UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND DEVELOPMENT OF MULTIFUNCTION JIG AND FIXTURES FOR PRESS RIVETCLUTCH USED IN MOTORCYCLE ENGINE ASSEMBLY: A CASE STUDY ON HICOM YAMAHA MANUFACTURING MALAYSIA.

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

By

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DECLARATION

I hereby declared this report entitled **"Design & Development of Multifunction Jig and Fixtures for Press Rivet Clutch Used in Motorcycle Engine Assembly: A Case Study on Hicom Yamaha Mfg Malaysia"** is the result of my own research except as cited in the references.

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ABSTRACT

Industry today has more challenging to compete not only in local but international also. Engineer must responsible to guiding the organization to achieve the mission. Manufacturing design engineer must know how to reduce time, cost and high quality of part, not only focus just in design. This report focus about jig and fixture press rivet clutch, purposed the project is to design and fabricate the jig and fixture for assemble the clutch used at motorcycle engine. The report consist introduction of jig and fixture, problem statement which is come from production line at Hicom Yamaha. Based on problem, jig and fixture with multifunction can be design. This report also consist the important definition of jig and fixture, type of jigs and fixtures and in addition this report consider the previous research in jig and fixture field as reference in design and develop this jig and fixture. To achieve the objectives, element in jig and fixture also consider in report. Other than that, materials also discuss in this report to fabricate the jig and fixture, choosing right material can be improved the jig and fixture strength and repeatability in work. Method and planning in chapter 3 include the process planning how to achieve the goal of project. Starting with indentifying the characteristics of the product and clutch working concept, then got to sketching and design with the end of fabricate the jig and fixture. Parameter of part, machine and processes involve to making a jig and fixture. Other than that function of each part also account in this report. Result and analysis the data from experimental conduct at Hicom Yamaha included in report. For that, the result and analysis using COSMOSXpress to analysis the design, Cp and Cpk concept used to decide the jig and fixture is capable or un-capable to run the future process assemble the clutch, all that describe in chapter 5. The last chapter for this thesis is discussion the result and conclusion for the overall this thesis with recommendations for the future work.

ABSTRAK

Didalam dunia penuh mencabar ini tugas seseorang jurutera terutama rekabentuk bukan sekadar merekabentuk produk baru adalah menjadi tanggungjawab bagi seseorang jurutera memikirkan kaedah terbaik bagi menjimatkan kos dan masa operasi bagi menjadikan sesebuah organisasi mantap dan mampu berdaya saing. Buku laporan kajian bertajuk *Jig and Fixture Press Rivet Clutch* ini adalah bertujuan untuk merekabentuk dan membangunkan produk pada enjin motosikal iaitu klac. Buku laporan ni menceritakan tentang permasalahan yang dihadapi semasa menjalankan operasi merivet klac iaitu memakan masa bagi menukar *Jig and fixture* apabila berlakunya pertukaran model. Projek ini memfokuskan kepada situasi yang sebenar dikilang. Laporan ini juga mengandungi definasi-definasi yang penting didalam *Jig and Fixture*, selain dari itu laporan ini juga mengaitkan kajian-kajian yang telah dijalankan oleh pengkaji terdahulu didalam bidang *Jig and Fixture* ini. Bagi merialisasikan projek merekabentuk ini, elemen-elemen penting berkaitan *Jig and Fixture* juga diambil kira. Bahan merupakan elemen yang penting bagi merekabentuk *Jig and Fixture Press Rivet* Clutch ini juga tidak ketinggalan dari buku laporan ini. Perancangan yang disusun bagi mencapai sasaran yang ditetapkan terkandung didalam bab 3, bermula dengan mengenalpasti sifat-sifat produk dan konsep klac tersebut beroperasi dan diakhiri dengan menghasilkan produk. Selain dari itu buku laporan ini juga mengandungi maklumat berkaitan Clutch dan parameter mesin yang diperlukan. Mesin yang digunakan bagi menjalakan proses-proses pemesinan yang berkaitan yang bertujuan membangunkan projek ini turut dinyatakan. Bagi melengkapkan buku laporan ini analisis menggunakan COSMOSExpress bagi mengetahui status produk setelah diberikan daya tertentu dan juga perbincangan tentang data-data yang diperolehi menggunakan kaedah Cp dan Cpk setelah menjalankan ujikaji. Seterusnya kesimpulan dan juga cadangan turut disertakan bagi tujuan penambahbaikan projek ini.

DEDICATION

Specially dedicated to my beloved father Abdul Ghani Bin Yaacob and my mom Raja Sah Binti Raja Salleh who are very concern, understanding, patient, and supporting. Thanks for everything to my supervisor Tajul Ariffin Bin Abdullah for his constructive guidance, encouragement and patient in fulfilling our aspiration in completing this project, to my sister, my younger brother and all my friends. I also would like to say thanks for everything. The work and success will never be achieved without all of you.

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Last but not least, I would like to thanks all my friends in UTeM who gave me supports ideas and information about the project. My especially thanks also goes to my parents for their support thought the course completing my project.

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LIST ABBREVIATIONS

PSM	-	Projek Sarjana Muda
UTeM	-	Universiti Teknikal Malaysia Melaka
FKP	-	Fakulti Kejuruteraan Pembuatan
WTO	-	World Trade Organization
CAD	-	Computer Aided Design
HSS	-	High Speed Steels
OHNS	-	Oil Hardening Non-Shrinking
CNC	-	Computer Numerical Control
CATIA	-	Integrated Systems
RC	-	Rockwell (to measure material Hardness)
MOSES	-	Model Oriented Simultaneous Engineering
FR	-	Functional Requirement
PCD	-	Pitch Center Diameter
ANSI	-	American National Standard Institute
JIS	-	Japan International Standard
AISI	-	American Iron and Steel Institute
EDM	-	Electric Discharge Machine
Cp	-	Capability Index
CpK	-	Capability Process

CHAPTER 1
INTRODUCTION

1.1 Background

Over the past century, manufacturing sectors play an important role to the economic development of a country. Nowadays new machine tools, high-performance cutting tools, and modern manufacturing processes enable today industries to produce parts faster and better than ever before. Although workholding methods have also advanced considerably, the basic principles of clamping and locating are still the same in design Anon (03 August 2008a). In recent years, owing to the World Trade Organization (WTO) agreements and business globalization, a new era of global trade has emerged. Industries today have to compete not only with local and regional rivals but also with competitors from all over the world Bahram and Vedaraman (2006). As like to compete and counterbalance using jigs and fixtures an important to produce the good parts, low cost and high quality.

Jigs and Fixtures are devices that used to facilitate production work in industry especially that involve in machine. A simple concept to understand, jigs as a guide tools and a fixtures is a holding the workpiece Wharton *et al.* (1954). These devices are provided with attachments for guiding, setting and supporting. The perfect jigs and fixtures can work repeatability and interchangeability to produce the same parts in production. In manufacturing industry, jigs and fixtures are most important device that can assist the workers in their production process become easier.

1.2 Objective of the Research

The main objective of this research is to design and develop jig and fixture with multifunction for rivet clutch to be used in motorcycle engine assembly. Among the other objectives want to achieve are follows:

i. To identify current jigs and fixtures limitation and design technology availability

ii. Carried out data collection based on need motorcycle engine assembly used to clutch rivet at machine press at Hicom Yamaha.

iii. To design and fabricate a jig and fixture press rivet based on data collection.

iv. To validity the performance of jig and fixture at Hicom Yamaha.

1.3 Scope of Study

Scope of assumption for this research is to design and produce jig press rivet clutch with multifunction. These jigs and fixture are used at main assembly line to assemble the engine motorcycle components. The jig and fixture design based on data clutch motorcycle specification, the data from machine press also accounts to realize this study. All the data collected based on references from Hicom Yamaha.

1.4 Problem Statement

The description of common jig and fixture in use today suggests that jig and fixture are currently designed for a specific task on specific part geometry. There is only limited flexibility in using the same jig and fixture for different part shapes and sizes. In order to comply with the needs of smaller batch sizes of the future jig and fixture should also be redesigned with a view to make them flexible and versatile to increase productivity. The goal of the jig and fixture design today is to provide user some

guidance so that these guides can be used for a wide variety of part sizes, shapes, materials and weights. In this research, a subset of this problem has been addressed the jig and fixture press rivet for clutch motorcycle engine assembly.

Use a different jig and fixture for different model can give effect to production when assemble the clutch at motorcycle engine, which is takes a longer time when changing the jig and fixture. Based on the problem has it, a study is carried out to develop a jig and fixture can be used for all motorcycle models in general to assemble clutch, however special focus is given for Yamaha motorcycle models. Therefore the design this jig and fixture can be increase a production and save cost when jig and fixture established at assembly line production.

1.5 Important of the Project

This project is important in order to generate design that can be improved a jig and fixture design assembly. Moreover the design also can reduce the time to assemble clutch rivet and increase production. In addition it also can encourage others to get some idea and knowledge to develop jig and fixture for press base on this research. Study of suitable jig and fixture used for press rivet operation to get the best design and can implement at real environment.

1.6 Stages of the report

Chapter 1: Introduction

This chapter includes of background of problem, definition of terms, problem statement, objectives, scope and importance of the project. All that an entire element becomes as an initial step before go through this research.

Chapter 2: Literature Review

Chapter two in this report discuss about literature review related with jig and fixture such as definitions of jig and fixture, type of jig and fixture, design

consideration, advantages and principles of jig and fixture and material used in jig and fixture.

Chapter 3: Methodology

In chapter three consist of process flow chart that describes what have been done to complete this project. This chapter also explain the way to achieve jig and fixture press rivet clutch objectives.

Chapter 4: Parameter of Clutch, Machine and Fabrication Process

This chapter includes the clutch data comparison, parameter each clutch, parameter of machine press, design project, process involve to produce the jig and fixture, function of each part and machine used to complete the jig and fixture.

Chapter 5: Result and Analysis

This chapter contains the result and analysis of the project after fabrication complete. Experiment conduct to get a data of this project comes out from Hicom Yamaha Manufacturing Malaysia.

Chapter 6: Discussion

This chapter discusses the result and analysis to complete this project. Discussion has also details about the project have a potential to approach at the real situation.

Chapter 7: Conclusion

This chapter contains summary of main findings and brief recommendation for further study.