

Fisher® HP and HPA Control Valves

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Figure 1. HP Valve with 667 Actuator
and FIELDVUE™ DVC6200 Digital Valve Controller



X0183-1

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 1 through 6 HP valves with CL900 and CL1500 ratings; NPS 1 through 2 HP with CL2500 ratings; NPS 1 through 8 HPA valves with CL900 and CL1500 ratings; and NPS 1 through 2 HPA valves with CL2500 ratings. Refer to separate manuals for instructions covering the actuator, positioner, and accessories.

Do not install, operate, or maintain HP 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 Process Management sales office before proceeding.

Unless otherwise noted, all NACE references are to NACE MR0175-2002 and MR0103.



Table 1. Specifications

End Connection Styles and Ratings^(1,2,3,4)

Flanged: Consistent with CL900, CL1500, and CL2500 per ASME B16.34

Socket Welding: Consistent with CL900, CL1500, and CL2500 per ASME B16.34

Buttwelding: Consistent with CL900, CL1500, and CL2500 per ASME B16.34

Also see table 2

Shutoff Classifications

See table 3

C-seal trim: High-temperature, Class V.
See table 4

TSO (Tight Shutoff) trim: See tables 5 and 6

Flow Characteristic

Standard Cage: ■ Equal percentage, ■ Modified equal percentage, or ■ Linear

Standard Cage with Micro-Form Valve Plug: (HPS and HPAS only): ■ Equal percentage or ■ Modified equal percentage

Standard Cage with Micro-Flute Valve Plug: (HPS and HPAS only): ■ Equal percentage or ■ Modified equal percentage

Standard Cage with Micro-Flat Valve Plug: (HPAS only): ■ Linear

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

Special cages: Special characterized flow cages are available. Consult your local Emerson Process Management sales office.

Flow Direction**Standard Cage**

■ *HPD and HPAD:* Normally flow down

■ *HPS and HPAS:* Normally flow up⁽⁵⁾

■ *HPAS Micro-Flat:* Flow down

■ *HPT and HPAT:* Normally flow down

■ *HPS and HPAS Micro-Form:* Flow up only

Cavitrol III Cage: Flow down

Whisper Trim III or WhisperFlo Cage: Flow up

Approximate Weights (valve body and bonnet assemblies)

See table 2

Additional Specifications

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

1. EN (or other) ratings and end connections can usually be supplied; consult your Emerson Process Management sales office.

2. CL900 and CL1500 globe valves are identical for NPS 1 and 2 valves. CL900 and CL1500 globe valves for NPS 3, 4, and 6 valves, however, are not identical.

3. The centerline-to-face dimension for CL2500 NPS 1 and 2 HPA valves does not conform to ANSI/ISA 575.12.

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

5. HPS and HPAS valves may be used flow down for on-off service only or where further limited by trim design. HPAS valves may be used flow down for erosive service.

Description

HP Series high-pressure globe and angle valves (figure 1) have metal seats, cage guiding, quick change trim, and push-down-to-close valve plug action. HPD, HPAD, HPT, and HPAT valves use balanced valve plugs. HPS and HPAS valves use an unbalanced valve plug. To provide a seal between the cage and a balanced valve plug, the HPD and HPAD valve plugs use piston rings; the HPT and HPAT valve plugs use a pressure-assisted seal ring. A Whisper Trim or WhisperFlo cage can be used with an HPD, HPAD, HPS, HPAS, HPT, or HPAT valve plug. A Cavitrol III cage can be used with an HPS, HPAS, HPT, or HPAT valve plug.

C-seal trim is available for HPD valves, CL900 and CL1500, in sizes NPS 3, 4, and 6; and for HPAD valves, CL900 and CL1500 in sizes NPS 4, 6, and 8.

With C-seal trim, a balanced valve can achieve high-temperature, Class V shutoff. Because the C-seal plug seal is formed from metal (N07718 nickel alloy) rather than an elastomer, a valve equipped with the C-seal trim can be applied in processes with a fluid temperature of up to 593°C (1100°F), provided other material limits are not exceeded.

Specifications

Specifications for the HP Series valves are shown in table 1.

Table 2. Approximate Weights (Valve and Bonnet Assemblies)

VALVE SIZE, NPS	PRESSURE RATING	KILOGRAMS		POUNDS	
		Flg	SWE & BWE	Flg	SWE & BWE
Globe Valves					
1	CL900 & CL1500	42	38	93	85
	CL2500	45	34	100	76
1-1/2 x 1	CL2500	---	34	---	76
2	CL900 & CL1500	72	52	158	115
	CL2500	104	74	229	164
3	CL900	125	---	276	---
	CL1500	129	97	284	213
4	CL900	230	---	507	---
	CL1500	249	201	548	444
6	CL900	511	---	1127	---
	CL1500	557	455	1228	1003
Angle Valves					
1	CL900 & CL1500	40	36	88	80
	CL2500	---	72 ⁽¹⁾	---	160 ⁽¹⁾
2	CL900 & CL1500	69	50	153	110
	CL2500	---	109 ⁽¹⁾	---	240 ⁽¹⁾
3	CL1500	123	78	278	173
4	CL1500	181	117	399	258
6	CL1500	357	202	788	445
8	CL1500	648	405	1428	893
1. Only SWE is available for CL2500.					

1. Only SWE is available for CL2500.

Educational Services

For information on available courses for Fisher HP and HPA valves, as well as a variety of other products, contact:

Emerson Process Management
 Educational Services - Registration
 Phone: 1-641-754-3771 or 1-800-338-8158
 E-mail: education@emerson.com
<http://www.emersonprocess.com/education>

Installation

⚠ WARNING

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

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or

damage, provide a relief valve for over-pressure protection as required by government or accepted industry codes and good engineering practices.

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

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

⚠ WARNING

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

⚠ WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions indicated when the valve was ordered. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson Process Management 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 Whisper Trim III, WhisperFlo, or Cavitrol III cages, consideration should be given to installing an upstream strainer to prevent the lodging of particles in these passages. This is especially important if the pipeline cannot be thoroughly cleaned or if the flowing medium is not clean.

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

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

VALVE DESIGN	PORT DIAMETER, mm (INCHES)	LEAKAGE CLASS
HPD, HPAD	47.6 (1.875) and smaller	II
	58.7 (2.3125) to 92.1 (3.625)	II - Standard
		III - Optional
	111.1 (4.375) and larger	III - Standard IV - Optional
HPS, HPAS w/ Cavitrol III, or HPT, HPAT w/ Cavitrol III, or HPAS w/Micro-Flat	All	V
HPS, HPAS, HPT, HPAT, HPS, HPAS w/ Micro-Form, or HPS, HPAS w/ Micro-Flute	All	IV-Standard
		V-Optional
HPT w/ PEEK anti-extrusion rings	47.6 (1.875) to 136.5 (5.375)	V - Standard

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

Valve Design	Valve Size, NPS		Port Diameter		Cage Style	Leakage Class
	HPD	HPAD	mm	Inches		
HPD, HPAD with optional C-seal trim	3	4	73.0	2.875	Equal Percentage, Modified Equal Percentage, Linear (std. cage), Linear (Whisper III, A1, B1)	V
	4	6	73.0	2.875	Linear (Whisper III, D3)	V
	4	6	92.1	3.625	Equal Percentage, Modified Equal Percentage, Linear (std. cage), Linear (Whisper III, A1, B3, C3)	V
	6	8	111.1	4.375	Linear (Whisper III, D3)	V
	6	8	136.5	5.375	Equal Percentage, Modified Equal Percentage, Linear (std. cage), Linear (Whisper III, A1, B3, C3)	V

Table 5. TSO (Tight Shutoff) Leakage Class per ANSI/FCI 70-2 and IEC 60534-4

Leakage Class	Maximum Leakage	Test Medium	Test Pressure	Leakage Class
TSO (Tight Shutoff)	Valves with TSO trim are factory tested to a more stringent Emerson Process Management test requirement of no leakage at time of shipment.	Water	Service $\Delta P^{(1)}$	V
1. Specify service ΔP when ordering.				

Table 6. TSO Shutoff Availability

VALVE DESIGN	CONSTRUCTION	LEAKAGE CLASS
HPS, HPT	Std or Cavitrol III trim. Replaceable, protected soft seat	TSO - Standard

Table 7. Recommended Torque for Packing Flange Nuts (Non Live-loaded Graphite Packing)

STEM DIAMETER		VALVE BODY RATING(1)	TORQUE			
			N•m		lbf•ft	
mm	Inches		Min	Max	Min	Max
12.7	1/2	CL900	12	18	9	13
12.7	1/2	CL1500	15	22	11	16
12.7	1/2	CL2500	18	24	13	18
19.1	3/4	CL900	27	41	20	30
19.1	3/4	CL1500	34	50	25	37
19.1	3/4	CL2500	41	61	30	45
25.4	1	CL900	42	62	31	46
25.4	1	CL1500	52	77	38	57
25.4	1	CL2500	61	91	45	67
31.8	1-1/4	CL900	56	83	41	61
31.8	1-1/4	CL1500	68	102	50	75
1. For intermediate class ratings, use the same torque as the next lower standard class.						

CAUTION

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

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

⚠ WARNING

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

Valves with ENVIRO-SEAL™ live-loaded packing or HIGH-SEAL Heavy-Duty live-loaded packing will not require this initial re-adjustment. See the instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves or HIGH-SEAL Live-Loaded Packing System (as appropriate) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit sub-section near the end of this manual.

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 HP series 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.

Table 8. Torque for Body-to-Bonnet Bolting Using Anti-Seize Lubricant⁽¹⁾

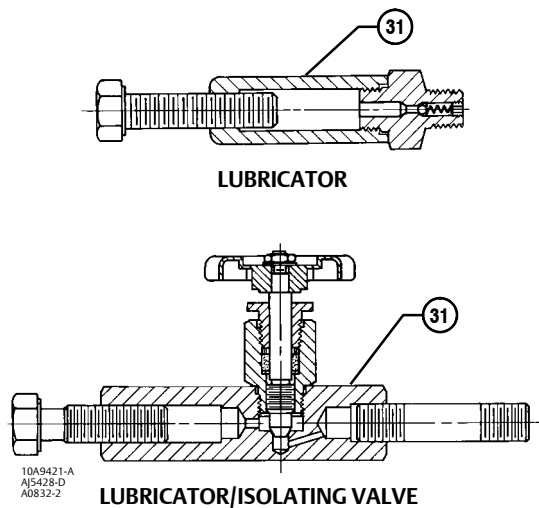
VALVE RATING	VALVE SIZE, NPS		TORQUE	
			N•m	lbf•ft
	HP	HPA	B7, B16, B8M CL2, BD, S20910, and 660 Studs	B7, B16, B8M CL2, BD, S20910, and 660 Studs
CL900 & CL1500	1	1	260	190
	2	2, 3	370	275
	3	4	710	525
	4	6	940	695
	6	8	1650	1220
CL2500	1	1	370	275
	2	2	710	525

1. For other materials, contact your Emerson Process Management sales office for torques.

CAUTION

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

Figure 2. Lubricator and Lubricator/Isolating Valve



Note

If the valve has ENVIRO-SEAL live-loaded packing installed (figure 4), see the instruction manual entitled “ENVIRO-SEAL Packing System for Sliding Stem Valves” for packing instructions.

If the valve has HIGH-SEAL Heavy-Duty live-loaded packing installed (figure 4), see the instruction manual entitled “HIGH-SEAL Live-Loaded Packing System” for packing instructions.

Packing Lubrication

CAUTION

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

Note

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

⚠ WARNING

Do not lubricate parts when used in oxygen service, or where the lubrication is incompatible with the process media. Any use of lubricant can lead to the sudden explosion of media due to the oil/oxygen mixture, causing personal injury or property damage.

If a lubricator or lubricator/isolating valve (figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the pipe plug (key 31, figure 16, 17, or 18). Use a good quality silicon-base lubricant. Packing used in oxygen service or in processes with temperatures over 260°C (500°F) should not be lubricated. To operate the lubricator, turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except the isolating valve must first be opened and then closed after lubrication is completed.

Packing Maintenance

If there is undesirable packing leakage in the spring-loaded PTFE V-ring packing shown in figure 3, tighten the packing flange nuts (key 21, figure 16, 17, or 18) until the shoulder on the packing follower (key 28, figure 16, 17, or 18) contacts the bonnet (key 18, figure 16, 17, or 18). If leakage continues, replace the packing by following the numbered steps presented in the replacing packing procedure.

If there is undesirable packing leakage with 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, figure 16, 17, or 18) to at least the minimum recommended torque in table 7. However, do not exceed the maximum recommended torque in table 7 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.

Adding Packing Rings

Key numbers referred to in this procedure are shown in figure 16, 17, or 18, 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. Remove the packing flange nuts (key 21) and lift the packing flange, upper wiper, and packing follower (keys 19, 27, and 28) away from the valve body.
3. 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.
4. Remove the stem connector and slip the packing rings over the end of the valve plug stem.
5. Reassemble the packing follower, upper wiper, packing flange, and packing flange nuts (keys 28, 27, 19, and 21).
6. Reconnect the body-actuator stem connection according to the appropriate actuator instruction manual.
7. 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 7).

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 figure 16, 17, or 18, 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 either the yoke locknut (key 32) or the hex nuts (key 30), and remove the actuator from the bonnet (key 18).
4. Loosen the packing flange nuts (key 21) so that the packing (keys 22, 23, 209, or 210, figure 3) is not tight on the valve plug stem (key 6). Remove any travel indicator disk and stem locknuts from the valve plug stem threads.

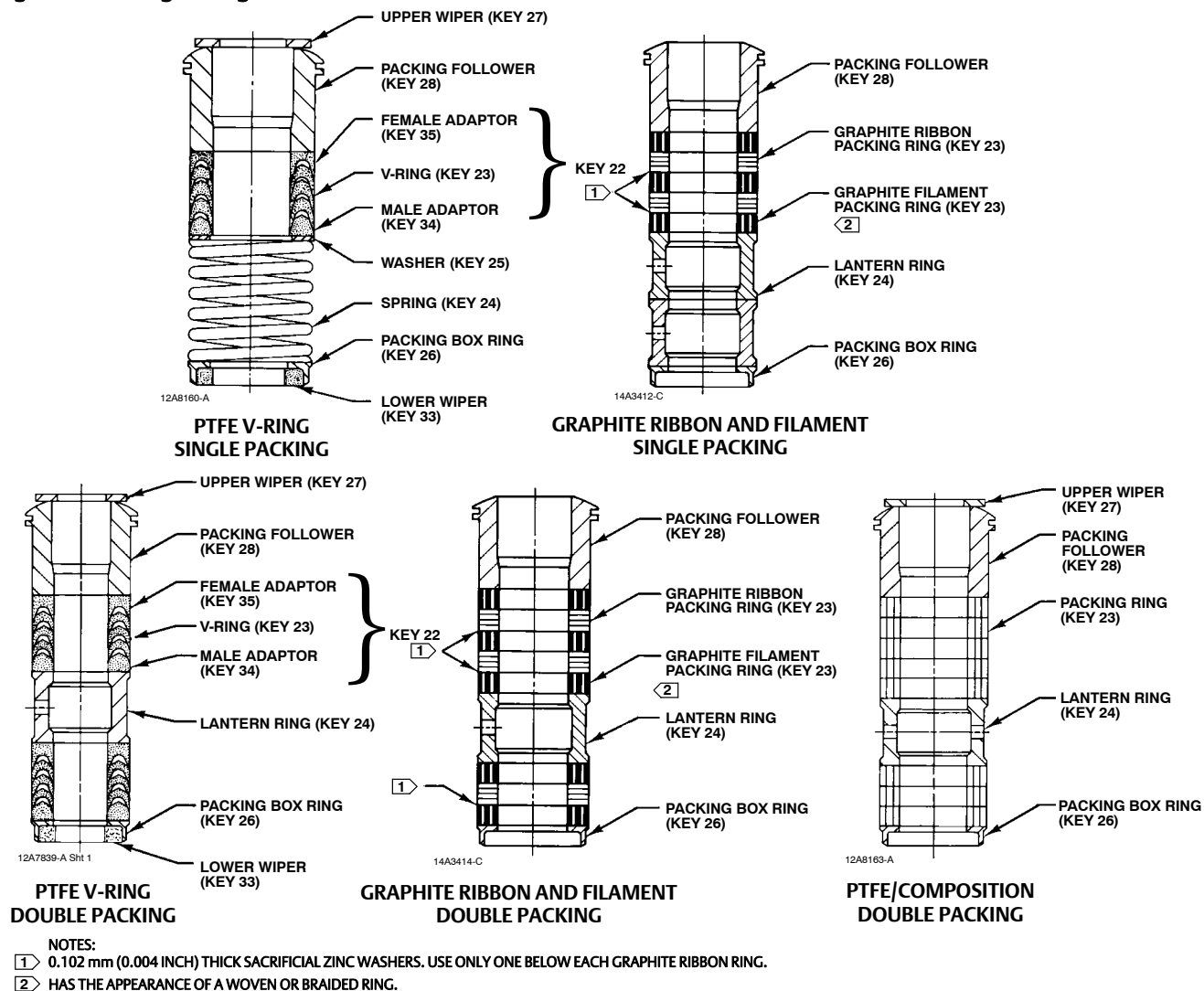
CAUTION

When lifting the bonnet (key 18), be sure that the valve plug and stem assembly (keys 5 and 6) remains on the seat ring (key 4). 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 HPD and HPAD piston rings (key 8) are brittle and in two pieces. Avoid damaging the piston rings by dropping or rough handling.

Figure 3. Packing Arrangements

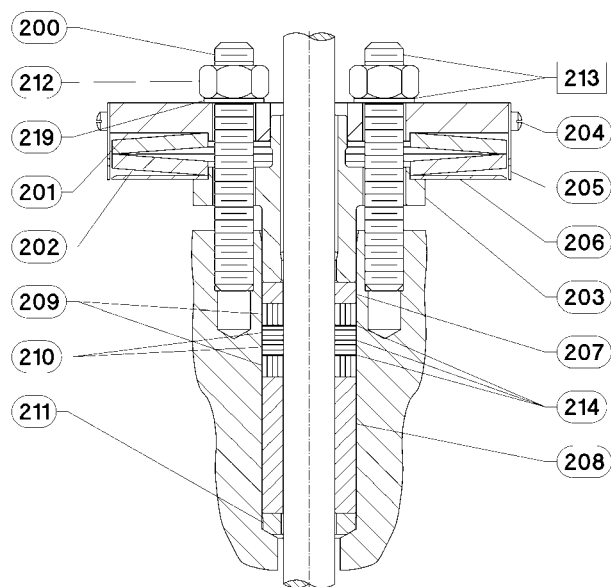


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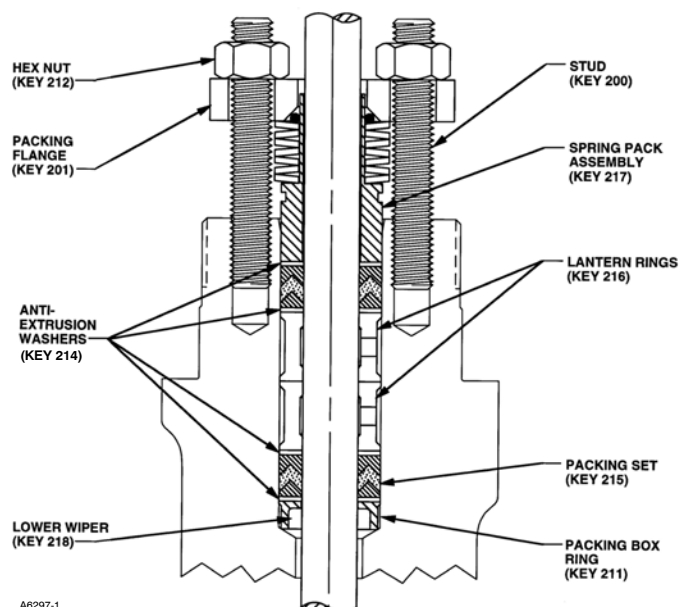
⚠ WARNING

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.

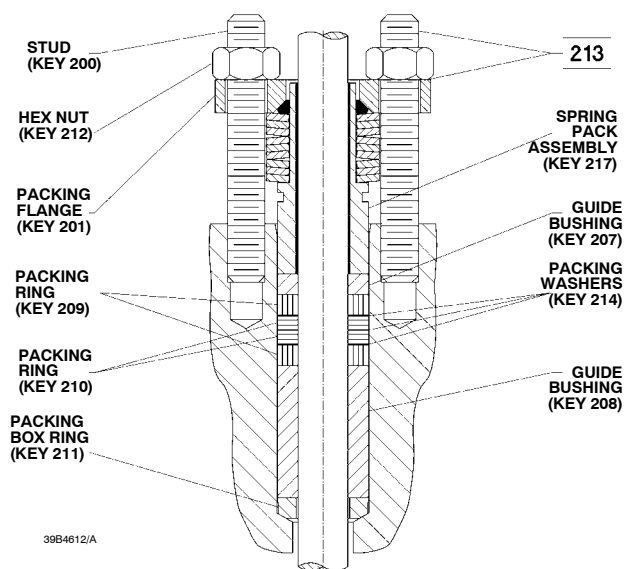
Figure 4. Live-Loaded Packing



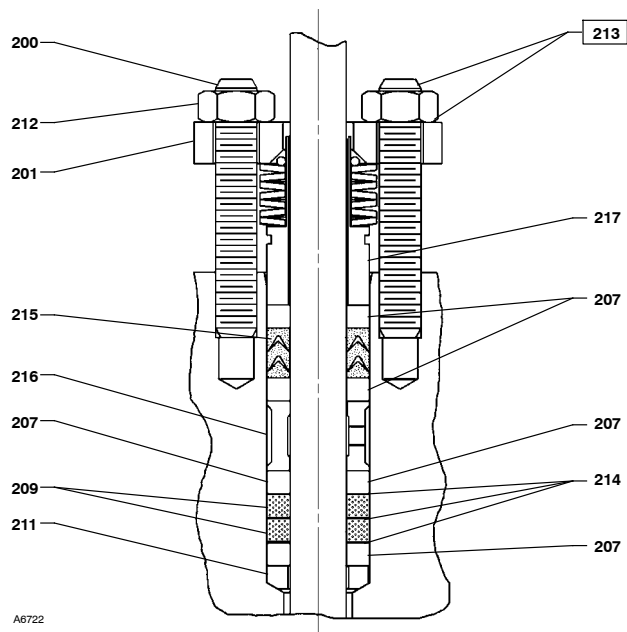
Typical HIGH-SEAL Graphite ULF Packing System



Typical ENVIRO-SEAL Packing System with PTFE Packing



Typical ENVIRO-SEAL Packing System with Graphite ULF Packing



Typical ENVIRO-SEAL Packing System with Duplex Packing

Note

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

5. Hex nuts (key 14) attach the bonnet to the valve body. Loosen these nuts or cap screws 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 the next step.
6. Unscrew the hex nuts (key 14) and carefully lift the bonnet off the valve stem. If the valve plug and stem assembly starts to lift with the bonnet, use a brass or lead 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.
7. Remove the valve plug (key 5), bonnet gasket (key 11), cage (key 2), seat ring (key 4), and the seat ring gasket (key 12).

CAUTION

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

8. Clean all gasket surfaces with a good wire brush. Clean in the same direction as the surface serrations, not across them.
9. Cover the opening in the valve body to protect the gasket surface and to prevent foreign material from getting into the valve body cavity.
10. Remove the packing flange nuts (key 21), packing flange (key 19), upper wiper (key 27), and packing follower (key 28). 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. For extension bonnets, also remove the baffle (key 36) and retaining ring (key 37).
11. Clean the packing box and the following metal packing parts: packing follower, packing box ring (key 26), spring or lantern ring (key 24), and, for single arrangements of PTFE V-ring packing only, special washer (key 25).
12. 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.
13. Remove the protective covering from the valve body cavity, and install the seat ring and cage using a new seat ring gasket (key 12) and bonnet gasket (key 11). Install the plug, then slide the bonnet over the stem and onto the studs (key 13). For a valve body with extension bonnet, also install the baffle and retaining rings (keys 36 and 37).

Note

The prelubricated hex nuts (key 14) referred to in step 14 can be identified by a black film coating on the nut threads.

The proper bolting procedures in step 14 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.

Table 9. 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
HP	HPA	mm	Inches		N•m	Lbf•ft	Inches
1	1	12.7	1/2	HPS, HPAS	81 - 115	60 - 85	1/8
		19.1	3/4	HPS, HPAS	237 - 339	175 - 250	3/16
2	2, 3	12.7	1/2	HPD, HPAD, HPS, HPAS ⁽¹⁾ , HPT, HPAT	81 - 115	60 - 85	1/8
		19.1	3/4	HPS, HPAS ⁽¹⁾	237 - 339	175 - 250	3/16
				HPD, HPAD, HPT, HPAT	237 - 339	175 - 250	1/8
		25.4	1	HPS, HPAS ⁽¹⁾	420 - 481	310 - 355	1/4
3	4	12.7	1/2	HPD, HPS, HPT, HPAD, HPAT	81 - 115	60 - 85	1/8
		19.1	3/4	HPD, HPS, HPT, HPAD, HPAT	237 - 339	175 - 250	3/16
		25.4	1	HPD, HPS, HPT, HPAD, HPAT	420 - 481	310 - 355	1/4
4	6	19.1	3/4	HPD, HPT, HPAD, HPAT	237 - 339	175 - 250	3/16
		25.4	1	HPD, HPT, HPAD, HPAT	420 - 481	310 - 355	1/4
6	8	19.1	3/4	HPD, HPT, HPAD, HPAT	237 - 339	175 - 250	3/16
		25.4	1	HPD, HPT, HPAD, HPAT	420 - 481	310 - 355	1/4
		31.8	1-1/4	HPD, HPT, HPAD, HPAT	827 - 908	610 - 670	1/4

1. HPAS available in NPS2 only.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 8 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended.

Note

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

⚠ WARNING

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

- Lubricate the stud threads and the faces of the hex nuts (key 14) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). 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 to no more than 1/4 of the nominal torque value specified in table 8.

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.

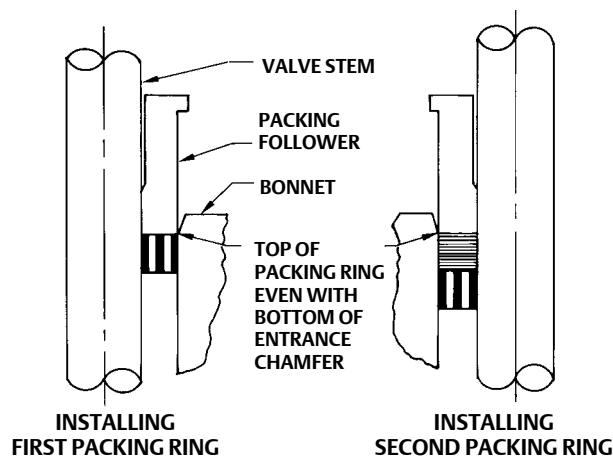
Note

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 5).

15. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 3. If desired, packing parts may be pre-lubricated with a silicon base grease for easier installation. 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.
16. Slide the packing follower, wiper, and packing flange into position. Lubricate the packing flange studs (key 20) and the faces of the packing flange nuts (key 21). Replace the packing flange nuts.

For the **spring-loaded PTFE V-ring packing** shown in figure 3, tighten the packing flange nuts until the shoulder on the packing follower (key 28) contacts the bonnet.

Figure 5. Installing Graphite Ribbon/Filament Packing Rings One at a Time



A2207-2

For **graphite packing**, tighten the packing flange nuts to the maximum recommended torque shown in table 7. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 7.

For **other packing types**, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 7. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

For **ENVIRO-SEAL or HIGH-SEAL live-loaded packing**, refer to the note at the beginning of the Maintenance section.

17. 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.

Trim Removal

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

Key numbers referenced in this procedure are shown in figure 16, 17, or 18, except where indicated.

1. Remove the actuator and bonnet by following steps 1 through 6 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. Lift out the cage (key 2) and the bonnet gasket (key 11). For an NPS 2 valve body with a Cavitrol III two stage cage, also remove the bonnet spacer and two gaskets.

Constructions other than TSO trim

1. Remove the seat ring (key 4) and the seat ring gasket (key 12).
2. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

TSO Trim

TSO trim: 0.8125 Inch Port Diameter (figure 7)

1. Remove the pin that locks the inner plug to the stem.
2. Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
3. Remove the protected soft seat seal.
4. Inspect the parts for damage and replace if needed.
5. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

TSO trim: 1.6875 Inch Port Diameter (figure 8)

1. Remove the retainer, backup ring, anti-extrusion rings, and piston ring.
2. Remove the set screws that lock the outer plug to the stem.
3. Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
4. Remove the protected soft seat seal.
5. Inspect the parts for damage and replace if needed.
6. Refer to the Valve Plug Maintenance procedure or to the Lapping Seats procedure.

TSO trim: 2.6875 Inch and Larger Port Diameters (figure 9)

1. Remove the retainer, backup ring, anti-extrusion rings, and piston ring.
2. Remove the set screws that lock the outer plug to the inner plug.
3. Using a strap wrench or similar tool, unscrew the outer plug from the inner plug. Do not damage the outer plug guide surfaces.
4. Remove the protected soft seat seal.
5. Inspect the parts for damage and replace if needed.
6. 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 16, 17, or 18, except where indicated.

1. With the valve plug (key 5) removed according to the trim removal procedure, proceed as appropriate:

For HPD and HPAD valves, the piston rings (key 8) are each in at least two sections; remove the sections from the grooves in the valve plug.

For HPS and HPAS valves, proceed to step 2.

For HPT and HPAT valves, work the retaining ring (key 10) off the valve plug with a screwdriver. Carefully slide the backup ring and seal ring (keys 9 and 8) off the valve plug.

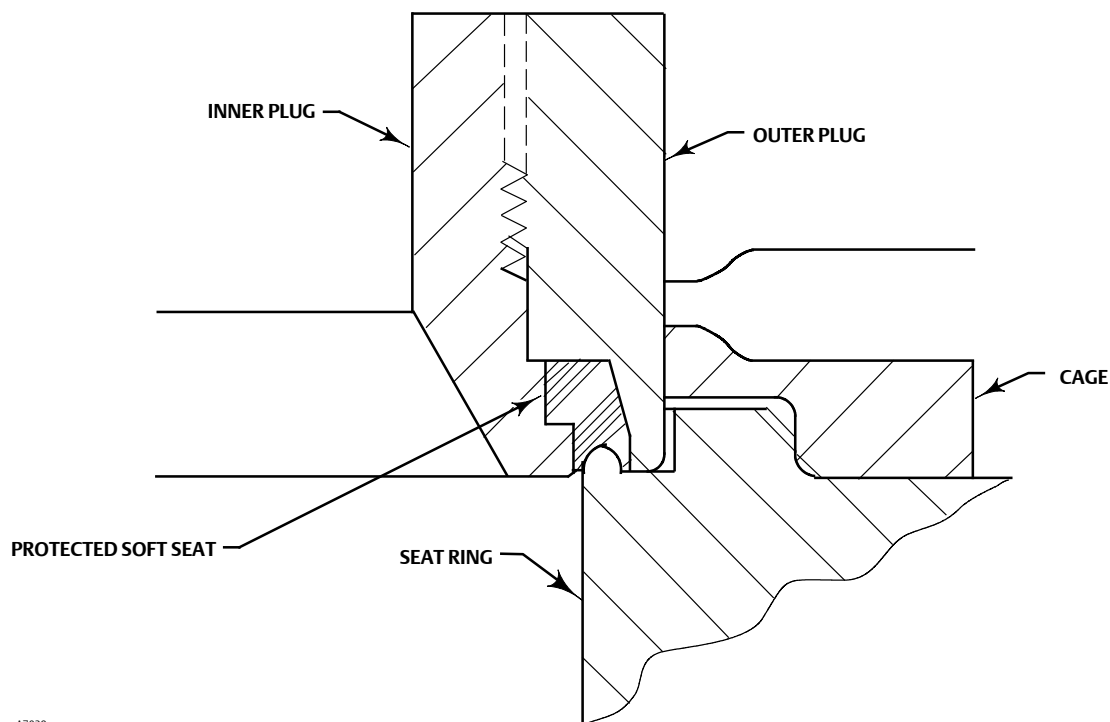
2. To replace the valve plug stem (key 6), drive out the pin (key 7), and unscrew the stem from the valve plug.

CAUTION

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.

Figure 6. Detail of Protected Soft Seat



A7039

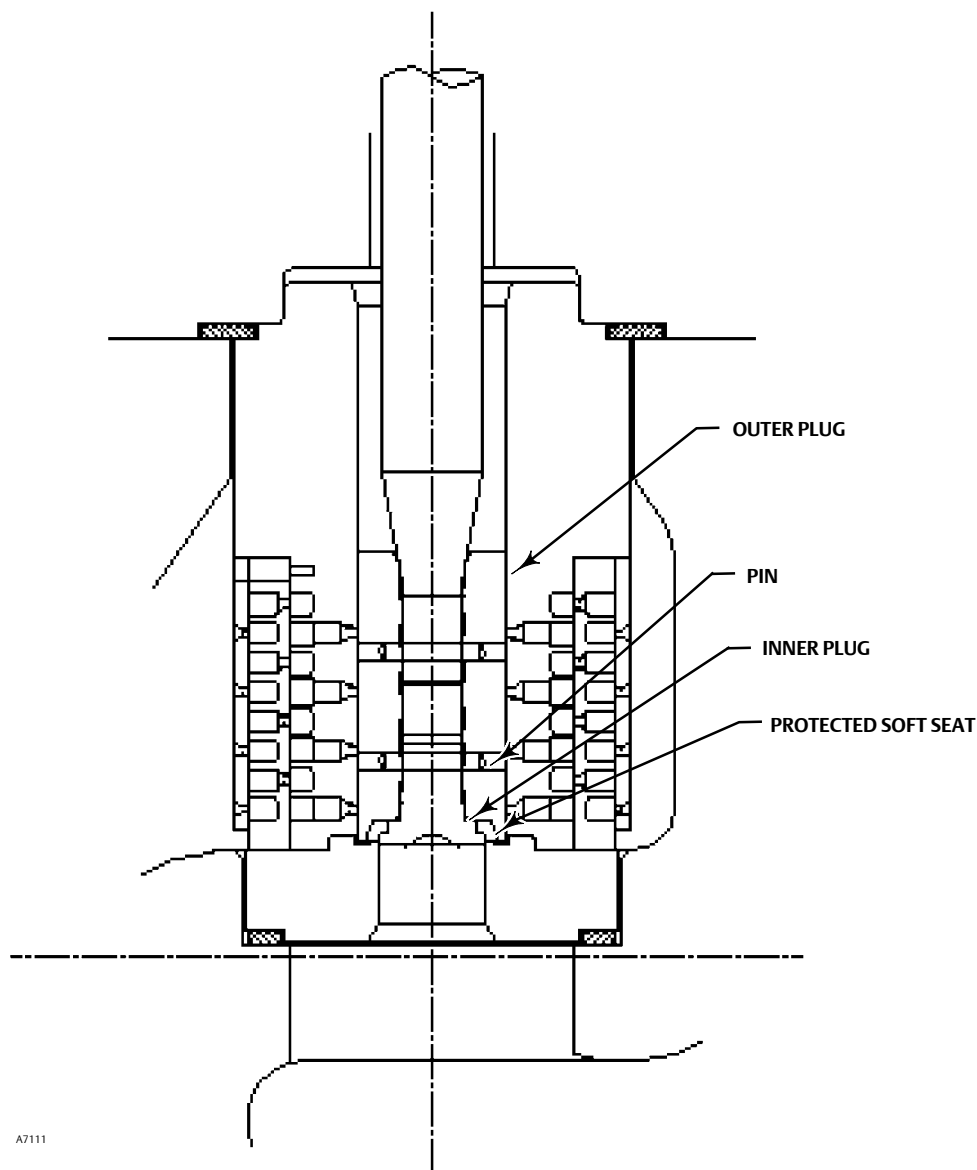
3. Thread the new stem into the valve plug and tighten it to the appropriate torque value given in table 9. Using the valve plug pin hole as a guide, drill the pin hole through the stem. Refer to table 9 for drill sizes.
4. Drive in the pin to lock the assembly.
5. If it is necessary to lap the seating surfaces, complete the lapping seats procedure before installing the HPD/HPAD piston rings or the HPT/HPAT seal ring. The Trim Replacement procedure provides piston ring and seal ring installation instructions and valve reassembly instructions.

Lapping Seats

Key numbers referenced in this procedure are shown in figure 16, 17, or 18, 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.

Figure 7. Typical Unbalanced TSO Trim Assembly, Small Port Designs (0.8125 Inch Port Diameter)



A7111

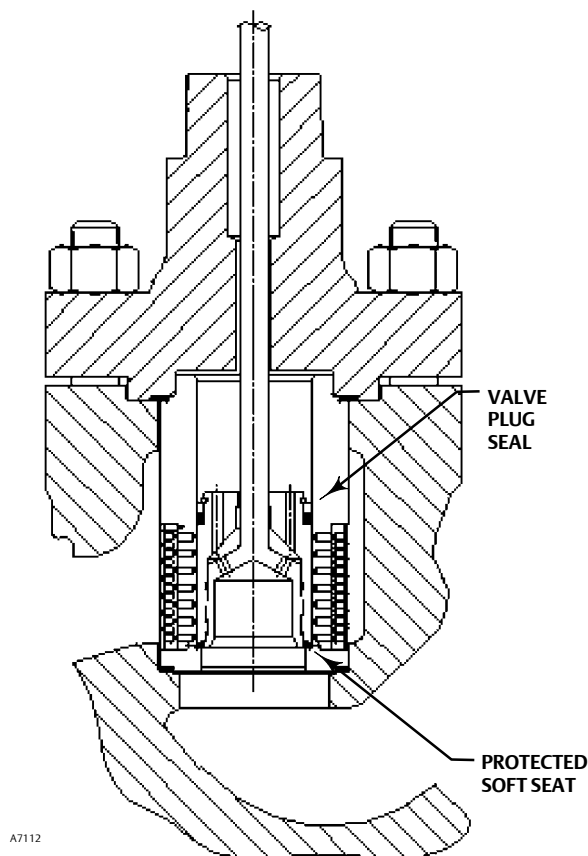
Note

HP Series valves use spiral-wound gaskets. These gaskets provide their seal by being crushed and therefore should never be reused. This includes reusing a gasket after the lapping procedure has been performed.

And "old" gasket can be used to lap the seat, however the gasket must be replaced with a new gasket.

To preserve the effects of lapping, do not change either 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. When the parts are removed for cleaning and replacement of the "old" gaskets, return them to the original positions.

Figure 8. Typical Balanced TSO Trim (1.6875 Inch Port Diameter)



Use the following procedure to lap the seating surfaces.

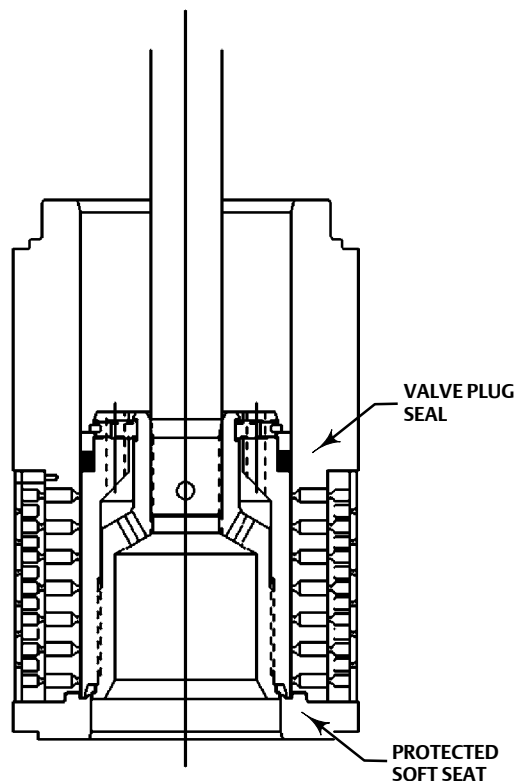
1. Install the following parts according to the instructions presented in the trim replacement procedure: "old" seat ring gasket (key 12), seat ring (key 4), cage (key 2), and "old" bonnet gasket (key 11).
2. Proceed as appropriate:

For an HPD, HPAD, HPT, or HPAT valve, install the valve plug and stem assembly (keys 5 and 6)--without piston rings or seal ring (key 8) --into the cage.

For an HPS or HPAS valve, install the valve plug and stem assembly (keys 5 and 6) into the cage.

3. Install the bonnet (key 18) over the valve stem, and secure the bonnet with four of the hex nuts (key 14).

Figure 9. Typical Balanced TSO Trim, Large Port Designs (2.6875 Inch and Larger Port Diameters)



A7096

Table 10. Actuator Groups by Type Number

Group 1 71 & 90 mm (2-13/16 & 3-9/16 Inch) Yoke Boss	Group 100 127 mm (5-Inch) Yoke Boss
472 & 473	472
585C	473
1B	474
644 & 645	476
655	585C
657 & 667	657
685SE & 685SR	
1008	
	Group 101 127 mm (5-Inch) Yoke Boss
	667

4. 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.
5. 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 16, 17, or 18, except where indicated.

CAUTION

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

1. Install the seat ring gasket (key 12) into the valve body. Install the seat ring (key 4).
2. Install the cage.

Constructions other than TSO trim

1. To install the piston rings and seal rings (key 8), proceed as appropriate:

For an HPD or HPAD valve, 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.

For an HPT or HPAT valve, install the seal ring (key 8) onto the valve plug (key 5). Install the ring with the open side facing the seat ring end of the valve plug for flow-down applications (view A of figure 19) or with the open side facing the valve plug stem end of the valve plug for flow-up applications (view B of figure 19). Slide the backup ring (key 9) onto the valve plug. Secure with the retaining ring (key 10).

2. Install the valve plug into the cage.

TSO Trim

TSO trim: 0.8125 Inch Port Diameter (figure 7)

1. Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
2. Mark the inner plug and outer plug with alignment marks in the assembled position.

3. Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
4. Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is compressed properly. Do not damage the outer plug guide surfaces.
5. Drill through the inner plug with the proper size drill bit (same size as stem pinning) and install the pin.

TSO trim: 1.6875 Inch Port Diameter (figure 8)

1. Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
2. Mark the top of the outer plug and stem with alignment marks in the assembled position.
3. Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
4. Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is compressed properly. Do not damage the outer plug guide surfaces.
5. Install set screws centering the stem in the outer plug and torque to 11 N•m (8 lbf•ft).
6. Assemble the piston ring, anti-extrusion rings, backup ring, and retainer.

TSO trim: 2.6875 Inch and Larger Port Diameters (figure 9)

1. Thread the outer plug onto the inner plug until the parts seat metal to metal, using a strap wrench or similar tool that will not damage the outer plug guide surfaces.
2. Mark the top of the inner plug and outer plug with alignment marks in the assembled position.
3. Disassemble the outer plug from the inner plug and install the seal over the inner plug, so that the seal rests below the threaded area.
4. Thread the outer plug onto the inner plug and tighten with a strap wrench or similar tool until the alignment marks line up. This will ensure that the plug parts are metal to metal and the seal is compressed properly. Do not damage the outer plug guide surfaces.
5. Install set screws centering the inner plug in the outer plug and torque to 11 N•m (8 lbf•ft).
6. Assemble the piston ring, anti-extrusion rings, backup ring, and retainer.

All Constructions

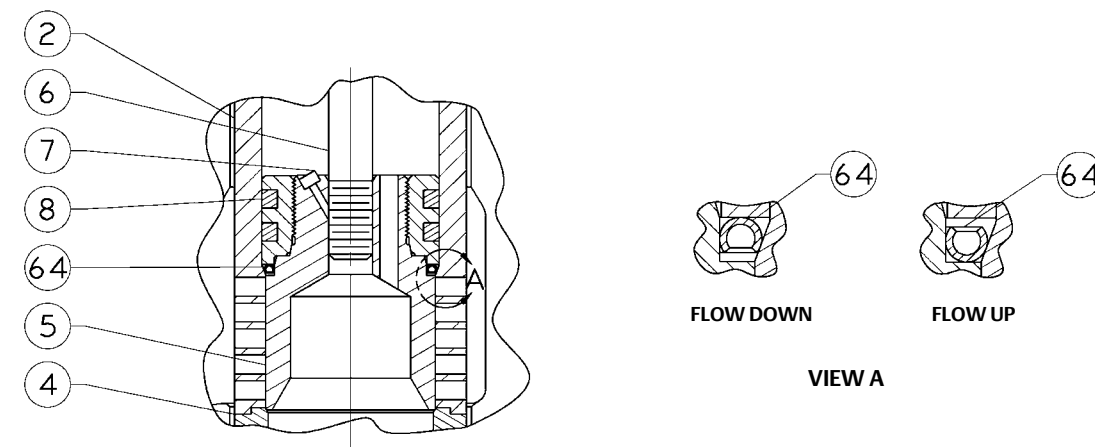
1. Install the bonnet gasket (key 11) on the cage.
2. Install the bonnet over the valve stem and onto the valve body.

Note

The prelubricated hex nuts (key 14) referred to in step 3 can be identified by a black film coating on the nut threads.

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

Figure 10. HPD with C-seal Trim

**CAUTION**

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 8 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended.

Note

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

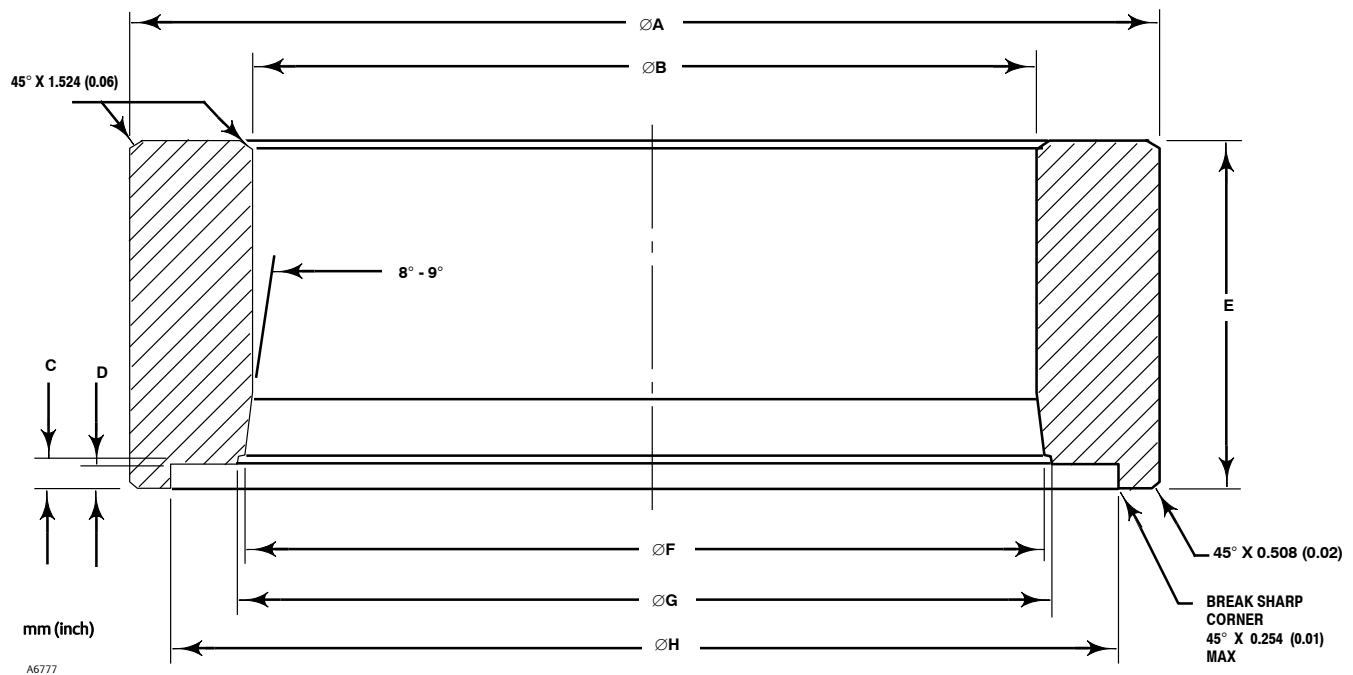
⚠ WARNING

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

3. Lubricate the stud threads and the faces of the hex nuts (key 14) with anti-seize lubricant (not necessary if new factory prelubricated hex nuts are used). Replace the hex nuts, but do not tighten them. Torque the nuts in a crisscross pattern to no more than 1/4 of the nominal torque value specified in table 8. 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.
4. Install new packing and packing box parts per steps 15 and 16 of the Replacing Packing procedure. Be certain to observe the note given prior to step 15 of that procedure.
5. 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 7).

FOR VALVE PLUGS FITTING PORT SIZE (Inches)	DIMENSIONS, mm (See Drawing Below)								Part Number (To Order A Tool)
	A	B	C	D	E	F	G	H	
2.875	82.55	52.324 - 52.578	4.978 - 5.029	3.708 - 3.759	41.148	52.680 - 52.781	55.118 - 55.626	70.891 - 71.044	24B9816X012
3.4375	101.6	58.674 - 58.928	4.978 - 5.029	3.708 - 3.759	50.8	61.011 - 61.112	63.449 - 63.957	85.166 - 85.319	24B5612X012
3.625	104.394	65.024 - 65.278	4.978 - 5.029	3.708 - 3.759	50.8	68.936 - 69.037	71.374 - 71.882	89.941 - 90.094	24B3630X012
4.375	125.984	83.439 - 83.693	4.978 - 5.029	3.708 - 3.759	50.8	87.351 - 87.452	89.789 - 90.297	108.991 - 109.144	24B3635X012
5.375	142.748	100.076 - 100.33	4.978 - 5.029	3.708 - 3.759	45.974	103.835 - 103.937	106.274 - 106.782	128.219 - 128.372	23B9193X012
FOR VALVE PLUGS FITTING PORT SIZE (Inches)	Dimensions, Inches (See Drawing Below)								Part Number (To Order A Tool)
	A	B	C	D	E	F	G	H	
2.875	3.25	2.060 - 2.070	0.196 - 0.198	0.146 - 0.148	1.62	2.074 - 2.078	2.170 - 2.190	2.791 - 2.797	24B9816X012
3.4375	4.00	2.310 - 2.320	0.196 - 0.198	0.146 - 0.148	2.00	2.402 - 2.406	2.498 - 2.518	3.353 - 3.359	24B5612X012
3.625	4.11	2.560 - 2.570	0.196 - 0.198	0.146 - 0.148	2.00	2.714 - 2.718	2.810 - 2.830	3.541 - 3.547	24B3630X012
4.375	4.96	3.285 - 3.295	0.196 - 0.198	0.146 - 0.148	2.00	3.439 - 3.443	3.535 - 3.555	4.291 - 4.297	24B3635X012
5.375	5.62	3.940 - 3.950	0.196 - 0.198	0.146 - 0.148	1.81	4.088 - 4.092	4.184 - 4.204	5.048 - 5.054	23B9193X012

Figure 11. C-seal Plug Seal Installation Tool



Retrofit: Installing C-seal Trim

Note

Additional actuator thrust is required for a valve with C-seal trim. When installing C-seal trim in an existing valve, contact your Emerson Process Management sales office for assistance in determining new actuator thrust requirements.

Assemble the new valve plug/retainer assembly (with C-seal plug seal) using the following instructions:

CAUTION

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

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 (figure 10).
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 up in a valve with flow-up construction (figure 10).
 - The open interior of the C-seal plug seal must face down in a valve with flow-down construction (figure 10).

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 11.

3. Place the C-seal plug seal over the top of the valve plug and press the C-seal plug seal onto the plug using the C-seal 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 12).
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 13) to secure the C-seal retainer.
6. Install the new plug/retainer assembly with C-seal plug seal on the new stem following the appropriate instructions in the Trim Replacement section in this manual.
7. Install piston rings by following instructions in the Trim Replacement section in this manual.
8. Remove the existing valve actuator and bonnet following the appropriate instructions in the Replacing Packing section in this manual.

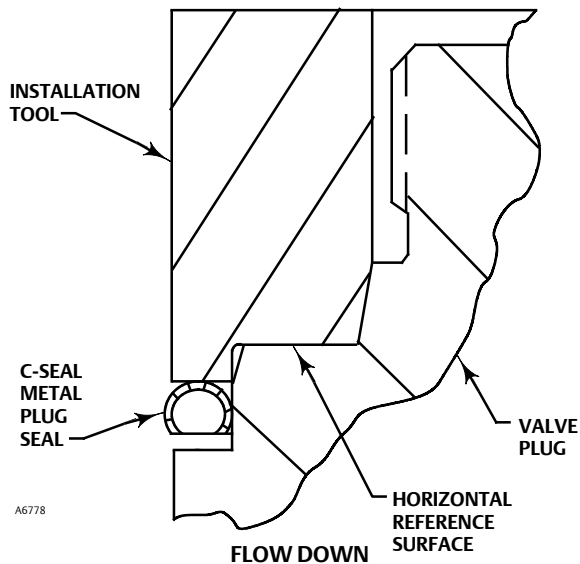
CAUTION

Do not remove the existing valve stem from the valve plug 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.

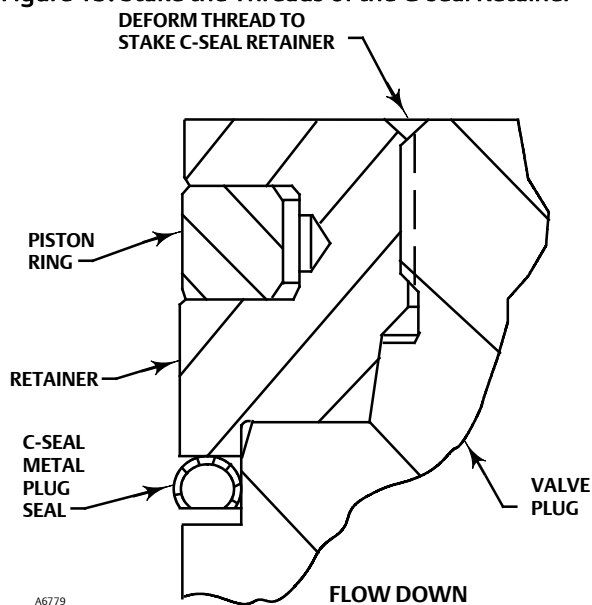
9. Remove the existing valve stem and plug, cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section in this manual.
10. Replace all gaskets according to appropriate instructions in the Trim Replacement section in this manual.
11. Install the new seat ring, cage, valve plug/retainer assembly, and stem into the valve body and completely reassemble the valve package following the appropriate instructions in the Trim Replacement section in this manual.

Figure 12. 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 13. Stake the Threads of the C-seal Retainer



CAUTION

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.

Replacement of Installed C-seal Trim

Trim Removal (C-seal Constructions)

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

CAUTION

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

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

CAUTION

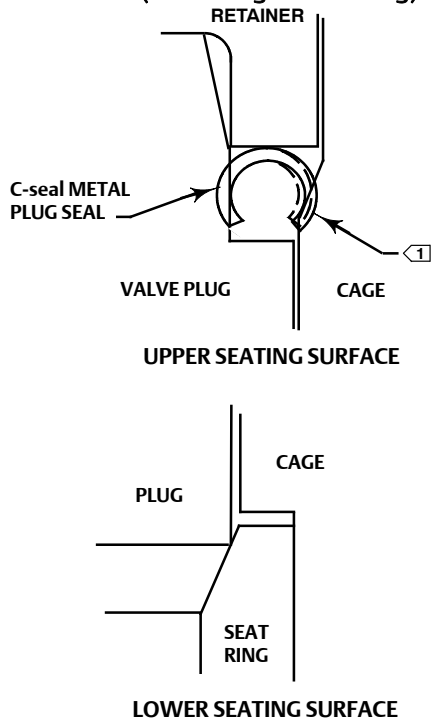
Do not remove the valve stem from the plug/retainer assembly unless you are planning to replace the valve stem.

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.

2. Remove the plug/retainer assembly (with C-seal plug seal), cage, and seat ring from the valve body following the appropriate instructions in the Trim Removal section in this manual.
3. Locate the staked thread on top of the valve plug (figure 13). 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 C-seal retainer.
5. 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.
6. 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.
7. 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 makes contact with the valve plug (figure 14).

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 C-seal plug seal contacts the cage, and inspect the sealing surface where the C-seal plug seal makes contact with the plug (figure 14).

Figure 14. Lower (Valve Plug to Seat Ring) and Upper (C-seal Plug Seal to Cage) Seating Surfaces



NOTE:

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

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9. Replace or repair trim parts according to the following procedure for Lapping Metal Seats, Remachining Metal Seats, or other valve plug maintenance procedures as appropriate.

Lapping Metal Seats (C-seal Constructions)

Before installing a new C-seal plug seal, lap the lower seating surface (valve plug to seat ring, figure 14) following appropriate procedures in the Lapping Seats section in this manual.

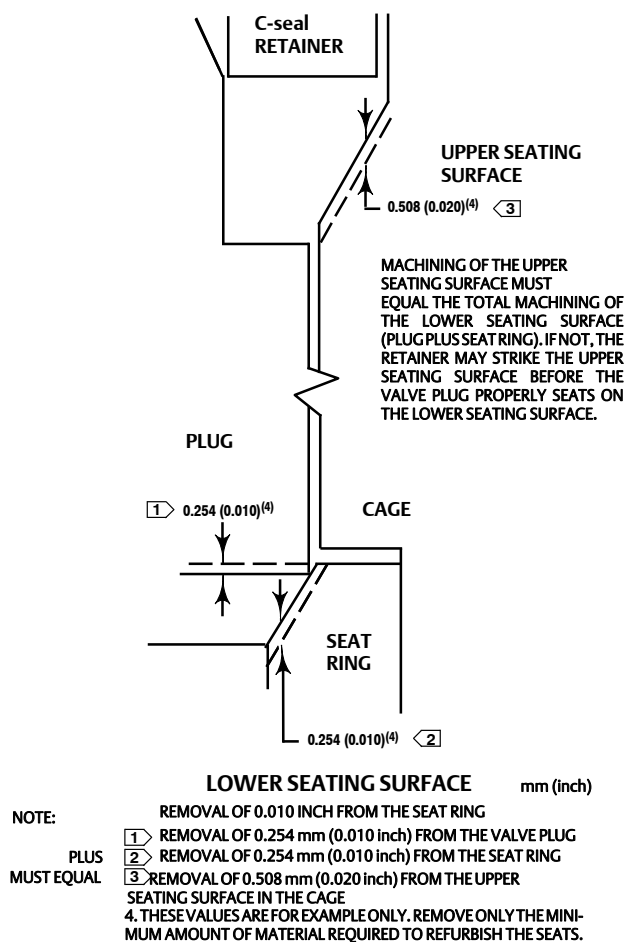
Remachining Metal Seats (C-seal Constructions)

See figure 15. A valve plug with a C-seal metal plug seal features two seating surfaces. One seating surface is found where the valve plug contacts the seat ring. The second seating surface is found where the C-seal plug seal contacts the upper seating surface in the cage. If you machine the seats on the seat ring and/or plug, you must machine an equal dimension from the seating area in the cage.

CAUTION

If metal is removed from the seat ring and plug and a corresponding amount is not removed from the cage seating area, the C-seal plug seal will be crushed as the valve closes and the C-seal retainer will strike the seating area of the cage, preventing the valve from closing.

Figure 15. Example of Machining the Lower (Valve Plug to Seat Ring) and Upper (C-seal Plug Seal to Cage) Seating Surfaces



A6781 /IL

Trim Replacement (C-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 (figure 10).
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 up in a valve with flow-up construction (figure 10).
 - The open interior of the C-seal plug seal must face down in a valve with flow-down construction (figure 10).

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 11.

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 12).
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 13) 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.

CAUTION

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 Process Management sales office for technical assistance or when ordering replacement parts.

When ordering replacement parts, also 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 Process Management 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)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
PTFE (Contains keys 22, 24, 25, 26, 27)	RPACKX00022	RPACKX00032	RPACKX00342	RPACKX00352
Double PTFE (Contains keys 22, 24, 26, 27)	RPACKX00052	RPACKX00062	RPACKX00362	RPACKX00372
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring], 24, and 26)	RPACKX00112	RPACKX00122	---	---
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring], and 26)	---	---	RPACKX00532	RPACKX00542
Single Graphite Ribbon/Filament (Contains keys 23 [ribbon ring], 23 [filament ring])	RPACKX00142	RPACKX00152	---	---

Repair Kits (ENVIRO-SEAL)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
Double PTFE (Contains keys 214, 215, 218)	RPACKX00202	RPACKX00212	RPACKX00222	RPACKX00232
Graphite ULF (Contains keys 207, 208, 209, 210, 214)	RPACKX00602	RPACKX00612	RPACKX00622	RPACKX00632
Duplex (Contains keys 207, 209, 214, 215)	RPACKX00302	RPACKX00312	RPACKX00322	RPACKX00332

Retrofit Kits (ENVIRO-SEAL)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)	31.8 (1-1/4) 127 (5, 5H)
Double PTFE (Contains keys 200, 201, 211, 212, 214, 215, 216, 217, 218, tag, cable tie)	RPACKXRT022	RPACKXRT032	RPACKXRT042	RPACKXRT052
Graphite ULF (Contains keys 200, 201, 207, 208, 209, 210, 211, 212, 214, 217, tag, cable tie)	RPACKXRT272	RPACKXRT282	RPACKXRT292	RPACKXRT302
Duplex (Contains keys 200, 201, 207, 209, 211, 212, 214, 215, 216, 217, tag, cable tie)	RPACKXRT222	RPACKXRT232	RPACKXRT242	RPACKXRT252

Parts List

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.

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson Process Management sales office.

Key	Description	Part Number
1	Valve Body If you need a valve body as a replacement part, order by valve size, serial number, and desired material.	---
2*	Cage/Baffle Assy	See following table
3	Bonnet Spacer	
4*	Seat Ring	See following table
5*	Valve Plug	See following table
6*	Valve Stem	See following table
7*	Pin	See following table
8*	Seal Ring/Piston Ring	See following table
9*	Back Up Ring	See following table
10*	Retaining Ring (for HPT/HPAT only) S30200 (302 SST)	
	For 38.1 mm (1.5 inch) port diameter	13A8519X012
	For 47.6 mm (1.875 inch) port diameter	10A4220X012
	For 63.5 mm (2.5 inch) port diameter	17A4311X012
	For 73.0 mm (2.875 inch) port diameter	10A4219X012
	For 87.3 mm (3.4375 inch) port diameter	10A5350X012
	For 98.4 mm (3.625 inch) port diameter	16A5484X012
	For 111.1 mm (4.375 inch) port diameter	10A4225X012
	For 115.8 mm (4.5625 inch) port diameter	17A4415X012
	For 133.4 mm (5.25 inch) port diameter	17A4398X012
	For 136.5 mm (5.375 inch) port diameter	10A5410X012
	N07750 for NACE	
	For 38.1 mm (1.5 inch) port diameter	13A8519X032
	For 47.6 mm (1.875 inch) port diameter	10A4220X082
	For 63.5 mm (2.5 inch) port diameter	17A4311X032
	For 73.0 mm (2.875 inch) port diameter	10A4219X082
	For 87.3 mm (3.4375 inch) port diameter	10A5350X082
	For 98.4 mm (3.625 inch) port diameter	16A5484X052
	For 111.1 mm (4.375 inch) port diameter	10A4225X062
	For 115.8 mm (4.5625 inch) port diameter	17A4415X032
	For 133.4 mm (5.25 inch) port diameter	17A4398X042
	For 136.5 mm (5.375 inch) port diameter	10A5410X052

Key	Description	Part Number
11*	Bonnet Gasket	See following table
12*	Seat Ring Gasket	See following table
13	Stud, Cont Thd	
14	Hex Nut	
15	Anti-Seize Lubricant (8 lb [3.6 Kg] can)	
16	Nameplate	
17	Wire	
18	Bonnet	---
	If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.	
19	Packing Flange	
20	Stud Bolt	
21	Hex Nut	
22*	Packing Set	See following table
23*	Packing Ring	See following table
24	Spring or Lantern Ring	
25	Washer, Special	
26*	Packing Box Ring	See following table
27*	Upper Wiper	See following table
28	Follower	
29	Stud Bolt	
30	Hex Nut	
31	Pipe Plug (optional)	
31	Lubricator (optional)	
31	Lubricator/Isolating Valve (optional)	
32	Yoke Locknut (optional)	
36	Baffle	
37	Retaining Ring	
38	Drive Screw	
39*	Piston Ring	See following table
40	Washer	
41	Flow Arrow	
63*	Anti-Extrusion Ring	See following table

C-seal Trim (figure 10)

2*	Cage	See following table
4*	Seat Ring	See following table
5*	Valve Plug/Retainer	See following table
6*	Valve Plug Stem, S20910	See following table
8*	Piston Ring, graphite (2 req'd)	See following table
64*	C-seal, N07718	See following table

TSO Trim (figures 7, 8, and 9)

2*	Cage	See following table
4*	Seat Ring	See following table
5*	Plug/Stem Assembly	See following table
8*	Seal Ring	See following table
63*	Anti-Extrusion Ring	See following table
9*	Back Up Ring	See following table
10*	Retaining Ring	See following table

Figure 16. NPS 1 HPS Valve

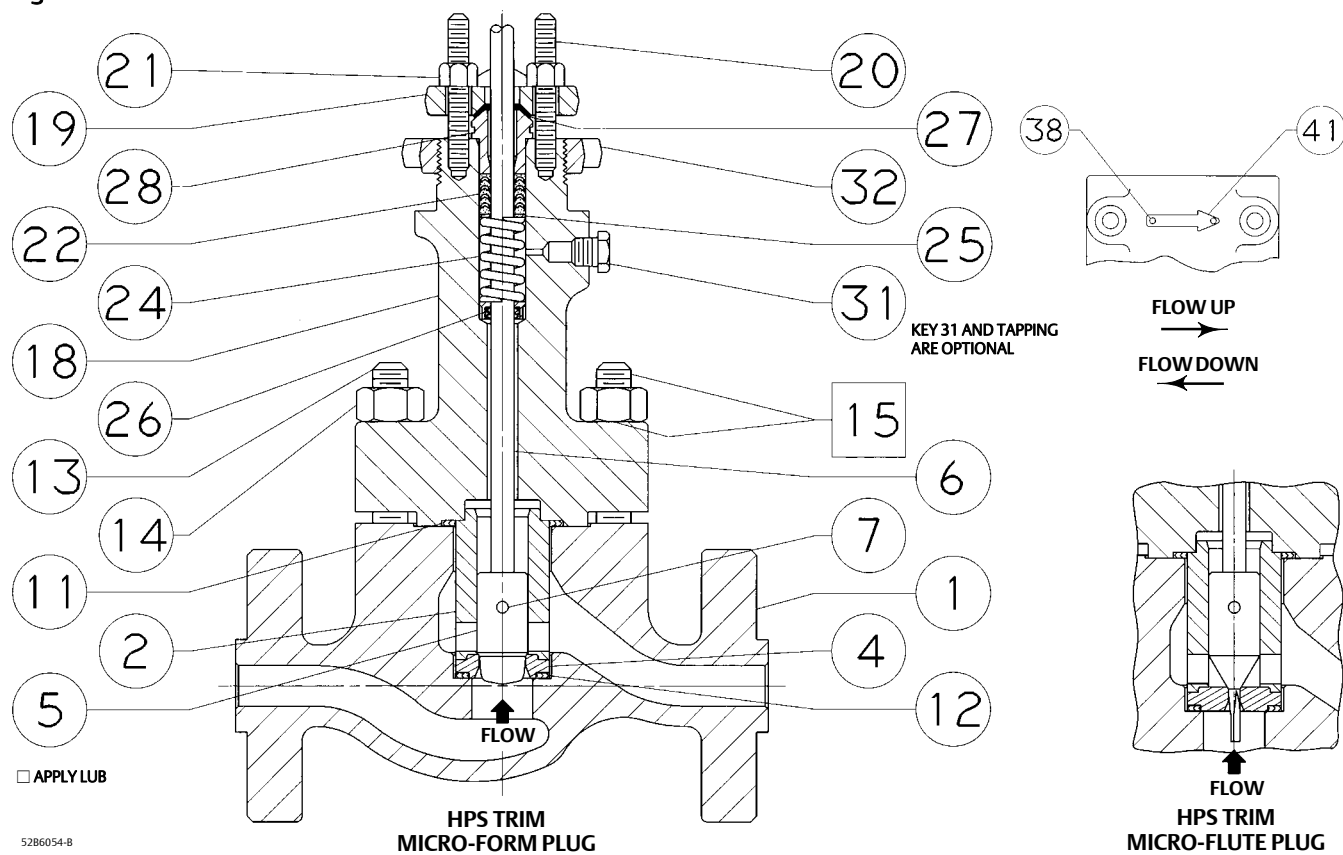


Figure 17. NPS 2 HPAD Valve

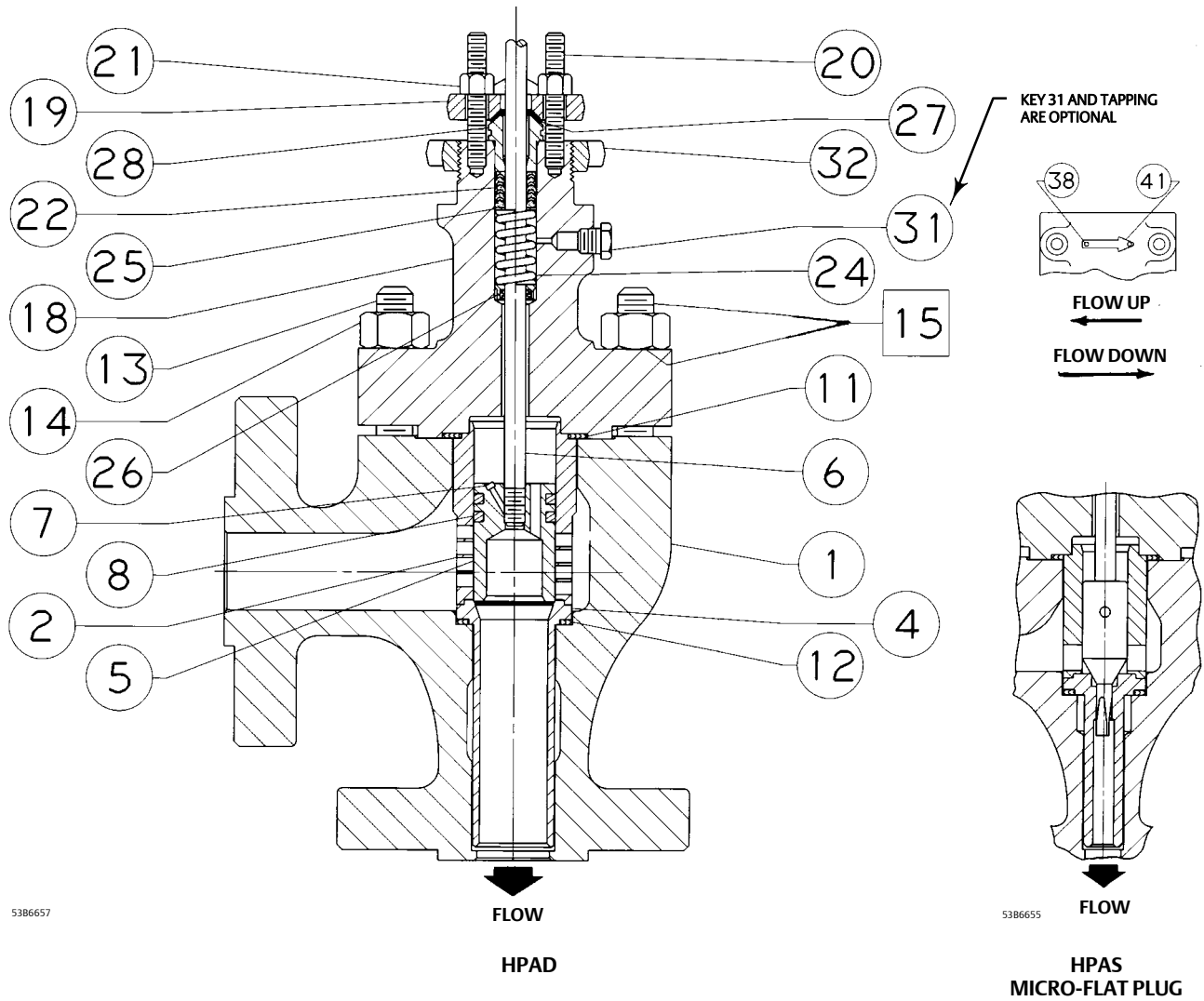


Figure 18. NPS 2-6 HPD Valve

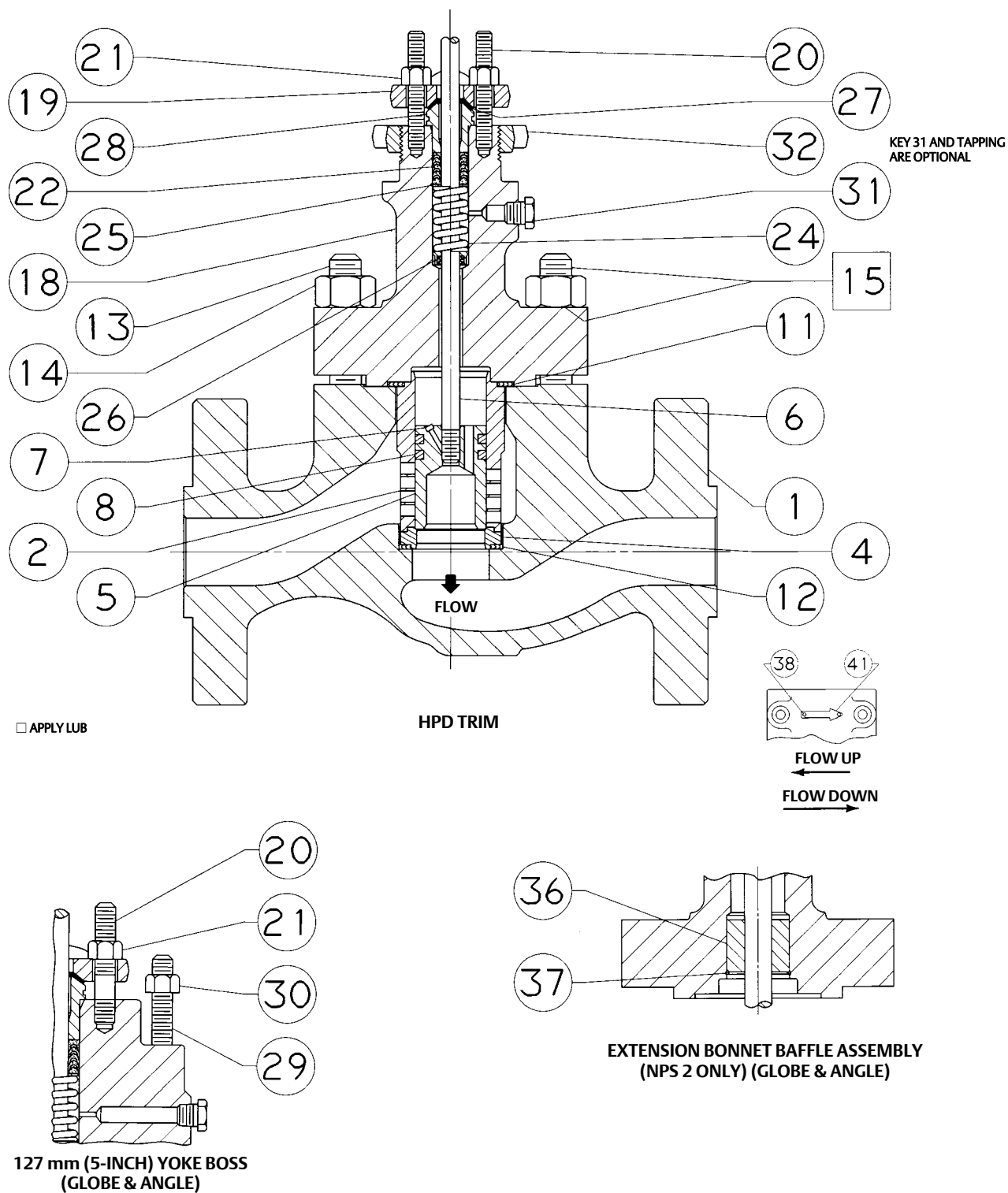


Figure 19. NPS 2-6 HP Valve - Alternate Configurations

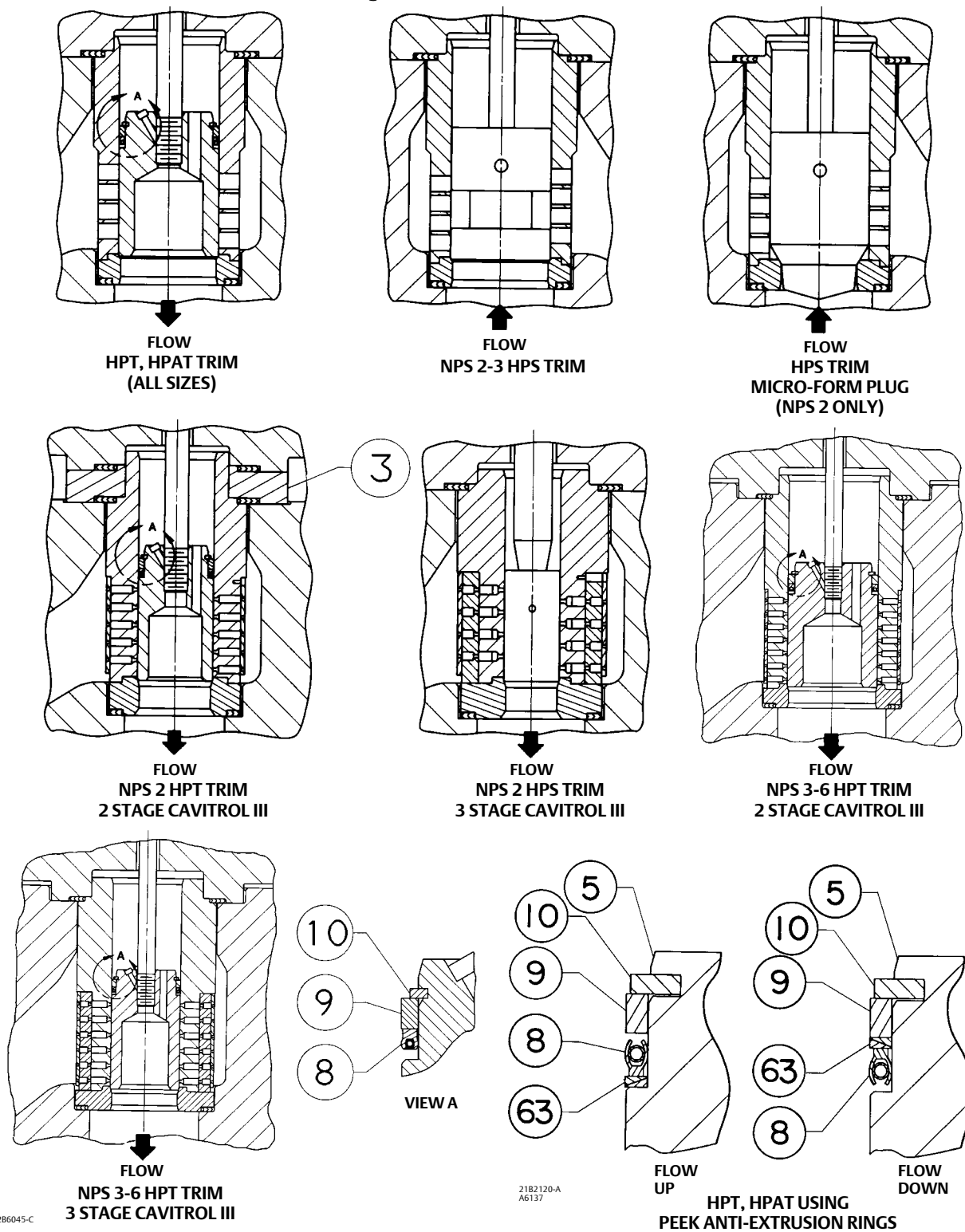
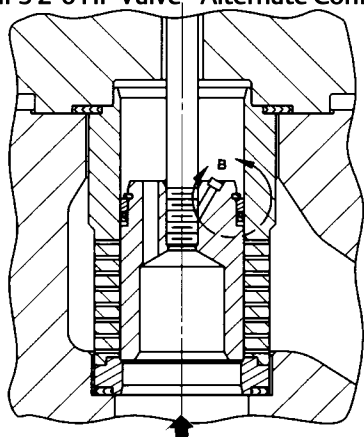
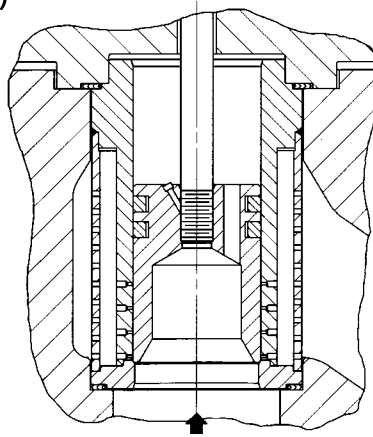


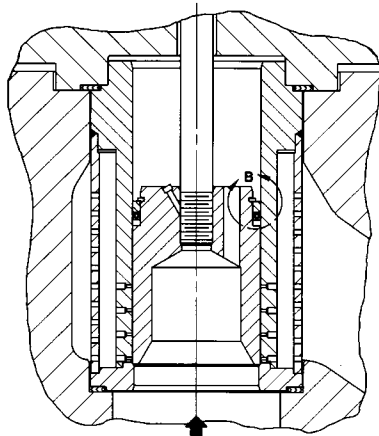
Figure 19. NPS 2-6 HP Valve - Alternate Configurations (Continued)



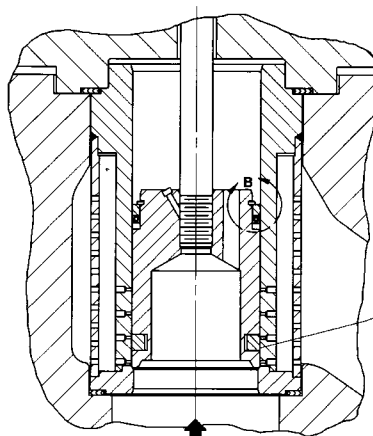
FLOW
HPT, HPAT TRIM WHISPER III,
AVAILABLE IN HPD, HPAD, HPS,
AND HPAS (NPS 2)



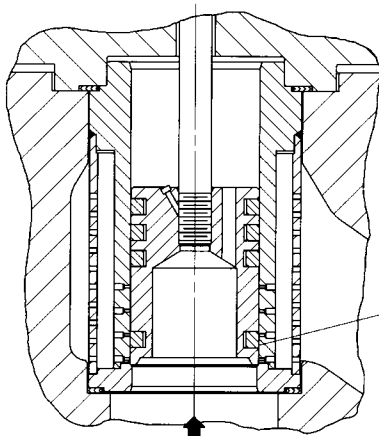
FLOW
NPS 4 HPD TRIM
WHISPER III
LEVEL D



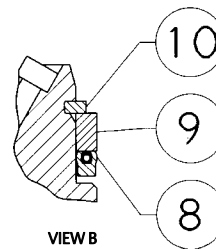
FLOW
NPS 4 HPT TRIM WHISPER III LEVEL D



FLOW
NPS 6 HPT TRIM WHISPER III LEVEL D



FLOW
NPS 6 HPD TRIM WHISPER III LEVEL D



52B6045-C

Keys 22*, 23*, 27*, 33*, 34*, and 35* Soft Packing Parts

PACKING ARRANGEMENT	KEY NUMBER	PACKING PART DESCRIPTION	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)
PTFE	22	Packing set (1 req'd for single, 2 req'd for double) ⁽¹⁾ [includes keys 23, 33, 34, and 35]	1R290201012	1R290401012	1R290601012	1R290801012
	27	Upper Wiper	1J872706332	1J872806332	1J872906332	1J873006332
Low chloride graphite ribbon and filament, single	23	Graphite Ribbon Ring (2 req'd)	1V3802X0022	1V2396X0022	1U6768X0022	1V5666X0022
	23	Graphite Filament Ring [2 req'd for 12.7 mm (1/2 inch) stem; 3 req'd for all others]	1E3190X0222	1E3191X0282	1D7518X0132	1D7520X0162
Low chloride graphite ribbon and filament, double	23	Graphite Ribbon Ring (3 req'd)	1V3802X0222	1V2396X0022	1U6768X0022	1V5666X0022
	23	Graphite Filament Ring [4 req'd for 12.7 mm (1/2 inch) stem; 5 req'd for all others]	1E3190X0222	1E3191X0282	1D7518X0132	1D7520X0162
PTFE/composition, double	23	Packing Ring [10 req'd for 12.7 mm (1/2 inch) stem; 8 req'd for all others]	1E3199001042	1E319101042	1D7518X0012	1D7520X0012
	27	Upper Wiper	1J872706332	1J872806332	1J872906332	1J873006332

* Recommended spare part.
1. Key 22 for double construction contains one extra Lower Wiper for all stem sizes. Discard upon assembly.

Key 26* Packing Box Ring

PACKING TYPE	QUANTITY REQUIRED		VALVE STEM CONNECTION		MATERIAL
	Single Packing	Double Packing	mm	Inches	S31600 (316) Stainless Steel
PTFE V-Ring	1	1	12.7	0.5	1J873235072
	1	1	19.1	0.75	1J873335072
	1	1	25.4	1	1J873435072
	1	1	31.8	1.25	1J873535072
Low Chloride Graphite Ribbon and Filament	1	1	12.7	0.5	1J873235072
	1	1	19.1	0.75	1J873335072
	1	1	25.4	1	1J873435072
	1	1	31.8	1.25	1J873535072
PTFE/Composition	---	1	12.7	0.5	1J873235072
	---	1	19.1	0.75	1J873335072
	---	1	25.4	1	1J873435072
	---	1	31.8	1.25	1J873535072

Key 2* Cage for Valves Without Whisper Trim III Cage or Cavitrol III Trim

VALVE SIZE, NPS		CAGE DESCRIPTION	TRAVEL		MATERIAL			
HP	HPA		mm	Inches	S17400 (17-4 SST) w/H1075 Heat Treatment	SA-182-F22 Ion Nitride	S31600 (316 Stainless Steel) Electrolized	NACE MR0175 S17400 H1150 DBL
1	1	Quick opening	29	1.125	22B6047X012	22B6047X022	22B6048X012	22B6047X032
2	2, 3	Equal percentage Linear	29, 38 38	1.125, 1.5, 1.5	32B6028X012 32B6025X012	32B6028X022 32B6025X022	32B6029X012 32B6026X012	32B6028X032 32B6025X032
3	4	Equal percentage Linear	38, 51 51	1.5, 2 2	42B8240X012 42B8242X012	42B8240X022 42B8242X022	42B8241X012 42B8243X012	42B8240X032 42B8242X032
4	6	Equal percentage Linear	38, 51 51	1.5, 2 2	42B9320X012 42B9322X012	42B9320X022 42B9322X022	42B9321X012 42B9323X012	42B9320X032 42B9322X032
6	8	Equal percentage Linear	64, 76 76	2.5, 3 3	43B0261X012 43B0079X012	43B0261X022 43B0079X022	43B0080X012 43B0081X012	43B0261X032 43B0079X032

Key 2* Cage for Angle Valves with Restricted Port Equal Percentage Trim

VALVE RATING	VALVE SIZE, NPS	PORT DIAMETER	TRAVEL		MATERIAL			
			mm	Inches	S17400 (17-4 SST) w/H1075 Heat Treatment	F22 Nitride	S31600 (316 Stainless Steel) Cr Ct	NACE MR0175 S17400 H1150 DBL
CL1500	1	0.75	19, 29	0.75, 1.125	23B6618X012	23B6618X022	23B6619X012	23B6618X032
	2	0.75	19, 29	0.75, 1.125	33B6642X012	33B66420X22	33B6643X012	33B6642X032
		1	19, 29	0.75, 1.125	33B6628X012	33B6628X022	31B2079X012	33B6628X032
		1.25	19, 29	0.75, 1.125	33B6631X012	33B6631X022	31B2080X012	33B6631X032
		1.5	29, 38	1.125, 1.5	32B4234X012	32B4234X022	31B2086X012	32B4234X032

Key 2* Cage or Cage and Baffle Assembly for Valves with Whisper Trim III Cage

VALVE RATING	VALVE SIZE, NPS		CAGE DESCRIPTION	PORT DIAMETER		TRAVEL		MATERIAL		
	HP	HPA		mm	Inches	mm	Inches	S17400 (17-4 Stainless Steel) with H1075 Heat Treatment	NACE MR0175 S17400 H1150 DBL	SA-182-F22 Nitride
CL1500	2	2, 3	Level A1	47.6	1.875	51	2	32B6057X012	32B6057X032	32B6057X022
	3	4	Level A1	73.0	2.875	51	2	42B8244X012	42B8244X032	42B8244X022
			Level B1	73.0	2.875	51	2	42B8245X012	42B8245X032	42B8245X022
	4	6	Level A1	92.1	3.625	51	2	32B9324X012	32B9324X022	32B9324X032
			Level A3	92.1	3.625	51	2	32B9325X012	32B9325X022	32B9325X032
			Level B3	92.1	3.625	51	2	32B9326X012	32B9326X022	32B9326X032
			Level C3	92.1	3.625	51	2	32B9327X012	32B9327X022	32B9327X032
			Level D3 ⁽¹⁾	73.0	2.875	51	2	32B9328X012	32B9328X022	32B9328X032
	6	8	Level A1	136.5	5.375	76	3	43B0082X012	43B0082X022	43B0082X032
			Level B3	136.5	5.375	76	3	43B0083X012	43B0083X022	43B0083X032
			Level C3	136.5	5.375	76	3	43B0084X012	43B0084X022	43B0084X032
			Level D3 ⁽¹⁾	111.1	4.375	76	3	33B0085X012	33B0085X022	33B0085X032

1. Cage and baffle assembly.

Key 2* Cage Assembly for HPS, HPAS⁽¹⁾, HPT, or HPAT⁽¹⁾ Valves with Cavitrol III Trim

VALVE RATING	VALVE SIZE, NPS	CAGE ASSEMBLY DESCRIPTION	PORT DIAMETER		TRAVEL		MATERIAL	
			mm	Inches	mm	Inches	S17400 (17-4 Stainless Steel) w/H1075 Heat Treatment	NACE MR0175 S17400 H1150 DBL
CL1500	1	Full 2-stage	22.2	0.875	38	1.5	32B8266X022	32B8266X012
	2	Full 2-stage	44.5	1.75	51	2	33B0160X012	33B0160X022
		Full 3-stage	25.4	1	51	2	32B6070X012	32B6070X022
	3	Full 2-stage	63.5	2.5	64	2.5	32B8252X012	32B8252X022
		Full 3-stage	47.6	1.875	64	2.5	32B8255X012	32B8255X022
	4	Full 2-stage	87.3	3.4375	76	3	32B9331X012	32B9331X022
		Full 3-stage	73	2.875	76	3	32B9334X012	32B9334X022
	6	Full 2-stage	133.4	5.25	102	4	33B0088X012	33B0088X022
		Full 3-stage	115.8	4.5625	102	4	33B0091X012	33B0091X022

1. NPS 1 and 2 only.

C-seal Parts for HPD and HPAD Valves (Keys 2*, 5*, 4*, 64*, 8*, and 6*)

VALVE SIZE, NPS		PORT DIA	TRAVEL	TRIM	STEM DIAMETER		CHARACTER-ISTIC	CAGE	PLUG/RETAINER	SEAT RING	C-seal	PISTON RING (2 req'd)	STEM
HPD	HPAD	Inch	Inch		mm	Inch		Key 2	Key 5	Key 4	Key 64	Key 8	Key 6
3	4	2.875	2	201B	19.1	3/4	Linear	44B9820X012	27B1676X012	22B6095X012	24B3621X012	14B3620X012	1U3416X0042
							Equal %	47B1674X012					
				202	19.1	3/4	Linear	---	24B7070X012	22B6095X012	24B3621X012	14B3620X012	1U3416X0042
							Equal %	44B7068X012					
				208	19.1	3/4	Whisper III-A1	47B2276X012	24B7070X012	22B6095X012	24B3621X012	14B3620X012	1U3416X0042
							Whisper III-B1	48B0643X012					
				210	25.4	1	Linear	44B9820X012	24B9822X012	22B6095X012	24B3621X012	14B3620X012	1K7447X0042
							Equal %	47B1674X012					
4	6	3.625	2	201B	19.1	3/4	Linear	---	37B2274X012	22B9339X012	23B9198X012	14B5340X012	10A9265XV62
							Equal %	47B1672X012					
				202	19.1	3/4	Linear	44B3622X012	34B5342X022	22B9339X012	23B9198X012	14B5340X012	10A9265XV62
							Equal %	---					
					25.4	1	Linear	44B3622X012	34B5342X012	22B9339X012	23B9198X012	14B5340X012	11A3429XG52
							Equal %	---					
				203	25.4	1	Whisper III-A1	34B9836X012	34B9837X012	22B9339X012	23B9198X012	14B5340X012	11A3429XG52
				208	19.1	3/4	Whisper III-C3	34B5343X012	34B5342X022	22B9339X012	23B9198X012	14B5340X012	10A9265XV62
					25.4	1	Whisper III-A1	37B0194X012	34B5342X012	22B9339X012	23B9198X012	14B5340X012	11A3429XG52
				6	8	5.375	3	202	25.4	1	Equal %	43B9204X012	34B3619X012
207	25.4	1	Whisper III-B3					47B3201X012	37B3203X012	23B0093X012			
208	25.4	1	Whisper III-A1					47B3208X012	34B3619X012	23B0094X012			
201B	31.8	1-1/4	Linear					47B8742X012	37B8744X012				
208	31.8	1-1/4	Whisper III-A1					47B3208X012	34B3619X022	23B0094X012	10A6073X072		

TSO Parts for HPS and HPT Valves (Keys 2*, 4*, and 5*)

VALVE SIZE	PORT DIA	TVL	TRIM	STEM DIAMETER		ACTUATOR GROUP	CHARACTER-ISTIC	CAGE	SEAT RING	PLUG/STEM ASSY
NPS	Inch	Inch		mm	Inch			Key 2	Key 4	Key 5
2 HPS	0.8125	2	810A	19.1	3/4	1	Cavitrol III 3-Stage	32B6070X012	37B9555X012	27B9559X022
			816					32B6070X012	38B1877X012	27B9559X032
3 HPT	1.6875	2.5	810A	12.7	1/2	400	Cavitrol III 3-Stage	32B8255X012	27B6587X012	27B3115X022
			816					32B8255X022	27B6588X012	27B3115X032
			810A	19.1	3/4	1		32B8255X012	27B6587X012	27B3115X042
			816					32B8255X022	27B6588X012	27B3115X052
4 HPT	2.6875	3	810A	19.1	3/4	1	Cavitrol III 3-Stage	32B9334X012	27B6596X012	27B6604X012
			816					32B9334X022	27B6597X012	27B6604X022
			810A	25.4	1	100 & 101		32B9334X012	27B6596X012	27B6604X032
			816					32B9334X022	27B6597X012	27B6604X042
6 HPT	4.375	4	810A	19.1	3/4	401, 403 402	Cavitrol III 3-Stage	33B0091X012	38B2652X012	38B2647X012 38B2647X022
			816					401, 403 402	33B0091X022	38B2653X012
			810A	25.4	1	404 405, 406 407		33B0091X012	38B2652X012	38B2654X012 38B2654X022 38B2654X032
			816			404 405, 406 407		33B0091X022	38B2653X012	38B2654X072 38B2654X082 38B2654X092
6 HPT	5.1875	2.5 & 3	812	19.1	3/4	1	Linear Equal %	43B0079X012 43B0261X012	38B2283X012	38B2274X012
			818			1	Linear Equal %	43B0079X032 43B0261X032	38B2284X012	38B2274X032
		2.5	812	25.4	1	100	Linear Equal %	43B0079X012 43B0261X012	38B2283X012	38B2275X012
						100	Linear Mod Equal %	43B0079X012 43B0261X012		38B2275X022
		3	812	25.4	1	101	Linear Mod Equal %	43B0079X012 43B0261X012	38B2283X012	38B2275X022
		3				100	Linear Equal %	43B0079X032 43B0261X032		38B2284X012
		2.5	818	25.4	1	100	Linear Mod Equal %	43B0079X032 43B0261X032	38B2275X062	
		3				101	Linear Mod Equal %	43B0079X032 43B0261X032	38B2275X062	

TSO Parts for HPS and HPT Valves (Keys 8*, 63*, 9*, and 10*)

VALVE SIZE	PORT DIA	TVL	TRIM	STEM DIAMETER		ACTUATOR GROUP	CHARACTER- ISTIC	SEAL RING	ANTI-EXT RING	BACKUP RING	RETAINING RING
NPS	Inch	Inch		mm	Inch			Key 8	Key 63	Key 9	Key 10
2 HPS	0.8125	2	810A	19.1	3/4	1	Cavitrol III 3-Stage	---	---	---	---
			816					---	---	---	---
3 HPT	1.6875	2.5	810A	12.7	1/2	400	Cavitrol III 3-Stage	10A4216X102	22B4694X012	10A4218X022	10A4220X012
			816							10A4218X012	10A4220X082
			810A	19.1	3/4	1				10A4218X022	10A4220X012
			816							10A4218X012	10A4220X082
4 HPT	2.6875	3	810A	19.1	3/4	1	Cavitrol III 3-Stage	10A4215X102	22B2617X012	10A4217X012	10A4219X012
			816							10A4217X022	10A4219X052
			810A	25.4	1	100 & 101				10A4217X012	10A4219X012
			816							10A4217X022	10A4219X052
6 HPT	4.375	4	810A	19.1	3/4	401, 403 402	Cavitrol III 3-Stage	17A4413X042	21B2141X012	17A4414X012	17A4415X042
			816			401, 403 402		17A4413X042	21B2141X012	17A4414X022	17A4415X032
			810A	25.4	1	404 405, 406 407		17A4413X042	21B2141X012	17A4414X012	17A4415X042
			816			404 405, 406 407		17A4413X042	21B2141X012	17A4414X022	17A4415X032
6 HPT	5.1875	2.5 & 3	812	19.1	3/4	1	Linear Equal %	10A5411X102	21B9342X012	10A5409X012	10A5410X012
			818			1	Linear Equal %	10A5411X102	21B9342X012	10A5409X022	10A5410X052
		2.5	812	25.4	1	100	Linear Equal %	10A5411X102	21B9342X012	10A5409X012	10A5410X012
		3				100	Linear Mod Equal %				
		3	812	25.4	1	101	Linear Mod Equal %	10A5411X102	21B9342X012	10A5409X012	10A5410X012
		2.5				100	Linear Equal %				
		3	818	25.4	1	100	Linear Mod Equal %	10A5411X102	21B9342X012	10A5409X022	10A5410X052
		3				101	Linear Mod Equal %				

Key 4* Seat Ring for Constructions without Cavitrol III Cage

VALVE SIZE, NPS	DESIGN	PORT DIAMETER		SEAT RING MATERIAL		
		mm	Inches	S41600 (416 SST)	S31600 (316 SST) CoCr-A Seat	S31600 CoCr-A Seat & Bore
1	Micro-Form, Micro-Flute	6.4	0.25	22B6020X012	---	22B6061X012
		9.5	0.375	22B6021X012	---	22B6062X012
		12.7	0.5	22B6022X012	---	22B6063X012
		19.1	0.75	22B6023X012	22B6064X012	---
		25.4	1	22B6019X012	22B6065X012	---
	HPAS	19.1	0.75	23B6626X012	23B6627X012	---
2	Micro-Form and Micro-Flute	6.4	0.25	23B0170X012	23B0171X012	---
		9.5	0.375	22B4186X012	22B4208X012	---
		12.7	0.5	23B0172X012	23B0173X012	---
		19.1	0.75	23B0174X012	23B0175X012	---
		25.4	1	23B0176X012	23B0177X012	---
		31.8	1.25	22B6000X012	22B6001X012	---
		38.1	1.5	22B6002X012	22B6003X012	---
	HPAS	19.1	0.75	23B6652X012	23B6653X012	---
		25.4	1	23B6629X012	22B4241X012	---
		31.8	1.25	23B6658X012	22B4242X012	---
		38.1	1.5	22B4235X012	22B4243X012	---
	HPD, HPT, HPS	47.6	1.875	22B6004X012	22B6005X012	---
3	All	73.0	2.875	22B6094X012	22B6095X012	---
4	HPD and HPT Whisper III Level A1, A3, B3, C3	92.1	3.625	22B9338X012	22B9339X012	---
	HPD and HPT Whisper III Level D3	73.0	2.875	22B9340X012	22B9341X012	---
6	HPD and HPT Whisper III Level A1, B3, C3	136.5	5.375	23B0093X012	23B0094X012	---
	HPD and HPT Whisper III Level D3	111.1	4.375	23B0095X012	23B0096X012	---

Key 4* Seat Ring for Globe Valve with Cavitrol III Trim

VALVE RATING	VALVE SIZE, NPS	2-STAGE		3-STAGE	
		S44004 (440C SST) with Heat Treatment	S31600 (316 SST) CoCr-A	S44004 with Heat Treatment	S31600 CoCr-A
CL1500	1	22B8353X012	22B8354X012	---	---
	2	23B0163X012	23B0164X012	22B6068X012	22B6069X012
	3	22B6096X012	22B6097X012	22B6098X012	22B6099X012
	4	22B9342X012	22B9343X012	22B9344X012	22B9345X012
	6	23B0097X012	23B0098X012	23B0099X012	23B0100X012

Key 4* Seat and Liner for Butt Weld End and Socket Weld End Angle Valves

VALVE RATING	VALVE SIZE, NPS	DESIGN	PORT DIAMETER		SEAT AND LINER MATERIAL	
			mm	Inches	S44004 (440C SST)	R30006 (Alloy 6)
CL1500	1	Micro-Flute	6.4	0.25	23B6623X012	23B6623X022
			9.5	0.375	23B6625X012	23B6625X022
			12.7	0.5	23B6624X012	23B6624X022
	2	Micro-Flute	6.4	0.25	23B6650X012	23B6650X022
			9.5	0.375	23B7141X012	23B7141X022
			12.7	0.5	23B6651X012	23B6651X022
		HPAS	19.1	0.75	23B6647X012	23B6647X022
			25.4	1	23B7143X012	23B7143X022
			31.8	1.25	23B7145X012	23B7145X022
			38.1	1.5	23B7147X012	23B7147X022
		HPAD, HPAT	47.6	1.875	23B6645X012	23B6645X022

Key 4* Seat and Liner for ASME and EN Flanged Angle Valves

VALVE RATING	VALVE SIZE, NPS	DESIGN	PORT DIAMETER		SEAT AND LINER MATERIAL	
			mm	Inches	S44004 (440C SST)	R30006 (Alloy 6)
CL1500	1	Micro-Flute	6.4	0.25	23B6620X012	23B6620X022
			9.5	0.375	23B6622X012	23B6622X022
			12.7	0.5	23B6621X012	23B6621X022
	2	Micro-Flute	6.4	0.25	23B6648X012	23B6648X022
			9.5	0.375	23B7140X012	23B7140X022
			12.7	0.5	23B6649X012	23B6649X022
		HPAS	19.1	0.75	23B6646X012	23B6646X022
			25.4	1	23B7142X012	23B7142X022
			31.8	1.25	23B7144X012	23B7144X022
			38.1	1.5	23B7146X012	23B7146X022
		HPAD, HPAT	47.6	1.875	23B6644X012	23B6644X022

Key 5* Valve Plug for HPS and HPAS Valves with Micro-Form Plug

VALVE SIZE, NPS	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL		
					Trim 201A S41600 (416 Stainless Steel)	Size 1 Trim 202, 203, 204, 210 Size 2 Trim 202 S31600 (316 Stainless Steel) CoCr-A Seat, Guide, and Contour	Size 2 Trim 203, 204, 210 S31600 (316 Stainless Steel) CoCr-A Seat, Guide, and Contour
	mm	Inches	mm	Inches			
1	12.7	1/2	6.4	0.25	16A5327X012	16A5404X012	---
			9.5	0.375	12B2696X052	19A6765X032	---
			12.7	0.5	16A5328X012	16A5405X012	---
			19.1	0.75	16A5329X012	16A5406X012	---
			25.4	1	16A5331X012	16A5408X012	---
2	12.7	1/2	19.1	0.75	16A5330X012	16A5407X012	---
			25.4	1	16A5332X012	16A5409X012	---
			6.4	0.25	23B0188X012	23B0165X012	23B0165X022
			12.7	0.5	10B3297X012	11B7697X012	11B7697X042
			19.1	0.75	19A5980X042	18A4133X012	18A4133X022
	19.1	3/4	25.4	1	23B0166X012	23B0167X012	23B0167X022
			31.8	1.25	18A1637X012	28A1638X052	28A1638X012
			38.1	1.5	16A5402X012	26A5410X052	26A5410X012
			19.1	0.75	23B0168X012	19A7924X032	19A7924X052
			25.4	1	18A4222X012	10B8013X012	10B8013X042
	25.4	1	31.8	1.25	18A1639X012	28A1640X132	28A1640X012
			38.1	1.5	16A5333X012	26A5411X122	26A5411X012
			25.4	1	23B0169X012	12B0079X012	12B0079X022
			31.8	1.25	18A1641X012	28A1642X062	28A1642X012
			38.1	1.5	16A5334X012	26A5412X072	26A5412X012

Key 5* Valve Plug for NPS 1 HPS and HPAS Valves with Micro-Flute Plug (Flow-Up Only)

VALVE RATING	PLUG STYLE	PORT DIAMETER		MATERIAL	
				Trim 201A S44004 (440C Stainless Steel) with Heat Treatment	Trim 202, 203, 204 S31600 (316 Stainless Steel) with Alloy 6 (CoCr-A) Seat, Guide, and Tip
		mm	Inches		
CL1500	1 Flute	6.4	0.25	18A1643X012	17A8607X052
	2 Flutes	6.4	0.25	18A1644X012	18A1646X012
	3 Flutes	6.4	0.25	18A1645X012	17A8608X052
	3 Flutes	9.5	0.375	18A1647X012	18A1648X012
	3 Flutes	12.7	0.5	18A1649X012	18A1650X012

Key 5* Valve Plug for HPAS Valves with Micro-Flute Plug (Flow-Down Only)

VALVE RATING	VALVE SIZE, NPS	PLUG STYLE	PORT DIAMETER		MATERIAL		
					Trim 201A S44004 (440C Stainless Steel) with Heat Treatment	Size 1 Trim 202, 203, 204 Size 2 Trim 202 S31600 (316 Stainless Steel) with Alloy 6 (CoCr-A) Seat, Guide, and Tip	Size 2 Trim 203, 204
			mm	Inches			
CL1500	1	1 Flute	6.4	0.25	18A1643X012	17A8607X052	---
			9.5	0.375	21B4245X012	21B4240X012	---
			12.7	0.5	21B4246X012	21B4243X012	---
	2	2 Flute	12.7	0.5	21B4244X012	21B4230X012	---
			6.4	0.25	21B4247X012	21B4254X012	21B4254X022
		1 Flute	9.5	0.375	21B4251X012	21B4255X012	21B4255X022
			12.7	0.5	21B4252X012	21B4259X012	21B4259X022
	2	2 Flute	12.7	0.5	22B5881X012	22B5882X012	22B5882X022

Key 5* Valve Plug for Cavitrol III Trim

VALVE SIZE, NPS	VALVE DESIGN	CAGE ASSEMBLY DESCRIPTION	ACTUATOR GROUP	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL		
				mm	Inches	mm	Inches	S44004 (440C Stainless Steel) w/ Heat Treatment w/ S20910 Stem	S31600 (316 Stainless Steel) w/ CoCr-A Seat and Guide w/ S20910 Stem	S31600 w/ CoCr-A Seat and Guide w/ S31600 Stem
1	HPS, HPAS	2-stage	1	12.7	1/2	22.2	0.875	22B8351X022	22B8352X022	22B8351X042
			1	19.1	3/4	22.2	0.875	22B8351X032	22B8352X032	22B8351X052
2	HPT, HPAT	2-stage	1	12.7	1/2	44.5	1.75	37A2294X052	37A2295X102	37A2294X072
			1	19.1	3/4	44.5	1.75	37A2294X062	37A2295X112	37A2294X082
	HPS, HPAS	3-stage	1	19.1	3/4	25.1	1	22B6074X012	22B6075X012	22B6074X032
3	HPT	2-stage	400	12.7	1/2	63.5	2.5	37A4303X052	37A4306X032	37A4303X062
			1	19.1	3/4	63.5	2.5	37A4304X052	37A4307X042	37A4304X062
			100	25.4	1	63.5	2.5	37A4304X052	37A4308X052	37A4305X012
			101	25.4	1	63.5	2.5	37A4305X062	37A4308X062	37A4305X032
3	HPT	3-stage	400	12.7	1/2	47.6	1.875	37A4320X052	37A4322X042	37A4320X062
			1	19.1	3/4	47.6	1.875	37A4321X112	37A4323X102	37A4321X122
			100	25.4	1	47.6	1.875	37A4321X132	37A4323X112	37A4321X032
			101	25.4	1	47.6	1.875	37A4321X142	37A4323X122	37A4321X042
4	HPT	2-stage	1	19.1	3/4	87.3	3.4375	24A5259X092	24A5280X052	24A5259X062
			100, 101	25.4	1	87.3	3.4375	24A5260X072	24A5281X092	24A5260X062
		3-stage	1	19.1	3/4	73	2.875	38A0014X062	38A0016X062	38A0014X022
			100, 101	25.4	1	73	2.875	38A0015X032	38A0017X032	38A0015X022
6	HPT	2-stage	401, 403	19.1	3/4	133.4	5.25	37A4390X042	37A4393X042	37A4390X022
			402	19.1	3/4	133.4	5.25	37A4390X052	37A4393X052	37A4390X032
			404	25.4	1	133.4	5.25	37A4391X072	37A4394X052	37A4391X022
			405, 406	25.4	1	133.4	5.25	37A4391X082	37A4394X062	37A4391X032
			407	25.4	1	133.4	5.25	37A4391X092	37A4394X072	37A4391X042
			404	31.8	1-1/4	133.4	5.25	37A4392X052	37A4395X052	37A4392X022
			405, 406	31.8	1-1/4	133.4	5.25	37A4392X062	37A4395X062	37A4392X032
			407	31.8	1-1/4	133.4	5.25	37A4392X072	37A4395X072	37A4392X042
		3-stage	401, 403	19.1	3/4	115.8	4.5625	37A4407X042	37A4410X042	37A4407X022
			402	19.1	3/4	115.8	4.5625	37A4407X052	37A4410X052	37A4407X032
			404	25.4	1	115.8	4.5625	37A4408X062	37A4411X052	37A4408X092
			405, 406	25.4	1	115.8	4.5625	37A4408X072	37A4411X062	37A4408X032
			407	25.4	1	115.8	4.5625	37A4408X082	37A4411X072	37A4408X102
			404	31.8	1-1/4	115.8	4.5625	37A4409X052	37A4412X052	37A4409X022
			405, 406	31.8	1-1/4	115.8	4.5625	37A4409X062	37A4412X062	37A4409X082
			407	31.8	1-1/4	115.8	4.5625	37A4409X072	37A4412X072	37A4409X042

**Key 5* Valve Plug for an NPS 2 to 6 CL1500 Globe Valve Without Micro-Form, Micro-Flute, or Cavitrol III Trim
Also for Use with an NPS 2 to 3 Globe Valve with a Whisper Trim III Cage**

VALVE SIZE, NPS	VALVE DESIGN	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL			
						Trim 201 and 207 Size 2 and 3 Trim 201 Size 4 and 6 S41600 (416 Stainless Steel)	Trim 202 and 208 Size 2 and 3 Trim 202 Size 4 and 6 S31600 (316 Stainless Steel) CoCr-A Seat/Guide	Trim 203 S31600 CoCr-A Seat/Guide	Trim 204 and 209, 210 Size 2 and 3 Trim 204, 210 Size 4 and 6 S31600
		mm	Inches	mm	Inches				
2	HPD	12.7 19.1	1/2 3/4	47.6 47.6	1.875 1.875	32B6006X012 32B6008X012	32B6007X022 32B6008X022	32B6007X012 32B6008X012	32B6007X012 32B6008X012
	HPT	12.7 19.1	1/2 3/4	47.6 47.6	1.875 1.875	32B6010X012 32B6012X012	--- ---	32B6011X012 32B6013X012	32B6011X012 32B6013X012
	HPS	12.7 19.1 25.4	1/2 3/4 1	47.6 47.6 47.6	1.875 1.875 1.875	16A5344X012 16A5345X012 16A5346X012	36A5423X062 36A5424X082 36A5425X042	36A5423X012 36A5424X012 36A5425X012	36A5423X012 36A5424X012 36A5425X012
3	HPD	12.7 19.1 25.4	1/2 3/4 1	73 73 73	2.875 2.875 2.875	32B8246X012 32B8248X012 32B8250X012	32B8247X032 32B8249X032 32B8251X032	32B8247X012 32B8249X012 32B8251X012	32B8247X022 32B8249X022 32B8251X022
	HPT	12.7 19.1 25.4	1/2 3/4 1	73 73 73	2.875 2.875 2.875	36A5350X012 36A5351X012 36A5352X012	--- --- ---	36A5429X012 36A5430X012 36A5431X012	36A5429X012 36A5430X012 36A5431X012
	HPS	19.1 25.4	3/4 1	73 73	2.875 2.875	16A5354X012 16A5355X012	36A5433X042 36A5434X062	36A5433X012 36A5434X012	36A5433X012 36A5434X012
4	HPD	19.1 25.4	3/4 1	92.1 92.1	3.625 3.625	32B9346X012 32B9348X012	32B9347X022 32B9349X022	32B9347X012 32B9349X012	32B9347X032 32B9349X032
	HPT	19.1 25.4	3/4 1	92.1 92.1	3.625 3.625	36A5358X012 36A5359X012	--- ---	36A5437X092 36A5438X062	36A5437X132 36A5438X092
6	HPD	19.1	3/4	136.5	5.375	36A5362X012	36A5441X092 ⁽¹⁾ 36A5441X132 ⁽²⁾	36A5441X052	36A5441X092
		25.4	1	136.5	5.375	36A5363X012	36A5442X102 ⁽¹⁾ 36A5442X112 ⁽²⁾	36A5442X042	36A5442X102
		31.8	1-1/4	136.5	5.375	36A5364X012	36A5443X082 ⁽¹⁾ 36A5443X092 ⁽²⁾	36A5443X042	36A5443X082
		50.8	2	136.5	5.375	39A6740X012	38A6943X072 ⁽¹⁾ 38A6943X082 ⁽²⁾	38A6943X042	38A6943X072
	HPT	19.1 25.4 31.8 50.8	3/4 1 1-1/4 2	136.5 136.5 136.5 136.5	5.375 5.375 5.375 5.375	36A5365X012 36A5366X012 36A5367X012 30B2224X012	--- --- --- ---	36A5444X012 36A5445X012 36A5446X012 38A8300X012	36A5444X012 36A5445X012 36A5446X012 38A8300X012

1. For -20° to 650°F (-29° to 343°) temperature range (Trim 202).
2. For 500° to 1050°F (260° to 566°C) temperature range (Trim 202H).

Key 5* Valve Plug for an NPS 2 to 8 CL1500 Angle Valve Without Micro-Form, Micro-Flute, or Cavitrol III Trim
Also for Use with an NPS 2 to 4 Angle Valve with a Whisper Trim III Cage

VALVE SIZE, NPS	VALVE DESIGN	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL			
		mm	Inches	mm	Inches	Trim 201 and 207 Size 2 and 3 Trim 201 Size 4 and 6 S41600 (416 Stainless Steel)	Trim 202 and 208 Size 2 and 3 Trim 202 Size 4 and 6 S31600 (316 Stainless Steel) CoCr-A Seat/Guide	Trim 203 S31600 CoCr-A Seat/Guide	Trim 204 and 209, 210 Size 2 and 3 Trim 204, 210 Size 4 and 6 S31600
2, 3	HPAD	12.7 19.1	1/2 3/4	47.6 47.6	1.875 1.875	32B6006X012 32B6008X012	32B6007X022 32B6008X022	32B6007X012 32B6008X012	32B6007X012 32B6008X012
	HPAT	12.7 19.1	1/2 3/4	47.6 47.6	1.875 1.875	32B6010X012 32B6012X012	--- ---	32B6011X012 32B6013X012	32B6011X012 32B6013X012
	HPAS ⁽³⁾	12.7 19.1 25.4	1/2 3/4 1	47.6 47.6 47.6	1.875 1.875 1.875	16A5344X012 16A5345X012 16A5346X012	36A5423X062 36A5424X082 36A5425X042	36A5423X012 36A5424X012 36A5425X012	36A5423X012 36A5424X012 36A5425X012
4	HPAD	12.7 19.1 25.4	1/2 3/4 1	73 73 73	2.875 2.875 2.875	32B8246X012 32B8248X012 32B8250X012	32B8247X032 32B8249X032 32B8251X032	32B8247X012 32B8249X012 32B8251X012	32B8247X022 32B8249X022 32B8251X022
	HPAT	12.7 19.1 25.4	1/2 3/4 1	73 73 73	2.875 2.875 2.875	36A5350X012 36A5351X012 36A5352X012	--- --- ---	36A5429X012 36A5430X012 36A5431X012	36A5429X012 36A5430X012 36A5431X012
	HPAS	12.7 19.1 25.4	1/2 3/4 1	73 73 73	2.875 2.875 2.875	36A5350X012 36A5351X012 36A5352X012	--- --- ---	36A5429X012 36A5430X012 36A5431X012	36A5429X012 36A5430X012 36A5431X012
6	HPAD	19.1 25.4	3/4 1	92.1 92.1	3.625 3.625	32B9346X012 32B9348X012	32B9347X022 32B9349X022	32B9347X012 32B9349X012	32B9347X032 32B9349X032
	HPAT	19.1 25.4	3/4 1	92.1 92.1	3.625 3.625	36A5358X012 36A5359X012	--- ---	36A5437X092 36A5438X062	36A5437X132 36A5438X092
	HPAS	19.1 25.4	3/4 1	92.1 92.1	3.625 3.625	36A5358X012 36A5359X012	--- ---	36A5437X092 36A5438X062	36A5437X132 36A5438X092
8	HPAD	19.1	3/4	136.5	5.375	36A5362X012	36A5441X092 ⁽¹⁾ 36A5441X132 ⁽²⁾	36A5441X052	36A5441X092
		25.4	1	136.5	5.375	36A5363X012	36A5442X102 ⁽¹⁾ 36A5442X112 ⁽²⁾	36A5442X042	36A5442X102
		31.8	1-1/4	136.5	5.375	36A5364X012	36A5443X082 ⁽¹⁾ 36A5443X092 ⁽²⁾	36A5443X042	36A5443X082
		50.8	2	136.5	5.375	39A6740X012	38A6943X072 ⁽¹⁾ 38A6943X082 ⁽²⁾	38A6943X042	38A6943X072
	HPAT	19.1 25.4	3/4 1	136.5 136.5	5.375 5.375	36A5365X012 36A5366X012	--- ---	36A5444X012 36A5445X012	36A5444X012 36A5445X012
		31.8 50.8	1-1/4 2	136.5 136.5	5.375 5.375	36A5367X012 30B2224X012	--- ---	36A5446X012 38A8300X012	36A5446X012 38A8300X012
		19.1 25.4	3/4 1	136.5 136.5	5.375 5.375	36A5365X012 36A5366X012	--- ---	36A5444X012 36A5445X012	36A5444X012 36A5445X012
		31.8 50.8	1-1/4 2	136.5 136.5	5.375 5.375	36A5367X012 30B2224X012	--- ---	36A5446X012 38A8300X012	36A5446X012 38A8300X012

1. For -20° to 650°F (-29° to 343°) temperature range (Trim 202).
2. For 500° to 1050°F (260° to 566°C) temperature range (Trim 202H).
3. HPAS is available in size NPS2 only.

Key 5* Valve Plug for an NPS 2 CL1500 Angle Valve Without Micro-Form, Micro-Flute, Micro-Flat, or Cavitrol III Trim
Also for Use with an NPS 2 Angle Valve with a Whisper Trim III Cage

VALVE SIZE, NPS	VALVE DESIGN	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL			
		mm	Inches	mm	Inches	Trim 201 Size 1 and 2 Trim 207 Size 2 Whisper III S41600 (416 SST)	Trim 202 Size 1 and 2 Trim 208 Size 2 Whisper III S31600 (316 SST) CoCr-A Seat/Guide	Trim 203 S31600 CoCr-A Seat/Guide	Trim 204 Size 1 and 2 Trim 209 Size 2 Whisper III S31600 CoCr-A Seat/Guide
2	HPAD	12.7 19.1	1/2 3/4	47.6 47.6	1.875 1.875	32B6006X012 32B6008X012	32B6007X022 32B6008X022	32B6007X012 32B6008X012	32B6007X012 32B6008X012
	HPAT	12.7 19.1	1/2 3/4	47.6 47.6	1.875 1.875	32B6010X012 32B6012X012	--- ---	32B6011X012 32B6013X012	32B6011X012 32B6013X012
	HPAS	12.7 19.1 25.4	1/2 3/4 1	47.6 47.6 47.6	1.875 1.875 1.875	16A5344X012 16A5345X012 16A5346X012	36A5423X062 36A5424X082 36A5425X042	36A5423X012 36A5424X012 36A5425X012	36A5423X012 36A5424X012 36A5425X012

Key 5* Valve Plug for an NPS 1 to 2 CL1500 Angle Valve without Micro-Form, Micro-Flute, Micro-Flat, or Cavitrol III Trim With Restricted Port Equal Percentage Cage, Flow Down Only

VALVE SIZE, NPS	VALVE DESIGN	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL			
		mm	Inches	mm	Inches	Trim 201 S41600 (416 SST)	Trim 202 S31600 (316 SST) CoCr-A Seat/Guide	Trim 203 S31600 CoCr-A Seat/Guide	Trim 204 S31600 CoCr-A Seat/Guide
1	HPAS	19.1	3/4	19.1	0.75	13B6632X012	13B6633X012	13B6633X012	13B6633X012
2	HPAS	19.1	3/4	19.1	0.75	13B6660X012	13B6661X012	13B6661X012	13B6661X012
		19.1	3/4	25.4	1	23B6630X012	21B2095X012	21B2095X012	21B2095X012
		25.4	1	31.8	1.25	23B6659X012	21B2098X022	21B2098X012	21B2098X022
		25.4	1	38.1	1.5	22B4236X012	21B2099X022	21B2099X012	21B2099X022

Key 5* Valve Plug for NPS 4 and 6 HP Valves with Whisper Trim III

VALVE SIZE, NPS	VALVE DESIGN	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL		
		mm	Inches	mm	Inches	Trim 207 Size 4 and 6 S41600 (416 Stainless Steel)	Trim 208 Size 4 and 6 S31600 (316 Stainless Steel) CoCr-A Seat/Guide	Trim 209 Size 4 and 6 S31600 CoCr-A Seat/Guide
4	HPD	19.1	3/4	92.1	3.625	32B9346X012	32B9347X022	32B9347X032
		25.4	1	92.1	3.625	32B9348X012	32B9349X022	32B9349X032
		19.1	3/4	73	2.875	32B8248X012	32B8249X032	32B8249X022
		25.4	1	73	2.875	32B8250X012	32B8251X032	32B8251X022
	HPT	19.1	3/4	92.1	3.625	36A5358X012	---	36A5437X132
		25.4	1	92.1	3.625	36A5359X012	---	36A5438X092
		19.1	3/4	73	2.875	36A5351X012	---	36A5430X012
		25.4	1	73	2.875	36A5352X012	---	36A5431X012
6	HPD	25.4	1	136.5	5.375	36A5363X092	36A5442X112 ⁽¹⁾ 36A5442X122 ⁽²⁾	36A5442X112
		31.8	1-1/4	136.5	5.375	36A5364X052	36A5443X092 ⁽¹⁾ 36A5443X102 ⁽²⁾	36A5443X092
		25.4	1	111.1	4.375	39A9100X022	39A9104X152 ⁽¹⁾ 39A9104X162 ⁽²⁾	39A9104X152
		31.8	1-1/4	111.1	4.375	39A9102X022	39A9106X152 ⁽¹⁾ 39A9106X162 ⁽²⁾	39A9106X152
	HPT	25.4	1	136.5	5.375	36A5366X072	---	36A5445X062
		31.8	1-1/4	136.5	5.375	36A5367X062	---	36A5446X032
		25.4	1	111.1	4.375	39A9101X022	---	39A9105X072
		31.8	1-1/4	111.1	4.375	39A9103X022	---	39A9107X072

1. For -29 to 343°C (-20 to 650°F) temperature range (Trim 208).

2. For 260 to 566°C (500 to 1050°F) temperature range (Trim 208H).

Key 5* Valve Plug for NPS 6 and 8 Angle Valves with Whisper Trim III

VALVE SIZE, NPS	VALVE DESIGN	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL		
		mm	Inches	mm	Inches	Trim 207 Size 4 and 6 S41600 (416 Stainless Steel)	Trim 208 Size 4 and 6 S31600 (316 Stainless Steel) CoCr-A Seat/Guide	Trim 209 Size 4 and 6 S31600 CoCr-A Seat/Guide
6	HPAD	19.1 25.4	3/4 1	92.1 92.1	3.625 3.625	32B9346X012 32B9348X012	32B9347X022 32B9349X022	32B9347X032 32B9349X032
		19.1 25.4	3/4 1	73 73	2.875 2.875	32B8248X012 32B8250X012	32B8249X032 32B8251X032	32B8249X022 32B8251X022
	HPAT	19.1 25.4	3/4 1	92.1 92.1	3.625 3.625	36A5358X012 36A5359X012	---	36A5437X132 36A5438X092
		19.1 25.4	3/4 1	73 73	2.875 2.875	36A5351X012 36A5352X012	---	36A5430X012 36A5431X012
8	HPAD	25.4	1	136.5	5.375	36A5363X092	36A5442X112 ⁽¹⁾ 36A5442X122 ⁽²⁾	36A5442X112
		31.8	1-1/4	136.5	5.375	36A5364X052	36A5443X092 ⁽¹⁾ 36A5443X102 ⁽²⁾	36A5443X092
		25.4	1	111.1	4.375	39A9100X022	39A9104X152 ⁽¹⁾ 39A9104X162 ⁽²⁾	39A9104X152
		31.8	1-1/4	111.1	4.375	39A9102X022	39A9106X152 ⁽¹⁾ 39A9106X162 ⁽²⁾	39A9106X152
	HPAT	25.4 31.8	1 1-1/4	136.5 136.5	5.375 5.375	36A5366X072 36A5367X062	---	36A5445X062 36A5446X032
		25.4 31.8	1 1-1/4	111.1 111.1	4.375 4.375	39A9101X022 39A9103X022	---	39A9105X072 39A9107X072

1. For -29 to 343°C (-20 to 650°F) temperature range (Trim 208).
2. For 260 to 566°C (500 to 1050°F) temperature range (Trim 208H).

Key 5* Valve Plug for HPAS Valves with Micro-Flat Plug/Seat Ring

VALVE RATING	VALVE SIZE, NPS	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL	
		mm	Inches	mm	Inches	Trim 201A S44004 (440C Stainless Steel)	Trim 202, 203, 204 S31600 (316 Stainless Steel) CoCr-A Seat, Guide, and Contour
CL1500	1	12.7	1/2	9.5 12.7	0.375 0.5	23B0645X012 23B0647X012	23B0646X012 23B0648X012
		19.1	3/4	19.1	0.75	23B0649X012	23B0650X012
	2	19.1	3/4	25.4	1	32B4237X012	32B4239X012

Key 5* Valve Plug for HPAS Valves with Micro-Flat Plug/Seat and Liner

VALVE RATING	VALVE SIZE, NPS	VALVE STEM CONNECTION		PORT DIAMETER		MATERIAL	
		mm	Inches	mm	Inches	Trim 201 S44004 (440C Stainless Steel)	Trim 202, 203, 204 S31600 (316 Stainless Steel) CoCr-A Seat, Guide, and Contour
For ASME and EN Flanged Valves							
CL1500	1	12.7	1/2	9.5 12.7	0.375 0.5	23B0645X022 23B0647X022	23B0646X022 23B0648X022
	2	19.1	3/4	25.4	1	32B4237X022	32B4239X022
For Butt Weld and Socket Weld Valves							
CL1500	1	12.7	1/2	9.5 12.7	0.375 0.5	23B0645X032 23B0647X032	23B0646X032 23B0648X032
	2	19.1	3/4	25.4	1	32B4237X032	32B4239X032

Key 6* Valve Plug Stem for CL1500 Standard and Whisper Valves with Whisper Trim III Cage

VALVE SIZE, NPS		ACTUATOR GROUP	VALVE STEM CONNECTION		VALVE STEM TRAVEL		DESCRIPTION	MATERIAL			
HP	HPA		mm	Inches	mm	Inches		S20910 ⁽¹⁾ (For Standard Bonnet)	S20910 ⁽¹⁾ (for Extension Style 1 Bonnet)	S31600 ⁽²⁾ (For Standard Bonnet)	S31600 ⁽²⁾ (For Extension Bonnet)
1	1	1	12.7	1/2	19.1	0.75	Micro-Form or Micro-Flute with 6.4 mm (0.25 inch) port	1N8210X0092	10A8840XAA2	1N821035162	10A8840X512
					19.1	0.75	Micro-Flute or Micro-Flat with 9.5 or 12.7 mm (0.375 or 0.5 inch) port	1N8210X0092	10A8840XAA2	1N821035162	10A8840X512
					19.1, 29	0.75, 1.125	Micro-Form with 12.7, 19.1 or 25.4 mm (0.5, 0.75, or 1-inch) port	10A8840XT82	1P6694X0092	10A8840XB42	1P669435162
			19.1	3/4	19.1, 29	0.75, 1.125	Micro-Form with 19.1 or 25.4 mm (0.75 or 1-inch) port	1K5878X0092	1L3841X0032	1K5878X0012	1L384135162
					19.1, 29	0.75, 1.125	HPAS with 19.1 mm (0.75 inch) port	16A4704X472	16A4704X522	16A4704X322	16A4704X532
2	2, 3	1	12.7	1/2	19.1, 29, 38	0.75, 1.125, 1.5	Micro-Form, Micro-Flute HPD, HPAD, HPT, HPAT, HPS, HPAS	1N8210X0092	23B0035X052	1N821035162	23B0035X062
			19.1	3/4	19.1, 29, 38	0.75, 1.125, 1.5	Micro-Form, Micro-Flat HPD, HPAD, HPT, HPAT	1P6696X0032	1P6697X0142	1P6696X0012	1P669735162
					19.1, 29	0.75, 1.125	HPAS with 19.1 mm (0.75 inch) port	16A4704X462	16A4704X482	16A4704X042	16A4704X492
							HPAS with 25.4 mm (1-inch) port	16A4704X472	16A4704X502	16A4704X322	16A4704X512

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Key 6* Valve Plug Stem for CL1500 Standard and Whisper Valves with Whisper Trim III Cage (Continued)

VALVE SIZE, NPS		ACTUATOR GROUP	VALVE STEM CONNEC- TION		VALVE STEM TRAVEL		DESCRIPTION	MATERIAL			
								S20910 ⁽¹⁾ (For Standard Bonnet)	S20910 ⁽¹⁾ (for Extension Style 1 Bonnet)	S31600 ⁽²⁾ (For Standard Bonnet)	S31600 ⁽²⁾ (For Extension Bonnet)
HP	HPA		mm	Inches	mm	Inches					
2	2, 3	100	25.4	1	19	0.75	Micro-Form with 25.4 mm (1-inch) port	10A3282X222	11A3429XN82	10A3282X012	11A3429X152
							Micro-Form with 31.8 mm (1.25 inch) port	10A3282X222	11A3429XN82	10A3282X012	11A3429X152
							HPAS with 31.8 mm (1.25 inch) port	13A9206X302	13A9206X362	13A9206X312	13A9206X372
					29	1.125	Micro-Form with 25.4 mm (1-inch) port	11A3429XG52	1L1990X0022	11A3429X232	1L199035162
							Micro-Form with 31.8 mm (1.25 inch) port	11A3429XG52	1L1990X0022	11A3429X232	1L199035162
							Micro-Form with 38.1 mm (1.5 inch) port	11A3429XG52	1L1990X0022	11A3429X232	1L199035162
							HPAS with 31.8 mm (1.25 inch) port	13A9206X322	13A9206X382	13A9206X332	13A9206X392
							HPS, HPAS with 47.6 mm (1.875 inch) port	1K7783X0032	11A3429XN92	1K778335162	11A3429X922
							HPS, HPAS with 47.6 mm (1.875 inch) port	11A3429XG52	1L1990X0022	11A3429X232	1L199035162
					38	1.5	Micro-Form with 38.1 mm (1.5 inch) port	1L2687X0152	11A3429XL32	1L2687X0012	11A3429X452
							HPS, HPAS with 47.6 mm (1.875 inch) port	1L2687X0152	11A3429XL32	1L2687X0012	11A3429X452
		101	25.4	1	19, 29, 38	0.75, 1.125, 1.5	Micro-Form, HPS, HPAS with 38.1 mm (1.5) & 47.6 mm (1.875) port	1K7447X0042	1L9086X0032	1K744735162	1L9086X00A2
							HPAS with 31.8 mm (1.25 inch) port	13A9206X342	13A2906X402	13A9206X352	13A9206X412
3	4	1	12.7	1/2	38, 50.8	1.5, 2	HPD with 73 mm (2.875 inch) port	1U2179X0072	---	1U217935162	---
							HPT with 73 mm (2.875 inch) port	1U4369X0072	---	1U4369X0012	---
			19.1	3/4	38, 50.8	1.5, 2	HPD with 73 mm (2.875 inch) port	10A9265XV62	---	10A9265X122	---
							HPT with 73 mm (2.875 inch) port	1P6696X0032	---	1P6696X0012	---
							HPS with 73 mm (2.875 inch) port	10A9265XV72	---	10A9265X202	---
		100	25.4	1	38	1.5	HPD	1K7783X0032	---	1K778335162	---
							HPT	1L2687X0152	---	1L2687X0012	---
							HPS	1N3256X0052	---	1N325635162	---
					50.8	2	HPD	1L2687X0152	---	1L2687X0012	---
							HPT	1K9289X0102	---	1K928935162	---
							HPS	1N6682X0072	---	1N6682X0032	---
		101	25.4	1	38, 50.8	1.5, 2	HPD	1L1446X0052	---	1L144635162	---
							HPT	1K7447X0042	---	1K744735162	---
							HPS	1L2687X0152	---	1L2687X0012	---

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Key 6* Valve Plug Stem for CL1500 Standard and Whisper Valves with Whisper Trim III Cage (Continued)

VALVE SIZE, NPS		ACTUATOR GROUP	VALVE STEM CONNEC- TION		VALVE STEM TRAVEL		DESCRIPTION	MATERIAL	
			mm	Inches	mm	Inches		S20910 ⁽¹⁾ (For Standard Bonnet)	S31600 ⁽²⁾ (For Standard Bonnet)
4	6	1	19.1	3/4	38, 50.8	1.5, 2	HPD with 92.1 mm (3.625 inch) port ⁽³⁾	1L4001X0042	1L400135162
							HPD with 73 mm (2.875 inch) port ⁽⁴⁾	1L4001X0042	1L400135162
							HPT with 92.1 mm (3.625 inch) port ⁽³⁾	10A6088X052	10A6088X012
							HPT with 73 mm (2.875 inch) port ⁽⁴⁾	1K5879X0032	1K587935162
		100	25.4	1	38	1.5	HPD with 92.1 mm (3.625 inch) port ⁽³⁾	1K7891X0242	1K7891X0012
							HPD with 73 mm (2.875 inch) port ⁽⁴⁾	1L8776X0032	1L877635162
							HPT with 92.1 mm (3.625 inch) port ⁽³⁾	10A3282X222	10A3282X012
							HPT with 73 mm (2.875 inch) port ⁽⁴⁾	1N3256X0052	1N325635162
					50.8	2	HPD with 92.1 mm (3.625 inch) port ⁽³⁾	11A3429XG82	11A3429XN62
							HPD with 73 mm (2.875 inch) port ⁽⁴⁾	1N3256X0052	1N325635162
							HPT with 92.1 mm (3.625 inch) port ⁽³⁾	11A3429XG52	11A3429X232
							HPT with 73 mm (2.875 inch) port ⁽⁴⁾	1N6682X0072	1N6682X0032
		101	25.4	1	38, 50.8	1.5, 2	HPD with 92.1 mm (3.625 inch) port ⁽³⁾	11A3429XG52	11A3429X232
							HPD with 73 mm (2.875 inch) port ⁽⁴⁾	1K7783X0032	1K778335162
							HPT with 92.1 mm (3.625 inch) port ⁽³⁾	1P5164X0152	1P516435162
							HPT with 73 mm (2.875 inch) port ⁽⁴⁾	1L2687X0152	1L2687X0012
6	8	1	19.1	3/4	63.5, 76.2	2.5, 3	HPD with 136.5 mm (5.375 inch) port	1U5071X0042	1J507135162
							HPT with 136.5 mm (5.375 inch) port		
		100	25.4	1	63.5	2.5	HPD with 136.5 mm (5.375 inch) port ⁽³⁾	10A3282X222	10A3282X012
							HPD with 111.1 mm (4.375 inch) port ⁽⁴⁾	1K7783X0032	1K778335162
							HPT with 136.5 mm (5.375 inch) port ⁽³⁾	10A3282X222	10A3282X012
							HPT with 111.1 mm (4.375 inch) port ⁽⁴⁾	1K7783X0032	1K778335162
					76.2	3	HPD with 136.5 mm (5.375 inch) port ⁽³⁾	11A3429XG52	11A3429X232
							HPD with 111.1 mm (4.375 inch) port ⁽⁴⁾	1L2687X0152	1L2687X0012
							HPT with 136.5 mm (5.375 inch) port ⁽³⁾	11A3429XG52	11A3429X232
							HPT with 111.1 mm (4.375 inch) port ⁽⁴⁾	1L2687X0152	1L2687X0012

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Key 6* Valve Plug Stem for CL1500 Standard and Whisper Valves with Whisper Trim III Cage (Continued)

VALVE SIZE, NPS		ACTUATOR GROUP	VALVE STEM CONNEC- TION		VALVE STEM TRAVEL		DESCRIPTION	MATERIAL	
								S20910 ⁽¹⁾ (For Standard Bonnet)	S31600 ⁽²⁾ (For Standard Bonnet)
HP	HPA		mm	Inches	mm	Inches			
6	8	100	31.8	1-1/4	63.5	2.5	HPD with 136.5 mm (5.375 inch) port ⁽³⁾	1L2298X0202	1L2298X0012
							HPD with 111.1 mm (4.375 inch) port ⁽⁴⁾		
							HPT with 136.5 mm (5.375 inch) port ⁽³⁾		
							HPT with 111.1 mm (4.375 inch) port ⁽⁴⁾		
			76.2	3	76.2	3	HPD with 136.5 mm (5.375 inch) port ⁽³⁾	10A6073X072	10A6073X012
							HPD with 111.1 mm (4.375 inch) port ⁽⁴⁾		
							HPT with 136.5 mm (5.375 inch) port ⁽³⁾		
							HPT with 111.1 mm (4.375 inch) port ⁽⁴⁾		
		101	31.8 x 50.8	1-1/4 x 2	63.5	2.5	HPD with 136.5 mm (5.375 inch) port	29A5895X482	---
							HPT with 136.5 mm (5.375 inch) port		
			76.2	3	76.2	3	HPD with 136.5 mm (5.375 inch) port	29A5895X472	---
							HPT with 136.5 mm (5.375 inch) port		
			25.4	1	63.5, 76.2	2.5, 3	HPD with 136.5 mm (5.375 inch) port ⁽³⁾	11A3429XG52	11A3429X232
							HPD with 111.1 mm (4.375 inch) port ⁽⁴⁾	1L2687X0152	1L2687X0012
							HPT with 136.5 mm (5.375 inch) port ⁽³⁾	11A3429XG52	11A3429X232
							HPT with 111.1 mm (4.375 inch) port ⁽⁴⁾	1L2687X0152	1L2687X0012
			31.8	1-1/4	63.5, 76.2	2.5, 3	HPD with 136.5 mm (5.375 inch) port ⁽³⁾	10A6073X072	10A6073X012
							HPD with 111.1 mm (4.375 inch) port ⁽⁴⁾		
							HPT with 136.5 mm (5.375 inch) port ⁽³⁾		
							HPT with 111.1 mm (4.375 inch) port ⁽⁴⁾		
			31.8 x 50.8	1-1/4 x 2	63.5, 76.2	2.5, 3	HPD with 136.5 mm (5.375 inch) port	29A5895X472	---
							HPT with 136.5 mm (5.375 inch) port		

1. Manufactured in U.S.A.
2. Manufactured in Europe and Japan.
3. Standard trim and Whisper Trim III Levels A1, A3, B3, C3.
4. Whisper Trim III Level D3.

Key 6* Valve Plug Stem for HP CL2500 Standard and Whisper Valves with Whisper Trim III Cage

VALVE SIZE, NPS	ACTUATOR GROUP	VALVE STEM CONNECTION		VALVE STEM TRAVEL		DESCRIPTION	MATERIAL
		mm	Inches	mm	Inches		S20910 (For Standard Bonnet)
1	1	12.7	1/2	19.1	0.75	Micro-Form or Micro-Flute with 6.4 mm (0.25-inch) port	1N8210X0092
				19.1	0.75	Micro-Flute with 9.5 or 12.7 mm (0.375 or 0.5 inch) port	1N8210X0092
				19.1, 29	0.75, 1.125	Micro-Form with 12.7, 19.1 or 25.4 mm (0.5, 0.75, or 1-inch) port	10A8840XT82
		19.1	3/4	19.1, 29	0.75, 1.125	Micro-Form with 19.1 or 25.4 mm (0.75 or 1-inch) port	10A9265XV62
2	1	12.7	1/2	19.1, 25.4, 29, 38	0.75, 1, 1.125, 1.5	Micro-Form HPD, HPT, HPS	1U2263X0082
		19.1	3/4	19.1, 25.4, 29, 38	0.75, 1, 1.125, 1.5	Micro-Form HPD, HPT	10A9265XV72

Key 7* Pin, CF8M Stainless Steel (Globe Valve Body)

VALVE RATING	VALVE SIZE, NPS	DESIGN	STEM DIAMETER				
			12.7 mm (1/2 Inch)	19.1 mm (3/4 Inch)	25.4 mm (1-Inch)	31.8 mm (1-1/4 Inch)	31.8 x 50.8 mm (1-1/4 x 2-Inch)
CL1500	1	HPS	1B599635072	1C5093X0022	---	---	---
	2	HPS HPD, HPT	1B599635072 1V322735072	1F723635072 1V322735072	1D269735072 ---	---	---
	3	HPS HPD, HPT	---	1F723635072 1V326035072	1D269735072 1V334035072	---	---
	4	HPD, HPT	---	1V326035072	1V334035072	---	---
	6	HPD, HPT	---	1V326035072	1V334035072	1V334035072	15A4000X012

Key 7* Pin, F316 Stainless Steel (Angle Valve Body)

VALVE RATING	VALVE SIZE, NPS	DESIGN	PORT SIZE	STEM DIAMETER		
				12.7 mm (1/2 Inch)	19.1 mm (3/4 Inch)	25.4 mm (1-Inch)
CL1500	1	Micro-Form	0.25, 1.5	1B599635072	---	---
			0.75, 1	1B599635072	1C5093X0022	---
		Micro-Flute	All	1B599635072	---	---
		Micro-Flat	0.375, 0.5	1B599635072	---	---
			0.75	---	1C5093X0022	---
		HPAS	0.75	---	1B627035072	---
	2	Micro-Form	0.25, 1.5	1B599635072	---	---
			0.75	1B599635072	1F723635072	---
			1, 1.25, 1.5	1B599635072	1F723635072	1D269735072
		Micro-Flute	All	1B599635072	---	---
		Micro-Flat	1	---	1F723635072	---
			0.75	---	1B627035072	---
		HPAS	1	---	1B599635072	---
			1.25	---	---	1B813635072
			1.5	---	---	1K249735072
			1.875	1B599635072	1F723635072	1D269735072
			1.875	1V322735072	1V322735072	---
		HPAD, HPAT	1.875	1V322735072	1V322735072	---

Key 8* Graphite Piston Ring for HPD (NPS 2 to 6) and HPAD (NPS 2 to 8) Only

VALVE SIZE, NPS		QUANTITY	PORT DIAMETER		CL1500	
HPD	HPAD		mm	Inches	-253°C to 426°C (-425°F to 800°F)	427°C to 537°C (801°F to 1000°F)
2	2, 3	2	47.6	1.875	1U2216X0012	1U2216X0022
3	4	2	73.0	2.875	1U2300X0012	1U2300X0022
4	6	2	73.0	2.875	1U2300X0012	1U2300X0022
		2	92.1	3.625	16A5482X012	16A5482X022
6	8	4	111.1	4.375	1U2392X0012	1U2392X0022
		3	136.5	5.375	11A9727X022	11A9727X032

Key 8* Seal Ring and Key 39* Graphite Piston Ring for HPT (NPS 2 to 6) and HPAT (NPS 2 to 8) without Cavitrol III Trim, N10276 with Glass and Moly-Filled PTFE

VALVE SIZE, NPS		PORT DIAMETER		KEY 8 SEAL RING	KEY 39 PISTON RING
HPT	HPAT	mm	Inches	Valve Body Rating	
				CL1500	
2	2, 3	47.6	1.875	10A4216X012	---
3	4	73.0	2.875	10A4215X012	---
4	6	73.0	2.875	10A4215X012	---
		92.1	3.625	16A5485X012	---
6	8	111.1	4.375	10A4223X012	---
Without Whisper Trim III	Without Whisper Trim III	136.5	5.375	10A5411X022	---
6	8	111.1	4.375	10A4223X012	1U2392X0012 ⁽¹⁾
With Whisper Trim III	With Whisper Trim III	136.5	5.375	10A5411X022	---

1. For use only with Whisper Trim III Level D with 111.1 mm (4.375 inch) port.

Key 8* Seal Ring for Cavitrol III Trim Only, N10276 with Glass and Moly-Filled PTFE

VALVE SIZE, NPS	2-STAGE	3-STAGE
2	17A2296X012	---
3	17A4309X012	10A4216X012
4	10A5351X022	10A4215X012
6	17A4396X012	17A4413X012

Key 9* Back-Up Ring for All HPT (NPS 2 to 6) and HPAT (NPS 2 to 8) Valves Except Those with Cavitrol III Trim

VALVE SIZE, NPS		PORT DIAMETER		MATERIAL	
HPT	HPAT	mm	Inches	S31600 (316 SST)	S41600 (416 SST)
2	2, 3	47.6	1.875	10A4218X012	10A4218X022
3	4	73.0	2.875	10A4217X022	10A4217X012
4	6	73.0	2.875	10A4217X022	10A4217X012
		92.1	3.625	16A5483X022	16A5483X012
6	8	111.1	4.375	10A4224X022	10A4224X012
		136.5	5.375	10A5409X022	10A5409X012

Key 9* Back-Up Ring for HPT (NPS 2 to 6) and HPAT (NPS 2 only) Valves with Cavitrol III Trim

VALVE SIZE, NPS	PORT DIAMETER		MATERIAL	
	mm	Inches	S41600 (416 SST)	S31600 (316 SST)
2 (2-Stage)	44.5	1.75	13A8520X012	13A8520X022
3 (2-Stage)	63.5	2.5	17A4310X012	17A4310X022
3 (3-Stage)	47.6	1.875	10A4218X022	10A4218X012
4 (2-Stage)	87.3	3.4375	10A5349X012	10A5349X022
4 (3-Stage)	73.0	2.875	10A4217X012	10A4217X022
6 (2-Stage)	133.4	5.25	17A4397X012	17A4397X022
6 (3-Stage)	115.8	4.5625	17A4414X012	17A4414X022

Keys 5*, 8*, 9*, 10*, and 63* HPT and HPAT Above 232°C (450°F) Using PEEK⁽¹⁾ Anti-Extrusion Rings

VALVE SIZE, NPS		TRIM	PORT DIAMETER		KEY 63	KEY 8	KEY 9	KEY 10	KEY 5	STEM CONNECTOR DIAMETER	
					Anti-Extrusion Ring	Seal Ring	Back-Up Ring	Retaining Ring	Anti-Extrusion Valve Plug		
HPT	HPAT		mm	Inches	PEEK	N10276/PTFE	S41600	S30200	S41600	mm	Inches
2	2, 3	Std, Whisper III	47.6	1.875	22B4694X012 22B4694X012	10A4216X032 10A4216X032	10A4218X022 10A4218X022	10A4220X012 10A4220X012	31B2146X012 31B2147X012	12.7 19.1	1/2 3/4
3	4	Std, Whisper III	73.0	2.875	22B2617X012 22B2617X012 22B2617X012	10A4215X032 10A4215X032 10A4215X032	10A4217X012 10A4217X012 10A4217X012	10A4219X012 10A4219X012 10A4219X012	31B2148X012 31B2149X012 31B2150X012	12.7 19.1 25.4	1/2 3/4 1
4	6	Std, Whisper III A,B,C	92.1	3.625	21B2115X012 21B2115X012	16A5485X062 16A5485X062	16A5483X012 16A5483X012	16A5484X012 16A5484X012	31B2151X012 31B2152X012	19.1 25.4	3/4 1
4	6	Whisper III D	73.0	2.875	22B2617X012 22B2617X012	10A4215X032 10A4215X032	10A4217X012 10A4217X012	10A4219X012 10A4219X012	31B2149X012 31B2150X012	19.1 25.4	3/4 1
6	8	Std, Whisper III A,B,C	136.5	5.375	21B9342X012	10A5411X032	10A5409X012	10A5410X012	31B2153X012	19.1	3/4
					21B9342X012	10A5411X032	10A5409X012	10A5410X012	31B2154X012	25.4	1
					21B9342X012	10A5411X032	10A5409X012	10A5410X012	31B2154X022	25.4	1
					21B9342X012	10A5411X032	10A5409X012	10A5410X012	31B2155X012	31.8	1-1/4
					21B9342X012	10A5411X032	10A5409X012	10A5410X012	31B2155X022	31.8	1-1/4
					21B9342X012	10A5411X032	10A5409X012	10A5410X012	31B2156X012	50.8	2
6	8	Whisper III D	111.1	4.375	21B9341X012 21B9341X012	10A4223X032 10A4223X032	10A4224X012 10A4224X012	10A4225X012 10A4225X012	31B2134X022 31B2135X022	25.4 31.8	1 1-1/4

1. PolyEtherEtherKetone.

Gasket Set* (Includes Key 11 Bonnet Gasket and Key 12 Seat Ring Gasket)⁽¹⁾

VALVE RATING	VALVE STYLE AND SIZE, NPS		MATERIAL	
	HP Globe	HPA Angle	N06600/Graphite	N07750/Graphite
CL1500 Globe and Angle Valves	1 (std)	1 (std)	12B7100X012	12B7100X022
	2 (std)	2 (std) and 3 (std)	12B7100X032	12B7100X042
	2 (Cavitrol III, 2-Stage)	2 (Cavitrol III, 2-Stage)	12B7100X072	---
	3 (std)	4 (std)	12B7100X052	12B7100X062
	4 (std)	6 (std)	12B7100X082	---
	6 (std)	8 (std)	12B7100X112	---
CL2500 Globe and Angle Valves	1 (std)	1 (std)	12B7100X152	12B7100X122
	2 (std)	2 (std)	12B7100X162	12B7100X132
	2 (Cavitrol III, 2-Stage)	2 (Cavitrol III, 2-Stage)	12B7100X172	12B7100X142

1. Gaskets should always be replaced as sets, not separately.

*Recommended spare parts

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