UNIVERSITI TEKNIKAL MALAYSIA MELAKA

THE DEVELOPMENT OF SLITTING SHEET METAL MACHINE FOR WIRE MESH USING TOTAL DESIGN APPROACH

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

by

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **The development of slitting sheet metal machine for wire mesh using Total Design Approach**

SESI PENGAJIAN: **2014/2015 Semester 2**

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I hereby, declared this report entitled "The development of slitting sheet metal machine for wire mesh using Total Design Approach" is the results of my own research except as cited in references.

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Date : 05th June 2015

APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Design) (Hons.). The member of the supervisory is as follow:

……

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ABSTRAK

Menurut tajuk projek, objektif utama projek ini ialah bagaimana untuk melaksanakan keseluruhan pendekatan reka bentuk untuk menghasilkan produk. Selain itu, objektif juga menyatakan bahawa fabrikasi atau perkembangan mesin slit lembaran besi perlu dicapai menjelang akhir jadual projek. Dalam kajian ini, terdapat tiga pendekatan yang digunakan iaitu Pugh matriks, Kegagalan Mod Kesan Analisis (FMEA) dan Reka Bentuk untuk Perhimpunan Pembuatan (DFMA). Kaedah Pugh adalah satu proses reka bentuk untuk memilih konsep reka bentuk yang terbaik mengikut keperluan pelanggan. Di samping itu, proses reka bentuk mempunyai beberapa kaedah iaitu kaedah Pugh, Pahl dan model Beitz, Otto dan metodologi Wood, Ulrich dan Eppinger dan model Perancis. Analisis Unsur Terhingga (FEA) digunakan untuk mengumpul data hasil analisis. Data ini akan menunjukkan bahagian yang paling lemah yang perlu diperbaiki sama ada pada bahan atau reka bentuk. Bahan yang dipilih hendaklah memenuhi spesifikasi seperti daya tahan, menyerap getaran dan tekanan tinggi di bawah beban tekanan. Selepas itu, integrasi antara matriks Pugh dan Kegagalan Mod Kesan Analisis (FMEA) kaedah yang digunakan untuk meningkatkan reka bentuk pisau dan batang besi. Terdapat tiga reka bentuk konsep membincangkan dalam bahagian ini untuk pemilihan terakhir bilah pisau dan batang aci. Akhir sekali, pendekatan yang digunakan ialah reka bentuk bagi Perhimpunan Pembuatan. Dalam pendekatan ini, reka bentuk terkini daripada dua reka bentuk pendekatan yang merupakan kaedah matrik dan FMEA Pugh dianalisis dalam kaedah DFMA. Objektif menggunakan kaedah DFMA dalam kajian ini adalah untuk mengurangkan bahagian dan pembuatan kos. Keluaran projek itu dijangka akan diperlukan untuk memenuhi objektif yang ditetapkan. Hasilnya adalah fabrikasi penamat slit mesin lembaran logam untuk wire mesh. Selepas selesai proses fabrikasi, mesin itu dihantar ke TR Technology Sdn, Bhd bagi pekerja yang digunakan dalam talian produksi mereka.Di samping itu, hasil yang dijangka juga perlu memenuhi keperluan pelanggan dan mendapatkan kepuasan pelanggan. Ia akan menjadi jelas bahawa kaedah yang digunakan oleh penyelidik sesuai untuk menghasilkan produk.

ABSTRACT

The main objective of this project is how to implement the total design approach to produce the product. Besides that, the objective also stated that the fabrication or developments of Slitting Sheet Metal Machine need to be achieved by the end of project schedule. In this study, there are three approaches used which is Pugh matrix, Failure Mode Effect Analysis (FMEA) and Design for Manufacturing Assembly (DFMA). Pugh method is a design process to select the best design concept according to customer requirement. In addition, the design process has several methods which is Pugh method, Pahl and Beitz' model, Otto and Wood methodology, Ulrich and Eppinger and French model. Finite Element Analysis (FEA) is used to collect the data of analysis result. This data will show the weakest part that needs to be improved either on the material or the design. Plus, the material chosen must consists of several specifications such as resistant to force, absorb the vibration and high pressure under stress load. After that, the integration between Pugh's matrix and Failure Mode Effect Analysis (FMEA) method is used to improve the designs of blade and shaft. There are three concept designs discussed in this section. The result from the approach is to select the best design of blade and shaft that is potential failure to the product. Lastly, the approach used is Design for Manufacturing Assembly. In this approach, the latest design from two designs approach which is Pugh's matric and FMEA method is analyzed in DFMA method. The objective using DFMA method in this study is to reduce the part and manufacturing cost. The output of the project is expected to be required to meet the objectives set. The result is fabrication of slitting sheet metal machine for wire mesh and testing it to achieve the process of slits the wire mesh. After complete the fabrication process, the machine is sent to TR Technology Sdn, Bhd for the workers used in their productions line. In addition, the expected outcome should also meet the needs of customers and gain customer satisfaction. It will be evident that the methods used by researchers suitable for producing a product.

DEDICATION

This report is dedicated to my parents, brothers and sisters for their endless love, support and encouragement. I also dedicate this work to my supervisor and friends who have supported me throughout the process. I will always appreciate all they have done. Thank you.

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First of all, I would like to express my thankfulness to Allah S.W.T the Almighty because I manage to finish this Final Year Project on time. With full of His merciful, now I am writing this report of this project.

I also like to state my gratitude to my supervisor for his assistance and guidance in producing this report and giving me his constructive comments, guidance, patience and encouragement until the completion of this report. Besides that, I would like to express my thankfulness to my parents and friends for their continuous supports and advices in complete the report.

I hope that this project report will fulfill the conditions as requested in Final Year Project in UTeM.

Thank You.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

UTeM	=	Universiti Teknikal Malaysia Melaka
2D	=	Two Dimensional
3D	=	Three Dimensional
PDP	=	Product development process
PDS	=	Product Design Specification
PM	=	Pugh Matrix
CPS	=	Creative Problem Solving
FEA	=	Finite Element Analysis
CAD	=	Computer Aided Drawing Design
FEM	=	Finite Element Method
BOM	=	Bill of Materials
FMEA	=	Failure Mode Effect Analysis
SEV	=	Severity
OCC	=	Occurrence
DET	=	Detection
RPN	=	Risk Priority Number
DFMA	=	Design for Manufacture Assembly
DFM	=	Design for Manufacturing
DFA	=	Design for Assembly
CE	=	Concurrent Engineering
AEM	=	Assemblability Evaluation Method

CHAPTER 1
INTRODUCTION

This chapter discusses the background of the project, problem statement, objective and scope of the project.

1.1 Background of Project

This project is industry project with concerned of collaboration between UTeM committee and TR Technology to solves a problem that occurs in a factory. TR Technology Sdn. Bhd. is located at Seksyen 16, Shah Alam, Selangor. This factory runs a business based on the process of stamping and cutting. Among the activities run in this factory is the process of cutting wire mesh sheet metal. According to their problem, they are still using old-fashioned scissors wire for cutting process of wire mesh. By using this conventional method, it has had wasted the time and cost, the workers' energy, productivity and the output of the product. To solve of the factory problems, the researcher used a framework of different approach which is Pugh matrix in Design Process method, Failure Mode Effect Analysis (FMEA) and Design for Manufacture Assembly (DFMA).

Using this approach, the design of slitting sheet metal machine for wire mesh will be through several steps before achieve the final design. In Pugh Matrix, there are three concept designs that used datum design as reference to select the best design. After that, FMEA is used to determine the potential failure of part in selected part of concept design. Lastly, DFMA approach is used to reduce the number of part, manufacturing cost and improve the design.

1.2 Problem Statement

TR Techonology Sdn. Bhd is the company of stamping machine industry, which also produces an automotive part. In industry we call as this factory as vendor company. This means that the vendor monitors the buyer's inventory and makes periodic resupply decisions regarding order quantities, shipping, and timing (Matt et al., 2001). At the TR Technology Sdn. Bhd, the wire mesh sheets metal cutting process is still done by using the conventional method which is using metal scissor cutter. After trough cutting process, this part will be process to produce a mold for filter casting in car engine. Figure 1.1 shows the worker at the company stills using metal scissor cutter to cut the wire mesh.

Figure 1.1: Conventional cutting method

To overcome the problem in TR Technology Sdn. Bhd. Their manager has asked UTeM committee to assist in development of slitting sheet metal machine for wire mesh. This product will reduce the lead time and increase the productivity. The problem is to design the slitting machine that has not yet available in industry. It also must meet with customer requirement. There also other problem occurs in this factory which is:-

i. Ineffective cost production and strategies to increase the productivity.
ii. Need to be competitive in market with further concerted effort.
iii. The target level in their production did not achieve as production level.