CORRECTION FACTORS USED IN BOILER EFFICIENCY CALCULATION

HOW TO CALCULATE CORRECTION FACTORS

FOR ADJUSTMENT OF BOILER EFFICIENCY CALCULATION

Interesting Facts

1. **Bagasse GCV @50%- 2272 kcal/kg or 2300 kcal/kg a RARE Phenomena but Dominant for Bagasse Fired Boiler Design & Guaranteed Efficiency Calculation**
2. **Normally, CUSTOMER DOES NOT RECEIVE any Contractual Guaranteed Boiler Efficiency Detailed Calculation BUT all CORRECTION are applied on the basis of these calculations only.**

MAIN FAVOURABLE for Efficiency Correction:

1. Fuel Hydrogen % Content
2. Fuel Moisture % Content
3. Fuel GCV
4. APH GAS Outlet temperature (Least preferable)
5. ESP Outlet / Chimney Inlet Gas temperature
6. Relative Humidity & Air Density
7. Ambient Air Inlet temperature **BUT** Efficiency Calculation done on Air Inlet temperature after Fan Rise Consideration OR SCAPH Outlet
8. Fuel Oxygen % Content
9. Fuel Ash % Content
10. Fuel Sulphur % Content
11. Fuel- Fixed Carbon / Volatile Matter Ratio
12. Limestone Size and Reactivity
13. Economiser Inlet Water Temperature and relatively Steam Flow Correction

NORMALLY AVOIDED for Efficiency Correction & Auxiliary Power Consumption:

1. Ash Unburnt Carbon
2. Radiation Loss
3. Deaerator Outlet Water Temperature
4. Excess Air
5. Flue Gas Volumetric Flow Rate w.r.t. temperature for Power Consumption & Change in Velocity
6. Change in APH Gas Outlet Temperature due to variation in Economiser Inlet Water temperature
7. Change in Auxiliary Power Consumption due to variation in Ambient Air temperature, Particle size distribution

NORMALLY IGNORED, if going beyond design predicted limits:

1. Attemperator Spray Water Quantity (to Achieve Final Steam Temperature)
2. Economiser outlet Feed water temperature
3. Air Pre-Heater (APH) Air outlet temperature
4. Change in Air Distribution Ratio in Primary vs Secondary

PROCEDURE TO PLOT EFFICIENCY CORRECTION CURVE

Essential Input Required for Efficiency Correction Curve is Contractual Guaranteed Boiler Efficiency Detailed Calculation

a. **Efficiency Loss % due to 3.10% Hydrogen in Fuel** e.g. 3.80% loss
   Correction Curve Calculation:-
   Variation/Correction for 4.20% Hydrogen= 4.20*(3.80/3.10) = 5.15% loss
   Net correction applied = 5.15% - 3.80% = 1.35%

b. **Efficiency Loss % due to 13.10% Moisture in Fuel** e.g. 1.80% loss
   Correction Curve Calculation:-
   Variation/Correction for 24.10% Moisture= 24.10*(1.80/13.10) = 3.31% loss

Net correction applied = 3.31% - 1.80% = 1.51%

c. **Efficiency Loss % Dry Gas at Fuel GCV 4500 kcal/kg** e.g. 4.50% loss. The Dry Gas produced 1650 Kg/Mcal, Combustion Air 1620 Kg/Mcal, Moisture in product 120 Kg/Mcal, Fuel in products 150 kg/Mcal

Correction Curve Calculation:-

Variation/Correction in dry gas loss for fuel GCV 4200 kcal/kg, the dry gas produced 1670 kg/Mcal, Fuel in products 160 kg/Mcal (variable), Moisture & Combustion air product (constant) = 4.50*(1670/1650) = 4.55% loss

Net correction applied = 4.55% - 4.50% = 0.05%

ANOTHER BEST FAVOURABLE ADJUSTMENT METHOD for GCV CORRECTION

Lets Assume Boiler Guaranteed Efficiency- 76%, then correction multiply factor is 100-76=**24**%

Variation/Correction for 4200 kcal/kg GCV = **24** - **24***(4200/4500) = 1.60% loss

Net correction applied DIRECTLY = 1.60% (It indicate major difference in both calculation)

d. **Efficiency Loss % due to 15.00% Ash in Fuel** e.g. 0.5% loss

Correction Curve Calculation:-

Variation/Correction for 25.0% Ash= **NO RULES ARE FOLLOWED during CALCULATION**- ENJOY & ADJUST AS PER REQUIREMENT

Net correction applied = 0.5% - xxx% = xxx%

e. **Efficiency Loss % Dry Gas at 35% Excess Air** e.g. 6.1% loss at 2300 kcal/kg GCV of Fuel. The Dry Gas produced 1710 Kg/Mcal, Combustion Air 1658 Kg/Mcal, Moisture in product 360 Kg/Mcal & Fuel in products 425 kg/Mcal

Correction Curve Calculation:-

Variation/Correction in dry gas loss for 40% Excess Air, the dry gas produced 1850 kg/Mcal, combustion air product 1785 kg/Mcal (variable), Moisture & Fuel in products (constant) = 6.10*(1850/1710) = 6.60% loss

Net correction applied = 6.60% - 6.10% = 0.50%

f. **Efficiency Loss % Dry Gas at 180 degC APH Gas Outlet Temperature** e.g. 9.1% loss and Dry Gas produced 2580 Kg/Mcal and 33 degC ambient temperature

Correction Curve Calculation:-

Variation/Correction in dry gas loss for 200 degC APH Gas Outlet Temperature, dry gas produced 2580 kg/Mcal and 33 degC ambient temperature = 2580*Specific heat of flue gas constant like 0.24 *(200 - 33) = 10.34% loss

Net correction applied = 10.34% - 9.10% = 1.24%

Like Above Details, Please do the Calculation for Each and Individual Correction applied on Boiler Efficiency Calculation and FINALLY YOU WILL BE SURPRISED to See the RESULT, because in many cases NO RULES ARE FOLLOWED during CALCULATION - ENJOY & ADJUST AS PER REQUIREMENT.

A CORRECT OBSERVATION will SAVE ENERGY & COST

"ENERGY CONSERVATION & TROUBLE FREE WORK ENVIRONMENT"

M/s Unite Energy Corporation LLP is keen to provide the Spares, Sales & service, Retrofit & Repair, Consultancy support to mitigate the irregularities in the plant, minimize breakdown & downtime, improvise design & system performance to improve the overall plant's health and performance.

Regards

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