Trunnion vs. Floating Ball Valve Designs

A Cornerstone Valve Case Study



About the Author

Cornerstone Valve's Engineering Manager Garret Cei leads the engineering team responsible for the design, development, and technical support of Cornerstone's severe service ball valve product lines. He oversees valve design and analysis, engineering documentation and change control, and the engineering processes that support Cornerstone's quality management system.

Garret works directly with end users, EPC contractors, and Cornerstone's sales team on application reviews, design calculations, actuation and torque requirements, and customer-specific engineering. His focus on sound design fundamentals and practical maintainability helps ensure that every Cornerstone valve performs reliably in the field and remains serviceable throughout its life.

Most ball valves use a floating ball design, and for general service it works well. When an application moves into severe service, however, the choice between a floating and a trunnion mounted ball becomes one of the most important decisions in valve selection. This case study explains how each design seals, where floating ball designs run into trouble, and what a trunnion design must get right to succeed.

How a Floating Ball Seals

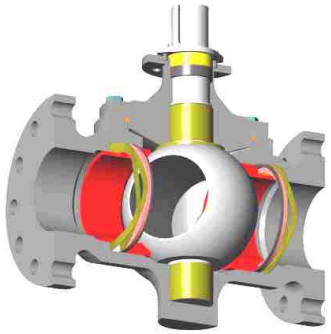
In a floating ball valve, the stem is connected to the ball by a slot or similar coupling. System pressure pushes the ball, allowing it to "float" into the downstream seat and make its seal. These are downstream sealing valves, and they are the most common ball valve design in use.

Where Floating Designs Struggle

Standard floating ball designs often encounter problems in severe service, which includes slurries, particulates, polymerization, shock, pulsation, high pressure, high temperature, and thermal cycling. Dirty services allow product to enter the cavity between the body and ball, where it can solidify, polymerize, or abrade. Pulsation can compromise shutoff, and operating torques can climb to the point where the valve can no longer be actuated.

How a Trunnion Ball Seals

A trunnion design couples the valve stem to the ball and to a lower stem, with the ball supported by upper and lower bearings called trunnions. The axis of rotation of the ball, trunnions, and stem never changes; there is no movement of the ball away from that axis. Instead, the seats are loaded against the ball and seal on its upstream side, usually with a pressure assist from upstream line pressure. Some designs provide upstream sealing on both seats and can be used in double block-and-bleed applications.



Trunnion Mounted Ball Valve – Cutaway

What a Successful Trunnion Design Requires

Trunnion mounting alone does not guarantee success. A reliable severe service trunnion design must have:

- **Proper stem sealing** to keep process media out of the bearing surface areas.
- **Special seat loading details** to maintain seat-to-ball contact across pressure and temperature swings.
- **Solids-proofing details** to prevent particles from interfering with valve operation.

Characteristic	Floating Ball	Trunnion Mounted Ball
Ball support	Held by the seats; moves with line pressure	Fixed upper and lower trunnions
Sealing side	Downstream	Upstream (loaded seats, pressure assist)
Double block-and-bleed	Not applicable	Available with upstream sealing on both seats
Severe service risk	Cavity fouling, torque growth, pulsation effects	Managed through stem sealing, seat loading, and solids proofing

Conclusion

Floating ball valves serve general applications well, but severe service exposes their limits: cavity fouling, rising torque, and compromised shutoff. A well-engineered trunnion design, with proper stem sealing, seat loading, and solids proofing, holds its axis, seals upstream, and keeps operating where floating designs cannot. Cornerstone Valve manufactures trunnion mounted ball valves engineered to these principles and has many years of experience solving difficult severe service application problems. Tell us about your application, and our engineering team will help you select the right design.