PROPOSE AN OPTIMUM PERIODIC SUPERVISION ON CONVENTIONAL SHEARING MACHINE AT POWER BOOSTER ENGINEERING & MAINTENANCE SDN BHD USING RELIABILITY METHODOLOGY

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in fulfillment of the requirement for the degree of
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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DECLARATION

I hereby declare that the work in this report is of my own except for summaries and quotations which have been duly acknowledged.

Signature:

Author: Qayyum Edlee bin Abdul Aziz

Date:

APPROVAL

I hereby declare that I have read this thesis and in my opinion, this report is sufficient in terms of scope and quality for the award of the degree of.

Bachelor of Mechanical Engineering (Design & Innovation)

Signature:

Supervisor's Name: Dr Mohd Asri bin Yusuff

Date:

Dedicated to my beloved family

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ABSTRACT

In this study, to propose optimum maintenance schedule there are several methodology to be done. The distribution related with reliability engineering are exponential, lognormal and Weibull distribution. This study needed to choose one of the distribution to analyse the reliability calculation such as MTBF value, hazard rate function and so on. The method to choose the distribution is using software Weibull ++ then the failure rate data was inserted and the software automatically choose them. Monte Carlo simulation also used to generate data due to lack of data that we get from the company. This study more used Microsoft Excel to get the data of reliability and regression analysis should be done to get the value such as characteristic life, shape parameter and many more. Next, the MTBF value was calculated from value of shape parameter and characteristic life and the gamma table function are used to insert in the formula. Furthermore, to propose the optimum maintenance schedule need MTBF value for each component, so to get that it related with the operation hour of that machine.

ABSTRAK

Di dalam kajian ini, terdapat beberapa kaedah yang perlu dilakukan untuk mencadangkan jadual penyelenggaraan optimum. Taburan yang berkait dengan kejuruteraan kebolehharapan adalah taburan exponential, lognormal dan Weibull. Kajian ini perlu untuk memilih salah satu daripada taburan untuk menganalisis pengiraan kebolehpercayaan seperti nilai MTBF, fungsi kadar risiko dan sebagainya. Kaedah untuk memilih taburan tersebut iaitu dengan menggunakan perisian Weibull ++, data kadar kegagalan dimasukkan dan perisian secara automatik memilih taburan yang bersesuaian dgn data tersebut. Simulasi Monte Carlo juga digunakan untuk menjana data kerana kekurangan data yang dikumpul daripada syarikat. Kajian ini juga menggunakan Microsoft Excel untuk mendapatkan data kebolehpercayaan dan analisis regresi yang perlu dilakukan untuk mendapatkan nilai seperti 'characteristic life', 'shape parameter' dan banyak lagi. Seterusnya, nilai MTBF itu dikira dari nilai 'shape parameter' dan 'characteristic life' dan jadual fungsi gamma digunakan untuk dimasukkan ke dalam formula. Tambahan pula, untuk mencadangkan jadual penyelenggaraan optimum nilai MTBF diperlukan untuk setiap component, jadi untuk mendapatkannya ia berkaitan dengan jam operasi mesin tersebut.

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MTTF	Mean time to failure
MTBF	Mean time to failure
MTTR	Mean time to repair
PDF	Probability density function
CDF	Cumulative density function

CHAPTER 1

INTRODUCTION

1.1 Background

A shearing machine is one of two things, an industrial machine that cuts metal or a machine that cuts the wool off sheep. An industrial shearing machine generally presses blades down into metal sheets to punch out shapes. These shapes may be the desired end product or they may be the waste product. While shearing metal sheets is most common, other metallic objects may be processed in one of these machines. A sheep-shearing machine maybe anything from a pair of small clippers similar to ones found in a barber shop to a large machine that features an external power supply and multiple clipping arms.

The part of the machine was broken is still one of the major problems in engineering. This is often caused by the part is not be maintenance wisely. The part broke caused the product that produced from the machine totally not in high quality. The part in the machine include frame, flywheel, table, support guides, pedal control, slide, and shear and hold down.

A metal shearing machine uses sharp blades and a lot of pressure to quickly cut shapes out of metal. The blades on a shearing machine are typically directly perpendicular to the surface getting punched. This maximizes the applied force and maintains an even cut. Some shearing machines operate like a pair a scissors. This shearing style is less common, as the pressure isn't evenly applied to the metal.

Depending on the quality and thickness of the sheared material, the blades on the shearing machine may be of a higher-quality metal. The general rule for metal cutting is that the blades must be harder than the material being cut, but this rule doesn't always hold true in a shearing machine. Since the cut is so fast and the pressure is so high, steel can often cut

steel with little problem. Still, some machines use special steel or carbide alloys for their blades.

While the majority of shearing machines cut sheet metal, some cut other metal forms. The most common metal behind sheets is metal bars. These bars are often very long, and the shearing machine cuts them into more manageable lengths for use in other machines. Other machines focus on nearly-finished parts; they cut along edges to remove burrs or leftover material from earlier manufacturing processes.

1.2 Problem Statement

Machine efficiency is one of the factors that are frequently overlooked by the management and this can lead towards losses which reduces the yield. Improper maintenance of machines will result in low standards of produced parts and increases the maintenance of machines. Machines are meant to work efficiently, but in some circumstances machines can be less productive due to improper preventive maintenance. Preventive maintenance is a key factor that keeps the machine running efficiently through the production process. The maintenance activity on machines needs extra attention by the management along with the responsible personnel to ensure optimum usage of machineries which will eliminate unwanted wastages due to machine stoppages.

The shearing machine at the Power Booster Sdn Bhd as shown in Figure 1. This machine should be maintenance wisely because if not do that, the efficiency of the machine is low. Next, the product made from this machine also is low of quality. The low of quality of product makes that product was rejected so it also make high cost caused by wastages. The low efficiency of the machine usually happen in industry because the technician or maintenance not maintain the reliability of the machine they because they take the easy about this. Besides that, maybe the company not improve their maintenance schedule so, the technician only follow the old maintenance schedule. After that happen, the production have some problem about the product.

Figure 1.0: Shearing machine at Power Booster Sdn. Bhd.

1.3 Objectives

The objectives of this project are as follow:

1. Recommend appropriate action in improving and increasing the efficiency of the machine.

2. To provide the best maintenance schedule of shearing machine to avoid low quality product.

1.4 Scope of Project

The scope of this project is review the history record of the system failure and component, distribution pattern failure for the shearing machine and determine the appropriateness of the distribution that is used to rate the failure of any component involves.

Study about the failure parts on the shearing machine and calculate the efficiency of the shearing machine until get the best efficiency. Next provide the best maintenance schedule for that machine.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The probability of performing a successful repair action within a given time that the definition of maintainability. In other words, maintainability measures the ease and speed with which a system can be restored to operational status after a failure occurs. System reliability analysis except that the random variable of interest in maintainability analysis is time-to-repair rather than time-to-failure similar to that. It can be obtain many useful results concerning the overall performance availability, uptime, downtime, when combine system maintainability analysis with system reliability analysis. It will help you to make decisions about the design and or operation of a repairable system. (reliasoft.com 1992)

High-integrated products and the maintainability assessment must take into account all these different aspects such as mechanical parts, electronic devices and software. Maintainability can be affected by actions beginning from the failure detection depending on what activities are considered and those concerning diagnostic, reparation and test. It also depends on all criteria that may affect the main maintenance steps with different actions to be carried out to bring the product back to its functional status. Different criteria that may affect product maintainability have been identified in (A. Coulibaly et al. 2007)

2.2 Shearing Machine

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While the majority of shearing machines cut sheet metal, other than that cut other metal forms. The most common metal behind sheets is metal bars. These bars very long, and the shearing machine cuts them into more manageable lengths for use in other machines. Other machines focus on nearly-finished parts, they cut along edges to remove burrs or leftover material from earlier manufacturing processes.

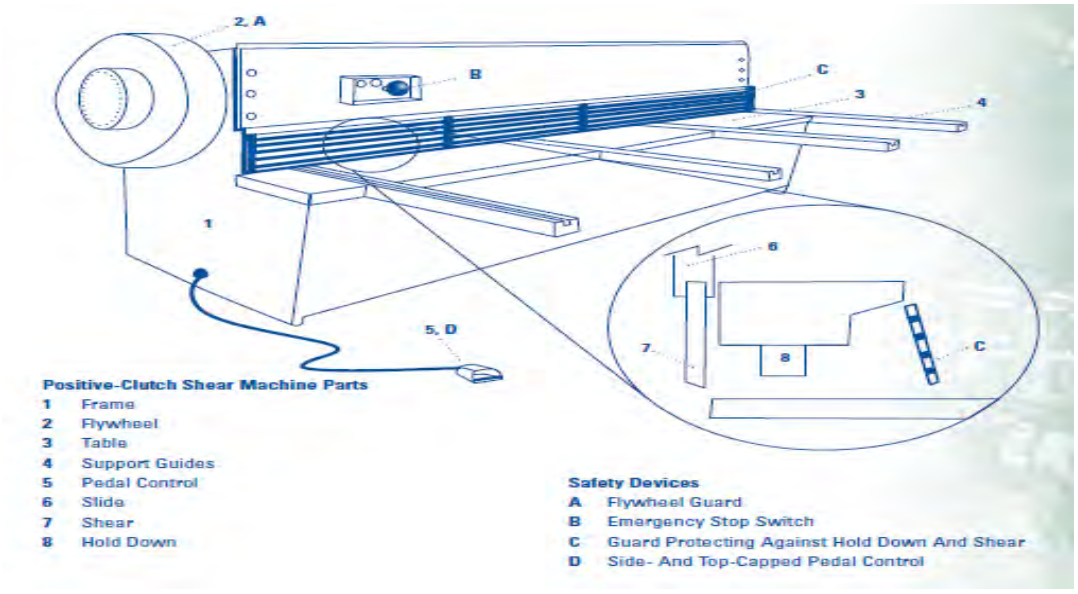

Figure 2.0: Part on shearing machine

(www.irsst.qc.ca)

2.2.1 History of Machine

The first shearing machines appeared in New Zealand in 1880, on stations such as Galloway in Otago, and Flax Bourne in Marlborough. They were originally driven by steam, often using a traction engine. Later, electricity made them more efficient and their use more widespread.

The first public demonstrations of shearing machines were in Australia in 1885. Although sheep owners were slow to accept the change, they became converts when they saw the extra pound (0.45 kilogram) of wool harvested from each sheep shorn with a machine rather than blades.

2.2.2 Function of machine

Both mechanical and hydraulic machines can perform shear machining. When use hydraulic shears cut and score sheet metal quickly and accurately. To do a lot of metal

fabrication, they work well for factories. In addition, hydraulic shears are best if the operation requires intense pressure and also do not require a lot of maintenance, will operate continuously, and are fast and quiet. While applying the same amount of pressure, hydraulic shear machines take up less space than mechanical shear machines.

When the metal is inserted into hydraulic machines, then it is secured by clamps so it does not slip under high pressure. Use a squaring arm or back gauge to ensure that the cut is smooth and even for a 90 degree cut. Minute burrs may be formed by the edge of the cut metal, these must be removed by grinding. Be careful of the little marks left by the cutting blades and holding clamps while working if you use hydraulic shears. You need to remove them or otherwise account for them

2.2.3 Problem of machine

Each time a fabricator works on a shearing job, he needs to check these factors that affect the blade:

i. condition of the cutting blade
ii. tonnage of the machine
iii. size of the area between the upper blade and lower blade
iv. angle required for the blade
v. how it is gripped to keep it stead

Each job needs to be evaluated for these variables:

i. grade of material needed to satisfactorily complete the job
ii. thickness of the material
iii. type and shape of the cut

2.2.4 Part of failure

According to the industrial visit, the engineer said the critical part or component usually break is:

i. Cutting edge
ii. Pedal control
iii. Emergency button
iv. Gear

2.3 Maintainability

Maintenance is another important aspect of system performance after reliability. There are several facets of maintenance management, and in this introductory chapter we would like to have these surveyed. Broadly speaking, maintenance is the process of maintaining equipment in its operational state either by preventing its transition to a failed state or by restoring it to an operational state following a failure. This leads to various types of maintenance activities that can be planned to realize the objective of maintenance, such as preventive, predictive, or corrective.

The cost of maintaining a machine is a direct function of the maintenance frequency and failure interval for the machine and major components, the time and labour required to completed unscheduled maintenance actions and the time and labour required to complete routine maintenance tasks. These cost control efforts have usually centre on optimizing scheduled maintenance operation, reducing maintenance staffs, better control spare parts inventories, use of contract maintenance support and deferring nonessential maintenance. Improved equipment design for maintenance can positively influence all these efforts.

2.3.1 Objective Maintenance

Maintenance is an important factor in quality assurance, which is another basis for the successful competitive edge. Inconsistencies in equipment lead to variability in product characteristics and result in defective parts that fail to meet the established specifications. Beyond just preventing break downs, it is necessary to keep equipment operating within specifications for example process capability that will produce high level of quality. Good maintenance management is important for the company's cost control.

Many manufacturing organizations, particularly those with JIT (Just-In-Time) programs are operating with inventories so low that, they offer no protection in the event of a lengthy equipment failure. Maintenance function can help prevent such as occurrence. Organizations like airlines and oil refineries have huge investments in the equipment. Equipment failure will be disastrous for such companies. They need proper maintenance to keep the equipment in good condition. Objectives of Maintenance Management: The following are some of the objectives of maintenance management:

i. Minimizing the loss of productive time because of equipment failure (i.e. minimizing idle time of equipment due to break down).
ii. Minimizing the repair time and repair cost.
iii. Minimizing the loss due to production stoppages.
iv. Efficient use of maintenance personnel and equipment.
v. Prolonging the life of capital assets by minimizing the rate of wear and tear.
vi. To keep all productive assets in good working conditions.
vii. To maximize efficiency and economy in production through optimum use of facilities.
viii. To minimize accidents through regular inspection and repair of safety devices.
ix. To minimize the total maintenance cost which includes the cost of repair, cost of preventive maintenance and inventory carrying costs, due to spare parts inventory.
x. To improve the quality of products and to improve productivity.

2.3.2 Advantage of maintainability

The purpose of maintainability engineering is to increase the efficiency and safety and to reduce the cost of equipment maintenance. To accomplish this, it is evident that the achievement design (Conway, E.J. and R. Unger 1998). Maintainability engineering will not eliminate the need for service and repair on mining equipment, it provides the following advantages:

i. Reduction of the time required to complete scheduled and unscheduled maintenance.
ii. Minimization of the frequency of unscheduled maintenance by improving accessibility for inspection and servicing.
iii. Reduction of maintenance errors and incorrect installation.
iv. Improvement of post maintenance inspection.
v. Reduction of maintenance-related injuries.
vi. Minimization of maintenance personnel training requirements.
vii. Improved troubleshooting performance.
viii. Inadequate component handling capability and component machine interface design.

2.3.3 Maintainability Need and Relationship between Reliability and Maintainability

According to Dhillon (1999), there are several factors responsible for the need of product maintainability. In particular two important are the alarmingly high operating and support costs because of failures and subsequent maintenance. The main objectives of both reliability and maintenance is to assure that the system manufactured will be in the readiness state for operation when required, capable of performing effectively its designated functions, and full fill all the required maintenance characteristics during its life time.

2.4 Reliability Engineering

Reliability is a broad term that focus on the ability of a product to perform in intended function. Mathematically speaking, assuming that an item is performing its intended function at time equals zero, reliability can be defined as the probability that an item will continue to perform its intended function without failure for a specified period of time under stated conditions. The product defined here could be an electronic or mechanical hardware product, a software product, a manufacturing process or even a service.

According to Rausand (2004), reliability is a design characteristic that result in durability of the system or equipment to carry out its designated function under a stated condition and time period. It is accomplished through various actions including controlling process, selecting optimum engineering principles, testing and adequate component sizing. Nonetheless, there are many specific general principles of reliability: design for simplicity, use less number of parts to perform multiple functions, design to minimize the occurrences failures, maximize the use of standard parts and provide for simple periodic adjustment of parts subject to wear.

2.4.1 Theory of reliability

According to Nakagawa T. (2005) reliability theory has grown out of the valuable experiences from many defects of military systems in World War II and with development of modern technology. The importance of reliability has been increasing greatly with the innovation of recent technology.

Failure occur in several different types of failure modes such as wear, fatigue, fracture crack, breaking, erosion, corrosion instability and many more. Failure is classified into intermittent failure and extended failure. Extended failure has been divided into complete failure and partial failure, both of which are classified into sudden failure and gradual failure. Extended failure also divided into catastrophic failure which is both sudden and complete, and degraded failure which is both partial and gradual (Rausand, 2004)