Trunnion Mounted Ball Valve Sealing Terminology

A Cornerstone Valve Case Study



About the Author

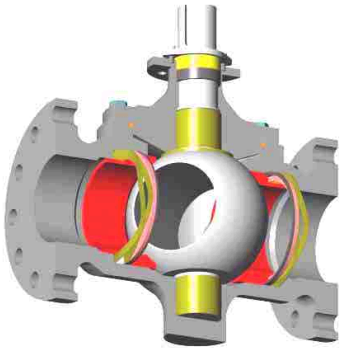
Cornerstone Valve's Application Engineer Raul Bueno serves as the technical link between Cornerstone's customers and its engineering team. He works directly with end users, EPC contractors, and distribution partners to translate process conditions into the right severe service valve solution, from initial inquiry through quotation and order.

Raul evaluates pressure, temperature, media, and cycling requirements to recommend valve type, materials, seat configuration, and actuation, and prepares the supporting torque data, general arrangement drawings, and technical submittals. His hands-on product knowledge across Cornerstone's top entry power valves and trunnion mounted designs helps customers specify valves that perform reliably in their most demanding services.

There is ongoing confusion among users and specifiers about the terms used to describe the sealing functions of trunnion mounted ball valves. The same phrase, most often “double block-and-bleed,” can mean very different valve designs depending on who uses it. This case study defines the terms clearly so specifications get the valve the service actually requires.

1. Trunnion Mounted

The ball is supported at both top and bottom and rotates about a fixed vertical axis. The bearing support areas are called trunnions. Unlike a floating ball, the ball does not move toward a downstream seat.



Trunnion Mounted Ball Valve – Cutaway

2. Upstream Sealing

Because the ball is fixed, the seats must move against it, usually through a spring preload system combined with a pressure assist. For this reason, API requires seat testing of trunnion mounted valves from the end of the valve to a center body test port, not through the valve end to end unless it is a single seated valve.

3. Bi-Directional Seats

A trunnion valve with two seats, where pressure from either side energizes its respective seat against the ball. Seat leakage can be checked through the center body test port with an appropriate fitting.

4. Self-Relieving Seats

The arrangement in a typical bi-directional valve. If one seat leaks, the opposite seat relieves when center body cavity pressure exceeds its spring preload plus any pressure assist from the low pressure side. If the center bleed is opened while the valve is closed and the leak rate is small, the low pressure seat may stay in contact with the ball with no through leakage. For that reason, some manufacturers describe their standard valve as “double block-and-bleed” when it is, in fact, only bi-directional.

5. Double Block-and-Bleed (Double Piston Seats)

Trunnion mounted valves with special double piston seats, energized both from line pressure on the upstream side and from the center body cavity. The pressurized areas are proportioned so that cavity pressure cannot overpower a seat. With an appropriate center body connection, this is a true double block-and-bleed valve.

6. Special Seat Arrangements

Seats can also be arranged so that pressure from one end energizes both seats at once, for example a standard seat on the inlet side and a double piston seat on the opposite side. Excess cavity pressure is then relieved, but only to the standard (upstream) seat side.

Term	Seats energized by	Cavity overpressure
Bi-directional / self-relieving	Line pressure on each respective side	Self-relieves past either seat
Double piston (true DBB)	Line pressure and center body cavity pressure	Requires external relief device
Standard + double piston	Inlet pressure energizes both seats	Relieves to upstream side only

> **Note on current API 6D terminology.** API 6D distinguishes double block-and-bleed (DBB), a single valve with two seats that seal against pressure from both ends with a vented cavity, from double isolation and bleed (DIB), in which each seat seals independently against pressure from a single source. The double piston designs above correspond to DIB, so specifications should name the required function explicitly.

Practical Considerations

- Some major operators always require two valves when they call for double block-and-bleed, even when a double piston single valve design is demonstrated to them.
- Torques on double piston valves are higher than on bi-directional valves, because both seats can be energized from the center body cavity.
- True double block-and-bleed valves require a device to prevent overpressurizing the center body cavity when the vent line is not open or connected. Like the vent line, this relief must be routed to a safe location, for example piped to the vent line downstream of the vent valve.

Specify Proof of Operability

Most test sequences in API 6D, API 6A, ASME B16.34, and API 598 do not require the valve to be cycled under pressure. To confirm a design is suitable, Cornerstone Valve recommends requiring the API 6A PSL 3 sequence: three hydrostatic holding periods and three seat holding periods for each seat, with the valve opened at full rated pressure at the end of each seat hold. We suggest this for all ASME Class 1500 and higher valves and for all valves in critical service. In gas service, add the same sequence using nitrogen; cycling under pressure is a common failure mode, and it is up to the user to make the manufacturer prove operability.

Conclusion

“Double block-and-bleed” is not a single design. Bi-directional, self-relieving, and double piston seats behave very differently when a seat leaks or the cavity is pressurized. By naming the required sealing function, accounting for torque and cavity relief, and requiring pressurized cycle testing, specifiers can be confident the valve installed is the valve the service requires.