

# Fisher® Vee-Ball™ V150, V200 and V300 Rotary Control Valves NPS 1 through 12

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## Introduction

### Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts information for the Vee-Ball Design V150 (1- through 12-inch sizes), V200 (1- through 10-inch sizes), and V300 (1- through 12-inch sizes) rotary control valves (see figure 1). Sizes 3- through 12-inch without an attenuator currently in production are referred to



W9161-1

Figure 1. Type Vee-Ball with Type 1052 Actuator and FIELDVUE™ DVC6000 Digital Valve Controller

as Series B (for more information on this distinction see Appendix A).

For larger valves (14-, 16-, and 20-inch size), refer to a separate instruction manual. For information on ENVIRO-SEAL™ packing, see the ENVIRO-SEAL Packing System for Rotary Valves instruction manual (form 5305). Refer to separate manuals for information concerning the actuator, positioner and accessories.

No person may install, operate, or maintain Design V150, V200, and V300 valves without first • being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance and • carefully reading and understanding the contents of this manual. If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.



# Vee-Ball Valves

Table 1. Specifications

<p><b>Valve Sizes and End Connection Styles</b></p> <p><b>Design V150:</b> ■ 1, ■ 1.5, ■ 2, ■ 3, ■ 4, ■ 6, ■ 8, ■ 10, and ■ 12-inch sizes with Class 150 raised-face flanges</p> <p><b>Design V200:</b> ■ 1, ■ 1.5, ■ 2, ■ 3, ■ 4, ■ 6, ■ 8, and ■ 10-inch flangeless valves that mate with Class 150, 300, or 600 (for size 1 through 8-inches) raised-face flanges</p> <p><b>Design V300:</b> ■ 1, ■ 1.5, ■ 2, ■ 3, ■ 4, ■ 6, ■ 8, ■ 10, and ■ 12-inch valves with Class 300 raised-face flanges</p> <p><b>Standard Flow Direction</b></p> <p>Forward (into the convex face of the Vee-ball)</p>	<p><b>Actuator Mounting</b></p> <p>■ Right-hand, standard or ■ left-hand, optional, as viewed from upstream end of valve (see figure 23 and the Actuator Mounting section)</p> <p><b>Maximum Ball Rotation</b></p> <p><b>Standard:</b> Ball rotates counterclockwise to close when viewed from actuator side of valve</p> <p><b>Optional:</b> Ball rotates clockwise to close</p> <p>Ball rotation is 90 degrees</p> <p><b>Valve/Actuator Action</b></p> <p>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.) See actuator manual for details</p>
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1. The pressure/temperature limits in this manual, and any applicable code or standard limitation, should not be exceeded.

## Description

The Designs V150, V200, and V300 Vee-Ball valves (figure 1) with a V-notch ball are used in throttling or on-off service. The Design V200 is a flangeless construction. The Design V150 and V300 valves are raised-face flanged constructions. The splined valve shaft of all these valves connect to a variety of rotary-shaft actuators.

## Specifications

Specifications for these valves are shown in table 1 and in bulletin 51.3:Vee-Ball.

## Installation

Separate installation steps are provided in this section for Design V150 and V300 flanged valves, and for Design V200 flangeless valves. Key numbers in installation procedures are shown in figures 24, 25 and 26 unless otherwise indicated.

Some types of ceramic trim, including VTC, can create a spark under certain conditions. If an edge of a ceramic part is struck against a second ceramic part with enough force, it can produce a spark.



### WARNING

**Avoid personal injury and property damage from ignition of process fluid caused by sparks from ceramic trim. Do not use ceramic trim where the process fluid is unstable or if it is an explosive mixture (such as ether and air).**



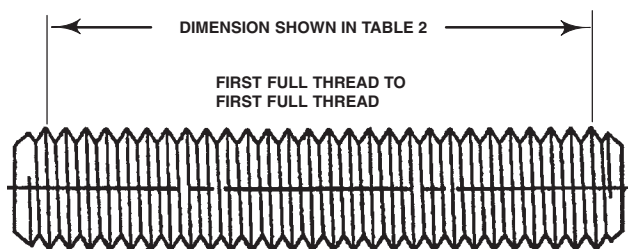
### WARNING

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

**Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed 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.**

Table 2. Flange Stud Lengths Required for Seal Protector Ring End of Design V150 and V300 Valves

VALVE SIZE, INCHES	DESIGN V150				DESIGN V300	
	ISA S75.04 Face-to-Face		ASME B16.10 Short Face-to-Face		ISA S75.04 Face-to-Face	
	mm	Inches	mm	Inches	mm	Inches
1	70	2.75	95	3.75	89	3.50
1.5	83	3.25	127	5.00	102	4.00
2	95	3.75	146	5.75	95	3.75
3	95	3.75	133	5.25	121	4.75
4	108	4.25	146	5.75	127	5.00
6	114	4.50	152	6.00	140	5.50
8	121	4.75	171	6.75	152	6.00
10	133	5.25	165	6.50	171	6.75
12	140	5.50	159	6.25	184	7.25



1A4520 / IL

Figure 2. Flange Stud Length for Seal Protector End

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

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

## WARNING

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. To avoid possible personal injury and because some valve/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first

contacting your Emerson Process Management sales office.

## WARNING

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

### Note

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. 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).

Attach the optional bonding strap assembly (key 131, figure 3) to the valve drive shaft (key 6) with the clamp (key 130, figure 3) and connect the other end of the bonding strap assembly to the valve body with the cap screw (key 23).

1. If the valve is to be stored before installation, protect the flange mating surfaces and keep the valve body cavity dry and free of foreign material.
2. Install a three-valve bypass around the control valve assembly if continuous operation will be

# Vee-Ball Valves

necessary during inspection and maintenance of the valve.

3. The valve is normally shipped as part of a control valve assembly, with an actuator mounted on the valve. 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 and the appropriate actuator instruction manual.

4. Standard flow direction is with the seal protector ring (key 3) facing upstream.

5. Install the valve in a horizontal or vertical pipeline with the drive shaft in a horizontal position.

## CAUTION

**Do not allow the valve to be installed in the pipeline with the drive shaft in the vertical position because of excessive wear to valve component parts.**

6. The actuator can be right- or left-hand mounted with the shaft in a horizontal orientation as shown in figure 1. If necessary, refer to the appropriate actuator instruction manual for actuator installation and adjustment procedures.

## CAUTION

**Ensure the valve and adjacent pipelines are free of foreign material that could damage the valve seating surfaces.**

7. Be certain the valve and adjacent pipelines are free of any foreign material that could damage the valve sealing surfaces.

8. Be sure the pipeline flanges are in line with each other.

## Installing Design V150 and V300 Valves

1. Install the Design V150 and V300 valve using studs (keys 32 and 33, not shown) 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 (key 32) than standard. Do not use standard-length line flange studs for the seal protector ring end of the valve.

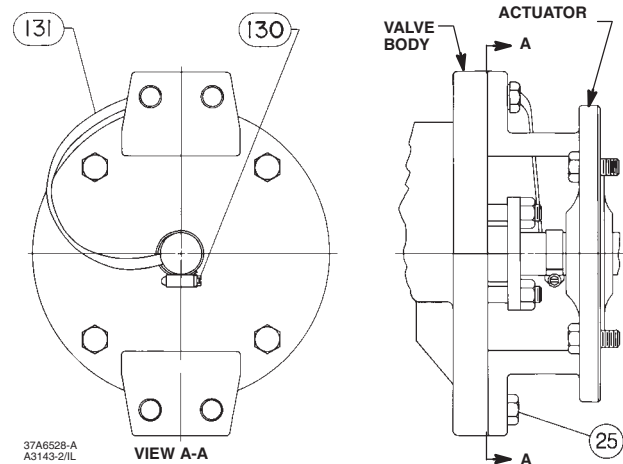


Figure 3. Optional Shaft-to-Body Bonding Strap Assembly

2. See table 2 and figure 2 for length of studs for the seal protector ring end of Design V150 and V300 valves. Lubricate the studs with anti-seize lubricant.

3. Insert flat-sheet line flange gaskets (or spiral-wound gaskets with compression-controlling center rings) that are compatible with the flowing media.

4. 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 require 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. See ENVIRO-SEAL Packing System for Rotary Valves instruction manual (form 5305) for packing instructions.

DESIGN V200 VALVE SIZE, INCHES	DIMENSION						
	A		B	M			
	Standard ISA S75.04 <sup>(1)</sup>	Class 150 ASME B16.10 <sup>(2)</sup> Short (Optional)		Standard Class 150 S75.04 <sup>(1)</sup>	Class 150 ASME B16.10 <sup>(2)</sup> Short (Optional)	Class 300	Class 600
mm							
1	102	127	58	176	202	202	202
1.5	114	165	64	189	240	224	224
2	124	178	57	211	268	237	237
3	165	203	87	254	286	279	286
4	194	229	92	286	321	305	343
6	229	267	119	343	381	362	423
8	243	292	119	343	394	387	426
10	297	330	151	419	451	- - -	- - -
Inches							
1	4.00	5.00	2.29	6.94	7.94	7.94	7.94
1.5	4.50	6.50	2.50	7.44	9.44	8.81	8.81
2	4.88	7.00	2.25	8.31	10.56	9.31	9.31
3	6.50	8.00	3.44	10.00	11.25	11.00	11.25
4	7.62	9.00	3.62	11.25	12.62	12.00	13.50
6	9.00	10.50	4.69	13.50	15.00	14.25	16.25
8	9.56	11.50	4.69	13.50	15.50	15.25	16.75
10	11.69	13.00	5.94	16.50	17.75	- - -	- - -
1. IEC 534-3-2 face-to-face dimensions are equivalent to S75.04 face-to-face dimensions. 2. 150 lb class only.							

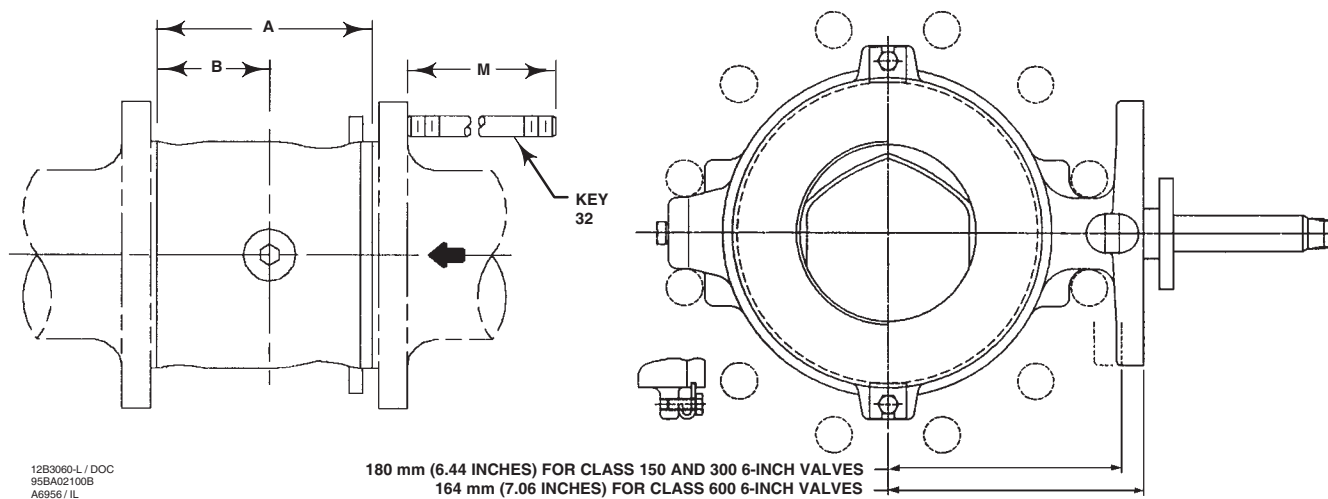


Figure 4. Design V200 Dimensions and Required Clearances for Installation

## Installing Design V200 Valves

Stud length dimensions are shown in figure 4 for the seal protector ring end of the valve. For Design V200, Class 600, the dimension from the center line of the valve bore to the mounting flange face is larger than a Class 150 or 300 valve.

1. Install the Design V200 valve using long studs (key 32, figure 4) to connect the two pipeline flanges. Refer to figure 4 for the size of studs required. Lubricate the studs with anti-seize lubricant.

2. Install two studs in the flanges before you place the valve in the line. Place the two studs so they will contact the line-centering notches at the bottom of the valve body.

3. Insert flat-sheet line flange gaskets (or spiral-wound gaskets with compression-controlling center rings) that are compatible with the process fluid.

4. Place the valve on the two studs. Install all remaining studs. Measure carefully to be sure the valve is centered on the pipeline flanges, and tighten

# Vee-Ball Valves

the flange stud nuts. Tighten the nuts in a criss-cross sequence to be sure the flange gaskets are properly torqued.

5. 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 require 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.**

## 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.

Key numbers in this procedure are shown in figures 24, 25, and 26, unless otherwise noted.



## WARNING

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

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

- **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 from both sides of the valve. Drain the process media from both sides of the valve.**

- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**

- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**

- **Always wear protective gloves, clothing, and eyewear when performing any maintenance operations.**

- **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 in this procedure are shown in figures 24, 25, and 26, unless otherwise noted. A detailed view of the packing is also shown in figure 5.

If the valve is equipped with the ENVIRO-SEAL Packing System, refer to:

- the separate ENVIRO-SEAL Packing System for Rotary Valves instruction manual (form 5305) for maintenance instructions, and
- the Parts List section of this manual for retrofit kits, parts kits, and individual parts.

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 or scratches on the packing box wall. Inspect the drive shaft and packing



box wall for nicks or scratches while performing the following procedure.

## Replacing Packing

When using this procedure, it is recommended that the actuator **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. Refer to the Determining Closed Position portion of the Actuator Mounting section.

## Disassembly



## WARNING

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

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, 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 are working on the equipment.
2. Remove line bolting, remove the control valve from the pipeline, and place the valve/actuator assembly on a flat surface with the seal protector ring facing up.
3. Remove the actuator cover. Take note of the orientation of the actuator with respect to the valve body and the lever orientation with respect to the valve drive shaft (see figure 6).



## WARNING

**When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, with a shearing, cutting motion, which could result in personal injury. To avoid injury, carefully rotate the ball to a stable position after the actuator is removed.**

## CAUTION

**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 puller to remove the lever or actuator from the valve shaft. It is okay to tap the puller screw lightly to loosen lever or actuator, but hitting the screw with excessive force could damage the ball, seal, and valve.**

4. Remove the clamped 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 applicable, remove the bonding strap assembly before attempting to remove the packing (see figure 3).
6. Remove the packing follower nuts and packing follower (keys 17 and 20). For alloy packing constructions, the packing follower (key 17) and a separate packing flange (key 40) must be removed if present.

If the valve is equipped with the ENVIRO-SEAL packing system, refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual (form 5305) for disassembly.



## WARNING

**Personal injury could result from packing leakage. Do not scratch the drive shaft or packing box wall while removing packing parts in the following procedure.**

7. Remove the packing parts (see figure 5, keys 16, 17, 35, and 39 depending on construction) using 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.

# Vee-Ball Valves

## Assembly

If the valve is equipped with the ENVIRO-SEAL packing system, refer to the ENVIRO-SEAL Packing System for Rotary Valves instruction manual (form 5305) for assembly.

### Series B only

1. For 8-, 10-, and 12-inch valves, install the packing spacer (key 34) if it has been removed.
2. To help ensure correct centering of the Vee-ball (key 2) on the seal (key 11), make sure the ball is closed while you install or tighten new packing. Insert a screwdriver, pry bar, or similar tool between the lower ear of the ball and the valve body. Use the pry to move the ball tightly against the bearing on the actuator side of the valve (see figure 6). Keep the ball in that position until you have completed packing installation and adjustment.
3. Install the new packing parts using the parts sequence shown in figure 5. Install the packing follower (key 17). Alloy constructions have a packing follower (key 17) and a separate packing flange (key 40) that must be replaced.
4. Secure the packing follower with the packing follower nuts (key 20). Tighten the nuts far enough to stop leakage under operating conditions.

Handle the seal protector ring, seal, and other parts carefully to prevent damage. A new gasket (key 15) is required whenever the seal protector ring (key 3) (figure 11) is removed.

**Flow ring construction** does not use a seal, shims, or spring seal. Use this procedure to remove the seal protector ring from flow ring constructions, but disregard any instructions calling for the seal, shims, or spring seal.

### Note

**If the valve is equipped with a bonding strap assembly (figure 3), re-install the assembly.**

5. Reconnect the actuator and lever in accordance with the orientations that were noted in step 3 of the disassembly procedures. If necessary, use figure 23 to identify the correct index marks.
6. Refer to the appropriate actuator instruction manual to complete actuator assembly and adjustment.

7. When the control valve is in operation, check the packing follower for leakage and retighten the packing follower nuts (key 20) as necessary.

## Replacing the Ball Seal

### Disassembly

Perform this procedure if the control valve is not shutting off properly or if seal inspection is necessary. If you find upon inspection that the ball, shaft, or bearings need to be replaced, use this procedure to remove the ball seal. Then, proceed to the Bearing and Ball Maintenance procedures. Then, return to this procedure and begin with the assembly of the ball seal steps.

While the actuator/valve assembly must be removed from the pipeline, the actuator may remain mounted on the valve as you replace the ball seal.

Key numbers are shown in figures 24, 25, and 26, unless otherwise indicated. Ball Seal assembly details (with key numbers) are also shown in figures 8, 9 and 10.

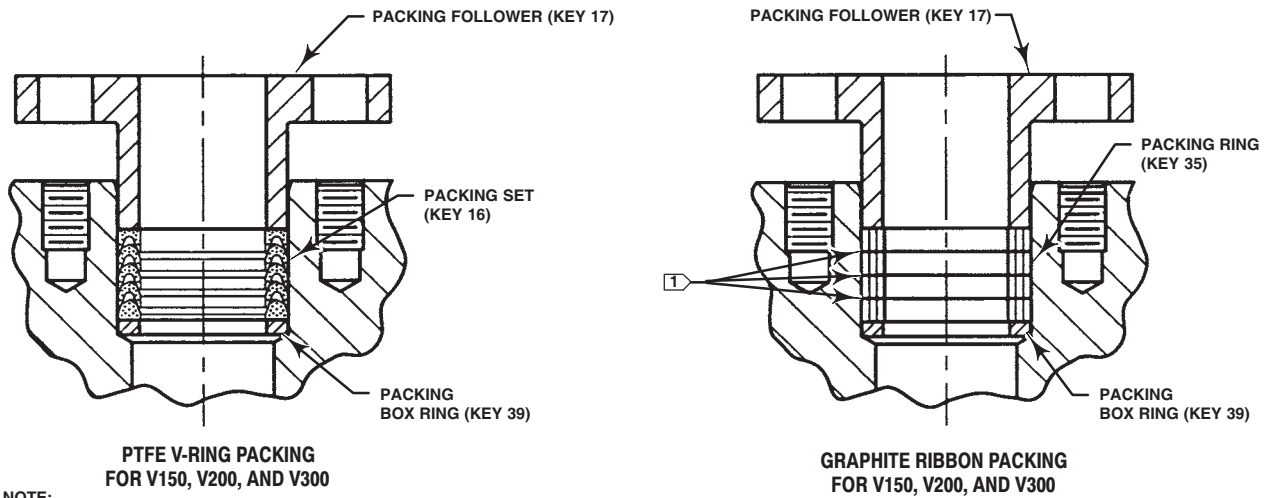


### WARNING

**Perform the steps in the WARNING at the beginning of the Maintenance section of this manual.**

1. Remove line bolting, remove the control valve from the pipeline, and place the valve on a flat surface with the seal protector ring facing up. Carefully rotate the ball to the open position.
2. Remove protector ring screws and washers (keys 21 and 22). Carefully remove the seal protector ring and gasket (keys 3 and 15). (For flow ring constructions, go to step 4.)
  - a. **For a Fisher TCM seal**, remove the seal (key 11) from the valve body. For 1-, 1.5, and 2-inch valves, also remove the backup ring (key 14, figure 8) from the valve body.
  - b. **For a flat metal seal**, remove the spring seal, seal, and shims (keys 13, 11, and 12). (Note: It may be necessary to re-use some of the original shims when reassembling the flat metal seal.)
  - c. **For an HD metal seal or a high temperature HD metal seal**, once the protector ring has been removed from the valve, push the metal seal (key

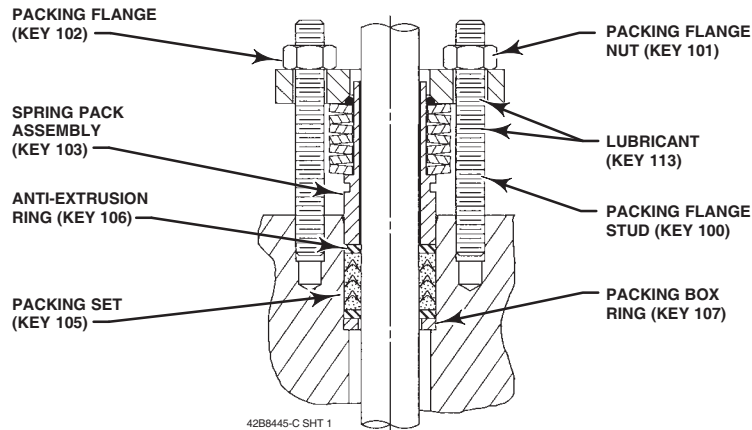




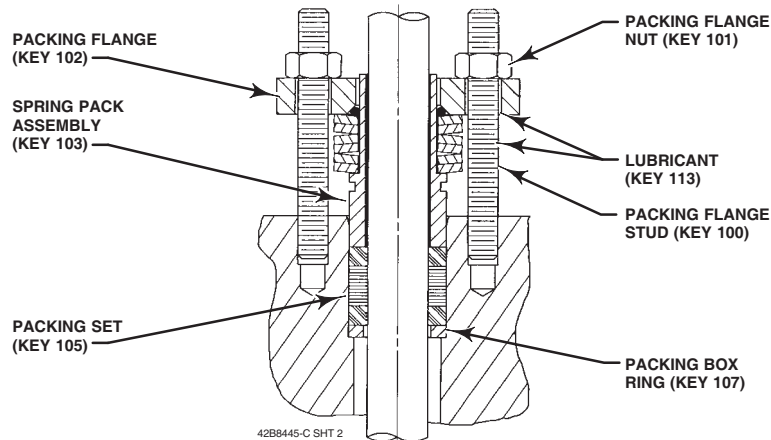
NOTE:  
 1 INCLUDES ZINC WASHERS (KEY 36) FOR GRAPHITE RIBBON PACKING ONLY.

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### STANDARD PACKING



### ENVIRO-SEAL PTFE PACKING SYSTEM



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### ENVIRO-SEAL GRAPHITE PACKING SYSTEM

Figure 5. Packing Arrangements

# Vee-Ball Valves

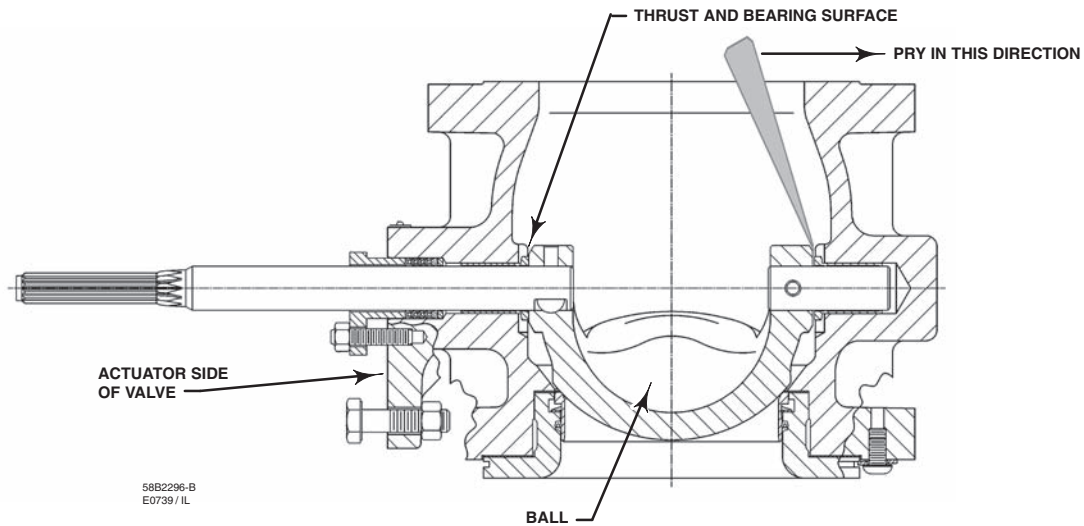


Figure 6. Typical Vee-Ball Valve Showing Pry Bar

11) out of the seal protector ring (key 3). Remove the wave spring (key 13), and on the HD metal seal, the radial seal (key 37).

## Note

The high temperature HD metal seal also has a piston ring (key 133) that will need to be removed. It will be in two pieces for the 1, 1.5 and 2-inch valves, and one piece with a break in it for the 3- through 12-inch valves.

## CAUTION

Exercise care to avoid damaging components in the following procedure.

- 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.
- **3- through 12-inch valves**, if the seal is difficult to push out, it is recommended that a seal removal plate be used to press the HD metal seal out of the seal protector ring. Refer to figure 12 for dimensions of the seal removal plate.
- **10- and 12-inch valves with an attenuator only**: Remove the retaining ring (key 41) in the seal protector ring. This

retaining ring is an octagonal-shaped support wire. To remove the retaining ring, find one of the free ends of the ring. Use a screwdriver or similar tool to pry inward and upward until the ring is removed.

3. Inspect the gasket and sealing surfaces on the valve body (key 1 or 1A), the seal protector ring (key 3), Vee-ball (key 2), and the retaining ring (key 41 for 10- and 12-inch valves with an attenuator only). Be sure the sealing surfaces are not damaged.
4. If replacement of the ball, shafts (keys 6 or 9), or bearings (key 10) is needed, proceed to the Bearing and Ball Maintenance procedure. If only the seal is to be replaced, proceed to the Assembly steps below.

## Assembly

Refer to figures 8, 9, and 10 for key number locations during seal installation. Valve key number locations are shown in figures 24, 25, and 26.

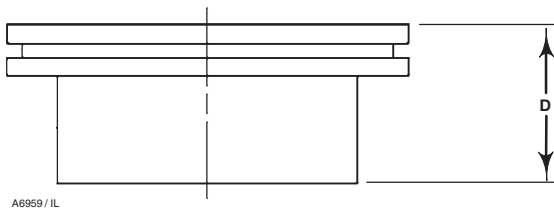
1. Thoroughly clean all parts that are to be re-used and obtain replacement parts. Be sure that all sealing surfaces are in good condition without scratches or wear. If the valve has been installed between line flanges and the flange studs and nuts have been tightened, always replace the gasket (key 15) with a new gasket.
2. To help ensure correct side-to-side centering of the ball (key 2) on the seal (key 11), make sure the ball is closed while you install the seal or flow ring and seal protector ring. Insert a screwdriver, pry bar, or similar tool between the lower ear of the ball and the valve body (see figure 6).

Valve Size, Inches	Construction (1)	TCM Seal "D"	HD Seal "D"	Flow Ring "D"
mm				
1	New	37.6	44.7	39.6
	Old	25.1	33.0	26.9
1.5	New	39.1	44.5	40.9
	Old	27.4	32.8	29.2
Inches				
1	New	1.48	1.76	1.56
	Old	0.99	1.30	1.06
1.5	New	1.54	1.75	1.61
	Old	1.08	1.29	1.15

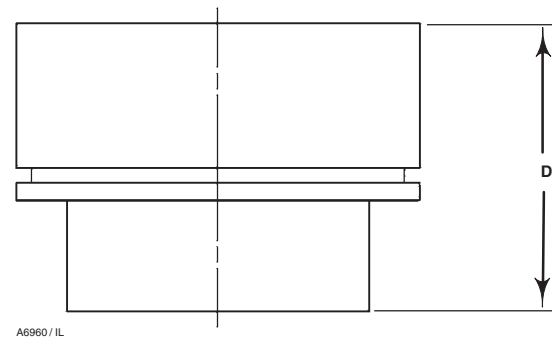
1. See the Note on page 14 of this Instruction Manual.

Valve Size, Inches	Construction (1)	TCM Seal "D"	HD Seal "D"	Flow Ring "D"
mm				
1	New	63.0	70.1	65.0
	Old	50.5	58.4	52.3
1.5	New	89.9	95.3	91.7
	Old	78.2	83.6	80.0
Inches				
1	New	2.48	2.76	2.56
	Old	1.99	2.30	2.06
1.5	New	3.54	3.75	3.61
	Old	3.08	3.29	3.15

1. See the Note on page 14 of this Instruction Manual.

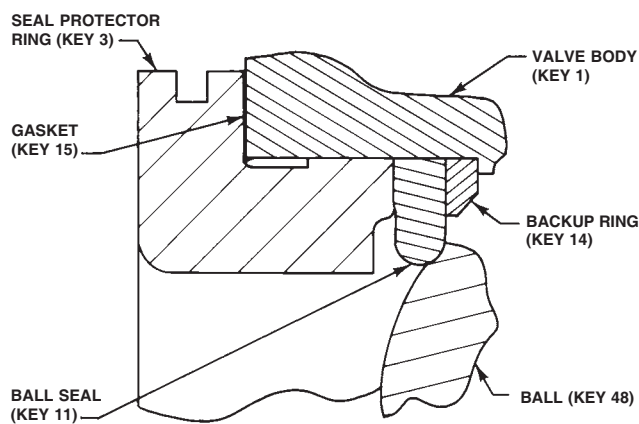


ISA S75.04 FACE-TO-FACE VALVE

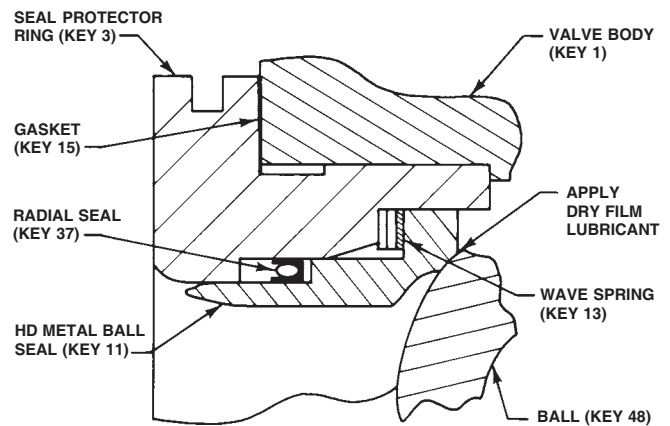


CLASS 150 ASME B16.10 (SHORT) FACE-TO-FACE VALVE

Figure 7. 1 and 1.5 Inch Seal Protector Ring Measurements



Fisher TCM Plus BALL SEAL



HD METAL BALL SEAL

Figure 8. Ball Seal Assembly for Size 1, 1.5, and 2-Inch Valves

# Vee-Ball Valves

May 2006

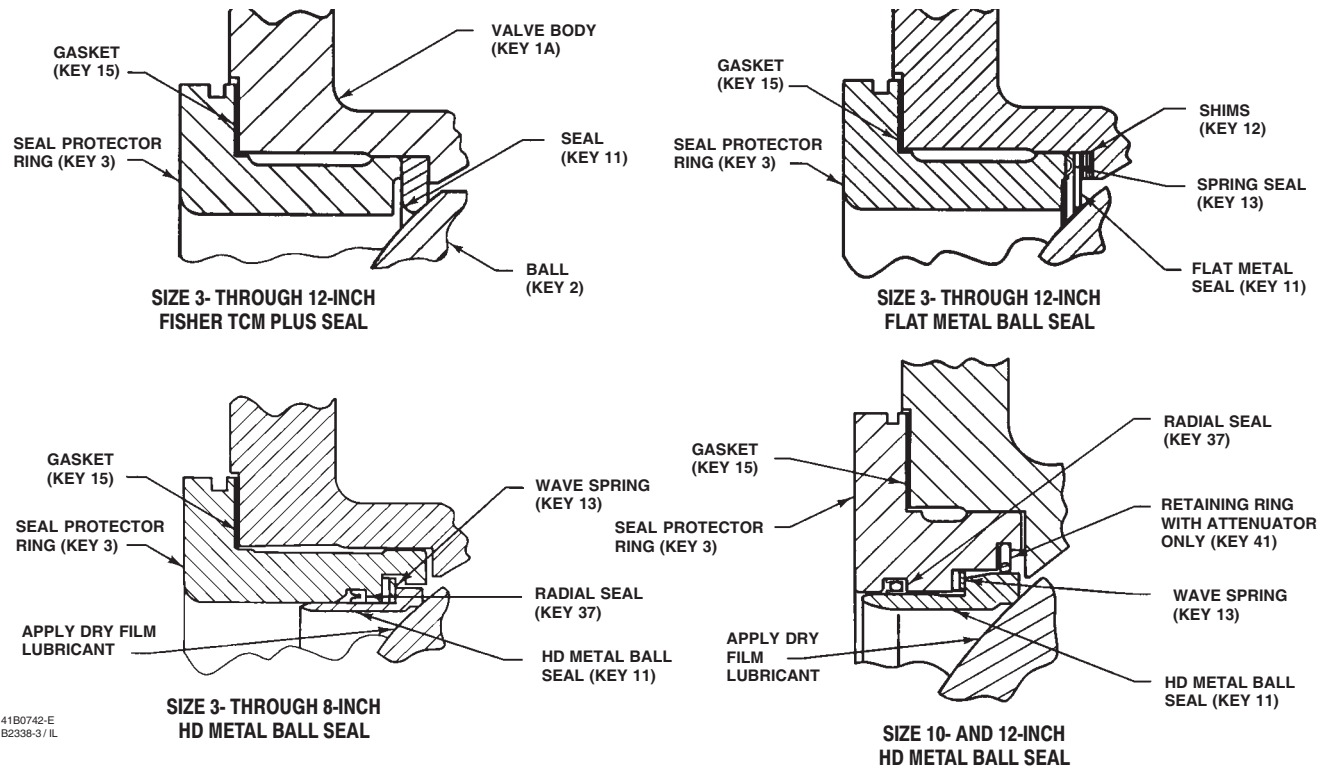


Figure 9. Ball Seal Assembly for Size 3 through 12-inch Valves

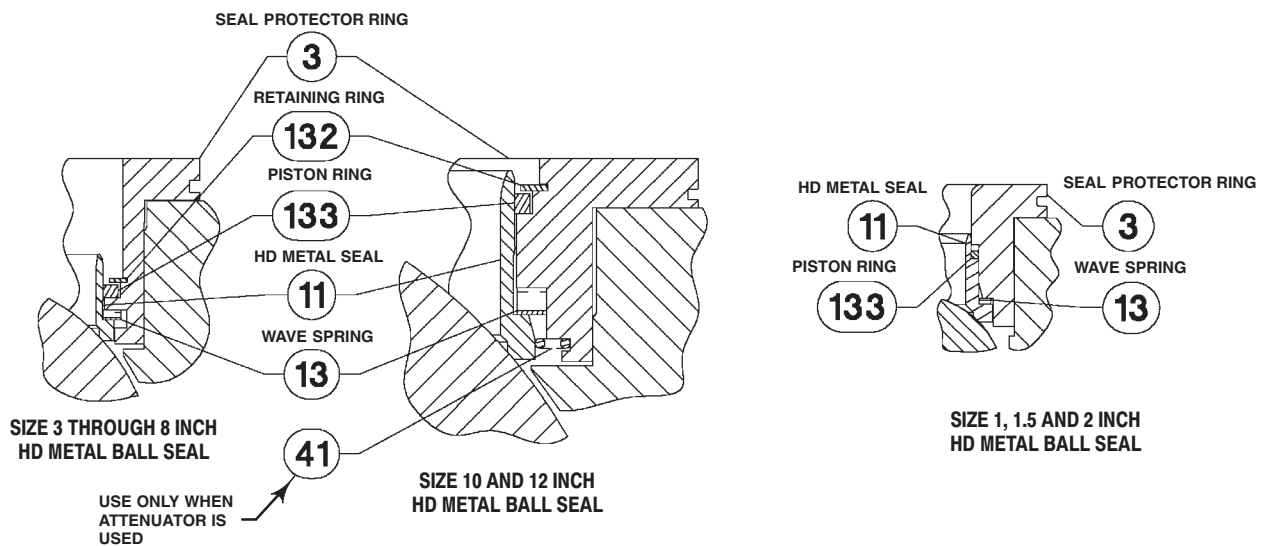


Figure 10. High Temperature HD Metal Seal Details

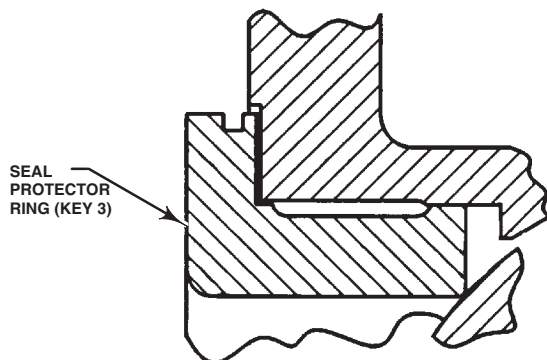
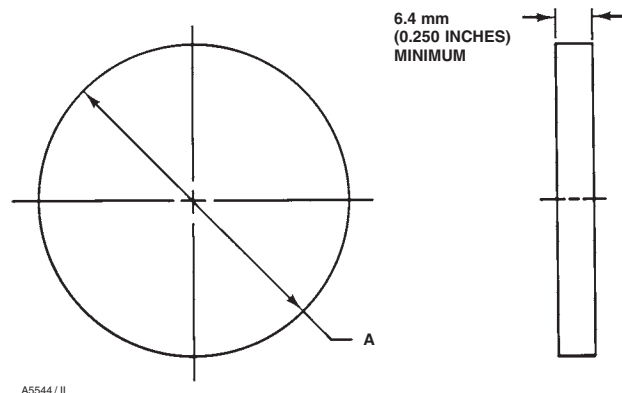


Figure 11. Seal Protector Ring

VALVE SIZE, INCHES	DIMENSION A	
	Minimum-Maximum, mm	Minimum-Maximum, Inches
3	75.9-76.2	2.990-3.000
4	95.0-95.3	3.740-3.750
6	126.7-127.0	4.990-5.000
8	158.5-158.8	6.240-6.250
10	212.5-212.7	8.365-8.375
12	263.3-263.5	10.365-10.375



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Figure 12. HD Seal Removal Plate Dimensions

3. Use the pry to move the ball tightly against the bearing on the actuator side of the valve. Be careful, excessive force may damage the ball. Keep the ball in that position until you have completed seal or flow ring installation. Check the ball's position periodically, and re-center if necessary, during lever assembly and packing adjustments.



## WARNING

The Vee-Ball closes with a shearing, cutting motion, which could result in

personal injury. To avoid injury or property damage, keep hands, tools, and other objects away from the Vee-Ball while stroking the valve.

4. Install the seal.

## CAUTION

Due to the Vee-ball shape, take care to never completely rotate either the front skirted edge or the circular back edge of the ball out of the ball seal as the seal could be damaged.

### Installing Fisher TCM Plus or Extra ball seals:

a. **1-, 1.5, and 2-inch valves:** Install the backup ring (key 14). Install the Fisher TCM seal (key 11) into the valve body. Refer to figure 7.

- Install the gasket (key 15) on the valve body.

- Install the seal protector ring (key 3) into the valve body. Now go to step 5 in this procedure.

b. **3- through 12-inch valves:** Install the Fisher TCM 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. Now go to step 5 in this procedure.

### Installing flat metal seals:

a. Install 12 shims in the valve and install the flat metal seal on top of the shims.

b. Install the spring seal (key 13) on the flat metal seal (key 11) with the convex side of the spring seal facing the ball.

c. Install the seal protector ring, and install the protector ring screws and washers (keys 21 and 22). Tighten the screws.

d. Add or remove shims under the ball seal as necessary to obtain zero ball seal deflection as accurately as possible.

### Note

Zero ball seal deflection for a flat metal seal is the point at which the addition



# Vee-Ball Valves

**of one 0.13 mm (0.005 inch) thick shim causes contact between the ball and ball seal to be broken. Hold the parts tightly together when determining zero deflection, or improper zero deflection might result.**

- e. After zero deflection is reached, remove the seal protector ring, spring seal, seal and 4 shims. Final assembly of the control valve should not exceed a maximum of 9 shims for zero deflection. If more than 9 shims are required, contact your Emerson Process Management sales office.
- f. Install the gasket (key 15) on the valve body.
- g. Install the seal protector ring (key 3) into the valve body. Now go to step 5 in this procedure.

## Installing HD metal seals:

### Note

**The older and newer designs of the 1- and 1.5 inch seal protector ring are functionally the same, but are different lengths and not interchangeable. All 1- and 1.5 inch sizes of Design V150 and V300 valves are the newer design. The change in seal protector ring length occurred in the 1992/1993 timeframe and affects 1- and 1.5 inch Design V200 valves only. To determine whether you have the older or newer design, measure the length of the seal protector ring (key 3, figure 26) from its pipeline flange mating surface to its opposite end. Compare your measurement to those listed in figure 7.**

- a. **For 1-, and 1.5 inch valves:** The older and newer designs of the 1- and 1.5 inch seal protector rings are functionally the same, but are different lengths and not interchangeable. Refer to figure 7 for protector ring dimensions.

- Install the wave spring (key 13) onto the ball seal.

- Lubricate and install the radial seal (key 37) onto the ball seal (key 11). Make sure the open side of the radial seal faces away from the ball.

- Push the ball seal assembly into the seal protector ring (key 3).

- Go to step 5 in this procedure.

## b. For all 3- through 8-inch valves and 10- and 12-inch valves without attenuator:

- Lubricate 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) into 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. Go to step 5 in this procedure.

## c. For 10- and 12-inch valves with attenuator:

- Lubricate the radial seal with lithium grease 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) into the seal protector ring (key 3).

- To install the retaining ring (key 41), find one of the free ends of the ring. Insert the free end into the groove in the seal protector ring. Work around the ring, pressing it into the groove until the ring is completely in its groove.

- 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.

- The HD metal seal uses a retaining ring (key 41) for 10- and 12-inch sizes only. This retaining ring is an octagonal-shaped support wire. Go to step 5 in this procedure.

## Installing high temperature HD metal seals:

- a. **For 1-, 1.5 and 2-inch valves:** The older and newer designs of the 1- and 1.5 inch seal protector rings are functionally the same, but are

different lengths and not interchangeable. All part numbers in this manual are for the newer design. Refer to figure 7 for ring dimensions.

- Place the wave spring (key 13) on top of the HD metal seal (key 11).
- Break the piston ring (key 133) into two approximately equal pieces either by placing the ring over a pencil or similar object and applying pressure down-wards on the ring until the ring snaps. Be sure to match the broken ends together as you install it on the HD metal seal (key 11).
- Lay the HD metal seal (key 11) down on a flat surface and push the seal protector ring (key 3) into place. Make sure the seal is level. Go to step 5 in this procedure.

**b. For 3- through 8-inch valves:**

- Place the piston ring (key 133) and retaining ring (key 132) into the appropriate groove in the seal protector ring (key 3). The piston ring has one break in it; do **not** break it further.
- Install the wave spring (key 13) into the seal protector ring (key 3).
- Lay the HD metal seal (key 11) down on a flat surface and push the seal protector ring (key 3) past the piston ring (key 133) and into place. Make sure the seal is level. Go to step 5 in this procedure.

**c. For 10- and 12-inch valves:**

- Place the piston ring (key 133) and retaining ring (key 132) into the appropriate groove in the seal protector ring (key 3). The piston ring has one break in it; do **not** break it further.
- Install the wave spring (key 13) into the seal protector ring (key 3).
- If the valve has an attenuator, install the retaining ring (key 41). The octagonal shaped support wire ring has two free ends. Place one of the free ends into the groove in the seal protector ring. Then starting at the

inserted end, press the rest of the ring into the groove completely.

- Lay the HD metal seal (key 11) down on a flat surface and push the seal protector ring (key 3) past the piston ring (key 133) and into place. Make sure the seal is level. Go to step 5 in this procedure.

5. Install a replacement gasket (key 15) on the valve body (key 1 or 1A). Install the HD metal ball seal/seal protector ring assembly into the valve body (key 1 or 1A).
6. Install washers (or clips), and screws that clamp the seal protector ring to the valve body [keys 3, 21, and 22; the Design V200 valve uses clips (key 22) in place of washers].
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.

***HD Metal Seal Lubrication***

To assist with break-in of the HD metal seals, it is recommended that the ball and seal be lubricated with dry film lubricant or equivalent moly disulfide.

**Bearing and Ball Maintenance**



**WARNING**

**Before performing the steps in this section, observe the WARNING at the beginning of the Maintenance section on page 6.**

***3- through 12-Inch Valves***

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

Refer to the Replacing Packing procedures to remove the actuator, and to remove the packing flange and packing follower from the valve. When the packing disassembly steps are complete, return to this section.

Refer to the Replacing the Ball Seal procedures to remove the ball seal from the valve.

# Vee-Ball Valves

Table 3. Continuous Threaded Rod

Valve Size, Inches	Threaded Rod Thread Size	Thread Depth in Follower Shaft
3	0.25-20	0.5
4	0.25-20	0.5
6	0.25-20	0.5
8	0.3125-18	0.62
10	0.3125-18	0.62
12	0.3125-18	0.94

## Disassembly



### WARNING

**When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, with a shearing, cutting motion, which could result in personal injury. To avoid injury, carefully rotate the ball to a stable position at the bottom of the valve body cavity. Make sure the ball will not rotate.**

Key numbers in this procedure are shown in figures 24, 25, and 26, unless otherwise indicated.

1. A taper key (key 4, figures 14, 24, 25 and 31) is used to connect the ball and drive shaft in 3-through 12-inch valves.
2. Carefully rotate the ball to the open position after the actuator is disconnected. Make sure the ball will not rotate (see warning above). Provide support for the ball during the following disassembly.
3. Working from the small end of the groove pin (key 7), use a pin punch to drive the groove pin out of the ball ear and follower shaft.

**For tack welded taper keys**, driving the taper key out of the ball ear will shear the tack welding.

4. Locate the small end of the taper key (key 4, see figures 14, 24, 25 and 31). Using a pin punch on the smaller end of the taper key, drive it out of the ball (key 2) and drive shaft (key 6). Note: driving the taper key in the wrong direction will tighten it.

5. Pull the drive shaft (key 6) out of the actuator side of the valve body.

## CAUTION

**Exercise care to avoid damaging components in the following procedure.**

6. The ball will be free to move when both shafts are removed. Make sure the sealing surface of the ball is not damaged while removing the follower shaft.

- a. Unscrew the pipe plug (key 25) if one is installed. Use a punch to drive the follower shaft (key 9) into the center of the ball.

- b. If a pipe plug is not installed, use a piece of continuous threaded rod as a removal rod when moving the follower shaft (key 9) into the center of the ball. Refer to the table 3 for a description of the size threaded rod needed. The length of the rod should allow easy working room from the valve body.

7. Carefully remove the follower shaft and ball (key 2) from the valve body.

**For 4-inch valves with attenuator**, remove the ball/attenuator through the inlet of the valve. Taking hold of the follower shaft ear on the ball/attenuator, you must position the scalloped edge of the attenuator against the valve bore opening and then pivot, or roll, the ball/attenuator out of the valve body (see figure 18).

**For 6-, 8-, 10-, and 12-inch valves with attenuator**, remove the ball/attenuator through the outlet of the valve by carefully turning and manipulating the ball. The 6-, 8-, 10-, or 12-inch ball/attenuator will not come straight out of the valve body.

8. Remove the bearings (key 10) by hand. If the bearings are tight in the valve body, then pull or drive them out with a slight pressure.

- To remove the follower shaft bearings, use a blind-hole bearing puller. If you do not have such a tool, you can machine the bearing out.

9. Thoroughly clean surfaces of all parts that are to be re-used or obtain replacement parts.

## Assembly

1. Inspect all sealing surfaces to ensure they are in good condition and without scratches or wear.

2. Install the replacement bearings (key 10) by hand. The bearing flanged end should touch the valve body.

### 3. Installing the Vee-Ball:



## 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 or out of the valve body cavity.

### Note

For ease of assembly, the follower shaft (key 9) should be inserted into the ball before installing the ball in the following applications:

- 3-inch valve without ball/attenuator
- 4- through 12-inch valves with ball/attenuator.

Carefully install the ball into the valve body cavity.

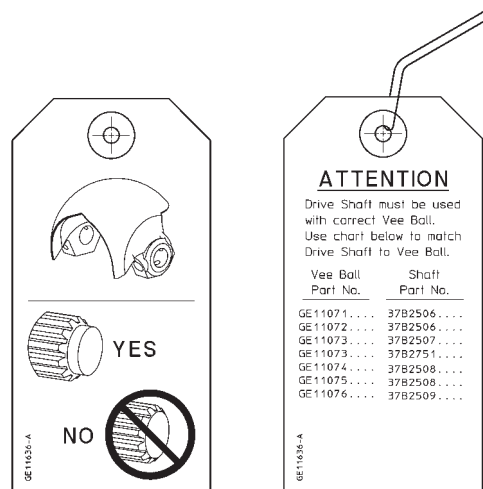
• **For Vee-Ball with attenuator (sizes 4 through 12-inch valves),** carefully install the ball into the valve body cavity. For 4-inch valves, install the ball/attenuator through the inlet of the valve. For 6-, 8-, 10-, and 12-inch valves, install the ball/attenuator through the outlet of the valve. Taking hold of the follower shaft ear on the ball/attenuator, you must position the scalloped edge of the attenuator against the valve bore opening and then carefully pivot, or roll, the ball/attenuator into the valve body (see figure 18).

After you have installed the ball (key 2) into the valve body assembly, firmly support the ball while installing the shafts.

### 4. Installing the follower shaft (key 9):

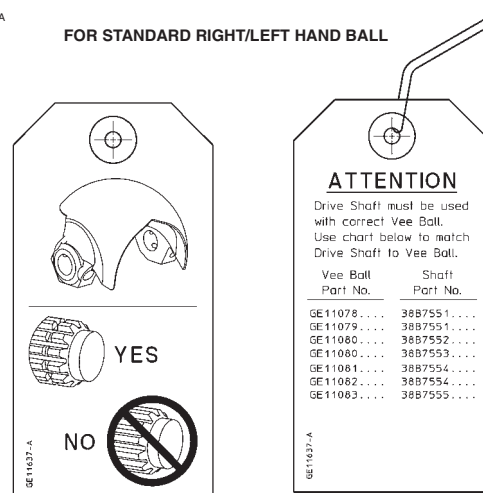
• **For 3-inch valves:** The follower shaft (key 9) should already have been inserted into the ball before the ball was put into the valve body. Insert the follower shaft (key 9) into the valve body bearing (key 10).

• **For 4-inch and larger valves:** Insert the follower shaft (key 9) through the ball, and into the valve body bearing (key 10).



GE11636-A

### FOR STANDARD RIGHT/LEFT HAND BALL



GE11637-A

### FOR OPTIONAL LEFT HAND BALL

Figure 13. Informational Tag

• **For 4- through 12-inch valves with ball/attenuator:** The follower shaft (key 9) should already have been inserted into the ball/attenuator before the ball was put into the valve body. Insert the follower shaft (key 9) into the valve body bearing (key 10).

**Then for all sizes,** align the hole in the follower shaft with the holes in the ball. Insert the small end of the groove pin (key 7) into the hole in the ball and into the follower shaft. The pin will hold the parts in place while the drive shaft (key 6) is being installed.

# Vee-Ball Valves

Table 4. Taper Key Minimum Depth

Valve Size, Inches	Minimum Depth To Drive Taper Key After Initial Solid Contact, mm (Inches)
3, 4, 6	4.8 (0.188)
8, 10, 12	5.6 (0.219)

Table 5. Taper Key Maximum Depth

Valve Size, Inches	Maximum Depth To Drive Taper Key After Initial Solid Contact, mm (Inches)
3, 4	7.1 (0.281)
6	7.9 (0.312)
8, 10	9.5 (0.375)
12	10.3 (0.406)

## 5. Installing the Drive Shaft:

### CAUTION

The drive shaft must be used with the correct Vee-Ball. Refer to the tag (see figure 13) attached to the Vee-Ball and to the drive shaft.

Failure to use the correct Vee-Ball/shaft combination may result in the ball not being in the position indicated by the slash mark on the end of the shaft. If the ball is not properly aligned with the slash mark, the valve will not function correctly and seal damage may result.

### CAUTION

Make sure the drive shaft is free of oil or grease, otherwise the taper pin or taper key will not seat properly. Failure to properly set the taper pin or taper key could result in it coming loose while in service. Loosening of the taper key in service could result in improper valve function and equipment damage.

- Insert the drive shaft into the valve body bearing (key 10), and into the ball ear. Align the hole in the drive shaft with the holes in the ball.
- Insert the taper key into the ball and drive shaft as shown in figure 14.

### ● Installing the Taper Key

Current standard construction materials for all 3-through 12-inch valves require the taper key (key 4,

figure 14) to be tack welded in place **after properly seating**, using the following procedure. Use standard welding preparations when preparing parts for reassembly.

### CAUTION

**Make sure the drive shaft (key 6) is free of oil or grease, otherwise the taper key will not seat properly. Failure to properly set the taper pin or taper key could result in it coming loose while in service. Loosening of the taper key in service could result in improper valve function and equipment damage.**

- Install the drive shaft (key 6) into the valve body through the ball and into the lower bearing.
- Insert the taper key (key 4) into ball and drive shaft (keys 2 and 6) as shown in figure 14. The taper key inserts, with the flat side of the key, facing the drive shaft (key 6).
- Using a flat end punch, drive the groove pin (key 7) into the ball ear and follower shaft until it is flat with the ball ear surface. Stake both ends of the pin hole with a center punch to ensure the groove pin does not come out.
- Using a flat end punch, drive the taper key (key 4) into the ball ear and drive shaft (key 6) until solid, heavy contact is obtained between the key and shaft.
- Measure the position of the taper key head.
- Drive the taper key in further using the minimum distance shown in table 4.
- Inspect the ball/shaft taper key connection to verify that the taper key spans the entire shaft flat width. If not, the taper key must be driven in further until this condition is satisfied. However, do not exceed the maximum depths shown in table 5.

### Note

**All valve taper keys are tack welded, except titanium.**

- When the above conditions are met, tack weld the taper key (key 4) to the ball ear on the head end of the key (see figures 24 and 25). Use a:

- 1/8 inch diameter weld on 3- through 6-inch valves,



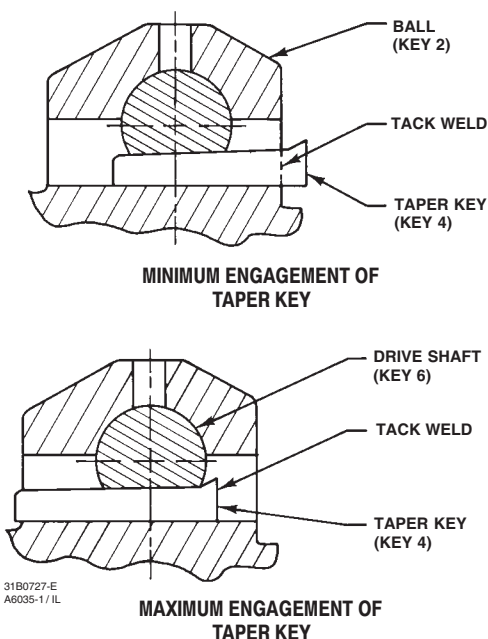


Figure 14. Taper Key Installation

- 3/16 inch diameter weld on an 8-through 10-inch valves, and
- 1/4 inch diameter weld on 12-inch valves.

**For all constructions:** Refer to Replacing the Ball Seal, Packing Maintenance, and other procedures as necessary to complete the assembly of the valve.

### 1- through 2-Inch Sizes

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

Refer to the Replacing Packing procedures to remove the actuator, and to remove the packing flange and packing follower from the valve. When the packing disassembly steps are complete, return to this section.

Refer to the Replacing the Ball Seal procedures to remove the ball seal from the valve.

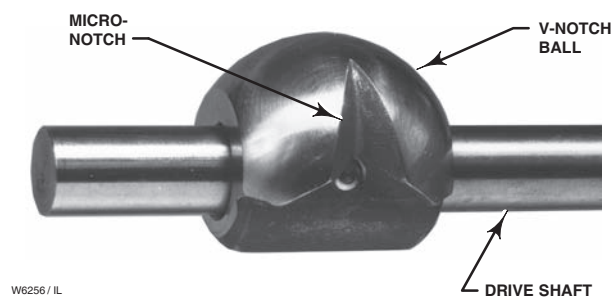


Figure 15. Typical Metal Micro-Notch™ Ball and Drive Shaft

### Disassembly



### WARNING

When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, with a shearing, cutting motion, which could result in personal injury. To avoid injury, carefully rotate the ball to a stable position at the bottom of the valve body cavity. Make sure the ball will not rotate.

Key numbers in this procedure are shown in figures 24, 25, and 26, unless otherwise indicated.

1. A taper pin (key 4, figure 20) is used in the 1-, 1.5, and 2-inch size valves, and in the 1-inch size Metal Micro-Notch valve (figure 21).
2. **Ceramic Micro Notch ball constructions:** A screw (key 4, figure 22) is used to attach the ball to the drive shaft.

### CAUTION

**Exercise care to avoid damaging components in the following procedure.**

- a. The parts are held together with a screw and an adhesive. Remove the screw (key 4) and separate the drive shaft from the ball. In some cases, a small amount of heat can be applied to help loosen the adhesive. However, excessive heat may damage other valve component parts.
- b. Once the shafts have been removed from the valve body, the ball may fall. To avoid personal injury or damage to the sealing surfaces, provide support for the ball to prevent it from falling as the shaft(s) are being removed.

# Vee-Ball Valves

Table 6. Continuous Threaded Rod

Valve Size, Inches	Threaded Rod Thread Size	Thread Depth in Follower Shaft
1	1/4-20	0.5
1.5	1/4-20	0.5
2	1/4-20	0.5

VALVE SIZE, INCHES	NEW – WITHOUT THRUST WASHER		OLD – WITH THRUST WASHER	
	mm	inches	mm	inches
1	32.9	1.29	31.8	1.25
1.5	48.6	1.91	47.7	1.88
2	64.5	2.54	63.4	2.50

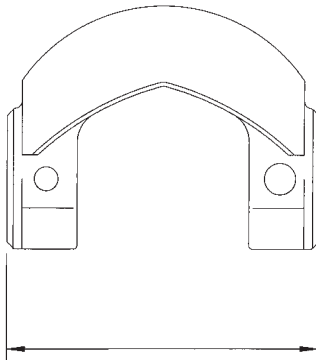


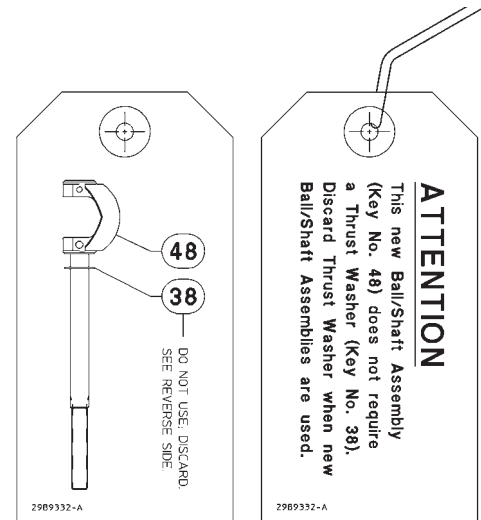
Figure 16. Dimensions of Ball in Ball / Shaft Assembly

- Carefully rotate the ball to the open position after the actuator is disconnected. Make sure the ball will not rotate (see warning above). Provide support for the ball during the following disassembly.
- Unscrew the pipe plug (key 25). (The pipe plug is optional and may not be available.)
- Working from the small end of the groove pin (key 7), use a pin punch to drive the groove pin out of the ball ear and follower shaft.

## Note

**All 1-inch Micro-Notch constructions use a one piece shaft. They do not have a follower shaft.**

- Locate the small end of the taper key (key 4, figure 14). Using a pin punch on the smaller end of the taper key, drive it out of the ball (key 2) and drive shaft (key 6). Note: driving the taper key in the wrong direction will tighten it.



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Figure 17. Informational Tag

- Pull the drive shaft (key 6) out of the actuator side of the valve body.

## Note

**The new ball/shaft assembly (key 48) does not require a thrust washer (key 38) in valves ordered after November 01, 2001.**

**Discard the thrust washer in valves ordered prior to this date when new ball/shaft assemblies are used as spare parts.**

**Figure 17 shows the informational tag that is attached with the new ball/shaft assembly when shipped as a spare part. Refer to figure 16 for dimensions of the ball in the ball/shaft assembly.**

## CAUTION

**Exercise care to avoid damaging components in the following procedure.**

- Make sure the sealing surface of the ball is not damaged while removing the follower shaft.
  - If a pipe plug (key 25) is installed, use a punch to drive the follower shaft (key 9) into the center of the ball.
  - If a pipe plug is not installed, use a piece of continuous threaded rod as a removal rod when moving the follower shaft (key 9) into the center

of the ball. Refer to the table 6 shown below for a description of the size threaded rod needed. The length of the rod should allow easy working room from the valve body.

9. **Remove the ball** (key 2) by carefully removing the follower shaft and ball from the valve body.
10. **Remove the bearings** (key 10) by hand. If the bearings are tight in the valve body, then pull or drive them out with a slight pressure.
11. Thoroughly clean surfaces of all parts that are to be re-used or obtain replacement parts.

## Assembly

1. Inspect all sealing surfaces to ensure they are in good condition and without scratches or wear.
2. **Install bearings** (key 10) by hand. The bearing flanged end should touch the body.
3. **Installing the ball (key 2):**



## WARNING

The Vee-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 or out of the valve body cavity.

### Note

For ease of assembly, the follower shaft (key 9) should be inserted into the ball before installing the ball in a 3-inch valve without ball/attenuator

Carefully install the ball into the valve body cavity.

After you have installed the ball (key 2) into the valve body assembly, firmly support the ball while installing the shafts.

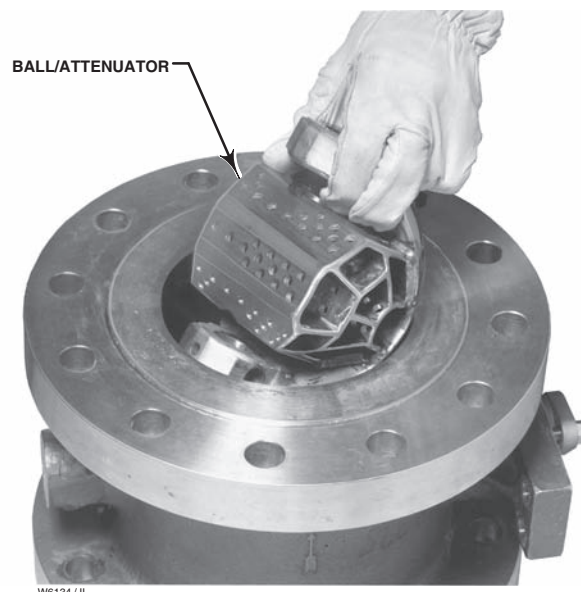


Figure 18. Ball/Attenuator Installation and Removal Method

## 4. Installing the follower shaft (key 9):

- **For 1- through 2-inch valves:** The follower shaft (key 9) should already have been inserted into the ball before the ball was put into the valve body. Insert the follower shaft (key 9) into the valve body bearing (key 10).

### Note

All 1-inch Micro-Notch constructions use a one piece shaft. They do not have a follower shaft.

## 5. Installing the Drive Shaft for Valves with Taper Pins

## CAUTION

The drive shaft must be used with the correct Vee-Ball. Refer to the tag (see figure 13) attached to the Vee-Ball and to the drive shaft.

Failure to use the correct Vee-Ball/shaft combination may result in the ball not being in the position indicated by the slash mark on the end of the shaft. If the ball is not properly aligned with the slash mark, the valve will not function correctly and seal damage may result.

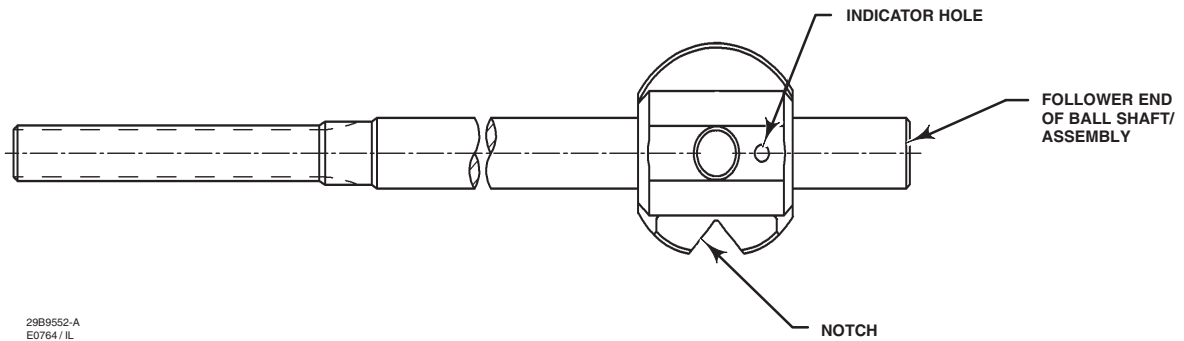


Figure 19. Location of Indicator Hole in Micro-Notch Vee-Balls

## CAUTION

Make sure the drive shaft is free of oil or grease, otherwise the taper pin will not seat properly. Failure to properly set the taper pin or taper key could result in it coming loose while in service. Loosening of the taper key in service could result in improper valve function and equipment damage.

6. Insert the drive shaft into the valve body bearing (key 10), and into the ball ear (or ball, for Micro-Notch constructions). Align the hole in the drive shaft with the holes in the ball.

### Note

There is an indicator hole drilled in all Micro-Notch balls. This indicator hole must be oriented closest to the follower end of the ball/shaft assembly. See figure 19.

7. Insert the taper pin into the ball and drive shaft as shown in figures 20 and 21. The small end of the taper pin must be inserted into the larger hole side of the ball ear (or ball, for Micro-Notch constructions), and into the large hole side of the drive shaft.

### Note

The taper pin will not fit correctly if inserted in the wrong direction through the ball ear (or ball, for Micro-Notch constructions) or through the drive shaft. Make sure the drive shaft and ball ear (or ball, for

Micro-Notch constructions) are in the correct orientation for installing the pin.

- Installing Taper Pins in 1-, 1.5, and 2-inch Valves

### Note

For 1-, 1.5, and 2-inch valves, the taper pins (figure 20) do not require welding.

Using a flat-end punch, drive the taper pin into the ball ear (or ball, for Micro-Notch constructions) and drive shaft until solid heavy contact is felt. Make sure the taper pin spans the width of the ball.

Using a flat end punch, drive the groove pin (key 7) into the ball and follower shaft until it is flat with the ball surface.

Installing the Drive Shaft in VTC Ceramic Vee-Ball Valves

## CAUTION

The drive shaft must be used with the correct Vee-Ball. Refer to the tag (see figure 13) attached to the Vee-Ball and to the drive shaft.

Failure to use the correct Vee-Ball/shaft combination may result in the ball not being in the position indicated by the slash mark on the end of the shaft. If the ball is not properly aligned with the slash mark, the valve will not function correctly and seal damage may result.

Valves with 1-inch ceramic micro-notch balls use a screw with a threaded valve shaft to connect the ball

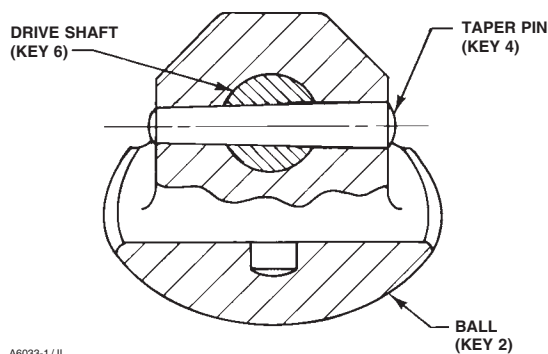


Figure 20. Taper Pin Installation for Design V150, V200, and V300 Sizes 1, 1.5, and 2-Inch Valves.

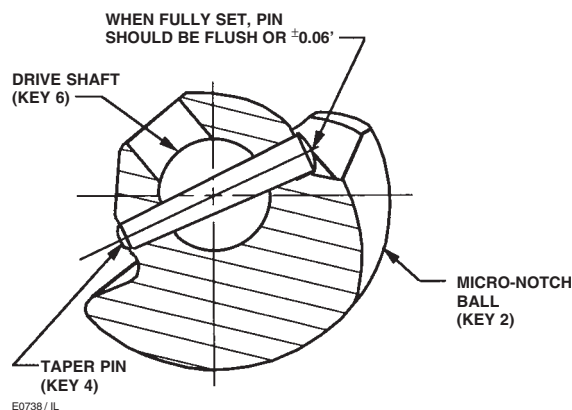


Figure 21. Taper Pin Installation for Design V150, V200, and V300 Size 1-Inch Valves with Micro-Notch Ball Construction

to the shaft. An adhesive is used to lock the screw in the valve shaft (keys 4 and 6, figure 22).

#### Note

**There is an indicator hole drilled in all Micro-Notch balls. The orientation of this hole in the ceramic Vee-Ball is to the right of the screw in the ball, and must be located closest to the follower end of the ball/shaft assembly. See figures 19 and 22.**



#### WARNING

**Avoid personal injury and property damage from ignition of process fluid caused by sparks from ceramic trim.**

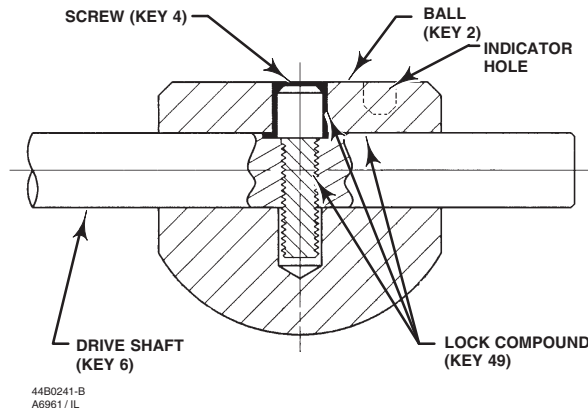


Figure 22. Screw Installation for Design V200, Size 1-Inch Valves with VTC Ceramic Micro-Notch Ball Construction

**Do not use ceramic trim where the process fluid is unstable or if it is an explosive mixture (such as ether and air).**

#### Within the valve body:

8. The threaded hole in the shaft, the screw and screw clearance hole in the ball must be free of oil and grease before applying an activator.
9. Apply Loctite® Depend® Activator 7387 to threaded hole, screw and ball clearance hole. Assemble the ball onto the shaft while aligning threaded shaft hole within the ball clearance hole.
10. The flat on the shaft must be oriented so that the head of the cap screw seats on the flat.
11. Apply 5 drops of Loctite Depend 330 into the hole in the ball.
12. Thread the screw into the shaft tightening it to 9.2 N•m (81 in•lbs) torque. Remove excess adhesive. Allow four hours to cure fully before continuing with assembly.

**For all constructions:** Refer to Replacing the Ball Seal, Packing Maintenance, and other procedures as necessary to complete the assembly of the valve.

## Actuator Mounting

Use the appropriate actuator instruction manual, this section of this manual, and figure 23 of this manual when mounting the actuator or changing actuator styles and positions.

1. To help ensure correct centering of the Vee-Ball (key 2) on the seal (key 11), be sure the ball is closed when mounting the actuator (for applications other than Spring Return Fail-Open).



# Vee-Ball Valves

2. Clean the valve shaft and actuator lever splines to be sure the actuator lever will slide on easily. Only drive the lever in if absolutely necessary.
3. Carefully wedge the ball solidly against the actuator-side bearing, using a screwdriver or similar tool inserted between the lower ear of the ball and the valve body. This will center the ball. See figure 6.
4. Keep the wedge in place while installing the lever, if necessary. Remove the wedge after you have clamped the actuator lever on the valve shaft and have connected the lever to the actuator piston rod or diaphragm rod.

## Determining Mounting Position

The actuator can be either right or left-hand mounted, with the actuator on the right or left side when viewed from upstream (see figure 23).

The Series B Vee-Ball, sizes 4- through 12-inch with attenuator, and the 1-inch micro-notch Vee-Ball have one V-notch. For **right-hand mounting (standard)**, the ball will be in the top of the valve body when the valve is open and the shaft is horizontal. In this position the ball rotates CCW to Close. For **left-hand mounting (standard)**, the ball will be in the bottom of the valve body when the valve is open and the shaft is horizontal. In this position the ball rotates CCW to Close. An optional ball for **left-hand mounting**, which rotates into the top of the valve body when the shaft is horizontal, is also available. In this position the ball rotates CW to Close.

The 1- through 2-inch has two notches, and can be rotated in either direction.

## Determining Closed Position

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



### WARNING

**The Vee-Ball closes with a shearing, cutting motion. To avoid personal**

**injury, keep hands, tools, and other objects away from the ball while stroking the valve.**

2. Rotate the ball to the closed position.
3. Position the ball in the proper location

### For Series B:

- When viewed from the valve body inlet, the ball is in the proper position when the flat spot on the top of the ball is exactly in the center of the seal package.

Make a copy of the centering template in figure 28 out of a suitable stiff material. Place the centering template in the opening at the seal (See figure 27). Find the center of the template and make sure the spot on the ball is centered directly below it.

### For valves with attenuators and 1-, 1.5, and 2-inch sizes: Follow one of the procedures below:

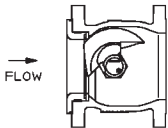
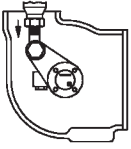
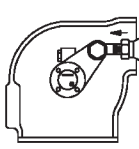
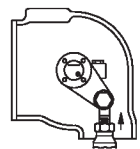
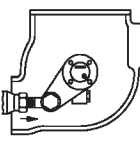
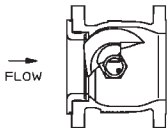
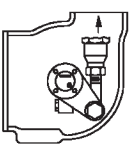
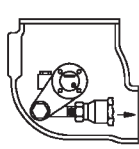
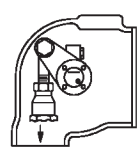
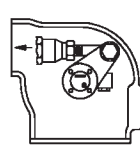
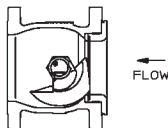
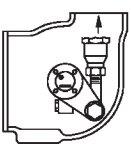
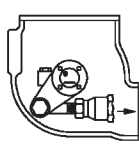
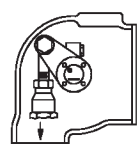
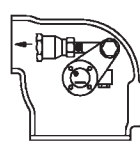
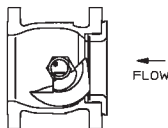
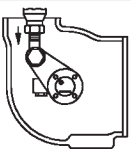
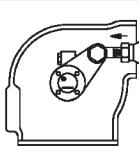
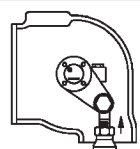
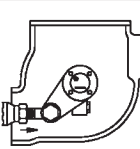
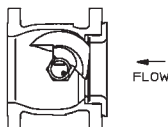
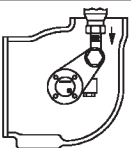
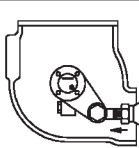
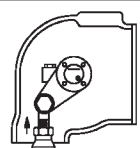
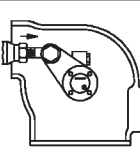
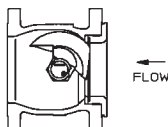
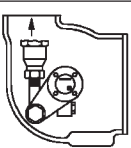
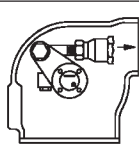
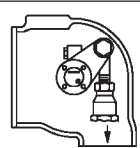
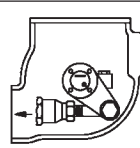
- When viewed from the valve body inlet, the ball is in the proper position when both V-notches of the ball are centered between the machined diameter of the ledge that supports the seal.

- If the ball has a spot machined on the top, align that spot to the exact center of the seal cavity.

4. Adjust the actuator linkage as described in the appropriate actuator instruction manual until the ball is centered in the closed position. A line is stamped on the actuator end of the drive shaft (see figure 23) to indicate the ball position.

Use the appropriate actuator instruction manual and figure 23 of this manual when mounting the actuator or changing actuator styles and positions.

**The Micro-Notch ball closed position** is approximately 5 degrees closed from the first point of flow. This establishes the zero degree position for the ball.

ACTUATOR		VALVE OPEN	ACTUATOR POSITION			
MOUNTING	STYLE		1	2	3	4
(STANDARD) RIGHT-HAND BALL ROTATES COUNTER-CLOCKWISE TO CLOSE	STYLE A PUSH DOWN TO CLOSE					
	STYLE B PUSH DOWN TO OPEN					
(STANDARD) LEFT-HAND BALL ROTATES COUNTER-CLOCKWISE TO CLOSE	STYLE C PUSH DOWN TO OPEN					
	STYLE D PUSH DOWN TO CLOSE					
(OPTIONAL) <sup>(2)</sup> LEFT-HAND BALL ROTATES CLOCKWISE TO CLOSE	STYLE C PUSH DOWN TO CLOSE					
	STYLE D PUSH DOWN TO OPEN					
<p>NOTE:</p> <p>1. ARROW ON LEVER INDICATES DIRECTION OF ACTUATOR THRUST TO CLOSE VALVE.</p> <p>2. THE OPTIONAL LEFT-HAND ORIENTATION IS NOT AVAILABLE FOR MICRO-NOTCH VEE-BALLS.</p>						

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Figure 23. Index Marks for Actuator Lever Orientation for 1- through 12-inch Valves with or without Attenuator

# Vee-Ball Valves

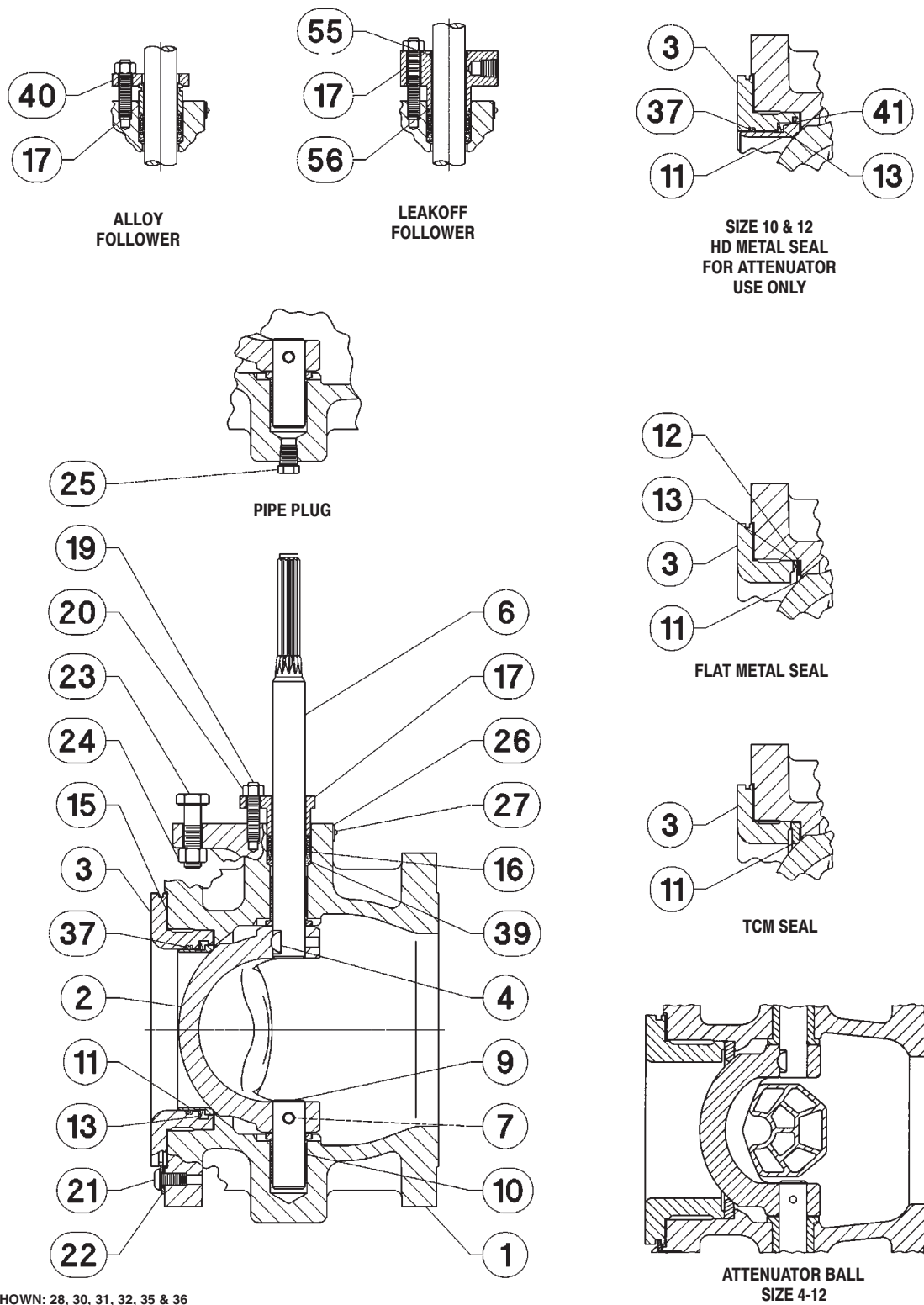


Figure 24. Design V150 or V300 Size 3- through 12-inch Valve Assembly  
(Details are typical for Design V200, except Design V200 does not have flanges).

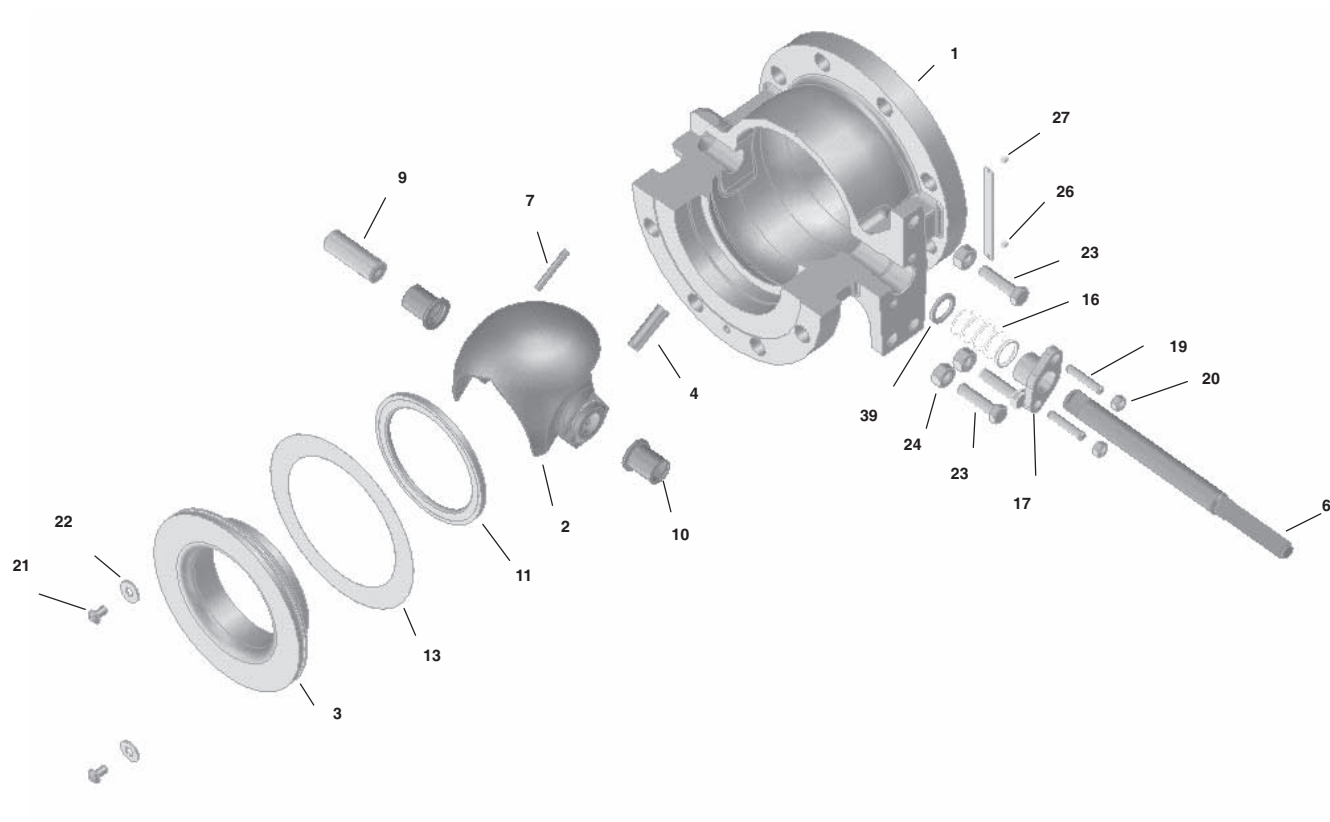
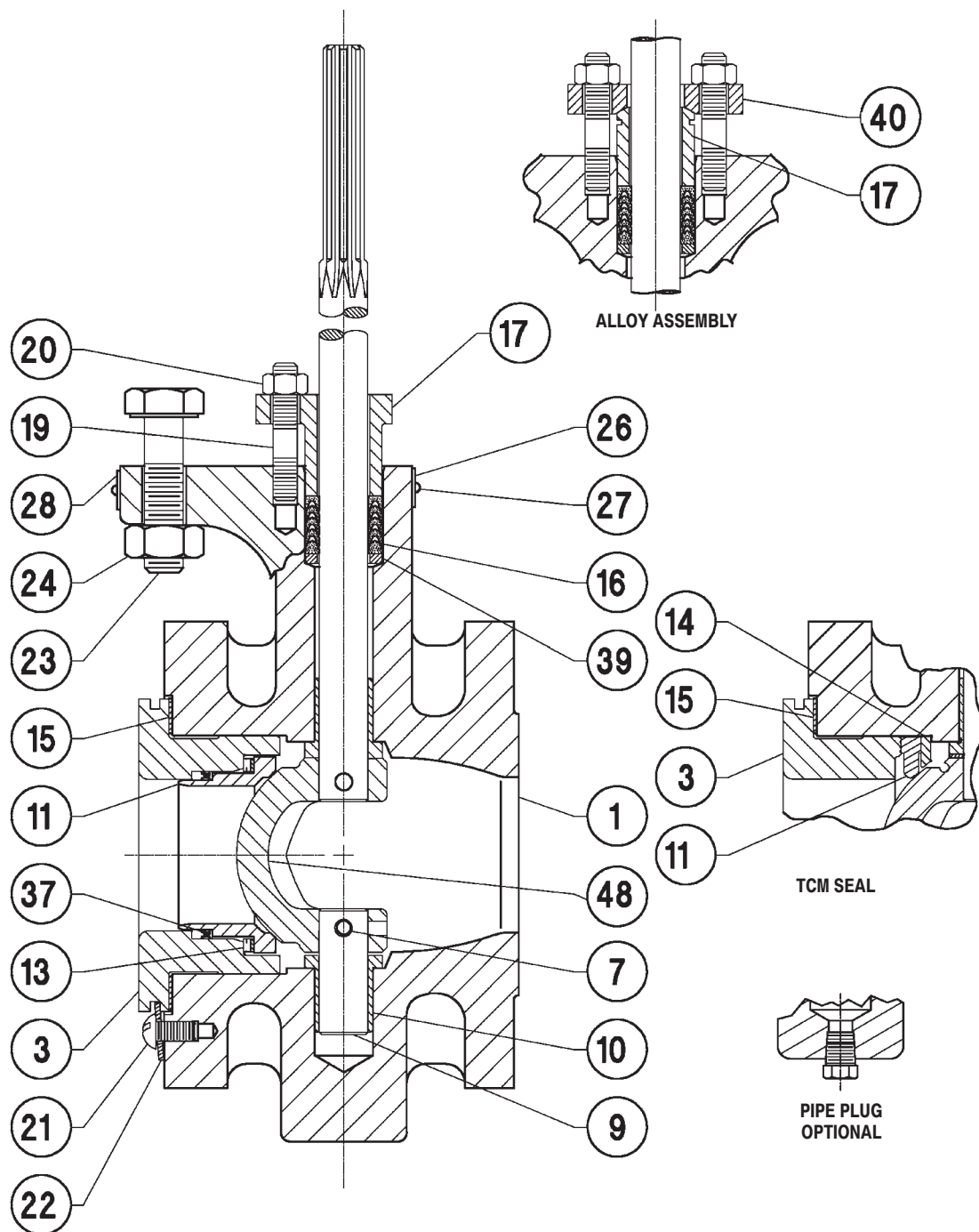


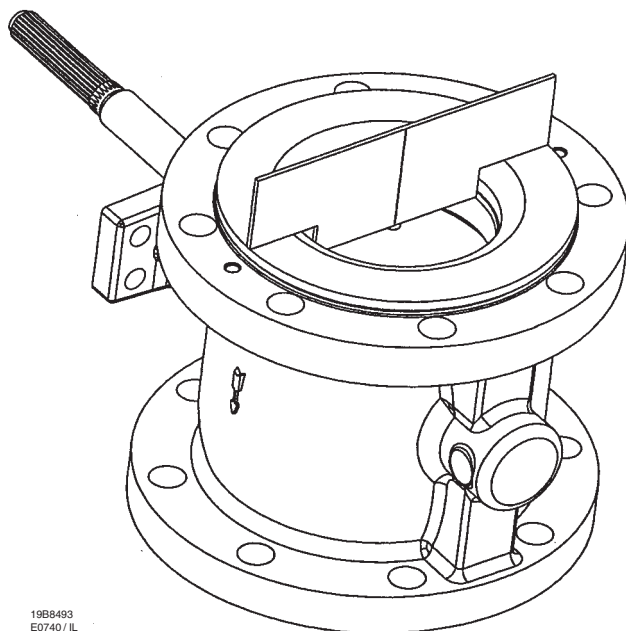
Figure 25. Exploded View, Design V150 and V300 Sizes 3- through 12-inch without Attenuator Assembly.



NOTE:  
PARTS NOT SHOWN: 30, 31, 32, 33, 35 & 36  
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Figure 26. Design V150 or V300 Size 1, 1.5, and 2-Inch Valve Assembly  
(Details are typical for Design V200, except Design V200 does not have flanges)



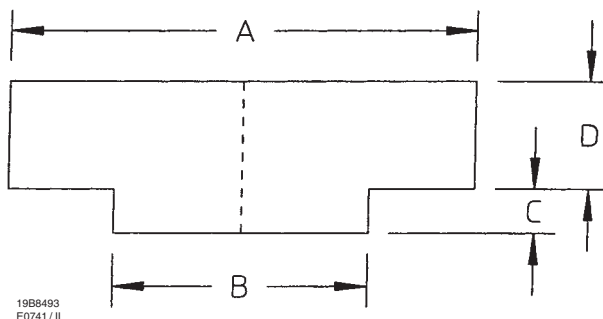


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Figure 27. Centering Template in Use

VALVE SIZE, INCHES	A (FOR ASME VALVES)	A (FOR DIN VALVES)	B <sup>(1)</sup>	C <sup>(1)</sup> (ISA S75.04)	C (ASME B16.10 Short <sup>(2)</sup> )	D <sup>(1)</sup>
mm						
1	63	68	19	35	61	25
1.5	82	88	28	34	85	25
2	102	102	38	31	85	25
3	127	138	63	24	62	38
4	157	157	82	36	71	44
6	216	212	117	21	59	51
8	270	268	139	12	61	57
10	324	320	203	2	35	60
12	381	378	254	2	20	63
Inches						
1	2.50	2.68	0.75	1.40	2.40	1.00
1.5	3.25	3.46	1.12	1.34	3.34	1.00
2	4.02	4.02	1.50	1.22	3.34	1.00
3	5.00	4.55	2.50	0.94	2.44	1.50
4	6.19	6.19	3.25	1.42	2.80	1.75
6	8.50	8.35	4.62	0.82	2.32	2.00
8	10.62	10.55	5.50	0.48	2.42	2.25
10	12.75	12.60	8.00	0.09	1.40	2.38
12	15.00	14.88	10.00	0.09	0.78	2.50

1. These dimensions are the same for ASME and DIN valves.  
2. Note that ASME B16.10 Short dimensions are actually longer than ISA S75.04 dimensions.



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Figure 28. Centering Template Dimensions

# Vee-Ball Valves

## 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 Process Management sales office regarding spare parts or technical information. When ordering replacement parts, also specify the complete 11-character part number from the parts kits or parts list information.

### Note

**Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher valve, because they will void your warranty, might adversely affect the performance of the valve, and might jeopardize worker and workplace safety.**

### Note

**Neither Emerson, Emerson Process Management, Fisher, nor any of their affiliated entities assumes responsibility for the selection, use and maintenance of any product. Responsibility for the selection, use, and maintenance of any product remains with the purchaser and end-user.**

### Note

**For the 2-inch Design V150 valve, this manual covers valves with serial numbers 12551183 and higher. Always reference the serial number of your valve when corresponding with your Emerson Process Management sales office.**

## Retrofit Kits for HD Metal Ball Seal

Retrofit Kits include parts to convert existing valves to HD metal ball seal construction. See following table.

*HD Metal Ball Seal Retrofit Kits for ISA S75.04 Face-to-Face Valves*

VALVE SIZE, INCHES		RETROFIT KIT NUMBER FOR HD METAL BALL SEAL	
For WCC Steel Seal Protector Ring		CF10SMnN (Nitronic 60) Seal Material	CD7MCuN (Alloy 255 Duplex SST) Seal Material
2 <sup>(1)</sup>		RV150X0R012	RV150XCR012
2 <sup>(2)</sup>		RV150X0R152	RV150XCR152
3		RV150X0R022	RV150XCR022
4		RV150X0R032	RV150XCR032
6		RV150X0R042	RV150XCR042
8		RV150X0R052	RV150XCR052
10		RV150X0R062	RV150XCR062
12 <sup>(3)</sup>		RV150X0R072	RV150XCR072
For CG8M (317 SST) Seal Protector Ring		CF10SMnN Seal Material	CD7MCuN Seal Material
2 <sup>(1)</sup>		RV150X0R082	RV150XCR082
2 <sup>(2)</sup>		RV150X0R162	RV150XCR162
3		RV150X0R092	RV150XCR092
4		RV150X0R102	RV150XCR102
6		RV150X0R112	RV150XCR112
8		RV150X0R122	RV150XCR122
10		RV150X0R132	RV150XCR132
12 <sup>(3)</sup>		RV150X0R142	RV150XCR142
Parts Included in Kit		Quantity in Kit	
Key No.	Description		
3	Seal Protector Ring	1	1
11	Ball seal	1	1
13	Wave spring	1	1
15	Gasket	1	1
21	Retainer screw	2 or 4 <sup>(4)</sup>	2 or 4 <sup>(4)</sup>
22	Retainer washer	2 or 4 <sup>(4)</sup>	2 or 4 <sup>(4)</sup>
37	Radial seal	1	1
41 <sup>(5)</sup>	Retaining ring	1	1
1. V150's only for serial numbers below 12551183. 2. V150's for serial numbers 12551183 and above. All V200's and V300's. 3. Design V200 is not available in 12-inch sizes. 4. A quantity of 2 is supplied for 1- through 8-inch valves, and a quantity of 4 is supplied for 10- and 12-inch valve kits. 5. Retaining rings (key 41) are supplied for sizes 10- and 12-inch valve kits.			

## Retrofit Kits for ENVIRO-SEAL Packing

Retrofit kits include parts to convert existing V150, V200 and V300 valves with shallow (single packing depth) packing box to the ENVIRO-SEAL packing box construction. Retrofit kits include single PTFE or graphite packing. See following table.

*ENVIRO-SEAL Packing Retrofit Kits*

SHAFT DIAMETER <sup>(1)</sup>		PART NUMBER	
mm	Inches	Single PTFE	Graphite
12.7	1/2	RRTYXRT0012	RRTYXRT0312
15.9	5/8	RRTYXRT0022	RRTYXRT0322
19.1	3/4	RRTYXRT0032	RRTYXRT0332
25.4	1	RRTYXRT0052	RRTYXRT0352
31.8	1-1/4	RRTYXRT0062	RRTYXRT0362
38.1	1-1/2	RRTYXRT0072	RRTYXRT0372
Parts Included in Kit			
Key	Description	Quantity	
100	Packing stud	2	2
101	Packing nut	2	2
102	Packing flange	1	1
103	Spring pack assembly	1	1
105	Packing set	1	1
106	Anti-extrusion washer	2	- - -
107	Packing box ring <sup>(2)</sup>	1	1
- - -	Tag	1	1
- - -	Tie Cable	1	1
1. Diameter through the packing box. 2. Not required for all sizes of Design V150 and V200 or for V300 with 1-1/4 or 1-1/2 inch diameter shafts.			

## Repair Kits for ENVIRO-SEAL Packing

Repair kits include valves parts for shallow (single packing depth) for ENVIRO-SEAL packing box construction. Repair kits include single PTFE or graphite packing. See following table.

*ENVIRO-SEAL Packing Repair Kits*

SHAFT DIAMETER <sup>(1)</sup>		PART NUMBER	
mm	Inches	PTFE	Graphite
12.7	1/2	RRTYX000012	13B8816X012
15.9	5/8	RRTYX000022	13B8816X032
19.1	3/4	RRTYX000032	13B8816X052
25.4	1	RRTYX000052	13B8816X092
31.8	1-1/4	RRTYX000062	13B8816X112
38.1	1-1/2	RRTYX000072	13B8816X142
Parts Included in Kit			
Key	Description	Quantity	
105	Packing set	1	1
106	Anti-extrusion washer	2	- - . <sup>(2)</sup>
1. Diameter through the packing box. 2. Included in key 105.			

# Vee-Ball Valves

## Repair Kits for Ball Seals

Seal repair kits include recommended spare parts for Fisher TCM Plus, S31600 stainless steel,

CF10SMnN, or CD7MCuN ball seal constructions.

The following table indicates the repair kit part number and the quantity of parts included in the kit.

*Design V150, V200, and V300 Repair Kits*

VALVE SIZE, INCHES		KIT PART NUMBER			
		Ball Seal Material			
		TCM Plus	---	Alloy 6	CD7MCuN (Alloy 255 Duplex SST)
1		RV150X00CA2	---	RV150XHDA2	RV150XHDC2
1.5		RV150X00CB2	---	RV150XHDB2	RV150XHDCB2
VALVE SIZE, INCHES		Ball Seal Material			
		TCM Plus	S31600 (316 SST)	CF10SMnN	CD7MCuN (Alloy 255 Duplex SST)
2 <sup>(1)</sup>		RV150X00C12	RV150X00M12	RV150X0HD12	RV150XHDC12
2 <sup>(2)</sup>		RV150X00C82	---	RV150X0H082	RV150XHDC82
3		RV150X00C22	RV150X00M22	RV150X0HD22	RV150XHDC22
4		RV150X00C32	RV150X00M32	RV150X0HD32	RV150XHDC32
6		RV150X00C42	RV150X00M42	RV150X0HD42	RV150XHDC42
8		RV150X00C52	RV150X00M52	RV150X0HD52	RV150XHDC52
10		RV150X00C62	RV150X00M62	RV150X0HD62	RV150XHDC62
12		RV150X00C72	RV150X00M72	RV150X0HD72	RV150XHDC72
Parts Included in Kit		Quantity in Kit			
Key No.	Description				
11	Ball seal	1	1	1	1
12	Shim seal <sup>(3)</sup>	---	4	---	---
13	Spring seal	---	1	---	---
13	Wave spring	---	---	1	1
15	Gasket	1	1	1	1
37	Radial seal	---	---	1	1
21	Retainer screw	2 or 4 <sup>(4)</sup>	2 or 4 <sup>(4)</sup>	2 or 4 <sup>(4)</sup>	2 or 4 <sup>(4)</sup>
22	Retainer washer	2 or 4 <sup>(4)</sup>	2 or 4 <sup>(4)</sup>	2 or 4 <sup>(4)</sup>	2 or 4 <sup>(4)</sup>
1. V150's only for serial numbers below 12551183. 2. V150's for serial numbers 12551183 and above. All V200's and V300's. 3. Fewer shim seals are furnished in the parts kits than are used in the original construction of the valve. Most original shim seals can be reused. 4. A quantity of 2 is supplied for 2- through 8-inch valves, and a quantity of 4 is supplied for 10- and 12-inch valves.					

## Parts List

### Note

Part numbers are shown for recommended spares only. For other part numbers, contact your Emerson Process Management sales office.

## Common Parts (figures 24, 25 & 26)

Key	Description	Part Number
1	If you need a valve body as a replacement part, order by valve size, serial number, and desired valve body material. Contact your Emerson Process Management sales office for assistance.	
2	Ball	
2	Ball w/ attenuator	
3	Seal Protector Ring	
4*	Taper Key	
	R30006 (cobalt alloy 6 casting)	
	3 and 4-inch	12B9530X012
	6-inch	12B9531X012
	8- & 10-inch	12B9532X012
	12-inch	12B9533X012
	N10276	
	3 and 4-inch	11B0674X032
	6-inch	11B0695X032
	8- & 10-inch	11B0722X032
	12-inch	11B4684X032
6	Drive Shaft	
6	Drive Shaft w/ attenuator	
7*	Groove Pin	
	S31600 (316 stainless steel)	
	1-inch	13B0345X012
	1.5 inch and 2-inch	11B0705X012
	3- and 4-inch	18A6135X012
	6-inch	18A6138X012
	8-inch	11B0738X012
	10- and 12-inch	11B8596X012
	N10276	
	1-inch	13B0345X022
	1.5 inch and 2-inch	11B0705X022
	3- and 4-inch	18A6135X022
	6-inch	18A6138X032
9	Follower Shaft	
9	Follower Shaft w/ attenuator	
10*	Bearing (2 req'd)	
	PEEK/PTFE	
	1-inch	14B3351X012
	1.5 inch	14B3352X012
	2-inch	14B3353X012
	3- and 4-inch	17B7142X012
	6-inch	27B7136X012
	8 and 10-inch	27B7775X012
	12-inch	27B9470X012
	R30016 (alloy 6B)	
	1-inch	23B0342X012
	1.5 inch	23B6819X022
	2-inch	23B6682X012
	3- and 4-inch	27B9673X012
	6-inch	27B9670X012
	8 and 10-inch	27B9547X012
	12-inch	27B9471X012

Key	Description	Part Number
10*	Bearing (2 req'd) (continued)	
	Silver-plated R30016 (alloy 6B)	
	1-inch	23B0343X012
	1.5 inch	23B6820X012
	2-inch	23B6683X012
	3- and 4-inch	28B2950X012
	6-inch	28B2951X012
	8 and 10-inch	28B2952X012
	12-inch	28B2953X012
	316L SST Nitride	
	1-inch	23B0342X032
	1.5 inch	23B6819X032
	2-inch	23B6682X032
	3- and 4-inch	27B9673X022
	6-inch	27B9670X022
	8 and 10-inch	27B9547X022
	12-inch	27B9471X022
	Carbon-filled PTFE with N10276 sleeve	
	1-inch	13B0349X012
	1.5 inch	13B6822X012
	2-inch	13B6685X012
	3- and 4-inch	17B9675X012
	6-inch	27B9672X012
	8 and 10-inch	27B9549X012
	12-inch	27B9472X012
	Glass-filled PTFE with N10276 sleeve	
	1-inch	13B0349X042
	1.5 inch	13B6822X042
	2-inch	13B6685X022
	3- and 4-inch	17B9675X022
	6-inch	27B9672X022
	8 and 10-inch	27B9549X022
	12-inch	27B9473X022
11*	Ball Seal	
	Fisher TCM Plus	
	1-inch	13B0339X052
	1.5 inch	13B6815X062
	2-inch	13B6686X062
	3-inch	13A2565X102
	4-inch	13A2585X102
	6-inch	13A2619X102
	8-inch	13A2645X072
	10-inch	13A2662X052
	12-inch	13A2677X062
	Fisher TCM Ultra	
	1-inch	13B0339X062
	1.5 inch	13B6815X072
	2-inch	13B6686X072
	3-inch	13A2565X112
	4-inch	13A2585X112
	6-inch	13A2619X112
	8-inch	13A2645X082
	10-inch	13A2662X062
	12-inch	13A2677X072
	Flat Metal	
	S31600	
	3-inch	11B4688X012
	4-inch	11B5704X012
	6-inch	11B5708X012
	8-inch	11B5712X012
	10-inch	11B5717X012
	S30200	
	12-inch	11B5722X012

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Key	Description	Part Number	Key	Description	Part Number
11*	Ball Seal (continued)		15*	Gasket	
	HD (Heavy-Duty) Metal			Graphite laminate (Standard)	
	CF10SMnN			1-inch	13B0344X032
	2-inch	33B6676X012		1.5 inch	13B6823X042
	3-inch	34B4766X012		2-inch	13B6687X052
	4-inch	34B4767X012		3-inch	11B0660X042
	6-inch	34B4768X012		4-inch	11B0672X052
	8-inch	34B4769X012		6-inch	11B0681X032
	10-inch	34B3365X012		8-inch	11B0693X032
	12-inch	34B3366X012		10-inch	11B0720X022
	CD7MCuN SST			12-inch	11B4682X022
	1-inch	33B0341X022		Graphite for Oxygen Service	
	1.5 inch	33B6817X022		1-inch	13B0344X022
	2-inch	33B6676X022		1.5 inch	13B6823X022
	3-inch	34B4766X022		2-inch	13B6687X022
	4-inch	34B4767X022		3-inch	11B0660X052
	6-inch	34B4768X022		4-inch	11B0672X062
	8-inch	34B4769X022		6-inch	11B0681X042
	10-inch	34B3365X022		8-inch	11B0693X042
	12-inch	34B3366X022		10-inch	11B0720X032
	R30006 cobalt alloy 6 casting			12-inch	11B4682X032
	1-inch	33B0341X012	16*	Packing Set, PTFE and carbon-filled PTFE V-ring	
	1.5 inch	33B6817X032		1-inch	12A9016X022
	2-inch	33B6676X032		1.5 inch and 2-inch	1R5795X0012
	3-inch	34B4766X032		3 and 4-inch	12A8995X022
	4-inch	34B4767X032		6-inch	12A8832X022
	6-inch	34B4768X032		8 and 10-inch	12A8951X022
	8-inch	34B4769X032		12-inch	12A8935X022
	S31700 (317 SST) w/ CoCr-A seat		17	Packing Follower w/integral flange	
	10-inch	34B3365X032	17	Packing Follower w/o integral flange	
	12-inch	34B3366X032	19	Packing Follower Stud	
12*	Shim Seal, S31600 (12 req'd)		20	Packing Follower Nut	
	Use w/flat metal seal only		21	Seal Protector Screw	
	3-inch	11B4689X012	22	Seal Protector Clip	
	4-inch	11B5706X012	23	Actuator Mounting Screw	
	6-inch	11B5710X012	24	Actuator Mounting Nut	
	8-inch	11B5714X012	25	Pipe Plug (Optional) (not shown)	
	10-inch	11B5718X012	26	Identification Nameplate	15A0460X012
	12-inch	11B5721X012	27	Drive Screw	
13*	Spring Seal, S31600		28	Flow Arrow	
	Use w/ flat metal seal only		30	Nameplate	
	3-inch	21B4687X012	31	Nameplate Wire (not shown)	
	4-inch	21B5705X012	32	Line Flange Stud	
	6-inch	21B5707X012	33	Line Flange Stud	
	8-inch	21B5713X012	34	Spacer	
	10-inch	21B5716X012	35*	Packing Ring, graphite ribbon (4 req'd)	
	12-inch	21B5720X012		1-inch	12A9134X012
13*	Wave Spring, N07750 (NACE)			1.5 and 2-inch	12A9135X012
	use w/ HD Metal Seal only			3- and 4-inch	12A9136X012
	1-inch	23B0347X012		6-inch	12A9137X012
	1.5 inch	23B6825X012		8- and 10-inch	12A9138X012
	2-inch	23B6689X012		12-inch	12A9139X012
	3-inch	24B4760X012	36*	Packing Washer, zinc	
	4-inch	24B4761X012		1-inch (3 req'd)	14A8362X012
	6-inch	24B4762X012		1.5 and 2-inch	14A9771X012
	8-inch	24B4763X012		3- and 4-inch (3 req'd)	14A8363X012
	10-inch	22B4509X012		6-inch (3 req'd)	14A8365X012
	12-inch	22B4514X012		8- and 10-inch (3 req'd)	14A8366X012
14	Backup Ring (Composition seal only)			12-inch (3 req'd)	14A8367X012



Key	Description	Part Number
37*	Radial Seal, PTFE/CG Use w/HD Metal Seal	
	1-inch	18B0261X012
	1.5 inch	18B0262X012
	2-inch	18B0263X012
	3-inch	18B0264X012
	4-inch	28B0265X012
	6-inch	28B0266X012
	8-inch	28B0267X012
	10-inch	28B0268X012
	12-inch	28B0269X012
39*	Packing Box Ring	
	316 SST	
	1-inch	16A6082X012
	1.5 and 2-inch	16A6083X012
	3- and 4-inch	16A6084X012
	6-inch	16A6085X012
39*	Packing Box Ring	
	316 SST (continued)	
	8- and 10--inch	16A6086X012
	12-inch	16A6087X012
	N10276	
	1-inch	16A6082X092
	1.5 and 2-inch, N04400	16A6083X102
	3- and 4-inch	16A6084X072
	6-inch	16A6085X092
	8- and 10-inch	16A6086X062
	12-inch	16A6087X092
40	Packing Flange	
41	Retaining Ring	
48*	Ball-Shaft Assembly	
	Ball Material – CG8M CRPL <sup>(1)</sup>	
	Shaft Material – S20910	
	1-inch	29B9535X012
	1-inch Micro-Notch	39B9538X012
	1.5 inch	
	5/8 spline	39B9542X012
	1/2 spline	39B9543X012
	2-inch	
	5/8 spline	39B9547X012
	1/2 spline	39B9548X012
	Ball Material – CF3M <sup>(2)</sup> CRPL	
	Shaft Material – S20910	
	1-inch	29B9535X092
	1-inch Micro-Notch	39B9538X032
	1.5 inch	
	5/8 spline	39B9542X092
	1/2 spline	39B9543X092
	2-inch	
	5/8 spline	39B9547X092
	1/2 spline	39B9543X092
130	Clamp	
131	Bonding Strap Assembly	

Key	Description	Part Number
<b>ENVIRO-SEAL Packing System (Parts in all Type Vee-Ball Valves) (figure 5)</b>		
100	Packing Flange Stud	
101	Packing Flange Nut	
102	Packing Flange	
103	Spring Pack Assembly	
105*	Packing Set	
	W/single PTFE packing	
	1-inch	12B7053X012
	1.5 and 2-inch	12B7402X012
	3-inch	12B7414X012
	4-inch	12B7414X012
	6-inch	12B7438X012
	8- and 10-inch	12B7450X012
	12-inch	12B7462X012
106*	Anti-Extrusion Ring (2 req'd)	
	W/single and double PTFE packing	
	1-inch	12B7054X012
	1.5 and 2-inch	12B7406X012
	3- and 4-inch	12B7418X012
	6-inch	12B7442X012
	8- and 10-inch	12B7454X012
	12-inch w/single PTFE packing only	12B7466X012
107*	Packing Box Ring	
	W/single and double PTFE packing	
	1-inch	16A6082X012
	1.5 and 2-inch	16A6083X012
	3- and 4-inch	16A6084X012
	6-inch	16A6085X012
108*	Packing Ring (2 req'd)	
	W/double PTFE packing	
	1-inch	1H7844X0012
	1.5 and 2-inch	1R5794X0012
	3- and 4-inch	12A8992X022
	6-inch	12A8831X022
	8- and 10-inch	12A8953X022
109*	Anti-Extrusion Ring (2 req'd)	
	W/double PTFE packing	
	1-inch (adapter rings) and (anti-extrusion rings)	12B7473X012
	1.5 and 2-inch (adapter rings) and (anti-extrusion rings)	12B7054X012
	3- and 4-inch PTFE packing	12B7410X012
	6-inch PTFE packing	12B7406X012
	8- and 10-inch PTFE packing	12B7422X012
		12B7446X012
		12B7458X012
110	Lantern Ring	
111	Tag	
112	Tie Cable	
113	Lubricant, anti-seize (not furnished with packing system)	

\*Recommended spare parts

1. Chrome-plated ball (CRPL)

2. CF3M is the standard material offered in Europe only.

# Vee-Ball Valves

## Appendix A Instructions for Non-Series B

The Series B changes affected only the 3- through 12-inch valves without attenuators. To determine if a Vee-Ball valve is Series B, you will need to examine several of the internal parts. Compare the distinctive skirted V-notch outline of the forward side and the circular edge on the reverse side of the Series B design ball to the V-notch on both sides of the non-series B design ball. Then look for bushings. The lack of bushings indicates the valve body is Series B.

All Vee-Ball valves 3- through 12-inch valves produced before the Series B design changes use the Specifications table, the Installation, Maintenance, Packing Maintenance, Replacing Packing, and Replacing the Ball Seal instructions found elsewhere in this manual. Bearing and Vee-Ball Maintenance and Actuator Mounting instructions for these valves may be found below.

## Maintenance

### Note

Neither Emerson, Emerson Process Management, Fisher, nor any of their affiliated entities assumes responsibility for the selection, use and maintenance of any product. Responsibility for the selection, use, and maintenance of any product remains with the purchaser and end-user.



### WARNING

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

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

- 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 from both sides of the valve. Drain the process media from both sides of the valve.

- Vent the power actuator loading pressure and relieve any actuator spring precompression.

- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

- 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.

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

1. Refer to the Replacing Packing procedures to remove the actuator, and to remove the packing flange and packing follower from the valve. When the packing disassembly steps are complete, return to this section.

2. Refer to the Replacing the Ball Seal procedures to remove the ball seal from the valve.

## Disassembly



### WARNING

When the actuator is removed from the valve, the ball/shaft assembly may suddenly rotate, with a shearing, cutting motion, which could result in personal injury. To avoid injury,

**carefully rotate the ball to a stable position. Make sure the ball will not rotate.**

Key numbers in this procedure are shown in figures 24, 26, and 31, unless otherwise indicated. A taper key (key 4, figure 14) is used in 3- through 12-inch Non-Series B valves.

3. Carefully rotate the ball to the open position after the actuator is disconnected. Make sure the ball will not rotate (see warning above). Provide support for the ball during the following disassembly.

4. Unscrew the pipe plug (key 25). (With newer valve constructions, the pipe plug is optional and may not be available.)

5. Working from the small end of the groove pin (key 7), use a pin punch to drive the groove pin out of the ball ear and follower shaft.

**For tack welded taper keys**, driving the taper key out of the ball ear will shear the tack welding.

6. Locate the small end of the taper key (key 4, see figure 14). Using a pin punch on the smaller end of the taper key, drive it out of the ball (key 2) and drive shaft (key 6). Note: driving the taper key in the wrong direction will tighten it.

7. Pull the drive shaft (key 6) out of the actuator side of the valve body.

8. Make sure the sealing surface of the ball is not damaged while removing the follower shaft.

a. If a pipe plug (key 25) is installed, use a punch to drive the follower shaft (key 9) into the center of the ball.

b. If a pipe plug is not installed, use a piece of continuous threaded rod as a removal rod when moving the follower shaft (key 9) into the center of the V-notch ball. Refer to the table 7 for a description of the size threaded rod needed. The length of the rod should allow easy working room from the valve body.

9. **Remove the ball** (key 2) by carefully removing the follower shaft and ball from the valve body.

10. Remove the packing box spacer (key 34) for 8-, 10-, and 12-inch valves.

11. **Removing the bearings (key 10):**

a. **For composition bearings**, remove the bearings by hand. If the bearings are tight in the valve body, then pull or drive them out with a

slight pressure. Allow the bushings (key 5 or 8) to remain in the valve body.

Table 7. Continuous Threaded Rod

Valve Size, Inches	Threaded Rod Thread Size	Thread Depth in Follower Shaft
3	1/4-20	0.5
4	1/4-20	0.5
6	1/4-20	0.5
8	5/16-18	0.62
10	5/16-18	0.62
12	5/16-18	0.94

b. **For metal bearings**, use a press and ram to remove the drive shaft bearings out of the valve body. Refer to figure 30 ram dimensions. The bushings (key 5 or 8) will normally remain in the valve body.

To remove the follower shaft bearings, use a blind-hole bearing puller. If you do not have such a tool, you can machine the bearing out.

#### 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 30.**

12. Thoroughly clean surfaces of all parts that are to be re-used or obtain replacement parts.

### Assembly

1. Inspect all sealing surfaces to ensure they are in good condition and without scratches or wear.

2. **Installing bearings (key 10):**

a. **For composition bearings**, install the bearings by hand. The bearing flanged end should touch the bushing (key 5 or 8).

b. **For metal bearings:**

• Use a press and ram to install the bearings (key 10). Refer to figure 30.

• Press the bearings in until each bearing is flush with the bushing (key 5 or 8). The acceptable tolerance for bearing location is: flush with the bushing to 1.52 mm (0.060 inches) inside the bushing. That is, the bearings should not protrude

# Vee-Ball Valves

into the flow cavity of the valve, and they should not be more than 1.52 mm (0.060 inches) inside the bushing.

- Take care not to change the position of the bushings (key 5 or 8) when pressing in new bearings (key 10), otherwise the ball will not center in the valve body and seal.

## 3. Installing the Vee-Ball (key 2):



### WARNING

**The Vee-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 or out of the valve body cavity.**

#### Note

**For ease of assembly, the follower shaft (key 9) should be inserted into the ball before installing the ball in a 3-inch valve without ball/attenuator**

Carefully install the ball into the valve body cavity.

After you have installed the ball (key 2) into the valve body assembly, firmly support the ball while installing the shafts.

## 4. Installing the follower shaft (key 9):

- **For 3-inch valves:** The follower shaft (key 9) should already have been inserted into the ball before the ball was put into the valve body. Insert the follower shaft (key 9) into the valve body bearing (key 10).

- **For 4-inch and larger valves without attenuator:** Insert the follower shaft (key 9) through the ball, and into the valve body bearing (key 10).

**Then for all sizes,** align the hole in the follower shaft with the holes in the ball. Insert the small end of the groove pin (key 7) into the hole in the ball and into the follower shaft. The pin will hold the parts in place while the drive shaft (key 6) is being installed.

5. Insert the drive shaft (key 6) into the valve body bearing (key 10), and into the ball ear. Align the hole in the drive shaft with the holes in the ball.

### CAUTION

**The drive shaft must be used with the correct Vee-Ball. Refer to the tag (see figure 13) attached to the Vee-Ball and to the drive shaft.**

**Failure to use the correct Vee-Ball/shaft combination may result in the ball not being in the position indicated by the slash mark on the end of the shaft. If the ball is not properly aligned with the slash mark, the valve will not function correctly and seal damage may result.**

## 6. Installing the Taper Key (key 4):

Current standard construction materials for all 3 through 12-inch valves require the taper key (key 4, figure 14) to be tack welded in place using the following procedure. Use standard welding preparations when preparing parts for reassembly.

### CAUTION

**Make sure the drive shaft (key 6) is free of oil or grease, otherwise the taper key will not seat properly. Failure to properly set the taper pin or taper key could result in it coming loose while in service. Loosening of the taper key in service could result in improper valve function and equipment damage.**

1. Install the drive shaft (key 6) into the valve body through the ball and into the lower bearing.
2. Insert the taper key (key 4) into ball and drive shaft (keys 2 and 6) as shown in figure 14. The taper key inserts, with the flat side of the key, facing the drive shaft (key 6).
3. Using a flat end punch, drive the groove pin (key 7) into the ball ear and follower shaft until it is flat with the ball ear surface.
4. Using a flat end punch, drive the taper key (key 4) into the ball ear and drive shaft (key 6) until solid, heavy contact is obtained between the key and shaft.
5. Measure the position of the taper key head.
6. Drive the taper key in further using the minimum distance shown in table 7.

Table 8. Taper Key Minimum Depth

VALVE SIZE, INCHES	MINIMUM DEPTH TO DRIVE TAPER KEY AFTER INITIAL SOLID CONTACT, mm (INCHES)
3, 4, 6	4.8 (0.188)
8, 10, 12	5.6 (0.219)

Table 9. Taper Key Maximum Depth

VALVE SIZE, INCHES	MAXIMUM DEPTH TO DRIVE TAPER KEY AFTER INITIAL SOLID CONTACT, mm (INCHES)
3, 4	7.1 (0.281)
6	7.9 (0.312)
8, 10	9.5 (0.375)
12	10.3 (0.406)

7. Inspect the ball/shaft taper key connection to verify that the taper key spans the entire shaft flat width. If not, the taper key must be driven in further until this condition is satisfied. However, do not exceed the maximum depths shown in table 8.

#### Note

**When welding standard valves that have a CG8M (317 SST) or CF3M (316L SST) ball, use 309 or 309L filler rod material.**

**Alloy valve taper keys are normally not welded.**

8. When the above conditions are met, tack weld the taper key (key 4) to the ball ear on the head end of the key (see figure 26). Use a:

- 1/8 inch diameter weld on 3- through 6-inch valves,
- 3/16 inch diameter weld on 8- through 10-inch valves, and
- 1/4 inch diameter weld on 12-inch valves.

**For all constructions:** Refer to Replacing the Ball Seal, Packing Maintenance, and other procedures as necessary to complete the assembly of the valve.

## Actuator Mounting

Use the appropriate actuator instruction manual and figure 23 of this manual when mounting the actuator or changing actuator styles and positions.

To help ensure correct centering of the ball (key 2) on the seal (key 11), be sure the ball is closed when mounting the actuator. Do not use a hammer or

other tool to drive the actuator lever onto the valve shaft.

Clean the valve shaft and actuator lever splines to be sure the actuator lever will slide on easily. If the lever does not slide on easily, carefully wedge the ball solidly against the actuator-side bearing using a screwdriver or similar tool inserted between the lower ear of the ball and the valve body.

Keep the wedge in place while installing the lever, but again, do not drive on the lever. Remove the wedge after you have clamped the actuator lever on the valve shaft and connected the lever to the actuator piston rod or diaphragm rod.

## Determining Mounting Position

The actuator can be either right or left-hand mounted.

#### Note

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

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

The preferred location of the ball is in the top of the valve body when the valve is open. To convert from right to left hand-mounting, turn the valve to position the actuator mounting pad on the left and rotate the ball to the top of the valve.

The number one V-notch controls flow on right-hand mounting. Turn the valve 180 degrees, and rotate the ball to the top of the valve to obtain left-hand mounting. The number two V-notch controls flow for this construction. See figure 29.

# Vee-Ball Valves

## Determining Closed Position

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



### WARNING

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

2. Rotate the ball to the closed position.
3. Follow one of the procedures below:
  - When viewed from the valve body inlet, the ball is in the proper position when both V-notches of the ball are centered between the machined diameter of the ledge that supports the seal.
  - If the ball has a spot machined on the top, align that spot to the exact center of the seal cavity.
4. Adjust the actuator linkage as described in the appropriate actuator instruction manual until the condition described in step 3 exists. A line is stamped on the actuator end of the drive shaft (see figure 23) to indicate the ball position.

### Note

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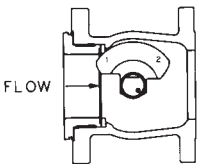
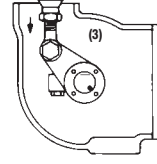
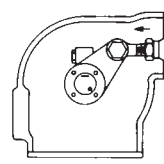
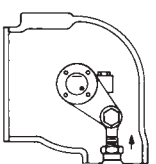
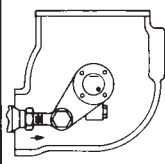
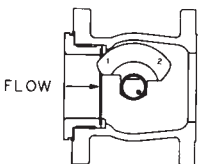
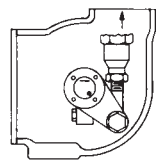
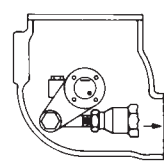
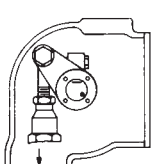
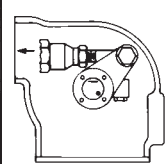
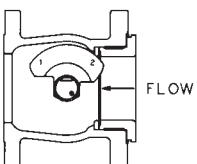
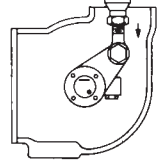
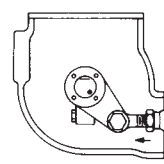
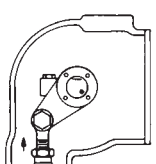
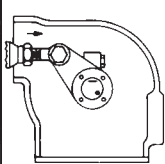
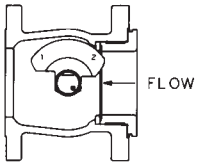
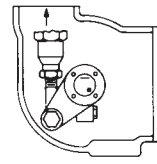
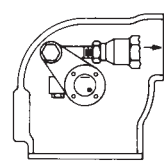
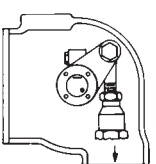
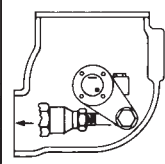
## Non-Series B Design Parts (figure 31)

### Note

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

Key	Description	Part Number
2	Ball	
2	Ball with attenuator (RH mtg in Common parts section)	
6	Drive Shaft	
9	Follower Shaft	
10*	Bearing (2 req'd)	
	PEEK	
	3- and 4-inch	14B3354X012
	6-inch	14B3355X012
	8 and 10-inch	14B3356X012
	12-inch	14B3357X012
	S44004 (440C SST)	
	2-inch	23B6682X022
	3- and 4-inch	14A5698X012
	6-inch	14A4618X012
	8 and 10-inch	14A5699X012
	12-inch	14A6549X012
	R30016 (alloy 6B)	
	3- and 4-inch	14A6546X012
	6-inch	14A6547X012
	8 and 10-inch	14A6548X012
	12-inch	14A6550X012
	Silver-plated R30016 (alloy 6B)	
	3- and 4-inch	14A6537X012
	6-inch	14A2498X012
	8 and 10-inch	14A6538X012
	12-inch	14A6539X012
	Carbon-filled PTFE with N10276 sleeve	
	3- and 4-inch	12B5944X012
	6-inch	12B5945X012
	Glass-filled PTFE with N10276 sleeve	
	3- and 4-inch	12B5944X042
	6-inch	12B5945X042



ACTUATOR		VALVE OPEN	ACTUATOR POSITION			
MOUNTING	STYLE		1	2	3	4
RIGHT-HAND <sup>(1)</sup>	STYLE A (PDTC) <sup>(2)</sup>					
	STYLE B (PDTO) <sup>(2)</sup>					
LEFT-HAND <sup>(1)</sup>	STYLE C (PDTC) <sup>(2)</sup>					
	STYLE D (PDTO) <sup>(2)</sup>					

1. Right-hand mounting controls with v notch no. 1; Left-hand mounting controls with v notch no. 2

2. PDTC-push down to close; PDTO-push down to open

3. Arrow on lever indicates direction of actuator thrust to close valve

B2703 / IL

Figure 29. Index Marks for Actuator Lever Orientation for Non-Series B Design Valves

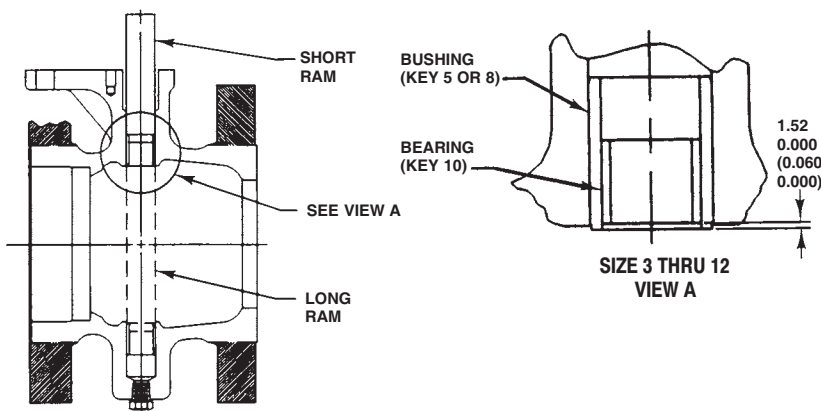
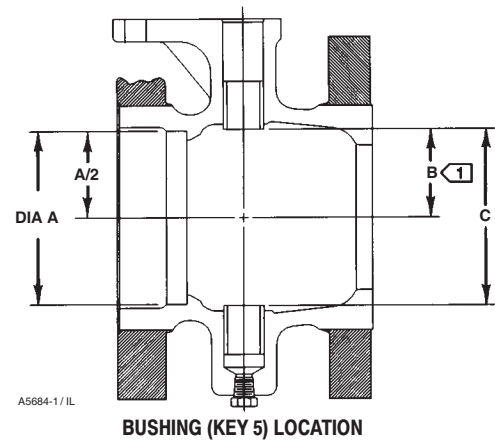
# Vee-Ball Valves

May 2006

VALVE SIZE, INCHES	BEARING RAM DIMENSIONS								BUSHING RAM DIMENSIONS					
	Ram Lengths				Ram Diameters				Ram Diameters					
	L		M		D		d		D		Long Ram d		Short Ram d	
	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches
3 & 4	201.42 MIN	7.930 MIN <sup>(1)</sup>	95.25 MIN	3.750 MIN	22.86 22.61	0.900 0.890	19.05 18.80	0.750 0.740	28.19 27.94	1.110 1.100	19.05 18.80	0.750 0.740	22.86 22.61	0.900 0.890
6	247.65 MIN	9.750 MIN	95.25 MIN	3.750 MIN	29.21 28.96	1.150 1.140	25.40 25.15	1.000 0.990	34.54 34.29	1.360 1.350	25.40 25.15	1.000 0.990	29.21 28.96	1.150 1.140
8	338.75 MIN	13.310 MIN	139.70 MIN	5.500 MIN	35.56 35.31	1.400 1.390	31.75 31.50	1.250 1.240	40.89 40.64	1.610 1.600	31.75 31.50	1.250 1.240	35.56 35.31	1.400 1.390
10	396.75 MIN	15.620 MIN	139.70 MIN	5.500 MIN	35.56 35.31	1.400 1.390	31.75 31.50	1.250 1.240	40.89 40.64	1.610 1.600	31.75 31.50	1.250 1.240	35.56 35.31	1.400 1.390
12	476.25 MIN	18.750 MIN	152.40 MIN	6.000 MIN	41.91 41.66	1.650 1.640	38.10 37.85	1.500 1.490	50.42 50.17	1.985 1.975	38.10 37.85	1.500 1.490	41.91 41.66	1.650 1.640

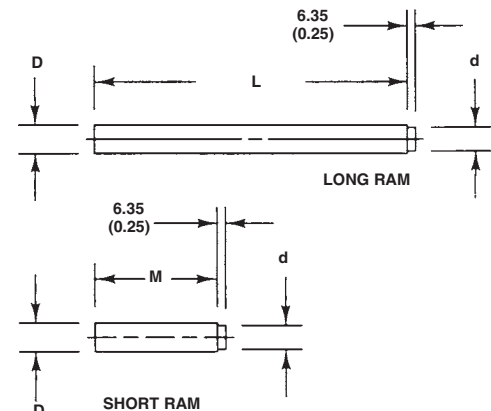
1. MIN = Minimum.

VALVE SIZE, INCHES	DIMENSION			
	B	C	B	C
	Millimeters		Inches	
3	48.26 50.04	100.38 100.63	1.960 1.970	3.952 3.962
4	60.10 60.35	121.01 121.26	2.366 2.376	4.764 4.774
6	83.59 83.85	168.00 168.25	3.291 3.301	6.614 6.624
8	106.20 106.45	213.21 213.46	4.181 4.191	8.394 8.404
10	135.33 135.59	271.48 271.73	5.328 5.338	10.688 10.698
12	169.67 169.93	340.16 340.41	6.680 6.690	13.392 13.402



NOTES:  
 1. DIMENSION B IS THE DISTANCE BETWEEN THE GUIDE BUSHING AND THE CENTER OF DIAMETER A.

## BEARING RAM



mm  
(INCHES)

Figure 30. Metal Bearing Ram and Bushing Location

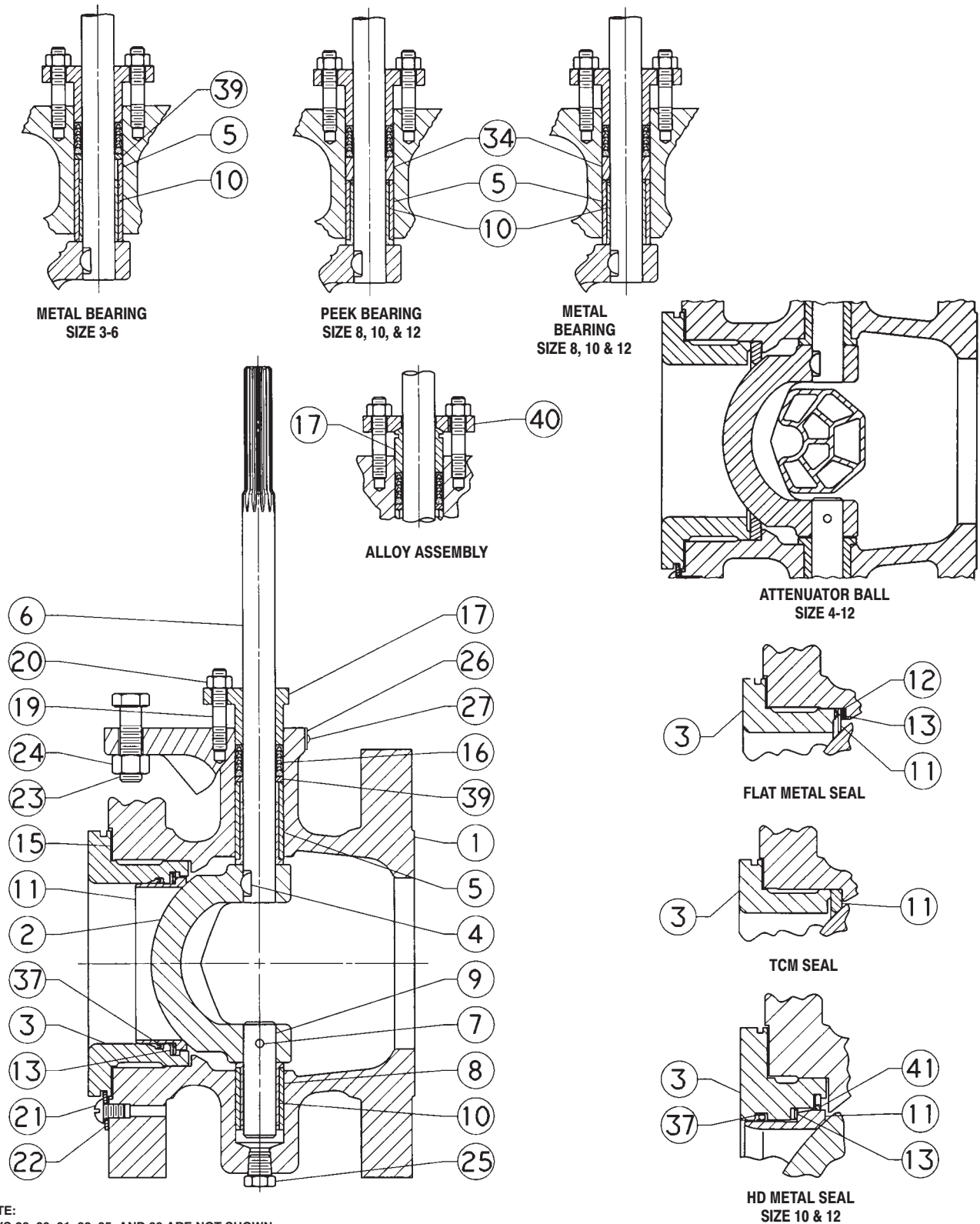


Figure 31. Designs V150 and V300 Non-Series B Valve Assembly (3- 12- Inch Sizes)  
(Details are typical for Design V200 Valves except Design V200 does not have flanges)

# Vee-Ball Valves

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