A Review Paper on Study of Multi Cylinder Petrol Engine

Bhushan Mahajan[1] Md. Mohid[2] Faizan Sheikh[3] Praful Nagpure[4]
[1]Assistant Professor [2,3,4]Student
[1,2,3,4]J.D. C.O.E.M, Nagpur, India

Abstract— The basic task of the development engineer is to reduce the cost and improve power output and reliability of the engine. Trying to achieve these goals there is various design concepts to find the effects on engine performance of a particular design concept to resorts to testing. Thus, in general, developments of engine will have to conduct a wide variety of engine tests. Engine performance is an indication of the degree of success with which it is doing its assigned job. These performance characteristics can be verified by using different Testing Methods. In this research to designed & fabricated multi cylinder petrol engine test rig for demonstration purpose as well as an experimental setup to carry out various performance characteristics trials on the same. Here set of demonstrated break power, break specific fuel consumption, Break thermal efficiency, mechanical efficiency and heat balance at various load conditions. Generally the Morse Test and Heat Balance can be performed on the multi-cylinder engine by running the engine at required speed and different parameters can be measured by using different measurement systems.

Key words: Multi Cylinder Petrol Engine, Performance Characteristics, Efficiency

I. INTRODUCTION

A. Multi Cylinder Petrol Engine

A multi-cylinder engine is a reciprocating internal combustion engine with multiple cylinders. It can be either a 2-stroke or 4-stroke engine, and can be either Diesel or spark-ignition. The cylinders and the crankshaft which is driven by and co-ordinates the motion of the pistons can be configured in a wide variety of ways. Multi-cylinder engines offer a number of advantages over single-cylinder engines, chiefly with their ability to neutralize imbalances by having corresponding mechanisms moving in opposing directions during the operation of the engine.[1]

A multiple-cylinder engine is also capable of delivering higher revolutions per minute (RPM) than a single-cylinder engine of equal displacement. This is true for two reasons. First of all, the stroke of the pistons is reduced. This decreases the distance necessary for a piston to travel back and forth per each rotation of the crankshaft, and thus limiting the piston speed for a given RPM. Secondly, in an engine with multiple cylinders, the piston mass is reduced. This reduces stress on internal components at higher RPM's. Typically, the more cylinders an engine has, the higher the RPM's it can attain for a given displacement and technology level, at a cost of increased friction losses and complexity. Peak torque is also reduced, but the total horsepower is increased due to the higher RPM's attained.

Although there are 1, 3 and 5-cylinder engines, almost all other inline engines are built with even numbers of cylinders, as it's easier to balance out the mechanical vibrations. Another form of multiple-cylinder internal combustion engine is the radial engine, with cylinders arranged in a star pattern around a central crankshaft. Radial engines are most commonly used as aircraft engines, and in basic single-row configuration are built with odd numbers of cylinders (from 3 to 9). An odd number of cylinders is necessary in a four stroke radial, since the firing order is such that every other cylinder fires as the crankshaft rotates. Only with an odd number of cylinders will all cylinders evenly fire in this manner in two crankshaft revolutions (first the odd cylinders, followed by the even cylinders). "Twin-row" or "multi-row" radials are also built, which is basically two or more single-row radials connected front-to-back and driving a common crankshaft. In this "twin row", or "multi-row" configuration, the total number of cylinders will be an even number, although each row still has an odd number. For example, a typical single row radial such as the Wright Cyclone has 9 cylinders. The twin row Wright Twin Cyclone is based on this engine and thus has two banks of 9 cylinders, for a total of 18, an even number.

Fig. 1.1: Set up of 3 Cylinder, 4 Stroke Petrol Engine.

The design and development of test setup and experimental data collection and analysis are equally important for any experimental research. For the success of test rig development depends on proper planning, design and selection of right kind of equipment and measuring instruments and skill in fabrication and the precession and accuracy of the observations during trial. All the above mentioned parameters are discussed in this paper. Four stroke

Four cylinder water cooled, Maruti Esteem engine is selected for the present study. This engine is converted into a Test Rig by attaching Retrofits. Rope brake dynamometer is used for Measurement of brake power. A belt is wound on the brake drum and loaded by a power screw on one side. Spring balance shows tensions in rope side. Air consumption is measured trough orifice meter air tank.

One end of a U tube manometer is connected to air tank while other is free to atmosphere. The difference in water levels in two sides indicates the pressure gradient acrossthe orifice. The rate of air consumption and volumetric efficiency can be calculated from this pressure gradient. Fuel consumption is measured with a three way cock and simple burette marked on its length. Calorimeter is a heat exchange with counter flow of water. The various inlet and outlet temperatures of water, exhaust gas are measured with

thermocouples and digital display. The flow rate of water passing through calorimeter is measured with Rota-meter.

B. Technical Details

Engine :	Make Maruti, Model Maruti 800,
Type	3 Cylinder, 4 Stroke,
Fuel	Petrol (MPFI), water cooled,
Power	27Kw at 5000 rpm
Torque	59 NM at 2500rpm,
Stroke	72 mm
Bore	66.5mm
Cylinder volume	796cc
Compression ratio	9.2
Dynamometer	Eddy Current Dynamometer.
Propeller Shaft	With Universal joints
Air Box	SS fabricated with orifice meter and manometer

C. Description

The setup consists of three cylinder, four stroke, and petrol engine connected to dynamometer for engine loading. The setup has stand-alone type independent panel box consisting of air box, fuel tank, manometer, fuel measuring unit. Engine jacket cooling water inlet, outlet and calorimeter temperature is displayed on temperature indicator. Flowmeters are provided for cooling water and calorimeter flow measurement. Provision is also made for conducting Morse test.

Electric Supply: 230+/- 10 VACS, 50 Hz, 1 Phase.

Water Supply: Continuous, clean and soft water supply @5000 LPH, at 10m. Head, Provide tap with 1" BSP size connection.

1) Fuel & Lubricants

Computer System: Pentium IV with DVD Drive, Windows 7 and MS Office pre-loaded. One USB slot required in PC for Data Acquisition Card.

Fig. 1.3: Experimental Setup of 3 Cylinder 4 Stroke Petrol Engine

II. LITERATURE SURVEY

A. J.D.V. at el [1]

In this paper the study of petrol engine using compressed Biogas as a fuel is carried out and the following results are obtained Fuel consumption on petrol mode is less than compressed biogas. BSFC of compressed biogas is higher. Brake thermal efficiency on petrol mode will be higher compared to compressed biogas. Exhausts gas temperature of petrol fuel engine is more compared to compressed biogas Engine produces somewhat less Power Ranger run on compressed biogas compared to petrol.

B. N.B.G. at el [2]

In this paper contains performance analysis of multi cylinder CI engine by using various alternate fuel. Experiment is conducted with fuel with mixing of cashew nut oil, cottonseed oil and its blends in various proportions by volume and then following results are obtained on multi cylinder Hindustan 4 stroke diesel engine BSFC is less for the blend 20 over the entire range of load compared to diesel fuel. Mechanical efficiency B20 blend was considered higher over entire load range Volumetric efficiency for B40 blend was consider higher over entire load range.B20 blend is preferred to use because of low specific fuel consumption, power utilized is more, and low exhaust gas temperature. Apart from this various performance tests have been carried out on different engines with different fuels [3-12].

III. FUTURE SCOPE

In the common test rig, each & every input parameter have to be changed manually and to find out the required output parameter, we have to measure by connecting the test equipment's manually and to carry out the calculations manually. In future this manual test rig can be computerized using software's which would be operator friendly. Modifications can be made such that it will result as a test bed and not as test rig which means any engine can be tested on the same setup. Fuel consumption can be measure by volume difference or by weight difference. Radiator can be eliminated with direct connections. Flow meter is required for calculating mass and flow of exhaust gas.

IV. CONCLUSIONS

The complete design of each component has been discussed in detail and the same details are used for fabrication. The trail is carried on the engine and various performance parameters such as specific fuel consumption, Break thermal efficiency, mechanical efficiency and heat balance at various load conditions.

1) As brake power increases fuel consumption also increases
2) Brake specific fuel consumption decreases with increase in brake power
3) Exhaust temperature increases as brake power increases
4) As brake power increases both brake thermal efficiency and mechanical efficiency increases our project might be have some its own limitations but an effort has been made to the fullest to make it successful.
5) Other than this theoretical view, in a real life scenario, the performance, comfort and fuel efficiency of a car depends on many other factors starting from the aerodynamics to the passenger weight.
6) There is no generalization that all three cylinder ones are fuel efficient and all four cylinder ones are better to drive.

7) It depends on many other factors like the manufacturer, engine refinement, quality components, performance of the subsystems et

REFERENCES

[1] Jayesh D.Vaghmashi1 Mr.D.R.Shah2 Mr.D.C.Gosai3 - An Experimental Study of Petrol Engine Using Compressed Biogas as aFuel - IJSRD Vol. 2, Issue 04, 2014 ISSN (online): 2321-0613
[2] N. BalajiGanesh1,Dr. B Chandra Mohan Reddy2 - Performance Analysis of Multi-Cylinder C.I. Engine by using Various Alternate Fules- Ijergs Volume 2,Issue 4, June-July, 2014 ISSN 2091-2730
[3] SavitaPatil 1, Rupesh Kumar Malviya2, Kuber Dwivedi3 -Investigation on Performance Characteristics of Petrol EngineUsing Alternate Fuel - IOSR e-ISSN: 2278-1684,p-ISSN: 2320- 334XIssue 4 Ver. V (Jul- Aug. 2014),
[4] AinaTFolayan,"influence of engine parameter on performance characteristics of spark ignition engine", Pelagia research (200 8) pp1915-1922.
[5] Ganeshan.V "Internal Combustion Engines", 7 Tata Mc.Graw Hill Publishing, New Delhi, 2002.
[6] A Text Book on "Internal Combustion Engines" by Domkundwar
[7] E.porpatham , A. Ramesh ,B. Nagalingam (2011) Effect of compression ratio on the performance and combustion of a biogas fuelled spark ignition enigne journal homepage :www.elsevier.com/locate/fuel
[8] Hey wood John.B, "Internal Combustion Enginees Fundamental", Mc. Graw Hill Book Company, New Delhi, 1988.
[9] Carl S. Hansen, Coyly Hansen, Greg Sullivan, "Using Biogas as a Fuel for Trucks and Tractors",paper number: 074145,ASABE Meeting at Minnesota during 17 - 20 June 2007
[10] C.C.M. Luijten, E. Kerkhof, "Jatropha oil and biogas in a dual fuel CI engine for rural electrification ",Energy Conversion and Management 52 (2011) 1426–1438
[11] R. Chandra, V.K. Vijay , P.M.V. Subarea , T.K. Kura, "Performance evaluation of a constant speed IC engine on CNG, methane enriched biogas and biogas ",Applied Energy xxx (2011)
[12] A. S. Gautam, R .Garrick. J. H. Lee, C. M. Demico, P.E. Hannum and L. A.Villasmil, "A Comparison of the Emission from Gasoline vs Compressed Natural Gas for an Electronic Fuel Injected Two Cylinder, Four- Stroke Engine" SAE Technical Paper 2012-32-0016, 2012.

