Industrial Water-tube Package Boilers

steam generation systems
for process and power

BABCOCK & WILCOX

RENEWABLE | ENVIRONMENTAL | THERMAL

With more than **5,000** *units and* **155** *years of experience,*

Babcock & Wilcox (B&W) is a global leader in supplying a wide range of industrial water-tube boiler designs to meet targeted, challenging, long-lasting operational and performance goals. Our industrial water-tube package boilers are custom-engineered to each project's unique specifications for varying inputs and desired outputs. All of our designs feature the high levels of quality, reliability and efficiency for which B&W is known.

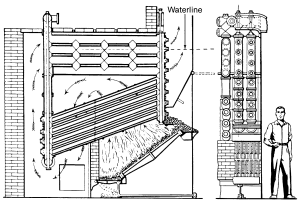
Evolution of B&W's package boilers

Over the years, B&W's industrial boiler configurations have been known by various model names, including FM, HCFM, PFM, PFI, PFT, TSSG® and others — D-type or O-type, single-drum or multi-drum. The unique designs offered by these various models provide our customers with flexible options and features to meet any steam generation demand.

B&W's line of industrial package boilers represents more than 155 years of ingenuity and experience, all providing dependable performance for a wide range of industries and applications.

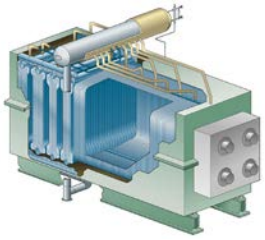
For firing solid fuels such as pulverized or stoker coal, wood, bark, and bagasse or other biomass products, we offer Stirling™ and/or Towerpak™ model boilers.

1867



B&W's first water-tube boiler

Today

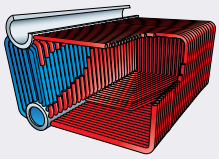


Today's range of designs for a variety of steam requirements

B&W Innovation

Developing firsts that last is a cornerstone of our company. Having earned more than 17,000 patents, we are committed to technological innovation that provides measurable benefits.

A few innovations that our industrial package boilers can include are multi-circulation systems, connection-ready installations and elevated-drum designs.



MultiCirc

Our multi-circulation systems accommodate lower-quality feedwater (sub-ASME) and maximize thermal efficiency while maintaining reliability by minimizing boiler tube internal scaling.

Connection Ready

The boiler and auxiliary equipment modules, depending on size, can be shop mounted to skids where they are pre-wired and piped to accelerate transportation and reduce field installation times.

Elevated Drum

Our elevated-drum design is used for drum retention times of 5 minutes or more from normal water level to low water fuel cutout. Additionally, this design is utilized where shipping limitations exist as it allows for a more symmetrical load with the upper steam drum shipped separately from the boiler and installed onsite.

Manufacturing capabilities

Our custom industrial package boilers can be fabricated in our Chanute, Kansas, manufacturing facility. With nearly 200,000 square feet of high bay manufacturing capacity, this facility has served a multitude of operations in a wide range of industrial and process sectors worldwide.

The B&W Chanute plant is served by five rail spurs with a total of 7,600 feet of track on the property to expedite shipping and minimize production bottlenecks. Manufacturing areas consist of 22 overhead cranes with capacities up to 200 tons and 35-foot hook heights to accommodate the largest of package boilers.

All major boiler components are fabricated and assembled in-house to ASME Boiler and Pressure Vessel Code Section I or Section VIII.

- Headers
- Steam drums
- Membrane wall panels
- Pressure part sections (economizers, superheaters)

We provide quality workmanship with a commitment to integrity and customer satisfaction.



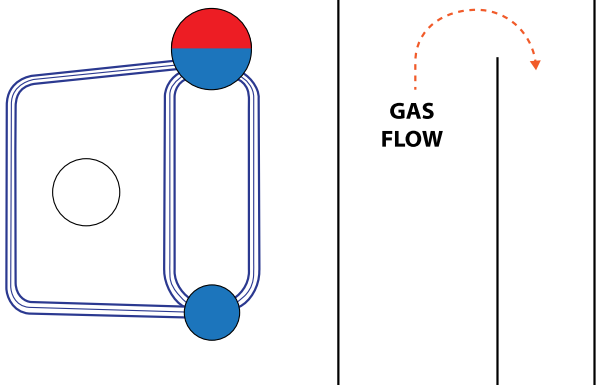


Design Features

Our industrial water-tube package boilers offer numerous features that benefit your operations, including:

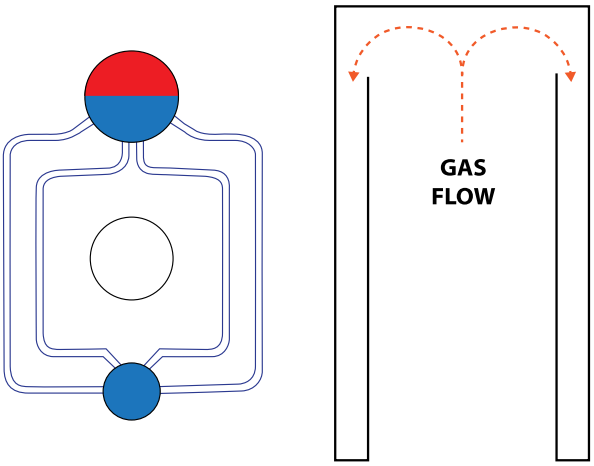
- Furnace wall water cooling – eliminates refractory and related maintenance
- Gas-tight setting membrane – inhibits dew-point sulfur corrosion and outages caused by gas leaks
- Rugged steel-based frame – supports boiler and allows jacking and skidding during erection
- Outer lagging – galvanized, weather-tight for outdoor installations
- Drum internals – ensure positive circulation, low-moisture, high steam purity
- Water wash troughs and drains
- Grooved tube seats – protect against leaks during transportation and throughout operation
- Solid membraned division wall – prohibits furnace gases from bypassing generating tubes
- Larger tube diameter – helps to prevent membrane thermal cracking and contributes to a faster load response
- Inverted loop, fully drainable superheaters

D-Style



- One steam drum and one lower drum
- Drums centered over each other with furnace offset to one side
- One generating bank

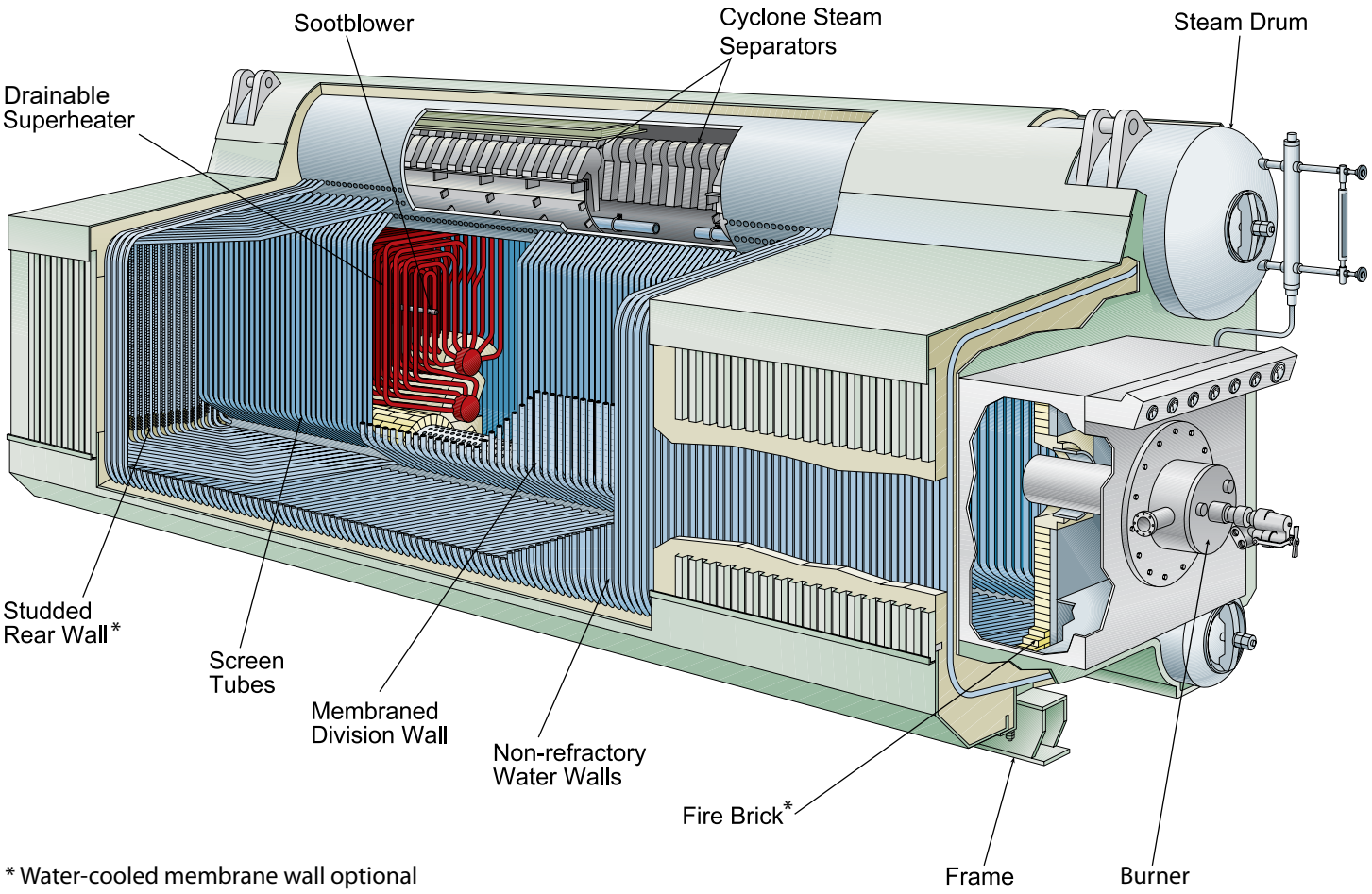
O-Style



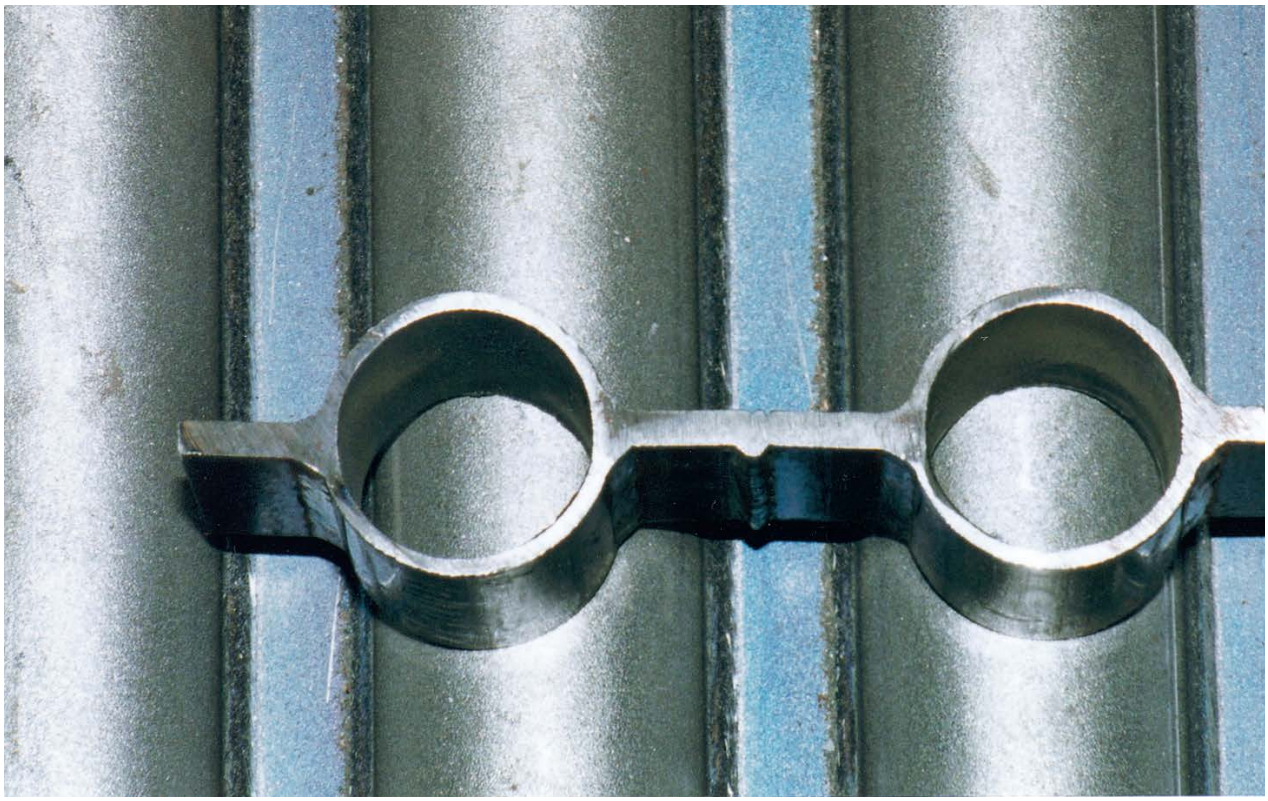
- One steam drum and one lower drum
- Drums centered over each other with furnace in center of boiler
- Two generating banks







* Water-cooled membrane wall optional



Fast load response

B&W's 2.5 in. (6.35 cm) tubes are spaced 1 in. (2.54 cm) apart (tube panel in background). This provides a larger volume of water in our furnace walls and contributes to a faster load response compared to competitors' units that are designed with 2 in. (5.08 cm) tubes spaced 2 in. (5.08 cm) apart (tube section in foreground). The reduced membrane area between tubes also helps to prevent membrane thermal cracking.

In addition, our uniquely designed drum internals can handle varying loads without circulation disruptions or carryover. Connections for lower drum heating coils are also standard.

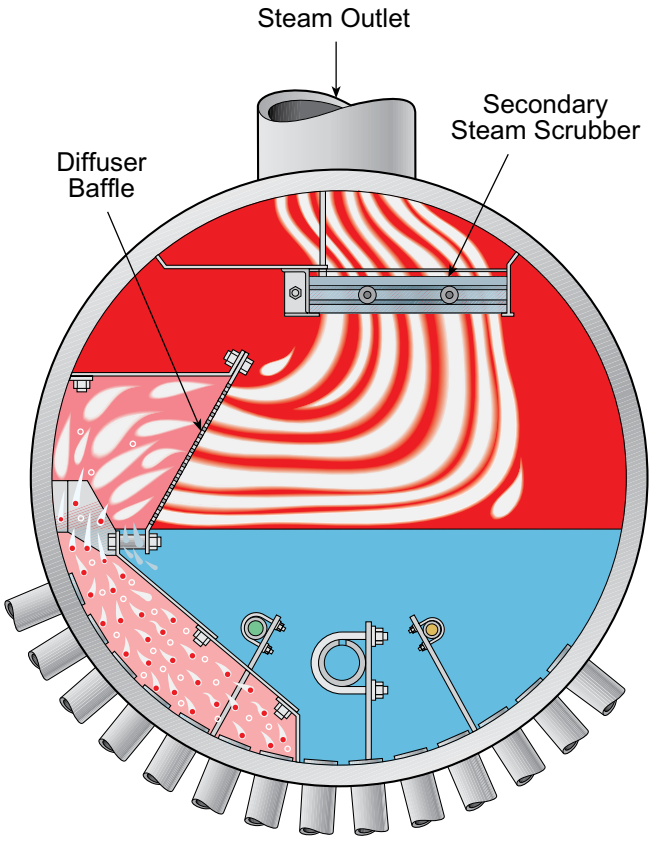
Efficient steam-water separation, positive circulation

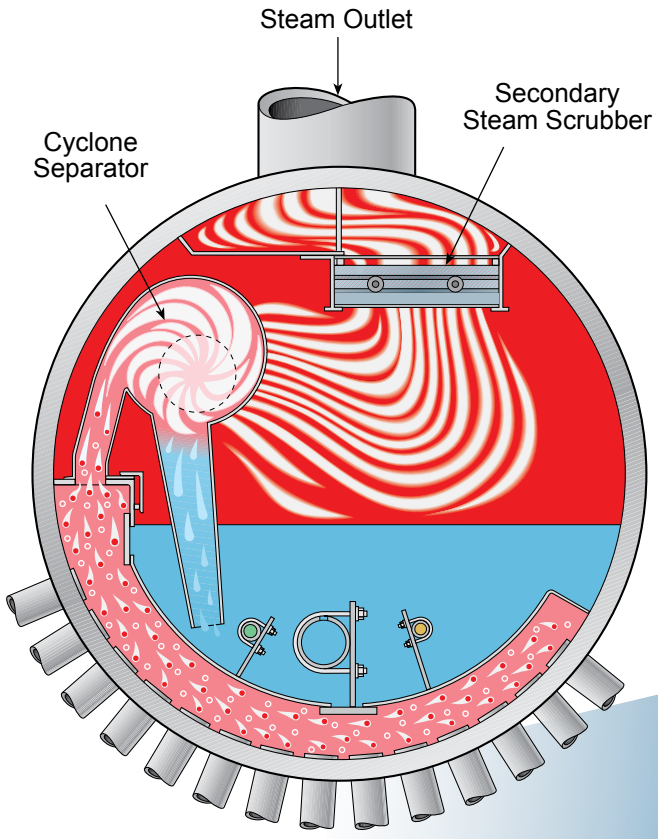
Even when load changes are wide or frequent enough to affect water level in the drum, positive circulation is assured with B&W drum internals. As hot furnace flue gas crosses the first row of tubes in the boiler bank, a considerable amount of steam is generated. This quantity is substantially greater on higher-capacity units for essentially the same drum length, imposing a tremendous burden on drum internals.

B&W separation equipment is specifically designed to handle this rapid, intense generation of steam effectively. Diffuser baffles direct portions of the steam to less turbulent zones of the drum, making use of the entire length of scrubbing elements to remove unwanted moisture droplets.

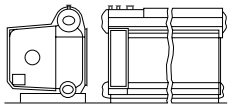
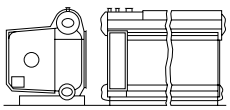
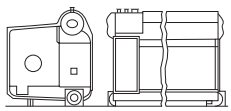
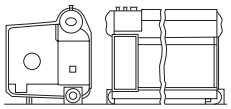
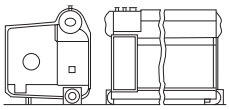
Enhanced superheater reliability

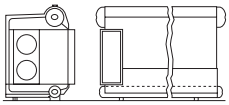
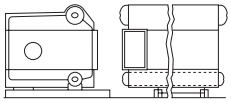
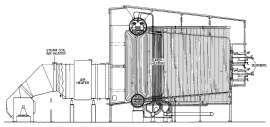
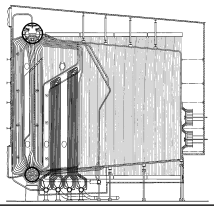
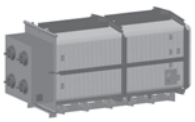
Steam with less than 1 ppm solids can be obtained when required by superheaters or special processes. Turbine blades are kept cleaner, and the reliability of the superheater is greatly enhanced. An equally important feature designed into B&W's drum internals is the supply of steam-free solid water back to the downcomer circuits for positive circulation. The drum internals' design also allows free end flow to minimize turbulence and end-to-end water level fluctuation.





Capacities to Meet the Most Demanding Requirements

	Boilers	Capacity Range* (lb/h)	Length	Width	Height	Drum Size
	FM 9-22 26 30 34 39 43 48 52 57	8,200 to 40,000	7 ft 7 in. 8 ft 11 in. 9 ft 11 in. 11 ft 3 in. 12 ft 7 in. 13 ft 11 in. 15 ft 3 in. 16 ft 7 in. 17 ft 11 in.	10 ft 2-7/8 in.	12 ft 4 in.	36 in. Steam Drum 24 in. Lower Drum
	FM 10-52 57 61 66 70 79 FM 101-88	35,000 to 75,000	16 ft 7 in. 17 ft 11 in. 19 ft 3 in. 20 ft 7 in. 21 ft 11 in. 24 ft 7 in. 24 ft 3 in.	10 ft 10-5/8 in. 11 ft 2-3/8 in.	13 ft 6 in.	36 in. Steam Drum 24 in. Lower Drum
	FM 103-70 79 88 97	70,000 to 100,000	21 ft 3-3/16 in. 23 ft 11-3/16 in. 26 ft 7-3/16 in. 29 ft 11 in.	11 ft 9 in.	13 ft 9-3/4 in.	42 in. Steam Drum 24 in. Lower Drum (Optional 30 in.)
	FM 106-79 88 97 FM 117-88 97	100,000 to 155,000	23 ft 11-3/16 in. 26 ft 7-3/16 in. 29 ft 3-3/16 in. 26 ft 7-3/16 in. 29 ft 3-3/16 in.	11 ft 9 in. 11 ft 11-1/4 in.	14 ft 3 in. 15 ft 4-1/2 in.	48 in. Steam Drum 24 in. Lower Drum (Optional 30 in.)
	FM 120-97 112 124 FM 160-124	155,000 to 275,000	29 ft 3-3/16 in. 33 ft 7-3/16 in. 37 ft 3-3/16 in. 37 ft 3-3/16 in.	12 ft 5-3/8 in. 14 ft 0-3/8 in.	16 ft 10-1/2 in. 20 ft 0-1/2 in.	54 in. Steam Drum (Optional 60 in. for FM 160-124) 24 in. Lower Drum (Optional 30 in.)

	Steam Capacity	Steam Pressure	Steam Temperature
	**HCFM** 200,000 to 350,000 lb/h (25.2 to 44.1 kg/s)	to 1250 psig (8.6 MPa)	to 825F (441C)
	**PFM** 200,000 to 600,000 lb/h (25.2 to 75.6 kg/s)	to 1800 psig (12.4 MPa)	to 900F (482C)
	**PFI** 100,000 to 700,000 lb/h (12.6 to 88.2 kg/s)	to 1150 psig (7.9 MPa)	to 960F (516C)
	**PFT** 350,000 to 800,000 lb/h (44.1 to 100.8 kg/s)	to 1800 psig (12.4 MPa)	to 1000F (538C)
	**TSSG** 300,000 to 1,200,000 lb/h (37.8 to 151.2 kg/s)	to 2400 psig (16.5 MPa)	to 1005F (540C)

Notes:

1. All package boilers are of membrane construction.
2. Because of B&W's constant effort to improve design, equipment supplied may differ slightly from that described above.

Metric conversions:
inches x 25.4 = mm
inches x 2.54 = cm
feet x 0.3048 = m
lb/h x 0.000126 = kg/s

* Steam capacities shown are saturated steam. Capacities shown will vary depending on conditions and limitations.

B&W package boilers offer:

- Reliable steam generation
- Low auxiliary power requirements
- Low emissions
- Simple operation and low maintenance
- Operational flexibility – high turndown and fast load ramping

Custom configurations meet targets for:

Capacity	8200 to 1,200,000 lb/hr (3.7 to 544.2 t/hr)
Size/Space	Various designs for shop and/or modular field assembly to fit most any space limitations
Temperature	Saturated to 1005F (540C)
Design Pressure	250 to 2400 psig (1.7 to 16.5 MPa)
Fuels	Liquid or gaseous fuels such as oil, natural gas, CO, blast furnace gas (BFG), coke oven gas (COG), hydrogen, and various other byproduct liquid and gaseous fuels
Air/Water Treatment	Emissions and water-side deposition control systems
Timeline/Budget	Ability to optimize and expedite to meet cost and scheduling expectations

More than 5,000 B&W industrial water-tube package boilers have been installed in a variety of facilities, including:

- Refining and petrochemical
- Utility power
- Pulp and paper
- Chemical and pharmaceutical
- Universities and institutions
- Food processing
- Metals and mining
- Composite and carbon fiber
- Carbon black
- Wood products
- and many more

Aftermarket Support

B&W's network of domestic and international sales representatives and field service engineers assures you of a prompt response – whether servicing and upgrading your existing system or specifying new equipment. We can provide services ranging from routine inspections and controls tuning to capacity increase engineering studies, low emissions conversions or new control systems.

Services

- Engineering studies
- Proprietary computational fluid dynamics (CFD) modeling and circulation analysis
- Equipment design, tuning and testing
- Stress analysis and graphics
- Manufacturing
- Transportation and logistics
- Turnkey installation and construction services
- Field advisory services for start-up, commissioning, equipment installation and operator training
- Retrofits and replacement parts
- Responsive global network of sales and field engineers to provide expert service and support

Codes and standards

Each project is designed to meet customer requirements and all applicable ASME and industry codes. Additional design standards typically followed are ANSI, API, PIP, SIL, UL, CSA and NFPA. B&W will meet or exceed most any requirement requested.

Auxiliary equipment

- Economizers
- Burners
- Controls
- Forced draft fan and drives
- Flues and ducts
- Stacks
- Deaerators, feedwater pump sets
- Oil pumps
- Heater sets
- Post-combustion emissions control systems
- Code piping
- Balance of plant

All major boiler components can be fabricated and assembled in-house at our manufacturing facility in Chanute, Kansas.

Proven Experience

Elevated three-drum unit for IRPC Clean Power Co., Ltd. in Rayong, Thailand

To meet the project's steam drum retention requirements, we engineered and delivered an elevated three-drum unit for the combined heat and power plant's use in supplying steam to a neighboring factory.

High-capacity unit for U.S. refinery

We engineered and supplied a 300,000 lb/hr (136,100 kg/hr) shop-assembled unit, which was shipped by barge and field-installed. The project scope also included all boiler auxiliaries, fans, economizer, valves, instrumentation and installation of all equipment on the boiler island.

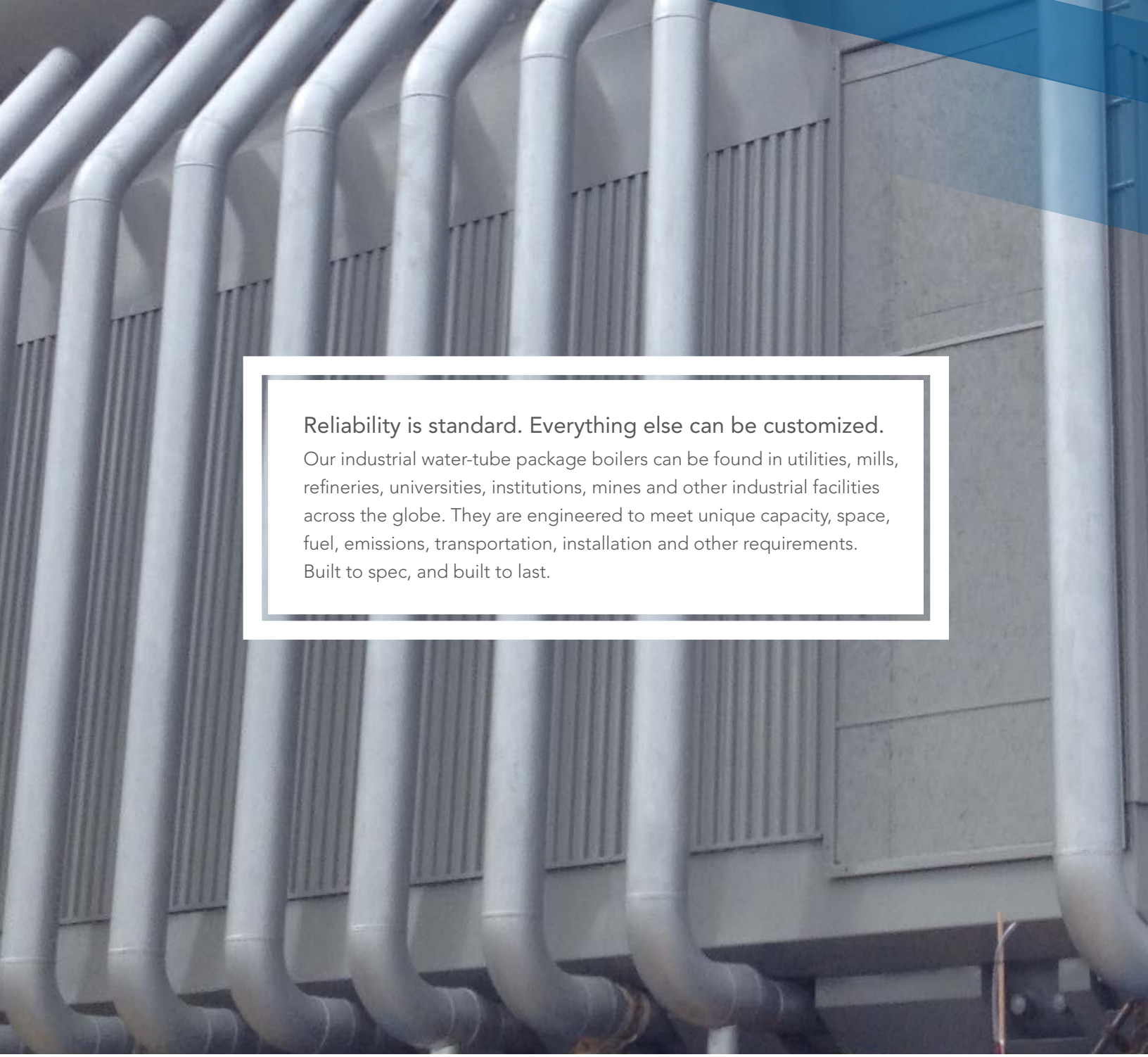
Single-drum modular units for oil sands project in Alberta, Canada

Challenged to provide a solution for highly reliable steam generation at high pressure with ultra-low NO_x emissions, minimized blowdown for zero liquid discharge requirements, multi-fuel usage, and low field erection and maintenance costs, we supplied eight high-performing modularized single-drum units.

Custom-finished units for U.S. universities

In addition to predefined specifications for operating conditions, our industrial package boilers can be delivered featuring designated colors and logos. We recently supplied two U.S. universities with multiple custom-finished units, each capable of providing approximately 80,000 lb/hr (36,300 kg/hr) of saturated steam with a design pressure of 250 psig (1.7 MPa).

More than **5,000** installations
in more than **60** countries



Reliability is standard. Everything else can be customized.

Our industrial water-tube package boilers can be found in utilities, mills, refineries, universities, institutions, mines and other industrial facilities across the globe. They are engineered to meet unique capacity, space, fuel, emissions, transportation, installation and other requirements. Built to spec, and built to last.

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BABCOCK & WILCOX

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Established in 1867, Babcock & Wilcox is a global leader in advanced energy and environmental technologies and services for the power, industrial and renewable markets.

For more information or to contact us, visit our website at www.babcock.com.

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