

Fisher™ HPNS Control Valve

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Figure 1. HPNS Valve with 667NS2 Actuator



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Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 1/2 through NPS 10 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](#) before proceeding.

Description

HPNS valves (figure 1) have butt-weld end connections in various schedules and are designed for use with Fisher 667NS2 and 657NS2 actuators and can also be used with a Fisher yoke and other piston actuator options. HPNS valves are designed to handle high seismic environments.

Table 1. Specifications

<p>End Connection Styles and Ratings^(1,2)</p> <p>Buttwelding: Consistent with Schedule 40-160</p> <p>Flanges: Not available</p> <p>Socket Welding: Not available</p> <p>Also see table 2</p> <p>Shutoff Classifications</p> <p>See table 3</p> <p>Bidirectional Trim: Class V. See table 4</p> <p>Bore Seal trim: High-temperature, Class IV and V. See table 4</p> <p>Flow Characteristic</p> <p>Standard Cage: ■ Equal percentage, ■ Modified equal percentage, ■ Linear or, ■ Quick opening on/off</p> <p>Micro-Form Valve Plug: ■ Equal percentage ■ Modified equal percentage or, ■ Quick opening on/off</p> <p>Cavitrol™ III or Whisper Trim™ III Cage: ■ Linear</p> <p>Special cages: Special characterized flow cages are available. Consult your Emerson sales office</p>	<p>Flow Direction</p> <p>Standard Cage</p> <ul style="list-style-type: none"> ■ HPNS Balanced: Normally flow up⁽³⁾ ■ HPNS Unbalanced: Normally flow down or up⁽⁴⁾ <p>Cavitrol III Cage: Flow down</p> <p>Whisper Trim III Cage: Flow up</p> <p>Approximate Weights (valve body and bonnet assemblies)</p> <p>See table 2</p> <p>Bolt Torque Tolerance</p> <p>Torque values given are +/- 5%, unless otherwise specified</p> <p>Special Tools</p> <p>Standard mechanics tools are used for assembly/disassembly, except for:</p> <p>Valves supplied with bore seal plugs:</p> <ul style="list-style-type: none"> ■ a bore seal installation tool is required for proper installation of the bore seal (see figure 13 for dynamic bore seal and figure 16 for static bore seal), ■ 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 <p>Valves supplied with hermetically-sealed bellows seal:</p> <ul style="list-style-type: none"> ■ a loading fixture is required for performing seal-weld between bellows flange and valve body (see figure 19) <p>Additional Specifications</p> <p>For specifications such as materials, valve plug travels, and port, yoke bolt circle, and stem diameters, see the Parts List section</p>
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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 Balanced valves may be used flow down where required by design.
 4. HPNS Unbalanced valves may be used flow down for on-off service or where required by design.

Specifications

Specifications for the HPNS valves are shown in table 1.

Educational Services

Emerson Automation Solutions
 Educational Services - Registration
 Phone: 1-800-338-8158
 E-mail: education@emerson.com
emerson.com/mytraining

Table 2. Valve Assembly Approximate Weights

VALVE SIZE, NPS	PRESSURE RATING	KG	LBS
1/2	2075	136	300
1		117	257
2		118	259
3		271	596
4	900	261	574
6		374	823
8		940	2071
10	1725	2064	4550

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

VALVE DESIGN	VALVE SIZE, NPS	PORT DIAMETER, mm (INCHES)	TRIM STYLE	LEAKAGE CLASS
Unbalanced HPNS	1/2	6.35 (0.25)	Micro-Form	V
	1	6.35 (0.25) to 25.4 (1)	Micro-Form	IV V
		25.4 (1)	Micro-Form	IV (forward) V (reverse)
	2	25.4 (1)	Special (Cavitrol III, 3-stage)	V
		47.63 (1.875)	Equal % (std or Whisper III, B3 cage)	
			Linear (std or Whisper III, B3 cage)	
	47.63 (1.875)	Linear	IV (forward) V (reverse)	
	3	73.03 (2.875)	Linear (std. cage)	V

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

VALVE DESIGN	VALVE SIZE, NPS	PORT DIAMETER, mm (INCHES)	CAGE STYLE	LEAKAGE CLASS
Balanced HPNS	3	73.0 (2.875)	Linear (Whisper III, C3)	V
			Equal %	III
	4	92.1 (3.625)	Modified Equal %	IV V
	5	136.525 (5.375)	Linear (std. cage)	IV V
			Linear (std. cage)	IV
	6	136.525 (5.375)	Linear (std. cage)	V (forward) IV (reverse)
		133.35 (5.25)	Special (Cavitrol III, 2-stage)	IV V
	8	177.8 (7)	Linear (std. cage)	IV Bidirectional V (forward)
		111.125 (4.375)	Special	IV (reverse)
	10	215.9 (8.5)	Linear	IV (reverse)

Table 5. 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
10	10420	10968	12613	7686	8090	9304

Table 6. Recommended Torque for Packing Flange Nuts (non live-loaded)

STEM DIAMETER		CLASS	TORQUE			
mm	Inches		N•m		lbf•ft	
			Min	Max	Min	Max
12.7	0.5	150	5	8	4	6
		900	12	18	9	13
		1500	18	24	13	18
19.05	0.75	1500	18	24	13	18
		2075	41	61	30	45
25.4	1	600	34	50	25	37

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

⚠ WARNING

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

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

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

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

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

NOTICE

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

The quantity of eyebolts for lifting purpose is the minimum recommendation. More eyebolts can be used per customer experience. 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 one or more lifting straps that are rigged to choke around the actuator under the diaphragm casing. Use protective pads between the strap(s) and casing to help prevent damage to the painted surface. A single hoist lift point on the strap(s) will balance and lift the valve/actuator assembly in a level manner. If necessary, use additional slings 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 inch shouldered pattern eyebolts into two threaded holes located on the top of the NPS 1/2 through NPS 6 valve bodies, positioned 180 degrees apart. For NPS 8 and NPS 10 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 lifting 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 one or more lifting straps that are rigged to choke around the actuator under the diaphragm casing. Use protective pads between the strap(s) and casing to help prevent damage to the painted surface. A single hoist lift point on the strap(s) will balance and lift the actuator in a level manner.

Installation

When welding butt-weld end valves in line, the control valve trim needs to be removed in order to prevent damage to trim parts. The control trim also needs to be replaced with temporary sacrificial trim to be used while conducting the system hydrostatic test and while flushing the system. Flushing the system helps to remove weld slag, rust, corrosion, etc. that could otherwise flow through the valve and potentially damage valve seating surfaces or plug drilled hole trims. The following installation description includes procedures and suggestions to follow for the flushing of the system.

For the NPS 1/2 HPNS with hermetically sealed bellows (DS150), the trim should not be removed during assembly. The position of the plug should be in the "up" position off the seat, with the bellows in the relaxed state. Because the bellows flange is welded directly to the body, it should not be removed until the recommended replacement period, see table 12.

▲ 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

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. 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](#).

⚠ 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

If you are hoisting the valve, use lifting 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. Remove the actuator and disassemble the valve body by completing steps 1 through 10 of the Replacing Conventional Packing section.
2. Before installing the valve, inspect it to ensure that the valve body cavity is free of foreign material.
3. 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.

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

NOTICE

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 for additional information.

5. Install the valve in the line. Use accepted piping and welding practices when installing the valve in the pipeline.
6. Install a three-valve bypass around the valve if continuous operation is required during maintenance.
7. After installing the valve, inspect it once again to ensure that the valve body cavity is free and clear of foreign material to avoid damaging any internals during flushing.

8. If the actuator and valve body are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.
9. If the valve body was shipped without packing installed in the packing box, install the packing before flushing the valve body or putting the valve into service. Refer to instructions given in the Packing Maintenance procedure.
10. For valves that are not being flushed, a replacement soft kit is needed because the trim is removed while the valve is installed. The new soft kit is then used during valve assembly after installation.
11. For valves that will be flushed, some valves are designed such that no damage to internals is expected if the standard valve trim parts are used during flushing. However, it is recommended that the soft parts (packing and gaskets) be replaced after flushing. Other valves are designed so that the trim can be removed and the valve assembled with a “flushing stem.” Lastly, other valves will require a full flushing trim to be installed instead of the standard trim. Valves using trim with hard-facing and valves using trim with small drilled holes or a small flow path where particulate up to 1/4 inch can become lodged will require flushing trim. Table 7 details which special trim parts are needed based on flow direction.

Table 7. Required Flushing Trim Items

FLOW CONDITION	PARTS ⁽¹⁾
Flow Up	Soft Parts, Flushing System, and Flushing Nuts
Flow Down	Soft Parts, Flushing System, Flushing Nuts, Flushing Cage and Flushing Seat Ring
1. For those datasheets that require only a flushing stem and flushing nuts, install the bonnet gasket. Refer to figure 26 for assemblies that do not require a flushing cage or flushing seat ring.	

- a. After installing the bonnet gasket, tighten 2 of the 4 flushing nuts to the base of the flushing stem. When installing the nuts, ensure that the flat side of the upper nut (the side closest to the bonnet) is facing the bonnet and that any of the grade markings are facing away from potentially contacting the bonnet.
 - b. Insert the flushing stem up through the bonnet (key 10), being careful not to scratch or otherwise damage the stem.
 - c. Install new packing and the metal packing box parts according to steps 19 and 20 of the Replacing Conventional Packing Section. If working on a valve with HIGH-SEAL Packing, follow steps 2 through 7 of the High-Seal packing installation section. At this point, do not tighten the packing bolts down.
 - d. Tighten the other two leftover flushing nuts to the top of the stem to secure the stem in position with the bonnet.
 - e. Following step 17 of the Replacing Conventional Packing Section, place the bonnet on to the studs (key 7), taking care to ensure that while moving the bonnet the flushing stem does not slide around and become damaged.
 - f. Follow step 18 of the Replacing Conventional Packing Section to torque the bonnet into place. Because the stem is not connected to the rest of the trim, the note about stroking the valve to center the trim can be omitted.
 - g. Now torque the packing bolts per table 6 if using conventional packing or step 8 of the HIGH-SEAL Packing Installation Section.
 - h. For those datasheets that require a full flushing trim, follow step 16 of the Replacing Conventional Packing section up to the installation of the bonnet gasket (key 6), ensuring that the standard seat ring and standard cage are replaced with the appropriate flushing cage and flushing seat ring. Then, follow the assembly directions shown above for the installation of the flushing stem and nuts.
12. After system flushing is completed, remove the bonnet (key 10), bonnet gasket (key 6), and, if necessary, flushing trim and seat ring gasket (key 5).
 13. Assemble the valve as described in the Replacing Conventional Packing procedure, steps 11 through 20.
 14. Refer to the actuator mounting procedure in the appropriate actuator instruction manual.

⚠ 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. Please read and follow the packing adjustment procedures in the Packing Maintenance section of this manual.

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.

NOTICE

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 help prevent damage to the bonnet nut faces. See figure 2 for a diagram of this procedure.

Packing Lubrication

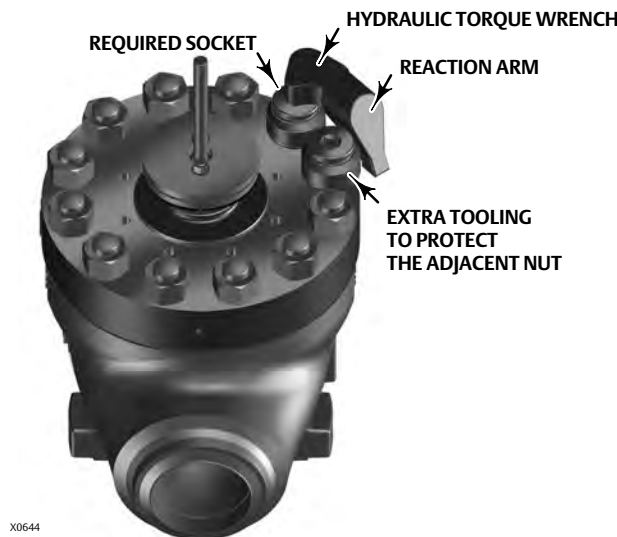
Note

No provisions for packing lubrication.

NOTICE

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 20, 22, 23, or 24) to at least the minimum recommended torque in table 6. However, do not exceed the maximum recommended torque in table 6 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 20, 22, 23, or 24) to at least the minimum spring load shown in figure 9. However, do not exceed the maximum spring load shown in figure 9 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 20, 22, 23, or 24, 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). If additional actuator removal clearance is required for disassembly, loosen, then remove the packing flange nuts (key 14) per step 6. Then lift the packing flange (key 9) to allow the actuator to pass underneath. Return the packing flange (key 19) and packing flange nuts (key 14) to the packing flange studs (key 15). Thread the packing flange nuts (key 14) to the packing flange studs (key 15) to realign with step 6.
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.

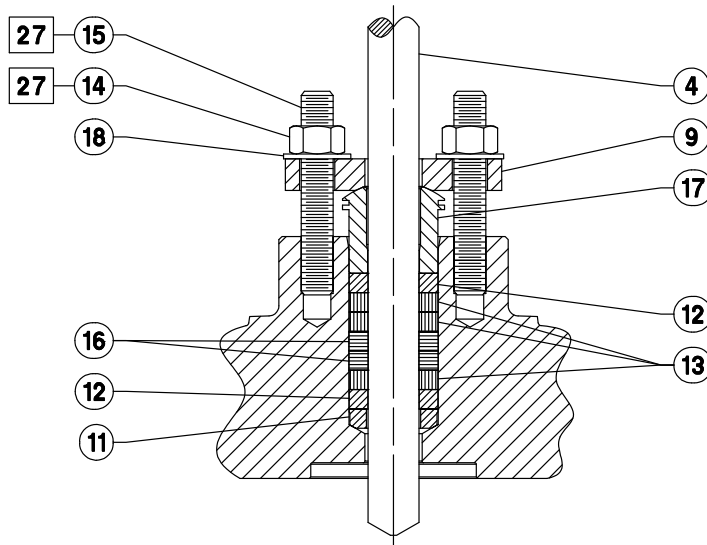
NOTICE

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.

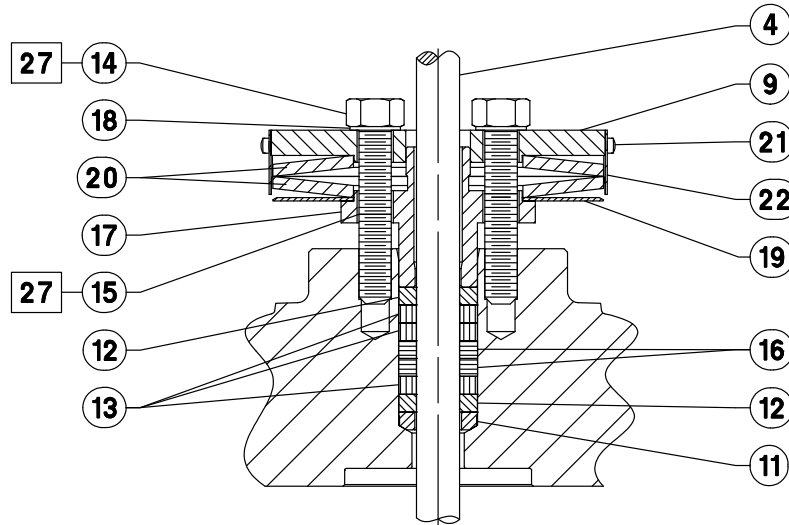
The HPNS balanced trim piston rings (key 23) are brittle and in two pieces. Avoid damaging the piston rings by dropping or rough handling.

Figure 3. Conventional Packing



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Figure 4. Graphite HIGH-SEAL Packing

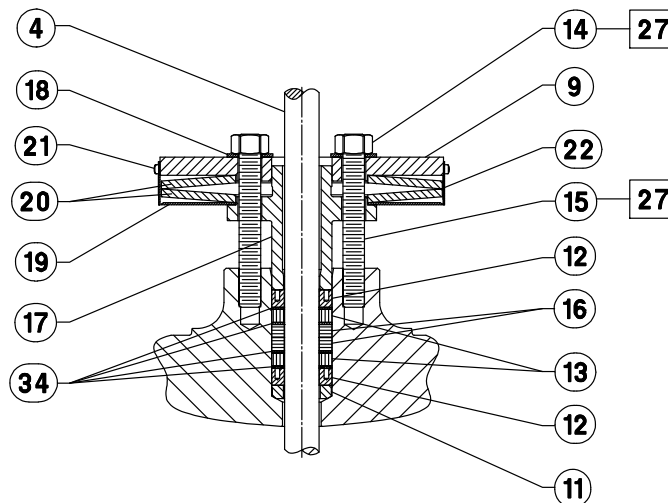


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⚠ WARNING

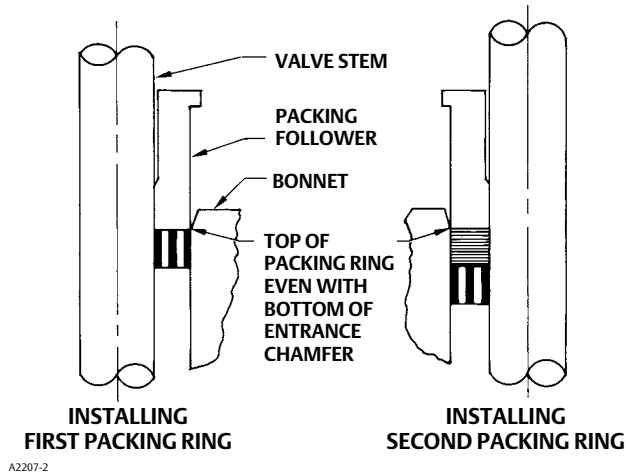
To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored 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



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



Note

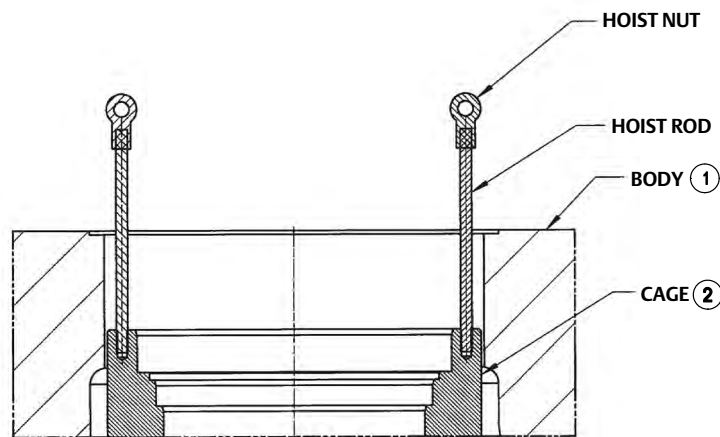
The following step also provides additional assurance that the valve body fluid pressure has been relieved.

7. Hex nuts (key 8) and washers (key 24) 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), remove the washers (key 24) and carefully lift the bonnet off the valve stem. If the valve plug and stem assembly starts to lift with the bonnet, use a deadblow 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 cage retainer (key 37), if applicable, and carefully lift it out of the valve body. If necessary, threaded rods can be installed in the threaded holes on the top of the cage or cage retainer along with eye nuts or hoist nuts, as shown in figure 7, to help lift the cage or cage retainer out of the valve body. Carefully lift the seat ring (key 3) out of the valve body. Remove the cage gasket (key 5).

⚠ WARNING

Lifting of the cage and cage retainer must be done with a vertical, or straight, lift using the equipment shown in figure 7. Lifting at an angle may damage the lifting equipment and cause property damage or personal injury.

Figure 7. Cage Removal and Installation Using Threaded Holes



Note

The cage and cage retainer lifting holes are provided for ease of assembly/disassembly. To prevent damage to the lifting holes, fully engage the threaded rod into the hole, but do not overtighten the hoist rod. It only needs to be hand tight. If it is hard to lift the cage or cage retainer, a piece of wood and a hammer can be used to strike on the top chamfer of the cage or cage retainer to loosen it from cage, body, or seat ring gasket. ASTM A193 B7 or comparable threaded rods are required for cage or cage retainer removal. Contact your [Emerson sales office](#) for more information.

NOTICE

Inspect the seat ring, cage, cage retainer (if applicable), 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, cage, and cage retainer (if applicable) using a new seat ring gasket (key 5), bonnet gasket (key 6), and cage gaskets (key 36) (if applicable). 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.

⚠ 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. Contact your [Emerson sales office](#) immediately if a discrepancy between actual parts and approved parts is suspected.

NOTICE

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 5 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.

18. Lubricate the stud threads (key 7) 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 8) to no more than 1/4 of the nominal torque value specified in table 5.

Note

If using a hydraulic torque wrench, please see the Bonnet Nut Torquing Considerations section on page 10 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.

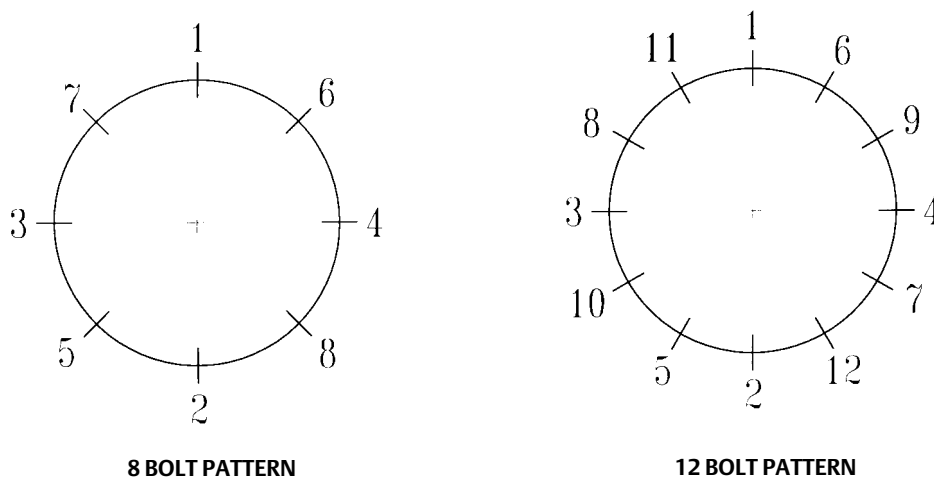
Note

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 6. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 6.

Figure 8. Bolting Diagram



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.

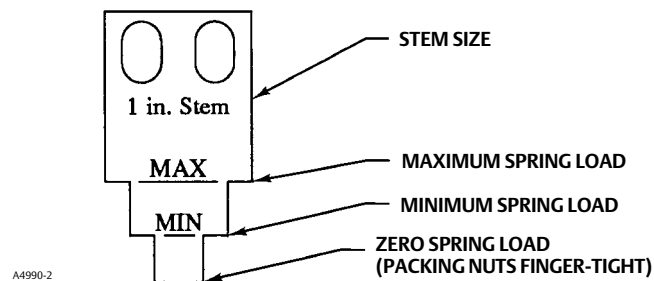
1. Follow steps 1 through 19 of the Replacing Conventional Packing section in this manual. Note: For step 13 of the Replacing Conventional Packing section, also remove the indicator disk (key 19), qty-2 Belleville springs (key 20), qty-4 load scale mounting screws (key 21), and Qty-2 load scales (key 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 9. 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.

NOTICE

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 9 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 20, 22, 23, or 24 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.

NOTICE

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 (key 33) 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 11).

4. Lift out the bonnet gasket (key 6), the cage retainer (key 37) and cage gaskets (key 36) (if applicable), and the cage (key 2). See step 10 of the Packing Removal section for more instructions on using threaded rods to assist in removing the cage and cage retainer if necessary.
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.

NOTICE

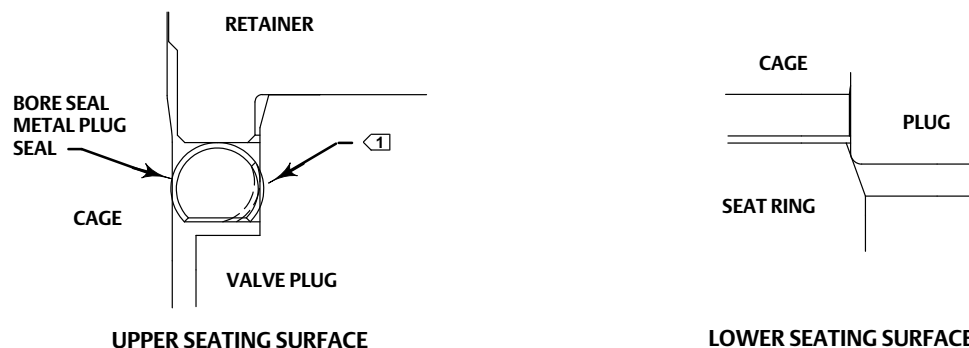
To avoid leakage when the valve is returned to service, use appropriate methods and materials to protect all sealing surfaces of the trim parts during maintenance.

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 retainer (if applicable), 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 15). 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 10).
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 10).

Figure 10. 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 20, 22, or 23, except where indicated.

NOTICE

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, because they will prevent the gaskets from sealing properly.

The pressure balancing holes in the valve plug are necessary for the proper and safe operation of the valve. Inspect the balancing holes every time the valve is disassembled for service. Any build-up, blockage, or clogging of the balance holes should be removed.

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.

NOTICE

For valves with a PTFE seal ring (figure 11), 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 11. 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 12) onto the valve plug (key 4) following the Installing Bore Seal Trim section in this instruction manual.

4. If applicable, install the cage gaskets (key 36) and cage retainer (key 37).
5. 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 11. HPNS Using Bidirectional PEEK Anti-Extrusion Seal Rings

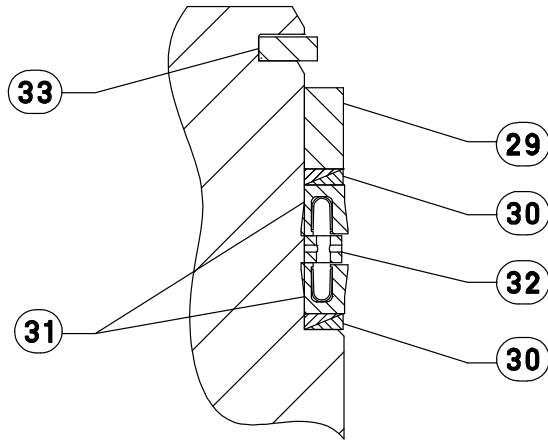
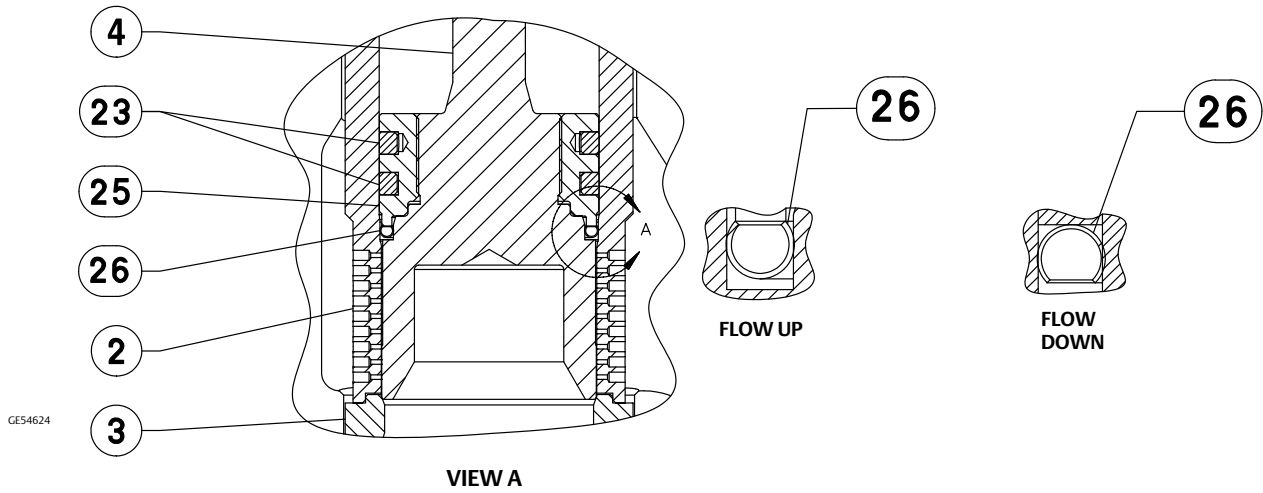


Figure 12. HPNS Balanced Bore Seal Trim



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.

NOTICE

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 5 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. Contact your [Emerson sales office](#) 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 8) to no more than 1/4 of the nominal torque value specified in table 5. 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 10 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 6).

Installing Dynamic 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 12.
 - 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 14). 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 13 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.

NOTICE

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.

NOTICE

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 8. Flow Up Dynamic Bore Seal Installation Tool

FOR PLUG SIZE (Inches)	Dimensions, Inches (See Drawing Below)								Part Number TO ORDER TOOL
	A	B	C	D	E	F	G	H	
2.875	2.92	2.72	2.75 - 2.77	2.88 - 2.86	0.16	0.16	0.3	R.08	GE50133X012
3.625	3.74	3.4	3.46 - 3.48	3.68 - 3.66	0.1	0.1	0.26	R.06	GE17835X012
5.375	5.49	5.07	5.17 - 5.19	5.39 - 5.37	0.1	0.1	0.32	R.06	GE22109X012

Figure 13. Flow Up Dynamic Bore Seal Installation Tool

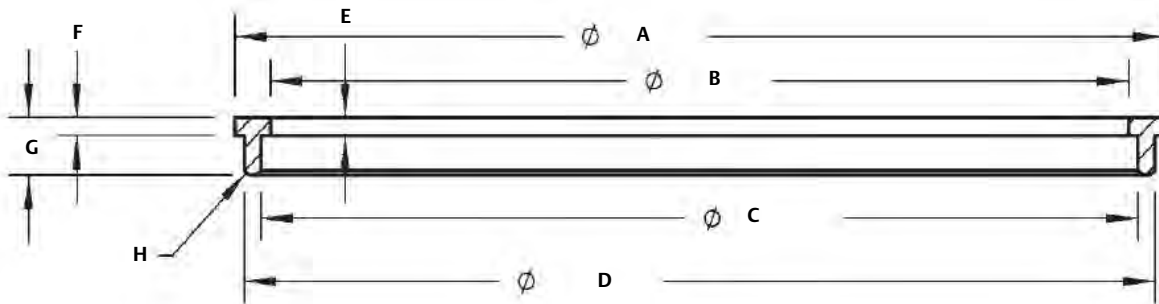


Figure 14. Retainer Guiding Fisher Bore Seal Onto the Plug

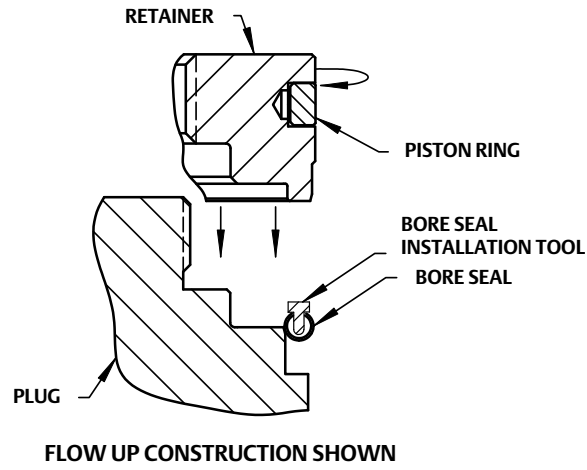
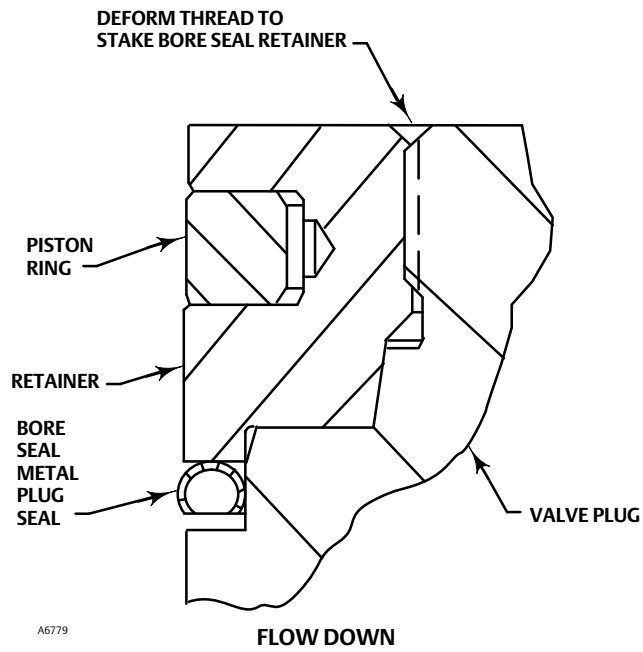


Figure 15. Stake the Threads of the Bore Seal Retainer



Installing Static Bore Seal Trim

- Orient the Bore Seal for correct sealing action based on the process fluid flow direction through the valve, as shown in figure 12.
 - 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.
- Place the bore seal ring onto the lowest groove of the cage. Note that seal installation should be done prior to installing the cage into the valve. Unless lubrication is not allowed to be in contact with the process media, apply a suitable high-temperature lubricant to the outside diameter of the bore seal. Also lubricate the inside of the cage where the bore seal must be pressed into the proper sealing position. Orient the bore seal for the correct sealing action based on whether the valve is flow up or flow down. The open interior of the bore seal must face up in a valve with flow-up construction and face down in a valve with flow-down construction. Place the bore seal at the top of the seal groove in the cage. The seal will not fit completely into the groove with hand force alone. Trying to force the seal in may damage the seal.
- An installation tool must be used as shown in figure 17 to help press the seal ring evenly onto the cage and make sure the seal ring is centered until the installation tool and cage contact metal-to-metal. See figure 16 and table 9 for tool dimensions and part numbers.
- Remove the installation tool and place the backup ring into the seal groove until it touches the seal ring.
- The cage can then be installed into the valve body by following the steps in the Trim Replacement section in this manual.

Table 9. Static Bore Seal Installation Tool

FOR PLUG SIZE (Inches)	Dimensions, Inches (See Drawing Below)				Part Number TO ORDER TOOL
	A	B	C	D	
8.5	6.57	8.583-8.587	9.014-9.034	10.270-10.290	GH08051X012

Figure 16. Static Bore Seal Installation Tool

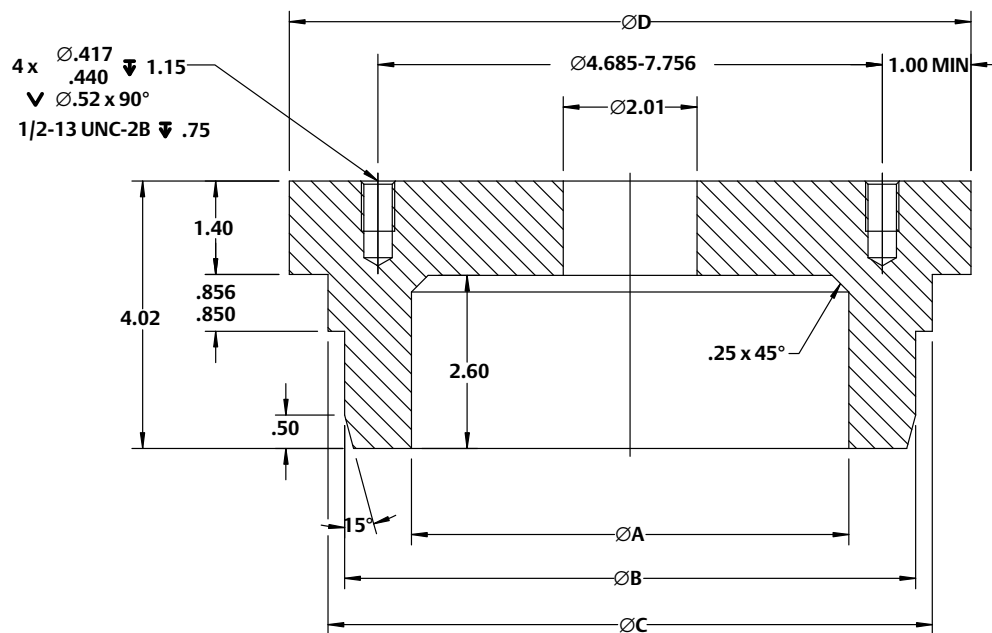
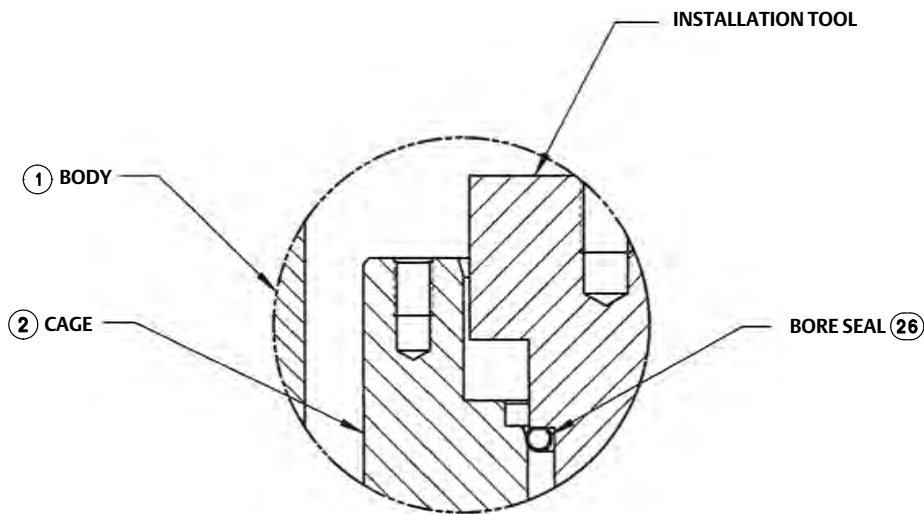


Figure 17. Static Bore Seal Installation Using Installation Tool



NOTICE

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.

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.

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

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 21, unless otherwise indicated.

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

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

NOTICE

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. Purge the line of any combustible process fluid.

⚠ WARNING

To avoid personal injury or property damage during removal of the bellows flange weld, combustible fluids must be purged from the valve and bellows prior to removal of the flange weld.

- 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 5.

Note

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

- 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.
- 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.
- 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).

NOTICE

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.

- 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.
- Cover the opening in the valve body to prevent foreign material from getting into the valve body cavity.
- 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.
- Clean the packing box and the following metal packing parts: packing follower (key 17), packing box ring (key 11).
- 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.
- Remove the protective covering from the valve body cavity, and install the seat ring and cage using a new seat ring gasket (key 5).
- Install new bellows/stem assembly (key 35) into the bore of the cage (key 3).
- 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.
- Slide loading fixture over the studs and bellows/stem assembly (key 35) shown in figure 18, make sure the bottom of the fixture is flush with the mating surface on the bellows flange.

-
16. 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.

17. 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.
18. 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.

NOTICE

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

19. 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.

20. Perform liquid penetrant examination of the weld joint and clean per applicable procedures.
21. Install a new bellows flange-to-bonnet spiral wound gasket (key 6) into the gasket groove on top of the bellows flange.
22. 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.
23. 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.
24. Lubricate the remaining bonnet studs (key 7) with Nuclear Grade anti-seize lubricant (key 27).

25. 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).

26. 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.
27. Continue the packing installation following step 3 through 9 of Replacing HIGH-SEAL Packing section.
28. 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 18. Loading Fixture Installation

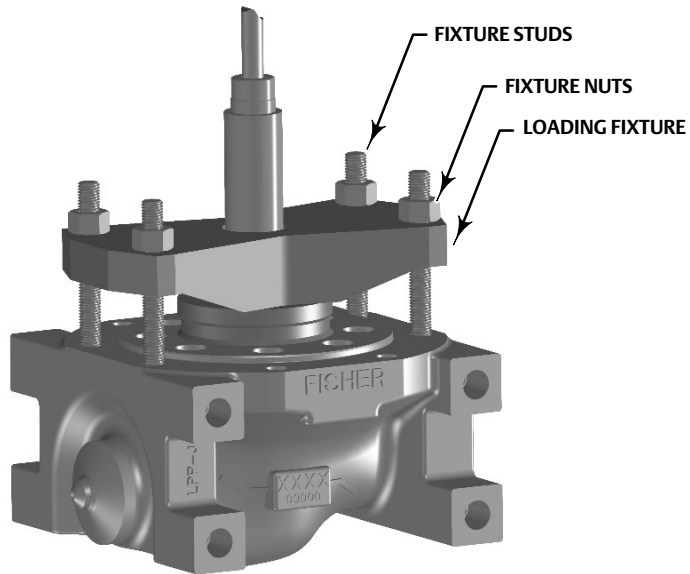


Table 10. Loading Fixture for Seal-Weld

VALVE SIZE, NPS	DIMENSIONS, INCHES (REFER TO FIGURE 19)															PART NUMBER TO ORDER TOOL
	A	B	C	D	E	F	G	H	J	K	L	M	N	P		
1/2	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	

Figure 19. Loading Fixture

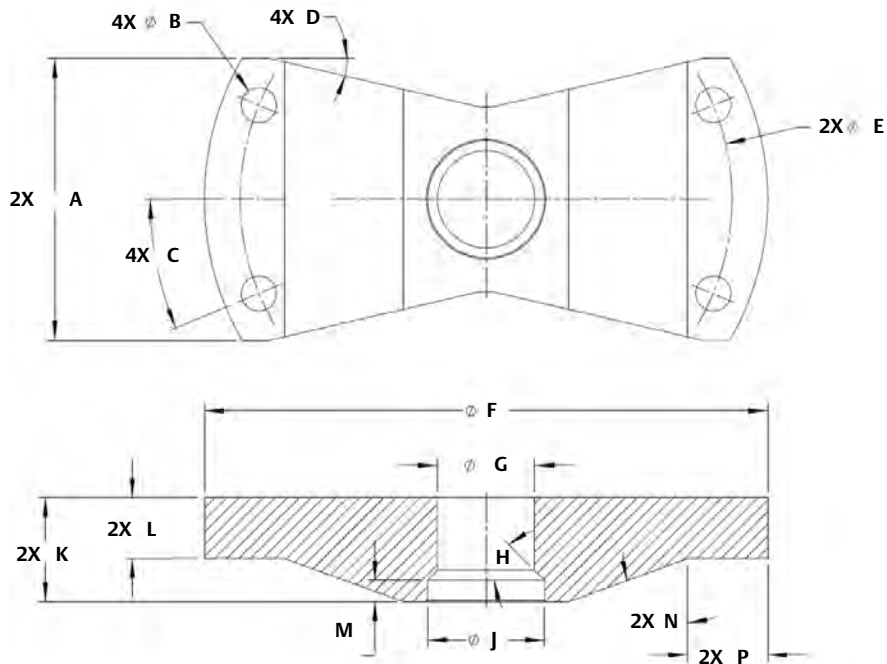


Figure 20. NPS 1 to 4 HPNS Valve

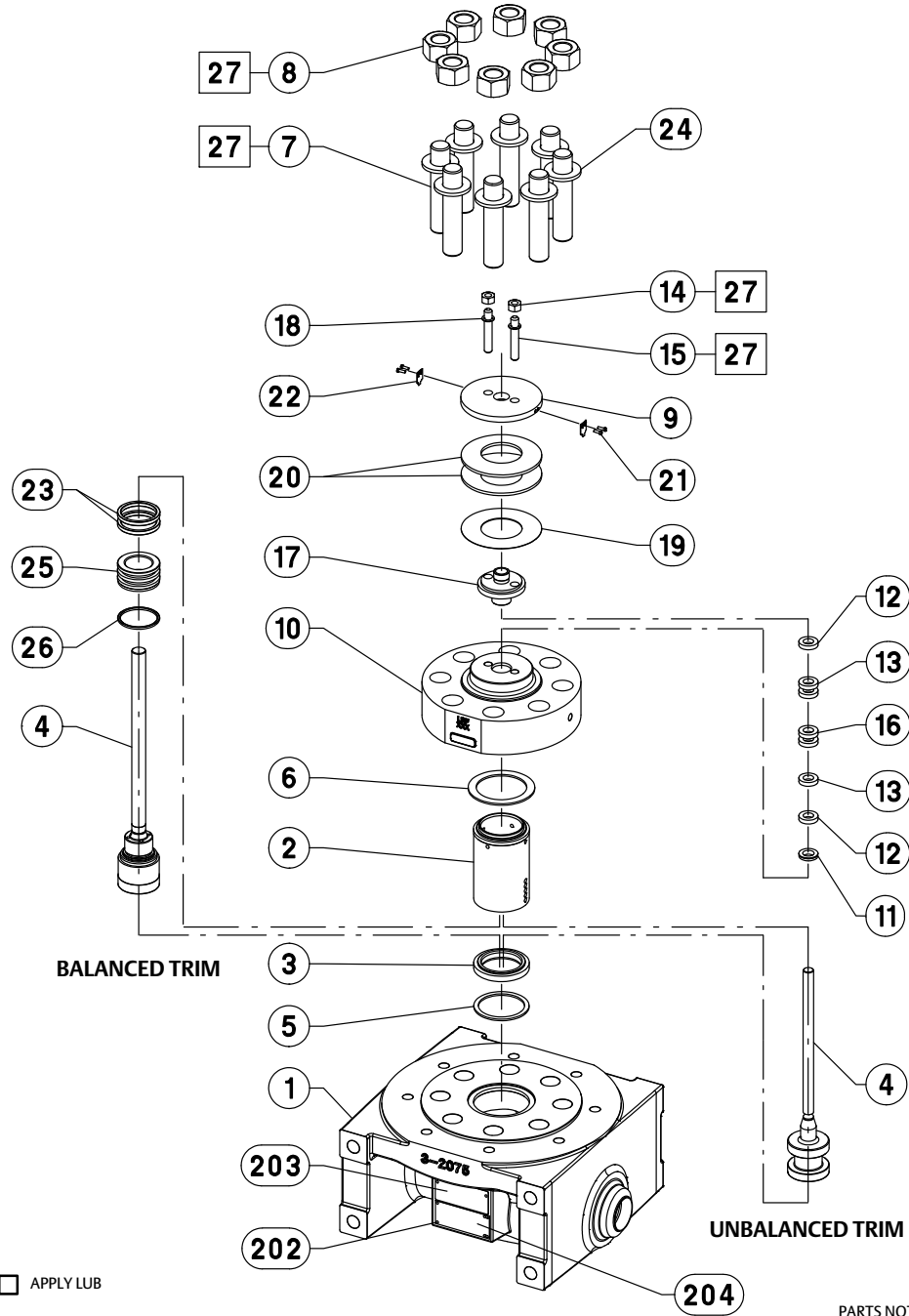


Figure 21. NPS 1/2 Hermetically-Sealed HPNS Valve

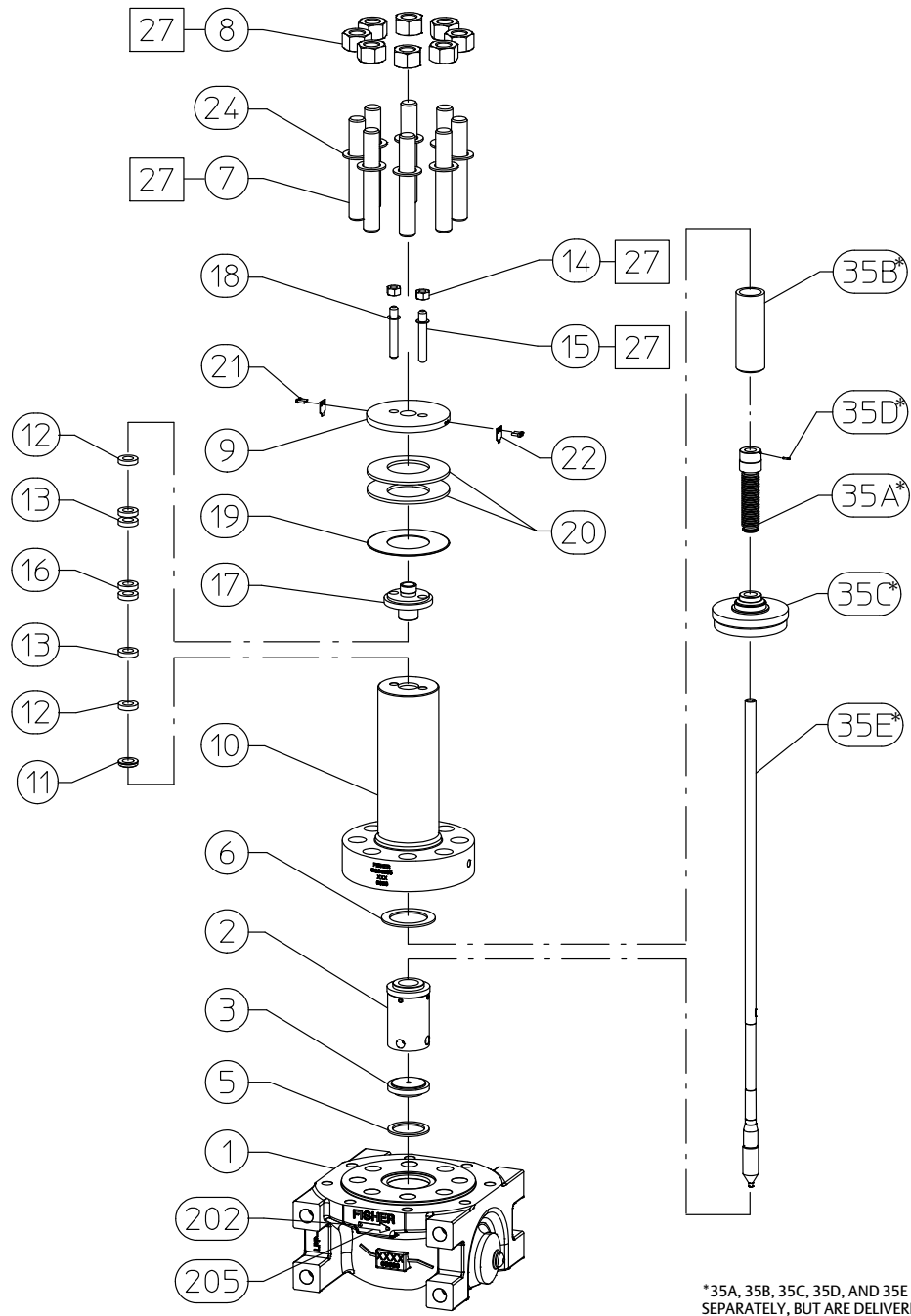
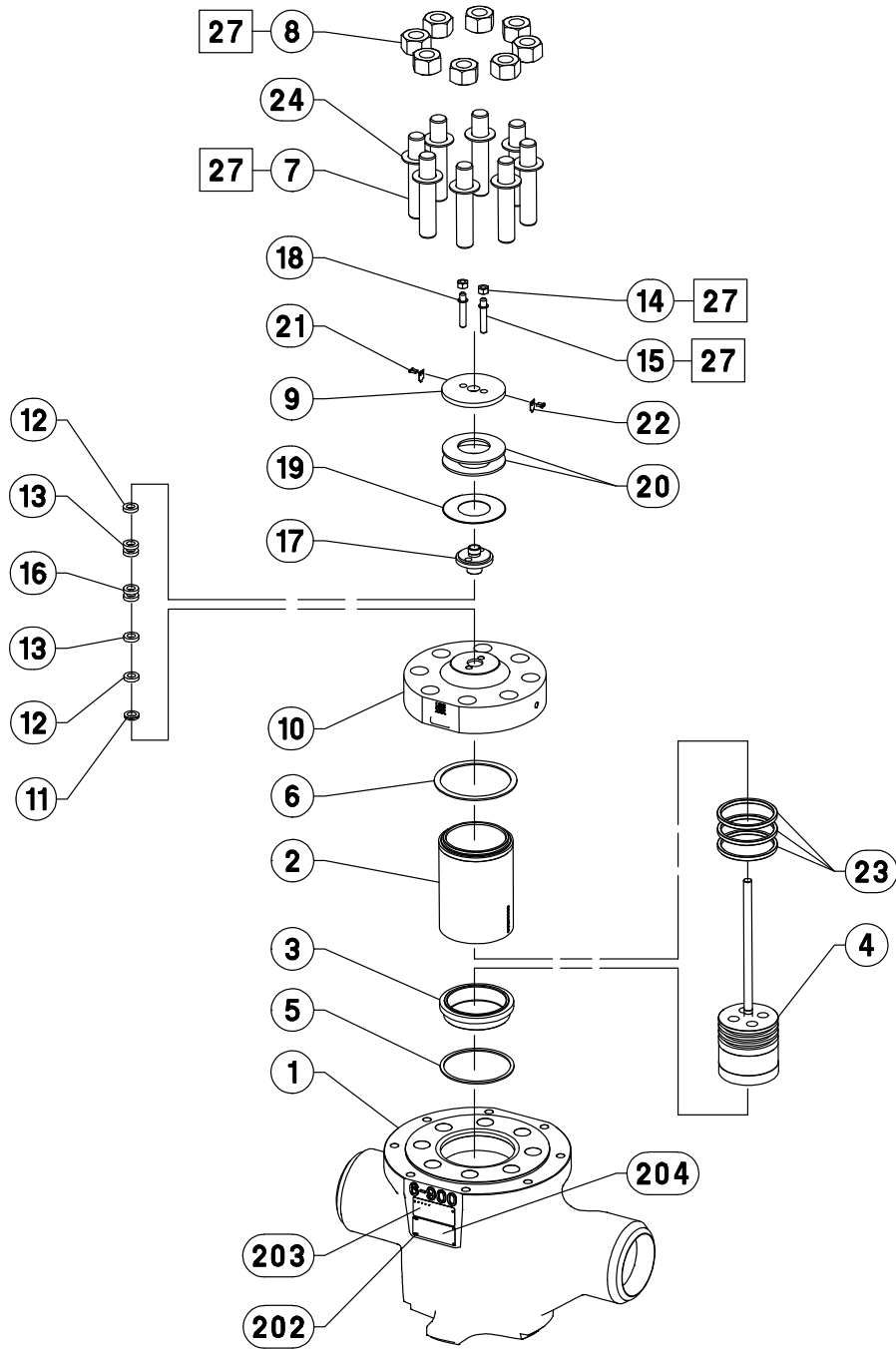


Figure 22. NPS 6 HPNS Valve

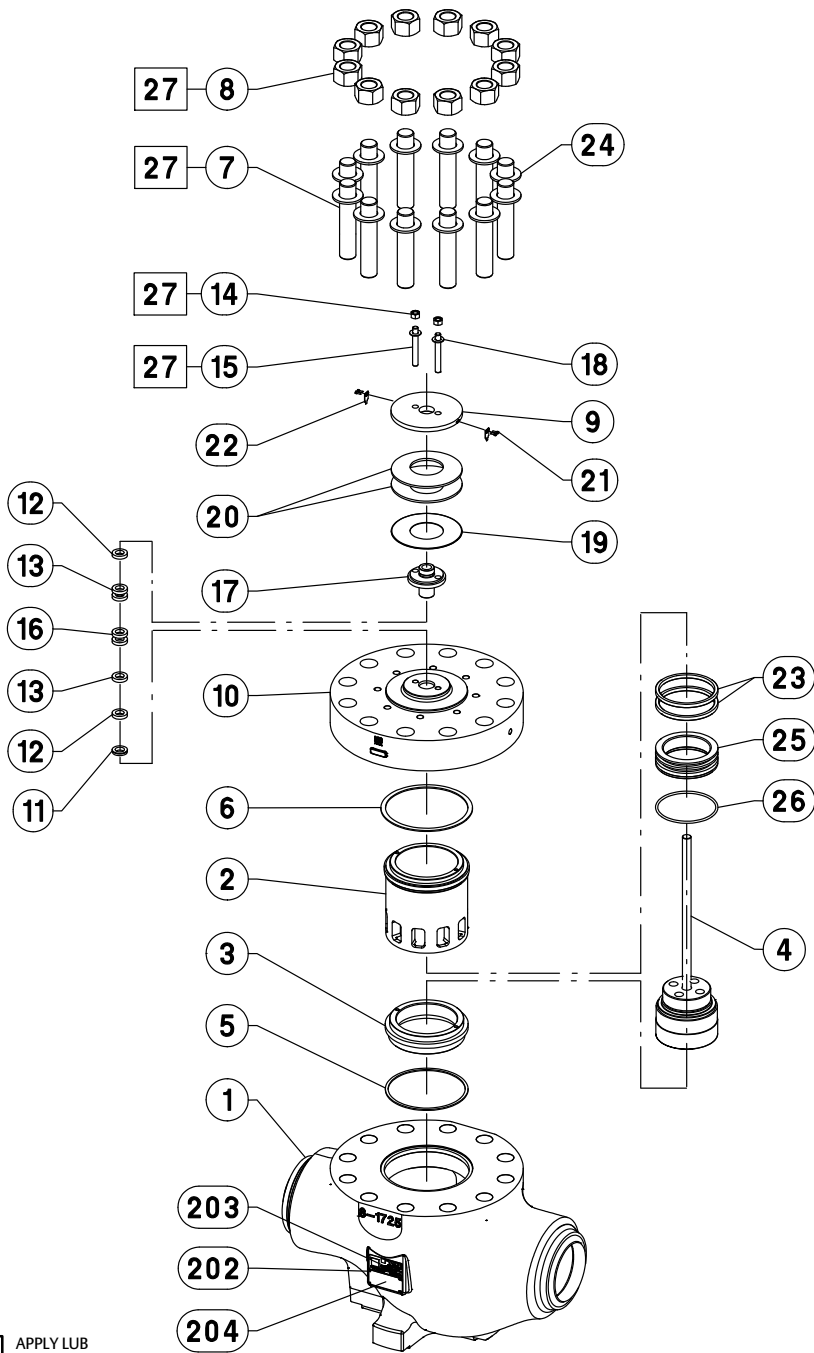


□ APPLY LUB

NOT SHOWN: KEY 205

GE49737-B

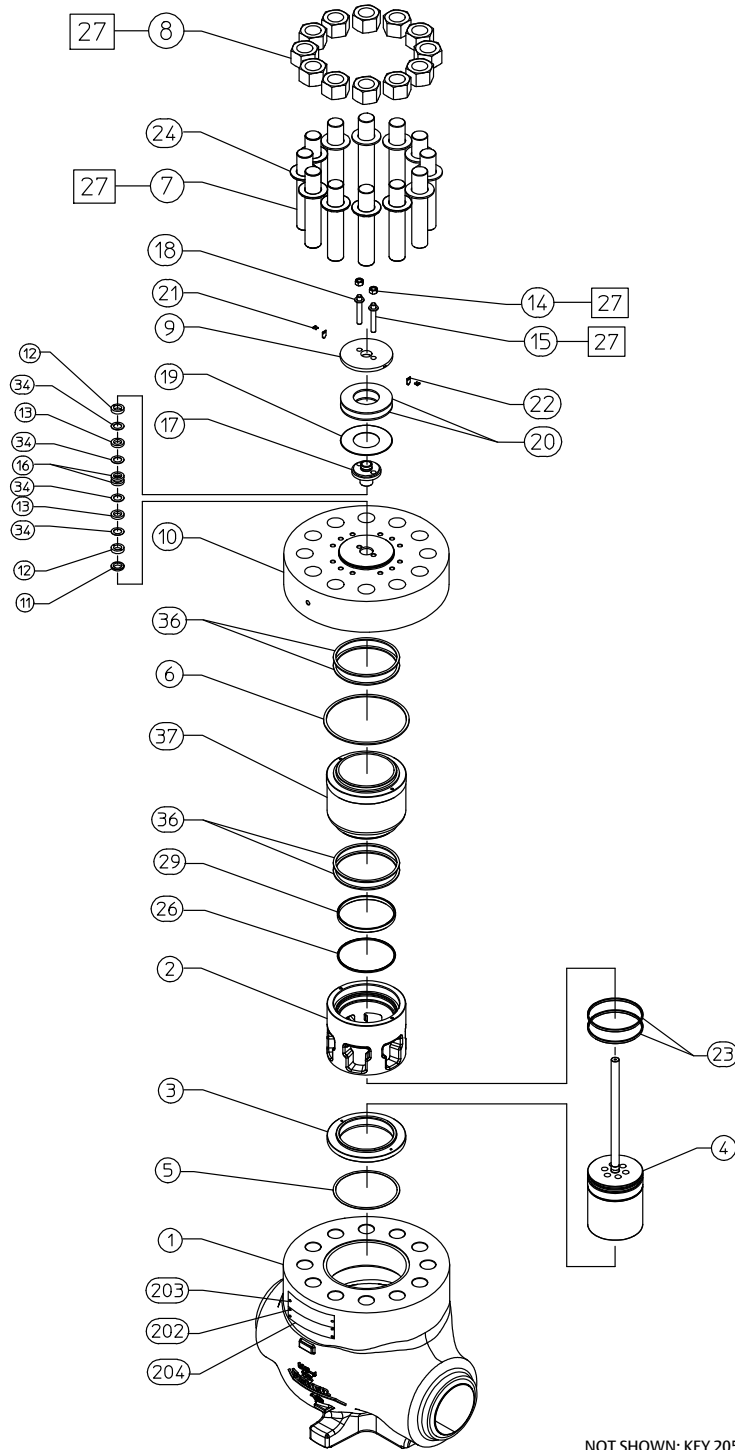
Figure 23. NPS 8 HPNS Valve



GE49537-D

NOT SHOWN: KEY 205

Figure 24. NPS 10 HPNS Valve

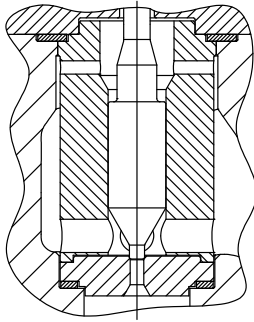


□ APPLY LUB

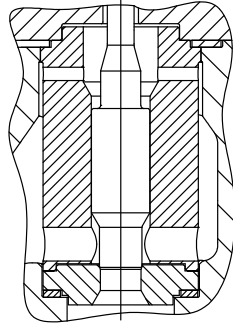
GH12620

NOT SHOWN: KEY 205

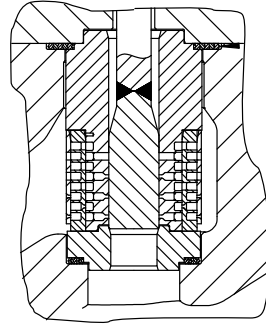
Figure 25. HPNS Valve - Alternate Configurations



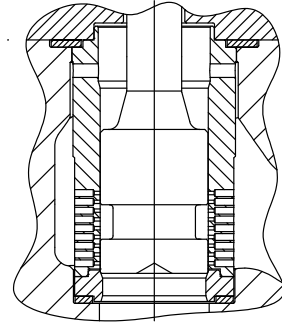
**NPS 1/2 and 1 HPNS
MICRO-FORM TRIM**



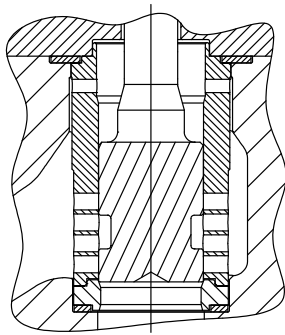
**NPS 1 HPNS
UNBALANCED TRIM**



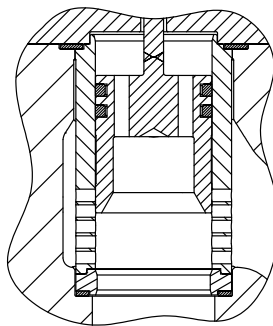
**NPS 2 HPNS
CAVITROL III TRIM**



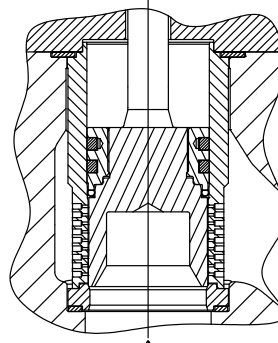
↑ FLOW
**NPS 2 HPNS TRIM
WHISPER III LEVEL B**



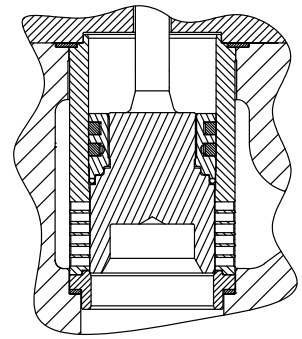
**NPS 2-3 HPNS
UNBALANCED TRIM**



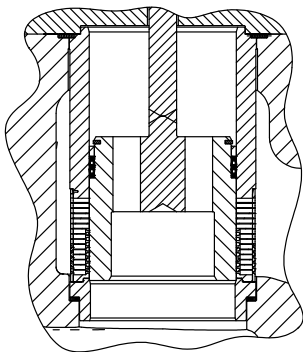
**NPS 3 HPNS
BALANCED TRIM**



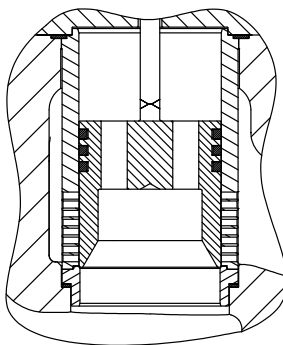
↑ FLOW
**NPS 3 HPNS BORE SEAL TRIM
WHISPER III LEVEL C**



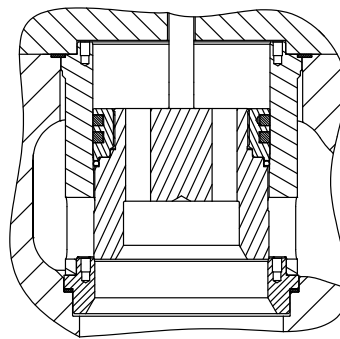
**NPS 4 HPNS
BORE SEAL TRIM**



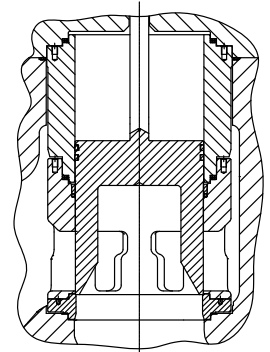
**NPS 6 HPNS
CAVITROL III TRIM**



**NPS 6 HPNS
BALANCED TRIM**

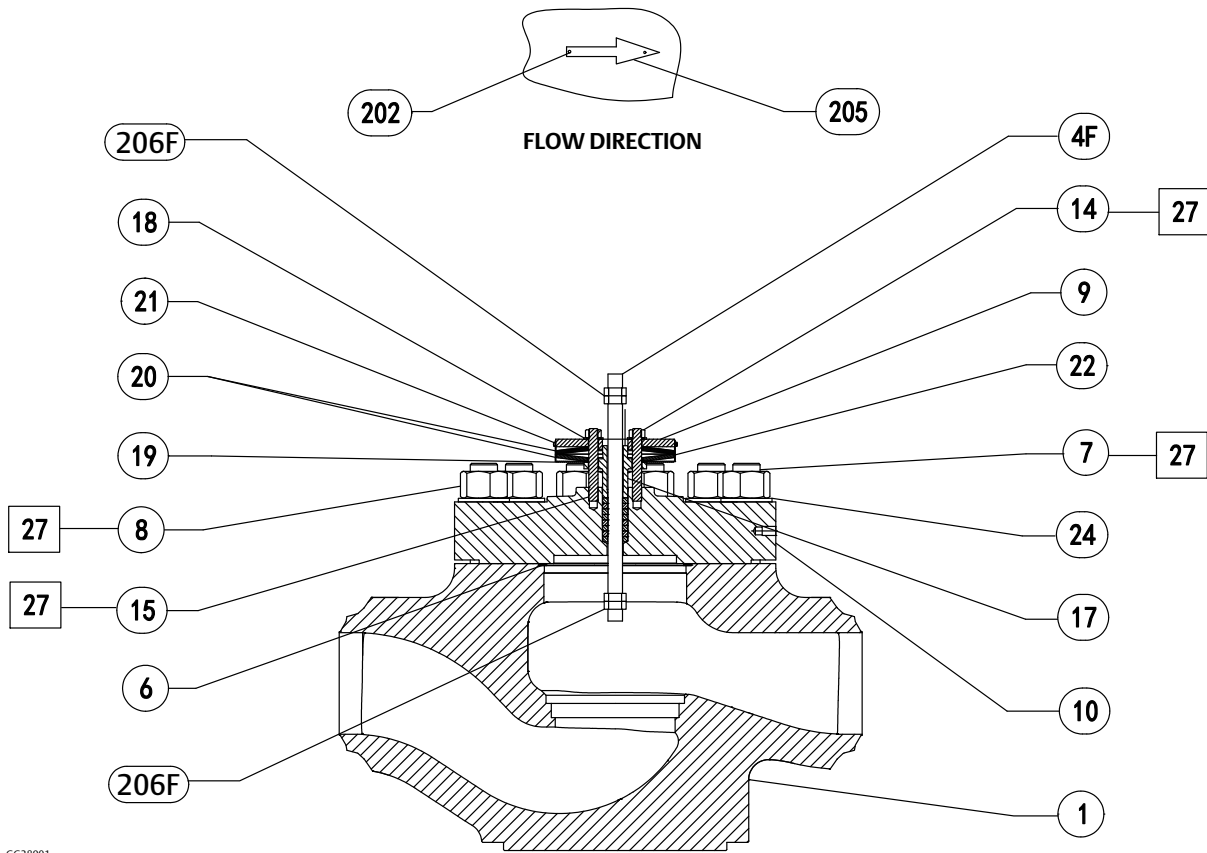


**NPS 8 HPNS
BORE SEAL TRIM**



**NPS 10 HPNS
STATIC BORE SEAL
TRIM WITH CAGE
RETAINER**

Figure 26. HPNS Valve - Alternate Flushing Configurations



GG38901

Troubleshooting

Table 11. 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](#) 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 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.

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

Key	Description	Part Number
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
36*	Cage Gasket	See following table
37*	Cage Retainer	See following table
202	Machine Screw	
203	Nuclear Name Tag	
204	Serial Tag	
205	Flow Arrow	
206	Bellows Name Tag	
206F	Flushing Nuts	
207	Warning Tag	
Special Tools		
	Dynamic Bore Seal Install Tool	See figure 13
	Static Bore Seal Install Tool	See figure 16
	Loading Fixture	See figure 19

Note

The replacement intervals listed in table 12 are general recommendations. Actual replacement interval of parts is up to the plant maintenance practices and dependent on valve service conditions and use. It is up to the plant to determine when a valve component will require replacement based on their plant performance criteria. Nothing herein is to be construed as a warranty or guarantee, express or implied, regarding the products, services or maintenance intervals described herein or their use, performance, merchantability or fitness for a particular purpose. Responsibility for proper selection, use and maintenance of any product or service remains solely with the purchaser and end user.

Table 12. 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.

- continued -

*Recommended spare parts

Table 12. 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 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
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 17 ^(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.

- continued -

Table 12. 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⁾
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.
Bonnet Gasket, Key 36	Refer to following table	4	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.
Cage Retainer, Key 37	Refer to following table	1	Non-Safety Related ⁽⁶⁾	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson recommends replacing this component every 12 years or as needed due to damage.	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, cage retainer, seat ring, and possibly guide bushings are safety related on active valves and are non-safety related on non-active valves.

Table 13. 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)	31.8 mm (1-1/4-inch)
Packing Box Ring	11*	1	ALL	12B5775X012	12B5776X012	12B5777X012	12B5778X012
Guide Bushing	12*	2	ALL OTHERS	12B5782X042	12B5784X052	12B5786X032	N/A
			PTFE HIGH-SEAL	N/A	N/A	GE50685X012	GE50671X012
Packing Ring	13*	3	ALL OTHERS	12B5799X032	12B5800X032	12B5801X022	N/A
		2	PTFE HIGH-SEAL	N/A	N/A	GE50684X012	GE50680X012
Packing Ring	16*	2	ALL OTHERS	1V3802X0092	1V2396X0072	1U6768X0062	N/A
			PTFE HIGH-SEAL	N/A	N/A	GE50682X012	GE50676X012
Packing Follower	17	1	Conventional	1E944335072	1E944735072	1H982335072	N/A
			HIGH-SEAL	21B2191X012	2B2192X012	22B5772X012	22B5773X012
Packing Flange	9	1	Conventional	1F380335072	1F380435072	1H788235072	N/A
			HIGH-SEAL	21B2196X012	21B2197X012	21B2198X012	21B2199X012
Packing Stud	15	2	Conventional	1E944435222	1E944935222	0V002535222	N/A
			HIGH-SEAL	1K7298X00A2	1R387335222	12B5844X012	1N471435222
Packing Nut	14	2	ALL	1E944535252	1E944635252	1A343335252	1A368135252
Packing Washer	18	2	ALL	19B2464X022	1K8995X0012	1A3517X0032	1A3757X0022
Indicator	19	1	HIGH-SEAL	11B3787X012	11B3788X012	11B3789X012	11B3811X012
Load Scale	22	2	Graphite HIGH-SEAL	11B2171X012	11B2173X012	11B2176X012	N/A
			PTFE HIGH-SEAL	N/A	N/A	GE51186X012	GE51187X012
Machine Screw	21	4	Graphite HIGH-SEAL	1B2752X0022	1B2752X0022	1B2752X0022	1B2752X0022
			PTFE HIGH-SEAL	N/A	N/A	1B2752X0022	1B2752X0022
Belleville Spring	20	2	Graphite HIGH-SEAL	11B2182X032	11B2184X032	11B2187X032	N/A
			PTFE HIGH-SEAL	N/A	N/A	GE50891X012	GE50875X012
Packing Washer	34*	4	PTFE HIGH-SEAL	N/A	N/A	GE50686X012	GE50681X012

* Recommended spare parts

Table 14. Keys 5* and 6* Gasket Sets

VALVE SIZE, NPS	QUANTITY	GASKET PART NUMBER	
		Seat Ring Gasket (Key 5*)	Bonnet Gasket (Key 6*)
1/2 1 2	1 Each	GE44740X012	GE44739X012
3	1 Each	GE44631X012	GE44630X012
4	1 Each	GE44475X012	GE44474X012
5 6 8 x 6	1 Each	GE44065X012	GE44066X012
8	1 Each	GE45631X012	GE45630X012
10 x 14	1 Each	GG62170X022	GG62165X022

Table 15. Key 2* Cages

VALVE SIZE, NPS	DESCRIPTION	TRAVEL		PART NUMBER	MATERIAL
		mm	Inches		
1/2	Quick Opening	6.4	0.25	GG34764X012	R30016 (ALLOY 6B)
1	Quick Opening	19.1	0.75	GE45434X012	S17400 H1100
				GE45434X022	R30016 (ALLOY 6B)
2	Equal %	38.1	1.5	GE44752X012	R30016 (ALLOY 6B)
				GE44752X022	S17400 H1100
	Linear	38.1	1.5	GE44865X012	R30016 (ALLOY 6B)
	Whisper III B3	38.1	1.5	GE44821X012	S17400 H1100
	Cavitrol III, 3-Stage	50.8	2	GE61417X012	N07718, PRECIP HRDN
3	Linear (Low Flow)	38.1	1.5	GH18321X012	S31603/COCR-A
	Linear	38.1	1.5	GG51631X012	S31603/COCR-A
	Linear w/ Unbalanced Plug	50.8	2	GE44628X012	S31603/COCR-A
	Linear w/ Balanced Plug	50.8	2	GE44706X012	S31603/COCR-A
	Whisper III C3, Bore Seal	50.8	2	GE44669X012	S17400 H1100
4	Modified Equal %	50.8	2	GE44452X012	S17400 H1100
		50.8	2	GE44469X012	S31603/COCR-A
	Modified Equal % (High Flow)	50.8	2	GE52354X012	S17400 H1100
5	Linear, for use with Bore Seal	44.5	1.75	GG49722X012	S17400 H1100
	Linear	44.5	1.75	GG50218X012	S17400 H1100
6	Linear	76	3	GE44063X012	S31603/COCR-A
	Cavitrol III, 2-Stage	76	3	GE48581X012	S17400 H1100
8 x 6	Cavitrol III, 3-Stage	76	3	GG52541X012	S17400 H1100
8	Linear	57.15	2.25	GE45474X012	CF3M/COCR-A
		50.8	2	GG66219X012	S31603/COCR-A
10 x 14	Linear	101.6	4	GH07359X012	S17400 H1075

Table 16. Key 3* Seat Ring Constructions

PORT DIAMETER		PART NUMBER	MATERIAL
mm	Inches		
6.4	0.25	GE45475X012	R30016 (ALLOY 6B)
19.1	0.75	GE45435X012	R30016 (ALLOY 6B)
25.4	1	GE45481X012	R30016 (ALLOY 6B)
		GE61240X012	N07718 PRECIP HRDN
47.6	1.875	GE44742X012	R30016 (ALLOY 6B)
73	2.875	GE44870X012	S31603/COCR-A
92.1	3.625	GE44440X012	S31603/COCR-A
111.1	4.375	GG52556X012	S17400 H1100
133.35	5.25	GE49104X012	S17400 H1100
136.5	5.375	GE44064X012	S31603/COCR-A
		GG50078X012	S31603/COCR-A
177.8	7	GE45629X012	S31603/COCR-A
215.9	8.5	GH07628X012	S31603/COCR-A

*Recommended spare parts

Table 17. Key 23* Graphite Piston Rings for Valves With Balanced Trim

PORT DIAMETER	USE WITH C-SEAL?	PISTON RING PART NUMBER	QUANTITY
Inch			
2.875	Yes	14B3620X032	2
	No	1U2300X0042	
3.625	Yes	14B5340X022	1 or 2
5.375	Yes	13B9186X022	3
	No	11A9727X052	
7	Yes	13B9176X022	2
	No	1U5069X0052	
8.5	Yes	GG62197X022	

Table 18. Key 7 Body/Bonnet Mounting Studs

VALVE SIZE, NPS	QUANTITY	STUD SIZE	PART NUMBER	MATERIAL
		Inch		
1/2	8	1 1/8-8 x 7.00	12A3576	SA 453 660 A
1 2	8	1 1/8-8 x 5.75	1J9582	SA 453 660 A SA 193 B7
3	8	1 3/8-8 x 6.75	15A5490	SA 453 660 A SA 193 B7
4	8	1 1/4-8 x 6.00	10A1461	SA 453 660 A SA 193 B7
5 6 8 x 6	8	1 1/2-8 x 8.00	12A5151	SA 453 660 A
		1 1/2-8 x 7.25	14B3926	SA 193 B7
8	12	1 7/8-8 x 9.25	GE46825	SA 453 660 A
10 x 14	12	2 1/2-8 x 14.00	GE02851	SA 453 660 A

Table 19. Key 8 Body/Bonnet Mounting Nuts

VALVE SIZE, NPS	QUANTITY	STUD SIZE	PART NUMBER	MATERIAL
		Inch		
1/2 1 2	8	1 1/8-8	1A4452	SA 453 660 A SA 194 2H
3	8	1 3/8-8	1D7167	SA 453 660 A SA 194 2H
4	8	1 1/4-8	1A4453	SA 453 660 A SA 194 2H
5 6 8 x 6	8	1 1/2-8	1A5011	SA 453 660 A SA 194 2H
8	12	1 7/8-8	1A5013	SA 453 660 A
10 x 14	12	2 1/2-8	1P3683	SA 453 660 A

Table 20. Key 24 Body/Bonnet Mounting Washers

VALVE SIZE, NPS	QUANTITY	PART NUMBER	MATERIAL
1/2 1 2	8	F16342	S41600
3 4	8	10A2630	
5 6 8x6	8	18A8227	
8	12	18A8861	
10x14	12	19A1043	

Table 21. Key 4* Valve Plug/Stem Assemblies

VALVE SIZE, NPS	DESCRIPTION	BACKSEAT	PORT DIAMETER	STEM DIAMETER		TRAVEL	PART NUMBER	MATERIAL
			Inch	mm	Inch	Inch		
1/2	Unbalanced	Yes	0.25	19.1	0.75	0.25	GG34905X012	Alloy 6B/S20910
1	Unbalanced	Yes	0.25	12.7	0.5	0.75	GE45478X012	Alloy 6B/S20910
		Yes	0.75	12.7	0.5	0.75	GE45433X012	
		No	0.75	12.7	0.5	1.25	GE45483X012	
		Yes	0.75	19.1	0.75	0.75	GG66432X012	
		No	1	12.7	0.5	0.75	GE45480X012	
		No	1	19.1	0.75	0.75	GG66462X012	
2	Unbalanced	Yes	1	19.1	0.75	2	GE61266X012	Alloy 6B/S20910
		No	1.875	19.1	0.75	1.5	GE47992X012	S31603/COCR-A/S20910
		Yes	1.875	25.4	1	1.125	GE48011X012	
		Yes	1.875	25.4	1	1.5	GE48003X012	
		No	1.875	25.4	1	1.5	GE50402X012	
3	Unbalanced	Yes	2.875	19.1	0.75	2	GE44619X012	S31603/COCR-A/S20910
	Balanced, Bore Seal	Yes	2.875	25.4	1	2	GE44639X012	
	Balanced	No	2.875	12.7	0.5	1.5	GE44700X12	
4	Balanced, Bore Seal	No	3.625	19.1	0.75	2	GE44436X012	S31603/COCR-A/S20910
		Yes	3.625	25.4	1	2	GE44516X012	F22/S31600/S20910
		No	3.625	25.4	1	2	GE44534X012	F22/COCR-A/S20910
5	Balanced, Bore Seal	Yes	5.375	25.4	1	1.75	GG49663X012	F22/COCR-A/S31603/S20910
	Balanced	No	5.375	25.4	1	1.75	GG50029X022	F22/COCR-A/S20910
6	Balanced	No	5.375	25.4	1	3	GG50029X012	S31603/COCR-A/S20910
	Balanced	No	5.375	19.1	0.75	3	GE44582X012	S31603/COCR-A/S20910
	Balanced, Bore Seal	No	5.25	25.4	1	3	GE49248X012	F6NM/S41000
8 x 6	Balanced	No	4.375	25.4	1	3	GG52297X012	F6NM/S41000
8	Balanced, Bore Seal	No	7	25.4	1	2.25	GE45907X012	S31603/COCR-A/S20910
	Balanced	No	7	25.4	1	2	GG50217X012	S31603/COCR-A/S20910
10 x 14	Balanced	No	8.5	31.8	1.25	4	GH07603X012	F6NM/S41000

Table 22. Key 25* Retainers for Valves With Bore Seal

VALVE SIZE, NPS	PORT DIAMETER	SHUTOFF CLASS	PISTON RINGS NEEDED	STEM DIAMETER		PART NUMBER	MATERIAL
	Inch			mm	Inch		
3	2.875	V	2	25.4	1	GE35717X022	S31603/COCR-A
4	3.625	V	1	25.4	1	GE48307X012	F22/COCR-A
			2			GE14715X022	F22/COCR-A
						GE14715X032	S31603/COCR-A
5 6	5.375	V	2	25.4	1	GE57237X022	F22/COCR-A
8	7	V	2	25.4	1	GE19242X032	S31603/COCR-A

Table 23. Key 26* Bore Seal Part Numbers for Valves With Bore Seal Trim

VALVE SIZE, NPS	PORT DIAMETER	BORE SEAL PART NUMBER
	Inch	
3	2.875	GE14956X012
4	3.625	GE14658X012
5 6	5.375	24B2191X012
8	7	23B9182X012
10 x 14	8.5	GG62213X012

Table 24. Yoke Bolt Circle Diameter

ACTUATOR SIZE	YOKE BOSS DIAMETER (INCH)
45A	11.35
45B	13.48
70A	11.35
70B	13.48
70C	15.3
80A	11.35
80B	13.48
80C	15.3

Table 25. Keys 29*, 30*, 31*, 32*, and 33* Part Numbers for Valves Using Bidirectional PEEK Anti-Extrusion Seal Rings

PART DESCRIPTION	KEY NUMBER	QUANTITY	PART NUMBER	
			4.375-inch Port Diameter	5.25-inch Port Diameter
Backup Ring	29*	1	10A4224X282	17A4397X012
Anti-Extrusion Ring	30*	2	21B9341X012	21B2142X012
Spring Loaded Seal Ring	31*	2	GE44061X012	GE43856X012
Spacer Ring	32*	1	GG52367X012	GG09153X012
Retainer Ring	33*	1	10A4225X012	17A4398X012

Table 26. Key 35* Part Numbers for Bellows/Stem Assembly

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

Table 27. Key 36* Cage Gasket

VALVE SIZE, NPS	QUANTITY	GASKET PART NUMBER
		Cage Gasket (Key 36*)
10 x 14	4	GG62169X022

Table 28. Key 37* Cage Retainer

VALVE SIZE, NPS	PART NUMBER	MATERIAL
10 x 14	GH08913	S31603

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