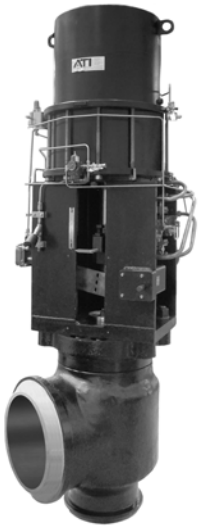
Fisher® EHAT NPS 16x20 Control Valve

Contents

Figure 1. EHAT NPS 16x20 Valve with Piston Actuator



Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 16x20 EHAT valves with CL900 ratings. **Note: Applications requiring lower pressure class ratings may use the same casting as a higher rated valve of the required size.** Refer to separate manuals for instructions covering the actuator, positioner, and accessories.

Do not install, operate, or maintain EHAT 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.

Description

NPS 16x20 EHAT valves (figure 1) have schedule 100 buttweld end connections for inlet and schedule 40 buttweld end connections for outlet. They are designed to use with a buyout piston actuator and also can be used with Fisher 667NS2 and 657NS2 actuators. NPS 16x20 EHAT valves are designed to handle high seismic environments. They are especially designed for the PV76 order used in the Next Generation Westinghouse AP1000 PWR Nuclear Generating Station as turbine bypass valves.

Specifications

Specifications for EHAT valves are shown in table 1.

Table 1. Specifications

Valve Sizes

NPS 16x20 (size designation is inlet end connection size x outlet end connection size)

Maximum Temperature and Pressure(1)

-29°C to 316°C (-20°F to 600°F), CL900 maximum

End Connection Styles and Ratings(1,2)

Buttwelding: Consistent with schedule 100 for inlet and schedule 40 for outlet

Flanges: Not available

Socket Welding: Not available

Also see table 2

Shutoff Classifications

Anti-extrusion Seal Trim: Class V.
See table 3

Flow Characteristic

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

Flow Direction

Whisper Trim™ III Cage: Flow up

Approximate Weights (valve body and bonnet assemblies)

See table 2

Bolt Torque Tolerance

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

Special Tools

Standard mechanics tools are used for assembly/disassembly

Additional Specifications

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

1. The pressure or temperature limits in this manual and any applicable standard limitations should not be exceeded.
2. EN (or other) ratings and other BWE can usually be supplied; consult your Emerson Process Management sales office.

Table 2. Valve Assembly Approximate Weights

VALVE SIZE, NPS	PRESSURE RATING	KILOGRAMS	POUNDS
16x20	900	1495	3296

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

VALVE DESIGN	VALVE SIZE, NPS	DATA SHEET(1)	PORT DIAMETER, mm (INCHES)	CAGE STYLE	LEAKAGE CLASS
Balanced EHAT	16x20	101	279.4 (11)	Whisper Trim III	V

1. Data Sheet Number refers to PV76 Data Sheets for the AP1000 Power Plant Design.

Table 4. Torque for Body-to-Bonnet Bolting Using Nuclear Grade Never-Seez® Lubricant

VALVE RATING	VALVE SIZE, NPS	TORQUE	
		N•m	lbf•ft
		B7 Studs	B7 Studs
All	16x20	2915	2150

Principle of Operation

NPS 16x20 EHAT valves are control valves based on the Fisher FB and EU valve products. The valve body and bonnet contain a fluid under pressure, while the internal valve parts control the flow of the fluid through the valve. The internal parts consist of gaskets, a cage-seat ring assembly, a plug-stem assembly, and PEEK anti-extrusion seal rings for both cage-seat ring assembly and plug-stem assembly. The gaskets and cage-seat ring assembly are stationary and held in

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

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

Lifting Guidelines

CAUTION

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

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

⚠ WARNING

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

Before rigging, ensure the crane/hoist/rigging hardware lifting capacity can safely accommodate the desired load.

Lifting Valve Only

To lift the valve, eyebolts should be used. Insert 2 - 8 inch shouldered pattern eyebolts into two diagonal threaded holes located on the top of the NPS 16x20 valve bonnet, as shown in figure 2. The eyebolt material should be ASTM A489-K04800 or stronger material. Be sure at least 90% of the threads are engaged in the receiving hole, with a minimum thread engagement of at least 1-1/2 times the thread diameter in steel. The valve can now be lifted using a hoist capable of leveling the lifting points.

Lifting Actuator Only

The ATI L269.5SRE80 actuator with accessories may be lifted using the lifting ears on top of the actuator piston, as shown in figure 2. A single hoist lift point on the strap or chain will balance and lift the actuator, keeping it level. Use padding as needed to protect any painted surfaces. Refer to the ATI actuator instruction manual for details.

Lifting Valve/Actuator Assembly

To lift EHAT NPS 16x20 valve assembly, ATI L269.5SRE80 actuator and accessories, the lifting ears on top of the actuator piston should be used. Refer to figure 2. A single hoist lift point on the strap or chain will balance and lift the actuator, keeping it level. Use padding as needed to protect any painted surfaces. Refer to the ATI actuator instruction manual for details.

Figure 2. Lifting Guidelines

VALVE/ACTUATOR ASSEMBLY

VALVE ONLY

ACTUATOR ONLY

Installation

⚠ WARNING

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

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

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

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

⚠ WARNING

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

⚠ WARNING

Take care to prevent people from being injured in case the hoist or rigging slips unexpectedly. Refer to table 2 for valve assembly weights. It is important to use adequately sized hoists and chains or slings when handling the valve.

1. Before installing the valve, inspect it to ensure that the valve body (key 1)cavity is free of foreign material.
2. Clean out all pipelines to remove scale, welding slag, and other foreign materials before installing the valve.
3. Flow through the valve must be in the direction indicated by the flow arrow, which is stamped on or attached to the valve body.

CAUTION

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

4. Use accepted piping and welding practices when installing the valve in the pipeline.
5. Install a three-valve bypass around the valve if continuous operation is required during maintenance.
6. If the actuator and valve body are shipped separately, refer to the Mounting the Actuator on the Valve procedure in this 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. Please read and follow the packing adjustment procedures in the Packing Maintenance section of this manual.

Mounting the Actuator on the Valve

CAUTION

The ATI actuator spring load pushes the stem down out of the actuator yoke, and it can come in contact with the valve stem during actuator mounting. If the valve stem is allowed to remain in the up position (towards the actuator) during actuator mounting,it can interfere with the actuator stem during mounting. It is possible to damage valve stem threads or bend the valve stem. Be sure the valve stem is pushed down (into the valve body), away from the actuator while mounting.

It may be necessary to apply a temporary loading pressure to the actuator to move the actuator stem away from the valve during installation.

If it is not possible to provide a temporary loading pressure, be very careful when lowering the actuator over the valve stem to prevent damage to valve stem and threads.

⚠ WARNING

When moving the actuator stem with loading pressure applied, exercise caution to keep hands and tools out of the actuator stem travel path. If the loading pressure is accidentally disconnected, personal injury and property damage may result if something is caught between the actuator stem and other control valve parts.

Refer to appropriate Type III drawings and actuator instruction manual. The steps below apply to the ATI actuator.

1. Provide a vise or some other method of supporting the valve and the weight of the actuator during assembly. Push the valve stem down away from the actuator while mounting the actuator.
2. Thread the stem locknuts all the way onto the valve stem (key 4).
3. Coat the threads of the actuator mounting studs with Nuclear Grade Never-Seez (key 27) up to the deformed thread. Thread the actuator mounting studs into the bonnet (key 10) until the deformed thread prevents further insertion.
4. Place the actuator on top of the bonnet. Mount the actuator as shown on Type III drawings.
5. Coat the remaining threads of the actuator mounting studs and the contact faces of the nuts with Nuclear Grade Never-Seez (key 27). Place the washers over the studs and thread the nuts onto the studs and hand-tighten. Torque the actuator mounting nuts evenly in a criss-cross pattern to 5534 N • m (4080 lbf • ft).
6. Do not connect the actuator stem to the valve stem at this time. Whenever the actuator is installed on the valve, it is recommended that you first refer to the appropriate actuator instruction manual to verify that the actuator is still adjusted correctly.

Maintenance

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

⚠ WARNING

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

- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.**
- **Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline.* Process fluids may spray out under pressure when removing the packing hardware or packing rings.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

Note
The NPS 16x20 EHAT valve uses spiral-wound gaskets (keys 5 and 28) which are crushed to provide their seal. A spiral-wound gasket should never be reused. Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket must be installed upon reassembly. This is necessary to ensure a good gasket seal, since the used gasket will not seal properly.

CAUTION

The spiral-wound gaskets (keys 5 and 28) are of special design. Failure to use Fisher replacement parts may result in valve damage.

Note
If the valve has HIGH-SEAL Heavy-Duty live-loaded packing installed (figure 3), see the Replacing HIGH-SEAL Packing section in this manual for packing instructions.

Packing Lubrication

Note
No provisions for packing lubrication.

⚠ WARNING

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

Packing Maintenance

If there is undesirable packing leakage in HIGH-SEAL packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts (key 14, figure 9) to at least the minimum spring load shown in figure 6. However, do not exceed the maximum spring load shown in figure 6 or excessive friction may result. If leakage continues, replace the packing by following the numbered steps presented in the Replacing HIGH-SEAL Packing procedure.

If the packing is relatively new and tight on the valve plug stem (key 4), and if tightening the packing flange nuts (key 14) 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 HIGH-SEAL Packing procedure, inspect the valve plug stem and packing box wall for nicks or scratches.

Replacing HIGH-SEAL 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 3 or 9, unless otherwise indicated.

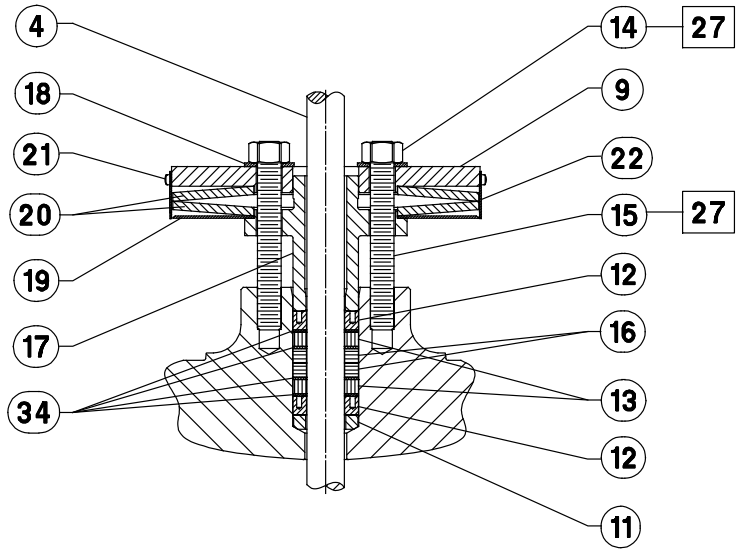
1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body (key 1), and drain the process media from both sides of the valve. If using a power actuator, also shut-off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out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

CAUTION

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

Use care to avoid damaging gasket sealing surfaces.

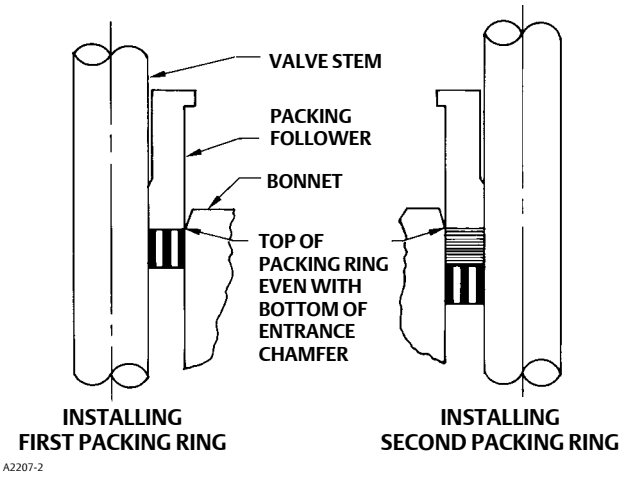
Figure 3. PTFE HIGH-SEAL Packing



⚠ WARNING

To avoid personal injury or property damage caused by uncontrolled movement of the bonnet (key 10), 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. Installing Graphite Ribbon/Filament Packing Rings One at a Time



Note

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

7. Hex nuts (key 8) and washers (key 24) attach the bonnet (key 10) to the valve body (key 1). Loosen these nuts approximately 3 mm (1/8 inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens. If no fluid leaks from the joint, proceed to step 9.
8. If leakage does occur from the joint, tighten the nuts (key 8) and verify that the process is properly shut down or the valve is properly bypassed.
9. Unscrew the hex nuts (key 8), remove the washers (key 24), and carefully lift the bonnet (key 10) off the valve stem. If the valve plug and stem assembly (key 4) starts to lift with the bonnet, use a hammer on the end of the stem and tap it back down. Set the bonnet on a cardboard or wooden surface to prevent damage to the bonnet gasket surface.
10. Remove the cage/bonnet gasket (key 28). Lift the valve plug and stem assembly (key 4) out of the valve body and set it on a protective surface. If the valve plug is to be reused, protect the valve plug seating surface to prevent scratches. Install screws or bolts into the tapped holes in the top of the cage (key 2), and carefully lift the cage and seat ring (key 3) assembly out of the valve body. Remove the other cage/body gasket (key 5).

CAUTION

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

11. Clean all gasket seating surfaces; refer to your process or safety engineer for appropriate cleaning tools. Clean in the same direction as the surface serrations, not across them.
12. Cover the opening in the valve body to protect the gasket seating surface and to prevent foreign material from getting into the valve body cavity.

13. Remove the packing flange nuts (key 14), packing flange (key 9), qty-2 Belleville springs (key 20), indicator disk (key 19), packing follower (key 17), qty-4 load scale mounting screws (key 21), and load scale (key 22). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall.
14. Clean the packing box and the following metal packing parts: packing follower (key 17), packing box ring (key 11).
15. Inspect the valve stem threads and packing box surfaces for any sharp edges that might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding or honing with a tool similar to a small honing stone, replace the damaged parts.
16. Remove the protective covering from the valve body cavity, and install the seat ring and cage using qty-2 new cage gasket (keys 5 and 28). Install the plug, then slide the bonnet over the stem and onto the studs (key 7).

Note

The proper bolting procedures in step 17 include--but are not limited to--ensuring that the bonnet stud threads are clean, and that the hex nuts are evenly tightened to the specified torque values.

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 4 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this procedure.

Hot torquing is not recommended.

17. Lubricate the stud threads (key 7) and the seating faces of the hex nuts (key 8) with Nuclear Grade Never-Seez (key 27). Install the washers (key 24) over the bonnet studs (key 7). Replace the hex nuts and tighten them finger-tight. Stroke the valve several times to center the trim. Torque the nuts in a crisscross pattern (reference figure 5) to no more than 1/4 of the nominal torque value specified in table 4.

When all nuts (key 8) 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

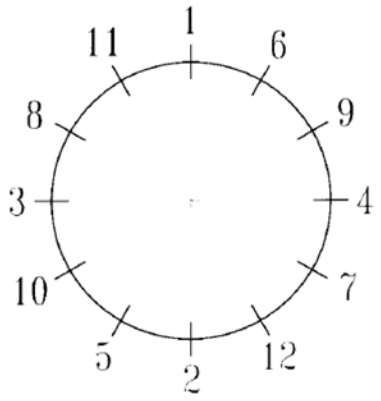
When installing packing rings (key 13 and key 16), prevent entrapping air between the rings. Add the rings one at a time without forcing them below the chamfer of the packing box (key 11) entrance chamber. As each successive ring is added, the stack should not be pushed down more than the thickness of the added ring (figure 4).

18. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 3. Place a smooth-edged pipe over the valve stem (key 4), the top end higher than the valve stem is recommended. An alternative way is to slide the packing follower (key 17) over the valve stem. Gently tap each soft packing part into the packing box one piece at a time, being sure that air is not trapped between adjacent soft parts.

Note

Be sure to install the packing rings in the sequence shown in figure 3.

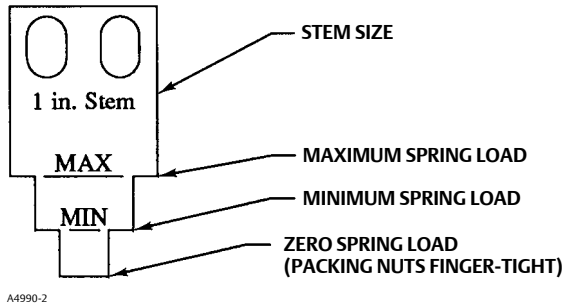
Figure 5. Bolting Diagram



12 BOLT PATTERN

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

Figure 6. Typical Load Scale



21. Place the second Belleville spring (key 20) with the convex side toward the packing flange (key 9); see figure 3. Position the packing flange on top of the spring, making sure the second spring fits into its guide in the flange.

CAUTION

Keep the packing follower (key 17) and flange (key 9) centered on the valve stem (key 4). If any metal part makes contact with the stem, it can cause damage to the stem surface. Vertical scratches or nicks on the stem surface can cause excessive leakage from the packing.

22. Lubricate the packing nuts (key 14) with Nuclear Grade Never-Seez lubricant (key 27) and tighten them hand-tight.
23. The load scale (key 22) is used to indicate compression on the Belleville springs. Position the qty-2 load scales (key 22) by slightly loosening the mounting screws (key 21). Align the bottom edge of the load scale with the indicator

disk and retighten the screws. Figure 6 illustrates the load scale properly adjusted before the nuts have been tightened and with the Belleville springs (key 20) not compressed.

24. Tighten the packing nuts (key 14) while observing the two load scales (key 22) to make sure the flange (key 9) is tightened evenly. Be sure to keep the follower (key 17) centered on the stem (key 4) while tightening the nuts. Tighten the nuts alternately and evenly, keeping the flange parallel with the valve, until the indicator disk (key 19) aligns with the maximum compression line on the load scales.
25. The packing is now properly loaded and the packing nuts (key 14) do not need to be retightened unless the indicator (key 19) begins to approach the minimum compression line. After the valve has been in service for awhile, visually check the load scale to determine loading. Under normal conditions, the packing nuts should not require retightening for the life of the packing.

Trim Removal

Key numbers referenced in this procedure are shown in figures 9 and 10 except where indicated.

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

CAUTION

Use care to avoid damaging gasket surfaces.

The surface finish of the valve stem (key 4) is critical for making a good packing seal. The inside surface of the cage or cage assembly (key 2) is critical for smooth operation of the valve plug and for making a seal with the anti-extrusion ring (key 30) and spring-loaded seal ring (key 31). The seating surfaces of the valve plug (key 4) and seat ring (key 3) are critical for proper shutoff. The inside surface of the valve body port is critical for making a seal with the anti-extrusion ring (key 35) and the spring-loaded seal ring (key 36). Assume all these parts are in good condition, and protect them accordingly unless inspection reveals otherwise.

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 the plug seal and seat ring seal to avoid scratching any sealing surface.

2. Remove the plug/stem assembly (key 4) (with anti-extrusion seal rings [keys 29-32]) from the valve body.
3. Use an appropriate tool and carefully remove the retainer ring (key 32) from the valve plug (key 4).
4. Use an appropriate tool to pry the remaining backup ring (key 29), spring-loaded seal ring (key 31), and anti-extrusion ring (key 30) from the top of the plug. Use caution to avoid scratches or other damage to the sealing surfaces where the plug seal makes contact with the valve plug (figure 8).
5. Remove the cage/bonnet gasket (key 28). Install screws or bolts into the tapped holes in the top of the cage/seat ring assembly (key 2), and carefully lift it out of the valve body. Remove the other cage/body gasket (key 5).
6. Inspect the seal rings (keys 33, 35-37) on the seat ring (key 3), and remove them in the same way as specified in step 2 and 3 if replacement is necessary. Use caution to avoid scratches or other damage to the sealing surfaces where the anti-extrusion seal rings make contact with the seat ring (figure 7).
7. The seat ring is screwed into the cage and secured with two tack welds, one on each side of the cage. Remove the tack welds by grinding or filing them off.
8. There are two 3/8-inch UNC tapped holes in the bottom of the seat ring (key 3). Screw cap screws into these holes. Use a bar to pry against the cap screws and turn the seat ring out of the cage.
9. Inspect the lower seating surface where the valve plug (key 4) contacts the seat ring (key 3) for wear or damage which would prevent proper operation of the valve. Inspect the sealing surface inside the cage where the anti-extrusion seal rings contact the cage (key 2), and inspect the sealing surface where the anti-extrusion seal rings make contact with the plug (figure 8). Also, inspect the sealing surface outside the seat ring where the anti-extrusion seal rings contact the seat ring, and inspect the sealing surface where the anti-extrusion seal rings make contact with the valve body (figure 7).

Trim Replacement

⚠ WARNING

Observe the warning at the start of the Maintenance section.

After all trim maintenance has been completed, reassemble the valve body (key 1) 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 figures 9 and 10, except where indicated.

CAUTION

Inspect the cage (key 2), bonnet (key 10), and body gasket seating 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.

CAUTION

If replacing the valve plug spring loaded seal ring (key 31) and seat ring spring loaded seal ring (key 36), be careful not to scratch the surfaces of the ring groove in the valve plug and seat ring or any of the surfaces of the replacement ring, or the replacement ring may not seal properly.

1. Place the seat ring (key 3) on the workbench with the threaded end down. Note the orientation of the spring loaded seal ring open side in figure 7. Slide the anti-extrusion ring (key 35), spring loaded seal ring (key 36), and backup ring (key 33) into the seat ring with the orientation shown in figure 7. Install the retainer ring (key 37) into the groove of the seat ring (key 3).
2. Screw two eye bolts into the two 3/8-16UNC tapped holes in the bottom of the seat ring (key 3). Use a bar to get through the holes of the two eye bolts, and rotate the bar to turn the seat ring into the bottom of the cage (key 2) until the bottom surface of the cage (key 2) contacts the seat ring (key 3).
3. Tack weld the seat ring to the cage using minimal heat. Two welds, 6 mm (1/4 inch) long and 180 degrees apart, are required.
4. Install qty-1 cage/body spiral wound gasket (key 5) in the gasket groove in the top of the valve body (key 1), making sure the bottom of the gasket is flush with the mating surface in the body.
5. Install the cage/seat ring assembly into the valve body trim bore. When installing the assembly, take care to ensure that the bottom diameter guides properly and the shoulder of the cage sits flush against the spiral wound gasket (key 5).
6. Inspect the sealing surface of the plug/stem assembly (key 4) for nicks and scratches. Install the anti-extrusion ring (key 30), spring loaded seal ring (key 31), and backup ring (key 29) onto the top of the plug with the orientation shown in figure 8. Install the retainer ring (key 32) into the groove on top of the plug.
7. Slide the valve plug/ stem (key 4) assembly into the cage (key 2). Make sure the valve plug seal rings (keys 30 and 31) are evenly engaged in the entrance chamfer at the top of the cage or cage assembly to avoid damaging the ring. Gently rest the plug seating surface against the seat ring (key 3).
8. Install qty-1 cage/bonnet spiral wound gasket (key 28) on the cage (key 2). The gasket groove will be formed by the valve bonnet (key 10) and cage.

9. Lubricate the bonnet stud with Nuclear Grade Never-Seez (key 27). Install the bonnet (key 10) over the bonnet studs (key 7) and onto the valve body (key 1), as shown on Type III drawings. The cage will center the bonnet.

Note

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

CAUTION

Failure to comply with good bonnet-to-body bolting practices and the torque values shown in table 4 may result in damage to the valve. Cheater bars or slug wrenches should not be used for this practice.

Hot torquing is not recommended.

10. Lubricate the stud threads and the faces of the hex nuts (key 8) with nuclear grade Never-Seez [key 27]. Install the washers (key 24) over the bonnet studs (key 7). Replace the hex nuts and tighten hand-tight. Torque the nuts in a crisscross pattern (as shown in figure 5) to no more than 1/4 of the nominal torque value specified in table 4. 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.
11. Install new packing and packing box parts per steps 18 and 25 of the Replacing Packing procedure. Be certain to observe the note given prior to step 18 of that procedure.
12. 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. Check for packing leakage as the valve is being put into service.

Troubleshooting

Table 5. Fisher NPS 16x20 EHAT Valve Troubleshooting

Problem	Possible Solution
Packing leakage	Verify the correct packing torque or compression.
	Disassemble and inspect packing box bore and valve stem for graphite adhesion, excessive wear or scratches.
	If needed, increase packing load to maximum per the Packing Adjustment section of this manual. Replace packing parts and inspect packing box and shaft at next available maintenance interval.
Body to Bonnet Leakage	Verify proper torque on bonnet studs and nuts.
	Disassemble and inspect sealing surfaces on the bonnet and valve body for scratches or nicks. Replace gaskets.
Valve Won't Stroke	Verify the correct packing torque or compression is not too high.
	Disassemble valve body, inspect cage bore and plug for damage and debris. Inspect plug and seat ring for indications of plug sticking in seat ring. Replace damaged parts as needed. Replace gaskets.
	Inspect actuator, refer to actuator instruction manual
Other	Contact your Emerson Process Management sales office if more assistance is needed.

Figure 7. Seat Ring Using Anti-Extrusion Seal Rings

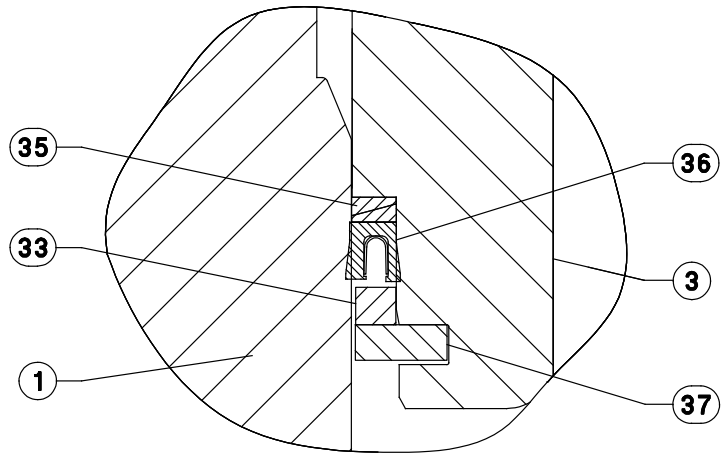


Figure 8. Plug Using Anti-Extrusion Seal Rings

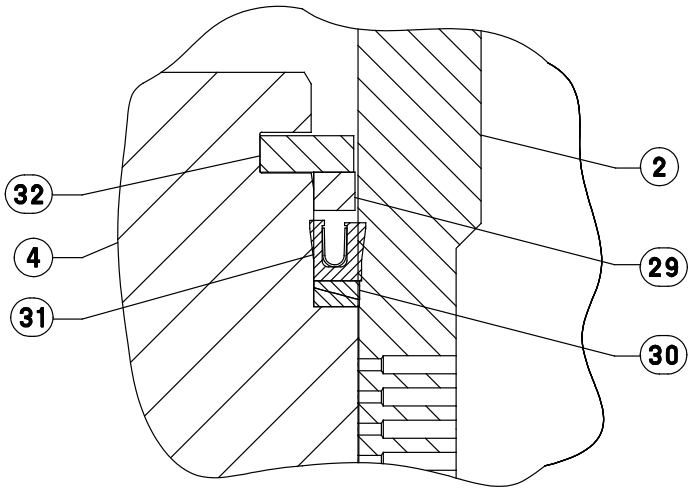


Figure 9. NPS 16x20 EHAT Valve - Exploded View

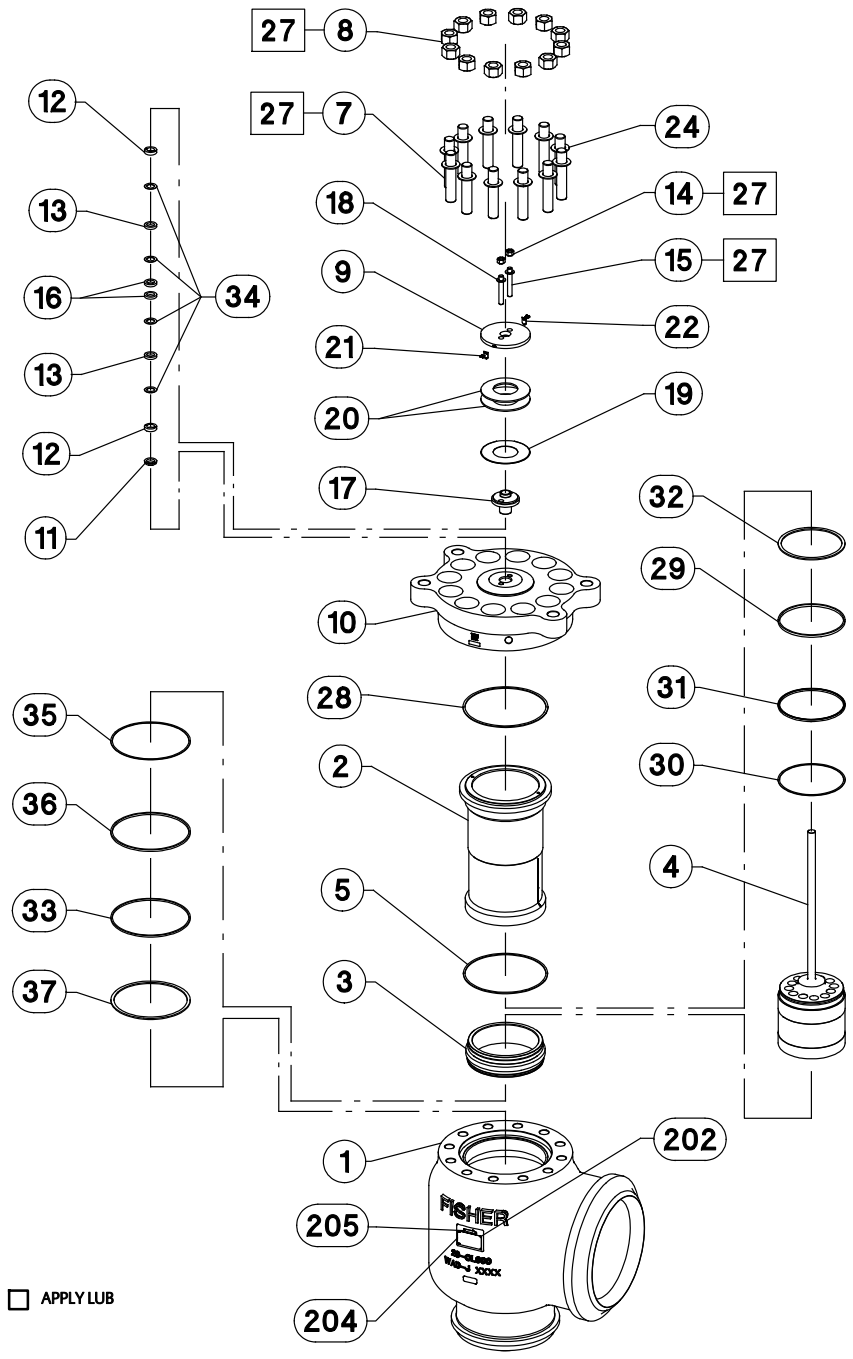


Figure 10. NPS 16x20 EHAT Valve - Section View

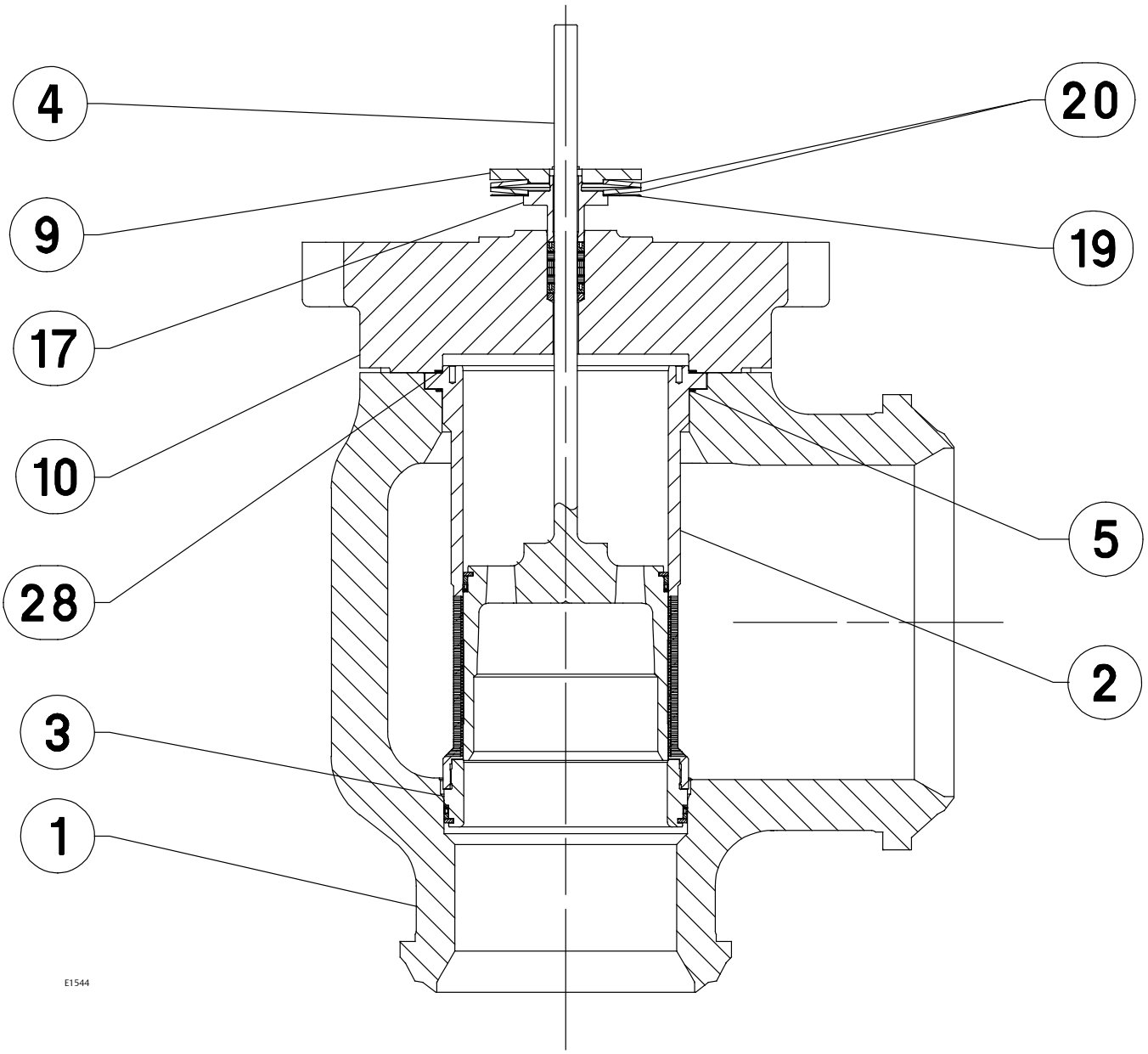
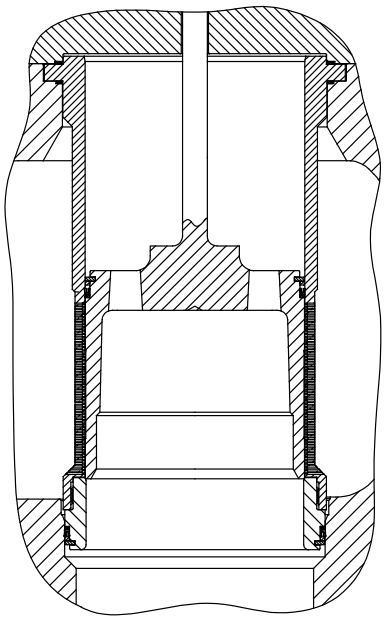


Figure 11. NPS 16x20 EHAT Valve Configuration



NPS 16x20 EHAT BALANCED TRIM

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, 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 List

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	---
2*	Cage	See following table
3*	Seat Ring	See following table
4*	Plug/Stem Assy	See following table
5*	Cage/body Spiral Wound Gasket	See following table
7	Body-Bonnet Stud	See following table
8	Body-Bonnet Nut	See following table
9	Packing Flange	See following table
10	Bonnet	---
11*	Packing Box Ring	See following table
12*	Guide Bushing	See following table
13*	Packing Ring	See following table
14	Packing Nut	See following table
15	Packing Stud	See following table
16*	Packing Ring	See following table
17	Packing Follower	See following table
18	Washer (Packing Stud)	See following table
19	Indicator	See following table
20	Belleville Spring	See following table
21	Machine Screw (Load Scale)	See following table
22	Load Scale	See following table
24	Washer (Body-Bonnet Stud)	See following table
27	Nuclear Grade Never-Seez	
28*	Cage/bonnet Spiral Wound Gasket	See following table
29*	Backup Ring (Plug)	See following table
30*	Anti-extrusion Ring (Plug)	See following table
31*	Spring Loaded Seal Ring (Plug)	See following table
32*	Retainer Ring (Plug)	See following table
33*	Backup Ring (Seat Ring)	See following table
34*	Packing Washer	See following table
35*	Anti-extrusion Ring (Seat Ring)	See following table
36*	Spring Loaded Seal Ring (Seat Ring)	See following table
37*	Retainer Ring (Seat Ring)	See following table
202	Machine Screw	
204	Serial Tag	
205	Flow Arrow	

*Recommended spare parts

Table 6. Spare Parts*

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

- continued -

*Recommended spare parts

Table 6. Spare Parts* (continued)

Part Description / Key No.	Replacement Part Number	Qty	Classification	Spare Part Code(1)	Spare Part Requirement Rationale(3)	Shelf Life	Shelf Life Rationale(2)
Packing Ring, Key 16	Refer to following table	4	Non-Safety Related	O/n	Routine maintenance of the valve, including replacing the packing, is a manufacturer's recommendation. Maintenance is a necessary requirement to ensure positive performance during the expected life of the valve. Emerson Process Management recommends replacing this component every 6 years or as needed due to individual valve operation and performance.	N/A	Graphite does not exhibit a tendency to degrade over time
Cage / Bonnet Spiral Wound Gasket, Key 28	Refer to following table	2	Non-Safety Related	O/n	Replace every time the bonnet is removed. Routine maintenance of the valve, including replacing this gasket, is a manufacturer's recommendation. Maintenance is a necessary requirement to ensure positive performance during the expected life of the valve. In order to perform maintenance on the trim, the bonnet must be removed. Once this seal is broken, ALL gaskets should be replaced.	N/A	Does not exhibit a tendency to degrade over time.
Backup Ring (Plug), Key 29	Refer to following table	1	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every outage to maintain maximum performance.	N/A	Does not exhibit a tendency to degrade over time.
Anti-Extrusion Ring (Plug), Key 30	Refer to following table	2	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every outage to maintain maximum performance.	N/A	Does not exhibit a tendency to degrade over time.
Spring Loaded Seal Ring (Plug), Key 31	Refer to following table	2	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every outage to maintain maximum performance.	N/A	Does not exhibit a tendency to degrade over time.
Retainer Ring (Plug), Key 32	Refer to following table	1	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every outage to maintain maximum performance.	N/A	Does not exhibit a tendency to degrade over time.
Backup Ring (Seat Ring), Key 33	Refer to following table	1	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every outage to maintain maximum performance.	N/A	Does not exhibit a tendency to degrade over time.
Packing Washer, Key 34	Refer to following table	4	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every 6 years.	N/A	Does not exhibit a tendency to degrade over time.
Anti-extrusion Ring (Seat Ring), Key 35	Refer to following table	2	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every outage to maintain maximum performance.	N/A	Does not exhibit a tendency to degrade over time.
Spring Loaded Seal Ring (Seat Ring), Key 36	Refer to following table	2	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every outage to maintain maximum performance.	N/A	Does not exhibit a tendency to degrade over time.
Retainer Ring (Seat Ring), Key 37	Refer to following table	1	Non-Safety Related	O/n	Cycled parts will exhibit wear over time. Based on experience and testing, Emerson Process Management recommends replacing this component every outage to maintain maximum performance.	N/A	Does not exhibit a tendency to degrade over time.

1. ME/n = construction/installation spares. P/n = preoperational spares. S/n = start-up spares. O/n = operational spares.
2. Dependent on good storage practices and conditions.
3. Maintenance schedule is dependent on service conditions.

*Recommended spare parts

Table 7. Keys 9, 11*, 12*, 13*, 14, 15, 16*, 17, 18, 19, 20, 21, 22, and 34* Packing Components

PACKING COMPONENT	KEY NUMBER	QUANTITY	PACKING STYLE	VALVE STEM SIZE
				31.75 mm (1-1/4-Inch)
Packing Flange	9	1	PTFE HIGH-SEAL	21B2199X012
Packing Box Ring	11*	1	PTFE HIGH-SEAL	12B5778X012
Guide Bushing	12*	2	PTFE HIGH-SEAL	GE50671X012
Packing Ring	13*	2	PTFE HIGH-SEAL	GE50680X012
Packing Nut	14	2	PTFE HIGH-SEAL	1A368135252
Packing Stud	15	2	PTFE HIGH-SEAL	1N471435222
Packing Ring	16*	2	PTFE HIGH-SEAL	GE50676X012
Packing Follower	17	1	PTFE HIGH-SEAL	22B5773X012
Packing Washer	18	2	PTFE HIGH-SEAL	1A3757X0022
Indicator	19	1	PTFE HIGH-SEAL	11B3811X012
Belleville Spring	20	2	PTFE HIGH-SEAL	GE50875X012
Machine Screw	21	4	PTFE HIGH-SEAL	1B2752X0022
Load Scale	22	2	PTFE HIGH-SEAL	GE51187X012
Packing Washer	34*	4	PTFE HIGH-SEAL	GE50681X012

Table 8. Key 5* and Key 28* Gasket Sets

VALVE SIZE, NPS	QUANTITY	PORT DIAMETER	GASKET PART NUMBER	
		Inch	Cage/Body Gasket (Key 5)	Cage/Body Gasket (Key 28)
16x20	1	ALL	GE06131X032	GG15396X012

Table 9. Key 2* Cage

VALVE SIZE, NPS	DATA SHEET(1)	DESCRIPTION	TRAVEL		PART NUMBER	MATERIAL
			mm	Inches		
16x20	101	Characterized	225.43	8.875	GG13901X012	S41000
1. Data Sheet Number refers to PV76 Data Sheets for the AP1000 Power Plant Design.						

Table 10. Key 3* Seat Ring Constructions

VALVE SIZE, NPS	DATA SHEET(1)	PORT DIAMETER		PART NUMBER	MATERIAL
		mm	Inches		
16x20	101	279.4	11	GE53102X032	F6A CL 1/CoCr-A
1. Data Sheet Number refers to PV76 Data Sheets for the AP1000 Power Plant Design.					

Table 11. Key 7 Body/Bonnet Mounting Studs

VALVE SIZE, NPS	DATA SHEET(1)	QUANTITY	STUD SIZE	PART NUMBER	MATERIAL
			Inch		
16x20	101	12	1-5/8-8 x 9.00	GE29630X022	SA 193 B7
1. Data Sheet Number refers to PV76 Data Sheets for the AP1000 Power Plant Design.					

Table 12. Key 8 Body/Bonnet Mounting Nuts

VALVE SIZE, NPS	DATA SHEET(1)	QUANTITY	STUD SIZE	PART NUMBER	MATERIAL
			Inch		
16x20	101	12	1 5/8-8	12A5208X052	SA 194 2H
1. Data Sheet Number refers to PV76 Data Sheets for the AP1000 Power Plant Design.					

Table 13. Key 24 Body/Bonnet Mounting Stud Washers

VALVE SIZE, NPS	DATA SHEET(1)	QUANTITY	PART NUMBER	MATERIAL
16x20	101	12	18B2801X032	18-8 SST
1. Data Sheet Number refers to PV76 Data Sheets for the AP1000 Power Plant Design.				

*Recommended spare parts

Table 14. Key 4* Valve Plug/Stem Assemblies by Data Sheet

VALVE SIZE, NPS	DATA SHEET(1)	DESCRIPTION	PORT DIAMETER	TRAVEL	STEM DIAMETER		PART NUMBER	MATERIAL
			Inch	Inch	mm	Inch		
16x20	101	Balanced	11	8.875	31.75	1.25	GG13904X022	F6A/CoCr-A/S41000
1. Data Sheet Number refers to PV76 Data Sheets for the AP1000 Power Plant Design.								

Table 15. Anti-extrusion Seal Part Numbers

VALVE SIZE, NPS	DATA SHEET(1)	PART DESCRIPTION	KEY NUMBER	QUANTITY	PORT DIAMETER	BORE SEAL PART NUMBER
					Inch	
16x20	101	Backup Ring (Plug)	29*	1	11	14B8273X032
		Anti-extrusion (Plug)	30*	1		GE14437X012
		Spring Loaded Seal Ring (Plug)	31*	1		GE43861X012
		Retainer Ring (Plug)	32*	1		14B8270X012
		Backup Ring (Seat Ring)	33*	1		GE53108X012
		Anti-extrusion (Seat Ring)	35*	1		GE53122X012
		Spring Loaded Seal Ring (Seat Ring)	36*	1		GE53126X012
		Retainer Ring (Seat Ring)	37*	1		GE53207X012
1. Data Sheet Number refers to PV76 Data Sheets for the AP1000 Power Plant Design.						

Table 16. Yoke Bolt Dimension

ACTUATOR SIZE	VALVE SIZE, NPS	DATA SHEET(1)	YOKE BOSS DIAMETER (INCH)
ATI 26	16x20	101	24 x 12.1
1. Data Sheet Number refers to PV76 Data Sheets for the AP1000 Power Plant Design.			

*Recommended spare parts

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