ISSN: 2614-6754 (print)
ISSN: 2614-3097(online)

Halaman 9162-9167
Volume 5 Nomor 3 Tahun 2021

The Effect of Changes in Ignition Timing on Power, Torque and Fuel Consumption on the Honda Supra X 125CC

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Abstract

This study aims to determine the effect of changes in ignition timing on power, torque and fuel consumption on a Honda Supra X 125 CC. This study used an experimental research method. The object of this research is a motorcycle Supra X 125 CC that uses premium fuel RON 88, pertalite RON 90 and pertamax RON 92 with a standard ignition time of 15 ° before TDC, 16 ° before TDC and 17 ° before TDC. The research instruments used were a chassis dynamometer, timing light, fuel meter and a stopwatch. Data analysis using descriptive method. Based on the results of the study it can be concluded that the use of pertalite fuel with a change in ignition time of 17 ° before TDC can increase the power at 9.87 HP, up by 1.25%, torque at 1.18 kgf / m or an increase of 1.70% and fuel consumption increases as the time / angle of ignition advances.

Keywords : Ignition Timing, Power, Torque, Fuel Consumption

PRELIMINARY

The development of automotive technology is one of the most rapid in Indonesia. According to Agency (Laki, Gunawan and Gede, 2013). Regarding the automotive sector, the number of vehicles in Indonesia, there was an increase from 2015 to 2018, where motorcycle vehicles increased from year to year. The increase in two-wheeled vehicles is due to the fact that these vehicles are easy to operate, along with low maintenance costs compared to four-wheeled vehicles, and affordable prices for consumers. The lack of motor power during acceleration is also what underlies the high desire of the community and mechanics to modify the supra x 125 cc motorcycle to get better engine performance but also fuel efficiency which is classified as economical for everyday use.

Based on observations of several workshops that researchers have conducted from 21 to 30 July 2020 in several workshops in the city of Padang namely Karisma Motor Workshop, Faira Motor, and Mild II Motor, the opinion of several mechanics says that for high engine performance on motorcycles, This can be done by modifying the component or machine. Society and mechanics assume that modifying the ignition timing can increase power and torque, they also do this because they see tutorials from the internet and youtube if by modifying changes in ignition timing the engine performance will increase, but which conditions have not been proven using test equipment.

One of the most important parts in a vehicle for combustion is the ignition system (Ignition). In gasoline engines, there is a spark plug installed in the combustion chamber gap that can spark a spark to ignite the fuel and air mixture at a certain desired point in a combustion cycle. Ignition Timing is the time at which the spark plug starts to ignite for combustion, ignition of the air and fuel mixture reaches a perfect need less than 2 milliseconds (B. Amin, F. Ismet, 2016). Sparks for the combustion process must be released early, thus the explosion pressure reaches its peak after a few degrees after TDC on the crankshaft and combustion takes place without detonation so that the results of complete combustion can produce good engine performance. So the researchers made changes to the degree of ignition in order to determine the effect of changes in ignition timing (Ignition Timing) on power, torque

and fuel consumption on the Honda Supra x 125 cc to determine good engine performance and economical fuel for everyday use.

METHOD

This type of research uses an experimental method. The implementation of the research begins with the procurement of testing materials and equipment. The engine used in this study is a Honda Supra X 125 CC motorcycle. While the fuel used is pertalite. The test equipment prepared are measuring cups and Gas Analyzer.

Research variable

Independent variable

Independent variables are variables that affect or are the cause of changes or the emergence of independent (bound) variables (Christalisana, 2018). In this study, the independent variable is the change in ignition timing. Ignition 15° (standard), 16° and 17° before TDC.

Dependent variable

The dependent variable is the variable that is influenced or that becomes the result, because of the independent variable (Demand et al., 2019). In this study the dependent variables are power, torque and fuel consumption of the motorcycle. Engine performance is measured by a chassis dynamo meter while fuel consumption is measured by a burette and ignition advance is measured by a protractor and timing light.

Control variable

The control variable is a variable that is controlled or made constant so that the influence of the independent variable on the dependent is not influenced by external factors that are not examined (Harsono, 2002). The control variable in this study was a supra x 125 cc motorcycle in 2007 (standard). Premium fuel RON 88, Pertalite RON 90 and Pertamax RON 92. Standard and precise measuring tools. One standard magneto and two modified magneto protrusions (Relucor).

Modifying the Magnetic Protrusion (Reluctor)

Modifications are carried out by shifting the position of the magnetic bulge (reluctor) according to the desired degree or increasing the length of the B end and cutting the A end. The trick is to grind the A end, then add the B end by welding and grinding to make it smooth.

The formula used to modify the magnetic bulge (reluctor) is the formula for the length of the segment on the circumference of a circle. The formula used to modify the magnetic bulge (reluctor) is the formula for the length of the segment on the circumference of a circle (Penyuluhan and Siswa, 2020). The segment length formula is used to determine the length of the magnetic protrusion (reluctor) to be cut per 1° ignition time.

$$\text{reluctor length} = \frac{1^\circ}{360^\circ}\ x \text{circumference}$$

$$\text{reluctor length} = \frac{1^\circ}{360^\circ} x\ \pi d \text{ (008-2005-PCM, 2007)}$$

From this formula, it can be determined the length of the magnetic bulge (reluctor) to be cut. The standard diameter of a supra x 125 cc motorcycle is 112 mm. From the diameter of the magnet, it can be calculated the length of the magnetic bulge (reluctor) to be cut using the formula:

$$\text{reluctor length} = \frac{1^\circ}{360^\circ}\ x\ \pi d$$
$$= \frac{1^\circ}{360^\circ}\ x\ 3{,}14\ x\ 112\ mm$$
$$= 0{,}98\ mm$$

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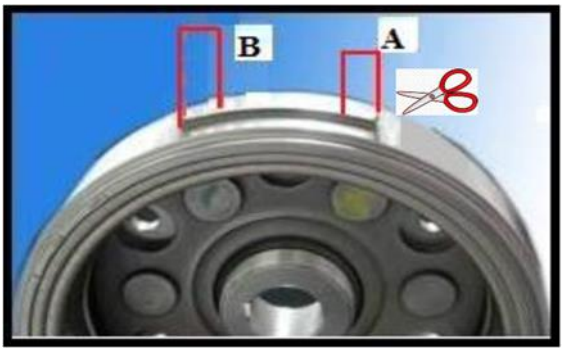

Figure 2. Part of the bulge
(reluctor) which is cut.

Data Collection Techniques and Tools

The data collection technique in this study was to collect data directly on the motorcycle being tested using a dynamometer, tachometer, thermometer, stopwatch, and burette test equipment to obtain power, torque and fuel consumption data on the motorcycle. While the data collection tool is in the form of tables that will be processed, resulting in the percentage of power, torque and fuel consumption of the motorcycle being tested.

Data Analysis Technique

The data generated from testing power, torque and fuel consumption generated by the vehicle from changes in ignition timing to power, torque and fuel consumption on the Honda Supra X 125 CC are analyzed using statistical calculations of the mean or average, after get the average then compare the average value of each statistic by using descriptive statistical techniques

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RESULTS AND DISCUSSION

Results

Based on data from the results of tests that have been carried out at the Tekleck Speedshop and Automotive Workshop, Faculty of Engineering, State University of Padang, then the data obtained can be used to answer problems by analyzing the data and providing an overview in the form of tables and graphs relating to the effect of changes in ignition timing (ignition timing).) on power, torque and fuel consumption on the Honda Supra X 125 CC the following data are obtained:

Power and Torque

Engine Power and Torque At Ignition Time 15° Before TDC (Standard).

Data from the power and torque test results for the Supra X 125 CC motorcycle engine with a standard ignition time of 15 ° before TDC, the power results according to specifications at 7500 rpm, namely premium 9.53 HP, pertalite 9.75 HP, Pertamax 92 at 9.64 HP then gets the highest power number on the type of pertalite fuel with an average engine power of 9.75 HP by showing a higher percentage increase compared to premium fuel -1.62% and Pertamax 92 -1.11%, for the results of testing torque according to specifications at 4000 rpm rotation, namely premium at 1.15 kgf/m, pertalite 1.16 kgf/m, Pertamax 92 at 1.16 kgf/m, the highest torque figure is obtained on the type of pertalite fuel with an average -average torque of 1.16 kgf/m with the highest percentage of premium fuel -0.58% and pertamax 92 of 0.00%.

Engine Power and Torque At Ignition Time 16° Before TDC

The data from the power and torque test of the Supra X 125 CC motorcycle engine with an ignition time of 16° before TDC shows the power results according to specifications at 7500 rpm, namely premium 9.72 HP, pertalite 9.85 HP, Pertamax 92 9.71 HP then the highest

power number is obtained on the type of pertalite fuel with an average engine power of 9.85 HP or an increase of 1.05% from the standard ignition power of 15 ° before TDC, for torque testing results according to specifications at 4000 rpm, namely premium of 1.16 kgf/m, 1.18 kgf/m pertalite, pertamax 92 of 1.15 kgf/m then the highest torque value is obtained for the type of pertalite fuel with an average torque of 1.18 kgf/m or an increase of 1 .70% of standard ignition torque 15° before TDC.

Engine Power And Torque At Ignition Time 17° Before TDC

The data from the power and torque test of the Supra X125 CC motorcycle engine with an ignition time of 17° before TDC shows the power results according to specifications at 7500 rpm, namely premium at 9.77 HP, pertalite 9.87 HP, Pertamax 92 at 9.78 HP then get the highest power number on the type of pertalite fuel with an average engine power of 9.87 HP or an increase of 1.25% from the standard ignition power of 15 ° before TDC, for the results of testing torque according to specifications at 4000 rpm rotation, which is a premium of 1.15 kgf/m, 1.18 kgf/m pertalite, pertamax 92 of 1.18 kgf/m, so the highest torque number is obtained for the type of pertalite fuel with an average torque of 1.18 kgf/m or an increase of 1, 70% of standard ignition torque 15° before TDC

Fuel Consumption

Fuel Consumption At Ignition Time 15° Before TDC (Standard).

The data from the test results of the Supra X 125 CC motorcycle fuel consumption with a standard ignition time of 15 ° before TDC shows the results of mf fuel consumption in kg / hour with three types of premium fuel, pertalite and pertamax 92, the smallest fuel consumption is obtained at 4000 rpm engine speed of 0.223 kg/hour on the use of Pertamax 92 fuel and the largest consumption results are found at 7500 rpm engine speed of 0.621 kg/hour on the use of premium fuel.

Fuel Consumption At Ignition Time 16° Before TDC.

The data from the test results for the SUPRA X 125 CC motorcycle fuel consumption with an ignition time of 16° before TDC shows the results of the average mf fuel consumption in kg/hour with three types of premium fuel, pertalite and pertamax 92, the smallest fuel consumption is obtained at engine speed. 4000 rpm at 0.237 kg/hour at the use of Pertamax 92 fuel or an increase of 5.78% from Pertamax 92 fuel consumption with a standard ignition time of 15° before TDC and the largest consumption results are at 7500 rpm engine speed of 0.635 kg/hour at the use of premium fuel also increased by 2.31% from premium fuel consumption with a standard ignition time of 15° before TDC.

Fuel Consumption At Ignition Time 17°Before TDC.

The data from the test results of the Supra X 125 CC motorcycle fuel consumption with an ignition time of 17 ° before TDC shows the results of the average mf fuel consumption in kg / hour with three types of premium fuel, pertalite and pertamax 92, the smallest fuel consumption is obtained at engine speed. 4000 rpm at 0.254 kg/hour at Pertamax 92 fuel consumption or an increase of 12.14% from Pertamax 94 fuel consumption with a standard ignition time of 15° before TDC and the largest fuel consumption is at 7500 rpm engine speed of 0.651 kg/hour at the use of premium fuel also decreased by 4.62% from the consumption of premium fuel with a standard ignition timing of 15° before TDC. When the ignition is advanced or the ignition is more advanced and the higher the engine speed, the greater the fuel consumption used.

Discussion

In accordance with the research objectives to be achieved, namely to find out how much power and torque resulting from changes in ignition timing on the Honda Supra X 125 CC and how much fuel consumption changes in ignition timing. In this study, based on the results of the data, it can be seen that the best power and torque results have been carried out after testing various ignition times and types of fuel.

The results of tests carried out with an ignition timing of 15° (standard), 16° and 17° before TDC show the best engine power and torque results at an ignition time of 17° before TDC using pertalite fuel at 9.87 HP, an increase of 1.25 % of power with standard ignition angle of 15° before TDC and the best torque is obtained at 1.18 kgf/m or an increase of 1.70% from torque with standard ignition angle of 15° before TDC.

These results show that changes in ignition timing or angle are able to produce a more complete combustion process and higher combustion pressure so that it will produce good engine performance with increased engine power and torque but must also be supported by the octane number of the fuel in accordance with the compression ratio. engine, air-fuel mixture ratio and engine speed. when the ignition timing is right, the combustion process becomes complete and the combustion pressure becomes higher, with increasing combustion pressure in the combustion chamber, the thrust of the piston also increases so that the power and torque produced are greater in the lower rotation up (Kurniawan, 2020). The results of consumption tests carried out with an ignition timing of 15° (standard), 16° and 17° before TDC show results such as the use of fuel in kg/hour with changes in ignition timing that there is an effect of changes in fuel consumption, based on the compression ratio of Honda motorcycles. Supra X 125 CC is 9.0:1, so the recommended fuel for engines with this compression ratio is fuel with an octane number of 90.

The best fuel consumption results are obtained at an ignition time of 17° before TDC, when referring to the torque rotation at 4000 rpm, the consumption results are obtained at 0.223 kg/hour at the use of Pertamax 92 fuel at a standard ignition time of 15° before TDC, when referring to the power output. The maximum fuel consumption is at 7500 rpm, the best fuel consumption is also obtained at a standard ignition time of 15° before TDC of 0.474 kg/hour on Pertamax 92 fuel type as well as at a standard ignition time of 15° before TDC.

Accordingly, the increase in engine power and torque is also offset by an increase in the rate of fuel consumption, the amount of fuel consumption is closely related to the combustion in the cylinder chamber. The more perfect the combustion process, the more efficient the fuel consumption. There are several factors that affect the combustion process in this cylinder, including the type and octane number of the fuel, the compression ratio ratio, the fuel and air mixture, the correct ignition timing, and engine speed.

(Murdianto, 2016) One of the factors that affect the amount of fuel consumption is the type of fuel, Pertamax 92 fuel is a factor that can affect the results of lower fuel consumption compared to pertalite and premium fuels, because the higher the octane value of a fuel used in an engine. with the same compression ratio, the resulting fuel consumption will be lower because the flame propagation period to burn fuel with a higher octane number occurs longer (H. Maksum, 2012).

CONCLUSION

Based on the results of testing the effect of changes in ignition timing (ignition timing) on power and torque carried out with variations in the ignition timing of 15° (standard), 16° and 17° before TDC, the results show the best engine power and torque at 17° before TDC by using pertalite fuel at 9.87 HP increased by 1.25% from power with a standard ignition angle of 15 ° before TDC and the best torque was obtained at 1.18 kgf / m or an increase of 1.70% from standard ignition torque of 15 ° before TDC.

Based on the fuel consumption test results from the best effect of changes in ignition timing (ignition timing) on fuel consumption carried out with variations in ignition timing 15° (standard), 16° and 17° before TDC, the best fuel consumption was obtained at 15° ignition timing. before TDC, when referring to the torque rotation at 4000 rpm, the consumption results are obtained at 0.223 kg/hour on Pertamax 92 fuel type at a standard ignition timing of 15° before TDC, when referring to the maximum power output, namely at 7500 rpm rotation, the best fuel consumption is also obtained at standard ignition timing 15° before TDC on Pertamax 92 fuel type.

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