Orientation Rules for Eccentric Plug Valves

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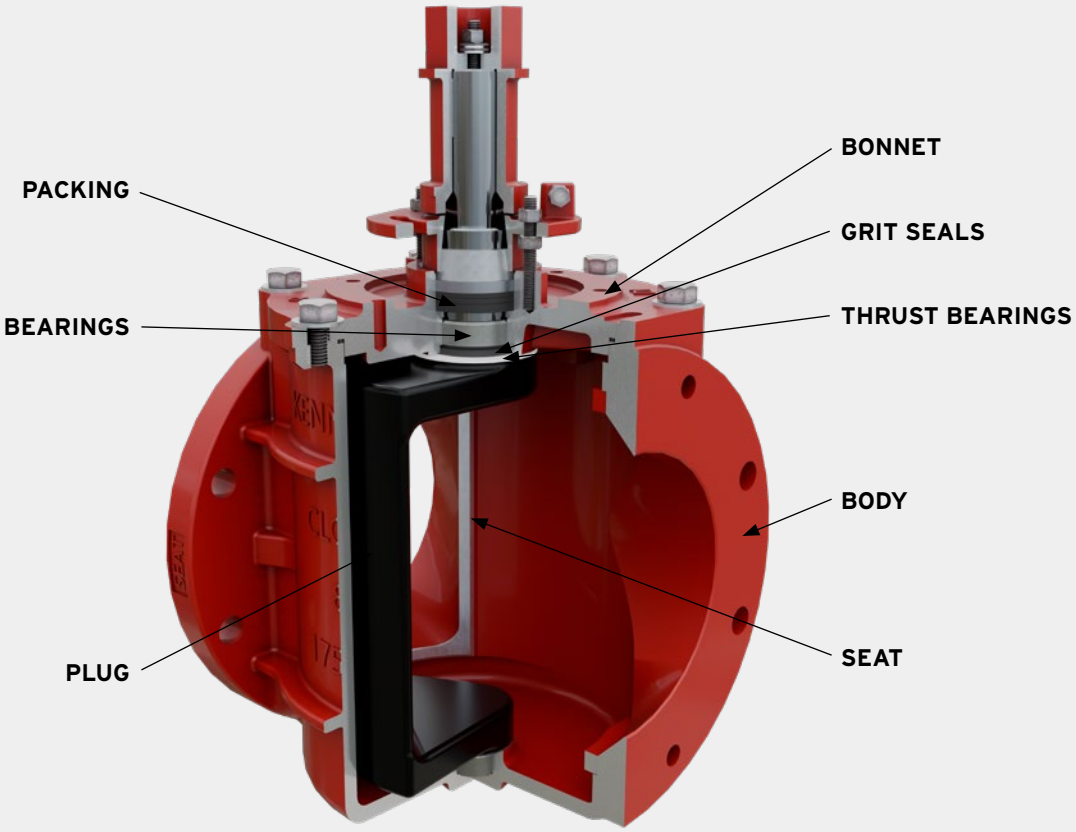
MPI MCWANE PLANT & INDUSTRIAL

Plug valve orientation may seem to be a complicated question, especially when solids are involved, but it can be simplified by first eliminating what's not important to the equation.

Before we get into the orientation rules, let's cover the basics of an Eccentric Plug Valve.

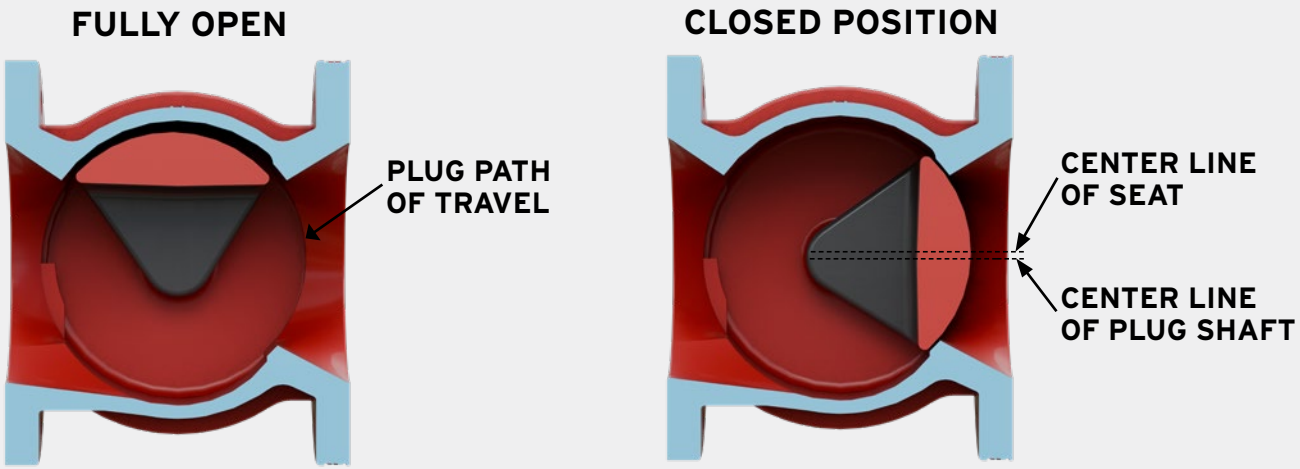
COMMON COMPONENTS

Here are the common components of an Eccentric Plug Valve we will be discussing.



ECCENTRIC ACTION

An Eccentric Plug Valve gets its name from a 100-year-old design where the valve seat is offset from the centerline of the valve shaft, thereby providing eccentric action.

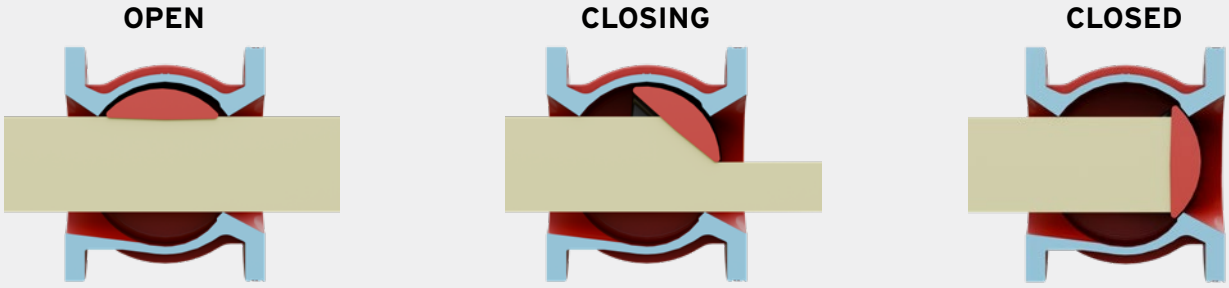


As the valve opens, the plug will lift or "cam" off the seat as it rotates, preventing the plug from rubbing against the body seat and reducing plug wear.

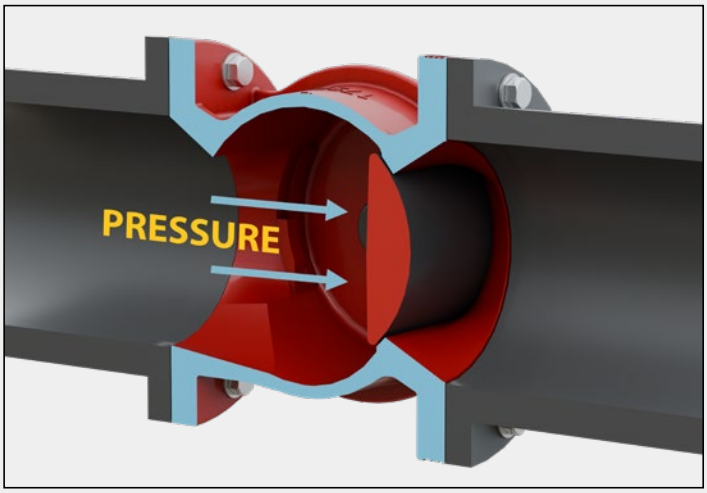
Due to the eccentric action, as the plug face wears, it can be rotated further into the seat to restore a drop-tight seal.

CLOSING DIRECTIONS

Closing directions are easy to remember for eccentric plug valves by using the old mnemonic device: "Righty tighty, lefty loosey." Standard Eccentric Plug Valves close by rotating the valve stem clockwise and standard gear actuators are also designed to close the valve by rotating the gear input shaft clockwise.

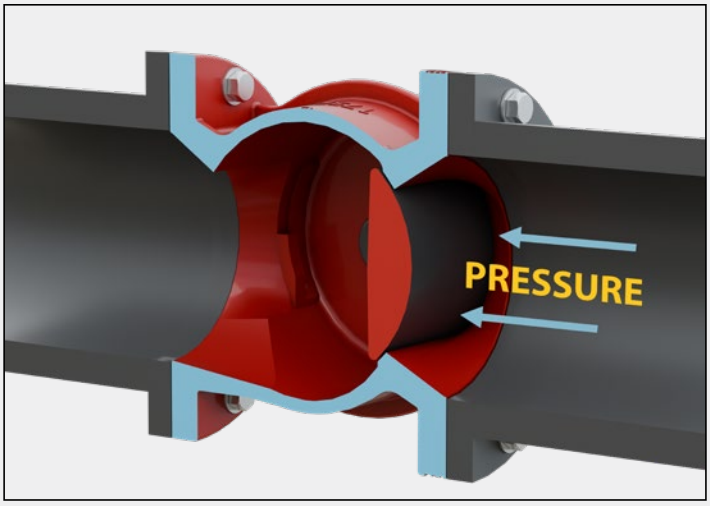


REVERSE/DIRECT PRESSURE



A direct pressure condition occurs when the system pressure pushes the plug into the body seat when the valve is closed.

Direct pressure is preferred over reverse pressure.



A reverse pressure condition occurs when the system pressure pushes the plug away from the body seat when the valve is closed.

If a valve must be installed in a reverse pressure condition, it is important to notify the manufacturer at the time of order so that appropriate testing measures can be taken. Reverse pressure can make it more difficult to ensure a drip tight seal at high differential pressures.

RULES AROUND SOLIDS

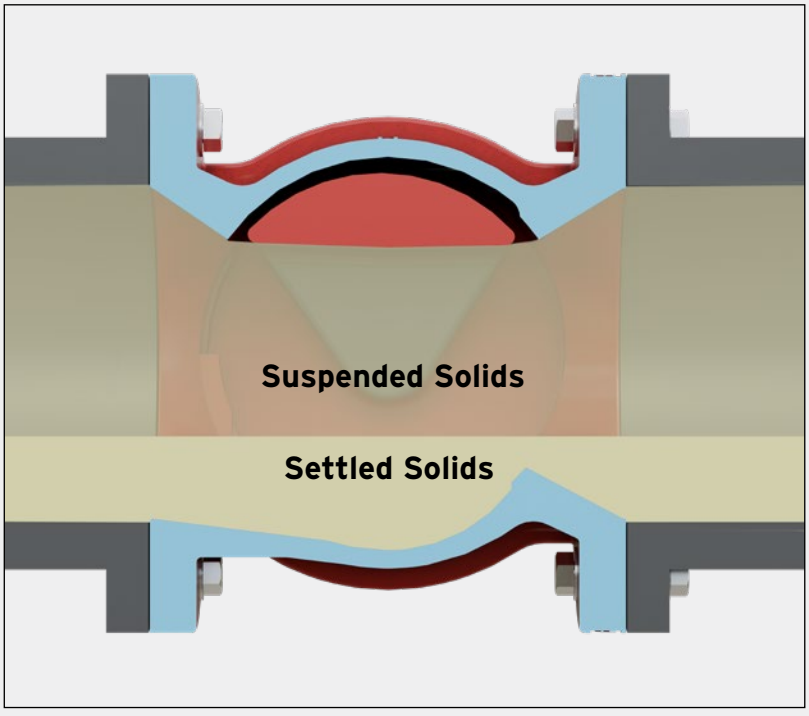
Solids are the #1 factor in determining the orientation of a plug valve. Built-up solids can easily seize a plug to the body of the valve when there is a lengthy time between cycles of the plug valve. To visualize how solids will accumulate in a plug valve, forget about pressure or flow direction and imagine the line with heavy solids dropping out of suspension just after the flow stops.

- **Will the plug get buried if the valve is left in the open position?**
- **Will the valve body fill with solids if the valve is left in the closed position?**

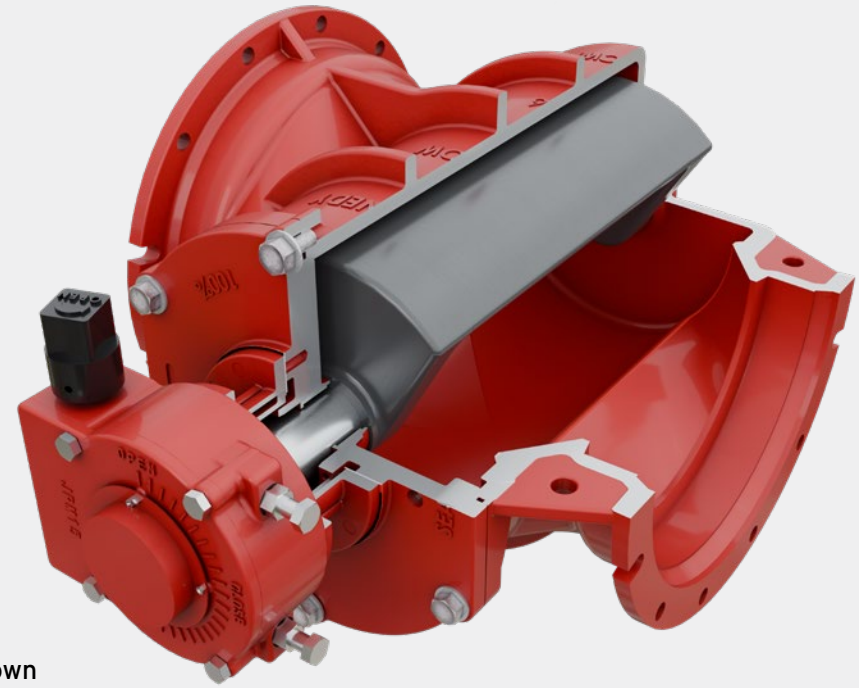
Both answers should be **NO.**

HORIZONTAL FLOW WITH SOLIDS PRESENT

A horizontal flow application is the simplest way to prevent solids from interfering with the operation of a plug valve. This corresponds with the industry standard and default orientation for plug valves which has the valve stem installed horizontally and the plug opening upwards into the valve body. Industry standards also have the input shaft of any gear unit facing up, assuming buried installations will need the gear input reaching the ground surface.



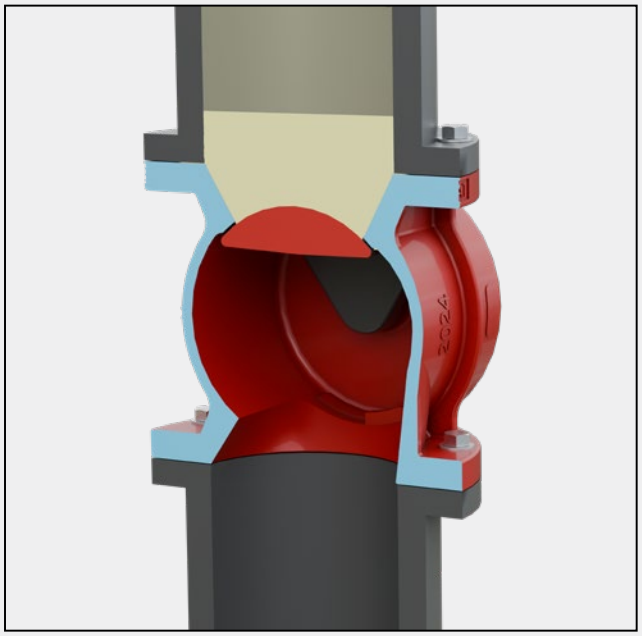
RECOMMENDED ORIENTATION FOR BURIED SERVICE:



NOTE:

- 36" Valve Shown
- Shown Open with Plug Up
- Valve with MJ connection

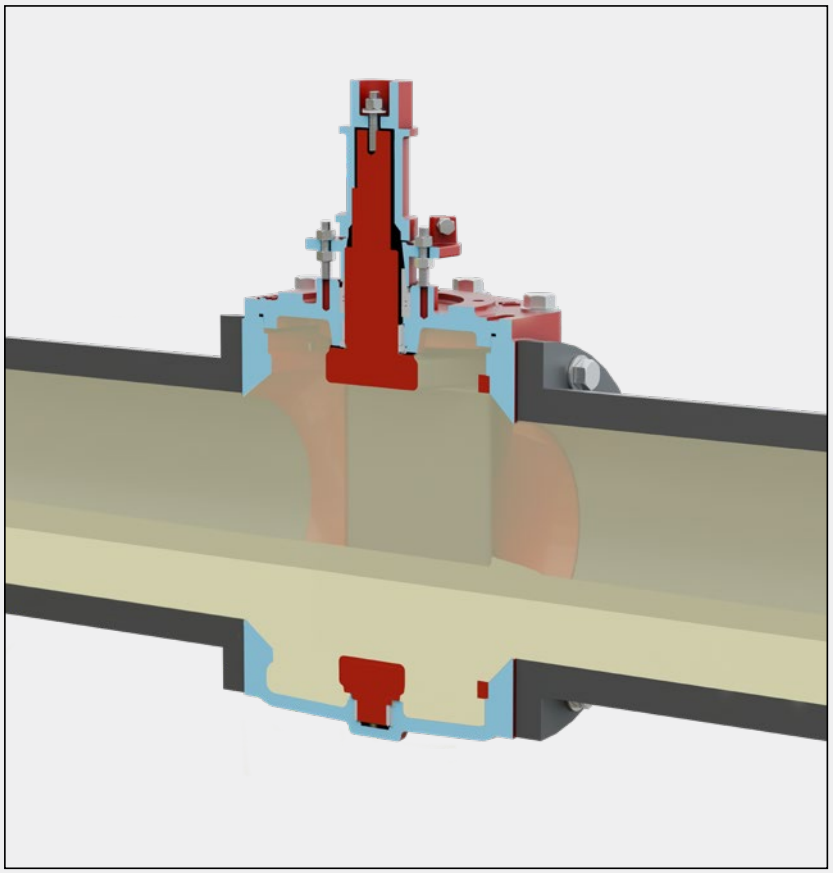
VERTICAL FLOW WITH SOLIDS PRESENT



In vertical flow applications involving solids, the plug valve should always be installed with the seat on the top side of the valve. This allows the valve to close with the plug up. Solids will build up against the plug face, in the pipeline, and not in the valve body. Note: This results in a reverse pressure situation with the natural head pressure pushing against the plug face.

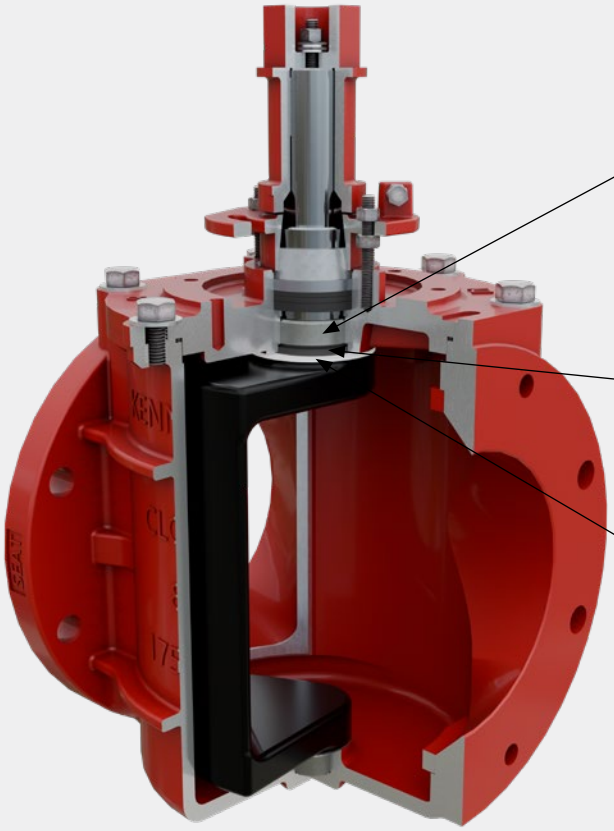
VERTICAL STEM APPLICATIONS WITH SOLIDS PRESENT

When a plug valve is buried, it is common practice to extend the bonnet of the valve to keep the manual gear unit or automatic actuator above ground. In this application, the bottom of the plug may be buried in solids. However, this typically is not an issue since there is plenty of room for the solids to be flushed through when the plug is rotated as the largest part of the plug (the face) is not covered in solids.



GRIT SEALS

In applications involving solids or grit, it is critical to have a dedicated grit seal protecting the valve stem bearings. You should not rely on a thrust bearing only to keep fine particulate (sand/silt) from penetrating the bearing cavity.



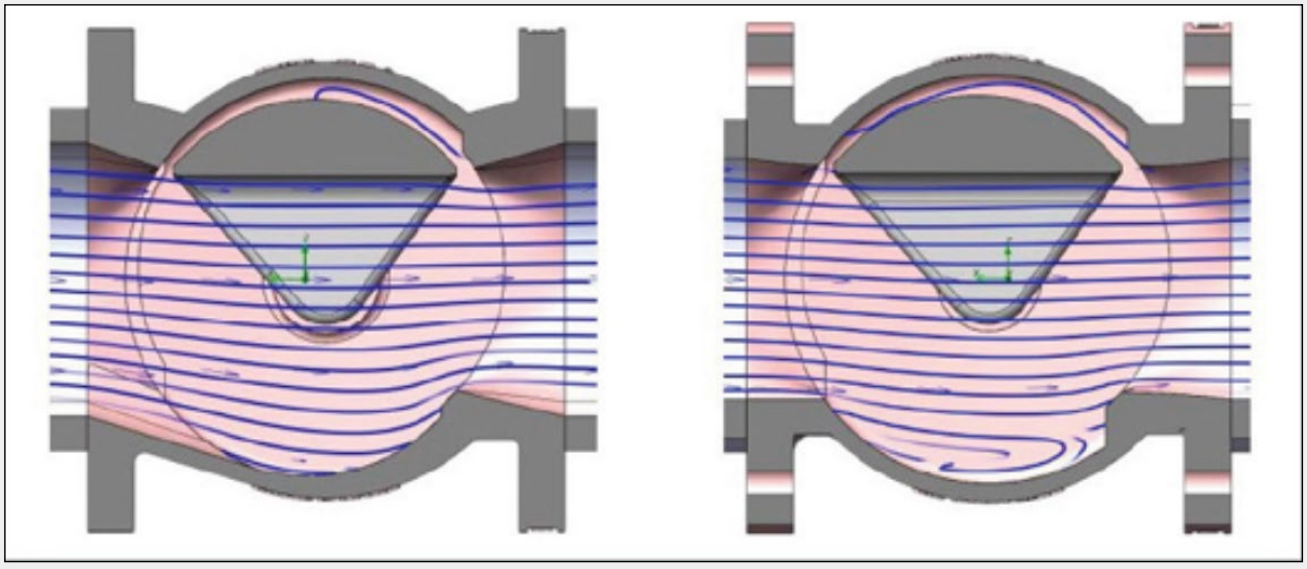
STEM BEARINGS (Top & Bottom)
Heavy-duty 316 stainless steel permanently lubricated bearings on upper and lower plug journals provide ease of operation even after long periods of inactivity.

GRIT SEALS (Top & Bottom)
Buna-N (NBR) grit seals on plug journals prevent fine particulate from entering bearing areas.

THRUST BEARING (Top & Bottom)
PTFE thrust bearings on plug journals reduce operating force and wear to the plug and body.

BODY DESIGNS

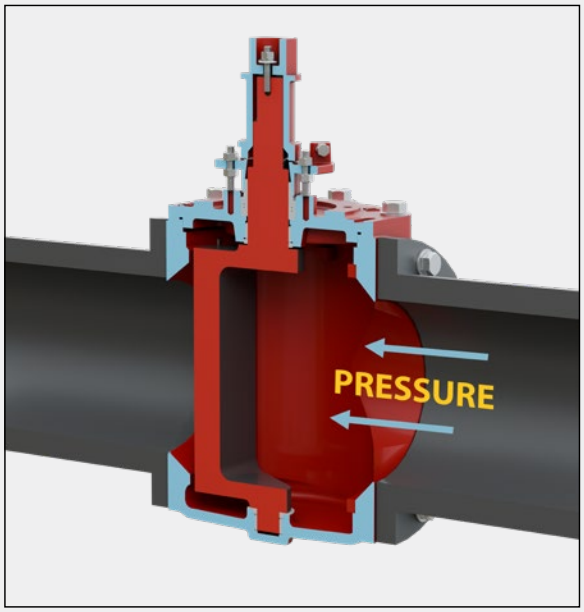
The shape of the Eccentric Valve body is also something to consider with solids or grit. Compared with other typical designs (on right), the Kennedy/Clow body design (on left) allows laminar flow in the body, providing better passage of solids and preventing clogging or buildup in the body.



PRESSURE AND FLOW CONSIDERATIONS

Pressure and flow are secondary factors to the risk of solids accumulating in a plug valve body. However, when possible, a couple of rules should be followed for better performance and reliability.

Direct pressure is the preferred installation for a plug valve. This is when the pressure will be pushing against the backside of the plug when the valve is closed, allowing the pressure differential to assist the plug in sealing against the seat. The benefit of this is a lower amount of torque required to operate the valve and to hold the valve closed, meaning a less expensive powered actuator will be required.



When a plug valve is used to isolate a gravity fed (clean water) line, the plug valve is typically installed with the seat downstream. This allows the pressure to assist in closing the valve (Direct Pressure).

When used to throttle or modulate the flow rate of a (clean water) line, the plug valve is also typically installed with the seat downstream (also Direct Pressure).

The reverse is true of the seat location when a plug valve is used for isolating a vertical/uphill (clean water) line after a pump. Since the valve will be used to isolate the line when the pump is shut down, the pressure and flow will be reversed from the normal line pressure and flow. The plug valve should be installed with the seat towards the pump, to prevent reverse flow from the head pressure of the downstream water column (still Direct Pressure).

ASK THE EXPERTS

If you have a complex situation beyond what we covered, or just need a second set of eyes to double-check your layout, please contact MPI for help with your valve and pipeline design.