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# *Analysis Of 135 CC Motorcycle Engine Performance Regarding The Use Of Various Reed Valves*

Rudy Sutanto[1], Made Mara[2]

[1]*Department of Mechanical Engineering, Faculty of Engineering*
*Mataram University,*
*Mataram, Indonesia.*
*E-mail : [1]r.sutanto@unram.ac.id*

[2]*Department of Mechanical Engineering, Faculty of Engineering*
*Mataram University,*
*Mataram, Indonesia.*
*E-mail : [2]made.mara@*unram*.ac.id*



**Abstract— Reed valve on a motorcycle is a one-way valve commonly used in two-stroke engines, especially in the intake manifold between the carburetor and the crankcase. The reed valve functions to regulate the flow of air and fuel mixture so that it can only enter the crankcase when the piston moves up (suction process), and prevents the mixture from coming back out when the piston goes down (compression process). The development of automotive industry technology, especially in motorcycles, demands good engine performance and fuel consumption. The purpose of this study is to analyze the effect of reed valve variations on the performance of a 135 CC motorcycle engine. In this study, tests were carried out on 3 reed valve variations, namely: standard reed valve, viber reed valve and carbon reed valve. This study uses a direct experimental method where power and torque testing is carried out using a dynotest tool. The results of this study show the highest torque on the viber reed valve at an engine speed of 8000 rpm with a value of 16.25 Nm. Meanwhile, the highest power value is found in the viber at 9000 rpm with a value of 20.85 hp. This shows that the viber reed valve provides the highest torque and power performance at high engine speeds, while the standard reed valve has the lowest torque and power performance. The analysis results show that the standard reed valve shows stable engine performance, the carbon reed valve shows better initial acceleration (light pull), while the viber reed valve shows high performance at high rpm (racing and top speed).**

**Keywords—Component; Reed Valve, Two Stroke Engine, Dynotest, Torque, Power.**

## I. INTRODUCTION

Technological developments in the automotive industry, especially in motorcycles, are currently increasing, recorded from early January to March 2024, the distribution of domestic vehicles was 1,737,090 units and 90.50% were scooters or automatic vehicles, 4.73% were cub vehicles and 4.77% were sports motorbikes [1]. Technological developments in the automotive industry, especially in motorcycles in the current era, are certainly increasing, wanting good engine performance and more efficient fuel consumption. Motorbikes are one of the means of transportation that generally use combustion engines with internal combustion engines. [2] States that combustion engines are heat engines or engines that convert chemical energy from fuel into mechanical energy in the form of work, the main driving engine that people often use is a heat engine but mostly in the form of a rotating shaft to drive the wheels on the vehicle. 2-stroke motorcycles are motorbikes with a 2-stroke work cycle, when mixing fuel, motorbikes still use a

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carburetor as a place to mix fuel. The fuel intake is regulated using a membrane (reed valve). Read valve or reed valve works based on suction in the crank chamber and a mechanism that is not connected to engine rotation [3]. The study was conducted to determine the effect of standard read valve and dual stage read valve on torque, horse power, fuel consumption on a Yamaha RX King 135cc motorcycle. The reed valve or membrane tongue is the inlet door for fuel, lubricants and air that have been mixed in the carburetor to the combustion chamber. The reed valve also functions as a barrier to the burning of fuel outside the cylinder [4] in a comparison of the effect of standard and custom membranes (reed valves) on the performance of a 135 cc 2-stroke engine.

The reed valve on a motorcycle is a one-way valve commonly used in two-stroke engines (2-stroke), especially in the intake manifold between the carburetor and the crank chamber. The reed valve functions to regulate the flow of the air and fuel mixture so that it can only enter the crank chamber when the piston moves up (suction process), and prevents the mixture from coming back out when the piston goes down (compression process). How the reed valve works: when the piston rises, the pressure in the crank chamber becomes low → the reed valve opens → the air-fuel mixture enters the crank chamber. While when the piston falls, the pressure in the crank chamber increases → the reed valve closes automatically → the mixture cannot return to the carburetor.

Some Yamaha RX King motorcycle users assume that when the manufacturer produces the motorcycle, there is a feeling of less than optimal engine performance at medium to high engine speeds due to the lack of responsiveness of the membrane at medium to high engine speeds. This makes RX King motorcycle users make modifications. One way to improve its performance is to vary the standard reed valve with a variation of the carbon racing reed valve from Kawahara and the viber racing reed valve from TK racing, which is more elastic and allows the reed valve to close longer, resulting in more fuel intake. The highest torque of 1.28 N.m, this value was obtained from experiments that have been carried out using a combination of modified reed valves and engine speeds of 5500 Rpm, while for the power output using a combination of modified reed valves and engine speeds of 6500 Rpm, it is 10,898 Hp. These results are appropriate when viewed from the level of influence effect given [5].

In a study of the effect of reed valve variations on torque and power on the Kawasaki Ninja150 RR two-stroke vehicle. The results obtained using a dynamometer, the highest power is produced at 9000 rpm engine speed using a variation of type 3 reed valve of 28.48 hp. The average power value for using type 1 and 3 reed valves gets higher results than using standard reed valves, because the spring force properties for the closing process of type 1 and 3 reed petals are higher so that it can increase the ratio of opening and closing or reed petal work with engine speeds that are not yet one hundred percent [6]. In the study of the effect of variations in the reed valve gap and variations in the size of the pilot jet, main jet, on fuel consumption on a 2013 Kawasaki Ninja 150 motorcycle. Stating that FA is greater than Ftable at a significance level of 0.01, it can be concluded that there is a very significant change in the effect of variations in the reed valve gap on the fuel consumption level of the 2013 Kawasaki Ninja 150 motorcycle. This is due to changes in the reed valve gap, so that the larger the gap, the greater the opening distance so that the amount of fuel mixture entering the cylinder is greater, the smaller the gap, the smaller the gap opening distance will be which causes the amount of fuel mixture entering the cylinder to be less and standard conditions [7].

## II. RESEARCH METHODS

This study uses a quantitative experimental research method, namely by conducting direct testing of independent variables (types of reed valves) and measuring their effects on dependent variables (torque and engine power) using a dynotest tool.

Tools and Materials

- 2-stroke motorcycle (Yamaha RX-King) in standard conditions.
- 3 types of reed valves:
  a. Standard reed valve (factory default).
  b. Viber reed valve.
  c. Carbon reed valve.

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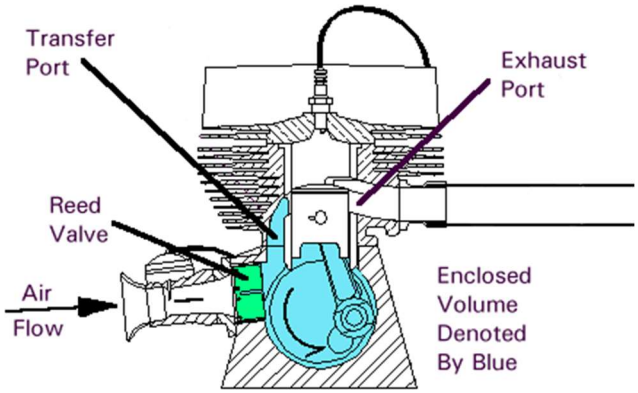
- Dynamometer (dynotest) to measure torque and power.




Gambar 1. Posisi reed valve pada sepeda motor RX-king 135 cc.

Research Variables

- Independent variable: Type of reed valve (standard, viber, carbon).
- Dependent variable: Torque (Nm) and power (Hp) at various engine speeds (rpm).

Research Procedure

1. Preparation of tools and materials:
   - Install the first reed valve (eg standard) to the motorcycle.
   - Make sure the motorbike is in prime condition and according to factory standard specifications.
2. Dynotest testing:
   - Start the engine and warm it up.
   - Run the motorbike on the dyno and measure the torque and power at engine speeds of 2000 to 9000 rpm, with certain intervals (eg 1000 rpm).
   - Record the measurement results.
3. Replacing the reed valve:
   - Repeat steps 1–2 for the vibration and carbon reed valves.

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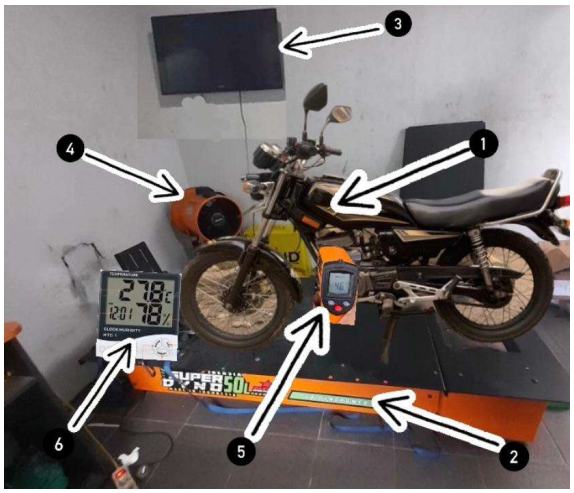


Figure 2 Schematic of dynotest test equipment. 1. Motorcycle, 2. dynotes, 3. monitor, 4. blower, 5. thermogun, 6. hygrometer.

## III. RESULTS AND DISCUSSION

Torque is a measure of the engine's ability to do work. Torque is a good parameter in determining the performance of an engine which is defined as the force acting at a distance for a moment with units of N.m. [8]. In this torque test, it was carried out on a dynotest tool by varying the harmonic plate reed valve (factory standard), viber reed valve and carbon reed valve.

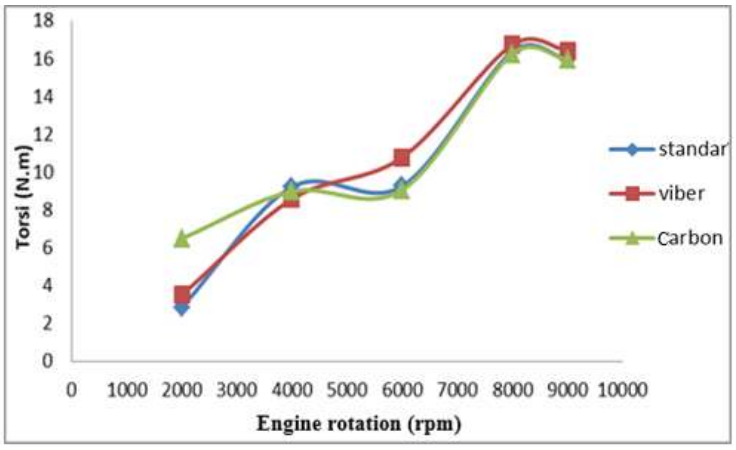


Figure 3 Graph of the relationship between torque and engine speed for various reed valves.

From figure 3, the graph of the relationship between torque and engine speed can be seen that the increase in torque value is directly proportional to the increase in engine speed, it can be seen that in each variation of the membrane tongue used, the torque value will continue to increase until the engine speed of 8000 rpm. This is because the amount of fuel entering the combustion chamber increases as the engine speed increases [9]. However, it is different if the maximum torque has been reached, the torque value will decrease, this is because the combustion speed is not balanced at high engine speeds so that the fuel combustion speed cannot keep up with the piston rotation with the air flow, at high engine speeds the engine needs more air and fuel to achieve efficient combustion. If the air or fuel supply is limited, this can result in a decrease in torque value.

The lowest torque among the 3 membrane tongue variations is found in the harmonica plate membrane tongue test (standard) at an engine speed of 2000 rpm with a value of 2.85 N.m. This is because the harmonica plate membrane tongue (standard) is thicker

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and more responsive in closing, which results in less fuel being used compared to the vibration and carbon membrane tongue at an engine speed of 2000 rpm or low speed.

Meanwhile, the highest torque among the 3 membrane tongue variations is found in the viber membrane tongue test at 8000 rpm with a value of 16.25 Nm. This is because the viber membrane tongue is more elastic with a faster and wider membrane tongue opening which results in more fuel intake compared to the harmonica plate membrane tongue and carbon membrane tongue at 8000 rpm or high speed. Meanwhile, the results of previous studies obtained the highest torque value on the standard membrane tongue with a value of 14.7 Nm at a rotation speed of 8400 rpm. The highest torque obtained by the dual stage membrane tongue at 12500 rpm was obtained with a value of 9.5 Nm. This difference is influenced by the material of the standard membrane tongue which is made of thin iron plate which is lighter for the initial opening at low to middle engine speeds, but is unable to maintain the valve opening duration so that the valve tongue slowly becomes heavier at high engine speeds. This will produce optimal torque but is less stable. Then for the dual stage membrane material made of fiber, the valve opening is less than optimal when the initial engine speed is towards the middle and starts to be optimal when the engine speed is middle towards the top and is able to provide a fairly long valve opening duration so that it produces a fairly stable torque [3]. Power is defined as the result of work, or in other words, power is the work or energy produced by the engine per unit time the engine is operating, power is the ability of an engine to produce power from the energy conversion process [10]. the more air and fuel mixture used, the greater the power produced [11].

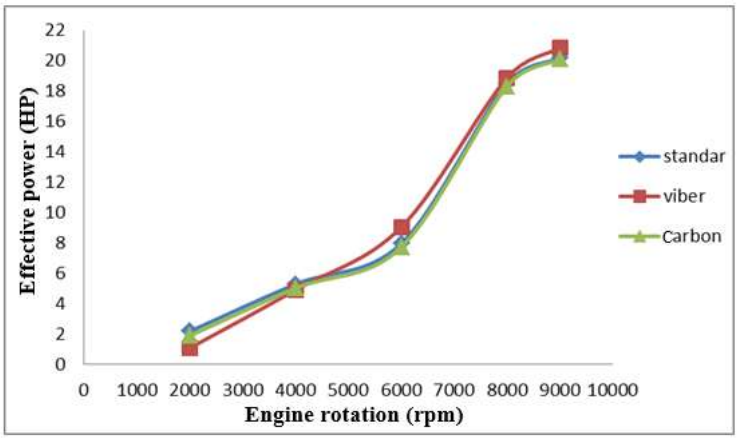


Figure 4 Graph of the relationship between power and engine speed for various reed valves.

Based on Figure 4, the graph of the relationship between power and engine speed is known that the power value is directly proportional to the torque and engine speed, through Figure 4, the graph of the relationship between power and engine speed, the test results can be seen that the increase in power value is directly proportional to the increasing engine speed, this then shows the power value from the lower engine speed of 2000 rpm to the high engine speed of 9000 rpm, the increasing engine speed, the wider the opening of the membrane tongue and its closing slows down with the use of more fuel which results in increased torque and power. From Figure 4, the graph of the relationship between power and engine speed, it can be seen that the lowest power among the 3 membrane tongue variations is in the viber membrane tongue test at 2000 rpm with a value of 1.06 hp. The lowest power on the viber membrane tongue is due to the low torque and characteristics of the membrane tongue which is responsive in closing and the surface of the membrane tongue is flatter with its housing at low engine speed so that it gets a low torque value resulting in low power. The highest power among the 3 membrane tongue variations is found in the TK racing viber membrane tongue test at 9000 rpm with an average value of 20.85 hp. The high power value is due to the high value of the torque produced by the membrane tongue which is more flexible or elastic so that it is not a wider membrane tongue at high engine speeds compared to the harmonica plate membrane tongue (standard) and carbon.

The results of previous studies showed that the highest power was obtained in the standard membrane tongue variation with a power of 18.91 HP at 9500 rpm, while the highest power obtained on the dual stage membrane tongue was 18.38 HP at 14500 rpm.

At medium engine speeds, the standard membrane tongue can optimally achieve high power and increase up to 9500 rpm and the graph shows a slow decline and cannot increase again up to 10500 rpm.

## IV. CONCLUSION

The highest torque on the reed valve viber at 8000 rpm engine speed with a value of 16.25 Nm. While the highest power value is found on the viber at 9000 rpm engine speed with a value of 20.85. hp. This shows that the reed valve viber provides the highest torque and power performance at high engine speeds, while the standard reed valve has the lowest torque and power performance. The analysis results show that the standard reed valve shows stable engine performance, the carbon reed valve shows better initial acceleration (light pull), while the reed valve viber shows high performance at high rpm (racing and top speed).

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