UNIVERSITI TEKNIKAL MALAYSIA MELAKA

STUDY OF ENGINE PERFORMANCE EFFECT USING VARIABLE AIR FILTER ON PERODUA VIVA 1.0 ENGINE

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Mechanical Engineering Technology
(Automotive Technology) (Hons.)

by

AHMAD SYAUQI HAIKAL BIN HARUN
B071310298
910708-10-6023

FACULTY OF ENGINEERING TECHNOLOGY
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I hereby, declared this report entitled “Study of Engine Performance Effect Using Variable Air Filter on Perodua Viva 1.0 Engine” is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Automotive Technology) (Hons.). The member of the supervisory is as follow:

…….

(**EN AHMAD ZAINAL TAUFIK BIN ZAINAL ARIFFIN**)

ABSTRAK

Kajian ini membincangkan tentang prestasi enjin, pelepasan ekzos dan bahan api ekonomi menggunakan penapis udara berubah-ubah pada enjin. Penapis udara adalah satu bahagian penting dalam sistem pengambilan untuk memastikan enjin beroperasi dalam keadaan sempurna dan berprestasi tinggi. Penapis udara "standard" yang disediakan oleh pengeluar diperbuat daripada kertas yang tidak boleh memberikan prestasi yang tinggi kepada enjin. Walaupun diperuntukkan, ia tidak dapat bertahan lama kerana kekotoran ditapis diserap kepada jenis penapis udara ini. Dan apabila ianya kotor, akan menyebabkan udara yang disedut masuk ke dalam enjin tidak mencukup untuk bakar bersama bahan api. Ia juga turut menjejaskan prestasi sesebuah enjin untuk melakukan kerja. Untuk mengatasi masalah ini penapis udara "aftermarket" telah dipilih sebagai gantian kepada penapis udara asal untuk memastikan enjin boleh berjalan dengan lancar dan dalam prestasi tinggi. Untuk membuktikan ia berjaya, beberapa eksperimen telah dijalankan dengan membandingkan hasil antara penapis udara "kotor", penapis udara "standard" dan penapis udara "performance".

ABSTRACT

This study discusses on the engine performance and exhaust emission using variable air filter on engine. Air filter is an important part in the intake system to ensure that the engine operates in perfect condition and high performance. Standard air filter that provided by the manufacturer made of paper that cannot provide the high performance to the engine. Even its appropriated cannot last long because the impurities are filtered absorbed to this type of air filter. And when its become clogged, will result in air being sucked into the engine is not enough to burn with fuel together. It also affects the performance of an engine to do the job. To overcome this problem an aftermarket air filter has been selected as a replacement to the original air filter to ensure that the engine can run smoothly and in high performance. To prove it successfully, several experiments were conducted by comparing result between the clogged air filter, standard air filter and performance air filter.

DEDICATION

I dedicate this final year project report to my father and mother, Mr. Harun Bin Othman & Mrs. Lailan Binti Yusoff for stay strong to care on my life journey and also to my lovely family.

ACKNOWLEDGEMENT

First of all, I would like to thank Allah SWT for giving me strength to complete this project successfully on time. I am using this opportunity to express my gratitude to everyone who supported me throughout the course of this "Projek Sarjana Muda" especially to my project supervisor, Mr. Ahmad Zainal Taufik Bin Zainal Ariffin who had giving me guidance, ideas and support for this project. I am thankful for their aspiring guidance, invaluably constructive criticism and friendly advice during the project work. It would be difficult to complete this project without his support and understanding. I would like to express the deepest appreciation to my friends who helped me in terms of services, moral support and ideas. I also would like to thank my parents for their love, prayer, financial, and never ending support. I hope it can bring success on this final project.

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LIST OF ABBREVIATIONS

OEM	-	Original Equipment Manufacturing
RPM	-	Revolution Per Minute
HP	-	Horsepower
HC	-	Hydrocarbon
CO	-	Carbon Monoxide
CO2	-	Carbon Dioxide
O2	-	Oxygen
NOx	-	Nitrogen Oxide
AFR	-	Air Fuel Ratio

CHAPTER 1
INTRODUCTION

1.0 Introduction

The primary function of the intake system is to keep the outside air to achieve your engine for breathing. A decent air intake system takes into consideration perfect and nonstop air into the engine, in this manner accomplishing more power and better mileage for your car's engine. A modern vehicle air intake system has three primary parts that is air filter, mass flow sensor and throttle body. It is located specifically behind the front grille, the air intake system keeps support air through a long plastic tube going into the air filter housing, which will be blended with the car fuel. At that point the air will be sent to the intake manifold that provisions the fuel and air mixture to the combustion chamber of the engine.

An air filter is a critical part of a vehicle intake system, since it is through the air the air intake part as filtration of the engine to breath. A vehicle' engine requires a correct mixture of fuel and air keeping in mind the end goal to work, and the greater part of the air enters the system first through the air filter. The air filter is a device that filter any foreign particles and other particles all around to keeping them from entering the intake system that can harming the vehicle's engine. The air filter is normally fitted in a plastic tube in an air duct to the throttle valve assembly. In vehicles, air is required in the combustion chamber where fuel is burned to produce power. There are only two types of air filters available in the market, an open pod air filter or a drop in air filter.

Open pods are commonly bigger in size and requires to remove whole standard air intake unit of vehicle. In terms of performance they are the best when it comes to air intake, but lacks in filtration capabilities. Drop in air filters on the other way provide

plug and play for consumers, as we can simply change original air filter to the aftermarket air filter for these things. Choosing on which to get for your vehicle is simple. It all depends on the type of transmission your vehicle uses. An automatic transmission's car will get benefit from a drop in filter, but will have little or no improvements if fitted with an open pod filter.

Using an open pod filter require a minimum rev at 3,000 rpm and above to be able to perform optimally and automatic cars generally change gears before the 3,000 rpm. Manual transmission cars however get benefit from both open pod and drop in filters, as the engine accelerate easier and the driver can decide when to change gears.

1.1 Project Title

Study of engine performance effect using variable air filter on Perodua Viva 1.0 Engine

1.2 Problem Statement

Filtration is one of the most vital part that will keep the lifespan of a vehicle's engine last longer. Among them is an air filter. Air filter play important thing to make sure the vehicle's engine performs optimally. The standard air filter is an original air filter that provide from the car manufacturer. Clogged air filter mean that the air filter become dirty because the air filter does their jobs in a long time use in filtration system. While performance air filter is an aftermarket air filter that can offer high airflow and better filtration of the air that entering your engine. All this three type of air filter will affect the engine fuel economy, torque, horsepower, engine life and exhaust emission. There are two types of the air filter that we can choose to use in our car to gain the performance of the car that is open pod air filter or performance drop in air filter. The drop in air filter is simplest and easy way to increase the performance of the engine, just plug and play the air filter in air filter box.

A clean air filter will offer the efficient and better air flow through the engine cylinder. As the air filter become clogged, the function of air filter to do the filtration is decrease. Due to this condition, the quantity of air that is supply to the engine is a little bit and cause the performance of the engine drop. While the performance air filter can support high and better air flow than standard air filter which can increase the air intake pressure to the engine. As we know when the high compressed air entering the engine can increase the performance and torque as well because of leaner air fuel mixture occur in the engine.

At the same time, it can give engine better fuel economy. Besides that, with better filtration it can minimize the car's emission. This is because of the type of material that used to develop this air filter. For this study I choose to use only drop in air filter for the engine in three conditions that is clogged air filter, new air filter and performance air filter.

As a consumer we need to choose the right air filter that we going to use to the vehicle. Usually the maintenance of air filter is underestimated by the consumer and lastly cause the engine performance drop. In certain cases, the consumers forgot to change their air filter because the air filter changing takes every 40,000km based on Perodua owner's manual book.

1.3 Objective

- Study effect using three condition type of air filter (clogged, new OEM and performance) and its effect to the performance of the engine's horsepower, torque and exhaust emission.
- To compare the result between using clogged, new or performance air filter.
- To get the result of horsepower, torque and exhaust emissions of the engine.

1.4 Project Scope

This project will focus on the study of the performance of Perodua Viva 1.0 engine, which is study of air filtration system using two type condition of air filter. By using the right machine, we can get the result of this two criteria. The chassis dynamometer will be use to get the result of torque and horsepower. Then, we choose to use the exhaust gas analyser to measure exhaust emission produce by the engine. The variables for this engine is the air filters use, whether using clogged air filter, new OEM air filter or performance air filter.

CHAPTER 2
LITERATURE REVIEW

2.0 Internal Combustion Engine

The internal combustion engine is an engine in which the burning of a fuel occurs in an enclosed space called as a combustion chamber. This exothermic reaction of a fuel with an oxidizer creates gases of high temperature and pressure, which are permitted to expand. The feature that indicate of an internal combustion engine is that work is performed by the expanding hot gases acting directly to cause movement. For example, by acting on pistons, rotors, or even by pressing on and indirectly will stir the entire part of the engine. The piston's movement then, turns a crankshaft that then turns the car wheels via transmission system of vehicle. The types of fuel commonly used for internal combustion engines are petrol, diesel, and kerosene.

Many people claimed the invention of the internal combustion engine in the 1860's, but only one has the patent on the four stroke operating sequence. In 1867, Nikolaus August Otto, a German engineer, developed the four-stroke "Otto" cycle, which is widely used in transportation even today. Otto developed the four-stroke internal combustion engine when he was 34 years old.

It is important to mention that the basic operating principles of the engines have been around for more than a hundred years and they are still in place. Some people get discouraged when they look under the hood and cannot recognize a thing on their vehicle. Rest assured that underneath all of those wires and sensors lies an engine with the same basic operating principles of that "Otto" engine over a century old.

The term *Internal Combustion Engine* (ICE) is almost always used to refer specifically to reciprocating engines, Wankel engines and similar designs in which combustion is intermittent. However, continuous combustion engines, such as Jet engines, most rockets and many gas turbines are also internal combustion engines.

Internal combustion engines are seen mostly in transportation. Several other uses are for any portable situation where you need a non-electric motor. The largest application in this situation would be an Internal combustion engine driving an electric generator. That way, you can use standard electric tools driven by an internal combustion engine.

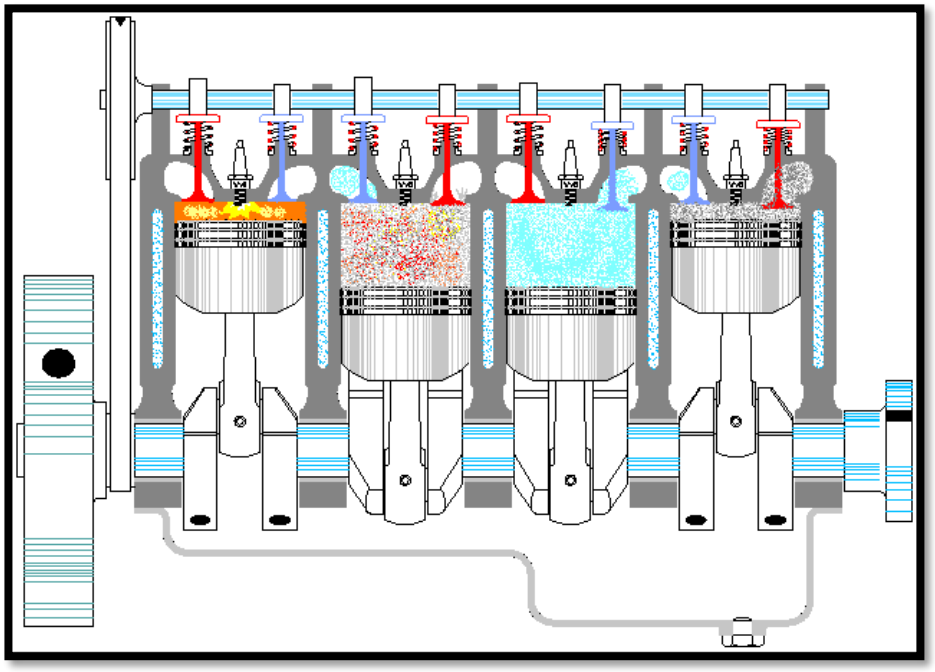

Figure 2.1: Four stroke operational of internal combustion engine

2.1 Intake System

An intake system is is blend of segments that significantly conveying air from the environment to the ignition council of engine. The air then causes an engine to inhale, similarly that the exhaust framework permits it to breathe out. An intake system contain of no less than four essential components including an air filter, a mass stream

sensor, a throttle body and an intake manifold, despite everything they act as a similar fundamental capacity that basic air bays did in early vehicles.

2.1.1 Component of Intake System

Modern (fuel injected) systems consist of little more than an air inlet, but this system typically includes:

- Air filter
- Mass flow sensor
- Intake manifold
- Throttle body

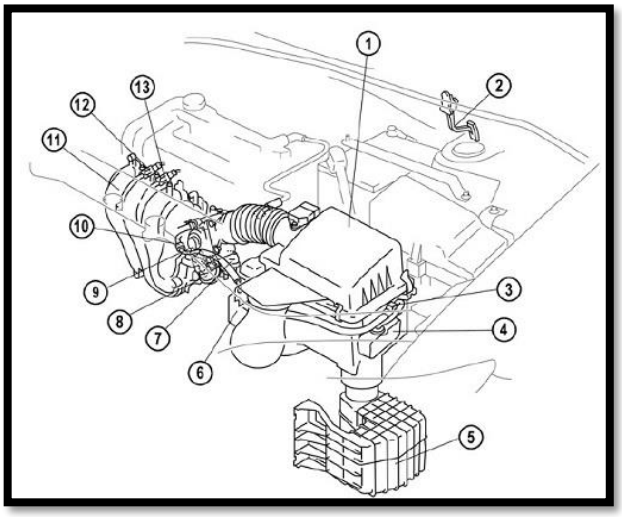

Figure 2.2**:** Intake filtration system

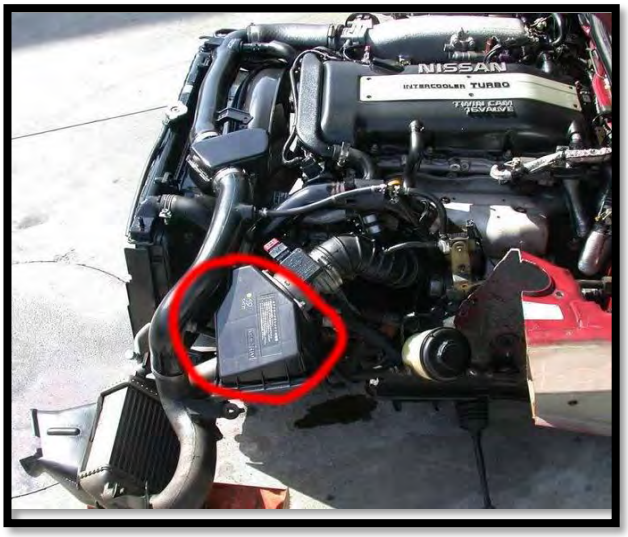

Figure 2.3**:** Air intake system located

Figure 2.4**:** Air box and air filter unit