



Armstrong®

GLOBAL EXPERTISE FOR THE
HOSPITALITY INDUSTRY

INTELLIGENT SOLUTIONS FOR YOUR GUEST ROOMS, MECHANICAL ROOMS, KITCHENS AND LAUNDRY FACILITIES

From major international hotel chains to Caribbean island resorts and a seven-star luxury hotel in India, some of the world's most respected names in hospitality have turned to Armstrong as their trusted thermal utility partner. We're global leaders in energy management and our experts understand the systems, requirements and complex issues your industry faces every day. Solving your problems and making things easier for you is the reason we're here.

ENGINEERED FOR THE HOSPITALITY INDUSTRY'S MOST DIFFICULT CHALLENGES

Armstrong brings you rugged, dependable products, state-of-the-art technology, and custom-engineered systems. We have solutions to satisfy your industry's most unique requirements for: steam and condensate, hot water, air quality and humidification, Legionella and scalding risk reduction, electricity generation, wastewater treatment, reverse osmosis for incoming water, and more. Armstrong experts can also provide 24/7 on-site staffing and supervision to operate and maintain your entire utility infrastructure.

ARMSTRONG DOES IT ALL

We can optimize your current thermal utility infrastructure, as well as design and implement complete, optimal systems for your new or existing facilities. Our on-site specialists will work with you on day-to-day maintenance, repair, and overhaul activities to keep everything running smoothly and efficiently.

For more information, or to find an Armstrong representative near you, visit armstronginternational.com/hospitality.

ON THE FOREFRONT OF TECHNOLOGY AND INNOVATION

Often the first to market, Armstrong holds more than 70 patents on exceptional products and software. Armstrong invented the Inverted Bucket Steam Trap and introduced digital water temperature control to the world with The Brain®. We brought you SAGE®, the most advanced monitoring and documentation software available, and our proprietary efficiency methodology was the first to be approved for international trading of resultant carbon dioxide (CO2) under the Kyoto Protocol. These are just a few of the many state-of-the-art tools and solutions found only at Armstrong.

ABOUT ARMSTRONG INTERNATIONAL

Founded in 1900, Armstrong International is a privately held, fifth-generation, family-owned company. Our unique heritage of knowledge, experience and insight reaches back more than a century, enabling us to serve you in ways no one else can.

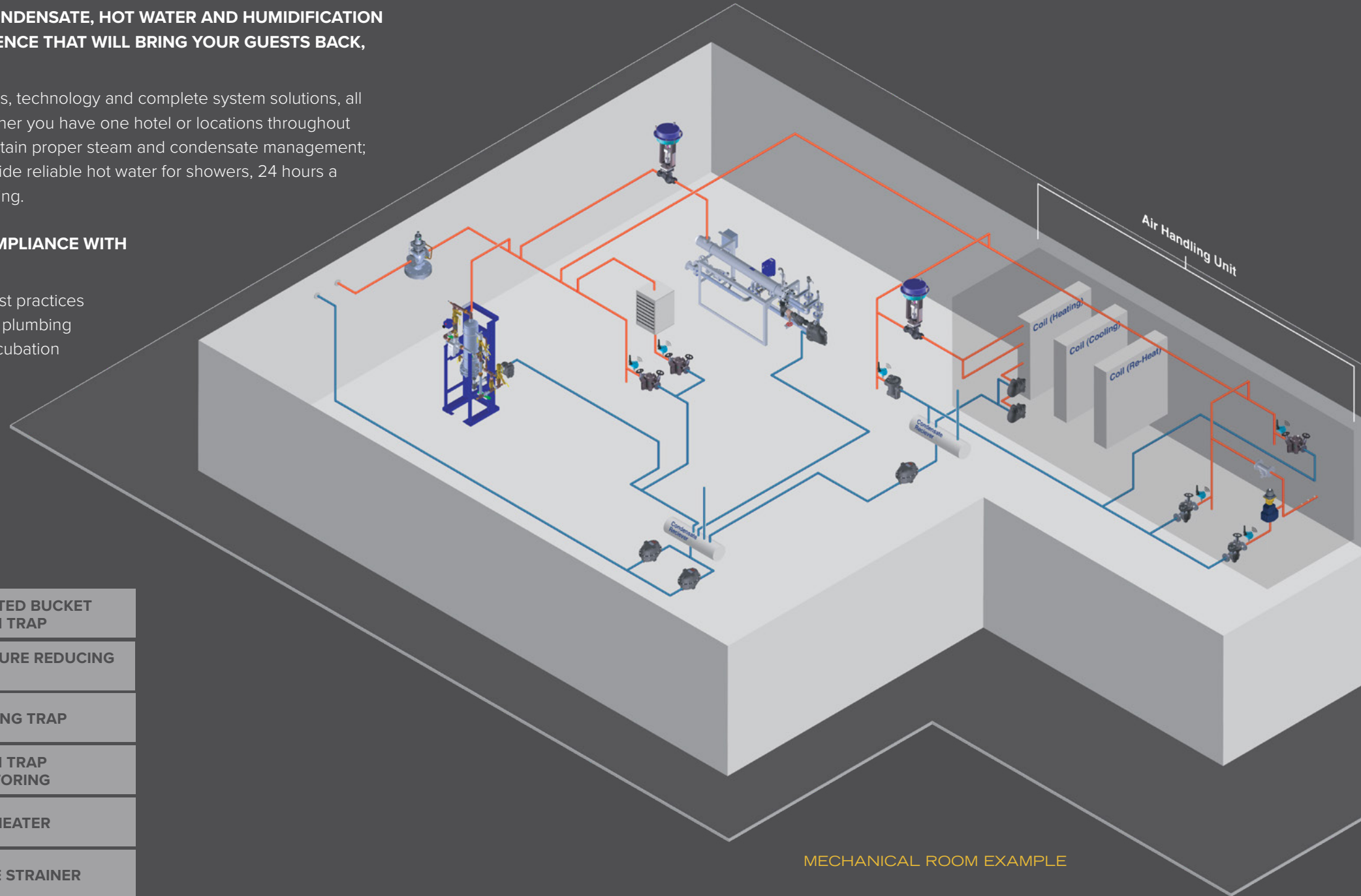
INCREASE GUEST SATISFACTION AND SAFETY

CUSTOM SYSTEM SOLUTIONS IN STEAM, CONDENSATE, HOT WATER AND HUMIDIFICATION TO ENSURE A SAFE, COMFORTABLE EXPERIENCE THAT WILL BRING YOUR GUESTS BACK, AGAIN AND AGAIN













Armstrong offers a vast range of equipment, tools, technology and complete system solutions, all built for best-in-class quality and durability. Whether you have one hotel or locations throughout the world, we can help you: implement and maintain proper steam and condensate management; improve humidity levels and air quality; and provide reliable hot water for showers, 24 hours a day, at consistent temperatures to prevent scalding.

BETTER WAYS TO ENSURE CONSISTENT COMPLIANCE WITH REGULATIONS AND STANDARDS OF CARE

Our specialists will work with you to establish best practices and address critical issues in mechanical rooms, plumbing systems, hot water tanks and heaters—where incubation of Legionella bacteria most commonly occurs. We're experts in helping you comply with regulations and Standards of Care, such as OSHA, ASHRAE, VA and World Health Organization.



MECHANICAL ROOM EXAMPLE

	CONTROL VALVE		INVERTED BUCKET STEAM TRAP
	DIGITAL RECIRCULATING VALVE		PRESSURE REDUCING VALVE
	DOMESTIC HOT WATER HEATER		PUMPING TRAP
	FLOAT AND THERMOSTATIC TRAP		STEAM TRAP MONITORING
	HUMIDIFIER		UNIT HEATER
	HW HEATERS FOR BUILDING HEATING		Y-TYPE STRAINER

ASHRAE Guideline 12-2000

4.1.6 RECOMMENDED TREATMENT

Hot water stored above 140°F (60°C), minimum recirculated return 124°F (51°C).

ASHRAE Standard 188-2015

6.1.7 DOCUMENTATION & RECORDKEEPING

Establish documentation and maintain records.

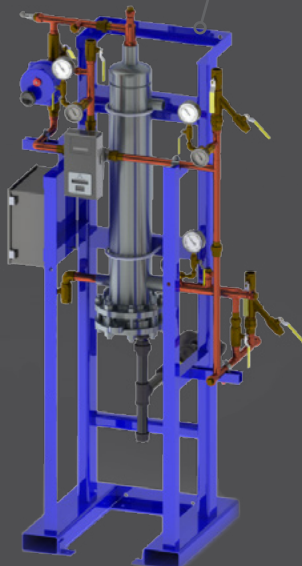
STANDARDS OF CARE TO REDUCE RISKS OF LEGIONELLA AND SCALDING

A Standard of Care is defined as acknowledged applicable laws, standards and guidelines. Following the appropriate Standard of Care can minimize the risk of Legionella-related illness and scalding injuries.

OSHA (1998), Joint Commission Environment of Care (2001), ASHRAE Guideline 12-2000, ASHRAE Standard 188-2015 and VA Directive 1061 (2014) are Standards of Care which include critical recommendations for establishing and monitoring hot water system temperature control limits.

LEGIONELLA AND LEGIONNAIRES' DISEASE

Legionella is a type of bacteria that can cause a severe, often lethal form of pneumonia known as Legionnaires' disease in persons at risk. Within the last decade, Legionnaires' disease has been reported throughout the world. Outbreaks have been linked to buildings with large or complex water systems that are improperly maintained. The potable water systems of hotels and other facilities are major sources of Legionella, and it is most often found in hot water tanks and heaters, large plumbing systems, faucets and showers, hot tubs, whirlpool spas, decorative fountains and water features, and cooling towers (air conditioning units).



Range Health System

HOT WATER SYSTEM SUMMARY REPORT

Range Health System Location	DRV80	Range Health System Equipment ID
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Overall Diagnostics
As calculated from 2015 system checks:

Setpoint	125°F		
Mixed Water Supply	123°F	125°F	126°F
System Return	119°F	124°F	125°F
Hot Water Supply	130°F	140°F	146°F
	Minimum	Average	Maximum

Service Life

Commissioned Date	2012-Apr-28	Days In Service	1602	Warranty Days Remaining	223
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System Performance Record

ASHRAE Standard 188-2015

6.1.3 CONTROL LIMITS

Establish limits within which a chemical or physical parameter must be monitored and maintained.

ASHRAE Standard 188-2015

6.1.4 MONITORING

Establish a system for monitoring the parameters associated with the control limits established in 6.1.3.





IMPROVE UTILITY PERFORMANCE, EFFICIENCY AND ENERGY SAVINGS

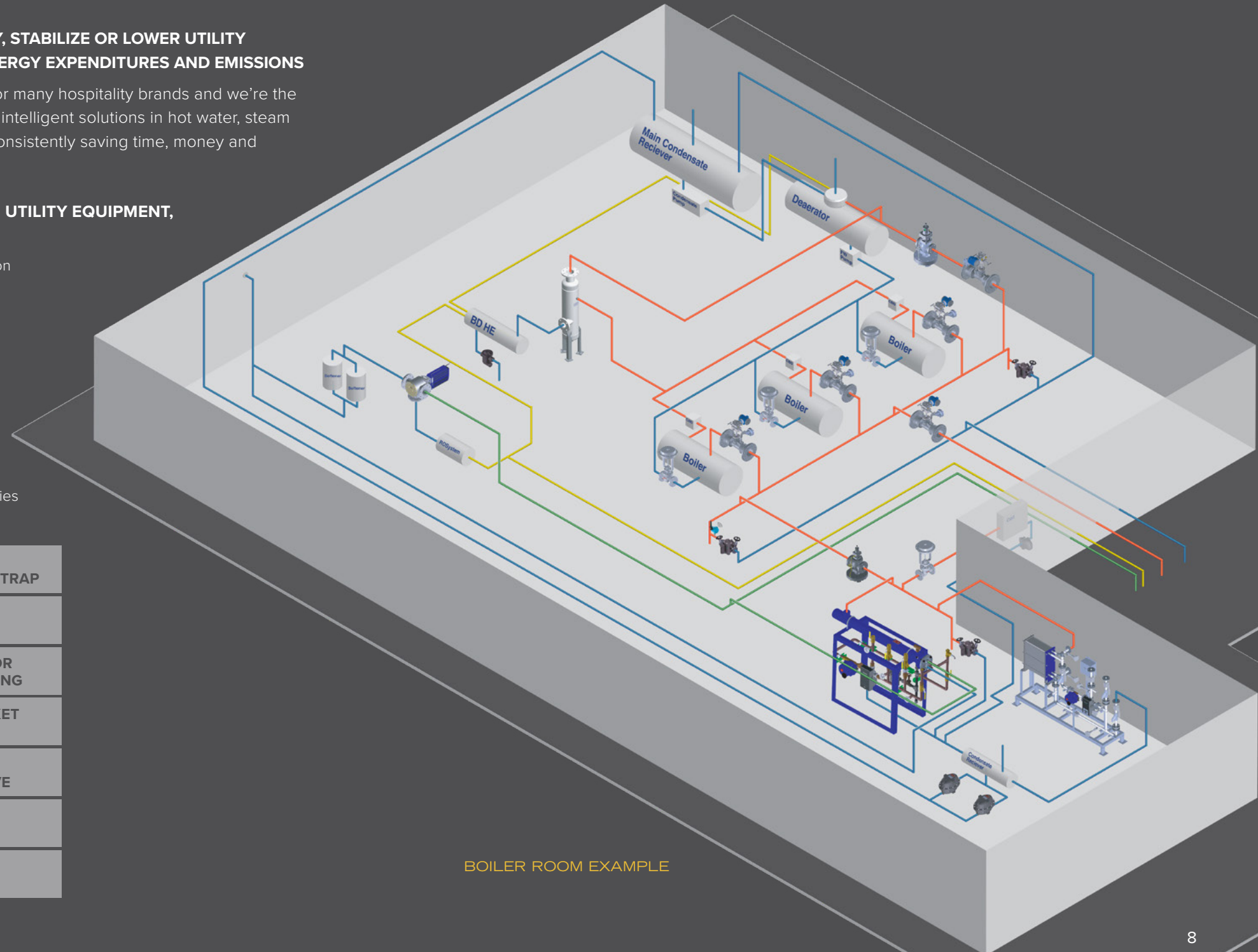
WE'LL HELP YOU MAXIMIZE EFFICIENCY AND SAFETY, STABILIZE OR LOWER UTILITY EXPENSES, AND ACHIEVE GOALS FOR REDUCING ENERGY EXPENDITURES AND EMISSIONS

Armstrong is swiftly rising as the international standard for many hospitality brands and we're the thermal utility partner for several major hotel chains. Our intelligent solutions in hot water, steam and condensate, and conditioned air are hard at work, consistently saving time, money and energy for institutions of all sizes, throughout the world.

WE OFFER A COMPREHENSIVE RANGE OF THERMAL UTILITY EQUIPMENT, TOOLS AND SERVICES

- | Instantaneous and semi-instantaneous hot water generation
- | Digital water temperature control
- | Precision-controlled humidification
- | Effective steam trapping and condensate removal
- | Cutting-edge software for smart steam and hot water system management
- | Wireless steam trap monitoring in real time
- | Industry-leading flow measurement
- | Complete, on-site operation and maintenance of your utilities

	AIR HEATING COILS		FLOAT AND THERMOSTATIC TRAP
	BACK-PRESSURE CONTROL VALVE		FLOW METER
	DIGITAL CONTROL VALVE		HW HEATERS FOR BUILDING HEATING
	DIGITAL RECIRCULATING VALVE		INVERTED BUCKET STEAM TRAP
	DOMESTIC HOT WATER HEATER		PRESSURE REDUCING VALVE
	FEED WATER CONTROL VALVE		PUMPING TRAP
	FLASH TANK		STEAM TRAP MONITORING



BOILER ROOM EXAMPLE

MONITORING, MEASURING AND AUDITING THAT DELIVERS WORLD-CLASS ACCURACY

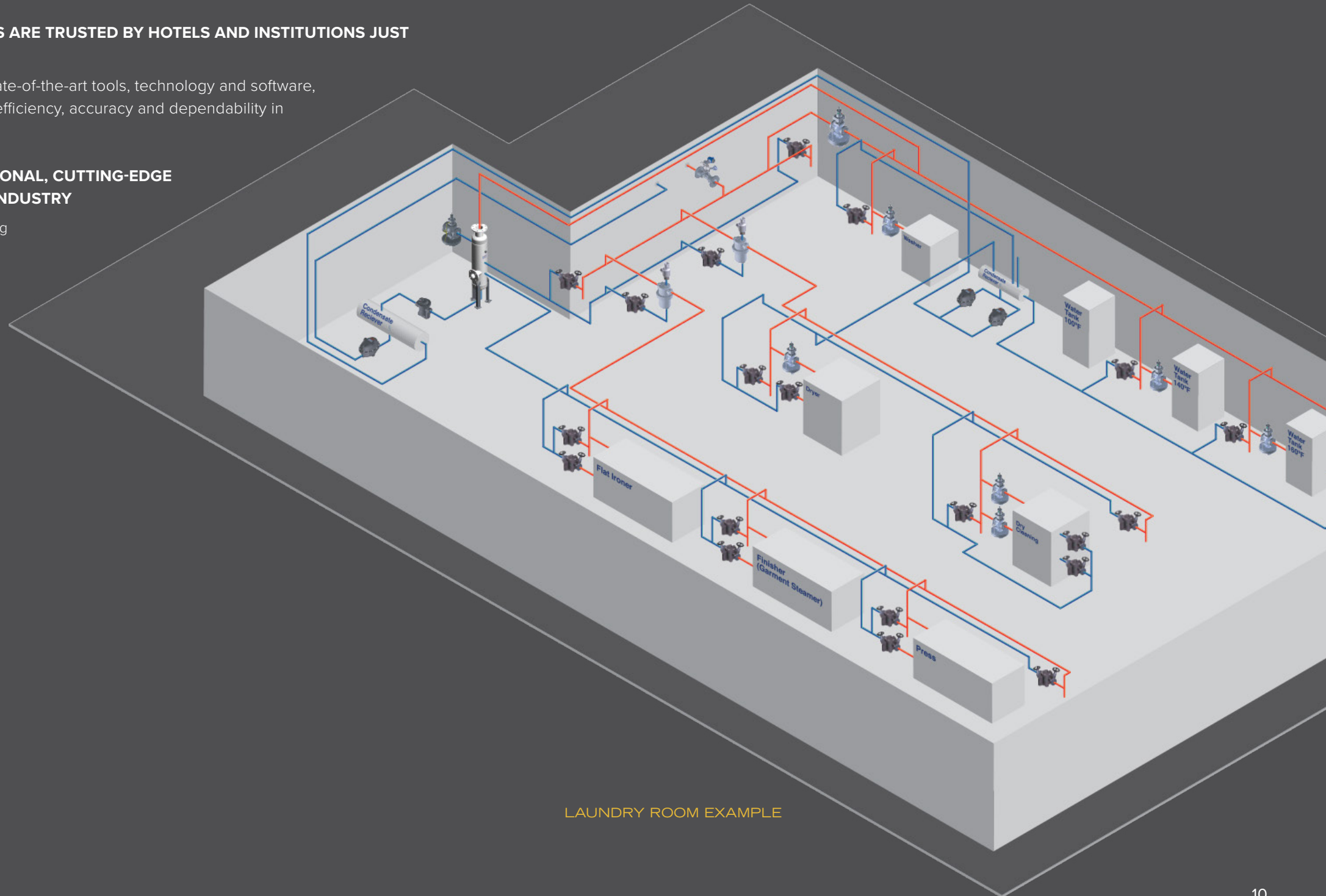
OUR INDUSTRY-LEADING SOLUTIONS ARE TRUSTED BY HOTELS AND INSTITUTIONS JUST LIKE YOURS, ALL OVER THE WORLD

Armstrong offers a complete array of state-of-the-art tools, technology and software, all engineered to provide unparalleled efficiency, accuracy and dependability in every application.

TURN TO ARMSTRONG FOR EXCEPTIONAL, CUTTING-EDGE SOLUTIONS FOR THE HOSPITALITY INDUSTRY

- | Wireless, real-time steam trap monitoring
- | Automatic steam quality monitoring
- | Flow meters for gas, water and steam
- | Smart steam and hot water system monitoring, measuring, reporting and documentation

	AIR VENT / VACUUM BREAKER
	BACK-PRESSURE CONTROL VALVE
	FLASH TANK
	FLOW METER
	INVERTED BUCKET STEAM TRAP
	PRESSURE REDUCING VALVE
	PUMPING TRAP
	STEAM SEPARATOR



LAUNDRY ROOM EXAMPLE

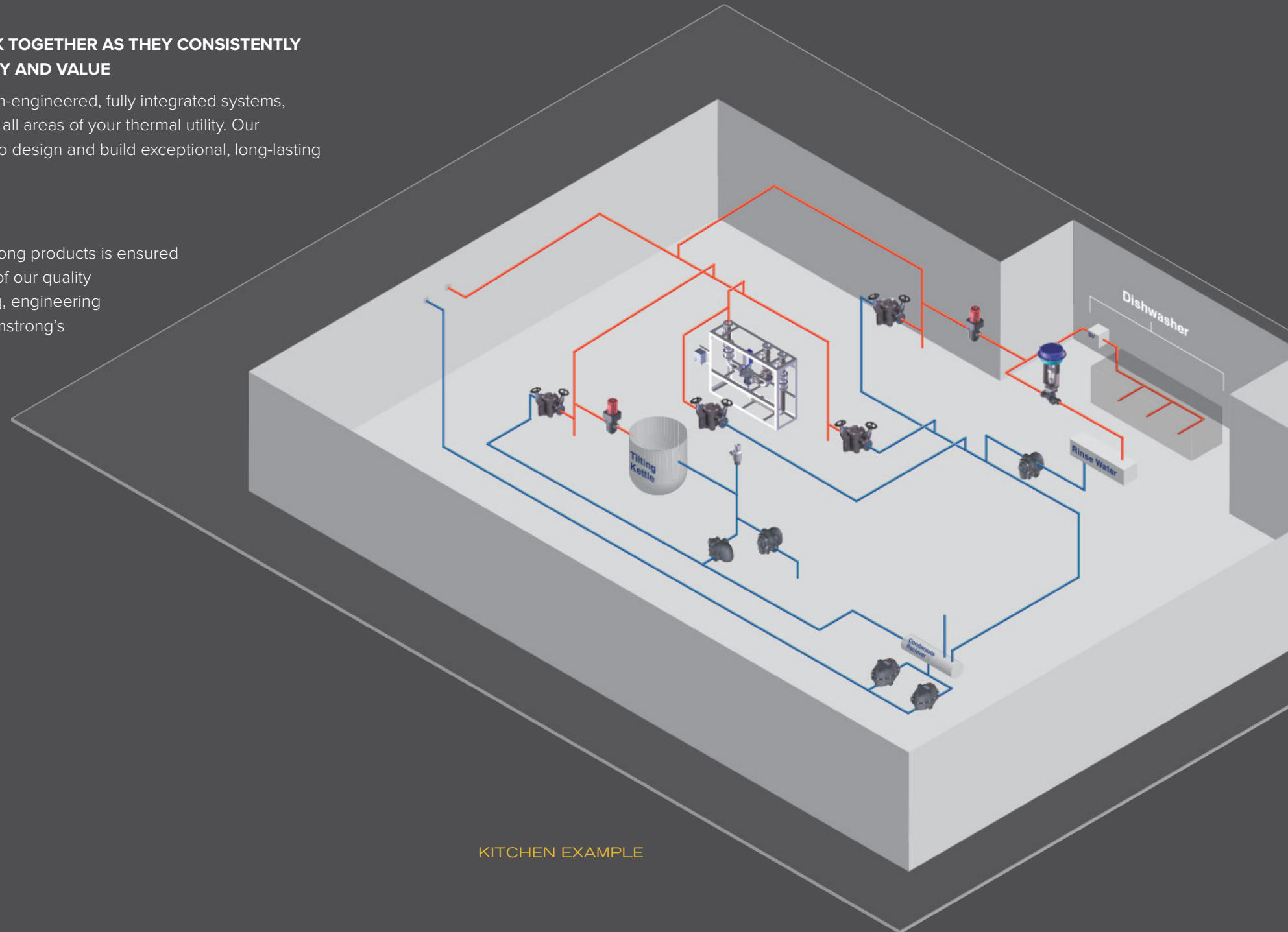
RUGGED, DEPENDABLE, HARDWORKING PRODUCTS

ARMSTRONG'S PRODUCTS ARE DESIGNED TO WORK TOGETHER AS THEY CONSISTENTLY PROVIDE OUTSTANDING PERFORMANCE, LONGEVITY AND VALUE








From single, state-of-the-art products to complete, custom-engineered, fully integrated systems, Armstrong provides the intelligent solutions you need for all areas of your thermal utility. Our extensive manufacturing strength and flexibility allow us to design and build exceptional, long-lasting equipment that meets your exact requirements.

BEST-IN-CLASS QUALITY

The unwavering reliability, safety and efficiency of Armstrong products is ensured by our stringent quality control and the rigorous support of our quality assurance and supply chain, as well as our manufacturing, engineering and maintenance teams. Our products are backed by Armstrong's distinctive technical support, and our digital monitoring technology enables us to perform real-time evaluations on many products.



KITCHEN EXAMPLE

	AIR VENT / VACUUM BREAKER
	FLOAT AND THERMOSTATIC TRAP
	INVERTED BUCKET STEAM TRAP
	MIXING VALVE
	PRESSURE REGULATOR
	PUMPING TRAP
	TEMPERATURE CONTROL VALVE

DOMESTIC HOT WATER GENERATION AND DIGITAL WATER TEMPERATURE CONTROL

GROUNDBREAKING SOLUTIONS TO REDUCE YOUR RISKS FOR LEGIONELLA-RELATED ILLNESS, SCALDING INJURY AND ASSOCIATED LITIGATION

Armstrong’s hot water solutions are designed to reduce risks for the growth and spread of Legionella and other opportunistic pathogens in building water systems, while preventing injuries from scalding. Our experts can help you meet ASHRAE, OSHA and other industry standards with hardware to guide your compliance, and accurate monitoring and documentation software that enables you to prove it. The Brain® and SAGE® are the first barriers to Legionella and essential to the prevention of Legionnaires’ disease.

THE BRAIN® DIGITAL RECIRCULATING VALVE (DRV)

As a stand-alone DRV or a pre-piped digital mixing center, The Brain® simplifies your hot water system to deliver unparalleled accuracy, stability and safety. Designed to improve the performance of hot water systems using all types of water heating technologies, The Brain® provides programmable temperature alerts and a platform to promote compliance with recommended Legionella guidelines.

PERFORMANCE

- | +/- 2°F / 1°C control
- | 1°F / 1°C minimum system temperature loss

FEATURES

- | Component self-diagnostics
- | Programmable set point and alerts
- | Programmable thermal disinfection

SAFETY

- | Over temperature shutoff
- | Power failure shutoff
- | Emergency mode



SAGE® SMART HOT WATER SYSTEM MONITORING AND DOCUMENTATION

This fully integrated software tool brings you the next level in smart hot water system monitoring and reporting. SAGE® works seamlessly with all our real-time monitoring products, including The Brain®, as it analyzes data to track behavior and performance—ensuring a consistent supply of hot water at precision-controlled temperatures, as well as full compliance with ASHRAE, OSHA, VA and World Health Organization hot water system safety guidelines and requirements. By providing regular updates and real-time alerts, SAGE® keeps you informed, 24 hours a day. Armstrong’s digital hot water solutions are all available SAGE®-enabled.

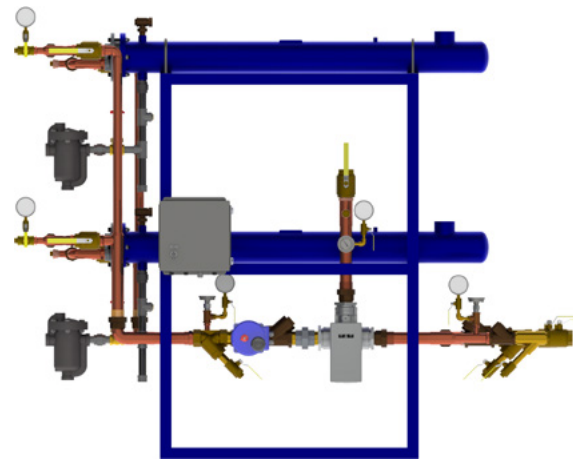
SAGE® offers simple, effective monitoring, logging and remote alerting of key temperature control components of a hot water system safety risk management plan, for a modest monthly fee.

FEATURES

- | Dashboard monitoring in real time
- | Secure remote programming you control
- | Multi-location view of all properties, simultaneously or filtered
- | Temperature and system diagnostic alerts in real time
- | Digital documentation and recordkeeping, retain as needed

CONNECTIVITY

- | Integral Modbus RTU interface (The Brain®)
- | SAGE® building system interface module
- | Web-enabled
- | Modbus, BACnet™ and LonWorks



DIGITAL-FLO® INSTANTANEOUS AND SEMI-INSTANTANEOUS WATER HEATERS

Armstrong's industry-changing series of water heaters achieves a level of hot water system temperature control accuracy previously considered unattainable. All Digital-Flo® Water Heaters feature our revolutionary digital water temperature control technology, The Brain® Digital Recirculating Valve (DRV), and come SAGE®-enabled.

Digital-Flo® is available in Steam to Water, Steam to Water Vertical, and Boiler Water to Water solutions.

THE BRAIN® AND SAGE®

SAGE® works seamlessly with The Brain® as it analyzes data to track behavior and performance as an integral component of a hot water system operation protocol which complies with a Standard of Care that minimizes risks of scald injury, Legionella-related illness and other hospital-acquired infections, and the associated litigation. Regular updates and real-time alerts keep you fully informed, 24 hours a day, helping to ensure compliance with VA, ASHRAE and WHO guidelines. Armstrong's digital hot water solutions are all available SAGE®-enabled.

DIGITAL-FLO® AND THE BRAIN®, WITH SAGE®

Combining our tankless hot water generation (Digital-Flo®) and our temperature control hardware (The Brain®) with our cloud-based, smart monitoring and documentation software tool (SAGE®) results in a complete, factory-integrated hot water system solution—found only at Armstrong.

STEAM AND CONDENSATE MANAGEMENT

MORE THAN 118 YEARS OF KNOWLEDGE AND EXPERIENCE ENABLES US TO MANAGE YOUR STEAM AND CONDENSATE BETTER THAN ANYONE IN THE WORLD

Armstrong has more than a century of in-depth expertise, enabling us to manage your steam and condensate requirements more effectively than anyone in the world. Our specialists can help you monitor steam traps and steam dryness fraction; ensure that your steam traps are properly sized, selected and in working order; and deaerate and maintain condensate at appropriately high temperatures.

EFFECTIVE STEAM TRAPPING FOR THE HOSPITALITY INDUSTRY

Whatever the application, Armstrong has the steam trap you need. Our traps are engineered for energy efficiency, minimal steam loss, corrosion resistance, CO2 venting, operation against back pressure, freedom from dirt problems, and long, dependable service.

CONDENSATE MANAGEMENT

Armstrong offers a full range of condensate recovery and management products and solutions, including pumps. We can help you reduce costs for: fuel and energy, boiler water makeup and sewage treatment, and boiler water chemical treatment.

ARMSTRONG OFFERS STEAM TRAPS FOR EVERY APPLICATION

- | Bimetallic superheat steam traps
- | Clean steam thermostatic steam traps
- | Disc steam traps
- | Dual orifice steam traps
- | Float and thermostatic steam traps
- | Inverted bucket steam traps
- | Steam trap options and connectors
- | Thermostatic steam traps
- | Thermostatic wafer steam trap
- | Trap valve stations

WIRELESS STEAM SYSTEM MONITORING

Our superior, groundbreaking solutions provide real-time monitoring of your critical steam trap population. You receive instantaneous notifications of any problems, enabling you to repair or replace failed traps before they create serious steam quality issues.



AIM® (Armstrong Intelligent Monitoring)—This wireless monitoring technology is built on the WirelessHART and ISA-100 communications protocols, which continuously monitors and evaluates the operating condition of steam traps and other critical equipment in your system. AIM® provides instantaneous notification in the event of steam trap or critical equipment failure.



SteamEye®—SteamEye® uses a proprietary radio frequency (RF) wireless transmitter mounted at the inlet of any type of steam trap to detect temperature and ultrasonic fluctuations in steam flow. In the event of steam trap failure, a signal is sent to a central receiver, alerting system operators that maintenance is required.

SAGE® SMART STEAM SYSTEM MANAGEMENT

SAGE® keeps you fully informed, 24 hours a day with regular updates, precise documentation, custom-filtered reports, and real-time alerts notifying you of any problems. This powerful software calculates steam loss data and reports it using Armstrong’s proprietary, UNFCCC-approved, steam system efficiency methodology.

SAGE® works seamlessly with all of our real-time monitoring products including SteamEye® and AIM®, ensuring that it always has access to the most current data.

SAGE® WORKS HARDER TO MAKE YOUR LIFE EASIER

- | Survey steam traps quickly and accurately with SAGE® Mobile
- | Accessible on tablets, laptops and PCs
- | Maximize your equipment’s reliability, efficiency and safety
- | Real-time dashboard monitoring
- | Customizable user experience
- | Secure remote programming
- | Multi-location view

PRESSURE REDUCING VALVES (PRVS)

Armstrong can help you manage your steam, air and liquid systems safely and efficiently with pressure reducing valves (PRVs) and temperature regulators to maintain constant pressure or temperature for process control, for uninterrupted productivity.

HUMIDIFICATION AND CONDITIONED STEAM EQUIPMENT

LEADING-EDGE DESIGN, MANUFACTURING AND APPLICATION OF HUMIDIFICATION AND CONDITIONED STEAM EQUIPMENT FOR HOSPITALITY ORGANIZATIONS OF ALL SIZES, WORLDWIDE

Armstrong’s energy-efficient, cost-effective solutions consistently deliver the clean, reliable, precisely controlled humidification necessary for reducing static discharge and achieving a pleasant, comfortable environment for your guests and staff.

HUMIDICLEAN™ HUMIDIFIERS

HumidiClean™ electric and gas-fired humidifiers feature replaceable, ionic bed inserts. This remarkable technology provides more efficient and safe operation, increased energy savings, and close to maximum output throughout their service life.



HUMIDIPACK® STEAM DISPERSION PANELS

This prefabricated steam humidifier system is ready for insertion in the duct. Armstrong HumidiPack® offers simplified installation, corrosion-resistant stainless steel, reduced heat gain to duct air, and compatibility with many steam sources. The HumidiPack® Family includes a variety of sizes and configurations to meet new installation or retrofit needs.



SERIES 1000 STAINLESS STEEL DIRECT STEAM HUMIDIFIERS

Armstrong offers Series 1000 steam-separator humidifiers for use in sensitive environments where pure demineralized, deionized or distilled water is used to generate clean steam. Wetted parts of the humidifier package are stainless steel, minimizing the carryover of impurities created by this highly corrosive water.



FLOW MEASUREMENT TECHNOLOGY

OUR STATE-OF-THE-ART FLOW METERS DELIVER OUTSTANDING ACCURACY AND RELIABILITY FOR GAS, LIQUID OR STEAM

Armstrong provides a full line of differential pressure flow elements and vortex meters, including VERIS Accelabar®—our proprietary meter that doesn't require any straight pipe lengths for installation. Other flow measurement solutions include the Armstrong ASME Flow Nozzle and Armstrong Orifice Plate.

VERIS ACCELABAR®

In a class of its own, this highly accurate flow measurement device has a patented no-straight-pipe installation requirement. VERIS Accelabar® provides exceptional versatility, with turndown capabilities over a large range of flow rates.



VERIS VERABAR®

VERIS Verabar® is the most accurate, reliable and advanced averaging pitot tube on the market today. It has a bullet shape and aerospace design principles that produce a stable flow signal with less propensity to clogging in the presence of dirt or debris.



ARMSTRONG VORTEX METER

Reliable, well-known vortex technology in a package that is easy to install and simple to operate. Armstrong inline and insertion vortex meters are capable of HART, Modbus, BacNet, or analog outputs with integral pressure and temperature compensation.



OPERATIONS AND MAINTENANCE SERVICES

ARMSTRONG IS HERE TO SOLVE YOUR PROBLEMS AND MAKE YOUR LIFE EASIER WITH OUR FULL RANGE OF EXPERT O&M SERVICES

Whether we're managing your utility system in one location, or in multiple locations throughout the world, our specialists can provide whatever you need. We offer everything from short-term supervision to ongoing management of your entire thermal utility system infrastructure, and our services can be tailored to meet your unique requirements. Armstrong can also provide training to help you manage your utility system yourself, more efficiently and safely.



ON-SITE UTILITY SYSTEM AND ASSET MANAGEMENT, OPERATIONS AND MAINTENANCE

- | On-site leadership and/or management of daily O&M activities
- | Safe, efficient utility system startups and/or shutdowns
- | Integrated on-site services for handling O&M function, which may include providing a complete staff or employment of current plant staff
- | Customized technical and safety training for all utility systems
- | Short-term O&M labor support
- | Utilities oversight, engineering support, and ongoing expert support
- | Audit and analysis of complete O&M function or specified areas
- | Project financing and management
- | Development and implementation of site-specific, best practices and procedures
- | Asset ownership and financing

ONLINE COURSES, TRAINING AND SEMINARS

ARMSTRONG UNIVERSITY ONLINE GIVES YOU EASY ACCESS TO MORE THAN A CENTURY OF IN-DEPTH KNOWLEDGE AND EXPERIENCE

Armstrong University offers online education, training and seminars, as well as on-demand webinars for the hospitality industry—all conveniently available on your computer, tablet or smartphone. Our extensive curriculum of individual courses and educational packages includes industry-specific content and learning opportunities to help you address tough, everyday issues.

CUSTOMIZED ONLINE COURSES

Armstrong University can tailor an online curriculum for the needs of your organization—to be delivered at your site or one of our global learning centers, whichever is most convenient.

INTRODUCTORY, INTERMEDIATE AND ADVANCED COURSES

Choose from more than 145 online courses in steam and condensate, humidification, hot water, Legionella prevention, water treatment, refrigeration, flow measurement, environmental health and safety, and more. Courses that qualify for Continuing Education Units (CEUs) are also available. Our coursework was developed by energy and thermal utility system specialists and leading technical experts with over 2,000 years of collective, practical experience.

GLOBAL LEARNING CENTERS

Armstrong has Learning Centers in: Three Rivers, Michigan (USA); Liege, Belgium; Beijing, China; Nagoya, Japan; and soon in Guadalajara, Mexico. Many of Armstrong's representatives throughout the world operate their own learning centers. Armstrong locations in India, Korea and other parts of the world have portable demonstration capabilities that allow us to bring the seminar to you.

RECOMMENDED COURSES FOR THE HOSPITALITY INDUSTRY

- | **Legionella**—Learn how Legionella develops in hot water systems, the dangers of Legionella if left untreated and how it can be killed, and how to design a hot water system that discourages Legionella growth.
- | **Hospitality Package**—More than 40 courses to help you: increase guest satisfaction and safety, operate your thermal utility systems more efficiently, and learn how monitoring, measuring and auditing your systems can save time, money and energy.
- | **Safety Training 101 Package**—Includes 21 courses that address environmental health and safety issues to help you provide a safe working environment. Each course can typically be completed in 30 minutes or less.

CONTACT ARMSTRONG INTERNATIONAL

For case studies, additional information on product models, sizes and custom solutions, or to find an Armstrong representative near you, visit armstronginternational.com/hospitality.

KNOWLEDGE NOT SHARED IS ENERGY WASTED®

One of Armstrong International's greatest strengths is our wealth of knowledge, experience and insight, derived from more than 100 years of providing thermal utility solutions for customers all over the world. As a true, sage brand and we're fully committed to sharing all that we've learned to help you make the smartest possible decisions for your company.



INTELLIGENT SOLUTIONS IN STEAM, AIR, AND HOT WATER

Armstrong International

North America • Latin America • India • Europe / Middle East / Africa • China • Pacific Rim

armstronginternational.com