

Date: June 1, 2019**Bulletin Number: HP609****Subject: Choosing the Right Commercial Boiler for the Job****Background**

When purchasing a boiler for new construction or replacing an existing boiler, proper selection of the type of boiler is probably the most important factor in the operation, life expectancy and efficiency of the heating system. Boilers typically last more than 15 years, therefore the investment and upfront selection is essential to meet the needs of the application. Boiler selection should be based on many factors such as operating pressure, capacity, type of fuel, boiler room footprint and the type heating system or process being considered.

Basic types of boilers

Scotch Marine (Steel fire tube):

30 psi or 125 psi water or 15 psi, 150 psi (or higher) steam. In a fire tube boiler, water surrounds the furnace and tubes that house the flame and hot gases. Fire tube boilers normally range in size from 15 to 1,200 horsepower.

Bent water tube:

160 psi water or 15 psi, 150 psi steam. In a bent water tube boiler, water flows through the tubes and the fire and hot gases surround them.

Firebox:

30 psi or 60 psi water or 15 psi steam.

Copper tube:

160 psi water only.

Cast iron:

80 psi water or 15 psi steam.

Stainless (condensing):

160 psi water only.

Applications

Here are some of the more common types of boiler applications. Each of these will use a different type of boiler. In some cases, there is overlap in the boiler type.

- Hot water space heating
- Domestic water production
- Low temperature water applications (snowmelt, radiant heat)
- Steam heating (both low & high pressure)
- Process steam

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Hot water heating systems that serve baseboard (fin tube), fan coils or unit heaters typically run at system temperatures around 180°F. This would allow the use of most of the types of hot water boilers listed above. If outdoor reset was being used, where the return temperatures to the boiler are less than 135°F, precautions should be used to avoid thermal shock (with the exception being a condensing boiler).

Domestic water production is an application where fairly constant temperatures are being produced. In this application the boiler types listed could either be connected to an indirect water heater, or the boiler could have its own tankless coil(s) for domestic production, if equipped as such.

Low temperature water applications such as snowmelt or radiant heat run at very low temperatures, typically 70°F-90°F. This is a good application for a condensing type boiler or bent water tube. Other boilers could be used, but would require separate heat exchangers or mixing valves to handle the low temperature water. Bent water tube boilers are also used in high pressure applications such as pharmaceutical companies, paper plants and the soft drink industry.

Steam space heating is typically low pressure 15 psi steam that feeds steam radiators, fan coils and unit heaters. Cast iron, fire tube and fire box boilers are great choices for this type of application.

Process steam is typically 150 psi or greater high pressure steam used for manufacturing processes such as tire manufacturing plants, laundries, hospitals, pharmaceutical, food processing plants and many other applications. The scotch marine (fire tube) boiler is the selection in this application. Fire tube boilers are also used in low pressure applications (15 psi) such as schools and office buildings.

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Existing buildings may have had a fire tube originally installed when the building was under construction. If the boiler room did not have access to an outside wall with doors, it would be nearly impossible to replace the fire tube boiler in one piece without considering demolition to the outside wall. In this case, a “knocked down” version of the fire tube can be brought down to the boiler room in pieces and then welded in the boiler room. If this is not desired, cast iron boilers can be substituted (only if low pressure).

Boiler footprint can be a determining factor. New construction is more flexible in that the architect can build in direct access to accommodate larger boilers. On replacement work, the boiler room may be small. The use of products such as the copper tube boiler may work here, if it's a water application.

Venting design should always be considered when replacing or designing a new boiler room. Venting materials vary from PVC pipe (condensing boilers) to stainless and galvanized single and double wall pipe. Each is dependent on fuel being used, stack temperature and positive or negative pressure. Location of the vent on the boiler may be a consideration. On a three pass fire tube, for example, the vent is at the rear of the boiler. On a four pass fire tube, the vent is in the front of the boiler. Depending on the existing stack connection, one design may be better than the other for ease in connection to the existing stack.

Fuels

Some boiler types can fire gas, oil and combination gas oil type burners. Others can only fire natural gas. Before selecting a boiler type, the fuel being used should be considered.

Boiler longevity & efficiency

Fire tube, cast iron: 20-30 years, 80-85%

Copper: 15-20 years, 80-85%

Stainless: 10-15 years, 95%

Bent Water tube: 20-25 years, 80-85%