



When selecting a boiler, consider operating pressure, capacity, application and lifecycle cost.

- Firtube boilers are used for both process and heating applications. They are at schools, hospitals, food processing plants and office buildings.
- Watertube boilers are high-pressure boilers found in large pharmaceutical, petro-chemical and pulp and paper plants as well as on the campuses of many universities and government buildings.
- An electric boiler is a good choice when there is no fossil fuel availability or an area has very low electric power rates.

Which Boiler Type is Right?

There are many different types of boilers on the market today. Deciding which boiler is best for your application should take into account a number of variables, including design type, operating pressure, capacity, physical size requirement and lifecycle cost. Here is an overview of the various types of boilers.

In a **firtube boiler**, water surrounds the furnace and tubes that house the flame and hot gases. Firtube boilers normally range in size from 15 to 2,200 horsepower as a package with design pressures between 15 and 250 pounds for steam and between 30 and 160 pounds for hot water. Firtube boilers are used in both process and heating applications and are frequently found in hospitals and schools as well as in industrial process applications such as food and chemical plants.

Firtube boilers can have either a horizontal or vertical orientation. A horizontal firtube is available in either a dryback or wetback design. The dryback design has the distinct advantage of providing easy accessibility to the rear tube sheet, which makes maintenance and cleaning simple. The wetback design does not have the heavy, rear-refractory-filled door found in the dryback design, which is sometimes cumbersome to open and reseal; however, lacking this large door, access to the rear tube sheet for maintenance, repair and inspection is greatly hindered.



CBEX Elite Firetube Boiler

A vertical firtube can fire from the top down, or the burner can be mounted on the side of the boiler at the bottom. A top-fire unit uses a mantle-type burner firing into the furnace. The hot gases often make one pass through the convection tubes using extended surfaces to greatly enhance the heat transfer coefficient, affording excellent heat exchange before exiting through the flue gas outlet at the base of the firtube. These boilers can be used in an array of commercial and industrial applications, especially when space is limited.

In a **watertube boiler** design, the water flows through the tubes and the fire and hot gases surround them. Many of the watertube boilers on the market today have been designed to naturally circulate the water/steam combination through properly-sized tubes connected to drums or headers that provide the pressure/density differentials required to naturally circulate. It is important to note that there are other watertube designs that require forced circulation, in which case the unit incorporates its own pump.

Smaller watertube boilers can be used in both commercial heating and industrial processes. A very popular commercial watertube boiler is the **flextube boiler**, which uses serpentine tubes connected to the upper and lower headers, thus forming the various gas passes required to absorb the heat contents therein. This boiler was originally designed primarily for hot water comfort heating, as it was much more resilient to the possibility of thermal shock often encountered in these systems. However, it was also found to be an excellent steam boiler, and is used in some process applications too.

A **steam generator** is normally a vertical, top-fired watertube boiler that requires a pump to circulate the water through the tubes and headers. Because of its very small water content, it produces steam very quickly but is also very sensitive to water quality issues.

Another type of watertube boiler is the **cast iron sectional boiler**. Used exclusively for residential and commercial applications, this boiler is limited in design pressure due to the use of castings and is therefore never used for high-pressure steam applications. In fact, 15 pounds of steam is its maximum limit, so it is a heating and very light process boiler with the advantage of being field erectable like the flextube.

A **copper-fin type boiler** was originally designed for pool heating, but it is now used quite extensively for commercial building heat. The size range is small, so these boilers are normally configured as multiple units with a control sequencer to stage the firing based on system demand. The tube bundle is typically copper, but cupronickel is also available if water conditions dictate. The headers can be either cast iron or bronze for the same reason. It is important to note that these units can be used only for hot water heating, not steam applications.



D-style Industrial Watertube Boiler

An **industrial watertube (IWT)** is a high-pressure boiler, used almost exclusively in industrial process applications. The IWT comes in three common styles depending on capacity and footprint requirements. The boiler is available in D-style, O-style and A-style, with the last style offering the greatest overall capacity in terms of overall output. These shippable packaged watertube boilers have capacities up to 9,000 horsepower and steam

pressures up to 900 pounds. The IWT is used in large central steam plants as well as in large processing plants, including food, petro-chemical, pharmaceutical, refining and pulp and paper.

A **vertical tubeless** is another type of boiler available that does not really fall into the firetube or watertube category. These boilers are generally used for high-pressure steam but are also offered in low pressure/hot water. They can either fire downward or fire with the burner mounted either on the side of the unit at about the midpoint or down lower at the bottom of the unit. Vertical tubeless boilers have a limited horsepower range, so they are often sold in multiples with sequencing control and applied to various process and heating applications of a smaller scale. A small metal pickling operation is a good example of where this type of boiler would be found.



Electric - S Boiler

The **electric boiler** is offered in both resistance and electrode designs. The output with the resistance is between 12 and 3,375 kW. The electrode boiler has a higher capacity, ranging from 2 to 65 MW. These boilers are used in a variety of applications since they are available for both high- and low-pressure steam and hot water. An electric boiler is a good choice when

there is no fossil fuel availability, a drastic reduction in emissions is required or the area has very low electric power rates. Otherwise, these boilers are expensive to operate because of the cost per kWh when compared to a fossil fuel, even though the losses within and from the boiler itself are negligible.

For more information about boiler types, capacities and applications, watch the [Boiler Basics: Design and Application Differences](#) webinar or visit cleaverbrooks.com.