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ANALYSIS OF THE INFLUENCE OF INSTALLATION OF TURBO CYCLONE TYPE AND INTAKE MANIFOLD MODIFICATION ON TORQUE AND POWER ON MOTORCYCLE

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KEYWORDS

turbo cyclone
modified intake manifold
torque
power
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ABSTRACT

This study aims to determine the increase of torque and power in a motorcycle with the installation of a turbo cyclone and modified intake manifold compared to the condition of a standard motorcycle. This research was conducted using maximum engine speed or rotation per minute (rpm) as the control variable, which is at 7500 rpm. The method used in this research is the experimental method. The results of this study are the highest torque and power when using free vane turbo cyclone with a standard intake manifold with an average increase of 0.15 Nm or 1.24% on torque and an increase of 0.27 HP or as large as 2.32% of the power when compared to the standard conditions.

INTRODUCTION

Motor vehicles serve to increase the mobility of humans so that they can make it easier to move places. Therefore, a vehicle must be able to overcome all conditions on the road to be traveled. The longer the vehicle is used, it will result in a decrease in torque and power in the vehicle, this problem can result in the vehicle being less able to fulfill the usefulness of the vehicle. The decrease in torque and power in the vehicle can occur due to several factors, including the fuel mixture that is less homogeneous or not ideal, the low octane value of the fuel used and the incomplete combustion process.

The incomplete combustion process causes the power generated by the explosion of the fuel mixture and the air in the combustion chamber to be not optimal so that fuel consumption increases. To get a fuel mixture with air that is more homogeneous or evenly mixed, it can be done by creating a vortex of air that enters the carburetor or combustion chamber so that the fuel has a greater chance of mixing with air and becoming more evenly distributed. The swirling flow of the fuel and air mixture in the combustion chamber will also speed up the heat transfer process. Mixing the burning mixture with the unburned will increase the combustion speed so that fuel consumption is more efficient (Zhang and Hill in Khoir and Marsudi, 2014: 80).

According to BPM.Arends and H. Berenschut in Sularto (2007: 22) The vortex in the combustion chamber produces a perfect mixture of fuel and air so that combustion occurs very regularly with the result of reducing the possibility of burning itself. So the vortex in the combustion chamber causes the mixture to move in it, so that when the mixture is turned on, the ignition will propagate quickly. Thus, the flame propagation of the fuel and air mixture increases rapidly with the vortex of the fuel and air mixture. With an increase in the ignition of the fuel and air mixture, the combustion takes place perfectly, so that the heat energy produced is also greater to be converted into mechanical power to drive the motor.

To create a vortex of air that enters the cylinder, it can be done by adding equipment that is able to change the straight (laminar) flow of air before it enters the combustion chamber into a turbulent flow, namely by using a turbo cyclone and modifying the intake manifold. According to Ping Wang in Suliyono and Marsudi (2013: 28) Turbo cyclone is an additional tool used in internal combustion engines which functions to create air flow that will enter the carburetor and combustion chamber cylinder to swirling. The swirling air flow will increase the efficiency of

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mixing fuel with air before entering the cylinder which will increase the intensity of combustion and can maximize the results of the combustion that occurs so that perfect combustion is obtained.

The intake manifold modification can also be used to increase the fuel and air mixture that will enter the cylinder. This can be done by adding a thread to the inner surface of the intake manifold in order to change the flow rate of air and fuel from laminar to turbulent flow. The turbulent flow that occurs in the intake manifold will change the motion of the fluid particles to move in an irregular path, resulting in a rotating flow. The change in flow shape aims to accelerate and maximize the mixing of fuel and air so that combustion will be more evenly.

Muchammad (2007) conducted a study on the simulation of the turbo cyclone effect on the air flow characteristics in the airways of a 4 stroke motorcycle. The results of this study indicate that the installation of a turbo cyclone in the air duct is able to change the air flow characteristics due to the pressure drop so that the outlet turbulence intensity increases. Miftakhul (2014) conducted research on the use of turbo cyclone and iridium spark plugs on the performance of the Honda Supra X 125 cc motorcycle in the 2011 assembly year, which resulted in the highest torque increase of 20% at 8000 rpm. The highest increase in effective power of 23.54% was obtained at 8000 rpm rotation.

This study compares a vehicle using a turbo cyclone and a modified intake manifold with a vehicle in standard conditions on torque and power on a 2012 Yamaha Byson 150 cc motorcycle.

RESEARCH METHODS

This research is a quantitative research with experimental methods. The experiment was carried out at the PT. Motocourse Technology which is located at Jalan Ringroad Selatan, Singosaren, Banguntapan, Bantul, Yogyakarta. Retrieval of data in this experiment using the dynotest tool. This study uses 2 variations of turbo cyclone, namely fix vane turbo cyclone and free vane turbo cyclone. There are 2 variations of the intake manifold used in this study, namely the standard intake manifold and the modified intake manifold.

The research data is taken from the results of the torque and power test using the dynotest test tool which will then determine the amount of torque and power. The test results are then converted into diagrams which are then analyzed using comparative descriptive data analysis techniques.

RESULTS AND DISCUSSION

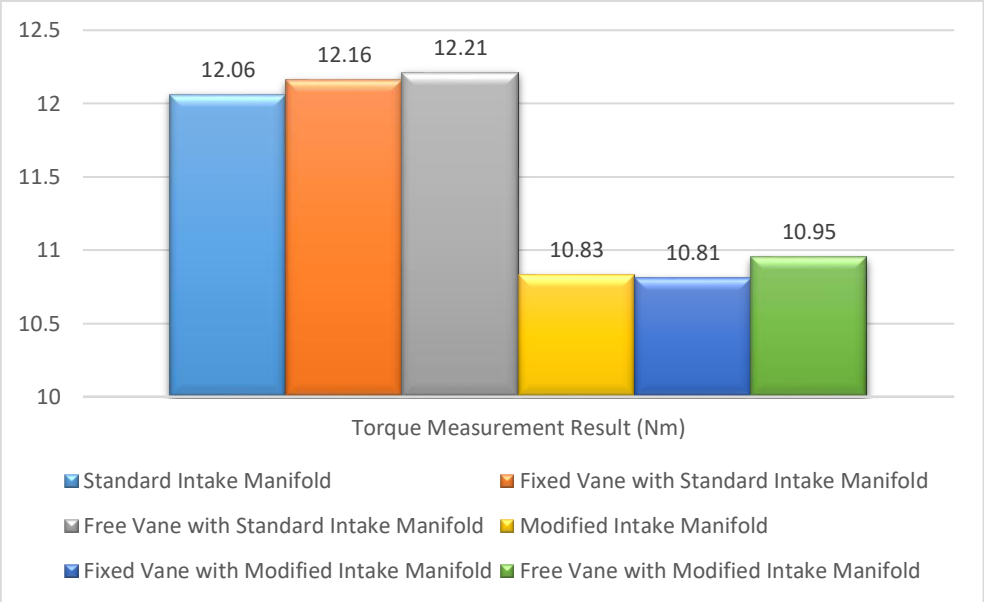

Figure 1. Yamaha Byson 150 cc Motorcycle Torque Data

Based on the results of the torque test in the graph above, the type of turbo cyclone that has the greatest effect on the increase in torque of the vehicle is the free vane turbo cyclone turbo cyclone. The maximum torque produced by the Yamaha Byson 150 cc motorcycle using the free vane turbo cyclone is 12.21 Nm, an increase of 0.15 Nm or 1.24% of the standard condition. The installation of the fix vane turbo cyclone produces a maximum torque of 12.16 Nm, or an increase of 0.1 Nm or 0.83% from the standard conditions. This increase in torque occurs due to changes in the rate of air flow that will enter the carburetor, causing the mixing of fuel and air to be more homogeneous and produce more complete combustion.

Modified intake manifold has an effect on reducing torque on a Yamaha Byson 150 cc motorcycle. Installation of modified intake manifold has an impact on reducing torque by 1.23 Nm or 10.20% of the standard condition. This is due to the design of the addition of threads on the inside of the intake manifold which actually narrows the size of the inner hole of the intake manifold, thereby inhibiting the flow of air and fuel entering the cylinder. This condition has an impact on the lack of supply of air and fuel into the engine resulting in a decrease in torque in the vehicle

The installation of a turbo cyclone with a modified intake manifold has an effect on reducing torque and power on the motorcycle. The biggest decrease occurred in the installation of a fix vane turbo cyclone with a modified intake manifold of 1.25 Nm or 10.36% of the standard condition due to flow resistance when installing a modified intake manifold.

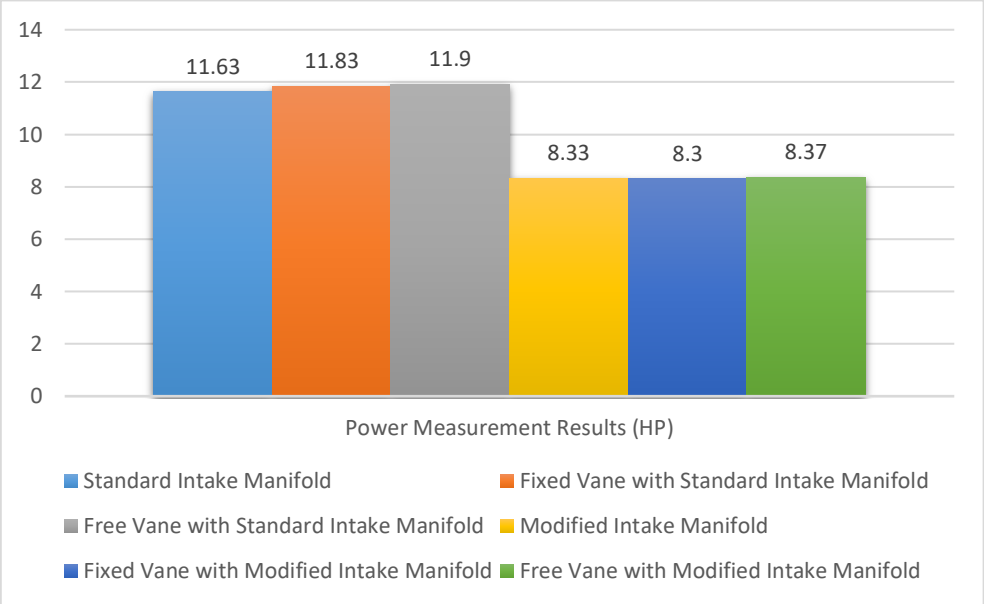

Figure 2. Yamaha Byson 150 cc Motorcycle Power Data

Based on the results of vehicle power measurements in the graph above, there is an increase in vehicle power when installing a turbo cyclone. The highest increase in power occurred when installing the free vane turbo cyclone, which was 0.27 HP or 2.32% when compared to the standard conditions. The installation of the fix vane turbo cyclone resulted in an increase in power by 0.2 HP or 1.732% from the standard condition. The increase in vehicle power occurs because the turbo cyclone changes the incoming air flow from laminar to turbulent, making the homogeneity of the fuel and air mixture better and resulting in more complete combustion, resulting in vehicle power hitting.

The installation of a modified intake manifold resulted in a decrease in power to the vehicle by 3.3 HP or 28.37% when compared to standard conditions. The decrease in power is caused by the design of the addition of threads to the intake manifold which actually reduces the hole of the intake manifold, thus inhibiting the flow of air and fuel that will enter the engine so that the air and fuel supply decreases and results in a decrease in power to the vehicle.

The installation of a turbo cyclone with a modified intake manifold has an impact on reducing the power of the vehicle. The biggest decrease in power occurred when using a fix vane turbo cyclone with a modified intake manifold, which was 3.33 HP or 28.63% of the standard condition. This decrease in power occurs because of the resistance caused by the design of the thread on the intake manifold coupled with the resistance of the fix vane turbo cyclone. The increase in power occurs when installing a free vane turbo cyclone with a modified intake manifold, which is 0.04 HP or 0.48% when compared to using a modified intake manifold only.

CONCLUTION

Based on the results of research and data analysis conducted on testing torque and power using a turbo cyclone and modified intake manifold, the following conclusions can be drawn:

1. The use of a turbo cyclone can increase torque and power on a Yamaha Byson 150 cc motorcycle. This is proven because there is an increase in torque and power at each measurement of torque and power using a turbo cyclone. The installation of the free vane turbo cyclone is the type of turbo cyclone that has the

greatest effect on the increase in torque and power on the Yamaha Byson 150 cc motorcycle. The largest increase in the installation of the free vane turbo cyclone and standard intake manifold was 12.21 Nm or 1.24% in the torque sector compared to standard conditions. In the power sector, there was an increase of 2.32% compared to the standard conditions when the trial was using the free vane turbo cyclone and standard intake manifold.

2. Installation of a modified intake manifold has an impact on reducing torque and power on the motorcycle. There was a decrease in vehicle torque by 1.23 Nm or 10.20% from the standard condition and a decrease in power of 3.3 HP or 28.37% from the standard condition.
3. The installation of a turbo cyclone and modified intake manifold has an impact on reducing torque and power on the Yamaha Byson 150cc motorcycle. The largest decrease occurred in the installation of the fix vane turbo cyclone and modified intake manifold, namely 10.36% in torque and 28.63% in power compared to the standard conditions. It is different when compared to the condition of using only modified intake manifolds, there is an increase of 1% in torque and 0.48% in power when using the free vane turbo cyclone and modified intake manifold.

REFERENCES

Arikunto, Suharsimi.2011. Prosedur Penelitian Suatu Pendekatan Praktik. Jakarta: Rineka Cipta

Khoir, Miftahul dan Marsudi.2014. Pengaruh Penggunaan Turbo Cyclone dan Busi Iridium Terhadap Performa Sepeda Motor Honda Supra X 125 cc Tahun Perakitan 2011. JTM UNESA Volume 02 Nomor 02 halaman 79-88

Shrirao, Pankaj.N dan Rajeskhumar U. Sambhe.2014. Effect of Swirl Induction by Internally Threaded Inlet Manifolds on Exhaust Emissions of Single Cylinder (DI) Diesel Engine. International Journal of Science and Research (IJSR). Volume 3 Issue 7

Sularto, Tri.2007. Pengaruh Modifikasi Diameter Venturi dan Pemasangan Turbo Cyclone terhadap Daya Mesin pada Sepeda Motor FIZ R 2003. Skripsi dipubikasikan: UNS Surakarta

Suliono dan Marsudi.2013. Pengaruh Penggunaan Turbo Cyclone dan Busi Iridium Terhadap Emisi Gas Buang pada Motor Bensin 4 Tak. JTM UNESA Volume 02 Nomor 02 halaman 27-35

Muchammad.2007. Simulasi Efek Turbo Cyclone terhadap Karakteristik Aliran Udara pada Saluran Udara Sepeda Motor 4 Tak 100 CC Menggunakan Computational Fluid Dynamics. ROTASI Volume 9 Nomor 1 Januari 2007

Khoir Miftakhul dan Marsudi.2014. Pengaruh Penggunaan Turbo Cyclone dan Busi Iridium Terhadap Performa Sepeda Motor Honda Supra X 125 cc Tahun Perakitan 2011. JTM Volume 2 Nomor 2 Tahun 2014, 79-88