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AN ANALYSIS OF EFFECT OF VARIABLE COMPRESSION RATIO IN C.I. ENGINE USING TURBOCHARGER

E.Saravanapprabhu[1] , M.Mahendran[2]

[1]E.Saravanapprabhu, PG Student, Thermal Engineering, Department of Mechanical Engineering, Sri Ramakrishna Engineering College, Coimbatore-641022.
[2]M.Mahendran, Assistant professor, Department of Mechanical Engineering, Sri Ramakrishna Engineering College, Coimbatore-641022, Tamilnadu, India

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Abstract - In a single cylinder four stroke diesel engines is used to analysis the effect of variable compression ratio in turbocharger of the combustion ignition engine. The turbocharger is used to increases the efficiency of the engine and to improve the performance will be higher only. For the single cylinder diesel engine used to run with the two revolutions for four strokes per unit crank revolution. The turbocharger is used to work with the engine of the inlet and outlet of the exhaust gas and air-fuel mixture. Turbocharger will be connected with the shaft of the oil; it will be run by both the wheel of the turbine wheel and compressor wheel. From this working of the turbocharger of the diesel engine, we can be analysis the performance test of the variable compression ratio.

Keywords: Diesel Engine, Performance Parameter, Turbocharger, Variable Compression Ratio.

1. INTRODUCTION

In the diesel engine, we can find the mutlicylinder of the automobiles vehicles are used to run by the turbocharger. For the single cylinder, we are using the turbocharger to find out the variable compression ratio in four stroke diesel engine and the performance test will be calculated at the different load of the different variable compression ratio from the valve of 12.1 to 18.1. From this valve we can find out the performance test like brake power, specific fuel power, thermal power, indicated power, mechanical efficiency. It is used to run in the engine capacity of the valve is 667cc. The turbocharger is used to reduce the emission and increase the efficiency and run smoothly of the engine.

2. LITERATURE REVIEW

It stated that turbocharging of internal combustion engines was an established technology used for the purpose of increasing both power density and in some cases the cycle efficiency of diesel engines relative to naturally aspirated engines. However, one significant drawback was the inability to match the characteristics of the turbocharger to the engine under full load and also to provide sufficiently good transient response. Under many conditions this results in reduced efficiency and leads to higher exhaust emissions. It can be perform by using with the turbocharger and without turbocharger. To find out the optimum compression ratio of the computerized variable compression ratio (VCR) single cylinder four stroke diesel engine using experimentation analysis. Various parameters defining the performance of V.C.R diesel engine are calculated and they are used as means for obtaining optimum compression ratio. By taking the variable compression ratio, we can calculate the performance parameter valve. A research on diesel engine have a better design can be improve the compression quality and brake thermal efficiency and saves the fuel. The present work deals for finding the compression ratio in better from of the diesel fuelled at variable load ratio and constant speed. It represents the volume ratio in combustion chamber is high capacity to lower capacity. A turbocharger is means the charging compressor is driven by an exhaust gas driven turbine. It will be increased the performance efficiency of the engine. The result were showed by theoretical calculate of the brake power, brake specific fuel consumption, thermal efficiency, etc. From this review paper, the parameter is calculated due to variable compression ratio for single cylinder four stroke diesel engine.

3. NOMENCLATURE

CR	-	Compression Ratio
BP	-	Brake Power
IP	-	Indicated Power
FP	-	Friction Power
BTE	-	Brake Thermal Efficiency
BSFC	-	Brake Specific Fuel Consumption

VCR - Variable Compression Ratio
IMEP - Indicated Mean Effective Power
BMEP - Brake Mean Effective Power
TE - Thermal Efficiency

4. EXPERIMENT SETUP

The setup consists of single cylinder, four stroke, VCR (Variable Compression Ratio) Research engine connected to eddy current dynamometer and to the turbocharger. It is provided with necessary instruments for combustion pressure, crank-angle, airflow, fuel flow, temperatures and load measurements. These signals are interfaced to computer through high speed data acquisition device. The setup has stand-alone panel box consisting of air box, twin fuel tank, manometer, fuel measuring unit, transmitters for air and fuel flow measurements, process indicator and piezo powering unit. Rotameters are provided for cooling water and calorimeter water flow measurement. Turbocharger is fixed into the engine of the exhaust gas of the outlet of the engine.

4.1 VARIABLE COMPRESSION RATIO OF AN I.C ENGINE

In IC engine, a fuel gas will not be expanding fully in the cylinder. Fuel energy is exhaust and it will be waste to the environment. The exhaust gas will be energy distribution to the diesel engine for the air fuel inlet injection by using turbocharger. The I.C energy exhaust energy is containing to the thermal energy and pressure energy. The I.C energy of the compression ratio is the ratio of the volume of the combustion chamber and it's from a largest capacity to the smallest capacity. It is a fundamental specification for this common combustion engine. The main concept of variable compression ratio is uses to improve the engine performance, efficiency and emissions will be reduced. The high cylinder pressures and temperatures during the early part of the combustion and small residual gas fraction over to high compression ratio give faster laminar flame speed. Ignition delay period is shorter. At a low loads, the compression ratio is greater, and the combustion time is shorter. Subsequently, time loss is reduced. The fuel consumption rate is lower with high compression ratios at part load.

4.2 VARIABLE COMPRESSION RATIO DIESEL ENGINE USING WITH TURBOCHARGER

A turbocharger is a device used to allow more power to be produced for an engine of a given size. Its purpose is uses to increase the volumetric efficiency of the combustion chamber. The first concept of the exhaust turbocharger is well known to reuse the I.C engine exhaust energy. In an exhaust turbocharger system, the I.C engine will be exhaust expands to turbine and an output is a shaft work to drive an air compressor. It means that exhaust energy will be used to boost an IC engine intake pressure. A turbine is directly couples to the I.C engine exhaust pipe to uses to run the exhaust for working medium without any mechanical connection between the I.C engine and turbine. The main faults of the exhaust turbocharger can be summarised to follows: due to the throttling exhaust of the turbine, there will be a higher exhaust back pressure and a larger exhaust loss in exhaust turbocharger engine. By using Single cylinder diesel engine gives one power stroke per crank revolution (2- Stroke) and two revolutions (4-stroke). The torque pulses are widely spaced and engine vibration and smoothness are significant problems. Used in small engine application where engine size is more important. Engine weight will increase and engine cost will increase. Engine power is proportional to the amount of air and fuel that can get into the cylinders. The power and performance of an engine can be increased by the turbocharger.

Figure1: Turbocharger with Engine Setup

Figure2: Engine Setup

4.3 TURBOCHARGER

Turbochargers are a type of forced induction system. A turbocharger unit is comprised of two main components: a turbine and a compressor, and its purpose is to increase the volumetric efficiency of the combustion chamber. The compressor of the turbocharger uses air from the ambient atmosphere and increases its density through the rotating impeller blade passages. The resultant high density airflow then enters the engine combustion chamber to mix with the fuel. A turbocharger consists of two chambers connected by a center housing. The two chambers contain a turbine wheel and a compressor wheel connected by a shaft which passes through the center housing. It is a turbine-driven forced induction device that increases an internal combustion engine's efficiency and power output by forcing extra air into the combustion chamber. That means the charging compressor is driven by an exhaust gas driven turbine. The turbocharger is bolted to the exhaust manifold of the engine. The exhaust from the cylinders spins the turbine, which works like a gas turbine engine. The turbine is connected by a shaft to the Compressor, which is located between the air filter and the intake manifold. The compressor pressurizes the air going into the pistons. The exhaust from the cylinders passes through the turbine blades, causing the turbine to spin. The more exhaust that goes through the blades, the faster they spin. On the other end of the shaft that the turbine is attached to the compressor pumps air into the cylinders. The compressor is a type of centrifugal pump -- it draws air in at the centre of its blades and flings it outward as it spins. It gives a high thermal efficiency and better volumetric efficiency and more power produced.

Figure3: Turbocharger

5. THEORETICAL CALCULATIONS

5.1 Compression Ratio

It is the ratio of the total volume of the combustion chamber if the piston moved at bottom dead centre to the total volume of the combustion chamber if the piston moved at top dead centre.

$$r_c = \frac{\text{Total volume at BDC}}{\text{total volume at TDC}}$$

5.2 Friction Power

The link between the output of brake power and the output of indicated power of an engine.

$$FP = IP - BP$$

5.3 Indicated Power

It may be the power developed by combustion of fuel in the combustion chamber. It is the sum of friction power and brake power.

$$IP = \frac{ImepLAN}{60}$$

5.4 Indicated Mean Effective Pressure

It may be the average pressure acting on a piston during a power stroke of its cycle.

$$Imep = \frac{60IP}{LAN}$$

5.5 Brake Specific Fuel Consumption

It may be thought of as fuel consumption per unit of thrust of the brake power.

$$BSFC = \frac{M}{BP}$$

5.6 Indicated Specific Fuel Consumption

It may be thought of as fuel consumption per unit of thrust of the indicated power.

$$ISFC = \frac{M}{IP}$$

5.7 Brake Thermal Efficiency

It is defined as brake power of a heat engine as a function of the thermal input from the fuel.

$$BTE = \frac{BP * 3600}{M * CV}$$

5.8 Indicated Thermal Efficiency

It is defined as the ratio between the indicated power output of an engine and the rate of supply of energy in the fuel.

$$ITE = \frac{IP * 3600}{M * CV}$$

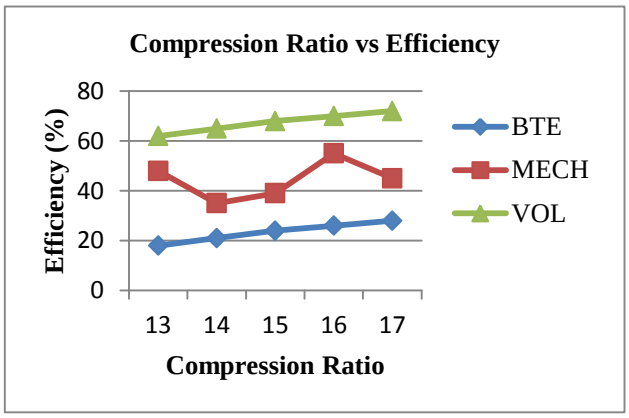
5.9 Mechanical Efficiency

It is measured as a ratio of the measured performance of an ideal machine.

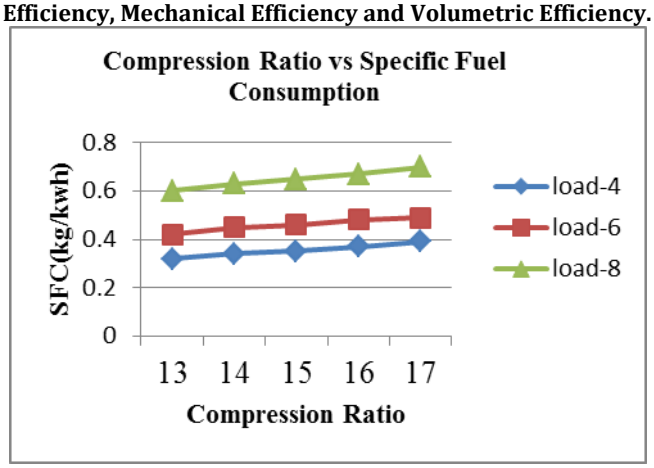
$$ME = \frac{BP}{IP}$$

6. PERFORMANCE ANALYSIS

In this paper, we are finding out the valve for compression ratio due to different load by using the turbocharger in the variable compression ratio engine. It will be increase the variable different parameter for the performance of the engine. It is good to research for the world in a good way to the environment friendly. It will be increases the valve like thermal efficiency, brake power efficiency, specific fuel efficiency, etc. in between the valve of the different compression ratio from 12.1 to 18.1.



Chapt1: Effect of Compression Ratio on Brake Thermal Efficiency, Mechanical Efficiency and Volumetric Efficiency.



Chapt2: Effect Of Compression Ratio on Specific Fuel Consumption at different loads.

7. CONCLUSIONS

Now a day, it is good for applications of a new technology regard to economic considerations and engine efficiency. A variable compression ratio concept has also been evaluated by means of the simulation of a turbocharged diesel engine. The effect of compression ratio on the engine performance at fixed loads will be presented. The increase in the intake boost pressure improves the brake thermal efficiency of the engine. For the compensation of drop in volumetric efficiency of the insulated engine 4% intake boost pressure is required for turbocharging. It is good way to reduce the pollution in a less manner of the environment friendly to the world. And it reduced the noise and makes it to run in smooth way and it is used to produce in high power to the engine.

8. REFERENCES

[1]. Pesic R. B., Milojevic S. T. and Veeinovic S. P., Benefits and Challenges of Variable Compression Ratio at Diesel Engines, Journal of Thermal Science, Volume 4, 2010.
[2]. Suyin Gan, Hoon Kiat Ng and Kar Mun Pang, Homogeneous Charge Compression Ignition (HCCI) combustion: Implementation and Effects on Pollutants in Direct Injection Diesel Engines, Journal of Applied Energy, Volume 88, 2011.
[3]. J.Heywood. Internal Combustion Engine Fundaments, McGraw-Hill, 1988.
[4]. M.Capobianco, A. Gambarotta, G. Gipolla, Influence of the Pulsating Flow Operation on the Turbine Characteristics of a Small Internal Combustion Engine Turbocharger, In: Turbocharging and Turbochargers. Inst. Mech. Eng., 1989. pp63-69.
[5]. J.X. Lu, Turbocharged Technology On Diesel Engine, China Machine Press, Beijing, 2004 (in Chinese).
[6]. J.P. Liu, J.Q. F, K. Feng, S.Q. Wang, A Study On The Energy Flow Of Diesel Engine Turbocharged System, Journal of Human University 38(5)(2011) 48-53(in Chinese).
[7]. Ganesan V. 1998. Internal Combustion Engines. Tata McGrawhill, New Delhi.

BIOGRAPHIES

E.Saravanapprabhu,
Master of Engineering,
Department of Thermal Engineering,
Sri Ramakrishna Engineering College,
Coimbatore – 641022.

Mr. M.Mahendran,
Assistant Professor,
Department of Mechanical Engineering,
Sri Ramakrishna Engineering College,
Coimbatore – 641022.