

- (a) **Stationary boilers:** Boilers that are used for stationary plants are called stationary boilers or land boilers.
- (b) **Mobile boilers:** Boilers, which are fitted on vehicles that can move from place to place called mobile boilers.

Examples are Marine and Locomotive boilers.

9. According to the Boiler Shell Material

According to the boiler shell material, boilers are classified as:

- (a) Cast Iron boilers, and (b) Steel boilers
- (a) **Cast Iron boilers:** These boilers are suitable for low pressure boilers.
- (b) **Steel boilers:** These boilers are suitable for high pressure boilers.

3.14 COMPARISON OF FIRE TUBE AND WATER TUBE BOILER

Sr. No.	Fire Tube Boiler	Sr. No.	Water Tube Boiler
1.	Hot gases from the furnace pass through the tubes which are surrounded by water.	1.	Water circulates inside the tubes which are surrounded by hot gases from the furnace.
2.	Generate steam pressure upto 25 bar.	2.	Generate steam pressure upto 250 bar.
3.	Rate of generation of steam is upto 9 tonnes per hour.	3.	Rate of generation of steam is upto 450 tonnes per hour.
4.	Floor area required is more.	4.	Floor area required is less.
5.	Overall efficiency upto 75%.	5.	Overall efficiency with economiser is upto 90%.
6.	Transportation and erection are difficult.	6.	Transportation and erection are easy as its parts can be separated.
7.	Water does not circulate in a definite direction.	7.	Direction of water circulation is well defined.
8.	Operating cost is less.	8.	Operating cost is high.
9.	Bursting chances are less.	9.	Bursting chances are more.
10.	Used in large power plants.	10.	Used in process industry.
11.	Can cope sudden increase in load for a shorter period only.	11.	Preferred for widely fluctuating loads.
12.	Greater risk of damage to property in case of bursting.	12.	Bursting does not produce any destruction to the whole boiler.

3.15 COCHRAN BOILER

Cochran boiler is a vertical, multitubular fire tube, internally fired, natural circulation boiler.

Construction

Figure 14 shows a Cochran boiler. It consists of a vertical cylindrical shell having a hemispherical top and furnace is also hemispherical in shape. The fire grate is arranged in the furnace and the ashpit is provided below the grate. A fire door is attached on the fire box. Adjacent to the fire box, the boiler has a combustion chamber which is lined with fire bricks. Smoke or fire tubes are provided with combustion chamber. These tubes are equal in length and arranged in a group with wide space in between them. The ends of these smoke tubes are fitted in the smoke box. The stack or chimney is provided at the top of the smoke box for discharge of the gases to the atmosphere. The furnace is surrounded by water on all sides except at the opening for the fire door and the combustion chamber. The smoke tubes are also completely surrounded by water.

Different boiler mountings and accessories are located at their proper place.

Working

The hot gases produced from the burning of the fuel on the grate rise up through the flue pipe and reaches the combustion chamber. The flue gases from the combustion pass through the fire tubes and the smoke box and finally are discharged through the chimney. The flue gases during their travel from fire box to the chimney gives heat to the surrounding water to generate steam.

The circulation of water in the shell is shown by arrows.

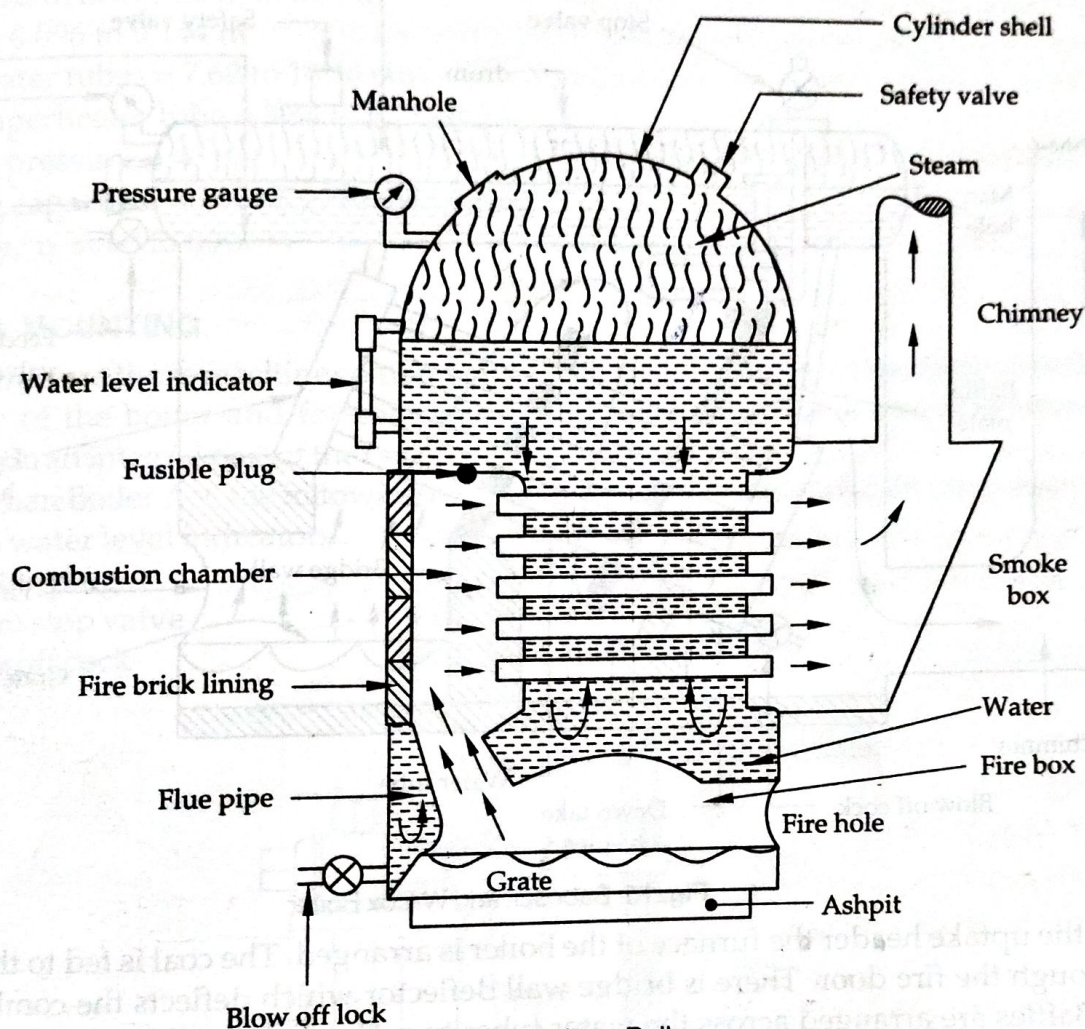


Fig. 14 Cochran Boiler

Specification of cochran Boiler

The diameter range from 0.9 m to a maximum of 2.75 m

Related reading of 2.75 m diameter shell

Steam pressure: 6.5 bar upto 15 bar

Heating surface: 120 m²

Maximum evaporative capacity = 4000 Kg/hr of steam

Height of the shell = 5.79 m

Generally 165 no. tubes and 62.5 mm External diameter of flue tube,

Efficiency, $\eta = 70$ to 75%

3.16 BABCOCK AND WILCOX BOILER

Babcock and Wilcox boiler is a horizontal drum or shell, multitubular, water tube externally fired, natural circulation boiler. The water tube boilers are used extensively when pressure above 10 bar and steaming capacity more than 7000 kg per hour is required.

Construction

Figure 15 shows the details of a Babcock and Wilcox water tube boiler. It consists of a drum mounted at the top and connected by upper header and down take header. A large number of water tubes are inclined 5 to 15 degrees to promote water circulation. The heating surface of the unit is the outer surface of the tubes and half of the cylindrical surface of the water drum which is exposed to flue gases.

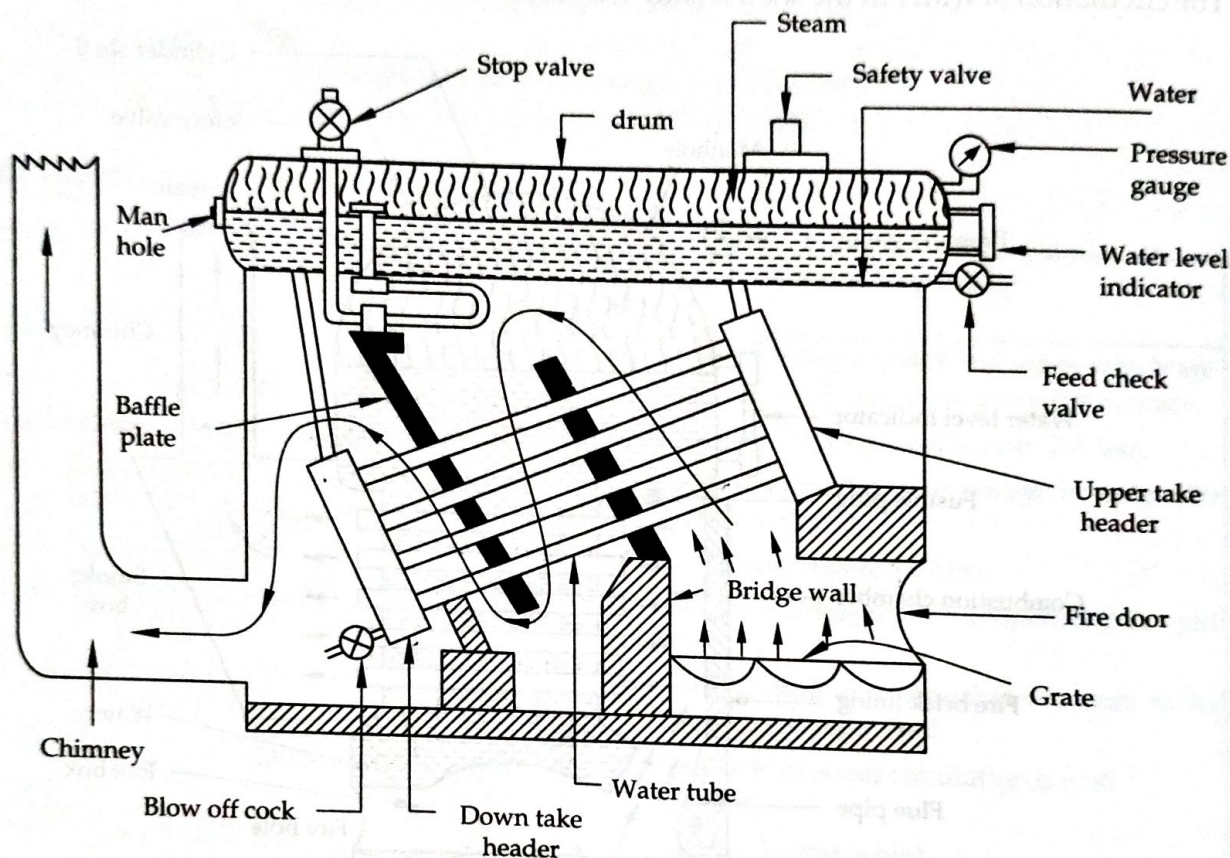


Fig. 15 Babcock and Wilcox Boiler

Below the uptake header the furnace of the boiler is arranged. The coal is fed to the chain grate upwards. Baffles are arranged across the water tubes to act as deflectors for the flue gases and to provide them with gas passes. Here, two baffles are arranged which provide three passes of the flue gases. A chimney is provided for the exit of the gases. A damper is placed at the inlet of the chimney to regulate the draught. There are superheating tubes for producing superheated steam. Connections are provided for other mounting and accessories.

Working

The hot combustion gases caused by burning of fuel on the grate rise and are deflected upwards by the bridge wall deflector and pass over to the front portion water tubes and drum. By this way they complete the first pass. With the provision of baffles they deflect downwards and complete the secondary pass. Again, with the provision of baffles they rise upwards and complete the third pass and finally come out through the chimney. The flow path of the combustion gases is shown by the arrows outside the tubes. During their travel they give heat to water and steam is formed. The circulation of water in the boiler is natural circulation set-up by convective currents (due to gravity). Feed water is supplied by a feed check valve.

The hottest water and steam rise from the tubes to the uptake header and then through the rise

enter the boiler drum. The steam vapour escape through the water to the upper half of the drum. The cold water flows from the drum to the rear header and thus the cycle is completed.

To get superheated steam, the steam accumulated in the steam space is allowed to enter into the superheater tubes which are placed above the water tubes. The flue gases passing over the flue tubes produce superheated steam. The steam thus superheated is finally supplied to the user through a steam stop valve.

Specification of Babcock and Willcox Bioler

Diameter of the drum : 1.22 m to 1.83 m

Length = 6.096 to 9.144 m

Size of water tubes = 7.62 to 10.16 cm

Size of superheater tube = 3.84 to 5.71 cm

Working pressure = 40 bar

Steaming capacity = 40,000 Kg/hr (Maximum)

Efficiency, η = 60 to 80%

3.17 BOILER MOUNTING

Boiler mountings are those machine components which are mounted over the body of the boiler itself for the safety of the boiler and for complete control of the process of steam generation. These mountings form an integral part of the boiler.

As per Indian Boiler Act, the following mountings are usually provided on the boiler:

- | | |
|--------------------------------|--------------------------|
| (i) Two water level indicators | (ii) Two safety valves |
| (iii) Fusible plug | (iv) Pressure gauge |
| (v) Steam stop valve | (vi) Feed check valve |
| (vii) Blow off cock | (viii) Man and mud holes |

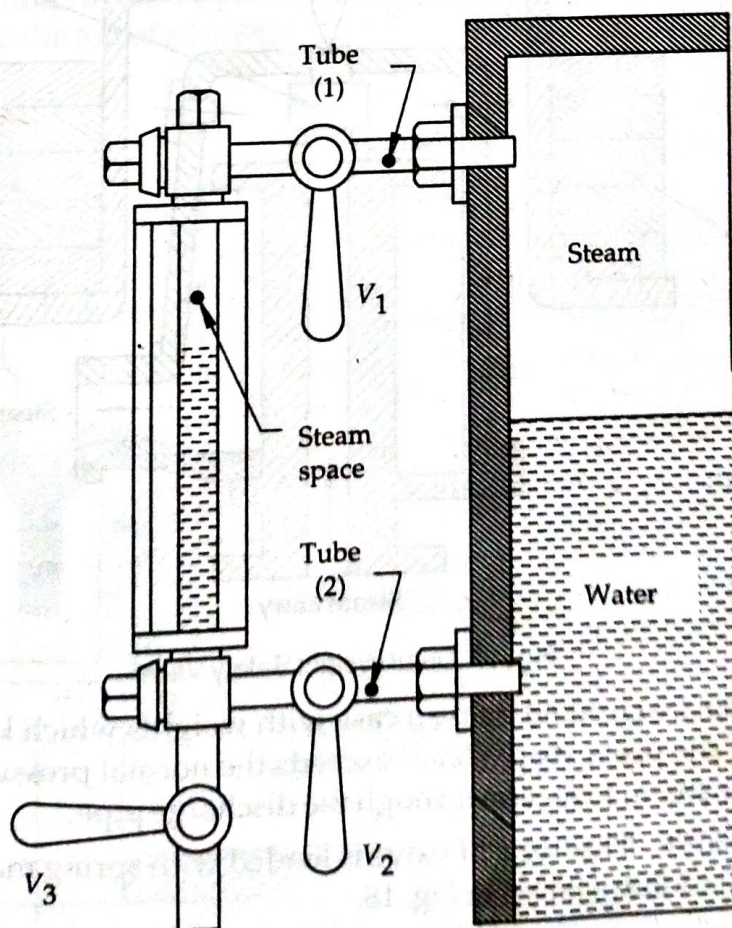


Fig. 16 Water Level Indicator