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DATE | Load test on a Multi-Cylinder Diesel Engine | SHEET NO. 1

Experiment no. 1

Aim: To perform load test on a Perkins Diesel engine and to draw performance curves.

Equipment: Four stroke, four cylinder water cooled Perkins Diesel Engine coupled to a hydraulic dynamometer; tachometer, stopwatch, fuel measuring device.

Theory: Brake thermal efficiency of an engine is defined as the ratio of power available at the shaft to the heat input for the engine.

$$\eta_{bth} = \frac{\text{Power available at shaft}}{\text{Heat Input}}$$

BSFC or brake specific fuel consumption is defined as $BSFC = \frac{\text{Fuel Consumption (kg/hr)}}{BHP (kW)}$

These parameters enable us to take a comparative look at diff. engines from a performance point of view.

Dynamometer const. (D.C.) = 1500

BHP = (Load × RPM) / (D.C.)

Calorific value of fuel = 39000 kJ/kg

Fuel density = 0.84 gm/cc

P.R.E.

$$\text{Fuel consumption} = \frac{V_d \cdot P_d \ (3600)}{\text{time (sec)}} = \text{kg/hr}$$

Procedure :-

1. Before the engine is started, cooling water system, lubricating oil system and fuel supply system is checked.
2. Atmospheric pressure & temperature have to be recorded before starting the test.
3. With a zero load applied (i.e. no water supply), the engine RPM is adjusted to a certain level. The dynamometer has to be made horizontal by turning the hand wheel and checking at the levelling pointer this is needed for every data point recorded. The speed needs to be checked at this point again & necessary adjustment has to be made.
4. When steady state is reached, time taken by engine to consume 10 ml of fuel is measured by stopwatch.
5. Gradually, increasing loads are applied by opening up the water line to the dynamometer & for each load level, the fuel consumption time is recorded. RPM is maintained constant by adjusting fuel control lever. For each data point, sufficient time should be allowed for the system to reach steady-state.

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DATE | | SHEET NO. 3

SN.	RPM	Load (Kg)	Time to consume 20ml of fuel (sec)	Exhaust smoke (%)
1	950	2	38.93	4
2	950	4	36.69	6
3	950	6	32.56	6
4	950	8	29.20	6
5	950	10	27.52	8
6	950	12	25.69	8

$$BHP = \frac{(Load \times RPM)}{D.C.}$$

D.C = Dynamo constant = 1500

$$\text{fuel consumption} = \frac{\rho \times \text{volume} \times 3600}{\text{time(sec)} \times 1000} \quad \frac{Kg}{h}$$

$\rho = 0.84$ gm/cc

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DATE | SHEET NO. 4

① $BHP = \frac{2 \times 950}{1500} = 1.266$

$FC = \frac{0.84 \times 20 \times 3600}{38.93 \times 1000} = 1.553 \text{ kg/h}$

② $BHP = \frac{4 \times 950}{1500} = 2.533$

$FC = \frac{0.84 \times 20 \times 3600}{36.69 \times 1000} = 1.648 \text{ kg/h}$

③ $BHP = \frac{6 \times 950}{1500} = 3.8$

$FC = \frac{0.84 \times 20 \times 3600}{32.56 \times 1000} = 1.857 \text{ kg/h}$

④ $BHP = \frac{8 \times 950}{1500} = 5.067$

$FC = \frac{0.84 \times 20 \times 3600}{29.20 \times 1000} = 2.071 \text{ kg/h}$

⑤ $BHP = \frac{10 \times 950}{1500} = 6.333$

$FC = \frac{0.84 \times 20 \times 3600}{27.52 \times 1000} = 2.198 \text{ kg/h}$

⑥ $BHP = \frac{12 \times 950}{1500} = 7.6$

$FC = \frac{0.84 \times 20 \times 3600}{25.69 \times 1000} = 2.354 \text{ kg/h}$

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DATE | η_{bth} and BSFC | SHEET NO. 5

① $\eta_{bth} = \frac{1.266 \times 3600}{1.553 \times 39000} = 0.075$

$BSFC = \frac{1.553}{1.266} = 1.227$

② $\eta_{bth} = \frac{2.553 \times 3600}{1.648 \times 39000} = 0.143$

$BSFC = \frac{1.648}{2.533} = 0.651$

③ $\eta_{bth} = \frac{3.0 \times 3600}{1.857 \times 39000} = 0.189$

$BSFC = \frac{1.857}{3.0} = 0.449$

④ $\eta_{bth} = \frac{5.067 \times 3600}{2.071 \times 39000} = 0.226$

$BSFC = \frac{2.071}{5.067} = 0.409$

⑤ $\eta_{bth} = \frac{6.333 \times 3600}{2.198 \times 39000} = 0.266$

$BSFC = \frac{2.198}{6.333} = 0.347$

⑥ $\eta_{bth} = \frac{7.6 \times 3600}{2.354 \times 39000} = 0.298$

$BSFC = \frac{2.354}{7.6} = 0.309$

P.R.E