METALOGRAM
-Mechanical Engineering and Energy-
December 15th 2024. Vol.01 No.01
Desember, 2024

ANALYSIS OF THE EFFECT OF PRIMARY PULLY INCLINATION ANGLE ON THE TORQUE OF THE 115 CC MIO SPORTY MOTORCYCLE ENGINE

Dedi Yanto S[1], Muhammad Lyan Syaputra[2], Bonggut Pakpahan[3], Wahyu Fernando[4]
Dediyantos@gmail.com, muhammadlyan5403@gmail.com, aldipakpahan2@gmail.com, wahyufer84@gmail.com

[1,2,3,4)]*Mechanical Engineering, Universitas Riau Kepulauan, Indonesia*

*Corresponding author: muhammadlyan5403@gmail.com

Paper History

Received: December 3rd, 2024
Received in revised form: December 8th, 2024
Accepted: December 15th, 2024

ABSTRACT

This test was conducted to determine the comparison of torque on 115centimeter cubic motorcycle, standard with different pully degree variations, 14 °, 13.5 °, 13 °, 12 °. With the maximum speed in each different pully test, at the 14 ° degree pully the resulting torque is averaged 6.35 with Rpm 6637 (The throttle opening is maximum), In the 2nd test using Pully 13.5 ° testing was carried out with rpm at 5900 - 5980 (Maximum throttle gas opening) produced a torque of 6.47 which is greater than the test using the previous 14 ° pully, but the maximum Rpm produced by the pully with a degree of 13.5 ° is slower than testing using a 14 ° pully. From this test, we can see the difference. That using Pully 13.5° the torque is greater but the engine rotation is slower. The 3rd test using a 13 ° pully with a maximum rpm at 6500 - 6,700 (maximum throttle opening) produces a torque of 6.29, from this test it can be seen the difference in torque and rpm produced by a 13.5 ° degree pully with a 13 ° degree pully, where the rpm is 720 rpm faster with a difference in torque at a lower rate of 0.18 Nm difference with a 13.5 ° degree pully. The 4th test using a 12° pully with a maximum Rpm at 7140 - 7190 Rpm (Maximum Gas throttle Opening) produced a torque of 6.02. From this test, it can be seen the difference with the test using a 13° pully, where the Rpm produced is higher but the torque is smaller, the torque difference is 0.27.

KEY WORDS: *analysis, torque, pully, primary, motor*

NOMENCLATURE

1.0 INTRODUCTION

The development of the automotive world demands better transportation tools. Currently it is not only a matter of talking about fuel economy but also on driving comfort, one of which is a change in the transmission system.

Along with the times everyone wants to be easier to drive, which is where the transmission system also affects the comfort and efficiency of driving, the change starts from moving the manual transmission to moving the automatic transmission. Currently there are two commonly used transmission systems, manual transmission and automatic transmission, manual transmission is one type of transmission that is also widely used for reasons of agility on the road terrain.

The use of manual transmission in urban areas is usually uncomfortable, especially in congested road conditions because you have to change the transmission on a motorcycle. with the automatic transmission or what is called continuously variable transmission (CVT), people feel more comfortable using a motorcycle with automatic transmission, especially on crowded or congested roads because they no longer have to act on the transmission on the motorcycle, just pull the gas without moving the transmission because the transmission will switch automatically.

There are three important components in a CVT: the front pulley, the rear pulley, and the V-belt that connects them. First, the front pulley is connected to the engine crutches and is responsible for accommodating the power from the engine and transferring it to the rear pulley which is connected to the axle. The rise of variations in Indonesia, which makes mechanics compete to modify motorbikes to get more performance than the manufacturer and want to adjust to the rider's request, therefore it is necessary to modify the pulley side to get more torque or power and usually adjust to what is desired.

1.1 Theoretical Foundation

The definition of a combustion motor is one type of heat engine, which is a machine that converts thermal energy to perform mechanical work or converts chemical fuel power into mechanical power. Energy is obtained from the combustion process, the combustion process also changes the energy that occurs inside and outside the heat engine (Kiyaku and Murdhana, 1998).

There is no process of transferring the heat of combustion

METALOGRAM
-Mechanical Engineering and Energy-
December 15th 2024. Vol.01 No.01
Desember, 2024

gases to the working fluid, therefore the number of components of the combustion motor is small, quite simple, more compact, and lighter than the external combustion engine (steam engine). Therefore, the use of combustion motors is very much and profitable. The use of combustion motors in society, among others, is in the fields of transportation, lighting, and so on.

1.2 Transmission

Motorbikes are currently produced not only one type of motorcycle, but various types of motorbikes, motorcycle vehicles are divided into two types based on the drive system, namely manual drive motorbikes and automatic drive motorbikes. The power transfer system is a power transfer mechanism generated by the engine to move the motor wheels so that it can run and can be driven. In automatic motorcycles such as the Mio sporty 115 cc, the power transfer system or transmission does not use gear shifting (manual), but uses automatic transmission, in vehicles that use automatic transmission the operation does not use gear shifting but uses pulleys and belts (belts) known as CVT (Continuous Variable Transmission).

Transmission is a power transmission system from the engine to the rear wheels through a V-belt that connects the drive pulley (primary pulley) to drive the driven pulley (secondary pulley) using the centrifugal force that occurs in its components. The speed change on the CVT is very smooth and there is no pounding like in a manual transmission.

1.3 Manual Transmission

Manual transmission is a vehicle transmission whose operation is carried out directly by the driver. Manual transmission and its components are part of the power transfer system of a vehicle, which is a system that functions to regulate the level of speed in the process of transferring power from the power source (engine) to the wheels of the vehicle. The main component of the transmission gear on a motorcycle consists of a paired arrangement of teeth that are shaped and produce a comparison of these teeth on the main shaft (main shaft /counter shaft). The number of speed gears attached to the transmission depends on the model and the use of the motorcycle attached to the transmission depends on the model concerned to enter the gear pedal must be stepped on.

1.4 Automatic Transmission

Automatic transmission is a vehicle transmission whose operation is carried out automatically by utilizing centrifugal force. The transmission used is the “V” belt automatic transmission or what is known as CVT (Continuous Variable Transmission). CVT is a power transmission system from the engine to the rear tire using a belt that connects the drive pulley with the driven pulley using the principle of friction.

2.0 METHOD

The research was conducted with the procedure as research process, starting with the initiation of the study. The first step involves conducting a literature review to gather relevant information and establish a foundation for the research. Following this, the research is carefully planned, including defining objectives, methods, and procedures. Once the plan is finalized, the necessary tools and materials are prepared to facilitate the experiments. The core of the study involves testing by varying the inclination angles of the pulley to specific values, namely 12°, 13°, 13.5°, and 14°. Data is then collected systematically during these tests. After gathering sufficient data, the information is analyzed and discussed to draw insights and understand the outcomes. The process concludes with summarizing the findings in the form of conclusions and providing recommendations for future studies. Finally, the research is wrapped up, marking its completion.

3.0 RESULT

3.1 Testing Material Modification Process

Testing begins by changing the Pully angle with the angle size determined by the author, where the pully that wants to be modified is three pulleys, by changing the pully angle one by one in the lathe until the angle size is appropriate, the lathe used is still a manual lathe, which is in the arjuna racing workshop, after turning, the slope angle is measured using an arc ruler to ensure that it is really precise, If all angles are appropriate, the next stage is to install the pully on the motorcycle by opening the automatic transmission section using the keys that have been prepared, where the keys are prepared, namely the 8 ml T key, 17 ml shock eye along with the shock handle and pully retaining device to make it easier to open the nut on the pully.

Table 1. Test with 14^0 pulley

No	Torque (Nm)	Rotation (rpm)	Power (Hp)
1	6.44	6680	8.26
2	6.30	6680	8.08
3	6.30	6550	7.99
Average	6.35	6637	8.11

From the results of the first test with a 14-degree pully carried out, with a maximum Rpm at 6550 to 6550, the torque results were obtained at 6.30 Nm. The experiment was carried out 3 times to get maximum results, the average of the three tests carried out with the same pully resulted in an average Rpm of 6,637, torque of 6.35 Nm and power at 8.11 Hp all of these experiments were carried out with the maximum gas opening of the motorcycle being tested.

Testing in one pully takes 15 minutes outside the installation of the pulley to the motorcycle, and the treatment of the throttle gas starts from low rpm to high rpm until the motor shows a sign that the motor is the limit or the gas opening is maximum, after all the data from the dyno machine is obtained from the test, then the next step is to lower the motorcycle from the dyno test machine bag to the next pit to replace the pully with a different size, by waiting for the motorcycle engine temperature to be considered the temperature is normal, this is done as a safety and keep the engine components when opening does not damage the bolt threads.

Table 2. Test with 13.5^0 pulley

No	Rotation (rpm)	Torque (Nm)	Power (Hp)
1	5980	6.46	7.35
2	5940	6.54	7.39
3	5900	6.42	7.12
Average	5940	6.47	7.32

Metalogram | Received: December 3rd, 2024| Accepted: December 15th, 2024 |
Published by Program Studi Teknik Mesin, Fakalutas Teknik, Universitas Riau Kepulauan

METALOGRAM
-Mechanical Engineering and Energy-
December 15th 2024. Vol.01 No.01
Desember, 2024

From the results of the 2nd test, the results obtained with a greater torque linear to using a 14^0 pulley, but the weakness in the slower rotation, the resulting torque is even greater. The results of the 2nd test with a 13.5^0 pulley with an average rotation at 5940 rpm, torque at 6.47 Nm and power at 7.32 Hp. Where the 2nd test is also the same as test 1, only the difference in the slope of the pully degree is different, the test is carried out with full throttle gas opening and the length of the test is also almost the same approximately in 15 minutes outside the installation of the pully on the motorcycle.

Table 3. Test with 13^0 pulley

No	Rotation (rpm)	Torque (Nm)	Power (Hp)
1	6500	6.3	8.1
2	6020	6.28	8.18
3	6700	6.28	8.17
Average	6007	6.29	8.15

The 3rd experiment using a 13 pully with a maximum RPM of 6500 - 6700 Rpm with a resulting torque of 6.28 - 6.30 Nm. Where if averaged from the test results with a 13 degree throttle pulley rotation at 6607, torque at 6.29 Nm, and power at 8.15 Hp, the test is also the same as the previous test where the throttle gas opening is done in full, this is done to find out the maximum torque and power from the test results carried out, the test time is also about 15 minutes outside the installation of the pully on the automotive transmission on the motorcycle.

Table 4. Test with 12^0 pulley

No	Rotation (rpm)	Torque (Nm)	Power (Hp)
1	7140	5.97	8.13
2	7900	6.02	8.25
3	7180	6.07	8.30
Average	7170	6.02	8.23

The 4th test using a 12^0 modified pully, is the result obtained using a 12^0 pulley with a maximum rotation 7140 - 7190 rpm, with a maximum torque of 6.02 Nm. The same conditions as the tests carried out in the 4th test with a 12^0 pulley, if averaged the results of this test rpm at 7170, torque at 6.02 Nm and power at 8.23. This test was also carried out within 15 minutes outside the installation of the pully on the motorcycle, this is the final experiment carried out, then from all tests will be made data on the difference in torque, power generated by each modified pully.

4.0 DISCUSSION

Calculation data sheet show at table below

Table 5. pulley testing experiment

No	Pulley	BHP (kW)	FC (l/h)	SFC (kWh)	Eff. Thermal (%)
1	14°	0.87	0.19	0.023	4.14%
2	13.5°	0.88	0.18	0.024	3.94%
3	13°	0.88	0.18	0.022	4.39%
4	12°	0.82	0.19	0.023	4.20%

From the calculation data, it can be seen the results of each pully influence test on an existing motorcycle, where if you look at the highest Brake Horse Power (BHP) with pully 13.5 ° and 13 ° at 0.88 (Kgf.m), Fuel Consumption (FC) Highest at 0.19 (l / h) with pully 14 ° and 12 °, Specific Fuel Consumption (SFC) highest using pully 13.5°. while for thermal efficiency the highest value using a 13% pully, meaning why torque and power in this data are not directly proportional, because this data is taken on average data where three tests are carried out and the results are averaged, from the test results the use of pulleys with an angle of 13.5 ° is more effective for increasing torque and power on this 115 cc Mio sporty motorcycle.

5.0 CONCLUSIONS

Based on the results of the analysis and discussion, the following conclusions are drawn:

1. Rare changes in pulleys with varying angles:
   a. Prepare the pully to be modified
   b. Turning the pulley with the desired angle at the boundary of the area touched by the v-belt
   c. Paying attention to the thickness of the turned pPaying attention to the thickness of the turned pulley, so that the pulley remains safe and strong to withstand the heat and friction of the v-belt pulley, so that the pulley remains safe and strong to withstand the heat and friction of the v-belt
2. The effect of the results of the pulley degree variation of 12°, 13 °, 13.5 ° and 14 ° on using the same 6 rollers with a weight of 12 grams each, the highest torque is produced by a 13.5 ° angled pulley which is 6.54 N with a rotational speed of 5940 Rpm.

REFERENCE

[1] Atmika, I. K. A., & Gede, I. D. A. S. (2015). Karakteristik Traksi Sepeda Motor dengan Continuose Variable Transmission System. Jurnal Energi Dan Manufaktur Universitas Udayana, 8, 64–70.
[2] Al farobi, Achmad. (2013). "Pengaruh Penggunaan Jenis Pemberat (roller) Terhadap Performa Mesin Yamaha Mio Soul Tahun 2010". Jurnal Teknik Mesin volume 02 nomor 02 jurusan teknik mesin UNS, hal 1-7.
[3] Gunawan, Q. (2009). Pembuatan Alat Peraga Transmisi Otomatis Sepeda Motor (Doctoral dissertation, Universitas Sebelas Maret).
[4] Jalius, Jama dkk 1. (2008). Teknik Sepeda Motor Jilid 3. Direktorat Pembinaan Sekolah Menengah Kejuruan : Departemen Pendidikan Nasional
[5] Ongkosulih, Nursyahhera Apriana. 2016. "Sistem Transmisi Otomatis (CVT) Sepeda Motor". Sekolah Tinggi Teknik Wiworotomo Purwokerto.
[6] Program Diploma Teknik Mesin
[7] PT. Suzuki Indomobil Sales. (2014). Manual Book Suzuki Nex FI. Yogyakarta. Rahman, A. (2017). Transmisi Sepeda Motor Matic Suzuki Skywave Lembaran
[8] Tugas Akhir Politeknik/IIK Negeri Padang.
[9] Rhois, F. (2016). Pengaruh Penggunaan Variasi Berat Roller 8 gram, 9 gram, 10 gram, 11 gram dan 12 gram Menggunakan Pegas CVT 800 rpm (standar) Terhadap Kinerja Motor Honda Scoopy 108 cc.
[10] Sahar, Ranjet Kumar Kohli. 2013. "Sistem Kopling CVT dan Roda Penggerak Honda Vario". Universitas Negeri

Semarang.

Metalogram | Received: December 3rd, 2024| Accepted: December 15th, 2024 |
Published by Program Studi Teknik Mesin, Fakalutas Teknik, Universitas Riau Kepulauan