Flush Valve Control Stop Designs:

The Pros & Cons of the Globe Valve Design Vs. the Ball Valve

October 2022

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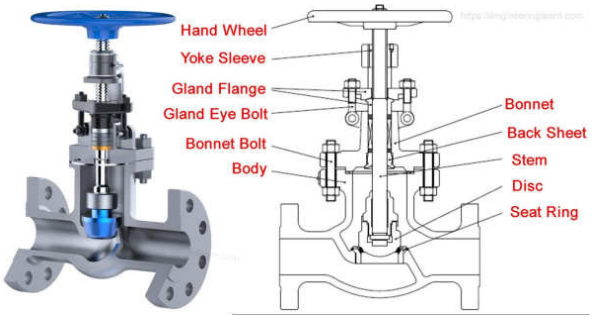
Introduction:

The globe valve and ball valve designs have been around for hundreds of years and used by engineers in applications across practically every industry in one form or other. The choice between these two types of designs has now come to the commercial flushometer. This paper will look at the two engineering designs, the pros and cons of each design and then how that applies to the flushometer control stop.

What is Globe Valve?

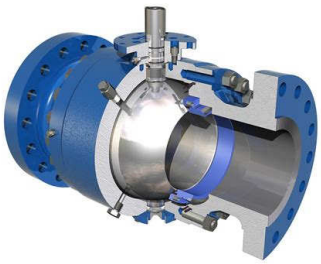
Globe valves are one of the most common valves used in industrial applications. It is used to regulate the flow of fluids. The "globe" valve name literally comes from the shape of the valve and its' globular cavity around the valve seat. The closure element of the globe valves consists of a plug that is either flat or in a convex shape to slide into a horizontal seat in the valve. Raising the plug allows the fluid to flow through valve.



Globe Valve Cutaway View

What is Ball Valve?

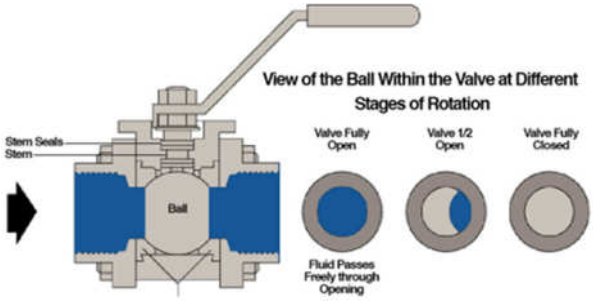
Ball valves are one of the most commonly used designs in both residential and commercial applications. The ball valve rather than using a plug to control the flow of fluids instead uses a spherical disc (or "ball") to control the flow by opening, closing, or partially opening the valve. The ball valve is often also referred to as a "quarter-turn" valve because a quarter turn is used for a 90-degree turn to open or close the ball.



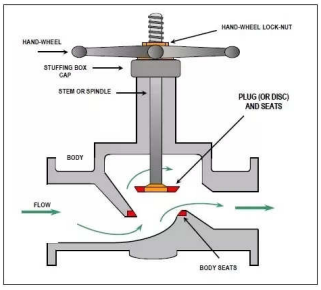
Ball Valve Cutaway View

Differences between the Ball Valve and Globe Valve

The major difference between the ball valve and globe valve is focused on the closure element of the two designs and what effect that has in its function. The ball valve uses a hollow spherical-shaped closure element that is then turned to the solid surface of the ball in order to seal and close the opening in the seat of the valve's body. The method provides a *full-bore open* design that then provides a minimal drop in pressure. The simple quarter turn open or closing of the ball is considered less effective in terms of regulating or throttling the flow of liquid. The globe valve by contrast uses a disk-shaped element to press against or plug the opening in the seat of the valve's body. This design of controlling the fluid results in a much greater drop of pressure than the ball valve. The disc/plug design is considered to be better in terms of the ability to *throttle* high pressure flows of fluid.

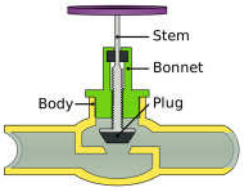


Picture of ball valve full bore



Picture of globe valve loss of pressure

Another major difference between the globe valve design verses the ball valve is the *leakage*. The disc/plug design of the globe valve employs generally a rubber like sealing material as part of its closure element while the ball valve seals the opening simply by closing the ball. The result is that the ball valve design is far less likely to leak due to the fact that there are no materials such as rubber that will breakdown or deteriorate.



Rubber plug closing element of globe valve

Metal ball closing element of ball valve

The Flushometer Control Stop
(Ball Valve vs. Globe Valve Design – the Pros & Cons)

The control stop is a device that is used to turn the water to the flushometer "on" or "off". As the name aptly suggests it is "controlling" the water flow into the flush valve and thus the flow rate. The control stop also acts like a check valve that opens in one direction only when the water pressure is on. When the pressure is not there, it closes. Thus, preventing the water from going in the wrong direction. The backflow prevention feature or element is referred to as the "back check". In today's market there are two types of designs for the control stop. The globe valve for at least 100 years has been the design used by the flushometer industry for its' control stop. The other design is based upon a ball valve. Aside from the closing element difference, the other key difference is the backflow prevention device. In the globe valve design a spring-loaded plug mechanism is used. The spring closes the plug when the pressure is off. In the ball valve designed control stop's backflow preventer is what is called an umbrella valve. This valve opens in one direction only when the water is flowing and then closes when the pressure is off and will not allow the water to flow the other direction.

The following is an examination within the flush valve application of the key feature differences between a control stop using a globe valve verses a ball valve design and then which design is better relative to that feature.

Flow Rate:

One of the well know advantages of the ball valve design is the full flow rate it provides. Flow rate is a critical feature for the flush valve. This is especially true for flush valves that are paired with high efficiency fixtures. In order to deliver less water as quickly as possible the flush valve depends on having adequate flow rate entering into it. The full open bore design of the ball valve allows for the least amount of drop off in the rate exiting the valve. Since the industry standard calls for an angle stop, a design that provides the least amount of degradation of the flow rate is superior. **Advantage: Ball valve**

Throttling:

The globe valve designed control stop takes advantage of globe valve's ability to be throttled. The ability to throttle the flow rate is important when considering the very different design parameters of two main china fixtures that flush valves are used with, the water closet and the urinal. In the US, most water closet fixtures use a symphonic jet design to prime the trap, which tends to need maximum flow rate of water into the flush valve to then be transferred into the fixture in initiate the trap and effectively take solids away. Conversely, the urinal is rather simple less sophisticated washdown design that merely rinses the fixture. This actually requires less flow rate into the fixture and thus the flush valve in order to prevent splashing. The ability to make minor adjustments to the stem and in turn the position of the plug is considered an advantage for the globe design within a commercial piping system. Additionally, the potential for vibration is reason why the ball valves should generally be either all the way open or all the way closed. This is a true statement in piping systems with large pipes and thus the amount of liquids flowing them. In the case of the flush, which has been stepped down to 1" or ¾" (in the case of the urinal) supply line pipes, this is far less of a disadvantage. **Advantage: Globe valve**

Plug Leakage:

The globe valve designed control stop used by flush valves employs a plug that is made with rubber. Today's municipal water supplies are being sanitized with higher and higher levels of chloramines. These chloramines while safe for human consumption deteriorate rubber. Once the rubber disintegrates like photo number 2, the control stop will leak. The metal surface of the ball valve

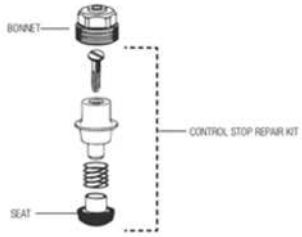
Healthy new rubber plug (back check)

Rubber Degrading – Leaking Likely

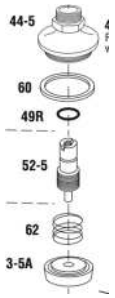
components will not deteriorate, making leaking rare. For flush valve maintenance teams, this is very important. **Advantage: Ball valve**

Plug Stem Design vs. Shutoff Key Design:

The globe valve design for a flush valve control stop uses a complicated stem design which then is used to either throttle the water flow or to drive the plug into the supply line opening to shut off the water to the control stop. This stem is composed of plastic, a metal spring and o'rings with a threaded brass stem rod that is being turned to open, close or throttle the control stop. This complicated system becomes another area that leakage can develop. Rupturing and subsequent water damage has been known to happen.



Version #1 of a Stem System



Version #2 of a Stem System

Contrast this with the simple design of the ball valve shut off key, which has a brass key that fits into a slot in the ball for the ¼ turn opening or closing operation. It is sealed then with an o'ring. The shut off key is also exposed to very little water and so the combination results in a very low probability of leakage. **Advantage: Ball valve**

Repair of Back Check* (The Difference in Design Locations)*:

The ball valve design allows the control stop to shut the water off by using the closing of the internal ball. This action is thus independent control stop's back check (aka backflow preventer). The globe valve by contrast has to use the back check/plug to shut the water off on the supply side of the valve. To do this, it has to be positioned on the incoming supply side of the valve. This critical design difference is what allows the ball valve design to move the back check from the supply line side of the control stop to the flush valve side away from the incoming supply of water side. Why is this important? The back check or plug as mentioned above uses a rubber material. Today's water supplies all contain chloramines, which causes rubber to breakdown. Once the rubber has reached a point of leaking, the repair of this part requires the water be turned off to the whole bathroom in order to access and replace the worn part. This issue is compounded in older building that were not designed with the shut off valve that is close to the bathroom. The facility team may be required in these situations to shutdown large sections of the building in order to replace/repair the plug. **Advantage: Ball valve**

Conclusion:

The above analysis goes through the key differences between the globe valve design verse the ball valve design as applied to the flush valve product application. Each element is judged as to which design provides the best advantage for the flushometer. Of the five elements called out, four of them favor the ball valve and one for the globe valve design. While the throttling aspect of the globe valve is noted as an advantage in the globe valve design as a whole, for control stop since the water flow has been stepped down significantly by the time it reaches the control stop and due to the mere washdown nature of a urinal fixture, the throttling advantage is not as pronounced in the flush valve control stop application.

Flushometers are used in commercial applications, many of which cannot afford to shut down a bathroom to repair a control stop's back check. This group includes facilities that operate virtually 24 hours a day such as hospitals, casinos, train/bus stations and airports. There are others, such as sports facilities or schools and universities or even remote rest stops, that have huge issues with having to shut down a bathroom. If it is an older building whose piping design requires shutting the water off to large sections of the facility, the problems are only compounded. The number one disadvantage of the globe valve and/or plug design is the need to shut the water off to the room to make any repair. For facilities teams this is their biggest concern. The other advantages of the ball valve design such as the improved flow rate or virtual leak free nature are icing on the cake.