πBOND

Volume : 1 **Issue : 1** **May 04/2015**

Combustion and Thermal resistance to heat transfer essentially governs the efficiency of boiler. The fuel quality plays a very critical role to output i.e equivalent evaporation ratio. Particularly in small plant where the proficient laboratory is not available, industries very much rely on fuel suppliers or third party laboratory. To differentiate calorific value based on as receive bases or dry bases, counting moisture inherent and total bases is the very important and should be tracked by operational staff of thermal system.

This article gives the brief description of coal conversion statics.

COAL CONVERSION STATISTICS

Basis of Analysis Definitions:

As Received (ar) : Includes Total Moisture (**TM**)
Air Dried (ad) : Includes Inherent Moisture (**IM**) only
Dry Basis (db) : Excludes all Moisture
Dry Ash Free (daf) : Excludes all Moisture & Ash

The **Proximate Analysis** of any coal i.e. the % content of **Moisture, Ash (A), Volatile Matter (VM)**, **Fixed Carbon (FC)** - also **Sulphur (S)** and **Calorific Value (CV)** - can be expressed on any of the above bases.

Conversions:

To obtain:-	**Air Dry**	**Dry Basis**	**As Received**
	- multiply		
ar by:	(100 - IM %) / (100 - TM %)	100 / (100 - TM %)	-
ad by:	-	100 / (100 - IM %)	(100 - TM %) / (100 - IM %)
db by:	(100 - IM%) / 100	-	(100 - TM%) / 100

[For **daf**, multiply **db** by 100/ (100-**A**)]

Example:

	ar	ad	db	daf
TM	11.0	-	-	-
IM	2.0	2.0	-	-
Ash	12.0	13.2	13.5	-
VM	30.0	33.0	33.7	39.0
FC	47.0	51.8	52.8	61.0
Sulphur	1.0	1.1	1.12	-

MASS

Units:

- Metric ton (t) = tonne = 1000 kilograms (= 2204.6 lb)
- Imperial or Long ton (lt) = 1016.05 kilograms (= 2240 lb)
- Short (US) ton (st) = 907.19 kilograms (= 2000 lb)

Conversions:

- From **long ton** to **metric ton** multiply by 1.016
- From **short ton** to **metric ton** multiply by 0.9072
- **Mt** - Million tonnes
- **Mtce** - Million tonnes of coal equivalent (= 0.697 Mtoe)
- **Mtoe** - Million tonnes of oil equivalent

Calorific Values (CV)

Units:

- **kcal/kg** - Kilocalories per kilogram
- **MJ/kg*** - Mega joules per kilogram
- **Btu/lb** - British Thermal Units per pound

* 1 MJ/kg = 1 Gigajoule/tonne (GJ/t)

Gross & Net Calorific Values

Gross CV or higher heating value' (HHV) is the **CV** under laboratory conditions. **Net CV** or 'lower heating value' (LHV) is the useful calorific value in boiler plant. The difference is essentially the latent heat of the water vapour produced

Conversions – Units

❖ From **kcal/kg** to **MJ/kg** multiply by 0.004187
❖ From **kcal/kg** to **Btu/lb** multiply by 1.800
❖ From **MJ/kg** to **kcal/kg** multiply MJ/kg by 238.8
❖ From **MJ/kg** to **Btu/lb** multiply MJ/kg by 429.9
❖ From **Btu/lb** to **kcal/kg** multiply Btu/lb by 0.5556
❖ From **Btu/lb** to **MJ/kg** multiply Btu/lb by 0.002326

Conversions - Gross/Net (per ISO, for As Received figures)

- ❖ kcal/kg: Net CV = Gross CV - 50.6**H** - 5.85**M** - 0.191**O**
- ❖ MJ/kg: Net CV = Gross CV - 0.212**H** - 0.0245**M** - 0.0008**O**
- ❖ Btu/lb: Net CV = Gross CV - 91.2**H** - 10.5**M** - 0.34**O**

- Where **M** is % Moisture, **H** is % Hydrogen, **O** is % Oxygen (from ultimate analysis*, also As Received).

* Ultimate analysis determines the amount of carbon, hydrogen, oxygen, nitrogen and sulphur.

For typical bituminous coal with 10% M and 25% Volatile Matter, the differences between gross and net calorific values are approximately as follows:

260 kcal/kg	1.09 MJ/kg	470 Btu/lb

Sources: GWC Coal Handbook & IEA Clean Coal Centre References:
http://www.worldcoal.org/resources/coal-statistics/coal-conversion-statistics/

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