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Research Article

The Effect of the Gap Spark Plug Electrode to The Performance of Motorcycle GL 200 D

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A B S T R A C T

The spark plug electrode gap is a narrow distance between the center of electrode and the mass of electrode. This gap has a very big influence on the performance of the gasoline motor. If the spark plug electrode gap is not adjusted correctly or too tight, it will result the spark produced be weaken and the power generated will decrease, meanwhile if the spark plug electrode gap is too wide, it will cause to combustion failure while operate with high rpm. In this research, the effect of the spark plug electrode gap (0.6 mm,0.7 mm and 0.8 mm) on the GL 200 D motorcycle performance is conducted with different input torque and power. The experimental results show that the maximum torque is 14,75 ft-lbs at 6000 rpm and the maximum power is obtained using 0.7 mm spark plug electrode gap where the maximum power is 19,31 Hp at 8000 rpm.

1. INTRODUCTION

The spark plug is one of most important component on a motorcycle. Without spark plug, the engine can not be operated even though the entire system is operating properly. The function of the spark plug is to splash fire in the combustion chamber for burning the fuel mixture that has been compressed in the combustion chamber thus generating the power to turn the wheels on the motorcycle.

Several techniques have been proposed to improve the motorcycle engine performance especially by remodeling the spark plug, replacing standard spark plug with racing spark plug and varying the spark plug electrode gap to.

Suprayitno et al. [1] analysed the effect of spark plug electrode gap on exhaust emissions on a 100 cc honda beat motorcycle. They have concluded that standard spark plug, iridium spark plug and platinum spark plug have no significant effect on exhaust emissions (co and hc).

Another studies using the GX-160 motor has shown that the highest torque is obtained at a spark plug electrode gap of 0.8 mm with a torque of 10.58 Nm at 1600 rpm, while the lowest torque was found at the spark plug electrode gap of 1 mm with torque of 7.25 Nm. Furthermore, it was found that the highest power obtained at the spark plug electrode gap of 0.8 mm with a torque of 2.63 hp at 1900 rpm and the lowest power was found at the spark plug electrode gap of 1 mm with a power 1.78 hp at 1900

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rpm[2].

The other studies discusses the effect of the spark plug electrode gap on the work of 4-stroke motor engine which produces the highest average pressure is 1,25 kPa with an engine rotation 6000 rpm and the spark plug gap at 0.8 mm. After rotate 6000 rpm, Bmep always decreases in the experiment with three spark plug electrode gaps, as a result if the power obtained is high, the Bmep is also high an then vice versa[3].

Based on the previous research, the author will discusses the analysis of the effect of spark plug electrode gap on the performance of a GL 200 D motorcycle.

1.1. 4-Stroke Combustion Motor

The 4-stroke combustion motor that studied in this work requires 4-stroke as shown in Figure 1. The engine requires a process of 4 times up and down the piston, two rotations (720 degrees) of the crankshaft and one rotation (360 degrees) of the chamshaft. The 4-stroke combustion motor is a motor that completes one cycle in four strokes of the piston or two times of crankshaft rotations. So, in 4-stroke motor, it has carried out the process of charging, compression and ignition, expansion and exhaust. Compared to 2-stroke motors, the 4-stroke motor is more difficult in maintenance, considering that there are more spare parts or engine parts [4].

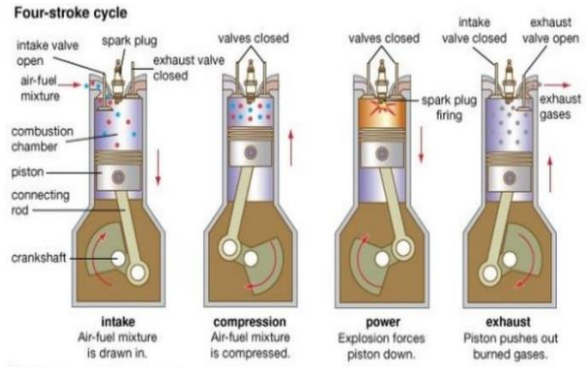

Figure 1. 4-Stroke combustion motor

1.2. 4-Stroke Engine Cylinder Head Components

A 4-Stroke engine consist of five main components i.e. cylinder head, piston, piston ring, crank shaft and cam shaft.

a. Cylinder Head

The cylinder head is used as the seat of the valve mechanism, combustion chamber, spark plug and as a cylinder block cover.

Figure 2. Cylinder head

b. Piston

The piston is useful for transferring the power obtained from the combustion of fuel to the crankshaft through the connecting road.

Figure 3. Piston

c. Piston Ring

The piston ring is used to prevents leakage of fuel gas during the compression stroke, prevents the entry of lubricating oil into the combustion chamber and transfers heat from the piston to the cylinder wall.

Figure 4. Piston Ring

d. Crank Shaft

A crank shaft converts the up and down motion of the piston into a rotating motion which eventually moves the wheels.

Figure 5. Crank shaft

e. Cam shaft

The main function of cam shaft is to open and close the valve according to the time (timing) that has been previously determined.

Figure 6. Cam shaft

2. RESEARCH METHOD

This research is carried out according to the research flow diagram as shown in Figure 7. The first step of this research is to collect tools and materials needed in the research process. After the data from the experiment is collected, the author then analyzed the data. In the final step, the results of data analysis are summarized and reported.

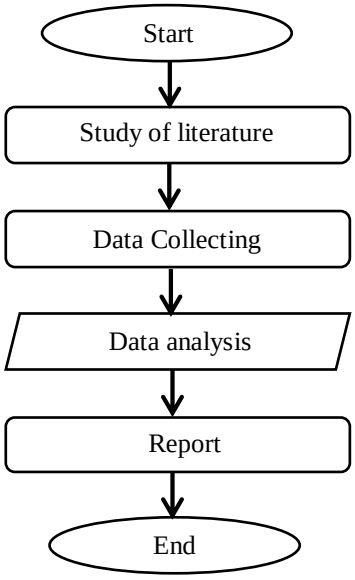

Figure 7. Research flow chart

Tools and materials that used during the research are explained as follows:

a. Screwdriver

A screwdriver is a mechanical device used to install and uninstall the bolts on the motor body.

b. Spark plug locks

A spark plug log is a device used to install and uninstall spark plug when the experiment is carried out.

c. Filer gauge

A filer gauge is a device used to measure the length between the center electrode and the mass electrode on the spark plug.

d. Dynotest

A dynotest is a device used to retrieve data of torque and power that can be reached by a motor and also to measure the highest speed that can be reached by a motor.

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e. A GL 200 D Motorcycle

Figure 8. Motorcycle of GL 200 D

f. Spark plug electrode gaps in various diameter (0.6; 0.7; 0.8 mm)

3. RESULTS AND DISCUSSION

3.1. Results of torque testing using variation of spark plug electrode gap

Table 1 show the torque data obtained from the experimental result of the spark plug electrode gap on a GL 200 D motorcycle. The machine rotataion speed and the gap are varied from 5000 to 9000 rpm and 0.6 to 0.8 mm, respectively. It can be shown that the torque decreases when the machine rotation speed is increased.

Table 1. Data of torque testing on the spark plug electrode gaps (0.6; 0.7; 0.8 mm)

Machine rotation (rpm)	Torque (Nm)		
	Gaps : 0.6 mm	Gaps : 0.7 mm	Gaps : 0,8 mm
5000	14,23	14,14	13,96
6000	14,57	14,75	14,06
7000	14,21	14,18	13,84
8000	12,03	12,67	12,77
9000	10,03	10,33	10,58

Figure 9 shows the relationship between torque and the spark plug electrode gap. It can be seen from Figure 9 that the maximum torque at the 0.6 spark plug electrode gap is 14.57 ft-lbs at 6000 rpm rotation, for the 0.7 spark plug electrode gap, the maximum torque is 14.75 ft-lbs at 6000 rpm engine speed, and at 0.7 rpm the maximum torque is 14.75 ft-lbs at 6000 rpm. At 0.8 spark plug electrode gap, the maximum torque is 14.06 ft-lbs at 6000 rpm.

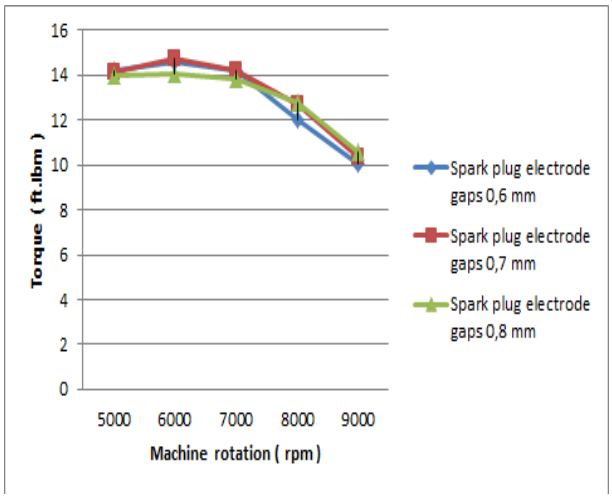

Figure 9. Graph of engine rotations with torque

3.2. Results of power testing using variation of spark plug electrode gap

Table 2 show the power data obtained from the experimental result of the spark plug electrode gap on a GL 200 D motorcycle. It is shown from Table 2 that the power increases when the machine rotation speed is increased.

Tabel 2. Data of power testing on the spark plug electrode gaps (0.6; 0.7; 0.8 mm)

Machine rotation (rpm)	Power (Hp)		
	Gaps : 0.6 mm	Gaps : 0.7 mm	Gaps : 0,8 mm
5000	13,55	13,45	13,28
6000	16,64	16,83	16,96
7000	18,95	18,91	18,47
8000	18,72	19,31	18,99
9000	17,71	17,07	18,13

Figure 10 shows the effect of spark plug electrode gap to the machine Power. It can be seen from Figure 10 that the maximum power at the 0.6 mm spark plug electrode gap is 18.95 Hp with 7000 rpm rotation. For the 0.7 mm spark plug electrode gap, the maximum power is 19.31 Hp with 8000 rpm rotation, and for 0.8 mm spark plug electrode gap, the maximum power is 18.99 Hp at 9000 rpm.

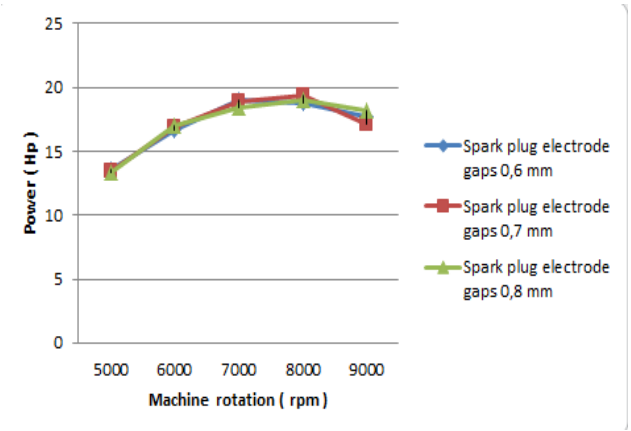

Figure 10. Graph of engine rotations with power

4. CONCLUSIONS

From the experimental results, the highest torque is obtained at the spark plug electrode gap of 0.7 mm which is 14.75 (ft-lbs) at 6000 rpm engine rotation and the highest power is at the spark plug electrode gap of 0.7 mm obtained 19.31 Hp at 8000 rpm engine rotation. The lowest torque is obtained at the spark plug electrode gap of 0.6 mm which is 10.03 ft-lbs at 9000 rpm engine rotation and the lowest power is at the spark plug electrode gap of 0.8 mm obtained 13.28 Hp at of 5000 rpm engine rotation. Based on the data above, it can be concluded that if the spark plug electrode gap adjustment is too narrow and too loose, so the torque and power on the engine will decrease. It can be concluded that the best adjustment of the spark plug electrode gap for a GL 200 D motorcycle based on the maximum torque and maximum power that obtained is the spark plug electrode gap of 0.7 mm.

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