



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**INVESTIGATION OF DEFECTS IN TRANSFER MOULDING  
PROCESS OF THE AUTOMOTIVE GLASS RUN CHANNEL  
SPECIFICALLY FOR THE CORNER JOINT**

This report submitted in accordance with requirement of the Universiti Teknikal  
Malaysia Melaka (UTeM) for the Bachelor Degree in Manufacturing Engineering  
Technology (Process & Technology) (Hons.)

by

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## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

**TAJUK: Investigation of Defects in Transfer Moulding Process of the Automotive Glass Run Channel Specifically for the Corner Joint**

**SESI PENGAJIAN: 2014/15 Semester 1**

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## **APPROVAL**

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering Technology (Process & Technology) (Hons.). The member of the supervisory is as follow:

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## **ABSTRAK**

Projek ini adalah untuk menyiasat punca kecacatan getah pelindung cermin automotif yang berlaku semasa proses pengacuan cantuman sudut. Getah pelindung adalah untuk mengelakkan hujan atau air memasuki kenderaan dan bertindak sebagai panduan gerakan untuk tingkap sama ada untuk dinaikkan atau diturunkan. Dalam konteks penemuan, punca kecacatan tertentu yang boleh didapati di cantuman sudut getah pelindung kenderaan semasa proses pengacuan cantuman. Tujuan penyiasatan ini adalah untuk mengetahui apa unsur yang boleh menyebabkan kecacatan pada cantuman sudut. Terdapat pelbagai jenis kecacatan yang boleh dilihat seperti buih, pengacuan tidak sempurna, tanda sink, tanda aliran, aliran yang berlebihan, kekosongan dan kotor. Tumpuan utama adalah pada acuan yang tidak lengkap dan buih. Kaedah yang digunakan untuk menangani isu ini adalah dengan menggunakan pendekatan alat kawalan kualiti yang berasaskan empat faktor yang mempengaruhi atau dipanggil sebagai analisis 4M (manusia, kaedah, dan mesin, bahan-bahan). Maklumat-maklumat mengenai getah pelindung cermin automotif diperoleh melalui laman sesawang untuk mengenal pasti elemen yang mungkin bagi kecacatan pada cantuman sudut. Lawatan telah dilakukan ke platform pengeluaran dan soal selidik yang telah diedarkan kepada pengendali berkenaan masalah ini dan data telah dikumpulkan. Berdasarkan keputusan yang dikumpul, tesis itu telah mencadangkan kepada pengilang dan penyelesaian untuk menyelesaikan masalah kecacatan dalam usaha untuk mengurangkan kadar kecacatan pada produk syarikat yang difokuskan.

## **ABSTRACT**

This project is to investigate the root cause of defects of the glass run channel that occurred during the transfer the moulding process. The glass run channel is to prevent rain or water entering the vehicle and act as motion guidance for glass window either to be raised or lowered. The purpose of this investigation is to find out what are the element that cause the defects. Defects of the glass run channel are varies such as bubbles, short moulding, sink mark, flow mark, excessive flow, void and dirty. Thus, this project will be focus on short moulding (incomplete moulding) and bubbles only. The methodology used are in order to tackle the issue by using quality control tools approach that is based on four influencing factor or called as 4M analysis (man, method, machine and, materials). Studies on literature from open sources such as internet have been performed in order to identify the possible element of the defects. A visit and discussion had been carried at the production line and the questionnaire has been distributed to the relevant operator and data were collected. Based on the result gathered of this root cause analysis, the suggestion on how to solve the defects problem were proposed to the company in order to help them to reduce the rejection rate.

## **DEDICATION**

This project is dedicated to my beloved family, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my lecturer and friends, who taught me that even the largest task can be accomplished if it is done one step at a time.



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# TABLE OF CONTENT

Abstrak	i
Abstract	ii
Dedication	iii
Acknowledgement	iv
Table of Content	v
List of Tables	viii
List of Figures	xi
<b>CHAPTER 1: INTRODUCTION</b>	<b>1</b>
1.1 Background	1
1.2 Problem Statement	2
1.3 Objectives	3
1.4 Project Scope	3
<b>CHAPTER 2: LITERATURE REVIEW</b>	<b>4</b>
2.1 Introduction	4
2.2 About Glass Run Channel	5
2.2.1 Function of Glass Run Channel	5
2.2.2 Design of Glass Run Channel	6
2.2.3 Material of Glass Run Channel	8
2.2.4 Chemical Additives of Glass Run Channel	8
2.2.5 Manufacturing Process of Glass Run Channel	9

2.3	Extrusion Process	11
	2.3.1 Principle of Extrusion	11
	2.3.2 Continuous Vulcanisation	12
	2.3.3 Extrusion Die	13
2.4	Transfer Moulding Process & Defects	14
	2.4.1 Introduction to Transfer Moulding	14
	2.4.2 Defects on Glass Run Channel	15
	2.4.2.1 Factor That Causes Short Moulding Defects	16
	2.4.2.2 Factor That Causes Bubble Defects	18
	2.4.3 Elimination of Defects	20
2.5	Previous Research	21
 <b>CHAPTER 3: METHODOLOGY</b>		<b>24</b>
3.1	Introduction	24
	3.1.1 Methodology of Project	26
3.2	Investigation of Root Cause	27
	3.2.1 Man Factor Contribution to Defects	28
	3.2.2 Method Factor Contribution to Defects	29
	3.2.3 Machine Factor Contribution to Defects	30
	3.2.4 Material Factor Contribution to Defects	31
3.3	Plan for Data Gathering	32
	3.3.1 Observation on Man Factor	32
	3.3.2 Observation on Method Factor	33
	3.3.3 Observation on Machine Factor	34
	3.3.4 Observation on Material Factor	35
3.4	Data Gathering	36
	3.4.1 Data Interpretation for the Man Factor	36
	3.4.2 Data Interpretation for the Method Factor	37
	3.4.3 Data Interpretation for the Machine Factor	39
	3.4.4 Data Interpretation for Material Factor	40
3.5	Analysis of Data & Identify the Root Cause	41

3.6 Recommend the Solution	41
3.7 Suggest Improvement Made	41
<b>CHAPTER 4: RESULT &amp; DISCUSSION</b>	<b>42</b>
4.1 Result for Man Factor	42
4.2 Result for Method Factor	46
4.2.1 Observation on Transfer Moulding Process	46
4.2.1 Observation on Joint Compound Weighing Process	50
4.3 Result for machine Factor	52
4.3.1 Process Capability Ratio for Mould Temperature	54
4.3.2 Process Capability Ratio for Injector Pressure	55
4.4 Result for Material Factor	56
4.4.1 Observation on Specific Gravity test	56
4.4.2 Observation on Joint Compound Weight Sample	58
4.5 Suggestion on Improvement Should Made by the Company	59
4.5.1 Improvement Suggestion to Man Factor	59
4.5.2 Improvement Suggestion to Method Factor	61
<b>CHAPTER 5: CONCLUSION &amp; RECOMMENDATION</b>	<b>62</b>
5.1 Conclusion	62
5.2 Recommendation	63
<b>REFERENCE</b>	<b>64</b>
<b>APPENDIX</b>	<b>67</b>

## LIST OF TABLES

3.1	Performance study data sheet of man factor	32
3.2	Data in transfer moulding process of machine factor	34
3.3	Specific gravity and joint compound weight of glass run channel	35
4.1	Summarized performance percentage of operator from month January to June 2014	43
4.2	Process capability of mould temperature for all machine	54
4.3	Process capability of injector pressure for all machine	55
4.4	Mean, standard deviation and control limit for specific gravity test	57
4.5	Mean, standard deviation and control limit for sample of joint compound weight	58

## LIST OF FIGURES

2.1	Example Application of glass run channel	5
2.2	Cross section of Glass Run Channel	6
2.3	Corner Joint of glass run channel	7
2.4	Manufacturing process flow of glass run channel	9
2.5	The schematic diagram of extrusion moulding machine	11
2.6	Example of continuous vulcanisation process	12
2.7	Example of die in Rubber Extrusion	13
2.8	Component of transfer moulding machine	14
2.9	Example bubble and short moulding as defective product	15
3.1	Methodology of Project	26
3.2	Ishikawa Diagram of bubble and short moulding defects for glass run channel corner joint.	27
3.3	Ishikawa diagram of man factor	28
3.4	Ishikawa diagram of method factor	29
3.5	Ishikawa diagram of machine factor	30
3.6	Ishikawa diagram of material	31
3.7	Bar graph to interpretation data of man factor	36
3.8	Flow chart to interpretation data from joining process of method factor	37
3.9	Flow chart to interpretation data from compound weighing process of method factor	38
3.10	Control chart to interpretation data from machine factor	39
3.11	Control chart to interpretation data from machine factor	40
4.1	The bar graph of average performance percentage of the operator	44
4.2	The line graph of performance percentage for operator at machine No. 5	45
4.3	Flow chart for glass run channel corner joint process	47
4.4	Flow chart for joint compound weighing process	50

4.5	Average mould temperature and injector pressure for machine 1 to 6 within six month of operation	52
4.6	Control chart for specific gravity test sample	57
4.7	Control chart for sample of glass run channel joint compound weight	58
4.8	Example sheet metal box for joint compound placement	60

# **CHAPTER 1**

## **INTRODUCTION**

In this chapter will discuss on the project background, problem statement, objectives and scopes of the project.

### **1.1 Background**

Automotive glass run channel is widely used in various kinds of vehicle since it's been introduced in earlier 1900's as a weather strip component. The function the run channel is to prevent rain or water entering the vehicle completely, and also to keep interior air conditioning at a comfortable temperature. Mainly, the function of the glass run channel is to provide motion guidance for glass window of a vehicle and as a seal component that will prevent from extensive outside environment. Glass run channel is made of EPDM rubber (ethylene, propylene, diene, M- class rubber) which is known as thermoplastic elastomer material or synthetic material. This synthetic rubber which has outstanding properties on temperature, weather fluctuations, tensile strength, and resistance to chemical and also act as electrical insulators, where do it chosen as good material of sealing capability of the glass run channel.

Glass run channel corner joint moulding process is being performed on automotive rubber based product in the industry. Glass run channel are mainly produced from extrusion process, later the product are cut into specified length before it assembled in the transfer



moulding machine. During this assembly process, there are several quality issues occurred on glass run channel which is bubble and short moulding. This kind of defects have led the production system inefficient and lowering the productivity of the company.

## **1.2 Problem Statement**

Quality issue regarding to the corner joint defects in glass run channel becomes a major concern for the assigned company. The defects cause the production system of the company to be less effective and decreasing and fail to meet customer requirement lead time. During corner joint assembly process of glass run channel, there are several types of defects occurred in the process such as bubble, short moulding (incomplete moulding), dirty, sink mark, warpage and flow mark. This project will focus on investigation of the root cause that contribute to bubble and short moulding.

The defects can only be observed after the product are ejected from the transfer moulding machine by visual inspection. The short term solution conducted by the company is by reworking process of each of the defective product. The defects section is being removed with cutter and remoulded again. This process consume time and extra labour that cause extra cost towards the company.

### **1.3 Objectives**

Objectives this project are:

- i. To identify the potential root cause that contribute to bubble and short moulding defects.
- ii. To apply the root cause analysis based on the 4 influencing factor (man, method, machine, and material).
- iii. To recommend the solution to solve the bubble and short moulding defects.

### **1.4 Project Scope**

This project scope are described as below;

- i. Glass run channel will be studied for this project. This project will be focused on to identify the root cause of two major types of defects that is bubble and short moulding.
- ii. This project will be apply root cause analysis procedure based on four main influencing factor which are man, method, machine and material.
- iii. Once the root cause of the defects has been identified, suggestion will be made on solving the problems.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter will provide the review of previous research which relates to this study. The review include the function of glass run channel, design and cross section. The process to manufacturing process involve in order to manufacture this product also will discussed on this section. The defects occur during transfer moulding process for the corner joint. The root cause of the defects involved on each factor and solution on how to reduce the defects are also described in this section.

#### **2.2 About Glass Run Channel**

This section will discuss application, design, manufacturing process and materials of glass run channel.

### 2.2.1 Function of Glass Run Channel

Glass run channel is a seal opening at the side window of automotive vehicle while allowing glass sliding within the U-shape gap of the product. The product mainly in black in colour which is made from synthetic rubber such as EPDM rubber which has reliable physical and mechanical properties needed for a glass window. The sliding function of the glass window achieved by flocking and lips design to prevent abrasion of glass towards the glass run channel. Abrasion material are also added to the contact surface of a glass window with the run channel which able to remove the abrasive force of both contact surfaces. Application of the glass run channel can be seen in the Figure 2.1. (Hutchinson, 2010).



Figure 2.1: Example Application of glass run channel. (Ford 4WD, 2008)

### 2.2.2 Design of Glass Run Channel

Glass run channel used in most vehicle, where corner joint can be manufactured by transfer moulding process. Generally it has a U - shape cross-section and within it have an outer and inner seal lip as shown in Figure 2.2. There are straight section which is made from extrusion process and the corner joint section which are made from transfer moulding process as shown in the Figure 2.3. Glass run channel attaches to an inner gap of the door frame for guiding door glass for raising or lowering. The glass run channel formed by joint

the extruded longitudinal section of an upper, vertical and side portion of the door glass gap while fitting with the corners of the door frame. The exterior surface of glass run channel which contact with the surface of the door metal body is brought into force that attach to an interior surface of the glass run channel, thereby fix the glass run channel into position. The inner and outer holding lips help to seal gaps between the metal body frame and glass run channel at inner side and outer side wall. Vertical straight cross section and upper side straight cross section of the glass run channel are joined to the corner section compound, thereby ensuring sealing properties and strongly secured to the door frame. (Tomoki Ota, 2012)

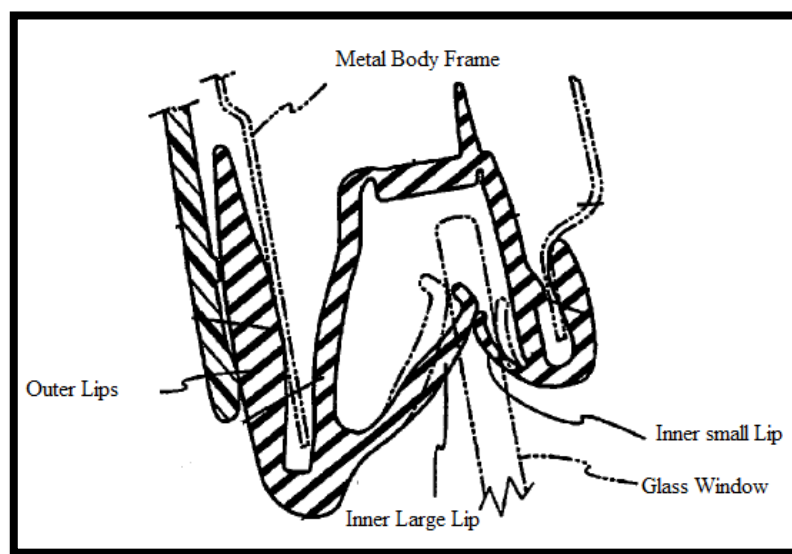


Figure 2.2: Cross section of Glass Run Channel (Tomoki Ota, 2012)

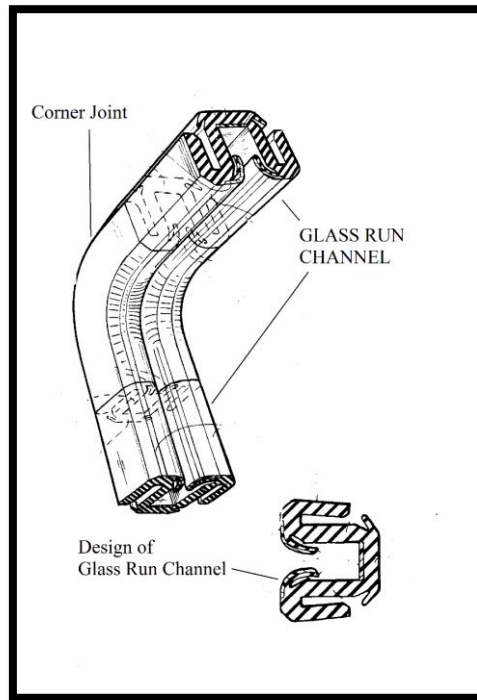


Figure 2.3: Corner Joint of glass run channel. (Kohji.Y, 1998)

### 2.2.3 Material of Glass Run Channel

The type of material been used in the transfer moulding process is EPDM rubber. EPDM is a synthetic rubber, an elastomer which refers E to ethylene, P to propylene, D to diene and M to. The extrusion process of run channel, EPDM rubber available in black and beige colour. EPDM rubber is frequently used for weather sealing application on all kinds of vehicle, usually on door, window, trunk and hood seals. Advantages of this EPDM provide excellent properties for outdoor application under sunlight, resistant to heat, ozone, UV-rays and also chemicals such as acid, alkali and other oxygenated solvent. Moreover, the EPDM rubber can withstand temperature fluctuation ranging from  $-45\text{ }^{\circ}\text{C}$  to  $+150\text{ }^{\circ}\text{C}$  especially resistance to water and steam. (G. Edward, 2012)

#### **2.2.4 Chemical Additives in Glass Run Channel Compound**

To achieve the rubber desired range and properties, is added with some additives. There are example of additives that mix with synthetic rubber which are described as below;

- a) Curatives – A chemical that actively creates internal bonding which is cross link of the long chain polymer such as sulphur.
  - b) Accelerators – A chemical that increases the rate of reaction for the curing process
  - c) Reinforcing filler – A material which increase the mechanical properties of a rubber, especially the strength of the product. Example material been used is carbon Black and silica.
  - d) Filler – Inert chemical such as clay that increase the bulk of the compound.
  - e) Plasticisers – To increase the process ability of the compound to produce specified product.
  - f) Anti – Oxidant – A chemical which added to help compound durability from ozone.
- (James A. Roth, 2009)

#### **2.2.5 Manufacturing Process of Glass Run Channel**

In this section will describe the manufacturing process of the glass run channel in the corner joint assembly process. The manufacturing process will begin from compounding to final finished good product are shown in the process flow in Figure 2.4.

Manufacturing process flow;

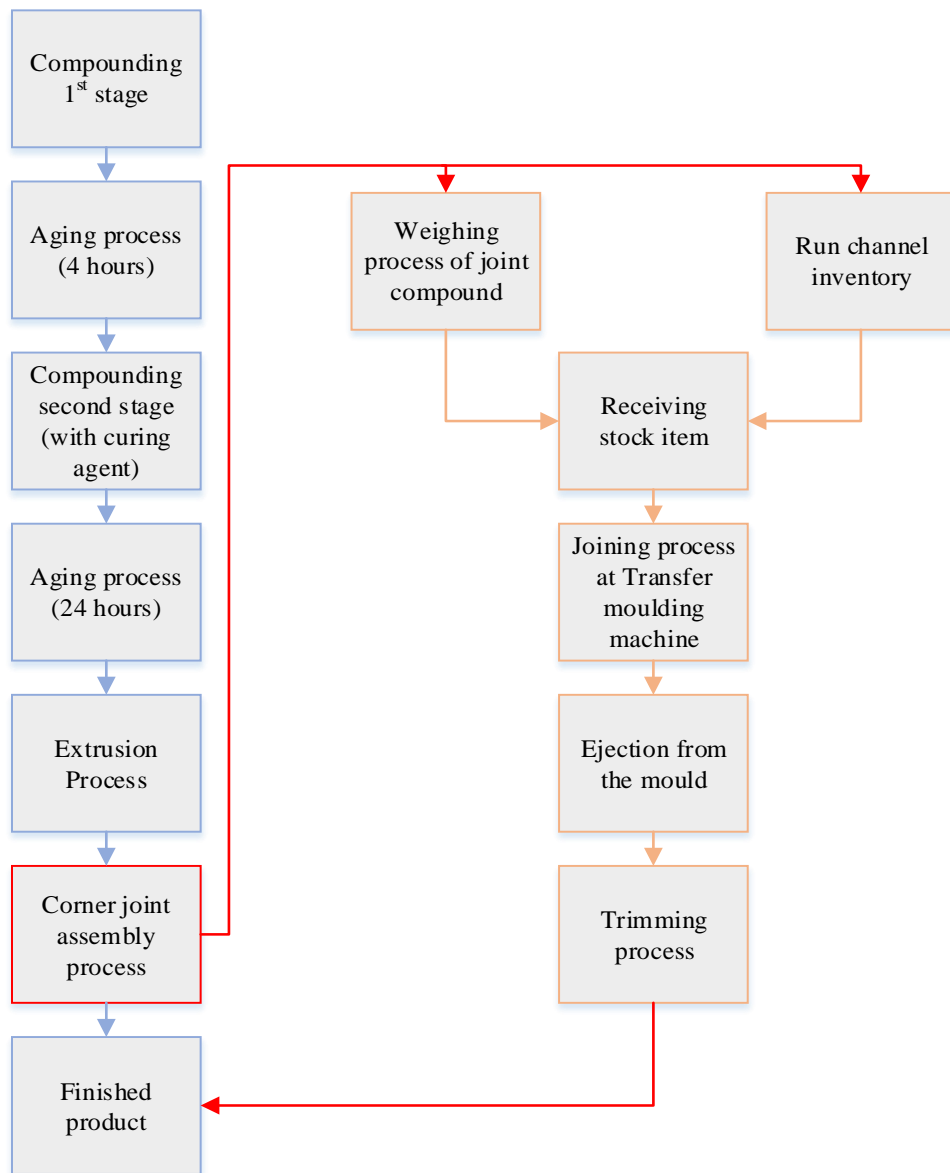


Figure 2.4: Manufacturing process flow of glass run channel.