Dual Ball vs. Single Valve Double Block-and-Bleed

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.

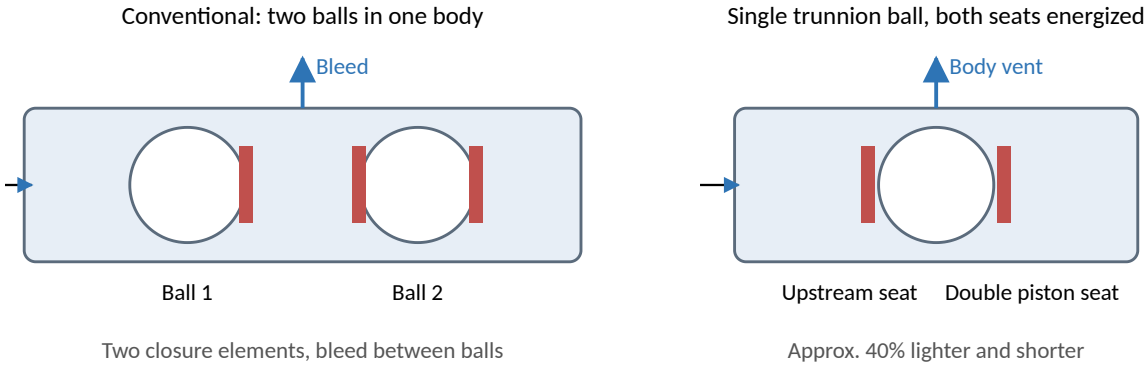
Raul evaluates pressure, temperature, media, and cycling requirements to recommend valve type, materials, seat configuration, and actuation, and prepares the supporting torque data, general arrangement drawings, and technical submittals. His hands-on product knowledge across Cornerstone's top entry power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

Double block-and-bleed isolation is often specified as two ball valves, or two balls housed in one body, with a bleed between them. A properly designed single trunnion mounted ball valve can deliver the same two-seat isolation from the pressure side while removing an entire closure element. This case study compares the two approaches and outlines the testing that should be required of either.

The Standard Dual Ball Arrangement

A conventional valve body with two balls consists of a valve inlet and a first rotating closure element (ball); an inlet seat (if trunnion mounted) and an outlet seat; a space between the first ball's exit seat and the second ball's inlet seat, where the bleed fitting is installed; and a second ball assembly followed by the valve outlet.

When the dual ball arrangement uses floating balls, each ball seals on its downstream seat, pushed there by line pressure from the upstream side. When the balls are trunnion mounted, the inlet seats are spring preloaded and pressure assisted against the balls on the upstream side. In either case, a standard arrangement offers just two seats that seal in the preferred flow direction.



Schematic comparison – dual ball body vs. single trunnion ball with both seats energized (not to scale)

The Single Valve Alternative

As an option, a trunnion valve can be designed so that the opposite (downstream) seat, as well as the upstream seat, is energized by pressure from the upstream side. A single valve then has two seats available to seal against the pressure source, the same function as two valves each sealing in one direction. The trunnion valve's center body vent performs the same function as the bleed between balls, and the bleed still sits between the two sealing elements.

The result removes the second ball without sacrificing shutoff capability, cutting roughly 40 percent from the weight of the valve assembly and shortening it by a similar amount, a significant advantage offshore and anywhere space and weight are at a premium.

Controlled Overpressure Relief

When both seats are energized, the valve can be arranged to relieve overpressure only to the high pressure side. This is done by using an upstream sealing seat on the inlet side and a double piston seat on the downstream side. Should the inlet seat leak, the outlet seat automatically energizes against the ball and shuts off, driven by pressure in the center body cavity. A double piston seat cannot be pushed back by line pressure.

Cornerstone Valve has supplied valves of this design for applications just off producing subsea wellheads and on inlet and export risers for offshore platforms, in sizes up to 26-inch Class 1500.

Prove It Works: Testing Requirements

Whichever arrangement is selected, and whoever manufactures it, the valves should be fully tested in accordance with API 6A, PSL 3. Beyond three hydrostatic body test holding periods, each seat is tested three times, and at the end of each seat holding period the valve is fully opened at its full rated differential pressure. In gas service, the cycle testing should be repeated with nitrogen or methane. Static tests alone do not prove a valve's operability.

Metal Seating Option

Metal-to-metal seating is more durable and can achieve bubble tight shutoff. If metal seats are selected, the ball coating should be upgraded from electroless nickel plating (ENP) to a hard surface coating such as nickel-boron or tungsten carbide.

Conclusion

A single trunnion mounted ball valve with an upstream seat and a double piston downstream seat provides two-seat isolation, a bleed between sealing elements, and controlled overpressure relief, at roughly 40 percent less weight and length than a dual ball assembly. Paired with API 6A PSL 3 testing that cycles the valve under full differential pressure, it gives operators verified, compact isolation for critical service.