Fisher™ SS-264 Rotary Control Ball Valve

Contents

Figure 1. Fisher SS-264 Valve with Bettis™ NG4020-SR3 Actuator and 3610J Positioner

09AA03200

Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for the Fisher SS-264 rotary control valve (see figure 1). It also outlines the assembly and testing procedures for the CL1725 SS-264 rotary ball valve designed for use with the Bettis NG4020-SR3 rotary actuator.

The SS-264 valve is the passive residual heat removal valve for use in third generation PWR Nuclear Generating Stations. The valve body has NPS 14 (AP1000, CAP1000) or NPS 16 (CAP1400) butt weld ends with a cammed ball operating against a one-piece metal seal.

Features include the following:

- Cammed, segmented ball with hard faced seat band manufactured from forged bar.
- Fisher involute spline connection for ball/shaft and a keyed connection which is used for the Bettis actuator connection.
- Tight tolerances and heavily loaded ball/seal interface.

Table 1. Specifications

Valve Sizes and End Connection Styles SS-264: NPS 14 and NPS 16 valve with Schedule 160 butt weld ends **Standard Flow Direction** Forward (into the convex face of the ball) **Actuator Mounting** Counterclockwise to open	**Maximum Ball Rotation** Standard: Ball rotates clockwise to close when viewed from the top of the valve Ball rotation is 90 degrees **Valve/Actuator Action** Clockwise to close on air stroke, counterclockwise to open on spring stroke. See actuator manual for details

1. The pressure/temperature limits in this manual, and any applicable code or standard limitation, should not be exceeded.

- Emerson Automation Solutions designed live-loaded packing with positive stop screws controlling Belleville spring deflection.
- The zero positioning of the ball is achieved by torque seating.

Do not install, operate, or maintain an SS-264 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your Emerson sales office or Local Business Partner before proceeding.

Description

The SS-264 ball valve (figure 1) is used in throttling or on-off service. The SS-264 valve is an NPS 14 (AP1000, CAP1000) or NPS 16 (CAP1400) schedule 160 buttweld construction, per customer specified weld end configuration requirements. The keyed valve shaft of this valve connects to a Bettis spring-return actuator.

Specifications

Specifications for these valves are shown in table 1.

Educational Services

For information on available courses contact:

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

Principle of Operation

The ball and machined body combine to create smooth transitioning flow geometry which enables efficient flow through the valve. The drive shaft and follower shaft center the ball in the flow stream to minimize dynamic torque and permit easy ball rotation.

The ball rotates counterclockwise out of the seal to a standard open rotation of 90 degrees. The ball is cammed into the seal to create an effective seal. The drive linkage between the ball and shaft has been designed for minimal lost motion using a “spline connection” on the shaft and ball.

Table 2. Recommended Bolting Torques

Description, Key Number	Size	Wrench Size	N • m	lbf • ft
Seat ring to Body - Sckt Hd Cap Screw, 28	1/2-13	3/8 Allen	92	68
Body to Bonnet - Hex Nut, 117	2 1/2-8	3 3/4	10970	8090
Bonnet to Actuator - Hex Hd Cap Screw, 3	3/4-10	1 1/4	271	200
Washer to Drive Shaft - Hex Hd Cap Screw, 31	5/8-11	15/16	163	120
Travel stop hex nut,	1 1/8-8	1 1/2	136	100
Go Switch/Positioner Mounting				
Go Switch Bracket to Actuator - Hex Hd Cap Screw	1/2-13	3/4	92	68
Namur Disc to Actuator - Sckt Hd Cap Screw	M6	4mm	10.2	90 in • b
Trip Arm Bracket to Namur Disc - Sckt Hd Cap Screw	M6	5mm	10.2	90 in • lb
Target Magnet to Trip Arm Bracket - Hex Nut	7/16-20	11/16	47	35
Go Switch to Go Switch Bracket- Hex Nut	5/8-18	15/16	47	35
Standoff - Pan Hd Mach Phillip Screw	6-32	Phillips	1.9	17 in • b
Travel Ind. Scale - Pan Hd Mach Phillip Screw	6-32	Phillips	1.9	17 in • lb
Positioner - Sckt Hd Cap Screws	5/16-18	5/16	23	17
546/67CFSR Mounting				
546 Bracket to Actuator - Hex Hd Cap Screw	1/2-13	3/4	92	68
546 to Bracket - Hex Hd Cap Screw	5/16-18	1/2	23	17
67CFSR to Bracket - Hex Hd Cap Screw	5/16-18	1/2	23	17
Solenoid/2625 Booster Mounting				
2625 Bracket to Actuator - Hex Hd Cap Screw	1/2-13	3/4	92	68
2625 V-blocks to Bracket - Hex Hd Cap Screw	5/16-18	1/2	23	17
Solenoid to Bracket - Hex Hd Cap Screw	5/16-18	1/2	23	17

Installation

Key numbers in installation procedures are shown in figure 18 unless otherwise indicated.

⚠ WARNING

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

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed either the valve body rating or the mating pipe flange joint rating. To avoid such injury or damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media. If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. To avoid possible personal injury and because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson sales office or Local Business Partner.

⚠ WARNING

The valve drive shaft is not necessarily grounded to the pipeline when installed. Personal injury or property damage could result from an explosion caused by a discharge of static electricity from valve components if the process fluid or the atmosphere around the valve is flammable. If the atmosphere around the valve or the process fluid is flammable, electrically bond the drive shaft to the valve.

Note

Standard graphite packing is composed of all conductive graphite ribbon packing. Alternate shaft-to-valve body bonding is available for hazardous service areas where the standard packing is not sufficient to bond the shaft to the valve.

1. If the valve is to be stored before installation, protect the buttweld ends and keep the valve body cavity dry and free of foreign material.
2. The valve is normally shipped as part of a control valve assembly, with an actuator mounted on the valve. If the valve and actuator have been purchased separately or if the actuator has been removed, mount the actuator according to the Actuator Mounting section.
3. Standard flow direction is forward flow, spherical face of the ball is upstream.
4. Install the valve in a horizontal pipeline with the drive shaft in the vertical position.
5. The actuator is counterclockwise to open with the shaft in a vertical orientation as shown in figure 1. If necessary, refer to the appropriate actuator instruction manual for actuator installation and adjustment procedures.

CAUTION

Ensure the valve and adjacent pipelines are free of foreign material that could damage the valve seating surfaces.

6. Be certain the valve and adjacent pipelines are free of any foreign material that could damage the valve sealing surfaces.
7. Be sure the pipelines are in line with each other.
8. Use accepted pipeline piping and welding practices when installing the valve in the pipeline.
9. Connect pressure lines to the actuator.

⚠ WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

10. Verify that gap “A”, in figure 4, is closed before pressurizing the pipeline.

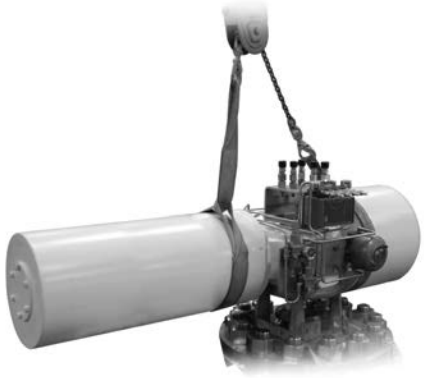
Lifting Guidelines

Figure 2. Lifting Guidelines

X0397

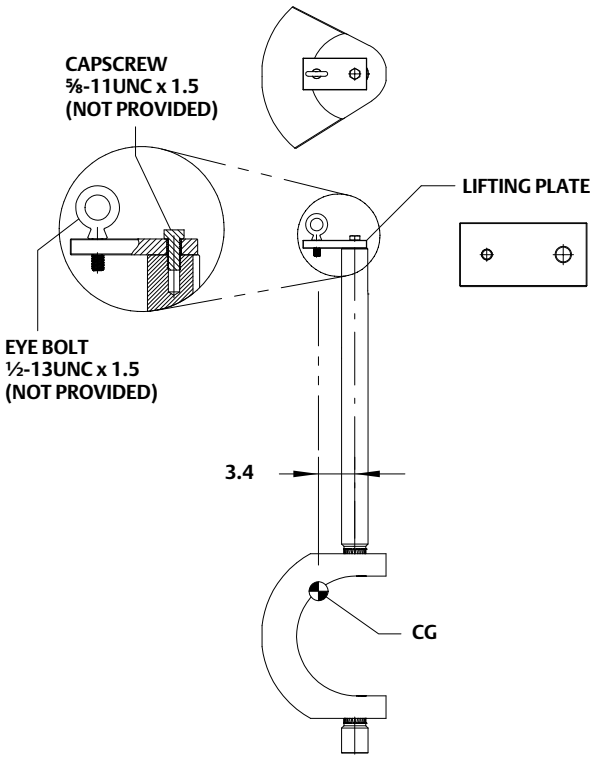
X0420

X0399



X0398

Figure 3. Lifting Guidelines (continued)



CAUTION

Care must be taken when lifting the valve/actuator assembly to ensure the accessories and tubing are not damaged in the process. The entire NPS 14 assembly with accessories weighs approximately 3656 kg (8060 lb) and the entire NPS 16 assembly with accessories weighs approximately 3597 kg (7930 lb). Make sure to use appropriate lifting straps/eyebolts/hoists capable of lifting this weight.

Lifting Valve/Actuator Assembly

To lift the assembly, insert 1-1/4-7 UNC swivel hoist rings into the four lifting hole locations on the outside diameter of the bonnet flange. The lifting point must be high enough away from the top of the accessory mountings to prevent damage to accessories or piping. The h-beam illustrated in figure 2 is adjustable axially along the pipe run in order to lift at the center of gravity (CG) of the assembly. Two adjustable length chains on one side of the valve body ensure the assembly is lifted vertically. Refer to the appropriate drawing for the CG of your assembly.

Lifting Actuator Only

⚠ WARNING

Do NOT attempt to lift the actuator while attached to the bonnet or valve body as this will damage components and could cause bodily harm.

To lift the actuator, choke two straps, one around the spring barrel and one around the air cylinder, and connect to an adjustable chain leveler. The chain leveler ensures the actuator and bonnet mating surfaces are parallel prior to removal or installation. Proper alignment of the actuator and bonnet is critical to prevent binding of the shaft and actuator. If accessories are not removed prior to lifting, use care to keep straps or chains away from piping and accessories.

Alternatively, if the four actuator lifting lugs are accessible, chains can be used to lift the actuator. Similarly, the actuator and bonnet mating surfaces must remain parallel.

Lifting Bonnet Only

To lift the bonnet, insert 1-1/4-7 UNC swivel hoist rings into the four lifting hole locations on the outside diameter of the bonnet flange. Use proper length, or adjustable chains to ensure the bonnet and valve body mating surfaces remain parallel when hoisted.

Lifting Valve Only

To lift the valve, insert two 2-1/2-8 swivel hoist rings, diametrically opposed and on opposite sides of the valve body run, into the body-to-bonnet bolt circle. An alternative to the swivel hoist rings is to use an internal thread lifting ring which can be threaded onto the existing 2-1/2-8 studs (key 10).

Lifting Ball/Shaft Assembly

To lift the ball/shaft assembly, install the lifting plate (GE48210) and 5/8-11x1.50 cap screw (not provided) as shown in figure 3. Align the lifting plate edge with the keyway groove of the shaft; this will position the lifting end of the plate over the ball. Torque the cap screw to 163 N • m (120 ft • bf). Install a 1/2-13 eye bolt into the lifting end of the plate and torque to 92 N • m (68 ft • lbf). Lift the ball/shaft assembly vertically out of the body, being careful not to damage the sealing surface of the ball.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

The open and closed travel stops of the actuator do not require adjustment unless the bonnet-to-body joint is loosened. If the actuator is removed for packing replacement, simply remount the actuator per the Actuator Mounting section of this manual. If the bonnet-to-body joint is loosened for any reason, establish the zero position per the Determining Closed Position section of this manual.

Key numbers in this procedure are shown in figure 18, unless otherwise noted.

⚠ WARNING

The ball closes with a shearing, cutting motion, which could result in personal injury. To avoid injury, keep hands, tools, and other objects away from the ball while stroking the valve.

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**

- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.**
- **The valve packing area may contain process fluids that are pressurized. Process fluids may spray out under pressure when removing the packing hardware or packing rings.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

Packing Maintenance

Key numbers in this procedure are shown in figures 15 and 18 unless otherwise noted. A detailed view of the packing is also shown in figure 4.

Refer to the Parts List section of this manual for individual parts.

If the packing is relatively new and tight on the drive shaft (key 8), and if tightening the packing nuts (key 16) does not stop leakage, it is possible that the drive shaft is worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches on the packing box wall. Inspect the drive shaft and packing box wall for nicks or scratches while performing the following procedure.

Replacing Packing

The open and closed travel stops of the actuator do not require adjustment unless the bonnet-to-body joint is loosened. If the actuator is removed for packing replacement, simply remount the actuator per the Actuator Mounting section of this manual.

Disassembly

⚠ WARNING

Observe the steps in the WARNING at the beginning of the Maintenance section.

1. Remove the actuator from the bonnet by removing the eight cap screws (key 18).
2. Remove the yoke key (key 103), coupler (key 102), and square key (key 15) from the drive shaft.
3. Loosen and remove packing nuts (key 16), packing flange (key 5), Belleville springs (key 6A), and the stop flange (key 6C).

Note

Do not loosen or adjust the stop cap screws (keys 22 or 24) on the packing flange (key 5) or the stop flange (key 6C).

⚠ WARNING

Personal injury could result from packing leakage. Do not scratch the drive shaft or packing box wall while removing packing parts in the following procedure.

4. Use packing removal tools to pull the packing set (key 11) out of the bonnet (key 7).
5. Carefully clean the drive shaft (key 8) and packing box bore of the bonnet (key 5). Using a flashlight, look into the packing box bore and ensure all packing and residue are cleaned out.
6. Properly dry out the packing box bore of the bonnet (key 7) before repacking the valve.

⚠ WARNING

When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate with a shearing or cutting motion, which could result in personal injury. To avoid injury, carefully rotate the ball to a stable position after the actuator is removed.

Packing Installation

1. Refer to figures 4 and 15 and install the following parts in the packing box bore by aligning each parts ID with the OD of the drive shaft. First, insert the packing box ring (key 19), then one anti-extrusion ring, two graphite ribbon packing rings, and lastly the other anti-extrusion ring.
2. Install the packing follower/bushing assembly (key 25).

Note

If the stop screws and nuts (keys 22, 23 and 24) were adjusted during disassembly, refer to the Packing Adjustment section in this instruction manual before proceeding.

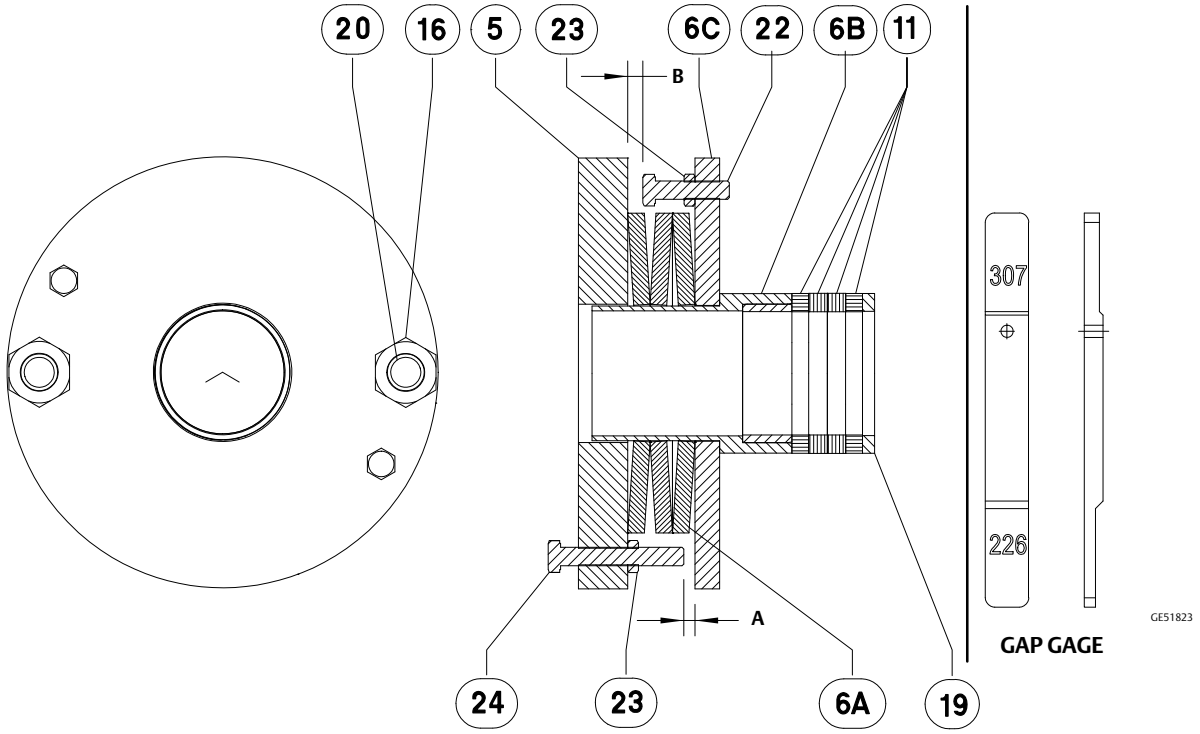
3. If the stop screws (key 22) were not adjusted during disassembly skip to step 5.
4. Apply Loctite 242 (key 77) to the two 3/8-24x1.50 hex cap screws (key 22). Install the cap screws with two 3/8-24 hex nuts (key 23) in the stop flange (key 6C). Final stop screw lock position will be set with gauged clearance to the packing flange.
5. Install the stop flange (key 6C) assembly against the packing follower/bushing assembly (key 6B).
6. Install three Belleville springs (key 6A) on top of the stop flange (key 6C). Orient the Belleville stack as shown in figure 3 (top spring with large OD against packing flange (key 5)).
7. If the stop screws (key 24) were not adjusted during disassembly skip to step 9.
8. Apply Loctite 242, (key 77) to two 3/8-24x2.50 stop cap screws (key 24). Install the two stop cap screws (key 24) with 3/8-24 hex nuts (key 23) in the packing flange (key 5). Final stop screw lock position will be set with gauged clearance to the stop flange
9. Install the packing flange assembly on top of the Belleville springs (key 6A).
10. Lubricate the two 3/4-10x5.75 continuous thread packing box studs (key 20) with Nuclear Grade anti-seize lubricant (key 36) and install into the bonnet (key 7).
11. Lubricate the threads and seating surface of the two 3/4-10 hex nuts (key 16) with Nuclear Grade anti-seize lubricant (key 36) and install onto the packing studs (key 20).
12. Tighten the packing nuts (key 16) without torque until they are snug against the packing flange (key 5).

Note

Use care to keep the packing flange parallel to the stop flange (key 16). Reference figure 4.

13. If the stop screws (key 22 and 24) were not adjusted during disassembly, then check the Gap A and Gap B clearance using the gap gage and adjust if necessary following Section Stop Screw Gap Settings steps 3 and 4; if adjustments are not necessary, then proceed to Section Stop Screw Gap Settings step 5.

Figure 4. Positive Stop Packing Loading Method



Packing Adjustment

The following instructions describe how to set the correct stop screw gaps A and B for proper packing load. Gap A is the nominal packing load and should be used under normal circumstances. Gap B is the maximum packing load and should not be exceeded.

Stop Screw Gap Settings

1. Loosen the packing flange nuts (key 16) until loose, do not remove nuts.
2. Retighten nuts until just finger-tight.
3. Use the gap gage GE51823 to set Gap A (nominal) to 5.74 mm (0.226 inch) for the packing flange stop screws (key 24) and the top of the stop flange (key 6C). While holding the flange stop screws (key 24) stationary, torque the nut (key 23) to 41 N•m (30 ft•lbf). Double-check Gap A clearance and adjust if necessary.
4. Use the gap gage to set Gap B (maximum) to 7.80 mm (0.307 inch) for the stop flange stop screws (key 22) and the packing flange (key 5). While holding the flange stop screws (key 22) stationary, torque nut (key 23) to 41 N•m (30 ft•lbf). Double-check Gap B clearance and adjust if necessary.
5. Tighten the packing flange nuts (key 16) evenly until the Gap A (nominal) 5.74 mm (0.226 inch) for the packing flange stop screws (key 24) goes to zero and just contacts the stop flange (key 6C) which will set the packing stress to its nominal value.

Packing Load Adjustment

Use the following steps to increase the packing load from nominal to maximum packing load.

1. Loosen the stop nuts (key 16) and retract the two 3/8-24 x 2.50 stop cap screws (key 24) three full turns.
2. Apply Loctite 242 (key 77) to the two stop cap screws (key 24) and torque the nut (key 23) to 41 N•m (30 lbf•ft).
3. Tighten the packing flange nuts (key 16) evenly until the Gap B (maximum) 7.80 mm (0.307 inch) for the packing flange stop screws (key 22) goes to zero and just contacts the packing flange (key 5), which will set the packing stress to its maximum value.

Replacing the Trim Parts

The open and closed travel stops of the actuator will need adjustment after any trim replacement per the Actuator Mounting section of this manual. If the bonnet-to-body joint is loosened for any reason, establish the zero position per the Determining Closed Position section of this manual.

Perform this procedure if the control valve components are at a recommended replacement interval, scratched or damaged, showing performance degradation at routine diagnostics, or the valve is not shutting off properly.

This section describes how to replace the thrust washers (key 1), Belleville spring (key 4), ball/shaft assembly (key 8), bearing (key 9), and seal ring components (keys 25, 26, and 27). Refer to figure 15.

Disassembly

1. Remove actuator taking care not to bind the coupler (key 101) on the drive shaft (key 8).
2. Loosen and remove packing nuts (key 16). Now remove the packing flange (key 5), Belleville springs (key 6A), stop plate (key 6C), and packing follower (key 6B).
3. Rotate the ball 180 degrees out of the seal so that the sphere and pin hole point downstream. The keyway at the top of the shaft will be facing towards the inlet side of the body.

Note

There is a linear indicating mark just above the packing parts on the drive shaft indicating the sphere-side of the ball

4. Loosen and remove the body/bonnet nuts (key 117).
5. Using a safe lifting method, lift the bonnet (key 18) vertically off of the valve body (key 12); make sure the ball/shaft assembly (key 8) does not lift with the bonnet.

CAUTION

Ensure the bonnet flange remains level and parallel to body (key 12) mounting face. Failure to maintain parallel will lead to binding of the drive shaft to the bonnet. If done improperly, this could damage the ball, shaft, bonnet, and body.

6. Remove cap screw (key 14) and washer (key 13) from the ball/shaft assembly (key 8).
7. Install lifting plate, GE48210, onto the drive shaft with a 316 stainless 5/8-11x1.50 cap screw (not provided). The 1/2-13 threaded hole of the lifting plate should be centered directly over the ball sphere. Torque to 163 N • m (120 lbf • ft).
8. Install a 1/2-13 eye bolt (not provided) into the ball/shaft lifting plate. Torque to 92 N • m (68 lbf • ft).
9. Lift the ball/shaft assembly (key 8) vertically out from the valve body.

CAUTION

While lifting the ball/shaft assembly, ensure the sphere does not come into contact with the valve body. Damage to the sphere will affect the seat leakage performance of the valve.

10. Remove the lower thrust washer (key 1), follower bearing (key 9), and ball Belleville spring (key 4).
11. Remove qty sixteen socket head cap screws (key 27) from the seal (key 25).
12. Remove seal (key 25), taking care not to damage the guide diameter of the valve body.
13. Completely remove any remaining flat sheet gasket (key 26) material from the valve body gasket surface.

⚠ WARNING

Observe the steps in the WARNING at the beginning of the Maintenance section of this manual.

CAUTION

Exercise care to avoid damaging components in the following procedure.

Thrust Washer Dimension Check Instructions

Thrust washer (key 28) is a machine-to-fit component and is unique for each valve assembly. The washer is cut to the specific thickness required to center the ball in the valve body based on dimensions measured from the valve assembly.

1. Gather precise measurements, ±0.025 mm (±0.001 in), of the following five dimensions (see figure 5):

   B The distance from the top of the body (key 12) to the seal ring (key 25): 230.91 mm (9.091 in) nominal.

∅ C Diameter of seal ring (key 25): 355.45 mm (13.994 in) nominal.

D Height of bonnet (key 7) boss: 180.77 mm (7.117 in) nominal.

E Height of ball (key 8A): 393.70 mm (15.500 in) nominal.

F Width of drive bearing (key 2) shoulder: 6.43 mm (0.253 in) nominal.

2. Calculate the width of the thrust bearing using table 3.
3. Compare the thrust washer thickness to dimension A, as calculated in table 3, to the measured value. If the thickness differs +0.64 mm (+0.025 in), then contact your Emerson sales office or Local Business Partner to order a replacement

Table 3. Thrust Bearing Calculation Table

Part Description	Key	Feature Number	Nominal Dimension		Measured Dimension	
			mm	in	mm	in
Valve Top to Seal Ring	12 - 25	B	230.91	9.091		
Diameter of Seal Ring	25	∅C	335.45	13.994		
Calculated		∅C/2	177.73	6.997		
Height of Bonnet Boss	7	D	180.77	7.117		
Height of Ball	8A	E	393.70	15.500		
Calculated		E/2	196.85	7.750		
Width of Drive Bearing	2	F	6.43	0.253		
Thrust Bearing Thickness A = B+∅C/2-D-E/2-F			24.59	0.968		

Figure 5. Measurements for Thrust Washer Calculations

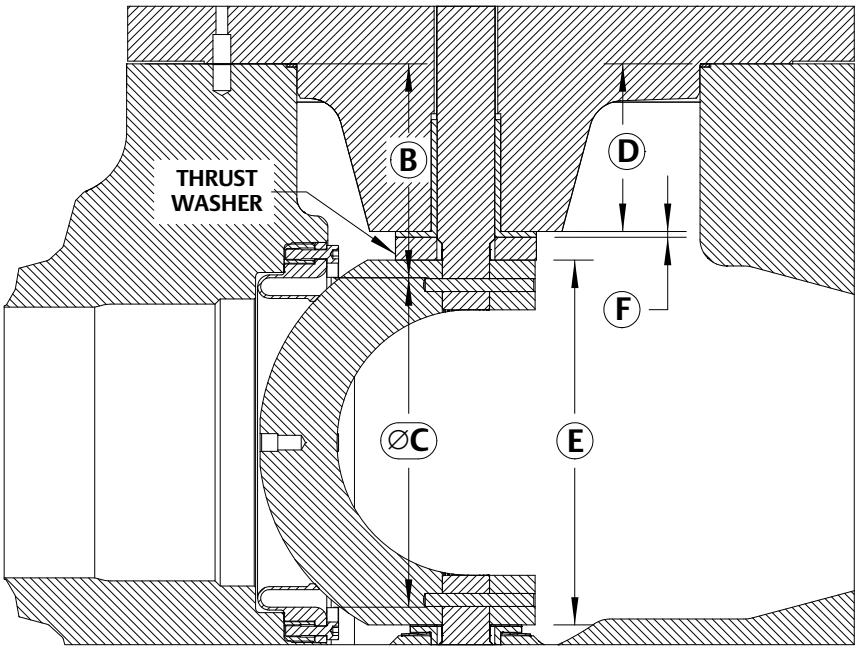
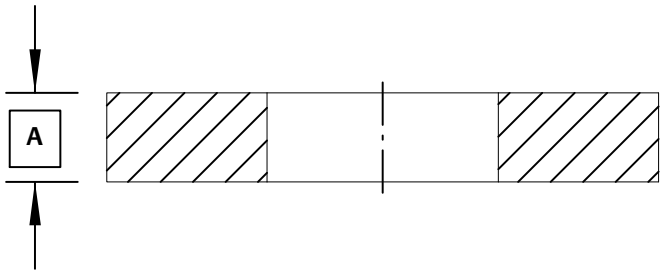
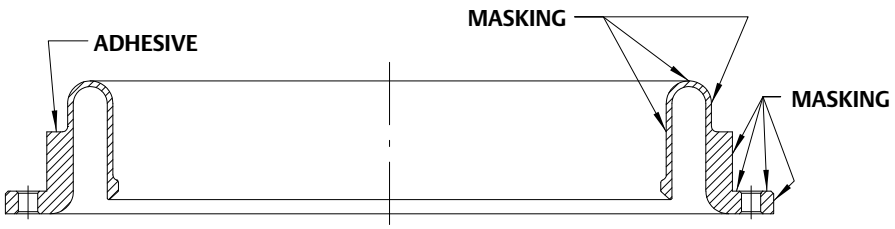


Figure 6. Thrust Washer Thickness Feature



Assembly

Figure 7. Seal Ring Masking



1. Inspect parts, ensuring no rust, corrosion, or foreign material is present and that bearing, guide, and sealing surfaces do not have nicks or scratches.
2. Mask the seal ring (key 25) as shown in figure 7 above and coat the gasket surface with spray adhesive (key 38). Do not over apply adhesive to cause oozing when applying gasket. Let the adhesive set for a minimum of 30 seconds prior to installing the gasket (key 26).
3. Carefully lower gasket (key 26) on to surface of the seal ring (key 25) with adhesive, pressing lightly and evenly in a criss-cross pattern until the gasket is fully pressed against the seal ring, remove masking.

CAUTION

Ensure that the gasket (key 26) does not extend out past the outer diameter of the seal ring as this may cause tearing of the gasket during installation of the seal ring (key 25).

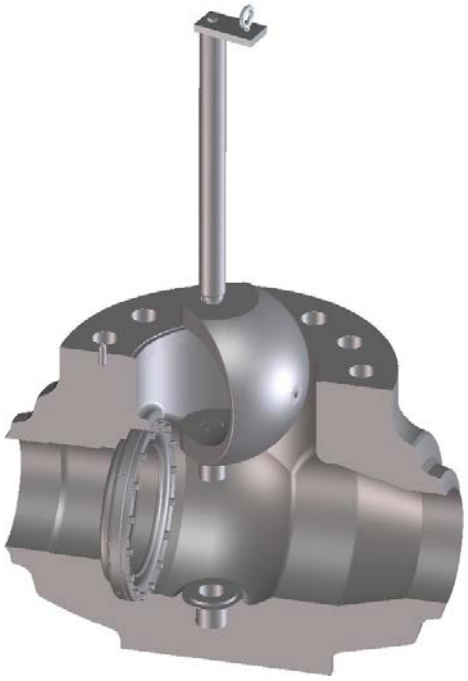
4. Lubricate the sixteen 1/2-13 cap screws (key 27) with NeoLube #1 (key 37) and install into the seal ring (key 25). Thread cap screws (key 27) all the way through the seal ring flange (key 25) until cap screw undercut shaft is in the threaded portion of the seal ring (key 25).
5. With all cap screws (key 27) in the seal ring (key 25), carefully position the seal ring with gasket thru the head of the valve body (key 12), being sure not to damage the seal ring flange OD.

6. Tighten cap screws (key 27) into the anchor ring (key 12B) tapped holes, using a multiple pass, cross pattern tightening procedure increasing the bolt torque at each pass until all the bolts are at the initial torque value of 45 N • m (33 ft • lbf) and a final torque value of 92 N • m (68 ft • lbf). Then switch to a circular tightening pattern and continue tightening until there has been no bolt movement at the final torque of 92 N • m (68 ft • lbf) for a complete circular pass. Use a 3/8" Allen socket for these socket head cap screws.

Note

Rotational orientation of the seal ring is not important. There are 32 tapped holes on the anchor ring in case an anchor ring thread is damaged out in service; the other set of 16 holes could be used by simply rotating the seal ring one hole.

Figure 8. Ball/Shaft Assembly Orientation



7. Install the Belleville spring (key 4), follower bearing (key 9), and thrust washer (key 1) as shown in figures 9 and 18.
8. Install lifting plate on the keyed end of the ball/shaft assembly as per the previous Disassembly section steps 7 and 8.
9. With the ball facing 180 degrees away from the seal, carefully lower the ball/shaft assembly (key 8) into the valve body until the follower shaft of the ball/shaft assembly (key 2) is guided and fully seated in the follower bearing. See figure 8.
10. Loosen and remove the cap screw and lifting plate.
11. Lubricate the 5/8-11x1.00 cap screw (key 14) with Nuclear Grade anti-seize lubricant (key 36) and install the washer (key 13) and cap screw (key 14) into the end of the drive shaft. Tighten to 163 N • m (120 ft • lbf).
12. Install the special thrust washer (key 28) onto the drive shaft and mate against the ball.
13. Install the drive bearing (key 2) onto the drive shaft and mate against the special thrust washer (key 28).

14. Lubricate with Nuclear Grade anti-seize lubricant (key 36) and install the fourteen 2-1/2-8x12.50 body-to-bonnet studs (key 10) down to the deformed thread into the valve body (key 12).

Note

If the ball/shaft assembly (key 8), drive bearing (key 2), or bonnet (key 5) are new or replacement parts, then a new special thrust washer (key 28) must be ordered. All four of the components are a matched set and ensure proper vertical alignment of the ball with the seal. Contact your Emerson sales office or Local Business Partner for assistance with procuring a new special thrust washer. Use section Thrust Washer Dimension Check Instructions above.

15. Install the spiral wound gasket (key 3) into the groove on top of the valve body (key 12).
16. Carefully lower the bonnet (key 7) over the drive shaft, ensuring the alignment pin hole of the bonnet (key 7) is guided over the alignment pin of the valve body (key 12).
17. Lubricate the threads and seating surface of the fourteen 2-1/8 UNC-2B body-to-bonnet heavy hex nuts (key 17) with Nuclear Grade anti-seize lubricant (key 36) and install onto each stud (key 10).
18. Using 2 torque wrenches follow the torque steps in table 4 up to an initial torque value of 6,780 N • m (5,000 ft • lbf) by torquing 2 opposing studs simultaneously. Recommend using a hydraulic torque wrench with multiple actuator/hose connections. Complete torque steps per tables 8, 9, and 10.

A four-stud pattern can also be used per table 4 if there is an available hydraulic torque wrench with the required number of actuators/fittings to achieve 4 simultaneous torque outputs.

Note

Recommend using a chloride-free marker to track the steps and sequences of the torquing procedure, and/or use tables 8, 9, and 10 to track the steps and sequences.

Table 4. Body-To-Bonnet Stud Torquing Procedure

Two-Stud Sequence Per Step	Four-Stud Sequence Per Step	Torque Step	Stud Torque		% Nominal Torque
			N • m	Ft • lbf	
1 and 2 3 and 4		1	698	515	6
5 and 6	1, 2, 3, and 4	2	1397	1030	13
7 and 8	5, 6, 7, and 8	3	2095	1545	19
9 and 10	9, 10, 11, and 12	4	4407	3250	40
11 and 12 13 and 14	13 and 14	5	6780	5000	60

19. Individually torque all nuts to 9,356 N • m (6,900 ft • lbf) and then to a final torque of 10,970 N • m (8,090 ft • lbf) per tables 9 and 10. Tighten the bolted joint using a criss-cross pattern shown in figure 10. Tighten each bolt evenly and in the sequence described.

Figure 9. Lower Thrust Washer and Ball Belleville Spring Installation

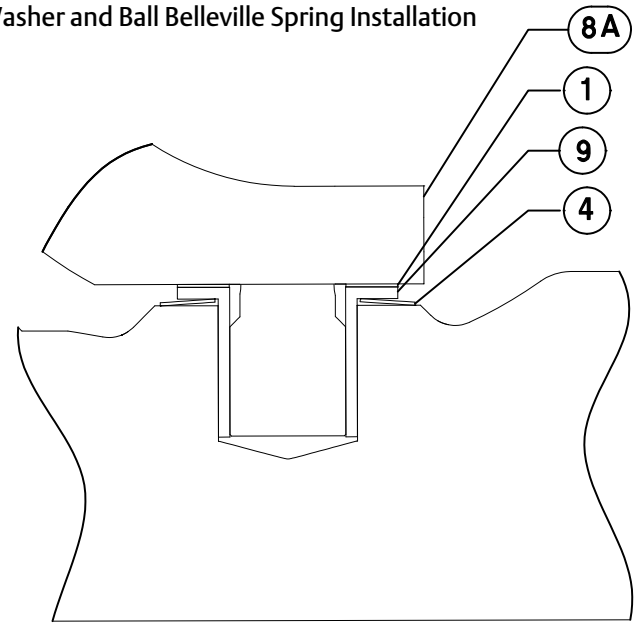
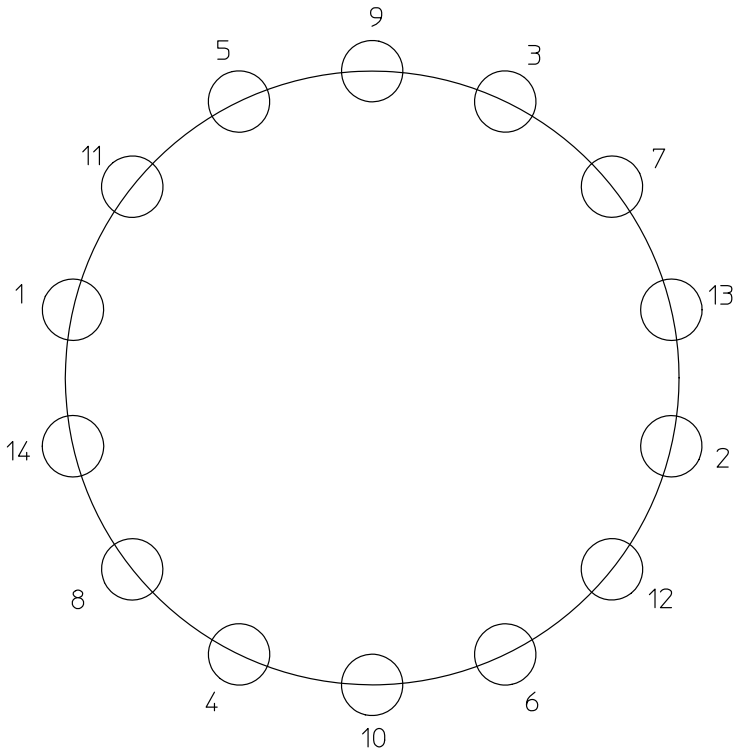


Figure 10. Body/Bonnet Bolting Sequence



Troubleshooting

Table 5. Troubleshooting

Problem	Possible Solution
Packing Leakage	Verify the correct packing load. Use gap gage to verify correct gap distances.
	Disassemble and inspect packing box bore and drive shaft for graphite adhesion, excessive wear or scratches.
	If needed, increase packing load to maximum per the Packing Adjustment section of this manual. Replace packing parts and inspect packing box and shaft at next available maintenance interval.
Bonnet Gasket Leakage	Verify proper torque on bottom flange studs and nuts in Assembly section of this manual.
	Disassemble and inspect sealing surfaces on the bottom flange and valve body for scratches or nicks.
Excessive Ball Seal Leakage	Verify the ball is positioned correctly in the closed position. Reference the Actuator Adjustments section of this instruction manual.
	Disassemble and inspect thrust washer (key 1), drive bearing (key 2), ball (key 8A), bearing follower (key 9), seal ring (key 25), and special thrust washer (key 28) for excessive wear or scratches.
Other	Consult your Emerson sales office or Local Business Partner.

Actuator Mounting

The open and closed travel stops of the actuator may require adjustment if the bonnet-to-body or bonnet-to-actuator joint is loosened. If the actuator is removed for packing replacement, remount the actuator per the this section. If the bonnet-to-body or bonnet-to-actuator joint is loosened for any reason, establish the zero position per the Actuator Adjustments section of this manual.

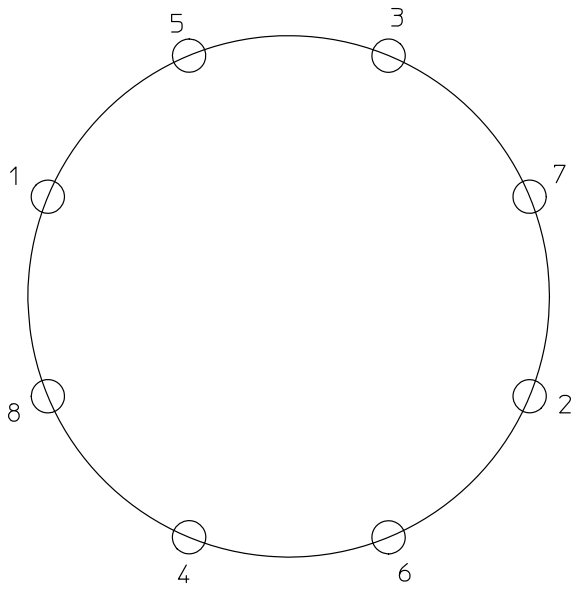
1. Prior to actuator installation, install shaft key (key 15) on drive shaft key slot.
2. Drive spring pin (key 102) into coupler (key 101).
3. Install coupler (key 101) over drive shaft (key 8), holding shaft key (key 15) in place.
4. Drive spring pin (key 104) into yoke key (key 103).
5. Install yoke key (key 103), with the spring pin (key 104) toward the drive shaft (key 8), onto the coupler (key 101). This yoke key will need to be held in place while lowering actuator onto shaft.
6. Lower the actuator over the drive shaft (key 8) and onto the bonnet (key 7). Ensure the actuator and bonnet mounting surfaces remain parallel to prevent binding. A long metal rod or screwdriver can be used to hold the yoke key (key 103) in place until it is fully seated into actuator.
7. Lubricate with Nuclear Grade anti-seize lubricant (key 36) and install 8 3/4-10x2.62 hex cap screws (key 18) finger-tight through the bonnet (key 7) into the actuator. Now rotate the entire actuator counter-clockwise (ccw) as far as the bolted joint will allow. This will bias the actuator slightly, relative to the valve pipe run; this is acceptable.

Note

Step 7 is essential to ensure the valve is always returned to the same closed position after removing the actuator and replacing the packing.

8. With the actuator rotated counter-clockwise on the bolted joint, tighten the cap screws (key 18) to an initial torque of 136 N • m (100 lbf • ft) and a final torque of 271 N • m (200 lbf • ft). Tighten the bolted joint using a criss-cross pattern illustrated below in figure 11. Tighten each bolt evenly and in the sequence described.

Figure 11. Actuator/Bonnet Bolting Sequence



Determination of Ball Closed and Open Position

The purpose of the following procedure is to establish the 'closed' and 'open' position for the ball/shaft assembly. Refer to figure 12.

When the valve assembly is put together, the exact position of the ball relative to the seal is not known. A procedure was developed to locate the closed or 0° position from a nonspecific open starting point which is considered a final ball position to achieve expected shut-off; however, at this final position, the exact centerline of the ball may or may not be aligned with the exact centerline of the seal ring/pipeline. The ball is slowly rotated from a general open position into the seal until a slow, low pressure stream of water flowing through the valve is reduced to near-zero flow (coarse-adjustment).

The closed, travel stop is then set. This is a starting position considered a point where the ball has rotated far enough into the seal to close off the flow passage, however, may still allow considerable seat leakage as compared to Class V shut-off performance. The closed travel stop is then incrementally adjusted to increase torque of the ball into the seal until Class V shutoff performance is attained (fine-adjustment).

The closed position is then considered final at this point. Once the closed position is established and seat leakage is acceptable, the ball is then rotated counter-clockwise (CCW) 90° to establish the open position, and the open travel stop is engaged. The valve assembly ball adjustment is then considered complete.

CAUTION

Dry cycling this valve into the metal seat may damage the ball and seal. Make sure process fluid is in the valve. If the system pressure can be relieved, then this is preferred.

1. Open the valve.

CAUTION

Do not over-pressurize the system or allow for a differential pressure greater than 66psi to develop during this procedure as it could alter the zero positioning of the valve.

Note

There is a linear indicating mark, just above the packing parts, on the drive shaft indicating the sphere-side of the ball.

2. Install a rotary encoder to the shaft or to the top-works of the Bettis actuator to monitor valve rotation.
3. On the Bettis actuator back out the closed travel stop by turning the stop counter-clockwise (CCW) about 5 turns (refer to figure 13 for location of travel stop). The closed travel stop is located closest to the large air cylinder of the Bettis actuator.
4. With the valve in the open position, allow water to flow through the valve while limiting the pressure drop across the valve to about 10-30 psi.

Note

It takes some time for the Bettis actuator and valve assembly to respond to the step inputs of the regulator. The values in the following procedure are to provide some guidance in finding the seated position. More important than the actual numbers; however, is the realization of what is trying to be accomplished: the point at which the ball seats properly and the flow begins to trend towards the shutoff requirement. Refer to the beginning of this section for more background information on this procedure. If you have any questions, contact your Emerson sales office or Local Business Partner for assistance.

CAUTION

The following step, if done incorrectly, could severely damage the seal or ball significantly and/or cause undue stress on the shaft assembly causing damage. Do NOT increase the actuator pressure rapidly.

5. Using a regulator and calibrated gauge capable of supplying 0-100 psig, slowly apply pressure to the Bettis air cylinder. Monitoring the flow through the valve; when the ball is seated into the seal there will be a step decrease of flow. The ball should be closed and set into the seal between 44 to 48 psig.
6. To find where this step change occurs (and the 0-degree position), perform the following steps:

   a. Once the regulated actuator supply pressure of 42 psig is reached wait 5 minutes then test and observe the leak rate.

   b. If the leak rate is not acceptable, increase the supply pressure by 0.5 psig. Then allow 5 minutes for the system to stabilize.

   c. Test the leak rate again until the step change decreases flow. Record the regulator pressure at which this water flow step change happened for future reference.

d. If the step decrease does not occur, repeat steps b and c until the step decrease is observed.

CAUTION

Do not fill the actuator cylinder too quickly as the fast stroking speed could alter the zero positioning of the valve.

Note

If the process is continued until the regulator pressure reaches 48 psig and the step change has still not been reached, contact your Emerson sales office or Local Business Partner.

Travel Stop Adjustments

CAUTION

Ensure all the step of the previous section have been followed before adjusting the travel stops.

Once an acceptable leakage rate has been confirmed in the previous section, the closed travel stop in the Bettis needs to be set. Refer to figures 12, 13, and 14.

1. With the supply air set to the recorded value from step 6.3 of the previous section, turn the Bettis "closed" travel stop clock-wise (CW) until the stop is firmly seated against the internal scotch yoke of the actuator. Snug the stop up against the yoke with a light turn of a wrench.

CAUTION

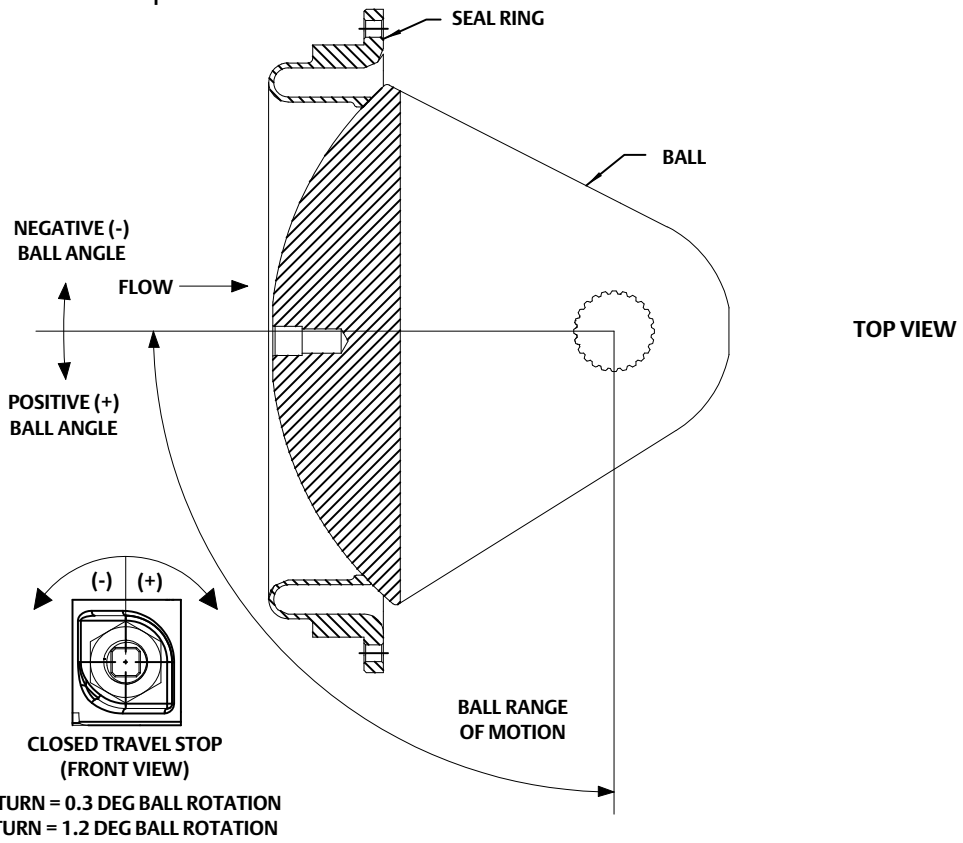
While torquing the travel stop lock nuts, take care not to move the travel stop screw which will change the position of the ball/shaft assembly.

2. While holding the travel stop stationary, securely tighten the closed travel stop lock nut using a 1-13/16" wrench. Torque to 136 N • m (100 ft • lbf).
3. Back out the Bettis "open" travel stop by turning the stop CCW approximately 5 turns.
4. Reduce pressure in the Bettis air cylinder until the ball/shaft assembly has rotated 90° ± 2° away from the zero (closed) position per the encoder readout. Once reached, this is now considered the full open position.
5. Turn the Bettis "open" travel stop clock-wise (CW) until the stop is firmly seated against the internal scotch yoke of the actuator. Snug the stop up against the yoke with a light turn of a wrench.
6. While holding the travel stop stationary, securely tighten the "open" travel stop lock nut using a 1-13/16" wrench. Torque to 136 N • m (100 ft • lbf).
7. Set the supply regulator pressure to the specified pressure, typically 70 psig.

Note

The Ball/Shaft assembly requires about 45 psig to achieve the zero position; 70 psig ensures the ball is always driven to the closed travel stop.

Figure 12. Ball Angle and Travel Stop Reference



8. With water or process fluid in the valve, lap the ball and seal by cycling the ball/shaft assembly into and out of the seal 3 times. During the opening of the valve, note the pressure that the ball begins to move. It should be between 26-30 psig. If the pressure noted is outside this range, then the following section can be followed to fine tune the travel stops.
9. After cycling the valve perform a seat leak test as described in the Ball Seating Check section.

Ball Seating Check

1. Rotate the valve into the closed position (apply actuator air).

⚠ WARNING

The following step, if done incorrectly, could severely damage the seal ring or the ball. Do NOT allow a differential pressure across the valve greater than 66 psi.

2. Perform a 5-minute seat leakage test with 60 (+6/-0) psi differential pressure.
   a. If seat leakage more than Class V allowable in the first 5 minutes is detected, then skip to step 3 below.
   b. If seat leakage meets Class V criteria in the first 5 minutes, then allow 5 additional minutes to stabilize.
   c. After the stabilization period, perform seat leakage test to confirm Class V leakage requirements are met. If Class V leakage requirements are met skip to step 5; If seat leakage does not meet Class V requirements in the initial

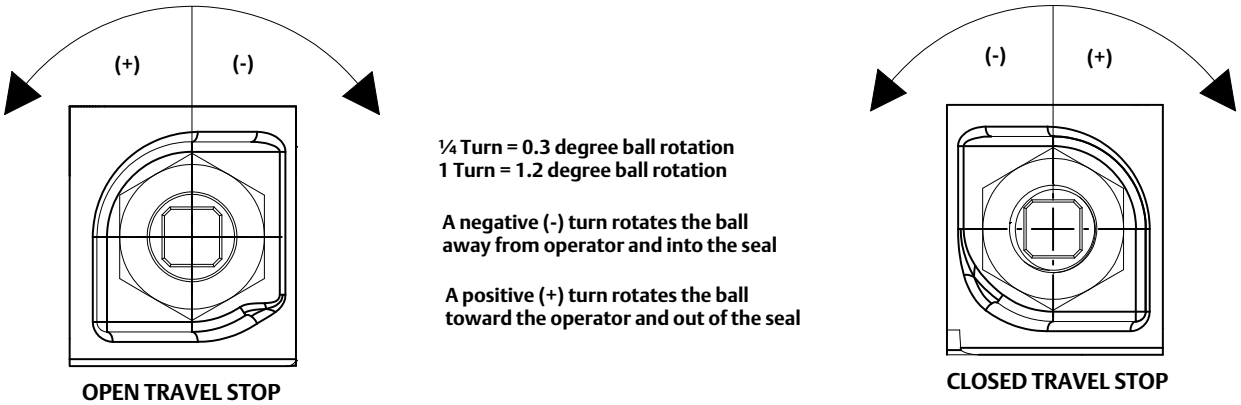
test, allow additional time to stabilize and retest the leakage rate. If the leakage rate does not meet Class V requirement, go to step 3.

Note

If Class V leakage was not met in steps a through c above, contact your Emerson sales office or Local Business Partner.

3. If seat leakage performance from steps a through c was not met, ensure 50 psig to the air cylinder which will rotate the ball into the seal and the actuator “closed” travel stop.
4. Loosen the “closed” stop lock nut, then back out the closed travel stop until the rotary encoder indicates the ball has rotated 0.3° farther into the seal.

Figure 13. Travel Stop



5. While holding the travel stop stationary, securely tighten the “closed” travel stop lock nut using a 1-13/16” wrench. Torque to 136 N • m (100 ft • lbf).
6. Recheck leakage per steps a through c. Contact your Emerson sales office or Local Business Partner if Class V cannot be achieved.

Note

Do NOT lap the ball and seal by cycling between each increment in step.

7. Perform steps 3 through 7 for the “open” travel stop of the previous Travel Stop Adjustments section above.
8. To ensure that adequate seating torque (ball seating) is achieved, cycle the valve open and observe the air pressure of the actuator at the point where the ball begins to move out of the seal.

Note

The ball should experience a ”jump” out of the seal, which can be confirmed by FlowScanner testing. This is typically a break-out pressure between 26 and 30 psig. If Class V shutoff is achieved with closing ”ramp-in” and opening ”jump” and the pressure is between 22-35 psig, then this is acceptable. See table 6 in the Periodic FlowScanner Testing section. For more information contact your Emerson sales office or Local Business Partner.

Actuator Mounting Instructions

Fisher 2625NS and Solenoid Mountings

Refer to figure 15 for this accessory mounting section.

1. Apply Loctite 242 (key 77) to the four 1/2-13 x 1.12 cap screws and attach the mounting bracket to the actuator, tightening to 92 N • m (68 ft • lbf) with a 3/4-inch wrench.
2. Bolt the 2625NS and SST nipples to the mounting bracket with the v-block assemblies as shown in figure 15. Apply Loctite 242 (key 77) to the four 5/16-18 x 4.25 cap screws and tighten to 23 N • m (17 ft • lbf) with a 1/2-inch wrench.
3. Attach the solenoid to the mounting bracket with 5/16-18 x 0.62 cap screws. Apply Loctite 242 (key 77) to the four 5/16-18 cap screws and tighten to 23 N • m (17 ft • lbf) with a 1/2-inch wrench.

Fisher 546NS I/P Transducer and 67CFSR Mountings

Refer to figure 16 for this accessory mounting section and table 2 for torque values. For ease of installation, install the 546NS I/P to the bracket prior to mounting the bracket to the actuator.

1. Attach the 546NS I/P to the mounting bracket with two 5/16-18 x 0.88 cap screws as shown in figure 16. Apply Loctite 242 (key 77) to the 5/16-18 cap screws and tighten to 23 N • m (17 ft • lbf) with a 1/2-inch wrench.
2. Apply Loctite 242 (key 77) to the four 1/2-13 x 1.50 cap screws and attach the mounting bracket, with spacer plate, to the actuator, tightening to 92 N • m (68 ft • lbf) with a 3/4-inch wrench.
3. Apply Loctite 242 (key 77) to the four 5/16-18 x 3.50 cap screws and attach the 67CFSR regulator with the pressure gauge range (0-60 psig) on the outer mounting holes and the 67CFSR regulator with the pressure gauge range (0-160 psig) on the inner mounting holes of the mounting bracket, tightening to 23 N • m (17 ft • lbf) with a 1/2-inch wrench. The outer regulator is connected to the 546NS, and the inner regulator is connected to the 3610J.

CAUTION

Do not swap parts on these regulators including pressure gauges, as they are not identical in design and operation.

Fisher 3610J Positioner and GO Switch Mountings

Refer to figure 16 for this accessory mounting section and table 2 for torque values.

1. Apply Loctite 242 (key 77) to the four 1/2-13 x 0.88 cap screws and attach the Go Switch Bracket to the actuator, tightening to 92 N • m (68 ft • lbf) with a 3/4-inch wrench as shown in figure 16.

Note

M6 screws in steps 2 and 4 are tightened in torque units of inch • lbf and NOT ft • lbf, take care not to over-tighten.

2. Apply Loctite 242 (key 77) to M6 x 12 socket head cap screw and attach the namur disc to the actuator, tightening to 10.2 N • m (90 in • lbf) with a 4 mm Allen wrench.
3. Attach each magnet to the trip arm assembly by using two 7/16-20 hex nuts, two 7/16 star washers, and two 7/16 plain washers as shown in figure 16, tightening to 47 N • m (35 ft • lbf) with a 11/16-inch wrench.
4. Apply Loctite 242 (key 77) to the two M6 x 20 socket head cap screws and attach the trip arm assembly with magnets, cam, and pointer to the namur disc as shown in figure 15, tightening to 10.2 N • m (90 in • lbf) with a 5mm Allen wrench.
5. Install each GO switch with a switch adaptor, 5/8 plain washer, 5/8 star washer and 5/8-18 hex nut to the bracket as shown in figure 16, tightening to finger tight.
6. Apply Loctite 242 (key 77) to the standoffs and attach to the bracket as shown in figure 16, tightening to 1.9 N • m (17 in • lbf) with a 1/4-inch wrench.
7. Attach the travel indicator scale to the standoff with 6-32 x 0.31 Philips pan head cap screws and No. 6 plain washers, tightening to average mechanics torque with a Philips screw driver.
8. Attach the 3610J positioner to the mounting bracket with the four 5/16-18 x 0.75 cap screws as shown in figure 16. Apply Loctite 242 (key 77) to the four 5/16-18 socket cap screws and tighten to 23 N • m (17 ft • lbf) with a 5/16 inch Allen wrench.
9. Adjust the valve to the desired closed/open position.
10. With the valve in the desired closed/open position, line up the target magnet and GO Switch, and then establish a 4.06 mm (0.160 inch) – 5.08 mm (0.200 inch) gap between the ends of the GO switch and target magnet. Torque the 5/8-18 hex nuts and switch adaptors to 47 N • m (35 lbf • lb).
11. Return the valve back to the closed/open position; line up the target magnet and GO switch. Then establish a 4.06 (0.160 inch) – 5.08 mm (0.200 inch) gap. Torque the 5/8-18 hex nuts and switch adaptors to 47 N • m (35 ft • lbf).

Periodic FlowScanner Testing

When the valve is operating at design pressure and temperature, it is recommended during regularly scheduled cycling of the PV20 valve to perform FlowScanner testing to verify “break-in” (“ramp-in”) and “break-out” torque to verify proper seating and unseating of the ball. Figure 14 shows a FlowScanner plot, which identifies the expected “ramp-in” of the upper (closing) line and the “break-out” or “jump” of the lower (opening) line of the ball out of the seal. The ideal break-out torque pressure is between 26-30 psig, and an acceptable overall pressure range is 22-35 psig based on PV20 testing of break-out profile and torque.

If these characteristics and the limits are met (both torque and pressure) in table 6, and Class V shutoff is achieved, then the valve is considered as properly set. Adjustments to the travel stops can be made by following the Actuator Adjustments section of this manual.

Table 6. Break -Out (Unseating) Upper and Lower Limits

Defined Limits	Torque (in • lbf)	Pressure (psig)
Required min. LL	11200	35.0
Preferred min. LL	21000	30.0
Preferred max. UL	28800	26.0
Required max. UL	36600	22.0

CAUTION

Refer to the Component Part Qualification Report for verification of the weak-link torque limits: 5,200 N • m (46,800 in • lbf). This torque limit should not be exceeded or damage to the valve is likely to occur.

Contact your Emerson sales office or Local Business Partner for assistance in performing the FlowScanner testing.

Figure 14. Travel Stop

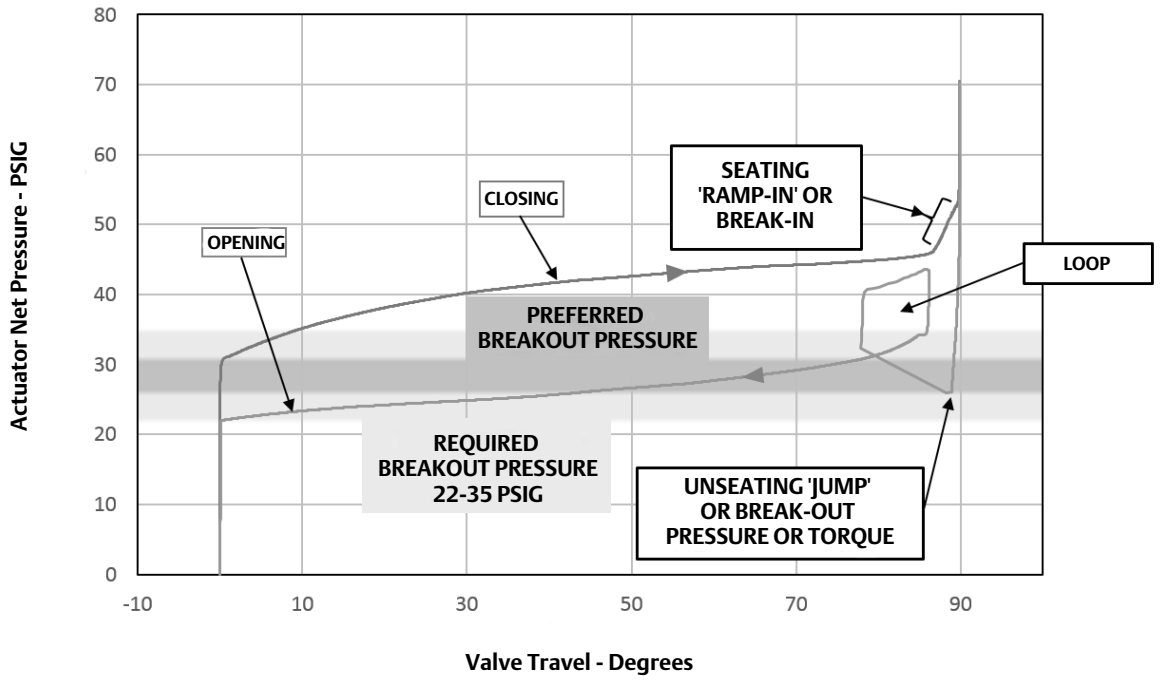


Figure 15. Fisher 2625NS/Solenoid Mounting

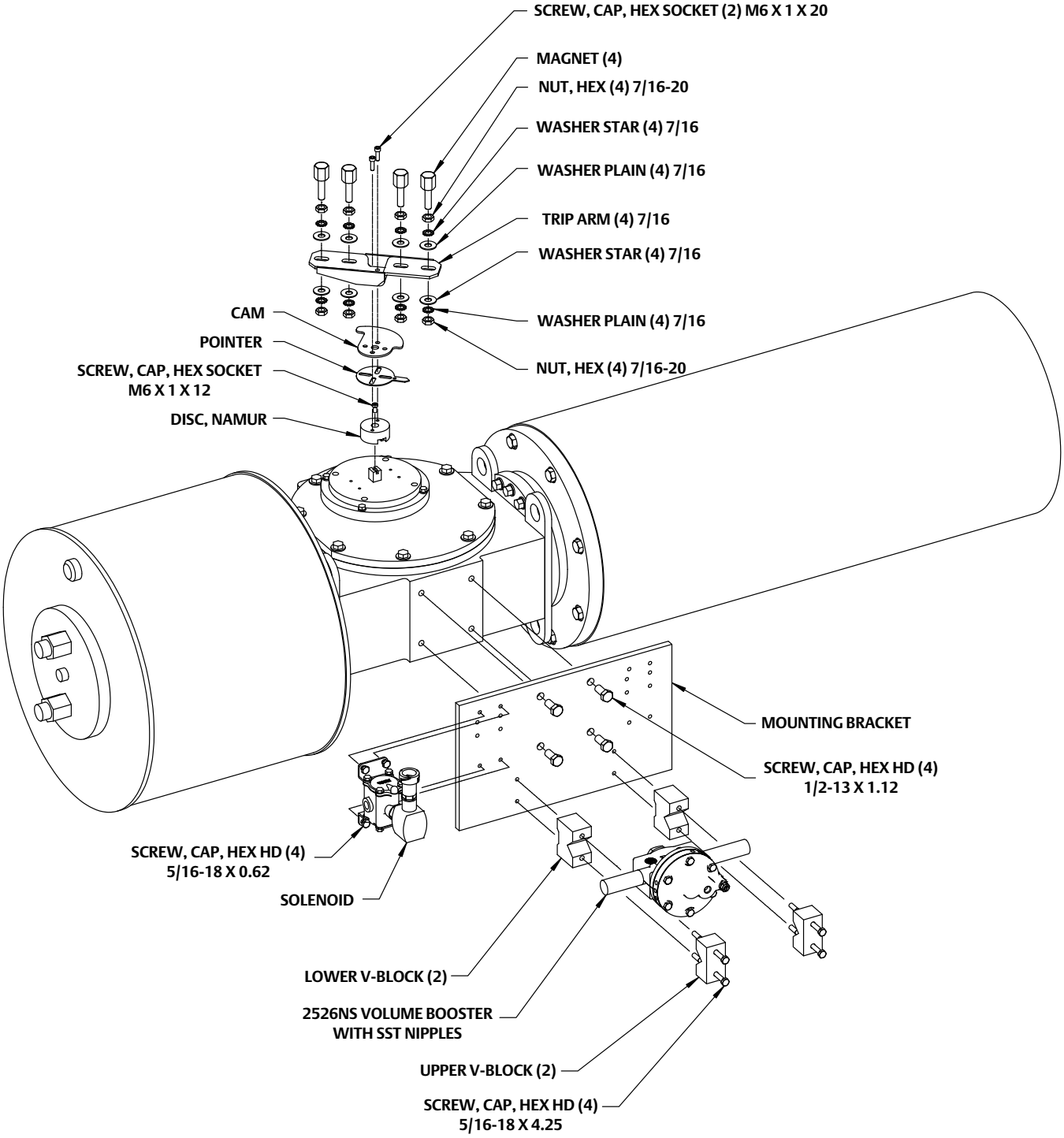


Figure 16. Fisher 546 I/P Transducer/67CFSR Mounting and 3610J Positioner/GO Switch Mounting

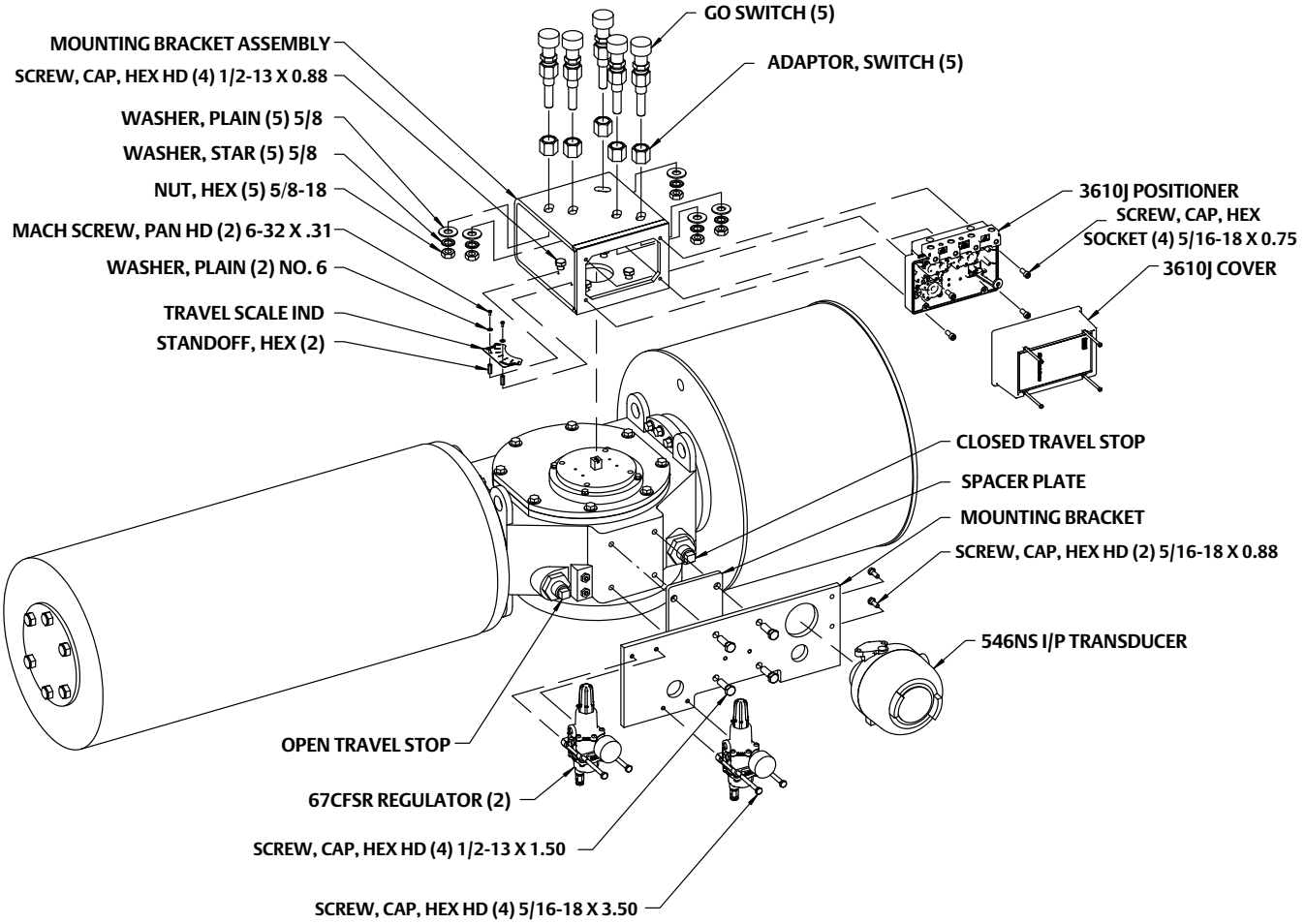
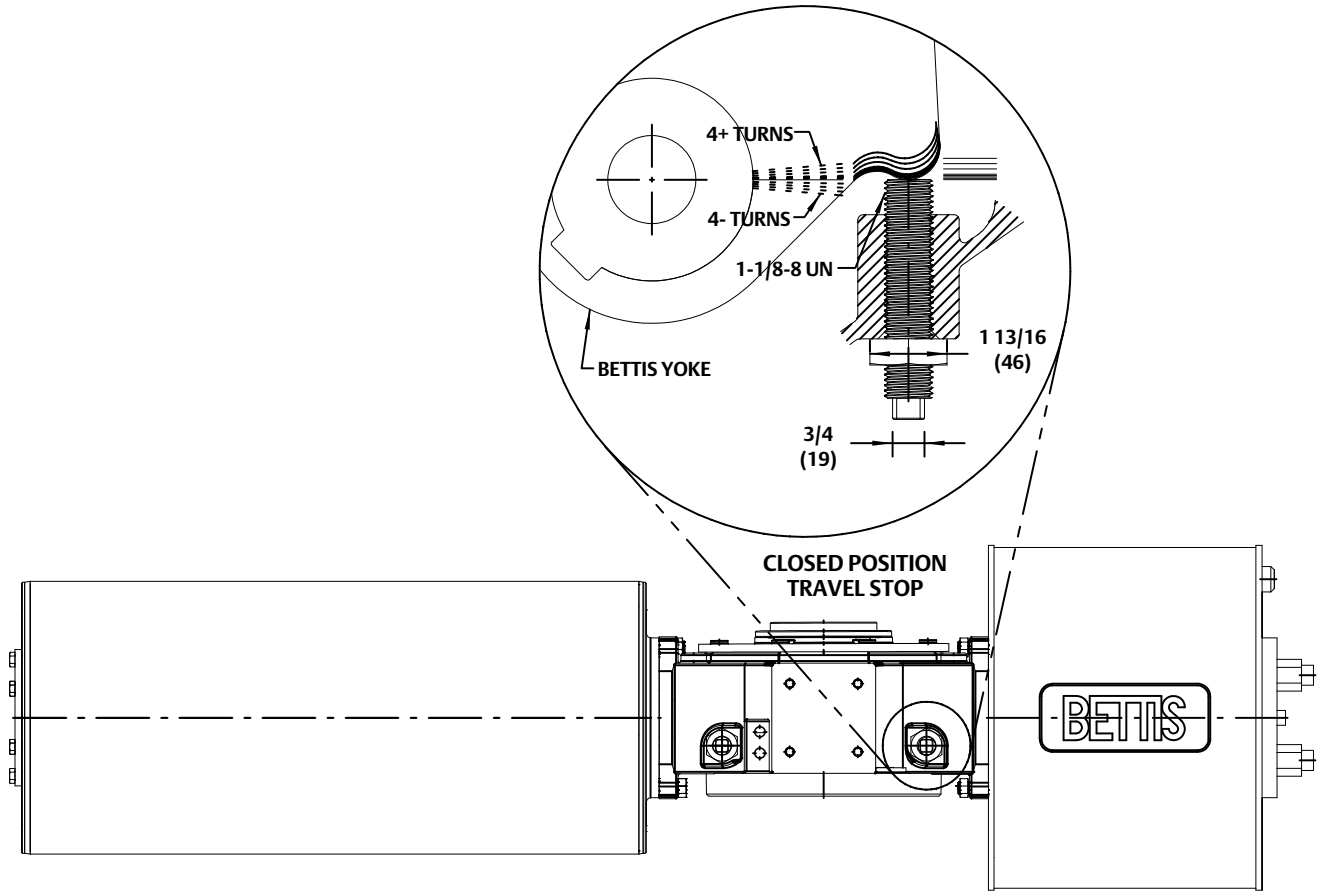


Figure 17. Closed Travel Stop Adjustment



Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your Emerson sales office or Local Business Partner regarding spare parts or technical information. When ordering replacement parts, also specify the complete 11-character part number from the parts kits or parts list information.

⚠ WARNING

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

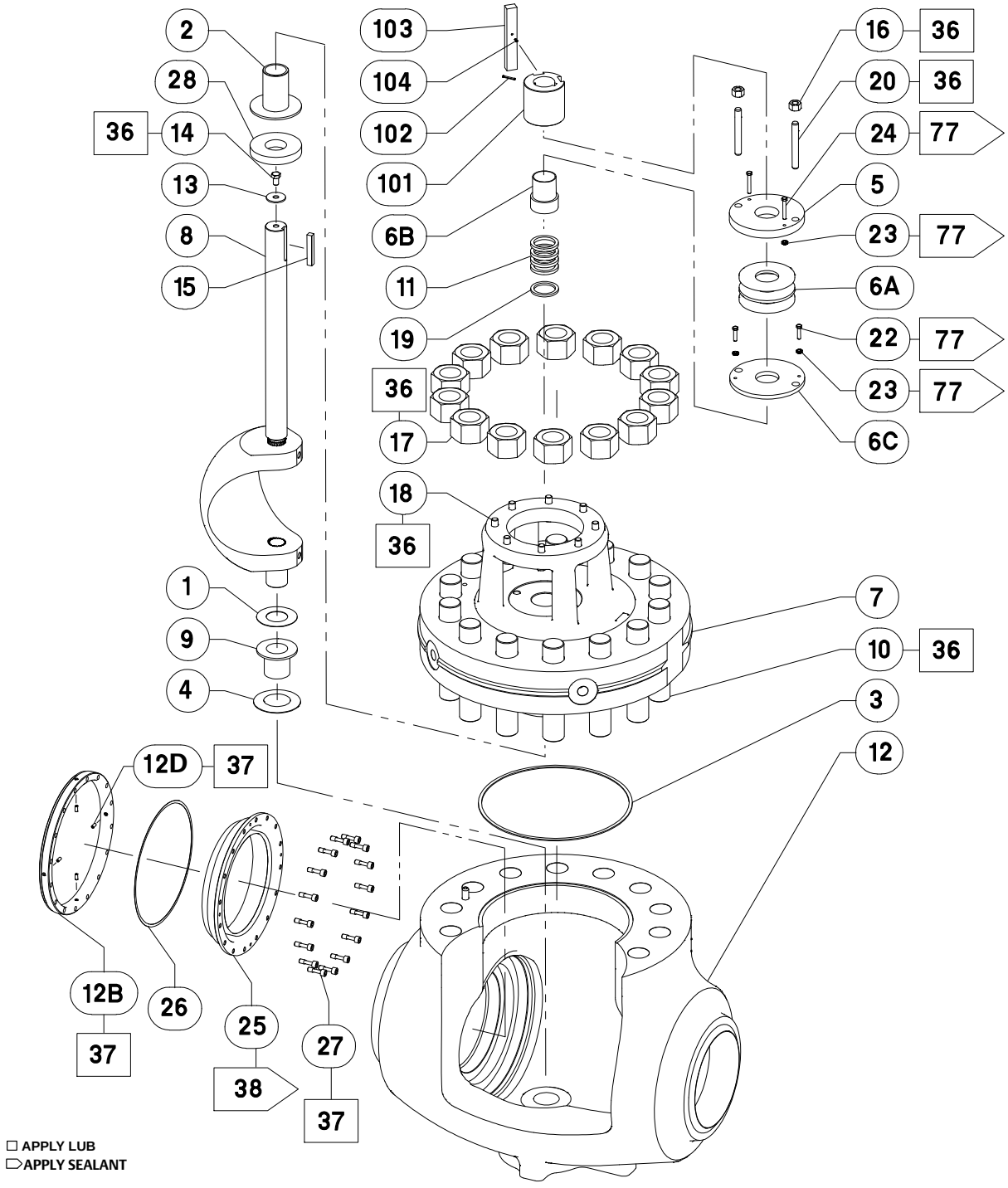
Parts List

Key	Description	Qty	Part Number
	SPRING PACK ASSY	1	GE46782X012
1*	WASHER THRUST, LOWER	1	GE46768X012
2*	BEARING, DRIVE	1	GE46775X012
3*	GASKET, SPIRAL WOUND	1	GE46776X022
4	SPRING, BELLEVILLE, BALL	1	GE46777X012
5	FLANGE, PACKING	1	GE46781X012
7	BONNNET	1	GE48043X012
8*	BALL/SHAFT ASSY	1	GE48198X012
9*	BEARING, FOLLOWER	1	GE48207X012
10	STUD, CONT W/ STOP 2 ½-8 X 12.50	14	GE48228X012
11*	PACKING SET	1	GE48229X012
12	VALVE BODY ASSY	1	GE48000X022
13	WASHER	1	GE46775X012
13*	BEARING, FOLLOWER	1	V151142X022
14	SCREW, CAP	1	V151143X022
15*	KEY SHAFT	1	V153364X042
16	NUT, HEX 3/4-10 UNC-2B	2	1A3464X0022
17	NUT, HEX HEAVY 2 1/2-8 UNC-2B	14	1P3683X0322
18	SCREW, CAP, HEX, HD 3/4-10 X 2.62	8	12A9458X022
19*	RING, PACKING BOX	1	13B8709X012
20	STUD, CONT THREAD 3/4-10 X 5.75	2	17B3084X012
22	SCREW, CAP, HEX, HD 3/8-24 X 1.50	2	1A3464X0022
23	NUT, HEX, JAM 3/8-24	4	1A680335252
24	SCREW, CAP, HEX, HD 3/8-24 X 2.50	2	GE51734X012
25*	RING, SEAL	1	GE49053X012
26*	GASKET	1	GE48209X022
27	SCREW, CAP, SPCL 1/2-13 X 1.75	16	GE47980X012
28*	WASHER, THRUST, SPCL	1	GE50801X012
29	NAMEPLATE, NUCLEAR	1	16A4171X012
30	NAMEPLATE	1	12B6400X012
31	DRIVE SCREW	4	1A368228982
101	BETTIS COUPLER	1	GE56443X012
102	PIN, ROLL	1	T1182636402
103	YOKE KEY	1	16B5430X032
104*	PIN, ROLL, DRIV-LOK	1	V143150X012

Key	Description	Qty	Part Number
Special Tools			
	LIFTING PLATE	1	GE48210X012
	GAP GAGE	1	GE51823X012
Solenoid/2625 Mtg			
	MTG ASSY, 2625NS	1	GE42525X022
	PLATE, MOUNTING	1	GE48227X012
	SCREW,CAP,HEX HD 5/16-18X3.50	4	T14109T0052
	SCREW,CAP,HEX HD 1/2-13X1.12	4	1H4469X0052
546NS/67CFSR Mtg			
	PLATE, MOUNTING	1	GE48235X012
	SPACER, PLATE	1	GE57096X012
	SCREW,CAP,HEX HD 5/16-18X3.50	4	T14109T0052
	SCREW,CAP,HEX HD 5/16-18X0.88	2	1C5958X0032
	SCREW,CAP,HEX HD 1/2-13X1.50	4	1A4533K0022
Positioner/GO Switch Mtg			
	POSITIONER/GO SWITCH MTG KIT	1	GE47904X012
Lubricant/Sealant			
36	NUCLEAR GRADE ANTI-SEIZE LUBRICANT		
37	NEOLUBE #1		
38	3M SUPER 77		
77	LOCTITE 242		

*Recommended spare parts

Figure 18. Fisher SS-264 Valve Assembly



Spare Parts

The spare parts replacement interval is based in part on plant operation, operating conditions, normal maintenance interval, process fluid, and other factors. Periodic inspection of the valve and actuator and diagnostics run on the control valve assembly are recommended to identify the optimum replacement timing.

Table 7. Fisher SS-264 Spare Parts

Drawing Number	Replacement Part Number	Key No.	Part Description	Qty	Classification	Spare Part Code(1)	Spare Part Requirement Rationale	Shelf Life	Shelf Life Rationale(2)
GE51823	GE51823X012	---	Gap Gage	1	Non-Safety Related	O/1	This tool is required to adequately set the packing deflection to achieve nominal or maximum packing load.	N/A	Does not exhibit a tendency to degrade over time.
GE46768	GE46768X012	1	Thrust Washer, Lower	1	Safety Related	O/1	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every 12 years.	N/A	Does not exhibit a tendency to degrade over time.
GE46775	GE46775X012	2	Drive Bearing	2	Safety Related	O/2	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every 12 years.	N/A	Does not exhibit a tendency to degrade over time.
GE46776	GE46776X012	3	Spiral Wound Gasket	1	Non-Safety Related	O/1	Routine maintenance of the valve, including replacing the gasket, is a manufacturer's recommendation. Maintenance is a necessary requirement to ensure positive performance during the expected life of the valve. Replace every time Bonnet is removed.	N/A	Graphite does not exhibit a tendency to degrade over time.
GE46781	GE46781X012	5	Packing Flange	1	Non-Safety Related	O/1	Replacement parts should be on hand in case of loss, damage, or excessive wear during maintenance.	N/A	Does not exhibit a tendency to degrade over time.
GE48229	GE48229X012	6A	Packing Set	1	Non-Safety Related	O/1	Routine maintenance of the valve, including replacing the packing, is a manufacturer's recommendation. Maintenance is a necessary requirement to ensure positive performance during the expected life of the valve. Emerson Process Management recommends replacing this component every 6 years.	N/A	Graphite does not exhibit a tendency to degrade over time.
GE46783	GE46783X012	6A	Belleville Spring	3	Non-Safety Related	O/3	Replacement parts should be on hand in case of loss, damage, or excessive wear during maintenance.	N/A	Does not exhibit a tendency to degrade over time.

Table 7. Fisher SS-264 Spare Parts (continued)

Drawing Number	Replacement Part Number	Key No.	Part Description	Qty	Classification	Spare Part Code(1)	Spare Part Requirement Rationale	Shelf Life	Shelf Life Rationale(2)
GE46784	GE46784X022	6B	Packing Follower Bushing Assy	1	Non-Safety Related	O/1	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every 30 years.	N/A	Does not exhibit a tendency to degrade over time.
GE46786	GE46786X012	6C	Stop Plate	1	Non-Safety Related	O/1	Replacement parts should be on hand in case of loss, damage, or excessive wear during maintenance.	N/A	Does not exhibit a tendency to degrade over time.
GE48198	GE48198X012	8	Ball Assy	1	Safety Related	O/1	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every 12 years.	N/A	Does not exhibit a tendency to degrade over time.
GE48207	GE48207X012	9	Follower Bearing	1	Safety Related	O/1	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every 12 years.	N/A	Does not exhibit a tendency to degrade over time.
V153364	V153364X042	15	Key, Shaft	1	Safety Related	O/1	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every 30 years.	N/A	Does not exhibit a tendency to degrade over time.
1A3520	1A352035252	16	Packing Flange Nut	2	Non-Safety Related	O/2	Replacement parts should be on hand in case of loss, damage, or excessive wear during maintenance.	N/A	Does not exhibit a tendency to degrade over time.
13B8709	13B8709X012	19	Packing Box Ring	1	Non-Safety Related	O/1	Routine maintenance of the valve, including replacing the packing, is a manufacturer's recommendation. Maintenance is a necessary requirement to ensure positive performance during the expected life of the valve. Emerson Process Management recommends replacing this component every 6 years.	N/A	Graphite does not exhibit a tendency to degrade over time.
17B3084	17B3084X012	20	Packing Flange Stud	2	Non-Safety Related	O/2	Replacement parts should be on hand in case of loss, damage, or excessive wear during maintenance.	N/A	Does not exhibit a tendency to degrade over time.
1A3464	1A3464X0022	22	Cap Screw, 1.50 in. Lg	2	Non-Safety Related	O/2	Replacement parts should be on hand in case of loss, damage, or excessive wear during maintenance.	N/A	Does not exhibit a tendency to degrade over time.
1A6803	1A680335252	23	Hex Nut, Jam 3/8-24	4	Non-Safety Related	O/4	Replacement parts should be on hand in case of loss, damage, or excessive wear during maintenance.	N/A	Does not exhibit a tendency to degrade over time.

Table 7. Fisher SS-264 Spare Parts (continued)

Drawing Number	Replacement Part Number	Key No.	Part Description	Qty	Classification	Spare Part Code(1)	Spare Part Requirement Rationale	Shelf Life	Shelf Life Rationale(2)
GE51734	GE51734X012	24	Cap Screw, 2.50 in. Lg	2	Non-Safety Related	O/2	Replacement parts should be on hand in case of loss, damage, or excessive wear during maintenance.	N/A	Does not exhibit a tendency to degrade over time.
GE49053	GE49053X012	25	Seal Ring	1	Non-Safety Related	O/1	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every 12 years.	N/A	Does not exhibit a tendency to degrade over time.
GE48209	GE48209X012	26	Gasket	1	Non-Safety Related	O/1	The gasket should be replaced at same time as seal ring. Based on experience and testing; Emerson Process Management recommends replacing this component every 12 years.	N/A	Does not exhibit a tendency to degrade over time.
GE50801	GE50801X012	28	Thrust Washer, SPCL	1	Safety Related	O/1	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every 12 years.	N/A	Does not exhibit a tendency to degrade over time.
1V87294	1V87294X022	101	Bettis Coupler	1	Safety Related	O/1	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every 30 years.	N/A	Does not exhibit a tendency to degrade over time.
T11826	T1182636402	102	Pin, Roll	1	Safety Related	O/1	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every 30 years.	N/A	Does not exhibit a tendency to degrade over time.
16B5430	16B5430X032	103	Yoke Key	1	Safety Related	O/1	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every 30 years.	N/A	Does not exhibit a tendency to degrade over time.
V143150	V143150X012	104	Roll Pin, Driv-Lok	1	Safety Related	O/1	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every 30 years.	N/A	Does not exhibit a tendency to degrade over time.

1. ME/n = construction/installation spares. P/n = preoperational spares. S/n = start-up spares. O/n = operational spares.
2. Dependant on good storage practices and conditions.

Table 8. 2-1/2-8X12.50 Body-to-Bonnet Studs Sequence and Torque Tables

Two-Stud Sequence					
	Torque Step	Torque		Mark Done	
Sequence		N•m	ft•lbf	☑	Intls
1&2	1	698	515		
3&4					
5&6					
7&8					
9&10					
11&12					
13&14					
1&2	2	1,397	1,030		
3&4					
5&6					
7&8					
9&10					
11&12					
13&14					
1&2	3	2,095	1,545		
3&4					
5&6					
7&8					
9&10					
11&12					
13&14					
1&2	4	4,407	3,250		
3&4					
5&6					
7&8					
9&10					
11&12					
13&14					
1&2	5	6,780	5,000		
3&4					
5&6					
7&8					
9&10					
11&12					
13&14					
Perform torque steps 6 and 7 per table 9.					

Four-Stud Sequence					
	Torque Step	Torque		Mark Done	
Sequence		N•m	ft•lbf	☑	Intls
1, 2, 3, & 4	1	698	515		
5, 6, 7, & 8					
9, 10, 11, & 12					
13 & 14					
1, 2, 3, & 4	2	1,397	1,030		
5, 6, 7, & 8					
9, 10, 11, & 12					
13 & 14					
1, 2, 3, & 4	3	2,095	1,545		
5, 6, 7, & 8					
9, 10, 11, & 12					
13 & 14					
1, 2, 3, & 4	4	4,407	3,250		
5, 6, 7, & 8					
9, 10, 11, & 12					
13 & 14					
1, 2, 3, & 4	5	6,780	5,000		
5, 6, 7, & 8					
9, 10, 11, & 12					
13 & 14					
Perform torque steps 6 and 7 per table 9.					

Name	Signature Line 1	Date
Name	Signature Line 2	Date

Table 9. Body-To-Bonnet Studs Torque Steps 6 and 7
(See Figure 9)

Two Stud Sequence					
		Torque		Mark Done	
Stud No.	Torque Step	N•m	ft•lbf	☑	Intls
1	6	9356	6900		
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
1	7	10970	8090		
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
Perform final circular torque per table 10.					
Name		Signature Line 1		Date	
Name		Signature Line 1		Date	

Table 10. Body-To-Bonnet Stud Final Circular Torque Step
(See Figure 9)

Stud No.	Torque		Mark Done	
	N•m	ft•lbf	☑	Intls
1	10,970	8,090		
11				
5				
9				
3				
7				
13				
2				
12				
6				
10				
4				
8				
14				

Name	Signature Line 1	Date
Name	Signature Line 2	Date

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