



UNIT 1-Fuels & Combustion

Calorific value

➤ Calorific value of fuels :

The calorific value (or) heating value of solid (or) liquid fuel may be defined as amount of heat given out by complete combustion of 1 Kg. of fuel.

It is expressed in Kcal/Kg. of fuel at N.T.P. in S.I. system J/Kg. KJ/Kg (or) MJ/Kg.

➤ Types of calorific values of fuels :

1. Higher calorific values of fuel (H.C.V.) (or) Gross C.V.

It is a total heat is liberated by complete burning of 1 kg or 1m^3 of fuel including heat of steam formed by combustion of Hydrogen in the fuel.

OR

The amount of heat obtained by complete combustion of fuel, when the products of its combustion are cooled down to temperature of surrounding supplied air (i.e. 15°C) is called as higher calorific value.

If C, H, O and S are the percentage of Carbon, Hydrogen, Oxygen and Sulphur by weight respectively present in a fuel then the higher

calorific value of fuel can be calculated from the following formula known as **Dulong's formula**.

$$\text{H.C.V.} = (33800 C + 144000 (H_2 - O_2/8) + 9270 S) \text{ KJ/Kg.}$$

2. Lower calorific value of fuel (L.C.V.) (or) Net C.V.

It is a total heat is liberated by complete burning of 1 kg or 1m³ of fuel deducting heat of steam formed by combustion of Hydrogen in the fuel.

OR

When heat absorbed (or) carried away by the products of combustion is not recovered and steam is formed during combustion is not condensed then amount of heat obtained per Kg of fuel is known as net (or) lower calorific value.

If H.C.V. is known then L.C.V. is obtained by

L.C.V. = H.C.V. – Heat of steam formed during combustion let.

m_s = Mass of steam formed in KJ/Kg. of fuel = 9 H₂

Since amount of heat per Kg. of steam is the latent heat of vaporization of water corresponding to a standard temperature of 25°C is 2466 KJ/Kg.

$$\text{L.C.V.} = \text{H.C.V.} - m_s \times 2466$$

$$\text{L.C.V.} = \text{H.C.V.} - 9 H_2 \times 2466 \text{ KJ/Kg.}$$

Dulong's formula used to calculate the theoretical calorific value of fuel if ultimate analysis is available and the calorific value of elementary combustibles are known.

Theoretical calorific Value of fuel = $33800 C + 144000(H_2 - O_2/8) + 9270 S$ kJ/kg

Where C, H₂ O₂ & S represents the mass of carbon, hydrogen, oxygen and sulfur in kJ/Kg