The Effect of Engine Temperature on Multi Cylinder SI Engine Performance with Gasoline as a fuel

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Abstract- This country is amongst the tropical countries where the deviation in the temperature is having very vast range. Looking in to this vast varying temperature range it is very difficult to say that which temperature is best suited for operating condition of engines and gives us best performance level as for as Thermal efficiency and brake power is concerned. In this work it tried to investigate the best option to run the S.I. engine. The development of engines with its complexity of in-cylinder processes requires modern development tools to exploit the full potential in order to reduce fuel consumption. A three cylinder, four stroke, petrol carburetor Maruti 800 engine connected to eddy current type dynamometer for loading was adopted to study engine power. The performance results that are reported include brake power and specific fuel consumption (sfc) as a function of engine temperature; i.e. 50, 60, 70, 80, and 90°C with varying engine speed of 1500, 1800, 2100 and 2400 rpm. The effect of increasing the temperature can have the multiple advantage of reducing the specific fuel consumption while on the other hand low head temperature will have good impact in reducing the thermal stress of the top portion, reduction in chance of knocking & pre-ignition, increase in the volumetric efficiency. It is indisputable conclusion that lower speed engines and large capacity engines, which are usually of low speed design, more efficient than high speed engines.

Keywords- Thermal Efficiency, S.I. Engine, Fuel, Engine Temperature, Four Stroke, Eddy Current, RPM

INTRODUCTION

We have two types of internal combustion engines, the spark ignition, SI, and the compression ignition, CI. Both have their merits. The SI engine is a rather simple product and hence has a lower first cost. The problem with the SI engine is the poor part load efficiency due to large losses during gas exchange and low combustion and thermodynamics efficiency.

The effect of increasing the liner temperature can have the multiple advantage of reducing the specific fuel consumption, while on the other hand low head temperature will have good impact in reducing the thermal stress of the top portion, reduction in chance of knocking and pre ignition, increase in the volumetric efficiency.

The experimental study is carried out on a three cylinders, four stroke, petrol carburetor water cooled, Maruti800 engine connected to eddy current type dynamometer for loading. The objective of this project is to examine engine performance parameter specific fuel consumption (SFC), brake power (BP) and with varying engine temperature at 50, 60, 70, 80, 90°C and at an engine speed of 1800, 2100, 2400 rpm with respect to engine load 6, 9, 12, 15 kg.
The results are shown by various graphs i.e. between engine temperature and specific fuel consumption, engine temperature and brake power, engine speed and specific fuel consumption, engine speed and brake power, engine load and specific fuel consumption, engine load and brake power.

There are two types of engine cooling systems used for heat transfer from the engine block and head; liquid cooling and air cooling. With a liquid coolant, the heat is removed through the use of internal cooling channels with in the engine block. Liquid systems are much quieter than air systems, since the cooling channel absorbs the sounds from the combustion process. However, liquid systems are subject to freezing, corrosion, and leakage problems that do not exist in air system.

The performance of the engine-cooling system has steadily improved as the power output & density of internal combustion engines gradually increases. With greater emphasis placed on improving fuel economy & lowering emissions output from modern IC engines, engine downsizing & raising power density has been the favored option. Through this route, modern engines can attain similar power outputs to larger convectional engines with reduced frictional losses.

EXPERIMENTAL DETAILS

Experiment was conducted on a three cylinder, four stroke, Petrol Carburetor Maruti 800 engine which is connected to eddy current type dynamometer for loading. The performance results which include Brake Power (B.P.) and Specific Fuel Consumption (SFC) as a function of engine temperature; i.e. 50,60,70,80 and 90°C are reported. The test has been conducted to study the effect of engine temperature on SFC and B.P. with varying engine speed i.e. 1500, 1800, 2100 and 2400 rpm with the load of 6,9,12 and 15 kg.

Engine temperature has been controlled by controlling cooling water flow rate. The cooling water flow rate for engine is measured manually by rotameter. The values of engine performance parameter are directly obtained by "Engine Soft" software.

A test matrix is created to record the engine performance parameter but main focal point was on specific fuel consumption and brake power of the engine at different engine speed 1500, 1800, 2100 and 2400 rpm with the engine load of 6,9,12,15 kg at engine temperature 50,60,70,80,90°C

RESULTS & DISCUSSIONS

An Experiment was conducted on a three cylinder, four stroke, Petrol Carburetor Maruti 800 engine which is connected to eddy current type dynamometer for loading. The performance results which include Brake Power (B.P.) and Specific Fuel Consumption (SFC) as a function of engine temperature; i.e 50,60,70,80 and 90°C are reported.

Following are the graphs which has obtained for various engine performance parameters:

i. The effect of engine temperature on specific fuel consumption with varying engine speed.
ii. The effect of engine temperature on brake power with varying engine speed.
iii. The effect of engine speed on specific fuel consumption with varying engine temperature.
iv. The effect of engine speed on brake power with varying engine temperature.
v. The effect of engine load on specific fuel consumption with varying engine temperature.
vi. The effect of engine load on brake power with varying engine temperature.

FIGURES

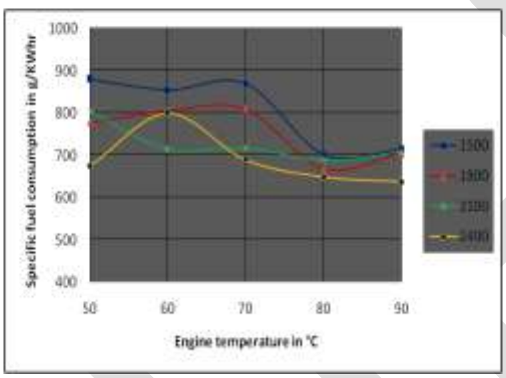


Fig. 1 Effect of engine temperature on specific fuel consumption with varying engine speed and at 6 Kg Engine load

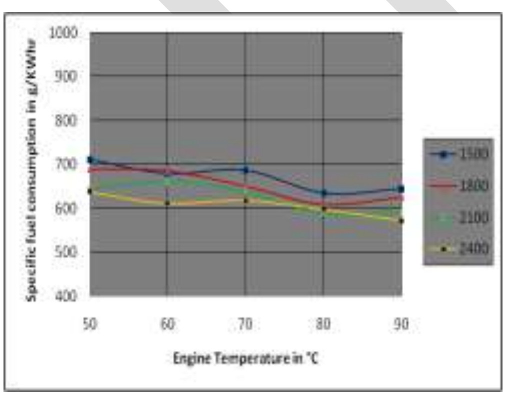


Fig 2 Effect of engine temperature on specific fuel consumption with varying engine speed and at 9 Kg Engine load

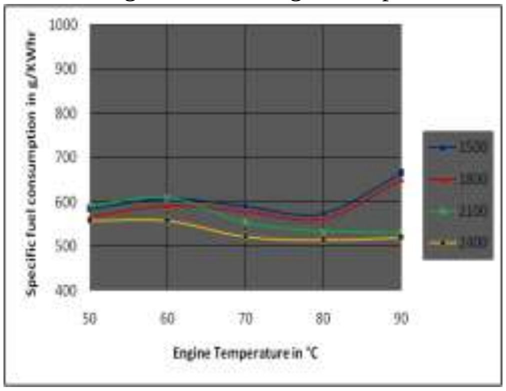


Fig 3 Effect of engine temperature on specific fuel consumption with varying engine speed and at 12 Kg Engine load

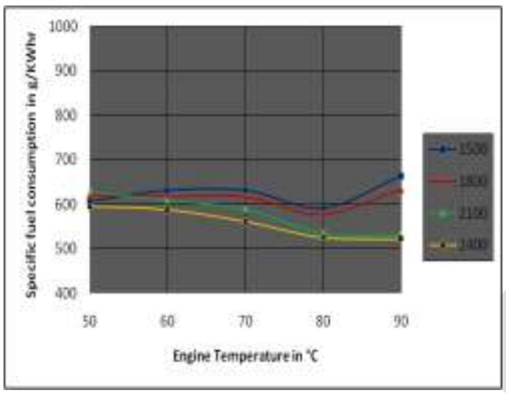


Fig 4 Effect of engine temperature on specific fuel consumption with varying engine speed and at 15 Kg Engine load

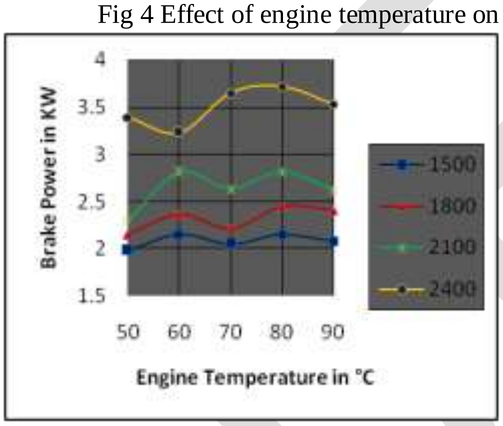
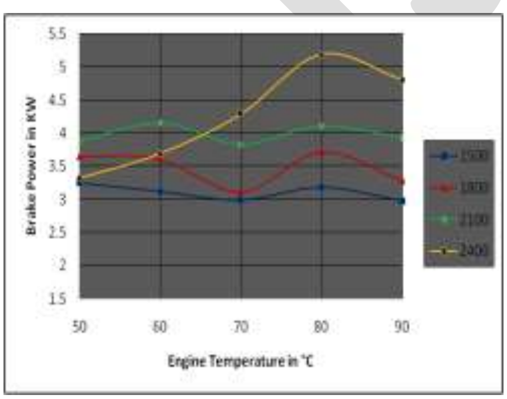


Fig 5 Effect of engine temperature on brake power with varying engine speed and at 6 Kg Engine Load



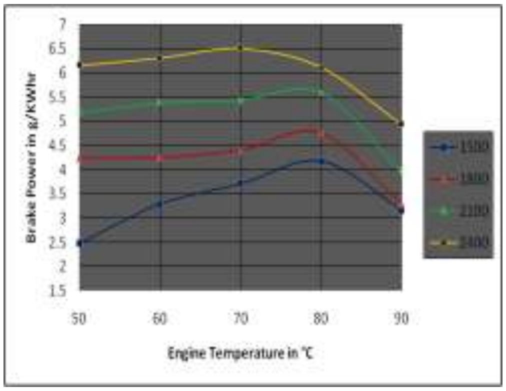


Fig 6 Effect of engine temperature on brake power with varying engine speed and at 9 Kg Engine Load

Fig 7 Effect of engine temperature on brake power with varying engine speed and at 12 Kg Engine Load

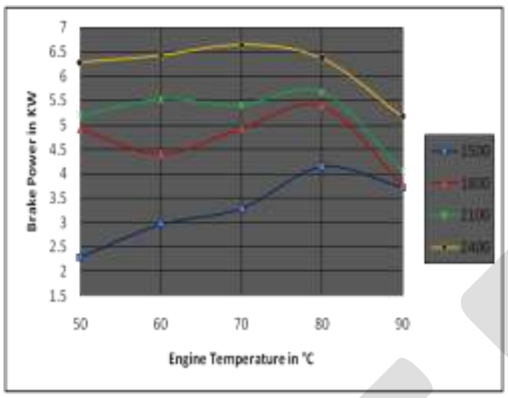


Fig 8 Effect of engine temperature on brake power with varying engine speed and at 15 Kg Engine Load

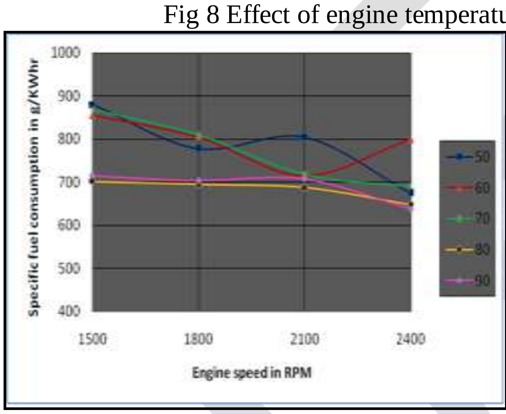


Fig 9 The Effect of engine speed on specific fuel consumption with varying engine temperature at 6 kg Engine Load

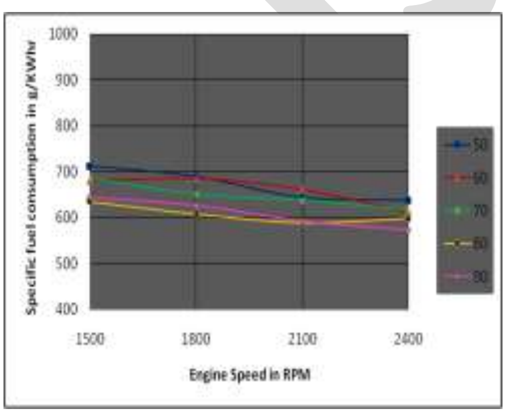


Fig 10 The Effect of engine speed on specific fuel consumption with varying engine temperature at 9 kg Engine Load

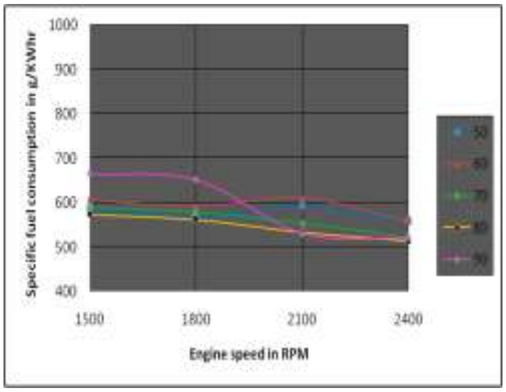


Fig 11 The Effect of engine speed on specific fuel consumption with varying engine temperature at 12 kg Engine Load

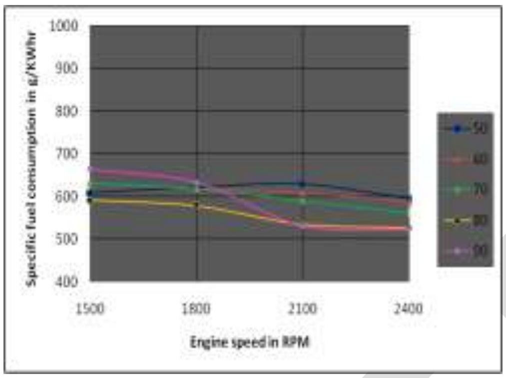


Fig 12 The Effect of engine speed on specific fuel consumption with varying engine temperature at 15 kg Engine Load

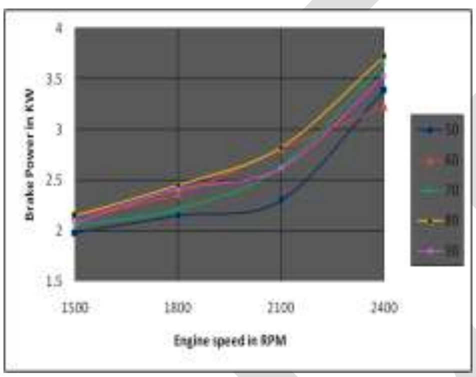


Fig 13 The Effect of engine speed on brake power with varying engine temperature at 6 kg Engine Load

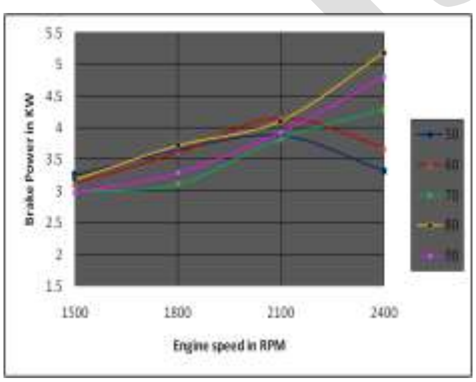


Fig 14 The Effect of engine speed on brake power with varying engine temperature at 9 kg Engine Load

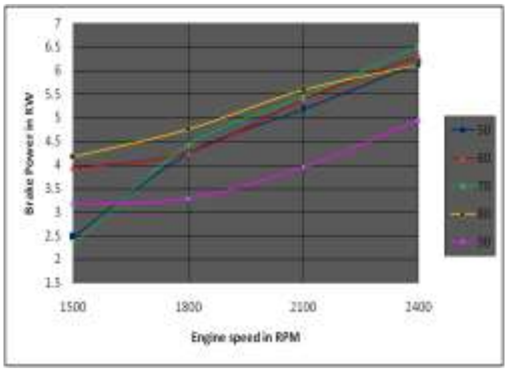


Fig 15 The Effect of engine speed on brake power with varying engine temperature at 12 kg Engine Load

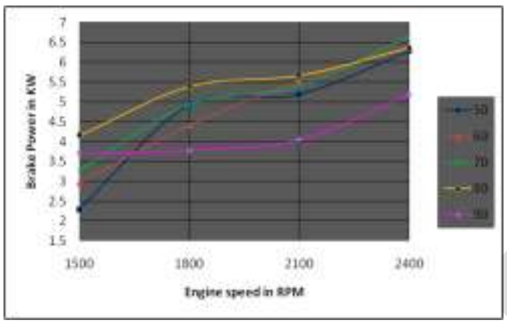


Fig 16 The Effect of engine speed on brake power with varying engine temperature at 15 kg Engine Load

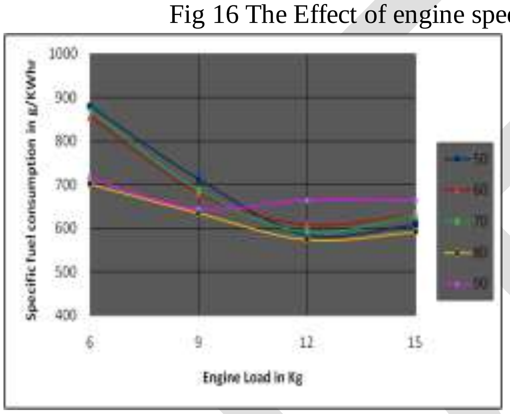


Fig 17 The Effect of engine load on specific fuel consumption with varying engine temperature and at 1500 rpm Engine speed

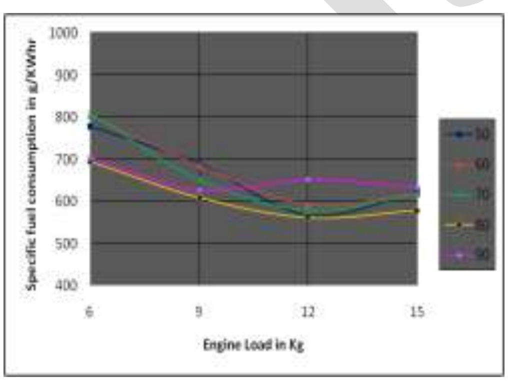


Fig 18 The Effect of engine load on specific fuel consumption with varying engine temperature and at 1800 rpm Engine speed

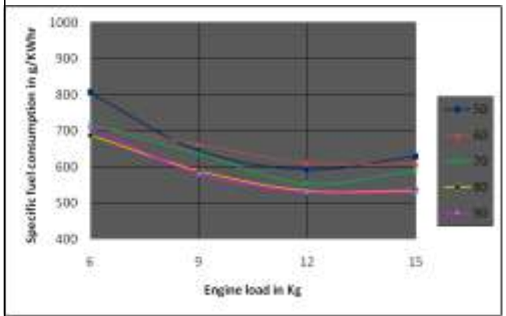


Fig 19 The Effect of engine load on specific fuel consumption with varying engine temperature and at 2100 rpm Engine speed

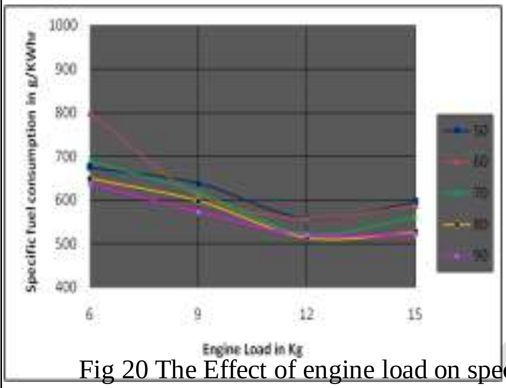


Fig 20 The Effect of engine load on specific fuel consumption with varying engine temperature and at 2400 rpm Engine speed

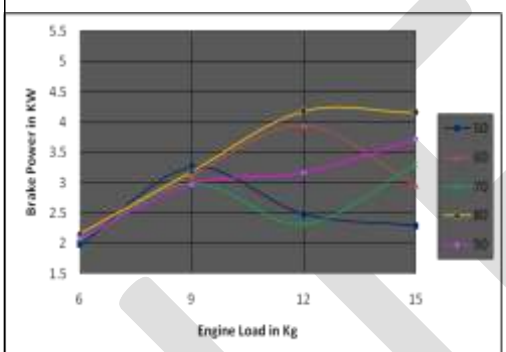


Fig 21 The Effect of engine load on brake power with varying engine temperature and at 1500 rpm Engine speed

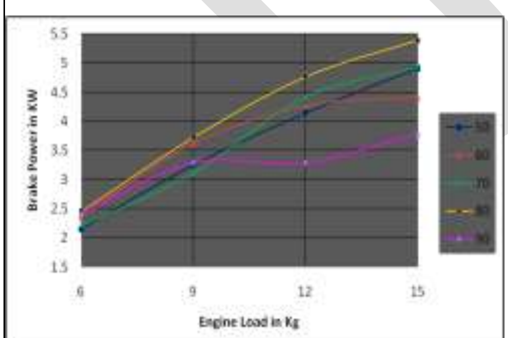


Fig 22 The Effect of engine load on brake power with varying engine temperature and at 1800 rpm Engine speed

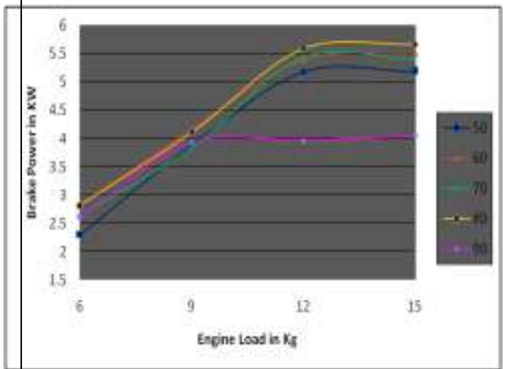


Fig 23 The Effect of engine load on brake power with varying engine temperature and at 2100 rpm Engine speed

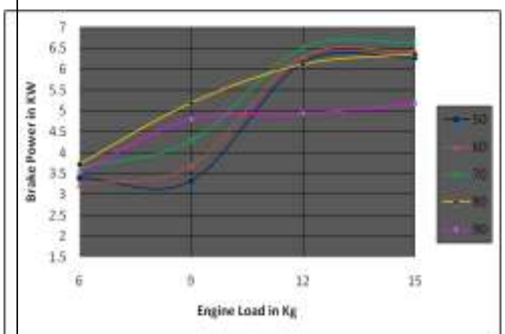


Fig 24 The Effect of engine load on brake power with varying engine temperature and at 2400 rpm Engine speed

CONCLUSION

It is concluded that if we are increasing engine temperature there is some fall in specific fuel consumption but brake power is unaffected but when increase in engine speed there is some decrement in specific fuel consumption and brake power is increased. It is also affected by applying different load on the engine. Best result we obtained in this study is 522 g/KWhr specific fuel consumption and 6.51 KW brake power at 70^{o}C engine temperature and 2400 rpm engine speed with 12 kg engine load.

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