Fisher™ HPNS Control Valve

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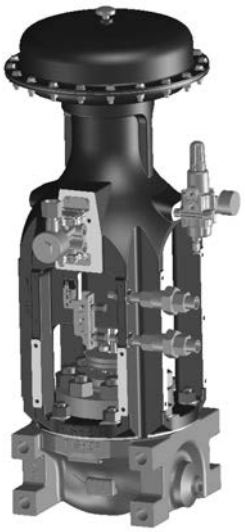
Figure 1. HPNS Valve with 667NS2 Actuator



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 1/2 through NPS 8 HPNS valves with CL900 through CL2075 ratings. **Note: Applications requiring lower pressure class ratings may use the same casting as a higher rated valve of the required size.** Refer to separate manuals for instructions covering the actuator, positioner, and accessories.

Do not install, operate, or maintain HPNS valves 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

HPNS valves (figure 1) have buttweld end connections in various schedules and are designed for use with Fisher 667NS2 and 657NS2 actuators. HPNS valves are designed to handle high seismic environments.

Specifications

Specifications for the HPNS valves are shown in table 1.

Table 1. Specifications

End Connection Styles and Ratings(1,2)

Buttwelding: Consistent with Schedule 40-160

Flanges: Not available

Socket Welding: Not available

See table 2

Shutoff Classifications

See table 3
Bidirectional Trim: Class V. See table 4

Bore Seal trim: High-temperature, Class IV and V. See table 4

Flow Characteristic

Standard Cage: ■ Equal percentage, ■ Modified equal percentage, ■ Linear or, ■ Quick opening on/off

Micro-Form Valve Plug: ■ Equal percentage ■ Modified equal percentage or, ■ Quick opening on/off

Cavitrol™ III or Whisper Trim™ III Cage: ■ Linear

Special cages: Special characterized flow cages are available. Consult your Emerson sales office or Local Business Partner.

Flow Direction

Standard Cage

■ *HPNS Balanced:* Normally flow up
■ *HPNS Unbalanced:* Normally flow down or up(3)

Cavitrol III Cage: Flow down

Whisper Trim III Cage: Flow up

Approximate Weights (valve body and bonnet assemblies)

See table 2

Bolt Torque Tolerance

Torque values given are +/- 5%, unless otherwise specified

Special Tools

Standard mechanics tools are used for assembly/disassembly, except for:
Valves supplied with bore seal plugs:
■ a bore seal installation tool is required for proper installation of the bore seal (see figure 12), ■ a center punch is also used to stake the bore seal retainer threads after installation, ■ a 1/8 inch diameter drill bit is recommended for removing the deformed section of thread on the bore seal retainer during bore seal replacement
Valves supplied with hermetically-sealed bellows seal:
■ a loading fixture is required for performing seal-weld between bellows flange and valve body (see figure 16)

Additional Specifications

For specifications such as materials, valve plug travels, and port, yoke bolt circle, and stem diameters, see the Parts List section

1. EN (or other) ratings and other BWE can usually be supplied; consult your Emerson sales office.
2. The pressure or temperature limits in this manual and any applicable standard limitations should not be exceeded.
3. HPNS Unbalanced valves may be used flow down for on-off service or where required by design.

Educational Services

For information on available courses for the Fisher HPNS valve, as well as a variety of other products, 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

Table 2. Valve Assembly Approximate Weights

VALVE SIZE, NPS	PRESSURE RATING	KILOGRAMS	POUNDS
1/2	2075	136	300
1	2075	117	257
2	2075	118	259
3	2075	271	596
4	900	261	574
6	900	374	823
8	1725	940	2071

Table 3. Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4

VALVE DESIGN	VALVE SIZE, NPS	DATA SHEET(1)	PORT DIAMETER, mm (INCHES)	TRIM STYLE	LEAKAGE CLASS
Unbalanced HPNS	1/2	150	6.35 (0.25)	Micro-Form	V
	1	100	19.05 (0.75)	Micro-Form	V
		105	6.35 (0.25)		
		106	6.35 (0.25)		
		201			
		113	25.4 (1)		
		117	19.05 (0.75)		IV
		118	25.4 (1)		
	2	101	47.63 (1.875)	Equal % (std cage)	V
		102		Linear (Whisper III, B3)	
		107		Linear (std. cage)	
		110	25.4 (1)	Special (Cavitrol III, 3-stage)	
		114	47.63 (1.875)	Equal % (Whisper III, B3)	
	3	108	73.03 (2.875)	Linear (std. cage)	V

1. Data Sheet Number refers to PV14 Data Sheets for the AP1000 Power Plant Design.

Table 4. Additional Shutoff Classification per ANSI/FCI 70-2 and IEC 60534-4

VALVE DESIGN	VALVE SIZE, NPS	DATA SHEET(1)		PORT DIAMETER, mm (INCHES)	CAGE STYLE	LEAKAGE CLASS
Balanced HPNS	3	PV14	111	73.0 (2.875)	Linear (Whisper III, C3)	V
			116		Equal %	III
	4	PV14	103	92.1 (3.625)	Modified Equal %	V
			115			IV
			120			IV
	6	PV14	121	136.525 (5.375)	Linear (std. cage)	IV
		PV69	101	133.35 (5.25)	Special (Cavitrol III, 2-stage)	V (forward) IV (reverse)
	8	PV14	104	177.8 (7)	Linear (std. cage)	V

1. Data Sheet Number refers to PV14 Data Sheets and PV69 Data Sheets for the AP1000 Power Plant Design.

Table 5. Recommended Torque for Packing Flange Nuts (non live-loaded)

STEM DIAMETER		DATA SHEET(1)	TORQUE			
			N•m		lbf•ft	
mm	Inches		Min	Max	Min	Max
12.7	0.5	100	18	24	13	18
		105	5	8	4	6
		116	12	18	9	13
		117	18	24	13	18
25.4	1	102	34	50	25	37
		103				
	0.75	110	34	57	25	42
	1	111	34	50	25	37
		114				
		115				

1. Data Sheet Number refers to PV14 Data Sheets for the AP1000 Power Plant Design.

Table 6. Torque for Body-to-Bonnet Bolting Using Nuclear Grade Anti-Seize Lubricant

VALVE SIZE, NPS	TORQUE					
	N•m			lbf•ft		
	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
1/2	676	711	818	498	524	603
1	883	929	1068	651	685	788
2	883	929	1068	651	685	788
3	1648	1735	1995	1216	1280	1472
4	1230	1295	1489	907	955	1098
6	2164	2278	2620	1596	1680	1932
8	4315	4542	5223	3183	3350	3853

Principle of Operation

HPNS valves are control valves based on the Fisher HP valve product. The valve body and bonnet contain a fluid under pressure, while the internal valve parts control the flow of the fluid through the valve. The internal parts consist of gaskets, a seat ring, a plug-stem assembly, and a cage. Additional seals might be used depending on the exact function and design of the valve.

The gaskets, seat ring, and cage are stationary and held in place inside the valve body and bonnet by the force applied by the body-to-bonnet bolting. The plug-stem assembly is designed to move up and down (axially) inside the cage. The stem passes through a hole in the bonnet, and can be moved up and down (axially) by an external actuator attached to the valve body, or bonnet. Sealing packing is used between the valve bonnet and plug stem to prevent the fluid from leaking out of the valve, while still allowing the plug stem to move axially.

Fluid enters one end of the valve. When the stem is pushed down, the plug moves to contact the seat ring, and “closes” the valve, preventing the fluid from passing through the valve. When the stem is pulled up, the plug disengages from the seat ring, and slides up through the center of the cage, exposing holes or flow passages in the cage. This allows the fluid to flow through seat ring and cage, and exit the valve through the opposite end of the valve which it entered. By positioning the plug at different "travels" in the cage, the amount of flow through the valve can be controlled.

Lifting Guidelines

CAUTION

Loads must be applied only in the plane of the lifting eyebolt. If the plane of the eyebolt is not aligned with the load, estimate the amount of unthreading necessary to properly align the eye. Remove the eyebolt and add shims to adjust the angle of the plane of the eye. The load should never be applied at more than a 45 degree angle from the bolt centerline. Refer to eyebolt manufacturer's instruction manual for further details.

The quantity of eyebolts for lifting purpose is the minimum recommendation. More eyebolts can be used per customer experience.

Weight on the lifting straps may cause them to unwind, which can cause a hanging load to rotate. Make sure the straps are not twisted before lifting, or if necessary use a tag line attached to one of the eyebolts, to which a person can grip and stabilize the weight during lifting.

⚠ WARNING

Always read, understand, and follow instructions. Failure to do so can result in severe injury or death. Never stand, work or crawl under the load. The load could swing, pieces could drop, or the load could fall or slip. Allow for this possibility by establishing a safe distance between yourself and the load.

When tightening the eyebolts and nuts, do not exceed the torque that is specified on the diaphragm casing cap screws and nuts (keys 119 and 120) in the following sections, to avoid damage on the diaphragm.

Lifting Valve/Actuator Assembly

To lift the valve/actuator assembly, eyebolts should be used. Insert four 3/8 inch shouldered pattern eyebolts positioned 90 degrees apart on the diaphragm casing flange for size 45 and 70. Use six 7/16 inch shouldered pattern eyebolts positioned 60 degrees apart on the diaphragm casing flange for size 80. Two nuts are required with one on each side of the diaphragm casing flange. A longer strap is recommended, so that the angle between the straps connecting each eyebolt can be smaller, which helps the eyebolts hold more weight. The eyebolt should be ASTM A489-K04800 or stronger material.

For a bellows seal valve, the valve/actuator assembly should be lifted using a nylon strap that is rigged to choke around the actuator under the diaphragm casing. Use protective pads between the strap and casing to help prevent damage to the painted surface. A single hoist lift point on the strap will balance and lift the valve/actuator assembly in a level manner. If necessary, use an additional sling around the valve inlet and outlet or around actuator legs for body stabilization.

Lifting Valve Only

To lift the valve, eyebolts should be used. Insert 3/4-10 shouldered pattern eyebolts into two threaded holes located on the top of the NPS 1/2-4, and NPS 6 valve bodies, positioned 180 degrees apart. For NPS 8 valve bodies, insert two 3/4-10 shouldered pattern eyebolts into two threaded holes located on the top of the bonnet, positioned 180 degrees apart. The eyebolt material should be ASTM A489-K04800 or stronger material. Be sure at least 90% of the threads are engaged in the receiving hole, with a minimum thread engagement of at least 1-1/2 times the thread diameter in steel. If necessary, place two nylon slings around the inlet and outlet of the valve body for stabilization. Use padding as needed to protect any painted surfaces. The valve can now be lifted using a hoist capable of leveling the lifting points.

Lifting Actuator Only

To lift the actuator and accessories, eyebolts should be used. Insert two 3/8 inch shouldered pattern eyebolts positioned 180 degrees apart on the diaphragm casing flange for size 45 and 70. Use four 7/16 inch shouldered pattern eyebolts positioned 90 degrees apart on the diaphragm casing flange for size 80. Two nuts are required with one on each side of the diaphragm casing flange. The eyebolt material should be ASTM A489-K04800 or stronger material. For a bellows seal valve, the actuator should be lifted using a nylon strap that is rigged to choke around the actuator under the diaphragm casing. Use protective pads between the strap and casing to help prevent damage to the painted surface. A single hoist lift point on the strap will balance and lift the actuator in a level manner.

Installation

⚠ 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 the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure 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

Some bonnet flanges have a tapped hole that was used to handle the bonnet during manufacture. Do not use this tapped hole to lift the valve assembly or personal injury may result.

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions indicated when the valve was ordered. Since some body/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

If you are hoisting the valve, use nylon slings to protect the surfaces. Carefully position the slings to prevent damage to the actuator tubing and any accessories. Also, take care to prevent people from being injured in case the hoist or rigging slips unexpectedly. Refer to table 2 for valve assembly weights. It is important to use adequately sized hoists and chains or slings when handling the valve.

1. Before installing the valve, inspect it to ensure that the valve body cavity is free of foreign material.
2. Clean out all pipelines to remove scale, welding slag, and other foreign materials before installing the valve.

Note

If the valve body being installed has small internal flow passages, such as with Whisper Trim III or Cavitrol III cages, consideration should be given to installing an upstream strainer to prevent the lodging of particles in these passages. This is especially important if the pipeline cannot be thoroughly cleaned or if the flowing medium is not clean.

3. Flow through the valve must be in the direction indicated by the flow arrow, which is stamped on or attached to the valve body.

CAUTION

Depending on valve body materials used, post-weld heat treating might be needed. Post-weld heat treatment can damage internal elastomeric, plastic, and metal parts. Shrink-fit pieces and threaded connections might also loosen. In general, if post-weld heat treating is needed, remove all trim parts. Contact your Emerson sales office or Local Business Partner for additional information.

4. Use accepted piping and welding practices when installing the valve in the pipeline.
5. Install a three-valve bypass around the valve if continuous operation is required during maintenance.
6. If the actuator and valve body are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.
7. If the valve body was shipped without packing installed in the packing box, install the packing before putting the valve body into service. Refer to instructions given in the Packing Maintenance procedure.

⚠ 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.

Valves with HIGH-SEAL Heavy-Duty live-loaded packing will not require this initial re-adjustment. See the Replacing HIGH-SEAL Packing section in this manual for packing instructions.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing maintenance and trim maintenance. All maintenance operations may be performed with the valve in the line.

⚠ WARNING

Avoid personal injury or damage to property from sudden release of pressure or uncontrolled process fluid. Before starting disassembly:

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.**
- **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 on 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.**
- **The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline.* 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.**

Note

The HPNS valve uses spiral-wound gaskets which are crushed to provide their seal. A spiral-wound gasket should never be reused. Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket must be installed upon reassembly. This is necessary to ensure a good gasket seal, since the used gasket will not seal properly.

CAUTION

The spiral-wound gaskets are of special design. Failure to use Fisher replacement parts may result in valve damage.

Note

If the valve has HIGH-SEAL Heavy-Duty live-loaded packing installed (figure 4 or 5), see the Replacing HIGH-SEAL Packing section in this manual for packing instructions.

Bonnet Nut Torquing Considerations

When using a hydraulic torque wrench to tighten the bonnet nuts, use an extra socket or some other form of tooling to prevent the reaction arm from contacting the adjacent bonnet nut. This will prevent any unsatisfactory marring of the bonnet nut faces. See figure 2 for a diagram of this procedure.

Packing Lubrication

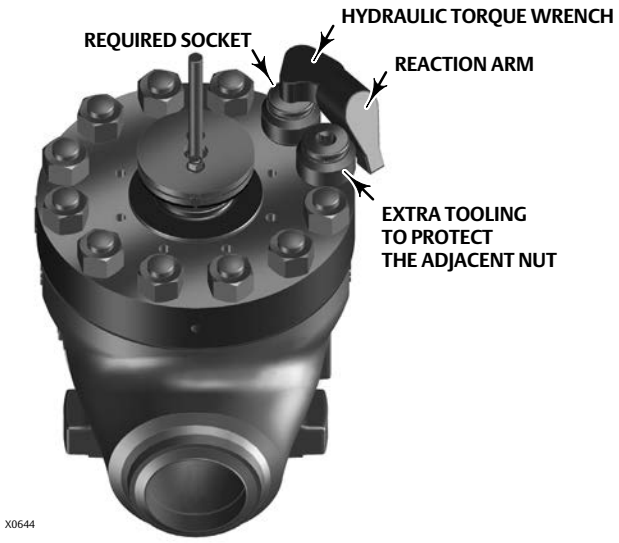
Note

No provisions for packing lubrication.

⚠ WARNING

Do not lubricate any parts or surfaces that may come into contact with the process media. Any use of lubricant can lead to the contamination of the process media and could lead to property damage or failure.

Figure 2. Diagram of Procedure to Prevent Marring of Bonnet Nuts During Assembly



Packing Maintenance

If there is undesirable packing leakage in conventional packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts (key 14, figure 17, 19, or 20) to at least the minimum recommended torque in table 5. However, do not exceed the maximum recommended torque in table 5 or excessive friction may result. If leakage continues, replace the packing by following the numbered steps presented in the Replacing Conventional Packing procedure.

If the packing is relatively new and tight on the valve plug stem, and if tightening the packing flange nuts does not stop the leakage, it is possible that the stem is worn or nicked so that a seal cannot be made. The surface finish of a new stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks or scratches around the packing box wall. While replacing the packing according to the Replacing Packing procedure, inspect the valve plug stem and packing box wall for nicks or scratches.

If there is undesirable packing leakage in HIGH-SEAL packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts (key 14, figure 17, 19, or 20) to at least the minimum spring load shown in figure 8. However, do not exceed the maximum spring load shown in figure 8 or excessive friction may result. If leakage continues, replace the packing by following the numbered steps presented in the Replacing HIGH-SEAL Packing procedure.

Replacing Conventional Packing

⚠ WARNING

Refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Key numbers referred to in this procedure are shown in figure 17, 19 or 20, unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Exhaust all actuator pressure, if any was applied, and disconnect the actuator supply and any leakoff piping.
3. Using the appropriate actuator instruction manual for reference, relieve all spring compression from the actuator.
4. Remove the cap screws in the stem connector, and separate the two halves of the stem connector.
5. Remove the hex nuts, and remove the actuator from the body (key 1) or bonnet (key 10).
6. Loosen the packing flange nuts (key 14) so that the packing (figure 3) is not tight on the valve plug stem (key 4). Remove any stem locknuts from the valve plug stem threads.

CAUTION

Avoid damage to the seating surfaces caused by the valve plug and stem assembly (key 4) dropping from the bonnet (key 10) after being lifted part way out. When lifting the bonnet (key 10), either be sure that the valve plug and stem assembly (key 4) remain in the valve and on the seat ring (key 3) or, temporarily install a valve stem locknut on the valve stem. This locknut will prevent the valve plug and stem assembly from dropping out of the bonnet.

Use care to avoid damaging gasket sealing surfaces.

The HPNS balanced trim piston rings (key 23) are brittle and in two pieces. Avoid damaging the piston rings by dropping or rough handling.

Figure 3. Conventional Packing

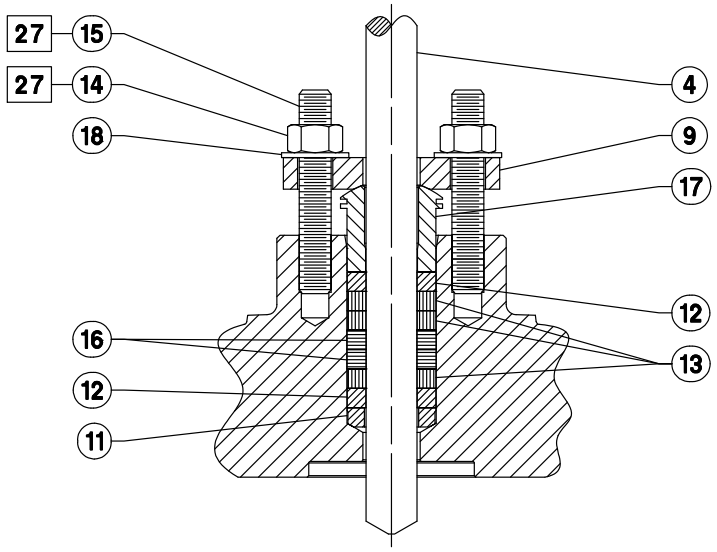
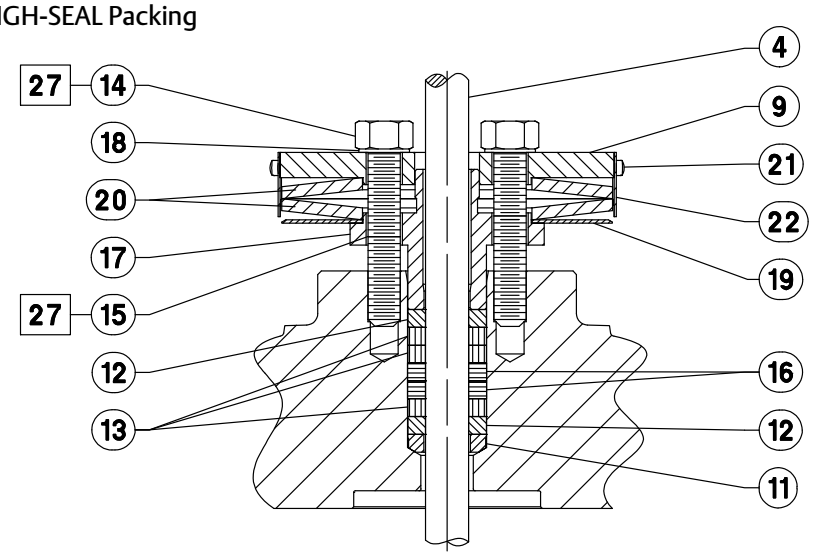


Figure 4. Graphite HIGH-SEAL Packing



⚠ WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. If the cage sticks to the bonnet, proceed carefully with bonnet removal and support the cage so that it will not fall unexpectedly from the bonnet.

Figure 5. PTFE HIGH-SEAL Packing

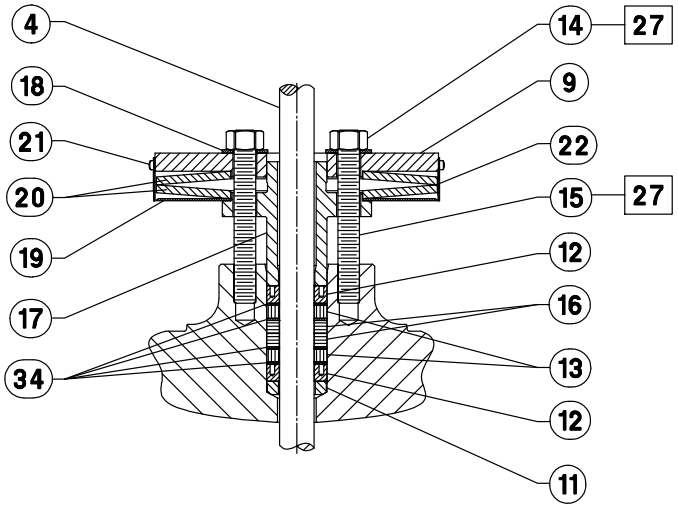
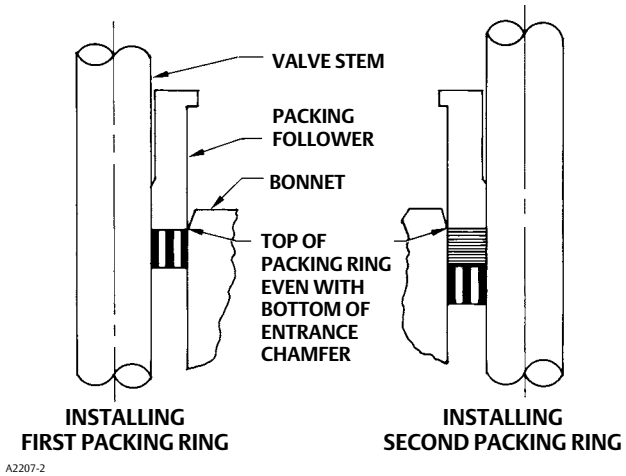


Figure 6. Installing Graphite Ribbon/Filament Packing Rings One at a Time



Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

7. Hex nuts (key 8) attach the bonnet to the valve body. Loosen these nuts approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed to step 9.
8. If leakage does occur from the joint, tighten the nuts and verify that the process is properly shut down or the valve is properly bypassed.
9. Unscrew the hex nuts (key 8) and carefully lift the bonnet off the valve stem. If the valve plug and stem assembly starts to lift with the bonnet, use a hammer on the end of the stem and tap it back down. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.
10. Remove the bonnet gasket (key 6). Lift the valve plug and stem assembly (key 4) out of the valve body and set it on a protective surface. If the valve plug is to be reused, protect the valve plug seating surface to prevent scratches. Install screws or bolts into the tapped holes in the top of the cage (key 2), and carefully lift it out of the valve body. Carefully lift the seat ring (key 3) out of the valve body. Remove the cage gasket (key 5).

CAUTION

Inspect the seat ring, cage, bonnet, and body gasket surfaces. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm (0.003 inches) in height (the thickness of a human hair) can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, since they will prevent the gaskets from sealing properly.

11. Clean all gasket seating surfaces; refer to your process or safety engineer for appropriate cleaning tools. Clean in the same direction as the surface serrations, not across them.
12. Cover the opening in the valve body to protect the gasket seating surface and to prevent foreign material from getting into the valve body cavity.
13. Remove the packing flange nuts (key 14), packing flange (key 9), and packing follower (key 17). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall.

14. Clean the packing box and the following metal packing parts: packing follower, packing box ring (key 11).
15. Inspect the valve stem threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding or honing with a tool similar to a small honing stone, replace the damaged parts.
16. Remove the protective covering from the valve body cavity, and install the seat ring and cage using a new seat ring gasket (key 5) and bonnet gasket (key 6). Install the plug, then slide the bonnet over the stem and onto the studs (key 7).
17. If required, place a body/bonnet mounting washer (key 24) over each stud, taking care to ensure that the washers are pushed as far as possible toward the center of the bonnet. Failure to do so could prevent successful actuator mounting. Before installing the washers, inspect each one to ensure no wear or galling is present on the washer faces. Replace if wear is detected. Also, lubricant is not required on the washers. All required lubricant will be applied when the nuts are installed.

Note
The proper bolting procedures in step 18 include--but are not limited to--ensuring that the bonnet stud threads are clean, and that the hex nuts are evenly tightened to the specified torque values.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 6 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure.
Hot torquing is not recommended.

Note
Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson sales office or Local Business Partner immediately if a discrepancy between actual parts and approved parts is suspected.

18. Lubricate the stud threads and the seating faces of the hex nuts (key 8) with Nuclear Grade anti-seize lubricant (key 27). Replace the hex nuts and tighten them finger-tight. Stroke the valve several times to center the trim. Torque the nuts in a crisscross pattern (reference figure 7) to no more than 1/4 of the nominal torque value specified in table 6.

Note
If using a hydraulic torque wrench, please see the Bonnet Nut Torquing Considerations section on page 8 to avoid any unsatisfactory marring of parts.

When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

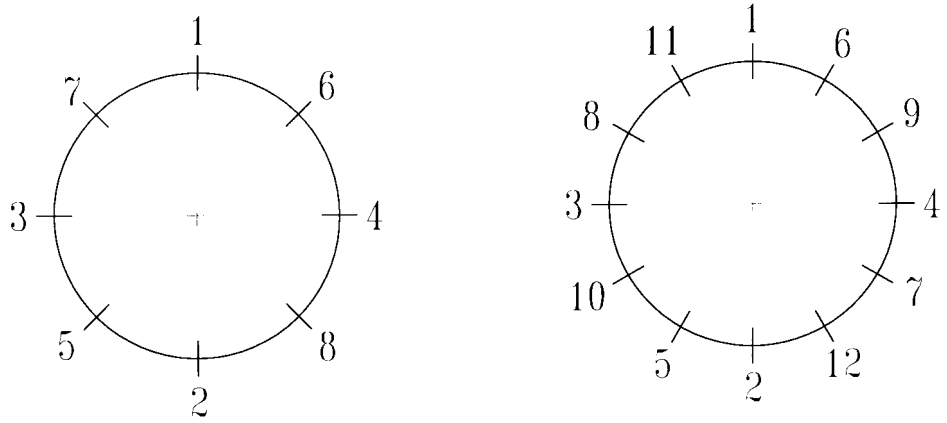
Note

When installing packing rings, prevent entrapping air between the rings. Add the rings one at a time without forcing them below the chamfer of the packing box entrance chamber. As each successive ring is added, the stack should not be pushed down more than the thickness of the added ring (figure 6).

19. Install new packing and the metal packing box parts according to the arrangement in figure 3, 4, or 5. Place a smooth-edged pipe over the valve stem, the top end higher than the valve stem is recommended. An alternative way is to slide the packing follower over the valve stem. Gently tamp each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.
20. Slide the packing follower and packing flange into position. Lubricate the packing flange studs (key 15) and the seating faces of the packing flange nuts (key 14) with Nuclear Grade anti-seize lubricant (key 27). Replace the packing flange nuts.

Torque evenly in increments of 1/4 of the full torque value, alternating between the packing flange nuts. Tighten the packing flange nuts to the maximum recommended torque shown in table 5. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 5.

Figure 7. Bolting Diagram



8 BOLT PATTERN **12 BOLT PATTERN**

Note

If the valve has HIGH-SEAL heavy-duty live-loaded packing installed (figure 4 or 5), see the Replacing HIGH-SEAL packing section in this manual for packing instructions.

21. Mount the actuator on the valve body assembly, and reconnect the actuator and valve plug stems according to the procedures in the appropriate actuator instruction manual.

Replacing HIGH-SEAL Packing

Key number locations are shown in figure 4 or 5.

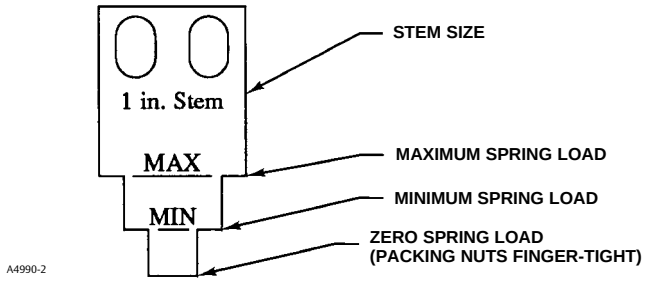
1. Follow steps 1 through 19 of the Replacing Conventional Packing section in this manual. Note: For step 13 of the Replacing Conventional Packing section, also remove the indicator disk (key 19), qty-2 Belleville springs (key 20), qty-4 load scale mounting screws (key 21), and Qty-2 load scales (key 22).
2. Install the packing arrangement into the valve packing box. Note: Be certain to observe the note given prior to step 19 of the Replacing Conventional Packing section in this manual.

Note

Be sure to install the packing rings in the sequence shown in figure 4 or 5.

3. Install the packing follower (key 17).
4. Place the indicator disk (key 19) and the first Belleville spring (key 20) while guiding them onto the packing follower (key 17). Make certain the convex side of the Belleville spring is towards the indicator disk as shown in figure 4 or 5.

Figure 8. Typical Load Scale



5. Place the second Belleville spring (key 20) with the convex side toward the packing flange (key 9); see figure 4 or 5. Position the packing flange on top of the spring, making sure the second spring fits into its guide in the flange.

CAUTION

Keep the packing follower and flange centered on the valve stem. If any metal part makes contact with the stem, it can cause damage to the stem surface. Vertical scratches or nicks on the stem surface can cause excessive leakage from the packing.

6. Lubricate the packing nuts with Nuclear Grade anti-seize lubricant (key 27) and tighten them hand-tight.
7. The load scale (key 22) is used to indicate compression on the Belleville springs. Position the load scale by slightly loosening the mounting screws (key 21). Align the bottom edge of the load scale with the indicator disk and retighten the screws. Figure 8 illustrates the load scale properly adjusted before the nuts have been tightened and with the Belleville springs not compressed.
8. Tighten the packing nuts while observing the two load scales (key 22) to make sure the flange (key 9) is tightened evenly. Be sure to keep the follower centered on the stem while tightening the nuts. Tighten the nuts alternately and evenly, keeping the flange parallel with the valve, until the indicator disk aligns with the maximum compression line on the load scales.
9. The packing is now properly loaded and the packing nuts do not need to be retightened unless the indicator begins to approach the minimum compression line. After the valve has been in service for awhile, visually check the load scale to determine loading. Under normal conditions, the packing nuts should not require retightening for the life of the packing.

Trim Removal

Standard Balanced and Unbalanced Trim Removal

Key numbers referenced in this procedure are shown in figure 17, 19, or 20 except where indicated.

1. Remove the actuator and bonnet by following steps 1 through 9 of the replacing packing procedure. Observe all warnings and cautions.

CAUTION

Use care to avoid damaging gasket surfaces.

The surface finish of the valve stem (key 4) is critical for making a good packing seal. The inside surface of the cage or cage assembly (key 2) is critical for smooth operation of the valve plug and for making a seal with the piston rings (key 23) or seal rings (key 31). The seating surfaces of the valve plug (key 4) and seat ring (key 3) are critical for proper shutoff. Assume all these parts are in good condition, and protect them accordingly unless inspection reveals otherwise.

2. Lift the valve plug/stem assembly out of the valve body. If the valve plug/stem assembly is to be reused, tape or otherwise protect the valve plug stem and the valve plug seating surface to prevent scratches.
3. To remove the piston rings and bidirectional PEEK anti-extrusion seal rings for a balanced HPNS construction, proceed as appropriate:

For piston-rings constructions, each of the piston rings (key 23) are in two pieces; locate the break between sections of the piston rings. Using an appropriate tool such as a flat-blade screwdriver, carefully pry out the piston rings from the grooves in the plug.

For bidirectional PEEK anti-extrusion seal rings constructions, use an appropriate tool and carefully remove the retainer ring (key33) from the valve plug. Then remove the remaining qty-1 backup ring (key 29), qty-2 anti-extrusion rings (key 30), qty-2 spring loaded seal rings (key 31), and qty-1 spacer ring (key 32) from top of the plug (figure 10).

4. Lift out the bonnet gasket (key 6) and the cage (key 2).
5. Remove the seat ring (key 3) and the seat ring gasket (key 5).

Bore Seal Trim Removal

1. Remove the valve actuator and bonnet following steps 1 through 9 in the Replacing Packing section in this manual.

CAUTION

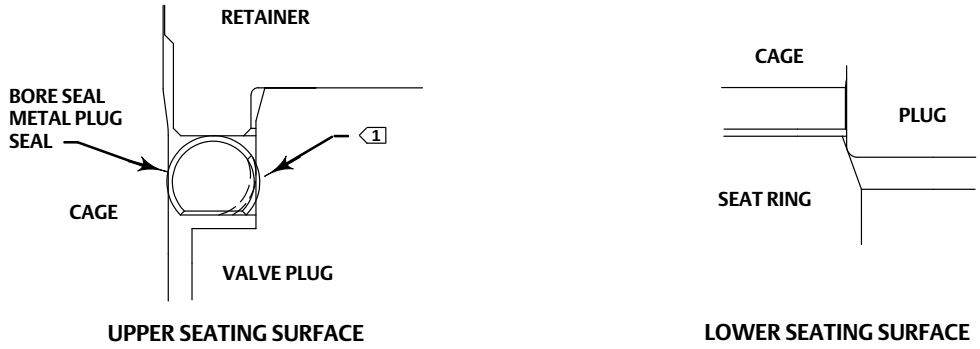
To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance.

Use caution when removing piston ring(s) and Bore Seal plug seal to avoid scratching any sealing surface.

2. Remove the plug/retainer assembly (with Bore Seal plug seal), cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section in this manual.
3. Locate the staked thread on top of the valve plug (figure 14). The staked thread secures the retainer. Use a drill with a 1/8 inch bit to drill out the staked area of the thread. Drill approximately 1/8-inch into the metal to remove the staking.
4. Locate the break between sections of the piston ring(s). Using an appropriate tool such as a flat-blade screwdriver, carefully pry out the piston ring(s) from the groove(s) in the Bore Seal retainer.

5. After removing the piston ring(s), locate the 1/4-inch diameter hole in the groove. In a retainer with more than one piston ring grooves, the hole may be found in the upper or lower groove.
6. Select an appropriate tool such as a strap wrench and rotate the retainer and free it from the valve plug. Remove the retainer from the plug.
7. Use an appropriate tool such as a flat-blade screwdriver to pry the Bore Seal plug seal off the plug. Use caution to avoid scratches or other damage to the sealing surfaces where the Bore Seal plug seal makes contact with the valve plug (figure 9).
8. Inspect the lower seating surface where the valve plug contacts the seat ring for wear or damage which would prevent proper operation of the valve. Also, inspect the upper seating surface inside the cage where the Bore Seal plug seal contacts the cage, and inspect the sealing surface where the Bore Seal plug seal makes contact with the plug (figure 9).

Figure 9. Lower (Valve Plug to Seat Ring) and Upper (Bore Seal Plug Seal to Cage) Seating Surfaces



NOTE:
1 UPPER SEATING SURFACE IS THE AREA OF CONTACT BETWEEN THE BORE SEAL METAL PLUG SEAL AND THE CAGE.

Trim Replacement

⚠ WARNING

Observe the warning at the start of the Maintenance section.

After all trim maintenance has been completed, reassemble the valve body by following the numbered steps below. Be certain that all gasketed surfaces have been well cleaned. Key numbers referenced in this procedure are shown in figure 17, 19, or 20, except where indicated.

CAUTION

Inspect the seat ring, cage, bonnet, and body gasket surfaces. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm (0.003 inches) in height (the thickness of a human hair) can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, since they will prevent the gaskets from sealing properly.

1. Install the seat ring gasket (key 5) into the valve body (key 1). Install the seat ring (key 3).
2. Install the cage (key 2).

3. To install the piston rings, bidirectional PEEK anti-extrusion seal rings, and bore seal (key 26) for a balanced HPNS construction, proceed as appropriate:

For piston rings constructions, if it is necessary to install new piston rings, the replacement piston rings will arrive in one piece. Use a vise with smooth or taped jaws to break a replacement piston ring into halves. Place the new ring in the vise so that the jaws compress the ring into an oval. Compress the ring slowly until the ring snaps on both sides. If one side snaps first, do not try to tear or cut the other side. Instead, keep compressing until the other side snaps. The piston ring can also be fractured by scoring and snapping over a hard surface such as a table edge. Sawing or cutting is not recommended.

Remove any protective tape or covering from the valve plug and stem assembly, and set it on a protective surface. Then, place the piston rings in the piston ring grooves with the fractured ends matched.

CAUTION

For valves with a PTFE seal ring (figure 10), if replacing the valve plug spring loaded seal ring (key 31), be careful not to scratch the surfaces of the ring groove in the valve plug or any of the surfaces of the replacement ring, or the replacement ring may not seal properly.

For bidirectional PEEK anti-extrusion seal rings constructions, install qty-1 anti-extrusion ring (key 30), qty-1 spring loaded seal ring (key 31), qty-1 spacer ring (key 32), qty-1 spring loaded seal ring (key 31), qty-1 anti-extrusion ring (key 30), and qty-1 backup ring (key 29) onto the top of the plug with the orientation shown in figure 10. Install the retainer ring (33) into the groove on top of the plug.

Note

To install the spring loaded seal ring (key 31), gently stretch the seal ring and work it over the top edge of the valve plug. Give the PTFE material in the seal ring time to cold flow during the stretching procedure. Avoid jerking sharply on the ring. Stretching the seal ring over the valve plug might make it seem loose when it is in the groove, but it will shrink to its original size after you have installed the plug into the cage.

For bore seal constructions, install the bore seal (key 26, figure 11) onto the valve plug (key 4) following the Installing Bore Seal Trim section in this instruction manual.

4. Install the valve plug into the cage.

All Constructions

1. Install the bonnet gasket (key 6) on the cage in the groove formed by the valve body and cage.
2. Install the bonnet over the valve stem and onto the valve body with the Fisher logo on the bonnet on the same side as the Fisher logo on the valve body. The cage will center the bonnet.

Note

The proper bolting procedures in step 3 include--but are not limited to--ensuring that the bonnet stud threads are clean, and that the hex nuts are evenly tightened to the specified torque values.

Figure 10. HPNS Using Bidirectional PEEK Anti-Extrusion Seal Rings

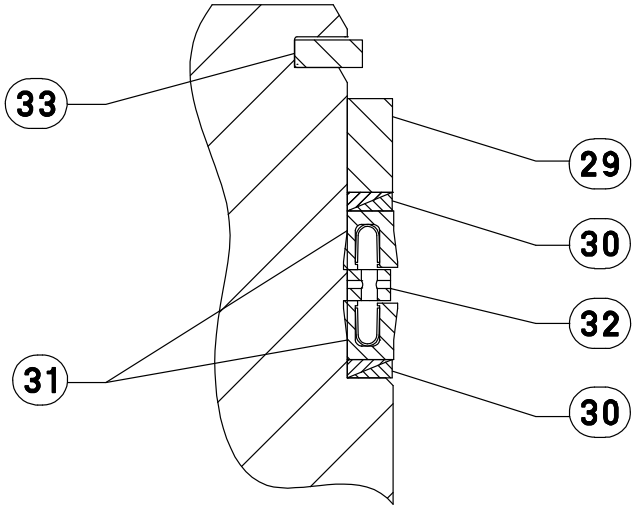
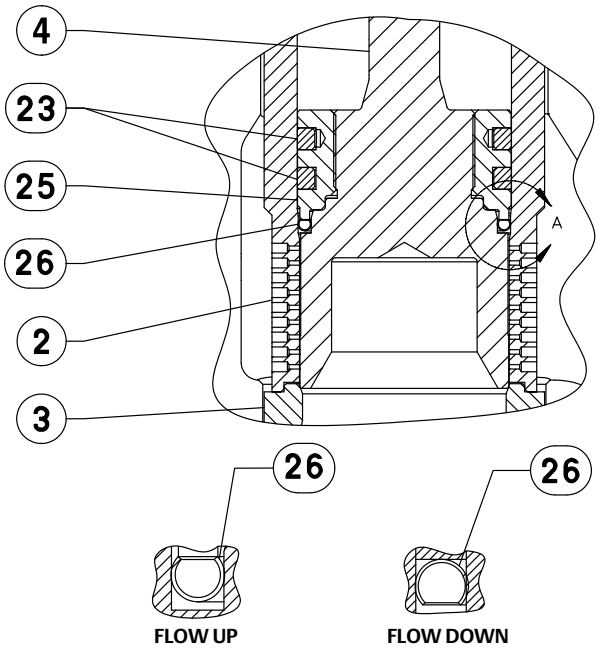


Figure 11. HPNS Balanced Bore Seal Trim



3. If required, place a body/bonnet mounting washer (key 24) over each stud, taking care to ensure that the washers are pushed as far as possible toward the center of the bonnet. Failure to do so could prevent successful actuator mounting. Before installing the washers, inspect each one to ensure no wear or galling is present on the washer faces. Replace if wear is detected. Also, lubricant is not required on the washers. All required lubricant will be applied when the nuts are installed.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 6 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure. Hot torquing is not recommended.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson sales office or Local Business Partner immediately if a discrepancy between actual parts and approved parts is suspected.

4. Lubricate the stud threads and the seating faces of the hex nuts (key 8) with Nuclear-Grade anti-seize lubricant (key 27). Replace the hex nuts, but do not tighten them. Torque the nuts in a crisscross pattern (as shown in figure 7) to no more than 1/4 of the nominal torque value specified in table 6. When all nuts are tightened to that torque value, increase the torque by 1/4 of the specified nominal torque and repeat the crisscross pattern. Repeat this procedure until all nuts are tightened to the specified nominal value. Apply the final torque value again and, if any nut still turns, tighten every nut again.

Note

If using a hydraulic torque wrench, please see the Bonnet Nut Torquing Considerations section on page 8 to avoid any unsatisfactory marring of parts.

5. Install new packing and packing box parts per steps 18 and 19 of the Replacing Packing procedure. Be certain to observe the note given prior to step 18 of that procedure.
6. Mount the actuator by following the procedures in the actuator instruction manual. Check for packing leakage as the valve is being put into service. Retorque the packing flange nuts as required (see table 5).

Installing Bore Seal Trim

1. Orient the Bore Seal for correct sealing action based on the process fluid flow direction through the valve, as shown in figure 11.
   - The open interior of the Bore Seal must face up in a valve with flow-up construction.
   - The open interior of the Bore Seal must face down in a valve with flow-down construction.
2. Place the Bore Seal plug seal over the top of the valve plug. The retainer will help guide the Bore Seal down onto the plug. Do not force the Bore Seal over the plug (figure 13). For flow down constructions, skip to step 4.
3. For flow up constructions, an installation tool must be inserted into the Bore Seal prior to using the retainer to guide it down the plug. Refer to figure 12 for dimensions and part number for ordering the installation tool.
4. Place the Bore Seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench. For flow down constructions, skip to step 6.

5. Remove the retainer and then the installation tool. Place the Bore Seal retainer back onto the plug and tighten the retainer using an appropriate tool such as a strap wrench. Visually inspect the retainer to ensure it is fully seated on the valve plug.
6. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place to secure the Bore Seal retainer.

CAUTION

To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the new trim parts while assembling the individual parts and during installation in the valve body.

7. Install piston rings by following instructions in the Trim Replacement section in this manual.

CAUTION

To avoid excessive leakage and seat erosion, the valve plug must be initially seated with sufficient force to overcome the resistance of the Bore Seal plug seal and contact the seat ring. You can correctly seat the valve plug by using the same force calculated for full load when sizing your actuator. With no pressure drop through the valve, this force will adequately drive the valve plug to the seat ring, thus giving the Bore Seal plug seal a predetermined permanent set. Once this is done, the plug/retainer assembly, the cage, and the seat ring become a matched set.

With full actuator force applied and the valve plug fully seated, align the actuator travel indicator scale with the lower end of valve travel. Refer to the appropriate actuator instruction manual for information on this procedure.

8. Replace trim parts if any damage to sealing surfaces has occurred.

Table 7. Flow Up Bore Seal Installation Tool

FOR PLUG SIZE (Inches)	DATA SHEET(1)	Dimensions, Inches (See Drawing Below)								Part Number TO ORDER TOOL
		A	B	C	D	E	F	G	H	
2.875	111	2.92	2.72	2.75 - 2.77	2.88 - 2.86	0.16	0.16	0.3	R.08	GE50133X012
3.625	103	3.74	3.4	3.46 - 3.48	3.68 - 3.66	0.1	0.1	0.26	R.06	GE17835X012
	115									
	120									

1. Data Sheet Number refers to PV14 Data Sheets for the AP1000 Power Plant Design.

Figure 12. Flow Up Bore Seal Installation Tool

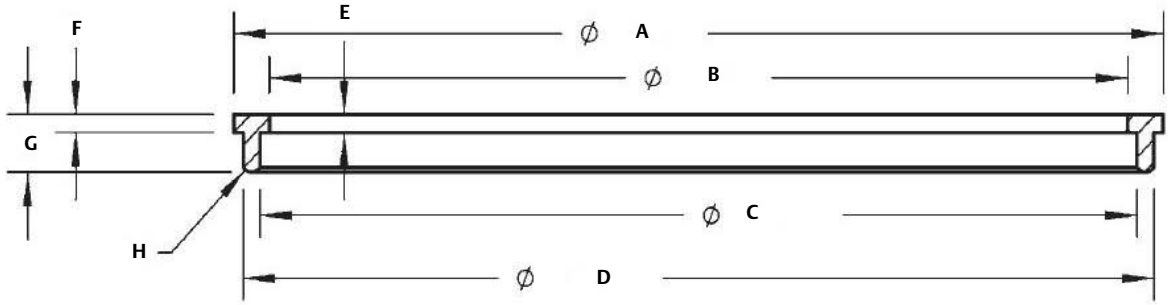


Figure 13. Retainer Guiding Fisher Bore Seal Onto the Plug

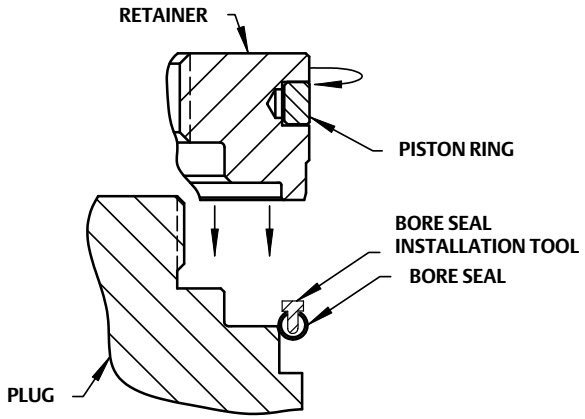
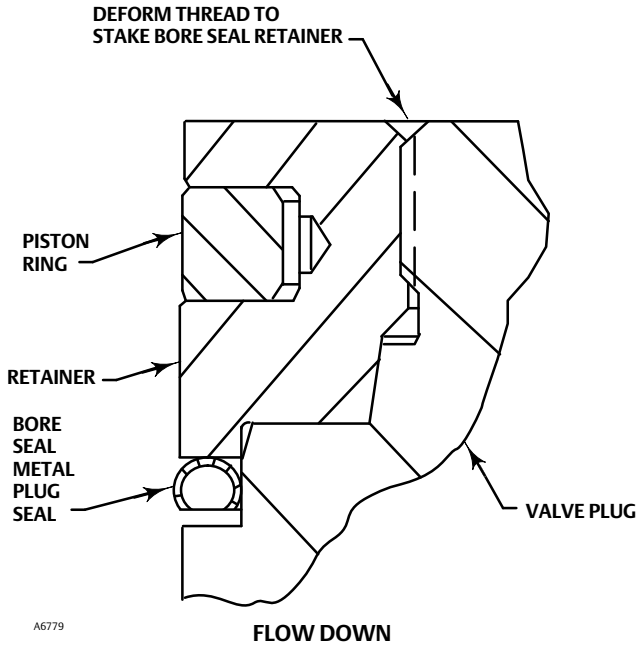


Figure 14. Stake the Threads of the Bore Seal Retainer



Hermetically Sealed Bellows Valve

Packing Maintenance

If there is undesirable packing leakage in HIGH-SEAL packing, replace the packing and bellows seal at same time by following the numbered steps presented in Replacement of an Installed Bellows Seal procedure.

Note

It is recommended the replacement of packing and bellows seal is always completed at same time.

Replacement of an Installed Bellows Seal

Key numbers referred to in this procedure are shown in figure 18, unless otherwise indicated.

1. Remove the actuator the body (key 1) following step 1 through 6 of Replacing Conventional Packing section.

CAUTION

Use care to avoid damaging gasket sealing surfaces on bonnet, bellows flange and body.

⚠ WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet and bellows flange, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet or bellows flange by pulling on it with equipment that can stretch or store energy in any other manner. The sudden released of stored energy can cause uncontrolled movement of the bonnet and bellows flange. If the cage sticks to the bellows flange, proceed carefully with bellows flange removal and support the cage so that it will not fall unexpectedly from the bellows flange.

Note

The following step also provides additional assurance that the valve body fluid pressure has been relieved.

2. Hex nuts (key 8) attach the bonnet to the valve body. Loosen these nuts approximately 3 mm (1/8 inch). Carefully remove the welding around the bellows flange with appropriate tools. If no fluid leaks from the joint, proceed to step 4.

Note

Use care to avoid damaging body top surface when removing the seal-weld between body and bellows flange.

3. If leakage does occur from the joint, tighten the nuts and verify that the process is properly shut down or the valve is properly bypassed.

4. Unscrew the hex nuts (key 8) and carefully lift the bonnet off the valve stem. If the valve stem starts to lift with the bonnet, use a hammer on the end of the stem and tap it back down. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.
5. Remove the bonnet gasket (key 6). Lift the bellows/stem assembly (key 35) out of the valve body and set it on a protective surface. Carefully lift the cage (key 2) and then seat ring (key 3) out of the valve body. Remove the seat ring gasket (key 5).

CAUTION

Inspect the seat ring and body (seat web) gasket surfaces. These surfaces must be in good condition, with all foreign material removed. Small burrs less than approximately 0.076 mm (0.003 inches) in height (the thickness of a human hair) can be ignored. Scratches or burrs that run across the serrations are not permitted under any conditions, since they will prevent the gaskets from sealing properly.

6. Clean all gasket seating surfaces; refer to your process or safety engineer for appropriate cleaning tools. Clean in the same direction as the surface serrations, not across them.
7. Cover the opening in the valve body to prevent foreign material from getting into the valve body cavity.
8. Remove the packing flange nuts (key 14), packing flange (key 9), indicator disk (key 19), qty-2 Belleville springs (key 20), qty-4 load scale mounting screws (key 21), qty-2 load scales (key 2) and packing follower (key 17). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall.
9. Clean the packing box and the following metal packing parts: packing follower (key 17), packing box ring (key 11).
10. Inspect the valve stem threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding or honing with a tool similar to a small honing stone, replace the damaged parts.
11. Remove the protective covering from the valve body cavity, and install the seat ring and cage using a new seat ring gasket (key 5).
12. Install new bellows/stem assembly (key 35) into the bore of the cage (key 3).
13. Coat qty-4 fixture studs with Nuclear Grade anti-seize lubricant (key 27) up to the deformed thread. Thread the studs into yoke mounted threaded holes in the valve body (key 1) by hand until the deformed thread prevents further insertion.
14. Slide loading fixture over the studs and bellows/stem assembly (key 35) shown in figure 15, make sure the bottom of the fixture is flush with the mating surface on the bellows flange.
15. Turn the nuts onto the studs until hand tight. Tighten the fixture nuts to the torque value of 250 ft-lb (339 N-m). Tighten each bolt evenly in at least 4 torque steps and follow the criss-cross bolting pattern. Dividing the torque procedure into even more equally spaced torque increments will ensure that the bellows flange is not unevenly loaded during assembly.

Note

Make sure metal to metal contact can be seen between valve body (key 1) and the bellows flange. Feeler gage needs to be used to make sure the metal contact was obtained.

16. Check if the stem is centered in the bellows tube connector (on top of the bellows assembly). If not, loosen the weld fixture slightly and then adjust the bellows flange to ensure the concentricity of the bellows tube connector and stem. This task may be accomplished with assistance of a wire gage or visual inspection and a dead blow hammer applied to the bellows flange to tap the assembly into place gently without damaging the parts.

17. Fillet-weld the bellows flange to the valve body (key 1) using GTAW weld process specified in weld procedure FMP 5CP8.8G1.1TSNN. The weld size shall be in range of 0.20 inch to 0.29 inch. The weld contour shall be flat.

Note

Do not damage or deform threaded bolt holes in valve body while performing seal-weld.

CAUTION

The weld needs to be fully cooled before fixture removal. Do not quench, but let metal cool naturally.

18. Remove the bolts, nuts and loading fixture.

⚠ WARNING

Pressurizing the valve before the bonnet is installed, can cause death, personal injury and/or property damage. Seal weld will NOT resist valve pressure without bonnet and bonnet-to-body bolting.

19. Perform liquid penetrant examination of the weld joint and clean per applicable procedures.
20. Install a new bellows flange-to-bonnet spiral wound gasket (key 6) into the gasket groove on top of the bellows flange.
21. Coat the bonnet studs (key 7) with Nuclear Grade anti-seize lubricant (key 27) up to the deformed thread. Thread the studs into the valve body (key 1) by hand until the deformed thread prevents further insertion.
22. Install the bonnet (key 10) over the bonnet studs and onto bellows flange. The bonnet should be standing up as straight as possible, and gently slide into the bellows assembly with care. Make sure that the “Fisher” logo on the bonnet is on the same side as the “Fisher” logo on the body. When installing the bonnet, take care to ensure that it sits flush against the spiral wound gasket (key 6) between the bellows flange and the bonnet.
23. Lubricate the remaining bonnet studs (key 7) with Nuclear Grade anti-seize lubricant (key 27).
24. Perform bonnet to body bolts installation following step 17 through 18 of Replacing Conventional Packing section, including all the cautions, notes and warnings.

Note

When installing packing rings, prevent entrapping air between the rings. Add the rings one at a time without forcing them below the chamfer of the packing box entrance chamber. As each successive ring is added, the stack should not be pushed down more than the thickness of the added ring (figure 6).

25. Install new packing and the metal packing box parts according to the arrangement in figure 4. Place a smooth-edged pipe over the valve stem, the top end higher than the valve stem is recommended. An alternative way is to slide the packing follower over the valve stem. Gently tamp each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.
26. Continue the packing installation following step 3 through 9 of Replacing HIGH-SEAL Packing section.
27. Mount the actuator by following the procedures in the actuator instruction manual.

Trim Removal

1. Remove the actuator, bonnet and trim by following step 1 through 5 of the Replacement of an Installed Bellows Seal section. Observe all warnings and cautions.
2. If the trim is to be reused, tape or otherwise protect the seating surface of plug and seat ring to prevent scratches.

Trim Replacement

⚠ WARNING

Observe the warning at the start of the Maintenance section.

After all trim maintenance has been completed, reassemble the valve body by following step 6 through 27 of the Replacement of an Installed Bellows Seal section. Observe all warnings and cautions.

Figure 15. Loading Fixture Installation

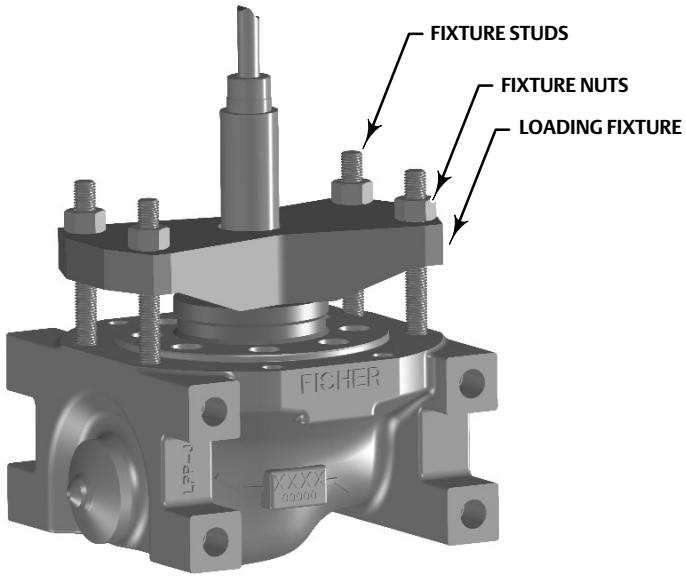


Table 8. Loading Fixture for Seal-Weld

DATASHEET(1)	DIMENSIONS, INCHES (REFER TO FIGURE 16)														PART NUMBER TO ORDER TOOL
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	
150	6.50	0.80 - 0.83	22.5°	13°	11.35	13.00	2.25	45°	2.70	2.40	1.40	0.50	70°	1.85	GG34627X012
1. Data Sheet Number refers to PV14 Data Sheets for the AP1000 Power Plant Design.															

Figure 16. Loading Fixture

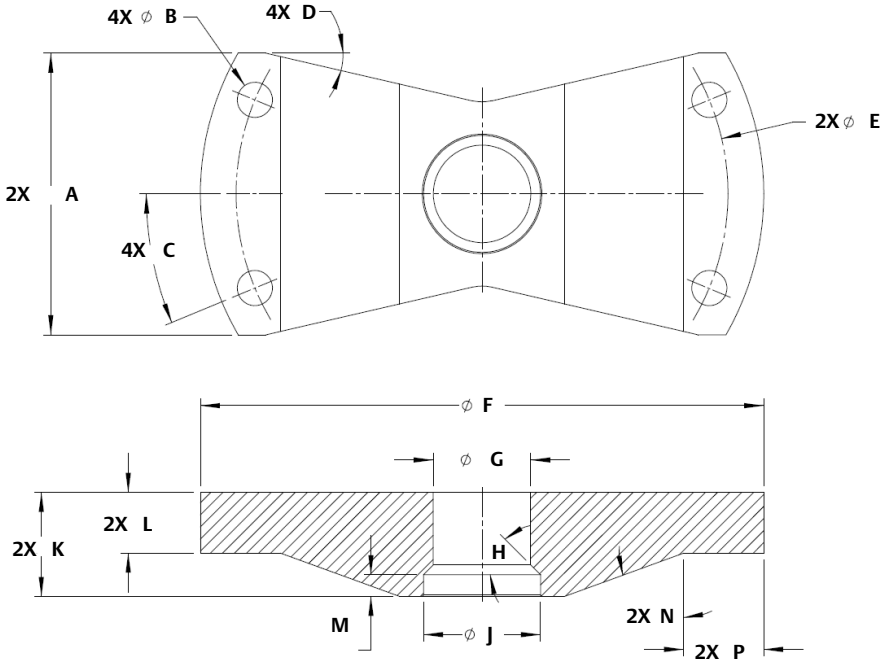


Figure 17. NPS 1 to 4 HPNS Valve

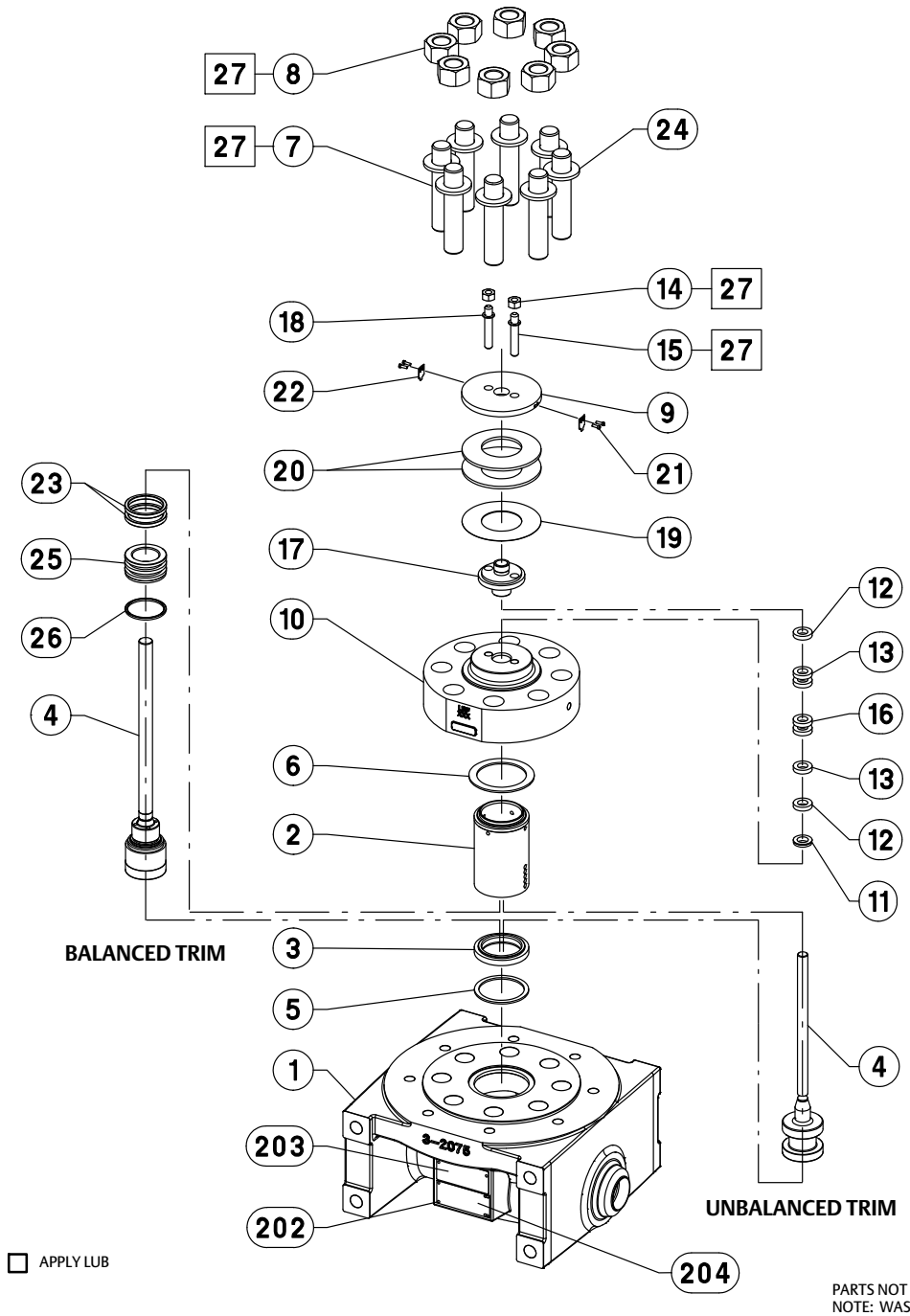


Figure 18. NPS 1/2 Hermetically-Sealed HPNS Valve

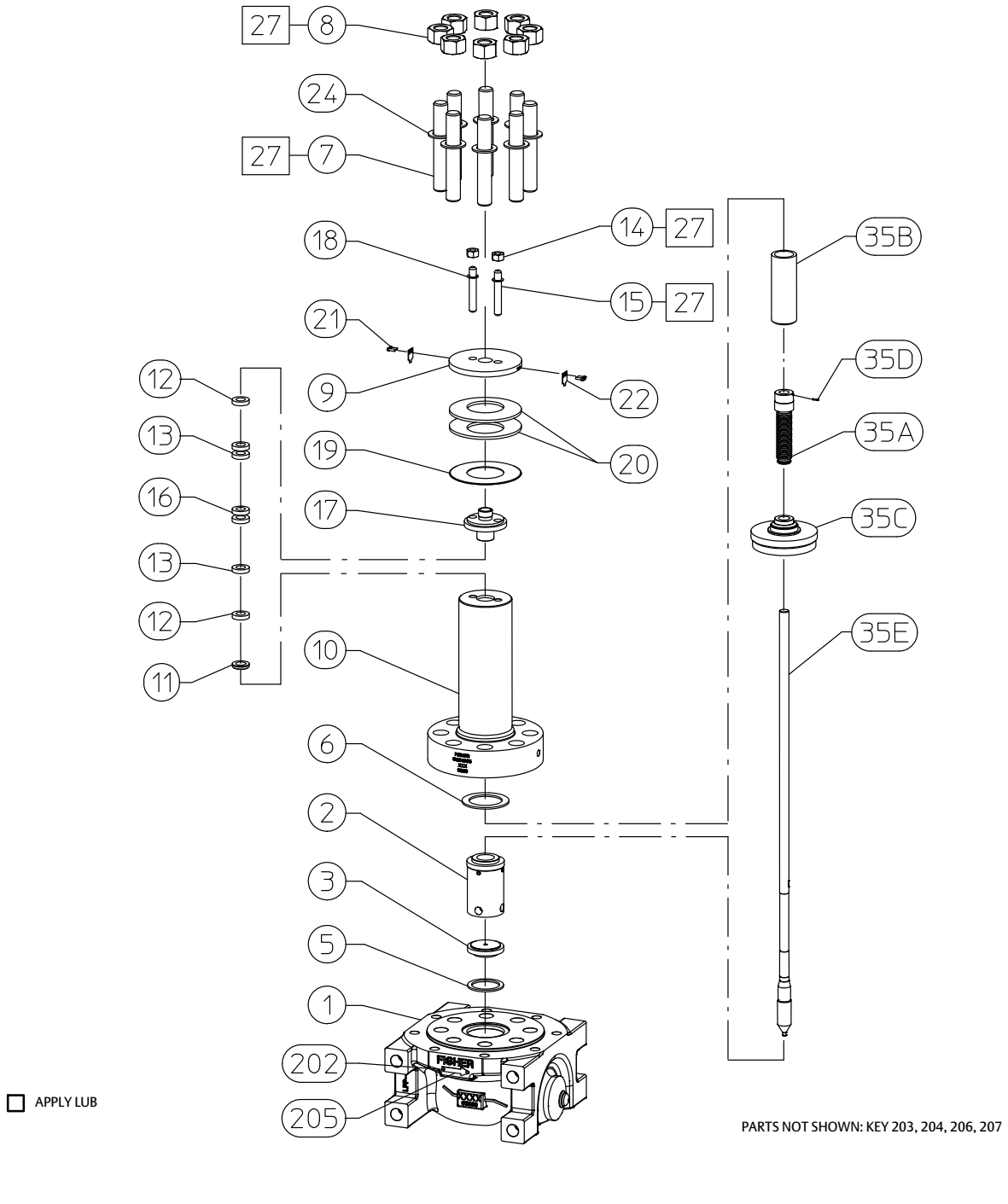


Figure 19. NPS 6 HPNS Valve

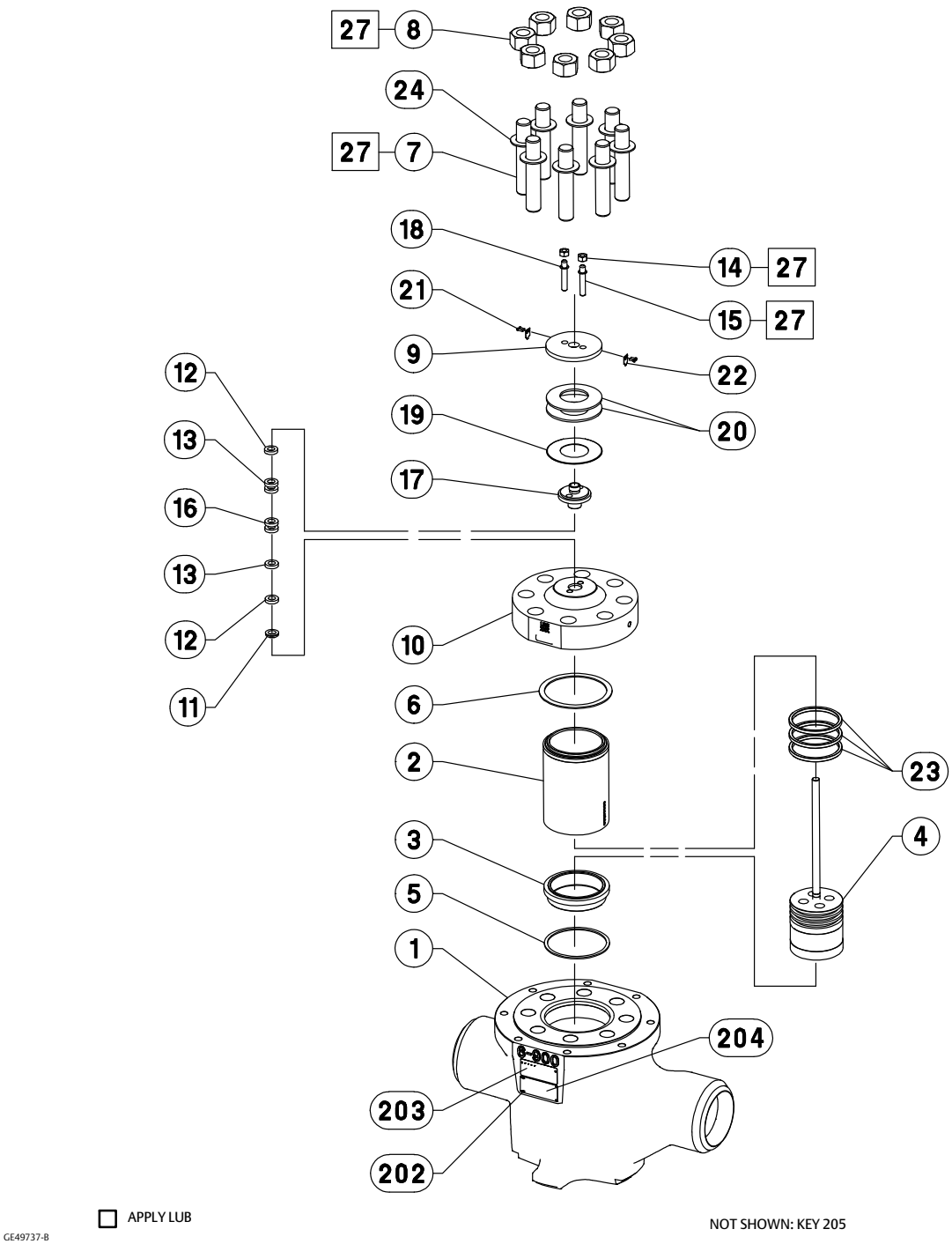


Figure 20. NPS 8 HPNS Valve

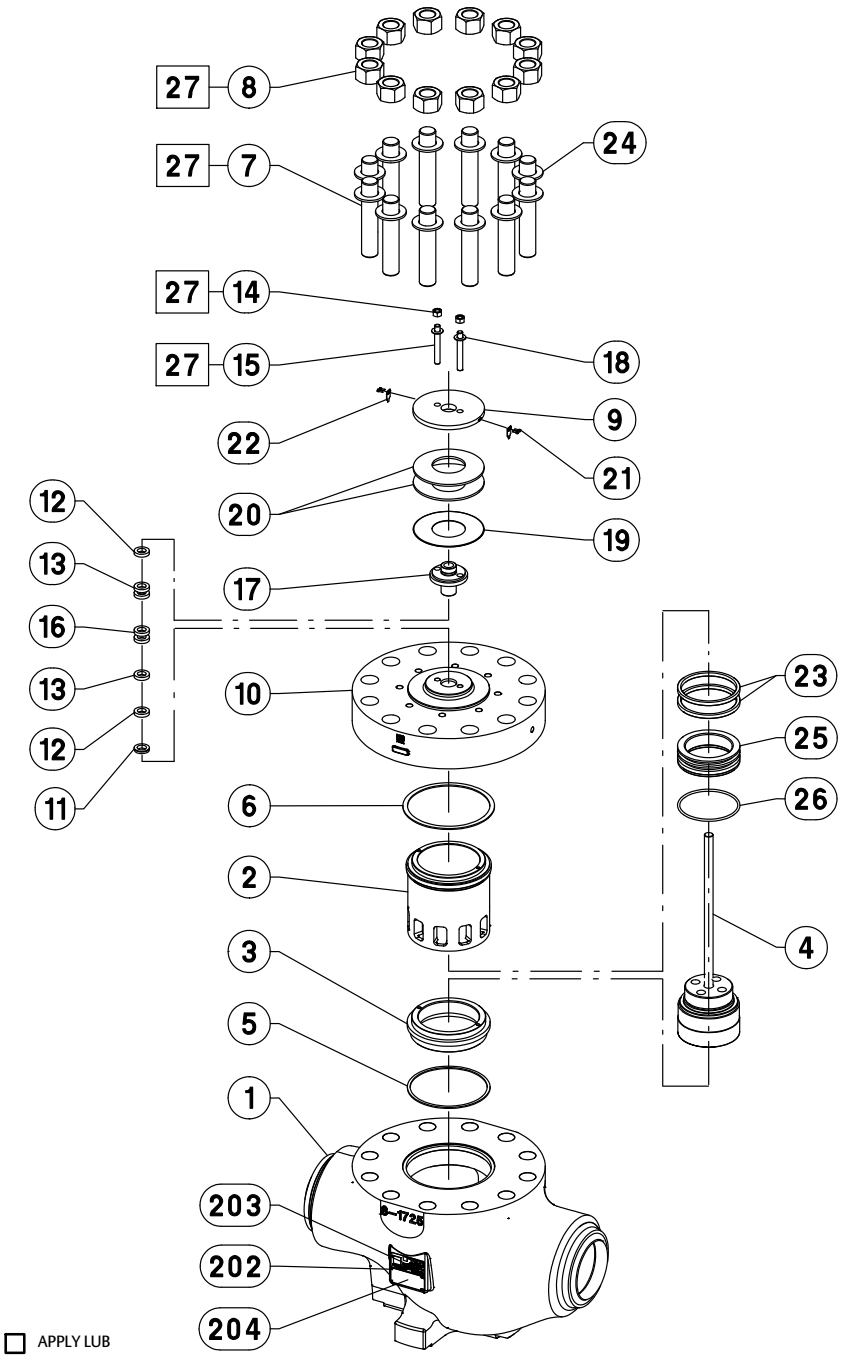
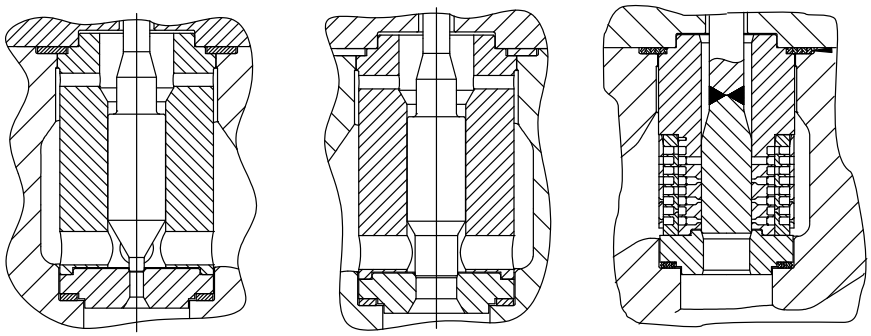


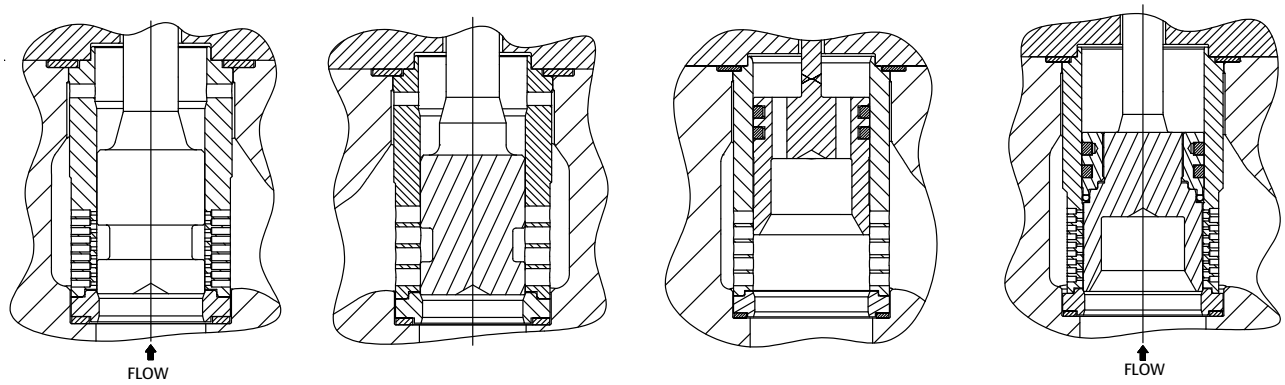
Figure 21. HPNS Valve - Alternate Configurations



NPS 1/2 and 1 HPNS MICRO-FORM TRIM

NPS 1 HPNS UNBALANCED TRIM

NPS 2 HPNS CAVITROL III TRIM

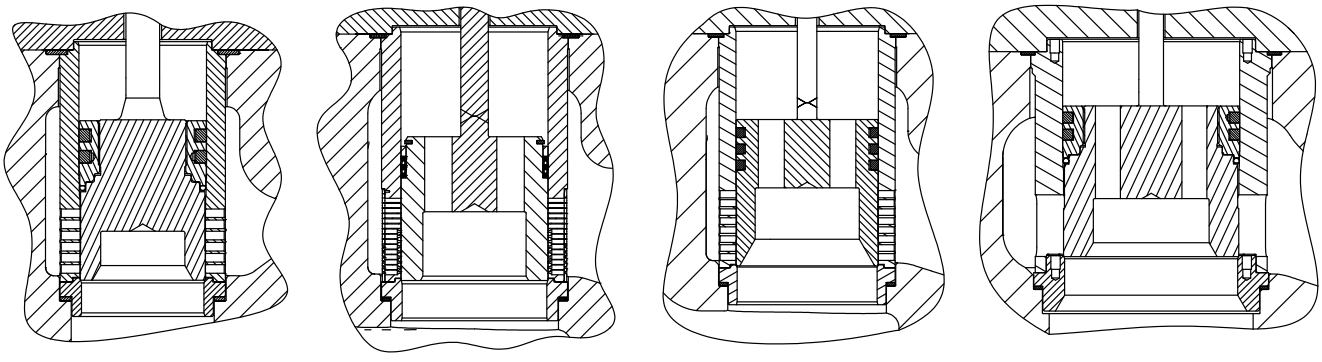


NPS 2 HPNS TRIM WHISPER III LEVEL B

NPS 2-3 HPNS UNBALANCED TRIM

NPS 3 HPNS BALANCED TRIM

NPS 3 HPNS BORE SEAL TRIM WHISPER III LEVEL C



NPS 4 HPNS BORE SEAL TRIM

NPS 6 HPNS CAVITROL III TRIM

NPS 6 HPNS BALANCED TRIM

NPS 8 HPNS BORE SEAL TRIM

Troubleshooting

Table 9. Fisher HPNS Valve Troubleshooting

Problem	Possible Solution
Packing leakage	Verify the correct packing torque or compression.
	Disassemble and inspect packing box bore and valve stem 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. For bellows seal, disassemble and replace bellows seal per the Replacement of an Installed Bellows Seal section.
Body to Bonnet Leakage	Verify proper torque on bonnet studs and nuts.
	Disassemble and inspect sealing surfaces on the bonnet and valve body for scratches or nicks. Replace gasket.
Valve Won't Stroke	Verify the correct packing torque or compression is not too high.
	Disassemble valve body, inspect cage bore and plug for damage and debris. Inspect plug and seat ring for indications of plug sticking in seat ring. Replace damaged parts as needed. Replace gaskets.
	Inspect actuator, refer to actuator instruction manual
Other	Contact your Emerson sales office if more assistance is needed.

Parts Ordering

Each body-bonnet assembly is assigned a serial number, which can be found on the valve body. This same number also appears on the actuator nameplate when the valve body is shipped from the factory as part of a control valve assembly. Refer to the number when contacting your Emerson sales office or Local Business Partner for technical assistance or when ordering replacement parts.

When ordering replacement parts, be sure to include the 11-character part number for each part required from the following parts list.

⚠ 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

Note

Numerous available combinations of valve parts make selection of some parts difficult; when ordering valve parts for which a part number is not listed, provide the valve serial number with the order, permitting proper selection of replacement parts to be made at the factory.

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson sales office or Local Business Partner.

Key	Description	Part Number
1	Valve Body	---
2*	Cage	See following table
3*	Seat Ring	See following table
4*	Plug/Stem Assy	See following table
5*	Lower Spiral Wound Gasket	See following table
6*	Upper Spiral Wound Gasket	See following table
7	Body-Bonnet Stud	See following table
8	Body-Bonnet Nut	See following table
9	Packing Flange	See following table
10	Bonnet	---
11*	Packing Box Ring	See following table
12*	Guide Bushing	See following table
13*	Packing Ring	See following table
14	Packing Nut	See following table
15	Packing Stud	See following table
16*	Packing Ring	See following table
17	Packing Follower	See following table
18	Washer (Packing Stud)	See following table
19	Indicator	See following table
20	Belleville Spring	See following table
21	Machine Screw (Load Scale)	See following table
22	Load Scale	See following table
23*	Piston Ring	See following table
24	Washer (Body-Bonnet Stud)	See following table
25*	Retainer	See following table
26*	Bore Seal	See following table
27	Nuclear Grade anti-seize lubricant	
29*	Backup Ring	See following table
30*	Anti-extrusion Ring	See following table
31*	Spring Loaded Seal Ring	See following table
32*	Spacer Ring	See following table
33*	Retainer Ring	See following table
34*	Packing Washer	See following table
35*	Bellows/stem Assembly	See following table
202	Machine Screw	
203	Nuclear Name Tag	
204	Serial Tag	
205	Flow Arrow	
206	Bellows Name Tag	
207	Warning Tag	
Special Tools		
	Bore Seal Install Tool	See figure 12
	Loading Fixture	See figure 16

*Recommended spare parts

Table 10. Spare Parts*

Part Description / Key No.	Replacement Part Number	Qty	Classification	Spare Part Code(1)	Spare Part Requirement Rationale(5)	Shelf Life	Shelf Life Rationale(2)
Cage, Key 2	Refer to following table	1	Non-Safety Related(6)	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Automation Solutions recommends replacing this component every 12 years or as needed due to damage.	N/A	Does not exhibit a tendency to degrade over time.
Seat Ring, Key 3	Refer to following table	1	Non-Safety Related(6)	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Automation Solutions recommends replacing this component every 12 years or as needed due to damage.	N/A	Does not exhibit a tendency to degrade over time.
Plug / Stem Assy, Key 4	Refer to following table	1	ASME Code	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Automation Solutions recommends replacing this component every 12 years or as needed due to damage.	N/A	Does not exhibit a tendency to degrade over time.
Seat Ring Gasket, Key 5	Refer to following table	2	Non-Safety Related	O/n	Replace every time the bonnet is removed. Routine maintenance of the valve, including replacing this gasket, is a manufacturer's recommendation. Maintenance is a necessary requirement to ensure positive performance during the expected life of the valve. In order to perform maintenance on the trim, the bonnet must be removed. Once this seal is broken, ALL gaskets should be replaced.	N/A	Does not exhibit a tendency to degrade over time.
Bonnet Gasket, Key 6	Refer to following table	2	Non-Safety Related	O/n	Replace every time the bonnet is removed. Routine maintenance of the valve, including replacing this gasket, is a manufacturer's recommendation. Maintenance is a necessary requirement to ensure positive performance during the expected life of the valve. In order to perform maintenance on the trim, the bonnet must be removed. Once this seal is broken, ALL gaskets should be replaced.	N/A	Does not exhibit a tendency to degrade over time.
Packing Box Ring, Key 11	Refer to following table	1	Non-Safety Related	O/n	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 Automation Solutions recommends replacing this component every 6 years or as needed due to individual valve operation and performance.	N/A	Does not exhibit a tendency to degrade over time.
Guide Bushing, Key 12	Refer to following table	4	Non-Safety Related	O/n	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 Automation Solutions recommends replacing this component every 6 years or as needed due to individual valve operation and performance.	N/A	Does not exhibit a tendency to degrade over time.
Packing Ring, Key 13	Refer to following table	6	Non-Safety Related	O/n	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 Automation Solutions recommends replacing this component every 6 years or as needed due to individual valve operation and performance.	N/A	Graphite does not exhibit a tendency to degrade over time

- continued -

*Recommended spare parts

Table 10. Spare Parts* (continued)

Part Description / Key No.	Replacement Part Number	Qty	Classification	Spare Part Code(1)	Spare Part Requirement Rationale(5)	Shelf Life	Shelf Life Rationale(2)
Packing Ring, Key 16	Refer to following table	4	Non-Safety Related	O/n	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 Automation Solutions recommends replacing this component every 6 years or as needed due to individual valve operation and performance.	N/A	Graphite does not exhibit a tendency to degrade over time
Graphite Piston Ring, Key 23	Refer to following table	See table 15(3, 4)	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Automation Solutions recommends replacing this component every 6 years or as needed due to individual valve operation and performance.	N/A	Graphite does not exhibit a tendency to degrade over time
Retainer, Key 25	Refer to following table	1(3)	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Automation Solutions recommends replacing this component every 12 years.	N/A	Does not exhibit a tendency to degrade over time.
Bore Seal, Key 26	Refer to following table	1(3)	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Automation Solutions recommends replacing this component every 12 years.	N/A	Does not exhibit a tendency to degrade over time.
Backup Ring, Key 29	Refer to following table	1(3)	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Automation Solutions recommends replacing this component every outage to maintain performance, or at least every 3 years.	N/A	Does not exhibit a tendency to degrade over time.
Anti-Extrusion Ring, Key 30	Refer to following table	2(3, 4)	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Automation Solutions recommends replacing this component every outage to maintain performance, or at least every 3 years.	N/A	Does not exhibit a tendency to degrade over time.
Spring Loaded Seal Ring, Key 31	Refer to following table	2(3, 4)	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Automation Solutions recommends replacing this component every outage to maintain performance, or at least every 3 years.	N/A	Does not exhibit a tendency to degrade over time.
Spacer Ring, Key 32	Refer to following table	1(3)	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Automation Solutions recommends replacing this component every outage to maintain performance, or at least every 3 years.	N/A	Does not exhibit a tendency to degrade over time.
Retainer Ring, Key 33	Refer to following table	1(3)	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Automation Solutions recommends replacing this component every outage to maintain performance, or at least every 3 years.	N/A	Does not exhibit a tendency to degrade over time.
Packing Washer, Key 34	Refer to following table	4(3)	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Automation Solutions recommends replacing this component every 6 years.	N/A	Does not exhibit a tendency to degrade over time.
Bellows/stem Assembly, Key 35	Refer to following table	1	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Automation Solutions recommends replacing this component every 12 years or as needed due to damage. It is recommended that the packing set is always replaced with bellows/stem assembly at the same time.	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. Dependent on good storage practices and conditions.
3. Not required for all constructions.
4. Keep two times the required number on hand.
5. Maintenance schedule is dependent on service conditions.
6. Cage, seat ring, and possibly guide bushings are safety related on active valves and are non-safety related on non-active valves.

- continued -

Table 11. Keys 11*, 12*, 13*, 16*, 17, 9, 15, 14, 18, 19, 22, 21, 20 and 34* Packing Components

PACKING COMPONENT	KEY NUMBER	QUANTITY	PACKING STYLE	VALVE STEM SIZE		
				12.7 mm (1/2-Inch)	19.1 mm (3/4-Inch)	25.4 mm (1-Inch)
Packing Box Ring	11*	1	ALL	12B5775X012	12B5776X012	12B5777X012
Guide Bushing	12*	2	ALL OTHERS	12B5782X042	12B5784X052	12B5786X032
			PTFE HIGH-SEAL	N/A	N/A	GE50685X012
Packing Ring	13*	3	ALL OTHERS	12B5799X032	12B5800X032	12B5801X022
			PTFE HIGH-SEAL	N/A	N/A	GE50684X012
Packing Ring	16*	2	ALL OTHERS	1V3802X0092	1V2396X0072	1U6768X0062
			PTFE HIGH-SEAL	N/A	N/A	GE50682X012
Packing Follower	17	1	Conventional	1E944335072	N/A	1H982335072
			HIGH-SEAL	21B2191X012	21B2192X012	22B5772X012
Packing Flange	9	1	Conventional	1F380335072	N/A	1H788235072
			HIGH-SEAL	21B2196X012	21B2197X012	21B2198X012
Packing Stud	15	2	Conventional	1E944435222	N/A	0V002535222
			HIGH-SEAL	1K7298X00A2	1R387335222	12B5844X012
Packing Nut	14	2	ALL	1E944535252	1E944635252	1A343335252
Packing Washer	18	2	ALL	19B2464X022	1K8995X0012	1A3517X0032
Indicator	19	1	HIGH-SEAL	11B3787X012	11B3788X012	11B3789X012
Load Scale	22	2	Graphite HIGH-SEAL	11B2171X012	11B2173X012	11B2176X012
			PTFE HIGH-SEAL	N/A	N/A	GE51186X012
Machine Screw	21	2	Graphite HIGH-SEAL	1B2752X0022	1B2752X0022	1B2752X0022
			PTFE HIGH-SEAL	N/A	N/A	1B2752X0022
Belleville Spring	20	2	Graphite HIGH-SEAL	11B2182X032	11B2184X032	11B2187X032
			PTFE HIGH-SEAL	N/A	N/A	GE50891X012
Packing Washer	34*	4	PTFE HIGH-SEAL	N/A	N/A	GE50686X012

Table 12. Keys 5* and 6* Gasket Sets

VALVE SIZE, NPS	QUANTITY	PORT DIAMETER	GASKET PART NUMBER	
		Inch	Seat Ring Gasket (Key 5*)	Bonnet Gasket (Key 6*)
1/2	1 Each	ALL	GE44740X012	GE44739X012
1	1 Each	ALL	GE44740X012	GE44739X012
2	1 Each	ALL	GE44740X012	GE44739X012
3	1 Each	ALL	GE44631X012	GE44630X012
4	1 Each	ALL	GE44475X012	GE44474X012
6	1 Each	ALL	GE44065X012	GE44066X012
8	1 Each	ALL	GE45631X012	GE45630X012

*Recommended spare parts

Table 13. Key 2* Cages for All Valves by Data Sheet

VALVE SIZE, NPS	DATA SHEET(1)		DESCRIPTION	TRAVEL		PART NUMBER	MATERIAL
				mm	Inches		
1/2	PV14	150	Quick Opening	6.4	0.25	GG34764X012	R30016 (ALLOY 6B)
1	PV14	100	Quick Opening	19.1	0.75	GE45434X012	S17400 H1100
		105				GE45434X022	R30016 (ALLOY 6B)
		106					
		113					
		117					
		118					
		201					
2	PV14	101	Equal %	28.6	1.125	GE44752X012	R30016 (ALLOY 6B)
		102	Whisper III B3	38.1	1.5	GE44821X012	S17400 H1100
		107	Linear			GE44865X012	R30016 (ALLOY 6B)
		110	Cavitrol III, 3-Stage	50.8	2	GE61417X012	N07718, PRECIP HRDN
		114	Whisper III B3	38.1	1.5	GE44821X012	S17400 H1100
3	PV14	108	Linear	50.8	2	GE44628X012	S31603/COCR-A
		111	Whisper III C3, Bore Seal			GE44669X012	S17400 H1100
		116	Linear	38.1	1.5	GE44706X012	S31603/COCR-A
4	PV14	103	Modified Equal %	50.8	2	GE52354X012	S17400 H1100
		115					
		120				GE44469X012	S31603/COCR-A
6	PV14	121	Linear	76	3	GE44063X012	S31603/COCR-A
	PV69	101	Cavitrol III, 2-Stage	76	3	GE48581X012	S17400 H1100
8	PV14	104	Linear	57.15	2.25	GE45474X012	CF3M/COCR-A

1. Data Sheet Number refers to PV14 Data Sheets and PV69 Data Sheets for the AP1000 Power Plant Design.

Table 14. Key 3* Seat Ring Constructions

VALVE SIZE, NPS	DATA SHEET(1)		PORT DIAMETER		PART NUMBER	MATERIAL
			mm	Inches		
1/2	PV14	150	19.1	0.75	GE45475X012	R30016 (ALLOY 6B)
1	PV14	100	19.1	0.75	GE45435X012	R30016 (ALLOY 6B)
		105	6.4	0.25	GE45475X012	
		106				
		201				
		113	25.4	1	GE45481X012	
		117	19.1	0.75	GE45435X012	
		118	25.4	1	GE45481X012	
2	PV14	101	47.6	1.875	GE44742X012	R30016 (ALLOY 6B)
		102				
		107				
		110	25.4	1	GE61240X012	N07718 PRECIP HRDN
		114	47.6	1.875	GE44742X012	R30016 (ALLOY 6B)
3	PV14	108	73.0	2.875	GE44870X012	S31603/COCR-A
		111				
		116				
4	PV14	103	92.1	3.625	GE44440X012	S31603/COCR-A
		115				
		120				
6	PV14	121	136.5	5.375	GE44064X012	S31603/COCR-A
	PV69	101	133.35	5.25	GE49104X012	S17400 H1100
8	PV14	104	177.8	7	GE45629X012	S31603/COCR-A

1. Data Sheet Number refers to PV14 Data Sheets and PV69 Data Sheets for the AP1000 Power Plant Design.

*Recommended spare parts

Table 15. Key 23* Graphite Piston Rings for Valves With Balanced Trim

VALVE SIZE, NPS	DATA SHEET(1)	QUANTITY	PORT DIAMETER Inch	PISTON RING PART NUMBER
3	111	2	2.875	14B3620X032
	116			1U2300X0042
4	103	1	3.625	14B5340X022
	115	2		
	120			
6	121	3	5.375	11A9727X052
8	104	2	7	13B9176X022

1. Data Sheet Number refers to PV14 Data Sheets for the AP1000 Power Plant Design.

Table 16. Key 7 Body/Bonnet Mounting Studs

VALVE SIZE, NPS	DATA SHEET(1)		QUANTITY	STUD SIZE Inch	PART NUMBER	MATERIAL
1/2	PV14	150	8	1 1/8-8 x 7.00	12A3576X122	SA 453 660 A
1	PV14	100	8	1 1/8-8 x 5.75	1J9582X0182	SA 193 B7
		105			1J9582X0172	SA 453 660 A
		106				
		113				
		117				
		118				
		201				
2	PV14	101	8	1 1/8-8 x 5.75	1J9582X0172	SA 453 660 A
		102			1J9582X0182	SA 193 B7
		107			1J9582X0192	SA 453 660 A
		110			1J9582X0172	
		114			1J9582X0182	SA 193 B7
3	PV14	108	8	1 3/8-8 x 6.75	15A5490X292	SA 453 660 A
		111			15A5490X102	SA 193 B7
		116			15A5490X292	SA 453 660 A
4	PV14	103	8	1 1/4-8 x 6.00	10A1461X132	SA 193 B7
		115				
		120			10A1461X142	SA 453 660 A
6	PV14	121	8	1 1/2-8 x 8.00	12A5151X242	SA 453 660 A
	PV69	101	8	1 1/2-8 x 7.25	14B3926X022	SA 193 B7
8	PV14	104	12	1 7/8-8 x 9.25	GE46825X012	SA 453 660 A

1. Data Sheet Number refers to PV14 Data Sheets and PV69 Data Sheets for the AP1000 Power Plant Design.

Table 17. Key 8 Body/Bonnet Mounting Nuts

VALVE SIZE, NPS	DATA SHEET(1)		QUANTITY	STUD SIZE Inch	PART NUMBER	MATERIAL
1/2	PV14	150	8	1 1/8-8	1A4452X1002	SA 453 660 A
1	PV14	100	8	1 1/8-8	1A4452X0122	SA 194 2H
		105			1A4452X1002	SA 453 660 A
		106				
		113				
		117				
		118				
		201				
2	PV14	101	8	1 1/8-8	1A4452X1002	SA 453 660 A
		102			1A4452X0122	SA 194 2H
		107			1A4452X0332	SA 453 660 A
		110			1A4452X1002	
		114			1A4452X0122	SA 194 2H
3	PV14	108	8	1 3/8-8	1D7167X0422	SA 453 660 A
		111			1D7167X0122	SA 194 2H
		116			1D7167X0422	SA 453 660 A
4	PV14	103	8	1 1/4-8	1A4453X0112	SA 194 2H
		115				
		120			1A4453X0742	SA 453 660 A
6	PV14	121	8	1 1/2-8	1A5011X0702	SA 453 660 A
	PV69	101	8	1 1/2-8	1A5011X0772	SA 194 2H
8	PV14	104	12	1 7/8-8	1A5013X0252	SA 453 660 A

1. Data Sheet Number refers to PV14 Data Sheets for the AP1000 Power Plant Design.

Table 18. Key 24 Body/Bonnet Mounting Washers by Data Sheet

VALVE SIZE, NPS	DATA SHEET(1)		QUANTITY	PART NUMBER	MATERIAL
1/2	PV14	150	8	F16342X0022	S41600
1	PV14	100	N/A	N/A	N/A
		105	8	F16342X0022	S41600
		106	8	F16342X0022	S41600
		113	8	F16342X0022	S41600
		117	8	F16342X0022	S41600
		118	8	F16342X0022	S41600
		201	8	F16342X0022	S41600
2	PV14	101	8	F16342X0022	S41600
		102	N/A	N/A	N/A
		107	8	F16342X0022	S41600
		110	8	F16342X0022	S41600
		114	N/A	N/A	N/A
3	PV14	108	8	10A2630X022	S41600
		111	N/A	N/A	N/A
		116	8	10A2630X022	S41600
4	PV14	103	N/A	N/A	N/A
		115	N/A	N/A	N/A
		120	8	10A2630X022	S41600
6	PV14	121	8	18A8227X022	S41600
	PV69	101	8	18A8227X022	S41600
8	PV14	104	12	18A8861X072	S41600

1. Data Sheet Number refers to PV14 Data Sheets and PV69 Data Sheets for the AP1000 Power Plant Design.

Table 19. Key 4* Valve Plug/Stem Assemblies by Data Sheet

VALVE SIZE, NPS	DATA SHEET(1)		DESCRIPTION	PORT DIAMETER	TRAVEL	STEM DIAMETER		PART NUMBER	MATERIAL
				Inch	Inch	mm	Inch		
1	PV14	100	Micro-Form, Unbalanced	0.75	0.75	12.7	0.5	GE45433X012	Alloy 6B/S20910
		105		0.25				GE45478X012	
		106							
		201							
		113	Micro-Form, Unbalanced	1	0.75	12.7	0.5	GE45480X012	
		117		0.75	1.125			GE45483X012	
		118		1	0.75			GE45480X012	
2	PV14	101	Unbalanced	1.875	1.125	25.4	1	GE48011X012	S31603/COCR-A/S20910
		102			1.5			GE48003X012	
		107				19.1	0.75	GE47992X012	
		110		1	2	19.1	0.75	GE61266X012	S20910/Alloy 6B
		114		1.875	1.5	25.4	1	GE50402X012	S31603/COCR-A/S20910
3	PV14	108	Unbalanced	2.875	2	19.1	0.75	GE44619X012	S31603/COCR-A/S20910
		111	Balanced, Bore Seal			25.4	1	GE44639X012	
		116	Balanced		1.5	12.7	0.5	GE44700X012	
4	PV14	103	Balanced, Bore Seal	3.625	2	25.4	1	GE44516X012	F22/S31600/S20910
		115						GE44534X012	F22/COCR-A/S20910
		120				19.1	0.75	GE44436X012	S31603/COCR-A/S20910
6	PV14	121	Balanced	5.375	3	19.1	0.75	GE44582X012	S31603/COCR-A/S20910
	PV69	101	Balanced, Bidirectional Seal	5.25	3	25.4	1	GE49248X012	F6NM/S41000
8	PV14	104	Balanced, Bore Seal	7	2.25	25.4	1	GE45907X012	S31603/COCR-A/S20910

1. Data Sheet Number refers to PV14 Data Sheets and PV69 Data Sheets for the AP1000 Power Plant Design.

Table 20. Key 25* Retainers for Valves With Bore Seal

VALVE SIZE, NPS	DATA SHEET(1)	PORT DIAMETER	SHUTOFF CLASS	STEM DIAMETER		PART NUMBER	MATERIAL
		Inch		mm	Inch		
3	111	2.875	V	25.4	1	GE35717X022	S31603/COCR-A
4	103	3.625	V	25.4	1	GE48307X012	F22/COCR-A
	115					GE14715X022	F22/COCR-A
	120					GE14715X032	S31603/COCR-A
8	104	7	V	25.4	1	GE19242X032	S31603/COCR-A

1. Data Sheet Number refers to PV14 Data Sheets for the AP1000 Power Plant Design.

Table 21. Key 26* Bore Seal Part Numbers for Valves With Bore Seal Trim

VALVE SIZE, NPS	DATA SHEET(1)	PORT DIAMETER	BORE SEAL PART NUMBER
		Inch	
3	111	2.875	GE14956X012
4	103	3.625	GE14658X012
	115		
	120		
8	104	7	23B9182X012

1. Data Sheet Number refers to PV14 Data Sheets for the AP1000 Power Plant Design.

*Recommended spare parts

Table 22. Yoke Bolt Circle Diameter

ACTUATOR SIZE	VALVE SIZE, NPS	DATA SHEET(1)		YOKE BOSS DIAMETER (INCH)
45A	1	PV14	100	11.35
			105	
			106	
			113	
			117	
			118	
			201	
45B	3	PV14	116	13.48
70A	1/2	PV14	150	11.35
	2	PV14	107	
			110	
70B	3	PV14	108	13.48
	4	PV14	120	
70C	6	PV14	121	15.3
80A	2	PV14	101	11.35
			102	
80A	2	PV14	114	
	8	PV14	104	
80B	3	PV14	111	13.48
	4	PV14	103	
			115	
80C	6	PV69	101	15.3

1. Data Sheet Number refers to PV14 Data Sheets and PV69 Data Sheets for the AP1000 Power Plant Design.

Table 23. Keys 29*, 30*, 31*, 32*, and 33* Part Numbers for Valves Using Bidirectional PEEK Anti-Extrusion Seal Rings by Data Sheet

VALVE SIZE, NPS	DATA SHEET(1)	PART DESCRIPTION	KEY NUMBER	QUANTITY	PORT DIAMETER, INCH	PART NUMBER
6	101	Backup Ring	29*	1	5.25	17A4397X012
		Anti-Extrusion Ring	30*	2		21B2142X012
		Spring Loaded Seal Ring	31*	2		GE43856X012
		Spacer Ring	32*	1		GG09153X012
		Retainer Ring	33*	1		17A4398X012

1. Data Sheet Number refers to PV69 Data Sheets for the AP1000 Power Plant Design.

Table 24. Key 35* Part Numbers for Bellows/Stem Assembly

VALVE SIZE, NPS	DATA SHEET(1)	PART DESCRIPTION	KEY NUMBER	QUANTITY	PORT DIAMETER, INCH	PART NUMBER
1/2	150	Bellows/Stem Assembly	35*	1	0.25	GG35420X012

*Recommended spare parts

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Marshalltown, Iowa 50158 USA
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Cernay, 68700 France
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