300, 600, and 900 valves, install one backup ring above (on the side nearest to the bonnet) the O-ring. For CL1500 rated Multiports, install two backup rings one on either side of the lower plug O-ring.
2. Lubricate and install the seal adjuster (key 18) by turning it clockwise (i.e. viewing toward the plug centerline) until solid. Follow with the correct number of wave springs (key 17). For NPS 2x4, 3x6, and 6x16 constructions, install three wave springs. For NPS 4x8 and 4x10 constructions, install four wave springs. Ensure the wave springs are properly aligned and seated on the seal adjuster.

Note

If the wave springs are not properly aligned and seated then the seal assembly may not function properly.

3. Install the back up plate (key 16) against the shoulder in the plug (key 2).
4. Install the O-ring (key 14) onto the seal carrier (key 13). Install the seal assembly into the plug. Hand force should only be required for proper installation.
5. Install the correct number of wave springs (key 11) followed by the scraper (key 10) into the plug over the seal assembly. For NPS 2x4 constructions, install two wave springs and for NPS 3x6, 4x8, 4x10, and 6x16 constructions, install one wave spring. Ensure the scraper fits freely into the plug. Check by pushing the scraper into the plug using both hands then letting go to see if it returns to its original position.
6. Lower the plug (key 2) into the body ensuring that the seal insert (key 12) and scraper (key 10) clear the bore of the body (key 1). When installed, the plug rests on top of the plug bushing (key 9).
7. Lubricate the tapered bearing cone and rollers (key 3) using a high temperature silicone grease (key 39) and install onto the plug.

Bonnet (Key 19)

1. Lubricate and press fit the bearing cup (key 3) into the bonnet using a high temperature silicone grease (key 39). Lubricate the bearing cup and press fit it into the bonnet.
2. Install the backup ring (key 6), O-ring (key 5), and rod seal (key 4) into the bonnet bore. Rod seal is not required for NPS 2x4 or 3x6 CL300, 600, and 900 rated valves.
3. Install the bonnet O-ring (key 20) into the groove of the bonnet. For NPS 4x8, 4x10, and 6x16 constructions, install the backup ring above this O-ring.
4. Install the wiper seal (key 24), lube fitting (key 28), and vent plug (key 27). For NPS 4x10 and 6x16 constructions, install the wiper seal on an external wiper retainer (key 24) with two extra O-rings (key 25 and 26).
5. Using two eye bolts threaded into the jack screw holes found on the bonnet, slowly lower the bonnet onto the body. Be careful not to damage any soft parts when feeding the plug through the bonnet. The bonnet has been properly positioned onto the body when the following has been achieved:
 - The bolt holes in the bonnet have been aligned with the stud holes in the body.
 - The centerline of the bonnet vent port has been aligned with the centerline of the group outlet of the body.

Excessive force should not be required to properly seat the bonnet onto the body. For NPS 2x4, 3x6, and 4x8 constructions, use hoist rings or eye bolts with 1/2 UNC threads. For NPS 3x6 CL1500, 4x10, and 6x16 constructions, use hoist rings or eye bolts with 3/4 UNC threads.
6. Lubricate studs (key 31) with an anti-seize lubricant (key 40) and thread into valve body (key 1). Place the appropriate number of lifting lugs (key 33) over these studs. The placement of these lifting lugs should be equally spaced with one being located directly above the group outlet. The placement of these lifting lugs is as follows:
 - For NPS 2x4, 3x6, 4x8, and 4x10 constructions, place two lifting lugs equally spaced with one being located directly above the group outlet port.
 - For NPS 6x16 CL300, 600, and 900 constructions, place three lifting lugs equally spaced with two of them straddling the group outlet port.
 - For NPS 6x16 CL1500 constructions, place four lifting lugs equally spaced with two of them straddling the group outlet port.
7. Lubricate the threads and the bottom surface of the nuts (key 32) with an anti-seize lubricant (key 40) paste prior to threading them on to the studs (key 31). Once all nuts have been threaded hand tight, tighten two nuts spaced 180-degrees apart to the recommended torque values per table 6. Rotate the plug (key 2) one complete revolution to ensure that it rotates with minimal resistance. If the plug rotates smoothly, then proceed to tighten the remaining nuts using an appropriate tightening pattern.
8. Using the lube fitting (key 28), fill the bearing bore with grease.

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Table 6. Bonnet Bolting Torque

VALVE SIZE, NPS	ASME CLASS RATING	STUD SIZE		TORQUE	
		mm	Inch	N • m	ft • lbf
2 x 4	300 600 900	25.4	1	217	160
3 x 6	150 300 600 900	31.8	1-1/4	441	325
	1500	38.1	1-1/2	814	600
4 x 8	300 600 900	34.9	1-3/8	651	480
4 x 10	1500	44.5	1-3/4	1356	1000
6 x 16	300 600	41.3	1-5/8	1085	800
	900	50.8	2	2034	1500
	1500	63.5	2-1/2	4203	3100

Plug Seal Adjustment

1. Prior to adjusting the seal assembly (key 12 and 13), align the plug (key 2) with an open inlet port and insert the supplied adjustment tool. Once this tool has been secured to the seal adjuster (key 18), rotate this tool counter clockwise until the scraper (key 10) touches the inside surface of the body (key 1). The resistance to rotate the adjustment tool will increase once the scraper contacts the body. Remove the adjustment tool.
2. Rotate the plug (key 2) a few revolutions to check for binding or excessive turning torque. If the plug rotates smoothly, then insert, secure, and rotate the adjustment tool counter clockwise to tighten the seal adjuster (key 18) to the appropriate torque value listed in table 7.

Note

Do not exceed the torque values listed in table 7. Exceeding these values may cause the valve to not function as intended.

Table 7. Plug Seal Torque

VALVE SIZE, NPS	ASME CLASS RATING	TORQUE	
		N • m	ft • lbs
2 x 4	300 600 900	41	30
3 x 6	150 300 600	48	35
	900 1500	41	30
4 x 8	300 600 900	54	40
4 x 10	1500	54	40
6 x 16	300 600 900 1500	95	70

3. Rotate the plug (key 2) a few revolutions while checking for smooth movement. If the seal assembly is binding during rotation, then the seal assembly or the wave springs (key 17) are not in their proper position(s). See disassembly procedure, if required.
4. Install the appropriate amount of pipe plugs (key 27).
5. Perform any required functionality test(s).

Troubleshooting

Actuator Does Not Align Plug to Inlet Port

1. Check the shaft coupler for looseness.
2. Check the motor for stalling or overload.
3. Check the visual leakage or noisy gear.
4. Refer to the Multiport Electric Actuator (MPA) O&M Manual — Supplied by Bettis ([MPA-400-0711](#)) for port calibration procedures and troubleshooting.

Seal Leakage

1. Check the travel indicator plate (key 53) and travel indicator pin (key 50) to ensure the plug (key 2) is properly aligned with the inlet ports.
2. Check the seal insert (key 12) for damage. To visually inspect the seal insert, the blind flange from an unused inlet port needs to be removed. Prior to removing this flange, verify the Multiport Flow Selector valve has been depressurized to a value of zero. With the blind flange removed, rotate the plug until visual inspection of the seal insert can occur. The sealing surface of the seal insert should be smooth, completely intact, and free of deep groove marks.

WARNING

Ensure that all pressures in the Multiport body, group outlet, and test port are ZERO before visually checking the seal.

3. If more information is required, please contact your [Emerson sales office](#).

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Multiport Flow Selector

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Figure 2. Multiport Drawing Assembly

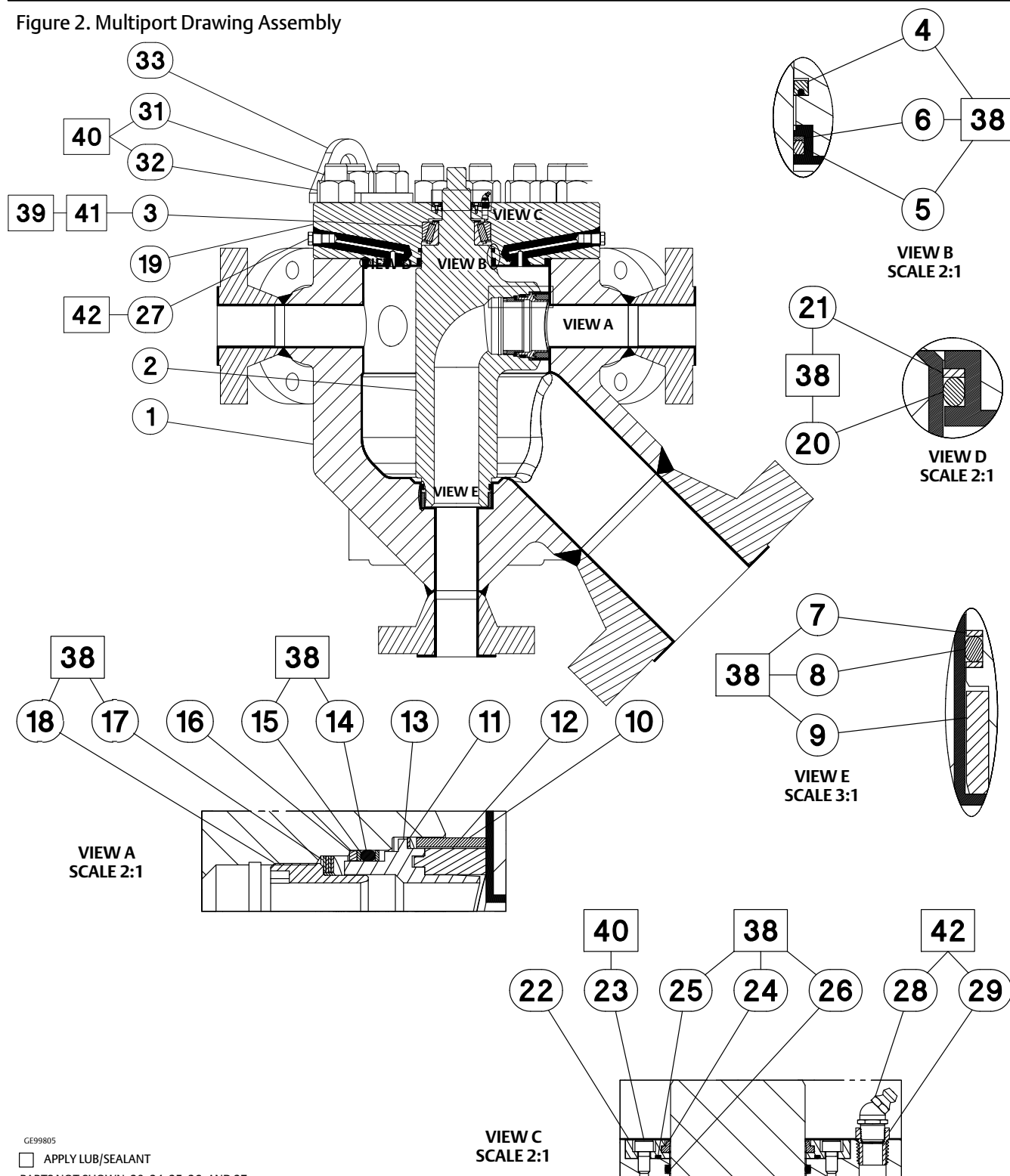
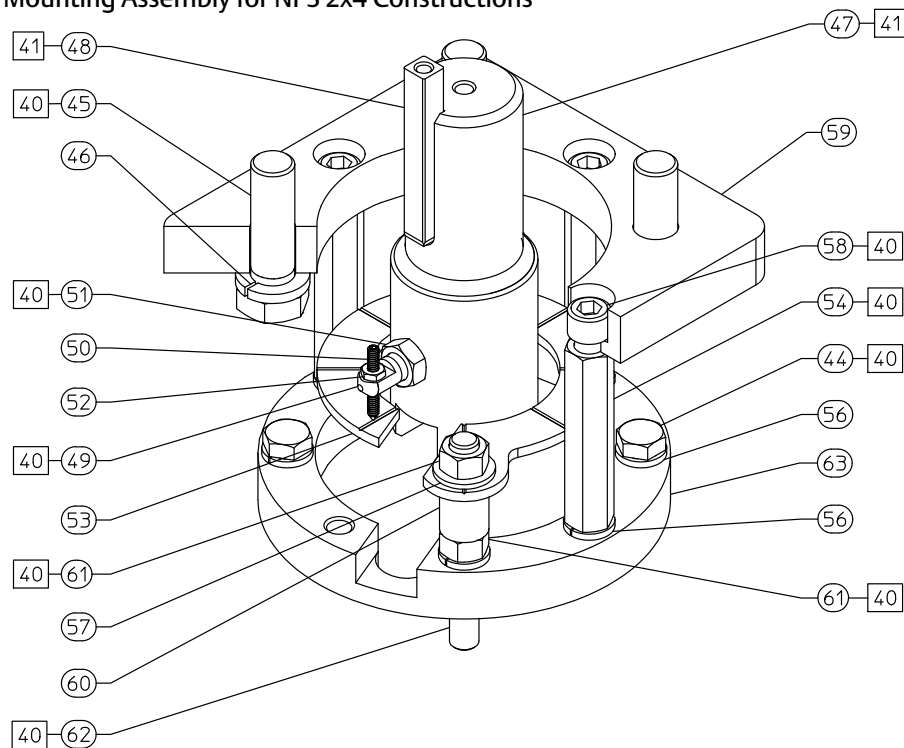
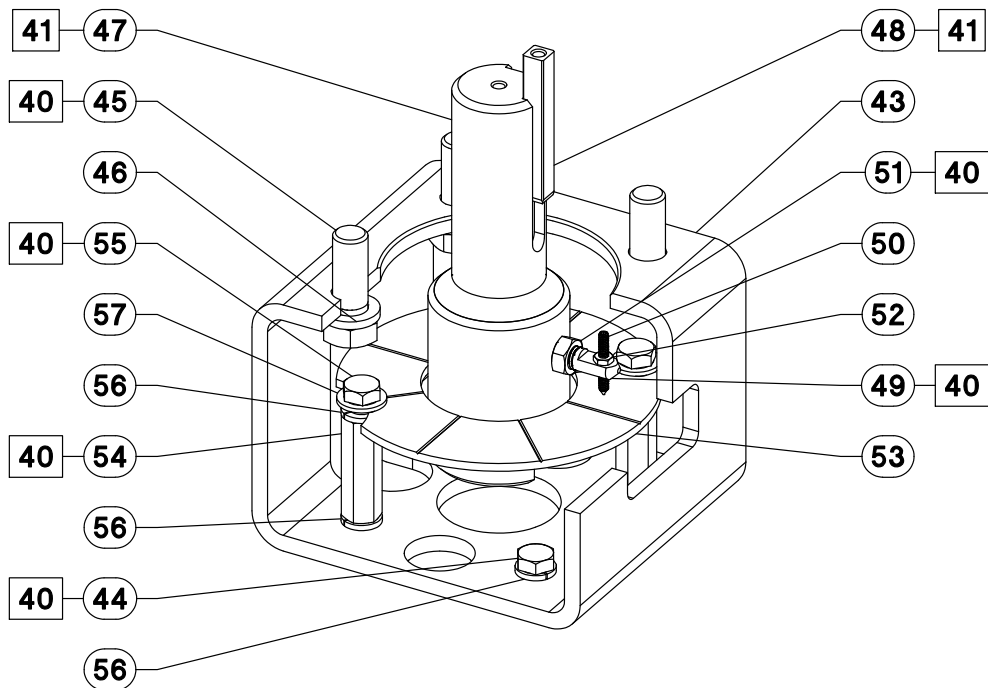


Figure 3. Multiport Mounting Assembly for NPS 2x4 Constructions



GE99891

Figure 4. Multiport Mounting Assembly for NPS 3x6, 4x8, and 6x16 Constructions



GE99891

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

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Parts Kits

Seal Kits

DESCRIPTION	PART NUMBER
MINOR REPAIR KIT, 316 FOR 2X4 MPFS	RMPFS20409X072
MINOR REPAIR KIT, AFLAS FOR 2X4 MPFS	RMPFS20409X052
MINOR REPAIR KIT, AFLAS/FLEXISEAL FOR 2X4 MPFS	RMPFS20409X062
MAJOR REPAIR KIT, 316 FOR 2X4 MPFS	RMPFS20409X082
MAJOR REPAIR KIT, AFLAS FOR 2X4 MPFS	RMPFS20409X012
HIGH DIFFERENTIAL PLUG UPGRADE, AFLAS/FLEXISEAL FOR 2X4 MPFS	RMPFS20409X042
MINOR REPAIR KIT, 316 FOR 3X6 MPFS	RMPFS30609X102
MINOR REPAIR KIT, AFLAS FOR 3X6 MPFS	RMPFS30609X082
MINOR REPAIR KIT, AFLAS/KALREZ FOR 3X6 MPFS	RMPFS30609X092
MINOR REPAIR KIT, AFLAS/25CFT/DSS FOR 3X6 MPFS	RMPFS30609X022
MINOR REPAIR KIT, AFLAS/25CFT/825 FOR 3X6 MPFS	RMPFS30609X112
MAJOR REPAIR KIT, 316 FOR 3X6 MPFS	RMPFS30609X132
MAJOR REPAIR KIT, AFLAS FOR 3X6 MPFS	RMPFS30609X042
MAJOR REPAIR KIT, AFLAS/25CFT/DSS FOR 3X6 MPFS	RMPFS30609X032
MAJOR REPAIR KIT, AFLAS/25CFT/825 FOR 3X6 MPFS	RMPFS30609X122
HIGH DIFFERENTIAL PLUG UPGRADE, AFLAS FOR 3X6 MPFS	RMPFS30609X062
MINOR REPAIR KIT, 316 FOR 4X8 MPFS	RMPFS40809X112
MINOR REPAIR KIT, AFLAS/VITON FOR 4X8 MPFS	RMPFS40809X102
MINOR REPAIR KIT, 718 FOR 4X8 MPFS	RMPFS40809X022
MINOR REPAIR KIT, AFLAS/25CFT/825 FOR 4X8 MPFS	RMPFS40809X032
MINOR REPAIR KIT, AFLAS/25CFT/SDS FOR 4X8 MPFS	RMPFS40809X132
MAJOR REPAIR KIT, 316 FOR 4X8 MPFS	RMPFS40809X122
MAJOR REPAIR KIT, AFLAS FOR 4X8 MPFS	RMPFS40809X072
MAJOR REPAIR KIT, 4X8 MPFS	RMPFS40809X082
MAJOR REPAIR KIT, AFLAS/25CFT/DSS FOR 4X8 MPFS	RMPFS40809X042
MAJOR REPAIR KIT, AFLAS/25CFT/718 FOR 4X8 MPFS	RMPFS40809X052
MAJOR REPAIR KIT, AFLAS/25CFT/825 FOR 4X8 MPFS	RMPFS40809X062
MAJOR REPAIR KIT, AFLAS/25CFT/SDS FOR 4X8 MPFS	RMPFS40809X142
HIGH DIFFERENTIAL PLUG UPGRADE, AFLAS FOR 4X8 MPFS	RMPFS40809X092

Adjustment Tool Kits

DESCRIPTION	PART NUMBER
ADJUSTMENT TOOL 2x4 CL 300, 600, and 900	RMP20409X012
ADJUSTMENT TOOL 3x6 CL 150, 300, 600, and 900	RMP30609X012
ADJUSTMENT TOOL 3x6 CL 1500	RMP30615X012
ADJUSTMENT TOOL 4x8 CL 300, 600, and 900	RMP41015X012
ADJUSTMENT TOOL 4x10 CL 1500	RMP41015X012
ADJUSTMENT TOOL 6x16 CL 300, 600, and 900	RMP61609X012
ADJUSTMENT TOOL 6x16 CL 1500	RMP61625X012

Parts List

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

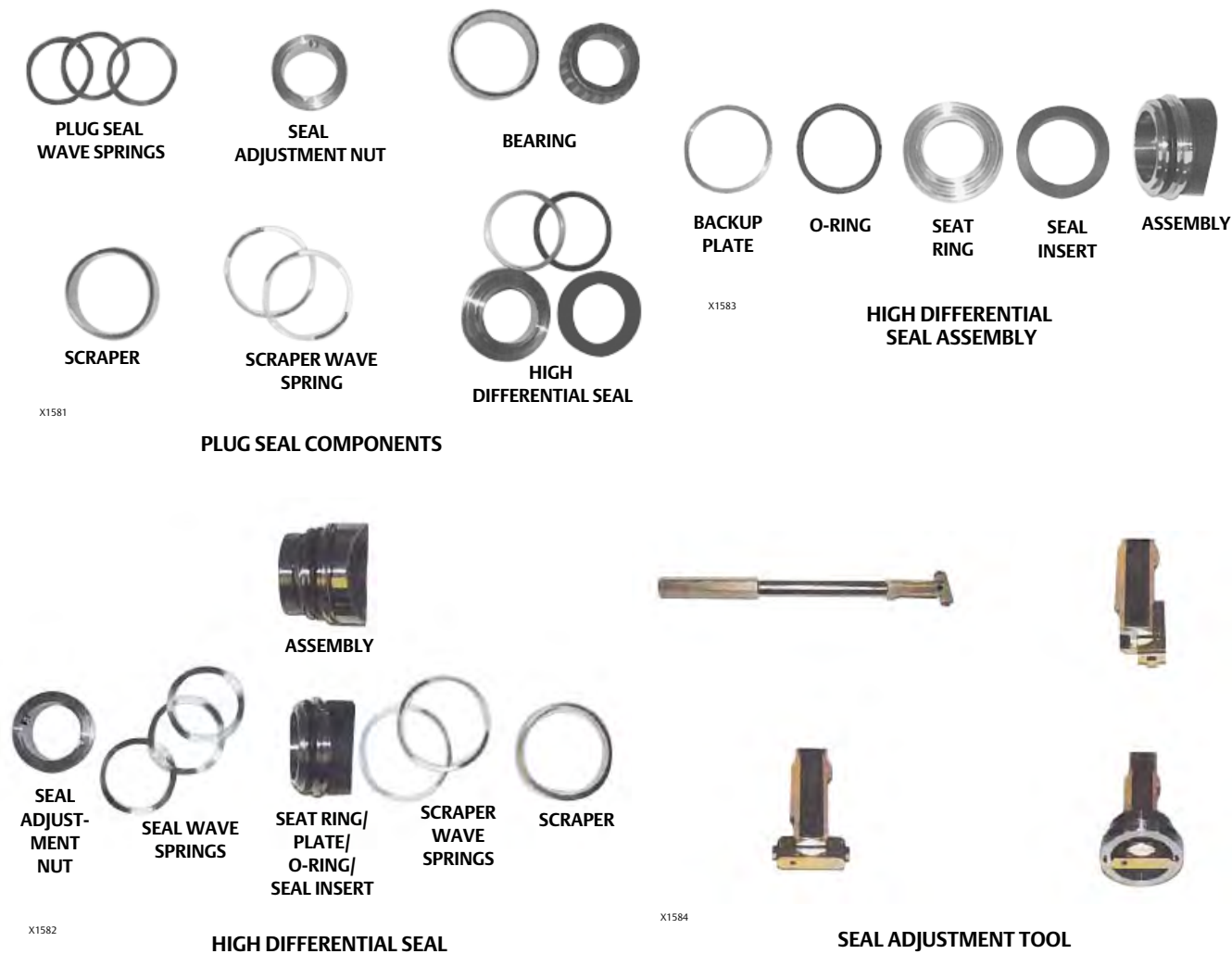
Note

Contact your [Emerson sales office](#) for part ordering information.

Multiport Assembly (see figure 2 and 3)

Key	Description	Key	Description
1	Valve Body	25	O-Ring, Wiper Retainer
2	Plug	26	O-Ring, Shaft
3	Bearing	27	Pipe Plug
4	Rod Seal	28	Lube Fitting
5	O-Ring, upper plug	29	Pipe Bushing
6	Back up Ring, upper plug	30	Set Screw
7	O-Ring, lower plug	31	Stud
8	Back up Ring, lower plug	32	Nut
9	Plug Bushing	33	Lifting Lug
10	Scraper	38	White Petrolatum
11	Wave Spring Scraper	39	High temperature silicone grease
12	Seal Insert	40	Anti-seize lubricant
13	Seal Carrier	41	Grease
14	O-Ring	42	Thread sealant paste
15	Back up Ring	43	Mounting Bracket
16	Back up Plate	44	Cap Screw
17	Wave Spring	45	Cap Screw
18	Seal Adjuster	46	Lock Washer
19	Bonnet	47	Coupler
20	O-Ring	48	Key
21	Back up Ring	49	Travel Indicator Holder
22	Wiper Retainer	50	Travel Indicator Pointer
23	Cap Screw, Wiper Retainer	51	Jam Nut
24	Wiper Seal	52	Nut
		53	Travel Indicator Plate
		54	Travel Indicator Stud
		55	Cap Screw
		56	Lock Washer
		57	Washer
		58	Cap Screw
		59	Bracket, Upper
		60	Travel Indicator Spacer
		61	Nut
		62	Stud
		63	Bracket, Lower

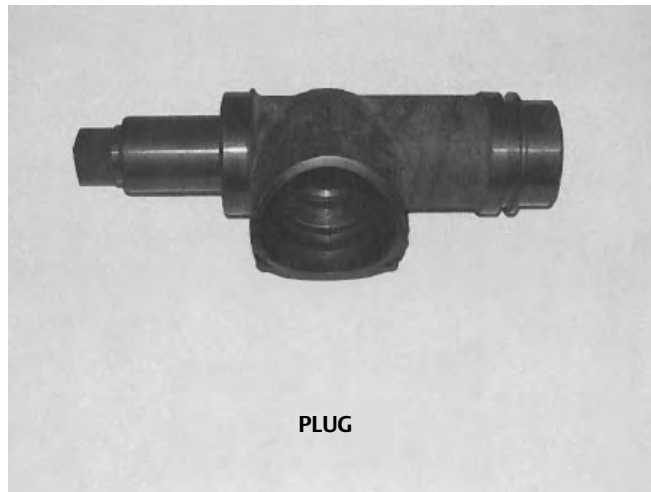
Figure 5. Typical Multiport Seal Components



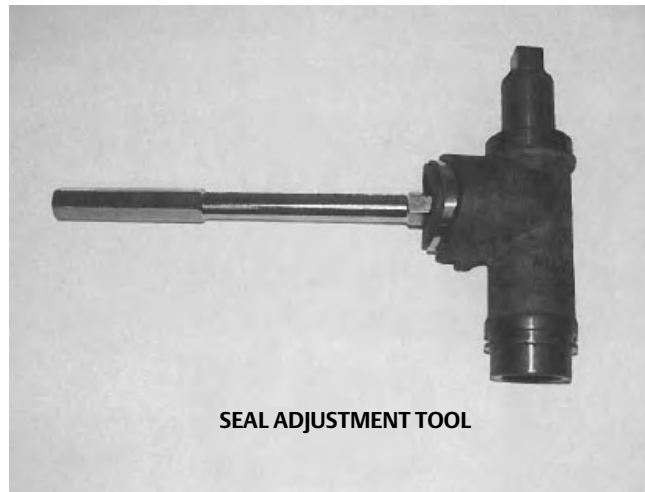
NOTE:

1 PLUG SEAL ADJUSTMENT TOOL SHOWN WITH BASE PARALLEL TO SHANK FOR INSERTION, BASE PERPENDICULAR TO SHANK, AND ENGAGED IN SEAL ADJUSTMENT NUT.

Figure 6. Typical Multiport Seal Components



E-60681009



NOTE:

- 1 PLUG (INDEX MARK CAN BE FOUND ON THE STEM FLAT THAT FACES THE SAME WAY AS THE PLUG SEAL OPENING.) PLUG SEAL ADJUSTMENT TOOL IN PLUG.

Recommended Periodic Multiport Maintenance Checklist Procedure

Half Yearly Check

1. Check the plug port position in the Local Display Module (LDM) and the mechanical indicator respectively and in remote feedback.
2. Check the plug travel sequence for smooth operation with local/remote.
3. Lubricate the bearing through the grease nipple with high temperature silicone grease.
4. Visual Inspection of Multiport Flow Selector (MPFS) valve.

Annual Check

1. Visual Inspection of MSV.
2. Lubricate the bearing through the grease nipple with high temperature silicone grease.
3. Check the seal torque (refer chart) and seal visual condition.
4. Check the plug position in LDM and the mechanical indicator respectively and in remote feedback.
5. Check the plug travel sequence for smooth operation with local / remote.
6. Check mechanical operation (using manual override).
7. Check electrical connections of Multiport Actuator (MPA) (power and communication port).
8. Check the Torque Encoder and Position Encoder.
9. Visual check of shaft penetrations for lubrication leakage.
10. Inspect stem nut or bushing for wear / damage of Multiport Actuator.
11. Run online seal integrity test.

Visual Seal Inspection

1. Local Shutdown should be take by end user to isolate the Multiport valve.
2. Check the plug alignment visually at home port (blind flange open condition).
3. If the seal visual inspection and seal torque are deemed acceptable, then assemble the home flange and run on line seal integrity test.

General

1. It is recommended to operate the Multiport, once in three weeks, at least one full rotation, if there is no well testing. Not recommended to keep Multiport idle for more than 3 to 4 weeks.
2. Recommended to replace the seat ring (complete Seal Kit Assembly) and all the soft seals every 5 years.

Multiport Actuator

O&M Manual — Supplied by Bettis

Document No. MPS-400-0711

⚠ WARNING

Use caution when working on, with, or around valves and actuators. High pressures, forces, voltages, and flammable media can be present.

Read this manual in its entirety before installing, operating, or performing maintenance on the MPA valve actuator.

Failure to follow instructions for proper electrical wiring, storage, setup, and maintenance may cause serious injury, damage equipment, or void the warranty. Refer to Manual E796 for instructions on storage, electrical hook-up, and maintenance.

Ensure that the installation is carried out in accordance with EN 60079-14 and IEC 60079-14.

Regulatory information:

II 2 GD



EEx d IIB T4 or EEx d IIB 120° C (T4) Tamb -20° C to +60° C

Revision M

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Introduction

The Multiport Actuator (MPA) is a Bettis single turn actuator for control of Multiport Flow Selectors (MPFS) with 3 to 8 ports. A typical application is oil or gas well selection for well production testing as shown in figure 1. Typically the MPA is the actuator of a Multiport Flow Selector as shown in figure 2. There are applications in other processes where control of Multiport valves is required.

Figure 1. Typical Well Test Application

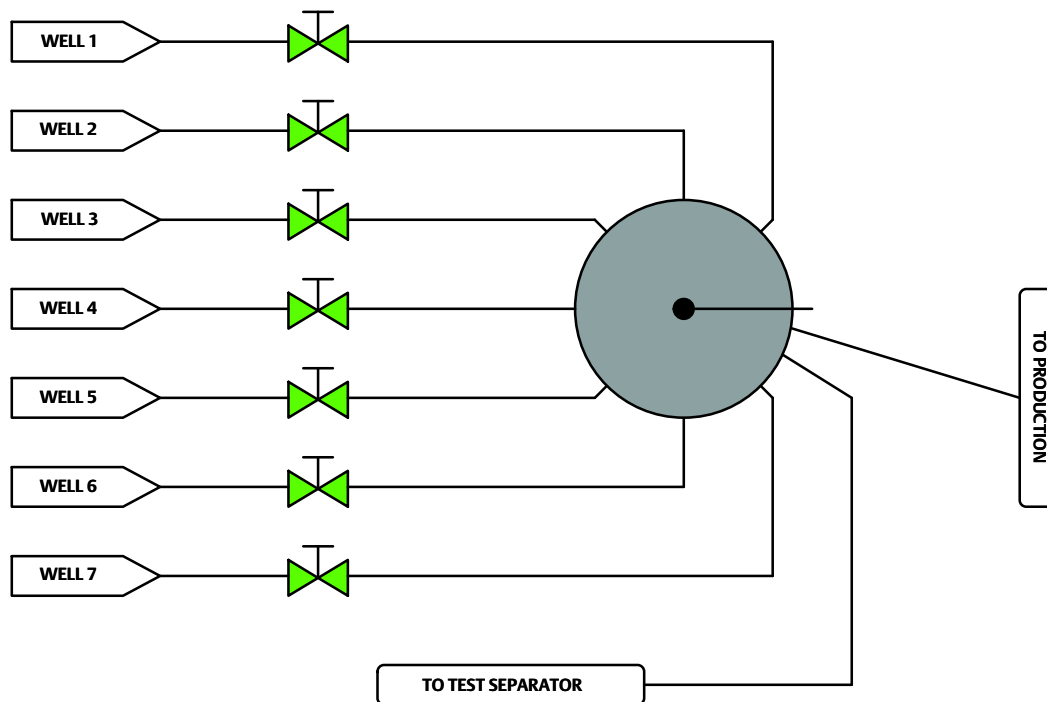
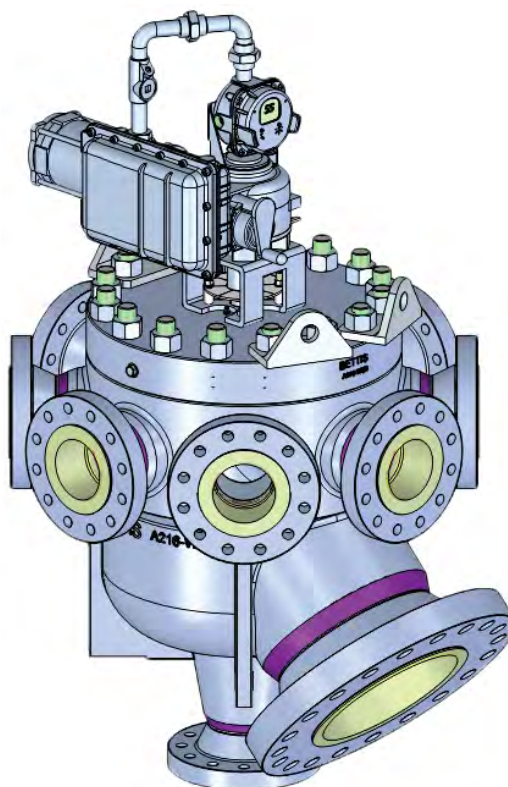


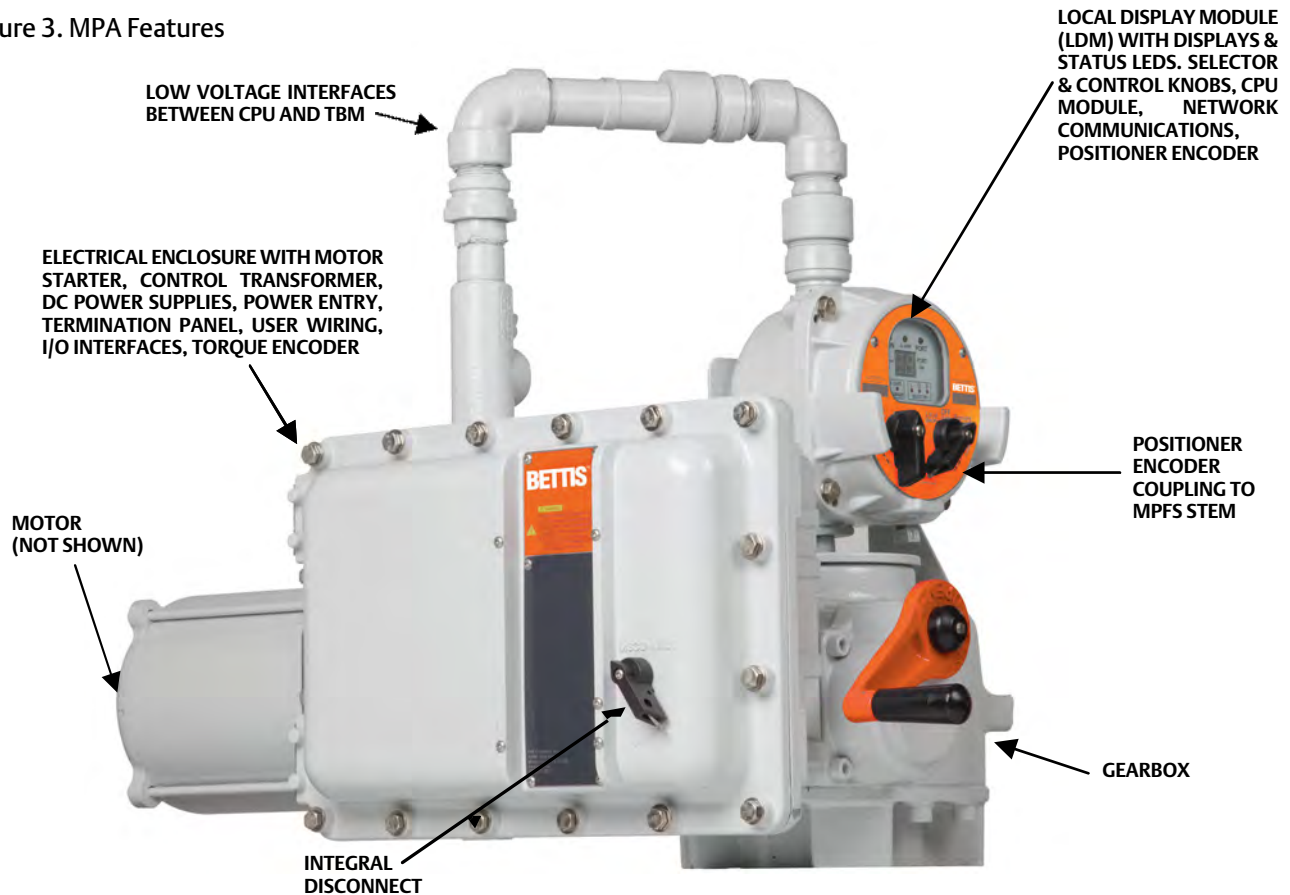
Figure 2. MPA Mounted on 6"x16" MPFS



Features

The actuator features several assemblies as shown in figure 3. Unique features of the actuator are listed below.

Figure 3. MPA Features



1. MPA uses Bettis's heavy duty gearbox with capacity of 3000 ft•lbs
 - a. Wide range of motors available for any voltage and torque
2. Configurable for Multiport flow selectors from 3 to 8 ports
 - a. Any port may be selected as home port and any port(s) may be skipped
 - b. Actuator calibrated at factory for exact match to alignment of flow selector ports
 - c. Calibration parameters stored in nonvolatile memory and available to DCS
3. 12-bit magnetic encoder coupled directly to valve stem for precision position feedback
 - a. Provides position measurement resolution of 0.088 degrees
4. Bettis's exclusive solid-state motor starter and control software provides precise positioning of flow selector within ± 0.26 degrees of selected port for the largest flow selector, and within ± 0.79 degrees for smallest flow selector, where accuracy is less of a concern because of reduced radius

5. High performance microcontroller updates motor control output every 4mS for precision motor control
6. 12-bit magnetic encoder coupled directly to torque pinion for torque feedback
 - a. Provides torque measurement resolution of 0.146% of full torque
7. MPA supports all network protocols available with all other Bettis actuators
 - ModbusRS485 Bus or E>Net ring available
 - Profibus Redundancy with Redcom
 - Foundation Fieldbus
 - DeviceNet
 - Ethernet Modbus TCP/IP
8. I/O and alarm monitoring include:
 - Integral circuit breaker/disconnect
 - Motor overload and motor thermal
 - Loss of control voltage
 - Encoder failure
 - Stall detection and alarming (detects mechanical faults)
 - 3-Phase monitoring and phase correction to insure correct motor rotation
 - ESD to send selector to home port (also goes to home port on fault)
 - Monitor relay for hardwired relay contact status on fault
9. Four models support five 8-port MPFS (Also see motor type on page 33)

Table 1.

MODEL	MPFS	CAPACITY		RPM			ACCURACY
		lb ft	Nm	1Ph	3Ph	DC	Degrees
MPA 150	2x4	150	203	1.0	1.0	1.0	0.79
MPA 650	3x6	650	881	0.7	1.0	0.5	0.49
MPA 800	4x8 and 4x10	800	1085	0.6	0.9	0.5	0.40
MPA 1500	6x16	1500	2034	0.3	0.4	0.3	0.26

Note: Accuracy based on worse case tests at 38% of maximum torque.

10. MPA includes local display module (LDM) standard
 - Uses rugged, high visibility LED display for port number, torque, and alarms (also displays setup menus and setup parameters)
 - Multiple color LEDs display
 - a. Port position within 1° of port

- b. Port position within 2° of port
 - c. Motor running
 - d. Alarm
 - e. Over torque
 - f. Position within 0.25° of home port
 - g. Local mode >
 - h. Off mode > Combined detection logic for two selector switches
 - i. Remote mode >
- Display blanking user setup option to conserve power in idle mode
 - Includes Local Off Remote selector switch
 - Local control knob for Port selection and Jog control when enabled by User

Figure 4. Local Display Module (LDM)



11. Remote display module (RDM) option available
 - a. RDM displays identical information and performs identical control as LDM
 - b. Bettis's patented combined switch logic allows detection of selector switch position on LDM and RDM
 - c. Allows remote control up to 4,000 feet (1,220 meters) away
 - d. Alarming includes loss of communication with RDM

Figure 5. MPA with Remote Display Module (RDM)



Mechanical and Electrical Installation

Do not connect power until you have gone through the following checklist:

1. Does the information given on the nameplate correspond with the application?
2. Have all wire terminations and the equipotential bonding system been connected correctly?
3. EEx d applications: are the cable entries, plugs and adaptors EEx d approved?
4. Are all cable entries of the correct internal diameter providing a good seal around the cable?
5. Do the ambient and process temperatures correspond to the ratings on the nameplate as shown below?

Wiring

All user wiring terminations are made inside the Electrical Enclosure shown in figure 3. Refer to wiring diagram located at the back of this manual for wiring connections. High voltage power connections are made to the disconnect/circuit breaker located inside the electrical enclosure. All low voltage connections, including network wiring, are made to the Termination Board Module (TBM) located inside the electrical enclosure. Use conduit and seals in accordance with National Electric Code (NEC) and local codes for all wiring entering the electrical enclosure.

Power Wiring

Connect power voltage leads to the circuit breaker located in the main electrical enclosure. Power wires must enter the electrical enclosure at the conduit entry on the lower right side of the enclosure to prevent water from entering. The controller provides automatic phase correction in case three-phase power is connected in the wrong phase rotation.

Network Wiring

If a single bus network connection, such as Foundation Fieldbus, is being made, connect to Network Port A at TBM terminals 24 (-) and 25 (+). If the cable is shielded, connect shield to TBM terminal 23. If redundant or repeater network connections such as Bettis E>Net are being made, connect the second network to Network Port B at TBM terminals 23 (+) and 24 (-). Connect cable shield of Port B to TBM terminal 25. Cable shields are isolated from earth in the actuator. Connect shields to only one earth ground point in the network, normally the host location.

Monitor Relay Wiring

The Monitor Relay is used for hardwiring an indication of availability of the actuator for remote control. When the selector switch is placed in the Remote mode and if there are no alarms present that prevent operation, the Monitor Relay is energized. If an alarm occurs or the selector switch is moved from the Remote position, the relay is deenergized. The Monitor Relay is a Form C relay with both normally open (N.O.) and normally closed (N.C.) contacts. Wire to either TBM terminals 31 and 32 if N.O. contacts are desired. Wire to TBM terminals 32 and 33 if N.C. contacts are desired. The relay is shown on the wiring diagram in the deenergized state, meaning that the actuator is not available for remote control.

Local ESD Wiring (Emergency Shutdown)

Remove jumper between TBM terminals 27 and 28. Connect Normally Closed (N.C.) dry contacts to terminals 27 and 28. When the contacts open, ESD is activated, causing the actuator to go to Home Port. The actuator will remain at the Home Port until the ESD contacts are closed and a new command is received from either Local or Remote control. The ESD circuit is a closed loop failsafe circuit. If the circuit is opened for any reason, broken wire, bad contact, 24VDC power supply failure, etc., the ESD function is activated. The closed loop circuit is powered by 24VDC from the actuator.

Optional Remote Display Module (RDM) Wiring

Connect twisted pair RS485 cable from the RDM to TBM terminals 18 (-) and 19 (+). If the RDM is being powered from the actuator 12VDC supply, wire the power wires from the RDM to TBM terminals 16 (-) and 17 (+). The RDM is polarity protected, preventing damage, but will not operate if polarity is reversed.

Local Display Module

Contains microprocessor controller, position encoder, and network interface. This is the main controller used to setup and operate the actuator.

This module displays operating parameters, port position, torque, and alarms. It also provides a means to configure the actuator by using the local controls.

To use the Local Control and Selector:

Note

Actuator moves in only the counterclockwise position.

Figure 6. Local Control and Selector



SELECTOR KNOB (right)	ROTATE	FUNCTION	RESULTS
OFF (Stop)	[return position]	Stop movement	Prevents motor operation
REMOTE (Auto)	Clockwise	Remote control	Allows control from remote location
LOCAL (Hand)	Counter-clockwise	Hand Operation	Allows Control from the local control knob or the control knob of the RDM, if connected.
SELECTOR KNOB (left) (while selector is in LOCAL (hand)mode)	ROTATE	FUNCTION	RESULTS
Spring return	Neutral position	No operation	Releases a local command when Local control is used
PORT (up)	Clockwise	Local command to go to next port	Commands actuator to move to the next port. Momentary knob control
Jog (dn)	Counter-clockwise	Local command to micro-step	Commands actuator to move only while knob is being held , i.e. maintained knob control.

Operation

Place the “Selector Knob” in the desired operating position –

LOCAL – hands on operation at the actuator by manipulation of Control Knob.

REMOTE – used within the context of plant operation, i.e. Remote Control Panel, PLC, DCS, etc. See wiring diagram for typical user wiring for remote control.

OFF (Stop) – to prevent local or remote operation.

Figure 7.



Local Operation

Place the “Selector Knob” in the “Local” position. If a remote display is connected, the remote selector switch must not be in the “Off” position. Verify that the selector “L” amber light is on. The actuator may now be operated using the port and jog Control Knobs. Jog control is normally disabled and must be enabled in the setup menu.

To jog or micro-step the actuator toward the next port, rotate the control knob in the counterclockwise direction. Jog to position and release when the desired position is reached. When using jog for calibrating the actuator, always stop short of the desired port and use the hand wheel to complete accurate positioning to center of the port.

To move only to the next port, momentarily rotate the control knob in the clockwise direction to the Port position and release.

To Stop or prevent actuator movement, move Selector knob to the OFF (Stop) position.

Operational Display

Operational indicators for RUN / ALARM / PORT position use long lasting LED's. Run torque and port position are shown on the digital readout during normal operation. Torque in percent of maximum is displayed as a 2-digit number only while the motor is running. Port position is displayed as a single digit when the motor stops. If the actuator stops between two ports, the two corresponding port numbers will alternate. Torque less than 10% is displayed as 0%.

RUN LED flashes Green while the actuator is moving to the next port and flashes Red while running within 2° of the selected port position.

PORT LED flashes Green when the actuator is within 2° and outside 1° prior to the setpoint of the selected port. The port LED flashes Red when within 2° and outside 1° beyond the setpoint. The port LED illuminates steady Green while within 1° of the selected port position.

ALARM (Yellow) LED flashes when any alarm is present. The LED is on solid when stopped between ports, otherwise it is off.

OVER TORQUE alarm condition is indicated when a torque alarm occurs in mid-travel. The over torque LED will flash so long as the over torque condition exists.

HOME PORT LED will light when the actuator is within 0.25° of the user selected Home Port position.

Selector switch LEDs are also made available for operational use in the bottom right corner. The selector LEDs are important when using a Remote Display Module (RDM) because these LEDs indicate the combined logic of the two selector switches, i.e. the selected mode of operation of the actuator. All three LOR LEDs flash while the actuator is in setup mode.

Display Blanking

The user has the option to have the display blank out (turn off) when not in use. This is a very important feature for solar power applications because power consumption is minimized. Option to enable or disable display blanking timeout is available by setup using MPA Config or the control knobs. See the field setup section for selecting the option. When control knobs are used for setup, the parameter is C9 as shown in the table on page 38. The default setting is display blanking timeout enabled for 24VDC versions and disabled for AC versions. If display blanking is enabled, the display will blank out after 60 seconds when left unattended while the selector switch is in Remote mode. The display will blank out after 3 minutes when left unattended while the selector switch is in Local mode. The display will not blank out while in setup mode. When selected, display blanking applies to both local (LDM) and remote (RDM) displays.

Alarms Display

When an alarm occurs, it is automatically displayed by the two character LED display. The yellow ALARM LED will flash while any alarm is present. The display will alternate between the current port position and the active alarm(s) except when stopped between parts. If more than one alarm is active, the display will cycle through a sequence of Port Position, newest alarm, Port Position, next oldest alarm and so on until all active alarms are displayed. The cycle is continuously repeated until all alarms are cleared. Each alarm is recorded in an Alarm History. The alarm history may be viewed by entering setup mode (see next section).

All possible alarms that may be displayed are listed on the name plate of the Local Display Module (LDM). Following are definitions of the listed alarms.

CE	Communication Error	Lost communication with the Remote Display Module (RDM) when configured.
SA	Stall Alarm	Actuator failed to move within 8 seconds after commanded by either local or remote controls.
LE	Local ESD	Hardwired Local Emergency Shut Down is active.
PH	Phase Alarm	Loss of one phase when configured for 3-Phase.
EF	Encoder Failed	Failure of either the position or torque encoders.
AF	Actuator Failed	A fault is detected by hardware electronics fault monitor. This is a non-recoverable condition that requires actuator service.
OL	Motor Overload	Motor thermals or motor overload relay has tripped.
LC	Lost Control Voltage	Loss of power to the motor control circuits. The control voltage supply has an automatic resetting fuse.

Note

Over torque alarm is displayed by dedicated LED. See Operational Display section above.

Field Setup Using DCMLink Software

DCMLink is an application for configuration, calibration, test, and operation of the MPA DCMLink is a licensed product. It is a Windows-based program. Compatible Windows Operating Systems are listed in the DCMLink IOM, DCM-402-0317.

Connection to the MPA to utilize DCMLink requires a RS485 link. The MPA supports several network protocols so it may be necessary to use a USB to RS485 converter for connection of a PC to the RDM port of the actuator. RDM port is at TBM terminals 18 (-) and 19 (+). DCMLink Software loaded to a laptop or other compatible PC device can connect the RS485 link to the TBM in the electrical enclosure. If opening the enclosure is undesirable, configuration may be performed using the local control knobs of the actuator as described in the next section of this manual. If the system is configured for Modbus networking, the PC may be connected to the local area network at any location in the network after disconnecting the Host system communication. The MPFS factory uses this software to configure and calibrate the MPA and saves the configuration to a “.mpa” file by MPFS serial number. Should loss of factory configuration or port calibration occur due to failure of a CPU module or user error, a copy of the file may be obtained from the MPFS factory and loaded to the actuator using DCMLink program.

DCMLink SetUp

HELP: Clicking the Menu Bar Help Tab button at the top of the screen will open linked documents or information. Passing the cursor across the Icons or Navigation Pane tabs will cause a description of that item to be displayed.

To setup communication and DCMLink Display Preferences, select the DCMLink Setup Tab in the Menu Bar as shown in figures 8b and 8c. To configure the network communication link select the Communication Tab in Preferences per figure 9.

Figure 8a.

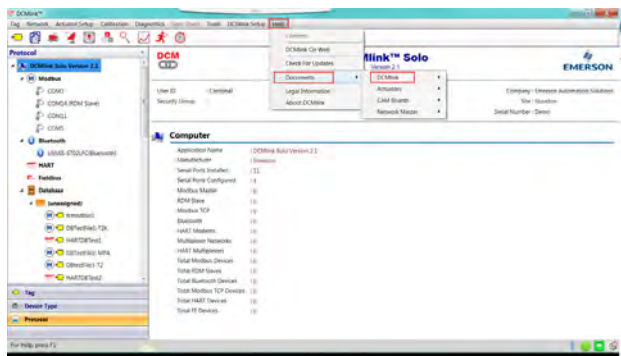


Figure 8c.

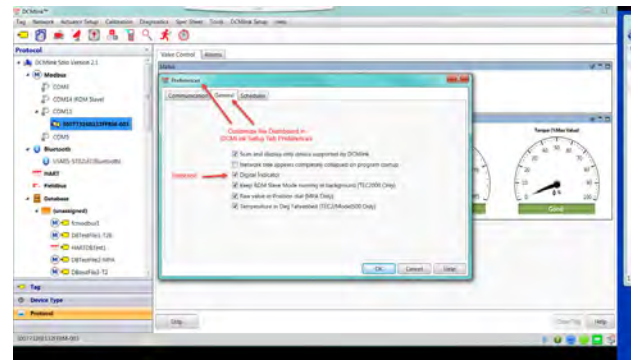
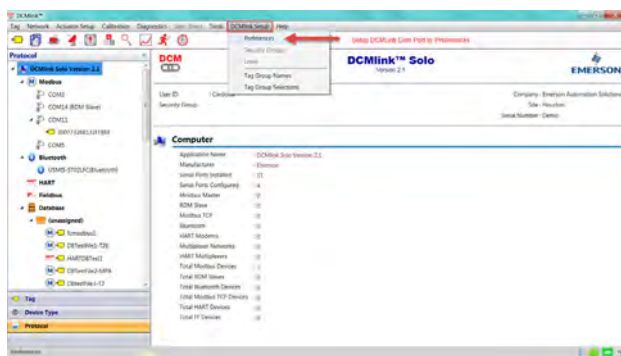


Figure 8b.



Communications Setup

If connected to the RDM port, set the computer Baud Rate to 9600, Parity None and Stop Bits to 1. Set the Slave Address to 99. The RDM port configuration of the MPA is fixed at 9600,N,8,1 and may not be changed by the user.

If connected to a Modbus local area network, the baud rate and slave address configured for the actuator must be known in order to setup the computer communication port. Default configuration for the MPA network port is 19,200 baud and default address is 99.

Select the configured Com Port in Navigation Pane and Right Click to Scan for Devices. Set address and Start Scan. When device is detected stop scan and close the window .

Figure 9.



Figure 10.

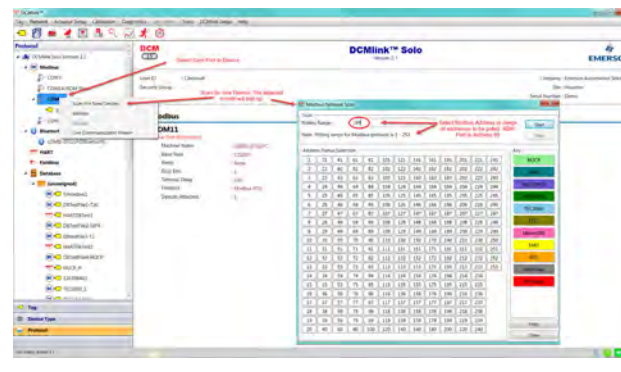
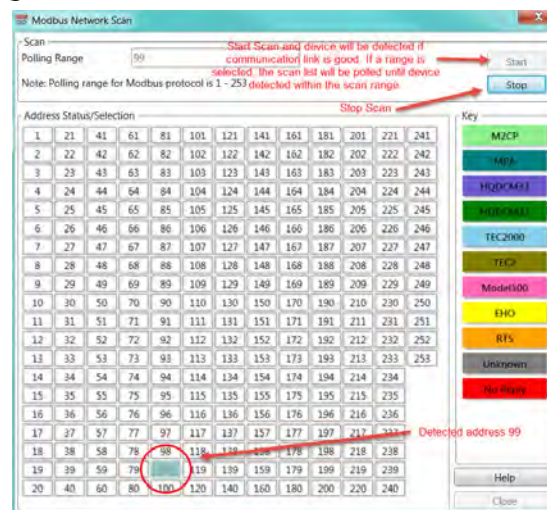


Figure 11.



User Setup Menus

To configure the actuator, select (highlight) the Device Tag in the Navigation Pane per figure 12. Then Right Click or use the Icon in the Menu Bar to select Detailed Setup as shown in figure 13. The current Actuator configuration and the default MPA settings or opened Dataset settings are displayed. A Dataset is a file on DCMLink based on the Device type and Displayed Device Tag. A yellow Tab indicates there are differences between the displayed Actuator configuration and the displayed Dataset. Configuration can be changed between the Actuator and the Dataset and the actuator Configuration File and Dataset can be saved to the PC. No passcode is required to change User Configuration Settings (Detailed Setup & Home Port Calibration) when using DCMLink.

The Network Tab allows changes in configuration only for the network ports. It does not affect the RDM port. The Control Tab allows unused/unconnected Ports of the MPFS to be bypassed. If a pipeline is not connected to any one or more ports, or if it is desirable to skip any one or more ports, click on the “Delete Port” number. The deleted ports will be skipped when a next port command is issued in either local or remote control modes.

Notice: When configuration changes are made, clicking the Blue arrows “Writes” the configuration to the Actuator or Dataset. If there are no differences between the Actuator and Dataset, the arrows will be grey. Using the dropdown box arrow of the Dataset allows for parameter change selections to be made. The “Read” button may be used to refresh the screen to verify the parameters have been properly written for storage in the actuator. You can read or write entire configuration or just the opened page using the Arrows or tab in upper right hand of the page. Values are written to EEPROM when the Setup page or Device Tag is closed. On the MPA LDM, within several seconds of writing the configuration, the 3 LOR LEDs will simultaneously flash slowly. This slow flash is a signal that all new values were successfully written to EEPROM.

Figure 12.

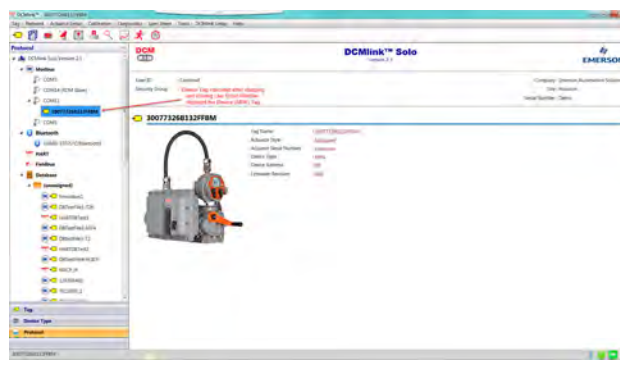
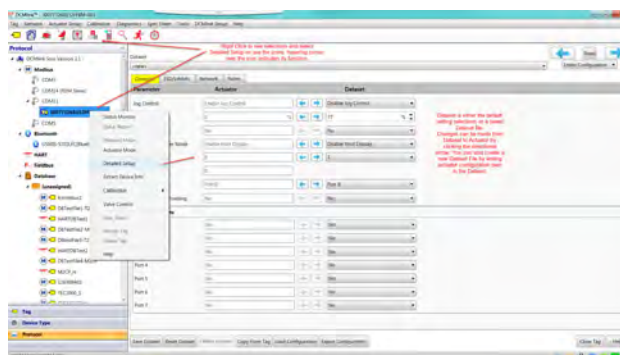


Figure 13.



Selecting New Home Port

The user may select any port as the new “Home Port” in the field. When a new home port is selected, the new home port is identified as Port 0 or 8 and the MPA reassigns all other port numbers (1-7) in a counterclockwise sequence around the MPFS. The MPA recalculates the exact calibrated port position based on factory calibration values so no accuracy is lost.

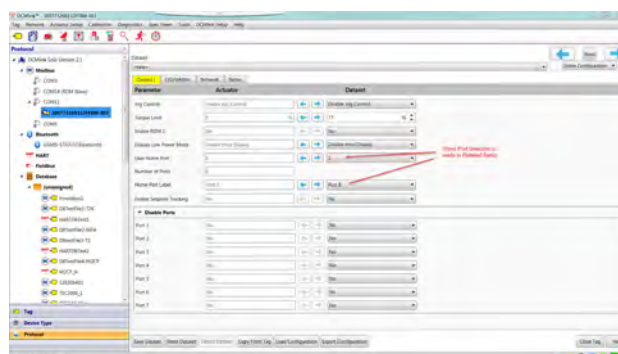
To select a new home port, click on the desired selection in Detailed Setup for User Home Port and Label (0 or 8) as shown in figure 14.

Note

When a new home port is selected, it must be a port without piping connected and must be fitted with a blind cover to allow for future seal inspection and visual port alignment. Selecting a new home port will cause the MPA to recalculate all calibration parameters based on the factory calibration and store the new values to EEPROM.

Home port may be identified as either Port 0 or Port 8. The desired designation may be selected by the CA configuration parameter as shown on page 38.

Figure 14.



Home Port LED Function

The home port LED on the LDM will now identify the newly selected home port position. This LED is on when the actuator is within 0.25 degrees of the selected home port. When the blind cover of the home port is removed in the field to inspect the seals, the home zero may be verified and corrected if an error is detected.

Home Port Calibration

If maintenance is performed on the actuator that can cause loss of calibration, the home port must be recalibrated. Examples of maintenance that affect calibration are removal of the actuator from the MPFS and replacement of the position encoder. If a MPA is removed from one MPFS and installed on another or if a CPU module is replaced, the factory configuration (.mpa) file for the MPFS must be loaded to the new actuator and the selected home port calibrated.

To calibrate the home port position, remove the blind cover from the selected home port. Use the hand wheel of the MPA to position the plug seal over the port as precisely as possible. Open DCMLink and connect to Device. Right click Device Tag or select Calibration button on the Menu Bar. Select the “Home Port Calibration” as shown in Figure 15. To avoid accidental setting of a new home port, the user is required to enter a passcode of 43 to gain access. A Pop-Up will appear as shown in figure 16 providing a warning and allow entry of the passcode. The Port Raw Value should be displayed in the Home Port Calibration Box. Select Calibrate Home Port and review the value before closing. The Home Port should be indicated on the MPA LDM as the MPA is aligned with the Home Port.

Factory Settings

Factory Settings are only accessible by Factory Authorized Technicians with DCMLink License authorization. Factory Setup contains protected configuration items defining the application and motor control as well as the User Password and Port Calibration. These items are in the “.mpa” configuration file saved by the Factory and can be loaded to or saved from a PC during any service or CPU Replacement. See figure 17.

Factory Settings Items are displayed in figure 18.

Figure 15.

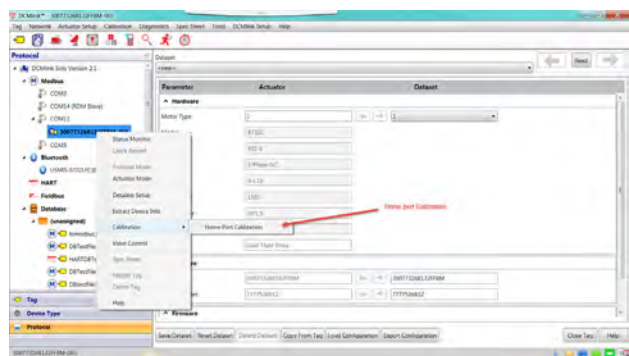


Figure 16.

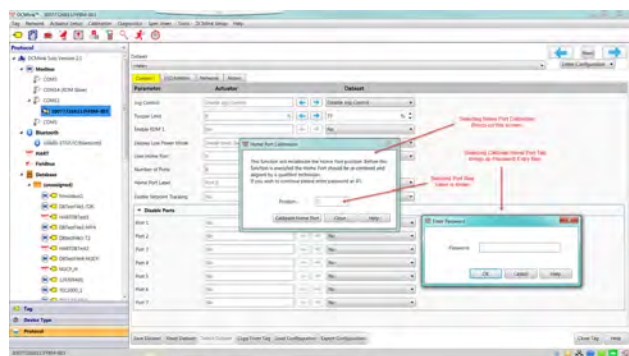
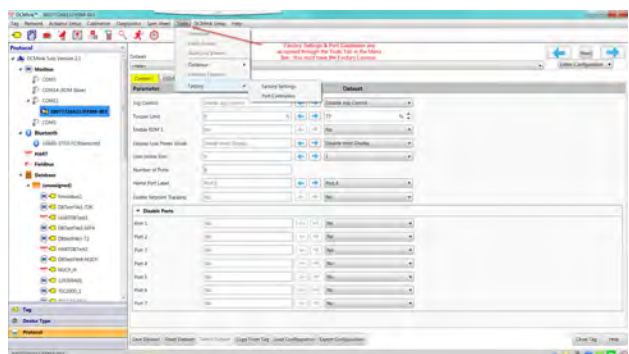


Figure 17.



Factory Settings - Port Calibration

Port Calibrations are made by Factory Authorized Technicians through the Factory Menu only accessible by Factory Authorized Technicians with DCMLink License authorization.

Select Port Calibration from the Factory Menu Options. See figure 19.

For precise MPFS port alignment, the factory calibrates each actuator to each of the ports of the mated MPFS. These items are in the “.mpa” configuration file saved by the Factory and can be loaded to or saved from a PC during any service or CPU replacement.

The calibrated values are displayed on the Port Calibration screen and may be compared to the current position (Encoder Feedback) to determine accuracy. When a new home port is selected by the user, these calibration values are recalculated and stored to EEPROM. See figure 20.

Figure 18.

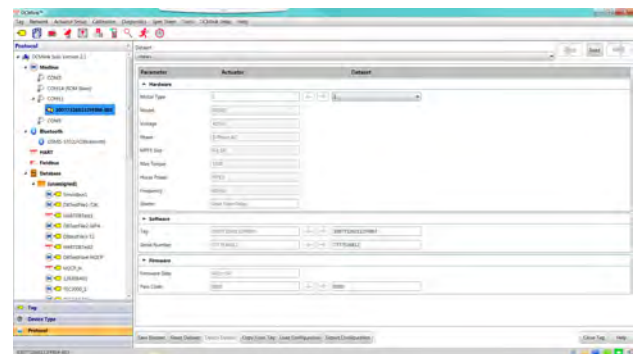


Figure 19.

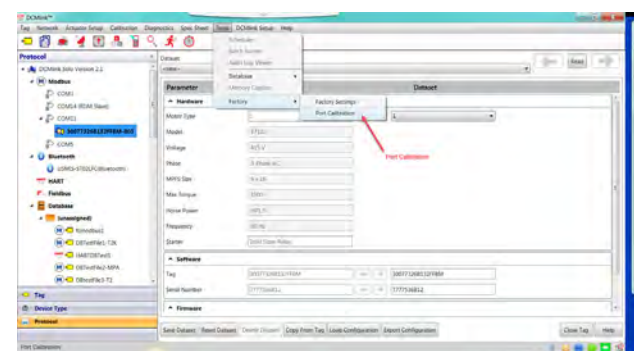
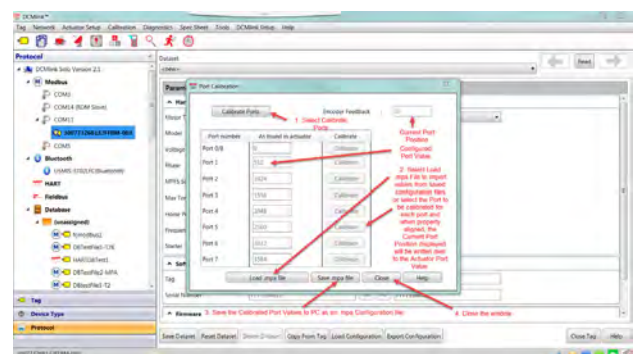


Figure 20.



FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104239X012

Multiport Flow Selector

April 2022

Motor Type

Motor Type is entered at the factory for the type of MPFS, power supply and motor horse power rating as shown in the table below. Motor type is displayed on the MPA Config Factory Setup Menu. If the motor type is changed, it is necessary to cycle power to the actuator after existing factory setup to ensure proper initialization.

Table 2. Motor Type

MPFS	Motor HP	1 Ph 115 VAC	1 Ph 230 VAC	3 Ph 220/230 VAC	3 Ph 380 VAC	3 Ph 415 VAC	3 Ph 460 VAC	3 Ph 575 VAC	24 VDC
2 x 4	1/12	2	6	10	14	18	22	26	---
2 x 4	1/6	---	---	---	---	---	---	---	30
3 x 6	1/6	3	7	11	15	19	23	27	31
4 x 8 / 4 x 10	1/6	4	8	12	16	20	24	28	32
6 x 16	1/6	5	9	13	17	21	25	29	33

Note

The user is not required to select motor type unless qualified to download firmware upgrade to the MPA. If a new HEX file for firmware upgrade is loaded to the MPA in the field, the motor type must be configured before the actuator will operate. When power is first applied to the MPA after a firmware upgrade, in order to know how to initialize the electronics, the Motor Type stored in the EEPROM will be examined. If a new HEX file was just downloaded, it will not yet have a Motor Type (it will be ZERO).

When firmware sees that the Motor Type is ZERO, firmware will immediately go to the display entry in the Factory Setup Menu for Motor Type. The user will NOT have to move the left control knob back and forth to go to Setup Mode or enter a passcode. The user will see alternate display of "F1" and "0". The "F1" is the abbreviation for Motor Type in the factory setup menu, and the current value is 0. Then the user (who just now completed the hex file download) will have to use the left hand control knob to increment the display number to the correct Motor Type (from 1 to 33 shown in the table above). Then a move of the right hand selector knob either left or right will force an exit out of the Setup Menu in this unusual one-time circumstance after a HEX file download.

Now the firmware will examine the Motor Type and know how to initialize the electronics. Normally when power is applied to the MPA, if it is NOT after a new download of the HEX file, the Motor Type will already be non-ZERO so the firmware will know how to initialize the electronics without forcing the user to use the knobs.

Table 3. MPA Model Selections and Capacities

Valve Size and Max Torque	Power Supply	Model Size	MOTOR DATA							
			Nominal Size (HP)	Start Current (amps)	Run Current		Speed (rpm)	Motor Torque		
					15 min (amps)	5 min (amps)		Start (ft•lb)	15 min (ft•lb)	15 min (ft•lb)
2 x 4 150 ft•lb	24 VDC	37RK-FJ	1/6	50	6.5	11.7	2000	2.58	0.42	0.76
	115/1/60	35RK-6J	1/12	4.4	2	3.6	1725	0.74	0.37	0.67
	230/3/60	35RK-2J	1/12	2.32	0.64	1.2	1725	1.07	0.35	0.63
	415/3/50	35RK-9J	1/12	0.94	0.32	0.6	1400	1.41	0.34	0.61
	460/3/60	35RK-3J	1/12	1.16	0.32	0.6	1725	1.4	0.33	0.59
3 x 6 650 ft•lb	24 VDC	37LK-FJ	1/6	50	6.5	11.7	2000	2.58	0.42	0.76
	115/1/60	37OK-6J	1/6	6.8	3.9	7.0	1725	1.43	0.53	0.95
	230/3/60	37RK-2J	1/6	3.8	1.1	2.0	1725	2.57	0.52	0.94
	415/3/50	37RK-9J	1/6	1.54	0.54	1.0	1400	2.61	0.64	1.15
	460/3/60	37RK-3J	1/6	1.9	0.55	1.0	1725	2.48	0.53	0.95
4 x 8 / 4 x 10 800 ft•lb	24 VDC	37MK-FJ	1/6	50	6.5	11.7	2000	2.58	0.42	0.76
	115/1/60	37MK-6J	1/6	6.8	3.9	7.0	1725	1.43	0.53	0.95
	230/3/60	37QK-2J	1/6	3.8	1.1	2.0	1400	2.57	0.52	0.94
	415/3/50	37QK-9J	1/6	1.54	0.54	1.0	1400	2.61	0.64	1.15
	460/3/60	37QK-3J	1/6	1.9	0.55	1.0	1725	2.48	0.53	0.95
6 x 16 1500 ft•lb	24 VDC	37DK-FJ	1/6	50	6.5	11.7	2000	2.58	0.42	0.76
	115/1/60	37DK-6J	1/6	6.8	3.9	7.0	1725	1.43	0.53	0.95
	230/3/60	37JK-2J	1/6	3.8	1.1	2.0	1725	2.57	0.52	0.94
	415/3/50	37DK-9J	1/6	1.54	0.54	1.0	1400	2.61	0.64	1.15
	460/3/60	37JK-3J	1/6	1.9	0.55	1.0	1725	2.48	0.53	0.95

Note: All valve torques are run torques.

Valve Status Monitor

The Status Monitor is a valuable tool for monitoring and commissioning the system. It provides a Dashboard for quick visual indication of status and provides tab for review of Alarm and ESD Status, as well as Device Info. This screen may be used to determine command and position status troubleshoot any problems should they occur. Red Tabs indicate an active alarm or event exists. Field diagnostic code or Alarms are displayed in the Monitor Tab. All active alarms may be viewed at a glance in the Alarms tab. See figures 21 through 23.

Mode displays the mode selected by the selector switch of the LDM or combined logic of both LDM and RDM selector switches.

Monitor provides a snapshot of the active conditions and and Logs displays the last 9 Alarms.

At Port displays the port number position of the actuator and whether the MPA is at the port within 1 degree or within 2 degrees.

Torque is displayed as percentage of the full torque rating of the actuator. Torque is displayed from 10% to 99% in 1% increments. Torque less than 10% is displayed as zero because torque between 0% and 10% cannot be accurately measured.

Tracking and trend graphics display Setpoint, Position, and Torque over travel time.

Encoder Value is the 12-bit raw data from the position encoder in the range of 0 to 4095. This value is the same as the value displayed during Port Calibration in the Factory on the Factory Setup screen so it can be compared to port calibration value of each port.

Figure 21.

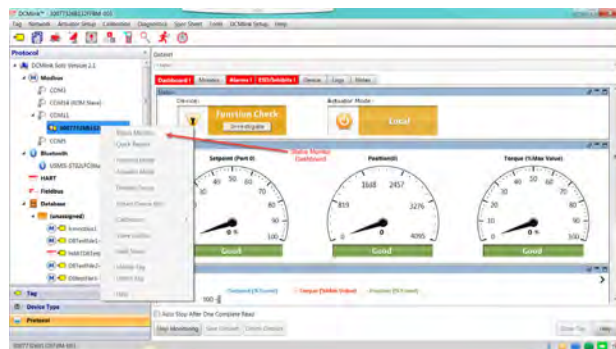


Figure 22.

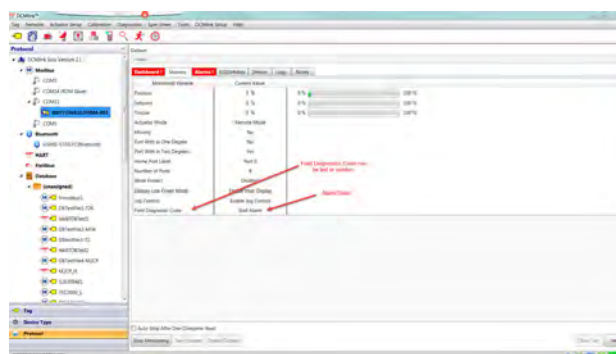
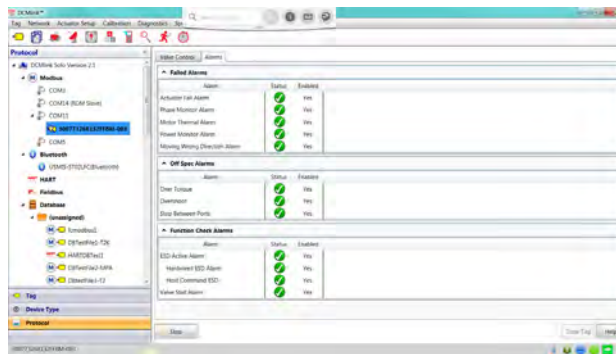


Figure 23.



Valve Control

Valve Control allows all functions of the system to be tested prior to commissioning with the DCS. It provides for a Dashboard for Controlling the MPA and providing Host ESD. It also includes a tab for Alarm Status.

Valve Control can be used to command the actuator to go to the next port or go to a desired port number. “Go to Port” is the new setpoint in the range of 0 to 8 for the 8 ports (including the Home Port).

Based on selections for general display preferences in DCMLink™ Setup, the Dashboard can display Digital indication of Setpoint, Port Position, and Torque.

Figure 24.

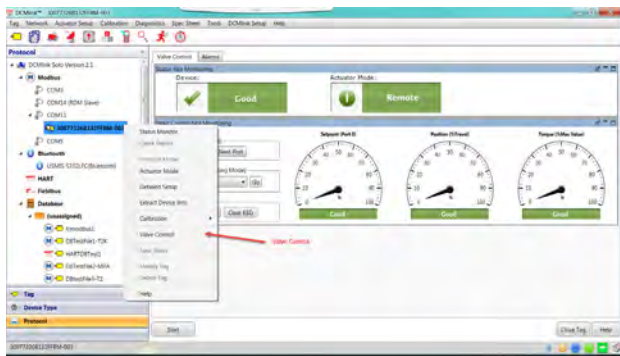


Figure 25.

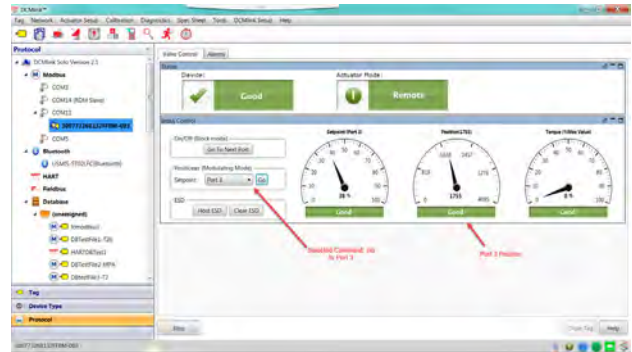


Figure 26.

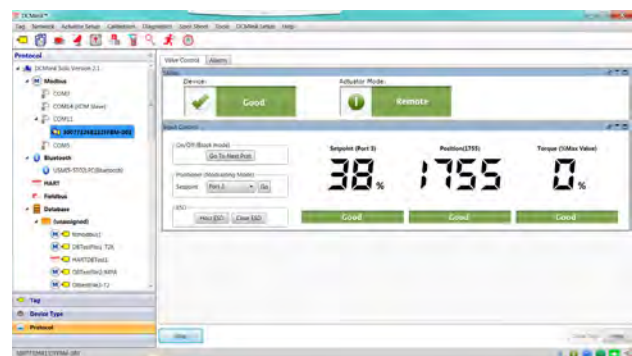
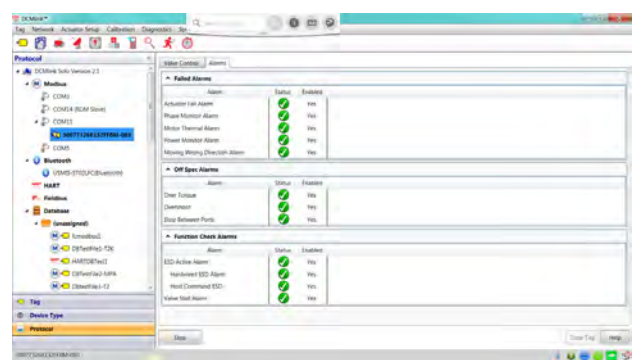


Figure 27.



Field Setup Using Local Controls

Use the Local Control (left) knob and Selector (right) knob to enter setup mode and to execute Setup functions. The table below outlines the knob functions for Setup mode.

To access the Field SETUP mode of operation ensure the Selector Knob is placed in the OFF (Stop) position. Once set, rotate the Control Knob to the “UP” and then to the “DOWN” position in right to left succession three times. Keep the knob in each position for at least ½ second but not more than 3 seconds. The display module will flash the (3) amber LOR selector LED’s when the SETUP mode is enabled.

Figure 28.



SELECTOR KNOB (right)	SETUP FUNCTION	RESULTS
OFF (Stop) [return position]	Neutral position	Allows entry to SETUP mode. Completes NEXT, or BACK entry cycle, except when knob is held for scrolling through various menus
Clockwise (REMOTE) (Auto)	NEXT	Advances to the next menu item. Displayed data is accepted
Counter-clockwise (LOCAL) (Hand)	BACK	Backs up to the last menu item
CONTROL KNOB (left)	SETUP FUNCTION	SETUP RESULTS
Spring return to Center	Neutral position	Completes UP or Down entry Cycle except when knob is held for continuous data entry update
Clockwise (CLOSE)	UP	Increments displayed data
Counter-clockwise (OPEN)	DOWN	Decrements displayed data

When the actuator LDM is placed in SETUP mode of operation it first displays the Field Diagnostics (Fd) menu item. The second menu item Alarm History (AH) menu. The field diagnostics and alarm history may be viewed without entering a passcode (See Field Diagnostics and Alarm History Display section).

Note

On any setup menu, use up/down to change a parameter and back/next to accept the displayed parameter. All menus and all parameters are wrap around, meaning they will advance from the highest or last value to the lowest or first value.

To view or change setup parameters of the actuator, Rotate the Selector Knob to the right or NEXT position to cycle through the alarm history display A1 through A8 until P1 is displayed. Alarm history (A1-A8) may be skipped by changing AH(1) to AH(0) and go directly to passcode menu. Passcode menu is displayed as two, 2-digit entries, P1 and P2. The actuator is shipped from the factory with the passcode disabled, meaning that the passcode is 00 00. Until the passcode is changed by the user, the passcode of 00 00 may be accepted by using the NEXT selector knob sequence to accept the passcode and continue to the setup menus. You will now be able to display and/or edit setup data. If you forget your configured passcode, factory trained technicians can reset the passcode back to 00 00.

Note

While in the SETUP mode the actuator will not turn on the motor control circuits and disables all control of discrete outputs until exiting the Setup Mode.

Alarm History Display

Setup always enters the main menu at the Field Diagnostics (Fd) and the next menu item is Alarm History (AH). The user may view the alarm history without having to enter a passcode. The AH menu will alternately display a value of 0 or 1. Use the Control Knob up or down to change the selection from 0 to 1 or 1 to 0. If display of the alarm history is desired, then the value must be 1. When AH with a value of 1 is displayed, use the Selector Knob REMOTE (NEXT) to advance through the alarms. If it is desirable to skip the alarm history and advance to the setup menus, use the control knob to select a value of 0 and then the Selector Knob Remote (Next) to advance directly to the P1 passcode entry. Alarms are displayed by a sequence number A1 through A8. The display alternates between the alarm sequence number (A1-A8) and the recorded alarm. A1 is the newest alarm and A8 is the oldest alarm. Use the NEXT and BACK selector positions to cycle through the alarms. Blanks are displayed for fewer than 8 alarms. The alarm history is cleared by cycling power to the actuator. If it is desirable to only display alarm history and not go into setup, use the LOCAL (BACK) selection repeatedly to back out of the alarm history and return to normal operating mode.

Setup Mode Display Sequence

The three (3) amber LED's for the LOR section flash to indicate Setup Mode. When in setup mode, the user must enter the REMOTE (NEXT) or LOCAL (BACK) within 120 seconds or the display will revert back to the normal display mode.

Setup data may be changed by using the Up and Down entries of the Control Knob. The Up and Down entries are active only after a valid pass-code is entered and the Selector Switch is in the STOP position. The default pass-code is P1 00 and P2 00. Once the correct passcode is entered and accepted at the actuator controls, the user will then be able to advance thru the displays shown in the Main Menu table on the following page.

The table on the following page shows the sequence of the setup menus. It also shows the selections, units, and defaults. Each time the REMOTE (NEXT) selector knob is selected, the display advances to the next menu item. Each time the LOCAL (BACK) selector knob is selected, the display backs up to the previous menu item. The Up and Down control knob is used to increment or decrement the value shown in the table.

Following is an example for changing the Torque Limit. In this example the current torque value is the default value of 60%.

1. Enter setup mode – Selector knob Off – Rock control knob back and forth until 3 selector LEDs begin to flash and Fd is displayed. When using the selector knob to advance to the next menu or back to the previous menu, always return the selector to the Off position to complete the cycle.
2. Use control knob to change the value of AH to 0 – Rotate selector knob clockwise to Remote (Next) to display P1 (1st passcode). The display will alternate between P1 and the value (default is 00). If the passcode has been changed, rotate the control knob clockwise to advance the display to the correct first passcode. Rotate the selector knob clockwise to advance to the next display, P2. The display will alternate between P2 and value of the second passcode (default is 00). If the passcode has been changed, rotate the control knob clockwise to increment the display to the correct second passcode.
3. Repeatedly cycle the selector knob clockwise to advance to the next menu item until C2 is displayed. This is the torque limit setting as shown in the following table. The display will alternate between C2 and the value of C2 which we have assumed to be 60.
4. Rotate the control knob clockwise to the “up” position to increase the torque limit setting. Rotate the control knob counterclockwise to the “dn” position to decrease the torque limit setting.
5. Repeatedly cycle the selector knob to the Remote (Next) position and the Off position to advance through the remaining menu items until the EP (Exit Program) is displayed.
6. If it is desirable to exit, use the control knob “up” to display a 1 value. Use the selector knob Remote (Next) to select exit. The system and display will return to normal operating mode.

Note

Use Selector Knob to select Menu and Use Control Knob to select Units.

FISHER VALVE & ACTUATOR INSTRUCTION MANUALS

Instruction Manual

D104239X012

Multiport Flow Selector

April 2022

Menu	Parameter	Value	Units	Default
Fd	Field diagnostics	0-27	Fault code	0
AH	Display Alarm History?	0-1	0=No, Skip to 1 st Passcode 1=Yes, Display History	
A1	1 st latest alarm	Alarm	None	
A2	2 nd older alarm	Alarm	None	
A3	3 rd older alarm	Alarm	None	
A4	4 th older alarm	Alarm	None	
A5	5 th older alarm	Alarm	None	
A6	6 th older alarm	Alarm	None	
A7	7 th older alarm	Alarm	None	
A8	8 th older alarm	Alarm	None	
P1	1 st Passcode	00-99	None	00
P2	2 nd Passcode	00-99	None	00
C0	Control Mode	0-1	0=Discrete 1=Network	1
C1	ESD Action	0-1	0=Stop/Stayput 1=Go to Home Port	1
C2	Torque Limit	15-99	Torque in %	77
C3	Network Node Address	1-99	99 = selection of default address 254 for other protocol CAM modules.	99
C4	Network Baudrate	0-3	0=4800 1=9600 2=19200 3=38400	2
C5	Network Parity	0-2	0=None 1=Odd 2=Even	0
C6	Network Stop Bits	1-2	1=1 Stop bit 2= 2 Stop bits	1
C7	Torque Spring Factor	0-81	None	81
C8	Disable Jog Control	0-1	0=No, 1=Yes	1
C9	Disable Display Timeout	0-1	0=No, 1=Yes	1
CA	Home Port Number (0 or 8)	0-1	0=0, 1=8	0
HP	Home Port (User selected)	0-7	Port No. 1-7	0
HC	Accept Home Port Calibration	0 or 43	0=No, 43=Yes	0
d1	Delete port 1	0-1	0=No, 1=Yes	0
d2	Delete port 2	0-1	0=No, 1=Yes	0
d3	Delete port 3	0-1	0=No, 1=Yes	0
d4	Delete port 4	0-1	0=No, 1=Yes	0
d5	Delete port 5	0-1	0=No, 1=Yes	0
d6	Delete port 6	0-1	0=No, 1=Yes	0
d7	Delete port 7	0-1	0=No, 1=Yes	0
E1	Edit 1 st Passcode	00-99	None	00
E2	Edit 2 nd Passcode	00-99	None	00
EP	Exit Program?	0-1	0=No, Return to last menu 1=Yes, Exit	
Note: RDM port configuration is fixed at 9600,N,8,1 address 254 and may not be changed by the user. Only the network port configuration may be changed. The address programmed for the network port will be accepted by the RDM port in addition to address 254.				

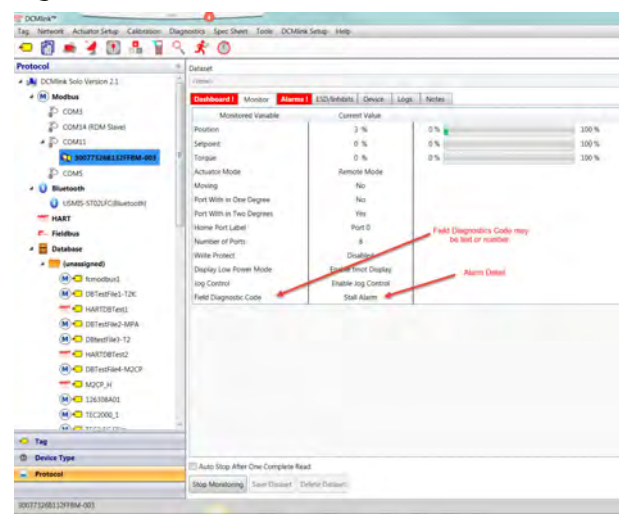
Field Diagnostics

Should trouble occur, the Field Diagnostics feature may be used to help diagnose the problem. Field diagnostics provides more detailed and definitive feedback than the alarms, i.e. possible root cause(s) for the alarm. For example, there may be many causes for an Actuator Fail alarm. Field diagnostics may be displayed by MPA Config as shown here.

Field diagnostic may be displayed by the local display by entering setup mode. In Setup Mode, the first entry is Field Diagnostics having visible code “Fd”. Its value is 0 if there is no fault. If there is a fault, its code is from 1 to 28. If there are multiple faults, only the first of those faults in the following list will be seen. When that fault is corrected, the next fault will display if present.

In DCMLink the Field Diagnostics Code is indicated in the Status Monitor.

Figure 29.



Fd Fault Codes

1. MCP23 Chip will not initialize (pertains to a three phase AC motor type)
2. Motor is wired to turn in the wrong direction
3. Self-detected wiring fault (Emergency Shut Down - LE)
4. Host transmitted ESD command (Emergency Shut Down - LE)
5. Lost Phase, pertains to a three phase AC motor type - PH
6. Motor has over-heated or overload relay trip (Motor overload - OL)
7. Stall Alarm. No motor movement after excess time of power applied - SA
8. Lost Control Voltage (Loss of power for motor control - LC)
9. Contactor is engaged, but there is no AUX feedback (= Control Failure)
10. SPI communication failure for GPA chip
11. AUX feed-back alarm (= Incorrect AUX feedback from contactor)
12. Three consecutive overshoots of the port
13. RDM is not communicating and is required (Communication Error - CE)
14. No input from Torque Encoder. Check for cable connection problems or encoder failure
15. Torque OCF bit is low. Power supply to the Torque Encoder is likely at fault
16. Encoder reports that Torque Encoder value is invalid
17. Torque Encoder Parity error
18. Torque Encoder Magnet is out of range
19. Over-Torque. Torque value is greater than the Torque Limit
20. Value from the Torque Encoder is out of range (invalid instead of over-torque)
21. No input from Position Encoder. Check for cable connection problems or encoder failure

22. Position OCF bit is low. Power supply to the Position Encoder is likely at fault
23. Encoder reports that Position Encoder value is invalid
24. Position Encoder Parity error
25. Position Encoder Magnet is out of range
26. Encoder Position inconsistent consecutive times. Expect Position Encoder problem
27. Stopped between ports (non-critical)
28. Home Port is the last port reached (stopped at Home Port, non-critical and may be normal operation)

Remote Control Network

Modbus RTU

The native language of the MPA is Modbus RTU. If other network protocols such as Foundation Fieldbus are used, a Communication Adapter Module (CAM) module is installed to translate between the selected protocol and Modbus. The controller supports Modbus function codes 01,02,03,04,05,06,15,16. Following are the memory maps for discrete I/O and unsigned 16-bit Holding registers used in this application. All memory maps shown are zero based, i.e. register 1 = holding register 40002. reading Input Bit 0 using FC02 = 10001.

Discrete Input Map (Valve Status and Alarms)

Bit	Input	
0	16	At commanded port within 1 degree
1	17	At commanded port within 2 degrees
2	18	Flow selector moving
3	19	Wrong direction alarm
4	20	Selector switch Local/Manual Mode
5	21	Selector switch Remote/Auto Mode
6	22	Over torque alarm
7	23	Stop between ports alarm
8	24	Flow selector stall alarm
9	25	Power monitor alarm
A	26	Motor thermal overload alarm
B	27	Phase monitor alarm
C	28	Local ESD alarm
D	29	Actuator fail alarm
E	30	No input (always zero)
F	31	Unit alarm (above alarms are OR'ed)

These same status and alarm bits are duplicated in Modbus Registers 01, 06, 09 (40002, 40007, 40010) in the same bit sequence shown above.

Coil Map (Discrete Network Control)

There are only two coils used for discrete network control as follows. When Coil 10 is set by the host, the actuator resets the coil automatically when the command is executed. When Coil 11 is set, the host must reset the coil before the actuator will respond to any other command.

Coil

10 Go to next port

11 Host ESD command, Go to Home Port

Holding Register Map

These are the recommended registers to use. Other registers are active but the user is cautioned not to use the data or write to any other registers.

Monitor and Control Registers

Register

01 Actuator status and alarms in the bit sequence shown for the input map

06 Actuator status and alarms in the bit sequence shown for the input map

07 Last Port position reached (0-7 or 1-8) (See CA Home port number on page 38)

09 Actuator status and alarms in the bit sequence shown for the input map

11 Port position Setpoint (0-7 or 1-8) (Data must be a single digit between 0 and 7 or 1 and 8 depending on Home configuration) (See CA Home port number on page 38) (MPA returns 255 (0xFF) in register 11 when the commanded port is reached)

12 Field diagnostic code 0-28 (See Fd Fault Codes on page 22)

13 Raw 12-bit position encoder value (0-4095)

14 Port position (0-4095)

15 Torque (0-4095)

Configuration and Calibration Registers

Register

211 Port 0 calibration value (0-4095)

212 Port 1 calibration value (0-4095)

213 Port 2 calibration value (0-4095)

214 Port 3 calibration value (0-4095)

215 Port 4 calibration value (0-4095)

216 Port 5 calibration value (0-4095)

217 Port 6 calibration value (0-4095)

218 Port 7 calibration value (0-4095)

Note

After the HC command is executed, Register 211 will be zero and remain zero.

⚠ WARNING

Extreme caution must be used when writing port calibration values to registers 211 through 218 (40212 thru 40219). Only values read from these registers shall be written to them. The purpose of these registers is to allow the network host to store the port calibration values and then write them back to the actuator in case of replacement of the CPU module.

Foundation Fieldbus (FF)

The MPA uses a CAM18 to convert between Modbus and Foundation Fieldbus. Refer to Bettis M2CP CAM18 & TEC2000 CAM218 Installation, Operation and Instruction Manual for installation and setup of the FF link. Relations between the Modbus and FF maps are identified as follows.

Foundation Fieldbus

Modbus Discrete Input Map

<u>Input</u>	
16	At port within 1 degree
17	At port within 2 degrees
18	Flow selector moving
19	Wrong direction alarm

Actuator Readback (Channel 2)

Note: Channel 2 has only 1 value

<u>DI</u>	<u>PV / Out_D</u>
1	
2	
4	
5	

Modbus Discrete Input Map

Actuator Status (Channel 5)

Note: Channel 5 has only 1 discrete value and depends upon Selector Switch position.

<u>Input</u>		<u>AUTO</u>	<u>DI</u>	<u>PV / Out_D</u>	<u>OFF</u>	<u>LOCAL</u>
20	SS Local/Manual					3
	Selector Switch Off			2		
21	SS Remote/Auto	0				
22	Over torque alarm	56		58		59
23	Stop between ports alarm	52		54		55
24	Flow selector stall alarm	9		11		12
25	Power monitor alarm	12		14		15
26	Motor thermal overload alarm	20		22		23
27	Phase monitor alarm	76		78		79
28	Local ESD alarm	40		42		43
29	Actuator fail alarm	44		46		47

Coil Map (Discrete Network Control)

Coil

10 Go to Next Port

Actuator Command (Channel 1)

DO SP / Out_D

1

Coil Map (Discrete Network Control)

Coil

11 Host ESD Command

ESD Command (Channel 10)

DO SP / Out_D

1

Monitor and Control Registers

Register

11	Port Position Setpoint (0-7 or 1-8)
14	Port position (0-4095)
15	Torque (0-99%)

Setpoint AO (Channel 3)
Position AI (Channel 4)
Torque AI (Channel 18)

SP / OUT
SP / OUT
SP / OUT

Modbus

Configuration and Calibration Registers

Foundation Fieldbus

MAO (Channel 19)

MAI (Channel 20)

Register		Parameter	Parameter
211	Port 0 calibration	IN_1	OUT_1
212	Port 1 calibration	IN_2	OUT_2
213	Port 2 calibration	IN_3	OUT_3
214	Port 3 calibration	IN_4	OUT_4
215	Port 4 calibration	IN_5	OUT_5
216	Port 5 calibration	IN_6	OUT_6
217	Port 6 calibration	IN_7	OUT_7
218	Port 7 calibration	IN_8	OUT_8

Note

Input and Output parameters are the number of hardware registers that are connected to the I/O block. They define the transducers to be used going to or from the physical world.

⚠ WARNING

Extreme caution must be used when writing port calibration values to registers 211 through 218. Only values read from these registers shall be written to them. The purpose of these registers is to allow the network host to store the port calibration values and then write them back to the actuator in case of replacement of the CPU module.

Note: The network host may write a Port Position Setpoint to Channel 3 (SP/OUT) as a 12-bit unsigned integer analog value corresponding to 0% to 8% where the percentage relates to the port number 0 to 8. The analog value is calculated as absolute value of Port Number / 100 * 4095. Example: Analog value for Port 6 = $6/100 * 4095 = 245.7 = 245$. The actuator will accept the percentage analog value within a tolerance as shown below:

Port 0 = 0
 Port 1 = 39 – 42
 Port 2 = 79 – 82
 Port 3 = 120 – 123
 Port 4 = 162 – 165
 Port 5 = 203 – 206
 Port 6 = 244 – 247
 Port 7 = 284 – 288

If CA is configured as 1 for Home Port = 8, the MPA will accept either 0 or 327 for setpoint of Home Port. The acceptable range for Port 8 is 325 to 329. (see page 21 for CA configuration)

Profibus DP Redundant Networks with Redcom

The MPA uses CAM20 to convert between Modbus RTU and Profibus DP. This section describes the data mapping between the Profibus DP host and MPA Modbus map. The mapping allows the Profibus DP host to control the Flow Selector and monitor the actuator status. The control information is mapped directly to words in the Profibus Output data and status information is mapped directly to words in the Profibus Input data.

Output Data

Location		Bit							
Word	Byte	7	6	5	4	3	2	1	0
1	1	Not used	Not used						
1	2	Not used	Not used	Not used	Not used	Host ESD Command	Go to Next Port	Not used	Not used
2	3	Flow Selector Port Position Setpoint (0-7) or (1-8) Single Byte							
2	4								
3	5	Not used							
3	6								

Input Data

Location		Bit							
Word	Byte	7	6	5	4	3	2	1	0
1	1	Not used	Not used	Not used	Not used	Not used			Actuator Fail Alarm
1	2	Not used		Not used	Not used	Host ESD Monitor	Not used		
2	3	Unit Alarm	Not used		Local ESD Alarm	Phase Monitor Alarm	Motor Thermal Alarm	Power Monitor Alarm	Flow Selector Stall Alarm
2	4	Stopped Between Ports	Over Torque Alarm	Selector Remote / Auto	Selector Local / Manual	Wrong Direction Alarm	Flow Selector Moving	Within 2 degrees of port	Within 1 degree of port
3	5	Flow Selector Position (0-7) or (1-8) Single Byte							
3	6								
4	7	Torque (0-99%)							
4	8								
5	9	Not used							
5	10								
6	11	Not used							
6	12								

DeviceNet

The MPA uses CAM09 to convert between Modbus and DeviceNet. This section describes the data mapping between the DeviceNet host and MPA Modbus map. The mapping allows the DeviceNet host to control the Flow Selector and monitor actuator status. The control information is mapped directly to words in the DeviceNet Output data and status information are mapped directly to words in the DeviceNet Input data.

Output Data

Location		Bit							
Word	Byte	7	6	5	4	3	2	1	0
1	1	Not used				Host ESD Command	Go to Next Port	Not used	
	2	Not used							
2	3	Flow Selector Port Position Setpoint (0-7) or (1-8) Single Byte							
	4								
3	5	Not used							
	6								

Input Data

Location		Bit							
Word	Byte	7	6	5	4	3	2	1	0
1	0	Not used		Not used	Not used	Not used	Not used	Not used	Not used
	1	Not used	Not used	Not used	Not used	Not used			
2	2	Stopped Between Ports	Over Torque Alarm	Selector Remote / Auto	Selector Local / Manual	Wrong Direction Alarm	Flow Selector Moving	Within 2 Degrees of Port	Within 1 Degree of Port
	3	Unit Alarm	Not used	Actuator Fail Alarm	Local ESD Alarm	Phase Monitor Alarm	Motor Thermal Alarm	Power Monitor Alarm	Flow Selector Stall Alarm
3	4	Flow Selector Position (0-7) or (1-8) Single Byte							
	5								
4	6	Torque (0-99%)							
	7								
5	8	Not used							
	9								
6	10	Not used							
	11								

Figure 30.



Figure 31. Wiring Diagram — Three Phase Power

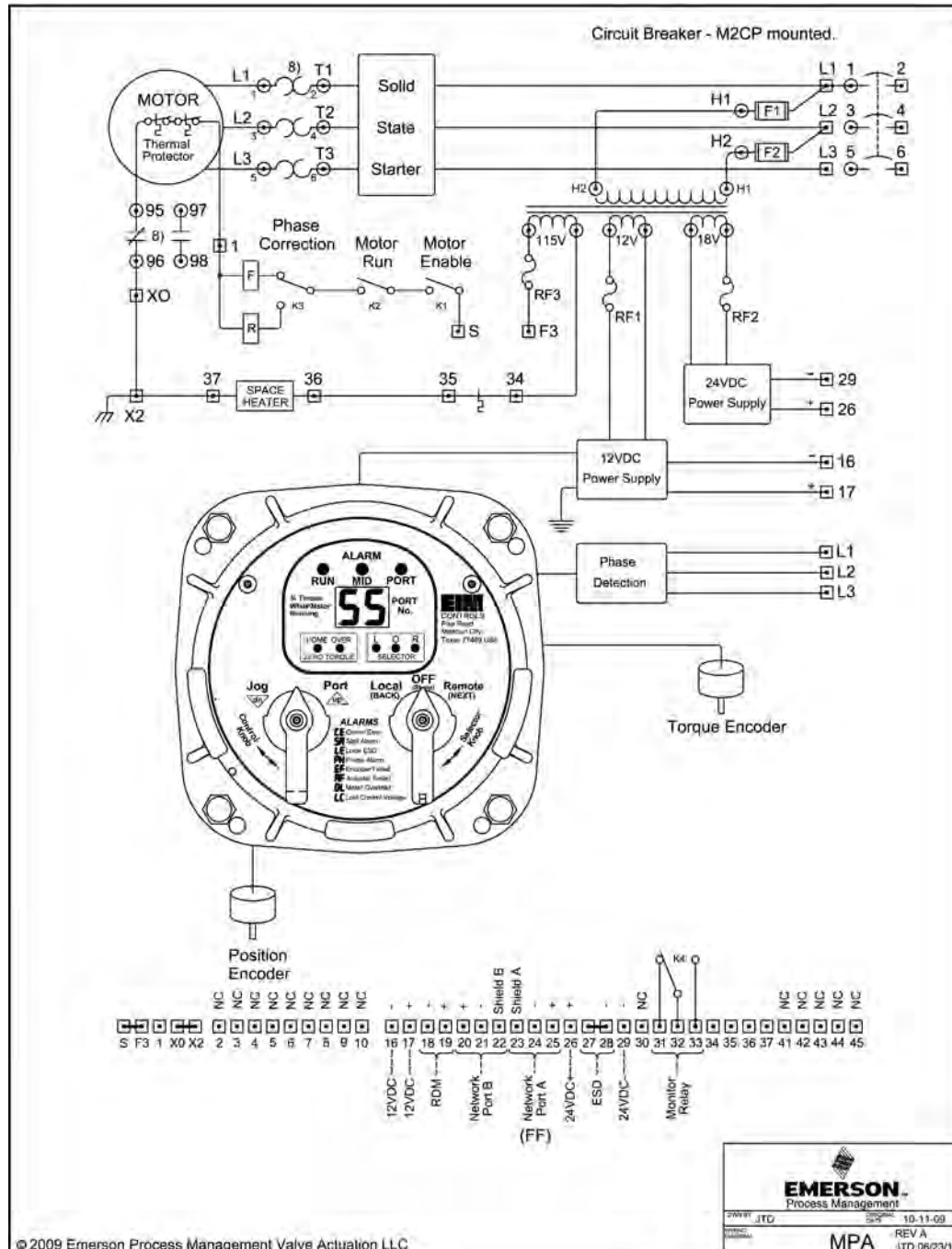


Figure 32. Wiring Diagram — Single Phase Power

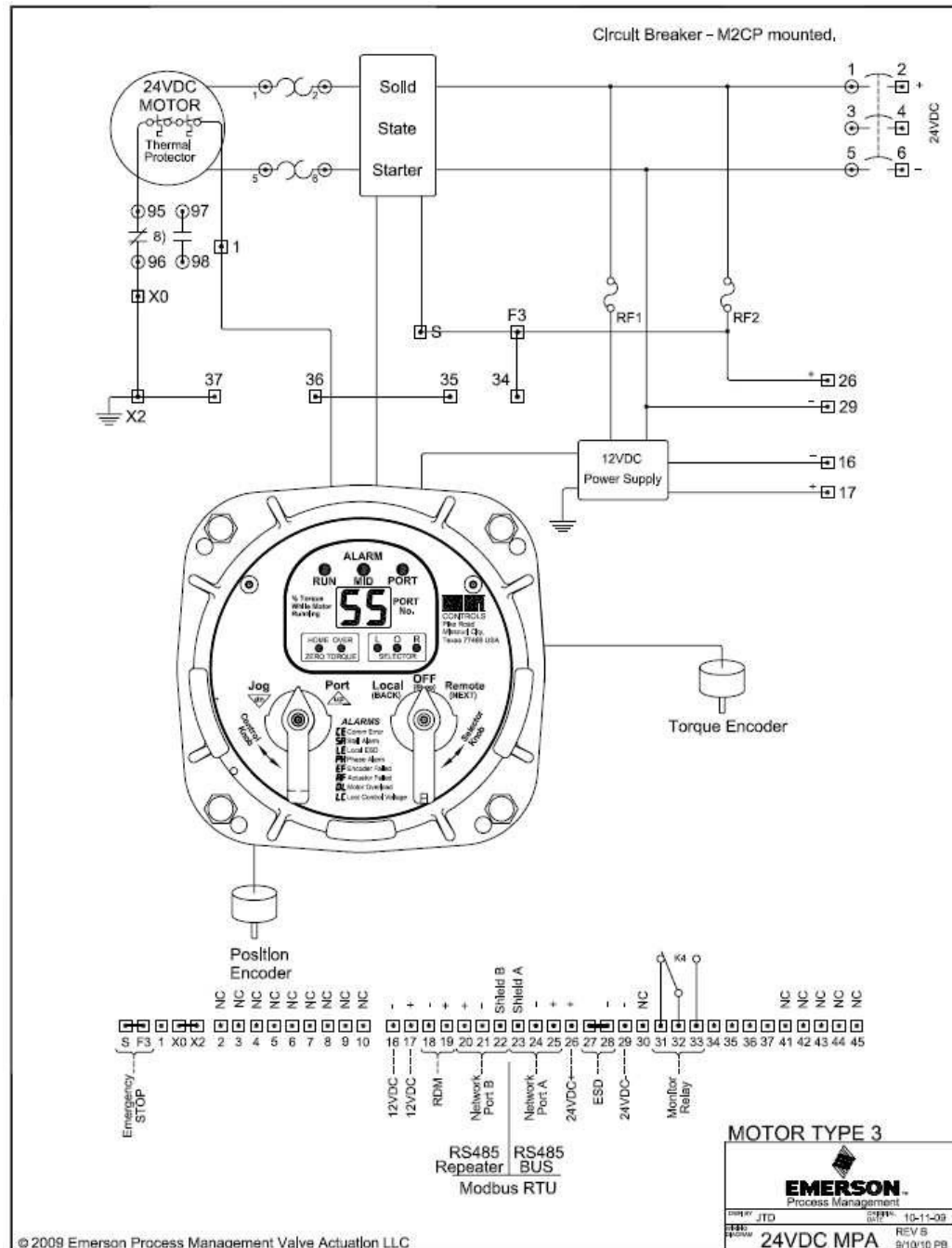
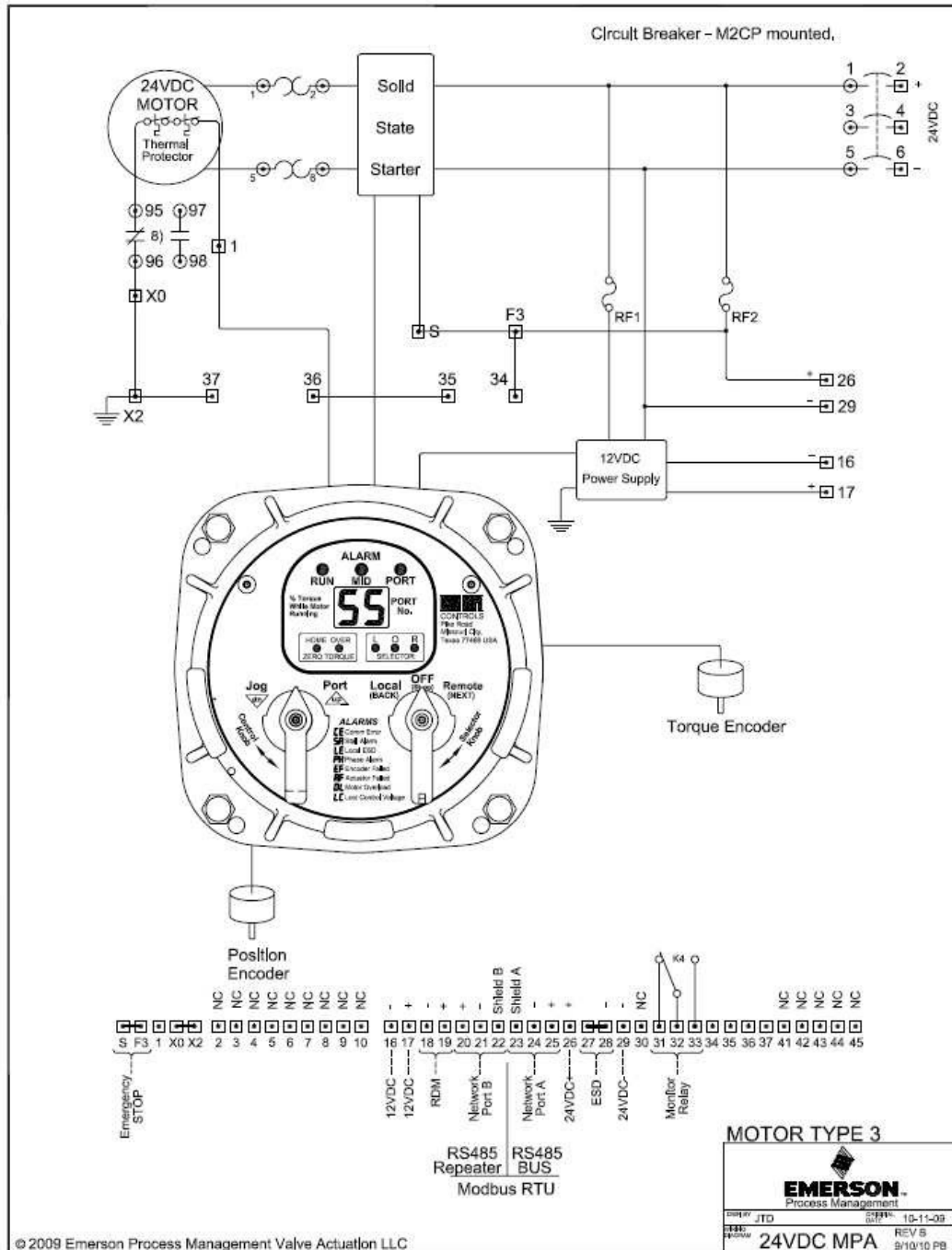


Figure 33. Wiring Diagram — 24VDC Power



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Multiport Flow Selector

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D104239X012

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Vonk™ Choke Valve Series (CHV, ICV, SCV, and YCV) (Obsolete)

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Introduction

The product covered in this document is no longer in production. This document, which includes the latest published version of the instruction manual, is made available to provide updates of newer safety procedures. Be sure to follow the safety procedures in this supplement as well as the specific instructions in the included instruction manual.

Part numbers in the included instruction manual should not be relied on to order replacement parts. For replacement parts, contact your [Emerson sales office](#).

For more than 30 years, Fisher products have been manufactured with asbestos-free components. The included manual might mention asbestos containing parts. Since 1988, any gasket or packing which may have contained some asbestos, has been replaced by a suitable non-asbestos material. Replacement parts in other materials are available from your sales office.

Safety Instructions

Please read these safety warnings, cautions, and instructions carefully before using the product.



These instructions cannot cover every installation and situation. Do not install, operate, or maintain this product without being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance. To avoid personal injury or property damage it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson sales office before proceeding.

Specifications

This product was intended for a specific range of service conditions--pressure, pressure drop, process and ambient temperature, temperature variations, process fluid, and possibly other specifications. **Do not expose the product to service conditions or variables other than those for which the product was intended.** If you are not sure what these conditions or variables are, contact your [Emerson sales office](#) for assistance. Provide the product serial number and all other pertinent information that you have available.

Inspection and Maintenance Schedules

All products must be inspected periodically and maintained as needed. The schedule for inspection can only be determined based on the severity of your service conditions. Your installation might also be subject to inspection schedules set by applicable governmental codes and regulations, industry standards, company standards, or plant standards.

In order to avoid increasing dust explosion risk, periodically clean dust deposits from all equipment.

When equipment is installed in a hazardous area location (potentially explosive atmosphere), prevent sparks by proper tool selection and avoiding other types of impact energy.

Parts Ordering

Whenever ordering parts for older products, always specify the serial number of the product and provide all other pertinent information that you can, such as product size, part material, age of the product, and general service conditions. If you have modified the product since it was originally purchased, include that information with your request.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher product, because they may void your warranty, might adversely affect the performance of the product, and could cause personal injury and property damage.

Installation

⚠ WARNING

- Personal injury or equipment damage caused by sudden release of pressure or bursting of parts may result if the valve assembly is installed where service conditions could exceed the limits given in the applicable product literature, the limits on the appropriate nameplates, or the mating pipe flange rating. Use pressure-relieving devices as required by government or relevant industry codes and good engineering practices. If you cannot determine the ratings and limits for this product, contact your [Emerson sales office](#) before proceeding.
- To avoid personal injury, always wear protective gloves, clothing, and eyewear when performing any installation operations.
- To avoid personal injury or property damage, use proper lifting and rigging practices while lifting, installing or removing the valve assembly. Be sure to use lifting and rigging equipment properly sized and selected for the weight and configuration of the valve assembly or component being lifted.
- Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions.
- Many rotary shaft valves are not necessarily grounded to the pipeline when installed in a flammable, hazardous, oxygen service, or explosive atmospheres. An explosion is possible, due to the discharge of static electricity from the valve components. To avoid personal injury or property damage, make sure that the valve is grounded to the pipeline before placing the control valve assembly into service. Use and maintain alternate shaft-to-body bonding, such as a shaft-to-body bonding strap assembly.
- Rotary shaft valves are designed and intended for installation between flanges. Personal injury or property damage may result from improper installation. To avoid personal injury or property damage caused by the sudden release of pressure or bursting of parts, do not use or install rotary shaft valves (including single lug constructions) for dead-end service.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- If installing into an existing application, also refer to the WARNING in the Maintenance section.
- When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. To avoid possible personal injury and because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson sales office.

CAUTION

- Ensure that the valve and adjacent pipelines are free of foreign material that could damage the valve seating surfaces.

Maintenance

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Always wear protective gloves, clothing, and eyewear.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure.
- Do not remove the actuator while the valve is pressurized.
- Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring pre-compression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box might contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids might spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug. Cautiously remove parts so that fluid escapes slowly and safely.
- Many valve parts that are moving can injure you by pinching, cutting, or shearing. To help prevent such injury, stay clear of any moving part.
- Never apply pressure to a partially assembled valve.
- To avoid personal injury or property damage caused by uncontrolled movement of a valve bonnet, loosen the bonnet by following these instructions: Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. Loosen bonnet nuts approximately 3 mm (0.125 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed with bonnet removal.
- As you remove parts, such as valve shafts, other parts, such as disks can fall from the valve body or suddenly move to another position in the valve. To avoid injury from falling or moving parts, be sure to support parts and be sure they are in a stable position as you disassemble the valve.
- Personal injury could result from packing leakage. Do not scratch the drive shaft or packing box wall while removing packing parts.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

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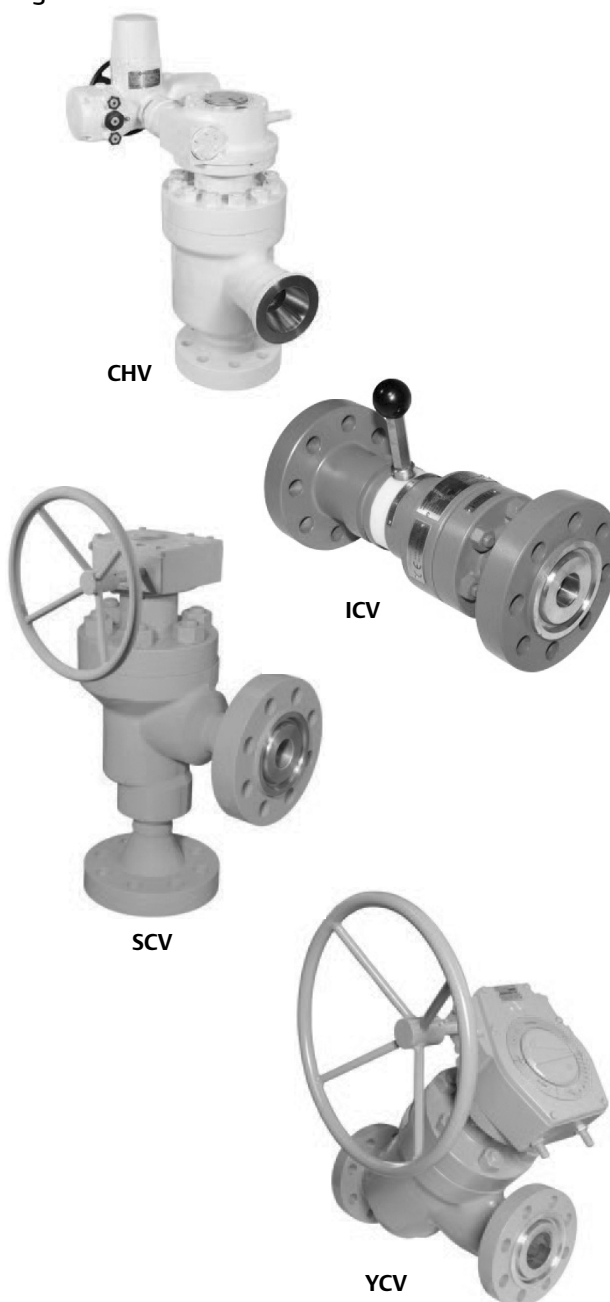


Vonk™ Choke Valve Series (CHV, ICV, SCV, and YCV)

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Figure 1. Vonk Choke Valves



Introduction

Scope of Manual

This instruction manual provides information on installation, adjustment, maintenance, and parts ordering for the Vonk choke valve. Refer to separate instruction manuals for information about the valve positioner and other accessories used with the valves.

Do not install, operate, or maintain a Vonk valve (see figure 1) without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Description

Vonk choke valves are of the rotary type. The valve can be used for tight shut off service to Class V of ANSI/FCI 70-2 standard for contaminated fluids and high-pressure drops. The throttling mechanism consists of two polished disks, each provided with an eccentric orifice. One disk is fixed into the body; the other one is rotated to achieve Class V seat leakage performance.

Educational Services

For information on available courses, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Specifications

Contact your Emerson sales office for additional information.

Temperature Range

Vonk choke valves are designed for three temperature ranges:

The **Standard** version (STD) equipped with O-rings.

The **Low Temperature** version (LT) equipped with special LT-seals.

The **High Temperature** version (HT) is the same as the LT version but has an extended bonnet construction to withstand high temperatures.

Each version is available with special fugitive emissions (FE) or fire safe (FS) seal option depending on application and choke valve type. Refer to table 1 for configurations covered in this manual.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations.

To avoid personal injury or property damage resulting from the sudden release of process pressure or bursting of parts, do not install the valve assembly where service conditions could exceed the limits given in this manual or on the appropriate nameplates. Use pressure-relieving devices as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions indicated when the valve was ordered. Because some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

1. Carefully remove the valve from the shipping package (box or pallet) avoiding any damage to the valve or, in case of automated valves, to the electric or pneumatic / hydraulic actuator or instrumentation.
2. The valves are shipped with the ends protected with caps and a thin layer of protective grease. Before installing the valve, remove the protective caps from the valve. Clean carefully and then de-grease both surfaces with a solvent. Clean the inside of the valve to ensure there are no solid objects such as pieces of wood, plastic or packing materials within the valve or on the valve seat. The valve must be free of all foreign matter.
3. Confirm that the materials of construction listed on the valve nameplate are appropriate for the service intended and are as specified.

Vonk chokes valves can be mounted in any position. Installation of the valve must match the flow direction is indicated by the arrow on the valve-body.

Unless otherwise recommended by Emerson:

1. The pipe ends must be properly aligned and supported so as to prevent the valve being subjected to unnecessary stress induced by connecting piping.
2. It is recommended to perform piping flushing before installation of valve.
3. After the down-stream flange (outlet flange), the piping shall be straight over a certain length (depending on the flow medium, the fluid phase and the pressure drop over the valve), but at least 1 meter (39-inches).
4. For choke valves provided with pneumatic actuators, the air pressure to the actuator shall be at least 4.5 bar (65 psi), and a maximum of 8 bar (116 psi), unless specified otherwise. Clean, dry compressed air can be used for the actuator. If a valve positioner is used, instrument air has to be used; do not install a drip feed lubricator in the supply line to the positioner.
5. During the installation of the valve, materials, such as connecting flanges, gaskets and bolting shall be used, appropriate for the design conditions of the application.
6. If present, do not cover or stop up the drain channels located at the actuator top-flange of the bonnet.

CAUTION

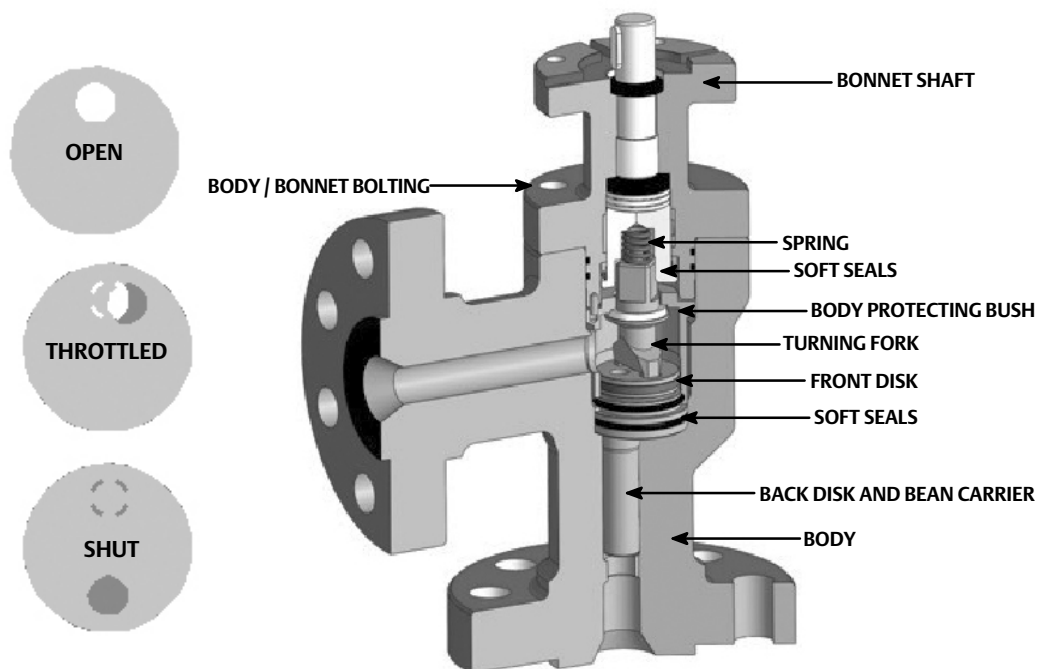
Make sure that the operating limits of the valve are the same or higher than the operating limits of the piping system. See the nameplate of the choke valve.

In case of a HT version valve, the bonnet should not be insulated (this may over-heat the bonnet).

After installation, check the operation of the valve by stroking it to 'full open' and 'full close'. The position of the valve can be indicated in the following ways:

1. Mechanical, by a dial plate showing the position of the valve. The following methods are available:
 - a. Percent of the full stroke of the actuator
 - b. Percent opening of the valve
 - c. Equivalent bean size in 1/64-inch increments
2. Electrical limit switches indicating end of stroke of the actuator.
3. Electronic valve position transmitter, presenting the position of the valve:
 - a. As a 4-20 ma signal
 - b. As a 4-20 ma signal with 'smart' transmitter information (HART® protocol)
 - c. As a fieldbus signal (e.g. FOUNDATION™ fieldbus, PROFIBUS)

Figure 2. Vonk Choke Valves Open / Throttled / Shut



Operation

Manual: Manual shut-off valves are designed to 'shut' when the handwheel is turned clockwise and 'open' when the handwheel is turned counter-clockwise (including valves with gearbox operators). Handwheels of electric actuators (or pneumatic actuators) are for emergency operation only.

Pneumatic / Hydraulic: Choke valves fitted with a pneumatic or hydraulic actuator must be connected and operated in accordance with the actuator manufacturer instructions. Refer to the actuator instruction manual.

Electric: Choke valves fitted with an electrical actuator must be connected and operated in accordance with the actuator manufacturer instructions. Refer to the actuator instruction manual.

Positioner: Choke valves fitted with a positioner must be connected and operated in accordance with the positioner manufacturers instructions. Refer to the positioner instruction manual.

Maintenance of Valve Internals

Valve parts are subject to normal wear and must be inspected regularly and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring pre-compression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

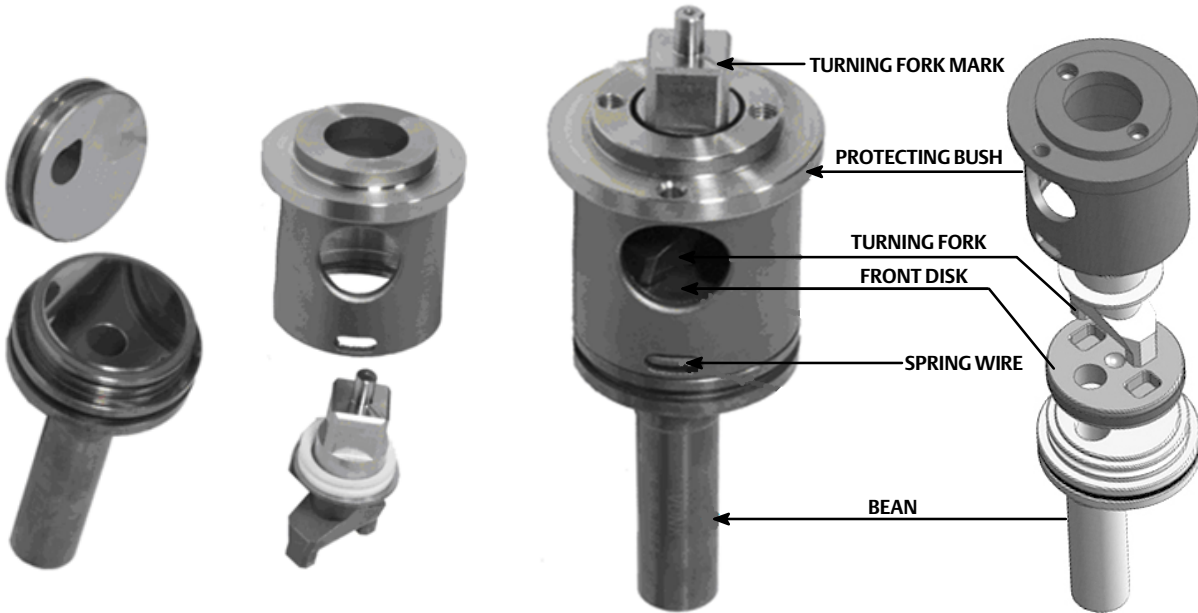
WARNING

Follow instructions carefully to avoid damaging the valve sealing and packing surfaces, which could result in excessive leakage at shutoff or allow process fluid to leak to atmosphere.

Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, install a new gasket during reassembly. This ensures a good gasket seal because the used gasket may not seal properly.

Figure 3. Vonk Choke Valve Internals



Prior to any inspection or maintenance, refer to the appropriate parts list and associated figure for the choke valve type and seal configuration.

After the choke valve has been disassembled, a new set of soft seals must be used. The trim and bonnet can be replaced and/or inspected without removing the body out of the line.

For inspection of the choke valve, an internal wrench tool is required.

Disassembly

⚠ WARNING

Refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

1. Isolate the choke valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator.
2. Unscrew the air tubing. In case of a conventional type valve positioner, check the cam in the valve positioner (zero position open when the actuator is spring to close, and zero position closed when the actuator is spring to open).
3. Unscrew the bonnet nuts and lift the bonnet and actuator from the body.

4. Check the position of the turning fork. If the mark on top of the turning fork is opposite the inlet flange, the valve is in the closed position. (See figure 3.)
5. Screw the bolts of the internal wrench tool into the thread holes of the body-protecting bush. (See figure 4.)
6. The complete trim can be removed out of the body by turning down the nuts of the internal wrench tool.
7. Disassemble the internals by removing the locking wire, and lift the protection bush from the bean.
8. Examine the internals for foreign material that may affect the operation of the choke.
9. Inspect the front disk and bean. The surface where the orifice is located should be smooth and free of any damage. If there is any visible damage, then the parts need to be replaced.
10. Clean the inside of the body very carefully. Special attention has to be given to places where soft seals are situated. Clean the sealing surfaces and inspect them for corrosion, pitting or scratches. After inspection, lightly grease the sealing faces (universal grease).

CAUTION

If a 'spring-energized seal' is used, use only a PTFE spray lubricant on the spring energized seal sealing face.

Assembly

1. Put one drop of light oil on the seating surface, and place the front disk on the bean.
2. Put the turning fork on the front disk, and ensure the mark on top of the turning fork is in the same position as the orifice in the front disk.
3. Install the scraper over the turning fork. Lightly grease it with an anti-seize lubricant.
4. Place the guide-strip of the internal and the scraper around the front disk. Mount the protecting bush. The protecting bush inlet hole should point to the same direction as the orifice of the bean. (See figure 3.)
5. Replace the locking-wire.
6. Using the turning fork, turn the orifice of the front disk and bean to a fully open position for valves with a spring-to-open actuator. For an actuator with a spring-to-close action, the orifice has to be put in a position of 180 degrees (90 degrees for NPS 1 choke valves) from the fully open position.
7. Mount the new seal around the bean.
8. Grease (universal grease) the seal slightly and insert the complete internal in the body.

CAUTION

If a 'spring-energized seal' is used, use only a PTFE spray lubricant on the spring energized seal sealing face.

9. Recheck the position of the turning fork and put spring in position.
10. Place the bonnet and the actuator on the body. Be sure that the adjusting pin is placed in the hole of the protecting bush.
11. Grease the stud bolts with anti-seize lubricant and tighten the nuts crosswise. See Retightening of Nuts Body Bonnet Connection in this manual for more information.
12. Connect the air tubing.
13. After assembling the choke valve, perform a functional test to check whether the valve functions properly.

Retightening Nuts Body Bonnet Connection

Due to the design of the choke valve, the nuts of the studs (body-bonnet connection) needs to be tightened sufficiently to provide a proper connection.

Valve Internals and Bonnet Maintenance

A replacement set of soft seals is required.

Disassembly

1. Complete steps 1 to 10 of the Maintenance of Valve Internals Disassembly section in this manual.
2. Take the shaft key out of the bonnet shaft and push the bonnet shaft out of the bonnet.
3. Remove all the seals, bearings, and scrapers.
4. Clean all the parts.
5. Clean all the sealing surfaces of bonnet and shaft very carefully and inspect them for corrosion, pitting or scratches.

Assembly

1. Complete steps 1 to 13 of Maintenance of Valve Internals Assembly section in this manual.
2. Grease all the sealing surfaces with PTFE spray lubricant.
3. Mount seals, bearings, and scrapers on the bonnet shaft. (For correct position, refer to applicable drawing and parts list.)

Note

For easy mounting, the O-ring needs to be pushed in (create a heart shaped form), to decrease the outer diameter. When the O-ring is in position push it back to its original shape.

4. Check if all the seals are mounted correctly (per applicable drawing and parts list) and fully in position.
5. Grease the seals with PTFE spray lubricant.

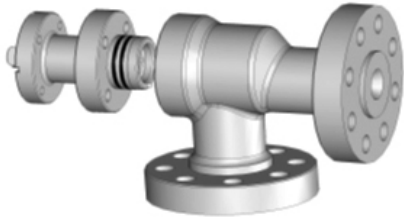
CAUTION

The seals are easily damaged. The right way to mount the seal holder is to carefully and gently push while turning it over the bonnet shaft.

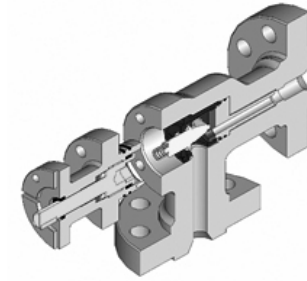
6. Mount the remaining seals around the bonnet. Then mount bearings and grease all with PTFE spray lubricant.
7. Push the bonnet shaft gently to the bonnet.
8. Place the bonnet on the body. Be sure the adjusting pin is placed in the hole of the protecting bush.
(1-inch TS bonnet has no adjusting pin.)
9. Complete steps 11 to 13 of the Maintenance of Valve Internals Assembly section in this manual.

Figure 4. Vonk Choke Valve Service Procedure

1.



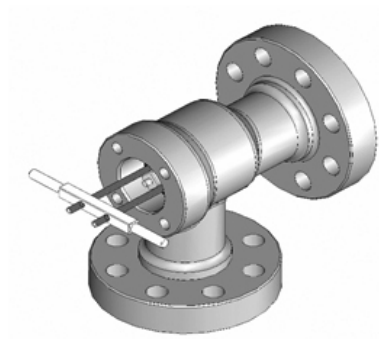
2.



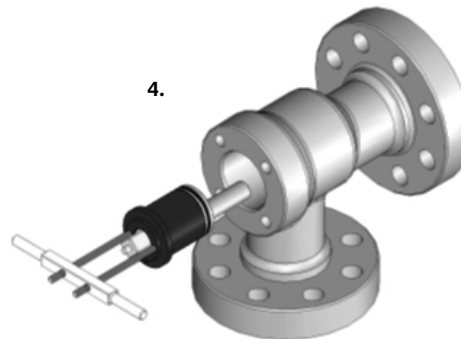
TRIM INSPECTION

1. Undo body/bonnet bolting.
2. Take off bonnet assembly.

3.



4.



TAKE OUT INTERNALS

3. Attach internal wrench tool.
4. Pull out internals.

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always mention this number when corresponding with your [Emerson sales office](#) regarding technical information or replacement parts.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Table 1. Vonk Assembly Arrangements

CHOKE TYPE	STD	STD/FE	STD/FE/FS	LT	LT/FE	LT/FE/FS	HT	HT/FE	HT/FE/FS
CHV	X	X	X	X	X	X	X	X	X
ICV	X			X					
SCV	X								
YCV	X		X	X			X		

Parts List

Note

Contact your [Emerson sales office](#) for Part Ordering information.

CHV Valve, STD (figure 5)

Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	Seal, Bean
20.40	Locking Wire
20.50	Guide Strip
20.60	Turning Fork
20.70	Protecting Bush
20.80	V-Ring
30.10	Bonnet
30.20	O-Ring, qty 2
30.30	V-Seal
30.40	Guide Strip
30.50	Spring
30.60	Bearing
30.70	Shaft
30.80	Radial Bearing, qty 2
30.90	Scraper
30.100	Wedge
30.110	Pin
30.120	Spring Sleeve
40.10	Stud Bolt, qty 4
	Nut, qty 4
40.30	Nameplate
40.40	Rivets, qty 2

CHV Valve, STD/FE (figure 6)

Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	O-Ring, Bean
20.40	Locking Wire
20.50	Guide Strip
20.60	Scraper
20.70	Turning Fork
20.80	Protecting Bush
20.90	V-Ring
30.10	Bonnet
30.20	O-Ring, qty 2
30.30	Seal
30.40	Bearing, qty 2
30.50	Spring
30.60	Bearing
30.70	Shaft
30.80	Radial Bearing, qty 2
30.90	Scraper
30.100	Wedge
30.110	Pin
30.140	Spring Sleeve
40.10	Stud Bolt, qty 4
	Nut, qty 4
40.30	Nameplate
40.40	Rivets, qty 4

CHV Valve, STD/FE/FS (figure 7)

Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	O-Ring
20.40	Locking Wire
20.50	Guide Strip
20.60	Scraper
20.70	Turning Fork
20.80	Protecting Bush
20.90	V-Ring
30.10	Bonnet
30.20	O-Ring, qty 2
30.30	Seal
30.40	Guide Strip
30.50	Spring
30.60	Bearing Ring
30.70	Shaft
30.80	Bearing
30.90	Scraper
30.100	Wedge
30.110	Pin
30.120	Bonnet Bush
30.130	O-Ring, qty 2
30.140	Spring Sleeve
30.150	Gland
30.160	Stem Packing, qty 3
30.170	Body Packing
30.180	Hex Screw, qty 6
40.10	Stud Bolt, qty 4
	Nut, qty 4
40.30	Nameplate
40.40	Rivets, qty 2
40.50	Bean Packing

CHV Valve, LT (figure 8)

Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	Seal
20.40	Locking Wire
20.50	Guide Strip
20.60	Turning Fork
20.70	Protecting Bush
20.80	V-Ring
30.10	Bonnet
30.20	Seal
30.30	Seal
30.40	Guide Strip
30.50	Spring
30.60	Bearing
30.70	Shaft
30.80	Radial Bearing
30.90	Scraper
30.100	Wedge
30.110	Pin
30.120	Support Ring
40.10	Stud Bolt, qty 4
	Nut, qty 4
40.20	Nameplate
40.30	Rivets, qty 2

CHV Valve, LT/FE (figure 9)

Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	Seal, Bean
20.40	Locking Wire
20.50	Bearing
20.60	Turning Fork
20.70	Protecting Bush
20.80	V-Ring
30.10	Bonnet
30.20	Seal
30.30	Seal
30.40	Bearing
30.50	Spring
30.60	Bearing
30.70	Shaft
30.80	Bearing
30.90	Scraper
30.100	Shaft Key
30.110	Pin
30.120	Bearing Holder
30.130	Spring Sleeve
40.10	Stud Bolt, qty 4
	Nut, qty 4
40.20	Nameplate
40.30	Rivets, qty 2

CHV Valve, LT/FE/FS (figure 10)

Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	Seal, Bean
20.40	Locking Wire
20.50	Bearing
20.60	Turning Fork
20.70	Protecting Bush
20.80	V-Ring
30.10	Bonnet
30.20	Seal
30.30	Seal
30.40	Bearing
30.50	Spring
30.59	Ring
30.60	Bearing Ring
30.61	Ring
30.70	Shaft
30.80	Bearing
30.100	Shaft Key
30.110	Pin
30.120	Gland
30.130	Spring Sleeve
30.140	Body Packing
30.150	Hex Screw, qty 6
30.160	Stem Packing, qty 4
40.10	Stud Bolt, qty 4
	Nut, qty 4
40.20	Nameplate
40.30	Rivets, qty 2
40.50	Bean Packing, qty 2

CHV Valve, HT (figure 11)

Key	Description
1	Body
10	Bean
20	Front Disk
31	Seal, Bean
32	Locking Wire
33	Bearing
35	Turning Fork
36	Protecting Bush
37	V-Ring
50	Bonnet
51	Seal
52	Seal, Back Up
53	Bearing
54	Spring
55	Bearing
56	Shaft
57	Radial Bearing
58	Protecting Ring
59	Wedge
60	Pin
61	O-Ring
63	Bearing Holder
80	Stud Bolt, qty 8
81	Nut, qty 8
82	Nameplate
84	Rivets, qty 2

CHV Valve, HT/FE (figure 12)

Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	Seal, Bean
20.40	Locking Wire
20.50	Bearing
20.60	Turning Fork
20.70	Protecting Bush
20.80	V-Ring
30.10	Bonnet
30.20	Seal
30.30	Seal
30.40	Bearing
30.50	Spring
30.60	Bearing
30.70	Shaft
30.80	Bearing
30.90	Protection Ring
30.100	Shaft Key
30.110	Pin
30.120	O-Ring
30.130	Bearing Holder
30.140	Spring Bush
40.10	Stud Bolt, qty 4
	Nut, qty 4
40.30	Nameplate
40.40	Rivets, qty 2

CHV Valve, HT/FE/FS (figure 13)

Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	Seal
20.40	Locking Wire
20.50	Bearing
20.60	Turning Fork
20.70	Protecting Bush
20.80	V-Ring
30.10	Bonnet
30.20	Seal
30.30	Seal
30.40	Bearing
30.50	Spring
30.59	Ring
30.60	Bearing Ring
30.61	Ring
30.70	Shaft
30.80	Bearing
30.100	Shaft Key
30.110	Pin
30.120	Gland
30.130	Spring Sleeve
30.140	Body Packing
30.150	Hex Screw, qty 6
30.160	Stem Packing, qty 4
40.10	Stud Bolt, qty 4
	Nut, qty 4
40.20	Nameplate
40.30	Rivets, qty 2
40.50	Bean Packing, qty 2

YCV Valve, STD (figure 14)

Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	Seal, Bean
20.40	Locking Wire
20.50	Bearing
20.60	Turning Fork
20.70	Protecting Bush
20.80	V-Ring
30.10	Bonnet
30.20	O-Ring
30.30	Seal
30.40	Bearing
30.50	Spring
30.60	Bearing
30.70	Shaft
30.80	Radial Bearing
30.90	Scraper
30.100	Shaft Key
30.110	Pin
30.120	Bearing Holder
30.130	Spring Bush
40.10	Stud Bolt, qty 4
	Nut, qty 4
40.30	Nameplate
40.40	Rivets, qty 2

YCV Valve, STD/FE (figure 15)

Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	Seal, Bean
20.40	Locking Wire
20.50	Guide Strip
20.60	Scraper
20.70	Turning Fork
20.80	Protecting Bush
20.90	V-Ring
30.10	Bonnet
30.20	O-Ring, qty 2
30.30	Seal
30.40	Guide Strip, qty 2
30.50	Spring
30.60	Bearing
30.70	Shaft
30.80	Radial Bearing, qty 2
30.90	Scraper
30.100	Wedge
30.110	Pin
30.120	Bonnet Bush
30.130	O-Ring, qty 2
30.140	Spring Sleeve
40.10	Stud Bolt, qty 2
	Nut, qty 6
40.30	Nameplate
40.40	Rivets, qty 2

YCV Valve, STD/FE/FS (figure 16)

Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	Seal, Bean
20.40	Locking Wire
20.50	Guide Strip
20.60	Scraper
20.70	Turning Fork
20.80	Protecting Bush
20.90	V-Ring
30.10	Bonnet
30.20	O-Ring, qty 2
30.30	Seal
30.40	Guide Strip, qty 2
30.50	Spring
30.60	Bearing
30.70	Shaft
30.80	Radical Bearing, qty 2
30.90	Scraper
30.100	Wedge
30.110	Pin
30.120	Bonnet Bush
30.130	O-Ring, qty 2
30.140	Spring Sleeve
30.150	Gland
30.160	Stem Packing, qty 3
30.170	Body Packing
30.180	Hex Screw, qty 6
40.10	Stud Bolt, qty 4
	Nut, qty 4

Key	Description
40.30	Nameplate
40.40	Rivets, qty 2
40.50	Bean Packing

YCV Valve, LT/FE (figure 17)

Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	Seal, Bean
20.40	Locking Wire
20.50	Bearing
20.60	Turning Fork
20.70	Protecting Bush
20.80	V-Ring
20.90	Dowel Pin
30.10	Bonnet
30.20	Seal
30.30	Seal
30.40	Bearing
30.50	Spring
30.60	Bearing
30.70	Shaft
30.80	Bearing
30.90	Scraper
30.100	Shaft Key
30.110	Pin
30.120	Bushing Holder
30.130	Spring Bush
40.10	Stud Bolt, qty 4
	Nut, qty 4
40.30	Nameplate
40.40	Rivets, qty 2

YCV Valve, HT (figure 18)

Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	Seal, Bean
20.40	Locking Wire
20.50	Bearing
20.60	Turning Fork
20.70	Protecting Bush
20.80	V-Ring
20.90	Dowel Pin
30.10	Bonnet
30.20	Seal
30.30	Seal
30.40	Bearing
30.50	Spring
30.60	Bearing
30.70	Shaft
30.80	Radial Bearing
30.90	Protecting Ring
30.100	Shaft Key
30.110	Dowel Pin
30.120	O-Ring
30.130	Bearing Holder
40.10	Stud Bolt, qty 4
	Nut, qty 4
40.30	Nameplate
40.40	Rivets, qty 2

ICV Valve, STD (figure 19)

Key	Description
10.10	Inlet Flange
10.20	Outlet Flange
20.10	O-Ring
20.20	O-Ring, qty 3
20.30	Back Disk
20.40	Rotating Shaft
20.45	Back-up Ring, qty 2
20.50	Spring
20.60	O-Ring, qty 4
20.70	Bearing
20.80	Front Disk
20.90	Spring Bush
30.10	Wedge
30.20	Stud Bolt, qty 6
	Nut, qty 6
30.40	Nameplate
30.50	Rivets, qty 4
30.60	Protecting Ring
30.70	Grease Cap
30.80	Outlet Nameplate

ICV Valve, LT (figure 20)

Key	Description
10.10	Inlet Flange
10.20	Outlet Flange
20.10	V-Seal
20.20	Rotating Shaft
20.40	Locking Wire
20.50	Pin
20.90	Spring Bush
20.100	Spring
20.110	Guide Bearing, qty 2
20.120	Seal, qty 2
20.130	O-Ring
20.140	Front Disk
20.170	Bean
20.180	Rotating Shaft
30.10	Wedge
30.20	Stud Bolt, qty 6
	Nut, qty 6
30.40	Nameplate
30.50	Rivets, qty 4
30.60	Protecting Ring
30.70	Outlet Nameplate

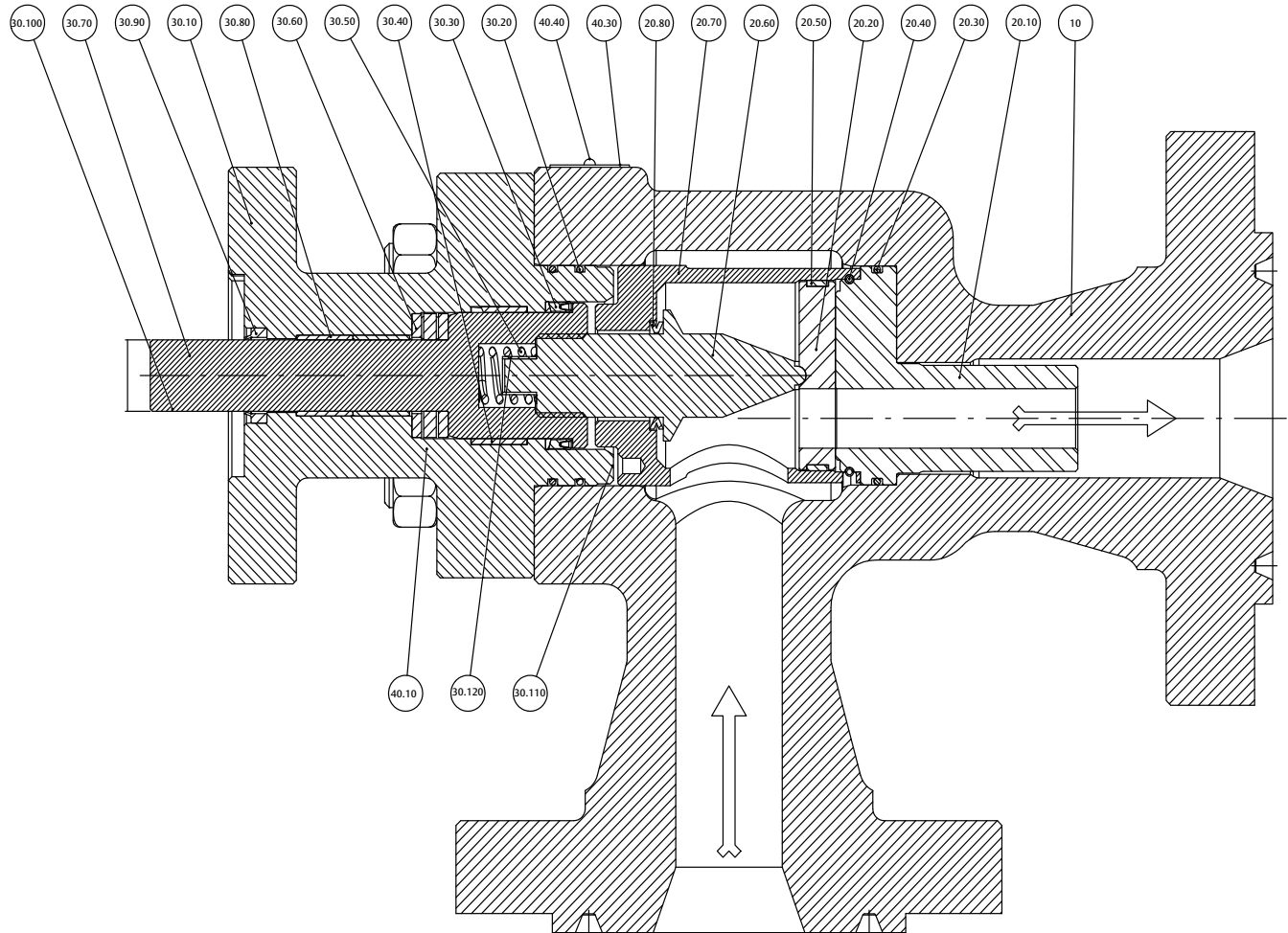
ICV Valve, HT (figure 21)

Key	Description
1	Inlet Flange
2	Outlet Flange
6	Seal
7	Seal
9	Bean
11	Pin
12	Handle Part, Rotating Shaft
13	Front Disk, Rotating Shaft
14	Spring Bush
15	Spring
16	Guide Bearing, qty 2
17	Seal, qty 2
18	O-Ring
19	Front Disk
20	Locking Wire, Rotating Shaft
22	Wedge
23	Stud Bolt, qty 6
24	Nut, qty 6
26	Nameplate
27	Rivets, qty 4
28	Protecting Ring
30	Outlet Nameplate
40	Rotating Shaft, Handle
41	Nut, qty 3
42	Fork, qty 2
43	Set-Screw, qty 2
44	Set-Screw
45	Eye-Bolt, Right
46	Eye-Bolt, Left
47	Nut
48	Shaft
49	Actuator Handle
50	Washer
51	Bolt
55	Mounting Plate
56	Pin
57	Retaining Ring
58	Bearing Ring
59	Coupling Shaft
60	Bolt, qty 2
61	Washer, qty 2
62	Bolt, qty 4
63	Washer, qty 4

SCV Valve, STD (figure 22)

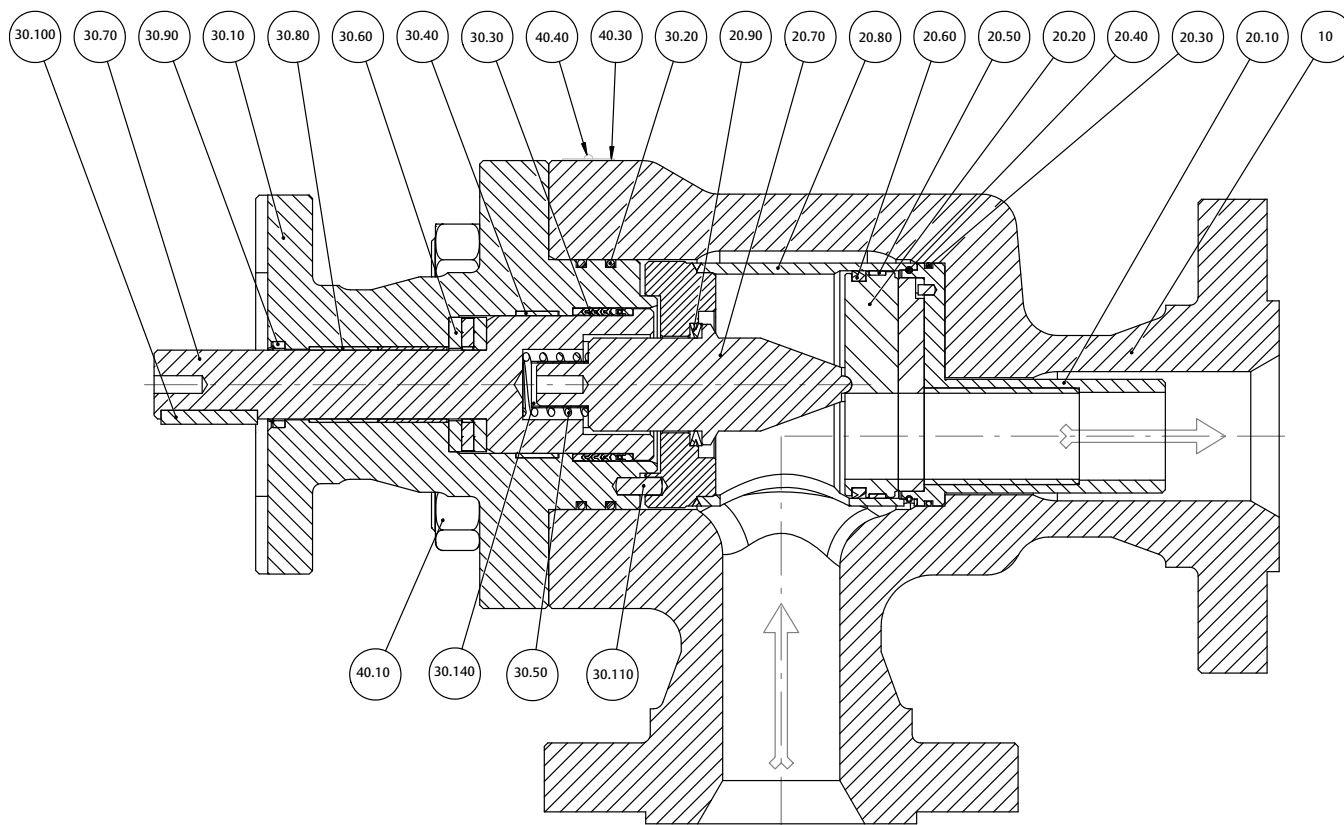
Key	Description
10	Body
20.10	Bean
20.20	Front Disk
20.30	O-Ring, Bean
20.40	Locking Wire
20.50	Bearing
20.60	Turning Fork
20.70	Protecting Bush
20.80	V-Ring
30.10	Bonnet
30.20	O-Ring
30.30	Lip Seal
30.40	Bearing
30.50	Spring
30.60	Bearing
30.70	Shaft
30.80	Bearing
30.90	Scraper
30.100	Shaft Key
30.110	Pin
30.130	Spring Bush
40.10	Stud Bolt, qty 6
	Nut, qty 6
40.30	Nameplate
40.40	Rivets, qty 2

Figure 5. Vonk CHV Valve, STD



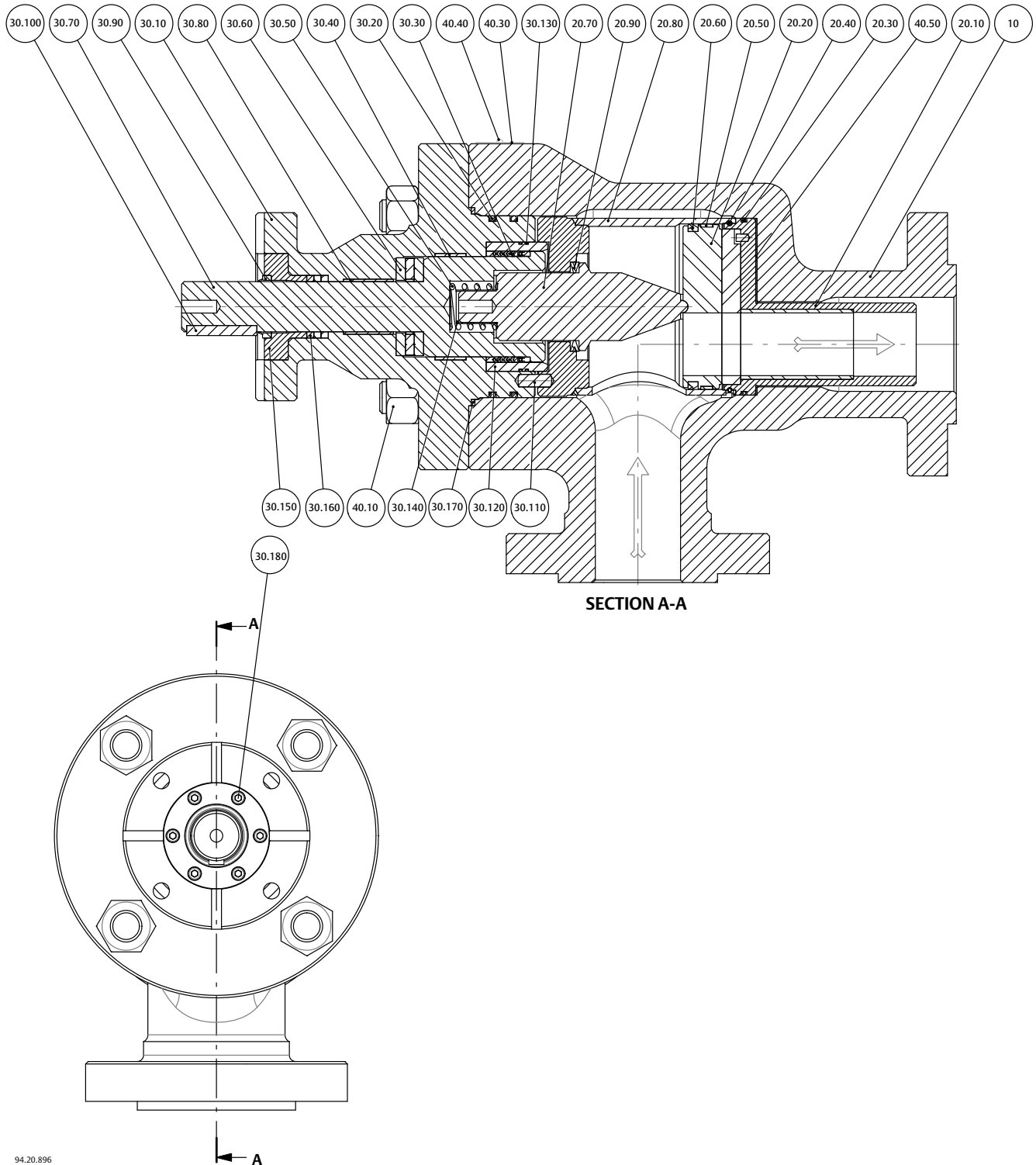
94.10.360

Figure 6. Vonk CHV Valve, STD/FE



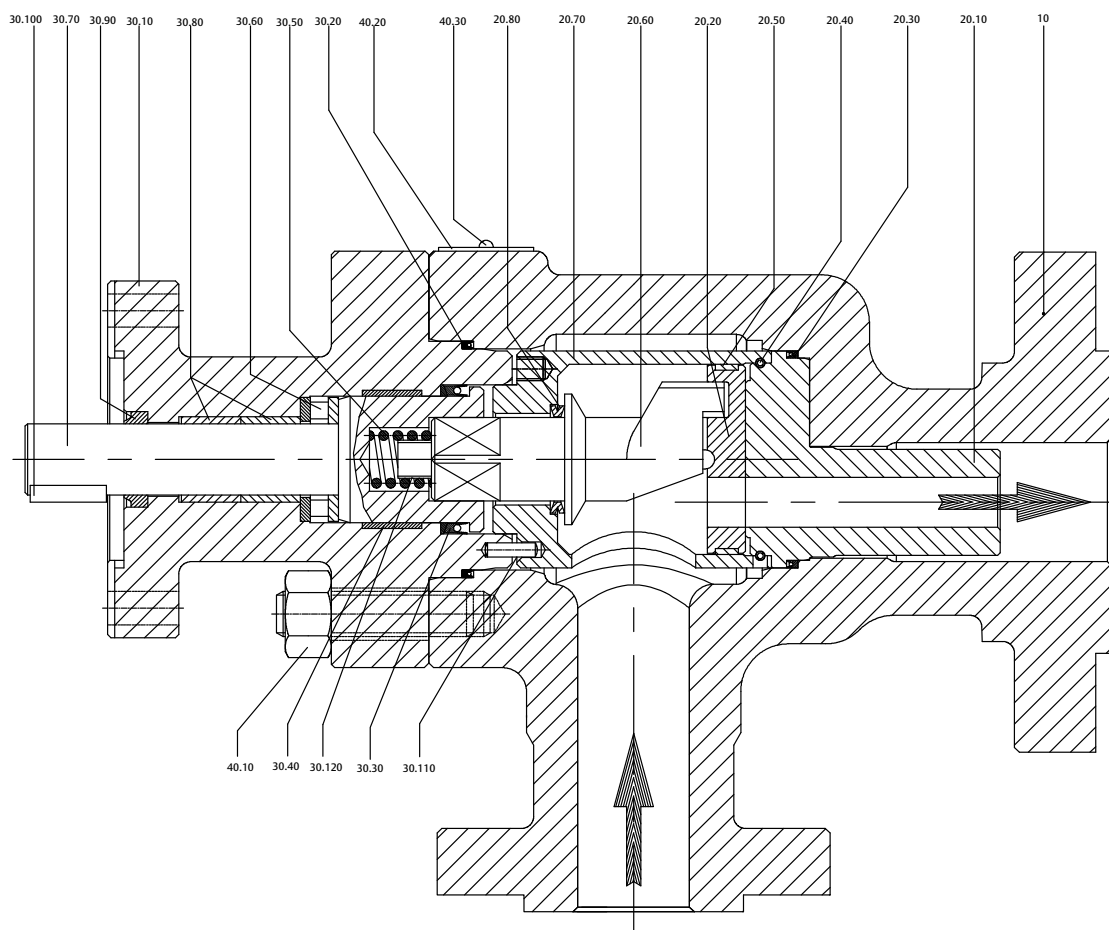
94.10.884

Figure 7. Vonk CHV Valve, STD/FE/FS



94.20.896

Figure 8. Vonk CHV Valve, LT



94.10.904

Figure 9. Vonk CHV Valve, LT/FE

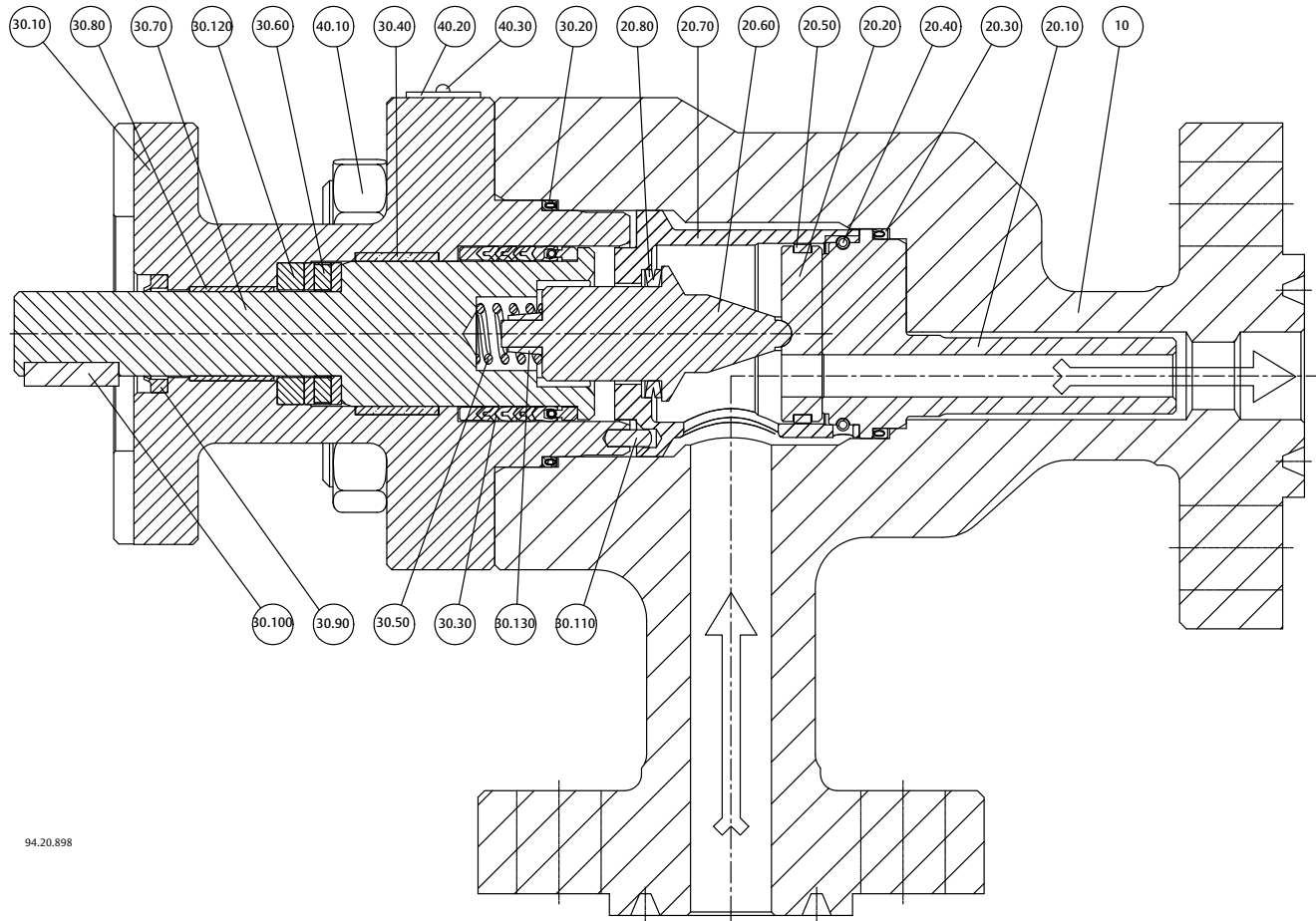


Figure 10. Vonk CHV Valve, LT/FE/FS

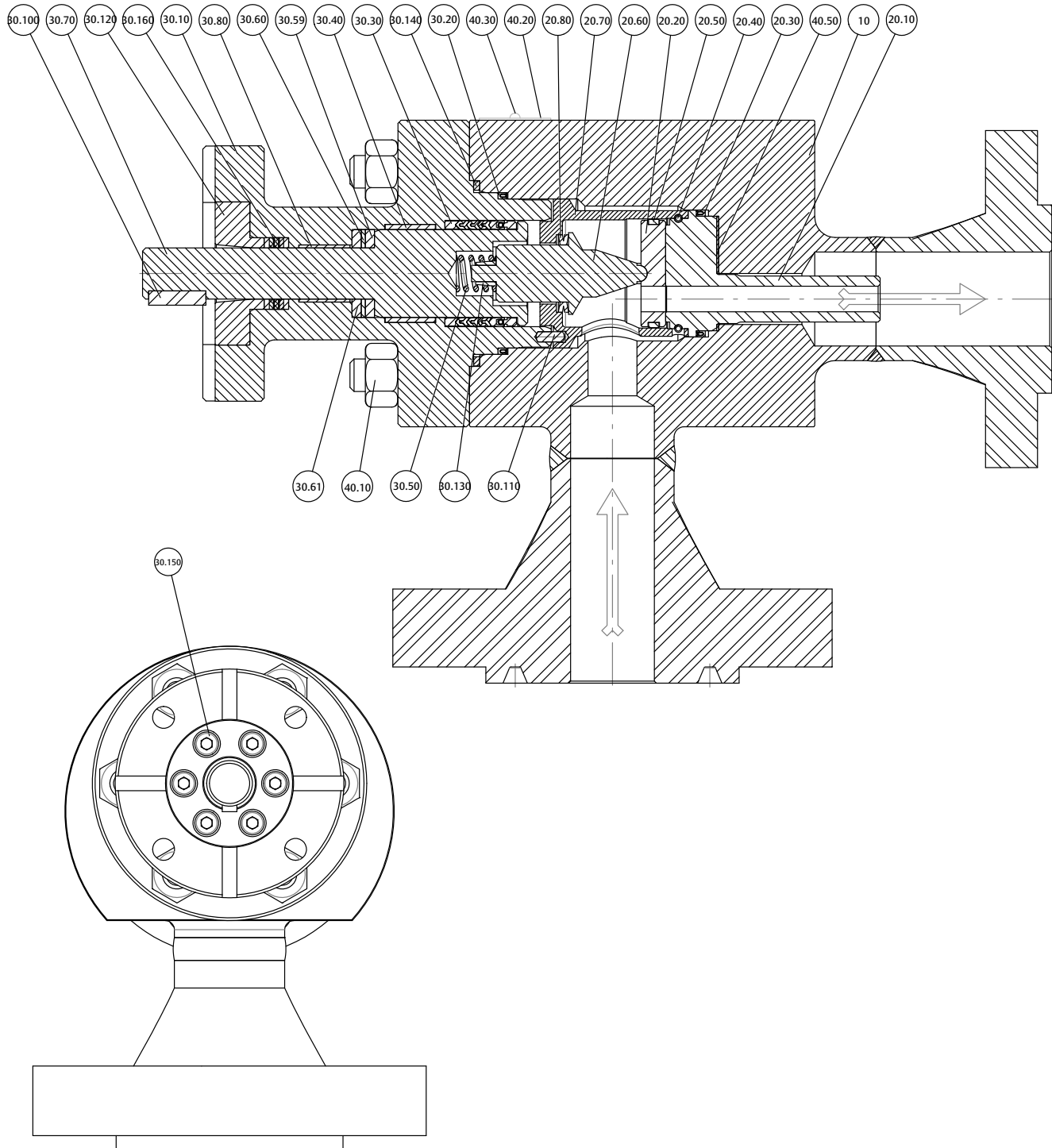
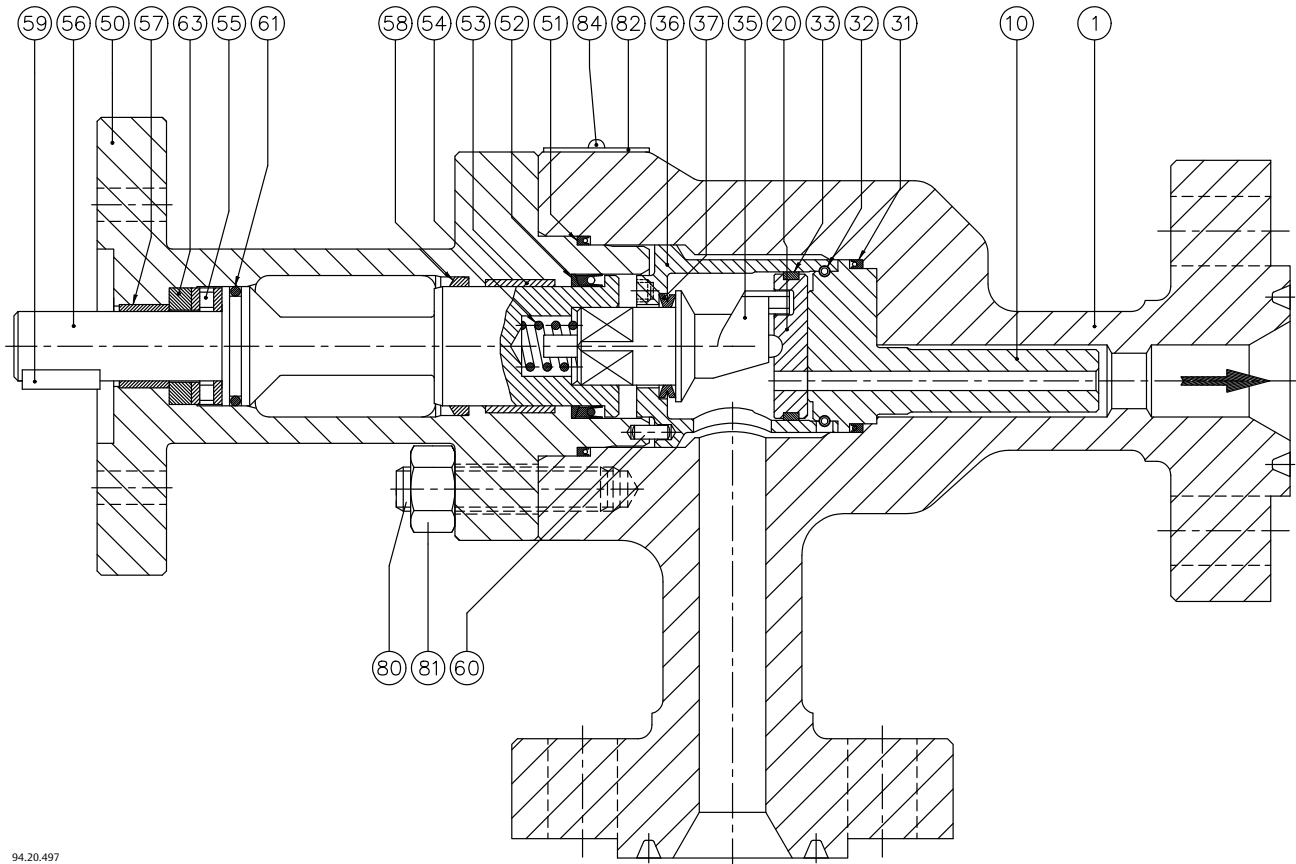
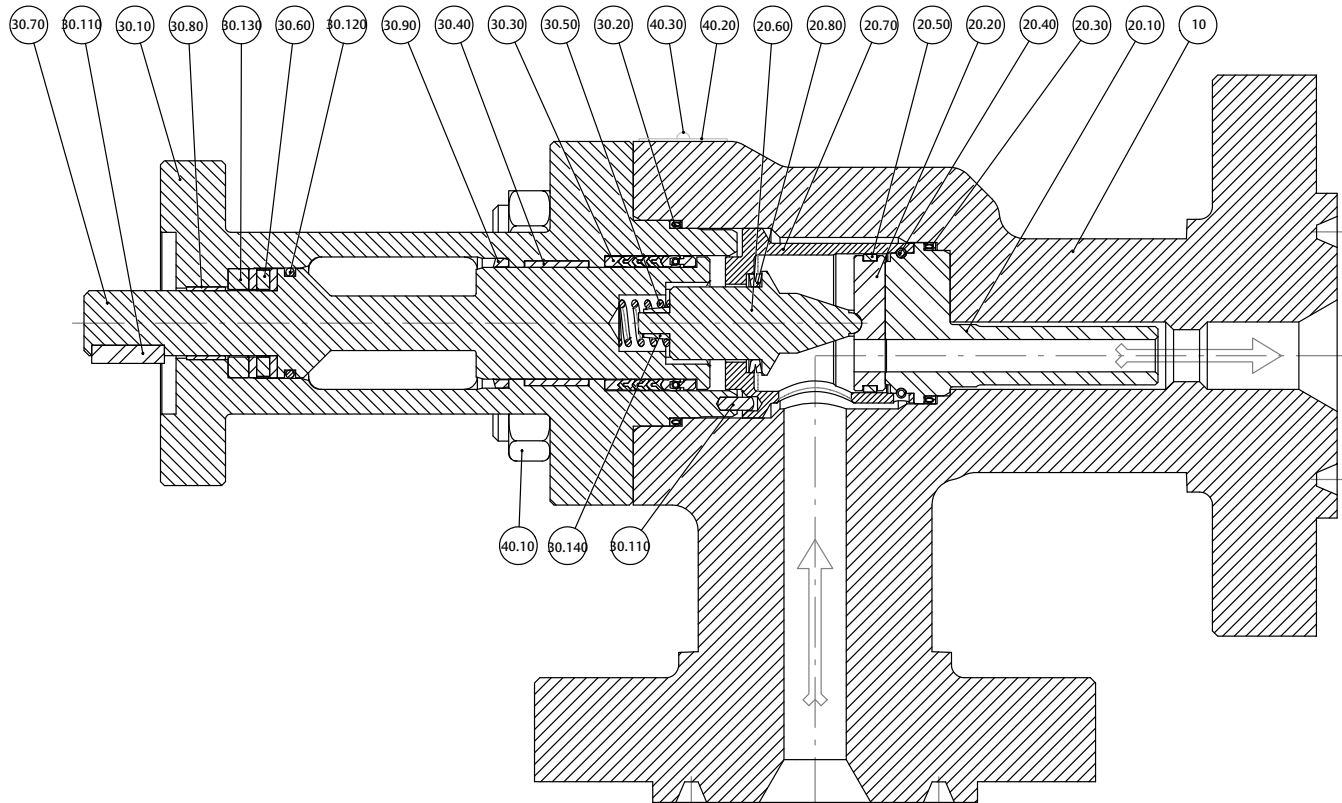


Figure 11. Vonk CHV Valve, HT



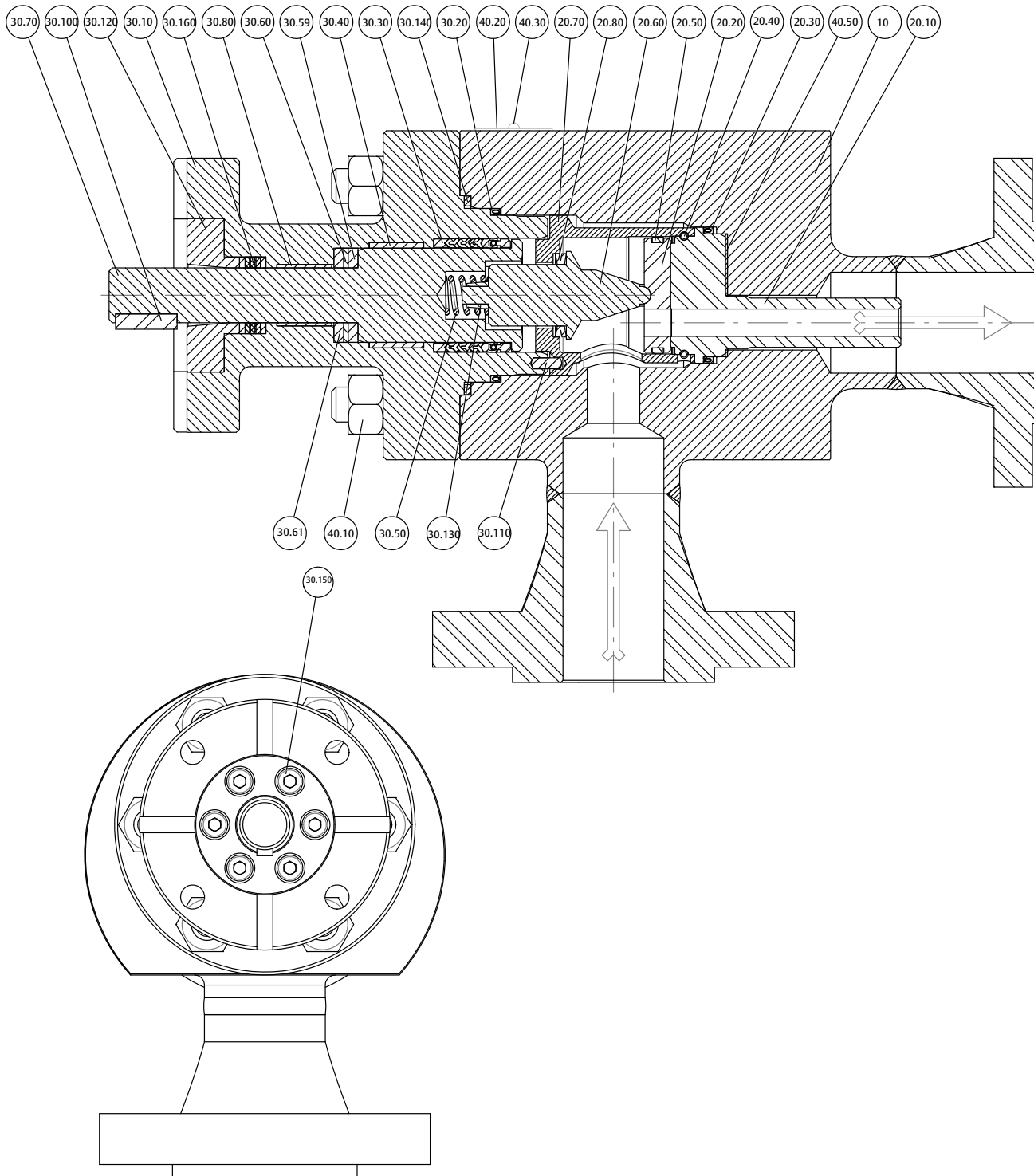
94.20.497

Figure 12. Vonk CHV Valve, HT/FE



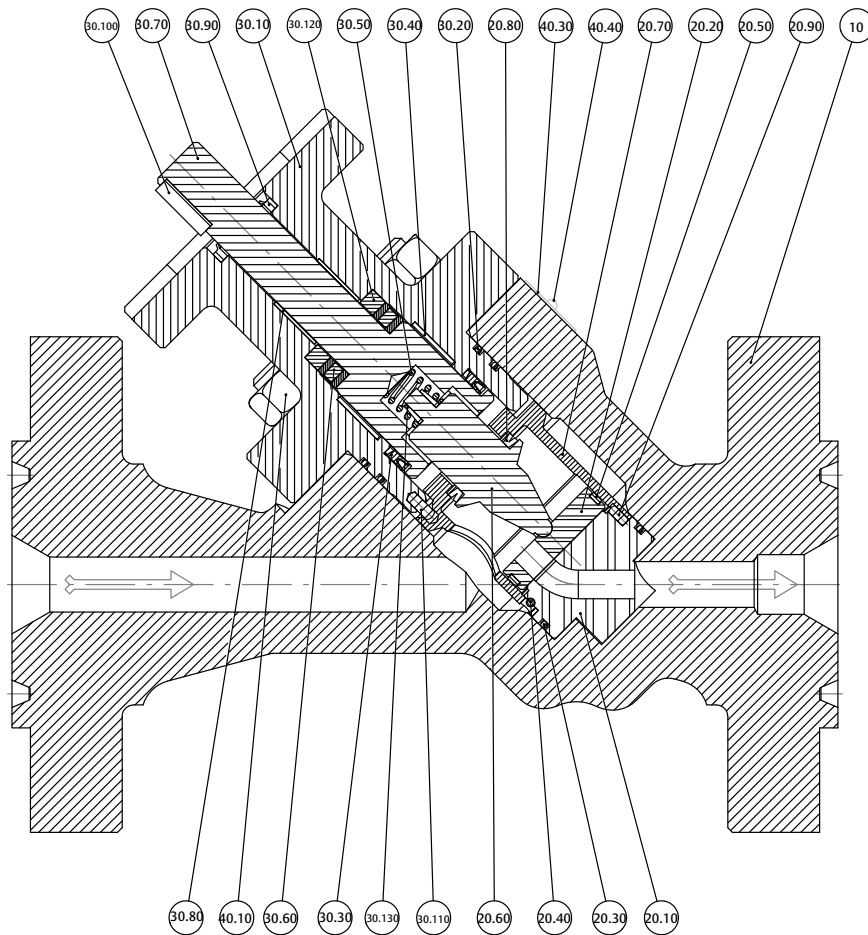
94.20.875

Figure 13. Vonk CHV Valve, HT/FE/FS



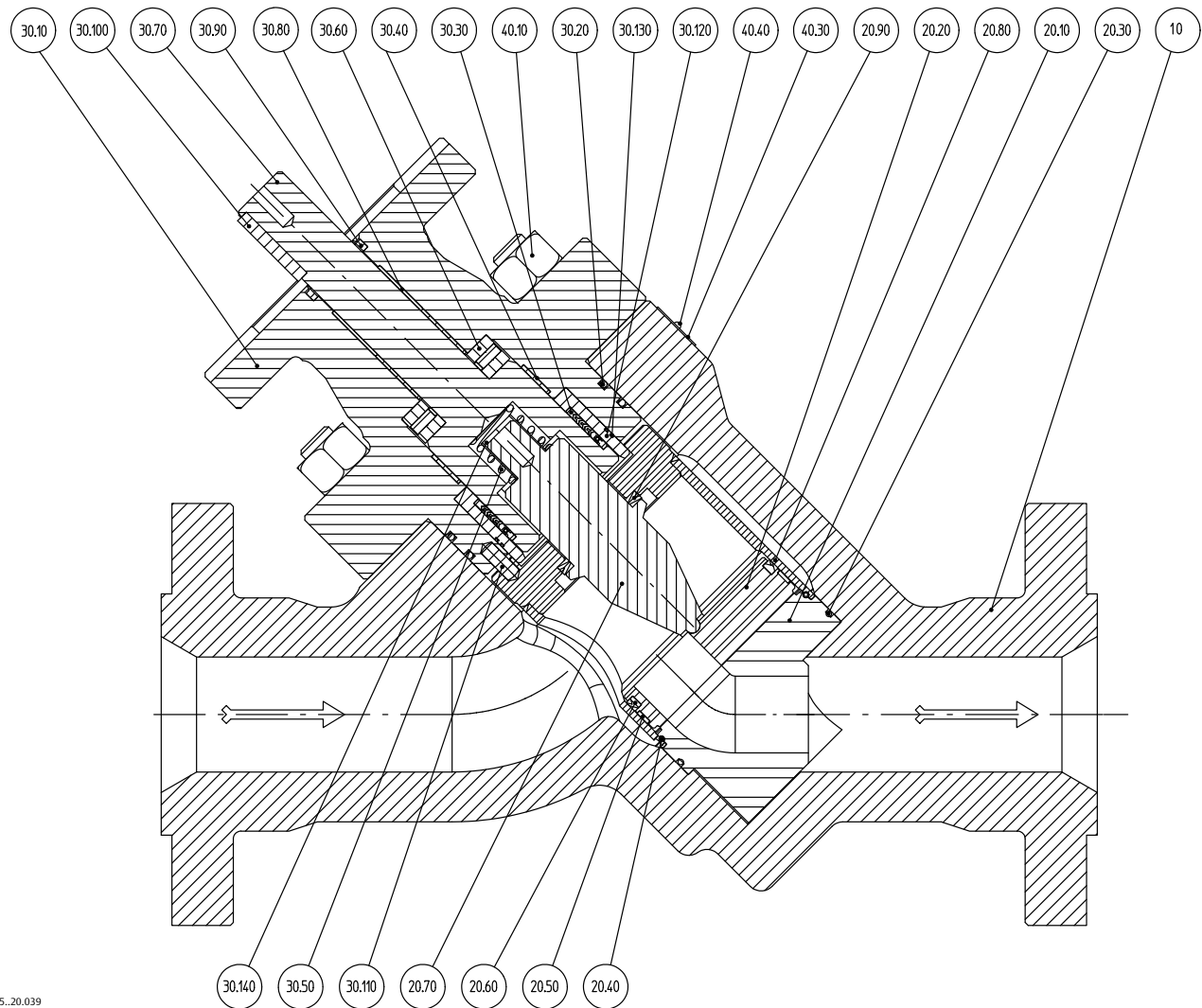
94.10.891

Figure 14. Vonk YCV Valve, STD



95.20.028

Figure 15. Vonk YCV Valve, STD/FE



95...20.039

Figure 16. Vonk YCV Valve, STD/FE/FS

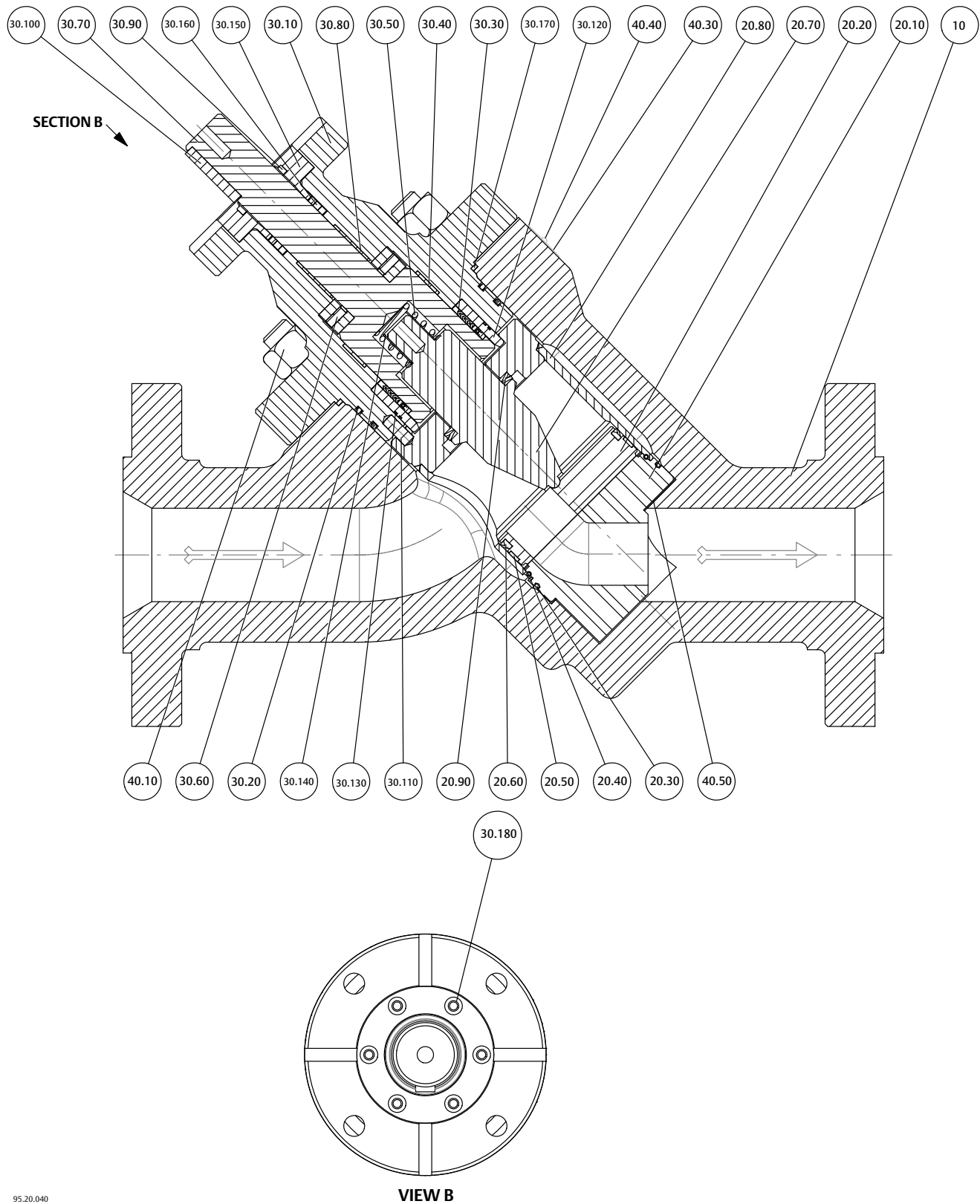


Figure 17. Vonk YCV Valve, LT/FE

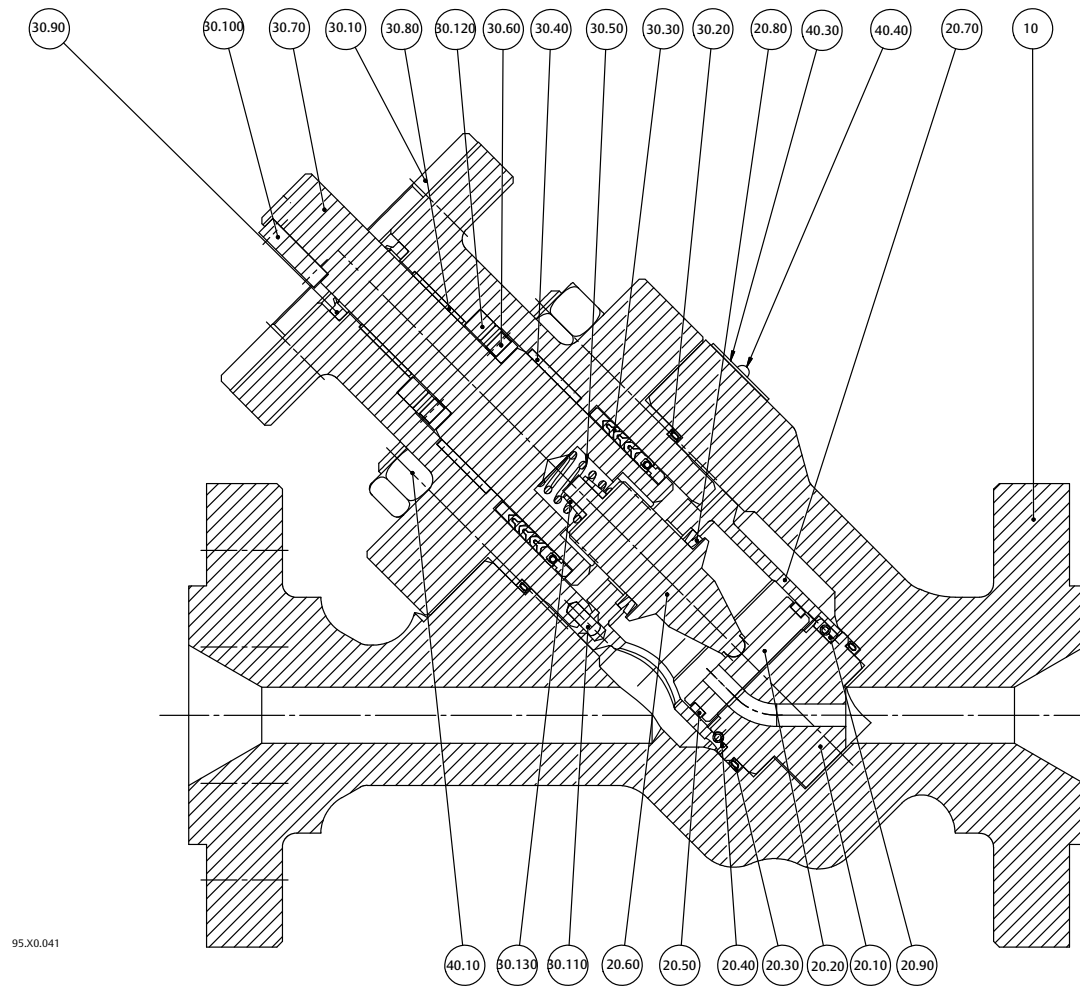
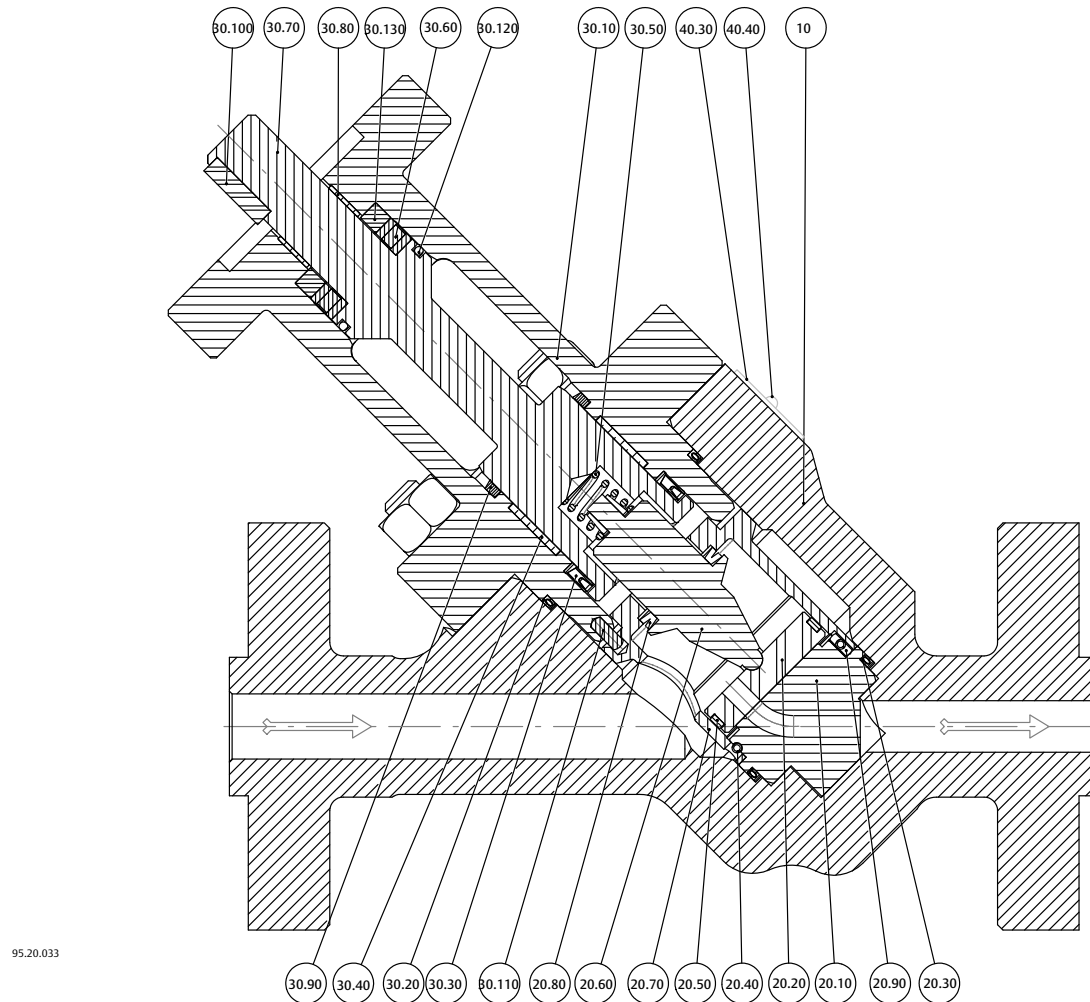


Figure 18. Vonk YCV Valve, HT



95.20.033

Vonk Choke Valves

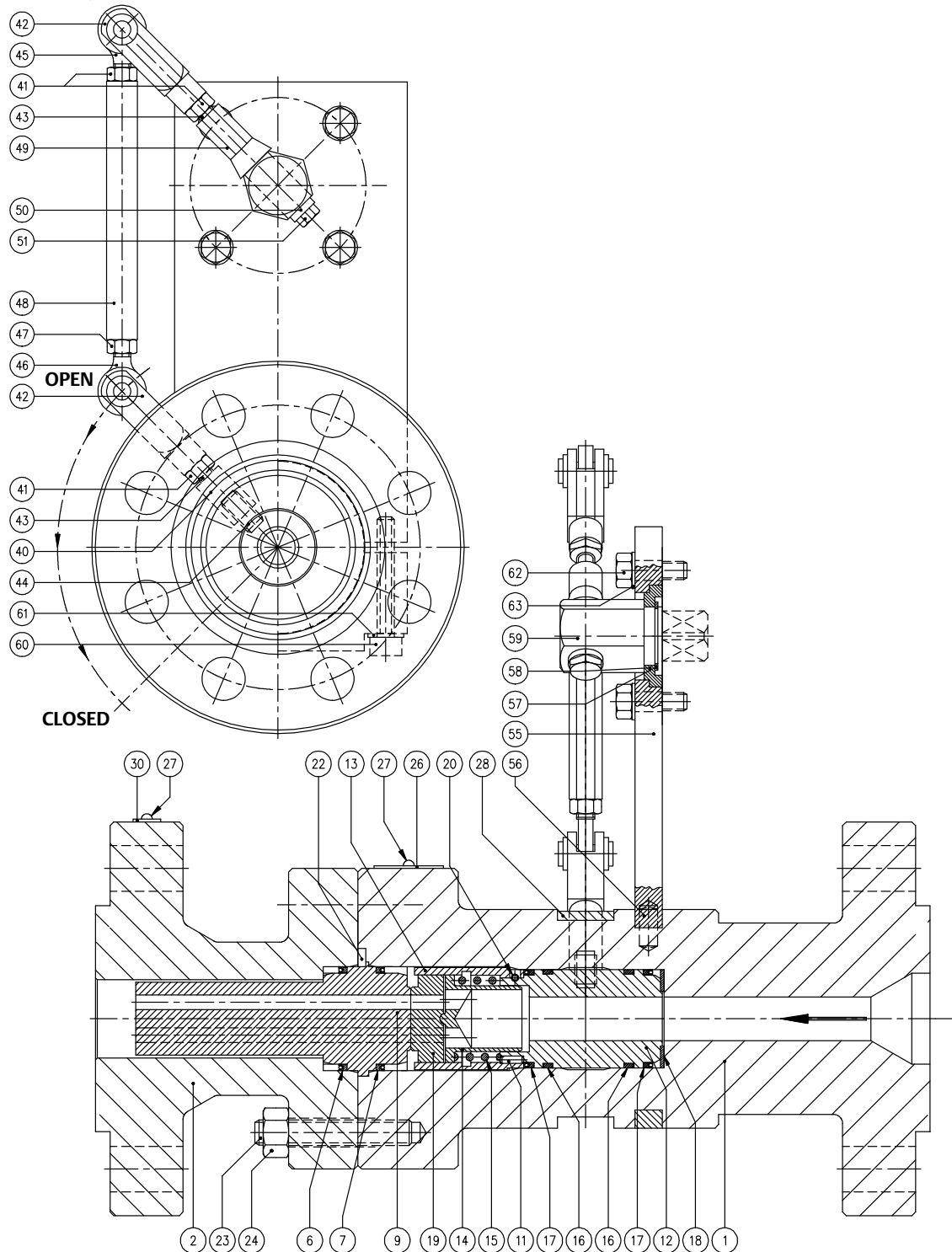
September 2019

Technical drawing of a mechanical assembly, showing a cross-section (SECTION A-A) and a top view.

SECTION A-A: This view shows the internal components of the assembly. The central shaft is labeled with a dimension of 10.20. The housing is shown with a cross-hatched pattern. The shaft is supported by bearings, and the dimensions for the bearing inner diameters are 30.20, 30.70, 20.10, 30.50, 30.40, 20.90, 20.40, 20.120, 20.110, and 20.130. The shaft diameter is 10. The dimensions for the housing bore are 20.170, 20.140, 20.100, 20.20, 20.50, 20.180, and 30.60. The section line A-A is indicated by a vertical line with arrows pointing to the right.

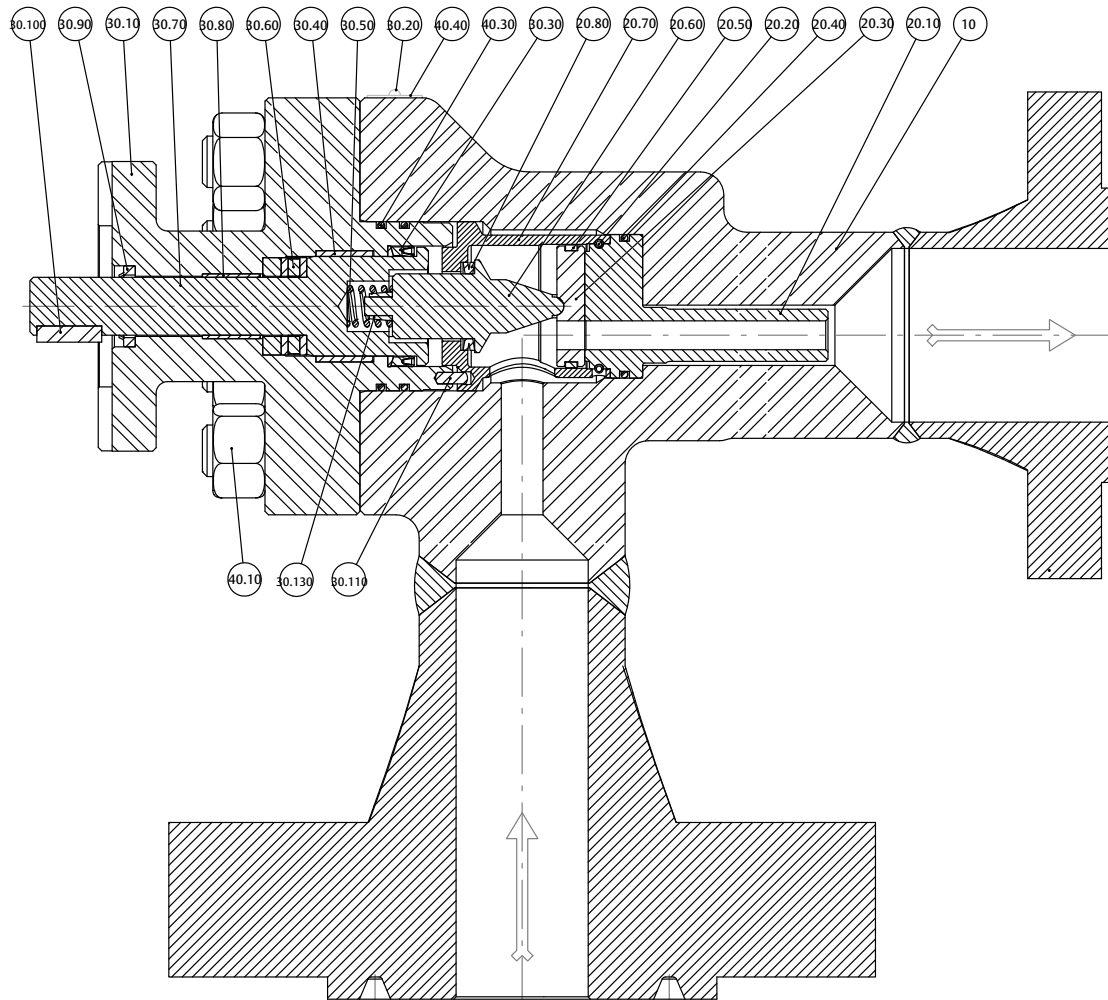
Top View: This view shows the circular profile of the housing. The outer diameter is 30.10. The inner bore is shown with a cross-hatched pattern. The top view includes four mounting holes, each with a diameter of 10. The section line A-A is indicated by a vertical line with arrows pointing to the right.

Figure 21. Vonk ICV Valve, HT



91.20.221

Figure 22. Vonk SCV Valve, STD



10.1A.000

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Vonk Choke Valves

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