DESIGN AND DEVELOPMENT OF A CHECKING FIXTURE FOR AN AUTOMOTIVE PRESS PART

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

by

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DECLARATION

I hereby, declared this report entitled "Design and Development of a Checking Fixture for an Automotive Press Part" is the results of my own research except as cited in reference.

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APPROVAL

This report is submitted to the Faculty of Manufacturing engineering of Universiti Teknikal Malaysia Melaka as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Design) (Hons.). The member of the supervisory committee is as follow:

…….

(WAHYONO SAPTO WIDODO)

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ABSTRAK

Projek ini mengenai reka bentuk dan penghasilan sebuah alat memeriksa kualiti untuk komponen automotif. Objektif bagi projek ini ialah untuk mereka bentuk dan menghasilkan sebuah alat memeriksa kualiti untuk komponen automotif. Selain itu, ianya juga untuk memeriksa kualiti komponen automotif atau kepingan besi. Permasalahan dalam projek ini ialah untuk memeriksa komponen automotif bagi memastikan tahap kualiti sesebuah komponen automotif mengikut standard piawaian yang telah ditetapkan daripada komponen yang asal. Bahagian kritikal di dalam produk ini ialah kedudukan '*datum*' dan had yang dibenarkan dalam setiap spesifikasi. Maka, setiap bahagian kritikal perlu dinilai dengan terperinci supaya bahagian kepingan besi berada dalam keadaan yang baik dan melancarkan operasi pemasangan. Kaedah yang digunakan untuk reka bentuk dan menghasilkan alat memeriksa kualiti ialah bermula dari peringkat reka bentuk, dimana kaedah kejuruteraan pembalikan digunakan untuk mendapat data geometri daripada bahagian kepingan besi yang sebenar. Selepas itu, bahagian edit menggunakan perisian reka bentuk seperti EXScan8, GeoMagic Studio 10 dan CATIA V5R19 bagi mendapatkan keputusan yang lebih baik dan menghasilkan lukisan yang lebih terperinci. Proses pembuatan termasuk pemesinan mudah dan susah, dimana pemesinan mudah mengandungi pembuatan pin 'locator' dan 'bushing'; dan pemesinan susah termasuk pemasangan semua komponen menjadi satu alat memeriksa kualiti. Akhir sekali, pemeriksaan kualiti dilakukan menggunakan produk sebenar bersama alat memeriksa kualiti dan borang semakan kualiti.

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ABSTRACT

This project is about the design and development of a checking fixture for an automotive press part. The objectives of this project are to design and develop the checking fixture for automotive press part. Besides that, it also to make quality inspection of automotive presses part or sheet metal part. The problem statement of this project is to make the inspection for metal press part to ensure that the quality of the automotive press part follow the standard specification from the original part. Critical parts of the product are datum and tolerance. So, every critical part needs to evaluate in detail to ensure that the sheet metal part in good condition and smooth operation during production line. The methods that used for design and develop the checking fixture are start from the design stage, whereby the reverse engineering used to obtain the geometrical data from actual metal press part. After that, the editing part using design software such as EXScan8, GeoMagic Studio 10 and CATIA V5R19 are used to get the better result and produce the detailed drawing. The manufacturing process involved the simple and complex machining, which are the simple machining contain the making of simple locator and bushing pin; and complex machining contain the assembly of all part until produced the checking fixture. Lastly, the quality inspection has been done using actual product together with the checking fixture and check sheet form.

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DEDICATION

To my late father,

Abdul Jalil bin Jaberal @ Saberan

My beloved mother,

Shahrina binti Sulaiman

My brothers and sister,

Muhammad Syafiq bin Abdul Jalil

Nur A'mirah Syuhada binti Abdul Jalil

Muhammad Danial bin Abdul Jalil

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In the name of ALLAH, the most gracious, the most merciful, with the highest praise to complete this final year project successfully without difficulty.

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Finally, I would like to expand my sincere appreciation to my beloved family and my friends for being very understanding, kind and supportive during completion of this final year project. My appreciation also goes to all those who help me directly and indirectly in completing this report. Thank you.

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LIST OF ABBREVIATIONS

CF	-	Checking Fixture
3D	-	3 Dimension
CAD	-	Computer Aided Design
CATIA V5	-	Computer Aided Three Interactive Application Version 5
CNC	-	Computer Numerical Control
SOP	-	Standard Operating Procedure
GDT	-	Geometrical, Dimensional and Tolerances

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CHAPTER 1

INTRODUCTION

This chapter will describe the introduction of the project. It includes the background, problem statement, objectives and the scope of work of this project. The investigation of checking fixture also involved in this project.

1.1 Background

Jigs and fixtures are tool for process in production line such as machine, assembly and inspection. These tools are specializing in their scope whereby work holding and tool guiding device. According to Edward Hoffman (2011), jig and fixture can be described as a device to hold the workpiece in production and make manufacture part more accurate. The relationship between cutter, workpiece and other tool must be aligned and maintained. To ensure that process will run smoothly, a jig and fixture is created to give support, hold, and clamp the product to make sure each of the manufacture process such as drilled under the specified limits and tolerances.

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Checking fixture is one of the important tools that used in industry. Every part that produced must follow the standard measurement given and to ensure the quality of the product. According to Edward Hoffman (2011), the main requirement of an inspection fixture is accuracy. Each inspection fixture should contain only those element needed to check the specified sizes of forms. Furthermore, a jig and fixture especially checking fixture is the production tools that to measure the accuracy of manufacture of duplicate product and interchangeable part. This tool is to ensure that the error and quality issue of the part will solve and also can smooth the production line in the large of the number. Besides that, it can scale and measure the complicated design part and productivity of parts into the final assembly line.

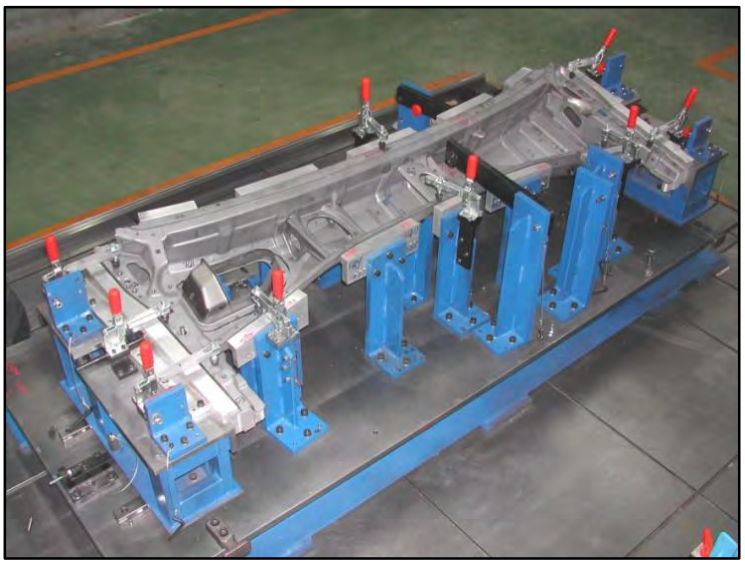

Figure 1.1: Example of checking fixture (DongGuan FongYi Precision Tooling Co., Ltd, 2011).

1.2 Problem Statement

Nowadays, the industrial sector rapidly growth due to the economics and market demand. As the high demand from the customer, every industry needs to increase their production due to the market needed. One of the machines that can increase the productivity

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and reduce lead time is stamping machine. Although the productions increase, it must follow the standard specification from the original part. The most appropriate tool to measure the part produce is checking fixture.

A checking fixture is required to perform quality inspection process of a sheet metal part of component. The sheet metal part need to pass the quality inspection by human to ensure that is smooth operation and do not have any problem during assembly production. Critical parts of the product are datum and tolerance. Every critical part needs to evaluate in detail to ensure that the sheet metal part in a good condition and smooth operation during production line.

1.3 Objectives

The main purpose of this study is to make the design and development of a checking fixture for an automotive press part.

The objectives of this study are:

(a) To design the checking fixture for automotive press part.

(b) To develop the checking fixture for automotive press part.

(c) To make quality inspection check sheet of automotive press part or sheet metal part.

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1.4 Scope of Work

In this study, the main focused on the design and development of a checking fixture for an automotive press part. The automotive part that will used is the reinforced front panel within need to use the stamping press machine and one of the main component in automotive door panel. The reinforced front panel must follow the specific requirement and accurate with the mold so that it will suit to the body part.

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CHAPTER 2

LITERATURE REVIEW

This chapter will describe the summarizing of all literature review gathered from the many academic resources. It includes the study of checking fixture, automotive body part, and automotive stamping process. Besides that, this chapter also will summarize the method that will involve in this project.

2.1 Checking Fixture

2.1.1 Definition

Checking fixture (CF) or in other word is inspection fixture, the tools that can we make a quality inspection of the part or product. For some the reasons, making a checking fixture need a lot of experience because this tools highly complex process for human designer like automotive press parts. Furthermore, checking fixture is used to locating and holding the product part in 3D surface area to ensure the quality, tolerances, etc. The checking fixture are very useful for monitoring the quality issue of finishing or semi-finishing parts due to the procedures and standardize the quality in automotive industries also part suppliers.

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Furthermore, the checking fixture is to verify the geometric feature of product, dimensions and tolerances according to the design specification. Basically, it can define the accurate of design dimension, surface geometry and the correct position of the surface. Specification of the checking fixture to ensure that the accuracy and efficiency of the quality control procedure and it easy to use, reliability, low cost and simple construction of service. The importance things about these tools are:

(a) It should have the specific element needed to check the sizes according to design specification.
(b) It used to make sure the part is produce in standard shape and size requirement.
(c) High accuracy of the standardize product.

According to Prakash Hiralal Joshi (2010), stated that the inspection fixtures is one of the inspection devices that high precision and interchangeability. Besides that, the uniformity of the devices must be in limited. Furthermore, the devices also need to be taken into the capability of the machine. In addition, the several of the variation in size or hole should to be taken as important data and must be allowed for some of economic reasons. Moreover, the inspection fixtures are very important in industry because it can speed up the inspection procedure to increase the rate of the manufacturing in industry.

2.1.2 Types of checking fixture

There are consists of two types checking fixture:

(a) Gauging fixtures.

These fixtures used to inspect a part against of standard size. For examples, it to check whether the part will pass through the fixtures follows the standard part. If

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the part too large or small, it will not fit to the fixtures. It also more like to Go-No gauge. Figure 2.1 below show the example of gauging fixture available at market.

Figure 2.1: Example of gauging fixture (Marposs S.p.A, 2016).

(b) Measuring fixtures.

These fixtures to ensure that how much the part will be detect out of tolerances. The part will be located on the center of the fixtures and the locator will used to ensure that the datum and tolerances at higher inspect. It consists of the gauging fixtures, locating, clamping and mounted elements in the body of the fixtures. Furthermore, the used of check sheet will more helpful during quality inspection. Figure 2.2 below shot the example of measuring fixture for body part of car.

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Figure 2.2: Example of measuring fixture (Witte Barskamp KG, 2016).

2.1.3 Functions, components and fixture design process

Typically, the checking fixture consists of three functions whereby the locating of part, clamping area and checking the critical part or datum. Figure 2.3 below is example of checking fixture for car fender part and all the function will place on the workbench.

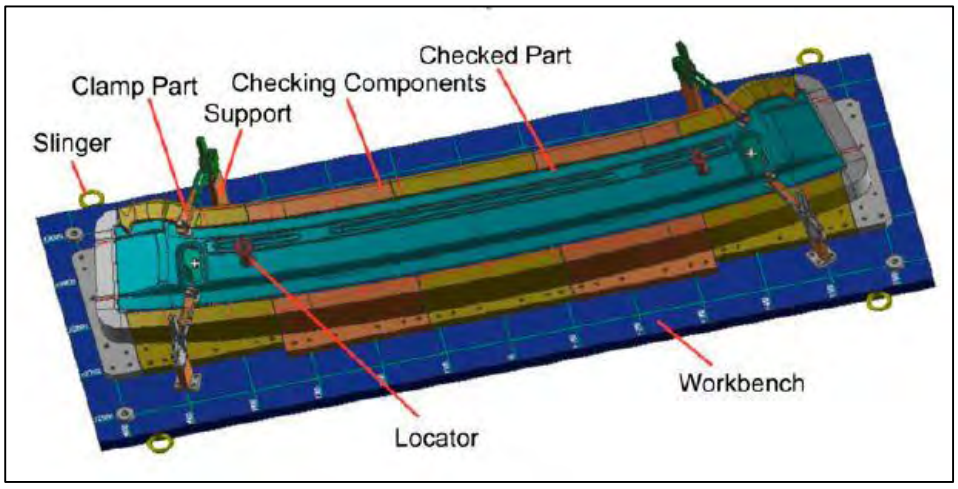

Figure 2.3: Example of checking fixture for car fender part (Hu Cai-qi *et al.*, 2005).

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