UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Design Validation And Development Of Hand Phone Housing Plastic Injection Mould (Cavity)

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

By

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APPROVAL

This PSM submitted to the senate of UTeM and has been as partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Process). The members of the supervisory committee are as follow:

……

Main Supervisor

(Mr. Hassan Bin Attan)

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ABSTRACT

From this study of Design Validation and Development of Hand Phone Housing Plastic Injection Mold cavity plate, all the work that had been done is planned first to achieve the main target. The importance of design validation and development is clearly gained by the research done to complete this study. The method to complete this study had been approached in order to understand the study clearly. The overall objective of this study is to design validation and development a mould for injection molding process. To approach this goal, the methodology proposed has certain method that were identifying the product, measure the product to be solid modeling, produce a solid model of the chosen product by using the Solid Works software, design a cavity for the product, analyze the mould flow to get the good position of gate location. Lastly, the drawing will transfer to CNC machine to produce the cavity plate. This study needs us to apply the knowledge that gained from education session such as the application of machining machine, the application of using Solid Works and many more. Furthermore, the new knowledge about mould design and mould parameter can be obtained.

ABSTRAK

Daripada kajian tentang pembangunan dan pengesahan rekabentuk kepingan rongga acuan suntikan plastik penutup telefon bimbit, segala perancangan kerja telahpun dirancang terlebih dahulu untuk mencapai sasaran utama. Kepentingan pembangunan dan pengesahan rekabentuk ini jelas sekali diperoleh daripada kajian-kajian terdahulu bagi melengkapkan pembelajaran ini. Kaedah untuk menyelesaikan pembelajaran ini telahpun didedahkan bagi memastikan proses pemahaman ini berjalan dengan lancar. Secara keseluruhan objektif pembelajaran projek ini adalah untuk membuat satu acuan pembangunan dan pengesahan rekabentuk dengan menggunakan proses acuan suntikan. Untuk mencapai matlamat ini, beberapa kaedah atau cara dicadangkan telahpun dikenalpasti dalam menentukan produk tersebut, mengukur produk tersebut supaya menjadi model yang sebenar atau pejal, menghasilkan satu model yang pejal atau yang sebenar hasil daripada pemilihan dan penggunaan perisian 'Solidworks', merekabentuk rongga pada produk tersebut, menganalisis aliran penghasilan acuan untuk mendapatkan kedudukan yang baik untuk pintu atau laluan. Akhirnya, lukisan ini akan dipindahkan ke mesin Kawalan Berangka Berkomputer untuk menghasilkan kepingan rongga tersebut. Oleh yang demikian, kajian ini memerlukan kami untuk menggunakan pengetahuan yang diperoleh melalui sesi pembelajaran seperti aplikasi mesin pemesinan, penggunaan perisian 'Solidworks' dan banyak lagi. Tambahan pula, pengetahuan baru tentang rekabentuk acuan dan juga parameter acuan itu boleh juga dikenalpasti.

DEDICATION

For my beloved parents, my family and to those who always gives me courage and support for all these times.

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

ABS	-	Acrylonitrile Butadiene Styrene
ABS/PC	-	Acrylonitrile Butadiene Styrene/Polycarbonate Alloy
CAD	-	Computer Aided Design
CAM	-	Computer Aided Manufacturing
CNC	-	Computer Numerical Control
EDM	-	Electrical Discharge Machining
PVC	-	Polyvinyl Chloride
PC	-	Polycarbonate
PC	-	Personal Computer
RP	-	Rapid Prototyping

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CHAPTER 1
INTRODUCTION

1.1 Project Background

Plastic industry is one of the world's fastest growing industries, ranked as one of the few billion-dollar industries. Almost every product that is used in daily life involves the usage of plastic and most of these products can be produced by plastic injection molding method.

Plastic injection molding process is well known as the manufacturing process to create products with various shapes and complex geometry at low cost. The plastic injection molding process is a cyclic process. There are four significant stages in the process. These stages are filling, packing, cooling and ejecting. The plastic injection molding process begins with feeding the resin and the appropriate additives from the hopper to the heating/injection system of the injection plastic injection molding machine. This is the "filling stage" in which the mould cavity is filled with hot polymer melt at injection temperature. After the cavity is filled, in the "packing stage", additional polymer melt is packed into the cavity at a higher pressure to compensate the expected shrinkage as the polymer solidifies. This is followed by "cooling stage" where the mould is cooled until the part is sufficiently rigid to be ejected. The last step is the "ejection stage" in which the mould is opened and the part is ejected, after which the mould is closed again to begin the next cycle.

This study is focused on the design validation and development of mold for plastic injection molding to produce the hand phone housing. To implement this study, the most essential thing must be considered is shape of the product that will produce

must have correlation and suitable with the process that use plastic injection molding. The application of the mold design is applied according to the first to the last process. First, the sample parts and 3D drawing must be providing. Then, the 3D drawing of the product and mold is analyzed using the 3D modeling software. And lastly, for this study the machining process using CNC machines or EDM machine will be conduct to produce the final product.

1.2 Problem statement

The mold and part design of plastic parts for injection molding is a complicated process, considerations for producing a part ranging from cost and speed of production to structural, ergonomics and aesthetic requirements. One of the routines faced by a designer when designing quality into a part is the process of cavity balancing. This entails controlling the plastic flow in the filling phase such that the melt front reaches the boundaries of the mold at the same time. So That the design of the mold must start from validate the part and mold design to increase the quality of product and reduce the cost and production time. This study is focus on building cavity plate and design of feeding system for Nokia hand phone housing model 6680 that continuity of previous student project that focuses on Reverse Engineering, 3D modeling and machining simulate. The previous drawing of hand phone housing Nokia 6680 must be validating first. This is because the dimension of part need to precise and tolerance before mold making.

1.3 Objectives

The objective of the study is to design and development plastic injection mold for hand phone housing. This study requires a student to be creative and work hard to apply mold design with knowledge on the product and to use equipment and software was not used throughout in the class. The main focused in this study is to build a cavity plate for a hand phone housing with the application of 3D modeling software,

to analyze the important of each part in hand phone cover to improve its design and to analyze the injection molding process to produce the product. The main objectives of the research are:

- To build of a cavity plate for Hand phone housing.
- To generate 3D model of a hand phone housing cavity plate.
- To do analysis of part arrangement with feeding system

1.4 Scope of Study

The scopes of study for this project are follows:

- Validate the design of the hand phone housing (Model Nokia 6680).
- Development of mold plastic injection molding for hand phone housing (Model Nokia 6680).
- Analyze the plastic flow of the part.

CHAPTER 2

LITERATURE REVIEW

This chapter is shows all about the information that related to this study such as method that will use in complete this study. All of this information is important to guide this study on gaining the objective of the study. This research is including the mold core and cavity and 3D solid modeling tools. The most suit mold to produce a hand phone housing product is the Three Plate mould.

2.1 Types of Mold

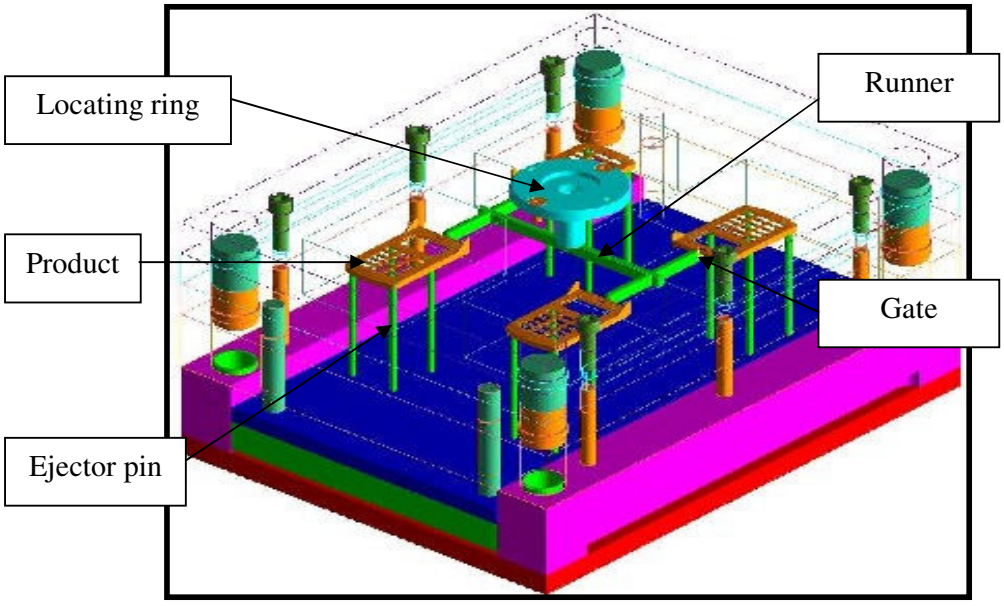

Figure 2.1: Mold assembly

A mould may have one cavity or several, even as many as 100, depending largely on part size. Multi-cavity moulds normally produce identical parts, though one type, known as a "Family" mould, is used to produce an assortment of parts later assembled as a single article. The main structural components of a mould are the mould plates, which, with the aid of pins and bushings, lock together to support and align the internal working parts of the mould. In operation, one mould half remains in a fixed position on the molding machine while the other is moved to and from the fixed half to accomplish mould closing and opening.

The fixed half of the mould contains a system of channels for delivery of melted resin to the mould cavity. This system consists of an entry port (sprue) which couples with 5 passages (runners) that convey resin from the sprue to the entrance way (gate) of the cavity. The part ejection mechanism is usually installed in the moving half of the mould. Moulds are equipped with a cooling system designed to withdraw heat from the melted resin in the cavity and thus cause the part or parts to solidify. Rapid cooling reduces machine cycle time and accelerates production, while uniformity in the rate of cooling throughout a part prevents warpage or undue shrinkage. Uniform part cooling requires that the most concentrated cooling take place in the vicinity of the hottest areas of the cavity (i.e. near the sprue and gates and, in parts of unequal thickness, in the areas of greatest thickness). Injection molding has two different types that were [2]:

1. Cold runner (two plate and three plate designs)
2. hot runner (the more common of the runner less molds)

The difference of both types is the presence of a sprue and runner with every molded part in the cold runner type. This extra molded component must be separated from the desired molded part.

2.1.1 Cold Runner

Molds Compared to the hot runner system, the cold runner mold type is very simple and cheaper. Due to its simplicity, that is why the mold requires less maintenance and less skill to set up and operate. Color changes easily since all the plastic in the mold is ejected with each cycle. So the product will be exchanged easily every time needed. The two plate and the three plate designs are the two major types of cold runner molds.

2.1.1.1Two Plate mold

The first type of cold runner molds is the two plates which is the simplest type of mold. Two plate molds has one parting line and two sections or halves. The runner system is be located on this parting line and the part must be gated on its perimeter as shown as Figure 2.2, Figure 2.3 and Figure 2.4. The runner is ejected together with the part for each time operates.

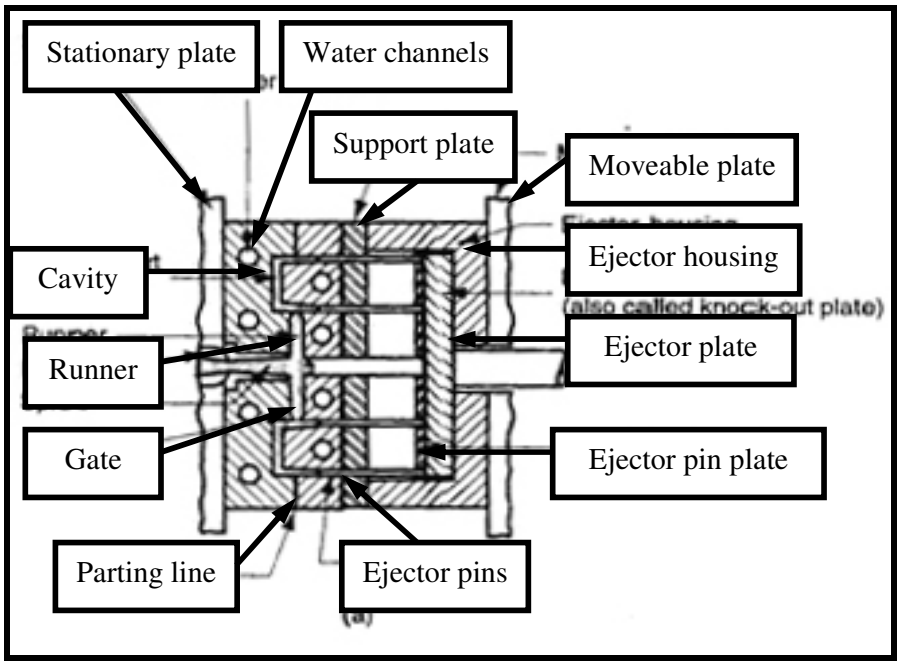

Figure 2.2: Two plate mold in closed position