

# Fisher™ Vee-Ball™ V150 and V300 NPS 14 through 24 Rotary Control Valves

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Figure 1. Fisher Vee-Ball Valves



## Introduction

### Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts ordering information for NPS 14, 16, 20, 24x20 and 24 V150 and NPS 14, 16, 20, and 24 V300 rotary control valves. For smaller valves (NPS 1 through 12), refer to the Vee-Ball V150, V200 and V300 Rotary Control Valves NPS 1 through 12 instruction manual ([D101554X012](#)). For information on ENVIRO-SEAL™ packing, see the ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)). Refer to separate manuals concerning the actuator, positioner, and mounted accessories.



Do not install, operate, or maintain V150 and V300 valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

<p><b>Valve Sizes and End Connection Styles</b>                  V150: NPS 14, 16, 20, 24x20, and 24 with CL150 raised-face flanges as shown in table 3                  V300: NPS 14, 16, 20, and 24 with CL300 raised-face flanges as shown in table 3</p> <p><b>Maximum Inlet Pressure<sup>(1)</sup></b>                  Consistent with applicable ASME B16.34 or EN 12516-1 ratings</p> <p><b>Standard Flow Direction</b>                  Forward (into the convex sealing face of the ball)</p> <p><b>Actuator Mounting</b>                  ■ Right-hand, or ■ left-hand as viewed from the upstream end of the valve. Standard valve construction with standard ball rotation is with</p>	<p>right-hand mounting. Optional valve construction with optional ball rotation for left-hand mounting is available upon request.</p> <p><b>Ball Rotation</b>                  Standard: Ball rotates Counterclockwise to Close (CCW) when viewed from actuator side of valve                  Optional: Ball rotates Clockwise to Close (CW)                  Maximum ball rotation is 90 degrees</p> <p><b>Valve/Actuator Action</b>                  With diaphragm or piston rotary actuator, field-reversible between push-down-to-close (extending actuator rod closes valve) and push-down-to-open (extending actuator rod opens valve)</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.

Table 2. Valve Sizes, Drive Shaft Diameters, and Valve Assembly Weights

VALVE SIZE		DRIVE SHAFT DIAMETER		VALVE ASSEMBLY WEIGHT			
mm	NPS	mm	Inch	kg		lb	
				V150	V300	V150	V300
350	14	44.5	1-3/4	206	374	545	825
400	16	54.0	2-1/8	333	510	735	1125
		54.0 x 50.8	2-1/8 x 2				
500	20	63.5	2-1/2	524	755	1155	1661
600 <sup>(1)</sup>	24x20 <sup>(1)</sup>	63.5	2-1/2	757	---	1666	---
600	24	76.2	3	965	1308	2122	2877
600 <sup>(2)</sup>	24 <sup>(2)</sup>	76.2	3	798	898	1755	1975

1. NPS 24x20 available only for V150, not for V300 valves.  
 2. Flangeless NPS 24.

Table 3. Valve Sizes, End Connection Styles, and Ratings<sup>(1)(2)</sup>

VALVE BODY MATERIAL	FLANGE COMPATIBILITY	RATING	FACE-TO-FACE DIMENSION mm (inch)
WCC or CG8M	CL150 (V150) raised-face	ASME B16.34 CL150	NPS 14 and 16 Valves: ASME B16.10 Short NPS 20 Valves: 508 (20) NPS 24 and NPS 24x20 Valves: 610 (24) NPS 24 Flangeless Valves: 508 (20) NPS 24 Valves: 610 (24)
	CL300 (V300) raised-face	ASME B16.34 CL300	NPS 14 Valves: 38 (15) NPS 16 Valves: 406(16) NPS 20 Valves: 508 (20) NPS 24 Flangeless Valves: 508 (20) NPS 24 Valves: 610 (24)

1. Do not exceed the material temperature capabilities or the pressure drop limitations shown in bulletin 51.3:Vee-Ball (D101363X012).  
 2. The pressure/temperature limits in this manual and any application code limitations, should not be exceeded.

## Description

The V150 or V300 Vee-Ball valve with a V-notch ball is used in throttling or on-off service. The V150 valve (figure 1) is a raised-face flanged construction available in CL150. The V300 valve is a raised-face flanged construction available in CL300. The splined valve shaft connects to a variety of rotary actuators.

## Specifications

Specifications for these valves are shown in table 1 and bulletin 51.3:Vee-Ball Fisher Vee-Ball V150, V200, and V300 Rotary Control Valves ([D101363X012](#)).

## Educational Services

Emerson Automation Solutions  
Educational Services - Registration  
Phone: 1-800-338-8158  
E-mail: [education@emerson.com](mailto:education@emerson.com)  
[emerson.com/mytraining](http://emerson.com/mytraining)

## Installation

Key numbers are shown in figure 10, unless otherwise indicated.

### **⚠ WARNING**

- Always wear protective gloves, clothing, and eyewear when performing any maintenance 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 either the valve body rating or the mating pipe flange joint rating. To avoid such injury or damage, provide a relief valve for overpressure 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.

### **⚠ WARNING**

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Because some valve body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#).

Install the valve with the drive shaft in the horizontal position as shown in figure 1.

### **NOTICE**

To maximize seal life, the valve should be installed so the drive shaft will be in the horizontal orientation while in service. Please contact your Emerson sales office for evaluating vertical drive shaft installations.

1. If the valve is to be stored before installation, protect the flange mating surfaces and keep the valve cavity dry and free 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. **Mounting the Actuator:**
  - a. The valve is normally shipped as part of a control valve assembly, with the actuator mounted on the valve. The factory makes actuator/valve adjustments before the valve is shipped.
  - b. If the valve and actuator have been purchased separately or if the actuator has been removed, mount the actuator according to the Actuator Mounting section of this manual.
4. Be certain the valve and adjacent pipelines are free of any foreign material that could damage the valve seating surfaces.
5. Be sure the mating line flanges are aligned. Provide standard flat sheet flange gaskets (or spiral wound gaskets with compression-controlling centering rings) that are compatible with the process fluid.

Refer to figure 2 for required clearance for valve installation and stud length. Lubricate the studs with anti-seize lubricant.

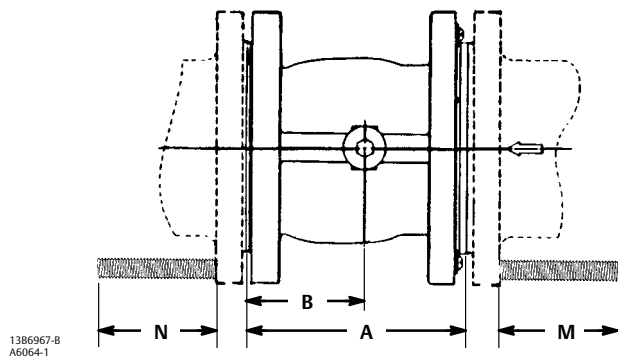
6. Install the valve using studs and nuts to connect the valve flanges to the pipeline flanges. The seal protector ring (key 3) end of the valve requires longer line flange studs than standard (see figure 2).

Table 4. Required Clearances for Installation of Fisher V150 and V300 Valves

VALVE SIZE, NPS	DIMENSION						
	A <sup>(5)</sup>		B <sup>(5)</sup>	M <sup>(2)</sup> (Min.)		N <sup>(6)</sup>	
	CL150 ASME B16.10 (Short) <sup>(1)</sup>	CL300		CL150 ASME B16.10 (Short) <sup>(1)</sup>	CL300	CL150	CL300
<b>mm</b>							
14	381	381	175	152	197	133	178
16	406	406	178	152	210	133	190
20 <sup>(3)</sup>	508	508	235 <sup>(3)</sup>	178	222	159	203
24x20 <sup>(3,4)</sup>	610	---	235	203	260	191	248
24	610	610	324	203	260	191	248
24 <sup>(7)</sup>	508	508	324	686	743	---	---
<b>Inch</b>							
14	15.00	15.00	6.88	6.00	7.75	5.25	7.00
16	16.00	16.00	7.00	6.00	8.25	5.25	7.50
20 <sup>(3)</sup>	20.00	20.00	9.25 <sup>(3)</sup>	7.00	8.75	6.25	8.00
24x20 <sup>(3,4)</sup>	24.00	---	9.25	7.50	---	6.75	---
24	24.00	24.00	12.75	8.00	10.25	7.50	9.75
24 <sup>(7)</sup>	20.00	20.00	12.75	27.00	29.25	---	---

1. ASME B16.10 (Short) applies to NPS 14 and 16 valves only.  
 2. Inlet flange stud bolt length is longer than the standard length as specified in ASME B16.5.  
 3. NPS 20, CL150 valves do not comply with ASME B16.10 (Short).  
 4. Valve body mates with NPS 24 ASME CL150 flanges. Internal based on NPS 20 valve design.  
 5. If the Cavitrol Hex anti-cavitation trim is installed, the A and B dimension will be 12.7mm (1/2-inch) longer than the dimension specified.  
 6. For V150 and V300 valve assemblies with the Cavitrol Hex anti-cavitation trim installed, dimension M bolt length is required for both the inlet and outlet flange ends.  
 7. For NPS 24 V150 and V300 flangeless option only.

Figure 2. Required Clearances for Installation of Fisher V150 and V300 Valves



Do not attempt to use standard-length line flange studs for the seal protector end of the valve. Refer to figure 2 for length of flange studs required.

Install all remaining studs. Tighten the nuts in a criss-cross sequence to ensure the flange gaskets are properly loaded.

**⚠ WARNING**

The valve drive shaft is not necessarily grounded to the pipeline when installed. Personal injury or property damage could result if the process fluid or the atmosphere around the valve is flammable, 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.

Standard PTFE packing is composed of a partially conductive carbon-filled PTFE female adaptor with PTFE V-ring packing. Standard graphite packing is composed of all conductive graphite ribbon packing rings. Alternate shaft-to-valve body bonding is available for hazardous service areas where the standard packing is not sufficient to bond the shaft to the valve (see the following step and figure 4).

7. For hazardous applications, attach the optional bonding strap assembly (key 131, figure 4) to the valve drive shaft (key 6) with the clamp (key 130, figure 4) and connect the other end of the bonding strap assembly to the valve body with the cap screw (key 23).
8. Connect pressure lines to the actuator as indicated in the actuator instruction manual. When an auxiliary manual actuator is used with a power actuator, install a bypass valve on the power actuator (if one is not supplied) for use during manual operation.

**⚠ WARNING**

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might need some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If the valve has ENVIRO-SEAL live-loaded packing installed, this initial re-adjustment will probably not be required. Refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)) for packing instructions.

## Maintenance

Valve parts are subject to normal wear and must be inspected and/or replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions.

**⚠ WARNING**

The Vee-ball closes with a cutting motion. To avoid personal injury, keep hands, tools, and other objects away from the ball while stroking the valve.

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Make 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.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- The valve packing area 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.

## Packing Maintenance

Key numbers are shown in figure 10, unless otherwise indicated. A detailed view of the packing is also shown in figure 3.

If the valve is equipped with the ENVIRO-SEAL Packing System, refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)).

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### Note

For the ENVIRO-SEAL Packing System, refer to the Parts List section for individual parts (see figure 3). Refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual (D101643X012) for maintenance instructions.

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## Stopping Leakage

For PTFE V-ring packing, leakage around the packing follower and packing flange (keys 17 and 40) can be stopped by tightening the packing follower nuts (key 20).

If the packing is relatively new and tight on the drive shaft (key 6), and if tightening the packing follower nuts does not stop leakage, it is possible that the drive shaft is worn or nicked so that a seal cannot be made. If the leakage comes from the outside diameter of the packing, it is possible that the leakage is caused by nicks, scratches, or corrosion on the packing box wall.

If the leakage cannot be stopped by the above steps, the packing must be removed and replaced. Inspect the drive shaft and packing box before installing new packing parts.

## Packing Replacement

When replacing the packing, the actuator should not be removed from the valve while the valve is still in the pipeline or between flanges. Valve/actuator adjustments must be made with the valve out of the pipeline.

## Disassembly

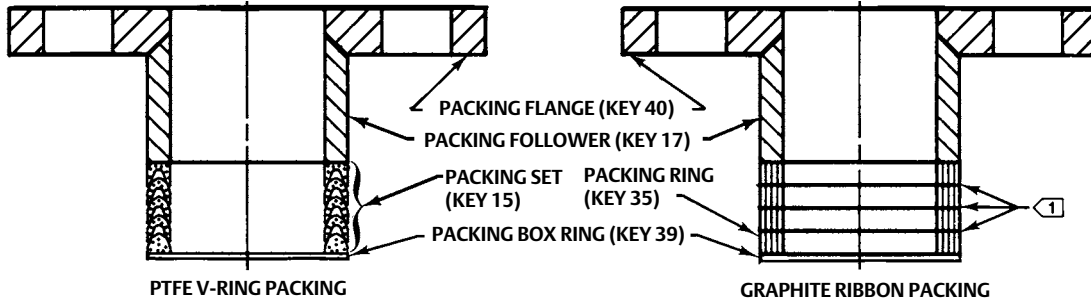
1. Isolate the control valve from the line pressure, release pressure from both sides of the valve, and drain the process media from both sides of the valve. If using a power actuator, shut off all pressure lines to the power actuator, release pressure from the actuator, and disconnect the pressure lines from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Remove line bolting, remove the control valve from the pipeline, and place the actuator/valve assembly on a protected flat surface with the seal protector ring facing up.
3. Remove the actuator cover. Note the orientation of the actuator with respect to the valve body and the lever orientation with respect to the valve drive shaft (see figure 8).

### **⚠ WARNING**

**When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, resulting in personal injury. To avoid injury, carefully rotate the ball to the stable position after the actuator is removed.**

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Figure 3. Packing Arrangements

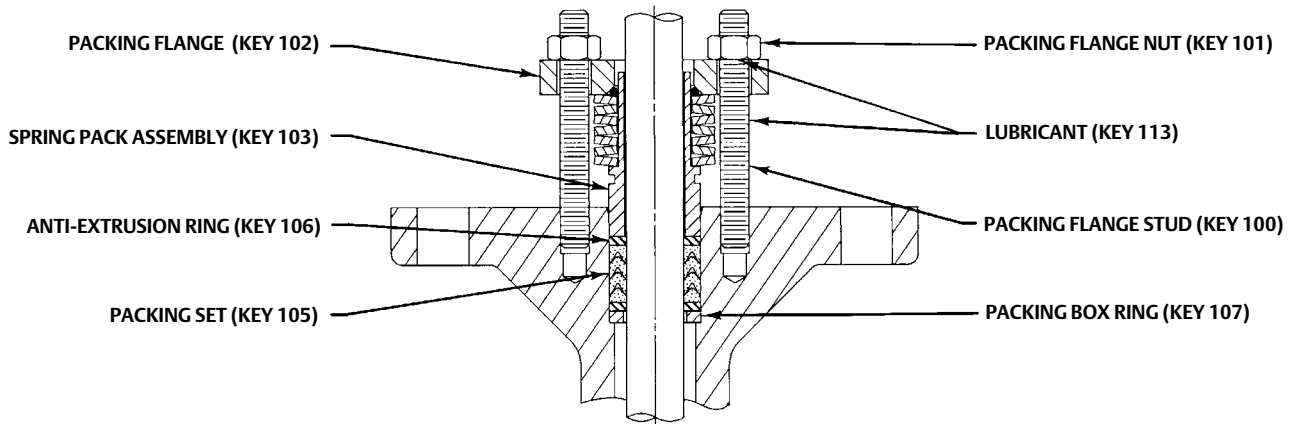


NOTES:

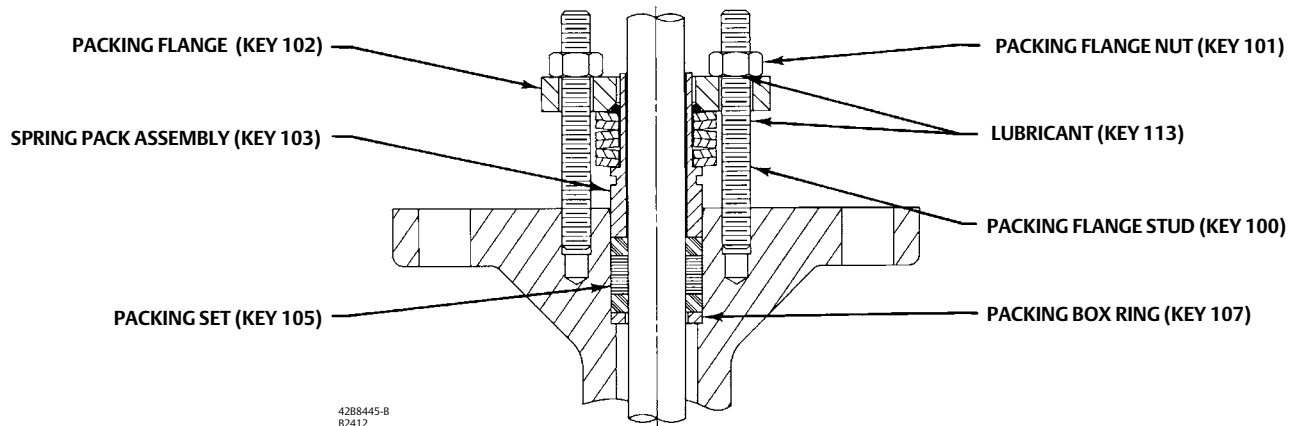
1 INCLUDES ZINC WASHERS (KEY 36) FOR GRAPHITE RIBBON PACKING ONLY.

A6063

STANDARD PACKING ASSEMBLY



ENVIRO-SEAL PTFE PACKING SYSTEM



42B8445-B  
B2412

ENVIRO-SEAL GRAPHITE PACKING SYSTEM



**NOTICE**

When removing the actuator from the valve, do not use a hammer or similar tool to drive the lever or actuator off the valve shaft. Driving the lever or actuator off the valve shaft could damage the ball, seal, and valve.

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 damage the ball, seal, and valve.

**Note**

Some actuator designs have a bolt inserted in the lever to spread the clamp on the valve spline shaft. Tightening the bolt expands the splined lever connection allowing the valve shaft to be removed.

4. When removing the lever (do not loosen the actuator turnbuckle adjustment), remove the actuator mounting screws and nuts (keys 23 and 24), and remove the actuator. (If necessary, refer to the actuator instruction manual for assistance.)
5. If necessary, remove the bonding strap assembly before attempting to remove the packing (see figure 4).
6. Remove the packing flange and nuts and packing follower (keys 20, 40, and 17).

If the valve is equipped with the ENVIRO-SEAL packing system, refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual ([D101643X012](#)) for disassembly.

7. Remove the packing parts (key 16 packing set includes additional key numbers) by making a formed wire hook with a sharp end. Pierce the rings with the sharp end of the hook in order to remove them. Do not scratch the drive shaft or packing box wall; scratching these surfaces could cause leakage. Clean all accessible metal parts and surfaces to remove particles that would prevent the packing from sealing. (Note: Metal packing parts are not provided in the packing set).

**Assembly**

If the valve is equipped with the ENVIRO-SEAL packing system, refer to the ENVIRO-SEAL Packing System Rotary Valves instruction manual (D101643X012) for assembly.

1. Install the new packing parts using the parts sequence shown in figure 3.
2. Insert the packing follower and packing flange (keys 17 and 40) and secure them with the packing follower nuts (key 20). Tighten the nuts far enough to stop leakage during operating conditions.

**Note**

If the valve is equipped with a bonding strap assembly (figure 4), re-install the assembly.

3. Reconnect the actuator and lever in accordance with the orientations that were noted in step 3 of the disassembly procedures. If necessary, use figure 8 to identify the correct index marks.
4. If necessary, refer to the appropriate actuator instruction manual to complete actuator assembly and adjustment.
5. When the control valve is in operation, check the packing follower for leakage and retighten the packing follower nuts (key 20) as necessary.

**Ball Seal Replacement**

Perform this procedure if the control valve is not shutting off properly, or if seal inspection is necessary. Remove the actuator/valve assembly from the pipeline.

The actuator may remain mounted on the valve during the ball seal inspection and replacement procedures. Ball seal assembly details (with key numbers) are also shown in figure 5. Upon inspection, if it is found that the ball, drive shaft, or bearings need to be replaced, use this procedure to remove the ball seal. Then, proceed to the Bearing and Ball Maintenance procedures to replace the ball, bearings, or shafts. Then return to this procedure and begin with the assembly steps in the Ball Seal Replacement section.

During disassembly and re-assembly procedures, handle the seal protector ring, seal, and other parts (keys 3, 11, 13, and 37) carefully to prevent damage. A new gasket (key 15) is required whenever the seal protector ring (key 3) is removed.

## NOTICE

**Due to the Vee-ball shape, take care to never rotate either the front skirted edge of the ball or the circular back edge of the ball through the ball seal at any time. The seal could be damaged.**

The flow ring construction does not use a seal (key 11), radial seal (key 37), or wave spring (key 13). Use this procedure to remove the seal protector ring for flow ring constructions, but disregard any instructions calling for the seal and other seal parts.

## Disassembly

### ⚠ WARNING

**If the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, resulting in personal injury. To avoid injury, carefully rotate the ball to the stable position after the actuator is removed. If necessary, lock the ball in a specific position when directed by the following steps.**

Key numbers are shown in figure 10, unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve, 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 and release all pressure from the actuator.
2. Remove line bolting, remove the control valve/actuator assembly from the pipeline, and place the valve on a protected flat surface with the seal protector ring facing up. Carefully rotate the ball to the open position.

### Note

Lifting bolt holes are provided in the seal retainer or flow ring to assist in its removal from the valve body.

3. Remove the retainer screws (key 21). Carefully remove the seal protector ring and gasket (keys 3 and 15). (For flow ring constructions, go to step 4.)
  - a. For valves with composition seal, remove the seal (key 11) from the valve body (key 1).
  - b. For valves with HD metal seal, once the protector ring has been removed from the valve, push the metal seal (key 11) out of the seal protector ring (key 3). Remove the radial seal (key 37). Inspect, clean, or obtain replacement parts as necessary.

It might be necessary to remove the HD metal seal by carefully tapping it with a soft punch and hammer. Take care not to damage the seal protector ring surfaces.

4. Inspect, clean, or obtain replacement parts as necessary. Inspect the gasket and sealing surfaces on the valve body (key 1), ball (key 2), ball seal (key 11), and seal protector ring (key 3) for damage.
5. If a replacement ball, drive and follower shafts, or bearings (keys 2, 6, 9, and 10) are needed, proceed to the Bearing and Ball Maintenance procedure for disassembly and assembly procedures. If only the seal is to be replaced, proceed to the assembly procedure below.

## Assembly

Refer to figure 5 for part and key number locations during seal installation.

1. Thoroughly clean all parts that are to be re-used or obtain replacement parts. Be sure that all sealing surfaces are in good condition without scratches or wear. If the valve has been installed between line flanges and the flange studs and nuts have been tightened, always replace the gasket (key 15).

If you have not already done so, lift the valve and place it with the outlet flange face flat on the protected working surface. Use the lever from the actuator, or provide some other safe method to rotate the ball into the closed position. The inlet flange face should be up, and the ball approximately centered within the opening.

2. Make sure the ball cannot rotate during seal assembly procedures (read the Warning on page 10).
3. For valves with composition ball seals:
  - Install the composition seal (key 11) into the valve body.
  - Install the gasket (key 15) on the valve body.
  - Install the seal protector ring (key 3) into the valve body. (Go to step 6 below.)
4. For valves with HD metal seals:
  - Lubricate with Mag Lub or an equivalent lubricant, and install the radial seal (key 37) into the appropriate groove in the seal protector ring making sure the open side of the radial seal faces away from the ball.
  - Install the wave spring (key 13) on the seal protector ring (key 3).
  - Install the HD metal seal (key 11) into the seal protector ring (key 3), past the radial seal. While pushing it past the radial seal, make sure the HD metal seal is level.
  - To assist with break-in of the HD metal seals, it is recommended that the ball and seal be lubricated. Apply dry film lubricant to the seat of the HD metal seal (key 11) and to the face of the ball.

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### Note

During break-in, if the Vee-Ball rotation is not smooth, it may be necessary to tighten the packing slightly to dampen any tendency for stick-slip motion of the ball and seal assembly.

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5. Install the HD metal ball seal/seal protector ring assembly into the valve body (key 1). Go to step 6 below.
6. Install the retaining screws (key 21) that secure the seal protector ring (key 3) to the valve body (key 1). Tighten the screws (key 21).
7. If necessary, refer to the Packing Maintenance procedures to install the packing. Install the actuator using the Actuator Mounting procedures or to the appropriate actuator instruction manual.

## Bearing and Ball Maintenance

Procedures for disassembly and assembly of the bearings and ball cannot be accomplished until the ball seal and valve packing are loosened.

- Refer to the Packing Maintenance procedures to remove the actuator.
- Refer to the Ball Seal Replacement procedures to remove the seal from the valve.
- Install an “eye” bolt into the threaded hole within the ball cavity (see figure 10). (Note: The eye bolt provides a method for lifting and controlling the rotation of the ball during the following procedures. (Read the following Warning.)
- When ball seal disassembly steps are complete, return to this section.

If you have not already done so, place the valve on a flat protected working surface with the seal side down, prior to removing and installing the ball and bearings. Key numbers in this procedure are shown in figure 10, unless otherwise indicated.

Figure 4. Optional Shaft-to-Body Bonding Strap Assembly

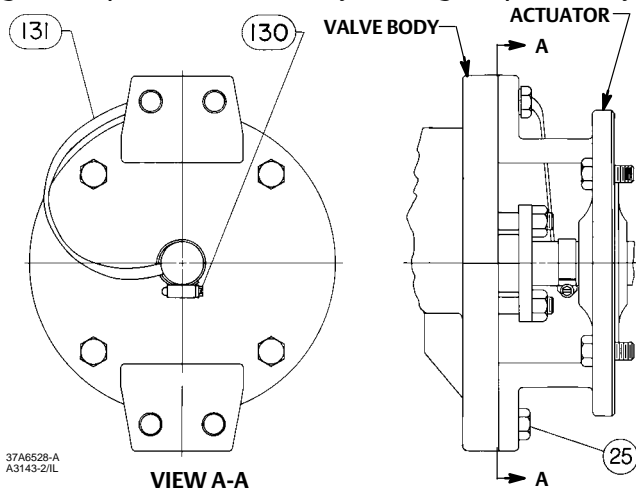


Figure 5. Ball Seal Assembly Detail

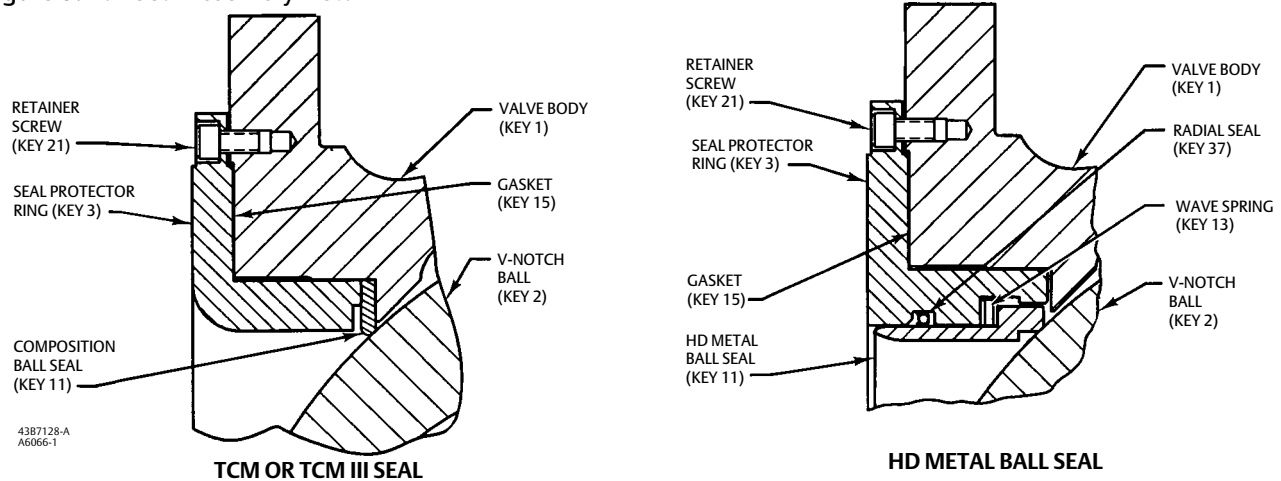
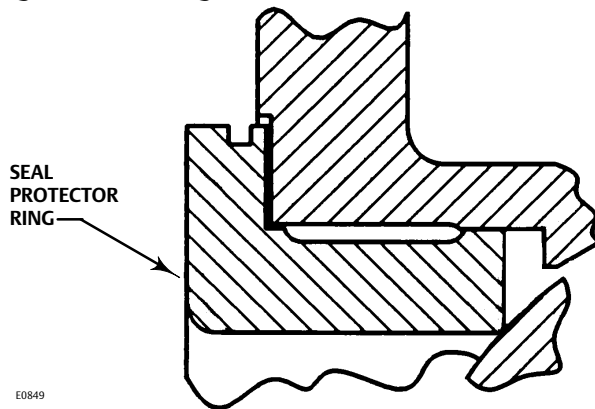


Figure 6. Flow Ring Construction



## Disassembly

### **⚠ WARNING**

**When the actuator is removed from the valve, the ball may suddenly rotate, resulting in personal injury. To avoid injury, carefully rotate the ball to a stable position.**

**Once the drive and follower shafts have been removed from the valve body, the ball may fall out of or into the valve body. To avoid personal injury or damage to the sealing surfaces of the ball, provide a hoist to support the ball to prevent it from falling as the shafts are being removed.**

1. Carefully lift the valve and set it on the edge of the flanges so the ball is in the open position, and in the down position. (Note: The weight of the ball should turn it into the open position.) Block the drive end of the valve body to hold the shaft in a horizontal position.
2. Drive the pins (key 7) out of the drive shaft and out of the follower shaft (keys 6 and 9).  
Both pins are tack welded to the ball ears. To remove a pin, insert a pin punch into the open hole, opposite the tack welded side, and break the tack weld while driving the pin out.
3. Carefully lift the valve and place the valve on the working surface with the seal side down (read the **Warning** above).  
Because of the weight of the ball, it should rotate so the contoured sealing surface of the ball is resting on the surface.
4. Remove the flange nuts (key 47), the bottom flange (key 44), and gasket (key 45) from the valve. Use a hoist to lift valve body slightly.  
Make sure the sealing surface of the ball is not damaged while removing the follower shaft (key 9).
5. Push the follower shaft (key 9) into the center of the ball. For valves with metal bearings, remove the thrust washer (key 38).
6. Pull the drive shaft (key 6) out of the actuator side of the valve body. For valves with metal bearings, remove the thrust washer (key 38).
7. Removing the bearings (key 10):
  - a. For PEEK bearings, remove the bearings by hand. If the bearings are tight in the valve body, pull or drive them out with a slight pressure.

- b. For metal bearings, use a press and ram to remove the drive shaft bearings out of the valve body. Refer to figure 7 for ram dimensions.
  - To remove the follower shaft bearing from the bottom flange (key 44), use a blind-hole bearing puller similar to CG2545AB, which is made by Snap-on Tools. If you do not have such a tool, you can machine the bearing out of the bottom flange.

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**Note**

For proper shutoff performance, the ball and seal require the bearing (key 10) to be positioned correctly. If you removed the bearings (key 10), be sure to locate the new bearings as shown in figure 7.

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8. Thoroughly clean all surfaces of parts that are to be re-used or obtain replacement parts. Upon reassembly, the pins needs to be tack welded to the ball ears. Remove excess weld material, if the parts are to be used during re-assembly.

## Assembly

1. Inspect all sealing surfaces to ensure they are in good condition and without scratches or wear. Thoroughly clean all parts and make sure they are free of oil or grease.
2. Installing bearings (key 10):
  - a. For PEEK bearings, install the drop-in bearings by hand. The bearing flanged end should touch the drive shaft bearing support surface (see figure 10). Also, install the bearing (key 10) into the bottom flange (key 44). The bearing flange should touch the surface of the bottom flange.

For NPS 24 V150 and V300 valve constructions, the PEEK bearings are flangeless and can be dropped in by hand. Install and stack two bearings on the drive shaft. Install two metal thrust washers in both ears of the ball.

- b. For metal bearings (key 10):
  - For the valve body, use a press and ram to install the bearings. Refer to figure 7 for dimensions and tolerances of the ram and bearings.
  - Press the bearing in until it is flush with the valve body (key 1).

The acceptable tolerance for bearing location is: flush with the valve body to 1.5 mm (0.06 inches) inside the bearing bore. That is, the bearings should not protrude into the flow cavity of the valve.

- Press the bearing into the bottom flange, using the same tolerances shown for bearing installation into the valve body.

## **⚠ WARNING**

**The ball might be damaged if it is allowed to fall into the valve body. To avoid personal injury or damage to the sealing surfaces, support the ball to prevent it from falling into the valve body cavity.**

---

3. Installing the ball, drive and follower shafts (keys 2, 6, and 9):
  - If you have not already done so, place the valve body (key 1) on a flat protected working surface with the seal side flat on the working surface.

- In the the next step, make sure the splined ear of the ball is aligned with the packing box side of the valve body.

**NOTICE**

**The ball might be damaged if it is allowed to hit the flange edge or interior of the valve cavity while it is being lowered into the valve body.**

- Using the "eye" bolt in the center of the ball cavity, lift the ball above the valve. Carefully, start lowering the ball, splined ear first, down into the valve body through the outlet flange. When the ball ear enters the valve body, it needs to be misaligned with the drive shaft bearing support.

As the ball clears the outlet opening, turn and rotate the ball as necessary to align the splined ball ear with the drive shaft bearing support (see figure 10).

Allow the ball to come to rest on the contoured sealing surface of the ball on the protected surface.

4. Carefully lift the valve body until the drive shaft (key 6) can be inserted through valve shaft bore and bearing (key 10), and into the drive shaft/splined ear of the the ball.

**Note**

1. See note 1, figure 10.
2. For valves with metal bearings and the NPS 24 flangeless PEEK bearings, hold the thrust washer (key 38, figure 10) in place before inserting the drive shaft.

Make sure that the "O" mark on the shaft aligns with the "O" mark on the ball ear, within the ball cavity. Insert the drive shaft (key 6) into the ball. If the "O" marks are aligned correctly, the drive shaft pin (key 7) should slide through the ball ear and drive shaft.

- With the valve body still lifted, align the ball follower shaft bore with the opening in the valve body for the lower flange (key 44). [Note: For valves with metal bearings and the NPS 24 flangeless PEEK bearings, hold the thrust washer (key 38, figure 10) in place before inserting the follower shaft.] While aligning the pin holes, insert the follower shaft into the ball.
- Place the gasket (key 45) in position on the bottom flange (key 44). Insert the bottom flange into the valve body, onto the follower shaft, and thread the bottom flange nuts (key 47) onto the studs (key 46). Hand tighten the nuts.

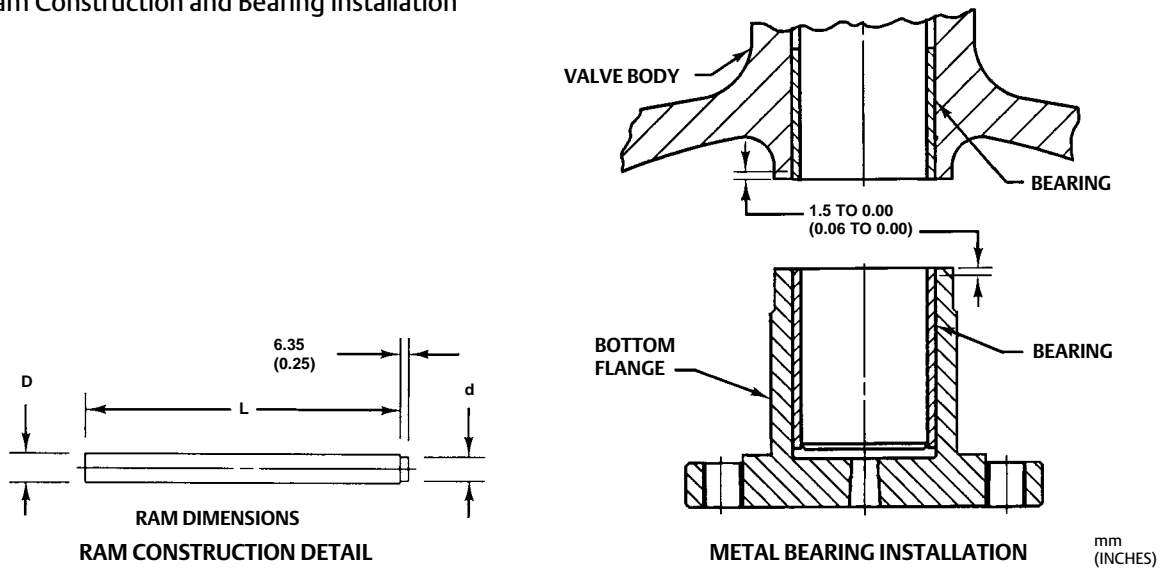
5. Installing the pins (key 7):

**NOTICE**

**The ball might be damaged if it is allowed to hit the flange edge or interior of the valve cavity while it is being lowered into the valve body.**

- Lift the valve and place it on the edge of both flanges. Make sure the ball is in its open position, and in the lower half of the valve cavity. Block the packing box side of the valve so the drive shaft is horizontal.

Figure 7. Ram Construction and Bearing Installation



4387128-A  
A6062-1

Table 5. Bearing Ram Dimensions

VALVE SIZE, NPS	RAM LENGTH		RAM DIAMETER			
	L		D		d	
	mm	Inch	mm	Inch	mm	Inch
14	172	6.75	51.30	2.02	44.45	1.75
			51.05	2.01	44.20	1.74
16	178	7.00	60.96	2.40	53.91	2.125
			60.71	2.39	53.72	2.115
20 and 24x20	216	8.50	70.35	2.77	63.50	2.50
			70.10	2.76	63.25	2.49
24	254	10	85.34	3.36	76.20	3.00
			85.09	3.35	75.95	2.99

- Insert the pin (key 7) into the ball ear and follower shaft until it is flat with the ball ear surface. (Note: the pin does not extend the full width of the ball ear).
- Refer to the Packing Replacement procedures and install the packing parts as described in that section. Slightly tighten the packing nuts (key 20).
- Using a pry bar, insert the bar between the ball ear and the follower shaft side of the valve body. Move the ball tightly towards the packing box side of the valve body, and against the bearing flange or thrust washer. The ball should be centered within the seal cavity.
- Again, insert the bar between the ball ear and the follower shaft side of the valve body. While holding the ball in place, tighten the packing box nuts (key 20).

If the ball is not held in place while tightening the packing box nuts, the ball will move to an off-center position.



6. Welding the pins (key 7):

**Note**

When welding the pins to the ball ears, use a compatible filler rod material. For CG8M (317 stainless steel) balls use 317L (most preferred), 316L, or 309L (least preferred) filler rod.

Tack weld both pins (key 7) to the ball ears with a 10 mm (3/8-inch) diameter weld. (Note: Good weld penetration is required on both the pin and ball ear.)

7. Tighten the bottom flange nuts using the following torque values:

Table 6. Torque Nut Values

VALVE SIZE, NPS	VALVE	STUD SIZE	QUANTITY	TORQUE	
				N • m	ft • lbs
14	V150	1/2-13	6	102	75
	V300	5/8-11		176	130
16	V150	9/16-12		141	104
	V300	5/8-11		176	130
20	V150	5/8-11		176	130
	V300	3/4-10		258	190
24	V150	7/8-9		373	275
	V300	7/8-9		373	275

8. Lift the valve and place it with the outlet flange face flat on the protected working surface. Use the lever from the actuator, or provide some other safe method to rotate the ball into the closed position. The inlet flange face should be up to allow the installation of the ball seal. The ball should be centered within the valve opening.

9. Refer to the Ball Seal Replacement procedures to install the ball seal and seal protector ring.

## Cavitrol Hex Replacement

### Disassembly

**⚠ WARNING**

Observe the steps in the WARNING at the beginning of the Maintenance section.

1. Isolate the control valve from line pressure, drain the process media from both sides of the valve, and remove the control valve/actuator assembly from the pipeline as described in the Ball Seal Replacement section.
2. Place the valve on a protected flat surface with the body outlet flange facing up.
3. Remove the four fasteners (key 67) securing the Cavitrol Hex trim to the valve body.

**⚠ WARNING**

To avoid personal injury or property damage, do not use the four threaded lifting holes provided in the Cavitrol Hex trim to lift the complete valve assembly. The four threaded holes are sized for lifting only the Cavitrol Hex trim.

All lifting and rigging must be completed in accordance with federal/national/provincial, state and local regulations and applicable lifting and rigging equipment standards. Lifting and rigging equipment used to lift, install, or remove the Cavitrol

**Hex trim must be properly selected and sized for the weight of the component. The weights of the Cavitrol Hex trim are provided in table 7.**

4. Install hoist rings or other appropriate lifting equipment into the four 3/8"-16 threaded holes provided in the Cavitrol Hex trim flange.
5. Remove the Cavitrol Hex trim and place on a protected flat surface.
6. Remove gasket (key 65) from the valve body outlet flange.

## Assembly

The Cavitrol Hex anti-cavitation trim (key 64) is available for the NPS 14, 16, and 20, V150 and V300 flanged, raised-face, body constructions. To retrofit the Cavitrol Hex to an existing valve assembly, special body machining is required. Four threaded holes must be added to the valve body outlet flange. Contact your [Emerson sales office](#) for retrofit information.

### Note

The Cavitrol Hex anti-cavitation trim will add 12.7 mm (1/2-inch) to the face to face dimension of the valve. Refer to table 4 of this manual for information on required flange stud length.

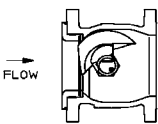
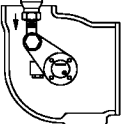
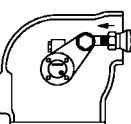
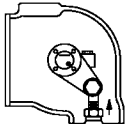
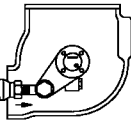
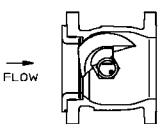
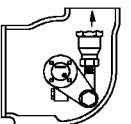
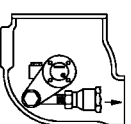
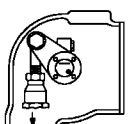
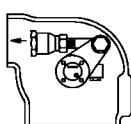
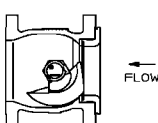
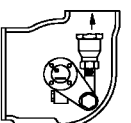
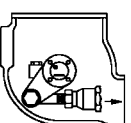
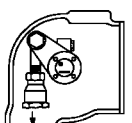
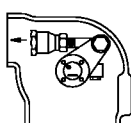
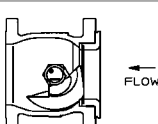
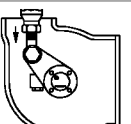
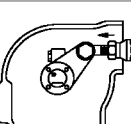
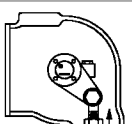

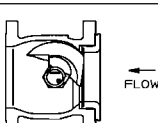
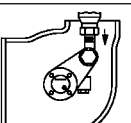
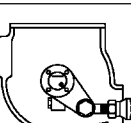
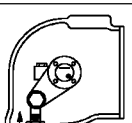
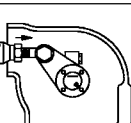
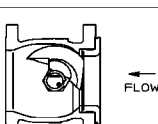
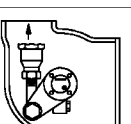
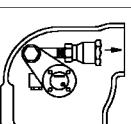
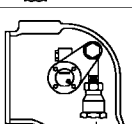
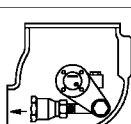
1. The Cavitrol Hex anti-cavitation trim (key 64) is to be installed last, after the Vee-Ball valve body assembly is complete. The recommended valve orientation for assembly is with the body outlet flange facing up.
2. Ensure the ball is in the open position.
3. Place the gasket (key 65) over the body outlet flange serrated surface as illustrated in figure 11.
4. Install hoist rings or other appropriate lifting equipment into the four 3/8"-16 threaded holes in the Cavitrol Hex flange.

Table 7. Fisher Cavitrol Hex Dimensions and Weight

VALVE SIZE	FLANGE THICKNESS C (ADD TO OVERALL FACE-TO-FACE DIMENSION)		WEIGHT	
	NPS	mm	Inch	kg
14	12.7	0.5	44.1	97.3
16	12.7	0.5	63.5	139.9
20	12.7	0.5	111.2	245.1

5. Insert the Cavitrol Hex anti-cavitation trim into the valve, ensuring the holes in the body outlet flange align with the holes in the trim flange. Remove lifting equipment used to install Cavitrol Hex trim.
6. Install four fasteners (key 67) and adequately tighten to secure the trim to the valve assembly.

Figure 8. Index Mark for Actuator Lever Orientation

ACTUATOR		VALVE OPEN	ACTUATOR POSITION			
MOUNTING	STYLE		1	2	3	4
(STANDARD) RIGHT-HAND	STYLE A  PUSH DOWN TO CLOSE					
	STYLE B  PUSH DOWN TO OPEN					
(STANDARD) LEFT-HAND	STYLE C  PUSH DOWN TO OPEN					
	STYLE D  PUSH DOWN TO CLOSE					
(OPTIONAL) LEFT-HAND	STYLE C  PUSH DOWN TO CLOSE					
	STYLE D  PUSH DOWN TO OPEN					

NOTE:  
1. ARROW ON LEVER INDICATES DIRECTION OF ACTUATOR THRUST TO CLOSE VALVE.

## Actuator Mounting

Standard flow direction is with the seal protector ring (key 3) facing upstream. Install the valve with the drive shaft horizontal and the ball closing in the downward direction (see figure 8).

### **⚠ WARNING**

The Vee-ball (key 2, figure 10) closes with a cutting motion. To avoid personal injury, keep hands, tools, and other objects away from the ball while stroking the valve.

Actuator travel must be adjusted before installing the valve in the pipeline because it is not possible to accurately determine the closed position once the valve is in the line.

The actuator can be right or left-hand mounted in any of four positions as shown in figure 8.

---

**Note**

Right-hand mounting—Actuator is on the right side of the valve when viewed from the valve inlet.

Left-hand mounting—Actuator is on the left side of the valve when viewed from the valve inlet.

---

However, when changing the valve from right to left-hand mounting, or vice versa, a different valve drive shaft and ball are required. If a new shaft and ball are required, refer to the Bearing and Ball Maintenance section and the Parts List in this manual.

---

**Note**

If necessary, it is possible to mount the valve in the left-hand position with the ball rotating to the top of the valve. This will require a non-standard ball. The ball rotates clockwise to close. Refer to figure 8, or contact your [Emerson sales office](#) for assistance.

---

## Determining Open Position

The valve must be removed from the pipeline to check the position of the ball.

1. Rotate the ball to the open position. The open position of the ball is shown in figure 9.
2. Adjust the actuator linkage until the open position is obtained using the appropriate actuator instruction manual procedures.
3. Stroke the valve to the closed position.

Make sure the actuator does not stroke the ball more than 90 degrees when rotating to the closed position (see figure 9).

Figure 9. Determining the Ball Position

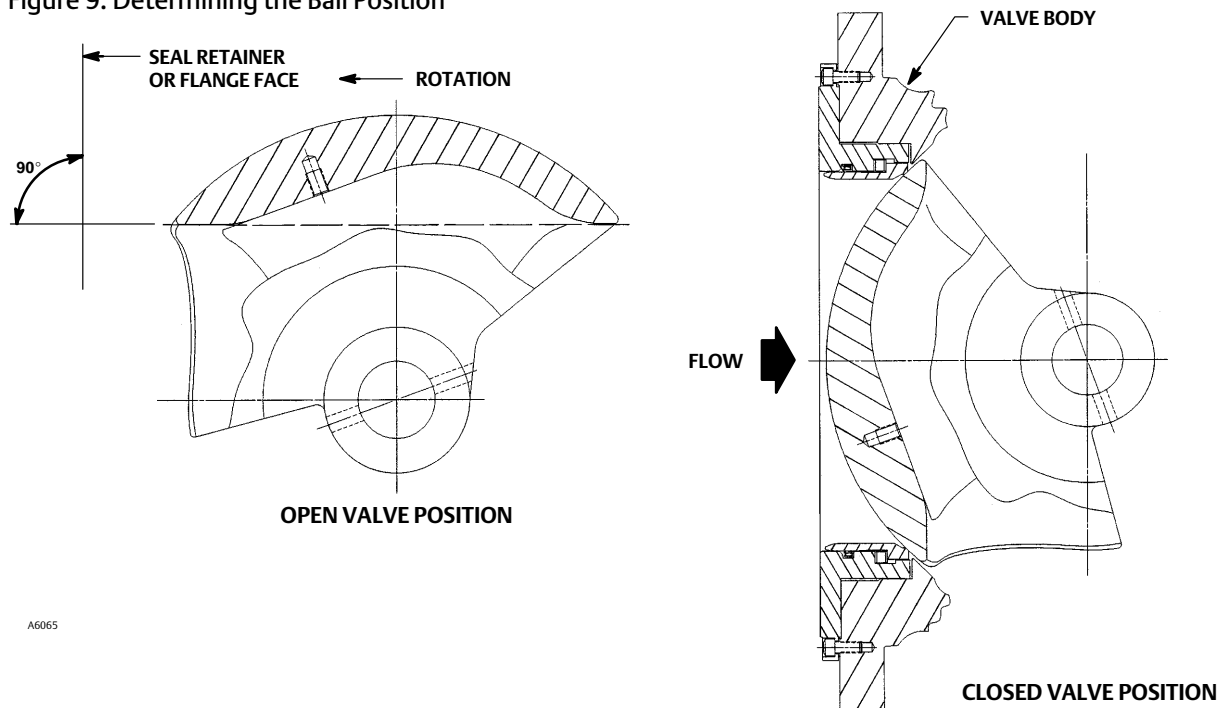
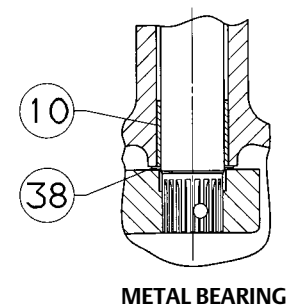
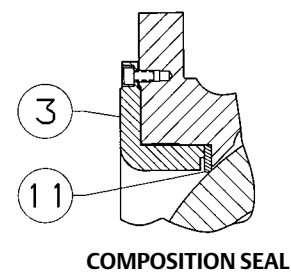
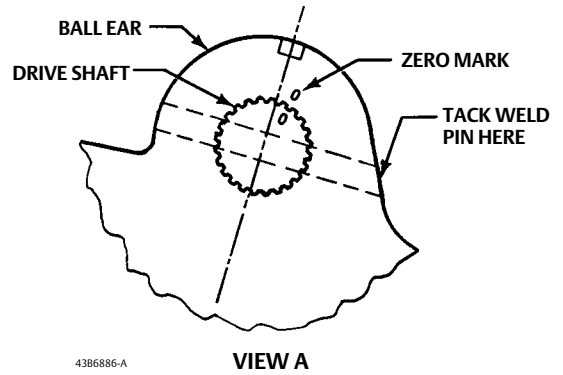
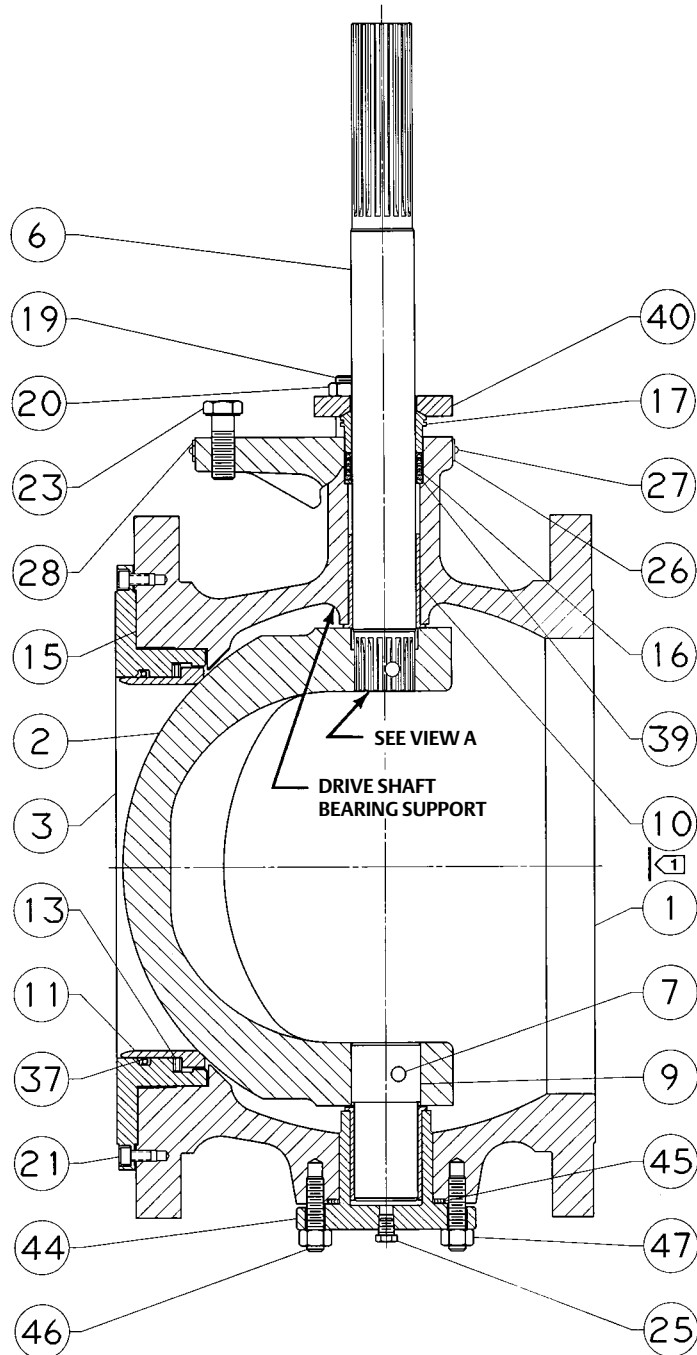
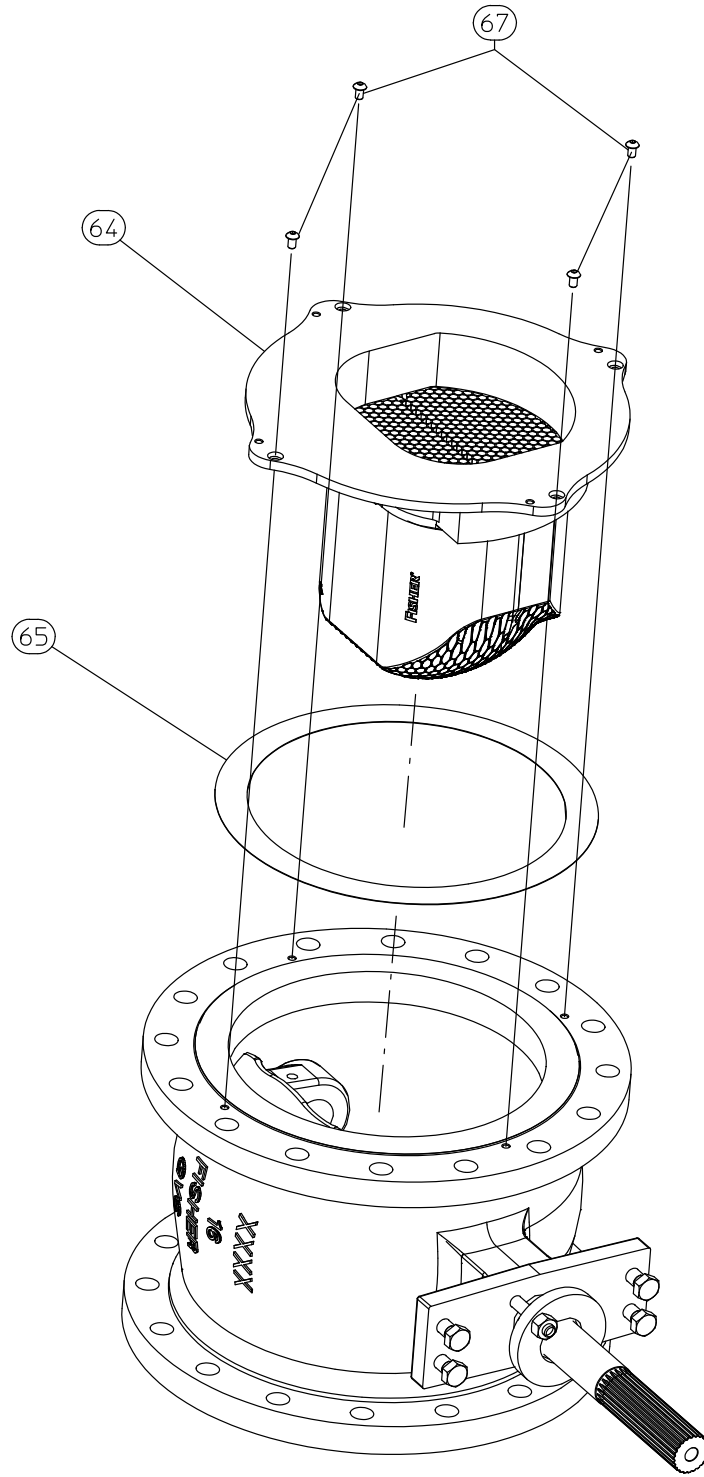


Figure 10. Fisher V150 and V300 Valve Assembly



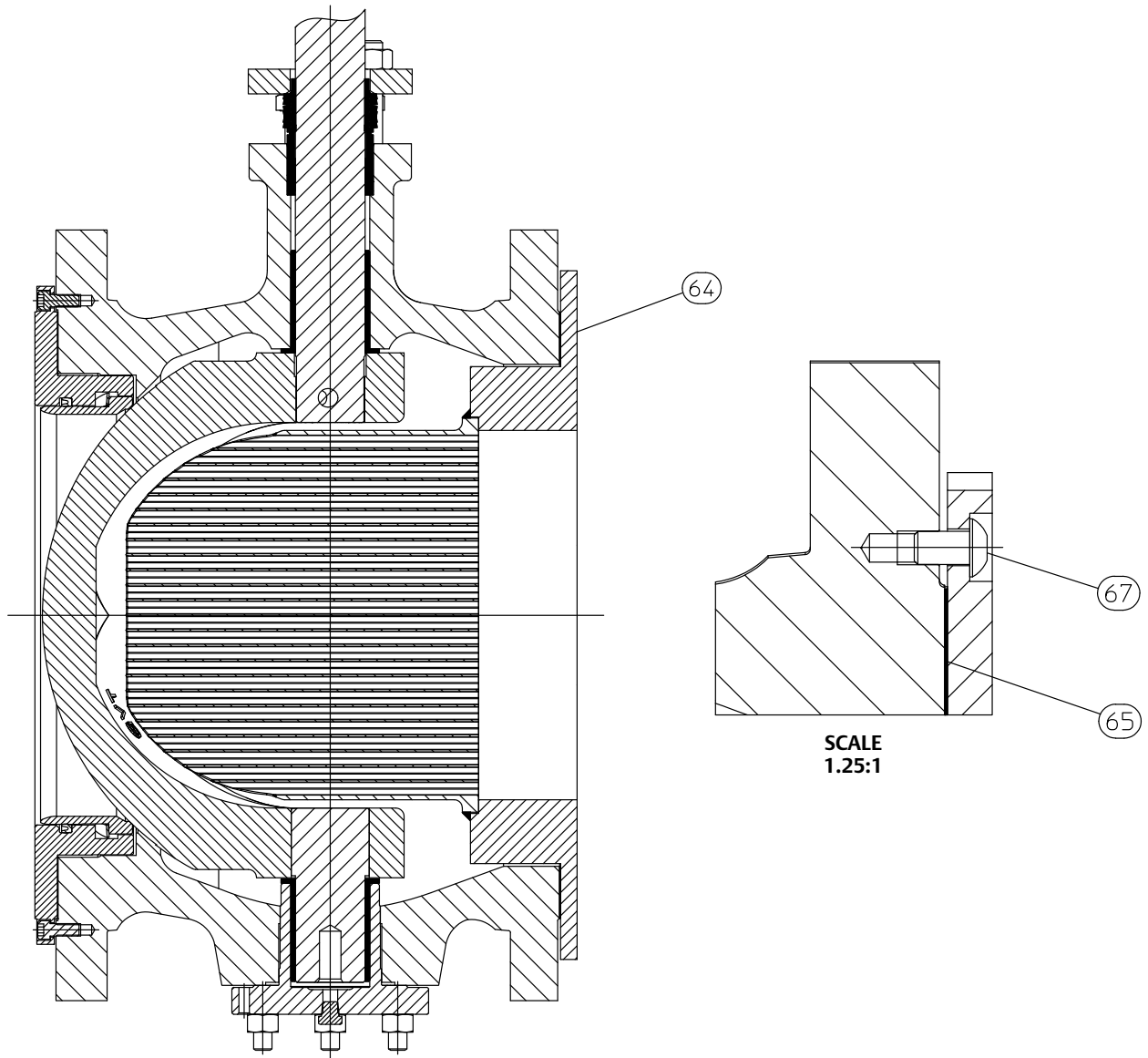
NOTES:  
 1. THE V-NOTCH BALL EXTENDS TO THIS POINT WHEN ROTATED 180 DEGREES AWAY FROM THE CLOSED POSITION. SEE BEARING AND V-NOTCH BALL ASSEMBLY PROCEDURES.  
 2. KEYS 24, 30, 31, 35, AND 36 ARE NOT SHOWN.

Figure 11. Fisher V150 with Cavitrol Hex Explosion View



GH12081

Figure 12. Fisher V150 with Cavitrol Hex Valve Assembly



## Parts Kits

### Cavitrol Hex Retrofit Kit

Kit includes the Cavitrol Hex (key 64), gasket (key 65), and fasteners (key 67). Kits are available for the NPS 14, 16, and 20 V150 and V300 flanged, raised-face body constructions. To retrofit the Cavitrol Hex anti-cavitation trim to an existing valve assembly, special body machining is required. Contact your [Emerson sales office](#) for retrofit information.

VALVE SIZE, NPS	MATERIAL	
	S31603	R31233
	KIT PART NUMBER	
14	RCAVHEX0102	RCAVHEX0112
16	RCAVHEX0122	RCAVHEX0132
20	RCAVHEX0142	RCAVHEX0152



## Parts Ordering

A serial number is assigned to each valve and stamped on the nameplate. Always refer to the valve serial number when corresponding with your [Emerson sales office](#) regarding spare parts or technical information.

### **⚠ WARNING**

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

## Parts List

**Note**  
Contact your [Emerson sales office](#) for Part Ordering information.

Key	Description
1	Valve Body Assembly If a part number is required, contact your Emerson sales office.
2*	Ball
3	Seal Protector Ring
6*	Drive Shaft
7*	Pin (2 req'd)
9*	Follower Shaft
10*	Bearing (2 req'd)
11*	Ball Seal
13*	Wave Spring Use w/HD Metal Seal
15*	Gasket
16*	Packing Set, Set includes PTFE V-ring packing with one carbon-filled conductive ring, male adapter, and female adapter
17	Packing Follower
19	Packing Follower Stud (2 req'd)
20	Packing Follower Nut (2 req'd)
21	Retainer Screw (used w/B&M)
23	Actuator Mounting Screw (4 req'd)
24	Actuator Mounting Nut (4 req'd)

Key	Description
25	Pipe Plug
26	Identification Nameplate
27	Drive Screw
28	Flow Arrow (2 req'd)
30	Body Size/Serial Number Nameplate
31	Nameplate Wire (not shown)
35*	Packing Ring (4 req'd)
36*	Packing Washer (Use w/graphite ribbon packing, 3 req'd)
37*	Radial Seal Use w/HD Metal Ball Seal
38	Thrust Washer (4 req'd)
39*	Packing Box Ring
40	Packing Flange
44	Bottom Flange
45*	Gasket
46	Bottom Flange Stud (6 req'd)
47	Hex Nut (6 req'd)
64	Cavitrol Hex
65	Gasket
67	Screw

### ENVIRO-SEAL Packing System (figure 3)

100	Packing Flange Stud
101	Packing Flange Nut
102	Packing Flange
103	Spring Pack Assembly
105*	Packing Set
106*	Anti-Extrusion Ring (2 req'd)
107*	Packing Box Ring
111	Tag
112	Tie Cable
113	Lubricant

\*Recommended spare parts





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