EXPERIMENTAL VALIDATION OF AFTERMARKET FUEL SAVING DEVICE (VOLTAGE STABILIZER)

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I have read this thesis and from my opinion this thesis is
sufficient in aspects of scope and quality for awarding
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Especially for beloved mom , dad, wife and family

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ABSTRACT

Aftermarket fuel saving devices (voltage stabilizer) manufacturer claim their product will reduce fuel consumption related to fuel economy and increase the engine performance. The functional of this product is to feed constant voltage current to electrical instruments and electronic devices and a combination of all these responses result in less fuel consumption and increase engine performance. This experimental validation has conducted by theory and experimental using one of aftermarket voltage stabilizer. The experimental validation has conducted with 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 behavior of driver and limit speed of this country.

ABSTRAK

Pengeluar produk eksesori penjimat minyak jenis penstabil voltan mengakui bahawa produk mereka dapat meningkatkan kuasa kecekapan pembakaran petrol dan menjimatkan kadar menggunakaan minyak serta secara tidak lansung meningkatkan prestasi injin. Ianya berfungsi dengan mengurangkan gangguan radas elektronik dengan menstabilkan arus elektrik agar semua kendalian peralatan elektronik ditahap yang optimum. Kajian secara teori dan ujikaji telah dilaksanakan terhadap salah satu alat penstabil voltan yang terdapat di pasaran dengan menggunakan alat penguji Dynamometer Kerangka ke atas sebuah kenderaan Grand Livina HR16DE 1.6 L. Hasil ujikaji mendapati terdapat sedikit peningkatan terhadap daya kilas injin selepas pemasangan alatan tersebut sebanyak 1.4 % iaitu bermula dari 2900 psm hingga 6050 psm. Namun demikian, tidak ada kesan penjimatan minyak dari aspek tabiat kebiasaan pemandu dan limitasi kelajuan kenderaan yang ditetapkan di negara ini.

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ABBREVIATION

AC	=	Alternating Current
CDT	=	Cylinder Deactivation Technology
CVT	=	Continuously Variable Transmission
DAC	=	Data Acquisition Control
DC	=	Direct Current
DGEC	=	Dry Gap Water Cooled Eddy Current
DRB	=	Diode Rectifier Bridge
DOHC	=	Double Overhead Cam
ECM	=	Engine Control Module
EPA	=	Environmental Protection Agency
LIVC	=	Late Intake Valve Closing
IC	=	Integrated Circuit
IRS	=	Interference Reducer System
MOSFET	=	Metal Oxide Semiconductor Field Effect Transistor
MPM	=	Mechanical Power Distribution
MVICSA	=	Motor Vehicle Information and Cost Saving Act
PAC	=	Power Acquisition Control
PDM	=	Intelligent Power Distribution Module
VVT	=	Variable Valve Timing Technology

CHAPTER 1

INTRODUCTION

1.1 Overview

Fuel consumption is a very hot topic when fuel prices getting high and seems set to increase. The market has responded with a dozen of fuel saving device sold on the market that claims to improve the fuel economy and possibly improve engine performance of a vehicle. There are several different designs, but many are designed to fit on the air filter or fuel host or battery of a car and purportedly optimize torque and power performance in some way. Most "fuel saving devices" fit this pattern:

a. About a 10 - 15% claimed fuel saving (gas saving / gas mileage improvement)

b. Claimed reduced emissions

c. Claimed improved performance

Most aftermarket fuel saving device products not been tested and verify by SIRIM or government approved. There no agency in Malaysia like Environmental Protection Agency (EPA) in United Stated with enforcement under Section 511 of the Motor Vehicle Information and Cost Savings Act (MVICSA) mandatory the manufacturer to submit data to the EPA and apply for EPA testing through the Voluntary Aftermarket Retrofit Device Evaluation Program. Until now only one

aftermarket fuel saver device by Sabertec Company have pass following the rigorous EPA 511 Protocol, a test created to evaluate claims to reduce automobile exhaust emissions and improve fuel economy. Most possibility after installing the aftermarket device or changes vehicle's engine, emission system, fuel system, or electrical system have the potential to cause one or more problems like increased emissions, reduced fuel economy, harm vehicle condition, void the manufacturer warranty and environmental hazards.

1.2 Aftermarket Voltage Stabilizer Fuel Saving Device

There are many aftermarket products that claim to improve economy and power via changes to the vehicle electrical system such as voltage stabilizer (VS) and grounding wires (to fit between the engine block and the vehicle body). It is true that vehicle electrical systems are inherently frequency noisy (due to ignition, alternator, etc), and by installing this add-on device could smooth this out. The electrical details of these devices are not specific and kept secret by the manufacturers. Most of voltage stabilizer manufacturer claims the benefits of their device such as:

a. Better sound for in-car entertainment system.

b. Smoother idle, especially when switch electrical devices on/off.

c. Steadier light from headlamps; increased bulb life.

d. Possibly sharp throttle response, especially from low engine revs and with a nearly flat battery.

e. Possibly good starting although nearly battery flat.

f. Increase battery life.

Commonly there are two various type voltage stabilizers for vehicle most popular among the customer depend on installation, price and warranty. 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 1.1 and Figure 1.2. Voltage stabilizer can be finding in the market show in Table 1.1.

Figure 1.1: Voltage Stabilizer Plug in Type

Figure 1.2: Voltage Stabilizer Battery Connector Type

Table 1.1: List Aftermarket Voltage Stabilizer

Name Product	Type	Price (RM)
I-Change	Plug In	595.00
E-Charge	Plug In	580.00
Echo Charge	Plug In	576.00
Echo Storm	Plug In	380.00
Oricharge	Plug In	400.00
Hot Enazma Eco	Plug In	400.00
Power8	Plug In	480.00
Max Energy	Plug In	50.00
Pivot Raizin	Battery Connector	240.00
DIY	Battery Connector	99.00
Max Speed	Battery Connector	89.00
Zaptor	Battery Connector	120.00
I-VS	Battery Connector	129.00

1.3 Problem Statement

From manufacturer advertisements, theirs similar claim that voltage stabilizer can decrease circuit noise and high frequency impedance for more stable voltage current to all electronic device. This will result in increase power, torque, improve fuel economy, and reduce emission and audio quality. For this research the aim is only to investigation the effectives of voltage stabilizer on the manufacturer claim of improving fuel economy and increase the engine performance. The effective of the voltage stabilizer will be validating after the experimental vehicle test with chassis dynamometer. The analyze data and results will approve or disapprove that the installation of voltage stabilizer will reduce the fuel consumption and increase torque and power.

1.4 Investigation of Aftermarket Voltage Stabilizer Selection

For the purpose of this thesis, four samples of aftermarket voltage stabilizers are shown in Figure 1.3. Sample VS4 has been selected for this investigation because of transparent design and easy to dismantle for investigation purpose. This investigation will be conducted by theory and experimental for petrol engine. Research on theory will include the working principle of voltage stabilizer and an effective voltage stabilizer for the role of fuel saver and increase engine power and torque performance.

Figure 1.3: Label of Sample Aftermarket Voltage Stabilizer Sampling

1.5 Selection Investigation Apparatus

Selection of apparatus for this investigation only base on validation of increase engine power performance and reduce fuel consumption. The apparatus has been choosing as follow:

a. Vehicle – Grand Livina 1.6L engine HR16DE. Detail technical data shown in Table 1.2

b. Experimental Test Equipment – Max 2000 Chassis Dynamometer.

Table 1.2: Nissan Livina Technical Data

(Source: Nissan Grand Livina User Manual)

Nissan Grand Livina HR16DE 1.6 L	
Engine	DOHC four cylinder
Displacement	1,598 cc
Bore X Stroke	(78 x 83.6) mm
Compression Ratio	9.8 : 1
Fuel System	ECCS, Electronic fuel injections system
Max power	77kW @ 5200rpm
Max torque	150Nm @ 4,400rpm
Fuel tank capacity	52 liter
Weight	1245 kg

1.6 Objectives

The objectives of this project are as follow:

a. To investigate the functional and working principle of aftermarket voltage stabilizer.

b. To investigate and validate the effectiveness of voltage stabilizer by experimental test using Chassis Dynamometer to manufacturer claim.

1.6 Experimental Validation Scopes

Investigation methodology chart shown in Fig. 1.6 and explanation as follow:

a. Literature study of working principle and functional voltage stabilizer related to increase torque and power performance and reduce fuel consumption.

b. Literature study on present engine vehicle technology with related power performance and reduce fuel consumption.

c. To identify suitable type of testing required for product validation.

d. Analyze engine performance data result.

e. Validation & reporting.

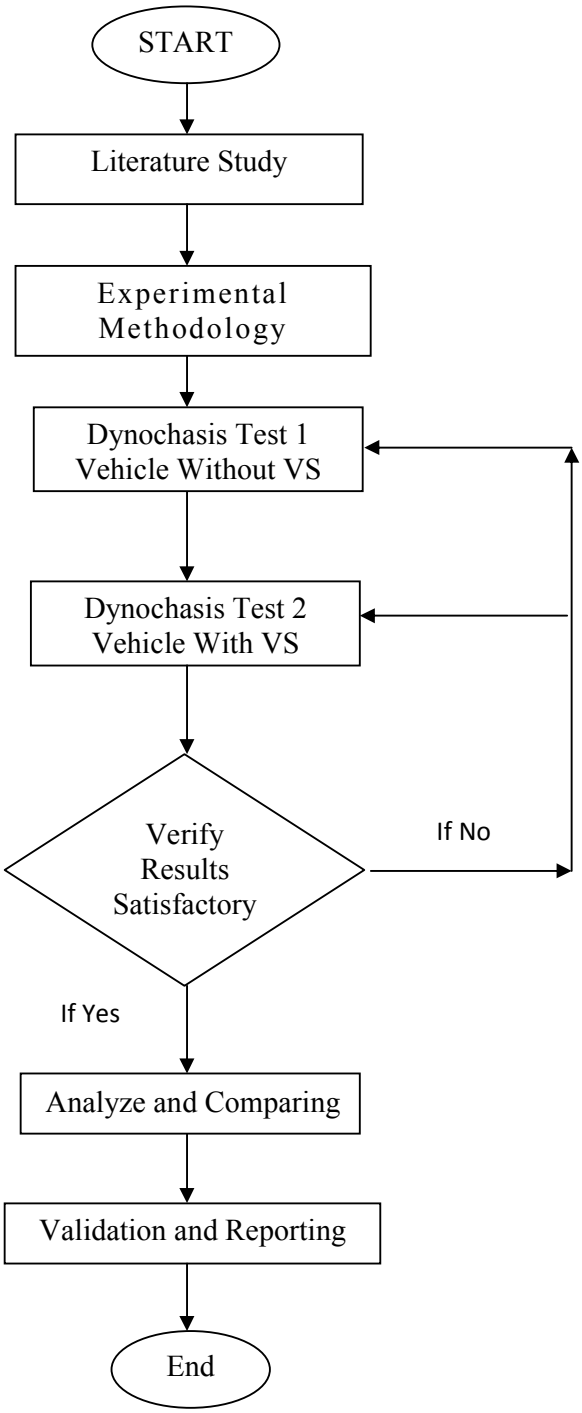

Figure 1.4: Experimental Validation Scope Chart