



Faculty of Manufacturing Engineering

ANALYSIS WORKING POSTURE AND PSYCHOPHYSICAL FACTOR IN STAMPING INDUSTRY USING RULA METHOD

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Master of Manufacturing Engineering (Industrial Engineering).

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**ANALYSIS WORKING POSTURE AND PSYCHOPHYSICAL
FACTOR IN STAMPING INDUSTRY USING RULA METHOD.**

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A thesis submitted

**In fulfilment of the requirements for the degree of Master Manufacturing
Engineering (Industrial Engineering).**

Faculty of Manufacturing Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2014

DECLARATION

I declare that this thesis entitled “Analysis Working Posture and Psychophysical Factor in Stamping Industry Using Rula Method.” is the result of my own research except as cited in the references. The thesis has not been accept for any degree and is not concurrently submitted in candidature of any other degree.

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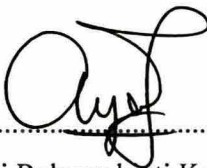
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APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Master of Manufacturing Engineering (Industrial Engineering).

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DEDICATION

This thesis is dedicated to my beloved mother, husband and family. They have been a source of motivation and strength during moments of despair and discouragement, support has been shown in incredible ways recently.

ABSTRACT

Nowadays, many industries unconcerned on ergonomics factor in their employee while doing job in manufacturing process. Stamping is one process in manufacturing industry that involves a lot of works by using position in standing. This study carried out to study working postures or conditions of operators suffering from musculoskeletal disorders, back pain, due to unscientific postures and movements during stamping processes others. Besides that, analysis physiological assessment for existing and improved postures or conditions. Workstation design proposal that have just been done for prevent work related musculoskeletal disorder. Apart from that, improvement in working posture or conditions is carried out. These studies use some methods to makes analysis and improvement. Among method used is through studies by using survey questionnaire form and observation in stamping industry. For analysis physiology, method used is Rapid Upper Limb Assessment or RULA form and Recommended Weight Limit or RWL. To get suitable design workstation, data collection needed. Data collection made at workers in stamping department through taking of anthropometry data, then use analysis RULA and Computer-Aided Three-Dimensional Interactive Application or CATIA. Improvement working posture or conditions does by using analysis through CATIA software. After improvement made, score about body posture could be reduced from score that is high to low. This is to giving condition or body posture that is safer when doing works at stamping in industry.

ABSTRAK

Kebanyakan industri pada masa kini tidak mengambil berat tentang faktor ergonomik pada pekerja mereka semasa kerja dilakukan dalam proses pembuatan. hentakan merupakan salah satu proses dalam industri pembuatan yang banyak melibatkan kerja-kerja dengan menggunakan posisi berdiri. Kajian ini dilakukan adalah untuk mengkaji posisi kerja atau keadaan pekerja yang mengalami gangguan otot, sakit belakang akibat postur tidak saintifik dan pergerakan semasa proses hentakan dan lain-lain. Disamping itu, analisis penilaian fisiologi yang sedia ada dilakukan untuk penambahbaikan pada keadaan postur. Cadangan rekabentuk stesen kerja yang baru dilakukan untuk menghindari kerja yang berkaitan dengan gangguan otot. Selain itu, cadangan penambahbaikan dalam postur atau keadaan kerja dilakukan. kajian ini menggunakan beberapa kaedah didalam membuat analisis dan penambahbaikan. Antara kaedah yang digunakan adalah melalui kajian dengan menggunakan borang soal selidik dan pemerhatian di industri penghentakkan. Untuk analisis fisiologi, kaedah yang digunakan adalah perincian perincian pada atas anggota badan (RULA) atau borang RULA dan pengiraan had berat yang dibenarkan (RWL). Untuk mendapatkan rekabentuk stesen kerja yang sesuai, pengumpulan data diperlukan. Pengumpulan data yang dibuat pada pekerja di bahagian penghentakkan melalui pengambilan data antropometri, kemudian menggunakan analisis RULA dan perisian aplikasi interaktif tiga dimensi berbantu komputer (CATIA). Penambahbaikan postur kerja dibuat dengan menggunakan analisis melalui perisian CATIA. Selepas penambahbaikan dibuat, perincian berkaitan postur badan dapat dikurangkan daripada perincian yang tinggi kepada rendah. Ini adalah untuk memberikan keadaan postur badan yang lebih selamat semasa melakukan kerja-kerja dibahagian hentakan di industri.

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LIST OF ABBREVIATIONS

AM	-	Asymmetric multiplier
CATIA	-	Computer-Aided Three-Dimensional Interactive Application
CM	-	Coupling multiplier
DM	-	Distance multiplier
EMG	-	Electromyography
FM	-	Frequency multiplier
HM	-	Horizontal multiplier
L	-	Actual weight
LC	-	Load constant
LI	-	Lifting index
MMSB	-	Miyazu Malaysia Sdn Bhd
MSD	-	Musculoskeletal disorder
MSDs	-	Musculoskeletal disorder
RULA	-	Rapid Upper Limb Assessment
RWL	-	Recommended weight limit
WMSD	-	Work-related musculoskeletal disorders
VM	-	Vertical multiplier

CHAPTER 1

INTRODUCTION

1.1 Background of study

Manufacturing process plays an important role in producing a good product. There are various types of processes in the manufacturing process. Among the process is material removal, forming, joining process and material additive. Forming process means changing the shape of existing solid body. The body, which is called the workpiece, stock or blank may be in the shape of a plate, a sheet, a bar, wire or tubing of various cross-section. Forming process include process of rolling, forging, extrusion, drawing and sheet metal forming or stamping. In sheet metal forming or stamping also include process such as shearing, blanking, punching, bending, deep drawing, spinning and roll bending.

In industrial workplaces, many workers perform processes jobs in standing position for a long period of time. Working in standing position can be linked to versatility because the mobility of legs position and having large degree of freedom. This working position promotes workers to be more efficient and productive. Such advantages contribute high value for company profits. However, standing in a long period of time can lead to discomfort, muscle fatigue, and occupational injuries to workers (Halim and Omar, 2011).

Working activities in stamping industry can contribute risk factor and injuries such as back, arm, wrist and shoulder. The main risk factors associated with the development of injuries include awkward posture (e.g bending, twisting), repetitive motions (e.g lifting, carrying) and forceful exertions. Musculoskeletal disorder or MSD as show in figure 1.1 is

type of injury that include damage to muscle, tendons, ligament cause by long time exposure to back injury, shoulders, hand, wrist and other parts of body. Various methods are found to assess the postures, motion and force exerted while performing a job or task and their effect on physical capability of a worker.

This study will be done at Miyazu Malaysia Sdn. Bhd, (MMSB), Tanjung Malim, Perak Darul Ridzuan was selected to perform the data collection through the company visit. MMSB is a company that development and manufacture of automotive tools. The company also provides services relating to dies, moulds and jigs. The company use process where it is related standing position. So, from the workers at this company Rapid Upper Limb Assessment or RULA by manual calculation and CATIA software to determine of Work-related musculoskeletal disorders (WMSD) will be done.

According to previous research from Halim and Omar 2011, the workers have experienced discomfort in one or multiple body parts (neck, shoulder, back, elbow, hand, hip and knee), pain in the joints, tingling, and swelling of working person in stamping industry. An ergonomic improvement is changes made to improve the fit between the demands of work task and capabilities of worker. There are two type of ergonomic improvement that is engineering improvement and administrative improvement. These studies also focusing on engineering improvement which modifies or propose the new work station design for prevent work-related musculoskeletal disorder.



Source: www.csao.org



Source: www.healthandsafetyontario.ca



Source: www.torridgemedical.co.uk



Source: www.aullmd.com

Figure 1.1: Example Types of Injury From Musculoskeletal Disorder

1.2 Problem Statement

In stamping industry, almost all jobs are practically to be performed in standing position (Halim et al., 2012). As a common symptom, worker who performs processes jobs in a long duration of standing may experience discomfort in the legs, neck and shoulder (Halim and Omar, 2011). These activities in stamping industry give risk factor and injuries. If this situation continues, it can make injuries such as back, arm, wrist, neck, shoulder and others. Besides that, it is also can make the position of workers working in stamping

industry get worse or facing various problems. Work station also give effect to the workers position or posture after workers doing the same job or repetitive at long period of time.

Industries in Malaysian, manual tasks using human labor such as lifting, loading and unloading are still widely used in production process due to highly flexible and cheap labors. However, most of the industrial workers are exposed to repetitive task, prolonged work and pain because of awkward postures that often lead to muscle fatigue and musculoskeletal discomfort among those workers. To overcome this problem, a study will be performed using surveys questionnaire or observations and RULA score method to the stamping industry. Hence, CATIA software will be used for RULA assessment for worker posture and suitable workstation design with job studied. Recommended weight limit (RWL), Minitab or SPSS form also will be used to analysis Psychophysical factor.

1.3 Objectives

The goal of this study is to:

- i. To study working postures/ conditions of operators suffering from musculoskeletal disorders, back pain, due to unscientific postures and movements during stamping processes etc.
- ii. To analysis physiological assessment for existing and improved postures/ conditions.
- iii. To propose the new workstation design for prevent work related musculoskeletal disorder.
- iv. To suggest improvements in their working postures/ conditions.

1.4 Scope

The purpose of this research is to analyze working posture and psychophysical factor in stamping industry using RULA method. This study use surveys questionnaire or observations and RULA score method to give to the workers in the stamping industry. From Surveys questionnaire, it will be analyze with Minitab or Statistical Package for the Social Sciences (SPSS) form. This Minitab or SPSS form will be used to analysis Psychophysical factor. Besides that, CATIA software will be used for RULA assessment for worker posture and to see suitable workstation design with job studied. Further analysis on all aspects of manikin posture was performed by using CATIA. Whole body and localized postures can be examined, scored, iterated, and optimized to determine operator comfort and performance throughout the complete range of task motion in accordance with published comfort databases. Color-coding techniques ensure that problem areas can be quickly identified and iterated to optimize posture. From all method use, it will determine or suggest suitable working posture or condition. Also to solve musculoskeletal disorder (MSD) during stamping processes and to give some idea or design new workstation to prevent work related musculoskeletal disorder (MSD).

1.5 Activity Planning

The activity planning is a guiding to manage the time to finish all tasks. Duration of time for each step to research will be shown. Based on this table, the process of research will be better organized within the time period specified in accordance with plans that has been made. Refer to appendix A1 and A2.

CHAPTER 2

LITERATURE REVIEW

2.1 Stamping industry

Sector industries especially from manufacturing such as stamping have many types of operation or process. Given the proper tooling, metal-stamping presses can perform a multitude of part-shaping operations. Stamping processes to be used for a panel depend on its design. However, normally the processes used extensively are blanking, piercing, notching, bending, drawing coining and others. Research on Metal- stamping presses and stamping operations (Lou, 2011) definition of the operation such as blanking is cutting flat sheet metal into a defined size and shape. Typically performed in one hit of the press, the result may be a finished part or a blank destined for further forming or processing into its final shape. Piercing is similar to blanking, the pierced piece instead is scrapped, with the surrounding material as the part. Notching is similar to piercing, but material is removed from the edges of the workpiece. Bending sometimes referred to as forming, tooling bends workpiece material into various angles. Drawing is the press essentially stretches sheet metal to a depth. Coining is the die forms an imprint on the workpiece.

Many of workers in the automotive industry work in stamping. Stamping is an industry that requires a standing posture. Halim and Omar (2012) classify a standing posture, especially when workers handle heavy equipment and products, reach for materials and goods, and push and pull excessive loads. These jobs are nearly impossible to do in a sitting posture. Standing upright for a long time can be attributed to the decrease