

## ***Effect of Variations in Velocity Air Intake Cyclone Dimensions on Motorcycle Torque and Power***

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### **Abstract**

*The Velocity Air Intake System is an important component in a motor vehicle engine, particularly in a 155cc engine. Its function is to optimize the airflow process to the throttle body or carburetor. However, many users or people tend to overlook the significance of improving engine performance by varying the model or replacing the velocity air intake system itself. One common issue is the diameter and shape of the airflow model, which can affect the power, torque, and exhaust emissions produced. Installing a velocity air intake system is one approach to achieve an efficient air delivery process into the combustion chamber. In our research conducted using a dyno test on a 155cc four-stroke engine, the results showed that using a 46 mm size yielded the highest power of 11.03 Hp and produced a torque of 12.39 N.m. Using a 47 mm size resulted in 11.02 Hp and decreased the torque to 12.28 N.m. With a 48 mm size, there was a decrease in power to 11.00 Hp and an increase in torque to 12.72 N.m, while using a 45 mm size led to a decrease in power to 10.09 Hp and produced a torque of 11.31 N.m.*

### **Keywords**

*Pressure, torque, Velocity Air Intake, Dynojet.*

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## **INTRODUCTION**

The development of the automotive industry as a means of transportation today greatly helps humans in carrying out their activities and work. The more vehicles there are, the more they assist our daily mobility, which has a positive impact. However, the development of this technology can also have serious negative impacts, including traffic congestion, environmental pollution, and air pollution[1]. Global warming and the scarcity of oil are reasons that encourage governments and societies to think about creating innovations in terms of energy and vehicle design itself. The engines in vehicles that we use today generally work with translational motion in the combustion chamber. Vehicle engines have different models and performance levels[2].

The development of the automotive industry today involves the use of Velocity Air Intake in internal combustion engines. The design of an intake is expected to produce a more perfect fuel mixture source so that the resulting air is more homogeneous[3]. Therefore, it is important to pay attention to the appropriate intake velocity size to increase homogeneous

airflow turbulence (swirl), making the combustion process more perfect[4]. The installation of Velocity Air Intake causes changes in the characteristics of the airflow, including the emergence of pressure drop and turbulence[5].

In the construction/design of the intake manifold channel, the most influential is the design of the intake volume itself[6]. Good fuel mixing is a balance between air and fuel, not too much or too little. Therefore, to obtain sufficient air intake and fuel, it is necessary to measure the diameter of the intake manifold channel [7].

Therefore, this study aims to examine the effect of using Velocity Air Intake on a 4-stroke gasoline engine to see its effect on torque and horsepower.

### Gasoline engine.

A petrol engine (Petrol Engine) is an energy conversion engine that converts chemical energy (air and fuel mixture) into mechanical energy through the combustion process using a spark plug[8]. A 4-stroke petrol engine is an engine that requires two crankshaft rotations to complete one cycle inside the cylinder. Each cylinder requires four strokes of the piston and there are two crankshaft rotations per cycle.

### Velocity air Intake

Velocity Air Intake is a device found in internal combustion engines that converts the airflow into a swirl that enters the combustion chamber[9]. Velocity is intended for use in vehicles or in a 155 cc engine. The device is made of stainless steel metal and consists of several fins with a specific angle of inclination relative to its vertical axis. It is installed in the air channel[10]. Please note that [Figure 1](#) clearly shows the appearance of the Velocity Air Intake device.



[Figure 1](#). The Velocity Air Intake device.

The velocity air intake aims to improve engine performance by increasing the supply of air into the combustion chamber[5]. The formula for determining the velocity of the air depends on a number of variables, including diameter of the pipe, flow rate, and pressure decrease. The most commonly employed equation is the Darcy-Weisbach equation[11], which relates the flow rate (Q), conduit diameter (D), velocity (V), pressure drop (P), and friction factor (f).

$$\Delta P = f * (L/D) * (\rho * V^2) / 2 \quad (1)$$

Where:

$\Delta P$  = Pressure drop in the pipe

f = Friction factor (depends on the pipe material, surface roughness, and Reynolds number)

L = Length of the pipe

D = Diameter of the pipe

$\rho$  = Density of the air

V = Velocity of the air

Some benefits of velocity air intake are: increasing engine power, by installing velocity air intake, the airflow into the engine becomes smoother and increases the amount of air

entering. This will help the engine produce more power and be more responsive. Increasing fuel efficiency, with smoother airflow, the engine can burn fuel more efficiently, thus saving fuel consumption. Sportier engine sound, velocity air intake can provide a louder and sportier engine sound when the gas is pressed.

### **Engine performance parameters**

The engine performance parameters discussed in this study are specific power output, which includes torque and power. In theory, the engine condition is determined by the torque and power, the higher the results, the better the engine condition.

### **Torsi**

Torsi (torque) is a force in translational motion that indicates the ability of a force to cause rotational motion. An object will rotate when subjected to torque. The rotational force on the engine's crankshaft is generated by combustion, which pushes the piston up and down. The up and down motion of the piston causes the crankshaft to rotate, which is then transferred to the drive wheels to achieve forward motion. This occurs when the vehicle is starting or accelerating, and the torque is useful in achieving high speeds. Torque is also a measure of the power generated by the engine in turning a shaft or gear wheel. Torque is measured in Newton meters (Nm). The larger the torque produced by an engine, the greater its ability to handle the load given. Several studies were conducted to increase the torque[12]-[14]

### **Power**

Kilowatts or horsepower are the units of measurement for power, which is the output of an engine's work over a period of time. [15], [16]. Power is the multiplication of the torque by the engine's rotational speed. It is seen from the speed at which the vehicle can reach a certain speed in a short and efficient time. Power can be measured from the rate of work or energy usage per unit of time. Power can be calculated by dividing the amount of energy used in a certain period of time, or by multiplying force by velocity. The standard unit for power is watts (W), which is equivalent to joules per second (J/s).

When speaking of an engine or motor, "power" refers to the force that is generated by the motor when it is used to rotate a shaft or gear wheel. If a motor is able to create a higher level of power, it will be able to complete a greater quantity of work in the allotted length of time.

## **METHOD**

Direct field testing is the approach that is used to address the problem of the volume of air pressure that enters the engine. This problem can be solved in a number of different ways. This research was carried out to directly illustrate the results of a modification that takes place throughout the combustion process and how its impact manifests itself in the performance of the engine.

The investigation was carried out by means of direct testing in the field with a Yamaha 155 cc engine serving as the instrument for the gathering of data. The primary objective of the research was to investigate how the performance of the engine would be affected by varying the amount of air pressure and volume. There were 4 experimental tests. Firstly, under standard conditions, then with diameters of 46mm (D-46), 47mm (D-47) and 48mm (D-48) respectively.

## **RESULT AND DISCUSSION**

The method of data collection consisted of performing direct testing on a vehicle powered by a 155 cc engine utilizing a dynamometer as the instrument of choice. After the testing was

completed, the research data results on variations of the Velocity Air Intake circuit dimensions in motorcycles are shown in Table 1. These results focus on differences in the bikes' torque and horsepower.

Table 1. Research data on power.

No	Model	Torque (N.m)	Horsepower (HP)
1	Standard	11.31	10.90
2	D-46	12,39	11.03
3	D-47	12,28	11.02
4	D-48	12,72	11.00

## Results

Based on the test results in the graph below, the engine's working condition at idle position (RPM 1500-2500) can be analyzed. The exhaust gas components can show how much power is generated from the standard torque, which is around 11.31 Nm and 10.9 HP. Then, in the second test with a 46 mm volume, it produced a torque of 12.39 Nm and 11.03 HP.

In the third test, we can see a decrease in torque, which is around 12.28 Nm and resulted in 11.02 HP. Then, in the next test period with a volume of 48 mm, it produced a torque of 12.72, which increased and resulted in 11.00 HP.

## Discussion

Graph in Figure 2 and Figure 3 are shows the trend of the torque and power comparison. From the torque graph, it can be seen that the larger the diameter of the velocity air intake, the lower the pressure drop produced, resulting in higher efficiency and thus higher power output. This can be observed in Type 2 (46 mm) where the torque increases to 12.51 N/m at 6343 RPM. Similarly, for the graph with 47 mm diameter, the larger the diameter of the velocity air intake, the lower the pressure drop produced, resulting in higher efficiency and thus higher power output. The torque increases to 12.21 N/m at 6470 RPM, but the best power output is observed at 7749 RPM.

For the graph with 48 mm diameter, the power output from the engine was tested on a dynojet chassis with constant loading. It was found that the best power output value from the standard engine of 155cc was at 6717 RPM with 11.6 Hp. However, there is a decrease in power output at 7000 RPM and beyond.

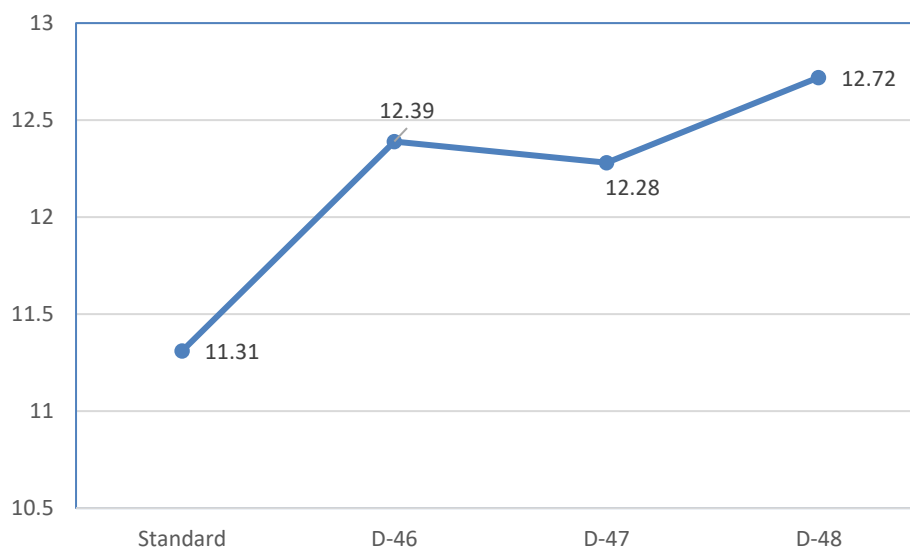


Figure 2. Torque graph comparison

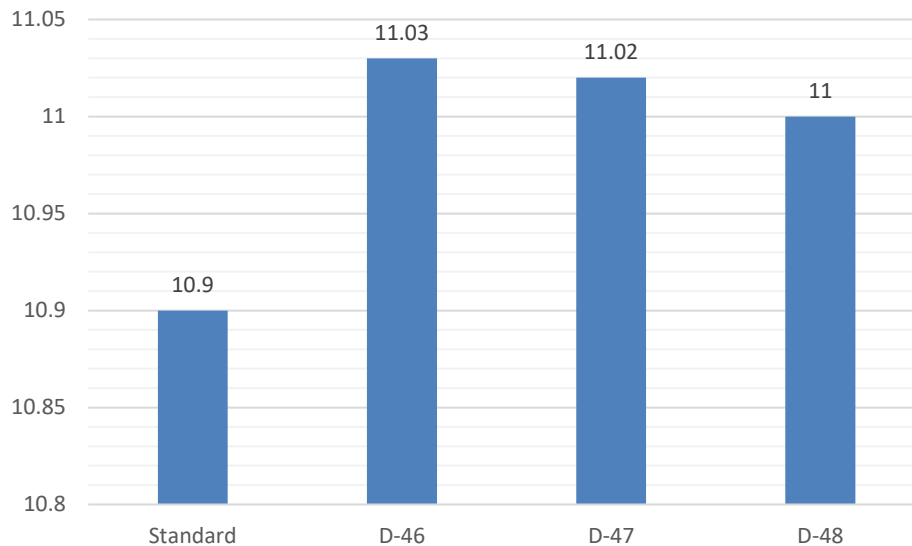


Figure 3. Power graph comparison

## CONCLUSIONS AND RECOMEDATION

### Conclusion

Based on the results of the research conducted, the following conclusions can be drawn. Simulation results show that the larger the diameter of the velocity air intake, the lower the pressure drop, and the higher the efficiency, resulting in higher power/energy output. The following data were obtained:

For a graph with a diameter of 46 mm, the torque testing results on the Dynojet chassis with constant loading indicate the following: When testing a vehicle with a 46 mm air intake velocity, at 6000 RPM, the torque begins to increase and then stops at 6343 RPM, with a torque value of 12.51 N/m. However, for the subsequent rotations, the torque starts to decrease until reaching 9000 RPM.

For a graph with a diameter of 47 mm, the torque testing results on the Dynojet chassis with constant loading indicate the following: When testing a vehicle with a 47 mm air intake velocity, at 6470 RPM, the torque reaches its peak value of 12.21 N/m, which is considered the best torque value. However, from 6500 RPM onwards, the torque starts to decrease until reaching 9000 RPM.

For a graph with a diameter of 48 mm, the torque testing results on the Dynojet chassis with constant loading indicate the following: When testing a vehicle with a certain air intake velocity, at 6308 RPM, the best torque value of 12.82 N/m is obtained. However, from 6500 RPM onwards, the torque starts to decrease until reaching 9000 RPM.

### Recommendations

Based on the conclusions presented above, this study still has limitations. Therefore, the researcher suggests the following recommendations: First, this study is still limited to using a motorcycle as the object of research, so it is necessary to conduct the same experiment on other research objects to ensure that further research is recommended.

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