

APPLICATION GUIDE WATER-TUBE BOILERS



Improve Water-tube Boiler Safety, Efficiency, and Reliability

Realize large savings in fuel usage and emissions reductions by optimizing performance of your industrial water-tube boiler.



Industry Facts You Need to Know

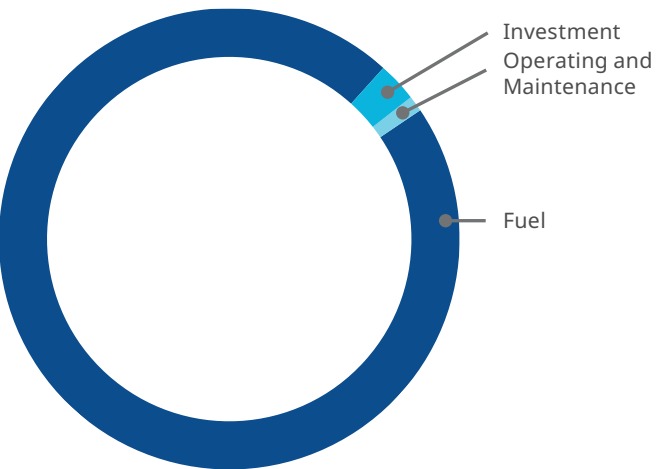
Improve Your Bottom Line

- Steam generation accounts for 40% to 50% of a chemical plant’s entire energy budget, so efficiency gains will significantly improve sustainability and profitability.
(Source: United States Department of Energy)

\$ 20 BILLION
Annual Production Losses

- ARC Advisory Group estimates that global process industries lose \$20 billion, or 5% of annual production as the result of unscheduled downtime. It is estimated that nearly 80% of these losses are preventable.
(Source: ARC Advisory Group, 2011)

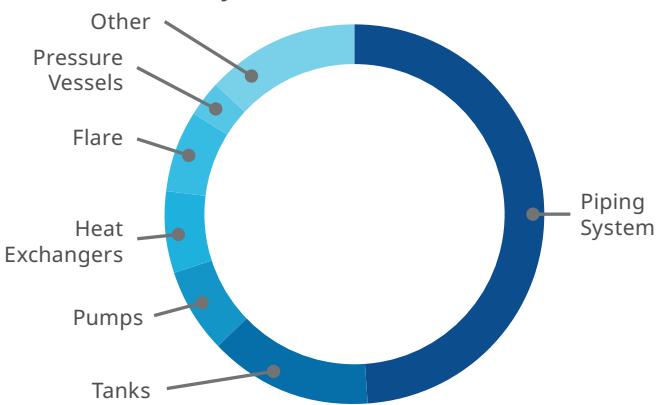
- Total Life-cycle Cost – Industrial Combustion Boilers



“The cost structure clearly demonstrates that the energy efficiency is the main cost driver.”
(Source: IEA ETSAP - Technology Brief I01 – May 2010)

Mitigate Risk – Focus On High-Incident Areas

- Process Safety Events – Points of Release



(Source: AFPM Annual Learnings Report, 2015)

- Malfunctioning Pressure Relief Valves (PRVs) can be a safety hazard if they don’t open and seat when needed.
 - When we analyzed PRV pre-test service records, we found that 20% of PRVs were leaking below 50% test pressure. On 8%, leaks were so extreme the PRV did not pop, so there was no visual indication of the leaks.
(Source: Emerson study of 10,000 PRV pre-test service records from a large North America customer)

Positively Impact Your Bottom Line by Optimizing Combustion and Steam Generation Efficiency

Creating steam is an expensive and energy-intensive process. Evaluating boiler performance offers many areas of potential improvement. Boiler efficiency gains will significantly improve sustainability and profitability.

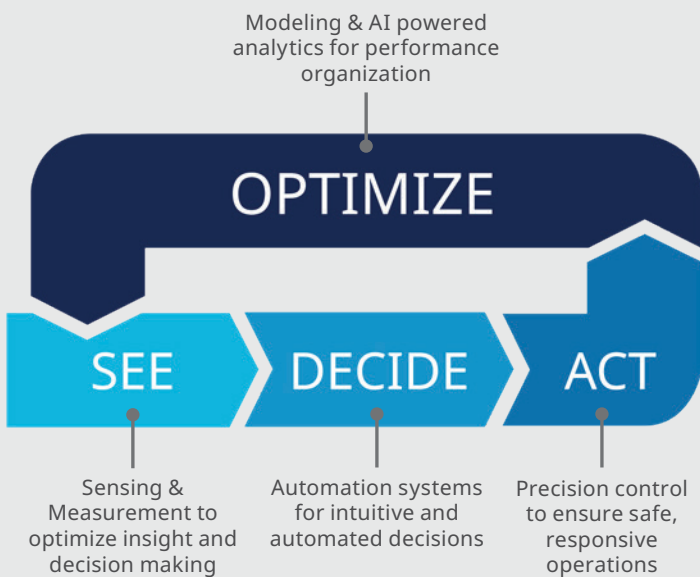


Emerson provides solutions to help you improve boiler control, which is key to achieving a safe operation, increasing reliability and optimizing performance with respect to load-change response, fuel cost and emissions. The quality of measurement instruments and valves are the foundation for building optimal control.

“Emerson’s Industrial Energy team helped overall boiler efficiency with up to a double-digit reduction in fuel usage and a significant drop in carbon levels in the ash. The boiler also operated more reliably.”
— *Engineering and Operations Teams, A Multinational Sugar Mill*

World-Class Automation Portfolio

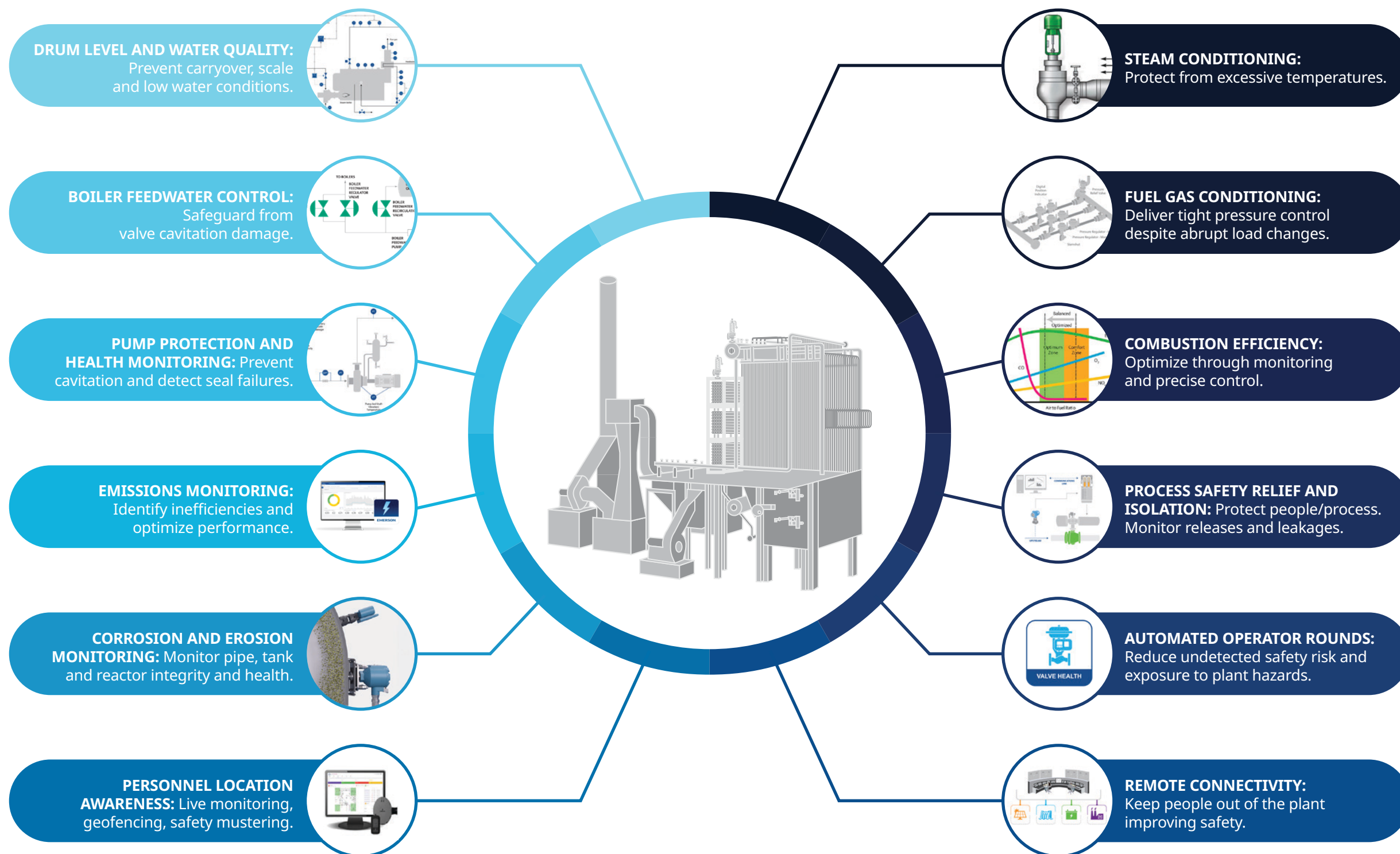
Emerson’s automation portfolio spans intelligent devices, control systems and optimization software to serve as the digital backbone and nerve center for your critical operations. Leveraging accumulated domain knowledge, automation provides important insights into what is happening in your process and provides the levers for enhancing product quality, yield, efficiency, reliability, uptime, energy efficiency, emissions intensity, regulatory reporting, asset integrity and personnel safety.



The Value of Emerson's Comprehensive Solutions

Emerson's automation technologies can help address industrial water-tube boiler and combustion process issues using a holistic improvement approach to deliver long-lasting reliability, lower costs, and optimal process performance.

Emerson is uniquely qualified to help you positively impact your bottom line through measurement and control throughout the boiler room including the deaerator, feed water, furnace, flue gas, boiler, and steam systems.



Valve Solutions

Emerson is a collaborative partner. Our team works along with you to meet your boiler performance and steam production goals.

On the next few pages, see how our valve solutions have helped customers meet their goals of:

- Reducing fuel costs and lowering emissions
- Improving reliability and reducing unplanned shutdowns
- Protecting people and equipment investments

Let's start a conversation on how our team can work with you.



Goal: Reduce Fuel Costs And Lower Emissions Solutions Featured Products

Issues	Solutions	Featured Products
Exceeding the minimum required blowdown rate increases fuel usage, emissions, make-up water costs, and chemical treatment costs.	Automate surface blowdown to optimize the blowdown rate.	 Yarway HyDrop Actuated Blowdown Valve • Controls the destructive force from the flashing high pressure boiler water through its design. • Rosemount™ 400 Conductivity Sensor and Rosemount 1056 analyzer continuously monitor the total dissolved solids level in the steam drum.
Inadequate measurement and control of heater air flow reduces combustion efficiency and increases emissions.	Optimize fuel usage and maintain stoichiometric balance by precise measurement and control of air and fuel gas flow to the boiler.	 Fisher™ ET and Vee-Ball Control Valves • Enables customers to meet precise control of air, oxygen, butane, propane and other fuels through excellent rangeability and speed-of-response. • Provides quick responsiveness to large step changes and precise control for small changes.  Bettis™ SCE300 and G-Series Damper Actuators • Enables customers to meet precise control of air, oxygen, butane, propane and other fuels through excellent rangeability and speed-of-response. • Provides quick responsiveness to large step changes and precise control for small changes.
Undetected relief events may lead to leakage or failure to reclose after a release. In addition to safety and regulatory concerns, an undetected failure may cause significant costs in energy losses that could remain unnoticed.	Monitor fuel gas relief valves and boiler safety valves.	 Anderson Greenwood™ and Crosby™ Relief Valve Monitoring • Detect leakage caused by improper valve seating and stuck-open valves. • In one of the largest refineries in the world, the alarms and health indications from the continuous online monitoring network initiated corrective actions when leakage occurred, saving over \$500K/year from leaking vent valves and PRVs. In addition, they have saved over \$200,000/year in hydrocarbon losses.



Goal: Reduce Maintenance And Unplanned Shutdowns

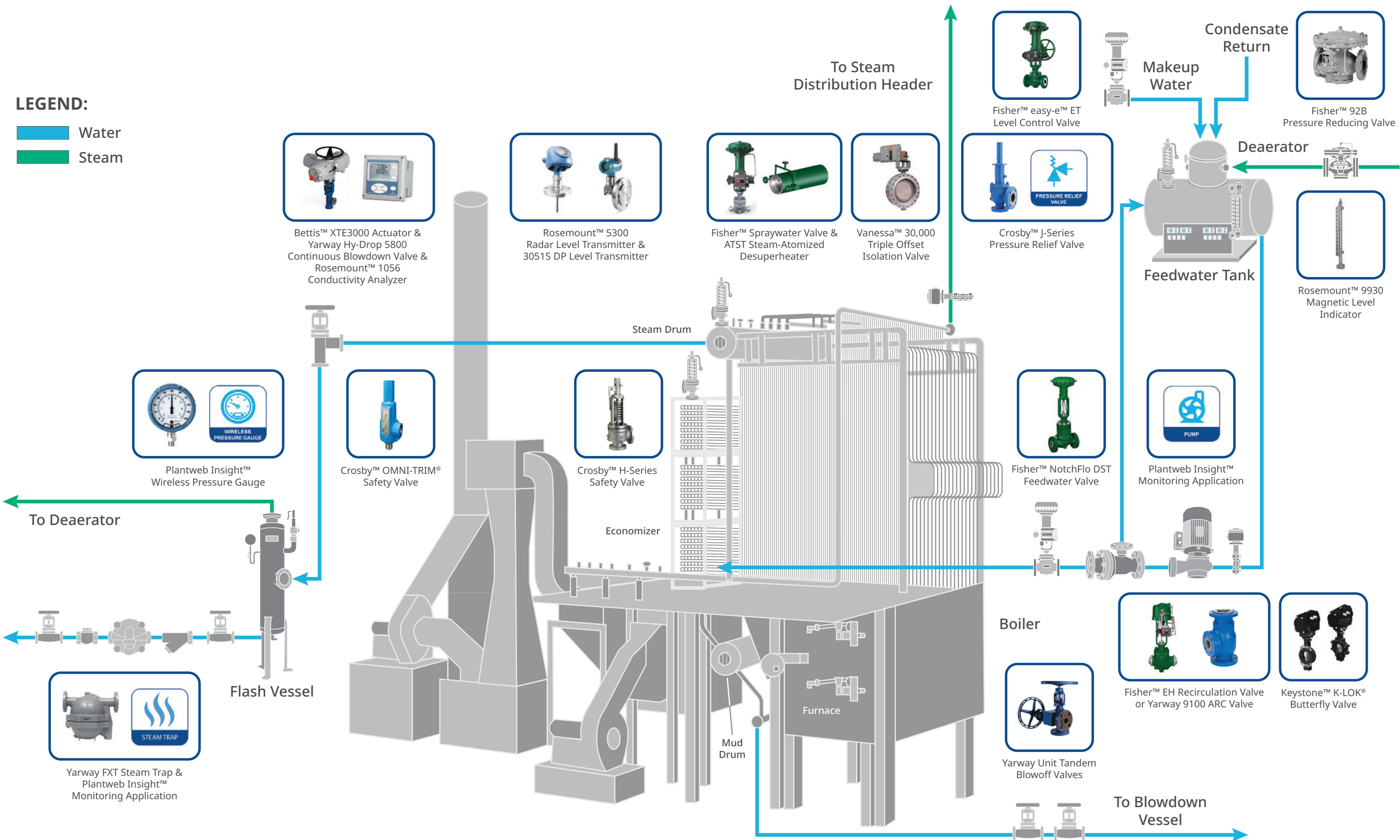
Issues	Solutions	Featured Products
Tight pressure control is a necessity in boiler fuel gas applications to prevent equipment damage. The downstream burner has high and low-pressure trip points which shut down the unit if the delivery pressure is not maintained.	Select pressure regulators with excellent accuracy and speed-of-response and design the station using overpressure and underpressure best practice.	 Tartarini™ FL Gas Pressure Regulator - Provides accurate pressure control regardless of inlet pressure variations or demand changes. - The metal plug design deflects particles and debris away from the soft-seat, which gives excellent particle erosion resistance. - Fisher and Tartarini offer an incredibly extensive range of fuel gas regulators to fit any combination of pressure and flow.
Unscheduled relief valve maintenance leads to the loss of steam and unexpected plant shutdowns.	Ensure continuous overpressure protection, with a standby spare on a single vessel penetration.	 Anderson Greenwood™ Safety Selector Valve - Continuous overpressure protection while never exceeding 3% non-recoverable pressure losses during routine or emergency servicing. - Can provide a back-up Section I safety valve for boilers.
Cavitation damage to the feedwater valve occurs due to high pressure drops causing accelerating valve leakage and potential loss of drum level control.	Guard the valve sealing surface with designs specifically designed for boiler feedwater applications.	 Fisher™ HPT Feedwater Startup and Regulator Valve with Cavitrol III Trim - Engineered to eliminate cavitation during initial operation and provide the rangeability required for smooth transition from startup through full load operation. - Emerson valve condition monitoring can further improve reliability by spotting problems before they affect your process.
Contaminated condensate return is unsuitable for boiler feedwater due to potential for corrosion and scaling on boiler tubes and distribution equipment, valves, and piping which can cause outages.	Prevent unplanned shutdowns with automated contamination monitoring.	 Fisher GX Condensate Dump Valve Used in combination with Rosemount™ 400 Contacting Conductivity Sensor and Rosemount T1056 Clarity™ II Turbidimeter sensor to prevent contaminated condensate from entering the feedwater tank.
Fluctuations in pressure and temperature in the deaerator can prevent removal of non-condensable gases in the feedwater and corrode piping and boiler tubes.	Maintain steady pressure to the deaerator to ensure de-oxygenation of the feedwater.	 Fisher 92EZ Deaerator Steam Valve Provides reliable and stable pressure control, even in dirty steam environments. Its rugged, time-proven design delivers long-lasting service, reducing maintenance costs and improving steam system efficiency.



Goal: Protect People And Investments

Issues	Solutions	Featured Products
Feedwater pumps must be protected from low flow operation. At low flow the pump can overheat, and the water flowing through the pump can separate, causing vortices that cavitate and damage the pump.	Pump protection against overheating and cavitation is gained by recirculating the minimum required amount of flow to the pump inlet.	  Fisher™ CAV4 Recirculation Control Valve - Specially designed solution for boiler feedwater pump recirculation, with the capability to handle up to an 8,000 psi pressure drop. Yarway Automatic Recirculation Valves - Protect your centrifugal pumps against thermal damage and destruction with reliable, self-contained, and low maintenance automatic recirculation control valves.
In both normal operation and emergencies, isolation valves must quickly and completely isolate affected areas to prevent equipment damage and ensure safety.	Leverage the correct technology, tailored to the application conditions.	  Feedwater Isolation Valves - Emerson's comprehensive range of KTM™ ball, Keystone™ butterfly, and Sempell gate valves suit a wide variety of applications including feedwater isolation. Vanessa™ Triple Offset Isolation Valves for Fuel Gas and Steam Isolation - Outperforms traditional valves with increased durability, reliability and lower ownership cost. The seat of the triple offset valve is designed to minimize wear, provide lower maintenance cost and extend service life.
During emergencies, safety relief valves are relied on to protect equipment and people from an incident. In normal operation safety relief valves must maintain tight shutoff.	Protect your assets from overpressure protection with reliable safety valves.	  Crosby™ and Sempell™ Boiler Safety Valves - High capacity, high pressure valves excel in drum, superheater, and reheater applications. Anderson Greenwood™ and Crosby Safety Valves - Anderson Greenwood 5200 economizer safety valve provides premium performance for mixed phase. - The Crosby JOS-E safety valves have a versatile and rugged design making them a proven solution for feedwater tank, feed booster pump, make-up water, flash tank, and blowdown tank applications. - Anderson Greenwood 400 Series gas safety valves offer best-in-class seat tightness to eliminate fugitive emissions during normal operation
Superheated steam can reach temperatures that exceed ratings of equipment like the boiler or turbine.	Control the superheated steam temperature to safe levels.	 Fisher and Sempell Steam Conditioning Valves Fisher offers a wide breadth of technologies designed to handle even the most severe steam conditioning and desuperheating applications.

Emerson Water-Tube Boiler Application Map



Please contact your Emerson sales representative to discuss solutions to meet your goals.

Emerson's Automation Portfolio

The broadest range of measurement and control technologies for industrial water-tube boilers.



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