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**RESEARCH STUDY ON THE  
NOISE LEVEL AT THE NGV ENGINE**

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This report is being proposed as a  
partial fulfillment in the requirement for bestowal of  
Degree in Bachelor of Mechanical Engineering (Thermal-Fluids)

Faculty of Mechanical Engineering  
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“I hereby, declare this report is the result of my own research except as cited in the references”

Signature : .....  
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For my beloved father and mother

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## ABSTRACT

A Natural Gas Vehicle or NGV according to Wikipedia online dictionary (*Internet reference,02/08/2008*) is an alternative fuel vehicle that uses compressed natural gas (CNG) or, less commonly, liquefied natural gas (LNG) as a clean alternative to other automobile fuels. NGVs are standard vehicles that have been modified to run on CNG and there are three types of NGV engines which are Dedicated, Bi-Fuel and Dual Fuel engines. As any other engines, the NGV engines are also producing some noise. In common use, the word noise means unwanted sound or noise pollution. Therefore, this report is mainly on the research to determine the noise level of NGV engines and compared the differences between both petrol and diesel engines. There are several engines which used the application of NGV which have been totally proved to save the fuel and money. Therefore, the main aim for this research is that to identify its sequences and merely focused it from the noise level area in the aspects of safety, durability and stability that might come from the usage of NGV. This research could be done by collecting the noise level data in experimental test using the noise level detector on several engines including NGV. Besides, the differences set of data will be studied, compared and analyzed to find out its sequences of safety, durability and stability so that the result that will be obtained afterwards might be useful in further studies of the NGV improvements system.

## ABSTRAK

*Natural Gas Vehicle* (NGV) ataupun Gas Kenderaan Semula jadi adalah merupakan bahan alternatif minyak kenderaan yang menggunakan gas semula jadi (*Compressed Natural Gas*, CNG) ataupun kebiasaannya lebih dikenali sebagai gas asli cecair (*Liquefied Natural Gas*, LNG) sebagai alternatif lain kepada bahan api kenderaan automobil mengikut takrif daripada kamus dilaman web Wikipedia (*Rujukan internet*, 02/08/2008). NGV adalah kenderaan piawaian yang telah diubah suai untuk digerakkan ke atas CNG yang mempunyai tiga jenis enjin iaitu *Dedicated*, *Bi-Fuel* dan *Dual Fuel*. Seperti enjin-enjin yang lain, enjin NGV juga menghasilkan bunyi bising. Kebiasaannya, perkataan bunyi bising ini bermakna bunyi yang tidak diperlukan ataupun penghasilan pencemaran bunyi. Disebabkan itu, laporan kajian ini sebahagian besarnya adalah tertumpu kepada kajian untuk menentukan paras bunyi bising pada enjin NGV dengan membanding serta membezakan diantara kedua-dua enjin diesel dan petrol. Terdapat beberapa jenis enjin yang menggunakan aplikasi NGV yang mana terbukti dan diakui dalam menjimatkan kos bahan api dan wang. Oleh kerana itu, tujuan utama laporan ini adalah untuk mengenalpasti rangkaiannya dan hanya menumpukan terhadap bidang paras bunyi bising dari segi aspek keselamatan, ketahananlasakan dan kestabilan yang terhasil daripada penggunaan NGV. Kajian ini dapat dilakukan melalui pengumpulan data paras bunyi bising melalui ujian eksperimen dengan menggunakan alat meter paras bunyi bising terhadap beberapa enjin termasuklah NGV. Disamping itu, perbezaan data yang diperolehi akan dikaji, dibanding dan dianalisis untuk mengenalpasti rangkaian keselamatan, ketahananlasakan dan kestabilan supaya keputusan yang akan diperolehi kelak mungkin bermanfaat untuk digunakan bagi mendalami sistem penambahbaikan NGV dengan lebih lanjut lagi.

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## LIST OF SYMBOL, UNIT AND NOMENCLATURE

|                                |   |   |
|--------------------------------|---|---|
| NGV                            | = | Natural Gas Vehicle                             |
| CNG                            | = | Compressed Natural Gas                          |
| LNG                            | = | Liquefied Natural Gas                           |
| °F                             | = | Degree Fahrenheit                               |
| BTU                            | = | British Thermal Unit                            |
| CH <sub>4</sub>                | = | Methane   |
| C <sub>2</sub> H <sub>6</sub>  | = | Ethane  |
| C <sub>3</sub> H <sub>8</sub>  | = | Propane   |
| C <sub>4</sub> H <sub>10</sub> | = | Butane  |
| H <sub>2</sub> S               | = | Hydrogen sulfide                                |
| MJ                             | = | Mega Joule                                      |
| kWh                            | = | Kilo Watt hour                                  |
| lbf/in <sup>2</sup> ,          | = | Pound feet per inches square                    |
| °C                             | = | Degree Celcius                                  |
| dB                             | = | Desibel   |
| dB(A)                          | = | Desibel (Ampere)                                |
| dBm                            | = | Desibel meter                                   |
| <b>L<sub>n</sub></b>           | = | n-percent exceeded level                        |
| <b>L<sub>An</sub></b>          | = | n-percent exceeded level with A-weighting scale |
| <b>L<sub>10</sub></b>          | = | 10-percent exceeded level                       |
| <b>L<sub>50</sub></b>          | = | 50-percent exceeded level                       |
| <b>L<sub>90</sub></b>          | = | 90-percent exceeded level                       |
| <b>L<sub>eq</sub></b>          | = | Equivalent Continuous Sound Pressure Level      |
| ms                             | = | Meter second                                    |

|          |   |                                   |
|----------|---|-----------------------------------|
| RMS      | = | Root Mean Square                  |
| $L_{AT}$ | = | Equivalent continuous sound level |
| rpm      | = | Rotational per minute             |

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# *INTRODUCTION*

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Background**

The NGV and noise will be introduced as parts of the basic general information before this project proceed any further. The details of description between these two characteristics for this project are important as a guideline throughout the research that is being studied.

##### **1.1.1 Details of NGV**

NGV stands for Natural Gas for Vehicles. It is equivalent to natural gas supplied to power stations, industries, commercial establishment and households. NGV is an environmentally friendly fuel and has been proven to be lighter than air. It is specially developed to provide economic value to users without compromising on quality. There are several of advantages that offered by NGV especially for all vehicle owners which include:

- Substantial savings (50%) in fuel cost
- Lower operating cost
- Contributes to a cleaner environment
- Extended travel range

NGV is supported by the government with incentives and legislation to encourage vehicles owner to use NGV. NGV price is only 63.5 cent/litre equivalent of petrol, which make it cheaper than other fuels. NGV conversion kits are exempted from import duty and sales tax. Besides that, the reduction of road tax from existing levels also offers:

- Monogas vehicle (NGV only) - 50% off.
- Bi-fuel vehicle (Petrol & NGV) - 25% off.
- Dual-fuel vehicle (Diesel & NGV) - 25% off.

All of these reasons are major factors for potential owners to consider when making their vehicle fuel choices. However, many owners may not be aware of the safety record of NGV vehicles. NGV vehicles safety record compares favorably to other traditional fuels or alternative fuels available today. This is due to the superior (and still improving) technology, higher safety standards and the physical properties of NGV itself which makes it as safe as or safer to use than petroleum-based fuels (*Internet reference*, 03/08/2008).

### **1.1.2 Details of Noise**

Noise is any sound that is undesired or interferes with one's hearing of something (*Internet reference*, 03/08/2008). From the noise level of the NGV engine, we can determine the aspects of safety, durability and stability of certain engine vehicles. The equipment used to measure the noise level is the sound level meter. The Noise Meter or

sound level meter is designed to accurately measure the noise that we can hear, putting a real value to something that is so affected by perception (*Internet reference*, 04/08/2008).

The NM102 Noise Meter has been one of most popular noise measurement products in the following areas:

- Police Departments (vehicle noise, community noise)
- Factories and industrial complexes
- Housing associations
- Fire alarms and other alarm systems
- Sound system installation

Figure 1 below shows some example of the Noise Meter or Sound Level Meter. It shows the models from NM102 Noise Meter and Noise Meter with Optional Calibration manufactured by NoiseMeters Limited Company located at North Yorkshire, in United Kingdom.



Figure 1.1: NM102 Noise Meter (Left) and Noise Meter with  
Optional Calibrator (Right)

(Source: *Internet reference*, 04/08/2008)

## 1.2 Problem Statements

This project is to determine and identify the sequences of the NGV and merely focus it from the noise level area in the aspects of safety, durability and stability that might come from the usage of NGV. Even though the NGV has been proven to save the money and fuel respectively, there are still few researches on the safety, durability and stability mainly on the sound or noise level which can necessarily resulting in the sound pollution and other side effects which can probably reduces the vehicle's performance.

## 1.3 Objectives

There are several objectives which are carried out while doing this research and needs to be fulfilled. The objectives are:

- To determine the noise levels of NGV engines and compare the differences with the petrol and diesel engines.
- To determine the aspect of safety, durability and stability that might come from the usage of NGV
- To familiarizes with the equipments that are being used to measure the noise level such as the noise level detector.
- To gain experiences in conducting and operating experiments such as follows sequence procedure, collecting data, analyzing results and making final conclusion.

## 1.4 Scope

While doing this research, there are some actions which are really necessary and not necessarily need to be followed as the scopes of this project. The main scopes include: