Fisher™ HPA Control Valve with Pressure Seal Bonnet

Contents

Introduction

Scope of Manual

This instruction manual includes installation and maintenance information for NPS 4x4 and 6x8 HPA valves with CL900 and CL1500 ratings and pressure seal bonnets. Refer to separate manuals for instructions covering the actuator, positioner, and accessories.

Do not install, operate, or maintain HPA series 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.

Table 1. Specifications

End Connection Styles and Ratings(1) **Flanged:** Consistent with CL900 and CL1500 per ASME B16.34 Also see table 2 Reference the product serial card for maximum pressure and temperature limits. **Shutoff Classifications** ANSI/FCI 70-2 and IEC 60534-4 CL IV	**Flow Characteristic** **Standard Cage:** ■ Equal percentage, ■ Modified equal percentage, or ■ Linear **Special cages:** Special characterized flow cages are available. Consult your Emerson sales office **Flow Direction** Standard Cage ■ *HPAD:* Normally flow down **Approximate Weights (valve body and bonnet assemblies)** See table 2

1. The pressure or temperature limits in this manual and any applicable standard limitations should not be exceeded.

Description

HPA Series high-pressure angle valves with pressure seal bonnets have metal seats, cage guiding, and push-down-to-close valve plug action. HPAD valves use balanced valve plugs.

The body head opening is sealed by a pressure seal bonnet. The process pressure presses the bonnet against the cover seal, which introduces force into the body via the backup ring and the segmented ring. The bonnet lid is braced against the segmented ring with a series of cap screws to guarantee a sufficient compression of the cover seal even when process pressure is low.

Specifications

Specifications for the HPA valves with Pressure Seal Bonnets are shown in table 2 through table 4.

Educational Services

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

Table 2. Approximate Weights (Valve and Bonnet Assemblies)

VALVE SIZE, NPS	PRESSURE RATING	KILOGRAMS	POUNDS
4 x 4	CL900	171	376
6 x 8	CL1500	387	854

Table 3. Recommended Torque for Packing Flange Nuts (Non Live-loaded Graphite Packing)

STEM DIAMETER		VALVE BODY RATING	TORQUE			
			N•m		lbf•ft	
mm	Inches		Min	Max	Min	Max
19.1	3/4	CL900	27	41	20	30
		CL1500	34	50	25	37

Table 4. Maximum Torque for Bonnet Cover Bolting Using Anti-Seize Lubricant

VALVE SIZE, NPS	VALVE RATING	TORQUE	
		N•m	lbf•ft
4 x 4 6 x 8	CL900 and CL1500	20	14.8

1. For other lubricants, contact your Emerson sales office for torque information.

Installation

⚠ WARNING

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

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

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

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

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions indicated when the valve was ordered. Because some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson sales office.

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

Note

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

3. Flow through the valve must be in the direction indicated by the flow arrow, which is stamped on or attached to the valve body.
4. The valve should be installed with the valve stem in the upward vertical orientation. If a different orientation is required, the cap screws (key 18) should be safety wired together. The actuator should also be properly supported if an orientation other than stem vertically up is used.
5. Use accepted piping and welding practices when installing the valve in the pipeline. For flanged valve bodies, use a suitable gasket between the body and pipeline flanges.
6. If the actuator and valve body are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.
7. If the valve body was shipped without packing installed in the packing box, install the packing before putting the valve body into service. Refer to instructions given in the Packing Maintenance procedure.

⚠ WARNING

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

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 lubrication, 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, or when loosening the packing box pipe plug.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

Note

The HPA valves with pressure seal bonnets use both spiral-wound gaskets and flat sheet gaskets which are compressed to provide their seal. Gaskets 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, because 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.

Packing Lubrication

Note

Do not lubricate graphite packing. Graphite packing is self-lubricated. Additional lubrication may result in slip-stick movement of the valve.

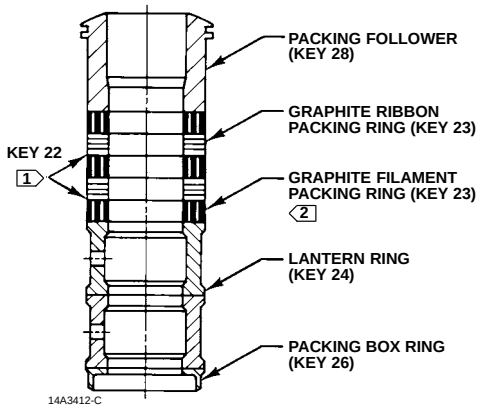
To avoid lubricants breaking down at elevated temperatures, do not lubricate packing used in processes with temperatures over 260°C (500°F).

Packing Maintenance

If there is undesirable packing leakage with packing other than spring-loaded PTFE V-ring packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts (key 21) to at least the minimum recommended torque in table 3. However, do not exceed the maximum recommended torque in table 3 or excessive friction may result. If leakage continues, replace the packing by following the numbered steps presented in the Replacing 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.

Figure 1. Packing Arrangements



GRAPHITE RIBBON AND FILAMENT SINGLE PACKING

NOTES:
1 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS. USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.
2 HAS THE APPEARANCE OF A WOVEN OR BRAIDED RING.

Adding Packing Rings

Key numbers referred to in this procedure are shown in figures 1, 8, and 9, unless otherwise indicated.

When using packing with a lantern ring (key 24) it may be possible to add packing rings above the lantern ring as a temporary measure without removing the actuator from the valve body.

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. Loosen the hose clamp (key 34) around the packing flange (Key 25) and raise the bottom of the stem dust cover boot (key 32) to access the packing.
3. Remove the packing flange nuts (key 21) and lift the packing flange, upper wiper, and packing follower (keys 25 and 28) away from the valve body.
4. It may be possible to dig out the old packing rings on top of the lantern ring but use care to avoid scratching the valve plug stem or packing box wall. Clean all metal parts to remove particles that would prevent the packing from sealing.
5. Remove the stem connector and slip the packing rings over the end of the valve plug stem.
6. Reassemble the packing follower, upper wiper, packing flange, and packing flange nuts (keys 28, 25, and 21).
7. Reconnect the body-actuator stem connection according to the appropriate actuator instruction manual.
8. Tighten the packing flange nuts only far enough to stop leakage under operating conditions. Check for leakage around the packing follower when the valve is being put into service. Retighten the packing flange nuts as required (see table 2).
9. Reattach the stem dust boot (key 32) to the packing flange and stem connector using the hose clamps (key 34).

Replacing 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 figures 1, 8, and 9, 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. Remove the cap screws in the stem connector, and separate the two halves of the stem connector. Then exhaust all actuator pressure, if any was applied, and disconnect the actuator supply and any leakoff piping.
3. Remove the hex nuts (key 30) and remove the actuator from the body (key 1).
4. Loosen and remove hose clamps (key 34).
5. Remove stem adaptor (key 33) and stem dust boot (key 32).
6. Loosen the packing flange nuts (key 21) so that the packing (key 23, figure 1) is not tight on the valve plug stem (key 4). Remove any travel indicator disk and stem locknuts from the valve plug stem threads.

NOTICE

When lifting the bonnet (key 13), be sure that the valve plug and stem assembly (keys 3 and 4) remains on the seat ring (key 5). This avoids damage to the seating surfaces as a result of the assembly dropping from the bonnet after being lifted part way out. The parts are also easier to handle separately. Lifting the bonnet (key 13), be sure that the valve plug and stem assembly (keys 3 and 4) remains on the seat ring (key 5). This avoids damage to the seating surfaces as a result of the assembly dropping from the bonnet after being lifted part way out. The parts are also easier to handle separately.

Use care to avoid damaging gasket sealing surfaces.

The HPAD piston rings (key 7) are brittle and in two pieces. Avoid damaging the piston rings by dropping or rough handling.

⚠ 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.

7. Cap screws (key 18) attach the bonnet lid to the bonnet. Unscrew these cap screws (key 18).
8. Lift the bonnet lid (key 17) off the bonnet.
9. Push the bonnet (key 13) slightly into the valve.
10. Knock segments of the four piece ring (key 16) out of the groove (smaller segments first.) To do this, insert a blunt tool into the side bores on the body head.
11. Remove the four pieces of the segmented ring (key 16) from the valve.
12. Remove bonnet (key 13) with backup ring (key 15) and cover seal (key 14) from the body and off the valve stem (key 4).
13. Lift the plug/stem assembly (key 3 and 4) from the valve.
14. Cover the opening in the valve body to protect the gasket surface and to prevent foreign material from getting into the valve body cavity.
15. Remove the packing flange nuts (key 21), packing flange (key 25), and packing follower (key 28).
16. 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.

17. Clean the packing box and the following metal packing parts: packing follower (key 28), packing box ring (key 26), and lantern ring (key 24).
18. Inspect the valve stem threads for any sharp edges that might cut the packing. A whetstone or emery cloth may be used to smooth the threads if necessary.

NOTICE

The HPA valve with pressure seal bonnet uses a cover seal to provide a bonnet seal and should never be reused. Whenever a cover seal is disturbed by removing or shifting parts, a new cover seal must be installed upon reassembly. This is necessary to ensure a good bonnet seal, because the used cover seal will not seal properly.

19. Remove the protective covering from the valve body cavity. Install the plug, then slide the bonnet over the stem (key 4).
20. Insert the new cover seal (key 14).
21. Insert the backup ring (key 15).
22. Push bonnet (key 13) slightly into the body (key 1) and insert the segments of the four-piece segmented ring (key 16) into the groove in the body (key 1). Larger segments should be inserted first.
23. Insert the bonnet lid (key 17).

⚠ WARNING

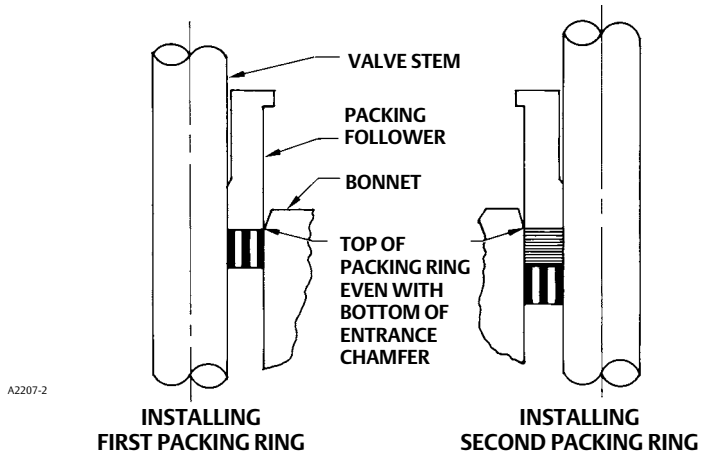
Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials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

24. Lubricate the cap screw threads and the faces of the heads (key 18) with anti-seize lubricant. Replace the cap screws and tighten them finger tight. Stroke the valve several times to center the trim. Torque the cap screws in a crisscross pattern to no more than half of the max torque in table 4. When all nuts are tightened to half the torque, repeat the crisscross pattern, tightening the cap screws to the specified max torque.

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 2).

Figure 2. Installing Graphite Ribbon/Filament Packing Rings One at a Time



25. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 1. Slip a smooth-edged pipe over the valve stem, and gently tamp each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.
26. Slide the packing follower into position.
27. For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 3. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 3.
28. 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.
29. To ensure tightness of pressure seal, cap screws (key 18) must be hand tightened when valve is under hydrostatic pressure.

Trim Removal

For bore seal construction, see the appropriate bore seal sections in this manual.

Key numbers referenced in this procedure are shown in figure 8, except where indicated.

1. Remove the actuator and bonnet by following steps 1 through 12 of the replacing packing procedure. Observe all warnings and cautions.

2. Lift the valve stem and attached valve plug out of the valve body. If the valve plug is to be reused, tape or otherwise protect the valve plug stem and the valve plug seating surface to prevent scratches.
3. Unscrew the cage retainer (key 11) and remove carefully.
   - Quantity 6, 3/8-16 tapped holes are provided to assist with removal.
   - Use a power torque wrench having torque capabilities equal to or greater than those shown in table 5.
   - Use the stud bolts (key 29) to prevent the power torque wrench from rotating.

Table 5. Recommended Torque for Cage Retainer

VALVE SIZE, NPS	TORQUE	
	N•m	lbf•ft
4 x 4	6170	4550
6 x 8		

4. Lift out the cage (key 2), cage gasket (key 10), seat ring (key 5), and seat ring gasket (key 9).
5. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

Valve Plug Maintenance

Key numbers used in this procedure are shown in figure 8 except where indicated.

With the valve plug (key 3) removed according to the trim removal procedure, proceed as appropriate:

1. The piston rings (key 7) are each in at least two sections; remove the sections from the grooves in the valve plug.
2. To replace the valve plug stem (key 4), drive out the pin (key 6), and unscrew the stem from the valve plug.

Table 6. Valve Stem Connection Torque and Drill Size for Pin Hole

VALVE SIZE, NPS	VALVE STEM DIAMETER		DESIGN	VALVE STEM CONNECTION TORQUE (MINIMUM-MAXIMUM)		DRILL SIZE FOR PIN
HPA	mm	Inches		N•m	Lbf•ft	Inches
4 x 4	19.1	3/4	HPD, HPT, HPAD, HPAT	237 - 339	175 - 250	3/16
6 x 8	19.1	3/4	HPD, HPT, HPAD, HPAT	237 - 339	175 - 250	3/16

NOTICE

Never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem. This weakens the stem and may cause the stem to fail in service. If a new valve plug is required, always order a valve plug, stem, and pin as an assembly. Specify the correct part number of each of the three parts, but state that the parts are being ordered as an assembly.

A used valve plug may be reused with a new stem.

3. Thread the new stem into the valve plug and tighten it to the appropriate torque value given in table 6. Using the valve plug pin hole as a guide, drill the pin hole through the stem. Refer to table 6 for drill sizes.
4. Drive in the pin to lock the assembly.
5. If it is necessary to lap the seating surfaces, complete the lapping seats procedure before installing the piston rings. The Trim Replacement procedure provides piston ring installation instructions and valve reassembly instructions.

Lapping Seats

Key numbers referenced in this procedure are shown in figure 8, except where indicated.

A certain amount of leakage should be expected with metal-to-metal seating in any valve body. If the leakage becomes excessive, however, the condition of the seating surfaces of the valve plug and seat ring can be improved by lapping. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Note

The HPA with pressure seal bonnet uses a cover seal which gets compressed and should never be reused. This includes reusing a cover seal after the lapping procedure has been performed.

An "old" cover seal can be used to lap the seat, however it must be replaced with a new cover seal prior to reassembly.

To preserve the effects of lapping, do not change the position of the seat ring in the valve body cavity or the position of the cage on the seat ring after lapping the seating surfaces. Lapping should only be performed once the cage retainer has been reinstalled to ensure the parts stay in the same orientation after lapping.

Use the following procedure to lap the seating surfaces.

1. Install the valve plug and stem assembly (keys 3 and 4) -- without piston rings or seal ring (key 7 and 8) -- into the cage.
2. Install the bonnet (key 13) over the valve stem, followed by the "old" cover seal (key 14), backup ring (key 15), four-piece segmented ring (key 16), and bonnet lid (key 17.) Secure the bonnet with the four cap screws (key 18).
3. Attach a handle, such as a piece of strap iron secured by stem locknuts, to the valve stem. Rotate the handle alternately in each direction to lap the seats.
4. After lapping, disassemble as necessary (you may mark the position of the seat ring and cage with a soft tip marker). Clean the seating surfaces, replace the gaskets, reassemble (taking care to return the seat ring and cage to their original positions), and test for shutoff. Repeat the lapping procedure if necessary.

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 8, except where indicated.

NOTICE

Inspect the seat ring, cage, cage retainer (as provided), 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.

Inspect the body and bonnet surfaces that come in contact with the cover seal. These surfaces must be in good condition, with all foreign material removed. Scratches or burrs that run across these surfaces are not permitted under any conditions, because they will prevent the cover seal 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.

Note

When installing the standard cage, align two of the holes in the cage with the centerline of the valve body. Refer to figure 8.

Inspect the dowel pins (key 12) ensure they are present and in good condition. If any are loose, worn, or damaged, remove and replace with new oversized pins.

NOTICE

To avoid galling or improper gasket loading that may result in leakage, thoroughly clean the threads and the gasket surfaces in the valve body (key 1), the valve body bore, and the cage retainer (key 11). Lubricate the surfaces indicated in figure 3 with the appropriate lubricant. Be certain to lubricate all of the following mating surfaces:

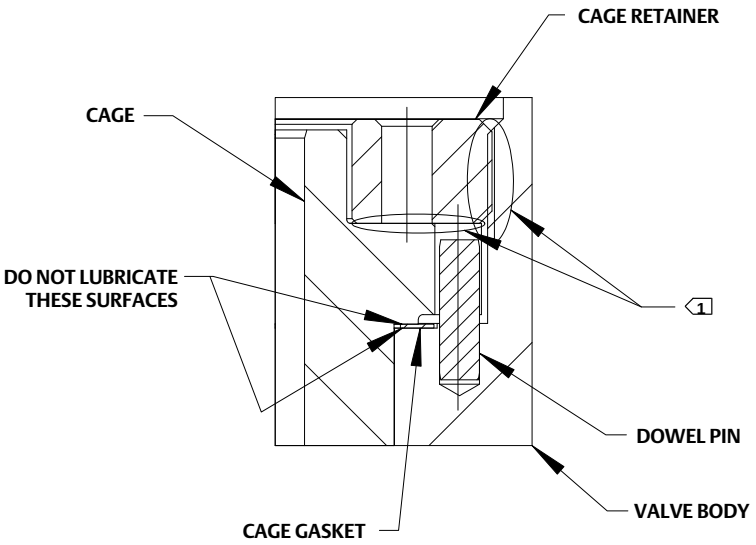
- **Cage retainer and valve body threads**
- **Bottom of the cage retainer and top of the cage flange**

Do not lubricate the gasket surfaces.

Position the valve vertically and carefully lower the lower cage into the valve body. When inserting the cage, use an even motion; do not rock the cage while installing it. Use care to avoid damaging the cage gasket (key 10).

1. Install the seat ring gasket (key 9) into the valve body. Install the seat ring (key 5).
2. Install the cage gasket (key 10) and cage (key 2).

Figure 3. Cage Retainer Lubrication



NOTES:
1 LUBRICATION REQUIRED, USE ANTI-SEIZE LUBRICANT.

3. Thread the cage retainer (key 11) into the valve body. Tighten the cage retainer to the torque specified in table 5.
   - Quantity 6, 3/8-16 tapped holes are provided to assist with removal.
   - Use a power torque wrench having torque capabilities equal to or greater than those shown in table 5.
   - Use the stud bolts (key 29) to prevent the power torque wrench from rotating.
4. To install the piston rings (key 7):
   - 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.
5. Install the valve plug into the cage.
6. Install the bonnet (key 13) over the valve stem, followed by a new cover seal (key 14), backup ring (key 15), four-piece segmented ring (key 16), and bonnet lid (key 17.)
7. Lubricate the stud threads and the faces of the cap screws (key 18) with anti-seize lubricant.
8. Replace the cap screws (key 18) and tighten them in a crisscross pattern to 1/2 the torque specified in table 4. When all cap screws are tightened to that torque, increase to the specified max torque, and repeat the crisscross pattern.

9. Install new packing and packing box parts per steps 25 to 29 of the Replacing Packing procedure. Be certain to observe the note given prior to step 25 of that procedure.
10. Mount 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 3).

Replacement of Installed Bore Seal Trim

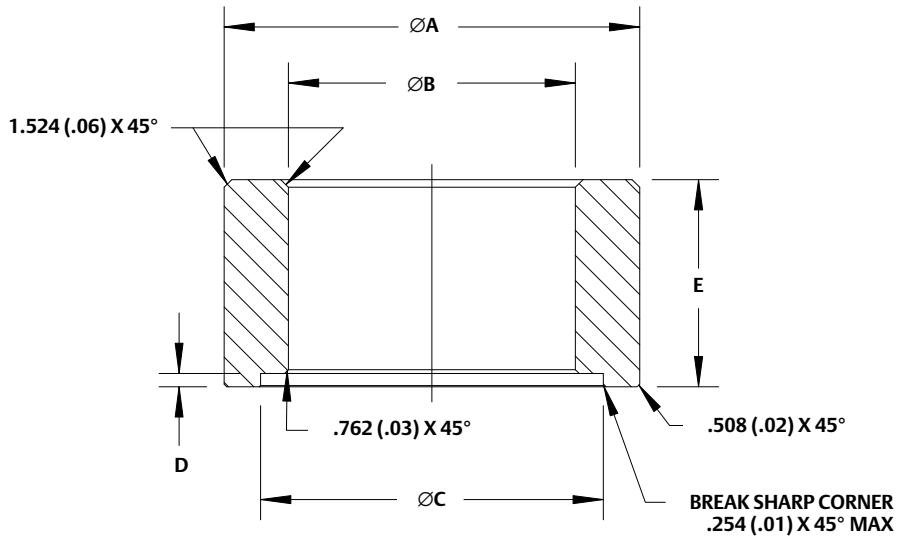
Trim Removal (Bore Seal Constructions)

1. Remove the valve actuator and bonnet following the appropriate instructions in the Replacing Packing section in this manual.

Table 7. C-Seal Installation Tool Dimensions

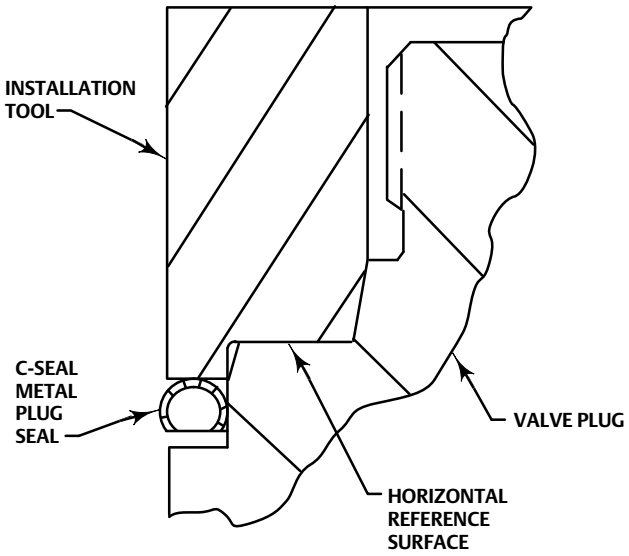
FOR VALVE PLUGS FITTING PORT SIZE (in)	DIMENSIONS, mm (See Drawing Below)				
	A	B	C	D	E
2.875	82.55	56.972 - 57.023	67.818 - 68.326	2.616 – 2.667	41.148
FOR VALVE PLUGS FITTING PORT SIZE (in)	**DIMENSIONS, in (See Drawing Below)**				
	A	**B**	**C**	**D**	**E**
2.875	3.25	2.243 - 2.245	2.670 - 2.690	0.103 - 0.105	1.62

Figure 4. C-Seal Installation Tool Dimensions



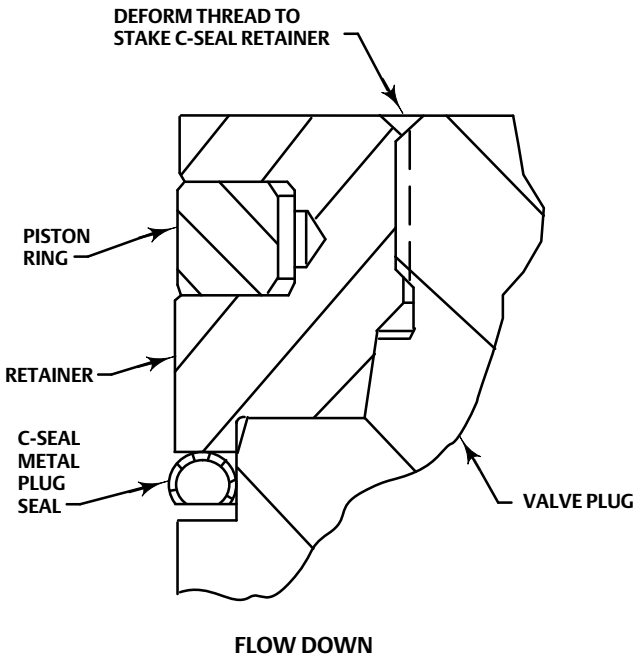
2. Remove the existing valve stem and plug from the valve body following the appropriate instructions in the Trim Removal section in this manual.
3. If cage or seat ring removal is required for maintenance, follow trim removal instructions, and replace all gaskets according to appropriate instructions in the Trim Replacement section in this manual.

Figure 5. Installing the C-seal Plug Seal Using the Installation Tool



NOTE: PRESS THE INSTALLATION TOOL OVER THE VALVE PLUG UNTIL THE TOOL CONTACTS THE HORIZONTAL REFERENCE SURFACE OF THE VALVE PLUG.

Figure 6. Stake the Threads of the C-seal Retainer



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 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.

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.

Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

NOTICE

Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem.

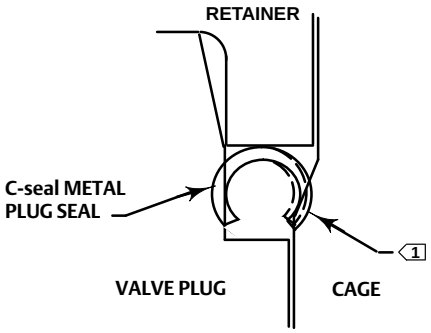
Never reuse an old valve stem with a new plug or reinstall a valve stem after it has been removed. Replacing a valve stem requires drilling a new pin hole in the stem. This drilling weakens the stem and may cause failure in service. However, a used valve plug may be reused with a new valve stem.

4. Locate the staked thread on top of the valve plug (figure 6). 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.
5. 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 C-seal retainer
6. After removing the piston ring(s), locate the 1/4-inch diameter hole in the groove. In a retainer with two piston ring grooves, the hole will be found in the upper groove.
7. Select an appropriate tool such as a punch and place the tip of the tool into the hole with the body of the tool held tangent to the outside diameter of the retainer. Strike the tool with a hammer to rotate the retainer and free it from the valve plug. Remove the retainer from the plug.
8. Use an appropriate tool such as a flat-blade screwdriver to pry the C-seal plug seal off the plug. Use caution to avoid scratches or other damage to the sealing surfaces where the C-seal plug seal contacts the valve plug (figure 7).
9. 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 sealing surface inside the cage where the C-seal plug seal contacts the cage, and inspect the sealing surface where the C-seal plug seal contacts the plug (figure 7).
10. Replace or repair trim parts according to the following procedure for Lapping Metal Seats or other valve plug maintenance procedures as appropriate.

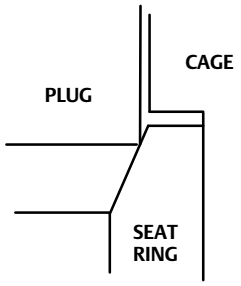
Lapping Metal Seats (Bore Seal Constructions)

Before installing a new bore seal plug seal, lap the lower seating surface (valve plug to seat ring, figure 6) following appropriate procedures in the Lapping Seats section in this manual.

Figure 7. Lower (Valve Plug to Seat Ring) and Upper (C-seal Plug Seal to Cage) Seating Surfaces



UPPER SEATING SURFACE



LOWER SEATING SURFACE

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

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Trim Replacement (Bore Seal Constructions)

1. Apply a suitable high-temperature lubricant to the inside diameter of the C-seal plug seal. Also, lubricate the outside diameter of the valve plug where the C-seal plug seal must be pressed into the proper sealing position.
2. Orient the C-seal plug seal for correct sealing action based on the process fluid flow direction through the valve.
   - The open interior of the C-seal plug seal must face down in a valve with flow-down construction (figure 7).

Note

An installation tool must be used to properly position the C-seal plug seal on the valve plug. A tool is available as a Fisher spare part or a tool could be manufactured following the dimensions given in figure 4 and table 7.

3. Place the C-seal plug seal over the top of the valve plug and press it onto the plug using the installation tool. Carefully press the C-seal plug seal onto the plug until the installation tool contacts the horizontal reference surface of the valve plug (figure 5).
4. Apply a suitable high-temperature lubricant to the threads on the plug. Then, place the C-seal retainer onto the plug and tighten the retainer using an appropriate tool such as a strap wrench.

5. Using an appropriate tool such as a center punch, stake the threads on top of the plug in one place (figure 6) to secure the C-seal retainer.
6. Replace the piston rings following instructions in the Trim Replacement section in this manual.
7. Return the seat ring, cage, plug/retainer assembly, and stem to the valve body and completely reassemble the valve package following the appropriate 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 C-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 C-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.

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.

⚠ 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 Kits

Standard Packing Kits (Non Live-Loaded)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	19.1 (3/4) 90 (3-9/16)
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring], 24, and 26)	RPACKX00122
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring], and 26)	---
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring])	RPACKX00152

Parts List

Numerous available combinations of valve parts make selection of some parts difficult. When ordering valve parts, provide the valve serial number with the order, permitting proper selection of replacement parts to be made at the factory.

Note
Contact your Emerson sales office for Part Ordering information.

Key	Description
1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number, and desired material.
2*	Cage
3*	Plug
4*	Valve Stem
5*	Seat Ring
6*	Pin
9*	Seat Ring Gasket
10*	Cage Gasket
11*	Cage Retainer
12	Dowel Pin
13	Bonnet If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.
14*	Cover Seal
15	Backup Ring
16	Segmented Ring
17	Bonnet Lid
18	Cap Screw
20	Stud Bolt
21	Hex Nut
23*	Packing Ring
24	Spring or Lantern Ring
25	Packing Flange
26*	Packing Box Ring
28	Packing Follower
29	Stud Bolt
30	Hex Nut
31	Hex Jam Nut
32*	Stem Dust Boot
33	Stem Adaptor
34	Hose Clamp

Bore Seal Trim (figure 3)

Key	Description
2*	Cage
3*	Valve Plug/Retainer
4*	Valve Stem
5*	Seat Ring
7*	Piston Ring (2 req'd)
8*	C-seal

*Recommended spare parts

Figure 8. 3/4-Inch Stem HPA Valve

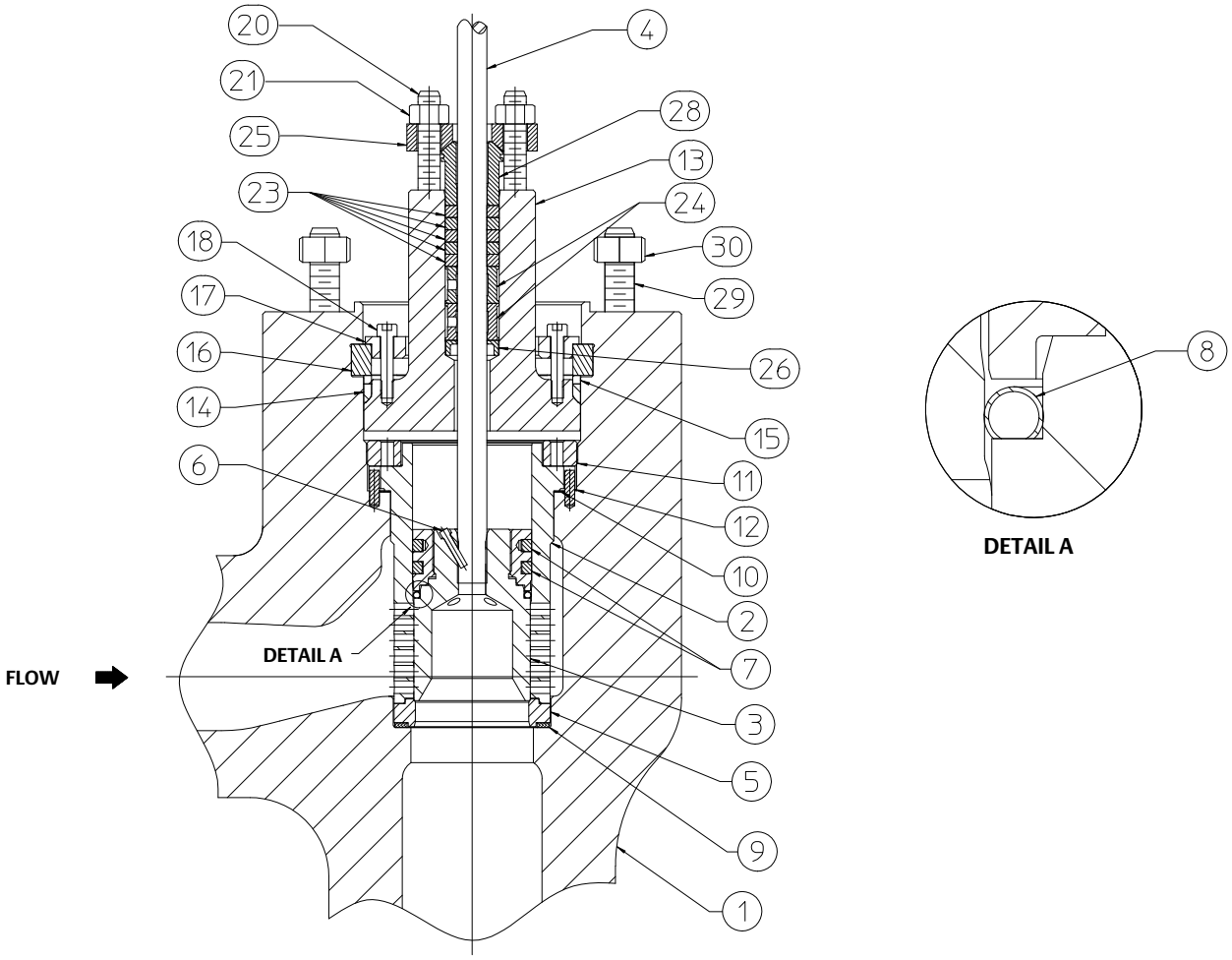
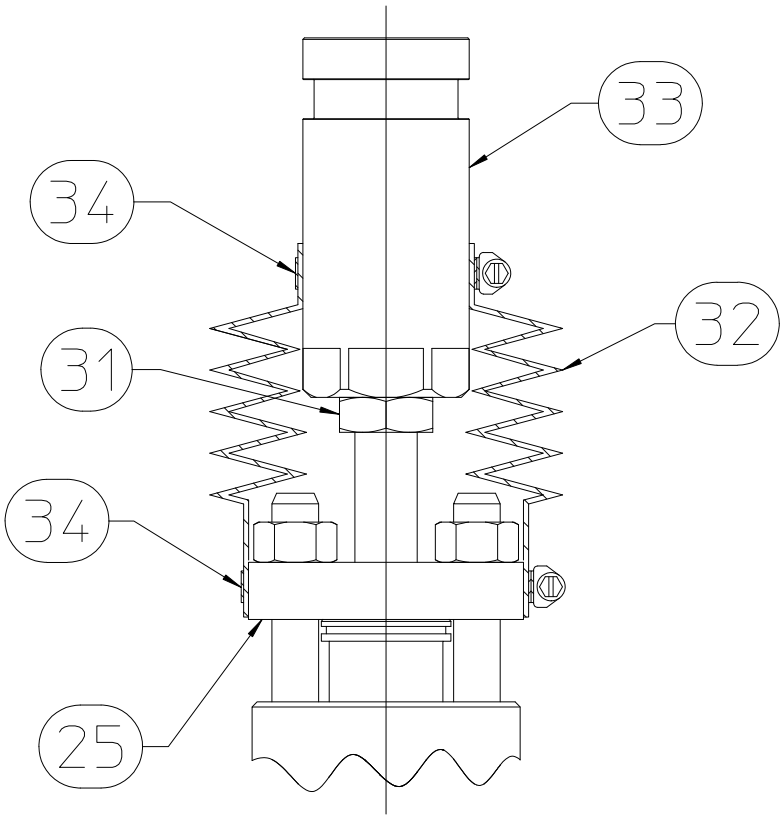


Figure 9. HPA Valve Dust Boot Assembly



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