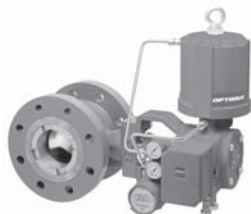


## Product Instruction Manual



# OpVEE V-Notch Ball Valve

### TABLE OF CONTENTS

#### INTRODUCTION

|                                 |       |
|---------------------------------|-------|
| <i>Scope of Manual</i> .....    | pg. 1 |
| <i>Safety Information</i> ..... | pg. 1 |
| <i>Unpacking</i> .....          | pg. 2 |

#### INSTALLATION .....

|                          |       |
|--------------------------|-------|
| <i>Quick-Check</i> ..... | pg. 2 |
|--------------------------|-------|

#### MAINTENANCE .....

|                                       |       |
|---------------------------------------|-------|
| <i>Removing Valve From Line</i> ..... | pg. 4 |
| <i>Removing Actuator</i> .....        | pg. 4 |

#### ASSEMBLY AND DISASSEMBLY

|                               |       |
|-------------------------------|-------|
| <i>Body Disassembly</i> ..... | pg. 4 |
| <i>Body Reassembly</i> .....  | pg. 5 |

#### REMounting ACTUATOR .....

### INTRODUCTION

#### *Scope of Manual*

This instruction manual includes installation, maintenance, and parts information for the Optimux™ OpVee control valve. Refer to separate manuals for information regarding installation, operation, and maintenance of additional features such as actuators, positioners, special accessories, fail-safe systems, etc. Only qualified persons should install, operate, and maintain an Optimux OpVee valve. Any questions about these instructions should be directed to your Optimux sales office or sales representative before proceeding.

This publication does not contain information on Optimux positioners. Refer to the appropriate manual for information on positioner installation, operation, maintenance, and calibration.

### SAFETY INFORMATION



**WARNING:** Indicates a potentially hazardous situation, which, if not avoided, could result in **death or serious injury**.



**CAUTION:** Indicates a potentially hazardous situation, which, if not avoided, could result in **minor or moderate injury and/or property damage**.

**Note:** Indicates a potential situation, which, if not avoided, may result in an *undesired result or state*.

**WARNING:** Standard industry safety practices must be adhered to when working on this, or any other, process control product. Specifically, personal protective and lifting devices must be used as warranted.

**Note:** *Selecting the proper fastener material is the responsibility of the customer. Typically, the supplier does not know what the valve service conditions or environment may be. Optimux's standard bolting material is B7/2H. Grade 660 bolting material is standard with stainless steel or NACE valves. The customer therefore must consider the material's resistance to stress corrosion cracking in addition to general corrosion. As with any mechanical equipment, periodic inspection and maintenance is required. For more information about fastener materials, contact your local Optimux representative or factory.*

### Unpacking

1. While unpacking the valve, check the packing list against the materials received. Lists describing the valve and accessories are included in each shipping container.
2. When lifting the valve from the shipping container, position lifting straps to avoid damage to tubing and mounted accessories. Valves up through 8-inch may be lifted by the actuator lifting ring. On larger valves, lift the valve using lifting straps or hook through the yoke legs and outer end of the body.

**⚠ WARNING:** When lifting a valve/actuator assembly with lifting straps, be aware the center of gravity may be above the lifting point. Therefore, support must be given to prevent the valve/ actuator from rotating.

3. In the event of shipping damage, contact your shipper immediately.
4. Should any problem arise, contact your Optimux representative.

### INSTALLATION

1. Before installing the valve, clean the line of dirt, scale, welding chips, and other foreign material. Clean the gasket surfaces thoroughly to ensure leak-proof joints.
2. Install the valve in line. Check flow direction to be sure valve is installed correctly. Be certain flanges are aligned correctly. Correct alignment of flanges is important to prevent possible future leakage.

**⚠ WARNING:** Keep hands, hair, clothing, etc. away from the rotating ball and the seal when operating the valve.

3. If the valve is supplied with an actuator and positioner, connect the air supply and instrument signal lines. Two connections are marked for the air supply and for the instrument signal. Most Optimux actuators are suitable for 80 to 150 PSI air supply. An air regulator is not required unless the supply pressure exceeds the maximum allowable actuator PSI (indicated on cylinder). An air filter is recommended unless the supply air is unusually clean and dry. All connections must be free of leaks.

**⚠ CAUTION:** On valves equipped with air filters, the air filter bowl must point down; otherwise, the air filter will not perform properly.

4. Apply the recommended torque values to the line flange bolting for proper sealing (see Table I).

### Quick-Check

Prior to startup, check the control valve by following these steps:

1. Check for full stroke by making the appropriate instrument signal change. Observe the position indicator plate mounted on the actuator transfer case. The indicator plate should change position in a smooth, rotary fashion.

**⚠ CAUTION:** The Optimux valve shaft is not designed to take full torque load of the actuator. If the ball were to seize and full torque continued, the shaft could twist and/or shear.

2. Check all air connections for leaks. Tighten or replace any leaky lines.
3. Evenly tighten the packing nuts to slightly over finger-tight.

**⚠ CAUTION:** Do not over-tighten packing nuts. This can cause excessive packing wear and high shaft friction, which may impede shaft rotation. After the valve has been in operation for a short time, check the packing nuts to make sure they are properly torqued (readjust if necessary). If packing box leaking occurs, tighten the packing nuts only enough to stop leakage.

- To observe the valve failure mode in case of air failure, position the valve to mid-stroke and shut off the air supply to the actuator or disconnect the instrument signal to the positioner. Observe the actuator indicator plate, it should move to either fail-open or closed position. If incorrect, refer to the “Actuator Action Reversal” section in the appropriate Actuator Instruction Manual.

## MAINTENANCE

At least once every six months, check for proper operation by following the preventive maintenance steps outlined below. These steps can be performed while the valve is in line and, in some cases, without interrupting service. If an internal problem is suspected with the valve, refer to the “Assembly and Disassembly” section.

- Look for signs of gasket leakage through the body and line flanges. Tighten flange bolting if necessary. (See Table I for specifications.)
- Note if any corrosive fumes or process drippings are damaging the valve.
- Clean valve and paint areas of severe oxidation.
- Check packing box bolting for proper tightness. Packing nuts should be tightened as necessary to prevent stem leakage.

| Valve Size (inches) | ANSI Class Rating | Bolt** Length (inches) | Torque* (ft. lbs.) |                       |
|---------------------|-------------------|------------------------|--------------------|-----------------------|
|                     |                   |                        | Low Strength       | Intermediate Strength |
| 1                   | 150               | 2.5                    | 23                 | 61                    |
|                     | 300               | 3.0                    | 46                 | 122                   |
|                     | 600               | 3.5                    | 46                 | 122                   |
| 1 1/2               | 150               | 2.75                   | 23                 | 61                    |
|                     | 300               | 3.5                    | 82                 | 218                   |
|                     | 600               | 4.25                   | 82                 | 218                   |
| 2                   | 150               | 3.25                   | 46                 | 122                   |
|                     | 300               | 3.5                    | 46                 | 122                   |
|                     | 600               | 4.25                   | 46                 | 122                   |
| 3                   | 150               | 3.5                    | 46                 | 122                   |
|                     | 300               | 4.25                   | 82                 | 218                   |
|                     | 600               | 5.0                    | 82                 | 218                   |
| 4                   | 150               | 3.5                    | 46                 | 122                   |
|                     | 300               | 4.5                    | 82                 | 218                   |
|                     | 600               | 5.75                   | 132                | 353                   |
| 6                   | 150               | 4.0                    | 82                 | 218                   |
|                     | 300               | 4.75                   | 82                 | 218                   |
|                     | 600               | 6.75                   | 199                | 531                   |
| 8                   | 150               | 4.25                   | 82                 | 218                   |
|                     | 300               | 5.5                    | 132                | 353                   |
|                     | 600               | 7.5                    | 296                | 789                   |
| 10                  | 150               | 4.5                    | 132                | 353                   |
|                     | 300               | 6.25                   | 199                | 531                   |
|                     | 600               | 8.5                    | 420                | 1119                  |
| 12                  | 150               | 4.75                   | 132                | 353                   |
|                     | 300               | 6.75                   | 296                | 789                   |
|                     | 600               | 8.75                   | 420                | 1119                  |

**Table I: Flange Bolting Specifications**

\*Torque values are recommended for low and intermediate strength bolting per ANSI B16.5 ¶5.3.2. Higher torques may be used with high strength bolting (ANSI B16.5 ¶5.3.1). In all cases the user must verify the selected bolting's ability to seat the joint under expected operating condition. Long thru-bolted joints generally require higher strength bolting and torque values than shorter flanged bolting depending on operating conditions.

\*\*Lengths are based on ANSI B16.5 stud bolts and raised face ends.

**⚠ CAUTION:** Do not over-tighten packing. This can cause excessive packing wear and high shaft friction, which may retard shaft rotation.

- If the valve is supplied with a lubricator, check lubricant supply and add lubricant if necessary.

6. If possible, stroke valve and check for smooth, full-stroke operation by observing the position indicator plate mounted on the transfer case. Unsteady movement of the plate could indicate an internal valve problem.
7. If a positioner is included, check its calibration by observing the gauges and the actuator position indicator plate. Make sure the positioner is calibrated to the correct range.
8. If an actuator is attached, refer to the appropriate maintenance instructions for preventive maintenance on it. If possible, remove the air supply and observe the actuator stroke plate for correct fail-safe action.
9. Be sure that all valve accessories, brackets and bolting are securely fastened.
10. Clean any dirt or other foreign material from the exposed portion of the valve shaft.
11. If an air filter is supplied, check and replace cartridge if necessary.

### Valve Removal From Line

If an internal problem is suspected with the valve and disassembly is required, remove the valve from the line by proceeding as follows:

**⚠ WARNING: Depressurize line to atmospheric pressure, drain all process fluids and decontaminate the valve (if caustic or hazardous materials are present).**

1. Attach a hoist or some means to support the valve.
2. Remove line bolting. Do not attempt to pry line flanges apart by pushing or pulling on the valve or actuator.
3. Slide the valve carefully from the line. To

avoid damage to the gasket surfaces, do not twist the valve.

4. After the valve is completely removed from the line, slowly relieve air pressure from the actuator.

### Actuator Removal

Three to twelve inch Optimux valves are designed to be disassembled without removing the Optimux actuator, however, removing the actuator is recommended. Refer to the appropriate actuator installation, operation, maintenance instructions, and proceed as follows:

1. Support the actuator assembly before disconnecting it from the body assembly.
2. Loosen the actuator adjusting screw to release the spring compression.
3. On Optimux actuators with a clamped lever-arm design, remove the actuator transfer case cover bolts, carefully pry or slide the cover plate from the transfer case, then loosen the linkage bolt.
4. Remove the bolts connecting the yoke to the body subassembly.
5. Slide the entire actuator assembly off the shaft. On Optimux actuators with a clamped lever-arm design, it may be necessary to wedge the splined lever arm apart to loosen it from the shaft splines.

## ASSEMBLY AND DISASSEMBLY

### Body Disassembly

It is not necessary to remove the actuator from the body assembly to disassemble 3 to 12-inch bodies, however, it is recommended. On valves with the clamped lever-arm design it is necessary to loosen the valve shaft from the actuator prior to body disassembly. Refer to Figures 1, 2 and 5 and proceed as follows:

1. Remove the seal retainer and seals.

**Screw-in style** – This requires loosening the retainer by turning it counterclockwise and removing it from the body. (A special cross-wrench tool may be ordered from

the factory. See Table IV.) Remove the metal seals. Remove the soft seal if applicable.

**Lock-ring style** – Some valve designs have a retaining ring held in with set screws. To remove it, loosen the set screws in the lock ring, then remove the retaining ring, lock ring and finally the seal retainer. If the lock ring set screws will not loosen, the retaining ring can be forced out using a flat-headed screwdriver and pliers. Remove the seals.

2. Remove the gland flange by removing both packing nuts. It is not necessary to remove the studs.
3. **On rotating post designs:** Drive both the shaft and post pins into the center of the shaft and post until the outward end of the pin clears the ball. Be careful to not damage the shaft or post. The pins can then be punched out of the shaft and post when they are removed from the valve. Carefully remove the shaft plug and O-ring and finally the rotating post. (Inserting a bolt in the jack screw hole, tapped in the post, will help in removing the post.)
- On stationary post designs:** Drive the shaft pin into the center of the shaft until the outward end of the pin clears the ball splines. Be careful to not damage the shaft. The pin can then be punched out of the shaft after the shaft is removed. Remove the anti-rotation clamp. Remove the post and the post O-rings.
4. On 3 through 12-inch designs, remove the shaft by pulling it out through the outboard end of the body. On 1 through 2-inch designs, remove the shaft by pulling it out through the inboard end of the body

**⚠ CAUTION:** Take special care to not damage the splined end of valve shaft during disassembly.

5. Rotate the ball inside the body so the non-splined end of the ball is toward the back port of the valve and remove the ball straight out of the body. If necessary, on stationary post designs remove the post bearing from the ball by pushing it out with a press.

**⚠ CAUTION:** Be extremely careful not to gall or scratch the sealing surface of the ball when removing it from body. Scratches may later cause excessive leakage and seal wear.

6. Push the packing and bearings out of the body using a bronze dowel with the appropriate diameter. Push the packing out of the body from the center of the valve.

### Body Reassembly

To reassemble the body subassembly, refer to Figures 1 or 2, 3, 4, and 5 and proceed as follows:

1. Clean all parts and replace all O-rings and soft seals.
2. Check the ball sealing surface to make sure it is smooth and free of scoring and scratches.

**⚠ CAUTION:** Damaged or dirty seal surfaces can cause excessive seat wear and high torque requirements. Damaged balls should be replaced.

3. Inspect the shaft and post for scratches or galled surfaces. For maximum performance, Optimux shafts and posts are machined to a very smooth finish. If damage exists, replace the shaft or contact the factory representative.

**Note:** Ball and shaft are interchangeable. Replacing the ball does not require replacing the shaft.

4. It is recommended to use a press to install new bearings in the body and/or ball. When correctly installed, the ends of the body bearings should be flush with the inside of the body.
5. Position the ball in the body by lowering it, splined hole first, into the back of the body. Rotate the ball surface toward the front of the body so that the splined hole is toward the packing box.

**⚠ CAUTION:** Be extremely careful not to gall or scratch the sealing surface of the ball when replacing it in the body. Scratches may later cause excessive leakage and seal wear.

6. On 3 through 12-inch designs, insert the shaft through the outboard end of the body and through the splined hole of the ball into the packing box. On 1 through 2-inch designs, insert the shaft through the inboard end of body and through the packing box into the splined hole of the ball. (For 1-inch body designs, the thrust bearing, packing spacer, packing, and packing follower must be inserted before installing the shaft.)
7. Position the shaft so that the pin hole in the shaft and ball are in alignment. (Some shafts have a half circle mark and line on the end. Align the line mark with the pin and the half circle symbol with the ball.) Install the shaft pin and drive it firmly into place so that half is in the ball and half in the shaft.
8. **On rotating post designs:** Insert the post through the outboard end of the body and into the hole of the ball. (For 1 through 2-inch valves sizes, insert thrust bearing before installing post.) Position the post so that the pin hole in the post

and ball are aligned. (For 6 through 12-inch valve sizes, be certain that the ball pin hole is aligned with the smallest diameter pin hole in the post. Some posts have a half circle mark on the end. Align this mark with the ball.) Install the post pin and drive it firmly into place so that half is in the ball and half is in the post. Torque the plug per Table II.

**On stationary post designs:** Ensure that the post and post threads are well lubricated with a high temperature bearing grease (or as required by the application) before installation. Replace the post O-ring and reinstall the post. Torque the post per Table II. Install the anti-rotation clamp kit.

9. Slide the thrust bearing, packing spacer, packing, and packing follower over the splined end of the shaft and into the body. Typical packing configurations are shown in Figure 3. (1-inch designs refer to Step 6.)

**Note:** Always use new packing whenever rebuilding the packing box.

| Valve Size (inches) | Stationary Design Post | Rotating Design Shaft Plug |
|---------------------|------------------------|----------------------------|
| 1, 1½               | N/A                    | 50                         |
| 2                   | 175                    | 85                         |
| 3, 4                | 300                    | 150                        |
| 6, 8                | 500                    | 250                        |
| 10, 12              | 600                    | 300                        |

**Table II: Post/Shaft Plug Torques (ft.-lbs.)**

**⚠ CAUTION:** Since the sealing on V-ring packing takes place at the feather edge, it is imperative to avoid damage to that edge.

10. Reinstall the gland flange and packing nuts and leave loose.

**⚠ CAUTION: Do not over-tighten packing. This can cause excessive packing wear and shaft friction, which may impede shaft rotation.**

11. Place the valve on a flat surface with the threaded (retainer) port facing up and pull the shaft toward the actuator until it is fully against the thrust bearing.
12. On 3 through 12-inch designs, make certain the ball surface is facing up and position the ball as close as possible in the center of the body's inside diameter. (The pinned connection between the ball and shaft is not a tight connection; the design includes a considerable amount of axial play between the ball and shaft.)

On 1 through 2-inch designs, make certain the ball surface is facing up and pull on the shaft until the post is fully against the thrust bearing. (The ball does not self center. There will be no axial play between the ball and shaft.)

13. Replace the soft and/or metal seal rings, as applicable to the application. (Refer to Figure 4.)

**For soft seal applications:** Insert the soft seal ring, followed by the two metal seal rings into the body.

**For metal seal applications:** Insert the two metal seal rings into the body. (For 1-inch designs, there is only one seal ring.)

14. With screwed-in retainer designs, replace the O-rings in the retainer (except on high temperature valves, which do not use O-rings). Refer to Figure 1 or 2. Lubricate the retainer threads and rings and reinstall the retainer in the front of the body. Torque the seal retainer according to Table III.
15. On some 10 and 12-inch valves where the retainer is held in place with set screws, reinsert the lock ring into the

| Valve Size (inches) | Torque Value (ft.-lbs.) | Valve Size (inches) | Torque Value (ft.-lbs.) |
|---------------------|-------------------------|---------------------|-------------------------|
| 1, 1½, 2            | 150-175                 | 8, 10               | 650-700                 |
| 3                   | 250-300                 | 12                  | 900-950                 |
| 4, 6                | 550-600                 |                     |                         |

**Table III: Screwed-in Retainer Torques**

body with the words “Ball Side” facing toward the ball. The lock ring has “Ball Side” and “Port Side” marked on it. Insert the retaining ring into the inner groove of the body, being certain it is fully seated. Tighten the lock ring setscrews evenly to a torque of 225 inch-pounds.

16. After the seal retainer is in tight, tighten the packing nuts just over finger-tight. Packing nuts should be tightened as necessary to prevent stem leakage.

**⚠ CAUTION: Do not over-tighten packing. This can cause excessive packing wear and high shaft friction, which may retard shaft rotation.**

## REMounting Actuator

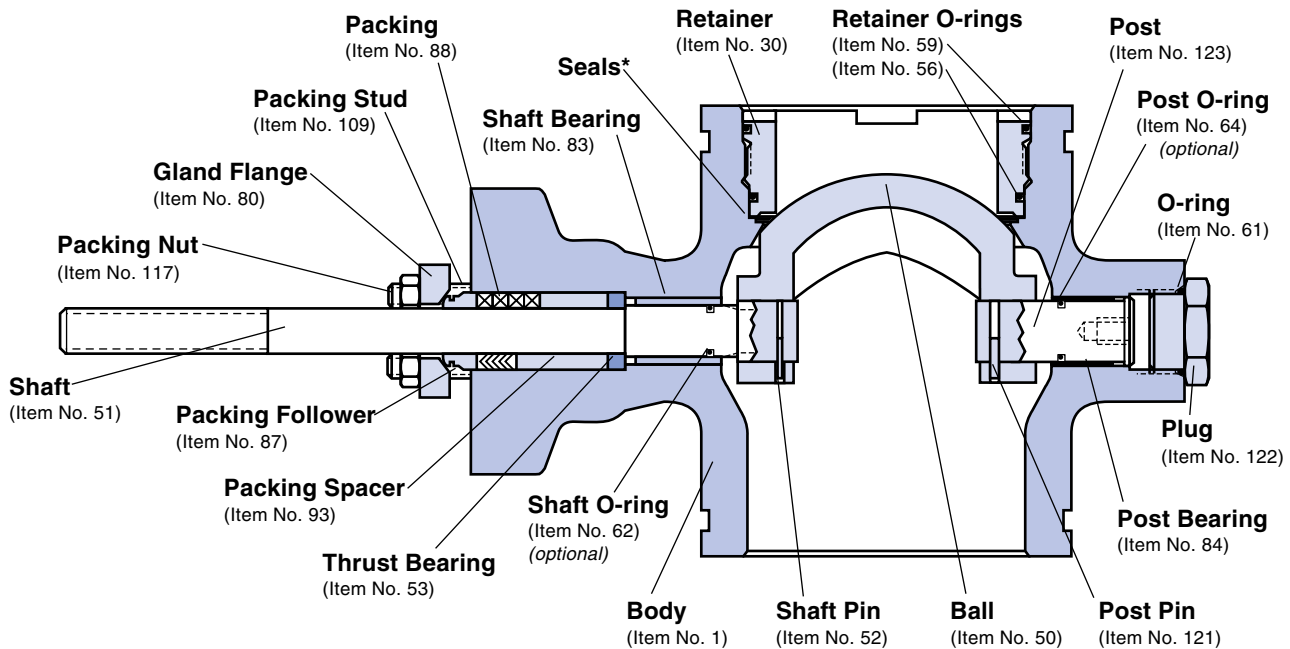
Before mounting an Optimux actuator on the valve body, verify that the ball rotation matches the actuator rotation and complies with the air failure requirements. Procedure for mounting the actuator is as follows:

1. Slide the entire actuator assembly onto the shaft. (If necessary on Optimux actuator designs with clamped lever-arm design, wedge the splined lever arm apart to loosen it on the shaft splines.)
2. Bolt the yoke to the valve body.
3. Position the actuator lever arm on the shaft so the actuator stem is centered in the transfer case.
4. On clamped lever-arm actuator designs, firmly tighten the linkage bolt. Bolt the transfer case cover plate into place.

5. Align the stroke indicator plate on the end of spline lever so it accurately indicates ball position.

**⚠ CAUTION:** On clamped lever-arm actuators, never apply air to the actuator without the cover plate installed; otherwise, the unsupported shaft may sustain damage.

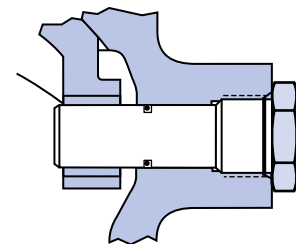
6. Install the valve in the line as outlined in the "Installation" section.



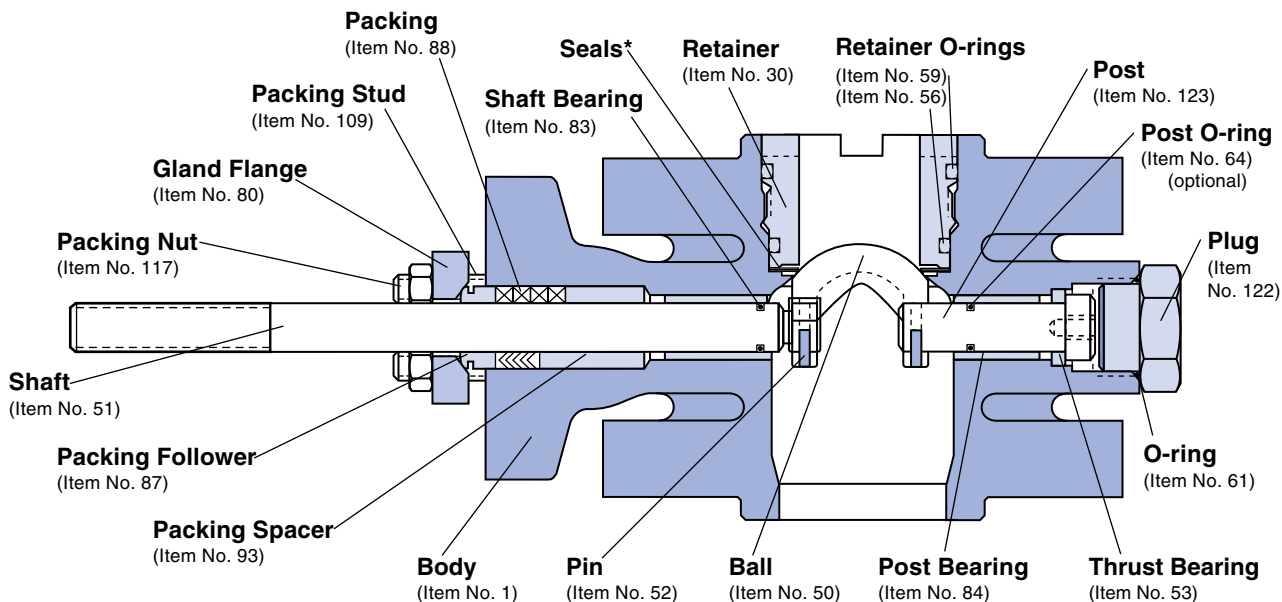
**Figure 1: 3 through 12-inch OpVee Body Assembly with Rotating Post Design**

(\*See Figure 4 for seal configurations and item numbers.)

**Note:** Item numbers correspond directly to the valve's bill of material. Refer to it for specific part numbers.



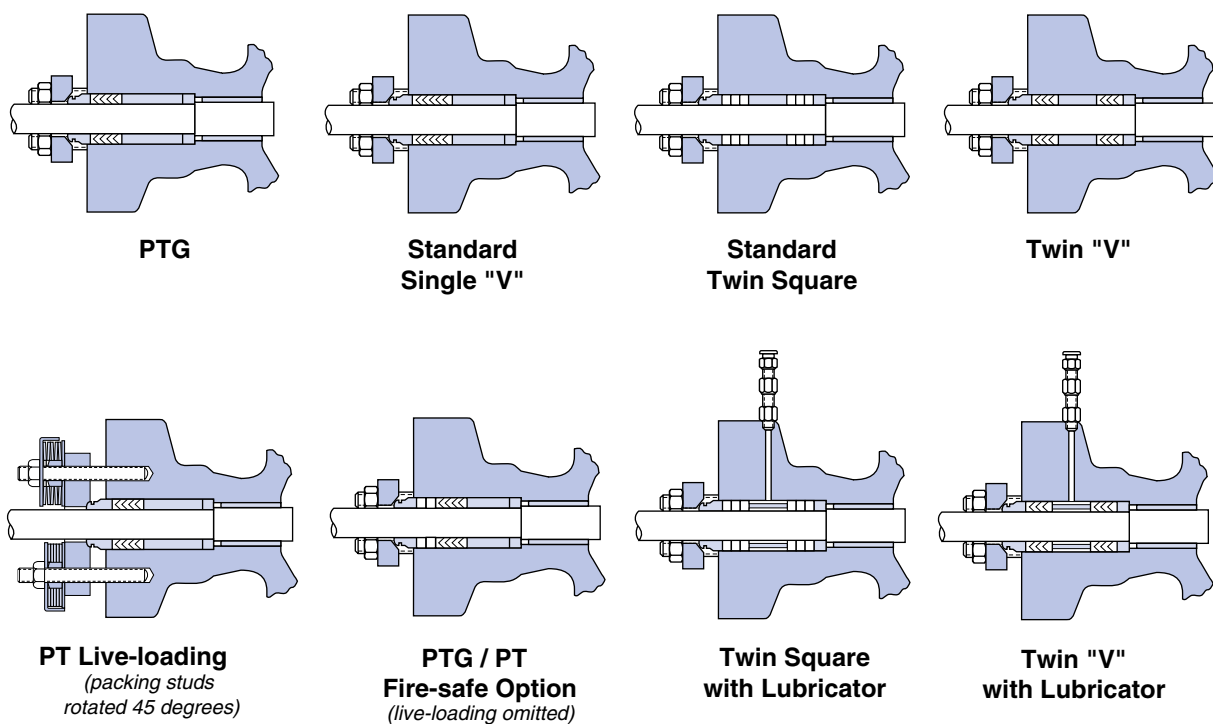
**Stationary Post Design**



**Figure 2: 1 through 2-inch OpVe Body Assembly**

(\*See Figure 4 for seal configurations and item numbers.)

**Note:** Item numbers correspond directly to the valve's bill of material. Refer to it for specific part numbers.



**Figure 3: OpVe Packing Configurations**

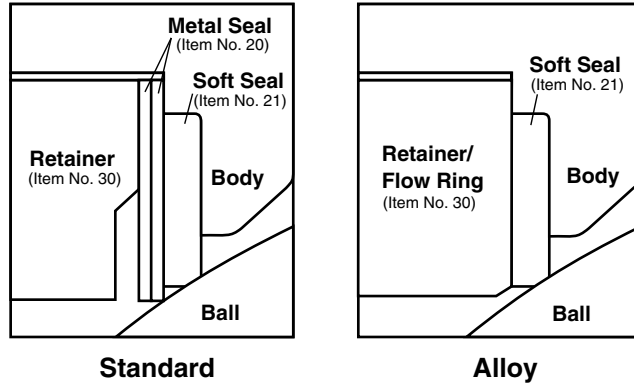


Figure 4: Soft Seals

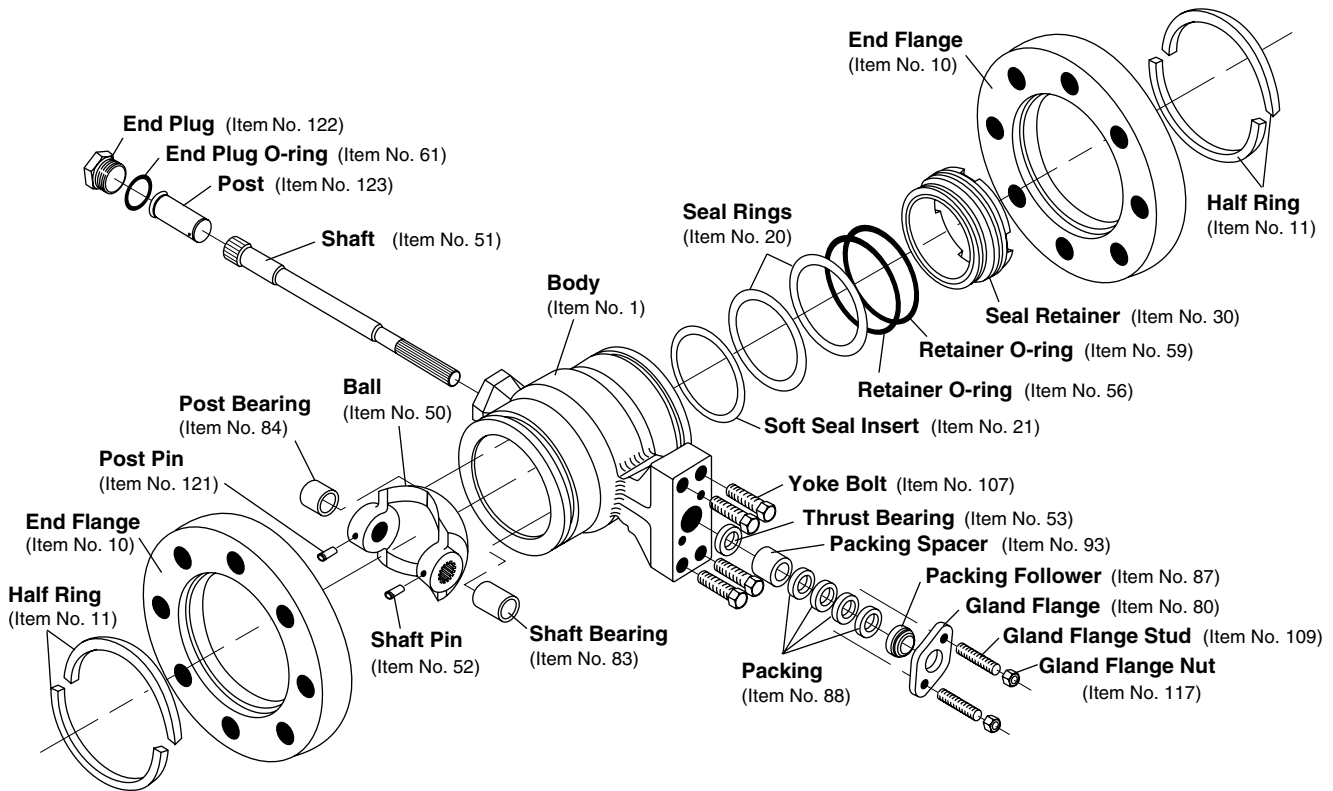
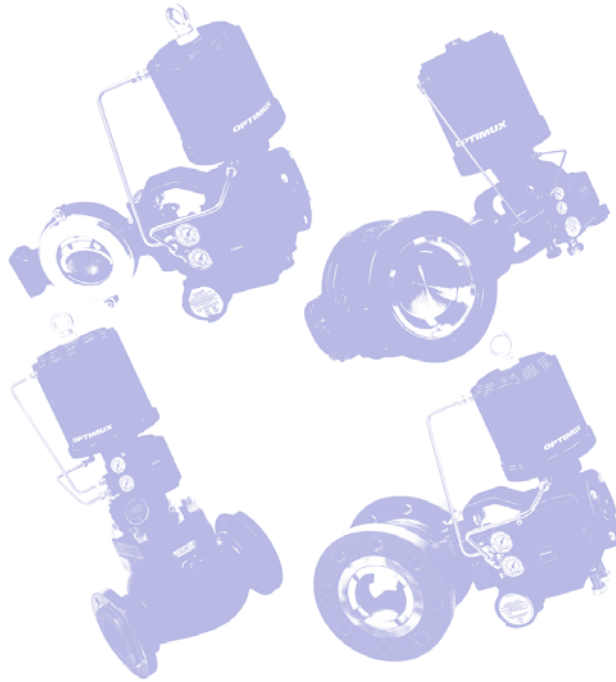


Figure 5: Exploded Body Subassembly, 3 through 12-inch Rotating Post Design

Note: Item numbers correspond directly to the valve's bill of material. Refer to it for specific part numbers.

### Troubleshooting OpVee Vee Ball Valve

| Failure  | Probable Cause  | Corrective Action  |
|--|---|--|
| Valve moves to failure position, excessive air bleeding from transfer case | <ol style="list-style-type: none"> <li>1. Failure of actuator stem O-ring</li> <li>2. Failure of sliding seal assembly</li> </ol>   | <ol style="list-style-type: none"> <li>1. Replace actuator stem O-ring</li> <li>2. Repair or replace stem adapter/linkage assembly</li> </ol>  |
| Jerky shaft rotation   | <ol style="list-style-type: none"> <li>1. Overtightened packing box</li> <li>2. Improper adjustment of lever arm on shaft causing arm to contact transfer case, thus failing to convert torque</li> <li>3. Actuator cylinder wall not lubricated</li> <li>4. Worn piston O-ring allowing piston to gall on cylinder wall</li> <li>5. Worn actuator stem O-ring causing actuator stem to gall on stem collar</li> <li>6. Worn (or damaged) thrust bearing, shaft bearing or packing followers</li> </ol> | <ol style="list-style-type: none"> <li>1. Retighten packing box nut to slightly over finger-tight</li> <li>2. Readjust lever arm; see actuator maintenance instructions</li> <li>3. Lubricate actuator cylinder wall with silicone lubricant</li> <li>4. Replace O-ring; if galling occurred, replace all damaged parts</li> <li>5. Replace O-ring; if actuator stem is galled, replace it</li> <li>6. Disassemble and inspect parts; replace any worn or damaged parts</li> </ol> |
| Excessive leakage through seal   | <ol style="list-style-type: none"> <li>1. Improper adjustment of external stroke stops on actuator</li> <li>2. Worn or damaged seal</li> <li>3. Damaged ball sealing surface</li> <li>4. Improper handwheel adjustment acting as limitstop</li> <li>5. Ball not centered in body I.D.</li> </ol>  | <ol style="list-style-type: none"> <li>1. Adjust the external stroke stops; see maintenance instructions</li> <li>2. Replace seal</li> <li>3. Replace ball (and shaft, if worn)</li> <li>4. Adjust handwheel until ball seals properly</li> <li>5. Center ball; replace damaged seals</li> </ol>   |
| Leakage through line flanges   | <ol style="list-style-type: none"> <li>1. Dirty line gasket surfaces</li> <li>2. Worn gaskets</li> <li>3. Improper torque on line flanges</li> <li>4. Flange or pipe misalignment</li> </ol>  | <ol style="list-style-type: none"> <li>1. Clean gasket surfaces and reinstall valve</li> <li>2. Replace gaskets</li> <li>3. Tighten line flanges evenly and completely (see Table I for proper torque)</li> <li>4. Realign flanged ends with piping</li> </ol>   |
| Leakage through packing box  | <ol style="list-style-type: none"> <li>1. Loose packing box nuts</li> <li>2. Worn or damaged packing</li> <li>3. Dirty or corroded packing box</li> </ol>   | <ol style="list-style-type: none"> <li>1. Tighten packing box nuts over finger-tight</li> <li>2. Replace packing</li> <li>3. Clean body bore, stem, replace packing</li> </ol>   |
| Valve slams, won't open, or causes severe water hammer                     | <ol style="list-style-type: none"> <li>1. Improper valve installation</li> </ol>  | <ol style="list-style-type: none"> <li>1. See step 2 in the "Installation" section and correct flow direction</li> </ol>   |
| Shaft rotates, ball remains open or closed                                 | <ol style="list-style-type: none"> <li>1. Broken shaft</li> </ol>   | <ol style="list-style-type: none"> <li>1. Replace shaft</li> </ol>   |
| Actuator operates, shaft does not rotate                                   | <ol style="list-style-type: none"> <li>1. Broken internal actuator parts</li> </ol>   | <ol style="list-style-type: none"> <li>1. Refer to appropriate actuator maintenance instructions</li> </ol>  |



Optimum customers should be aware that Optimum products might be used in numerous applications under a wide variety of industrial service conditions. Although Optimum can (and often does) provide general guidelines, it cannot provide specific data and warnings for all possible applications. The purchaser/user must therefore assume the ultimate responsibility for the proper sizing and selection, installation, operation and maintenance of Optimum products. The purchaser/user should read and understand the Product Instruction Manual (PIM) included with the product, and train its employees and contractors in the safe use of Optimum products in connection with the specific application.

While the information and specifications presented in this literature are believed to be accurate, they are supplied for informative purposes only and should not be considered certified or as a guarantee of satisfactory results by reliance thereon. Nothing contained herein is to be construed as a warranty or guarantee, express or implied, regarding any matter with respect to this product. Because Optimum is continually improving and upgrading its product design, the specifications, dimensions and information contained herein are subject to change without notice. Should any question arise concerning these provisions, the purchaser/user should contact TRIMTECK, LLC at any of its worldwide operations or offices.

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