2.1 Rising-Stem Valves

Rising-stem valves are those valve designs that are operated by pushing or pulling the valve stem. The valve stems do not rotate, thus the valve stems are threaded and matched to a stem nut that converts the rotational output motion of the motor actuator to linear movement of the valve stem. The most common rising-stem valve designs are gate valves and globe valves.

2.1.1 Gate Valves

Gate valves are used to start or stop flow, but are not intended to regulate or throttle flow. The name "gate" comes from the appearance of the disc in the flow stream. Figure 2-2 shows a common rising-stem gate valve design.

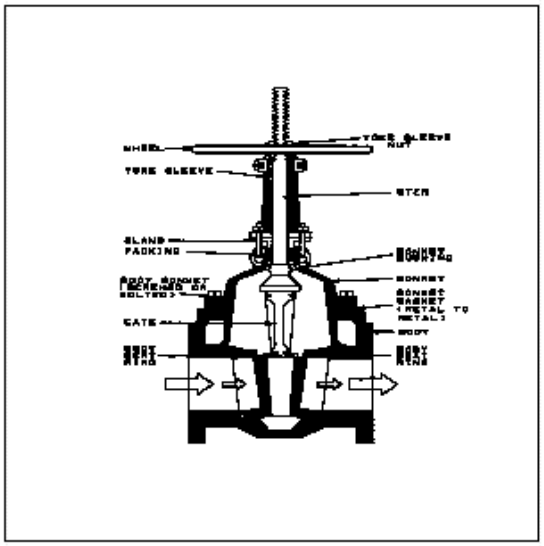

Figure 2-2 Gate Valve

In a gate valve the disc is completely removed from the flow stream when it is fully open. This characteristic offers virtually no resistance to flow and very little pressure drop across the open gate valve. When the valve is closed, the disc seals on all 360 degrees of the downstream seat ring's contact surface.

With proper mating of disc to seat ring, very little or no leakage occurs across the disc when the valve is fully closed. As the valve opens, the flow area is enlarged in a non-linear manner with respect to percent of opening. Thus gate valve are not well suited for precise flow control or throttling applications.

Gate valves are most often found in flow isolation applications..They can be designed for use at any system pressure and are very common in large diameter, higher pressure piping systems. In systems with flow during normal operations, gate valves often have a closing safety function such as containment isolation. In systems with no flow during normal operations, gate valves often provide the capability to open the flow path to initiate safety system function such as emergency core cooling.

Gate valve discs typically provide seating on both the upstream and downstream seats. Discs may be parallel or wedge design. Parallel discs have seating surfaces that are parallel to each other and perpendicular to the flow path. Wedge discs have angled seating

surfaces which form a "V" shape that wedges the disc between the seat rings. Wedge discs can be solid, split, or flexible as shown in Figure 2-3. Split and flexible wedge discs provide some automatic adjustment of sealing surfaces for wear.

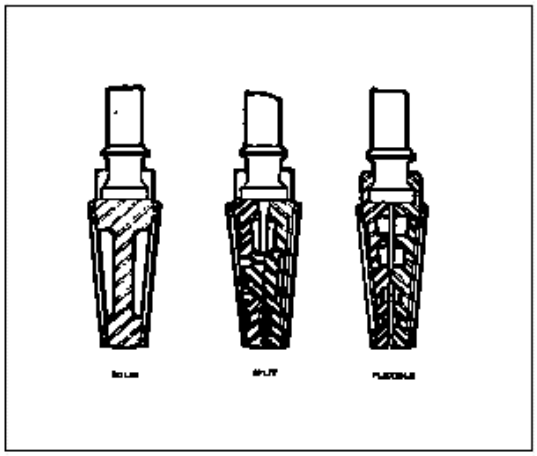

Figure 2-3 Gate Valve Wedge Disks

Parallel disc gate valves consist of two separate discs that are sometimes spring loaded or connected at the valve stem with some type of wedging mechanism. Most parallel disc gate valves seal on only one of the two disc surfaces, usually the downstream side. In these designs, the amount of seat leakage decreases as the differential pressure across the valve increases.

Rising-stem gate valve are the most common design, but non-rising-stem gate valve designs can also be found, usually in high pressure applications. In non-rising-stem gate valves, the stem is threaded into a sleeve which is connected to the disc within the bonnet. Rotational motion of the stem is translated into vertical motion of the threaded sleeve such that the sleeve and disc rise within the bonnet but the stem does not rise.

2.1.2 Globe Valves

Globe valves are used to stop, start, and regulate fluid flow. The name "globe" is derived from the shape of the disc which can be somewhat similar to a globe; however, the disc often looks more like a plug. This can sometimes lead to confusion with true plug valves which are quarter-turn valves. A simplified globe valve is shown in Figure 2-4.

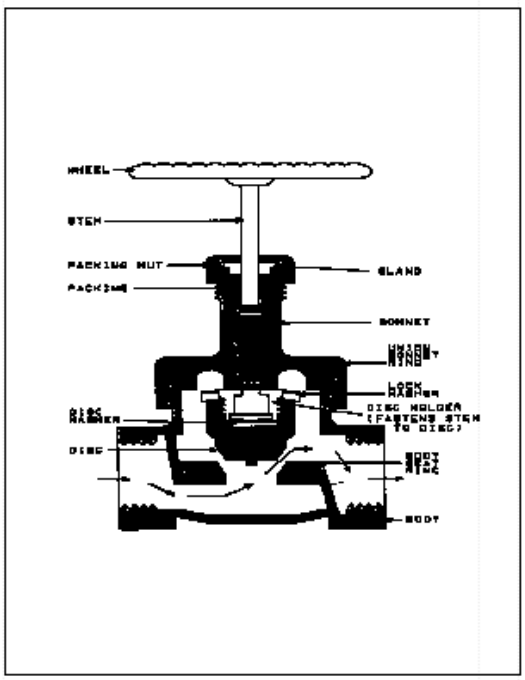

Figure 2-4 Globe Valve

A globe valve disc can be designed so that upon opening, a large flow area is realized around the disc with small stem movement. This allows the valve to serve a quick opening or closing function. Another option is to

design the annular region around the disc and seat ring so that the flow area gradually changes with stem movement. This characteristic gives the globe valve good throttling ability for use in regulating flow.

Globe valves can be configured in piping systems so that the disc closed against the direction of the fluid flow (flow under disc). In this orientation the kinetic energy of the fluid impedes closing but aids in opening the valve. When the disc closes in the same direction as the fluid flow (flow over disc), the kinetic energy of the fluid aids closing gut impedes opening the valve. This characteristic makes globe valves for fail-open or fail-close valve applications.

Like gate valves, globe valves can be rising-stem or non-rising-stem designs. Globe valves may be designed for any system pressure; however, direction of flow becomes an important factor in the actuator sizing. Unlike gate valves, an open globe valve does not provide a unobstructed flow path and significant pressure drops across globe valves are common.