



## **UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

### **DESIGN OF NOISE INSULATOR FOR METAL STAMPING OPERATION IN MANUFACTURING INDUSTRY**

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

by

**LEE SONG JIN**

**B051210218**

**920513-02-5345**

FACULTY OF MANUFACTURING ENGINEERING

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I hereby declared this report entitled “Design of a Noise Insulator for Metal Stamping Operation in Manufacturing Industry” 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 Manufacturing Engineering of UTeM as partial fulfillment of the requirements for degree of Bachelor of Manufacturing Engineering (Management) (Hons). The member of the supervisory is as follows.

.....

Supervisor

(Dr. Isa bin Halim)

## **ABSTRAK**

Industri pembuatan memainkan peranan yang penting dalam ekonomi Malaysia. Salah satu industri pembuatan adalah kilang penekanan logam. Proses penekanan logam menggunakan dai untuk memotong atau membentuk kepingan logam menjadi bentuk yang dikehendaki. Proses ini mengeluarkan bunyi yang bising. Pendedahan kepada bunyi bising yang berpanjangan boleh menjejaskan kesihatan, produktiviti dan prestasi kepada pekerja. Tujuan kajian ini adalah untuk mereka bentuk satu penebat bunyi bagi mengurangkan tahap bunyi dalam kilang penekanan logam. Kajian ini menggunakan teknik pemerhatian di tempat kerja, soal selidik dan pengukuran tahap bunyi bising di stesen kerja penekanan logam dengan menggunakan meter paras bunyi (SLM). Satu reka bentuk prototaip penebat bunyi telah dihasilkan dengan melalui proses percambahan fikiran di kalangan pekerja, soal selidik dan carta morfologi. Bahan penebat bunyi tersebut menggunakan kertas kitar semula dan serat kelapa. Tahap bunyi dapat dikurangkan sebanyak 17.2%. Kajian ini merumuskan bahawa penggunaan bahan-bahan seperti kertas kitar semula dan serat kelapa bagi menghasilkan penebat bunyi, dapat mengurangkan tahap bunyi dalam operasi penekanan logam. Kajian ini juga mencadangkan bahawa penebat bunyi ini harus dipasang dalam kilang penekanan logam bagi mengurangkan risiko pendedahan bunyi bising kepada pekerja.

## ABSTRACT

Manufacturing industries play an important role in the economy of Malaysia. One of the manufacturing industries is metal stamping industry. Basically, the processes in the metal stamping industry are using die to cut or form a flat metal sheets into desired shape. Consequently noise is produced from the processes. Noise considered as an unwanted or undesired sound. Prolonged exposure to the noise can lead to the health problems, low productivity and low performance of workers. The aim of this study is to design a noise insulator for reducing the noise level in the metal stamping industry. This study applied a workplace observation, questionnaire survey and noise level assessment at the metal stamping workstations by using a sound level meter (SLM). A prototype design of noise insulator was developed through brainstorming among the metal stamping workers, questionnaire survey and morphological chart. Recycle papers and coconut fibers were used as materials of the noise insulator. This study conducted a noise level assessment to determine the effectiveness of the developed noise insulator. The noise levels have effectively reduced the noise level up to 17.2%. This study concluded that application of used materials such as recycle papers and coconut fibers in making of noise insulator is able to reduce noise levels in metal stamping operation. This study suggests that the real fabrication and application should be implemented in the metal stamping industry to reduce the risk of noise exposure to the workers.

## **DEDICATION**

I would like to dedicate my thesis to my beloved parent:

Mr. Lee Sek Hoong  
Mdm. Wong Sum Mooi

And for my respected sister:

Lee Chue Yeok  
Lee Chue Peng

Thank you for the endless support to me all the ways to complete this final year project.

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## **LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURES**

NIOSH	-	National Institute of Occupational Safety and Health
WHO	-	World Health Organization
OSHA 94	-	Occupational Safety and Health Act 1994
OSHA	-	Occupational Safety and Health Administration
PPE	-	Personal Protective Equipment
dB	-	Decibels
SLM	-	Sound Level Meter
NIHL	-	Noise-induced Hearing Loss
WRUC	-	Western Region Universities Consortium
NIDCD	-	National Institute on Deafness and Other Communication Disorder
ACGIH	-	American Conference of Governmental Industrial Hygienists
SOP	-	Standard Operation Procedures
HR	-	Human Resource
cm	-	centimeter
DEFRA	-	Department for Environment, Food and Rural Affairs



# CHAPTER 1

## INTRODUCTION

This chapter discusses about the background of the study, problem statements of the study and objectives of the study. This chapter also provides the scope and limitation of the study.

### 1.1 Background of Study

Manufacturing industries play an important role in the Malaysia's economy. These industries can attract local and foreign investment that can increase the income of the country. Besides, these industries can also support sufficient products or machines to local customer in the short waiting time.

Manufacturing industry is a company that manufacture based on the fabrication, processing or production from the raw materials into products. This includes automotive, foundry, chemical, foods, or metal stamping industry.

Metal stamping is a process that uses die to cut or form flat metal sheets into desired shape. Since the process is a machining process, there are some safety issues have been considered such as heavy lifting, standing posture in the long period, noise and so on. Noise is produced when operating the metal stamping process. The noise is produced when the die of the metal stamping machine cuts or forms the flat metal sheets into shapes. Generally, noise is usually unwanted or undesired sound (Manish Raman and R. C. Chippa., 2014).

Prolonged exposure to the excessive noise has been linked to the physical disorders like increase in blood pressure, constricting blood vessels, ulcers, increasing the heart rate that can lead to heart disease, insomnia and hypertension to name a few. Some peoples may also facing the problem about headaches, which can reduces down their performance levels and the quality of their daily task. Continuous contact with the high level of noise pollution also can lead to many adverse effects of hearing such as tinnitus and noise-induced hearing loss (NIHL) (Deborah I. Nelson et al., 2005). Hence, the workers working in the metal stamping were facing these hearing and health problems.

There are several solutions can solve the excessive noise such as technical training, personal protective equipment, administrative control, engineering control like a noise insulator and to name a few. The aim of the study is to design a noise insulator for the metal stamping process in the manufacturing industry. At the machining department, the metal stamping process produces excessive noise that can affect operators' concentration and hearing.

## **1.2 Problem Statement**

Excessive noise exposure was affecting the performance, productivity and efficiency of operators (J. Errett et al., 2006). Besides that, the excessive noise exposure also can lead to hearing loss and health problems. The following section describes the factors of excessive noise exposure.

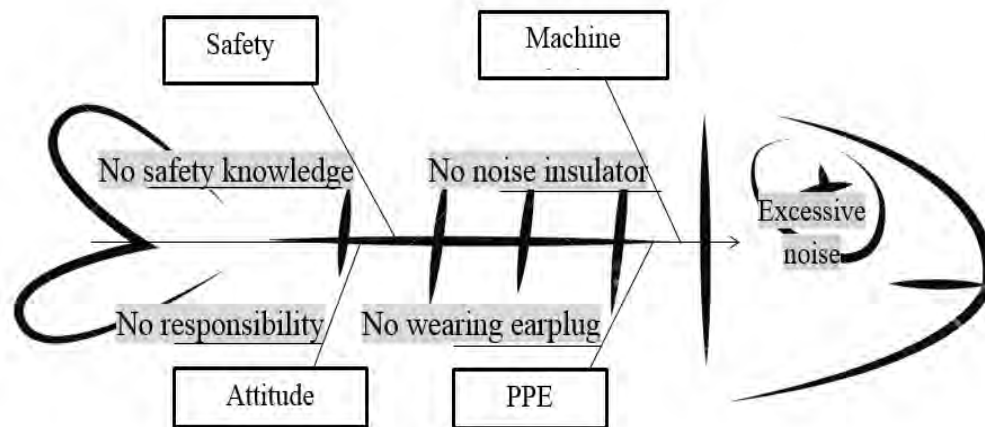


Figure 1.1: Cause and effect of excessive noise.

### 1.2.1 Safety

The operators should aware about the safety when working in the manufacturing industry especially in noise workplace. The operators without safety knowledges about noise could be having serious hearing loss when doing his responsible tasks in long period. Hence, the company should give several trainings, briefing about the job scope and delivering some knowledges about the Standard Operation Procedures (SOP), material handling and Personal Protective Equipment (PPE) to avoid them from the hazard.

### 1.2.2 Attitude

Attitudes of operators are important to carry out their tasks. The attitude of not concerning, irresponsibility and lack of self-motivation can lead to the lower productivity and lower efficiency. In the end, the health and life of the operators also may in risky if they are not taking serious of their responsible in their task. Hence, the Human Resource (HR) department should observe the employees' performance from time to time.

### **1.2.3 Machine Design**

The poor design of metal stamping machine produced high excessive of noise. This excessive of noise not only affect the productivity and efficiency of operators, the health of worker affected. The noise insulator is important to help in reducing the excessive noise that harm to operators.

### **1.2.4 Personal Protective Equipment (PPE)**

PPE playing an important role when doing a task related to the health and life of the operators. It helps to reduce the risk to the operators when carry out their task. Normally, the PPE used is wearing earplugs. Unfortunately, most of the company are not concern about the health of operators and not providing the PPE to the operators. However, some company are provided PPE to the operators but the operators itself complained that wearing earplugs causing them to felt uncomfortable. As a consequence, this practice may lead to operators hearing loss.

## **1.3 Objectives of Study**

The purpose of this study is to design a noise insulator for metal stamping workstation in manufacturing industry. Hence, the objectives are:

- a) To investigate workstation that produce excessive noise in a metal stamping company.
- b) To assess the level of noise at various workstations in a metal stamping company.
- c) To design a noise insulator to reduce the excessive noise produced by metal stamping machine.

## **1.4 Scope of Study**

This study is focused at the excessive noise exposed by the operators in a metal stamping company. The level of noise produced by metal stamping machines are measured using sound level meter during the operators operating their daily tasks. The data is collected when the day-shift only. Hence, the engineering techniques to control the noise level was applied to design a noise insulator for reducing the noise level.

## **1.5 Limitation of study**

The limitation of this study is designing the noise insulator in a model scale. Consequently, the noise insulator model is used to evaluate the level of noise that can be minimized. It is not fabricate and assemble to the metal stamping machine. The actual implementation depends on the willingness of the company, whether they want to assemble it or not.

## **CHAPTER 2**

### **LITERATURE REVIEW**

This chapter is discusses the literature review of the study. This chapter is performed through the online databases like journals, books, thesis and other related sources to this study. The information discussed will be used in the methodology and discussion of the study to achieve the feasible results based on the objectives of the study.

#### **2.1 Investigation of Workstations that Produce Noise in Metal Stamping Industry.**

##### **2.1.1 Manufacturing Industry**

According to the Ministry of Human Resources Malaysia, (2010), in the Malaysia's industrials and economic developments, the metals manufacturing industry plays the significant part of developments. The most of the developments are focused in the fabricated metals sub-sectors. Basic metals subsector includes the manufacture of primary iron and steel that including the manufacture of structural metal products, tanks, reservoirs and steam generators. Meanwhile the processes involved are:

- a) Mold and die
- b) Machining
- c) Metal casting
- d) Metal stamping

- e) Heat treatment
- f) Surface treatment or finishing
- g) Metal fabrication

### **2.1.2 Metal Stamping Operation**

According to the Art Hedrick (2009), metal stamping operation is the formation and cutting sheet metal into a desired or designed shape. The three basics metal stamping operations are the sheet metal from which the part to be made, the stamping die and the stamping press. Normally, the processes are hot stamping while cold stamping or forming mostly are done by sheet metal stamping operations. However, although the stamping is known as cold stamping or forming process, but the heat is still generated due to the friction when the cutting or forming between the die and raw materials.

### **2.1.3 Noise Exposure at Metal Stamping Workstation**

Based on the Mokhtar et al. (2007), any sound which is annoying or level of sound exceeds 75 dBA may be conceived as noise. The effects from the noise exposure are counting the sensitivity and psychological of a person. Noise can affects a person to be bad feelings, feeling of surprise and frustration. Noise also affects the quality of sleeping, shallow sleep or rest time and make it difficult to hear other sound. The effects of noise causing a short-term or long-term changes in the body and hearing capability. These causing the effectiveness of the human sensory and feeling capabilities to be reduced.

According to World Health Organization (WHO) (2010), noise is known as one of the occupational health hazards in the industrial work environment such as the textile, metal and chemical industries. Noise from the working environments and reach the workers' ears by several methods like reflection of other surfaces, directly through the surrounding

air, vibration through the building wall or supporting items in the workplace. Hence, the industrial noise badly affects the workers and facing the various unawake health problems physically, psychologically and socially.

High impact noise pressure levels are produced by automation presses under operation. Each time the press of hammer on the metal sheet, a large amount of energy is released that is produced noise. The stamping process is basically noisy, and radiates large amounts of sound energy directly to the surrounding areas (Azevedo et al., 2005).

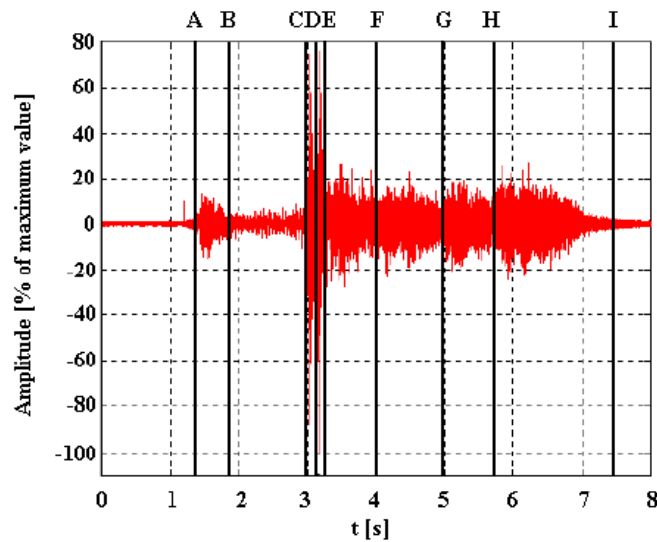


Figure 2.1: Noise time history signal acquired in front of press (Source: Azevedo et al., 2005).

Based on the Figure 2.1 from Azevedo et al. (2005), the noise observed at the initial phase (A-B), although presents in lower level value. The hammer produced the highest noise level phases are hammer impact (C-D) and material fracture (D-E). The following period (E-H) also produced vibration levels and noise as a consequence of the hammer impact. Deceleration and braking of the hammer (H-I) also produce noise and the level values are equivalent to those of the preceding phase.