



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**MACHINING DEVELOPMENT OF A TRIPARTITE RUBBER  
DIE HOLDER**

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

by

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**FACULTY OF MANUFACTURING ENGINEERING**

**2011**



# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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Tajuk: **Machining Development of a Tripartite Rubber Die Holder**

Sesi Pengajian: 2010/11 Semester 2

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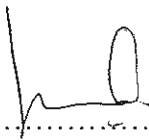
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## APPROVAL

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). The members of the supervisory committee are as follow:



A handwritten signature in black ink, consisting of a vertical line on the left, a horizontal line across the middle, and a loop on the right, positioned above a horizontal dotted line.

Supervisor

## **ABSTRACT**

The title of this project is “Machining Development of a Tripartite Rubber Die Holder”. This project will discuss on the process selection and machining operation of manufacturing a Tripartite Rubber Die Holder. The Tripartite Rubber Die Holder is a set of dies includes in a manufacturing of CV joint boot rubber. The function of this die holder is to hold the CV joint boot rubber and eject it while it manufactured. This project is divided into three sections, first is design and analysis, second is material selection and third is machining development of a Tripartite Rubber Die Holder. For machining development of a Tripartite Rubber Die Holder, it consists of process planning, machining simulation by using CATIA software, generating NC codes and a detail step of machining operation on producing a Tripartite Rubber Die Holder. The process development of a Tripartite Rubber Die Holder is specifically based on the design and material proposed. All aspects from design consideration and material selection will gather together in order to produce the Tripartite Rubber Die Holder. By the end of this project we hope the new design of Tripartite Rubber Die Holder has improved and extend the life of the die holder.

## ABSTRAK

Tajuk untuk projek ini adalah “Pembangunan pemesanan acuan pemegang getah”. Projek ini akan membincangkan mengenai pemilihan proses dan operasi pemesanan untk menghasilkan acuan pemegang getah. Acuan pemegang getah merupakan salah satu komponen dalam pembuatan getah kelajuan malar sambungan but di kenderaan. Fungsi acuan pemegang getah ini adalah untuk menahan dan melepaskan getah kelajuan malar sambungan but semasa proses pembuatannya dijalankan. Keseluruhan projek ini merangkumi kepada tiga bahagian, pertama reka bentuk dan analisis, kedua pemilihan bahan dan ketiga pembangunan pemesanan acuan pemegang getah. Untuk pembangunan pemesanan acuan pemegang getah, maklumatnya adalah seperti proses perancangan, simulasi pemesanan menggunakan perisian CATIA, penghasilan kod NC dan juga langkah pemesanan yang terperinci untuk menghasilkan acuan pemegang getah. Proses pembangunan pemegang getah ini juga berdasarkan dari reka bentuk dan juga pemilihan bahan yang telah dicadangkan. Semua aspek dari pertimbangan reka bentuk dan pemilihan bahan akan disatukan bersama untuk menghasilkan pemegang getah ini. Pada akhir projek ini kami berharap reka bentuk pemegang getah ini akan dipertingkatkan dan usia penggunaannya akan dipanjangkan.

## **DEDICATION**

To my beloved mother Salmah Bte Abd Ghani, my father Zainal Abidin Bin Hj  
Abdullah and my siblings.

I love you all.

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## LIST OF ABBREVIATIONS

CV	-	Constant Velocity
Sdn	-	Sendirian
Bhd	-	Berhad
R & D	-	Research and Development
Ltd	-	Limited
EDM	-	Electrical Discharge Machine
ECM	-	Electro Chemical Machine
CAD	-	Computer Aided Design
CAM	-	Computer Aided Manufacturing
CATIA	-	Computer Aided Three-dimensional Interactive Application
CNC	-	Computer Numerical Control
NC	-	Numerical Control
ISO	-	International Standard Organization
PVD	-	Physical Vapour Deposition
CVD	-	Chemical Vapour Deposition
CMM	-	Coordinate Measuring Machine
APT	-	Automatically Programmed Tools
MCU	-	Machine Control Unit
UTeM	-	Universiti Teknikal Malaysia Melaka
mm	-	Milimeter
m	-	Meter
min	-	Minute
sfm	-	Surface Feed Per-Minute
No.	-	Number
Rev	-	Revolution

# CHAPTER 1

## INTRODUCTION

Chapter 1 will give a brief explanation about this project, starting with the background of the company and the background of the project title, “Machining Development of a Tripartite Rubber Die Holder”. This chapter will also discuss about the problem statement, the objectives, the scope and limitation for this project.

### 1.1 Background of the Company

Jebco Company (M) Sdn Bhd located at Kawasan Perindustrian Kg Jaya, Sungai Buluh, Selangor was incorporated in 1975 to produce custom molded rubber products, rubber compounds and moulds for industrial and automotive applications.

Today the company offers design and manufacturing solutions for the country leading automotive and other original equipment manufacturers in their requirements for molded and extruded rubber and plastic products. Their integrated design, tool and die facilities, manufacturing, assembly and R & D facilities offer customers competitive outsourcing advantages, such as access to computer modeling and simulation studies, advanced manufacturing technologies, shortened development as well as throughput time and commitment towards continuous product and process improvements.

ISO 9001 / QS 9000 certified, the company has received numerous quality and service awards from its customers. Its objective to pursue excellence saw the company's network through technical assistances with renowned companies such as

Tokai Rubber Ltd, Hyperlast Ltd., TARRC Ltd., Romar Engineering Pty Ltd.; its subsidiaries with Norcros Adhesives Ltd. And Chung Kwang Rubber Co. Ltd.

The company products are based on the moulded rubber products for all types of applications. Jebco Company (M) Sdn Bhd manufactures high quality products from synthetic and natural rubber for the automotive, motorcycle industries and also for the other diverse industrial application. Each product application places specific demands on the physical and dynamic characteristic properties of the rubber compound developed by Jebco Company (M) Sdn Bhd.

## 1.2 Background of the Project

Die holder is an essential tool widely used in manufacturing sector. As it well known various die holders have been utilized in the prior art which interface with rotating spindle of a machine tool such as milling or turning machine during cutting of a work piece. Thus, die design making operations play a critical role in maintaining maximum productivity. As for this project, the die holder is used in a CV joint boot rubber manufacturing as shown in figure 1.1. The die holder is one of the die set used to hold the CV joint boot rubber during the process of manufacturing. The shape of this die holder is cylindrical, at the front side of this die holder is diverged into three parts, meanwhile at the middle section of this die holder is slotted and at the end of the die holder is a thread which connected to the other die set. The name of tripartite come from front of this die set because it segmented into three parts as shown in figure 1.2.



**Figure 1.1:** CV joint boot rubber (Wenzhou Wendong Rubber and Plastic Product Co., Ltd. 2010)



Figure 1.2: Tripartite Rubber Die Holder

### 1.3 Problem Statement

Reducing a cost is one of the elements used in a company to maintaining their productivity. By reducing the cost of tool selected they also will face certain problem such as the durability and the toughness of the die holder. The problem that can be state in this project is about comparing the two die holders at the different design come with different manufacturer. The factor concerning about this problem where the die holder life span is different from each manufacturer. Thus by selecting appropriate manufacturing processes we will compare both existing die holder processes and the new die holder will be manufactured from the design proposed. Below are the two existing types of Tripartite Rubber Die Holder that used by this company for production of the product as shown in figure 1.3 and 1.4.

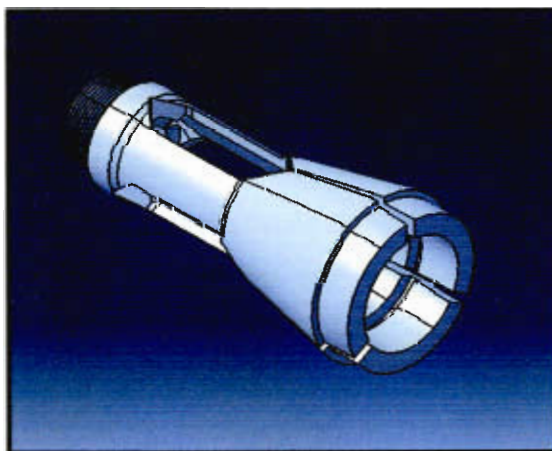
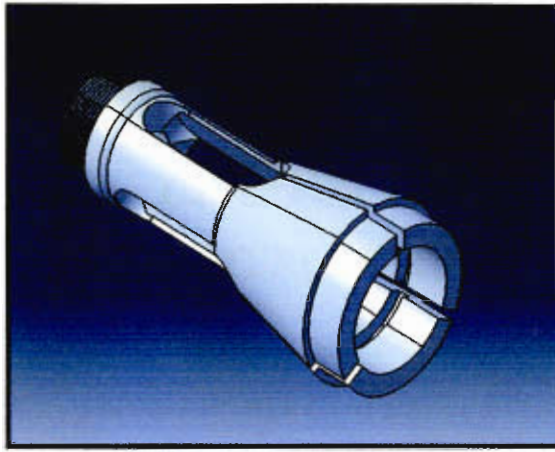


Figure 1.3: Tripartite Rubber Die Holder A



**Figure 1.4:** Tripartite Rubber Die Holder B

## **1.4 Objectives**

To fulfil the requirement needed for this project, the objectives to be achieved at the end of this project are as below;

- (a) To investigate and propose the process selection of the manufacturing Tripartite Rubber Die Holder according to the proposed design.
- (b) To fabricate the Tripartite Rubber Die Holder according to the proposed processes.

## **1.5 Scope and Limitation**

This project will cover the selected process regarding on the Tripartite Rubber Die Holder. This project will also contain all machining processes after the design proposed has completed and selected material is chosen. There are few limitations to complete this project. The limitation is when the university workshop does not have the material proposed, thus the material that will be use is either mild steel or aluminium. The second limitation is the machining operation, as the machining facilities is limited, thus the machining operation needs to be done at externally.

## CHAPTER 2

### LITERATURE REVIEW

Literature review or academic study is one earlier research process to help in process introduce new method for the process development of a Tripartite Rubber Die Holder. Through this method early retrieval on a project weakness and advantage will be acquired through study method and comparison with present method and equipment. With this literature review also a product produced can fulfil current need without fomenting.

#### 2.1 Definition of Die

A die is a specialized tool used in manufacturing industries to cut or shape material using a press as shown in figure 2.1. Like moulds, dies are generally customized to the item they are used to create. Products made with dies range from simple paper clips to complex pieces used in advanced technology (Degarmo et al., 2003). According to Britannica Encyclopedia tool holder is a short steel bar having a shank at one end by which it is clamped to a machine and a clamp at the other end to hold small interchangeable cutting bits (Britannica Encyclopedia, 2010).



**Figure 2.1:** Die in manufacturing industry (Degarmo et al., 2003)

## **2.2 Dies According to their Construction**

Dies and molds are composed of functional and support components that generally are cavity and core inserts in injection molding and die casting, die cavities in forging, and punch and die in stamping. Cavity and core inserts are usually machined out of solid blocks of die steel. However, large stamping dies and punches are often cast to near-final geometry with a machining allowance. Support components are standard parts and assure the overall functionality of the tooling assembly in such areas as alignment, part ejection, and heating or cooling. By using standard die and mold components, the time necessary for manufacturing a die is reduced, and machining is mainly devoted to producing the core and cavity, or the punch and the die (Altan et al., 2001). Therefore, die and mold makers are forced to develop and implement the latest technology in: part and process design including process modeling, rapid prototyping, rapid tooling, optimized tool path generation for high speed cutting and hard machining, machinery and cutting tools, surface coating and repair as well as in EDM and ECM (Cakir, 2005).

### **2.2.1 Die Making**

Die making is one of the most common tooling procedures is the design and production of dies, i.e., die making. Industry uses a great variety of dies (Hwaiyu, 2004).

- (a) Stamping, blanking, and punching dies
- (b) Bending and forming dies
- (c) Combination or progressive dies
- (d) Forging dies
- (e) Dies for die casting metals and metal alloys
- (f) Beading dies (a form of bending die)
- (g) Extrusion dies
- (h) Drawing dies (for wire, rod, and bar)
- (i) Wire-form dies

There are considerable differences in a way dies are built to function. In some, the metal strip is fed through the die, which produces the desired part in stages. Another die makes a complete part with a single hit of a single station. According to their construction and function, all dies can be separated into the following four groups (Suchy, 1998).

- (a) Compound dies
- (b) Progressive dies
- (c) Steel-rule dies
- (d) Miscellaneous dies

### **2.2.2 Significance of the Technology**

Die and mould making covers a broad range of activities, including:

- (a) Manufacturing of new dies and fixtures,
- (b) Maintenance and modifications, and
- (c) Technical assistance and prototype manufacturing for the customer as shown in figure 2.2.

Process development and die try-out as well as die maintenance are especially important because they tie up expensive production equipment and affect lead times. These activities must be scheduled and completed within very rigid deadlines. Such requirements make scheduling in a die shop an extremely challenging task. The automotive industry constantly tries to reduce the development time for new models which puts enormous pressure on die makers and requires new production systems (Altan et al., 2001).