UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Ergonomic Evaluation of Manual Load Lifting In Metal Industry

Thesis submitted in accordance with the partial requirements of the Universiti Teknikal Malaysia Melaka for the
Bachelor of the Manufacturing Engineering (Management)

By

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Faculty of Manufacturing Engineering
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DEDICATION

Specially dedicated to my beloved father, Mohd Alias B. Loman and my mother, Rafiah Bt. Jaafar and who are very concerns, understanding patient and supporting, thank you for everything to my supervisors, Mdm. Seri Rahayu Bt. Kamat, Mr Johny Purnomo, Mr Zaibidi, my brothers and all my friends. The work and success will never be achieved without all of you.

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ABSTRACT

This paper gives the study on ergonomic evaluation of manual load lifting for metal industries. This study is done at Winco Precision Engineering Sdn. Bhd. This study is on ergonomic topic with focused on manual load lifting when working in metal industries. The study consists of analyze the improper lifting by using the computer software and implementation of safe load lifting in this factory. Several data was having taken in order to analyze the posture of manual load lifting before and suggestion right posture for implementation. The right posture of manual load lifting was implemented at the CNC machines which produce a roller piston, line 7, 6, 5 and 21. There are optimum manual load lifting have been provide from literature review and analyze in order to implement at specified line. From the picture that showed the real of problem, the angle part of body was finding and then simulated it into CATIA software and 2D Static Strength Biomechanical Tool. Then, these software's have showed the finding results from according to angle posture of worker's body and load weight that they have lifted. The conclusion and potential task modification would have given by these software's too to improve and to prevent any injuries that would happen to workers when done a manual load lifting activities. The results will be used as purpose to represent a recommendation and improve the manual load lifting task in any company using the ergonomic concept.

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ABSTRAK

Kajian ini membincangkan penilaian tentang mengangkat beban secara manual di kilang membuat produk berasaskan besi. Mengangkat beban secara manual adalah aktiviti yang biasa dilakukan di dalam industri. Begitu juga dalam industri pembuatan besi. Besi adalah logam yang mempunyai kadar ketumpatan yang tinggi dan beratnya juga berkadar terus dengan kadar ketumpatan yang tinggi. Aktiviti mengangkat beban secar manual ini didefinisikan sebagai aktiviti yang melibatkan mengangkat, menolak, menarik, menggerakkan, memegang atau menahan objek. Aktiviti mengangkat secara manual memerlukan penggunaan tenaga yang banyak seperti aktiviti mengangkat kotak atau menolak barang yang berat. Terlebih dahulu, kajian dibuat secara mendalam dan terperinci dengan membuat bacaan dan penyelidikan melalui artikel-artikel, buku-buku, majalah-majalah, jurnal dan internet. Gambaran mengenai penyelidikan ini secara ringkas diterangkan melalui gambarajah haluan proses penyelidikan di dalam tajuk bahagian kaedah penyelidikan. Kajian ini bermula dengan mengenal pasti masalah kajian, dan disertakan dengan penetapan objektif dan skop kajian. Kemudian, maklumat dikumpulkan bermula daripada soal selidik dan menyelesaikan masalah dengan pengambilan gambar postur tubuh pekerja semasa mengangkat beban. Analisis terhadap kesan mengangkat beban secara manual akan dibuat bermula dengan melakar sudut berpandukan kecondongan tubuh pekerja dan kemudian dipindahkan ke dalam CATIA dan Ergoweb dengan membina semula tubuh pekerja tersebut untuk dianalisa. Akhirnya keputusan yang diperolehi akan dijadikan cadangan untuk penambahbaikan aktiviti menangangkat beban secara manual menggunakan konsep ergonomik terhadap syarikat berkenaan.

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED, NOMENCLATURE

CATIA	-	Computer Aided Three dimensional Interactive Application
CNC	-	Computer Numerical Control
CTDs	-	Cumulative Trauma Disorders
EDM	-	Electrical Discharge Machine
EMG	-	Electromyography
L5/S1	-	Lumbar 5/ Sacrum 1
LBP	-	Low-Back Pain
LMM	-	Lumbar Motion Monitor
MAHTI	-	Minimal Acceptable Handling Time Interval
MMH	-	Manual Material Handling
MSDs	-	Musculoskeletal Disorders
NIOSH	-	National Institute for Occupational Safety and Health
PFM	-	Panasonic Foundry Malaysia
PRDM	-	Panasonic Refrigerator Device Malaysia
RMD	-	Repetitive motion disorders
RSI	-	Repetitive strain injuries
RULA	-	Rapid Upper Lamb Assessment

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CHAPTER 1

INTRODUCTION

1.1 The Project

The project is a study on ergonomic evaluation of manual load lifting in metal industry at WINCO Precision Engineering Sdn Bhd in Melaka. This project is specified to use production line 7 as a project area.

There are some problems about ergonomic can be found in this company. When the products have been finished machining by Computer Numerical Control (CNC) machine, the worker put them into paper boxes. These boxes become heavier than earlier if they were fulfilled by the products and ready to send to customer. The worker needs to lift the heavy boxes from work rack to the table and after the table is full with boxes, they are moved from the table to the trolley. The condition was become more worst because the work rack is lower than worker waist level and the trolley too.

The main objective of this project is to improve the manual load lifting by evaluate it with computer software to prevent the low back pain for worker.

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1.1.1 Winco Precision Company

Winco is a company that known as specialist in CNC machine (computerized numerical control), first established in Singapore in 1988 and function as buyer and seller metal processing equipment. In 1992, Winco start to expand their territory by opening new branch in Taman Teknologi Cheng. Starting from 5 lathe CNC machine and one CNC milling machine, Winco develop from day to day till today and Winco Melaka now have about 50 CNC lathe machine and 10 CNC milling machine.

Figure 1.1 Winco Company main building

Figure 1.2 Winco Quality policies

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The product that produced in Winco is like Cylinder, Roller piston, Cylinder plate, Crankshaft, Bearing, Cylinder head and many more. That product was sort and given responsible under department and supervisor involve, which section function to control the production of related product, they also find a solution to improve product, jig & fixture and layout machine so productivity can increase.

1.1.2 The Organization Structure

Winco organization chart can be seen from table below:

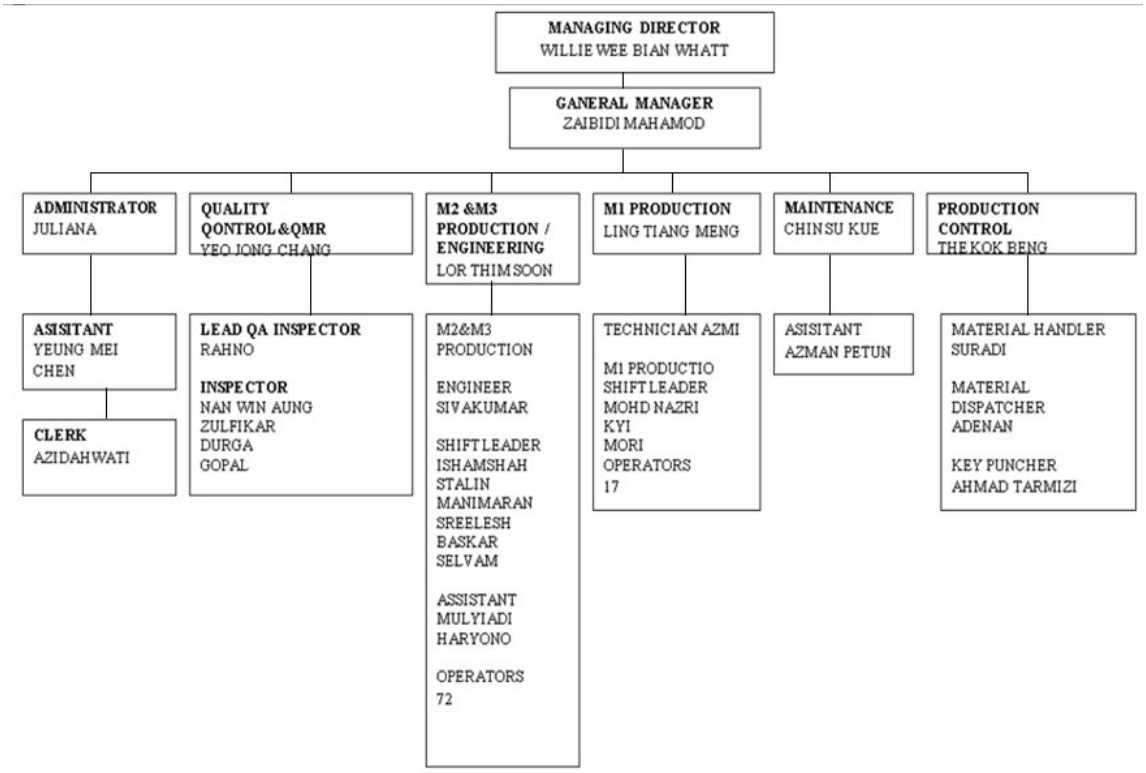

Figure 1.3 Winco Organization chart

Nowadays, Winco are very familiar in industries especially CNC machining industries in Malaysia and Singapore. Winco also provide effective cost and high quality product, this company is freely to accept tender for processing metal part for any shape and

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dimension as long as it is possible to produce. Beside that Winco have sufficient equipment to fulfill customer needed, example of equipment involve in this company is such as Precision CNC milling process, Precision auto lathe machine, Electrical discharge machine (EDM), Fabrication of tool and die spare and design & manufacturing jigs and fixtures.

Those CNC milling department service the replacement of mould and tool spare in industries where continuous replacement moulds spare are required. Winco are able to produce precise components up to 10 microns in customer's material specification. If there have product that require harder metal than cast iron, Winco also can produce it using EDM machine.

1.1.3 The Products

Product produce in Winco this lately usually relate with PFM (Panasonic Foundry Malaysia) PRDM (Panasonic refrigerator device Malaysia), other Panasonic and some company. But the most requests are from PFM and PRDM. Majority of the product was be used in manufacturing of refrigerator and air conditioner compressor. Many model produced for this product, one of them is show in picture below.

Figure 1.4 Roller cylinder

Figure 1.5 Cylinder plate

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In picture above is cylinder plate and person that responsible handle quality and productivity on this product also same as cylinder product, the major problem occur during machining this product is chamfer is doing manually using machine.

Figure 1.6 Cylinder heads

Figure 1.7 Bearings and crankshafts

1.1.4 The Project Area

Generally Winco has four sections that are named M1, M2, M3 and Wincast. M1 function more on storage of raw material to M2 and M3 but there are some roughing machine at there. Usually burr on raw material is removed using a kind of grinding machine in M1. While another section like M2 and M3 are functioning as a CNC

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machining place. M2 is more on CNC turning machining place and M3 is specialized on CNC milling machine.

Figure 1.8 Project area

M3 function as a drilling and taping section because more 50 percent machine placed in M3 is milling machine that used for drilling and taping. This section is the most problem section, this is because all machines here is high precision machine and need to supplies high maintenance and during process of changing of jig and fixture, it take a long time even more than lathe machine.

The specific area for this project is M2 at production line 7 which specialized produce roller piston products.

Figure 1.9 Roller pistons was packing in boxes

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It can be seen in line 21, line 7, line 16, line 17, line 18, and line 19. It is packed in paper box like in picture. After these boxes were full, their weight will increase average in around 20 kilogram and above. Usually, the workers lift these boxes by manual load as like using human body and force in awkward body position. They must bend their body when want to lifting the boxes because the position of boxes is lower than their waist.

1.2 Background Problems

There are usual problem was happening to the worker when doing a manual load lifting to move the finished product from work rack to other table. Then, those heavy items must lift from the table to trolley which has low lifting level range. The usage of this trolley type just can lift the heavy containers which have low leg support only. The problem is the worker must bend his trunk to take the heavy finish product from lowed rack, lifting and then twisting their body in order to load it onto table. After the table is full with box of finish products, they must lift all the heavy boxes to the unsuitable trolley (lowed trolley).

From the observation, guess that this experiment must going forward until get the result to solving the problem since the age of workers, comfortable characteristic and safety must be highlighted in order to improve the productivity without ignore the important things at above.

After they doing this job repeatedly in long time during working time, the effect to their body will occur during lifting and after finished the products in high quantity on everyday working. By using CATIA and Ergomaster software, it can determine an appropriate angel trunk, arm position and stability of leg during bending, lifting and twisting. In addition the suitable body posture and right way to doing the manual load lifting will be identified and the work culture can be improved as well.

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1.3 Objectives of Project

The objectives of this project are;

i) Make a survey for identify the effect of the worker when lifting.

ii) To analysis the condition of body while lifting a heavy load by a manual method.

iii) To provide suggestion and recommended for avoid any injuries during lifting a heavy object.

1.4 Scope of Project

This project will be done in metal industry Winco Precision Sdn Bhd Malacca. The analysis is more on manual load lifting activities in production line areas. Two software should be use to do the analysis of the manual load lifting problem are CATIA and Ergoweb based from observation and questionnaires. From the result, the recommendation can be done purpose regarding the result of the analysis.

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