

APPLICATION OF TORQUE EXPANSION CHAMBER (TEC) AND NOZZLE ON EXHAUST MANIFOLD HONDA SUPRA X 125

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ABSTRAK

Sepeda motor bensin merupakan sarana transportasi yang saat ini paling diminati oleh masyarakat Indonesia. Sebagian besar kalangan pemuda menantikan motor bakar bensin dengan performa unggul sehingga banyak pecinta dari kalangan otomotif, peneliti maupun industri yang melakukan modifikasi untuk meningkatkan performa kendaraan tersebut. Penelitian ini bertujuan untuk meningkatkan performa motor bakar bensin. Metode penelitian yang dilakukan adalah dengan memodifikasi bagian exhaust manifold pada motor bakar, Modifikasi dilakukan dengan menambahkan Torque Expansion Chamber (TEC) 1 tabung 2 saluran dan variasi nozel 40, 50 dan 60. Langkah selanjutnya yaitu melakukan pengujian torsi, daya dan konsumsi bahan bakar spesifik (KBBS). Hasil menunjukkan bahwa penggunaan TEC 1 tabung 2 saluran dan variasi nozel 40, 50, dan 60 dapat meningkatkan torsi, meningkatkan daya dan mengurangi KBBS. Torsi tertinggi sebesar 9,94 Nm diperoleh pada putaran 5500 rpm pada penggunaan TEC 1 tabung 2 saluran dan variasi nozel 50. Daya tertinggi sebesar 8,03 HP diperoleh pada putaran 6250 rpm dengan menggunakan TEC 1 tabung 2 saluran dan variasi nozel 50. KBBS minimum dengan nilai 0,14145 kg/kWh didapatkan dengan penggunaan TEC 1 tabung 2 saluran dan variasi nozel 40. Peningkatan torsi dengan penggunaan modifikasi TEC 1 tabung 2 saluran dan variasi nozel 40, 50 dan 60 tersebut disebabkan adanya tekanan balik (back pressure) sehingga kalor yang keluar bersama gas buang tidak sepenuhnya dikeluarkan oleh lingkungan. Peningkatan daya disebabkan karena daya berbanding lurus dengan torsi, sedangkan penurunan KBBS disebabkan karena KBBS berbanding terbalik dengan daya.

Kata kunci: motor bakar, exhaust manifold, torque expansion chamber (TEC), nozel

ABSTRACT

Gasoline motorcycles are a means of transportation that is currently the most in-demand by the people of Indonesia. Most of the youth are waiting for gasoline-fueled motorbikes with superior performance so many lovers from the automotive sector, researchers and industry make modifications to improve the performance of these vehicles. This study aims to improve the performance of the gasoline engine. The research method used is to modify the exhaust manifold on the combustion engine. Modifications are made by adding a Torque Expansion Chamber (TEC)

1 tube 2 channels and variations of nozzles 40, 50, and 60. The next step is to test torque, power, and specific fuel consumption. The results show that the use of 1 tube 2 channel TEC and variations of nozzles 40, 50, and 60 can increase torque, increase power and reduce specific fuel consumption. The highest torque of 9.94 Nm was obtained at 5500 rpm using 1 tube 2 channel TEC and 50 nozzle variations. The highest power of 8.03 HP was obtained at 6250 rpm using 1 tube 2 channel TEC and 50 nozzle variations. Minimum specific fuel consumption with a value of 0.14145 kg/kWh was obtained by using TEC 1 tube 2 channel and nozzle variation 40. Increasing torque by using modified TEC 1 tube 2 channel and nozzle variation 40, 50, and 60 is due to back pressure so that heat that comes out with the exhaust gases is not completely removed by the environment. The increase in power is caused because the power is directly proportional to the torque, while the decrease in specific fuel consumption is caused because the specific fuel consumption is inversely proportional to the power.

Keywords: *combustion engine, exhaust manifold, torque expansion chamber (TEC), nozzles*

1. INTRODUCTION

The consumption of motor vehicles in Indonesia is increasing. The type of motor vehicle that is most in demand by the Indonesian people at this time is gasoline-fueled motorcycle. Gasoline-fueled motorcycles are often referred to as piston-fueled motors or gasoline-fueled motors where in the combustion process a spark plug is used to ignite the ignition. Most of the youth are looking forward to gasoline-fueled motorbikes with superior performance, so many automotive enthusiasts, researchers, and industry make modifications to improve the performance of these vehicles.

Three indicators that show the working performance of a combustion engine are power, torque and specific fuel consumption. Power can be defined as the engine's ability to do work. Power is affected by cylinder volume, the larger the cylinder volume, the greater the power generated. Torque can be defined as the force generated by the pressure of the combustion process. While the specific fuel consumption is the amount of fuel needed to produce engine power. Therefore, the efficiency of fuel consumption is also very influential. Efficiency in this study is obtained by reducing the heat from the exhaust manifold. The resulting net is greater when the heat that comes out is getting smaller so that the efficiency is also getting bigger.

Many previous studies were carried out to improve the performance of combustion engines, including making changes to the intake (the entry of the fuel and air mixture), the use of injection technology for fuel mixing, adding an intake resonator (air storage tube) turbocharger technology and any other modification. Most of the research results have been applied to motor vehicle technology, and some are still under further development.

The exhaust manifold plays an important role in increasing the fuel consumption of the engine in an internal combustion engine. Thus, an exhaust manifold that is in good condition will improve engine performance [1]. The function of the exhaust manifold is very complex and depends on many parameters viz. back pressure, exhaust speed, flushing, etc [2]. The exhaust manifold with the addition of wrap functions as a damper for a certain permissible noise level with a small possibility of a decrease in torque and engine power [3].

Research on the optimization of intake and exhaust pipes of a particular internal combustion engine (Opel Astra F, code C18NZ, 2000) was carried out using the Lotus Engine Simulation software. Variations in intake and exhaust geometry are carried out in order to obtain the optimum value [4]. Sanata (2011) conducted a study to determine the effect of exhaust pipe diameter on the performance of a straight throw gasoline engine, pressure, exhaust gas flow rate, and the intensity of the resulting noise. The results showed that there was an increase by using a larger and straighter exhaust pipe diameter.

Torque Expansion Chamber (TEC) is a space in the form of a tube with a certain location and size on the Exhaust Manifold or exhaust neck. In 2009 this technology was patented by Bajaj, and now this technology has been applied to racing exhausts under the name powerbomb or megabomb. This technology is able to increase the torque of lower rotation on motorized [5]. In this study, modifications of the exhaust manifold on the Honda Supra X 125 were carried out using a Torque Expansion Chamber (TEC) 1 tube 2 channels and Nozzle Variations 40, 50, and 60 to improve the performance of the combustion engine.

2. RESEARCH METHODOLOGY

The research methodology used in this study can be seen in Figure 1.

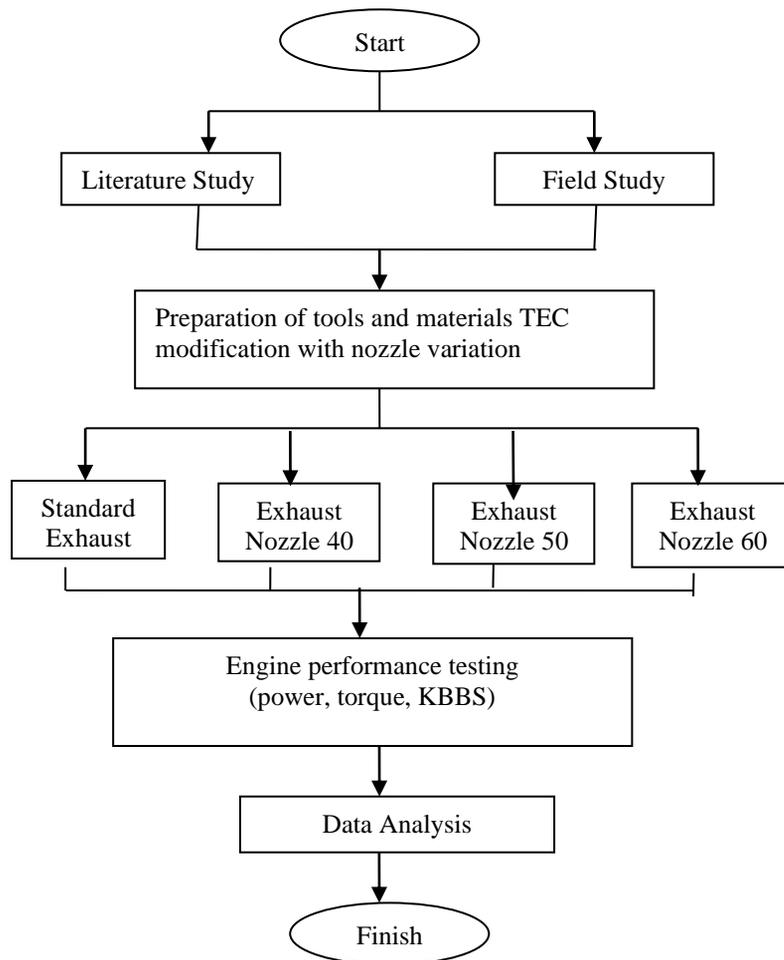


Figure 1. Research Flow Chart

3. RESULT AND DISCUSSION

3.1 Torque Test

The results of torque testing at engine speeds ranging from 4000-7500 rpm modified exhaust manifold using TEC 1 tube 2 channels and variations of nozzles 40, 50, and 60 and under standard conditions are shown in Figure 2

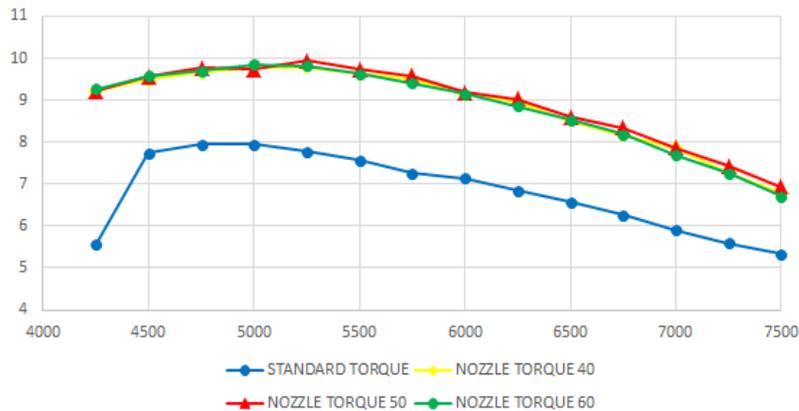


Figure 2. Torque Test Results.

Based on Figure 2, it shows that under standard conditions, the highest torque obtained at 5250 rpm is 7.78 Nm. When the motorcycle is installed with TEC 1 tube, 2 channels and 40 nozzles, it produces the highest torque of 9.78 Nm at 5000 rpm. As for the other two placement variations, the TEC 1 tube 2 channel variation and nozzle 50 produce the highest torque of 9.94 Nm at 5500 rpm, and the TEC variation 1 tube 2 channel and nozzle 60 produces the highest torque of 9.82 Nm at 5250 rpm.

The highest torque produced under standard conditions at 4750-5000 rpm is the lowest when compared to all other variations. This is because under standard conditions the heat of the exhaust gases will be directly discharged into the environment so that the heat in the exhaust gases does not return to the combustion chamber to assist the next combustion process.

The torque generated when the exhaust manifold uses TEC 1 tube 2 channels and variations in nozzle changes 40, 50, and 60 has increased when compared to standard conditions. This increase is due to back pressure so that the heat that comes out with the exhaust gases is not completely removed by the environment. Some of the heat is retained in the nozzles and the presence of TEC also provides a back pressure effect so that the heat returns to the combustion chamber to increase the temperature of the combustion chamber so that the subsequent combustion process becomes more complete.

3.2 Power Test

The results of torque testing at engine speeds ranging from 4000-7500 rpm modified exhaust manifold using TEC 1 tube 2 channels and variations of nozzles 40, 50 and 60 and under standard conditions are shown in Figure 3.

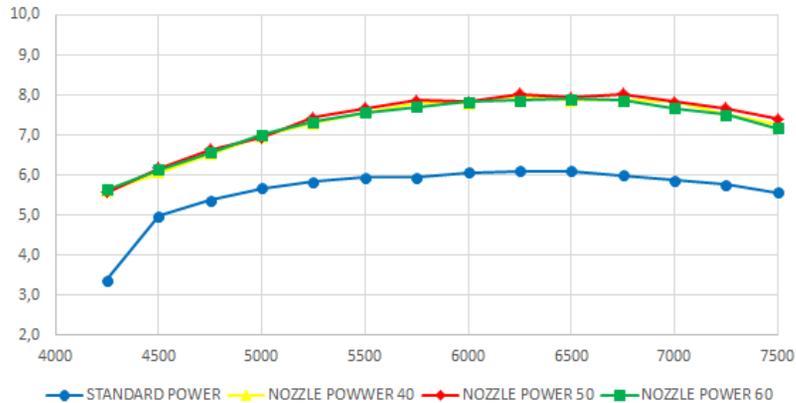


Figure 3. Power Test Result

Based on Figure 3, it shows that under standard conditions the highest power obtained at 6250-6500 rpm is 6.1 HP. When the motorcycle is installed with TEC 1 tube, 2 channels and 40 nozzles, it produces the highest power of 7.96 HP at 6250 rpm. As for the other two placement variations, namely the TEC 1 tube 2 channel variation and nozzle 50 it produces the highest torque of 8.03 HP at 6250 rpm, and the TEC variation 1 tube 2 channel and nozzle 60 produces the highest torque of 7.90 HP at 6500 rpm.

The highest power produced under standard conditions at 6250-6500 rpm is the lowest when compared to all other variations. Meanwhile, the exhaust manifold installed with TEC 1 tube, 2 channels, and variations in nozzles experienced an increase in power. The increase in power is due to the amount of power depending on engine speed and torque. The higher the engine speed, the greater the power generated.

3.3 Specific Fuel Consumption Test Results (KBBS)

The results of the specific fuel consumption test at engine speeds ranging from 4000-7500 rpm modified exhaust manifold using TEC 1 tube 2 channels and variations of nozzles 40, 50 and 60 and under standard conditions are shown in Figure 4.

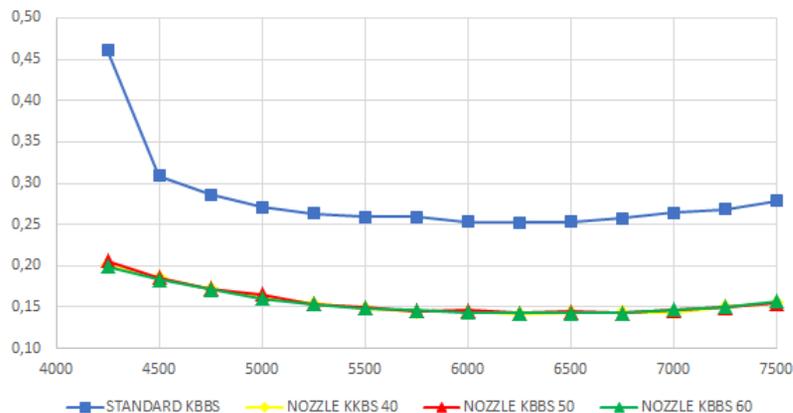


Figure 4. The specific fuel consumption test

Based on Figure 4, it shows that under standard conditions the lowest specific fuel consumption is 0.25228 kg/kWh at 6250 rpm. When the motorcycle is installed with TEC, one tube, 2 channels, and 40 nozzles, it produces the lowest specific fuel consumption of 0.14145 kg/kWh at 6250 rpm. While the TEC one tube two channels and nozzles 50 produces the lowest specific fuel consumption of 0.14247 kg/kWh at 6500 rpm. Then at TEC, two single-channel tubes and 60 nozzles produce the lowest specific fuel consumption of 0.14240 kg/kWh at 6500 rpm.

The value of specific fuel consumption in standard variations is higher than the value of specific fuel consumption in other variations. This phenomenon is caused by the heat in the exhaust gases from the combustion is directly discharged into the environment so that no heat returns to the combustion chamber. Thus, it results in higher fuel consumption and lowers fuel efficiency.

In the modified condition of the exhaust manifold, TEC 1 tube 2 channel and variations in nozzle changes 40, 50, and 60 have a lower specific fuel consumption value compared to standard conditions. This is because the relationship between power and fuel consumption is inversely proportional. The higher the power generated, the lower the specific fuel consumption..

4. CONCLUSION

Based on the data analysis from the motorcycle performance tests including torque, power, and KBBS with a modified exhaust manifold using TEC 1 tube 2 channels and variations of nozzles 40, 50, and 60, the conclusions can be drawn as follow:

1. The use of exhaust manifold modifications with 1 tube 2 channel TEC and variations of 40, 50, and 60 nozzles generated higher torque than the use of exhaust manifold in standard conditions. The peak torque occurred at 5500 rpm using a TEC 1 tube 2 channel variation of 50 nozzles, resulting in 9.94 Nm.
2. Engine power performance has increased with the use of 1 tube 2 channel TEC and variations of 40, 50, and 60 nozzles compared to standard conditions. The greatest power with a value of 8.03 HP at 6250 rpm was obtained from the use of TEC 1 tube 2 channels and 50 nozzle variations.
3. The decrease in KBBS is caused using 1 tube 2 channel TEC and variations of nozzles 40, 50, and 60. The lowest KBBS of 0.14145 kg/kWh was obtained by using 1 tube 2 channel TEC and 40 nozzle variations.

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