

Val-Matic® 3-Way Plug Valve

Operation, Maintenance and Installation Manual

INTRODUCTION.....	2
RECEIVING AND STORAGE	2
DESCRIPTION OF OPERATION.....	2
VALVE CONSTRUCTION.....	3
INSTALLATION.....	4
MAINTENANCE	5
TROUBLESHOOTING	7
DISASSEMBLY.....	7
REASSEMBLY.....	8
PARTS & SERVICE	8
WARRANTY.....	9



VALVE AND MANUFACTURING CORP.

905 Riverside Dr. • Elmhurst, IL 60126
Phone (630) 941-7600 • Fax (630) 941-8042
www.valmatic.com

VAL-MATIC'S 3-WAY PLUG VALVE OPERATION, MAINTENANCE AND INSTALLATION

INTRODUCTION

The 3-Way 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 a 360 degree, resilient seated plug valve with three seats and is 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 intended for tight shutoff with pressure pushing the plug into the three seats.

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 1, the valve consists of a body and a tapered plug that pivots 360 degrees in the body. Three nickel seats are provided so that the plug can seal off any of the three pipe connections. The seat is tapered to provide adjustable seat interference and tight shutoff service. The molded rubber plug sealing surface also contains raised o-ring type sealing surfaces to provide superior sealing and low operating torque. The valve seals drop-tight at the full rating in the direct pressure direction (pressure pushing the plug into the seat).

An externally adjustable two-way thrust bearing assembly is located in the valve bonnet to precisely position the height of the plug in the valve.

The valve is operated by turning the handwheel of the gear actuator. The valve can be turned in any direction through a full 360 degrees. The pointer on the top of the actuator cover indicates the location of the plug face. Adjustable round head bolts provide for adjustable indication of the exact seat location for tight shutoff.

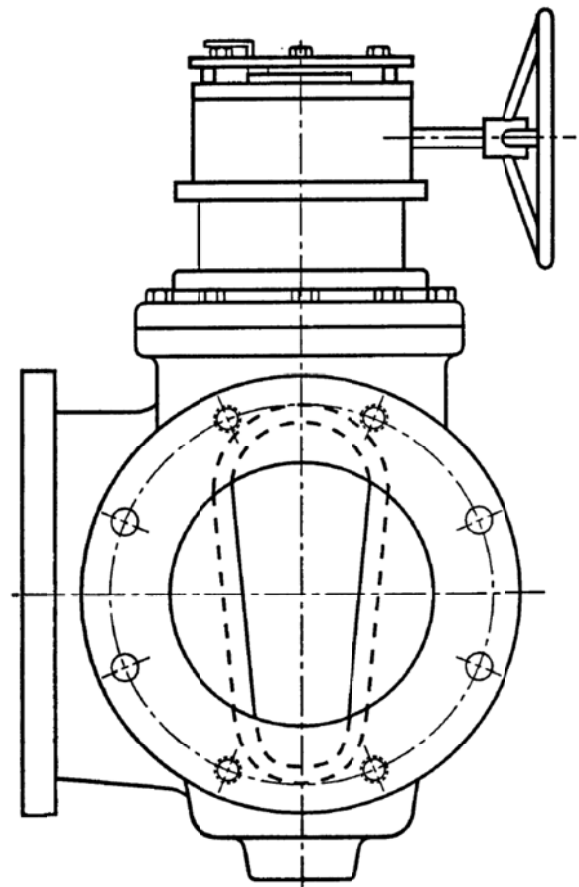


FIGURE 1. 3-WAY PLUG VALVE WITH ACTUATOR

VALVE CONSTRUCTION

The standard Cam-Centric® Plug Valve is constructed of rugged cast ductile iron with a welded nickel seat and permanently lubricated stainless steel 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 2.

The body (1) is available with 3-Way flanged ends for connection to the pipeline. The valve is designed to be serviced in-line by removing the cast cover (2). The plug (3) has integral shafts and 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 one of the nickel seats.

ITEM	DESCRIPTION	MATERIAL
1	Body	Ductile Iron with Overlay Welded Nickel Seat
2	Cover	Ductile Iron
3	Plug*	Ductile Iron with Resilient Facing
6	Bearings*	316 Stainless Steel
7	V-Type Packing*	Buna-N
8	Cover Seal*	Buna-N
12	Hex Nut*	Steel
13	Stud*	Steel
15	Cover Bolt	Alloy Steel, Gr 5
17	Spring Pin*	Carbon Steel
18	Packing Follower	Cast Iron
21	Grit-Guard®*	Buna-N
22	Thrust Bearing*	Bronze
23	Support Plate*	Carbon Steel
24	Key	Carbon Steel
29	Shims*	304 Stainless Steel

*RECOMMENDED SPARE PART

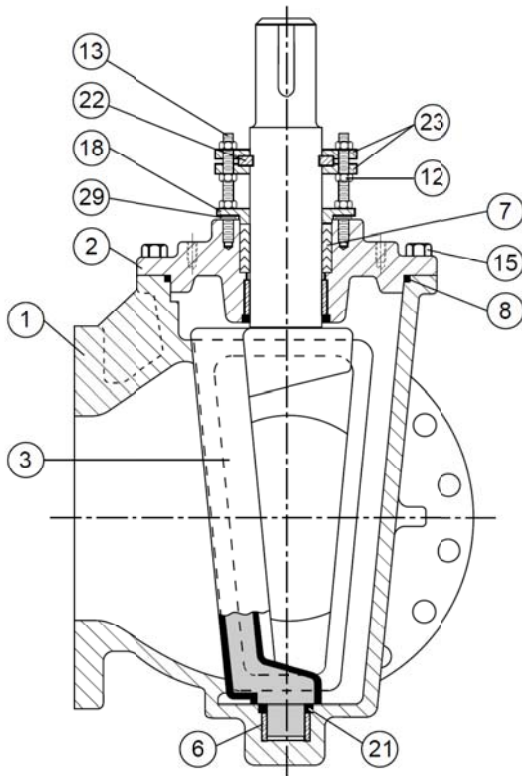


TABLE 1. STANDARD PLUG VALVE PARTS LIST

FIGURE 2. STANDARD PLUG VALVE CONSTRUCTION

INSTALLATION

The installation of the valve is important for its proper operation. The valve can be installed in either horizontal or vertical pipelines.

FLOW: The valve is capable of flow in any direction. The various flow configurations are shown in Figure 3. The Valve Configuration number indicates through which ports the plug will be moved. For example, Valve Configuration 012 indicates that the plug will be rotated between ports 1 and 2 which will require 90 degrees of rotation. The boxes filled with X's illustrate which ports can be closed off. Other configurations, such as 123, indicate 180 degree travel and the use of three ports. If the valve has a manual actuator, the valve is capable of being field configured to any configuration. There are no stops in the actuator. The arrow on the actuator cover should be in line with a port to indicate the location of the plug.

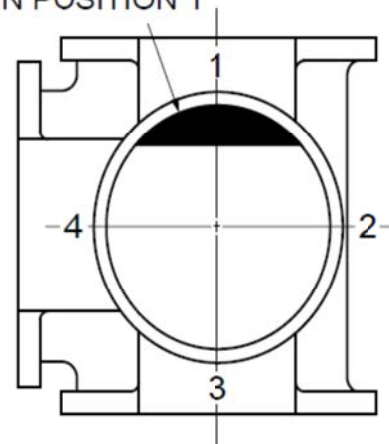
PRESSURE: The valve is factory tested to provide tight shutoff with pressure pushing the plug into the seat. If reverse pressure direction is needed, an adjustment of the plug position may be needed (see section on thrust bearing adjustment).

FLANGES: Valves should be mated with flat-faced pipe flanges equipped with resilient 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.

BOLTING: The tightening of the bolts should then be done in graduated steps using the cross-over tightening method. 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.

OPERATION: An indicator on the top of the actuator housing indicates the position of the valve plug. The handwheel must be rotated through 20-80 turns (depending on model) to open or close the plug valve.

PLUG IN POSITION 1



VALVE CONFIG.	PLUG TRAVEL	PLUG POSITIONS			
		1	2	3	4
012	90°	X	X		
023	90°		X	X	
034	90°			X	X
041	90°	X			X
123	180°	X	X	X	
234	180°		X	X	X
341	180°	X		X	X
412	180°	X	X		X
1234	360°	X	X	X	X

FIGURE 3. FLOW CONFIGURATIONS

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 rotating the valve 360 degrees to verify smooth operation.

CAUTION: Opening and Closing of the valve should be done 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.

POSITION ADJUSTMENT: The standard valve is factory-set to seal with pressure pushing the plug into the seat. Reverse pressure applications may require adjustment of the thrust bearing assembly; consult the factory. The closed position indicator arrow should point to the port to be shut off. Adjustable indicator screws in slotted holes allow for precise positioning of the plug.

If the valve is found to leak in the closed position due to wear, the plug position should be moved to the left or right until a seal is made. The indicator bolt on the actuator cover should then be loosened and moved directly under the target arrow.

Valves that have been in service for several years may require inspection of the plug for damage or wear. See the Disassembly Instructions on page 8.

PACKING ADJUSTMENT: The top shaft is equipped with a set of V-shaped packing which is factory-set for drop-tight service. The packing is pressure assisted and does not normally require adjustment. However, depending on line media and wear, a small adjustment can be made. If a leak develops, move shims (29) from under to above the follower (18) and tighten the follower bolts (19) to stop the leak. If the leak persists, remove another shim or replace the packing.

THRUST BEARING ADJUSTMENT: The tightness of the plug against the seat can be adjusted by raising and lowering the plug in the valve. The seat has a 5 degree taper, so every vertical adjustment of 1/16 in. will provide an additional .005 in. of rubber interference. If leakage in the valve occurs, the plug should first be rotated 1-2 degrees to the left and right to see if the leak stops. If the leak still occurs, then a thrust bearing adjustment is necessary.

The thrust bearing support plates (23) are vertically positioned with hex nuts (12). To increase the seating interference, lower the plug:

1. Rotate the lower nuts (12) 1/2 turn away from the support plate.
2. Lock the support plate down by tightening the top nuts (12) against the top support plate (23).
3. Check for leakage and verify that the valve will rotate through the seat smoothly.

To decrease the seating interference, raise the plug.

1. Rotate the upper nuts (12) 1/2 turn away from the support plate.
2. Tighten the lower nuts until the plug is lifted and the support plates touch the upper nuts.
3. Check for leakage and verify that the valve will rotate through the seat smoothly.

If leakage continues to occur after the thrust bearing has been adjusted, then the valve should be drained, and the cover removed to inspect for plug damage or debris in the valve.

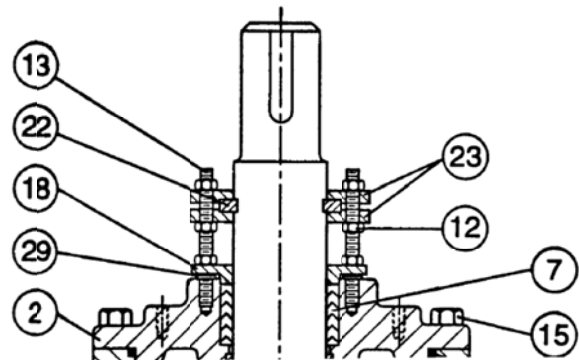


FIGURE 4. THRUST BEARING ASSEMBLY

MAINTENANCE (Cont'd)

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 place the plug in the blind port position (port No. 2). For power actuators, turn off and lock out electrical and hydraulic supplies before proceeding.

CAUTION: Drain Line before removing actuator. Take precautions against exposure to toxic or hazardous fluids in the line.

Remove 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. Remove nuts (12) and lift follower (18) from 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) under follower (18). Place the actuator over valve and reinsert key (24). Finally, reinstall cover on actuator.

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.

Remove nuts (12) and slide 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° slope to allow insertion around the shaft and provide some overlap. Install rings one at a time with the lips down towards the valve. Stagger all joints 180° around the shaft. Pull down follower (18) and reinsert nuts (12) 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 5 and consists of a worm (8) mounted on an input shaft (4). The worm engages a worm wheel (3). When the worm is turned, it drives the wheel through 360° of rotation. The rotation of the valve plug is displayed by the top indicator (5). The gears are lubricated with EP2 grease in a cast iron housing (1).

The gear box is factory lubricated and sealed. No regular maintenance is required. If difficult operation is observed, the cover 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 an EP-2 grease such as Mobil Mobilux EP2. Buried units should be packed 100% with grease.

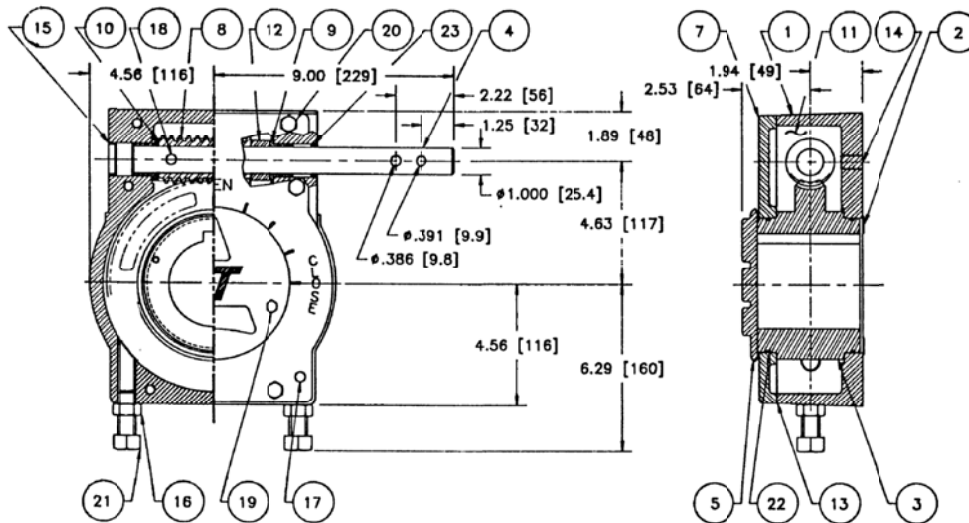


FIGURE 5. GEAR ACTUATOR CONSTRUCTION

ITEM	DESCRIPTION	MATERIAL
1	Housing	Cast Iron
2	Plug	Plastic
3	Wormwheel	Ductile Iron
4	Shaft	Steel
5	Indicator	Cast Iron
6	Paint	Primer
7	Cover	Cast Iron
8	Worm	Hardened Steel
9	Bearing	Bronze
10	Bearing Race	Steel
11	Grease	EP-2
12	Worm Spacer	Steel
13	Gasket	Fiberflex
14	Pipe Plug	Steel
15	Expansion Plug	Steel
16	Jam Nut	Hardened Steel
17	Dowel Pin	Hardened Steel
18	Spirol Pin	Steel
19	1/4-20 Cap Screw	Steel
20	3/8-16 Cap Screw	Steel, Gr. 5
21	5/8-11 Set Screw	Steel
22	O-Ring	Buna-N
23	U-Cup Seal	Buna-N

TABLE 2. GEAR ACTUATOR PARTS LIST

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. Adjust thrust bearing to lower plug if problem persists or pressure direction is reverse.
- **Hard to Open:** Check thrust bearing adjustment; raise plug. Check interior of valve for grit buildup or debris. On buried valves, check alignment of operating stem and nut.
- **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 2 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. Rotate handwheel until plug is between two seats. Remove the indicator bracket and the small cover on the actuator to expose the shaft key.
2. Remove the actuator mounting bolts and lift actuator from valve taking care not to lose key (24).
3. Remove cover bolts (15). Matchmark cover (2) and body. Screw eye-bolts into actuator mounting holes and use hoist to lift cover (2) and plug assembly from valve. Use caution to prevent plug from dropping while lifting cover. To remove plug (3) from valve, use sling around top portion of plug.
4. 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". The upper bearing can be pressed out with bar smaller than the bearing outside diameter. The lower bearing is removed with a gear puller from inside the valve body. Bearings are permanently impregnated with oil.
5. Thrust bearing assembly (23) and packing gland (18) can be removed by removing all of the hex nuts (12).

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. Bolts should be lubricated and torqued per Table 3 during reassembly.

<u>SIZE</u>	<u>TORQUE (FT-LBS)</u>
3/8"-16	20 - 30
7/16"-14	30 - 50
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

TABLE 3. LUBRICATED BOLT TORQUES

1. Press new bearings (6) into cover and body with round, flat bar 1/4" below inside surfaces of body (1) and cover (2). Apply a 1/16" bead of 3M DP-190 2-Part Epoxy in the 1/4" recess above the sleeve bearings and press in Grit Seals (21) and allow to set for 1 hour.
2. Insert key (24) into shaft and place actuator over valve. Reinstall actuator mounting bolts and torque per Table 6. Install cover on actuator.
3. 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.
4. If valve does not shut off tight, rotate the plug to the right and left to find the center of the seat. If the leak persists adjust the thrust bearing to lower the plug. Adjust the leveling nuts 1/2 turn at a time.

5. Install cover seal (8) over cover lip.
6. Apply thin film of FDA silicone grease such as Dow Corning #7 to plug rubber surface. With the valve in the upright position, lower the plug into one of the body seats and guide the bottom shaft into the bottom grit seal and bearing in the body. Do not force plug down into body seat.
7. Install cover (2) over plug shaft and into recess in body (the plug may need to be lifted so that the cover can be centered. Align match marks between body and cover (2). Torque cover bolts (15) per Table 6.
8. Lubricate ID and OD of packing set with FDA grease and install in packing bore one ring at a time taking care to keep lips pointing down toward plug. Reinstall follower, gland bolts, and 2 shims per bolt.
9. Install nuts (12) and first support plate over studs (13). Install Thrust bearing halves (22) into recess in support plate. Install second support plate and nuts.

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
PH: 630/941-7600
FAX: 630/941-8042

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.



VALVE AND MANUFACTURING CORP.

905 Riverside Dr. • Elmhurst, IL 60126
Phone (630) 941-7600 • Fax (630) 941-8042
www.valmatic.com