3-WAY PLUG VALVE OPERATION, INSTALLATION AND MAINTENANCE

Design Details of 3-way Plug Valve

Body & Seat

The 3-Way valve body is a high integrity casting in cast iron ASTM A126 Class B. The precision machined, internal tapered surface of the body is the valve seat which is provided with a corrosion and erosion resistant epoxy coating. Other materials are available.

End Connections

The 3-flanges are to ASME/ANSI B16.1 Class 125 flat faced.

Certain sizes of valve require some tapped bolt holes because of limited access for nuts behind the flange, details are shown on page 5.

Plug

The ductile iron plug is totally encapsulated (3" thru 12") with a molded and vulcanized elastomer providing sealing and tight shut-off. For tight shut-off applications, it is advisable that the flow is against the rear of the plug. Tight shut-off not available with double-style plug or on 14" and 16" valves.

A large-diameter stem and upper and lower trunnion are integral with the plug casting. The upper end of the stem has a 2" square drive for wrench operation and also 2 keyways for maximum versatility when mounting gear operators. A cast marking on the end of the shaft indicates the plug face orientation.

The single style plug is standard in the 3-Way valve to provide straight-through and 90° flow paths. A double-style plug is optionally available upon request (not tight shut-off).

Bearings

The plug rotates in permanently lubricated, corrosion resistant stainless steel bearings in the body and bonnet.

Bonnet Seal

The bolted bonnet is assembled in a precision location in the body and uses superior 'O'-Ring sealing, with metal to metal contact, providing lower stress compared to traditional gaskets.

Stem Seal

Multiple self-adjusting U-cup seals provide positive stem sealing with trouble-free service.

Operation

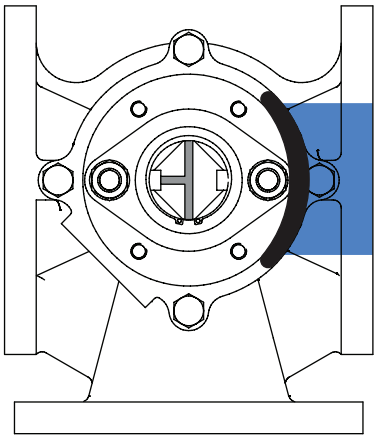
Manual operation by lever or gear available on all sizes. Chainwheel operation is also available.

Electric or pneumatic actuation is available on request.

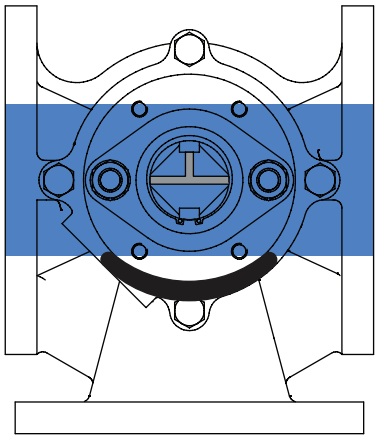
Coating

The valve interior and exterior surfaces are coated with 10-12 mils of 2-Part epoxy.

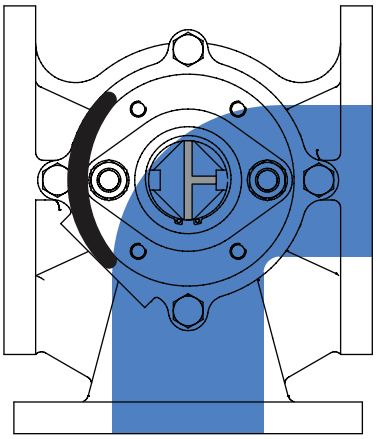
Available Flow Paths



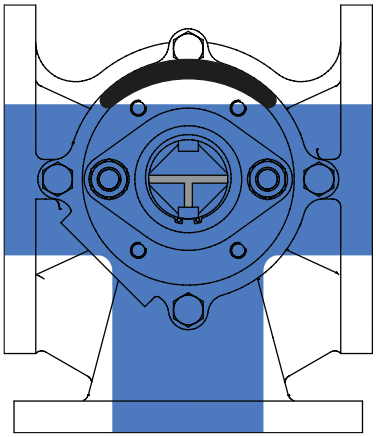
Valve in closed position*



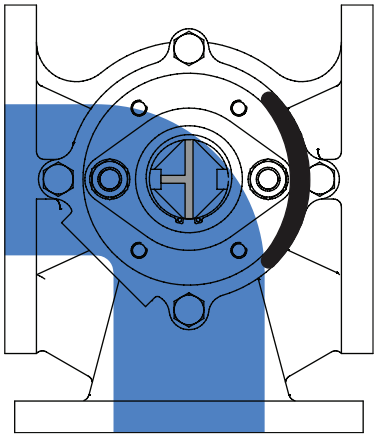
Flow straight through valve



Flow through 90˚ to side port



All 3 ports connected and open



Flow through 90˚ to side port

*It is advisable that the flow is against the rear side of the plug for tight shut-off applications. Not available with double-style plug.

Pressure/Temperature ratings

Flange rating to ASME/ANSI B16.1 Class 125, the maximum cold working pressure for all sizes is 175psi.

The operating temperature of the valve may depend on the elastomer used for the plug and seals. Refer to the elastomer selection guide on page 4.

Installation

The 3-Way valve can be installed in any orientation although it is advisable to have the valve stem vertical for ease of access.

If the valve has been supplied for tight shut-off, the flow path and therefore the upstream pressure should be against the rear side of the plug.

In-Line Maintenance

In the unlikely event of gland leakage, the stem seals can be replaced without removing the bonnet. Access to the inside of the body for inspection or cleaning does not require removal of the valve from the line.

If wear should occur between the plug face and the seat, the plug can be adjusted externally.

OPERATION, INSTALLATION AND MAINTENANCE

DESCRIPTION OF OPERATION

The valve is designed to block flow to one of the three ports or allow flow through all ports.

The plug location is shown by the actuator position indication arrow and blocks the port it is pointing toward.

The valve is equipped with an adjustable thrust bearing. This adjustment pulls or lifts the tapered plug into intimate contact with the body seating surfaces. It should be adjusted to just seal against the system operating pressure to provide for the longest seal life and additional future adjustment when needed.

INSTALLATION

The 3-Way Tapered Plug Valve can be used in any orientation relative to vertical. Avoid locating the valve immediately downstream of a pipe elbow or in a cavitation zone because the turbulence in these regions will cause premature wear or damage.

Before installing the valve in the space provided, check to make sure that the piping is free of foreign objects such as lumber, tools, rocks, etc., which can damage the 3-Way Plug Valve when it is placed in service.

When lifting the valve for installation, make sure that lifting chains or straps are not attached to or allowed to come in contact with the plug face or sealing surfaces. Also do not allow the weight of the valve to rest on the actuator handwheel.

Three-Way Plug Valves are furnished with flat faced flanges and should only be mated to a flat faced companion flange. A full faced or ring gasket, that has been lubricated with a gasket joint compound, must be installed between the valve's flange and the companion flange to affect a seal. Flange bolting shall be in accordance with ANSI B16.1 Section 5.2 for cast iron bodies and ANSI B16.42 for ductile iron bodies. Note: It is not recommended to use high strength flange bolting with these valves.

Before installing the flange bolting, the valve and the adjacent piping must be supported and aligned to prevent cantilevered stress being transferred to the valve's flanges when installing the flange bolts or studs.

Apply a thread lubricant to the flange bolt threads and install the flange bolts and nuts around the flange. Once all the flange bolts or studs are inserted around the flange bolt circle, hand-tighten them.

Recommended flange bolt lubricated target torque values for use with resilient gaskets (75 durometer) are given in Table 1. If leakage occurs, allow gaskets to absorb system fluid and check torque and leakage after 24 hours. Do not exceed the bolt rating, the maximum torque of Table 1, compress to more than the gasket manufacturer's thickness recommendation or extrude gasket.

TABLE 1. Flange Bolt Target Torque

Valve Size (in)	Bolt Dia (in)	Target Torque (ft-lbs)	Maximum Torque (ft-lbs)
2" to 4"	5/8	25	90
6"-8"	3/4	30	150
10"-12"	7/8	45	205

The target torque for flange bolting is based on the flange construction, system pressure, system temperature, and the gasket material. The valve flange construction is per ASME B16.1 Class 125 (cast iron bodies) or ASME B16.42 Class 150 (ductile iron bodies). The gasket material and design is often the limiting factor for the flange bolt target torque and should best be obtained from the gasket manufacturer. Note: Flange joint leakage can be caused by exceeding the recommended target torque as well as inadequate or non-uniform bolt torque.

The flange bolt torque should be applied in several graduated steps using the cross-over bolt tightening method to load the bolts evenly and eliminate concentrated stresses which could fracture or crack the piping or valve's flange. See ASME PCC-1-2010 for details of the cross-over bolt tightening sequence and torque methods. Note that the target torque values provided in ASME PCC-1-2010 are based on the ANSI/ASME steel flange pressure and temperature ratings which exceed those of AWWA and are, therefore, often higher than appropriate for AWWA rated iron valves and flanges.

OPERATION, MAINTENANCE AND INSTALLATION

CAUTION

The use of ring gaskets or excessive bolt torque may damage valve flanges.

VALVE START-UP PROCEDURE

When the 3-Way Plug is completely installed, follow the steps outlined below to place valve into service.

Once installed, manually operate the valve through all positions of normal operation, check for smooth operation, and pressure test the pipeline. Become familiar with the following adjustments that will affect the closing characteristics of the 3-Way Plug Valve.

THRUST BEARING ADJUSTMENT

The thrust bearing adjusting screw is covered by a sealed lock cap. After removal of the cap the thrust bearing adjusting screw can be turned to affect the proper seal. Turning the screw to the right pulls the plug farther down into the tapered seat and increases the sealing pressure ability. Turning the screw to the left pushes the plug farther upward away from the tapered seat and decreases the sealing pressure ability. For best long term operation the thrust bearing screw should be adjusted first left (upward) to initiate a small leakage and then back to the right (downward) just until the leakage is stopped. This minimizes seat wear and prolongs the seat life. If after extended service leakage occurs, the thrust bearing can be re-adjusted to eliminate the leakage or the rubbered plug may be replaced.

TROUBLESHOOTING

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

- Leakage at Cover or Flanges: Tighten cover or flange bolts, replace cover seal or flange gasket.
- Valve Leaks When Closed: Adjust thrust bearing or replace rubbered plug. Inspect rubbered plug for damage or debris. Clean or replace as needed. Inspect body seating surface for damage or debris. Clean, polish, or replace as needed.
- Valve Does Not Open: Check for obstruction in valve or pipeline; see disassembly procedure.

DISASSEMBLY

The valve can be disassembled without removing it from the pipeline. The valve may also be removed from the pipeline. All work on the valve should be performed by a skilled mechanic with proper tools and a power hoist for larger valves. Disassembly may be required to inspect the disc for wear or the valve for debris or deposits.

Refer to Figure 3 and Table 3 for parts identification. Always relieve pressure and drain pipeline before working on the valve.

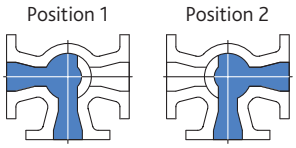
WARNING

The pipeline must be relieved of all pressure and drained before removing the actuator, valve, or the valve cover or pressure may be released causing bodily harm.

ACTUATOR REMOVAL

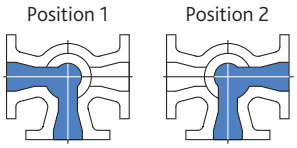
The valve plug may be positioned to block any port or to leave all ports open by rotating through a 360° arc. The actuator may limit some of these positions based on the application of travel stops in the actuator. The possible configurations are shown in Figure 2 and designations are given in Table 2 below. The actuator should be match-marked before removal and the actuator configuration designation should be recorded. This configuration should also be indicated on the submittal drawings if available.

3-Way Valve Port Positions



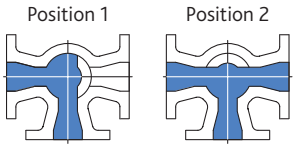
3 way, 3 port, 180˚ turn

Style A180



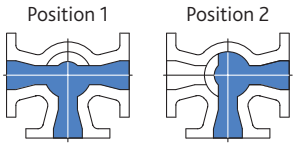
3 way, 2 port, 90˚ turn

Style A90*



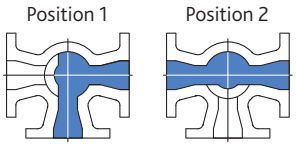
3 way, 3 port, 90˚ turn

Style C



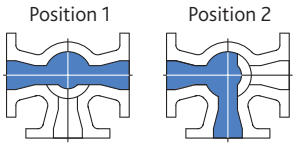
3 way, 3 port, 90˚ turn

Style D



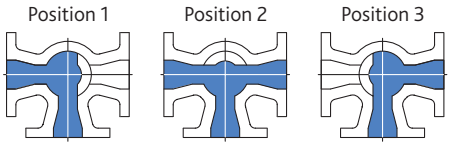
3 way, 3 port, 90˚ turn

Style E



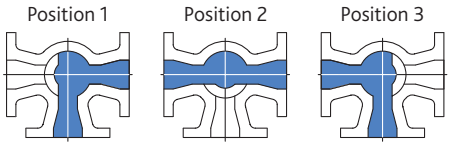
3 way, 3 port, 90˚ turn

Style F



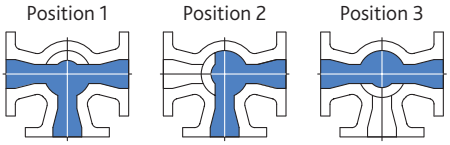
3 way, 3 port, 180˚ turn

Style G



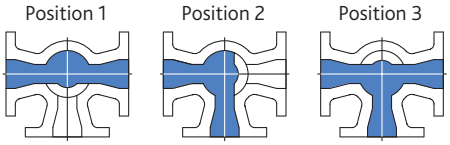
3 way, 3 port, 180˚ turn

Style H



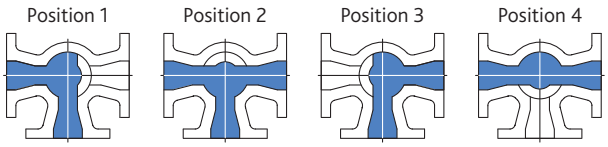
3 way, 3 port, 180˚ turn

Style I



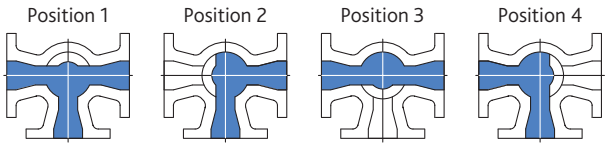
3 way, 3 port, 180˚ turn

Style J



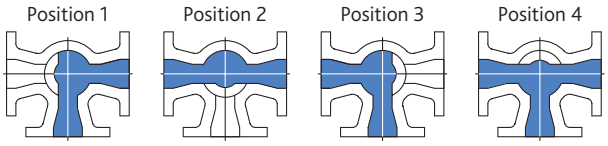
3 way, 3 port, 270˚ turn

Style K



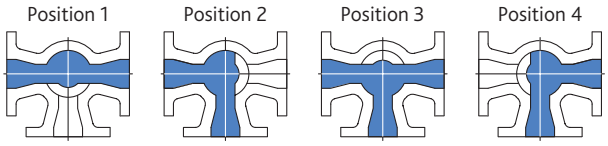
3 way, 3 port, 270˚ turn

Style L



3 way, 3 port, 270˚ turn

Style M



3 way, 3 port, 270˚ turn

Style N