



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

A STUDY OF THE PERFORMANCE OF CAMPRO 1, 600CC ENGINE

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

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DECLARATION

I hereby, declared this report entitled “A STUDY OF THE PERFORMANCE OF CAMPRO 1,600CC 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 (Bachelor of Engineering Technology Automotive) (Hons.). The member of the supervisory is as follow:

.....

(Project Supervisor)

This thesis I dedicate to Shahrin Bin Abd. Rashid, Rokiah Binti Kassim,
siblings and friends.

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First of all, I would like to thank Allah SWT for giving me strength to complete this project successfully on time. Then I would like to express my deepest gratitude to my project supervisor, Mr. Ahmad Zainal Taufik Bin Zainal Ariffin who had giving me guidance, ideas and support for this project. It would be difficult to complete this project without his support and understanding.

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ABSTRACT

Performance of an engine is very important nowadays so that the car is still at its top condition even after long use. The air filter of an internal combustion engine plays a part in the performance of an engine. The use of stock OEM air filter or aftermarket air filter is in debate whether which one is better to be installed to maintain or increase the performance of the engine of the car. By using scanner tool (Launcher X431) and exhaust gas analyzer, the stock OEM air filter and aftermarket air filters are tested to determine which one is better to the performance of the engine.

ABSTRAK

Prestasi enjin adalah sangat penting pada masa kini supaya prestasi kereta itu masih sama selepas lama digunakan. Penapis udara enjin pembakaran dalaman memainkan peranan dalam prestasi enjin. Penggunaan penapis udara dari kilang atau penapis udara keluaran luar ialah di dalam perdebatan, sama ada mana satu yang lebih baik untuk di pasang untuk mengekalkan atau meningkatkan prestasi enjin kereta. Dengan menggunakan alat pengimbas kenderaan (Launcher X431) dan juga pengimbas gas ekzos, penapis udara keluaran kilang dan penapis udara keluaran luar akan di uji untuk menentukan mana satu yang lebih baik untuk prestasi enjin.

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LIST OF ABBREVIATIONS

AFR	-	Air/fuel Ratio
CamPro	-	Cam Profiling
OEM	-	Original Equipment Manufacturer
cc	-	cubic centimeters
OBD	-	On-board Diagnostic
ICE	-	Internal Combustion Engine
UK	-	United Kingdom
IAFM	-	Intake Air-Fuel Module
DOHC	-	Dual-OverHead Camshaft
RPM	-	Revolution Per Minute
HC	-	Hydrocarbon
CO ₂	-	Carbon Dioxide
NO _x	-	Nitrogen Oxide
CO	-	Carbon Oxide
O ₂	-	Oxygen

CHAPTER 1

INTRODUCTION

1.0 Background

Air filter is a device composed of fibrous materials which removes solid particulates such as dust, pollen, mould, and bacteria from the air. A chemical air filter consists of an absorbent or catalyst for the removal of airborne molecular contaminants such as volatile organic compounds or ozone. Air filters are used in applications where air quality is important, notably in building ventilation systems and in engines. Some buildings, as well as aircraft and other man-made environments (e.g., satellites and space shuttles) use foam, pleated paper, or spun fiberglass filter elements. Another method, air ionisers, use fibers or elements with a static electric charge, which attract dust particles. The air intakes of internal combustion engines and compressors tend to use either paper, foam, or cotton filters. Oil bath filters have fallen out of favour.

The air filter for internal combustion engine is used to prohibit the entry of foreign particles such as road dust, debris, etc. into the engine. This helps in the enhanced functionality of engines. It minimizes the emissions from vehicles and prevents the engine and its component from damages by foreign particles. It also will help in maintaining or significantly increase the performance of the engine by using a different type of air filter that are accessible in the aftermarkets. The market for automotive air filter is influenced by production trends in the automotive industry, emission norms, health safety regulations, buyer's preferences, and lifestyle, whereas factors such as vehicle park, average miles driven, and the types of filter used influence the aftermarket demand for air filters.

1.1 Problem Statement

There are various type and brands of conventional cars nowadays to choose, from the new one to buy or which are already on the road. One of the issue for regular drivers is to maintain the performance and fuel emissions of the engine car. There are so many parts which will affect the performance of the engine. One of the parts is the air filters. Air filter is one of the variable for an engine car performance, whether a good or bad air filter will resulting in the increase or decrease in performance of the engine car. There are so many type of air filter in the aftermarket which differentiate between the design, materials use and type. The issue with engine air filter is, it is the less likely parts to be maintain regularly. Conventional drivers don't usually change the air filter even when it needs to. In some cases, the drivers is confuse whether to change the engine air filter to just the standard OEM air filter or using aftermarket air filter to use with the engine car. This report is done to verify the importance of air filters to the engine car performance and to identify which air filters is better, the OEM air filter or aftermarkets air filters.

1.2 Objective

The objective of this project are:

1. To study and monitor the onboard computer of an engine in respect to the engine performance.
2. To determine the fuel emissions of the engine.
3. To decide which air filters from the selected air filter is best to be use to maintain/maximize the engine.

1.3 Project Scope

This project focus on the study of the performance of the engine, which is the study and experimental work of air/fuel ratio (AFR) and etc. by using CamPro 1, 600cc engine type. The CamPro 1, 600cc engine also is used in determining the fuel emissions. The variables for the CamPro 1, 600cc engine is the air filters use, whether using a stock OEM filter or an aftermarkets air filters. The experimental test that will be conduct on the CamPro 1, 600cc engine by using a scanner tool (Launcher X431) and an exhaust gas analyser.

1.4 Organization of Research

This research is write with necessary details for the understanding of this project. Excluding the introduction, which is the first chapter for this report, the main point of this project is divided into four chapters. Literature review is several previous studies on the effect of air filter on the performance and fuel emissions of an engine in Chapter 2. Chapter 3 focus about the analysis and experimental method of several air filters that will be use to examine the effect of air filters on performance and fuel emissions of the engine. Chapter 4 consists of experimental result and data and also the analysis of the performance and fuel emissions that will be collect from the engine in respect to the air filters use. Lastly, Chapter 5, it presents the conclusion of the overall experimental study and analysis and the future work recommendation.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The aim of this chapter is to provide all the information about the air filter for internal combustion engine. What will be the effect on the performance of the internal combustion engine when using different type of air filter? Which air filter is better, stock OEM air filter or the aftermarket air filter in respond to the engine performance? The air filter for the internal combustion engine will be discussed thoroughly in this chapter. Various sources including journal, thesis, reference books and literature reviews have been investigated and revised in writing this chapter.

2.1 Air Filter in Automotive

Air filters are the key components for automobiles, and evolves with developments in the automotive industry. Taking the automotive industry as a whole it must be observed that the air filtration applications around road vehicles have increased and are still increasing. Besides filters for the crankcase ventilation and transmission filters a whole new range of filter systems in the vehicle has developed. This is mainly due to the so-called On-board diagnostics (OBD) II standard and driven by the trend to zero emission vehicles. A multitude of sensors on the cars, which can be very sensitive to contamination (with particles and gases) and in many cases have to be protected, require specific air filters. Today there are 30 to 40 different filter applications around the automobile to be found. The technological performance requirements of the majority of these products are usually more straightforward and are often but vaguely

defined. The definition of performance profiles does not yet follow standardized filter tests but are negotiated. Further by proper maintenance can help vehicles perform as designed, positively affecting fuel economy, emissions, and overall drive ability. Automotive air filters are classified into two categories-engine/intake air filter and cabin air filter. The intake air filter is used to prohibit the entry of foreign particles such as road dust, debris, etc. into the engine. This helps in the enhanced functionality of engines. It minimizes the emissions from vehicles and prevents the engine and its components from damages caused by foreign particles. Cabin air filters are the new types of air filters, which are specifically designed for the vehicle's cabin air filtration.

2.2 History of Air Filter

The internal combustion engine air filter prevents abrasive particulate matter from entering the engine's cylinders, where it would cause mechanical wear and oil contamination. Most fuel injected vehicles use a pleated paper filter element in the form of a flat panel. This filter is usually placed inside a plastic box connected to the throttle body with ductwork. Older vehicles that use carburetors or throttle body fuel injection typically use a cylindrical air filter, usually a few inches high and between 6 inches (150 mm) and 16 inches (410 mm) in diameter. This is positioned above the carburettor or throttle body, usually in a metal or plastic container which may incorporate ducting to provide cool and/or warm inlet air, and secured with a metal or plastic lid. The overall unit (filter and housing together) is called the air cleaner.

2.2.1 Air Cleaning Apparatus for Internal Combustion Engine

The first patented air filter was inspired by Charles Mathias Streete dated Oct 19, 1965. This invention relates to the extraction of powder or granular material from hoppers and is particularly concerned with gas filters or dust extractors in which the extracted dust is collected in a hopper, as in the cyclone type gas filters for use in the air intakes of internal combustion engines. The object of the invention is to provide convenient means for emptying a hopper or, at least, for preventing it from becoming too full. The drawing of the air filter is as shown in Figure 2.1.

According to the invention Engine (Mathias Streete Charles, 1965), a hopper for powder or granular material is provided with a gas operated ejector for removing the powder or granular material from the container. Conveniently the ejector may be arranged to act continuously during the operation of a filter or dust extractor. Thus, where the filter is used to supply clean air to a supercharged internal combustion engine, the ejector may be fed continuously with a stream of air bled from the high-pressure side of the supercharger.

Where the filter is a cyclone separator used to supply an internal combustion engine, the pressure in the hopper is depressed below atmospheric pressure by the engine, or supercharger, suction. Therefore, the ejector system, or jet, must be throttled to produce a depression sufficiently below the hopper pressure to entrain the dust. Beyond the point at which the dust is entrained, the dust laden stream is expanded to approximately atmospheric pressure to enable the dust to be deposited. One form of ejector that is suitable for such operation comprises a venturi tube with a coaxial tapered nozzle which delivers a jet into the throat of the venturi tube while the dust is entrained by the jet in the convergent part of the venturi tube.

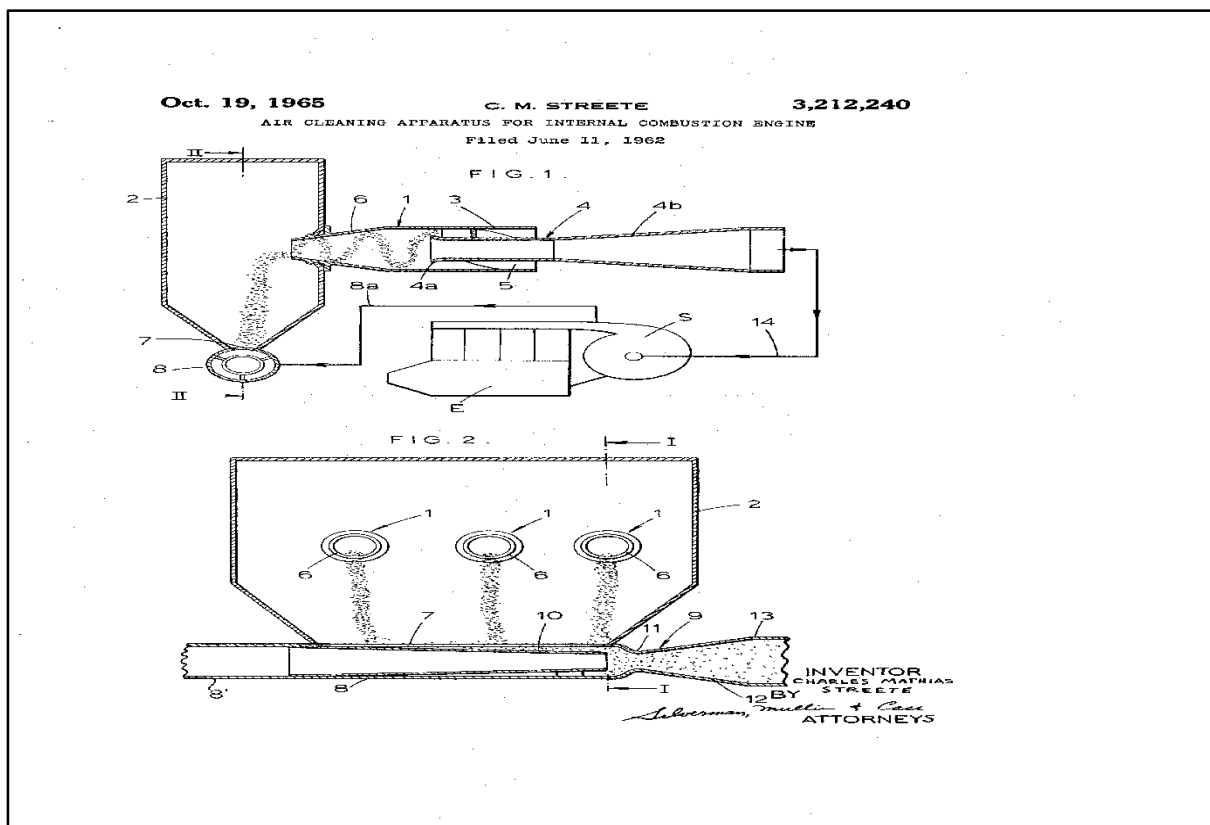


Figure 2.1: Air Cleaning Apparatus for Internal Combustion Engine (Mathias Streete Charles, 1965)

Based on the previous Figure 2.1:

FIGURE 1 is a section (taken on the line I-I in FIG 2) of a cyclone dust extractor diagrammatically shown connected to an internal combustion engine.

FIGURE 2 is a section on the line II-II in FIGURE 1.

2.2.2 Air Cleaner with Air Pump Dust Remover

The Air Cleaner with Air Pump Dust Remover is invented and patented by N Schaeffer on Oct 1, 1974. This invention relates to an air cleaner apparatus as is commonly used in connection with an internal combustion engine and which is intended for the purpose of removing foreign particles in-the form of dust, trash and the like from the air that is normally aspirated into the engine for combustion purposes. The drawing of the invented is as Figure 2.2 below:

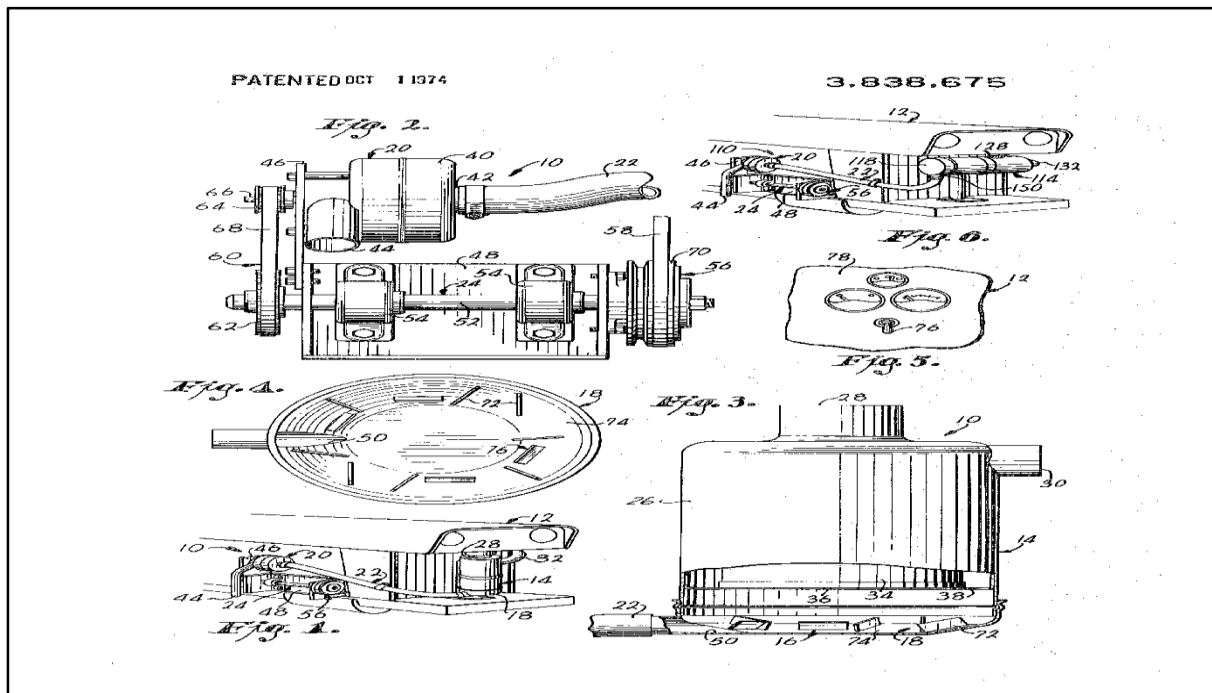


Figure 2.2: Air Cleaner with Air Pump Dust Remover (N Schaeffer, 1974)

Based on Figure 2.2:

FIG. 1 is a fragmentary perspective view of a combination air cleaning and purging apparatus made pursuant to the present invention as adapted for use with the engine of an agricultural or industrial tractor;

FIG. 2 is an enlarged, fragmentary, side elevational view of the air pump portion of the apparatus along with its associated drive and clutching mechanism;

FIG. 3 is an enlarged, fragmentary, elevational view of a dry element type air filtering device used in connection with the combination air cleaning and purging apparatus, a portion of the casing being broken away to reveal details of construction;

FIG. 4 is a plan view of the collector cap portion of the air filtering device showing the randomly placed, upright vane structure provided for creating an air turbulence during purging of the collector cap;

FIG. 5 is a fragmentary view of an operators control panel having a switch mounted thereon for selectively actuating the air pump; and

FIG. 6 is a fragmentary perspective view of an alternate form of the air cleaning and purging apparatus in which the air filter device is disposed horizontally.

A combination dry element type air cleaning and purging apparatus is provided for use with an internal combustion engine for the purpose of separating foreign material from the atmospheric air prior to its being introduced into the engine. The apparatus includes an air pump for purging the material which has been separated from the air being filtered without necessitating the removal of any portion of the filtering device or the manual handling of the collected foreign material. The power-driven air pump is operably coupled with the engine in such a manner that it may be selectively actuated during operation of the engine and includes a switch control so that an operator may cause such purging to be accomplished without leaving the operator's station. Vane structure is provided in a dust collector cap portion of the filtering device and causes an air turbulence for increasing the dust transferring capabilities of the airstream to insure removal of substantially all of the foreign matter from the collector cap during operation of the air pump (N Schaeffer, 1974).

FIG. 3 is a schematic view showing yet another preferred embodiment of the invention.

This invention of air filter device is disclosed which includes a dry air filter and a dust precipitator for an internal-combustion engine, having a dust extraction blower in a dust exhaust-air line leading away from the dust precipitator. In order to maintain perfect operation of the internal-combustion engine, in addition to the dust exhaust-air line there is provided an additional exhaust-air line which is connected to the intake side of the motor-driven blower and has a shut-off element which opens in the event of failure of the dust extraction blower (Stefan Bopp, 1993).

2.3 Design Trends of Air Filter

According to (Jaroszczyk, Byron A. Pardue, Christopher E. Holm, 2004), the need for either reduced filter size for a stated airflow rate or increased flow rate for an air filter with a size comparable to a conventional panel or cylindrical filter design resulted in the development of in-line fluted or pleated element air filters. In the designs, the entire volume of filter housing accommodates filter media. Furthermore, new filter media with high permeability enabled size reduction of the air filter even further. Panel and cylindrical air filters still dominate the market. These designs require large housing volumes with relatively small inlets and outlets. Flow turbulences that usually develop in the transition, sudden contraction or sudden expansion areas are sources of increased pressure drop. Turbulence can be reduced by incorporating media into the empty spaces.

The conical design as in Figure 2.4a that was introduced by Ford in the 1990's was one of the first designs fully utilizing the low resistance coefficient of the bullet shaped insert and the flow-straining feature of open pleats at the filter element inlet. For almost identical media surface area, pressure drop of the conical filter element is only 46% of the panel filter element. Pressure drop for the conical air filter, including housing and the filter element, is 39% lower than the panel filter counterpart. The conical filter captured 4.5 times more dust at a pressure increase of 1 kPa than did the panel filter. This indicates that filter performance characteristics greatly depend on filter design.