



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**IMPLEMENTATION OF “POKA-YOKE” DURING DFMEA STAGE  
FOR SME INDUSTRY IN MALAYSIA**

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

by

**NURUL SYUHADA BINTI CHE HUSSIN**

**870615-08-5784**

**B050910001**

**FACULTY OF MANUFACTURING ENGINEERING**

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## DECLARATION

I hereby, declared this report entitled “Implementation of “Poka-Yoke” During DFMEA Stage For Sme Industry In Malaysia” is the results of my own research except as cited in references.

Signature : .....

Author's Name : .....

Date : .....

## **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 (Manufacturing Design) with Honours. The member of the supervisory committee is as follow:

.....  
(Official Stamp of Principal Supervisor)

.....  
(Official Stamp of Co-Supervisor)

## **ABSTRAK**

Tujuan projek ini dijalankan adalah untuk mengaplikasikan konsep Poka Yoke dalam proses pengeluaran sesebuah industri yang besar. Ini bermakna Poka Yoke adalah digunakan untuk mengurangkan kadar barang yang mengalami kecacatan dalam proses pengeluaran. Poka Yoke juga amat berguna semasa Design failure Mode Effect analysis dalam mengesan sesuatu kegagalan di dalam proses pembuatan sesuatu produk. Adalah mustahil untuk menghapuskan kesalahan dalam diri manusia kerana manusia adalah dilahirkan sebagai insan yang tidak boleh lari dari membuat kesilapan. Namun begitu, organisasi dapat mengelakkan kesilapan ini daripada berlaku dengan cara mengaplikasikan kaedah Poka Yoke. Ini adalah kerana Poka Yoke adalah satu kaedah yang mudah untuk dilakukan oleh semua peringkat umur. Konsep Poka yoke dapat menyelesaikan masalah dengan cara mengubah proses pembuatan sesuatu produk. Satu jig Poka Yoke telah direka untuk membuktikan teori Poka Yoke sebagai alat yang boleh mengesan dan memperbetulkan kecacatan yang berlaku dalam proses pembuatan produk. Bagi syarikat yang berusaha kearah kecacatan sifar pada produk, kajian ini adalah amat berguna kepada mereka. Dalam kes ini, industry SME dipilih dalam membuktikan teori keberkesanan Poka Yoke.

## **ABSTRACT**

This project is aimed how to apply mistake proof concept which known as Poka Yoke to control the process during the mass production. It means that Poka Yoke is become a tools to reduce reject rate during production. Poka Yoke also is useful during Design failure Mode Effect Analysis as detection approaches of the failure during mass production. It is not possible to eliminate all mistakes that people make because people are not a mistake proof by their nature. The organization can avoid this mistakes by using the Poka Yoke method. Poka Yoke is a very simple concept in nature to be implemented by human. The basic concept of Poka Yoke is avoiding the problem by correcting the process. A jig of Poka Yoke has been created to proof the theory as a tools that detecting the defects. For those company strive for Zero Defect , this study is useful for them. In this case, a SME industry was selected to apply and analyze the Poka Yoke effectiveness.

## **DEDICATION**

*Special thanks to my supervisor Engr. Dr. Hambali Bin Arep@ Ariff, my co- supervisor  
Engr. Mohd Soufhwee bin Rahman and my friends.*

*For my beloved parent Che Hussin bin Saad and Saayah Bt Ishak*

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## LIST OF ABBREVIATION

FMEA	-	Failure Mode effect And Analysis
PFMEA	-	Process Failure Mode Effect Analysis
ZDQ	-	Zero Defect Quality
DFMEA	-	Design Failure Mode Effect Analysis
DMAIC	-	Define-Measure-Analyze-Improve-Control
IPQC	-	Internal Product Quality Check
RPN	-	Risk Priority Number
NASA	-	National Aeronautics and Space Administration



# CHAPTER 1

## INTRODUCTION

This project is used to introduce the term of Poka-Yoke system that have been applied in the industry in recent years and to investigate how the effective of the Poka Yoke system in industry. According to the Robinson and Harry (1997), Poka-Yoke is a Japanese term that means "fail-safing" or "mistake-proofing". A Poka-Yoke is a mechanism in the lean manufacturing process that helps an operator to avoid mistakes. The purpose is to eliminate product defects by preventing, correcting, or drawing attention to human errors as they occur. It is also a technique that has been designed to prevent accident errors made by workers performing a process.

This technique of "Poka Yoke" can helps people and processes work right for the first time. It also can improve the quality and reliability of the product. "Poka Yoke" refers to the technique that makes it impossible to make mistakes. It is a term of FMEA. FMEA is a procedure in product development and operations management which were used for the potential failure modes analysis within a system for classification by the severity and likelihood of the failure. A failure mode is a definition for any errors or defects that occur in a process, design, and etc especially the defect that affect the customer. The effects analysis was studying about the effect of those failures.

## **1.1 Background**

Poka Yoke is useful during the DFMEA which will function as the detection approaches of the failure during mass production. It is not possible to eliminate all the mistakes that people make. People are not mistake proof but the organization can avoid this human error from reaching to the customer by using this method. Mistakes can be stopped as soon as they happen at least. Poka Yoke is a very simple method in the nature. For those company strive for Zero Defect, this study will be useful for them. In this case, a SME industry had been chosen in order to apply and analyze the Poka Yoke effectiveness.

## **1.2 Problem Statement**

Poka-Yoke is used to achieve the Zero Defect Quality of a product in the production line. It has been implemented by the big industries around the world because it is a simple solution whereas can improve the quality of the product and minimize the cost. According to the Philips (2006), Zero Defects is a business practice which aims to reduce and minimize the number of defects and errors. The ultimate aim was to reduce the level of defects to zero.

Poka-Yoke also have used to decrease set-up times with related to the reduction in production time and improved production capacity. Besides that, Poka-Yoke also can increase the safety of the worker in addition to improve the workers attitudes. Poka-Yoke can be as simple as a steel pin on a fixture that keeps incorrectly placed parts from fitting properly, or they can be as complex as an electronic circuit that used to automatically detect tool breakage and immediately stop the machine. This is the simple and the low cost devices.

Although Poka-Yoke is a famous method in the industry, but it is not widely used to correct the error before the error occurred. It is because the Poka-Yoke used only when the error has occurred in the production line. The action only be taken when the error available in the production line. Poka-Yoke can be implemented with the other approach during quality management such as FMEA, QFD and DMAIC. Many industries are not combining the Poka-Yoke with the other famous tool like FMEA because there are not have the enough information about this tool. In the future, Poka-Yoke should be applied before the defect or problems occur.

### **1.3 The Objective of Study**

The objectives of this study are as follows:

- (a) To study about the implementation of Poka-Yoke as a process control system in DFMEA.
- (b) To apply GO/NOGO jigs as a technique in order to detect the problem in Poka-Yoke.

### **1.4 Scope of Study**

The scope of this study is more focusing on how to apply the Poka-Yoke system during the design stage with concerns the manufacturing processes such as design the jig, modified the working instruction and etc. DFMEA was applied in this research since it is the famous method should be used in design process. DFMEA is a method that applies in the detection step of FMEA. Detection is a last step of FMEA in order to evaluate the RPN number. DMAIC process had used in the application of Poka-Yoke through DFMEA stage because it is a suitable method to develop framework of correlation between DFMEA and process capability.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

A literature review is a body of text that aims to review the critical points of current knowledge as well as theoretical and methodological which is offering to a particular topic. It uses to determine how much work has already been done and to identify any gaps in the knowledge. Besides that literature review also used to generate knowledge of the general subject within the specific area and to discover all the information that have used in this project.

The literature review for this project had performed in order to implement the process control system through Poka Yoke during DFMEA stage for SME industry in Malaysia. DFMEA is a type of FMEA tool whereas used to solve the problem which was related with the design of the product. This chapter also explored about the recent study of Poka Yoke, FMEA, DFMEA, DMAIC, design method and automotive automotive car jack from the journal, website, articles and books. To implement the Poke-Yoke during DFMEA stage, design of the jig have been chosen in order to complete this study.

## **2.2 Poka-Yoke**

Poka-Yoke refers to techniques that make it impossible to make mistakes. These techniques can drive defects out of products and processes and substantially improve quality and reliability (Anonymous, 2007a).

### **2.2.1 Overview of Poka-Yoke**

Poka-Yoke helps people and processes work right at the first time. It can be thought of as an extension of FMEA. It can also be used to fine tune improvements and process designs from six-sigma DMAIC projects. The use of simple Poka-Yoke ideas and methods in product and process design can eliminate both human and mechanical errors (Anonymous, 2007a).

Dr Shigeo Shingo was the person that introduced the Poka-Yoke method in year 1961. He was an engineer in the Toyota Motor Corporation. Poka-Yoke is use to prevent defects and errors originating in the mistake. In the years 50 Shigeo Shingo being an adviser of statistical process control systems in Japanese companies realizes that such a solution would never improve the manufacturing process. It is therefore started in Japanese organizations to implement a Zero Quality Control (Ketola and Roberts, 2000).

The name of Poka-Yoke established in 1963 by Shigeo Shingo, it is translated as "resistance to errors" and errors resulting from inattention. It is used to avoid the defects that come from the human error. In the course of repetitive operations which depend on human alert and memory, Poka-Yoke may save time and release the mind of worker for operations more creative and increase the worker value (Lachajczyk and Dudek, 2006). At each stage of the product life cycle, in each process and its operations there is a possibility of errors. In the consequence of errors the final product has defects and customer is not satisfied and disappointed. The method Poka-Yoke is based on

simplicity that it is not acceptable to produce even very small quantities of defective products (Ishikawa, 1982).

### **2.2.2 History of Poka-Yoke**

Recent research by Grout and Downs (1997), the term "Poka-Yoke" comes from the Japanese words "Poka" (inadvertent mistake) and "Yoke" (prevent). The essential idea of poka yoke is to design your process so that mistakes are impossible or at least easily detected and corrected. Shigeo Shingo was a leading proponent of statistical process control in Japanese manufacturing in the 1950s, but became frustrated with the statistical approach as he realized that it would never reduce product defects to zero. Statistical sampling implies that some products to go untested, with the result that some rate of defects would always reach the customer.

While visiting the Yamada Electric plant in 1961, Shingo was told of a problem that the factory had with one of its products. The problem was both costly and embarrassing. Management at the factory would warn the employees to pay more attention to their work. Shingo went on to develop this mistake proofing concept for the next three decades. One crucial distinction he made was between a mistake and a defect. Mistakes are inevitable; people are human and cannot be expected to concentrate all the time on the work in front of them or to understand completely the instructions they are given. Defects result from allowing a mistake to reach the customer, and defects are entirely avoidable. The goal of Poka-Yoke is to engineer the process so that mistakes can be prevented or immediately detected and corrected. Poka-yoke devices proliferated in Japanese plants over the next three decades, causing one observer to note. It is not one device, but the application of hundreds and thousands of these very simple "fail-safing" mechanisms that day after day has brought the quality miracle to Japan (Anonymous, 2011b).

### 2.2.3 Case study by Dr. Shinge Shingeo

(a) Problem Statement

Dr. Shinge Shingeo has visiting the Yamada Electric Plant in year 1961. He was told for a problem that the factory had with one of its products. The part of the product was a small switch with two push buttons support with two springs. Occasionally, the worker assembling the switch would forget to insert a spring under each push button. Sometimes, error would not be discovered until the unit reached to the customer, and the factory would have to dispatch an engineer to the customer site to disassemble the switch. Insert the missing spring and reassembled the switch. This problem of missing spring was both costly and embarrassing. Management at the factory will warn the employees to pay more attention to their work, but despite everyone's best intentions, the missing spring problem would eventually re-appear (Chong, 2011).

(b) Old Approach ( Before Poka Yoke)

The process step of assembly the spring is shown like below:

- i. Take springs out from parts box that contain many springs.
- ii. Assemble to the switch.

(c) New Approach ( After Poka Yoke)

The process step of assembly the spring is shown like below:

- i. Take two springs out from parts box that contain many springs.
- ii. Place the two springs at the small dish in front of the part box.
- iii. Assemble to the switch.

(d) Solutions Statement

Dr. Shinge Shingeo has get the solution in year 1963 to place the small dish in front of the parts box and the worker's first task is to take two springs out

of the box and place them on the dish, then the worker will know if worker has forgotten to insert the spring (Chong, 2011).

#### **2.2.4 Types of error**

Poka-Yoke is a method to reduce or eliminate the defect occurs in the production line in the industry. Every day, many kind of mistake can be available in the complex environment of workplace that cause by human error. The mistake will cause the defective of products. According to Nikkan (1987), Defects are wasteful, and if they are not discovered they will disappoint the customer's expectation quality. The Poka-Yoke method is a simple method in order to achieve the Zero Defect of the products. Almost all the defects at the production line are cause by the human error. The example of mistake that causes by human error are shown as below:

(a) Forgetfulness

Sometimes, human are forget thing when they are not concentrating. Poka-Yoke solution for this error is alerting operator in advance or checking at the regular interval.

(b) Errors due to misunderstanding

Sometimes worker make mistakes when they are jump to the wrong conclusion before they are familiar with the situation. Poka-Yoke solution for this error are training and standardizing work procedure.

(c) Errors in identification

Sometimes human misjudge a situation because they view it too quickly or too far away to see it clearly.