Ingolf's insight

Floating ball valves are more than just floating ball valves: Part 1

Norwegian consultant and valve instructor, Ingolf Fra Holmslet begins a new, bimonthly series of informative articles.

Floating ball valves are usually considered to be a simple type of valve and are not, in fact, particularly appreciated. When one talks about floating ball valves, most people think of valves with fixed seats and floating balls, usually smaller valves in relatively low pressure systems, similar to the valve illustrated in Figure 1.

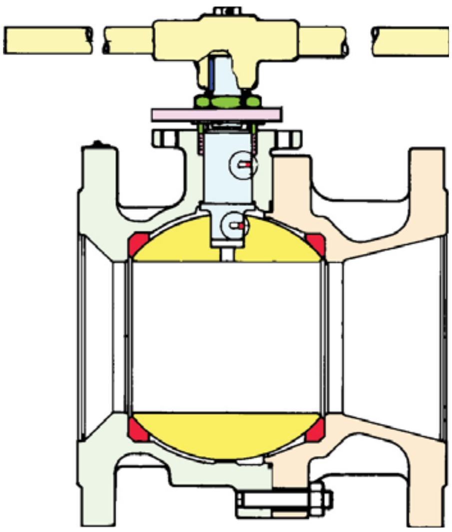

Figure 1.

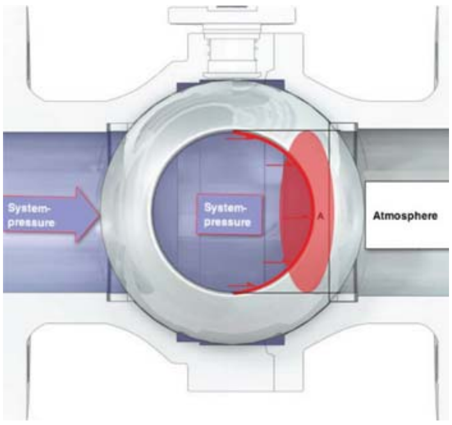

Figure 2.

However, when it comes to tightness, floating ball valves are more reliable than trunnion ball valves. The reason is that in floating ball valves, unlike in trunnion ball valves, the system pressure forces the entire ball against the downstream seat, see Figure 2. In trunnion ball valves the pressure usually forces the upstream seat against the ball and hence they depend on seats that can be locked in the seat pocket due to various impurities. Since it is the force from the system pressure acting against the entire surface of the external seat diameter that gives the sealing force to the floating ball valve, its sealing force is much stronger, in relative terms, than that of a trunnion ball valve. This is also one of the drawbacks of this kind of ball valve – it can be difficult to open with a differential pressure.

Another advantage of the floating ball valve, as compared to the trunnion ball valve, is that the former is better suited for opening with differential pressure. This is due to the fact that the main seal in a floating ball valve is against the downstream seat. When a ball valve is opened with differential pressure, the damage from erosion/cavitation will always be inflicted on the upstream seat because this is where the highest pressure drop is recorded. Thus, in a trunnion ball valve it is the main seal of the valve that suffers the damage when opening with differential pressure. This is the basic principle of a floating ball valve but, as the title says, there is more to this type of valve than most people think.

A comparison of the outer appearance of the valve body in Figures 1 and 3 fails to show any significant differences. They are both split body having two-piece bodies and RF flanges. However, if we take a look on the inside of the valve body, at the shape of the seats, there is a major difference. The valve in Figure 3 has spring-loaded floating seats with radial seals. Both valves in Figures 1 and 3 are bi-directional with the downstream seat providing the main sealing function. The major difference is that, in the case of the valve illustrated in Figure 3, double sealing can be achieved if the cavity is depressurized. The problem is that auxiliary valves are not usually fitted into the valve body, nor are there normally any holes where an auxiliary valve could be fitted so as to take advantage of all the possibilities available.

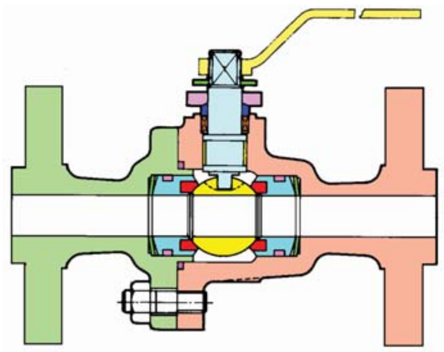

Figure 3.

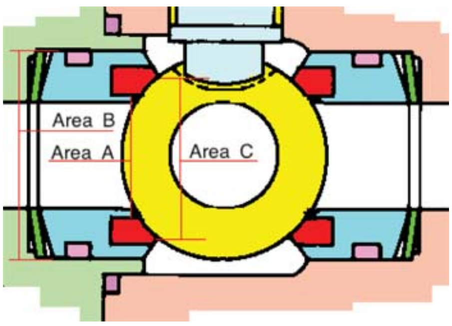

Figure 4.

If the body was equipped with an auxiliary valve in its cavity, it would be possible to depressurize the cavity once the valve is in the closed position. The valve would function just like a solid slab gate valve. Figure 4 indicates the areas on which the system pressure will act. When the valve is in the closed position, the sealing force applied to the downstream seat is equal to the system pressure multiplied by the surface area marked C. When the cavity is depressurized, the sealing force applied to the downstream seat equals the system pressure multiplied by the surface area marked B. The sealing force applied to the downstream seat hence increases by 25-30%. Moreover, we also have a sealing force applied to the upstream seat, amounting to the force of the system pressure multiplied by the area between B and A. Once the valve is closed and the cavity depressurized, leave the valve for 15 minutes and check the upstream seat's tightness. If the seat is tight, we have a double-sealing valve which is just as reliable as a blind flange. If the lever or actuator is taken off, the valve cannot under any circumstances start to leak. We can easily agree with the fact that the valve is difficult to operate now, and sometimes there can be situations where we may need to equalize the pressure across the valve before operating the valve.

To be continued...

About the author

Ingolf Fra Holmslet's career in the world of valves began in 1972 as a production operator on the first production platform on the Norwegian continental shelf in the North Sea. From 1975 to 1985 he went onshore, working for a valve repair shop, after which he developed his first valve training course. In 1986 he started Klyde Consultants AS and for the last 27 years has been working as a valve consultant and instructor to Norwegian oil companies including Phillips Petroleum Co., BP, Shell, Norsk Hydro, Elf and Statoil, moving his valve training operation to Statoil's training centre in Bergen in 1994. Ingolf has also written 2 books, both due for release in 2013.

Outside work, his spare time is taken up with looking after his menagerie consisting of 3 borzois, 4 alaska huskies, 2 american paint horses and 2 african gray parrots.

Ingolf can be contacted on ingolf@valve.no