



Vespa Motorcycle Modification Effects to Increase Power and Torque

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Abstract

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This study aims to determine the effect of modifying the Vespa Sprint I-Get 150 ABS motorcycle on power and torque. The method used is to modify the intake manifold, combustion chamber, ignition, and exhaust channels. Power and torque were tested using the Bethar Racing Team Dunamometer. The test results show that: 1) modification of the piston from 58 mm to 66 mm increases engine capacity by 200.4 cc; 2) Modifications to the intake manifold, combustion chamber, ignition, and exhaust ducts can increase power by 24.8 hp at 5122 Rpm; 3) Modifications to the intake manifold, combustion chamber, ignition, and exhaust ducts can increase torque by 41.68 Nm at 1890 Rpm.

Keywords: Modification, Vespas, Power, Torque

Abstrak

Penelitian ini bertujuan untuk mengetahui efek modifikasi sepeda motor Vespa Sprint I-Get 150 ABS terhadap daya dan torsi. Metode yang digunakan dengan memodifikasi saluran intake manifold, ruang bakar, pengapian, dan saluran buang. Daya dan torsi diuji menggunakan Dunamometer Bethar Racing Team. Hasil pengujian diperoleh bahwa: 1) modifikasi piston dari 58 mm menjadi 66 mm meningkatkan kapasitas mesin sebesar 200,4 cc 2) Modifikasi pada saluran intake manifold, ruang bakar, pengapian, dan saluran buang dapat meningkatkan daya sebesar 24,8 hp pada 5122 Rpm. 3) Modifikasi pada saluran intake manifold, ruang bakar, pengapian, dan saluran buang dapat meningkatkan torsi sebesar 41,68 Nm pada 1890 Rpm.

Kata-kata kunci: Modifikasi, Vesp, Daya, Torsi



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1. Introduction

Modifications to vehicle components or systems are carried out to optimize the vehicle for the better, which include: torque, power, fuel efficiency, and quality of exhaust emissions. In motor vehicles, optimizing fuel octane values and variations in engine speed affect environmentally friendly exhaust emissions [1][2]. The use of additives in fuel, namely hydrogen gas to premium and eucalyptus oil to pertalite, can reduce exhaust emissions on motorcycles [3][4]. In addition to reducing exhaust emissions, a mixture of additives in fuel can increase the power and torque of motorized vehicles [5][6].

The motorcycle valve mechanism through a modification process affects optimizing vehicle performance. Vehicle optimization can be achieved by changing the intake camshaft and exhaust lobe lift to increase the air and fuel mixture volume and facilitate the combustion process's exhaust [7]. Changes in the intake camshaft and exhaust lobe lift affect the intake and exhaust strokes and change cylinder pressure during compression. In the valve mechanism, changes in the valve clearance and size affect the power, torque, and fuel consumption of the motorcycle [8][9]. Adjustment of the intake and exhaust valve gaps that are too small or large can affect vehicle performance [10].

Vehicle performance can be improved by changing the diameter of the piston to be larger (bore up) and increasing the length of the piston stroke (stroke up) [11] so that the volume of the air and fuel mixture increases [12]. Bore up and stroke up of the vehicle also affects fuel consumption, power, torque, and exhaust emissions. Fuel consumption tends to increase with every increase in engine speed [13]. In vehicles that have been modified, bore up and stroke up have increased power and torque than standard vehicles, but exhaust emissions have increased at high rpm [14].

Based on the previous paragraph, it is known that replacing, changing, or adding vehicle components can affect the power and torque of the motorcycle. However, the modification process is only applied to one vehicle component or system. What if the modification process is carried out by more than one vehicle component or system? Based on the description of the previous paragraph, research will be carried out by modifying several components or vehicle systems to determine the effect on power and torque.

2. Method

Research using Vespa motorcycles. The research method uses descriptive methods. The descriptive method is used to explain the characteristics of the research subjects. The specifications of the Vespa motorcycle used for the study are presented in [Table 1](#).

Table 1. Vespa Motorcycle Specifications

Name	Specifications
Vespa	Sprint I-Get 150 ABS
Capacity	154,8 cc
Maximum Power	11,8 hp/7500 Rpm
Maximum Torque	12 Nm/5000 Rpm
Cooling System	Air conditioner
Number of Cylinders	1
Exhaust Pipe	<i>Single Exhaust</i>
Machine Type	<i>4-Stroke</i>
Number of Valves	3
Drive Type	<i>Chain Drive</i>
Injection Type	<i>Electric Injection</i>
Transmission Type	CVT

Vespa Sprint I-Get 150 ABS modification was improved by modifying the piston size of the Vespa Sprint I-Get 150 ABS motorcycle. The replacement of the piston diameter, larger than the standard size, will increase the motorcycle's compression cylinder (cc) [15]. In addition to the piston size modification, other components were modified to maximize vehicle power and torque. Modification of the components of the Vespa Sprint I-Get 150 ABS motorcycle is presented in [Table 2](#).

Table 2. Modification of the Components of the Vespa Sprint I-Get 150 Motorcycle ABS

Name	Standard	Modification
Piston Diameter	58 mm	66 mm
Valve	In 20 mm & 20 mm Ex 22 mm	In 24 mm & 24 mm Ex 28 mm
Compression	10,5	11,5
injectors	<i>8 Hole</i>	<i>10 Hole</i>
Diameter In Throttle Body	28 mm	34 m
Roller Weight	72 gram	33 gram
Inner Diameter of Exhaust Flange	26 mm	17,7 mm
Ignition	ECU	ECU Aracer
Per Valve	Standard	AHRS

After the modification of the Vespa Sprint I-Get 150, ABS motorcycle was completed, a power and torque test were carried out using the Bethar Racing Team dynamometer. The installation of the Vespa Sprint I-Get 150 ABS motorcycle on the dynamometer is presented in **Figure 1**.



Figure 1. Installation of the Vespa Sprint I-Get 150 ABS Motorcycle on the Dynamometer

At the time of testing using a dynamometer, the temperature in the room was 32.10 C, the humidity was 74%, and the pressure was 997 bar.

3. Results and Discussion

a. Power and True Result

Modification of the piston size impacts increasing the engine capacity (cc) of the Vespa Sprint I-Get 150 ABS motorcycle. The results of measuring engine capacity or compression cylinder (cc) are as follows:

$$\text{Machine Capacity} = \frac{\pi}{4} \times D \times S \quad (1)$$

$$\text{Machine Capacity} = \frac{3,14}{4} \times 66 \times 58,6 = 200,4 \text{ cc} \quad (2)$$

Description:

π = konstanta 3,14

D = Piston Diameter (mm)

S = Step Length from TDC to TMB (mm)

Modify the pistons of the Vespa Sprint I-Get 150 ABS motorcycle by changing the piston diameter from the standard size of 58 mm to 66 mm and the standard stride length of 58.6 mm, increasing the engine capacity by 45.6 cc. So the engine capacity rose to 200.4 ccs from the standard size of 154.8 ccs.

Testing of power and torque is done using a dynamometer. The test results are presented in **Figure 2**.

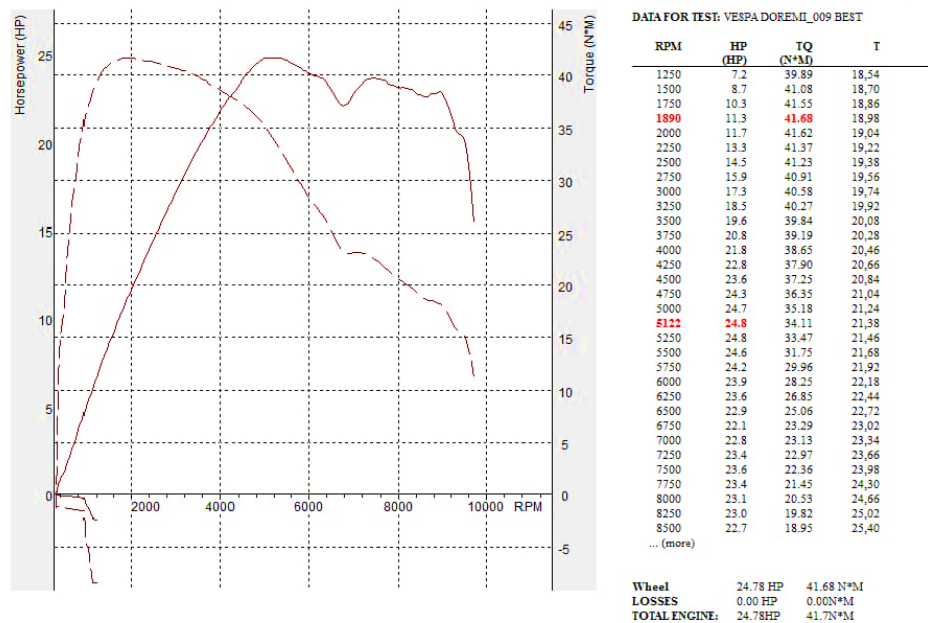


Figure 2. Graph of Power and Torque Testing Using a Dynamometer

In **Figure 2**, the maximum power generated from the Vespa Sprint I-Get 150 ABS motorcycle modification is 24.8 hp at 5122 Rpm. The maximum torque generated from the Vespa Sprint I-Get 150 ABS motorcycle modification is 41.68 Nm at 1890 Rpm.

The increase in power and torque is influenced by modifications to the Vespa Sprint I-Get 150 ABS motorcycle. The increase in cylinder volume impacts increasing the power and torque of the motorcycle [16]. Cylinder volume is increased by increasing the diameter of the piston and intake manifold. In the throttle body, the larger the diameter of the throttle body, the more air that enters the combustion chamber to increase power and torque [17].

In addition to modifying the inside diameter of the throttle body, changes to the valve diameter and an increase in the amount of fuel are applied to maximize vehicle performance. In the valve modification, the valve diameter is enlarged so that the flow of the air and fuel mixture entering the cylinder chamber is getting better to increase the vehicle engine's performance [18].

When more air enters the combustion chamber, it is necessary to add more fuel so that the mixture becomes homogeneous. The air and fuel mixture data homogeneity are achieved by replacing the injectors with more orifices. Modification of the Vespa Sprint I-Get 150 motorcycle injector with standard 8-hole ABS replaced with a 10-hole injector so that there is more fuel and better fogging.

4. Conclusion

Based on the results and discussion, it can conclude the change in the piston diameter of the Vespa Sprint I-Get 150 ABS motorcycle from 58 mm standard to 66 mm can increase the engine capacity to 200.4 ccs. Modifications applied to the intake manifold, valves, fuel, ignition, and exhaust lines can maximize motor power by 24.8 hp at 5122 Rpm. In addition, modifications applied to the intake manifold, valves, fuel, ignition, and exhaust channels can maximize motor torque of 41.68 Nm at 1890 Rpm.

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