

Study of Pertamina and Pertamina Turbo Comparison on the Performance of 135CC 2-Stroke Motorcycles

Sefnath Josep Etwan Sarwuna^{1*}, Willem Marthinus Eric Wattimena², Ekinov Limbong³

¹Program Studi Teknik Mesin, Universitas Pattimura, Ambon, 97233, Indonesia

²Program Studi Teknik Mesin, Universitas Pattimura, Ambon, 97233, Indonesia

³Program Studi Teknik Mesin, Universitas Pattimura, Ambon, 97233, Indonesia

*Email Corresponding Author: Etwansarwuna19@gmail.com

ABSTRAK

Perkembangan teknologi kendaraan serta permasalahan terkait cadang bahan bakar fosil mendorong Pertamina selaku produsen bahan bakar minyak untuk menghasilkan jenis bahan bakar yang ramah lingkungan, ekonomis, irit tapi juga berpengaruh untuk menghasilkan kinerja mesin maksimal. Terdapat beberapa jenis bahan bakar untuk bermotor diantaranya jenis premium, pertalite, pertamax dan pertamax turbo. Masing – masing jenis tersebut memiliki spesifikasi dan nilai oktan yang berbeda. Semakin tinggi nilai oktan dari bahan bakar yang digunakan pada kendaraan berpengaruh pada meningkatnya kinerja mesin, selain itu mengurangi endapan karbon pada ruang bakar dan dampak emisi yang dihasilkan tidak berbahaya pada lingkungan. Untuk itu maka, dalam penelitian perlu dikaji terkait pengaruh dari penggunaan jenis bahan bakar pertamax dan pertamax turbo terhadap torsi dan daya sepeda motor RX-King berkapasitas 135CC. Penelitian bersifat eksperimental dengan menggunakan alat uji *Power dyno*. Sepeda motor ke tempatkan pada *chasis Powerdyno* dan dihubungkan dengan perangkat komputer selanjutnya nilai torsi dan daya pada putaran tertentu ditampilkan pada layar monitor. Hasil penelitian menunjukkan bahan bakar pertamax menghasilkan nilai torsi maksimum sebesar 9,00 Nm pada putaran 7116 RPM dan daya sebesar 9,17 HP pada putaran 8181 RPM sedangkan bahan bakar pertamax turbo menghasilkan nilai torsi maksimum sebesar 9,26 Nm pada putaran 7250 RPM dan daya sebesar 10,71 HP pada putaran 8181 RPM. Hal menunjukkan terjadi peningkatan kinerja mesin Yamaha rx-king 135 pada saat menggunakan bahan bakar pertamax turbo dengan spesifikasi nilai oktan lebih tinggi dibandingkan bahan bakar pertamax.

Kata kunci: Torsi dan Daya Mesin; Pengujian dyno

ABSTRACT

Advances in vehicle technology and issues related to fossil fuel reserves have prompted Pertamina, as a fuel producer, to produce environmentally friendly, economical, and fuel-efficient fuels that also maximize engine performance. There are several types of motor fuels, including premium, pertalite, pertamax, and pertamax turbo. Each type has different specifications and octane number. The higher the octane number of the fuel used in a vehicle, the better the engine performance, while also reducing carbon deposits in the combustion chamber and producing emissions that are not harmful to the environment. Therefore, this study examines the effect of using Pertamina and Pertamina Turbo fuels on the torque and power of a 135cc RX-King motorcycle. This research is experimental in nature, using a Power Dyno testing device. The motorcycle is placed on the Power Dyno chassis and connected to a computer device, after which the torque and power values at certain revolutions are displayed on the monitor screen. The results of the study show that Pertamina fuel produces a maximum torque value of 9.00 Nm at 7116 RPM and power of 9.17 HP at 8181 RPM, while Pertamina Turbo fuel produces a maximum torque value of 9.26 Nm at 7250 RPM and power of 10.71 HP at 8181 RPM. This shows an increase in the performance of the Yamaha RX-King 135 engine when using Pertamina Turbo, which has a higher octane number than Pertamina.

Keywords: Engine Torque and Power; Powerdyno Test

INTRODUCTION

Motorcycles are classified as internal combustion engines, commonly referred to as piston engines, which work by converting the chemical energy of fuel into kinetic/mechanical energy. The chemical energy of the fuel mixes with air thru combustion or oxidation, transforming into

heat energy, causing the temperature and pressure inside the cylinder to expand, pushing the piston and generating rotational motion with the crankshaft as the mechanical output of the engine.[1]. The fuel used by gasoline engines is classified into several types: premium, pertalite, pertamax, and pertamax turbo, with some of the specifications, including the octane rating (RON; Research Octane Number) for each fuel type.[2].

Premium with an octane rating of 88, Pertalite 90, Pertamina 92, and Pertamina Turbo 98, the difference in octane ratings between each type of fuel impacts the engine performance produced. [3][4][5][6].

Previous research conducted by Hajar Isworo et al. on the use of Pertamina and Pertalite fuels showed that Pertamina had the highest torque of 12.34 Nm and maximum power of 14.15 HP, while Pertalite fuel had a torque of 11.22 Nm and power of 12.58 HP.[5]. Previous research by Dwi Sutrisno M. Z. et al. on the use of Pertalite and Pertamina fuel types showed that the highest torque and power were obtained using Pertalite fuel, with a torque of 12.82 Nm at 4500 RPM and a power of 15.62 HP at 9000 RPM, compared to Pertamina fuel, which yielded a torque value of 12.64 Nm at 4330 RPM and a power of 15.44 HP at 9000 RPM.[7]. Previous research by Yohanes Rengga et al. on comparing the use of several types of fuel on the performance of the R15 155CC motorcycle engine showed that fuel type 4 had the highest torque value of 10.14 Nm at 7000 RPM and 9.96 HP. This result is higher compared to the other 3 fuel types.[8]. Previous research by Zul Fahmi Syaputra et al. on the effect of using Pertamina and Pertamina Turbo fuels with ethanol blending showed that blending 90% Pertamina + 10% ethanol produced the highest torque of 12.1 N.m at 5000 RPM and power of 8.4 HP. This was higher than blending 90% Pertamina Turbo + 10% ethanol, which produced a torque of 11.3 Nm at 5000 RPM and power of 7.8 HP.[9].

Based on the above explanation and several previous studies that examined the effect of using different types of fuel on improving motorcycle engine performance, this research is focused on determining the extent to which the use of Pertamina and Pertamina Turbo fuel types affects the improvement of the Yamaha RX-King 135cc motorcycle engine performance.

RESEARCH METHODS

This research is experimental, where the effects caused by each variable are examined. The variables are Pertamina fuel and Pertamina Turbo fuel as independent variables, and engine performance as the dependent variable. The test results will be presented in the form of graphs. The research plan is structured in the form of a flowchart, as shown below;

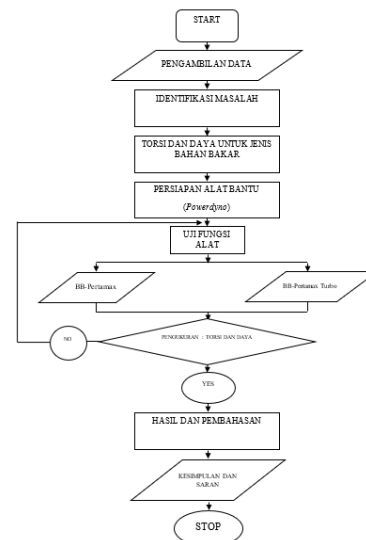


Figure 1. Research flowchart

Testing Procedure

1. Preparation of research tools and materials
 - a. Pertamina fuel
 - b. Pertamina Turbo fuel
 - c. Engine oil
 - d. Motul 510 side oil
2. Preparation of 1 Yamaha RX-King 135cc motorcycle.
3. Computer equipment is turned on.
4. The motorcycle is placed on the power dyno chassis and connected to the computer equipment's sensor cables.
5. Start the engine at idle rpm for 5 minutes until the engine reaches operating temperature.
6. Test the function of the power dyno tool.
7. Testing for Pertamina fuel type, shift to 4th gear and increase the speed to 9500 RPM. For torque and power data collection. The test was repeated 5 times.
8. The engine was cooled for 10-15 minutes.
9. Procedures 5 to 9 were repeated for the use of Pertamina Turbo fuel.

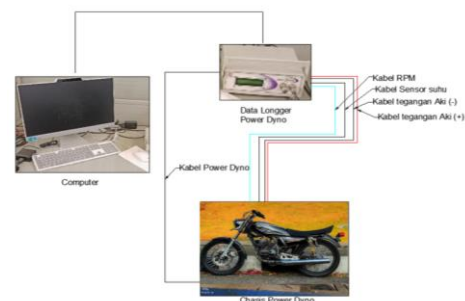


Figure 2. Research Instrument Scheme

RESULTS AND DISCUSSION

a. Torque Testing Results & Discussion

The data from the torque testing results show that using Pertamina and Pertamina Turbo fuels produces different torque values at almost every engine speed variation, from low, medium, to high speeds. This is intended to determine the type of fuel that has an impact on increasing the torque produced by the Yamaha RX-King 135cc motorcycle engine.

Table 1. Comparison of Torque using Pertamina & Pertamina Turbo Fuel

Time (s)	Kph	Rotation (RPM)	Torsion (Nm)	
			Pertamax	Pertamax Turbo
0.5	37	3500	3.77	4.07
0.9	41	3750	4.73	5.14
1.2	43	4000	5.12	6.23
1.5	46	4250	5.65	6.94
1.8	49	4500	6.40	7.23
2	52	4750	6.78	7.44
2.3	53	5000	6.98	7.83
2.6	55	5250	7.07	7.98
2.8	58	5500	7.25	8.17
3.1	60	5750	7.59	8.40
3.4	62	6000	7.86	8.44
3.6	65	6250	8.01	8.55
3.9	67	6500	8.24	8.64
4.1	70	6750	8.56	8.80
4.4	72	7000	8.82	9.00
4.5	73	7116	9.00	9.16
4.6	74	7250	8.90	9.26
4.9	76	7500	8.56	8.86

5.1	78	7750	8.15	8.45
5.4	80	8000	8.01	8.21
5.6	81	8181	7.81	8.05
5.7	82	8250	7.63	7.93
6	84	8500	7.18	7.50
6.3	85	8750	6.50	6.89
6.6	86	9000	5.45	5.92
7.1	88	9250	4.73	4.90
7.6	90	9500	3.56	4.01

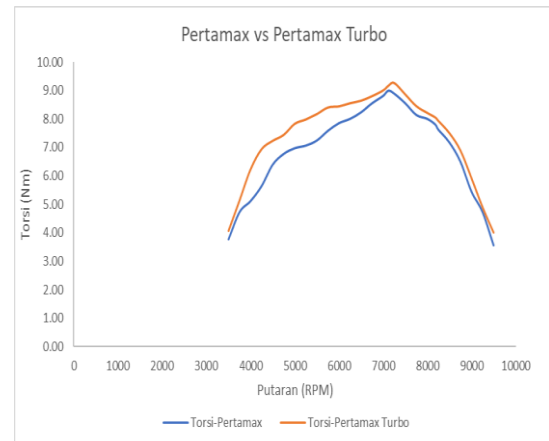


Figure 3. Comparison graph of Torque using Pertamina & Pertamina Turbo

Based on the data presented in Figure 3, it can be seen that there is a correlation between engine speed increase and the resulting torque, which is also influenced by the type of fuel used. For Pertamina fuel, the lowest torque value was 3.77 Nm at 3500 RPM, increasing with engine speed to a maximum of 9.00 Nm at 7116 RPM. Pertamina Turbo fuel produced the lowest torque value of 4.07 Nm at 3500 RPM, increasing with engine speed to a maximum of 9.26 Nm at 7250 RPM. After reaching the maximum torque value, there was a decrease in torque for Pertamina to 3.56 Nm and for Pertamina Turbo to 4.07 Nm, both at 9500 RPM. This decrease is generally caused by factors such as limitations in engine volumetric efficiency, increased mechanical friction at high speeds, and limitations in fuel and air supply. There was a 3% increase in torque value from Pertamina Turbo compared to the torque produced

by Pertamina fuel. This indicates that using Pertamina Turbo fuel with an octane rating of 98 has a more efficient combustion compared to Pertamina fuel, resulting in an increase in the torque produced by the RX-King 135CC motorcycle.[10][11].

b. Power Testing Results & Discussion

The power testing data shows that Pertamina and Pertamina Turbo fuels produce different power values at almost every engine speed, from low to medium to high. This is intended to determine which fuel type has an impact on increasing the power output of the Yamaha RX-King 135cc motorcycle.

Table 2. Comparison of Power Output Using Pertamina and Pertamina Turbo

Time (s)	Kph	Rotation (RPM)	Power (HP)	
			Pertamax	Pertamax Turbo
0.5	37	3500	2.85	4.25
0.9	41	3750	3.54	4.75
1.2	43	4000	3.99	5.27
1.5	46	4250	4.50	5.60
1.8	49	4500	5.00	5.92
2	52	4750	5.35	6.19
2.3	53	5000	5.75	6.55
2.6	55	5250	6.21	6.80
2.8	58	5500	6.49	7.18
3.1	60	5750	6.76	7.63
3.4	62	6000	7.09	7.93
3.6	65	6250	7.48	8.28
3.9	67	6500	7.87	8.61
4.1	70	6750	8.31	8.92
4.4	72	7000	8.8	9.42

4.5	73	7116	8.97	9.65
4.6	74	7250	9.03	9.87
4.9	76	7500	9.05	10.10
5.1	78	7750	9.07	10.56
5.4	80	8000	9.10	10.61
5.6	81	8181	9.17	10.71
5.7	82	8250	9.12	10.55
6	84	8500	8.92	10.10
6.3	85	8750	8.44	9.34
6.6	86	9000	7.46	8.84
7.1	88	9250	5.85	7.43
7.6	90	9500	4.90	6.41

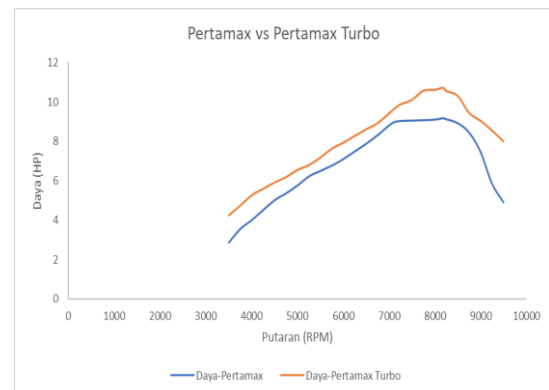


Figure 4. Comparison graph of power output using Pertamina and Pertamina Turbo

Based on the test data shown in Figure 4, it can be seen that there is a relationship between engine speed increase and the resulting engine power, which is also influenced by the type of fuel used. When using Pertamina fuel, the lowest power output was 2.85 HP at 3500 RPM, increasing with engine speed to a maximum of 9.17 HP at 8181 RPM. When using Pertamina Turbo fuel, the lowest power output was 4.25 HP at 3500 RPM, increasing with engine speed to a maximum of 10.71 HP at 8181 RPM. After reaching the maximum power output, there was a decrease in power output for Pertamina to 4.90 HP and for Pertamina Turbo to 6.41 HP, both at 9500 RPM. This decrease is generally caused by factors such as limitations in engine volumetric efficiency,

increased mechanical friction at high speeds, and limitations in fuel and air supply. There was a 16% increase in value from Pertamina Turbo compared to the power generated by Pertamina fuel. This indicates that using Pertamina Turbo fuel with an octane rating of 98 results in more efficient combustion and supports improved vehicle performance compared to Pertamina fuel with an octane rating of 92, leading to an increase in power generated by the RX-King 135CC motorcycle.[10][11][12].

CONCLUSION

The research results show that using Pertamina Turbo fuel has an impact on improving engine performance in terms of torque and power. The highest torque and power values for Pertamina Turbo are 9.26 Nm at 7250 RPM, which is higher than the 9.00 Nm at 7116 RPM produced by Pertamina. This represents an increase of 3%. Similarly, the highest power is also produced by Pertamina Turbo, at 10.71 HP at 8181 RPM, which is higher than the 9.17 HP at 8181 RPM produced by Pertamina. This represents an increase of 16%.

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