White Paper

DBB and DIB Seating for Trunnion Mounted Ball Valves

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Introduction

General industrial ball valves seal by fluid pressure pushing the ball into the downstream resilient seat. At extreme pressures however, the floating ball valve may wear prematurely and require high torques during operation. Conversely, trunnion mounted ball valves are ideally suited for extreme pressures because the ball is supported by trunnions rigidly secured in the body thereby reducing the operating torque. The upstream and downstream seats are pressure-energized to seal the ball and therefore minimize wear.

Figure 1. Trunnion-Mounted Ball Valves (Courtesy of Val-Matic Valve)

Ball valve seats can be configured to seal in one or both directions which gives rise to the two types of configurations as defined by API 6D, see below. There is mystery and confusion as to what is meant by Double Block and Bleed (DBB) versus Double Isolation and Bleed (DIB) and when to specify them. When working on a process line application you need to be able to answer the question, "Which is the correct valve configuration for my application or process?" You will first need to understand your desired outcome and the differences between the two configurations.

API 6D DEFINITIONS

DBB – Double-Block-and-Bleed: *single valve with two seating surfaces that, in the closed position, provides a seal against pressure from both ends of the valve with a means of venting/bleeding the cavity between the seating surfaces.*

DIB – Double-Isolation-and-Bleed: *single valve with two seating surfaces, each of which, in the closed position, provides a seal against pressure from a single source, with a means of venting/bleeding the cavity between the seating surfaces.*

Seat Configurations

Let us first look at the definitions of DBB and DIB. This should help clarify what you need to know to answer your question. The following figures show cross sections of single valves with an upstream seat ring, the trunnion mounted ball, and a downstream seat ring. The seat rings contain a resilient seat insert (shown in orange) to make the seal against the ball. When process pressure in the pipeline is applied (dark blue areas), the springs and line pressure move the seats toward the ball to make a tight seal. The seat rings and ball are contained within the valve body which contains a vent valve used to drain the body cavity behind the ball or check for leakage.

Figure 2 illustrates the DBB configuration where in the closed position, the valve provides a seal against pressure from both ends of the valve thereby isolating the cavity between the ball and the valve body. The cavity can now be manually relieved of any gas or liquid to test for leakage. In the lower image the downstream pressure is removed, and any cavity pressure or leakage from the upstream seat is automatically released or bled through the downstream seat. This is an important feature for pipeline valves when the cavity pressure in a closed valve can build due to thermal expansion. On the other hand, this could be very harmful to equipment or people that are working on the pipeline or equipment downstream of the valve.

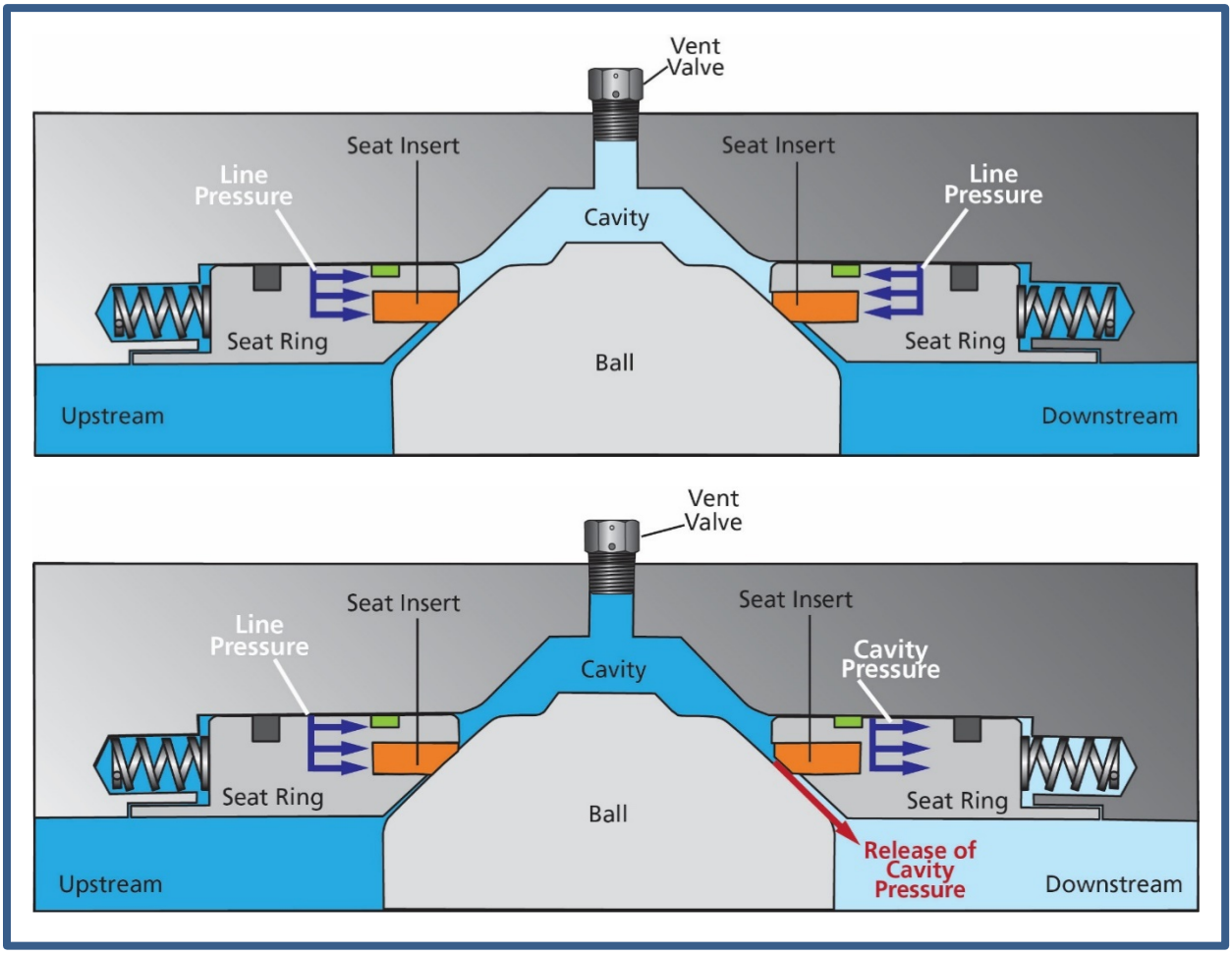

Figure 2. DBB Seat Configuration

Figure 3 illustrates the DIB configuration where in the closed position, the valve provides a seal against pressure from both ends of the valve thereby isolating the cavity between the ball and the valve body just like the DBB configuration. The cavity can now be relieved of any gas or liquid to test for leakage as in the DBB configuration. In the lower image though, the downstream pressure is removed, and there is a marked difference from the DBB configuration. In the DIB configuration, any cavity pressure or leakage from the upstream seat exerts thrust on the downstream seat causing it to press against the ball and hold pressure. The fact that both seats seal from the same direction is why the configuration is called "double isolation". The DIB valve will redundantly protect equipment and people that may be working on or repairing the pipeline downstream. With DIB valves, the cavity must be relieved through an automatic relief valve mounted on the body if thermal expansion takes place.

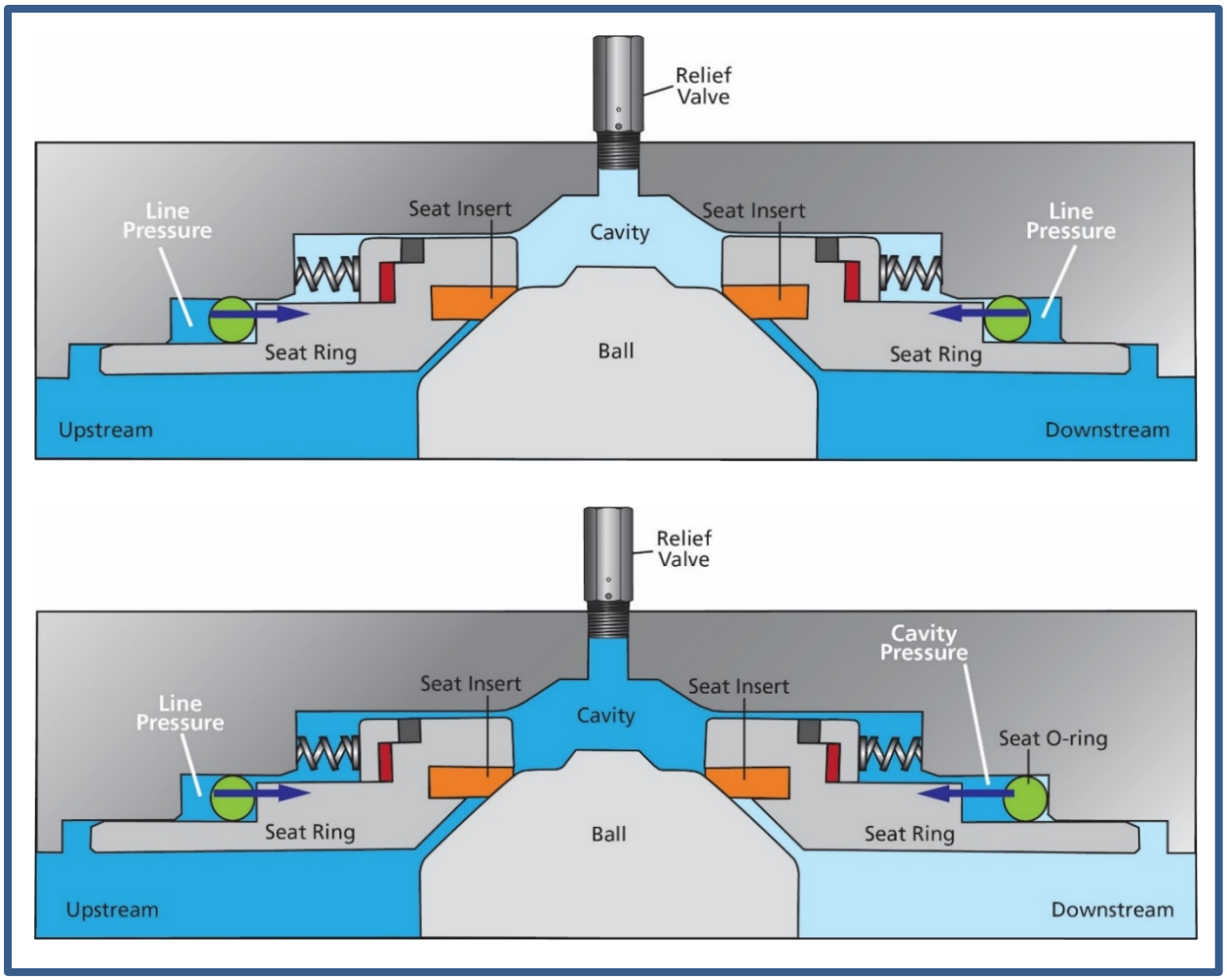

Figure 3. DIB Seat Configuration

Applications

If a seat configuration is not specified for your trunnion-mounted ball valve, you will likely receive the DBB configuration depending on the manufacturer. DBB valves will seal in both directions and the cavity will be self-relieving when leakage from one of the seats occurs or the process fluid trapped in the body cavity is subject to thermal expansion. But with a DBB valve, when one seat leaks, there will be no backup sealing

from the other seat. The vent valve can be used to regularly conduct a leak test on the valve while under operation to monitor leak rates. Unfortunately, if done infrequently, vent valves can clog and mask valve leakage. Regular maintenance and testing are important to maintain safety.

When effective double isolation is required to reduce the risk of downstream leakage, a DIB configuration should be specified. A DIB valve is also specified when there is a low tolerance for leakage. DIB valves can also be used when the process fluid contains grit or abrasive material which can promote leakage. With a DIB valve, both seats must be compromised before downstream leakage will occur. Since a DIB valve may expel fluid from the body cavity due to thermal expansion, provisions to collect that fluid should be made. The key benefit to being able to evacuate the cavity is to eliminate possible harm to equipment or people and possible damage to the valve that could cause the media to escape into the atmosphere.

It should also be noted that some high-risk piping systems may require a special valve arrangement where two individual DBB or DIB ball valves are piped in series with a smaller bleed valve piped between the two valves. This arrangement is more reliable than the use of the valve-mounted relief valve for releasing pressure and leakage from the valve when downstream maintenance to the pipeline is needed, especially when hazardous fluids are used and downstream maintenance is a regular part of the process.

Conclusion

The key is knowing your process application and how the media reacts to choose the proper valve configuration. Knowing the differences between the DBB and DIB valve configurations will allow you to make the correct decision. Consider your tolerance for leakage, how to evacuate the valve cavity, and the required level of safety that is needed. When in doubt, contact the valve company for further guidance.

References

1. American Petroleum Institute, “ANSI/API Specification 6D Specification for Pipeline Valves”, 23rd edition, April, 2008. Washington D.C.

2. Manson, Ron and Tashika Varma, “DBB and DIB Which is Which?”, VALVE MAGAZINE, Spring 2014. pp. 20-24. Washington D.C.