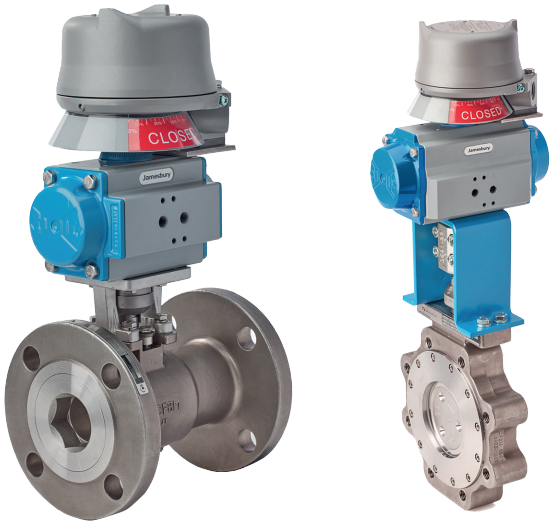
Ensuring seat and stem sealing in Jamesbury™ ball and high performance butterfly valves

Dependable isolation where and when you need it most.



Process valves have evolved to handle an increasing array of media from liquids to gases, high temperatures to cryogenics, and high pressure to vacuum. Through it all, valve seat and stem seals have played a defining role in judging the effectiveness of ball and butterfly valve solutions. Valve seat sealing materials and technologies must reliably isolate process flow where and when it is needed, particularly in the event of an emergency. Valve stem seals have to prevent hazardous emissions from leaking into the atmosphere. In addition, the structural integrity of valve body castings needs to be maintained without fail. Human and environmental safety, process uptime and productivity, product quality and investment return depend on it.

Seat sealing

There are two important aspects to examine when determining the seat sealing capability of valves: seat geometry and seat materials.

Seat geometry: Ball valves

Flexible lip seats, first introduced in Valmet's Jamesbury valves in the mid 1950s, are still the proven standard in tight, long-lasting seat sealing capability. Jamesbury ball valves' unique floating ball design, together with flexible lip seat geometry, centers the ball and stores energy for low pressure sealing, and provides optimal, bi-directional seat recovery (see Figure 1). Jam seats used in competitive products cannot shift position to accommodate pressure from the ball and as a result, develop higher stress that diminishes seat recovery. Also, when pressure builds up in the body cavity due to trapped process fluid, both upstream and downstream flexible lip seats flex outward to release expanded fluids in the cavity without damaging the valve, permitting true bi-directional sealing. Again, because jam seats cannot move, they do not provide body cavity relief. This allows the pressure of trapped fluids to increase and compromise valve integrity and performance.

Additionally, Jamesbury ball valves with flexible lip seat design require considerably less torque to form a tight bi-directional seal. As a result, actuation packages can be lighter and more compact.

Ball valve seat cross-section

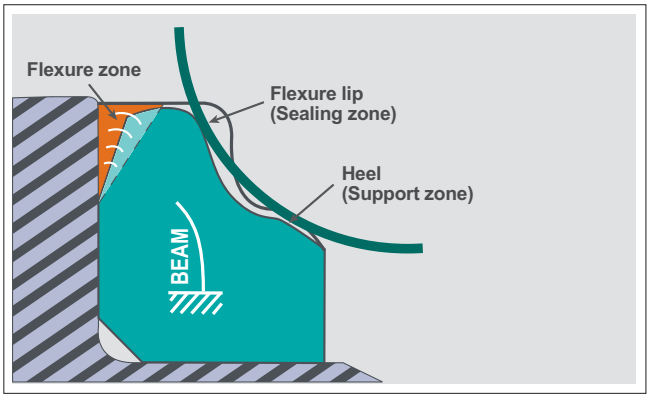


Figure 1- Flexible lip seat design: The Jamesbury Flexible Lip Seat is a unique seat lip and heel design. Deflection of the flexible lip allows the seat to store energy. The flexible lip contacts the ball in the sealing zone, while the heel supports the ball as a bearing surface. The valve body design includes a specific flexure zone that allows the seat to flex but prevents excessive movement that would cause permanent deformation.

Seat geometry: High performance butterfly valves

Flexible lip seat geometry for high-performance butterfly valves plays an equally critical role in ensuring tight sealing over extended periods. Like Jamesbury ball valves, Wafer Sphere™ high-performance butterfly valves use a flexible lip seat technology that provides full bi-directional sealing, leading to reduced costs and improved process efficiency. The seat geometry also serves to minimize permanent deflection and compensates for temperature and pressure changes (see Figure 2). No O-ring or metal components are needed for a bubble-tight seal. Adding to the superior sealing capability of the Wafer-Sphere valve – especially over the long term – is the valve's double offset disc and shaft, which pulls entirely away from the seat when opened (see Figure 3).

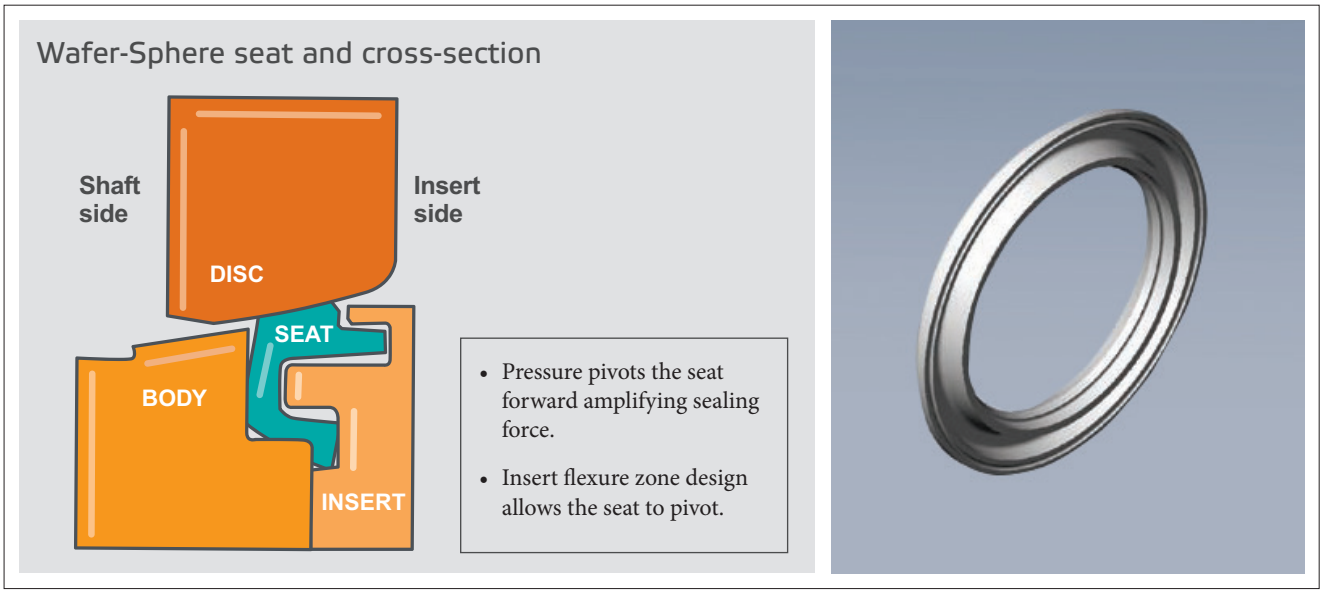


Figure 2 - Performance under pressure: When assembled, the Wafer-Sphere's flexible lip seat is energized by the disc, allowing bubble-tight sealing. On the insert side of the valve, flow pressure pivots the seat forward, amplifying sealing force. On the shaft side, the spherical seat profile creates a tighter seal as pressure pivots the seat against the insert.

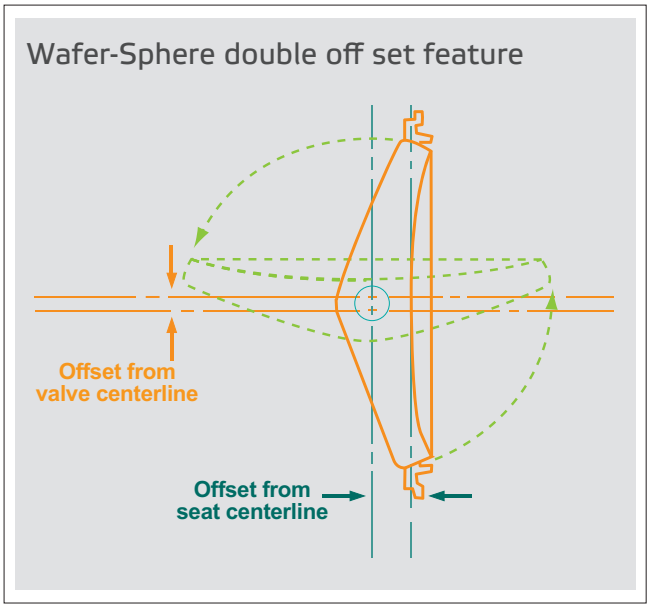


Figure 3 - Offsetting seat wear: One of the most innovative and proven features of the Jamesbury Wafer-Sphere high-performance butterfly valve is its double offset disc and shaft. The disc pulls completely away from the seat material when opened or throttling, eliminating wear.

Seat materials: Ball and high performance butterfly valves

We can see how flexible lip seat geometry effects sealing capability for Jamesbury's ball and Wafer-Sphere high-performance butterfly valves. Now, let us look at how today's advanced seat materials have redefined the whole sealing equation.

Through the years, advancements in seat materials have moved steadily in the direction of optimizing seat recovery and sustaining high recovery levels over long periods. The industry has progressed beyond materials such as PTFE and filled PTFE to include the highly engineered filled-fluorocarbon composition of Jamesbury Xtreme™® seat material. It has a lower permeability than filled PTFE that results in fewer pores and a more moldable finished surface. Xtreme greatly enhances seat recovery to deliver pressure and temperature ratings that were only achievable using PEEK seat material in ball valves and metal seats in butterfly valves (see Figure 4). And because of its excellent chemical and abrasion-resistant properties, it extends the valve cycle life for a wide range of process flow applications.

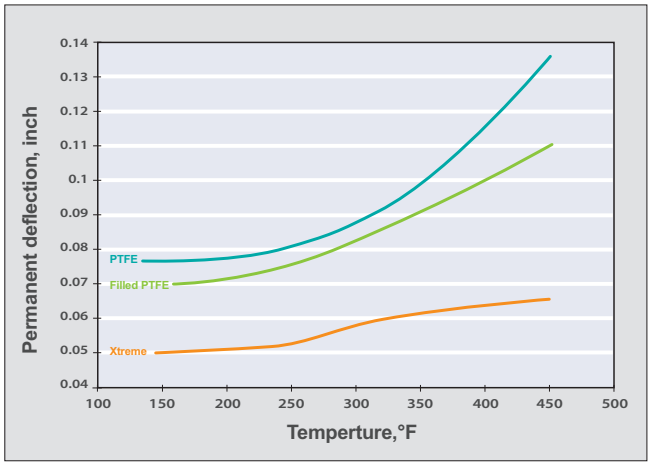


Figure 4 - Towards optimal seat recovery: The data presented in this graph was generated using a 2" Series 4000 ball valve with a 2500 lb. load. It shows that the permanent deflection of Xtreme seat material, across a wide temperature excursion, is far less than that of PTFE or filled PTFE. This underscores Xtreme's improved seat recovery and its ability to retain tight sealing performance under both pressure and temperature cycling points on the seat and dramatically increasing its service life.

Stem sealing: Ball and butterfly valves

Creating and maintaining a tight seat seal under an expanding variety of process conditions is just part of the sealing story. As process media flows through a valve, it is up to the valve assembly's stem seal to prevent leakage into the atmosphere, not only because it threatens human and environmental safety, but also because of costly downtime and maintenance concerns. Our ball and high-performance butterfly valves go through extensive testing to ensure valve stem seals perform reliably.

Jamesbury standard ball valves and high- performance butterfly valves are qualified using EPA Method 21 of the Clean Air Act to ensure emissions of no more than 100 ppm. Comparable valves on the market frequently test to up to 500 ppm. For even more stringent control of fugitive emissions, live-loaded ball valves with patented stem seal design and high-performance butterfly valves with live-loaded shaft seals, undergo strict qualification testing to consistently provide sealing performance to ISO 15848 Class BH, API 641 and TA-Luft VDI-2440. This ensures tight sealing for increased process quality, improved process uptime, a safer work environment and conformance to regulatory mandates.

When it absolutely, positively must be contained

There are valve emissions prevention technologies that incorporate additional components designed to provide an added barrier to possible leakage at the valve stem. Perhaps the most proven product available for this purpose is the Emission-Pak™ Assembly. Available on Jamesbury branded flanged ball valves ranging from ½" to 8", the assembly has a double-packed, live-loaded V-ring stem seal design, which utilizes stacked and guided spring washers to maintain a constant packing force without over-compression. A special graphite gasket on the mounting face of the Emission-Pak maintains a leak-free joint at the valve bonnet, and assures that the valve retains its API 607 fire-tested rating. The Emission-Pak Assembly provides the same live-loaded stem packing integrity for Jamesbury Wafer-Sphere high-performance butterfly valve in either lugged and wafer designs from 3" to 12".

Valve body integrity

The most dependable seat sealing solution can be totally undermined by a deficient casting. It is critical to test the valve casting for metallurgical integrity. Jamesbury valves are put through a battery of non-destructive and destructive testing procedures to ensure the sealing integrity of body castings. Besides 100% visual inspection of valve castings, other non-destructive methods include hydro-testing, full dimensional analysis and conformance to ANSI specifications. Destructive procedures such as cutaway analysis, metallurgical screening, die penentrant and burst testing ensure that process engineers can acquire valve solutions with complete confidence in the long-life performance of the valve body.

It's all about control and reliability

The ability of a valve to isolate media where needed and prevent leakage of hazardous material is at the top of the list when it comes to ensuring process safety, productivity, product quality and, ultimately, profitability.

Jamesbury branded valves through a combination of engineered designs, advanced seat materials, and rigorous material testing are an industry proven solution.

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