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Engineering Academic Discipline



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Powertrain Technology

Powertrain Technology | ACHA4029

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Motorcycle Engineering

Word count 1060

March 2026

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1. Introduction

1.1 - What is a Dyno

An engine dynamometer (dyno) is a tool used to measure and calculate data of an engine by using a controlled load in a controlled environment. In this experiment the W230 Dynamometer(W230 Dynamometer [no date]). Testing engines on a dyno is important as it allows engineers to collect multiple precise data points, the data collected from the dyno are; air fuel ratio (lambda), Torque, and the revolutions per minute (RPM) at each point the data was recorded(*Revolutions per minute - Wikipedia* [no date]).

In the test, a 16 valve DOHC (dual overhead camshaft) 1,590cc Honda four cylinder engine was used(Honda engine Manuel [no date]). The test collected data to calculate important data such as the brake power, specific fuel consumption (SFC) and Brake Mean Effective Pressure (BMEP)(*Brake-specific fuel consumption - Wikipedia* [no date]; *Torque - Wikipedia* [no date]; *Engine power - Wikipedia* [no date]).

For the test, engine was connected directly to the engine dyno and setup to run a programmed test. Data points were recorded at regular intervals of 50 RPM, this allowed for accurate and granular data while not requiring excessive data.

2 - Equipment used during the test

2.1 - test equipment used

- The test used a SCHENCK W230, the calibration arms were set to 815.776mm. the engine tested was
- A 16 valve DOHC (dual overhead camshaft) 1,590cc Honda four cylinder.

2.2 - method used

Due to the limited access to the engine Dyno, the test was unable to be done. This was due to its unavailability due to repairs. This has caused this document to reuse old collected data from the same test done previously. This reduces the credibility and reliability of the data and information as the test cannot be reproduced under the same conditions and verified.

The first step to run the test was to set up the engine and dyno. To ensure reliable data and the safe operation of the engine, the engine is set to run at idle and the ancillaries are checked ensuring that they functioning correctly. The operator then selects p-curve test, selecting the 'step test' option. The operator configures the test to run the engine, increasing the RPM by the preset amount and holding it at that level until the set time to take the reading is done. This step repeats until the engine reaches a programmed RPM limit then it will return to idle. This automatic processes is done as it is accurate and repeatable. The data is recorded to be used to calculate the data on the engine.

After the test the data was input into excel and used to calculate the SFC, power (Kw), BMEP and thermal efficiency. The SFC is calculated using the fuel flow rate multiplied by 60 then 0.75. then this value is divided by the power(Kw) to result the SFC. Power is calculated using torque and rpm.

3 - Collected data

3.1 - Data presented in graphical form

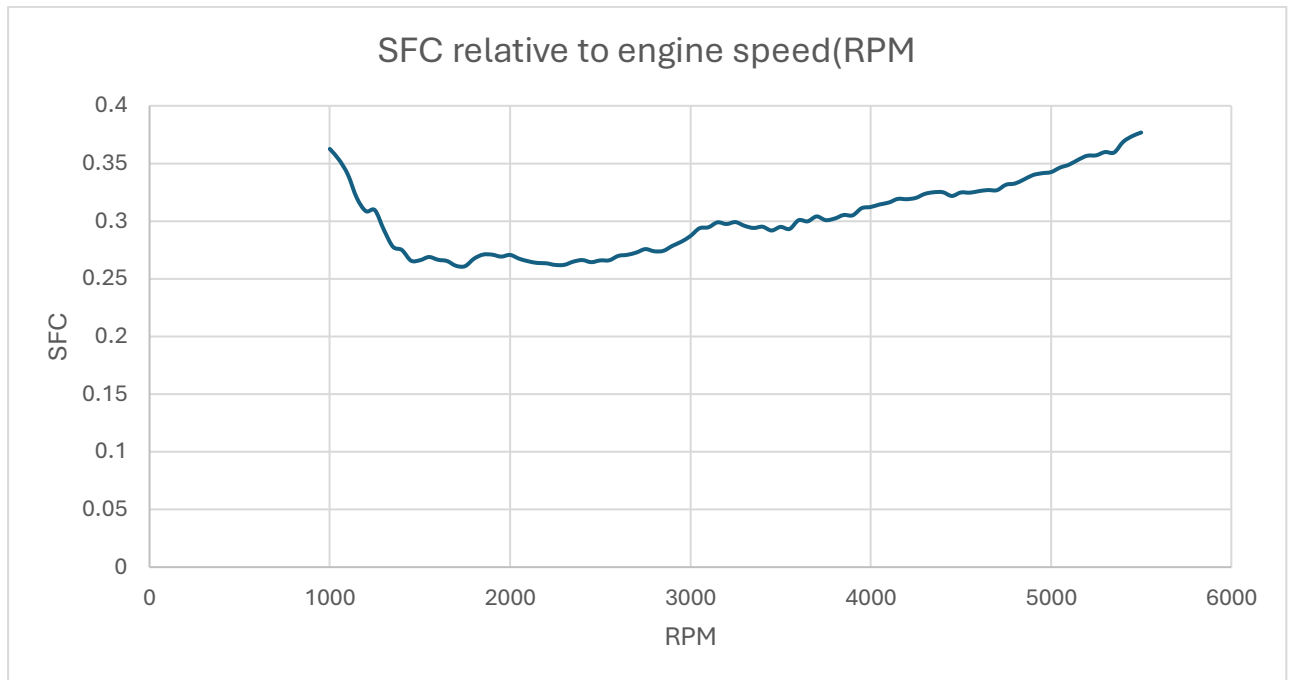


Figure 1 - A graph comparing SFC and RPM

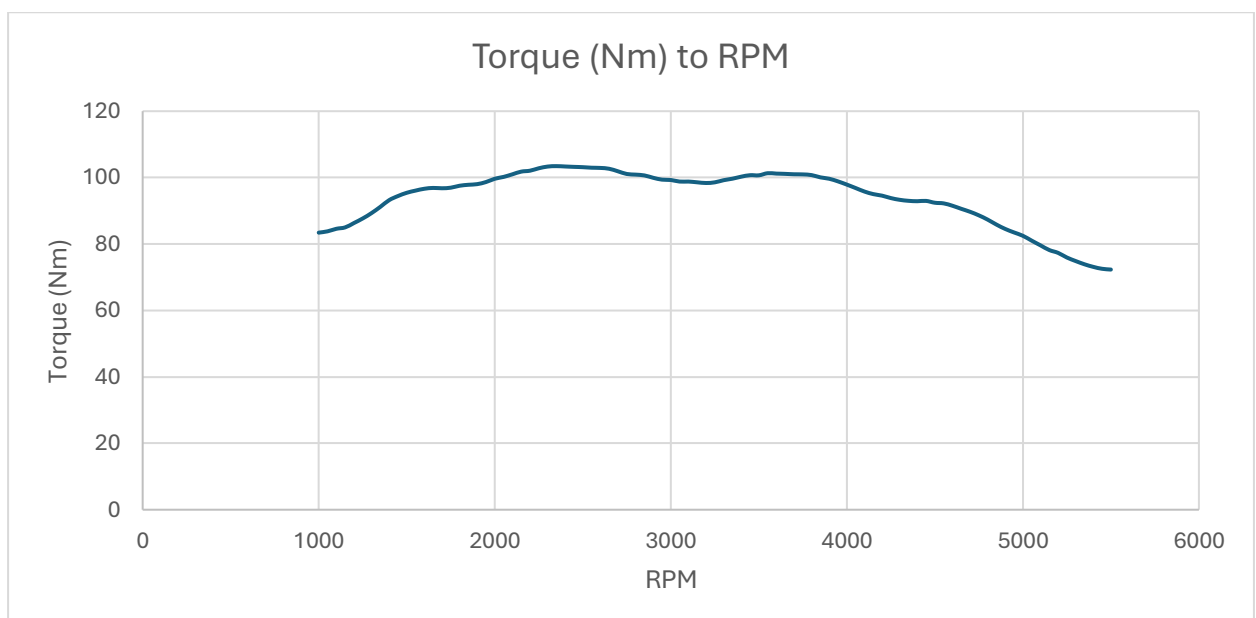


Figure 2 - A graph comparing Torque and RPM

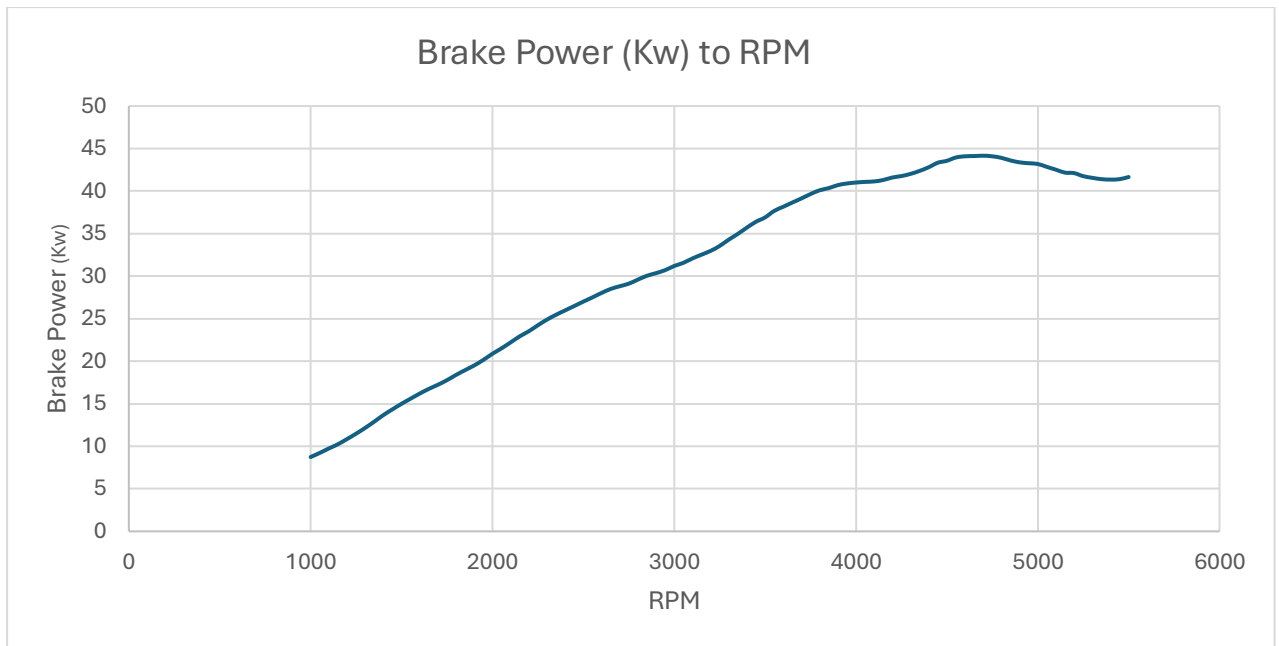


Figure 3 - A graph comparing Power and RPM

4 Calculations and Results

4.1 – effects RPM has on SFC

In figure 1, the data calculated shows that at low RPM, the engine is at its second least efficient stage. This is normal for engines as they are often designed to run lean for emissions reasons. Due to the under fuelling, the SFC is poor as the thermal efficiency at low RPM is poor. As the RPM the thermal efficiency raises quickly, causing the SFC to reach its most efficient at 1,700 RPM. Despite its low SFC the engine is still unrefuelled at approximately at 1.3 on the lambda sensor.

At midrange RPM, the engines fuel economy is where its most optimal, despite the lambda reading showing that it remains too lean for optimal combustion. This is where the thermal efficiency is most optimal, at 0.3% - 0.27%. from this point the SFC increases with rpm.

At high RPM, the thermal efficiency drops, and the SFC increases. Despite this the lambda reduces from 1.1 to 1.08, making a more complete combustion with more fuel into the air fuel mixture.

4.2 – effects RPM has on Torque

Figure 2 shows that at low RPM, torque is in the middle of its extremes. As the RPM increases initially the torque increases, until 2,400 RPM where it levels off and drops. As the RPM reaches the midrange, a trough between 2,600 and 3,500 RPM. This behaviour in torque is due to emission control. At high RPM the Torque drops off as the volumetric efficiency of the engine falls.

4.3 – effects RPM has on Power

Figure 3 shows that at low RPM power is low, around 9Kw(*What Is RPM and How Does It Affect Engine Performance? - Engineer Fix* [no date]). As rpm increases its almost a direct correlation as it increases at a steady rate with RPM through low and the entirety of midrange RPM. However at high RPM the power peaks and drops off for the final 1,000 RPM.

5 - Evaluation

5.1 - future improvements

This experiment was flawed due to the limited access to the engine Dyno. This was due to its unavailability due to repairs. This has caused this document to reuse old collected data from the same test done previously. This reduces the credibility and reliability of the data and information as the test cannot be reproduced under the same conditions and verified.

One way this test can be improved is by conducting multiple test runs and collecting various sets of data. This will allow the results to be calculated as an average, reducing effects of anomalies and erroneous data. Any inconsistency and potential errors of the data will affect all calculations and comparisons. However with multiple data sets require keeping as many variables identical, to ensure valid data.

The spreadsheet used to log and calculate the data can me improved my making it automated. This will reduce potential human error and make the data logging process more efficient and faster.

Finally, an improvement would be using multiple engines of varying types to gather a broader range of data to compare. These other engine types and variations, such as two stroke engines, diesel and forced induction engines will allow for grater depth into how different engines differ with fuel efficiency, power, torque and SFC.

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