# TE4 Ball Valves for HRSG Service

## 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.

Modern heat recovery steam generators (HRSGs) operate in increasingly aggressive conditions driven by cycling duty, rapid startups, and steeper thermal gradients. Valve failures in these systems lead to extended outages, expensive hot work, and lost generation revenue. In HRSG service, valve selection is not simply a purchasing decision; it is a reliability strategy.

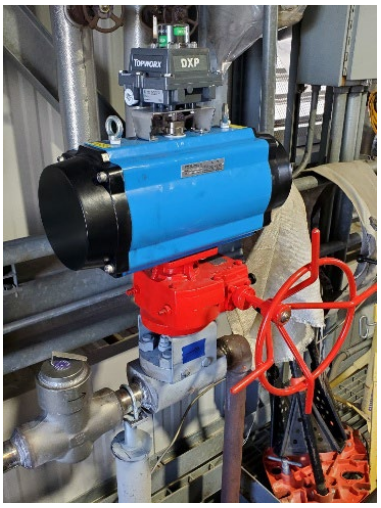
The Cornerstone Valve TE4 is a second-generation, top entry, floating ball valve engineered specifically to reduce outage risk and lifecycle cost in high-pressure, high-temperature HRSG service. Unlike conventional two-piece or three-piece welded ball valves that must be cut from the line for major service, the TE4 allows in-line internal trim replacement with no cutting, no pipe spreading, no welding, and no post-weld heat treatment (PWHT).

## The HRSG Operating Reality

**Extreme thermal cycling.** Cold starts, warm starts, and rapid ramping create differential expansion between body, trim, and bonnet, placing repeated stress on body-bonnet joints.

**High pressure and temperature.** HRSG valves see service up to ASME Class 4500 and high temperatures, where material creep and relaxation become real concerns.

**Welded-in installations.** Most HRSG valves are butt weld or socket weld, installed in tight pipe racks and surrounded by insulation. When a conventional valve fails, repair typically means cutting out the valve, pipe spreading, re-welding, PWHT, NDE, and an extended outage. This is where the TE4 fundamentally changes the risk equation.



*Cornerstone Valve TE4 – Power Service*

## TE4 Engineering Architecture

**Top entry, one-piece rigid body.** The body remains welded in-line while internal components are removed vertically through the bonnet, with no disturbance to the piping. This eliminates the largest cost driver in HRSG valve maintenance: line removal and reinstallation. The rigid one-piece construction also minimizes external leak paths, maintains alignment under pipe stress, and reduces flex-induced leakage risk.

**In-line trim replacement in about 15 minutes.** Using a Cornerstone factory trim kit, the seats, ball, and internal components are replaced in place. Seat retraction pins are included, no special tools are required, and there is no hot work, pipe spreading, welding, or PWHT. By contrast, most competing floating ball valves require full valve removal, a shop rebuild, and a multi-day outage. For operators, that means fewer outage hours, lower labor cost, lower safety risk, and a faster return to service.

**Proprietary pressure-energized metal-to-metal bonnet seal.** Conventional bolted body ball valves rely on gaskets, elastomeric seals, and torque-dependent preload that can relax, creep, and develop fugitive leakage under thermal cycling. The TE4's self-aligning metal-to-metal "memory seal" is pressure energized, so higher system pressure improves sealing integrity and thermal expansion improves contact rather than degrading it. This is particularly valuable in HP main steam isolation, bypass lines, and cycling drain systems.

**Zero leakage and emissions performance.** The TE4 is type-tested to zero bubbles seat leakage and references API 622, API 641, and ISO 15848 fugitive emissions requirements. Compared with conventional packing systems that relax under cycling, this reduces long-term emissions and compliance risk.

## Severe Service Capability

| Parameter | TE4 Capability |
|---|---|
| Sizes | ½" to 4" (larger on request) |
| Pressure class | ASME Class 150 to 4500 |
| Temperature | -50°F to +1200°F (higher available) |
| Materials | A105, F11, F22, F91, stainless, duplex, Inconel 718; HVOF and chrome carbide coatings |
| End connections | Butt weld, socket weld, RF, RTJ |
| Actuator mounting | ISO 5211 |
| Typical HRSG services | Main steam isolation, HP/IP bypass, attemperator isolation, blowdown, high-pressure drains, superheater and reheater service |

## Where the TE4 Wins

| Performance Factor | Typical Welded Ball Valve | Cornerstone TE4 |
|---|---|---|
| Line removal for major repair | Yes | No |
| Hot work required | Yes | No |
| PWHT after repair | Often | No |
| Outage duration | Multi-day | Hours |
| Bonnet seal type | Gasket-based | Metal-to-metal, pressure energized |
| Leak path risk | Higher (multi-piece body) | Reduced (one-piece body) |
| Fugitive emissions | Standard | API 622 / 641 referenced |
| Lifecycle cost | Higher | Lower |

## HRSG-Specific Risk Reduction

In combined cycle plants, a single day of forced outage can cost hundreds of thousands of dollars in lost generation. The TE4's in-line repair capability sharply reduces repair time, labor cost, safety exposure, and hot work permitting. Removing welded valves introduces fire risk, welding defects, heat distortion, schedule delays, and added inspection; the TE4 eliminates all of these for internal rebuilds. Even where the TE4's initial cost equals or slightly exceeds a competitor's, fewer and shorter outages, reduced maintenance labor, and lower emissions liability produce substantial savings over a 15 to 25 year HRSG life.

## Value Across the Project Team

- **EPC contractors:** reduced warranty risk, fewer commissioning issues, and fewer startup leaks.
- **Plant operators:** faster return to service, predictable maintenance, and lower long-term operating risk.
- **Maintenance teams:** no special tooling, no pipe modification, and no welding crews required.

## Conclusion

HRSG environments demand more than pressure containment; they demand maintainability under severe cycling. The Cornerstone TE4 solves the largest operational pain point in welded HRSG systems: the cost, time, and risk of valve removal. With a one-piece rigid body, top entry in-line serviceability, rapid trim replacement, a proprietary pressure-energized metal-to-metal bonnet seal, zero leakage performance, and high-pressure, high-temperature capability, the TE4 delivers measurable reliability and lifecycle advantages over conventional welded ball valves.