15th NATIONAL CERTIFICATION EXAMINATION
FOR
ENERGY AUDITORS – August, 2014

PAPER – 4: Energy Performance Assessment for Equipment and Utility Systems

Date: 24.8.2013 Timings: 14:00-16:00 Hrs Duration: 2 Hrs Max. Marks: 100

Section - I: BRIEF QUESTIONS Marks: 10 x 1 = 10

(i) Answer all **Ten** questions
(ii) Each question carries **One** mark

S-1	Which loss is not considered while evaluating boiler efficiency by "Indirect Method"?
Ans	Blow down loss
S-2	What will be the synchronous speed of a VFD driven 4-pole induction motor operating at 40 Hz ?
Ans	Ns = 120 x f/P = 120 x 40/4= 1200 RPM
S-3	What is the refrigerant used in a vapour absorption system with lithium bromide as an absorbent?
Ans	Water
S-4	Other than rated kW of motor and the actual power drawn, what other parameter is required to determine the percentage loading of the motor ?
Ans	Motor Efficiency or rated motor efficiency
S-5	Inclined tube manometer is used for measuring gas flow in a duct when the air velocity is very high: True or False?
Ans	False.
S-6	A pump will cavitate if the $NPSH_{required}$ is _________ than the $NPSH_{available}$.
Ans	More
S-7	To determine the effectiveness of the cooling tower, it is required to measure cooling water inlet, outlet and _____temperatures.
Ans	Ambient Wet bulb
S-8	The ratio of actual heat transfer to the heat that could be transferred by heat exchanger of infinite size is termed as ………

Ans	Effectiveness
S-9	If the unit heat rate of a power plant is 3070 kcal/kWh ,what is the power plant efficiency ?
Ans	(860/3070) x 100 = 28 %
S-10	The difference between GCV and NCV of hydrogen fuel is Zero: True or False
Ans	False

………… End of Section - I …………

Section - II: SHORT NUMERICAL QUESTIONS Marks: 2 x 5 = 10

(i) Answer all **Two** questions
(ii) Each question carries **Five** marks

L-1	Hot water at 80 ^{O}C is used for room heating in a 5 Star hotel for 4 months in a year. About 200 litres per minute of hot water is maintained in circulation with the return temperature at 50 ^{O}C. The hot water is generated using a 'hot waste stream', through a Plate Heat Exchanger (PHE). The hot stream enters the PHE in counterflow direction at 95 ^{O}C and leaves at 60 ^{O}C. The area of the heat exchanger is 20 m^2. Calculate the LMTD and the overall heat transfer coefficient.
Ans	Heat load, Q = 200 * 60 * (80 – 50) = 360000 Kcals/hr (or) 418.7 kW LMTD (for counter flow) $= \frac{(95 - 80)/(60 - 50)}{\ln (15/10)} = 3.7\ ^{O}C$ Overall Heat Transfer Coefficient, U = Q/(AxLMTD) = 418.7/(20 x 3.7) = 5.66 kW/m^2.^{O}C (OR) = 4864.8 kcal/hr.m^2.^{O}C
L-2	A gas turbine generator is delivering an output of 20 MW in an open cycle with a heat rate of 3440 kcal/kWh. It is converted to combined cycle plant by adding heat recovery steam generator and a steam turbine raising the power generation output to 28 MW. However, with this retrofitting and increased auxiliary consumption, the fuel consumption increases by 5% in the gas turbine.

	Calculate the combined cycle gross heat rate and efficiency.
Ans	Gas turbine output = 20 MW Combined cycle output = 28 MW Heat rate in GT open cycle for 20 MW = 3440 kcal/kwh Increase in fuel consumption in combined cycle operation = 5% Combined cycle heat rate = (3440 X 1.05) X(20 / 28) = 2580 kcal/kwh Combined cycle plant efficiency = (860 / 2580) X 100 = 33.33%

………… End of Section - II …………

Section - III: LONG NUMERICAL QUESTIONS Marks: 4 x 20 = 80

(i) Answer all **__Four__** questions

N-1	The steam requirement of an export oriented unit is met by a 6 TPH oil fired package boiler generating steam at 10 kg/cm^2. The monthly steam consumption of the unit is 3000 tonnes. Other data are given below: Fuel oil composition: Carbon = 86%; Hydrogen = 12%; Oxygen= 0.5%; Sulphur =1.5% Specific heat of flue gases, Cp = 0.27 kcal/kg^{o}C G.C.V. of fuel oil = 10,000 kcal/kg Sp.heat of super heated water vapour = 0.45 kcal/kg^{o}C Enthalpy of steam at 10 kg/cm^2 = 665kcal/kg Feed water temperature = 85 ^{o}C % O$_2$ in dry flue gas = 6% Flue gas temperature at boiler outlet = 240 ^{o}C Ambient temperature = 30^{o}C Cost of fuel oil = Rs.43 per kg. Radiation and other unaccounted losses = 2.45% The export oriented unit is costing its steam cost based on the fuel consumption cost with additional 15% to account for the auxiliary and consumables. A neighbouring continuous process plant now offers to supply the required steam at 10

kg/cm2 to the export oriented unit at a cost of Rs 3300 per tonne with a condition that all the condensate will be returned back.

Calculate the following:

a) Boiler efficiency
b) Cost advantage per tonne of availing steam from neighbouring plant in place of in-house generation and also monthly monetary saving.

Ans

First calculate the efficiency of Boiler (in EOU)

Theoretical air required =
= 11.6 C + 34.8 (H – O/8) + 4.35 S
= [11.6 X 86 + 34.8 (12 – 0.5/8) + 4.35 X 1.5] x 1/100
= 14.195 = Say 14.2

% Excess Air = [% O_2 / (21 - % O_2)] X 100
= [6 / (21 – 6)] X 100 = 40%

AAS = Actual amount of air supplied = 14.2 X 1.4
= **19.88 kg per kg. of fuel oil**

Mass of dry flue gas m_{dfg} = Mass of combustion gases due to presence of C,H,S +Mass of N_2 supplied
= (0.86 X 44/12) + (0.015 X 64 / 32) + [(19.88 – 14.2) X 23 / 100] + (19.88 X 77/100)
= 19.797

Mass dry flue gas ,say = 19.8 Kg / kg fuel

Or

Alternatively mass of dry flue gas = (AAS + 1) – 9 H
= (19.88 + 1) – 9 X 0.12 = 19.8 Kg./Kg. fuel

L1 = % heat loss in dry flue gas = [m_{dfg} x Cp x (T_q – T_a) / GCV] x 100

$$= \frac{19.8 \times 0.27 \times (240 - 30)}{10{,}000} \times 100$$

L1 = **11.23%**

L2 = Loss due to presence of hydrogen forming water vapour

$$= \frac{9 \times H \; [584 + Cps\,(T_g - T_a)]}{GCV} \times 100$$

$$= \frac{9 \times 0.12\,[584 + 0.45\,(240 - 30)]}{10000} \times 100$$

L2 **= 7.33%**

L3 = Radiation and other unaccounted losses **= 2.45%**

Total losses = L1 + L2 + L3

= 11.23 + 7.33 + 2.45 = **21.05 %**

Efficiency of the EOU boiler by indirect method

= 100 – 21.05 =78.99 %

= **Say 79 %**

<u>Secondly calculate the cost of steam in the EOU plant</u>

Evaporation Ratio = [(n X GCV) / (h_g – h_f)] X 100

= [(0.79 X 10000) / (665 – 85)] X 100

= 13.62 kg Steam / kg. Fuel

Fuel oil consumption = 1000 / 13.62 kg. per tonne of steam

Fuel oil consumption = 73.42 kg./tonne of steam gen

Cost of fuel oil. = Rs. 43 per kg

Cost of steam in EOU = Fuel cost + 15% fuel cost

= 73.42 x 1.15 x 43

= Rs.3,599 per tonne

Say = Rs 3600 per tonne

Selling cost of steam from neighboring plant = Rs 3300 per tonne

Cost advantage = 3600 – 3300 = Rs.300 per tonne

Annual Savings = Rs.300 per tonne x 3000tonne/month X 12 month

= Rs.108 Lacs

N-2

a) The operating parameters of a Vapour Compression Refrigeration system are indicated below.

Parameter	Chiller side	Condenser side
Water Flow (m^3/hr)	89	87
Inlet Temperature (^{O}C)	10.1	32.3
Outlet Temperature (^{O}C)	6.8	36.6
Density (kg/m^3)	1000	990

Find the COP of the Refrigeration system ignoring heat losses.

b) A 6 pole, 415 volt, 3 Φ, 50 Hz induction motor delivers 22 kW power at rotor shaft at a speed of 950 rpm with PF of 0.88. The total loss in the stator including core, copper and other losses, is 2 kW. Calculate the following.

i) Slip
ii) Rotor Copper Loss
iii) Total Input to motor
ivi) Line current at 415 V and motor pf of 0.88
v) Motor operating efficiency

a) Refrigeration Effect = 89 x 1000 x (10.1 – 6.8)

Ans

= 293700 kcal/hr

Condenser load = 87 x 990 x (36.6 – 32.3)

= **370359 kcal/hr**

Compressor work = Condenser load – Refrigeration effect

= 370359 – 293700

= **76659 Kcal/hr**

C.O.P. = Refrigeration Effect/ Compressor work

= 293700/76659 = **3.83**

b) Synchronous Speed = (120 x 50 / 6) = 1000 rpm

Motor Speed = 950 rpm

(i) Slip = (1000 – 950) / 1000 = **5%**

Power input to rotor = { (22 / (1 – 0.05) } = 23.16 kW

(ii) Rotor Copper Loss = (0.05 x 23.16) = **1.158kW**

Or = 23.16-22 =1.16 kW

(iii) Total Input to motor = (23.16 + 2) = **25.16 kW**

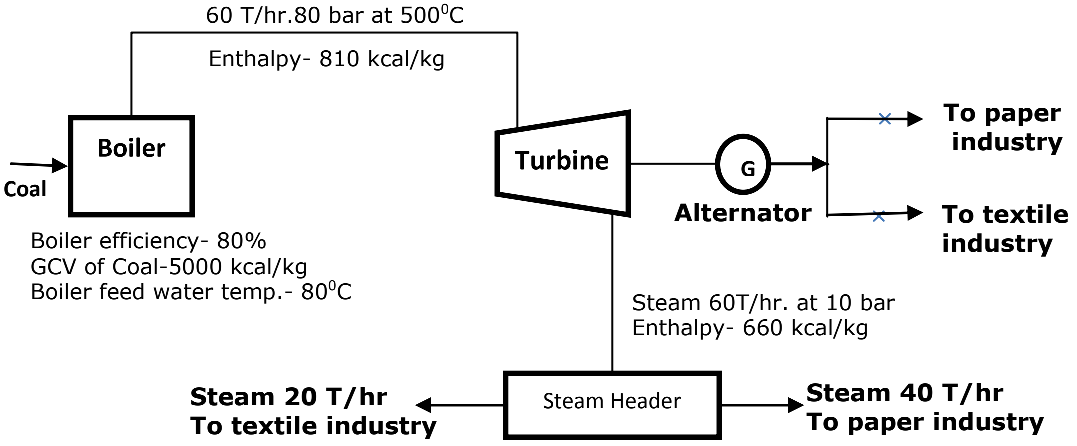
(iv) Line Current = (25.16 x 1000) /(√3 x 415 x0.88)

= **39.75 Amps**

(v) Motor Efficiency = (22 / 25.16) = **87.44 %**

N-3

A common plant facility is installed to provide steam and power to textile and paper plant with a co-generation system. The details and operating parameters are given below:

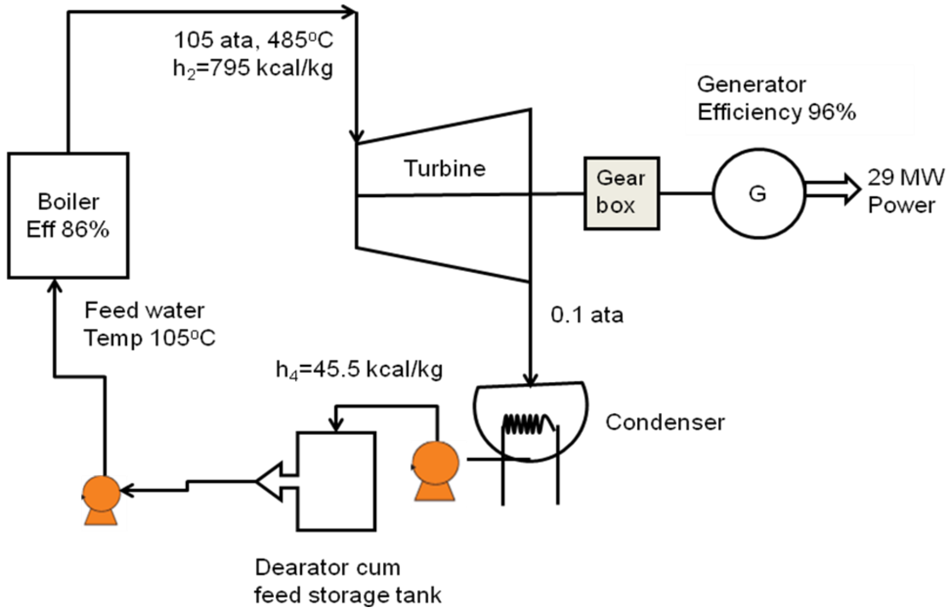


Other data:

- Turbine, alternator and other losses = 8%
- Specific steam consumption in paper industry= 5 Tons/Ton of paper
- Specific power consumption in paper industry= 600 kWh/Ton of paper

Calculate:

	i. Coal consumption in boiler per hour or per day. ii. Power generation from co-generation plant iii. If 10% is auxiliary power consumption in co-generation plant, how much power is consumed by the textile industry per hour? iv. What is the gross heat rate of turbine?
Ans	i) Boiler efficiency = Steam production (steam enthalpy- Feed water enthalpy) / Quantity of coal x G.C.V. of coal Quantity of coal = 60,000 (810-80)/ 0.8 x 5000 **= 10.95 tons/hr**. ii) Gross power generation from co-generation plant Total enthalpy input to turbine = 60,000 x 810 = 48.6 Million kcal. Total enthalpy out put through back pressure= 60,000* 660 = 39.6 Million kcal Enthalpy difference = 48.6- 39.6 = 9 Million kcal/hr Turbine,alternator and other losses =8% or 9x0.08 = 0.72 Million kcal/hr Useful energy for power generation = 9- 0.72 = 8.28 Million kcal/hr Power generation from co-generation plant = 8.28 x 10^6/860 = **9628kWh** iii) If 10% is auxiliary power consumption in co-generation plant, power consumed by textile industry 10% of total power generation = 9628 x 0.10 = 962.8kWh Total power consumed by industries = 9628 – 962.8 = 8665.2kWh Total steam consumption in paper plant 40 tons/hr. and specific steam consumption 5 ton/ton of paper. So Paper production per hour is 8 tons. Specific power consumption = 600kWh/ton. Total power consumption in paper industry = 8 x 600 = 4800kWh Total power consumption in textile industry = 8665.2- 4800 = **3865.2 kWh** iv) Gross heat rate= Input enthalpy – output enthalpy/ gross generation =(48.6- 39.6) 10^6/ 9628 = **934.7 kCal/kWh**
N-4	To attempt **ANY ONE OF THE FOLLOWING** among A, B, C and D
A	A captive thermal plant is delivering an output of 29 MW at the generator terminal. The generator efficiency is 96%. The steam generated in a utility boiler with an efficiency of 86% at 105 ata and 485^{o}C is fed to the turbine. The turbine exhausts steam to condenser maintained at 0.1 ata and 45.5^{o}C. The feed water temperature at inlet to the boiler is 105^{o}C.



The other data pertaining to captive power plant are,

Enthalpy of steam at 105 ata 485^{o}C = 795 kcal/kg.
Dryness fraction of steam at inlet to condenser = 0.9
Enthalpy of dry saturated steam at 0.1ata =618 kcal/Kg.
Enthalpy of water at 0.1 ata & at 45.5^{o}C = 45.5 kcal/Kg.
Loss in the gear box connecting turbine and generator = 1100 kW
Enthalpy of feed water at inlet to the boiler , = 105 kcal/Kg.

Based on the above data determine:

i. Output of the steam turbine in kW
ii. Steam flow through the turbine
iii. Turbine heat rate
iv. Unit heat rate

Ans

Enthalpy of steam at turbine exhaust = 45.5 +0.9 (618 – 45.5)
i.e. h_3 = 560.75 Kcal/Kg.

Generator electric output = 29000 KW
Generator input = 29000 / 0.96 = 30208.33 KW

Loss in gear box = 1100 KW
Output of steam turbine = Generator input + Gear box loss
= 30208.33 + 1100
= 31308.33 KW

i) Output of the steam turbine **Say = 31308 KW**

ms = Steam flow through turbine

= (Turbine output x 860) / ($h_2 – h_3$) Turbine enthalpy drop

h_2 = Enthalpy at turbine inlet = 795 kcal/kg

h_3 = Enthalpy at turbine exhaust = 560.75 kcal/Kg.

m_s = 31308 x 860 / 795 – 560.75) = 114940.78 kg/Hr.
= 114.94 TPH

ii) Steam flow through the turbine **Say = 115 TPH**

iii) Turbine heat rate = Heat input to turbine / Generator output
= [m_s ($h_2 – h_1$)] / 29000
= 115000 (795 – 105) / 29000
= 2736.2 kcal/ kWh

iv)Unit heat rate = Turbine heat rate / Efficiency of boiler

Unit heat rate = 2736.2 / 0.86 = **3181.63 kcal/ kWh**

Or

B In a textile unit a stenter is delivering 80 meters/min of dried cloth at 5% moisture. The moisture of wet cloth at inlet is 50%. The stenter is heated by steam at 7 kg/cm^2 with inlet enthalpy of 660 kcal/kg. and condensate exits the stenter at 135 kcal/kg.

Other data

- Latent heat of water evaporated from the wet cloth = 540 kcal/kg
- Weight of 10 meters of dried cloth = 1 kg
- Inlet temperature of wet cloth = 27°C
- Outlet temperature of dried cloth at stenter outlet = 80°C.

i) Estimate the steam consumption in the stenter considering a dryer efficiency of 48%.

ii) Determine the specific steam consumption kg/kg of dried cloth

Ans Output of stenter = 80 mts/min.
= 80 x 60 /10 = 480 Kg/hr.

Moisture in the dried output cloth = 5%

Wt of bone dry cloth = 480 X (1 – 0.05)

i.e. W = 456 Kg/hr.

m_o =moisture in outlet cloth
=(480 – 456)/456 =0.0526 Kg./Kg. of bone dried cloth

Inlet moisture = 50%

Wt of inlet cloth = 456 / (1 – 0.50) = 912 Kg./hr.

m_i = moisture in inlet cloth
= 912 X 0.5 / 456 = 1.00 Kg./Kg. bone dried cloth

Inlet temperature of cloth = 27°C

Final temperature of cloth = 80^{o}C

Heat load on the dryer = w x (m_i – m_o) X [(T_{out} – T_{in}) + 540] Kcal/hr.

Heat load on the dryer = 456 (1 – 0.0526) X [(80 – 27) + 540]
= 2,56,184.5 Kcal/hr

Efficiency of the dryer = 48%

Heat input to the stenter = 2,56,184.5 / 0.48 = 5,33,717.71 Kcal/hr

Steam consumption in the stenter = 5,33,717.71 / (660 – 135)
= 1016.61 Kg/hr

Steam consumption per Kg. of dried at stenter outlet cloth
= 1016.61 / 480
= 2.12 Kg./Kg. dried cloth

Or

C Determine the **cooling load** of a commercial building for the following given data.

Outdoor conditions :

DBT = 35°C ; WBT = 25°C; Humidity = 18 g of water / kg of dry air

Desired indoor conditions :

DBT = 25.6°C ; RH = 50 %; Humidity = 10 g of water / kg of dry air

Total area of wall = 40 m^2

Total area of window = 20m^2

U – Factor (Wall) = 0.33 W / m^{2}K

U – Factor (Roof) = 0.323 W / m^{2}K

U – factor [fixed windows with aluminum frames and a thermal break] = 3.56 W / m^{2}K

- 15 m x 25 m roof constructed of 100 mm concrete with 90 mm insulation & steel decking.
- CLTD at 17:00 h :Details : Wall = 12°C Roof = 44°C Glass Window = 7°C
- SCL at 17 : 00 h :Details : Glass Window = 605 W/ m^2
- Shading coefficient of Window = 0.74
- Space is occupied from 8:00 to 17:00 h by 25 people doing moderately active work.
- Sensible heat gain / person = 75 W ; Latent heat gain / person = 55 W ; CLF for people = 0.9

- Fluorescent light in space = 21.5 W/m^2 FLF for lighting = 0.9
- Ballast factor details = 1.2 for fluorescent lights & 1.0 for incandescent lights
- Computers and office equipment in space produces 5.4 W/m^2 of sensible heat
- One coffee maker produces 1050 W of sensible heat and 450 W of latent heat.
- Air changes / hr of infiltration = 0.3
- Height of building = 3.6 m

Ans

I External Heat Gain

(i) Conduction heat gain through the wall =U – factor x net area of wall x CLTD
=[0.33 x 40 x 12] = 158.4 W

(ii) Conduction heat gain through the roof =U – factor x net area of roof x CLTD
=0.323 x (15 x 25) x 44 = 5 329.5 W

(iii) Conduction heat gain through the windows =U – factor x net area of windows x CLTD
= (3.56 x 20 x 7) = 498.4 W

(i) Solar radiation through glass = Surface area c Shading coefficient x SCL

=(20 x 0.74 x 605) = 8 954 W

II Internal Heat Gain

(i) Heat gain from people =Sensible heat gain + Latent heat gain

Sensible heat gain =(No.of people x Sensible heat gain / person x CLF)
=(25 x 75 x 0.9) = 1 687.5 W

Latent heat gain =No.of people x Latent heat gain / person
=(25 x 55) = 1 375 W

Therefore, Heat gain from people=(1687.5 + 1375) = 3 062.5 W

(ii) Heat gain from lighting =(Energy input x Ballast factor x CLF)

Energy input =(Amount of lighting in space / unit area) x Floor area
=21.5 x (15 x 25) =8 062.5 W

Therefore, heat gain from lighting =(8062.5 x 1.2 x 0.9) =8 707.5 W

(iii) Heat generated by equipment :

Sensible heat generated by coffee maker =1050 W

Latent heat generated by coffee maker =450 W

Sensible heat gain by computers and office equipment = 5.4 x 375 = 2025 W

Therefore, Heat generated by equipment = **3 525 h**

(iv) Heat gain through air infiltration=(Sensible heat gain + Latent heat gain)

Sensible heat gain =(1210 x airflow x ΔT)

Airflow =(Volume of space x air change rate) / 3600

={ (15 x 25 x 3.6) x 0.3 } / 3600

=0.1125 m^3 / s

Therefore, sensible heat gain =1210 x 0.1125 x (35 – 25.6) =1 279.58 W

Latent heat gain =3010 x 0.1125 x (18 – 10) = 2 709 W

No	Space Load Components	Sensible Heat Load (W)	Latent Heat Load (W)
1	Conduction through exterior wall	158.4	------
2	Conduction through roof	5 329.5	------
3	Conduction through windows	498.4	------
4	Solar radiation through windows	8954	------
5	Heat gained from people	1 687.5	1 375
6	Heat gained from lighting	8 707.5	------
7	Heat gained from equipment	3 075	450
8	Heat gained by air infiltration	1 279.58	2 709
Total space cooling load		**29 689.88**	**4 534**

Or

D During heat balance of a 5 stage preheater Kiln in a cement plant, the following data was measured at Preheater (PH) Fan Inlet and clinker cooler vent air fan inlet:

Parameter measured	Temperature	Static Pressure	Avg. Dynamic Pressure	Specific heat	Gas Density at STP	Duct Area
Unit	^oC	(P_s) mm WC	(P_d) mm WC	kcal/kg ^oC	kg/m^3	m^2
PH Exit Gas at PH fan Inlet	316	-650	28.6	0.248	1.4	2.27
Clinker cooler vent air at cooler Stack Fan Inlet	268	-56	9.7	0.24	1.29	2.01

Note: take Pitot tube constant as 0.85, reference temperature 20 ^oC and atmospheric pressure 9908 mm WC.

Other Data

Clinker Production	Designed specific volume of PH gas	NCV of Coal	Cost of coal	Annual Operation
TPH	Nm^3/kg clinker	kcal/kg	Rs./ton	hrs
45.16	1.75	5500	6500	8000

Calculate the following:

i. Specific volume of PH gas as well as cooler vent air (Nm^3/kg clinker)

ii. Heat loss in pre-heater exit gas (kcal/kg clinker)

iii. Heat loss in cooler vent air (kcal/kg clinker)

iv. If the measured specific volume of PH gas (Nm^3/kg clinker) exceeds the design value, calculate the heat loss (kcal/kg clinker) and annual monetary loss due to excessive specific volume of PH gas.

Ans

i. Density of Pre-heater gas at PH Fan Inlet at prevailing temp., pressure conditions:

$$\rho_{T,P} = \rho_{STP} \text{ X } \frac{273 \text{ X } (9908 + P_S)}{(273 + T) \text{ X } 10334}$$

$$\rho_{T,P} = 1.40 \text{ X } \frac{273 \text{ X } (9908 - 650)}{(273 + 316) \text{ X } 10334} = 0.581 \text{ kg/m}^3$$

Velocity of PH gas

$$v = P_t \sqrt{\frac{2 g P_d}{\rho_{T,P}}}$$

$$v = 0.85\sqrt{\frac{2 X 9.8 X 28.6}{0.581}}$$ = 26.4 m/sec

Volumetric flow rate of PH gas = velocity X duct cross-sectional area
= 26.4 X 2.27
= 59.9 m^3/sec
= 59.9 X 3600
= 215640 m^3/hr

Specific volume of PH gas = 215640 X 0.58/1.4
= 89491 Nm^3/hr
= 89491/45160 = **1.98 Nm^3/kg clinker**

Similarly density of cooler vent air at cooler vent air fan Inlet at prevailing temp., pressure conditions:

$$\rho_{T,P} = \rho_{STP} X \frac{273 X (9908 + P_S)}{(273 + T) X 10334}$$

$$\rho_{T,P} = 1.29 X \frac{273 X (9908 - 56)}{(273 + 268) X 10334}$$ = 0.62 kg/m^3

Velocity of cooler vent air in the fan inlet duct

$$v = P_t\sqrt{\frac{2 g P_d}{\rho_{T,P}}}$$

$$v = 0.85\sqrt{\frac{2 X 9.8 X 9.7}{0.62}}$$ = 14.88 m/sec

Volumetric flow rate of PH gas = velocity X duct cross-sectional area
= 14.88 X 2.01
= 29.9 m^3/sec
= 29.9 X 3600
= 107640 m^3/hr

Specific volume of cooler vent air = 107640 X 0.62/1.29
= 51734 Nm^3/hr
= 51734/45160 = **1.15 Nm^3/kg clinker**

ii)Heat loss in PH exit gas

Q1 = $m_{ph}\ c_p\ \Delta T$ (C_p of PH gas = 0.248 kcal/kg ^oC)
Q1= 1.98 X 1.4 X 0.248 x (316-20)
= 203.5 kcal/kg clinker

iii) Heat loss in cooler vent air

Q2 = $m_{CA}\ c_p\ \Delta T$ (C_p of cooler vent air = 0.24 kcal/kg ^oC)
Q2= 1.15 x 1.29 x 0.24 x (268-20)
= 88.3 kcal/kg clinker

iv) Heat Loss due to excess specific volume of PH gas

V_{excess} =1.98 – 1.75 = 0.23 **Nm^3/kg clinker**

Heat loss Q = 0.23 x 1.4 x 0.248 x (316-20) = 23.6 **kcal/kg clinker**

Equivalent coal saving = 23.6/5500 = 0.0043 kg coal/kg clinker or ton of coal/ton of clinker
Coal saving in one hour = 0.0043 x 45.16 = 0.194 TPH
Annual Coal Saving = 0.194 x 8000= 1552 tons of coal per annum
Annual Monitory Saving = 1552 x 6500 = Rs. 100.88 lakhs

-------- End of Section - III ---------