

**BOILER ACCESSORIES:**

Boiler can fail by explosion as a results of either faulty construction or improper operation .To minimize the danger of failure the following are added to the boiler:

1-Pressure gage for saturated steam pressure recording.

**BOILER AUXILIARIES:**

1-Superheater      2-Air preheater

**BOILER HEAT BALANCE:**

1-Useful (heat absorbed by steam) =  $\dot{m}(h_f + xh_{fg} - h_w)$

2-Heat absorbed in boiler fluids

a-preheater      b-superheater   c- reheater   d-economizer

3- Heat loss to dry gases.

4-Heat loss to moisture content .

5-heat loss due to evaporation of moisture.

6- heat loss due to co formation.

7- heat loss due to unburned fuel .

8- heat loss due to exhaust gases.

9- heat loss by radiation.(  $H_{\text{gained}} - H_{\text{losses}}$ )

**HEAD LOSSES AND BOILER EFFICIENCY:**

Conversion of energy from fuel to potential energy of steam is accompanied by heat losses.

$$\eta_f = \frac{\text{heat generated from 1 kg fuel by furnace}}{\text{lower calorific value of fuel}}$$

$$\eta_f = \frac{Q_f}{H_L}$$

$$H_L > Q_f$$

Heat surface ( $\eta_h$ ):

$$\eta_h = \frac{h_s}{Q_f} < 1$$

$\eta_h$ : involves heat losses from the hot gases to the steam

$$\eta_h = 0.61 - 0.87$$

$\eta_e$ =total boiler efficiency

$$\eta_e = \eta_h * \eta_f = \frac{Q_f}{H_L} * \frac{h_s}{Q_f} = \frac{h_s}{H_L} = (60 - 90)\%$$

### **FEED WATER:**

It is the boiler water that must be clean i.e (free from impurities):

### **WATER IMPURITIES:**

- Mechanical: sand , stone, grass, wood,....
- Chemical: salts , acids,...
- Gases :CO<sub>2</sub>,O<sub>2</sub> ,ammonia ,...

### **TWO GROBECE OF SCALE FORMING IMPROTUTING:**

- 1- In suspension med ,silica, clay ,ect ..they must be removed outside the boiler (before entering) by filter and dram.
- 2- Dissolved impurity:  
Salt: a-Calcium      b-magnesium

### **METHOD OF TREATEMENT:**

- 1- Evaporation
- 2- Lame, soda treatment.
- 3-Zeol treatment (grean sand)

### **REQUIREMENTS OF A GOOD BOILER:**

A good boiler must possess the following qualities:

1. The boiler should be capable to generate steam at the required pressure and quantity as quickly as possible with minimum fuel consumption.
2. The initial cost, installation cost and the maintenance cost should be as low as possible.
3. The boiler should be light in weight, and should occupy small floor area.