HEAT BALANCE SHEET ON IC ENGINE

Ex.No. **Date:**

Aim :

To conduct the test on the given IC engine and to prepare the heat balance sheet .

Apparatus Required : :

1. Given IC engine with loading arrangement
2. measuring tape or Thread and scale
3. Tachometer
4. Stop watch
5. Bucket
6. Spring balance
7. Thermometer (3 Nos)

Theory and Description :

A heat balance sheet is an account of heat supplied and heat utilised in various ways in the system . Necessary information concerning the performance of the engine is obtained from the heat balance sheet . The heat balance sheet is generally done on second basis or minute basis or hour basis.

The engine should equipped with suitable loading arrangement to measure the brake power of the engine. Provisions are also made to measure the amount of air intake . amount of fuel consumed , temperature of cooling water at inlet and outlet of the engine amount of cooling water circulated and temperature of exhaust gases .

The heat supplied to the engine is only in the form of fuel – heat and is equal to .

$$Q_s = m_f \times C.V$$

Where,

m_f = mass of fuel used in kg/min

C.V = Calorific value of fuel in KJ /kg

The various way in which the heat is utilised are

1. Heat equivalent to brake power of the engine.
2. Heat carried away by the cooling water
3. Heat carried away by the exhaust gases
4. Unaccounted heat losses.

Observation and Tabulation

1. Brake power B.P = _____ KW

2. Speed N = ___ . RPm

3. Type of loading : Rope .

4. Fuel used :

5. Calorific value of fuel CV = _____ KJ/kg
   For diesel : 42,000 KJ/kg to 45000 KJ/kg
   For petrol : 41,000 KJ/kg to 44000 KJ/kg

6. Effective Radies of the durm : Re = _____

7. Specific gravity of fuel :
   For diesel = 0.83
   For petrol = 0.78

8. Diameter of orifice d = _____ m.

S.No:	Loading				Manometer Reading			mass of air consumed 'ma' in kg/min	Time taken for 10cc fuel consumption 't' in sec	Time for 5 lit water collection tw sec	Cooling water Temp		Room Temp	Exhaust gas Temp	Engine speed
	W_1 kg	W_2 kg	Net load W_1-W_2 kg	Net load W in 'N'	L_1 'Cm'	L_2 'Cm'	$h = L_1 - L_2$ 'Cm'				Inlet T_1 Twi°C	Outlet T_2 Two°C	T_A in °C	T_G °C	'N' in RPm

Formulae Used :

Heat equivalent to B.P:

The brake power in KW is converted into KJ/min

$Q_{B.P}$ = B.P x 60 = _____ KJ/min

Heat carried away by the cooling water : (Qw)

Qw = Mw x CPw (Two – Twi) in KJ/min

Where,

Mw = mass of cooling water circulated in kg/min

CPw = Specific heat of cooling water

= 4.186 KJ/kgK

Twi = Temperature of cooling water at inlet in °C

Two = Temperature of cooling water at outlet of the engine in °C

Heat carried away by the exhaust gases : (Q_g)

Q_g = m_g CP_g (T_g – T_R)

m_g = mass of the exhaust gases in kg/min

m_a = mass of air consumed in kg/min

m_f = mass of fuel consumed in kg/min

C_{pg} = Specific heat of exhaust gases

= 1.005 KJ/kgK

T_g = Temperature of exhaust gases in °C

T_R = Room temperature in °C

Unaccounted heat losses :

Qun = Qs - (Q.B.P + Qw + Qg) in KJ / min

Procedure :

1. From the name plate details , calculate the maximum load that can be applied on the given engine.
2. Check the engine for fuel availability , lubricant and cooling water connection
3. Release the load on engine completely and start the engine with no load condition. Allow the engine to run for few minute to attain the rated speed
4. Adjust the cooling water flow and maintain steady flow of water.
5. Apply the load , from no load to required load slowly . At required load slowly . At required load note the following .
   - i) Load on the engine
   - ii) Speed of the engine in Rpm
   - iii) Time taken for 10 cc of fuel consumption
   - iv) Manometer readings
   - v) Temperature of cooling water at engine inlet and engine outlet in °C
   - vi) Time taken for collection of 5 lit or 10 lit of cooling water
   - vii) Room temperature and temperature of exhaust gases

Heat Balance Sheet :

S No	Particulars	Credits		Debits	
		KJ/min	%	KJ/min	%
1	Qs				
2	Q_{BP}				
3	Q_w				
4	Qg				
5	Qun				
	Total				

Result :

The test was conducted on the given IC engine and the heat balance sheet was prepared for the particular load.