UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN OF TIMING CHAIN COVER ASSEMBLY JIGS

This report submitted in accordance with the requirements of the University Technical of Malaysia Melaka for the Bachelor Degree of Manufacturing Engineering Manufacturing (Design) with Honours

by

ARMAN SHAH BIN ABDULLAH

FACULTY OF MANUFACTURING ENGINEERING
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I hereby declare that this report entitled “Design of Timing Chain Cover Assembly Jigs” is the result of my own research except as cited in the references.

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Author’s Name : Arman Shah Bin Abdullah

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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 members of the supervisory committee are as follow:

Nik Mohd. Farid Bin Che Zainal Abidin
(Main Supervisor)
ABSTRACT

This paper concerns about design of jigs and fixtures which that will be used in assembly process. The jig is used in timing chain cover assembly process. The function of jigs is to assemble pin ring, sealant and screw. This project starts from identifying the requirement of jig by determining the detail function of jigs. A few conceptual designs are generated and translated into computer drawing in which the best design will be selected from the concept design and used in this project. Concept scoring and screening are used in this project to select the best design. Then, the part is analyzed using finite element analysis software to identify any weak or point of the jig. In this analysis the part is safe when two of 30N force (force to insert pin ring) and two of 67.5N (force to clamp the part) was applied at the part. In the design process, Solidwork is used to draw the jig and fixtures which consist of two stations. The first station includes the process assembly of pin ring and the second station to seal the part using a sealant and screw process. In this design, the cylinder was electro- pneumatic mechanism due to its high clamping force and quick in loading and unloading process.
ABSTRAK

DEDICATION

To my beloved father Abdullah Bin Ahamad,
my mother Saadia Binti Ismail and my siblings
I love you all
ACKNOWLEDGEMENTS

In The Name of Allah Almighty and The Most Merciful and Blessings
Be Upon His Messenger Prophet Muhammad S.A.W and His Companions.

Alhamdullillah, I would like to express my thankfulness to Allah S.W.T the almighty for his divine inspirational guidance, which had helped me in completing this final year project. All the praise and selawat is upon to The Prophet Muhammad S.A.W. I would like to express my utmost appreciation to Mr. Nik Mohd Farid Bin Che Zainal Abidin who is my supervisor for his constructive guidance, advice, encouragement, and patience in fulfilling our aspiration in completing this project.

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Arman Shah Bin Abdullah
April 10, 2009
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CHAPTER 1
INTRODUCTION

1.1 Introduction of the Project

The timing chain cover is one of the automotive parts used in car engine that cover and protect the timing chain from any contaminant. It functions also as a preventive that reduce wear of the chain and sprocket. Basically, if dusk accurate to adhere at the sprocket and timing chain during the both parts rotates, it does generate heat and wear is become faster. This part manufactured using aluminum as a material and the main process involved is die casting (Joseph M. Liebig, 1966). This study involves design, analysis, and best design selection of jigs and fixtures to produce a good part. The jigs and fixtures are necessary as a work holding device during part assembly. The process involve are insertion of pin ring, sealant and screw assembly. This holding device should be able to hold part securely during assembly process occur. It is because the part position must be aligned and fixed to allow the pin ring insertion into holes, sealant process and assemble of screw. The holes are very fix with the pin ring so the accuracy required in the process. In this design, it must consider the customer requirement in order to produce the best design. Besides, concept of scoring and screening used to compares several before the best design selected to fulfill the customer requirements. The solidwork used as design software to draw the jigs and fixtures. After this process completed, jigs shall be analyzed through Patran/Nastran to ensuring no failure occur on the part when the force is applied.
1.2 **Objective of Project**

The objective of the project is to design and analyze the jigs and fixtures for timing chain cover assembly, which consists of pin ring, sealant and screw assembly.

1.3 **Scope of Project**

The scopes of the project are:

1. Design of the timing chain cover jigs and fixtures assembly that does not include to fabrication of the jigs and fixtures which it will be done by company.
2. Certain part or component of design of jigs and fixtures such as motor electric, cylinder, linear guide, bearing, etc are based on standard part available in market.

1.4 **Problem Statement**

Timing chain cover assembly involves the process of insertion pin ring, sealant and screw assembly. The process of pin ring insertion requires precise due to the size of pin ring to be fixed to the hole. The manual processes to assemble this part to timing chain cover are difficult and time consuming raise the cost to produce this product. The production need to complete in short time without neglecting quality. The jigs and fixtures required to solve the problem and increase production rate with minimum time and precise part. In process of producing the jigs, a several factor must be consider such as type of clamping mechanism, material, tool to insert the pin ring, etc. The concept of jigs and fixtures is using pneumatic system to push pin ring into the hole. These systems device also used to clamp the product because it generates force that required in process of clamping.
1.5 Significant of Findings

In process of producing the jigs and fixtures, designer must be considering customer requirement. The jigs and fixtures shall produce using concept make to order that mean it will produce if customer make requires. It difference in producing of the product which it use the concept of standards product that will be producing without order from customer. To achieve the goal, a several factor must be considered in term of safety, cost, maintenance, efficiency and quality. The selection of clamping shall consider the process of pin ring insertion, application of sealant and assembly of screw. For example, the type of clamping must be selected in order a force that produce is enough to clamp the part. Solidwork used in this study to draw 2D and 3D part. It also shows error occur during design process through the use of 3D assembly. After design completed, the jigs and fixtures must be analyzing using Patran/Nastran to get stress and the part shall be analyzed.

1.6 Application of the Research

This study has been many applications in industries especially in design of jigs and fixtures. It is explains about the concept of selection, clamping process, material involves, system pneumatic, and analysis using solid work. A lot of company especially small company has problem in design if they are not analyzing of product before process fabrication is done. This study is also reducing the cost of product due to reduce of failure especially in design. If failure of design occurs, it is influences to the process of manufacturing and the process redesign and manufacturing will done. It usually occurs on the frame or structure of design and shall cause of vibration on the jigs and fixtures. In the pneumatic system, the bore size, stroke, air preparation and type of air control valve must be considered to produce the best part. This study is also capable to reduce of cost and it prevents of fault during to order the material and standard part.
1.7 Summary

This project is used to design and analyze the timing chain cover assembly jigs. It is used to decrease of time during process assembly will be done. The scope of the project is only design and analyze but the fabricate make by company. The scopes of the projects are design of the jigs and fixtures that does not include fabrication of the part and it use of standard part available in market. The problem statement of the project is during process of assembly of the jigs and fixtures that include the process of insertion pin ring, sealant and screw assembly. It is because of the parts that assemble need of fix during assembly process will be done. The outcomes of the project are to study the element of jigs and fixtures, concept selection that involve in this project, concept of design the part, soft skill to communicate with the customer, and identify of standard part that command used in industries
CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter explains about the importance of element to generate idea to produce the best result. This chapter consists of six major areas which are important in this project. They are jigs and fixtures, locating, clamping element, concept selection, belt drive and electric motor. The types and different of jigs and fixture is discuss in this chapter. For locating element, this study discuss about the types, principle, and differences of locator. The types of locator discussed are sighting, dowel pin and keys and keysets. The result of discussion will be used in next chapter. For the clamping element, a study is focuses on the different type of clamping mechanisms in term of strength, cost and accuracy. Types of clamping discussed are toggle clamp, pneumatic and hydraulic clamp. Another elements need to be studied are pneumatic and hydraulic system. This chapter also looks on the belt drive and electric motor system. It consists of type of the belt drive and electric motor. For the aspect of belt drive system, the types that taken into study are flat, v belt and the synchronous belt. The AC motor and DC motor are also discussed in this chapter which looks on the advantages and disadvantages of the two type of motor.
2.2 Jigs and Fixtures

Jigs and Fixtures are workholding device used in locate and hold the work that is used to manufacture accurately. In the Jigs and fixtures, the alignment between the cutter, or other tool and workpiece must be maintained so the jigs and fixtures must be design to hold, support and locate every part (Hoffman, 2004). It will ensure that each process or machine within the specific limit. These devices are provided with attachments for guiding, setting, and supporting the tools in such a manner that all the workpieces produced in a given jig or fixture will be exactly alike in every way. It can be used in production work to employment of unskilled labor. The repetitive layout and setup (which are time-consuming activities and require considerable skill) are eliminated. The device also cause a degree of accuracy that workpieces can be assembled with a minimum amount of fitting. A jigs and fixtures also produce a product depends on the shape and requirement (Hoffman, 2004).

2.2.1 Jig

Jigs are a special device to holds, support or are place on a part to be machine or other process. It is production to guide the cutting tool and not only locate and hold workpiece during operation occur. For guiding drills or other tool, jigs must be hardened fitted with hardened steel bushings for guiding tool such as shown in Figure 2.1 (Hoffman, 2004).
Figure 2.1: Referencing the tool to the work (Hoffman, 2004).

2.2.1.1 Type of jigs

Jigs divided into two general classes are clamp jig and box jig. Other type of jigs are drilling, reaming, and tapping according to the operation to be performed. Clamping jigs also call open jig. Clamp jigs are for simple operation where work is done on only one side of the part. Box jigs also call closed jigs which are used for part that must be machined or other operation on more than one side. Other jigs type is template jigs where used for accuracy rather than speed. Usually this jig not clamp and it fits over, on, or into the work. Figure 2.2 are showing the type of Template Jigs. This jigs simple to used and least expensive. It usually have bush and the jigs plate is normally harden when bushing are not used (Hoffman, 2004).

Figure 2.2: Template Jigs (Hoffman, 2004).
Plat jigs are similar template jigs such as show in Figure 2.3. The plate jigs have built in clamp to hold the work compare to template jig. The bushing can be used depending on the number of part to be made. To raise the jigs off the table for large work, it shall be designed with leg and this style knows as table a jig which is shown in Figure 2.4. Sandwich jigs are a form of a plate jigs with a back plate such as shown in Figure 2.5. This type of jigs ideal for thin or soft part that cold bend or wrap in another style of jig. This bushing used with determines the number of the part to be producing (Hoffman, 2004).

Figure 2.3: Plate Jigs (Hoffman, 2004).

Figure 2.4: Table Jigs (Hoffman, 2004).