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EXPERIMENTAL STUDY OF PERFORMANCE CHARACTERISTICS OF 4-STROKE DIESEL ENGINE USING BLOWER AT EXHAUST

Prof. Bhavik D. Upadhyay[1], Ms. Sonal T. Dave[2]

[1]*Department of Mechanical Engg.,Shantilal Shah Engineering College, Bhavnagar-364002, Gujarat, India*
[2]*Department of Mechanical Engg.,Sir Bhavsinhji Polytechnic Institute, Bhavnagar-364002, Gujarat, India.*

Abstract — *The present analysis is an experimental work prepared for the performance Characteristics of the 4-stroke diesel engine using suction blower at the exhaust. The experiment integrates the device consisting of a suction blower based on requirements. The experiment is carried out for the constant compression ratio with the variation of load on engine. The result shows the improvement in the break power, specific fuel consumption, and finally increasing in the break thermal efficiency and mechanical efficiency of the engine with the exhaust blower when compared with the normal 4- stroke diesel engine.*

Keywords- *I.C. Engines, blower, break power, thermal efficiency, mechanical efficiency.*

I. INTRODUCTION

The world is presently confronted with the twin crises of fossil fuel depletion and environmental degradation. Indiscriminate extraction and lavish consumption of fossil fuels have led to reduction in underground carbon-based resources. In developed and developing countries of the world are using diesel engines in many applications such as thermal power stations for various purpose like generating electricity and transportation. These engines consume serious amount fuel per hour. Research on IC engines has many frontiers: optimum engine design to get better fuel utilization and mitigate specific emissions; development of alternate fuels to reduce the dependence on fast depleting fossil fuels; use of oxygenated hydrocarbons in conventional compression ignition (CI) and spark ignition (SI) engines; development of reaction kinetics and thermal databases for different hydrocarbons to simulate combustion process in IC engines. An effort is made in this experiment to increase the efficiency, thermal and mechanical both, of an I. C. engine using the suction blower at the exhaust of an engine.

II. LITERATURE REVIEW

Bharath R, Pavan Hp, Prashanth B, and Dr. K.S Badarinarayan [1], they presented study of an experimental work for the performance parameters of the I C engine using suction blower at the exhaust with variable frequency drive. The output of the study about the improvement in the break power, specific fuel consumption, and finally increasing in the break thermal efficiency of the engine with the exhaust blower when compared with the normal 4 stroke diesel engine.

R. Sudheer, N. Ranjeeth, and Prof .V.Pandurangadu,[2] they presented study of an experimental work about the performance characteristics of an internal combustion engine by arranging a whirl air fan before the intake manifold. The target of the study was to reinforce the swirl result within the cylinder that causes higher performance and reduces the emissions. The output of the study was about the enhancement of the performance of the engine in terms of brake thermal efficiency and BSFC. Also the emission of CO and HC was reduced. The emission of NO_x increases in the study and that is the point on which efforts are to be made to decrease the emission of NO_x.

Osama H. M. Ghazal, and Mohamad S. H. Dado,[3] presented a study based on maximizing the engine brake power and specific fuel consumption (BSFC) at any engine speed by continuously varying the phase between the cam shaft angle and the crank shaft angle. A single-cylinder engine was simulated by the “LOTUS” software to find out the optimum phase angle for maximum power and minimum fuel consumption at a given engine speed. They used the mechanism, planetary gear drive designed for precise and continuous control. This mechanism has a simple design and operation conditions which can change the phase angle without limitation.

Bello Lawal and Dr. Isa Garba, [4] discussed about evaluation of parameters affecting the performance of spark ignition engine and studied the different throttle position and its effect on the various performance parameters.

III. SPECIFICATIONS OF ENGINE

Table 1. Specifications of engine

Item	Specifications
Engine Make	Kirloskar
Engine power	3.50 kW
Engine speed	1500 rpm
No. of cylinders	1
No. of strokes	4
Type of cooling system	Water Cooled
Type of fuel used	Diesel
Cylinder Bore	87.50 mm
Stroke Length	110.00 mm
Connecting Rod length	234.00 mm
Compression Ratio	18.00
Swept volume	661.45 (cc)
Dynamometer Type	eddy current, water cooled, with loading unit

IV. EXPERIMENTAL SET UP

The experiments are conducted on single cylinder four stroke water cooled direct injection diesel engine as shown in figure 1. The engine was coupled to eddy current, water cooled dynamometer. Fuel flow rates were regular with calibrated measuring device.

The engine was run at the idling condition for certain period of time. The engine was properly fitted with the mechanical loading arrangement for better results. After running the engine with this condition for certain time, readings were taken for different load conditions. The suction blower was attached with the exhaust of the engine as shown in figure 2.

The experiment is performed on Diesel Engine with the variation of load in normal condition (When suction blower is not attached at exhaust of an engine) and the performance parameters are recorded. Again the experiment is performed on Diesel Engine with the variation of load when the suction blower is attached at exhaust of an engine and the performance parameters are recorded.

"Figure 1. Experiment Set-up"

"Figure 2. Suction Blower at exhaust"

V. RESULT

From the experimental information the graphs are drawn. These graphs show the variation in brake power, brake thermal efficiency, mechanical efficiency and specific fuel consumption at various loads on the diesel engine.

Based on the above experimental results, a graph was drawn between Load and Brake power which is shown in below Figure 4. The graph indicates that the brake power increases 4 % with increase in load when the suction blower is attached with exhaust.

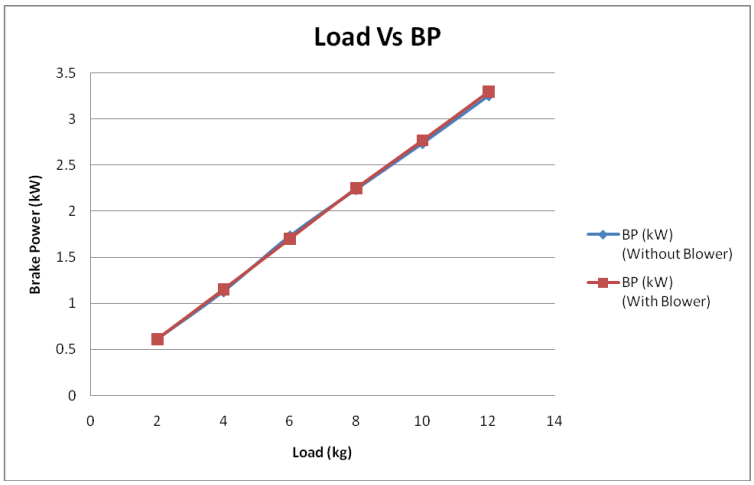

Figure 4. Graph – Load Vs Brake Power

Based on the above experimental results, a graph was drawn between Load and Mechanical efficiency which is shown in below Figure 5. The graph indicates that the mechanical efficiency increases 2.54 % with increase in load at constant compression ratio as 18 when the suction blower is attached with exhaust.

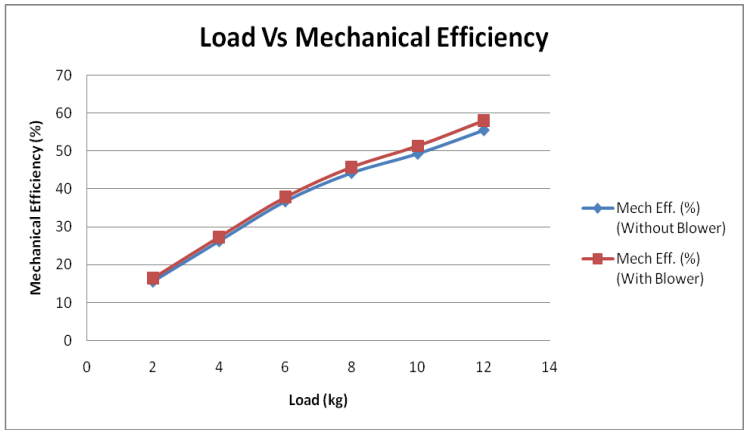

Figure 5. Graph – Load Vs Mechanical Efficiency

Based on the above experimental results, a graph was drawn between Load and Brake thermal efficiency which is shown in below Figure 6. The graph indicates that the brake thermal efficiency increases diminutive with increase in load at constant compression ratio as 18 when the suction blower is attached with exhaust.

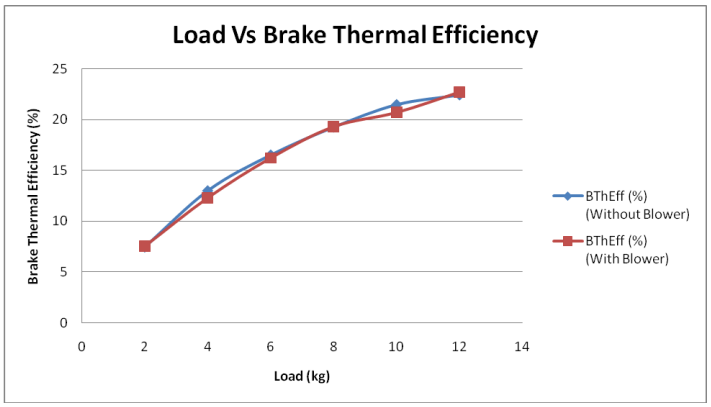

Figure 6. Graph – Load Vs Brake Thermal Efficiency

Based on the above experimental results, a graph was drawn between Load and Specific fuel consumption which is shown in below Figure 6. The graph indicates that the Specific fuel consumption remains almost same and does not defer much compared to normal engine condition (without suction blower) with increase in load at constant compression ratio as 18 when the suction blower is attached with exhaust.

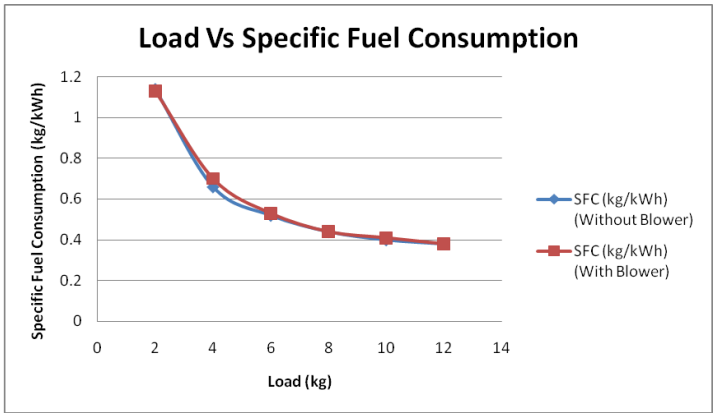

Figure 7. Graph – Load Vs Specific Fuel Consumption

VI. CONCLUSION

The following conclusions are drawn from the experimental work.

1. Break power increases by 4 % when suction blower is used at exhaust.
2. Break thermal efficiency is also increased diminutive with increase in load on the engine using suction blower at exhaust.
3. Mechanical efficiency increases considerably as load increases using suction blower at exhaust.
4. Specific fuel consumption is not differing in both the situations as the suction blower is attached at exhaust.

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