UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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EXPERIMENTAL ANALYSIS AND STUDY OF FUEL SAVER DEVICE

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

by

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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 Mechanical (Automotive.). The member of the supervisory is as follow:

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ABSTRAK

Kajian ini adalah untuk memeriksa dan membandingkan keberkesanan alat penjimatan bahan api (Voltage Stabilizer, Magnectic Fuel Saver dan Mini Turbo Fan) dalam enjin petrol 4 lejang. Menurut pengilang, penstabil voltan akan mengurangkan penggunaan radas elektronik semasa memandu di dalam kenderaan dan oleh itu enjin akan berasa lebih ringan dan akan menyebabkan penggunaan bahan api dapat dikurangkan. Untuk penjimat bahan api magnet, menurut pengilang bahan api ini akan berinteraksi didalam medan magnet di dalam talian bahan api dan menyebabkan bahan api dibakar dengan mudah dalam kebuk pembakaran oleh dengan itu ia akan menghasilkan pembakaran yang sempurna serta penggunaan bahan api dapat dikurangkan. Alat terakhir sekali, menurut tuntutan pengilang kipas mini turbo boleh meningkatkan aliran udara di dalam sistem pengambilan seperti sistem turbo atau sistem supercharger dan ini akan dapat meningkatkan prestasi enjin. Oleh itu ia dapat mengurangkan penggunaan bahan api. Untuk mengesahankan tuntutan daripada pengilang, eksperimen akan dijalankan secara teori dan ujian menggunakan ketiga-tiga alat penjimat bahan api . Pengesahan eksperimen akan dijalankan dengan menggunakan Toyota Wish 1.8 2ZR 1.8 L dengan Transmisi Automatik . Ujian akan dijalankan di jalan raya sebenar di jalan bandar atau jalan persekutuan dan lebuh raya. Projek ini akan dilakukan dengan mengikut jadual atau perancangan yang dicadangkan kepada penyelia.

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ABSTRACT

This study to examine and compare the effectiveness of fuel saving devices (Voltage Stabilizer, Magnetic Fuel Saver and Mini Turbo Fan) in the petrol engine. According to the manufacturer, the voltage stabilizer will reduce current consumption in the vehicle and therefore the engine will feel lighter and will result in reduced fuel consumption. For magnetic fuel saver, manufacturer claimed fuel will interact in the magnetic field inside fuel line and cause fuel to be burned easily inside combustion chamber and thus will produce perfect combustion and reduced fuel consumption. For last device, according manufacturer claim mini turbo fan can increase air flow inside intake system like turbo or supercharger system and this will increase engine performance thus reduce fuel consumption. The experimental validation will be conducted by theory and testing using three aftermarket fuel saver. The experimental validation will conduct with using Toyota Wish 2ZR 1.8 L with Automatic Transmission. The tests have been conducted on actual road at city road or federal road and high way.

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DEDICATION

Especially to my beloved mother, father and family

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I would like to express my greatest gratitude to **ALLAH S.W.T** for giving me courage and strength to complete this thesis successfully. With HIS blessing and bestowed, I be able to complete and finishing this thesis on time.

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Hope this thesis will become the guideline and reference for the other student in the future.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

NEDC	-	New European Driving Cycle
KM	-	Kilometre
L	-	Litre
AVG	-	Average
DC	-	Direct Current
V	-	Voltage
RPM	-	Rotation/Revolution Per Minute
ADC	-	Athens Driving Cycle
FTP-75	-	US Environment Protection Egency
EUDC	-	Extra Urban Driving Cycle
AT	-	Automatic Tranmission
RM	-	Ringgit Malaysia
VVT-i	-	Variable Valve Timing-intelligent
DOCH	-	Double Overhead Camshaft Head
DIS	-	Direct Ignition System
ETCS-i	-	Electronic Throttle Control System-intelligent
°	-	Degree
C	-	Celsius
m	-	Metre
UMNO	-	United Malays Nation Organization
MBMB	-	Majlis Bandaraya Melaka Bersejarah
psi	-	Pound Per Square Inch
RON	-	Research Octane Number
kg	-	Kilogram
%	-	Percent
ECU	-	Electronic Control Unit

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CHAPTER 1
INTRODUCTION

As long as there are vehicles that use internal combustion engines, there is a revolutionary device that promises improvements in performance and mileage. And every time the fuel price hike, this device is growing like mushrooms after the rain. According to dealer and testimony from customer that have use this device said to get the significant and bigger reduction in fuel consumption, the vehicle should equip more than one fuel saving device.

1.1 Project Background

At present, oil prices are unstable and this will further burden the lower class worker. In this unstable situation, some people are trying to take advantage of the difficulties of others such as selling useless items like fuel saving device. There are a variety of fuel-saving devices such as electronic, magnet and air flow device in the current market and according to the manufacturer claim, their fuel saving devices truly effective in reducing fuel consumption and some dare to guarantee the device being sold. Most of dealer and testimony from customer that have use this device said to get the significant and bigger reduction in fuel consumption, the vehicle should be equip more than one fuel saving device. If not get the desired results, the money will be refunded.

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1.2 Problem statement

From manufacturer advertisements, theirs similar claimed the voltage stabilizer, magsaver and mini turbo fan can give high frequency impedance for more stable voltage current to all electronic device, give a boost of air flow and also give a better fuel ablaze. This will result in increased power, torque and improve fuel economy. For this research the aim is only to investigation the effectives of this device on the manufacturer claim of improving fuel economy. The effective for this device will be validated after the experimental vehicle test with road testing. The analyze data and results will approve or disapprove that the installation of this device will reduce the fuel consumption.

1.3 Objective

The objective of this project is to validate the effectiveness of these fuel saver device products by experimental method using actual road test at federal/city road and highway road based on supplier and manufacturer's claims which states that their product has impact on fuel saving usage.

1.4 Scope

The scope of this project is:-

(a) Determine and compare with and without the use of each fuel saver device on vehicle.

(b) The experimental is conducted using Toyota Wish second generation (2013) 2ZR-FAE 1.8L.

(c) The test is conducted at city road and highway using Driving cycle.

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CHAPTER 2
LITERATURE REVIEW

A case study on crude oil prediction at 2007 by Prof L. David Roper from Virginia Polytechnic Institute and State University said, crude oil price prediction will increase about 400 percent in 2020. This will lead about 30 percent increase price of crude oil each year. With higher oil demand over the years, a variety of fuel-saving devices have been created by the manufacturer to reduce fuel consumption on a vehicle. This study is important because it will have a significant impact on daily vehicle consumer.

2.1 History of fuel saver device

Fuel saver device already exist in early 1980's when a company started by Mr. Joel Robinson introduced a product called "The platinum fuel saver" in which device is placed in vehicle vacuum line. This product claims that it can increase 22% of overall gas mileage (platinum 22). Since then, there are many devices available today that boast about saving gasoline and harnessing more miles per gallon by using their product.

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2.2 Type of device

There are many type of fuel saver device at the market today and most of device is to optimize the ignition, fuel flow and air flow in engine system. This device usually is easy to install at vehicle without cutting a wire or changing the part of engine. This research is more on electronic device, air flow device and magnets device because this entire device is more popular than other type and easy to install

2.3 Electronic device

Some of electronic devices is marketed as fuel saver and this device is the most popular among the many types of fuel saving devices. This product also knows as voltage stabilizers. This is because many types of electronic fuel saving device requires no complicated installation in vehicles and easy to use. There are two various type voltage stabilizers for vehicle. First type voltage stabilizer is installation by plug in at cigarette lighter socket and the second type is installation by connection to battery terminal. The voltage stabilizer types are shown in Figure 2.1 and Figure 2.2.

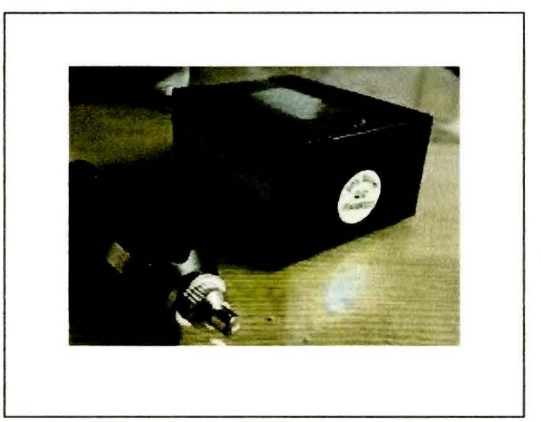

Figure 2.1 : Voltage stabilizer plug in type
(www.mudah.my/Fps+for+stabilizer+car+9936475.htm)

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Figure 2.2 : Voltage stabilizer battery connection type
(www.zerotohundred.com/431896-pivot-raizin-voltage-stabilizer-with-meter.html)

Example from FPS voltage stabilizer manufacturer claim that their device gives benefit such as:-

(a) Lowered fuel consumption and increase engine efficiency up to 10 - 15%.
(b) Smoother engine, less noise and better throttle response.
(c) Increase lifespan of battery, alternator and electronic parts.
(d) Improved audio system and other electronic devices.

2.3.1 Component of voltage stabilizer

Most of the product have a simple design and have same component at each product. The component is:-

(a) Aluminium Electrolytic Capacitor
   - An aluminium electrolytic capacitor consists of cathode aluminium foil, capacitor paper (electrolytic paper), electrolyte, and an aluminium oxide film, which acts as the dielectric, formed on the anode foil surface. The function of this capacitor is to accumulate energy and then to discharge the energy over time. (Nichicon Corporation, 2013)

(b) LED (Light Emitting Diode)
   - To signify correct installation

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(c) Replaceable fuse

- Low resistance resistor that acts as a sacrificial device to provide overcurrent protection of either the load or source circuit.

(d) Polyester capacitor

- Paul Harden (n.d) state that polyester films use layers of metal and polyester dielectric to make a wide range of capacitances in a relatively small package at low voltages. These have become the standard caps for DC applications.

(e) Metal oxide varistor resistor

- Varistor is polycrystalline ceramic devices exhibiting highly nonlinear electrical behavior and greater energy absorption capability. The fabrication of varistor is done by mixing semiconducting ZnO powder with other oxide powders, and subjecting the powder mixture to conventional ceramic pressing and sintering. The sintering results in a polycrystalline ceramic with grain-boundary property which produces the nonlinear current-voltage characteristics of the device. When applied voltage exceeds rate clamping voltage, the device effectively become short circuit and protecting the component. (Thinking Electonic Industrial Co. LTD, 2012)

2.3.2 Operation of voltage stabilizer

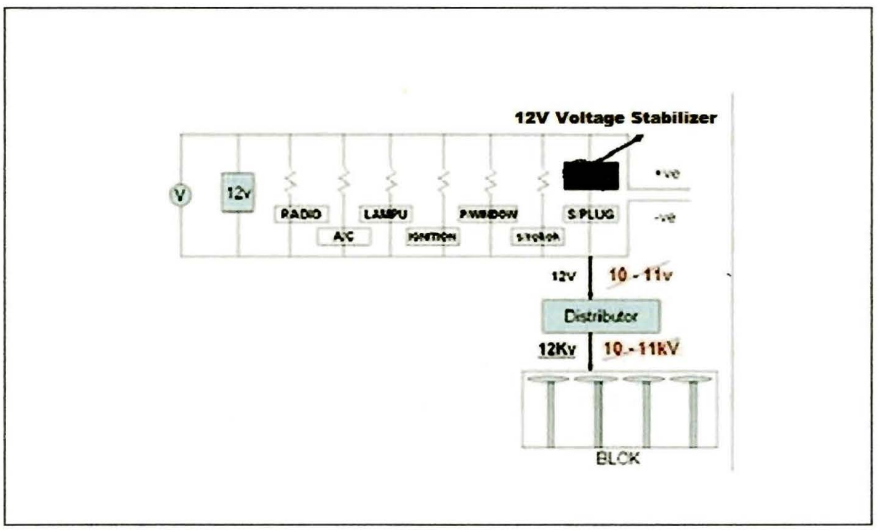

Figure 2.3 : Block diagram of fuel saver device in electrical system (http://jimatminyakfps.blogspot.com/)

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Before engine start, voltage stabilizer used the power source from battery, combination of series and parallel of Aluminium Electrolytic Capacitor will case and store energy. When ignition switch on, Aluminium Electrolytic Capacitor will discharge output voltage. Polyster Capacitor will precision voltage rate not higher than 14V and delivers the relatively constant voltage to measure by digital voltmeter before transmitted voltage output to electrical load. Aluminium Electrolytic Capacitor will case and discharge all overtime. When the input voltage from alternator is lower than 14V, this device still deliver a constant output of 14V by using restore current energy from Aluminium Electrolytic Capacitor. If the input voltage higher that limit, Polyester Capacitor will close the circuit, store energy from Aluminium Electrolytic Capacitor will discharge and the same time recharge simultaneously using the surplus voltage from polyester capacitor. Metal Oxide Varistor resistor will protect this system when voltage exceeds rated clamping voltage; the device effectively becomes a short circuit. (Noor affandy, 2010)

2.3.3 Previous research of voltage stabilizer device

Noor affandy bin abas, 2010. Studied on Experimental Validation Of Aftermarket Fuel Saving Device (Voltage Stabilizer). The experiment was conduct using Nissan Grand Livina 1.6L HR16DE 1.6 L with Automatic Transmission. The vehicle has tested before and after the installation voltage stabilizer with Dynomax 2000 Chassis Dynamometer for torque and power performance to determine its effects on fuel economy. The results indicated that the voltage stabilizer device has increase of torque performance about 1.4% begins at 2900 rpm and continuously to 6050 rpm. However, there is no significant effect for the purpose of fuel saving and reducing the cost of fuel consider the behaviour of driver and limit speed of this country.

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2.4 Air flow device

Air flow device usually know as turbo jet. This device is mounted on air flow system at engine system. It was not easy to install but it was not too complicated to install. There are two type of turbo jet. First type is using electrical motor to rotate or spin the fan and the second type is not using any electrical motor. The turbo jet types are shown in Figure 2.3 and Figure 2.4.

Figure 2.4 : Electric turbo jet (http://www.ebay.com/itm/Electric-Turbo-Air-Intake-Supercharger-Fan-Power/251323712822)

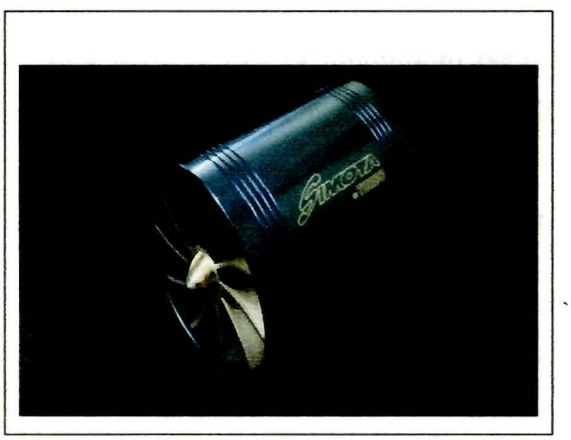

Figure 2.5 : Turbo jet without electrical motor (www.lelong.com.my/simota-super-spiral-turbo-ventilator-twin-fan-I928982C-2007-01)

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Example from simota super spiral turbo jet manufacturer claim that their device gives benefit such as:-

(a) Improves fuel efficiency and save fuel up to 30%

(b) Increase horse power 30%

(c) Increase top speed 30%

(d) 15 times stronger air flow

2.4.1 Component of turbo jet

Both devices have a same component but for electrical turbo jet, it use electrical motor. According to Guilas (2011), each component is variations in size, materials, shape, form, function, and the manner of operation, assembly and use. The component is:-

(a) Fan

- Wherein the fan is mounted within the housing and is free to rotate inside of the housing. The fan is only powered by movement of the air intake, which more air entering the device, the faster the fan is rotate and creating turbulence and compress the air that improves atomization with fuel

(b) Housing

- Wherein the housing is of hollow or aluminium contruction.The housing is fitted in line between an air filter and the engine of an air intake line.

(c) Shoulder bracket

- Wherein the shoulder bracket seals and secures the first end to second end of the housing.

(d) Hose adapter

- These components use to connect the devices inside engine air flow system.

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2.4.2 Function of turbo jet

The air intake accessory includes a housing containing a non-electric fan. The housing has an inlet and outlet each of which connects between the air filter and engine on the air intake line. The housing has a nozzle along the side of the fan closest the air filter, which speeds up movement of the intake air. The inclusion of the nozzle and non-electric fan improves fuel efficiency and engine performance. (Guilas. M, 2011)

2.4.3 Operation of turbo jet

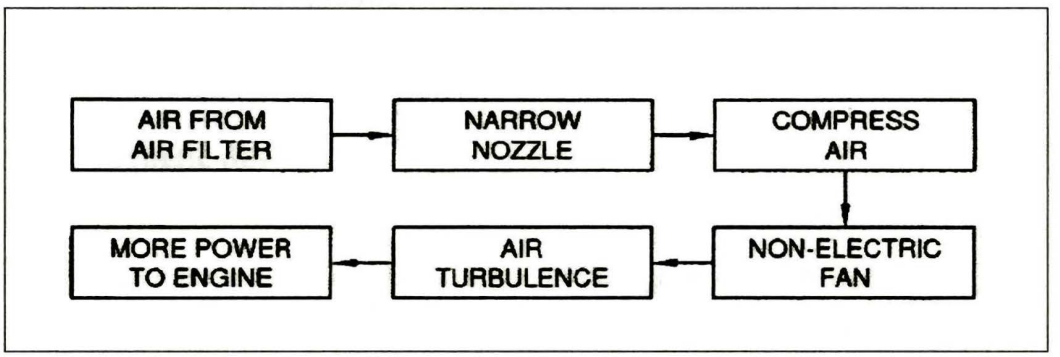

Figure 2.6: Illustrates a diagram of the various stages the air intake undergoes when the device is installed on the air intake line.

The device is inserted into the air intake system of a motor vehicle in order to save fuel and boost power. However, the of air movement, as opposed to a non-electric fan that spins as air enters the device and of which boosts the volumetric flow rate of the air in order to improve fuel efficiency. Some turbo-assisted vehicles are equipped with at least two turbo fans, one placed in the inlet to the engine and another in the outlet, the two axles of the turbo fans being connected directly to each other with a shaft and, in some cases, with additional intervening gears. The resulting inlet outlet turbo fans have opposite rotations. (Burnett , 2005)

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