Department of Mechanical Engineering

LAB MANUAL

FOR

THERMAL LAB II

DEPT. OF MECHANICAL ENGINEERING

1. COOLING CURVE TEST ON SINGLE CYLINDER FIELDMARSHAL DIESEL ENGINE

AIM

To study the influence of cooling water temperature (outlet temperature) on the efficiency of the engine and plot the graph cooling water temperature Vs Brake thermal efficiency.

TEST RIG DETAILS

BP of the engine	= 6HP	= 6 x 736 W
Bore diameter of the engine	= 114.3mm.	
Stroke length of the engine	= 139.7mm.	
Speed of the engine	= 650rpm.	
Orifice diameter	= 20 mm	

PRECAUTIONS

Cooling water circulation should never be closed. The temperature of the outlet water should never increase beyond 70^0C.

PROCEDURE

This test is to be conducted at constant load (half full load) and constant speed. Calculate the load corresponding to half the output of the engine at rated speed. Now start the engine taking all the necessary precaution. Allow the engine to run for few minutes at no load. Now load the engine to half full load, keeping the quantity of cooling water circulation as low as possible. Wait for few minutes till the outlet water temperature becomes steady.

Note the cooling water temperature and also the time for 10cc fuel consumption. Repeat the experiment for different rates of cooling water circulation, keeping the load constant. After the completion of experiment, unload and then stop the engine.

OBSERVATION AND TABULAR COLUMN

Sl No	Load (kg)	Time for 10cc fuel consumption (s)	Water outlet temperature (^{0}C)	Total fuel consumption T.F.C (kg/hr)	Brake thermal Efficiency Br.Thη (%)

FORMULAE

1. Maximum load calculation

Brake power, BP = (2πNT)/60. Watt

Where,

N = Speed of the engine in rpm.

T = Torque on the brake drum in Nm

= (W1 – W2) R x 9.81Nm.

W1 = weight on hanger + hanger weight in kg.

W2 = spring balance reading in kg.

R = Radius of brake drum + thickness of rope in meters.

2.Total fuel consumption, TFC= $\frac{10 \times 3600 \times 0.83}{t \quad 1000}$ kg/hr

Where,

t = time for 10cc fuel consumption in s

Specific weight of diesel = 0.83

3. Brake thermal efficiency Br.Thη = BP X 3600 X 100 %

TFC X Cv

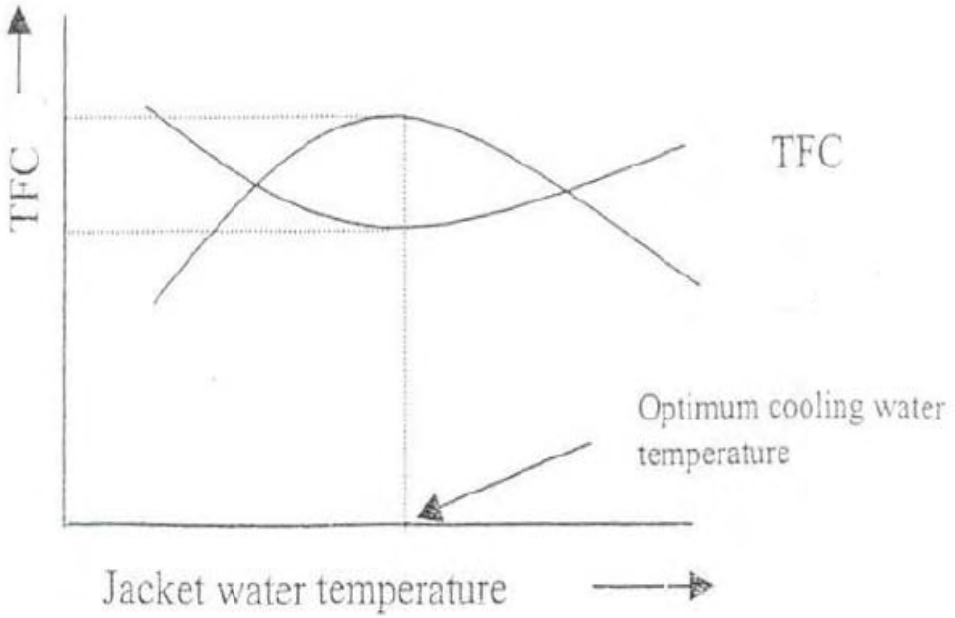
Where,

TFC = Total fuel consumption in kg/hr

CV = Calorific value of diesel = 45.2 X 10^6 J/Kg.K

BP = Brake power in watts

SAMPLE GRAPH



RESULT

Best cooling water temperature (from graph) =

INFERENCE

2. RETARDATION TEST ON SINGLE CYLINDER VERTICAL DIESEL ENGINE

AIM

To determine the frictional horse power of the engine by conducting retardation test and Plot the graph Rated Speed Vs Retardation Time.

ENGINE DETAILS

Brake Power = 6HP =6 x 736 W
Rated Speed = 650 rpm
Stroke length = 139.7 mm
Bore diameter = 114.3 mm
Brake drum Radius = 197 mm

APPARATUS REQUIRED

Stop watch

MAXIMUM LOAD CALCULATION

Maximum brake power; B.P max = $2\pi NT/60$ Watts.

Where B.P max = 4.416 KW = 4416 Watts,

N = speed of the engine = 650 rpm,

T = torque on the engine shaft in Nm = WR in Nm

Where W = load on the engine in Kg

R = radius of the Brake drum = 197 mm

Maximum load in Kg W max = B.P max x60/ ($2\pi NR*9.81$)

PROCEDURE

Calculate the load to be applied for the maximum output. Take the following precautions before starting the engine.

1. Check the fuel level
2. Check the lubricating oil level.
3. Check the cooling water circulation.
4. Check whether the engine is on no load.

Engine is started at No- load condition and is run at rated speed. The fuel is then cut- off using fuel cut off lever and the time taken for the speed to drop to a

lower speed is noted using a stop watch. The fuel is again turned on [fuel cut off lever is engaged] and the engine is again brought back to the rated speed. The experiment is repeated with various lower speeds. The engine is loaded to half load and the above procedure is repeated and noted the readings. Plot the graph and frictional power is determined.

OBSERVATION AND TABULAR COLUMN

Sl. No.	Speed Range (rpm)	Time in seconds		Frictional Torque, T_F (N m)	Frictional Power, F.P W
		No- load	Half-Load		

FORMULAE

Frictional power, F.P. = 2π N TF / 60 Watts

Where, N= speed = 660 rpm

Frictional Torque, TF = TL x [t3 /(t2-t3)] N m

Where, t3 = Retardation time at half load [from the graph]

t2 = Retardation time at No- load [from the graph]

TL = Load Torque

TL = WR* 9.81 Nm

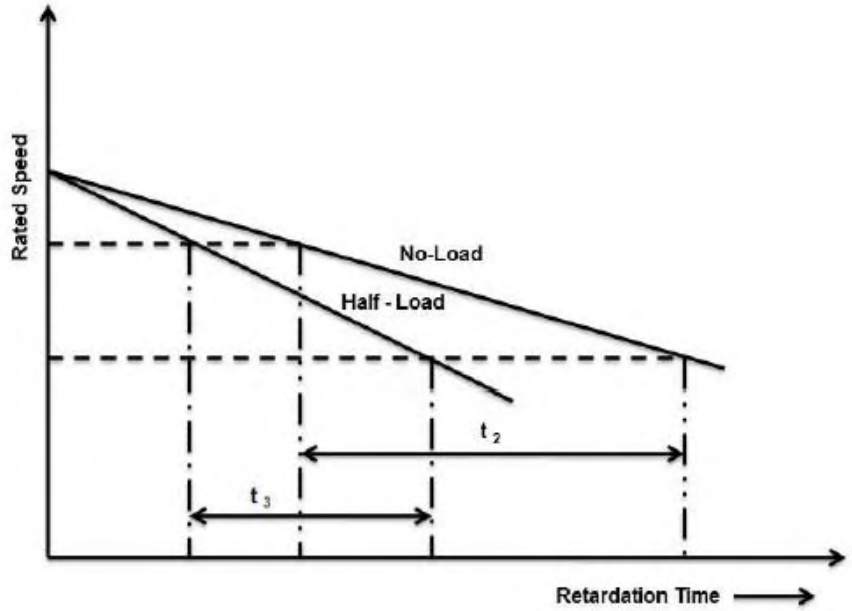
Where, W = Load on engine

R = Radius of brake drum

Mechanical Efficiency, Mech η = BP/IP

Where, Indicated Power, IP = BP + FP

SAMPLE GRAPH



RESULT

Frictional power of the engine = …….. W
Mechanical efficiency =.....%

INFERENCE