

Fisher™ V250 Ball Valve

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Figure 1. Fisher V250 Ball Valve with 1061 Actuator



Introduction

Scope of Manual

This instruction manual provides installation, maintenance, and parts ordering information for NPS 4 through 24 Fisher V250 valves (figure 1) that mate with ASME flanges. Other instruction manuals provide information covering the actuator and accessories.

Do not install, operate, or maintain a V250 valve without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Description

The V250 valve is a flangeless rotary control valve used for high pressure, throttling or on-off control of liquid or gas applications (see figure 1). These valves operate on a rotary motion input through a splined valve-shaft/actuator-shaft connection for use with power or manual handwheel actuators. The single seal, dual seal, and flow ring constructions are covered in this instruction manual.

Table 1. Specifications

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| <p>Valve Sizes and End Connection Styles</p> <p>NPS 4 through 24 flangeless valves retained by line flange bolts and designed to fit between ASME raised-face or ring-type joint flanges. See table 2 for valves that install between ASME flanges</p> <p>Maximum Inlet Pressure⁽¹⁾</p> <p>Consistent with applicable pressure-temperature ratings listed in table 2</p> <p>Maximum Allowable Shutoff Pressure Drop^(1,2,3)</p> <p>Single-Seal and Dual-Seal Construction: 155 bar (2250 psi) at 38°C (100°F) and 103 bar (1500 psi) at 82°C (180°F) except where further limited by the pressure-temperature rating of the valve body</p> <p>Flow Ring Construction: Limited by the pressure-temperature rating of the valve body</p> <p>Seal Material Temperature Capability⁽¹⁾</p> <p>Single-Seal and Dual-Seal Construction: -46 to 82°C (-50 to 180°F) with LCC or stainless steel valve bodies</p> <p>Flow Ring Construction with Nitrile O-Rings: -46 to 93°C (-50 to 200°F) with LCC steel and stainless steel valve bodies</p> <p>Flow Ring Construction with Fluorocarbon O-Rings: -46 to 204°C (-50 to 400°F) with LCC steel and stainless steel valve bodies</p> | <p>Flow Characteristic</p> <p>Modified equal percentage</p> <p>Flow Direction</p> <p>Forward Flow: Single seal construction is standard for forward flow (see figure 4)</p> <p>Bidirectional Flow: Flow ring construction can be used for either forward or reverse flow (see figure 5)</p> <p>Bidirectional Shutoff: Dual seal construction is required to provide shutoff for bidirectional flow (see figure 12)</p> <p>Shutoff Classification</p> <p>Single Seal and Dual Seal Constructions: 0.0001% of maximum valve capacity (less than 1% of Class IV, ANSI/FCI 70-2)</p> <p>Flow Ring Construction: 1% of maximum valve capacity</p> <p>Maximum Ball Rotation</p> <p>90 degrees</p> <p>Actuator Mounting</p> <p>Right-hand or left-hand mounted as viewed from the valve body inlet for forward flow</p> <p>Approximate Weights</p> <p>See table 3</p> |
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1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.
 2. Maximum allowable shutoff pressure drops are further limited for the following constructions. The NPS 12 with S20910 drive shaft is limited to 128 bar (1862 psi) from -46 to 59°C (-50 to 139°F) and to 103 bar (1490 psi) at 93°C (200°F). The NPS 16 with 17-4PH steel, with 2-1/2 inch splined drive shaft is limited to 69 bar (1000 psi), and with the S20910, 2-1/2 inch splined drive shaft is limited to 55 bar (795 psi) at all service temperatures. The NPS 24 with S20910 drive shaft is limited to 92 bar (1336 psi) at all service temperatures.
 3. NPS 20 CL900 and NPS 24 CL900 flow ring is limited to 1500 psi.

Table 2. Pressure Rating and Flange Compatibility

| Valve Size, NPS | Inlet Pressure Capability | ASME Flange Compatibility |
|-----------------|--------------------------------------------|-----------------------------------------------------------------|
| 4 | Consistent with CL600 or 900 (ASME B16.34) | CL600 or 900 raised face or ring-type joint flange (ASME B16.5) |
| 6 | | |
| 8 | | |
| 10 | | |
| 12 | Consistent with CL600 (ASME B16.34) | CL600 raised face or ring-type joint flange (ASME B16.5) |
| 16 | | |
| 20 | Consistent with CL600 or 900 (ASME B16.34) | CL600 or 900 raised face or ring-type joint flange (ASME B16.5) |
| 24 | | |

Table 3. Approximate Weights

| VALVE SIZE, NPS | WEIGHT | |
|-----------------|-----------|--------|
| | Kilograms | Pounds |
| 4 | 73 | 160 |
| 6 | 132 | 290 |
| 8 | 222 | 490 |
| 10 | 345 | 760 |
| 12 | 431 | 950 |
| 16 | 771 | 1700 |
| 20 (CL600) | 1814 | 4000 |
| 20 (CL900) | 2045 | 4500 |
| 24 | 2404 | 5300 |

Installation

⚠ WARNING

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

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given on the valve and actuator nameplates. Use pressure-relieving devices as required by accepted industry, local, state, or federal 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

Avoid personal injury or property damage caused by uncontrolled movement or dropping of the valve assembly.

Hoist rings are sized to lift only the valve and actuator. Do not use hoist rings to lift the valve if piping or other structures are added.

Rig the lift to use two hoist rings and take appropriate precautions to avoid unbalanced loading which may result in sudden swinging or movement of the assembled unit, including additional lifting and/or support methods when necessary.

Failure to utilize safe lifting practices may result in equipment damage and/or personal injury.

1. If the valve will be placed in storage prior to installation, protect the flanges and keep the inside of the valve dry and clear of foreign material.
2. Install a three-valve bypass around the control valve assembly if continuous operation will be necessary during inspection and maintenance of the valve.
3. Inspect the valve body for damage and be certain that the valve body cavity is free of foreign material.
4. Be certain that adjacent pipelines are free of any foreign material, such as pipe scale or welding slag, that could damage the valve body seating surfaces.
5. A V250 valve is normally shipped as part of a control valve assembly, with a power or manual handwheel actuator mounted on the valve. If the valve and actuator have been purchased separately or if the actuator has been

removed for maintenance, mount the actuator according to the actuator mounting procedure and adjust actuator travel before inserting the valve into the pipeline. This allows necessary measurements to be made during the actuator adjustment process.

The actuator can be either right-or left-hand mounted, as viewed from the valve body inlet, in any of the positions shown in figure 10. Refer to the Actuator Mounting procedure in this manual and to the actuator instruction manual for mounting and adjusting instructions before proceeding.

6. Before installing the valve, make sure the flow through the valve matches the flow direction arrow on the valve. Failure to do so can damage the seal in a valve with a single seal construction.

For bidirectional flow, install the valve so the highest pressure flow matches the flow direction arrow on the valve. Install the V250 valve in any position, but the recommended orientation is in a horizontal pipeline with the shaft positioned horizontally and the ball closing in the downward direction.

CAUTION

To avoid damage to the ball sealing surface, rotate the ball to the fully open position before installing the valve between the pipeline flanges.

7. With the ball in the fully open position, install line flange gaskets and insert the valve between the pipeline flanges. Use standard composition gaskets, or other flat sheet gaskets compatible with the flow media, between the valve and the pipeline flanges. Spiral wound gaskets without compression controlling centering rings are not recommended.

CAUTION

Uneven tightening of line bolts may cause uneven wear of the ball surface, leakage downstream or to atmosphere, or uneven flange gasket alignment. Tighten line bolts evenly when installing the valve.

8. Center the valve in the line by making sure the mating flanges are aligned. Secure the valve in the line with the cap screws (keys 33 and 34, figures 11 and 12), line bolts (key 35, not shown), and hex nuts (key 44, not shown). Required clearances for installation of the line bolts and cap screws are shown in figure 2. When tightening the cap screws and line bolts, use accepted bolting procedures. Lubricate the studs or bolts and tighten the nuts in a crisscross sequence to ensure proper alignment of the valve with the flanges.
9. For hazardous atmosphere or oxygen service valves, read the following **WARNING**, and perform the instruction provided in the **WARNING** and provide the bonding strap assembly mentioned in Step 10 below if the valve is used in a hazardous application.

⚠ WARNING

The V250 is not necessarily grounded to the pipeline when installed. If the process fluid or the atmosphere around the valve is flammable, personal injury or property damage could result from an explosion caused by a discharge of static electricity from the valve components. If the valve is installed in a hazardous area, electrically bond the drive shaft to the valve.

Note

The packing is composed of all conductive packing rings (graphite ribbon packing) to electrically bond the shaft to the valve for hazardous area service or non-conductive PTFE packing rings. For oxygen service applications, perform the following step.

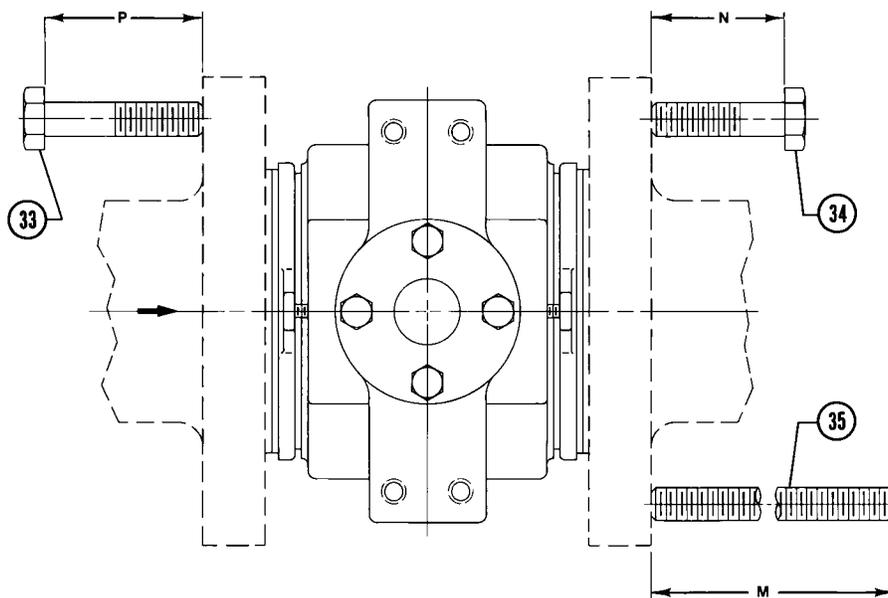
Figure 2. Flange Bolt Lengths

| VALVE SIZE, NPS | CL600 BOLTING DIMENSIONS | | | | | |
|-----------------|--------------------------|-------|------------------|-------------------------|-------|------------------|
| | Raised Face Flanges | | | Ring Type Joint Flanges | | |
| | P | N | M ⁽¹⁾ | P | N | M ⁽¹⁾ |
| mm | | | | | | |
| 4 | --- | --- | 343 | --- | --- | 343 |
| 6 | 118 | 118 | 413 | 124 | 124 | 413 |
| 8 | 140 | 137 | 445 | 143 | 140 | 451 |
| 10 | 159 | 162 | 527 | 165 | 165 | 527 |
| 12 | 178 | 152 | 584 | 178 | 165 | 584 |
| 16 | 197 | 197 | 660 | 203 | 203 | 673 |
| 20 | 254 | 254 | --- | 254 | 254 | --- |
| 24 | 330 | 330 | --- | 343 | 343 | --- |
| Inch | | | | | | |
| 4 | --- | --- | 13.50 | --- | --- | 14.50 |
| 6 | 4.63 | 4.63 | 16.25 | 4.88 | 4.88 | 16.25 |
| 8 | 5.50 | 5.38 | 17.50 | 5.63 | 5.50 | 17.75 |
| 10 | 6.25 | 6.38 | 20.75 | 6.50 | 6.50 | 20.75 |
| 12 | 7.00 | 6.00 | 23.00 | 7.00 | 6.50 | 23.00 |
| 16 | 7.75 | 7.75 | 26.00 | 8.00 | 8.00 | 26.50 |
| 20 | 10.00 | 10.00 | --- | 10.00 | 10.00 | --- |
| 24 | 13.00 | 13.00 | --- | 13.50 | 13.50 | --- |

1. These bolts may be installed from either end of the valve.

| VALVE SIZE, NPS | CL900 BOLTING DIMENSIONS | | | | | |
|-------------------|--------------------------|------|------------------|-------------------------|------|------------------|
| | Raised Face Flanges | | | Ring Type Joint Flanges | | |
| | P | N | M ⁽¹⁾ | P | N | M ⁽¹⁾ |
| mm | | | | | | |
| 4 | 124 | 124 | 375 | 124 | 130 | 375 |
| 6 | 127 | 127 | 445 | 127 | 133 | 445 |
| 8 | 152 | 149 | 483 | 152 | 156 | 483 |
| 10 | 168 | 171 | 546 | 168 | 175 | 546 |
| 12 | 184 | 168 | 610 | 184 | 191 | 610 |
| 20 ⁽²⁾ | --- | --- | 420 | --- | --- | 420 |
| Inch | | | | | | |
| 4 | 4.88 | 4.88 | 14.75 | 4.88 | 5.13 | 14.75 |
| 6 | 5.00 | 5.00 | 17.50 | 5.00 | 5.25 | 17.50 |
| 8 | 6.00 | 5.88 | 19.00 | 6.00 | 6.13 | 19.00 |
| 10 | 6.63 | 6.75 | 21.5 | 6.63 | 6.88 | 21.50 |
| 12 | 7.25 | 6.63 | 24 | 7.25 | 7.50 | 24.00 |
| 20 ⁽²⁾ | --- | --- | 16.5 | --- | --- | 16.5 |

1. These bolts may be installed from either end of the valve.
2. For NPS 20 size, only studs and nuts are used. See the M dimension.



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- Attach the bonding strap assembly (key 41, figure 3) to the shaft with the clamp (key 40, figure 3), and connect the other end of the bonding strap assembly to the valve with the machine screw (key 43, figure 3).
- Connect pressure lines to the actuator as indicated in the actuator instruction manual. When a manual actuator is used with a power actuator, install a bypass valve on the power actuator (if not already supplied) for use during manual operation.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions. Instructions are presented in this section for replacing the shaft seals, the ball seal or flow ring, the drive and follower shafts, the ball and bushing, and the valve outlet gasket.

Key number locations are shown in figure 11 for single seal and flow ring constructions, and in figure 12 for dual seal constructions.

⚠ WARNING

Personal injury or property damage can result due to a sudden release of pressure or process fluid if the pipe plug (key 42, figure 12) is removed while the valve is pressurized. To avoid such injury or damage, remove the pipe plug only when the control valve is isolated from the pressure system, or provide a hand valve to control relief of internal valve pressure to avoid personal injury or property damage.

A V250 valve with a dual seal construction contains a pipe plug port (key 42, figure 12) on the underside of the valve. This port can be used to relieve internal valve pressure for testing seal integrity when in the pipeline.

If the pipe plug port is to be used for testing seal integrity when the valve is in the pipeline, the plug should be replaced with a hand valve to allow controlled relief of valve pressure during seal leak rate testing.

⚠ 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 either side of the valve.
- For dual seal valve constructions, remove pressure and drain the valve interior by removing the pipe plug (key 42).
- Vent the power actuator loading pressure.
- 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.

Replacing the Follower Shaft Seal

Both the follower and drive shaft seals should be replaced at the same time. Key number locations are shown in figure 11 or 12.

Perform this procedure if there is leakage around the follower shaft (key 7). Such leakage is an indication that the shaft seal, which includes the seal and a backup ring, (key 16) must be replaced. The following procedure may be performed with the valve in the pipeline.

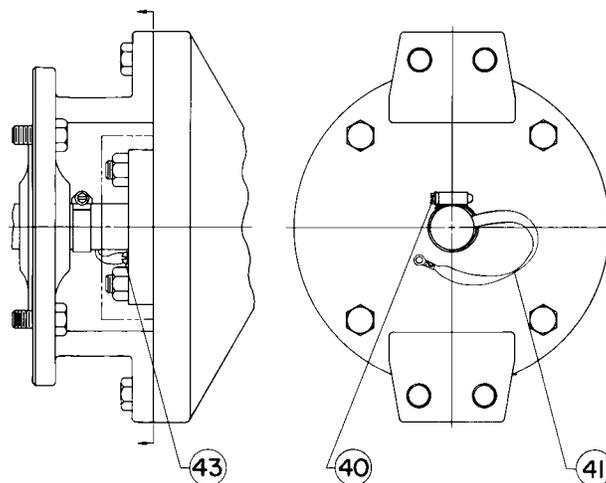
1. Isolate the control valve from the line pressure, release pressure from both sides of valve, and drain the process media from both sides of the valve. For dual seal valve constructions, remove pressure and drain the valve interior cavity. Shut off and disconnect all lines from the power actuator.

⚠ WARNING

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

2. Unscrew the hex nuts (key 8) and remove the seal carrier (key 3) and shaft seal (key 16). Inspect and clean all parts and sealing surfaces on the seal carrier and follower shaft (key 7). Also, inspect and replace the O-ring (key 23) if necessary.
3. Install the new backup ring and shaft seal in the seal carrier.

Figure 3. Optional Shaft-to-Body Bonding Strap Assembly



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4. Align the drive pin (key 28) with the drilled hole on the inner surface of the seal carrier, replace the seal carrier, and secure it with the hex nuts (key 8). Be careful not to damage the shaft seal or O-ring during replacement of the seal carrier.

Replacing the Drive Shaft Seal

Perform this procedure if there is leakage around the drive shaft (key 6). Such leakage is an indication that the shaft seal, which includes the seal and a backup ring, (key 16) must be replaced. This procedure may be performed with the valve in the pipeline. However, the actuator must be removed from the valve.

Note

The valve shaft's sealing surfaces are critical in obtaining a good seal. If the valve shafts are scratched, nicked or worn, replace or repair the valve shaft before installing new shaft seals.

Both seal rings, drive end and follower end, should be replaced at the same time.

1. Isolate the control valve from the line pressure, release pressure from both sides of valve, and drain the process media from both sides of the valve. For dual seal valve constructions, remove pressure and drain the valve interior cavity. Shut off and disconnect all lines from the power actuator.

⚠ WARNING

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

CAUTION

When removing the actuator in the following step, use a wheel puller to separate the actuator parts from the valve shaft. Failure to do this could cause damage to the actuator parts and the drive shaft.

2. Remove the cap screws (key 29) from the actuator mounting yoke and, while referring to the actuator instruction manual for assistance, remove the actuator. For oxygen service and hazardous area applications, remove the clamp and bonding strap assembly (keys 40 and 41, figure 3).
3. Install the new backup ring and shaft seal in the seal carrier. Be sure to install the backup ring on the correct side (see figure 4).
4. Replace the seal carrier and secure it with the hex nuts (key 8). Be careful not to damage the shaft seal or O-ring during replacement of the seal carrier.
5. Mount the actuator to the valve while referring to the Actuator Mounting section of this instruction manual and to the appropriate actuator instruction manual. If appropriate, install or replace the bonding strap assembly and the clamp (key 41 and 40, figure 3).

Replacing Ball Seal or Flow Ring

Perform this procedure if the control valve is not shutting off properly (that is, leaking downstream). This procedure does not require removing the actuator from the valve. In addition to being shown in figures 11 and 12, key numbers are shown in figure 5 for the ball seal constructions and in figure 6 for the flow ring construction.

Removal

1. Isolate the control valve from the line pressure, release pressure from both sides of valve, and drain the process media from both sides of the valve. For dual seal valve constructions, remove pressure and drain the valve interior cavity. Shut off and disconnect all lines from the power actuator.

⚠ WARNING

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

⚠ WARNING

The ball (key 2) closes with a shearing motion. To avoid personal injury, keep hands, tools, and other objects away from the ball while stroking the valve.

CAUTION

Damage to the ball (key 2) may occur if the ball is not in the fully open position while the valve is being removed from the pipeline. If necessary, pressure the actuator temporarily to retain the ball in the open position while removing the valve from the pipeline.

2. With the ball in the fully open position, unscrew the line bolts and remove the valve from the pipeline.
3. Unscrew the cap screws (key 15, figures 11 and 12 only) and remove the seal protector ring (key 14) or the flow ring (key 14) from the inlet end of the valve. Then remove the O-ring (key 13), the ball seal (key 11), and the shim seals (key 10). The flow ring construction will have no ball seal. For a dual seal construction, repeat this procedure on the other end of the valve.
4. Thoroughly clean all metal surfaces. Check all parts for damage, and replace damaged parts with new parts if necessary.

Figure 4. Ball Seal Detail

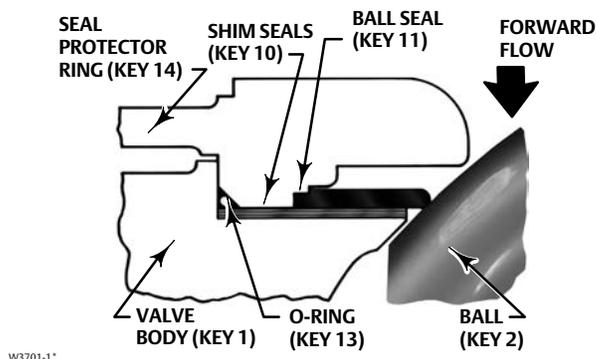


Figure 5. Flow Ring Detail

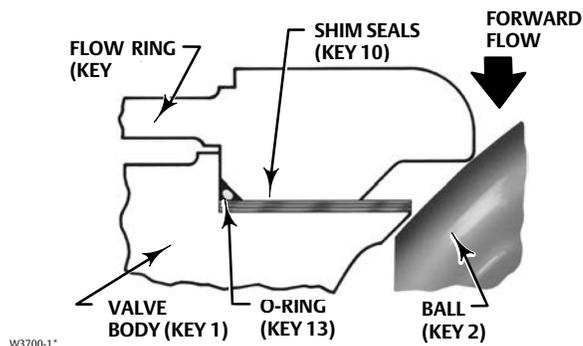
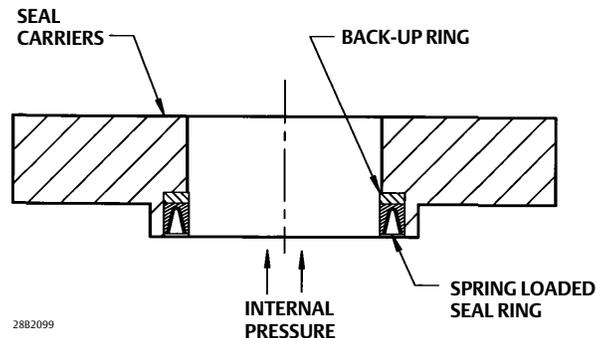


Figure 6. Seal & Backup Ring Assembly



5. Proceed to the appropriate Installation procedure to install the removed parts.

Installation of Single or Dual Ball Seal

1. Check the seal surface of the valve (key 1) for scratches that may prevent the shim seals (key 10) from sealing off internal valve pressures.
2. Rotate the ball (key 2) to the closed position as indicated by the travel indicator scale (key 37, figures 10 and 11 only).
3. Place the appropriate number of shim seals into the valve:
 - For NPS 4 through 10 valves, insert up to 6 shim seals into the valve.
 - For NPS 12 through 24 valves, insert up to 7 shim seals into the valve.
4. Inspect the sealing surface of the ball seal (key 11) for possible damage. Then place the ball seal on top of the shim seals with any nicks or scratches facing away from the ball.
5. Add or remove the 0.25 mm (0.010 inch) thick shim seals to the valve until the ball seal firmly contacts the ball sealing surface (i.e., without rocking) when pressed tightly against the shim seal assembly.
6. Temporarily remove the ball seal, and remove 3 shim seals.
7. Replace the ball seal, and then place the O-ring (key 13) into the valve.
8. With the ball seal centered on the ball, install the seal protector ring (key 14) and secure it to the valve with the cap screws (key 15).
9. For dual seal constructions, repeat this procedure on the other end of the valve.

Installation of Flow Ring

1. Check the seal surface of the valve (key 1) for scratches that may prevent the shim seals (key 10) from sealing off internal valve pressures.
2. Rotate the ball (key 2) to the closed position as indicated by the indicator scale (key 37, figure 11 only).
3. Place the appropriate number of shim seals into the valve:
 - For NPS 4 through 10 valves, insert 6 shim seals into the valve.
 - For NPS 12 through 24 valves, insert 7 shim seals into the valve.
4. Making certain the flow ring (key 14) is centered and does not contact the ball, secure the flow ring to the valve with the cap screws (key 15).

5. Measure the clearance between the flow ring and the ball with a wire gauge. Add or subtract shim seals until the minimum clearance is 0.38 mm (0.015 inches) for valves used for forward flow and 0.76 mm (0.030 inches) for reverse flow.
6. Once minimum clearance is obtained, temporarily remove the flow ring.
7. Insert the O-ring (key 13) into the valve, and secure the flow ring to the valve with the cap screws (key 15).

Installing Live-Loaded PTFE Packing

These steps refer only to the Live Loaded PTFE Packing. Key number locations are shown in figures 11, 12, and 13.

Note

The valve shaft's packing surfaces are critical in obtaining a good seal. If the valve shafts are scratched, nicked or worn, replace or repair the valve shaft before installing the Live Loaded PTFE Packing parts. Both seal rings, drive end and follower end, should be replaced at the same time.

1. Remove the hex nuts (key 8) from the seal carrier (key 17 on the drive shaft end and key 3 on the follower shaft end). Remove the spacer (key 22). On NPS 4, 12, and 24 valves, the stud bolt (key 4) will need to be removed. The drive pin (key 28) needs to be removed from the outboard end of the valve body.
2. Replace the seal carrier and spacer with the new packing box (key 17 or 3). To keep the ball properly centered inside the valve body, the bushing spacer shims may need to be added or removed (see the Replacing Drive Shaft, Follower Shaft, Ball, Bushings, and Valve Outlet Gasket -- Assembly section).
3. Secure the packing box with hex nuts (key 8), for NPS 6, 8, 10, 16, or 20 valves, or socket head cap screw (key 4), for NPS 4, 12, or 24 valves. Lubricate the hex nuts or cap screws and tighten them. Be careful not to damage the O-ring during installation of the packing box.
4. Install the packing box studs (key 100).

Note

The Belleville springs must be stacked properly and packing box parts must be assembled in the correct order, if the packing parts are to function properly.

5. Install the packing ring, female and male adaptors, anti-extrusion rings, and packing box rings (keys 105, 106, and 107). Be sure to install the packing rings in the order and quantity shown in figure 13.
6. Install the spring pack assembly (key 103 or 104), which includes the Belleville springs, packing follower, and O-ring. The O-ring is a non-functional part used to retain the packing springs during assembly.
7. Install the packing flange (key 102) on the shaft. Then lubricate and install the packing nuts (key 101), hand tightening them. Apply lubricant to the stud threads, internal nut threads and contacting face of the nut. Packing flanges with flats on the sides may need to be oriented with the mounting bracket so the flange will fit between the legs of the bracket.
8. To obtain optimum maximum benefit from the packing system, tighten the packing flange nuts and compress the Belleville springs to their Target Load. The Belleville springs are designed to provide optimum performance at their Target Load, 85% of their maximum deflection/compression.

To obtain the Target Load compression, tighten the packing flange nuts alternately and evenly, keeping the packing flange parallel with the valve flange, until the Belleville springs are compressed 100%. Then loosen each packing flange nut one half turn (180° of rotation).

Replacing Drive Shaft, Follower Shaft, Ball, Bushings, and Valve Outlet Gasket

This procedure is to be performed to replace the valve ball, the drive shaft, and the follower shaft, if the ball does not rotate in response to rotation of the actuator end of the drive shaft, or if there is leakage around the outlet gasket.

Disassembly

CAUTION

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever off the valve shaft. Driving the actuator lever off the valve shaft could move the ball (key 2) from the centered position, causing damage to the ball, the ball seal (key 11), and the valve (key 1).

Use care when removing the actuator lever and, if necessary, use a wheel puller to remove the lever or actuator from the valve shaft. It is okay to tap the wheel puller screw lightly to loosen the lever or actuator, but hitting the screw with excessive force could also damage the valve.

1. Remove the cap screws (key 29) from the actuator mounting yoke and, while referring to the actuator instruction manual for assistance, remove the actuator. If appropriate, remove the clamp and bonding strap assembly (key 40 and 41, figure 3).
2. Remove either the seal protector ring (key 14) or the flow ring (key 14) from the inlet end of the valve assembly by following steps 1, 2, and 3 of the Replacing Ball Seal or Flow Ring section. For dual seal constructions, note that this procedure should be repeated on the outlet end of the valve.
3. Proceed as appropriate: For single seal constructions and flow ring constructions (figure 11 only), remove the cap screws (key 15). Then, remove the valve outlet (key 5) and gasket (key 12).

Note

Perform the following step with the inlet end of the valve assembly facing upward and with the ball (key 2) in the fully open position.

4. Remove the hex nuts (key 8) from the follower shaft (key 7) side of the valve. Then remove the seal carrier (key 3). Inspect and replace the seal (key 16) and O-ring (key 23) if necessary.

Note

During the following step, it may be necessary to apply heat to the retainer screw (key 32) to disengage the thread locking adhesive (high strength) (key 30) that holds the retainer screw in place.

5. Remove the retainer screw (key 32).
6. Using a soft-faced hammer to prevent damaging the end of the follower shaft (key 7), drive the follower shaft into the flow bore of the ball just enough so that the split ring (key 31) can be removed. Then remove the split ring.

Table 4. Shaft Retainer and Retainer Screw Torques

| VALVE SIZE, NPS | N•m | | Lbf•Ft | |
|--------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| | Shaft Retainer (Key 25) | Retainer Screw (Key 32) | Shaft Retainer (Key 25) | Retainer Screw (Key 32) |
| 4 | 136 | 27 | 100 | 20 |
| 6 | 759 | 27 | 560 | 20 |
| 8 | 1390 | 41 | 1025 | 30 |
| 10 | 1760 | 41 | 1295 | 30 |
| 12 | 2390 | 68 | 1760 | 50 |
| 16 | 3830 | 68 | 2825 | 50 |
| 20 | 6660 | 68 | 4910 | 50 |
| 24 | 12300 | 68 | 9075 | 50 |

7. Remove the follower shaft (key 7), the spacer (key 22), the bushing spacer shims (key 18), the bushing (key 20), the thrust washer (key 19), and the thrust spacer (key 21) from the valve.
8. Insert a ball support post (see figure 7) into the follower shaft (key 7) bore of the valve. Use of the ball support post will ensure that the ball sealing surfaces will not get damaged as the shaft retainer (key 25) is being removed. Position the ball support post so that the ball will be supported firmly inside the valve body cavity during the performance of the next three steps.

Note

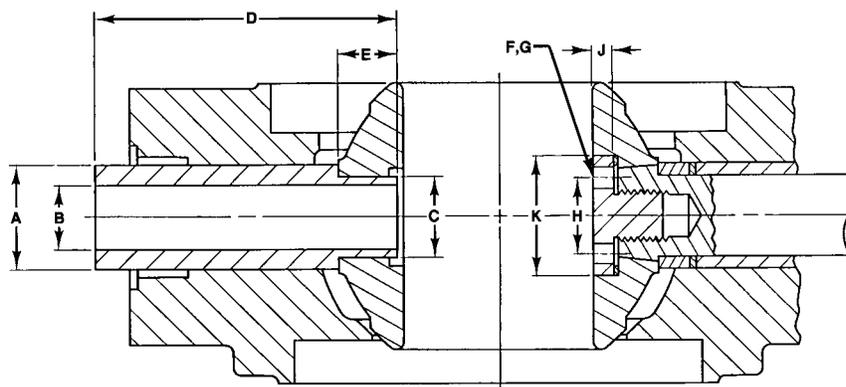
During the following step, it may be necessary to apply heat to the shaft retainer (key 25) to disengage the thread locking adhesive (high strength) (key 30) that holds the shaft retainer in place.

9. Remove the shaft retainer (key 25) and the washer (key 24).
10. Remove the hex nuts (key 8) from the drive shaft (key 6) side of the valve. Then remove the seal carrier (key 17). Inspect and replace the seal (key 16) and O-Ring (key 23) if necessary.
11. With the ball firmly supported, remove the drive shaft (key 6) and attached parts out of the valve. Attached parts will include the spacer (key 22), the bushing spacer shims (key 18), the bushing (key 20), the thrust washer (key 19), and the thrust spacer (key 21).
12. While maintaining firm support of the ball (key 2), proceed as follows:
 - a. First, remove the ball support post through the follower shaft bore of the valve.
 - b. Then, while being careful not to damage the sealing surfaces of the ball, remove the ball through the outlet end of the valve.
13. Inspect and, if necessary, replace all parts. Then, proceed to the assembly procedure below.

Figure 7. Ball Support Post Dimensions

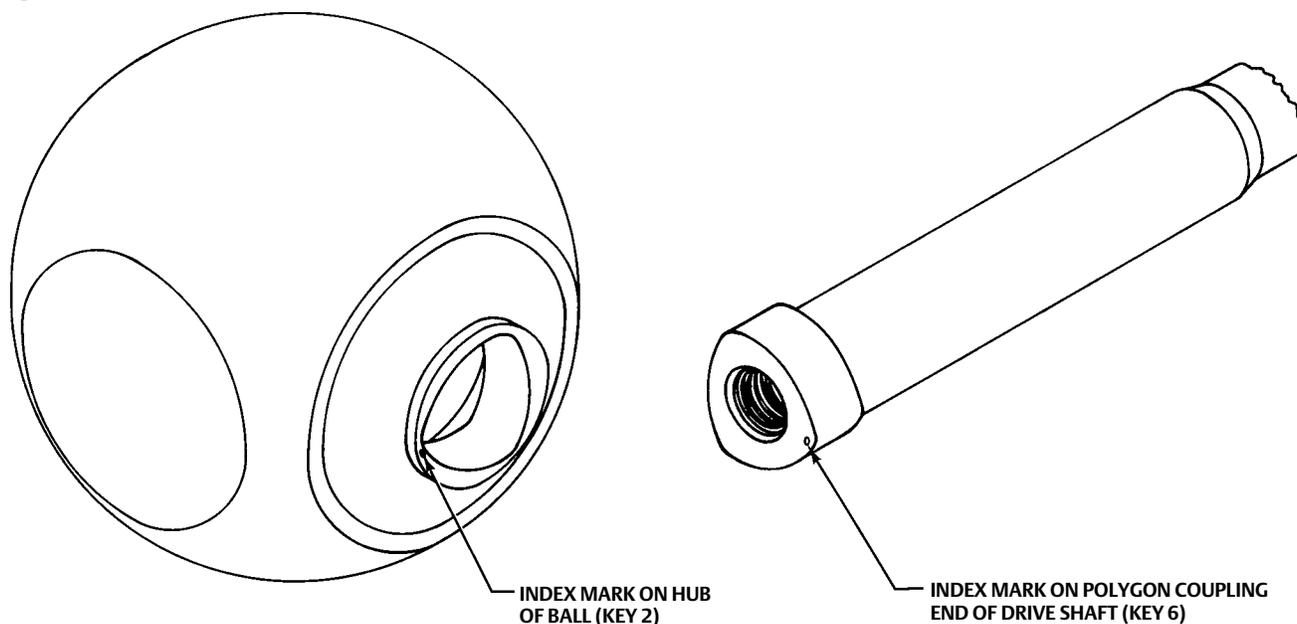
| VALVE SIZE NPS | A ⁽¹⁾ | B | C ⁽¹⁾ | D | E | F ⁽²⁾ | G ⁽¹⁾ | H | J | K |
|-------------------|------------------|-------|------------------|--------|-------|------------------|------------------|--------|-------|--------|
| mm | | | | | | | | | | |
| 4 | 41.02 | 23.83 | 31.62 | 146.1 | 22.23 | 4 | 8.69 | 30.18 | 7.95 | 46.05 |
| | 40.77 | | 31.37 | | | | 9.04 | | | |
| 6 | 63.25 | 41.28 | 50.67 | 165.1 | 25.40 | 4 | 13.39 | 46.02 | 11.13 | 68.28 |
| | 62.99 | | 50.42 | | | | 13.89 | | | |
| 8 | 75.95 | 50.80 | 63.37 | 215.9 | 34.93 | 4 | 16.56 | 55.58 | 12.70 | 85.73 |
| | 75.69 | | 63.12 | | | | 17.07 | | | |
| 10 | 85.47 | 53.98 | 69.72 | 215.9 | 44.45 | 4 | 16.56 | 55.58 | 15.88 | 87.33 |
| | 85.22 | | 69.47 | | | | 17.07 | | | |
| 12 | 91.82 | 60.33 | 76.07 | 228.6 | 50.80 | 4 | 19.74 | 65.07 | 14.30 | 100.03 |
| | 91.57 | | 75.82 | | | | 20.35 | | | |
| 16 | 126.7 | 82.55 | 101.3 | 292.1 | 66.68 | 4 | 26.04 | 93.68 | 19.05 | 138.13 |
| | 126.4 | | 101.0 | | | | 26.70 | | | |
| 20 | 152.1 | 104.8 | 126.7 | 336.6 | 85.73 | 4 | 26.04 | 93.68 | 23.83 | 163.53 |
| | 151.8 | | 126.4 | | | | 26.70 | | | |
| 24 | 180.6 | 127.0 | 152.1 | 368.3 | 92.08 | 4 | 32.39 | 136.53 | 25.40 | 195.28 |
| | 180.2 | | 151.8 | | | | 33.05 | | | |
| Inches | | | | | | | | | | |
| 4 | 1.615 | 0.938 | 1.245 | 5.750 | 0.875 | 4 | 0.342 | 1.188 | 0.313 | 1.813 |
| | 1.605 | | 1.235 | | | | 0.356 | | | |
| 6 | 2.490 | 1.625 | 1.995 | 6.500 | 1.000 | 4 | 0.527 | 1.812 | 0.438 | 2.688 |
| | 2.480 | | 1.985 | | | | 0.547 | | | |
| 8 | 2.990 | 2.000 | 2.495 | 8.500 | 1.375 | 4 | 0.652 | 2.188 | 0.500 | 3.375 |
| | 2.980 | | 2.485 | | | | 0.672 | | | |
| 10 | 3.365 | 2.125 | 2.745 | 8.500 | 1.750 | 4 | 0.652 | 2.188 | 0.625 | 3.438 |
| | 3.355 | | 2.735 | | | | 0.672 | | | |
| 12 | 3.615 | 2.375 | 2.995 | 9.000 | 2.000 | 4 | 0.777 | 2.562 | 0.563 | 3.938 |
| | 3.605 | | 2.985 | | | | 0.801 | | | |
| 16 | 4.990 | 3.250 | 3.990 | 11.500 | 2.625 | 4 | 1.025 | 3.688 | 0.750 | 5.438 |
| | 4.975 | | 3.975 | | | | 1.051 | | | |
| 20 | 5.990 | 4.125 | 4.990 | 13.250 | 3.375 | 4 | 1.025 | 3.688 | 0.938 | 6.438 |
| | 5.975 | | 4.975 | | | | 1.051 | | | |
| 24 | 7.110 | 5.000 | 5.990 | 14.500 | 3.625 | 4 | 1.275 | 5.375 | 1.000 | 7.688 |
| | 7.095 | | 5.975 | | | | 1.301 | | | |

1. Tolerances for the A and C dimensions are indicated by showing maximum and minimum dimensions.
 2. Numbers of holes in port.



39A1059-B
A3141-1

Figure 8. Index Marks on Drive Shaft and Ball



79BA08073-A
B1793

Assembly

1. Position the ball (key 2) so that it is firmly supported inside the valve (key 1). Insert a ball support post (see figure 7) into the follower shaft (key 7) bore of the valve. Position the ball support post so that the ball will be supported firmly inside the valve body cavity while performing steps 2 through 5.

CAUTION

Damage to the valve assembly and downstream equipment could occur if the shaft retainer (key 25) should become disengaged from the drive shaft (key 6) during operation of a V250 control valve assembly. To prevent such damage, make sure that the internal threads in the Polygon coupling end of the drive shaft and the external threads of the shaft retainer are cleaned thoroughly before applying thread locking adhesive (high strength) (key 30) as described in step 5 of this assembly procedure.

2. Insert the drive shaft (key 6) into the drive shaft side of the valve and ball assembly. When inserting the drive shaft, make sure that the index mark on the Polygon coupling end of the drive shaft is aligned with the index mark on the hub of the ball. Refer to figure 8 for the location of these index marks.
3. Install the thrust spacer (key 21) into the drive shaft side of the valve and position it so that it is in contact with the ball hub. Then, install the thrust washer (key 19) and the bushing (key 20).
4. Insert the washer (key 24) into the ball. Lubricate the exposed surface of the washer with a good quality grease or lubricant.

CAUTION

Improper tightening of the shaft retainer (key 25) could allow the shaft retainer to become disengaged from the drive shaft (key 6) during operation of a V250 control valve assembly. This could cause damage to the valve assembly and downstream

equipment. To prevent such damage, make sure that the shaft retainer is tightened to the appropriate torque value listed in table 4.

5. Apply thread locking adhesive (high strength) (key 30) to the threads of the shaft retainer (key 25). Then, install the shaft retainer into the inside end of the drive shaft. Tighten the shaft retainer to the torque value listed in table 4.

CAUTION

Damage to the valve assembly and downstream equipment could occur if the retainer screw (key 32) should become disengaged from the follower shaft (key 7) during operation of a V250 control valve assembly. To prevent such damage, make sure that the internal threads in the inside end of the follower shaft and the external threads of the retainer screw are cleaned thoroughly before applying thread locking adhesive (high strength) (key 30) as described in step 8 of this assembly procedure.

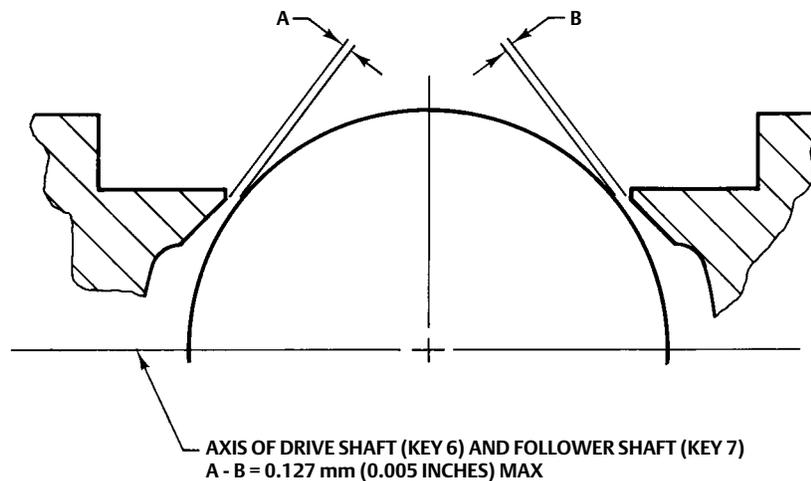
6. While maintaining firm support of the ball (key 2), remove the ball support post through the follower shaft bore of the valve. Then install the follower shaft into the valve. When installing the follower shaft, make sure that the drilled hole containing the two pins (key 9) is aligned with the two notches machined on the inside surface of the ball hub.
7. Temporarily position the follower shaft so that it protrudes slightly into the flow bore of the ball. Place the split ring (key 31) on the end of the follower shaft. Then, return the follower shaft to its original position.

CAUTION

Improper tightening of the retainer screw (key 32) could allow the retainer screw to become disengaged from the follower shaft (key 7) during operation of a V250 control valve assembly. This could cause damage to the valve assembly and downstream equipment. To prevent such damage, make sure that the retainer screw is tightened to the appropriate torque value listed in table 4.

8. Apply thread locking adhesive (high strength) (key 30) to the threads of the retainer screw. Then, install the retainer screw into the inside end of the follower shaft until it is at least flush with the end surface of the follower shaft. Make sure that the drilled hole containing the two pins (key 9) is still aligned with the two notches machined on the inside surface of the ball hub. Tighten the retainer screw to the torque value listed in table 4.
9. Install the thrust spacer (key 21) into the follower shaft side of the valve and position it so that it is in contact with the ball hub. Then, install the thrust washer (key 19) and the bushing (key 20).
10. Center the ball inside the valve along the axis of both the drive shaft and the follower shaft. The maximum deviation in measurement between the valve and ball from one side to the other should be no more than 0.005 inches (0.127 mm) as shown in figure 9.
11. In order to maintain proper centering of the ball inside the valve, the bushing spacer shims (key 18) must be installed in the following manner:
 - a. For the **drive shaft** side of the valve, install several bushing spacer shims around the drive shaft and into the valve.
 - b. Then, temporarily install the spacer (key 22) and the seal carrier (key 17).
 - c. Repeat this process, but add only one more bushing spacer shim into the valve each time, until contact between the seal carrier and the valve is broken.
 - d. Then, remove one bushing spacer shim and secure the spacer and seal carrier to the valve with the hex nuts (key 8). Be careful not to damage the seal (key 16) or O-ring (key 23) during replacement of the seal carrier.

Figure 9. Proper Alignment for Centering the Ball



FG51287-A
A3142

- a. For the follower shaft side of the valve, install several bushing spacer shims around the follower shaft and into the valve.
 - b. Then, temporarily install the spacer (key 22) and the seal carrier (key 3).
 - c. Repeat this process, but add only one more bushing spacer shim into the valve each time, until contact between the seal carrier and the valve is broken.
 - d. Then, remove one bushing spacer shim and secure the spacer and seal carrier to the valve with the hex nuts (key 8). Be careful not to damage the seal (key 16) or O-ring (key 23) during replacement of the seal carrier.
12. Install the seal protector ring (key 14, figure 5) or the flow ring (key 14, figure 6) and all remaining parts by following the appropriate procedures presented in the Ball Seal and Flow Ring Maintenance section.
 13. For NPS 20 CL900 and NPS 24 CL900 valves, lifting hoist rings are provided. If the safety hoist rings were removed, replace them and torque them to 312 N•m (230 lbf•ft).
 14. Mount the actuator to the valve while referring to the actuator mounting section of this instruction manual and to the appropriate actuator instruction manual. If appropriate, replace the bonding strap assembly and the clamp (key 41 and 40, figure 4).
 15. Install the valve into the pipeline by referring to the Installation section of this instruction manual.

Figure 10. Index Marks for Actuator Mounting

| NPS 4 TO 12 V250 MOUNTING | | | | | | |
|---------------------------|----------------|------------|-------------------|---|---|---|
| ACTUATOR | | VALVE OPEN | ACTUATOR POSITION | | | |
| MOUNTING | STYLE | | 1 | 2 | 3 | 4 |
| RIGHT-HAND | STYLE A (PDTC) | | | | | |
| | STYLE B (PDTO) | | | | | |
| LEFT-HAND | STYLE C (PDTC) | | | | | |
| | STYLE D (PDTO) | | | | | |

| NPS 16 TO 24 V250 MOUNTING | | | | | | |
|----------------------------|---------|------------|-------------------|---|---|---|
| ACTUATOR | | VALVE OPEN | ACTUATOR POSITION | | | |
| MOUNTING | STYLE | | 1 | 2 | 3 | 4 |
| RIGHT-HAND | STYLE A | | | | | |
| LEFT-HAND | STYLE C | | | | | |

- NOTES:
1. ARROW ON LEVER INDICATES DIRECTION OF ACTUATOR THRUST TO CLOSE VALVE.
 2. PDTC—PUSH DOWN TO CLOSE; PDTO—PUSH DOWN TO OPEN.
 3. THE NPS 16 TO 24 V250 MOUNTING CHART APPLIES TO VALVES USED WITH 1069 ACTUATORS ONLY.

48A8905-B
48A8827-A

Actuator Mounting

Use the appropriate actuator instruction manual and figure 10 of this instruction manual when changing actuator styles and positions. The actuator may be either right- or left-hand mounted. Figure 10 shows the correct lever/shaft orientation for both left-hand mounting and right-hand mounting configurations.

Travel Adjustment

Actuator travel adjustment can be performed with the valve either in or out of the pipeline. Key numbers referenced in the following procedures are shown in figure 11 for single seal and flow ring constructions and in figure 12 for dual seal constructions.

For valve assemblies in the pipeline:

1. Rotate the ball (key 2) to either the open or closed position as indicated by the travel indicator scale (key 37) on the outboard end of the valve.
2. Adjust the actuator as described in the appropriate actuator instruction manual until the arrow stamped on the end of the follower shaft (key 7) is fully aligned with the open or closed position on the travel indicator scale.

For valve assemblies out of the pipeline, proceed as follows:

1. Rotate the ball to the fully open position. The fully open position is achieved when the inside surface of the ball bore (key 2) is completely square with the line flange gasket surface of the seal protector ring (key 14) or flow ring (key 14).
2. Adjust the actuator as described in the appropriate actuator instruction manual until the inside surface of the ball bore is at right angles to the line flange gasket surface of the seal protector ring or flow ring.
3. Adjust the travel indicator scale (key 37) until the arrow stamped on the end of the follower shaft (key 7) is fully aligned with the open position.

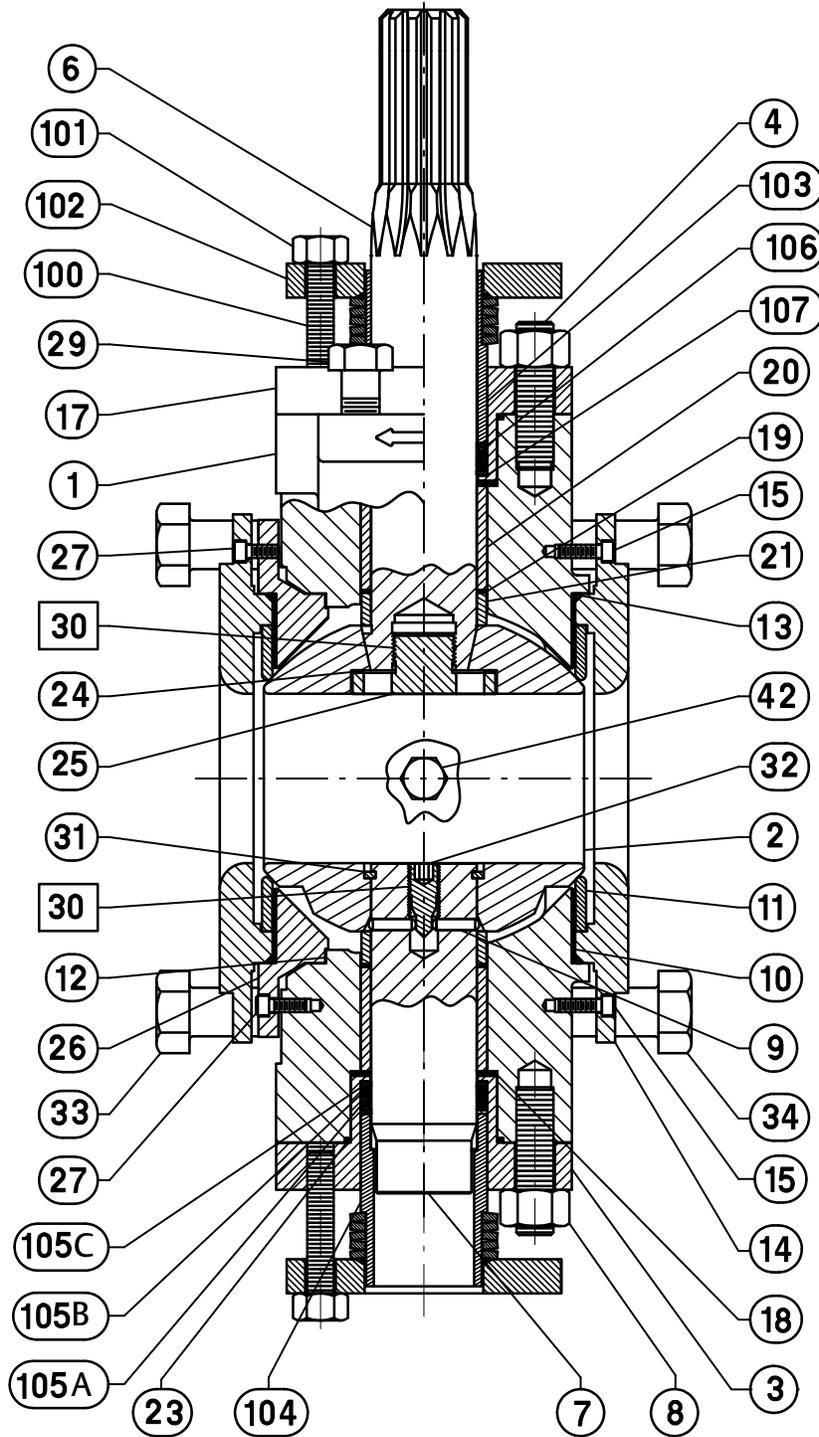
Parts Ordering

When corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment, always mention the valve serial number.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

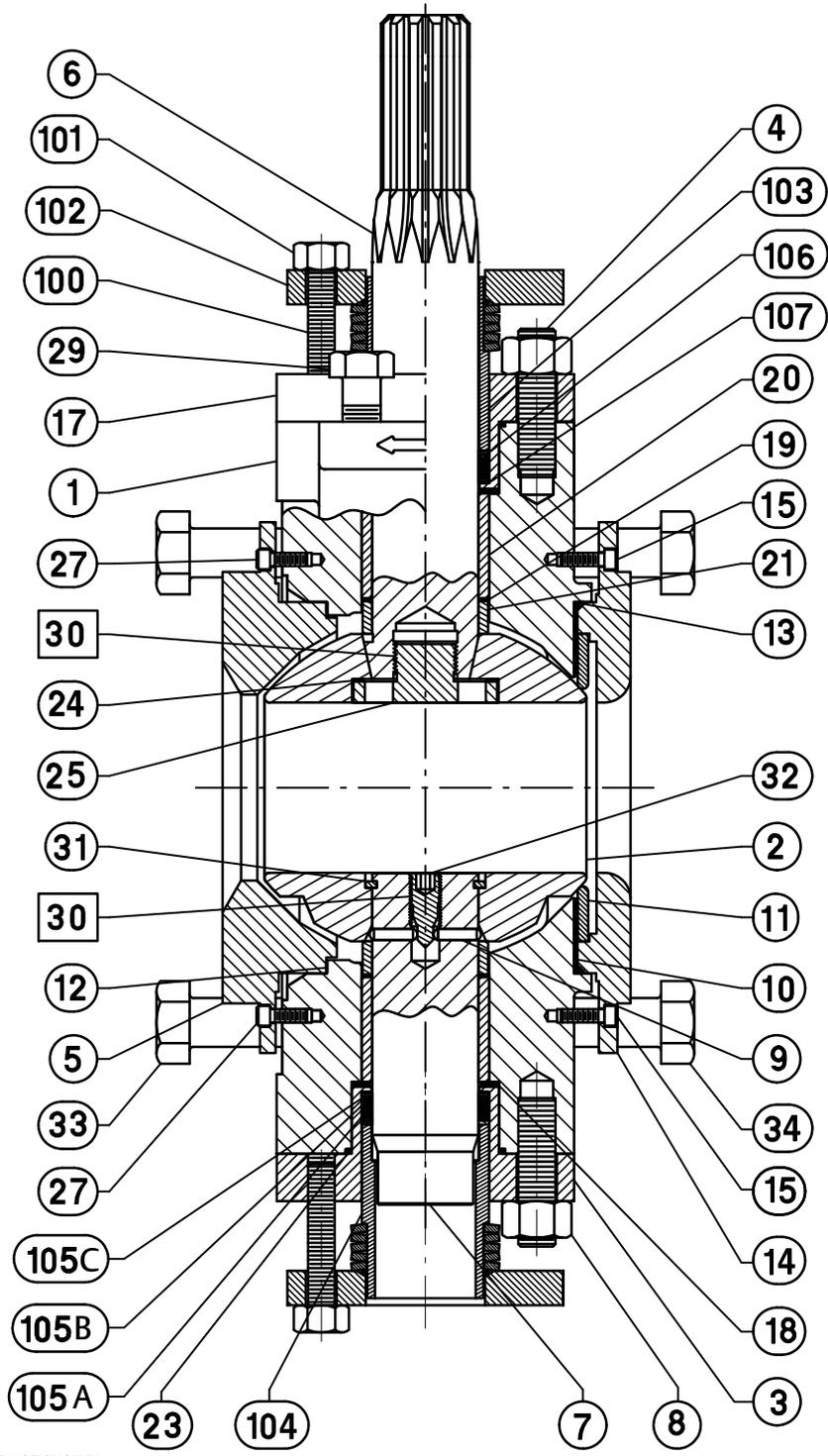
Figure 11. Fisher V250 Valve Assembly with Single Seal Construction



NOTE:
 1. KEY NUMBERS 35, 38, 39, AND 44 ARE NOT SHOWN.
 □ APPLY AN ADHESIVE

GE84944

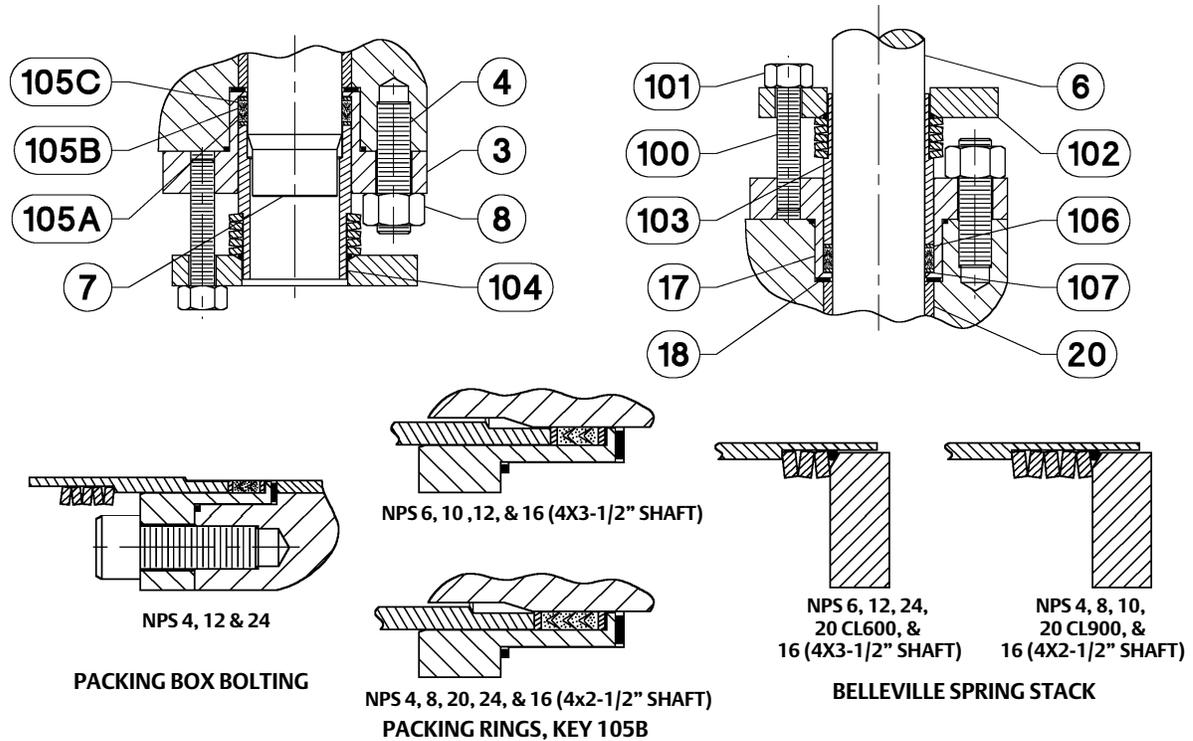
Figure 12. Fisher V250 Valve Assembly with Dual Seal Construction



NOTE:
1. KEY NUMBERS 35, 38, 39, AND 44 ARE NOT SHOWN.
□ APPLY AN ADHESIVE

GE88081

Figure 13. Live Loaded Packing Assembly



37B3095-F

Parts Kits

Live-Loaded PTFE Packing kits

| VALVE SIZE, NPS | KIT PART NUMBER |
|-----------------|-----------------|
| 4 | 37B3095X142 |
| 6 | 37B3095X102 |
| 8 | 37B3095X062 |
| 10 | 37B3095X042 |
| 12 | 37B3095X182 |
| 16 | 37B3095X132 |
| 20 | 37B3095X082 |
| 24 | 37B3095X162 |

Part kits include keys 10, 11, 12, 13, 16, 18, 19, and 23. See following table.

| VALVE SIZE, NPS | KIT PART NUMBER | | |
|-----------------|-----------------|-------------|-------------|
| | Single Seal | Dual Seal | Flow Ring |
| 4 | RV250X00412 | RV250X00422 | RV250X00432 |
| 6 | RV250X00612 | RV250X00622 | RV250X00632 |
| 8 | RV250X00812 | RV250X00822 | RV250X00832 |
| 10 | RV250X01012 | RV250X01022 | RV250X01032 |
| 12 | RV250X01212 | RV250X01222 | RV250X01232 |
| 16 | RV250X01612 | RV250X01622 | RV250X01632 |
| 20 | RV250X02012 | RV250X02022 | RV250X02032 |
| 24 | RV250X02412 | RV250X02422 | RV250X02432 |

| KEY NUMBER | DESCRIPTION | QUANTITY IN KIT | | |
|------------|---------------------|-----------------|-----------|-----------|
| | | Single Seal | Dual Seal | Flow Ring |
| Key 10 | Shim seal | 2 | 4 | 2 |
| Key 11 | Ball seal | 1 | 2 | --- |
| Key 12 | Gasket | 1 | 1 | 1 |
| Key 13 | O-ring | 1 | 2 | 1 |
| Key 16 | Seal ring | 2 | 2 | 2 |
| Key 18 | Bushing spacer shim | 4 | 4 | 4 |
| Key 19 | Washer | 2 | 2 | 2 |
| Key 23 | O-ring | 2 | 2 | 2 |

Parts List

Note

Contact your [Emerson sales office](#) for part ordering information.

| Key | Description |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Valve Body If you need a valve body as a replacement part, order by valve size and trim diameter, serial number, and desired material. |
| 2 | Ball |
| 3 | Outboard Seal Carrier |
| 4 | Stud Bolt |
| 5 | Valve Outlet (for single ball seal & flow ring constructions only, none req'd for dual ball seal construction) |
| 6 | Drive Shaft |
| 7 | Follower Shaft |
| 8 | Hex Nut |
| 9 | Pin |
| 10* | Shim Seal, S31600 SST (a maximum of 14 req'd for any construction) |
| 11* | Ball Seal, POM (polyoxymethylene) (1 req'd for single ball seal construction; 2 req'd for dual ball seal construction; none req'd for flow ring construction) |
| 12* | Gasket, PTFE |
| 13* | O-Ring (1 req'd for single ball seal & flow ring constructions; 2 req'd for dual ball seal construction) |
| 14 | Seal Protector Ring |
| 15 | Cap Screw |
| 16* | Shaft Seal Kit (1 req'd) (includes 2 seals and backup rings) |
| 17 | Seal Carrier |
| 18* | Bushing Spacer Shim, S31600 SST |
| 19* | Thrust Washer, Graphite filled PTFE (2 req'd) |
| 20* | Bushing (2 req'd) |

| Key | Description |
|-------|-----------------------------------------------------------------------|
| 21 | Thrust Spacer |
| 22 | Spacer |
| 23* | O-Ring (2 req'd) |
| 24 | Washer |
| 25 | Shaft Retainer |
| 26 | Adaptor Ring |
| 27 | Cap Screw |
| 28 | Drive Pin |
| 29 | Cap Screw |
| 30 | Thread Locking Adhesive (High Strength) (not furnished with valve) |
| 31 | Split Ring |
| 32 | Retainer Screw |
| 33 | Cap Screw |
| 34 | Cap Screw |
| 35 | Line Bolt (see figure 2) |
| 36 | Drive Screw |
| 37 | Indicator Scale |
| 38 | Nameplate, SST (use when actuator is not furnished; not shown) |
| 40 | Clamp, SST (see figure 3) |
| 41 | Bonding Strap Assembly, SST (see figure 3) |
| 42 | Pipe Plug |
| 43 | Machine Screw, steel (see figure 3) |
| 44 | Hex Nut |
| 100 | Packing Flange Stud |
| 101 | Hex Nut |
| 102 | Packing Flange |
| 103 | Spring Packing, Drive End |
| 104 | Spring Packing, Follower End |
| 105A* | Packing Female Adaptor, PTFE (2 req'd) |
| 105B* | Packing Ring, PTFE |
| 105C* | Packing Male Adaptor, PTFE (2 req'd) |
| 106* | Anti-Extrusion Ring, Carbon/Graphite filled PEEK (4 req'd) |
| 107* | Packing Box Ring (2 req'd) |

*Recommended spare parts

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