

CHAPTER FOUR:

Steam Boiler

4.1 Boiler Design and Construction

Boiler: A boiler is a closed vessel in which water is heated, steam is generated, superheated or any combination thereof under pressure or vacuum by the direct application of heat from combustible fuels or electricity. The steam produced is used for: *[function of boiler]*

- (i) Producing mechanical work by expanding it in steam engine or steam turbine.
- (ii) Heating the residential and industrial buildings
- (iii) Performing certain processes in the sugar mills, chemical and textile industries.

Usually boilers are coal or oil fired. A boiler should fulfill the following requirements

- (i) **Safety.** The boiler should be safe under operating conditions.
- (ii) **Accessibility.** The various parts of the boiler should be accessible for repair and maintenance.
- (iii) **Capacity.** The boiler should be capable of supplying steam according to the requirements.
- (iv) **Efficiency.** To permit efficient operation, the boiler should be able to absorb a maximum amount of heat produced due to burning of fuel in the furnace.
- (v) It should be simple in construction and its maintenance cost should be low.
- (vi) Its initial cost should be low.
- (vii) The boiler should have no joints exposed to flames.
- (viii) The boiler should be capable of quick starting and loading.

The performance of a boiler may be measured in terms of its evaporative capacity also called power of a boiler. It is defined as the amount of water evaporated or steam produced in kg per hour. It may also be expressed in kg per kg of fuel burnt or kg/hr/m² of heating surface.

4.1.1 Boiler Classifications

Boilers are classified by their pressure capacity, their design type and by their use.

High & Low Pressure Boilers –

The **M.A.W.P** or Maximum Allowable Working Pressure is the highest amount of pressure that the vessel is designed to withstand. Pressure is measured in terms of pounds per square inch or **psi**. **Psig** (gauge) indicates gauge pressure, which ignores the atmospheric pressure. **Psia** (absolute) is the sum of gauge pressure plus the atmospheric pressure at that location, which varies based on altitude. A **compound gauge** measures indicates pressure and vacuum.

- **Low-pressure boilers** are designed to withstand a maximum of 15 psig steam or a M.A.W.P. 160 psig water.

The boilers can be classified according to the following criteria.