2.2 Quarter-Turn Valves

Quarter-turn valves are those valves that are operated by turning the valve stem 90 degrees clockwise or counterclockwise. Quarter-turn valve discs rotate within the valve seats to open or close the flow path and are driven directly by the rotational motion of the motor actuator.. Common quarter-turn valve designs include ball, plug, and butterfly valves.

2.2.1 Ball and Plug Valves

Ball and plug valves are used to stop or start fluid flow. The names are derived from the shape of the disc which resembles a ball or a plug. A ball valve is shown in Figure 2-5 and a plug valve is shown in Figure 2-6.

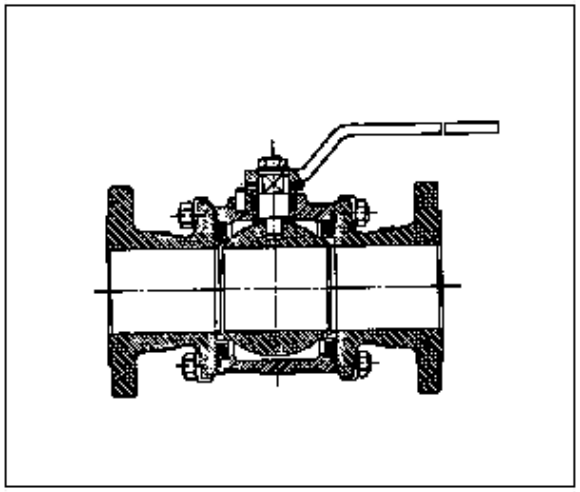

Figure 2-5 Ball Valve

The body of a ball valve is machined to accept a ball shaped disc. The disc is a solid sphere with a stem attachment and a passage bored through the center of the sphere at a right angle to the axis of the valve stem.

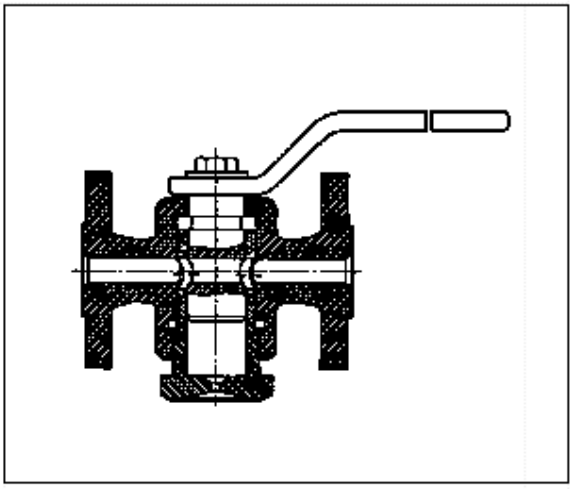

Figure 2-6 Plug Valve

In the open position, the passage in the ball lines up with the inlet and outlet ports of the valve body providing an unobstructed flow path through the valve. Then the ball is turned 90 degrees from the open position, the solid part of the ball blocks the ports and stops fluid flow. Plug valves function similarly, except that a cylindrical plug with a bored passage is used as the disc.

Both ball and plug valves offer little resistance to operation. Differential pressure across the disc has little effect on the torque needed to turn the valve stem. These valves can be relatively quick opening and closing and can be designed for any system pressure.

The primary disadvantages of ball and plug valves are cost, rapid wear and corrosion of seats, and inability to regulate flow. Weight of the ball or plug is also a disadvantage for use in large diameter piping systems.

2.2.2 Butterfly Valves

Butterfly valves are used to stop, start, and regulate fluid flow. A butterfly valve is illustrated in Figure 2-7. The valve stem penetrates the valve body running through a packing and bushing. The stem extends completely through the valve body to the other side, where it sits in another bushing. The disc is literally a flat or slightly curved disc attached to the valve stem.

Butterfly valves typically use a soft, resilient seat made of rubber or neoprene. The disc is rotated about an axis at a right angle to fluid flow.

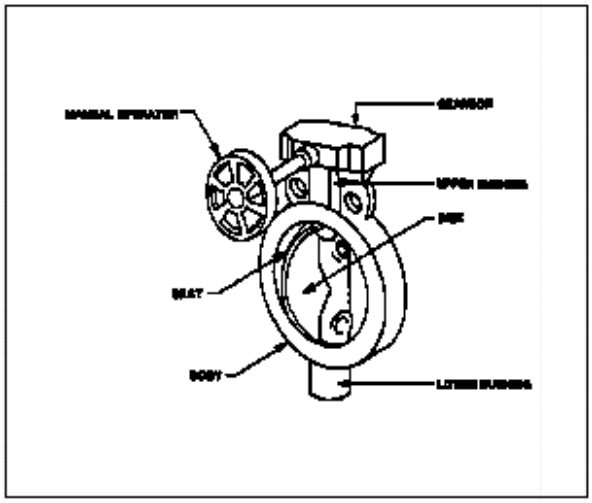

Figure 2-7 Butterfly Valve

In the fully open position, little resistance to flow exists and pressure loss is minimal. In the fully closed position little seat leakage occurs provided the resilient seat is in good condition. At intermediate positions, throttling of the fluid flow occurs although the flow regulating characteristics are not as good as that of globe valves.

Butterfly valves are used in low pressure systems. They are inexpensive and fairly easy to maintain. The torque required to operate the valve can be difficult to predict, especially in compressible flow service do to aerodynamic effects. The resilient seat material prevents butterfly valve use in harsh environments. Butterfly valves are typically used in circulating water systems of nuclear power plants.