

STUDY ON BOILER

A boiler is a closed vessel in which water or other fluid is heated under pressure. The steam or hot fluid is then circulated out of the boiler for use in various process or heating applications.

Construction material

Construction of boilers is mainly limited to copper, steel and cast iron. In Live steam toys, brass is often used.

carbon steel and high carbon steelLink title

Fuel

Sources of heat for the boiler can be the combustion of fuels such as wood, coal, oil or natural gas. Electric boilers use resistance or immersion type heating elements. Nuclear fission is also used as a heat source for generating steam. Waste-heat boilers, or HRSGs use the heat rejected from other processes such as gas turbines.

Classification

Fire tube

Boilers can be classified into fire-tube, water-tube boilers or cast iron sectional depending on whether the heat source is inside or outside the tubes or in the case of the cast iron sectional the design and manufacture of the boiler. The goal in all cases is to maximise the heat transfer between the water and the hot gases heating it.

For example, steam locomotives have fire-tube boilers, where the fire is inside the tube and the water on the outside. These usually take the form of a set of straight tubes passing through the boiler through which hot gas flows.

In a cast iron sectional boiler, sometimes called a "pork chop boiler" the water is contained inside cast iron sections. These sections are mechanically assembled on site to create the finished boiler. There are other types of boiler, largely of historical interest. For example, the Cornish boiler developed around 1812 by Richard Trevithick ^{[[1]]} for generating steam for steam engines. This was both stronger and more efficient than the simple boilers which preceded it. It was a cylindrical water tank around 27 feet long and 7 feet in diameter, and had a coal furnace placed in a single cylindrical tube about three feet wide which passed centrally along the long axis of the tank.

The fire was tended from one end and the hot gases from it travelled along the tube and out of the other end, to be circulated back along flues running along the outside of the boiler before being expelled via the chimney.

This was later improved upon in the Lancashire boiler which had a pair of furnaces in separate tubes side-by-side. This was an important improvement since each furnace could be stoked at different times, allowing one to be cleaned whilst the other was operating.

The above designs are really primitive fire tube boilers, and led on to the Scotch boiler which was a popular fire tube design.

Water tube

In water-tube boilers the water flows through a large number of narrow tubes around the fire. The tubes frequently have a large number of bends and sometimes fins to maximise the surface area. This type of boiler is generally preferred in high pressure applications since the high pressure water/steam is contained within narrow pipes which can contain the pressure with a thinner wall.

These are very common in Electricity generating stations with different types of fuels.

Supercritical Boilers

Supercritical boilers use a much higher temperature and pressure. This is more efficient resulting in less fuel use and therefore less greenhouse gas production.

These are very common for large units of about 300MW and above, mostly used in Electricity generating stations.

Others

There are other types of boilers which use instead of water, oil or mercury for specific purposes. They are however of small capacities and are few in use today.

Hydronic boilers

Hydronic boilers are used in generating heat typically for residential uses. They are the typical power plant for central systems fitted to houses in northern Europe, as opposed to the forced air furnaces or wood burning stoves more common in North America. The hydronic boiler operates by way of heating water/fluid to a preset temperature and circulating that fluid throughout the home typically by way of radiators, baseboard heaters or through the floors. The fluid can be heated by

any means....gas, wood, fuel oil, etc, but in built-up areas where piped gas is available, natural gas is currently the most economical and therefore the usual choice. The fluid is in an enclosed system and circulated throughout by means of a motorized pump. These hydronic systems are being used more and more in new construction in North America as they are more economical than forced air furnaces and it easier to construct smaller diameter water pipes as it is the larger ventilation piping. Most new systems are fitted with condensing boilers for greater efficiency. "Boiler" is clearly a misnomer for this kind of device, which is really nothing but a large water heater in which the water is never intended to boil; but the name is universal and unlikely ever to change.

Control and safety fittings

To help the operator control and monitor the operations from satisfactory and safety point of view, well designed control and supervisory equipment are provided at suitable places. These are being regularly updated with the technological improvements.

Source : <http://engineering.wikia.com/wiki/Boiler>