UNIVERSITI TEKNIKAL MALAYSIA MELAKA

A Precision Assembly in Plastic Injection Mould

Thesis submitted in accordance with the requirements of the Universiti Teknikal Malaysia Melaka for the Degree of Bachelor of Engineering (Honours) Manufacturing (Process)

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

Mohd Amran Bin Ali
(PSM Supervisor)

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ABSTRACT

This project describe the method that was used to assemble plastic injection moulding. This project was done in the Manufacturing Workshop in Universiti Teknikal Malaysia Melaka (UTeM) that located at Fasa B. The material that been used in this mould project was Acrylic. This acrylic material was choose because of the characteristic that are transparent. The purpose of this project is to assemble plates that been provided to be one completed plastic injection moulding. The problem has been investigate such as machining with wrong dimension, off set, over cut, not enough cut, standard part cannot fit into plate and sharp edges. As a result, the plate must be remachining to get an actual dimension according to the drawing that been provided. Type of machining that been use in this project such as, milling machine, lathe machine, Computer Numerical Control (CNC) machine and Electrical Discharge Machine (EDM) wirecut. This project started from checking all plates to find out any defect or machining error or out of dimension in plastic injection mould. Every plate will be using quality measurement tool. It will be remachine if any defects found at mould plate. Various machines will be use such as milling machine, EDM machine, CNC, chamfering machine, drilling machine and lathe machine. During this project, all of learning outcome will be implement in every aspect of work. In order to get accurate result in measurement, various equipment have been used including vernier calliper, micrometer, high gauge, and Coordinate Measuring Machine (CMM). In this project also use a quality measurement equipment to get an accurate dimension. The equipment that involve in this project such as vernier caliper, micrometer, height gauge and Coordinate Measuring Machine (CMM). As a result, the measuring plate have been easier assembled with various mould component and finally one completed mould set was produce.

ABSTRAK

Projek ini akan memperihalkan tentang cara untuk menggabungkan acuan suntikan. Secara amnya, projek ini akan dijalankan di bengkel pembuatan Universtiti Teknikal Malaysia Melaka (UTeM) yang terletak di kompleks Fasa B. Dalam projek ini, bahan yang digunakan untuk membuat acuan ialah acrylic. Acrylic adalah bahan yang diperbuat daripada plastik. Bahan ini dipilih kerana sifatnya yang lutsinar. Tujuan projek ini dijalankan ialah untuk menyambung plat-plat yang dibekalkan menjadi satu acuan yang lengkap. Ini kerana plat-plat yang dibekalkan mempunyai masalah seperti dimensi yang salah, terpotong lebih, tidak cukup potong dan sebagainya. Maka plat-plat tersebut perlu di mesin semula untuk mendapatkan ukuran sebenar mengikut lukisan yang disediakan. Jenis mesin yang terlibat di dalam projek ini adalah mesin pengisar mesin pengejat, mesin pengawalan berangka komputer dan mesin penyahcas elektrik Projek ini dimulakan dengan menyemak kesemua plat untuk mengetahui kerosakan, kesilapan memesin, dan terkeluar daripada dimensi yang ditetapkan. Setiap plate akan menggunakan alat pengukuran yang berkualiti. Ianya akan dimesin semula jika terdapat kerosakan. Pelbagai mesin digunakan seperti mesin pengisar mesin pengejat, mesin pengawalan berangka komputer dan mesin penyahcas elektrik. Sepanjang projek ini, segala hasil pembelajaran akan digunakan dalam setiap aspek kerja. Untuk mendapatkan pengukuran yang tepat, pelbagai peralatan mengukur digunakan termasuk angkup venier, tolok skru mikrometer, tolok tinggi dan mesin pengukur koordinasi. Hasilnya, plat yang telah diukur, mudah untuk dicantumkan dengan pelbagai komponen acuan dan akhirnya satu set acuan lengkap telah dihasilkan.

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LIST OF ABBREVIATIONS

CMM	-	Coordinate Measurement Machine
EDM	-	Electric Discharge Machine
CAD	-	Computer Aided Design
CAM	-	Computer Aided Machining
CNC	-	Computer Numerical Control
NC	-	Numerical Control
DRO	-	Digital Read Out

CHAPTER 1

INTRODUCTION

1.1 Background

Injection moulding is a process in which a polymer is heated to a highly plastic state and forced to flow under high pressure into a mold cavity, where it solidifies. The moulded part, called a moulding, is then removed from the cavity. The process produces discrete components that are almost always net shape. The production cycle time is typically in the range 10 to 30 seconds, although cycles of one minute or longer are not uncommon.

Mould consists of various type of component. Such as locating ring, sprue bush, guide bushes and guide pillar, ejector system, sprue puller, return pin and ejector rod. Mould is devided into two parts. moveble half dan stationary half. Moveable half consist of several component that which are core plate, support plate, space block, top ejector plate, bottom ejector plate and bottom clamping plate, meanwhile stationary half is consist of top clamping plate and cavity plate. There are two type of mould, firstly two plate mould, and three plate mould.

In this project, the 2 plate mould was chosen in order to produce a cup mould. The purpose is to assemble the cup mould and define any defect on the mould and proceed to remachine the mould back if any defect is found. Mould are usually made from pre hardener metal, but in this project, acrylic material was used as a mould. Acrylic is a

useful, clear plastic that resembles glass, but has properties that make it superior to glass in many ways. Common brands of high-grade acrylic include Polycast, Lucite and Plexiglass. There are two basic types of acrylic, extruded and cell cast. Extruded or "continuous cast" acrylic is made by a less expensive process, is softer, can scratch easier and may contain impurities. Cell cast acrylic is a higher quality acrylic and it has been use for jet and airplane glass. The advantages using acrylic mould in this project, the mould is transparent and clear. This mean every process in injection mould can be see clearly.

Conventional machine has been used in this project. Variety machine such as milling and lathe were use to remachine the defect area. The machining process that are learn at the last semester such as drilling, boring, facing, surfacing and others are practiced in this project.

Measurement equipment such as verniar caliper, high gauge, dial indicator and Coordinate Measurement Machine (CMM) has been implemented in this project. This is to ensure the accuracy of each plate. Accuracy is very important in injection moulding, it is because it will influent the size of product.

1.2 Objectives

The main objective of this project is to assemble the plastic injection mould. To achieve this project there are five objectives:

1. To find out any defect, machining error, out of dimension in plastic injection mould.
2. To fix all mould plates at movable half and stationary half.
3. To align all the guide pin and guide bush between moveable half and stationary half.
4. To fix all mould components and inserts to the reference follow the assembly drawing.
5. To assemble all plates, component and insert for producing one set of mould.

1.3 Problems Statement

After machining, all plates of injection mould need to be assemble into one mould. However, there are some plates and components cannot assembly in one mould. Due to that, procedure of mould assembly should be prepared for industrial guide.

There are many sources, why plastic injection mould cannot assembly. Firstly the method to assemble between moveable half and stationary half is not documented. The wrong method to assemble the mould was use. To solve this problem, procedure of assembling mould should be documented.

Secondly, some plate may be machine with wrong dimension. For example offset, over cut, not enough cut and etc. To ensure that all plate were machine accurately, all plate should be checked using measurement tool such as vernier caliper, micrometer, and CMM.