



**Faculty of Mechanical and Manufacturing Engineering  
Technology**

**DESIGN AND DEVELOPMENT AN INTEGRATED QUALITY  
INSPECTION GAUGE FOR MOTORCYCLE CLUTCH  
PRESSURE PLATE**

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**Bachelor of Mechanical and Manufacturing Engineering Technology (Process and  
Technology)**

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**DESIGN AND DEVELOPMENT AN INTEGRATED INSPECTION GAUGE FOR  
MOTORCYCLE CLUTCH PRESSURE PLATE**

**NURUL ATIKAH BINTI IBRAHIM**

**A thesis submitted  
in fulfillment of the requirements for the degree of Bachelor of Manufacturing  
Engineering Technology (Process and Technology)**

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## DECLARATION

I declare that this thesis entitled “DESIGN AND DEVELOPMENT AN INTEGRATED QUALITY INSPECTION GAUGE FOR MOTORCYCLE CLUTCH PRESSURE PLATE” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : .....

Date : .....

## **APPROVAL**

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

Signature : .....

Supervisor Name : Profesor Madya Ts. Dr. Wan Hasrulnizam Bin  
Wan Mahmood

Date : .....

## **DEDICATION**

Dedicated to

My beloved father Ibrahim Bin Abdullah

My beloved late mother Rajimah Binti Yahya

My siblings Ridhzuan, Azhar and Farah Wahida for continues support and understanding.

May Allah bless you with endless happiness.

## **ABSTRAK**

Tujuan projek ini ialah untuk merekabentuk dan membangunkan pengukur pemeriksaan kualiti bersepadu untuk plat tekanan klac motosikal. Alat semasa untuk mengukur motosikal plat tekanan klac adalah dengan menggunakan vernier caliper dan pemeriksaan spacer. Kaedah penyelidikan termasuk Mod Kegagalan dan Analisis Kesan, Peningkatan Fungsi Kualiti, Matriks Penapisan dan Pemarkahan menggunakan Kaedah Pugh. Konsep reka bentuk melibatkan tiga bahagian utama yang menentukan paling kritikal untuk proses pemeriksaan berdasarkan analisis spesifik menggunakan Mesin Pengukur Selaras dan Perbandingan Optik Horizontal. Terdapat tiga konsep reka bentuk yang telah dibangunkan berdasarkan ukuran tolok sedia ada semasa dalam industri. Prototaip itu direka dengan menggunakan bahan kos rendah yang dapat meningkatkan proses pemeriksaan plat tekanan klac motosikal dan rujukan piawaian toleransi untuk produk ANSI / ASME B89.1.5. Sebaliknya, projek ini melibatkan penggunaan proses pemesinan canggih termasuk mesin pemotong laser dan peralatan pengukur ketepatan tinggi. Kepentingan projek untuk reka bentuk dan pembangunan alat pemeriksaan baru boleh menjadi rujukan yang baik untuk merekabentuk produk. Konsep tolok reka bentuk telah dibangunkan dengan menggunakan Matriks Penapisan dan Skor Konsep menggunakan Kaedah Pugh.

## **ABSTRACT**

The purpose of the project is to design and develop an integrated quality inspection gauge for motorcycle clutch pressure plate. The current tools for measuring the clutch pressure plate motorcycle is by using vernier caliper and spacer inspection. The research method includes Failure Mode and Effect Analysis, Quality Function Deployment, Screening and Scoring Matrix using Pugh Method. The design concept involves three major part which determine most critical for inspection process based on specific analyses using Coordinate Measuring Machine and Horizontal Optical Comparator. There are three design concepts had been developed based on current existing standard gauge in the industry. The prototype was fabricated using low cost material that able to enhance the inspection process for motorcycle clutch pressure plate and the tolerance standard reference for the product is ANSI/ASME B89.1.5. On the other hand, the project involved the use of advanced machining process including laser cutting machine and high precision measuring equipment. The project significance for design and development of new inspection tool can be a good references to design a product. The concept of design gauge has been develop by using concept Screening and Scoring Matrix using Pugh Method.

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## **LIST OF ABBREVIATIONS**

CoQ	Cost of Quality
CoPQ	Cost of Poor Quality
CoGQ	Cost of Good Quality
CMM	Coordinate Measuring Machine
FMEA	Failure Mode Effect Analysis
GRRS	Gauge Repeatability and Reproducibility Studies
HOQ	House of Quality
LCL	Lower Specification Limit
MSA	Measurement System Analysis
OC	Optical Comparator
QC	Quality Control
USL	Upper Specification Limit



# CHAPTER 1

## INTRODUCTION

This chapter briefly present the main idea of this study. Additionally, this chapter explains the background, problem statement, objective and scope related to the study.

### 1.1 Project Background

Quality has been understood as a defect free product. Since then, quality has become an organisation's comprehensive business concept and a critical success factor. Vivek and Priyam, (2017) describes quality is the standard of something measured against similar things and something's degree of excellence. There are three aspects usually associated with the definition of quality: quality of design, quality of conformance and quality of performance. Quality is required product, process, service and environment.

Quality inspection is the first stage of quality approach development. Quality inspection is a measure to check, measure or test one or more product characteristics and to relate the results to the requirements for confirmation of conformity. According to the ISO 2859 standard – derived from MIL-STD 105 E – quality inspection involves activities such as testing, gauging or measuring one or more product features. Inspection, testing measurement and determining the product quality level are the activities or techniques used to verify the product quality as well as to ensure that the manufacturing process results are the same as expected. Inspection and testing activities are carried out to detect the defects in

the products and report to production management who decide to allow or deny the release of the product.

The most common methods of achieving standardization, uniformity and quality of workmanship are inspection and testing during the manufacturing process of a product. These are the process of controlling the quality of the product by comparing it to the standards and specifications established. It is one of the quality control operational components. During inspection and testing, if the product does not fall within the acceptability zone, the product is rejected and the production management will have to take corrective measures to ensure that the product manufactured complies further with specified standards and specifications.

## **1.2 Problem Statement**

A clutch is a mechanical device that allows power transfer and movement between two assemblies to be controlled. These two assemblies are the outer clutch basket and the transmission input shaft in a motorcycle. Holding the plate tight against the flywheel and allowing the power to flow from engine to transmission is the main function of the pressure plate. This project are carry out to check quality specification for measurement of clutch pressure plate motorcycle when handling inspection quality in more efficient method using gauge inspection. For now, the tools used to measure the clutch pressure plate is venire calliper. There are few possible problem will occur while the operators inspect the product. One of the problem is human error and the opening calliper not fit well with the product to be measured. However, in order to improve this problem, new prototype gauge inspection are design followed by criteria and requirement need to follow when designing a gauge. The clutch pressure plate motorcycle must meet the standard requirement of measurement so the product can be absorb into the market today.

### **1.3 Objective**

This study has the following objective:

- i. To study the type of measurement motorcycle clutch pressure plate.
- ii. To design a gauge of motorcycle clutch pressure plate.
- iii. To fabricate a prototype of gauge motorcycle clutch pressure plate.

### **1.4 Scope**

The scope of this study are:

- I. The gauge fit for clutch pressure plate motorcycle EX5 Dream/Wave 100/Wave 110 Honda.
- II. Three part dimension are integrated to limit the measurement inspection gauge on product.
- III. The gauge is focus on design the prototype gauge clutch pressure plate motorcycle.

### **1.5 Significant Project**

The rational of study are as follows:

- a) To study and better understanding on different types of gauges depending on the function and purpose.
- b) Generate the idea and concept of design for gauges by using concept design tools.
- c) To study and better understanding of the desirable properties of gauge material.
- d) To be widely analyzed in order to make this research a reference or benchmark for future study.

## **1.6 Report Organization**

The report is arranged in accordance with the order of chapter 1. It contains the general information about project, problem statement, objectives, scope and the significant project. Chapter 2 covers the literature review that has been point out by previous research on design consideration of gauge and quality inspection. This is include the cost of quality, inspection technique, types and function of gauge. Chapter 3 present the methodology of the study conducted. It contain flow chart, data analysis and concept design for gauge. Chapter 4 clearly discuss about the result and finding of research. Last but not least, Chapter 5 conclude recommendation and suggestion for future of this research.

## CHAPTER 2

### LITERATURE REVIEW

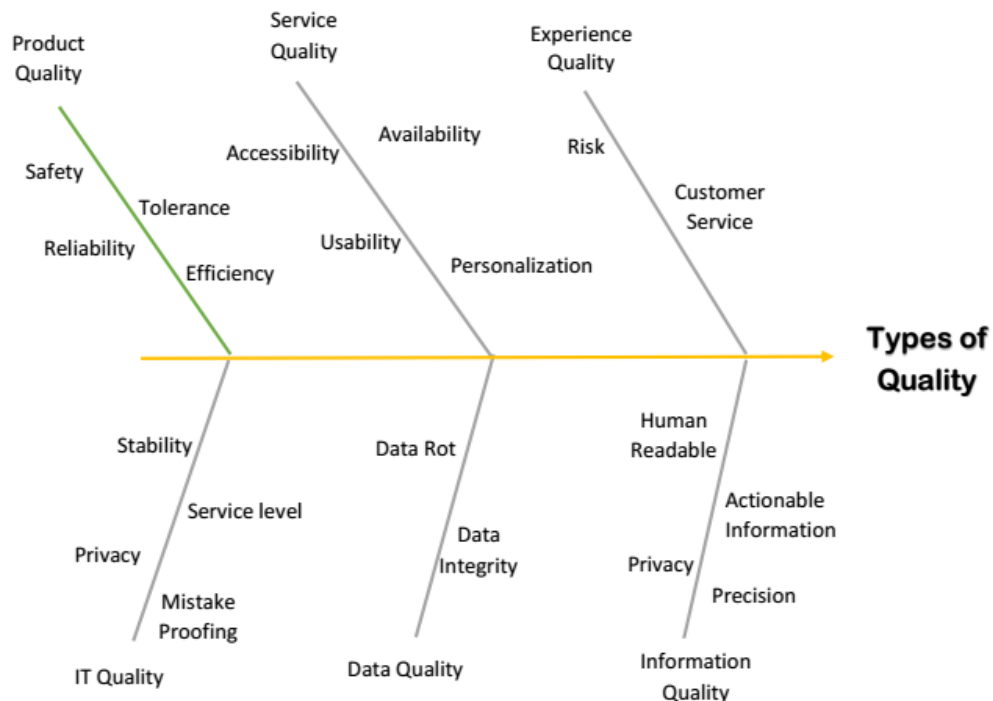
#### 2.1 Introduction

In this chapter explains all findings from various literature reviews that come from the internet, newspapers, articles, journals, and books related to the subject and study. The first part discusses about quality control and inspection by providing definition as well as method of inspection method. This followed by study related of cost of quality, measurement system analysis, definition and type of gauges.

#### 2.2 Quality

The term quality has been used to refer to the fulfillment of a product's standard specification in order to achieve customer needs without defects. This definition is close to those of Weele.V (2005) and Crosby (2006) who define quality is the degree in which customer requirement are met and specified requirement can be measured. However, the development of quality thinking and the growing importance of quality have made it increasingly difficult to define quality. Moreover, Lecklin (2002) stated that the concept of quality depends to a large extent on the situation that varies from case to case.

According to a definition provided by Spicey.J (2017), quality can be described in terms of quality or lack of quality as any product, service, experience or asset. Figure 2.1 shows different methods have been proposed to classify quality: product quality, service quality, experience quality, IT quality, data quality and information quality.



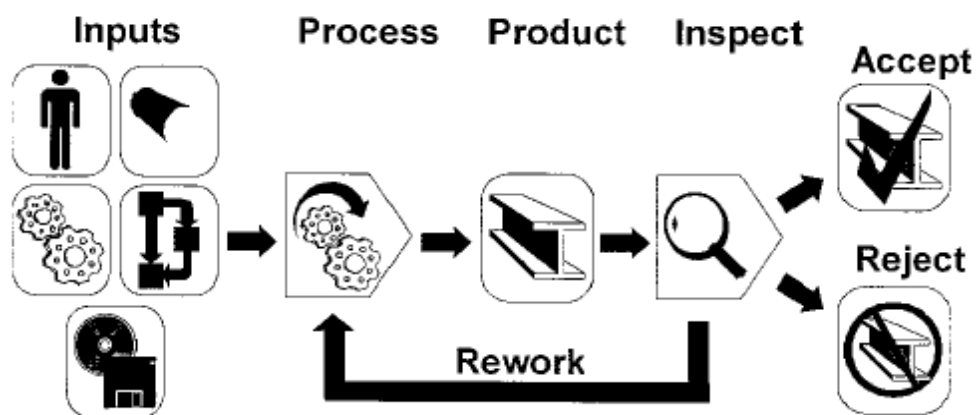
**Figure 2.1: Types of Quality**

### 2.2.1 Quality Control

Quality control or QC refers to activities to ensure the highest possible quality of the products produced. Most quality control tools and techniques are statistical techniques. Hairulliza et al., (2011) divided quality techniques into three broad types: basic, intermediate, and advance level, but there is no consensus among researchers in the classification. Although differences of opinion still exist, there appears to be some agreement that QC techniques are applied by using inspection equipment and certain procedures to inspect and measure product quality characteristics (Nani et al., 2015). Quality control in each production system is aimed at eliminating non-conformity and its consequences, eliminating rework and wasted resources, and eliminating the lowest possible cost.

## 2.2.2 Evolution of Quality Control

The relationships between inspections of judgments, the process of manufacturing and related decisions (Figure 2.2) show that inspection takes place after the product is made. Thus, inspections of judgments can detect non-compliance only after it has been generated. Inputs for each process is included for the man, materials, methods, information, and machines as show on the left of the figure. The product is accepted, rejected or reworked on the basis of inspection.



**Figure 2.2:** Judgment inspection after process has transformed input into a product.

Next, a gauge inspection refinement of judgment inspections. In (1990), Womack et al., stated that while the concept of interchangeable parts has been developed by Eli Whitney, Henry Ford was credited with broad acceptance. Ford acknowledged that partial variability was a major obstacle to genuinely interchangeable parts being achieved. Ford continued to use inspections of judgments to check part characteristics in order to achieve greater consistency, but replaced visual inspection with gaging inspection. Gauges had to be traceable to standards throughout the Ford production system as a procedure to overcome gauge differences from one location to another. This effective implementation increased

interest in international standards of measurement and played a major role in mass production development.

### **2.2.3 Quality Inspection**

Quality inspection is a measure for checking, measuring or testing one or more product characteristics and related to requirements for confirmation of conformity (Wawak.S, 2018). Quality inspection is the first step in the development of a quality approach and final inspection in production line. In the fast-growing industry, the rules of scientific management were developed by Taylor.F.W (1915). With rapidly increasing labour productivity, quality was not up to speed. The customer often had to count on defective products.

By replacing the defective product with a new one, this problem was solved one to alleviate customer frustration. This type of procedure has resulted in considerable costs being generated. Controller position, unknown to craft was introduced to reduce manufacturers of excessive cost escalation. Through inspections, the designated employee ensured that as many good products as possible left the factory gate. Post-operative or post-production check of products is concerned with quality inspection. It has no direct impact on the manufacturing process. Quality inspector sorts only products and does not leave the factory with products of poor quality. There is no quality inspection feedback loop. That means information is not passed on to workers or managers about failures and their causes.

### **2.2.4 Inspection Technique**

During the manufacturing process, inspections are carried out at different times. Include inspection of raw materials and components from external sources (incoming inspection) and finished product inspection to ensure functional quality and product