DEVELOPMENT OF FLAT BAR GAUGE USING TOTAL DESIGN APPROACH

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

by

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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 (Manufacturing Design) (Hons.). The member of the supervisory is as follow:

……

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ABSTRAK

Projek ini adalah berkaitan dengan pembangunan konsep rekabentuk *jig* (tolok) untuk membantu dalam kerja pemeriksaan kualiti bar rata menggunakan kaedah *"Total Design"* yang merangkumi proses pemasaran, spesifikasi rekabentuk produk, konsep rekabentuk, perincian lukisan, pembuatan, dan akhir sekali mewujudkan sifat dan ciri-ciri produk yang akan dibuat melalui penyelidikan pasaran. Objektif projek ini adalah untuk membangunkan *jig* bar rata (tolok) untuk rekabentuk produk dan pembangunan pemilihan konsep untuk memilih rekabentuk yang sesuai. Seterusnya adalah proses mereka bentuk dengan menggunakan *Solidwork 2011*, dan akhir sekali adalah untuk membuat 3D prototaip dengan menggunakan mesin 3D printer. *"Total Design"* digunakan untuk menyelesaikan masalah dan mendapatkan rekabentuk dengan menggunakan kaedah *"Pugh Method"*. Selepas itu konsep lakaran digunakan untuk menjana idea untuk rekabentuk *jig* (tolok). Pemilihan konsep dijalankan untuk mengenal pasti konsep rekabentuk yang paling sesuai boleh dipilih sebagai konsep akhir. Dengan menggunakan perisian rekabentuk *SolidWorks 2011*, konsep akhir dilukis dalam bentuk tiga dimensi (3D) dan seterusnya menghasilkan 3D prototaip dengan menggunakan mesin 3D printer. Kemudian prototaip akan diuji keberkesananya dengan menggunakan flat bar yang sebenar. Manakala pada bahagian keputusan dan perbincangan menunjukkan perbandingan kedudukan pemilihan rekabentuk, ciri-ciri bahan yang digunakan dan ujian analisis terhingga, factor yang memberi kesan selepas melakukan penambahbaikan, dengan menggunakan "*Gauge Go/No Go",* perbandingan kitaran masa sebelum dan selepas, alat-alat pengukuran, perbandingan kos, proses pengukuran dan pengurangan bilangan kerja,

Untuk cadangan pada masa akan datang adalah menggunakan mesin *"Selective Laser Sintering (SLS)"* proses untuk membina prototaip. Ini kerana SLS adalah salah satu AM mesin yang terbaik untuk menghasilkan prototaip dengan beberapa manfaat seperti ciri-ciri mekanikal yang lebih baik dan permukaan yang baik.

ABSTRACT

This project is related to the development of design concepts jig (gauge) to assist in the work of quality inspection flat bar using the "Total Design" which includes marketing, product design specifications, concept design, detail drawings, manufacturing, and finally realize the nature and characteristics of products to be made through market research. The objective of this project is to develop the jig flat bar (gauge) by using the "Total Design. Various design activities were employed such as Solidwork 2011. “Total Design" is used to solve problems and get the design by using the "Pugh Method". After that, concept sketches used to generate ideas for the design of jigs (gauge). Concept selection is carried out to identify the most appropriate design concept can be selected as the final draft. By using design software SolidWorks 2011, the final draft is drawn in the form of three-dimensional (3D) and thus produce a 3D prototype using a 3D printer machine. For the expected result, a new design of Flat bar jig (gauge) prototype were developed by using 3D printer machine. Then the prototype was tested effectiveness by using actual flat bar. While, on the results and discussion shows comparison of ranking for selection design, material properties for selection design, finite element analysis, factor that effect the improvement by using go/no go gauge, cycle time comparison between before and after, inspection tools, cost comparison, inspection process and reduce the number of job. To reserve for the future is to use the machine "Selective Laser Sintering (SLS)" process to build a prototype. This is because SLS is one of the best AM engine for producing prototypes with several benefits such as mechanical features better and good surface.

DEDICATION

Especially to my beloved parents and whole my family thank you very much to give me fully support, and also for my respective Lecture and my Supervisor Associate Professor Engr. Dr. Hambali Bin Arep@Ariff , thank you so much for teaching and guided me. Last for my friends, I appreciate for your support. And all people participate also thank you very much.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

3D	-	3 Dimensional
SLS	-	Selective Laser Sintering
AM	-	Additive Manufacturing
FKP	-	Fakulti Kejuruteraan Pembuatan
TNB	-	Tenaga Nasional Berhad
QC	-	Quality Control
PDP	-	Product Development Process
PDS	-	Product Development Specification
EDM	-	Electrical Discharge Machining
SESG	-	Systems Engineering Study Group
FMC	-	Federal Maritime Commission
CAD	-	Computer Aided Design
PSM	-	Projek Sarjana Muda
MM	-	Millimetre
PDD	-	Product Design and Development
RP	-	Rapid Prototyping

CHAPTER 1

INTRODUCTION

This chapter provides the history of the task. The jobs concentrate on the development of the conceptual jig of the flat bar measure making use of complete Design approach. This chapter additionally describes the issue declaration, used by the goal, and scopes of the task.

1.1 Background

These days, the technology expand extremely quickly. Production sector, especially impacted by this circumstance to help manufacturing to fulfill greater customer need. In the item development procedure, designers as a crucial part in finding brand new tips, in purchase to resolve the issues faced by the employees. Mass manufacturing is meant to boost efficiency in purchase to reduce the product expense of the item. Therefore, to attain objectives those need tools to help the manufacturing and fulfil the market need. In production works, a jig is a kind of custom made device used to guide and locate the workpiece. The function of a jig is to offer accuracy, repeatability, and interchangeability in the production of items (Henriksen and Erik Karl, 1973). The usage of jigs and fixtures is related and similar that the terms are often used or confused interchangeably. The distinction is in the method the device is directed to the work piece. A jig is a unique product that holds, aids, or is put on a

component to be machined. The jig is maybe not just locates and keeps the workpiece but additionally guides the cutting device although the procedure is done. Jigs are generally prepared with hardened metal bushings for directing drills or other cutting tools (Hoff man, 2011). An installation is utilized for locates, keeps, and supports the work firmly so the needed machining. Another device such as set obstructs and feeler or depth gauges are utilized with fixtures as guide the cutter to the workpiece (Hoff man, 2011). There are numerous kinds of jigs, every kind is custom made to-do a certain work. Numerous jigs are developed because there's a necessity to-do by the tradesmen. Some are made to boost efficiency through persistence, to do repeated tasks or to do a work much more exactly (Hoff man, 2011). Flat bar is one of the components that are put with triangular for Tenaga Nasional Berhad item. Flat bar is an item ensuing from the stamping procedure. The function of flat club is to help the human body of triangular from greater load although the programs.

1.2 Problem Statement

The issue examined in this research is associated to quality assessment and efficiency issues at the manufacturing line for flat bar component. Flat bar is a component ensuing from the stamping procedure. Flat bar is one of the triangular for TNB components positioned at the part of triangular. Because of quality issues usually happen, this interferes using the smooth manufacturing of the items. This might be because the quality of the assessment procedure is nevertheless making use of the conventional technique by hand in the assessment procedure and calls for a QC inspector to carry out these obligations. Quality of the human being assessment procedure is not possible at a time as soon as the manufacturing procedure is in progress because it takes time lengthy time. Hence, the manual method is no longer relevant to be use at present because there's method or tool had been designed and fabricated in the present. Then to enhance the productivity and quality to create a good product and a constant, technique or new ideas require to be created to change the conventional manual technique. In addition, it additionally can reduce the work and time assessment carried out by QC inspector.

1.3 Objective

The main objective is to develop conceptual of flat bar gauge using 3D printer. To more specific of this project are:

a) To identify concept design that suitable for flat bar gauge by using Solidwork Software.

b) To develop the gauge prototype in order to improve the production line.

c) To compare old inspection method and new inspection method of purpose flat bar gauge.

1.4 Scope of Project

This project focuses on the design of conceptual jigs (gauge) for flat bar by using Total Design Approach. This project is not described about process selection. The Total Design Approach method are used as problem solving and as guideline to identify the design principle. Product design and development is used for concept selection to select the suitable design concept of jig (gauge) for the flat bar. As the result, SolidWorks 2011 software is used to design in 3 dimensions (3D) and to fabricate the gauge in order to improve the production line.

CHAPTER 2

LITERATURE REVIEW

Chapter 2 consists all the data and information which related to study about development of conceptual gauge for flat bar using "Total Design Development" approach. This chapter also discussed about jigs and fixtures, detail of product "Flat bar", and also Total Design Development as method in this project. In addition, product design and development method is described for concept selection of gauge. Finally, Software SolidWorks 2011 is described as a tool for design in solid modelling 3D.

2.1 Jigs and Fixtures

Jigs and fixtures are also known as media production and its function is to hold the workpiece with a tool or guide, or define the settings (Joshi, 2003). Jigs and fixtures are typically used to ensure that the workpiece is in the correct position to facilitate alignment between the cutter, or tools and other materials. The purpose of jigs and fixtures designed to hold, support, drive, and put in to ensure the workpiece or the tool is in a steady state and when it is operating properly (Hoffman, 2011). By using jigs and fixtures, it can ease the procedure and will be easier and more practical without the need for highly skilled and can save time. Jig is a tool dedicated to holding,