

The Basics of Eccentric Plug Valves

BY JOHN V. BALLUN, P. E.

Wastewater systems present many challenges to pumps and valves because the flow can contain grit, solids and debris, depending where in the process the equipment is located. That's why the eccentric plug valve is often the valve of choice.

THE VALVE MAKE-UP

First used in the 1930s in the paper industry, the eccentric plug valve can handle fluids with solid content in a manner similar to a gate valve. But the plug valves also provide important advantages of a quarter-turn valve such as modulating service.

These plug valves consist of a cast iron body and bolted removable cover. The plug has a resilient coating for sealing against a nickel-welded seat in the body. The valve shaft is typically integrally cast as part of the plug and rotates in stainless-steel bearings in the bottom of the body and the cover. In Figure 2, the plug valve is actuated with a worm gear actuator, which is necessary on valves larger than 8 inches. A worm gear actuator may also be beneficial in holding the valve in position against flow, and pneumatic, electric and hydraulic actuation are also options.

ECCENTRIC ACTION

The unique feature of this valve is that its seat is offset from the valve shaft, thereby providing eccentric action. Figure 3 illustrates the second



Figure 1. Installation of 24-inch plug valve in a vault in Collingwood, Ontario

offset between the centerlines of the seat and shaft. A mid-size valve may have a half-inch second offset. As the valve opens counterclockwise about the shaft, the double offset causes the plug to lift off the seat as it rotates open. The lifting action helps to prevent wear in gritty wastewater service.

Figure 3 also illustrates two pressure directions. "Direct" pressure is applied on the end of the valve opposite the seat and "reverse" pressure is applied on the seat end. The sealing function of the valve is assisted by the direct pressure because it pushes the plug tightly into the seat. The valve will also seal with pressure in the reverse pressure direction, but the plug needs to be turned clockwise past the center of the seat. Because of

the eccentric action, the greater the closing rotation, the tighter the seal. If the valve becomes worn during service, it can be closed further to restore a leak-tight seal.

PLUG VALVE STANDARDS

The eccentric plug valve was first standardized in MSS [Manufacturers Standardization Society] Standard SP-108 in 1991. As the American Water Works Association (AWWA) expanded into wastewater applications, it published AWWA Standard C517 (in 2005). Both standards are congruent with similar materials of construction and scope.

Eccentric plug valves are provided in sizes ranging from 3–72 inches with a cold working pressure rating of 150 or 175 psig depending on size

Figure 2. Construction of an eccentric plug valve

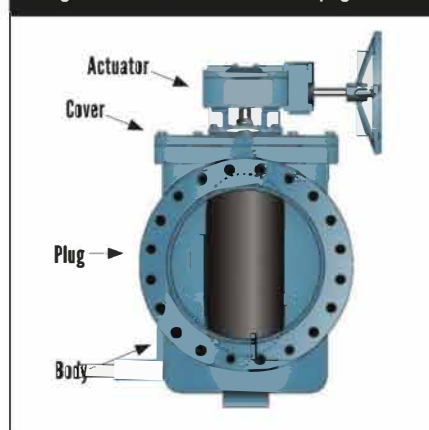
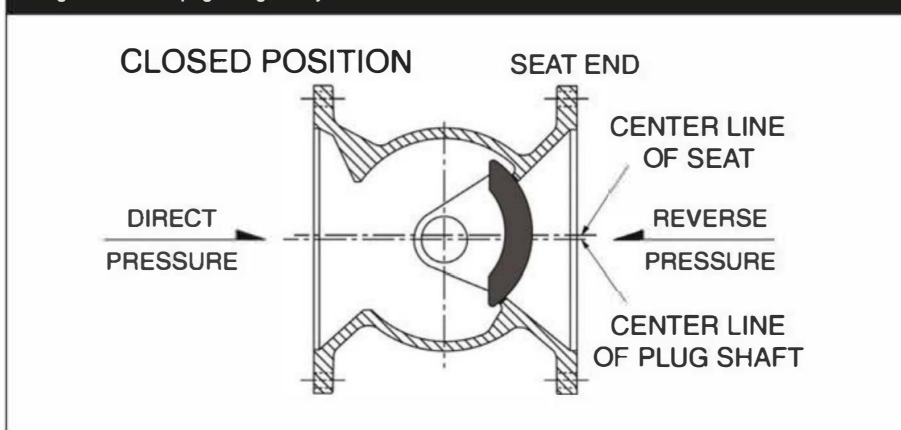
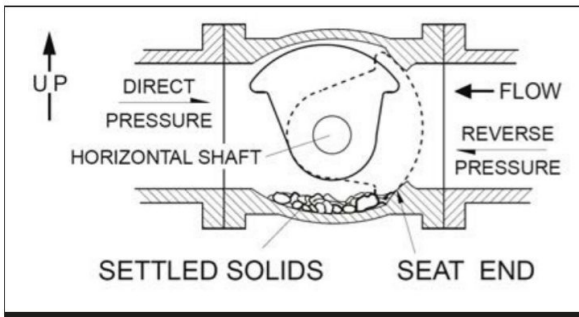


Figure 3. Eccentric plug valve geometry





□ Figure 4. Horizontal installation guidelines

and have a flow rating of 8 feet per second. The valves are available in short-body and long-body configurations and are seat-tested in the direct pressure direction unless otherwise specified.

Despite published standards, alternate plug valve designs are available that comply. One design has a cylindrical plug face and cylindrical seat (Figure 2). In another design, the port and plug face are round, similar to a half ball valve. Both designs, rectangular and round, can be provided with standard 80% port openings or full 100% port openings and are piggable using flexible urethane pigs. Plug valves also can be provided with metal-to-metal seats for severe applications such as activated sludge service.

PLUG VALVE INSTALLATION

Because of the geometry of the eccentric plug valve and its use in wastewater service, special installation recommendations should be followed. As shown in Figure 4, when settling solids are expected, the valve should

be installed with the shaft horizontal so that when the valve is open, the plug is at the top of the pipe. Also, the seat end should be towards the pump so that when the pump is off, the system pressure pushes the plug into the seat.

As shown in Figure 5, the valve should be installed for vertical pipes regardless of flow direction with the seat end up so that settled solids will not collect in the valve when closed.

CONCLUSION

The resilient-seated eccentric plug valve is a unique valve in that it is designed to handle wastewater fluids; when equipped with rubber or glass lining, this valve can also handle abrasive fluids. Because it is a quarter-turn valve, it is easily automated for controlling process flow or pressure.

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□ Figure 5. Vertical installation guidelines

