



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DESIGN VALIDATION AND
DEVELOPMENT OF PLASTIC
INJECTION MOULD CAVITY FOR
CONTAINER PLASTIC PRODUCT**

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

By

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May 2008

DECLARATION

I hereby, declare this thesis entitled “Design Validation and Development of Plastic Injection Mould Cavity for Container Plastic Product” is the results of my own research except as cited in the reference.

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Date : 10TH MAY 2008

APPROVAL

The thesis submitted to the senate of UTeM has been accepted as partial fulfillment of the requirement for the degree of Bachelor of Manufacturing Engineering (Manufacturing Design). The members of the supervisory committee are as follows:

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Main Supervisor: Mr. Hassan Attan
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ABSTRACT

Plastic Injection Moulding is one of the popular commercial manufacturing in plastic industry, it has the ability to produce any complex design product. This project, aims to validate design of the plastic container to be manufactured by using plastic injection molding. The design of the product needs to convert into cavity and core of the mould and the form of mould cavity is done by using several advanced manufacturing processes to fabricate the product.

This project begins with the validation of the dimension of the mould by measuring the existing mould using CMM machine. The procedures of handling mould and the method to measure the mould dimension will be state out. The next step is modeled process using CAD/CAM software to construct the 3D model. The CAD/CAM software used in this modeling process is CATIA, because it has wide flexibility and capabilities in the 3D modeling. After the modeling, a process plan is generated and the mould fabrication processes will be carried out using various type of manufacturing process. The design feature and process parameter is analyzed and verified.

The project is concluded with a discussion of the manufacturing process in general, including some of the future developments, and some of the recommendations

ABSTRAK

'Plastic Injection Moulding' adalah salah satu proses pembuatan komersial yang popular dalam perindustrian plastik, ia dapat menghasilkan pelbagai jenis produk rekabentuk kompleks. Projek ini, bertujuan untuk mengesahkan rekebetuk kotak plastik yang digunakan dalam mesin suntikan plastik. Rekebetuk plastik produk itu perlu ditukar dalam bentuk acuan dengan menggunakan beberapa jenis proses pembuatan termaju untuk menghasilkan produk ini.

Projek ini dimulakan dengan mengesahkan ukuran acuan dengan menggunakan mesin CMM. Seterusnya ialah menunjukkan langkah-langkah untuk menguruskan acuan dan cara-cara untuk mengukur ukuran acuan itu. Permodelan 3D akan menggunakan perisian CAD / CAM sebagai satu alat model untuk membina 3D model. Perisian CAD / CAM yang akan digunakan dalam proses permodelan 3D adalah CATIA, kerana ia mempunyai fleksibiliti yang luas dalam permodelan 3D. Selepas permodelan 3D, menghasilkan suatu proses rancangan dan proses fabrikasi acuan akan mengikut rancangan yang ditentukan. Fabrikasi acuan akan dijalankan dengan menggunakan berbeza jenis mesin dan proses.

Projek ini ditamatkan dengan satu penbincangan berkaitan dengan proses pembuatan, serta termasuk beberapa cadangan untuk masa hadapan.

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TABLE OF CONTENT

Declaration.....	ii
Approval.....	iii
Abstract	iv
Abstrak.....	v
Acknowledgement.....	vi
Table of Contents	vii
List of Figures	xi
List of Tables	xvi
List of Abbreviations	xvii
1. INTRODUCTION	1
1.1 Background of the Problem	2
1.2 Statement of the Problem	2
1.3 Objectives	3
1.4 Scope	3
1.5 Importance of the Project	3
1.6 Organization of the Report	4
1.7 Flow Chart of the Project	6
1.8 Schedule of the project	6
1.9 Summary	7
2. LITERATURE REVIEW	8
2.1 Introduction	8
2.2 Mould Development Process	8
2.3 Mould Design	14
2.3.1 Number of cavities and Surfaces Finish	17
2.4 Introduction of Mould	19
2.4.1 Function of Mould	21

2.4.1.1 Sprue and runner system	21
2.4.1.2 Cavity Layout	24
2.4.1.3 Parting Line	24
2.4.1.4 Cavity Half	25
2.4.1.5 Core Half	25
2.4.1.6 Venting system	25
2.4.1.7 Ejection system	26
2.4.1.8 Ejector System Operations	26
2.5 Summary	26
3. METHODOLOGY	27
3.1 Introduction	27
3.2 Material Selection for Mould Cavity	27
3.3 Measure the Dimension of the Mould	29
3.3.1 Release Mould from the Machine	29
3.3.2 Open Mould to separate core and cavity side	31
3.3.3 Mould Structure of Plastic Container	32
3.3.4 Measure the Mould Cavity By Using CMM and Digital Calipers	34
3.3.4.1 Coordinate Measuring Machine	34
3.3.4.2 Vernier Caliper	39
3.4 Design Validation	
3.3.1 Differentiate Dimension between measuring original mould and measuring product	44
3.5 Part Modeling	46
3.5.1 3D MODELING SOFTWARE: CATIA	46
3.5.2 MOULD MODELING METHODS	47
3.5.2.1 Sketcher	47
3.5.2.2 Part Design	49
3.5.2.3 Drafting	53
3.5.2.4 3D MODEL	54
3.6 Summary	55
4. DEVELOPMENT OF CAVITY AND DIE	56
4.1 Introduction	56

4.2	Process Plan for Cavity Mould	58
4.3	Process Plan for Die No.1	70
4.3.1	Die No.1 Stock Dimension	70
4.3.2	Calculation for Material Removed	70
4.3.3	Die No.1 Fabrication Steps	71
4.3.4	Second Part of Die No.1 Fabrication Procedures.....	74
4.4	Process Plan for Die No.2	75
4.4.1	Die No.2 Stock Dimension	75
4.4.2	Calculation for Material Removed	76
4.4.3	Die No.2 Fabrication Steps	77
4.5	Process Plan for Die No.3	81
4.5.1	Die No.3 Stock Dimension	81
4.5.2	Calculation for Material Removed	82
4.5.3	Die No.3 Fabrication Steps	83
4.6	Process Plan for Die No.4	87
4.6.1	Die No.2 Stock Dimension	87
4.6.2	Calculation for Material Removed	88
4.6.3	Die No.1 Fabrication Steps	89
4.7	Summary	92
5.	RESULT	93
5.1	Introduction	93
5.2	Dimension of Mould Cavity	93
5.3	Produced Mould Cavity and Die.....	94
5.4	Summary.....	97
6.	DISCUSSION.....	98
6.1	Introduction	98
6.2	Procedure of Handling Mould	98
6.3	Process Planning.....	99
6.3.1	Drilling Process.....	101

6.3.2 Screw Threading.....	102
6.3.3 Milling Process.....	102
6.3.4 EDM Die-sinking.....	105
6.4 Process Sequent.....	107
6.5 Work Piece Alignment.....	109
6.6 EDM Die Alignment.....	110
6.7 Design Improvement.....	112
6.8 Action Taken to Ensure Core and Cavity are Matched.....	113
6.9 Summary.....	113
7 CONCLUSION AND RECOMMENDATION	114
7.1 Introduction.....	114
7.2 Recommendation.....	115
7.3 Future Work.....	115
REFERENCE.....	116
APPENDIX A.....	119
APPENDIX B.....	127

LIST OF FIGURES

1.1: Flow Chart of project.....	6
1.2: Schedule of project.....	6
1.3: Schedule for the second part of the project.....	7
2.1: New Mould Design Process, Z.lou, H,Jiang, X. Ruan (2004).....	9
2.2: Flow Diagram in Mould-base Design.....	10
2.3: Parting Design Module, [L.Kong, J.Y.H. Fuh, K.S. Lee, X.L. Liu, L.S. Ling, Y.F. Zhang, and A.Y.C. Nee (2003)].....	12
2.4: Design and Process Planning Message Exchange for Integration.....	14
2.5: Mould Design Procedure.....	15
2.6: Mould Structure provide by DSM.....	18
2.7: Basic Injection Mould Structure.....	20
2.8: Sprue Brush.....	22
2.9: Runner, and Gate illustration.....	22
2.10: Cold Slug Designation.....	23
3.1: Electrical Lifter.....	29
3.2: Mould mounting to the machine.....	30
3.3: Open the Clamp Screw.....	30
3.4: Type of clamp used.....	30
3.5: Using Trolley to move the mould.....	30
3.6: Core Plate.....	32
3.7: Core Insert.....	32
3.8: Ejection Plate.....	32
3.9: Spacer Block.....	32
3.10: Plastic Container Mould.....	32
3.11: Ejector Plate.....	32
3.12: Cavity Plate.....	32
3.13: Clamp Plate/Guide Pin.....	32
3.14: Accessory of the mould.....	33
3.15: Equipment to Open Mould.....	33

3.16: CMM Model: Wenzel LH 54.....	35
3.17: Measure Method for Distance Two Surfaces.....	36
3.18: Measure Method for Outer Diameter of a circle.....	36
3.19: Measure Method for Inner Diameter of a circle.....	37
3.20: Measure Method for Correct Pointing for Angle Between Two Surface....	37
3.21: Measure Method for Wrong Pointing for Angle Between Two Surfaces...38	
3.22: Measure Method for Distance Between Two Circle Center.....	38
3.23: Mitutoyo Vernier Caliper.....	40
3.24: Defined dimension in Front View of the mould.....	40
3.25: Defined dimension in front of the mould.....	41
3.26: Defined dimension in side View of the mould.....	42
3.27: Defined dimension in isometric of the mould.....	43
3.28: Side View of Product.....	44
3.29: Front View of the Product.....	44
3.30: Used of Square, Round, Line, Axis, Mirror and Fillet feature.....	48
3.31: Used of Project 3D Elements, Constraint Definition and Constraint.....	49
3.32: Pad Feature in CATIA.....	50
3.33: Fillet Definition in CATIA.....	51
3.34: Plane Creation in CATIA.....	51
3.35: Hole in CATIA (can used to create taper, counter-bored, and counter-sunk in the TYPE icon.....	51
3.36: Pocket in CATIA(the Reverse Side icon is used to control the direction the removal of part inside the profile or outside the profile).Above figure is the Reverse Side arrow in direct inside the profile so the removal process will be in the profile..52	
3.37: Used the same function in the Pocket feature but this time the Reverse Side arrow is direct to outside of the profile so the removal process will done on the outside area of the profile.....	52
3.38: Isometric View of the Mould Cavity.....	53
3.39: Different view of model.....	54
3.40: Top View of the 3D model.....	54
4.1: Stock Material.....	58
4.2: Wheel path.....	58

4.3: Location of screw thread.....	59
4.4: Taps.....	59
4.5: Hand Tap Tool.....	59
4.6: Tapper Position.....	59
4.7: First bulk material being removed.....	60
4.8: Path of the cutting tool.....	60
4.9: Removal of bulk material.....	61
4.10: Path of the Cutting tool.....	61
4.11: EDM machining (Die No.1).....	62
4.12: Cross Section View.....	62
4.13: Side View.....	62
4.14: EDM machining (Die No.1 modification).....	63
4.15: Cross Section View.....	63
4.16: Side View.....	63
4.17: Shape of mould after milling process.....	64
4.18: Top View.....	64
4.19: EDM machining (Die No.2).....	65
4.20: Front View.....	65
4.21: Cross Section View.....	65
4.22: Remove of extra material.....	66
4.23: Illustration of cutting area after finish the EDM Die-sinking.....	66
4.24: The black line show in the above picture is the tool path of the end mill...66	66
4.25: EDM machining (Die No.3).....	67
4.26: Side Section View,work piece is placed on the machine's table vertically.....67	67
4.27: Work Piece is placed on the machine's table horizontally.....67	67
4.28: Frequent of the machining steps.....	68
4.29: Frequent of the machining steps.....	69
4.30: Die No.4.....	69
4.31: Die No.1 stock material dimension.....	70
4.32: Shown the ways of the material removal from the stock.....	71
4.33: Ways of remove extra material from the stock to obtained required length.....72	72
4.34: Location of the fillets on the work piece.....	73

4.35: Location screw threads on the one of the work piece surface.....	73
4.36: Schematic illustration of the triangle slot.....	74
4.37: Schematic illustration of the bending process; a) front view; b) isometric view.....	75
4.38: Die No.2 stock material dimension.....	75
4.39: Die No.2 dimension and specification.....	76
4.40: Remove extra length from the work piece Die No.2.....	77
4.41: Remove extra width from the work piece Die No.2.....	78
4.42: Schematic illustration of way to locate the gauge block and the red area is the material need to remove from the work piece.....	79
4.43: Square shape area need to remove from the work piece.....	79
4.44: Shape of the work piece after step 8.....	79
4.45: Position of the work piece and read area show the material will be removing from the work piece.....	80
4.46: Shape of the work piece after the step 10.....	80
4.47: Screw thread location.....	81
4.48: Die No.3 stock dimension.....	81
4.49: Die No.3 dimension and specification.....	82
4.50: Remove extra length from the work piece Die No.2.....	83
4.51: Remove extra width from the work piece Die No.3.....	84
4.52: Remove extra height from the work piece Die No.3.....	84
4.53: Schematic illustration of red area is the material need to remove from the work piece.....	85
4.54: Schematic illustration of way to located the gauge block to achieve 48°	85
4.55: Square shape area need to remove from the work piece.....	86
4.56: Screw thread location.....	86
4.57: Size of the screw thread (M6).....	87
4.58: Die No.4 Stock Dimension.....	87
4.59: Die No.4 Dimension.....	88
4.60: Remove extra width of die No.4.....	89
4.61: Remove extra height of die No.4.....	89
4.62: Remove the length of the die.....	90

4.63: Method to align the work piece into 48°	90
4.64: Schematic illustration of the chamfer the 4 edges of the work piece with 48°	91
4.65: Screw thread location.....	91
4.66: Drill tap on the center of the work piece. The diameter of the hole is 5 mm and deep of the hole is 6 mm.....	92
4.67: Form of screw thread with M6 screw taper.....	92
5.1: Finished mould.....	94
5.2: Finished mould with 2 long screw which attached to the tap-hole.....	94
5.3: Top view of the mould.....	95
5.4: Set of Die using in the EDM.....	95
5.5: Die 2 use in the EDM.....	96
5.6: Die 4 use in the EDM.....	96
5.7: Cavity of the mould.....	96
5.8: Die 3 use in EDM.....	96
5.9: Die 1 use in the EDM.....	96
6.1: Open the mould mounting screw. The mould is support by a trolley.....	99
6.2: Shown the 6 mm corner radii at the sharp corner.....	104
6.3: a) Circle area is the area of sharp corner and edge, b) magnify the circle area to have a clear view on the sharp edge and corner.....	105
6.4: a) Circle area is the area of sharp corner, b) magnify the circle area to have a clear view on the sharp corner.....	105
6.5: Shown the stock will undergo a series of processes between milling and EDM process.....	108
6.6: Shown the process sequent to machine the EDM Die.....	108
6.7: Method of alignment the work piece X and Y-axis.....	109
6.8: Method of alignment the die X, Y, and Z –axis.....	110
6.9: Show the path of the indicator' probe during the alignment.....	110
6.10: Existing Mould Cavity.....	112
6.11: New Design Mould Cavity.....	112

LIST OF TABLES

2.1: Part and Mould Characteristic.....	16
2.2: Mould Accuracy Standard.....	17
3.1: Mould and Product Differentiate Dimension.....	45
5.1: Dimension of the cavity mould.....	93

List of Abbreviations

LDPE	=	Low Density Polyethylene
HDPE	=	High Density Polyethylene
PP	=	Polypropylene
PMP	=	Polymethylpentene
PVC	=	Polyvinylchloride
PC	=	Polycarbonate
PS	=	Polystyrene
SAN	=	Styrene Acrylonitrile
ABS	=	Acrylonitrile Butadiene Styrene
RP	=	Rapid
CAD	=	Computer-Aided-Design
CAM	=	Computer-Aided-Manufacture
CMM	=	Coordinate Measuring Machine
RT	=	Rapid Tooling

CHAPTER 1

INTRODUCTION

This project is to design and develop a cavity insert of mould for the container plastic product by using CAD/CAM software and advanced manufacturing process. Develop a mould cavity is require combination of several stages until to the final product and is aimed to the mould are able to function as well. In the design and develop of a mould which needed many of the computer-aided design or manufacturing software and machine to complete the design and development of a mould. Listings below show the stages of design and development of a cavity mould:

- Design and determination on specification and dimension of the product
- Technical Drawing Generation in 2D and 3D with full scale of dimension
- Study the structure of the mould, characteristics
- Modeling the mould cavity for the product
- Mould fabrication and construct
- Select the appropriate process for fabrication and planning the process sequences

1.1 Background of the Problem

This project is continuous of previous study. Previous study is focus on the analysis and design the mould for Container Plastic Product. While in this project will concentrate on the validate the previous design's dimension and plan a process to develop the mould for container plastic product. The development process of the mould is generally a critical way for the newcomer in the mould industry. Mould development require years of experience and knowledge or either the effort or money are sacrificed will just waste it without any return rate. So it is very difficult for a new comer in this field to develop a mould without years of experience.

1.2 Statement of the Problem

The most efficient way to improve the knowledge in the mould development is research on the existed mould development procedure in the market. Apply these methods or the systems into the mould development process. From the development process try to analysis all the failure and successful factor and sure its all these result and study will be the best experience and knowledge base for the next mould development process. Below is the list of the problems statement:

- Unsure dimension accuracy provided by the previous study.
- Process selection and process planning for mould development

1.3 Objectives

In this final project objective is to study on design and develop cavity of a mould, the objectives are listing below:

- 1.3.1 Learn to use CAD/CAM software to design a mould
- 1.3.2 Understanding the Mould Structure and its function especially in the cavity side of the mould.
- 1.3.3 Learn to choose most appropriate manufacturing process for the mould construction.
- 1.3.4 Aims to obtain tolerance of the mould dimension become as precise as possible

1.4 Scope

The scope of this final project is listing below:

- 1.4.1 Study, verify the dimensions of container plastic product. Confirmation on the dimension is precise and suitable for fabricated.
- 1.4.2 Study function of the components and configuration of the mould. These include understand all the components in the mould and its each function.
- 1.4.3 Developed cavity of the mould by using most suitable manufacturing process.
- 1.4.4 Planning the whole process for the mould fabrication, the process planning include tools and process used in the fabrication and methods of removal material.

1.5 Importance of the Project

This project enable to widen the knowledge in the injection moulding process including design and development of a mould. Form this project surely will improve the understanding the whole mould structure, components, features and its components function. Beside that, through this project can gain more understanding in the mould design and mould development process. All these knowledge are very useful when involve in the mold making industrial.

1.6 Organization of the Report

Chapter 1: Introduction

In this chapter, will explain the objective and the scope of this project. Beside, in the introduction has been stated out the problems statement of the se project and the importance of this project for the future study.

Chapter 2: Literature Review

Literature review will study on all the research and study has been done and relevant to this project. The literatures are providing very useful information and knowledge to important to finish project.

Chapter 3: Methodology

In the methodology, will explain the all the procedure and progress to finish this project including release mould, assembly and disassembly mould procedure, measuring process by using the CMM, and the manufacturing process involved during the machining job.

Chapter 4: Development of Cavity mould and Dies

In this chapter, will explain the process plan to machining the mould cavity and dies by using several manufacturing process.

Chapter 5: Result

Finished mould cavity and the dies will be show at this chapter.

Chapter 6: Discussion

In this chapter, will discuss on the adjustment and few considerations should be concerns of. These factors will help to improve the quality and the accuracy of the mould.

Chapter 7: Conclusion and Recommendation

Conclude what has been gained during the whole progressing of this project. Beside that, recommend some opinion to improve the process planning quality.

1.7 Flow Chart of the Project

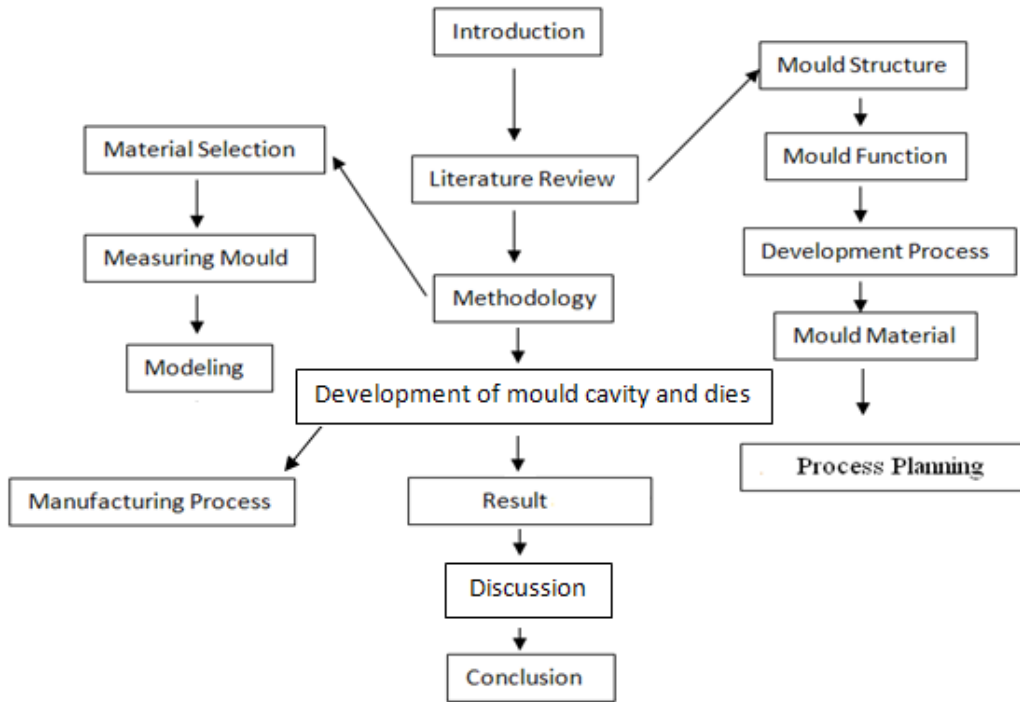


Figure 1.1: Flow chart of the project

1.8 Schedule of the project

Figure 1.2 below show the plan of schedule for the first part of the project:

Task/Week	1	2	3	4	5	6	7	8	9	10	11	12
Literature Review	█	█	█									
Mould Study			█	█	█	█	█	█				
Data Collection				█	█							
Refinement					█	█						
Analysis							█	█				
Verification									█			
Drawing										█		
Writing Up									█	█	█	█

Figure 1.2: Schedule of project

Figure 1.3 below show the plan of schedule for the second part of the project:

Task/Week	1	2	3	4	5	6	7	8	9	10	11	12	13
Process Planning - Process selection - Tools selection - Graphic process flow - Die fabrication - Operation details													
Fabrication													
Writing Up													

Figure 1.3: Schedule for the second part of the project

1.9 Summary

Overall in this project will more concentrate on the mould design, material selection for product and the mould base, analysis and modeling the cavity mould, measure the existing mould by using CMM, study the injection moulding machine function and selection development process for the mould fabrication.