

Val-Matic® 3" - 72" Cam-Centric® Plug Valve

Operation, Maintenance and Installation Manual

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VAL-MATIC'S CAM-CENTRIC PLUG VALVE OPERATION, MAINTENANCE AND INSTALLATION

INTRODUCTION

The Cam-Centric® Plug Valve has been designed to give years of trouble-free operation. This manual will provide you with the information to properly install and maintain the valve to ensure a long service life. The valve is an eccentric, resilient seated, quarter-turn plug valve capable of handling many types of fluids including fluids with suspended solids. The Size, Cold Working Pressure (CWP), Actuator Rating, and Model No. are stamped on the nameplate for reference.

CAUTION

Do not use valve for line testing at pressures higher than nameplate rating or leakage and damage to valve may occur.

The "Cold Working Pressure" is the non-shock pressure rating of the valve at 150°F. The valve is not intended as a block valve for line testing above the valve rating. The "Actuator Rating" is the pressure that was used to size the actuator for operating conditions and may be less than the "Cold Working Pressure". Because the valve is eccentric, the valve may have a different actuator rating for reverse and direct pressure. If the valve is operated at pressures higher than the actuator ratings, the valve may be difficult to operate or leak.

RECEIVING AND STORAGE

Inspect valves upon receipt for damage in shipment. Unload all valves carefully to the ground without dropping. Do not lift valves with slings or chains around the actuator or through the seat area.

Valves should remain crated, clean and dry until installed to prevent weather-related damage. For long term storage greater than six months, the valve must remain open and the rubber surfaces of the plug coated with a thin film of FDA approved grease such as Dow Corning # 7. Do not expose plug to sunlight or ozone for any extended period.

DESCRIPTION OF OPERATION

As shown in Figure 2, the valve consists of a body and quarter-turn plug that is offset from the seat centerline.

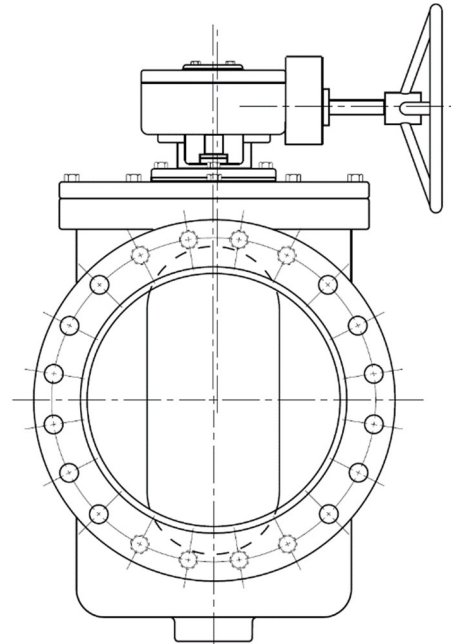


FIGURE 1. PLUG VALVE WITH GEAR ACTUATOR

The eccentric offset causes the plug to lift and rotate off the seat simultaneously to reduce seat friction and wear during operation. Direct Pressure pushes the plug into the seat and Reverse Pressure pushes the plug away from the seat. The valve can be operated with a direct nut, lever, or gear actuator. The gear actuator as shown in Figure 1 requires multi-turn input on a 2" square nut, handwheel, or chainwheel. The valve can also be automated with power actuators such as an electric motor or hydraulic cylinder.

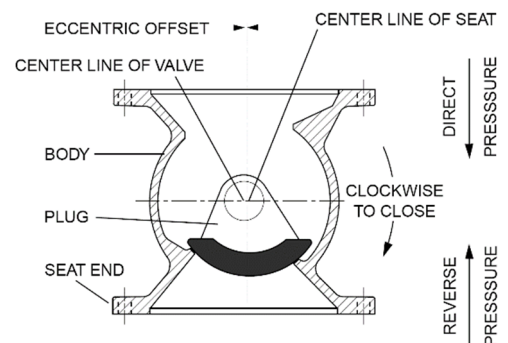


FIGURE 2. PLUG VALVE TERMS

VALVE CONSTRUCTION

The standard Cam-Centric® Plug Valve is constructed of rugged cast iron with a welded nickel seat and permanently lubricated bearings. See the specific Materials List submitted for the order if other than standard cast iron construction. The details of construction are illustrated in Figure 3.

The body (1) is available with flanged or mechanical joint ends for connection to the pipeline. The valve is designed to be serviced in-line by removing the cast cover (2). The quarter-turn plug (3) is guided by sleeve bearings (6) located in the cover and lower boss in the body. Grit-Guard seals (21) are located at the bottom of the bearings (6) to prevent abrasive material from wearing the bearing. Leak-tight closure is made when the rubber-coated plug (3) is rotated into the nickel seat on the “SEAT END” of the body.

Table 1. Standard Plug Valve Parts List		
Item	Description	Material
1	Body	Cast Iron with Overlay Welded Nickel Seat
2	Cover	Cast Iron
3	Plug*	Cast Iron with Resilient Facing
4	Key	Carbon Steel
6	Bearings*	316 Stainless Steel
7	V-Type Packing*	Buna-N
8	Cover Seal*	Buna-N
12**	Bottom Cover Seal*	Buna-N
14**	Bottom Cover Bolts	Alloy Steel, Gr. 5
15**	Bottom Cover	Cast Iron
16	Cover Bolt	Alloy Steel, Gr. 5
17	Washer	Carbon Steel
18	Packing Follower	Cast Iron
19	Follower Bolt	Alloy Steel, Gr. 5
21	Grit-Guard*	Buna-N
22	Thrust Bearing*	Teflon
23	Thrust Bearing*	316 Stainless Steel
24	Key	Carbon Steel
29	Shims	304 Stainless Steel
*Items available in spare parts kit		
**42" & Larger		

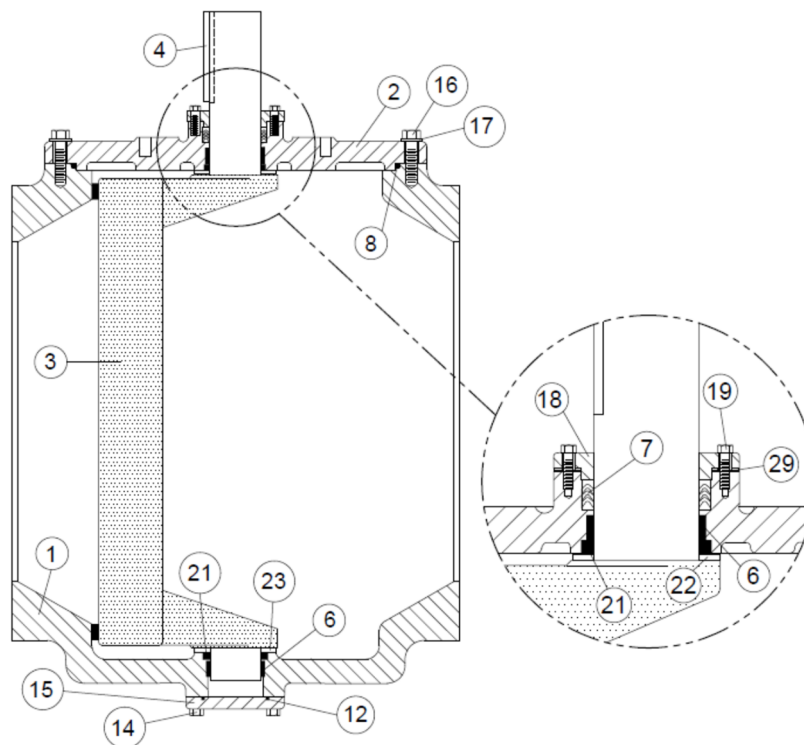


FIGURE 3. STANDARD PLUG VALVE CONSTRUCTION

INSTALLATION

The installation of the valve is important for its proper operation. The valve is capable of flow in either direction but the maximum operating pressure can vary with the location of the seat end (Figure 4). The words "SEAT END" are marked on the valve flange. Actuators are available for pressures up to the full rating in both direct and reverse pressure orientations. Actuator ratings will be indicated on the nameplate. Higher operating pressures may require adjustment of the closed position stop or a larger actuator; consult the factory.

SUSPENDED SOLIDS SERVICE: For fluids containing suspended solids, special orientations are needed to prevent debris from collecting in the valve. For horizontal installations (Figure 5), the valve should be installed with the flow entering the seat end of the valve and the shaft in a horizontal position with the plug up when open. For vertical installations (Figure 6), the valve must be installed with the seat end up regardless of flow direction.

CLEAN SERVICE: For both horizontal and vertical installations, install in the direct pressure orientation (pressure opposite the seat end).

AIR AND GAS SERVICE: Install valve in the direct pressure orientation (pressure opposite the seat end). Lubricate plug face with FDA approved silicone grease such as Dow Corning #7 before installation. Gear actuators are required for gas service applications.

PUMP DISCHARGE SERVICE: On all horizontal pump discharge applications (Figure 7), the seat end should be towards the pump.

BURIED SERVICE: Gear actuators are recommended for buried valves to hold the valve in position and provide multi-turn closure to prevent water hammer. The valve should be installed with the shaft horizontal and the actuator nut directed upwards. The valve box or extension pipe should be installed so that the actuator nut and extension stem turn freely.

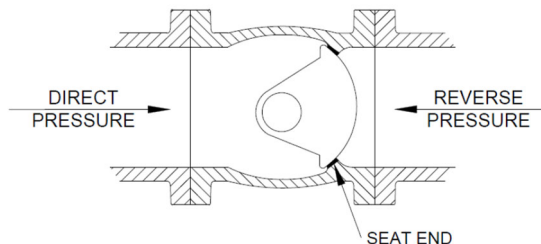


FIGURE 4. INSTALLATION ORIENTATION

NOTE: Adjust and test valve prior to backfill.

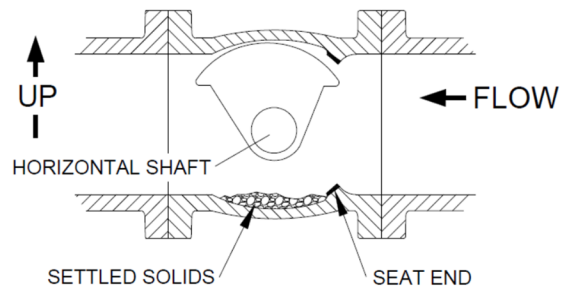


FIGURE 5. HORIZONTAL PIPE WITH SOLIDS

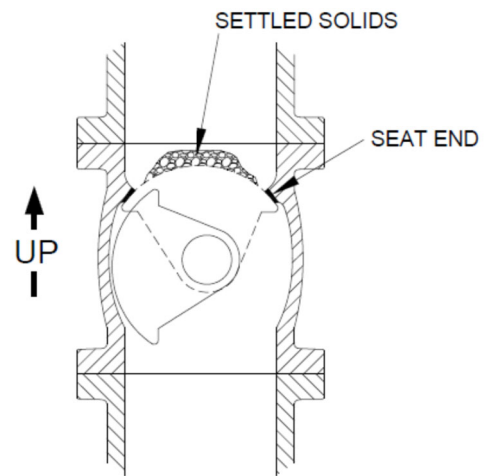


FIGURE 6. VERTICAL PIPE WITH SOLIDS

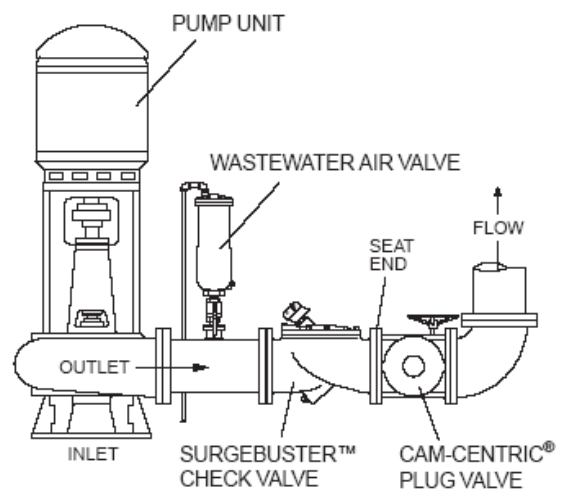


FIGURE 7. PUMP DISCHARGE SERVICE

FLANGED ENDS: Flanged valves should be mated with flat-faced pipe flanges equipped with resilient gaskets. When ring gaskets are used, the bolt material should be ASTM A307 Grade B or SAE Grade 2 Carbon Steel. Higher strength bolts may only be used with full-face gaskets.

The valve and adjacent piping must be supported and aligned to prevent cantilevered stress on the valve. Lower valve into line using slings or chains around the valve body. Lubricate the flange bolts or studs and insert them around the flange. Lightly turn bolts until gaps are eliminated.

The torquing of the bolts should then be done in graduated steps using the cross-over tightening method. Recommended lubricated torques for use with resilient gaskets (75 durometer) are given in Table 2. If leakage occurs, allow gaskets to absorb fluid and check torque and leakage after 24 hours. Do not exceed bolt rating or crush gasket more than 50 percent of its thickness.

Table 2. Flange Bolt Torques			
Valve Size (in)	Bolt Dia (in)	Recom Torque (ft-lbs)	Max Torque (ft-lbs)
3	5/8	25	100
4	5/8	25	100
6	3/4	30	150
8	3/4	40	150
10	7/8	45	200
12	7/8	65	200
14	1	80	300
16	1	90	300
18	1 1/8	100	425
20	1 1/8	120	425
24	1 1/4	150	600
30	1 1/4	175	600
36	1 1/2	175	1000
42	1 1/2	200	1000
48	1 1/2	250	1000
54	1 3/4	300	1500
60	1 3/4	350	1500
66	1 3/4	400	1500
72	1 3/4	400	1500

CAUTION

The use of raised-face flanges or excessive bolt torque may damage valve flanges.

MECHANICAL JOINT ENDS: Clean ends of mating pipe and valve sockets with soapy water (Figure 8). Place lubricated gasket and retainer gland over pipe end prior to installing valve. Install valve socket over pipe. Press gland and gasket toward valve until gasket is evenly set into valve socket.

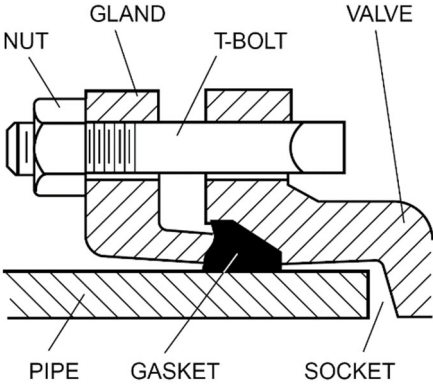


FIGURE 8. MECHANICAL JOINT INSTALLATION

Insert T-bolts in valve flange and hand tighten nuts. Torque nuts in four graduated steps using the cross-over tightening method without exceeding the torque listed in Table 3. Maintain an equal gap between the gland and the face of the valve at all points around the socket.

If a tight connection is not achieved, then the joint should be disassembled, thoroughly cleaned, and reassembled. Over-tightening may cause damage to the valve or gland.

Table 3. Mechanical Joint Nut Torques			
Valve Size (in)	T-Bolt Dia (in)	Recom Torque (ft-lbs)	Max Torque (ft-lbs)
3	5/8	45	60
4	3/4	75	90
6	3/4	75	90
8	3/4	75	90
10	3/4	75	90
12	3/4	75	90
14	3/4	75	90
16	3/4	75	90
18	3/4	75	90
20	3/4	75	90
24	3/4	75	90
30	1	75	120
36	1	75	120
42	1 1/4	75	150
48	1 1/4	75	150

DIRECT NUT OPERATED VALVES: 8" and smaller valves may be equipped with a top-mounted nut for direct quarter-turn operation. The nut is 2" square to fit most valve wrenches and is mounted directly to the valve plug. To open the valve, slowly rotate the nut 90 degrees in the counter-clockwise (CCW) direction. The closed position is adjusted with a set screw and lock nut, see Figure 9. The open position can be adjusted by moving the bolt along the curved slot.

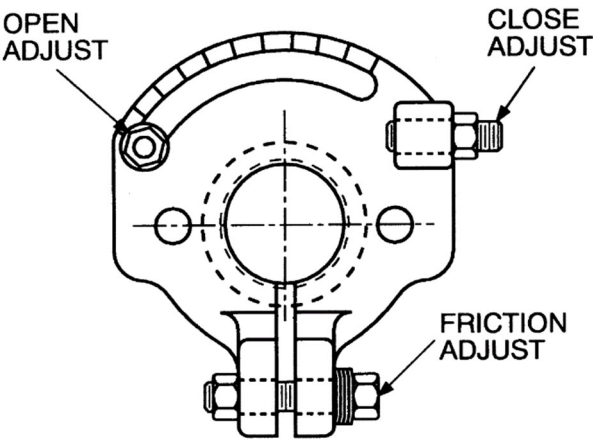


FIGURE 9. DIRECT NUT ADJUSTMENTS

DIRECT NUT FRICTION ADJUSTMENT: As shown in Figure 10, valves with direct nut actuators have a flanged packing follower (18) above the packing (7) to hold the valve in the open or closed position. If the valve is difficult to operate or does not maintain its set position, adjust the clamp bolt (17) to provide sufficient friction to hold the valve in position. If the valve is equipped with a hand lever, the setting should allow the valve to be operated with about 80 pounds of force on the end of the pipe handle.

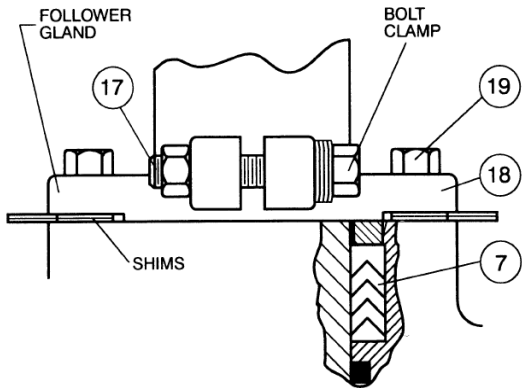


FIGURE 10. FRICTION ADJUSTMENT

LEVER OPERATED VALVES: A wrench head and lever (Figure 11) are available for use over the 2" nut for direct quarter-turn operation. Various lever lengths are available for specific direct and reverse pressure conditions as shown in Table 4.

Table 4. Application of Levers				
Valve Size	Wrench Length, (Inches)			
	Direct Pressure		Reverse Pressure	
	100 psi	175 psi	50 psi	175 psi
2 1/2	22	22	22	22
3	22	22	22	22
4	22	22	22	22
6	44	*	44	*
8	44	*	44	*

* Worm gear recommended due to operating torque

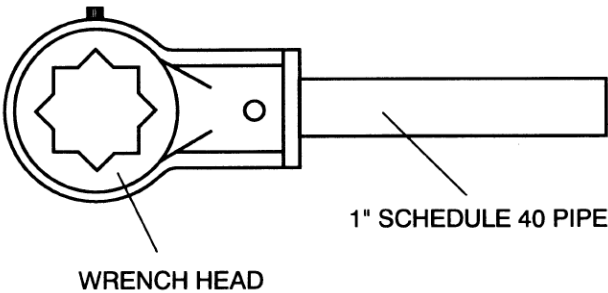


FIGURE 11. HANDLEVER

The wrench head is placed over the nut and can be secured with the set screw provided. To open the valve, rotate the lever 90 degrees in the CCW direction. The closed position is adjustable with a set screw and lock nut mounted below the nut, see Figure 9.

CAUTION

Open and close the valve slowly to prevent water hammer.

GEAR OPERATED VALVES: 4" and larger plug valves are available with a multi-turn manual gear actuator. The gear unit has a self-locking worm gear which multiplies the turning force on the handwheel or nut so that the valve can be operated with ease. A clamp-on chainwheel kit can also be used for installations high above the floor. An indicator on the top of the actuator housing indicates the position of the valve plug. The handwheel or nut must be rotated through 12-80 turns (depending on model) to open or close the plug valve. The direction of rotation to open the valve is indicated on the 2" square actuator nut.

GEAR ACTUATOR ADJUSTMENT: The standard gear actuator is provided with factory-set open and closed position stops. If the valve does not shut off tight, the stop bolt can be adjusted allowing the plug to rotate further into the seat. Loosen the locknut and turn the closed stop bolt CCW 1 turn at a time (Figure 12). If the valve continues to leak after all the adjustment is taken verify the orientation of the valve during installation. If a tight shut-off cannot be achieved, a larger gear actuator may be required for the system operating pressure; consult the factory.

CAUTION

Adjust closed stop bolt for tight shut-off only. Over adjustment may cause high operating torques and damage to the plug.

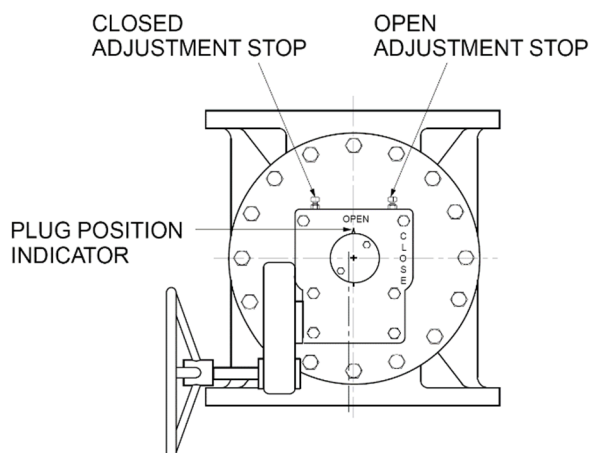


FIGURE 12. GEAR ACTUATOR ADJUSTMENT

MAINTENANCE

The Cam Centric® Plug Valve requires no scheduled lubrication or maintenance other than regular exercising and occasional inspection of the plug. The exercising is achieved by fully opening and closing the valve to verify smooth operation. If operation is difficult, it may be necessary to flush sediment from the valve by opening and closing the valve several times under flowing conditions.

CAUTION

Open and close the valve slowly to prevent water hammer.

The recommended interval for exercising is every six months or annually if the valve is regularly operated. Over the life of the valve, inspection and some regular adjustments may be needed as given below.

For valves in air service, apply a thin film of FDA silicone grease such as Dow Corning #7 to the exposed rubber surface once per year.

CLOSED POSITION ADJUSTMENT: The standard valve is factory-set to seal at the "Actuator Pressure Ratings" shown on the nameplate for direct and reverse pressure directions (see Figure 2). Higher pressure applications may require adjustment of the closed position stop or a larger actuator; consult the factory.

If the valve is found to leak in the closed position due to wear, the plug can be adjusted by loosening the closed position stop on the actuator and rotating the plug further into the seat. Because of the eccentric action of the valve, further rotation will provide additional interference between the rubber plug surface and the body seat. Valves that have been in service for several years may require inspection of the plug for damage or wear. See the Disassembly Instructions of this manual.

PACKING ADJUSTMENT: V-type packing is pressure sensitive and therefore self-adjusting in nature. Over tightening will destroy both the pressure sensitive nature of the packing as well as its sealing capabilities. The packing configuration used in Cam-Centric Plug Valves follows the guidelines and recommendations of V-packing manufacturers.

Additional adjustment can be achieved by removing one or more shims found under the packing follower (18). If a leak develops, remove one shim (29) from the underside of the follower (18). An equal number of shims must be removed from both the left- and right-hand sides. Re-tighten the follower bolts (19) and check for leakage. If the leakage continues, remove additional shims or replace the packing.

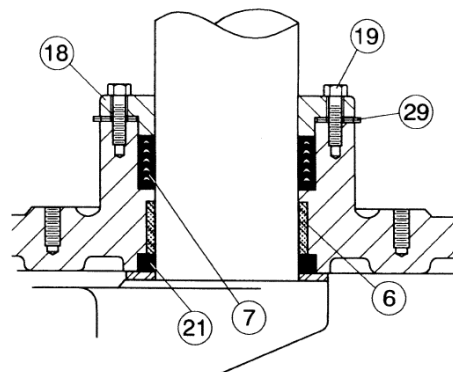


FIGURE 13. PACKING ASSEMBLY

PACKING REPLACEMENT: To replace the packing (7), it is recommended that the line be drained and the actuator removed. The valve can remain in the line. To replace the packing, first open the valve and drain the line. Close the valve to hold it in position. For power actuators, turn off and lock out electrical and hydraulic supplies before proceeding.

CAUTION

Drain line and close valve before removing actuator or valve may rotate suddenly. Take precautions against exposure to toxic or hazardous fluids in the line.

Remove the small round cover on actuator to expose shaft and key. Remove actuator mounting bolts and lift actuator from valve taking care not to lose square key. See Figure 13 and remove gland bolts (19) and lift follower (18) from the valve shaft. Remove old packing (7) with packing hook. Lubricate new packing with FDA grease and set in place one ring at a time taking care not to bend over the lips of the packing rings. Reinstall follower with 2 shims (29) per bolt (3 shims for 12" and larger valves). With valve in the closed position, place the actuator over valve and reinsert key (24). Finally, reinstall cover on actuator indicating "Closed".

CAUTION

If packing assembly contains clamp style follower as shown in Figure 9 do not lubricate shaft or sleeve.

PACKING REPLACEMENT WITH ACTUATOR: The above procedure with removal of the actuator will result in the most reliable shaft seal. But if the actuator cannot be removed, the following alternate procedure can be followed. To prevent the possibility of leakage during this procedure, open valve and drain the line.

CAUTION

Take precautions against exposure to toxic or hazardous fluids in the line.

Referring to Figure 13, remove follower bolts (19) and side follower (18) up to actuator. Remove packing adapters and rings (7) with packing hook. Cut rings with knife to remove. New packing rings should be cut at a 45-degree slope to allow insertion around the shaft and provide some overlap. Install rings one at a time with the tips down toward the valve. Stagger all joints 180 degrees around the shaft. Pull down follower (18) and reinsert bolts (19) with 2 shims (29)

under follower (18). V-packing is pressure assisted and only requires light compression.

GEAR ACTUATOR MAINTENANCE: A typical gear actuator is shown in Figure 14 and consists of a worm (3) mounted on an input shaft (9). The worm engages a worm wheel (2). When the worm is turned, it drives the wheel through 90° of rotation. The rotation of the valve plug is displayed by the top indicator (5). The open and closed positions of the segment gear are controlled by an end position stop bolts (20). The stops can be adjusted by loosening the lock nut (21) and rotating the bolts. The gears are lubricated with EP2 grease in a cast iron housing (1). Other parts are listed in Table 5.

The gear box is factory lubricated and sealed. No regular maintenance is required. If difficult operation is observed, the cover (4) can be removed and the unit inspected for wear. All moving parts should be coated with grease. The grease should have an even and smooth consistency. If needed, coat all moving parts with a lithium-based EP-2 grease such as Shell Alvania #2 or equal. Buried units should be packed 90% with grease.

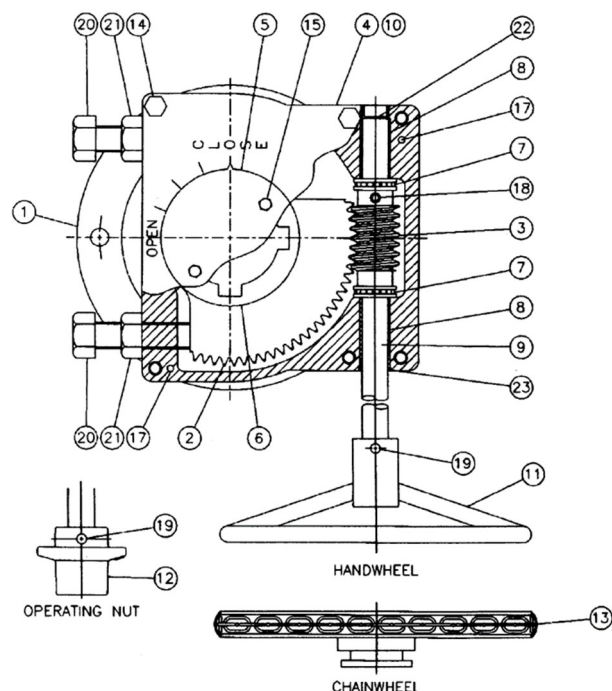


FIGURE 14. GEAR ACTUATOR CONSTRUCTION

Table 5. Gear Actuator Parts List		
Item	Description	Material
1	Housing	Cast Iron
2	Wormwheel	Ductile Iron
3	Worm	Steel
4	Cover	Cast Iron
5	Indicator	Cast Iron
6	O-Ring	Buna-N
7	Roller Bearing	Steel
8	Shaft Bearing	Bronze
9	Shaft	Steel
10	Gasket	Fiber
11	Handwheel	Steel or Iron
12	Operating Nut	Iron
13	Chainwheel	Iron
14	Cover Bolt	Steel
15	Indicator Bolt	Steel
16	Pipe Plug	Steel
17	Pin	Steel
18	Spirol Pin	Steel
19	Spring Pin	Steel
20	Screw	Steel
21	Jam Nut	Steel
22	Plug	Steel
23	U-Cup Seal	Buna-N

TROUBLESHOOTING

Several problems and solutions are presented below to assist you in troubleshooting the valve assembly in an efficient manner.

- Leakage at Valve Shaft: Adjust or replace packing.
- Leakage at Flanges: Tighten flange bolts, replace gasket.
- Valve Leaks when Closed: Pressure should be in the direction of pushing the plug into the seat. Adjust plug position by rotating the handwheel. Inspect plug for damage and replace.
- Hard to Open: Flush debris from valve. Check interior of valve for grit buildup or debris. On buried valves, check alignment of operating stem.
- Leaking Oil: Tighten actuator cover bolts. If leak persists, remove actuator cover, inspect grease, and replace actuator gasket.
- Noisy Operation: Flow noise is normal. Loud flow noise similar to hammering may be cavitation from dropping high pressures across valve, review application of valve. For gear actuator noise, inspect grease; add new grease if there are uncoated moving parts or grease has broken down into oil.

DISASSEMBLY

Disassembly may be required to inspect the plug for wear or remove debris and deposits from the valve. Work on the valve should be performed by a skilled mechanic with proper tools and a power hoist for large valves. The valve can be disassembled without removing the valve from the pipeline. Refer to Figure 15 for valve construction and parts.

WARNING

Open valve and drain line before removing cover bolts or pressure may be released causing injury. Place plug in lowest position before removing actuator or plug may rotate suddenly and jam or damage plug surface.

1. Open valve and drain the pipeline. Close valve until plug just touches the seat. Remove the small cover on the actuator to expose the shaft key (4).
2. Remove the actuator mounting bolts and lift actuator from valve taking care not to lose key (4).
3. Remove cover bolts (16). Matchmark cover (2) and body (1). Screw eyebolts into actuators mounting holes and use hoist to lift cover (2) and plug assembly (3) from valve. Use caution to prevent plug from dropping while lifting cover. To remove plug from valve, use sling around top portion of plug.
4. Remove bottom cover bolts (14). Remove bottom cover (15) and seal (12) (42" and larger).
5. Inspection of the bearings (6) is done by measuring diameter of shaft and inside diameter of bearing. Check for a normal running clearance of .005". Bearings are permanently lubricated.
6. Remove packing gland hex bolts (19). Remove packing set (7) and packing gland (18).

REASSEMBLY

All parts must be cleaned and gasket surfaces should be cleaned with a stiff wire brush in the direction of the serrations or machine marks. Worn parts, gaskets and seals should be replaced during reassembly. Parts 12, 14, and 15 only appear on valves 42" and larger.

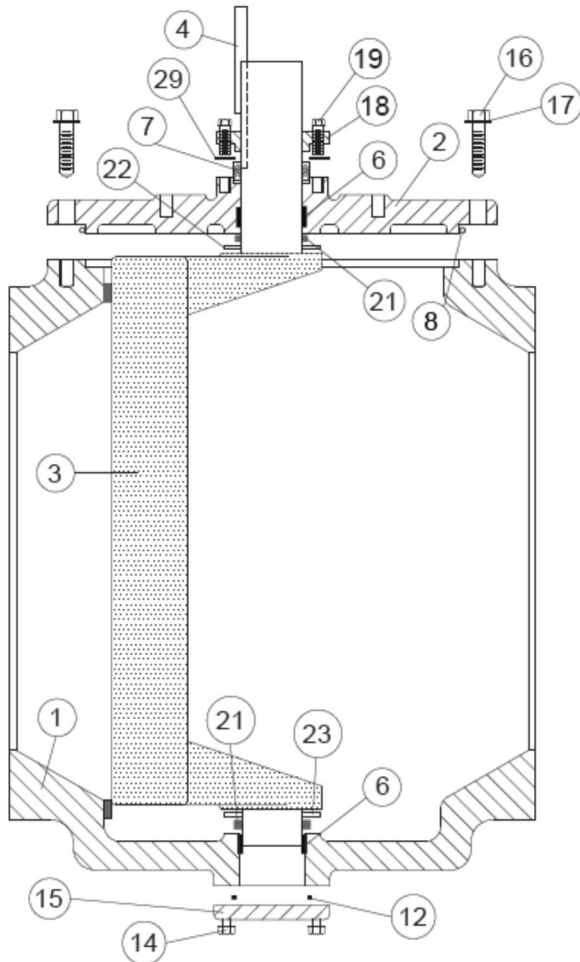


FIGURE 15. PLUG VALVE PARTS

1. Press new bearings (6) into cover and body with round, flat bar 1/4" below inside surfaces of body (1) and cover (2).
2. Install new cover seal (8) over cover lip (42" and larger) and new bottom cover seal (12) in bottom cover (15) groove.
3. Apply thin film of FDA silicone grease such as Dow Corning #7 to plug rubber surface. Place stainless steel thrust bearing (23) over lower shaft of plug, Teflon bearing (22) over the upper shaft. Install grit seals (21) over the shafts of the plug.

4. Carefully place plug into the body (1) and insert lower plug shaft into bottom bearing (6). Plug (3) should be in the open position. Install cover (2) over plug shaft and into recess in body. Align match marks between body and cover (2). Torque cover bolts (14 & 16) per Table 6 in 3-4 increments using the cross-over tightening method. Repeat for bottom cover.

Table 6. Tightening Torques	
Size	Torque (ft-lbs)
1/2" - 13	45-75
5/8" - 11	100-150
3/4" - 10	150-250
7/8" - 9	200-350
1" - 8	300-500
1 1/8" - 7	450-700
1 1/4" - 7	650-1000
1 1/2" - 6	750-1100
1 3/4" - 5	1650-2350
2"-4-1/2	2350-3350

5. Lubricate ID and OD of new packing set (7) with FDA grease and install in packing bore one ring at a time taking care to keep lips pointing down toward plug. Reinstall follower (18), gland bolts (19), and 2 shims per bolt (29).

NOTE: If valve has friction assembly with direct nut actuator, follow "Friction Adjustment" procedure on page 6.

6. Insert key (4) into shaft and place actuator over valve. Reinstall actuator mounting bolts and torque per Table 6. Install cover on actuator.
7. Apply power to actuator and cycle valve. Apply pressure to valve and check for cover and shaft leakage. Tighten bolts as necessary. Adjust packing if necessary.
8. If valve does not shut off tight, adjust the closed position stop as described on page 6 under "Closed Position Adjustment."

PARTS AND SERVICE

Parts and service are available from your local representative or the factory. Make note of the valve Size, Series No, and Serial No. located on the valve nameplate and contact:

Val-Matic Valve and Mfg. Corp.
905 Riverside Drive
Elmhurst, IL 60126
Phone: (630) 941-7600
Fax: (630) 941-8042
www.valmatic.com

A sales representative will quote prices for parts or arrange for service as needed.

LIMITED WARRANTY

All products are warranted to be free of defects in material and workmanship for a period of one year from the date of shipment, subject to the limitations below.

If the purchaser believes a product is defective, the purchaser shall: (a) Notify the manufacturer, state the alleged defect and request permission to return the product; (b) if permission is given, return the product with transportation prepaid. If the product is accepted for return and found to be defective, the manufacturer will, at his discretion, either repair or replace the product, f.o.b. factory, within 60 days of receipt, or refund the purchase price. Other than to repair, replace or refund as described above, purchaser agrees that manufacturer shall not be liable for any loss, costs, expenses or damages of any kind arising out of the product, its use, installation or replacement, labeling, instructions, information or technical data of any kind, description of product use, sample or model, warnings or lack of any of the foregoing. NO OTHER WARRANTIES, WRITTEN OR ORAL, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY, ARE MADE OR AUTHORIZED. NO AFFIRMATION OF FACT, PROMISE, DESCRIPTION OF PRODUCT OF USE OR SAMPLE OR MODEL SHALL CREATE ANY WARRANTY FROM MANUFACTURER, UNLESS SIGNED BY THE PRESIDENT OF THE MANUFACTURER. These products are not manufactured, sold or intended for personal, family or household purposes.



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