

1. INDICATED MEAN EFFECTIVE PRESSURE (IMEP) or P_{mi}

From the area of indicator diagram it is possible to find an average gas pressure that acts on piston throughout power stroke would account for the network done. This pressure is called indicated mean effective pressure (I.M.E.P.). It is the hypothetical pressure which is thought to be acting on the piston throughout the power stroke

2. INDICATED POWER (I.P.) : Total power developed by combustion of the fuel in combustion chamber.

indicated horse power (I.H.P.) of the engine can be calculated as follows:

$$I.P. = (n \cdot P_{mi} \cdot L \cdot A \cdot N) / (60000 \times k) \text{ kW}$$

Where,

P_{mi} = I.M.E.P. in N/m^2

L = Length of stroke in metres

A = Piston areas in m^2

N = Speed in R.P.M.

n = Number of cylinders

k = 1 for two stroke engine

= 2 for four stroke engine.

3. BRAKE POWER (B.P.)

Brake horse power is defined as the net power available at the output shaft. It is found by measuring the output torque with a dynamometer.

$$B.P. = 2\pi NT/60 \text{ kW}$$

Where, T = Torque in N.m, N = Speed in R.P.M.

4. FRICTIONAL HORSE POWER (F.H.P.)

The difference of I.H.P. and B.H.P. is called F.H.P. It is utilized in overcoming frictional resistance of rotating and sliding parts of the engine. $F.H.P. = I.H.P. - B.H.P.$

5. EFFICIENCY (η_i)

It is defined as the ratio of indicated work to thermal input (energy supplied by fuel) $\eta_i = (I.H.P.) / (m_f \times CV)$

Where, m_f = Mass of fuel supplied in kg per second. CV = Lower Calorific value of fuel oil in kJ/kgK.

6. BRAKE THERMAL EFFICIENCY

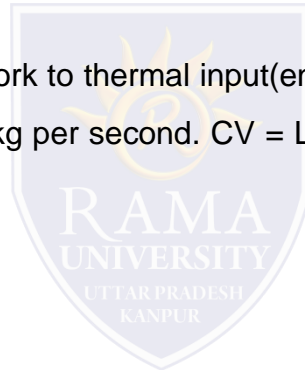
6. (OVERALL EFFICIENCY)

It is defined as the ratio of brake output to thermal input. $\eta_b = (B.H.P.) / (m_f \times CV)$

7. MECHANICAL EFFICIENCY (η_m) It is defined as the ratio of B.H.P. to I.H.P. Therefore,

8. Specific output:

It is defined as the brake o/p per unit of piston displacement and given by $\text{Specific output} = \frac{B.P.}{A \times L} = \text{constant} \times P_{mb} \times \text{rpm}$



9. Volumetric efficiency :

It is defined as the ratio of actual volume of the charge to the swept volume of the piston. the average value is 70-80%, but for supercharged case it is more.

10. Fuel-Air ratio:

It is the ratio of mass of the fuel to the mass of the air in fuelair mixture. "Relative Fuel-air ratio":

It is defined as the ratio of the actual fuel air ratio to that of stoichiometric fuel-air ratio.

11. Specific Fuel consumption:

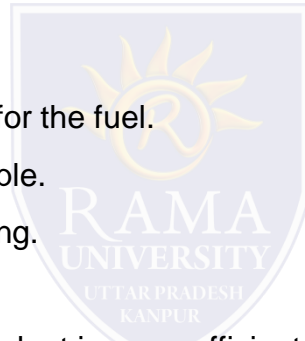
It is the mass of the fuel consumed per kW power developed per hour & it is a criteria for economical power production $s.f.c = m_f / B.P \text{ kg/kWh}$.

12. Heat Balance sheet:

Heat supplied by fuel Heat absorbed in I.P. Heat taken away by cooling water Heat taken away by exhaust gases

Advantages of diesel power plant

1. Very simple design also simple installation.
2. Limited cooling water requirement.
3. Standby losses are less as compared to other Power plants.
4. Low initial cost.
5. Quickly started and put on load.
6. Smaller storage space is needed for the fuel.
7. Layout of power plant is quite simple.
8. There is no problem of ash handling.
9. Less supervision is required.
10. For small capacity, diesel power plant is more efficient as compared to steam power plant.
11. They can respond to varying loads without any difficulty.
12. It can also be designed for portable use.
13. Thermal efficiency of diesel is higher than of coal.



DISADVANTAGE OF DIESEL POWER PLANT

1. High Maintenance and operating cost.
2. Fuel cost is more, since in India diesel is costly.
3. The plant cost per kW is comparatively more.



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4. The life of diesel power plant is small due to high maintenance.
5. Noise is a serious problem in diesel power plant.
6. Diesel power plant cannot be constructed for large scale.
7. The plant generally used to produce small power requirement.
8. Cost of lubricants is high.

ESSENTIAL COMPONENTS OF A DIESEL POWER PLANT

Refer Fig. 4.7. The essential components of a diesel power plant are listed and discussed :

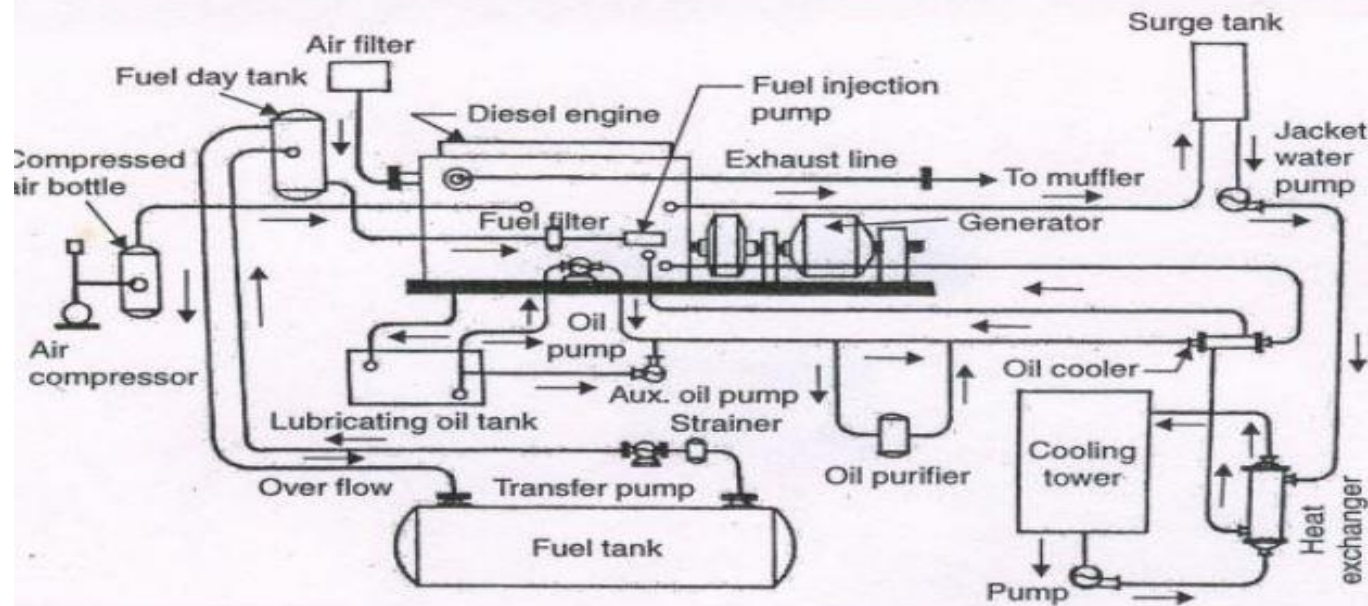


Fig. 4.7. Schematic arrangement of a diesel power plant.

1. Engine
2. Air intake system
3. Exhaust system
4. Fuel system