ROOT CAUSE ANALYSIS OF CORE PIN QUALITY PROBLEM USING CAUSE AND EFFECT DIAGRAM

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

by

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of University Technical Malaysia Melaka (UTeM) as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Process) with Honours. The member of the supervisory committee is as follow:

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This report represents the study of Root Cause Analysis in Core Pin quality problem. Due to the purpose, the issue that was study is about quality in manufacturing process especially in a field of injection molding which contributes by the Core Pin. This aspect is very important to minimize a product cost without affecting its quality. The objective of this study is to identify the root cause of Core pin problem using a Root Cause Analysis technique. This study also requires preventing and improved the encountered problem identified in Core Pin quality problem for long term. This report focuses on the process to solve the cause that occurs as the quality problem for the Core Pin. The methods of Root Cause Analysis, Fishbone Diagram and 5Why analysis are used during the study. This method helps in data collection and data analysis before further conclusion is made as reflect of finding. A structure of Root Cause Analysis which consists of identifying and analyzing the problems is expected to be developed at the end of the study. Data were collected from the manufacturing plant, which indicated that the monthly defect rate were significant ranging between 1.3 % to 5.7%. These figure give a clear indication regarding to the number of defect occurs within the total production. This would be achieved if appropriate manufacturing practices were adopted with the aim of reducing the effect of manufacturing system variable that effect overall quality. A process attributes chart has been used to monitor the defect in each process of Core Pin. Upper and lower limit were given and the data are plotted in statistical control chart. If the defect above the upper limits the study meet the objective but if the defect below in the lower limits, some action must be taken to improve it.
ABSTRAK

DEDICATION

I would like to dedicate my special thanks to my beloved family especially for my father Allahyarham Ngah Deman Bin Hj Ahmad and my mother Puan Jamilah Bte Banan. Thanks for all your love and support. Also to all my friends and classmate for contributing to the success of my final year project and not to forget my supervisor Mr. Ismail Bin Abu Shah, thanks for all your advices and support. The successful of this project cannot be achieved without all of you. Once again, thank you to all for everything.
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Foremost, I would like to take this opportunity to express my sincerely gratitude to all those efforts facilitated in the completion of this thesis. Without helped and support from various people, the completion of this study would not be made possible.

Firstly, I would like to express my deepest gratitude and thanks to my most respected thesis examiner, Dr. Bagas Wardono and Encik Jeefferic Bin Abd Razak, from whom I sought and received valuable guidance, comments, views, advices as well as encouragement based upon her own extensive experience. I am also grateful for her tolerance towards my weaknesses and ignorance in completing this thesis. I wish to express my special word of thanks and indebted to En.Ismail Bin Abu Shah, who also responsible for the preparation of the contents and the flow of the thesis. Last but not least, special word of thanks and sincere gratitude to my beloved family, for the prayer and constant support for the beginning until the end of this study. Thanks a million.
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LIST OF ABBREVIATION

QA - Quality Assurance
ISO - International Organization for Standardization
FOS - Features of Size
GDT - Geometric Dimensioning and Tolerancing
MMC - Maximum material condition
LMC - Least material condition
RCA - Root Cause Analysis.
CHAPTER 1
INTRODUCTION

This chapter consist the background of study where it explains about the meaning of Root Cause Analysis in industrial practice and the quality of product, problem statement where it highlights the actual problem happened in Core Pin quality also objective and scope of this study. Later on next chapter will explain about the objective and scope. Then, followed by significance and the outline of the study will done to complete this report.

1.1 Background of the study

The issue highlights in this study is about quality in the manufacturing process. Quality is a high degree of excellence or good of highest of quality in manufacturing product. Simply and generally quality may be defined as a product’s fitness for use (Kalpakjian, and Schmid, 2006a).

Product quality has been one of the most important aspects in manufacturing process because quality is a broadcast characteristic or property and it consists not only of well-defined technical consideration but also of subjective opinions. The emphasize that quality must be built into a product and not merely checked for after the product already have been made. It’s to minimize a product’s cost without affecting its quality. Major advances in quality engineering and productivity has been made, largely because of the efforts of quality experts like used the Root Cause Analysis technique.
In quality management, it has three different conditions that have been used; it is ‘Yesterday’, ‘Real Time’ and ‘Breakthrough’. In ‘yesterday’ condition, only the inspection and sampling plan that being used. It is not effective to find the cause and problem. For the real time the Statistical Process Control that being used and to define the real time, Root Cause Analysis technique is used to analyze the data collection. Breakthrough is the stage where it used for a long term (continuously).

<table>
<thead>
<tr>
<th>Yesterday</th>
<th>Real Time</th>
<th>Breakthrough</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection</td>
<td>Statistical Process Control</td>
<td>FMEA</td>
</tr>
<tr>
<td>Sampling Plan</td>
<td></td>
<td>POKA YOKE</td>
</tr>
<tr>
<td>Root Cause Analysis technique</td>
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</tbody>
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*Figure 1.1: Relationship between Yesterday, Real time and Breakthrough*

### 1.1.1 Injection molding

The plastics injection molding process is important to many of today’s mainstream manufacturing processes in industries such as telecommunications, consumer electronics, medical devices, computers and automotive all have large, constantly increasing demands for injection molded plastic parts. In the production of injection molded parts is a complex process where, without the right combination of material, part and mold design and processing parameters, a multitude of manufacturing defects can occur, thus incurring in high costs. The injection molding process itself is a complex mix of time, temperature and pressure variables with a multitude of manufacturing defects that can occur without the right combination of processing parameters and design components (Moldflow, 2005).
The main part that is concerned in this study is Core Pin Insert Mould which is the part inside the mould. The function of the Core Pin is to push a molded part of a core in a mold as shown at **Figure 1.2**.

![Core Insert Pin](image)

**Figure 1.2**: Core Insert Pin

Core pins fit into ejector sleeves require special considerations. Core Pin are mounted on an ejector plate attached to a piston called an ejector rod. The principles of heat flow should be understood and applied in the injection mold design as the mold acts as a heat exchanger during the molding cycle. It is because core pins are then ideal for use in cooling plastic in a mold as they are in contact with the plastic and will remove heat by conduction. Core pin can transfer heat rapidly to an area of cooler temperature, insuring flow from the plastics through the core pin, due to the greater temperature difference between them. Standard off the shelf ejector sleeves are built to accept pins with tolerances applicable to core pins. Apparently when ejector sleeves were first introduced the only close tolerance pins available were core pin and the precedent was established. Core is mounting fit at the surface of cavity. Both the plastic material shrink rate and thermal expansion of the mold cavity and core must be taken into consideration in the design of close tolerance molds.
1.1.2 Root Cause Analysis

Root Cause is the most basic reason for an undesirable condition or problem which if eliminated or corrected would have prevented it from exiting or occurring (Wilson et al., 1993a). In keeping with the definition of root cause, care must be taken to distinguish symptoms clearly from cause, as well as apparent causes. Root Cause usually is defined in terms of specific systematic factor. Since the definition states that it is the most basic cause, a root cause is usually expressed in terms of the least common organizational, personal, or activity denominator. Proper Root Cause Analysis identifies the basic source or origin of the problem. Root Cause Analysis is a step by step approach that leads to the identification of a fault's first or root cause. Every system, equipment, or component failure happens for a reason. There are specific successions of events that lead to a failure. A root cause analysis investigation follows the cause and effect path from the final failure back to the root cause.

In certain industries, the cost of mistake cannot be calculated as easily. Particular attention has been given to the effectiveness of preventing recurrence of identified problems. The manufacturing industry, perhaps more so than others, also deals with problems that are only postulated as well as those that have already occurred. For the problem solving process to be effective the estimation must therefore uncover and correct the condition's root cause, not just treat the symptoms but find the best way to make solution of the problem.

Root cause analysis techniques are designed to provide with the proper focus for identifying and resolving problem as well as potential occurrences. This focus is to provide input to the management decisions making regarding quality and productivity improvement on a long term basis. Root cause analysis can be an effective management tool to find the true or actual cause of unwanted events or conditions, facilitating effective action and prevent their recurrence. It also provides the most obvious opportunities for improvement since it identifies obstacles and the basic reasons for problems in current activities or processes.