Industrial Water-tube Package Boilers
steam generation systems for process and power
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.

Over the years, B&W’s industrial boiler configurations have been known by various model names, including FM, HCFM, PFM, PFI, PFT, TSG® 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 150 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.

With more than 5,000 units and 150 years of experience,

B&W’s first water-tube boiler

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

Evolution of B&W’s package boilers
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.
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
- 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

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

**Steam Capacity**

<table>
<thead>
<tr>
<th>HCFM 200,000 to 350,000 lb/h (25.2 to 44.1 kg/s)</th>
<th>Steam Pressure to 1250 psig (7.2 MPa)</th>
<th>Steam Temperature to 825F (441C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFM 200,000 to 600,000 lb/h (25.2 to 75.6 kg/s)</td>
<td>Steam Pressure to 1800 psig (12.4 MPa)</td>
<td>Steam Temperature to 900F (482C)</td>
</tr>
<tr>
<td>TSSG 300,000 to 1,200,000 lb/h (37.8 to 151.2 kg/s)</td>
<td>Steam Pressure to 2400 psig (16.5 MPa)</td>
<td>Steam Temperature to 1005F (540C)</td>
</tr>
</tbody>
</table>

**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:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>10,000 to 1,200,000 lb/hr (4.5 to 544.2 t/hr)</td>
</tr>
<tr>
<td>Size/Space</td>
<td>Various designs for shop and/or modular field assembly to fit most any space limitations</td>
</tr>
<tr>
<td>Temperature</td>
<td>Saturated to 1005°F (540°C)</td>
</tr>
<tr>
<td>Design Pressure</td>
<td>250 to 2400 psig (1.7 to 16.5 MPa)</td>
</tr>
<tr>
<td>Fuel</td>
<td>Liquid or gaseous fuels such as oil, natural gas, CO, blast furnace gas (BFG), coke oven gas (COG), and various other byproduct liquid and gaseous fuels</td>
</tr>
<tr>
<td>Air/Water Treatment</td>
<td>Emissions and water-side deposition control systems</td>
</tr>
<tr>
<td>Timeline/Budget</td>
<td>Ability to optimize and expedite to meet cost and scheduling expectations</td>
</tr>
</tbody>
</table>

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
- 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 reviewed to meet customer requirements and all applicable ASME and industry codes. Additional design standards typically provided 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
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 NOx 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.