GARVIT SHAH
F-24

EXPERIMENT : No. 01

Page No. 1
Date

- **Aim**: To find the indicated power (IP) on multi-cylinder petrol engine by Morse Test.

- **Apparatus**: Multi-Cylinder Petrol Engine Test Rig, Stop-watch, Hand gloves, digital Tachometer.

- **Theory**:
The purpose of Morse Test is to obtain the approximate Indicated Power of a Multi-cylinder Engine. It consists of running the engine against a dynamometer at a particular speed, cutting out the firing of each cylinder in turn & noting the fall in BP each time while maintaining the speed constant. When one cylinder is cut off, Power developed is reduced & speed of engine falls. Accordingly the load on the dynamometer is adjusted so as to restore the engine speed. This is done to maintain FP constant, which is considered to be independent of the load & proportional to the engine speed. The observed difference in BP between all cylinders firing with one cylinder cut off is the IP of the cut off cylinder. Summation of IP of all the cylinders would then give the total IP of the engine under test.

- **Formula used**:

- Indicated Power - $IP = BP + FP$

Teacher's Sign. : _____

- Brake Power - $BP = BP_{123} = \frac{2\pi NT}{60 \times 1000}$ kW

where N - speed of engine
T - Torque = $W \times g \times R$
R - arm length

- Total indicated power of the engine -
$$IP = IP_1 + IP_2 + IP_3$$

- Frictional Power - $FP = IP - BP$

- Mechanical Efficiency - $\eta = \frac{BP_T}{IP_T}$

- Procedure -

1. Before starting the engine check the fuel supply, lubrication oil and availability of cooling water.
2. Set the dynamometer to zero load.
3. Run the engine till it attains the working temp. & steady state condition. Adjust the dynamometer reading for the BP ~~cal~~ calculation.
4. Now cut off one cylinder. Short circuiting its spark plug can do this.
5. Reduce the dynamometer load so as to restore the engine speed as at step 3. Record the dynamometer reading for the BP calculation.
6. Connect the cut off cylinder & run the engine on all cylinders for a short time. This is necessary

for the steady state conditions.

7. Repeat steps 4, 5 & 6 for other remaining cylinders turn by turn & record the dynamometer readings for each cylinders.

8. Bring the dynamometer load to zero, disengage the dynamometer & stop the engine.

9. Do the necessary calculations.

• Conclusions:

This experiment verifies that Morse test can be successfully used to determine indicated power of a multi-cylinder engine.

• Questions:

Q.1. Define Morse Test.

A.1. Morse Test is used to ~~ott~~ obtain the approximate Indicated Power of a Multi-Cylinder ~~Experiment~~ Engine. It consists of running the engine against a dynamometer at a particular speed, cutting out the firing of each cylinder in turn & noting the fall in BP each time while maintaining the speed constant.

Q.2. What is transmission dynamometer ?

A.2. A dynamometer in which power is measured without being absorbed or used up during transmission.

Q.3. What is the need of measurement of speed of an IC Engine ?

A.3 When one cylinder is cut-off, power developed is reduced & speed of ~~time~~ engine falls. Accordingly, the load on the dynamometer is adjusted so as to restore the engine speed. This is done to maintain FP constant, which is considered to be independent of the load & proportional of the engine speed.

Q.4. What is the break power of IC Engines ?

A.4. Break power is the power available at the crankshaft. In the case of IC engine, it is output power. It is the useful power, which means the total power generated due to combination subtracted by frictional losses.

Q.5. What is the limitations of Morse Test ?

A.4. • Using morse test we cannot determine the indicated power of single cylinder engine.

No. of cylinders = 3

Brake Power, BP = $(2\pi NT/60\times1000)$ kW

Calorific value of fuel used, C.V = 42000 KJ/Kg

Arm Length (R) = 210 mm

Observations Table:

Observations			Results	
Cut off Cylinder Number	Speed N (rpm)	Load W (kg)	Brake Power	Indicated Power
All working	3050	15	9.8597	15.5426
1	3015	7.1	4.6134	5.2463
2	3021	7.2	4.6876	5.1721
3	3010	7.3	4.7355	5.1242
			Friction Power (kW) = 5.6829	
			Mechanical eff, η = 63.44 %	

CALCULATIONS

ALL WORKING

$$BP_{123} = \frac{2\pi(3050)(15\times9.8\times0.21)}{60\times1000}$$

BP_{123} = 9.8597 kW

1

$$BP_1 = \frac{2\pi(3015)(7.1\times9.8\times0.21)}{60\times1000} = 4.6134 \text{ kW}$$

2

$$BP_2 = \frac{2\pi(3021)(7.2\times9.8\times0.21)}{60\times1000}$$

BP_2 = 4.6876

3

$$BP_2 = \frac{2\pi(3010)(7.3\times9.8\times0.21)}{60\times1000}$$

BP_2 = 4.7355

Friction Power = $IP_T - BP_T$

= 15.5426 − 9.8597 = 5.6829

$$\eta = \frac{9.8597}{15.5426}\times100 = 63.44$$