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PERFORMANCE ANALYSIS OF SUPERCHARGING OF TWO WHEELERS

Yashvir Singh[1], Nishant Kr. Singh[2], Rakesh Prasad[3], Hemant Kr. Nayak[4]
Hindustan College of Science and Technology, Mathura, UP, India-281122
Email: yashvirsingh21@gmail.com

ABSTRACT

The objective of this work is to increase the torque and power of the two wheeler by supercharging the vehicle. For this purpose LML freedom 125 cc is analysed for the work and certain parameters like torque, power, and specific fuel consumption vs rpm are calculated. The data calculated is used in software Engine Analyser for analysis purpose together with the data of supercharger. It can be seen that power and torque of the engine increases from 7 to 11 KW and 9 to 13 NM at 7500 and 9000 RPM respectively.

Index Terms-Power, torque, supercharger

I. INTRODUCTION

A supercharger is essentially a large pump that compresses air and forces it into the engine's air intake. Turbochargers do the same thing, only they are run by exiting exhaust gasses, while superchargers are powered by the engine's spinning crankshaft, normally via the accessory belt. Supercharging an engine often results in huge power increases in the range of 50% to 100%, making them great for racing, cross country flying, or just having fun. And because of the way superchargers work, they provide power only when the engine is under full throttle or under load not under normal cruising conditions. This means that the supercharger will not affect the engine's reliability, longevity, or fuel economy under normal conditions.

Most of the superchargers sold today are centrifugal-style superchargers, which are internal-compression superchargers, meaning they create the boost (compress the air) inside the supercharger head unit (blower) before discharging it into the engine's air intake. External compression superchargers (roots or screw-type superchargers) have become less popular as centrifugal superchargers have evolved. Centrifugal superchargers (Aero Superchargers,Vortech and Paxton) are more reliable, especially at higher boost levels, and are capable of creating much more boost than external compression superchargers, while creating a much cooler intake charge (which results in an even denser intake charge). Boost is created at the point when the supercharger's internal impeller pushes enough air through the blower to overcome the vacuum force naturally created by the engine's air intake, so air is being forced, rather than pulled, into

the air intake. Boost is measured in Manifold Pressure, or MAP. More boost equates to a more dense air charge into the engine's combustion chamber, which allows the engine to burn more air and fuel and create more horsepower.
Different researchers work on increasing the performance of the superchargers. But only very few did research on the supercharging of two wheelers. As we knew that racing bikes are equipped with superchargers. But commercial two wheelers do not come with superchargers. So, in this work the author tries to increase the power and torque characteristics of the 125 cc engine of the LML freedom equipped with centrifugal compressor.

II. EXPERIMENTAL SETUP

A single cylinder 4-stroke air-cooled petrol engine developing a power output of 3.7 kW is used for the work. Engine specification is given (see Table 2.1.). A rope brake dynamometer is used for loading the engine. Computerized SI engine is observed at different at different RPM. The parameters related to the performance of the engine, which were evaluated, are: specific fuel consumption, brake power, torque, fuel consumption. These parameters were evaluated for each RPM.

TABLE 2.1 TECHNICAL SPECIFICATIONS OF THE ENGINE

Item	Technical Data
Type	4 stroke single cylinder
Model	Freedom
Make	LML
Bore x Stroke	53 mm x 49.5 mm
Compression ratio	9:1
Max. Power	8.5bhp@7750 rpm
Max. Torque	8.6 Nm@5000 rpm
Lubrication	Wet sump
Oil pump type	Trochoidal
Method of Cooling	Air

Experiments were performed at each 1000 rpm ranging from 4000 rpm to 9000 rpm. At each rpm, the performance characteristics of the engine are evaluate and the results are shown in figure 2.1.
After evaluating the data of the engine without supercharger is used in the software ENGINE ANALYZER. Now attempts are made so that the performance of the engine with supercharger can be evaluated. First of all, centrifugal compressor is used as supercharger but the blower was unable to withstand the heavy blows of the engine and the sudden jerks. In this case the supercharger takes power direct from the engine with the help of chain drive. Now we need a blower which must have good strength so that it can sustain the jerks and blows from the engine. So, blower is connected to a DC motor

and was supplied power from the battery. The performance of the engine with supercharger is shown is figure 2.2

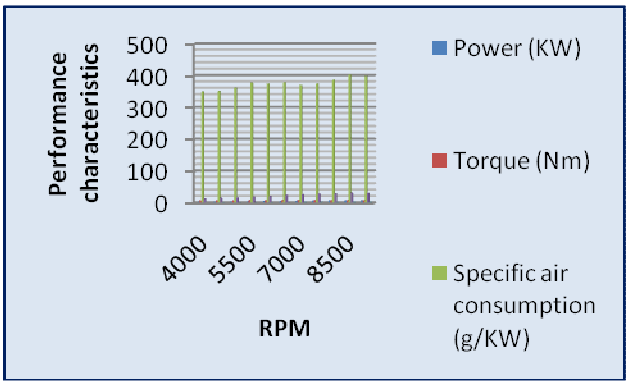

Figure 2.1 Performance characteristics of the engine

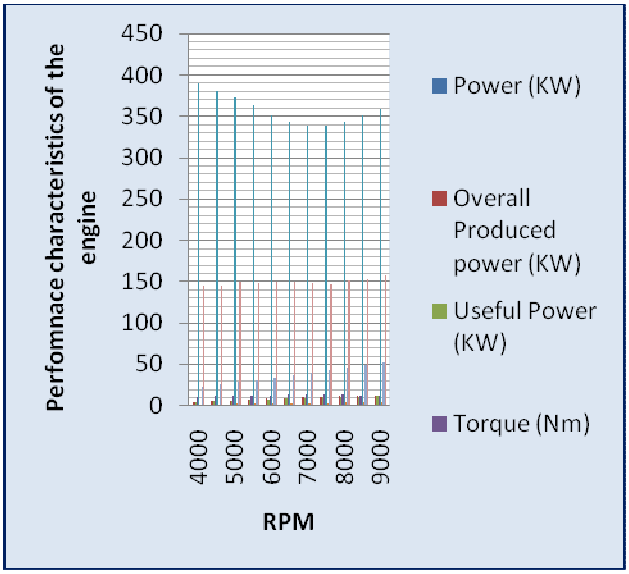

Figure 2.2 Performance characteristics of the engine with supercharger

III. RESULTS AND DISCUSSIONS

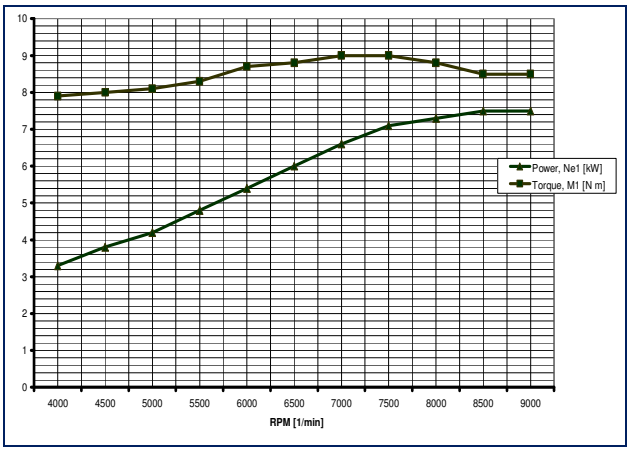

Figure 3.1 Power and torque characteristics of the engine

The data analysis in the ENGINE ANALYZER software shows that the power and torque of the engine without modification and modified engine which can be seen in the figures 3.1 and 3.2 respectively.

The figure 3.1 shows that the power developed at 4000 rpm is more than 3.3 KW and increases as the rpm of the engine increases and becomes maximum at 9000 rpm about 7.5 KW. The torque of the engine starts from 7.9 Nm at 4000 rpm and becomes maximum about 9 Nm at 7000 rpm. Now from figure 3.2 it can be seen that the useful power developed at 4000 rpm is more than 300 KW which is much more than the power developed without supercharger. Also, the torque developed by the modified engine shows the value of 11.48 Nm at 4000 rpm and gives highest value of about 13.35 Nm at 7000 rpm. This increase in power and torque of the engine is due to the more air consumption by the engine.

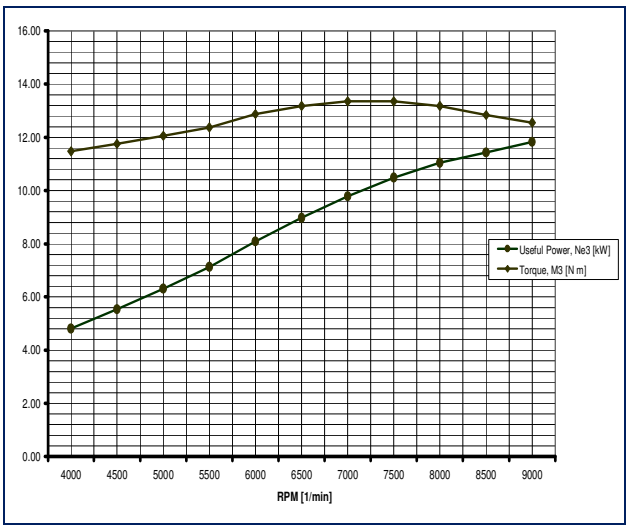

Figure 3.2 Power and torque characteristics of the modified engine

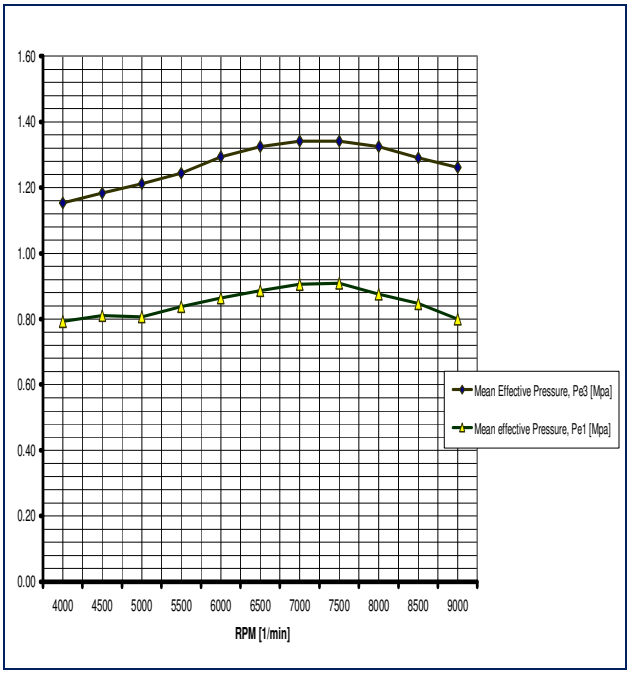

Figure 3.3 Comparison of the mean effective pressure of the given engine and modified engine

Figure 3.3 shows that the mean effective pressure of the modified engine is much higher than the original engine. The modified engine gives 1.35 Mpa of mean effective pressure as compared to 0.80 Mpa in case of original engine. From the figure 3.4 it can be that the specific fuel consumption of the modified engine increases due to supercharging. Figure 3.5 shows the air consumption of the modified engine and the give engine. It can be concluded from the figure that the hourly air consumption in case of supercharged is more which increases the power of the engine.

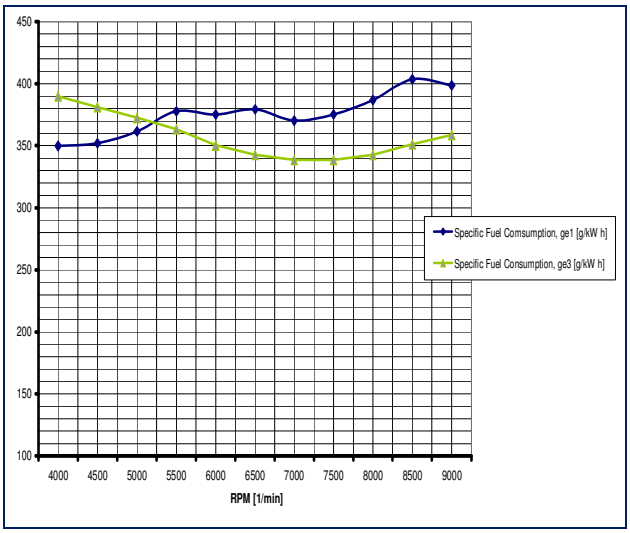

Figure 3.4 Comparison of the specific fuel consumption of the given engine and modified engine

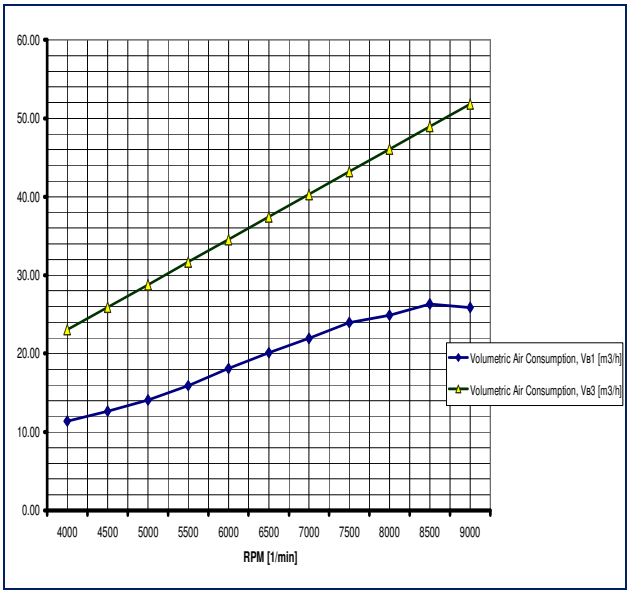

Figure 3.5 Comparison of the hourly air consumption of the given engine and modified engine

CONCLUSIONS

It can be concluded that it is possible to install a supercharger in case of commercial two wheelers which increases their power on an average about 152 % more than the original engine. So, supercharging can be done on those engines where maximum power and torque is desired on the verge of more fuel consumption. Fig.1 shows the power and torque characteristics of the given engine and the modified engine. It can be seen the

torque of the modified engine is highest at 7000 rpm and after that there is decrement of torque due to the fast opening and closing of valves of the engine.

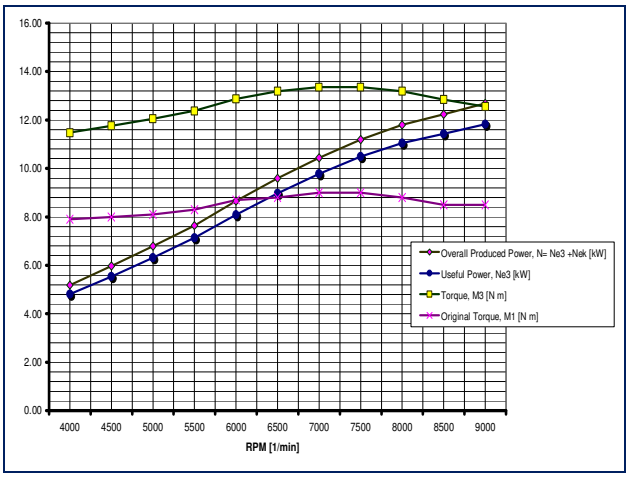

Figure 1 Power and torque characteristics of the given and modified engine

REFERENCES

[1] Attard W., Watsom H.C., Konidaris S., and Mohammad A.K. *Comparing the performance and limitations of a downsized sae engine in normally aspirated, supercharged and turbocharged modes*. SAE Technical Paper Series, 2006.
[2] Attard W., Watsom H.C., Konidaris S., and Mohammad A.K. *Comparing the performance and limitations of a downsized sae engine in normally aspirated, supercharged and turbocharged modes* SAE Technical Paper Series, 2006.
[3] Jawad B.A, DeGain M.D, and Young jr A.P. *Design of restricted induction system for a high speed four cylinder engine* SAE Technical Paper Series, 2006.
[4] E. Codan, C. Mathey, '*Emissions – A new Challenge for Turbocharging'*, paper no. 245, 25th CIMAC Congress, Vienna 2007.
[5] The Engineering Society For Advancing Mobility Land Sea Air and Space. *Supercharger Testing Standard* SAE, 2005-08.