



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

# **Autonomous Maintenance Programme for Drilling Machine**

Report submitted in accordance with the requirements of the Universiti Teknikal  
Malaysia Melaka for the Bachelor's Degree in Manufacturing Engineering  
(Manufacturing Management)

By

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**UNIVERSITI TEKNIKAL MALAYSIA MELAKA (UTeM)**
**BORANG PENGESAHAN STATUS TESIS\***
**JUDUL:** AUTONOMOUS MAINTENANCE PROGRAMME FOR DRILLING MACHINE

**SESI PENGAJIAN:** 2007/2008

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## **APPROVAL**

This PSM submitted to the senate of UTeM and has been as partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management). The member of the supervisory committee is as follow:

.....  
(Mr.Wan Hasrulnizzam Bin Wan Mahmood)  
(Official Stamp & Date)

## **ABSTRACT**

This project is performed as a preliminary study on 16/20 mm drill press machine towards Autonomous Maintenance. This project covers *Fuguai* or abnormalities investigation and the remedy for continuous improvement. For analysis, the *Fuguai* have been divided into three main categories which are physical, safety and function. The results on seven weeks of observation show that *Fuguai* for physical is the most critical, followed by safety and function. Almost all of *Fuguai* have been eliminated; however, there are several *Fuguai* that can not be eliminated because of higher technical knowledge required, new part replacement and others.

## ABSTRAK

Projek ini dikendalikan sebagai kajian asas penyelenggaraan sendiri (AM) ke atas mesin gerudi (16/20 mm). Projek ini merangkumi penyiasatan *Fuguai* dan cara-cara untuk mengatasi masalah secara berterusan. *Fuguai* telah dibahagikan kepada tiga kategori utama; iaitu fizikal, keselamatan dan fungsi sebagai analisis. Kajian selama tujuh minggu menunjukkan bahawa *Fuguai* fizikal adalah yang paling kritikal, diikuti keselamatan dan fungsi. Hampir kesemua *Fuguai* telah diselesaikan. Walau bagaimanapun, terdapat beberapa *Fuguai* yang tidak dapat diselesaikan kerana memerlukan pengetahuan teknikal yang tinggi, penggantian komponen baru dan sebagainya.

## DEDICATIONS

*For my beloved family especially to my parents:*

Mr. Othman Bin Mohd.Noor and Mrs. Dayang Ling Bt.Awang Bujang

*For my supervisor:*

Mr. Wan Hasrulnizam B. Wan Mahmood

*For my friends in UTeM:*

Especially for the BMFU students

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## **LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE**

AC	-	Alternate Current
AM	-	Autonomous Maintenance
Anon	-	Anonymous
CBM	-	Condition-Based Maintenance
CM	-	Condition Monitoring
FKP	-	Fakulti Kejuruteraan Pembuatan
F-tag	-	Fuguai Tag
HP	-	Horse power
In	-	Inch
JH	-	<i>Jishu Hozen</i>
JIPM	-	Japan Institute of Plant Maintenance
JIT	-	Just-In-Time
KG	-	Kilogram
MM	-	Millimeter
MI	-	Maintainability Improvement
MP	-	Maintenance Prevention
NPC	-	National Productivity Corporation
OEE	-	Overall Equipment Efficiency
OEL	-	Overall Equipment Losses
PdM	-	Predictive Maintenance
PDCA	-	Plan, Do, Check and Act
PM	-	Preventive Maintenance
RCM	-	Reliability-Centered Maintenance
Rev	-	Revolution
RPM	-	Rotation Per Minute
SHE	-	Safety, Health and Environment

SPC	-	Statistical Process Control
TBM	-	Time Based Maintenance
TPM	-	Total Productive Maintenance
TQM	-	Total Quality Management
USA	-	United States of America
UTeM	-	Universiti Teknikal Malaysia Melaka
Vs	-	Versus

# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Ford, Eastman Kodak, Dana Corporation., Allen Bradley, Harley Davidson; these are just a few of the companies that have implemented Total Productive Maintenance (TPM) successfully. All report an increase in productivity using TPM. Kodak reported that a \$5 million investment resulted in a \$16 million increase in profits which could be traced and directly contributed to implementing a TPM program (Roberts, 2007). Patra *et. al* (2005) indicated that TPM is a new philosophy of continuous improvement and teamwork that focuses on delivering these objectives. It is a program for the fundamental improvement of maintenance functions in an organization, which involves its entire human resources. TPM was originally developed by the Japanese from the preventive maintenance strategies used in the United States of America over 30 years ago. TPM is implemented through eight core activities known as pillars.

Most industrial production systems are subject to deterioration with usage and age. Such system deterioration may lead to higher production costs and lower product quality and the increased possibility of breakdown (Hwang and Wang, 2004). It is important for the machine to be concerned in order to achieve the extended lifetime. Besides that, AM also suggested to the machines because the technique would assist to eliminate the non-value added and to keep the machines and work place in a clean and attractive area. The clean working environment would reduce the number of injuries and accidents. AM attempts to achieve zero breakdowns, zero accidents, and zero defects situation on the shop floor. If AM is implemented in a systematic and phased manner in the shop floor, it can bring in substantial benefits (Nadarajah, 2005).

## **1.2 Problem Statement**

Drilling machines are frequently used in Universiti Teknikal Malaysia Melaka (UTeM) and specifically in the Fitting Laboratory. However, the level of machines maintenance is not achieving the excellent stage. Moreover, proper maintenance is important to the machines in order to obtain the extended lifetime. Therefore, it is important for the project to develop an AM for the drill press (16/20 mm) due to the current total of machine breakdown in the FKP laboratory.

## **1.3 Objectives**

Specific objectives of the project are:

1. To identify and analyze the abnormalities of the drilling machines and the remedy towards developing an AM programme for the drill press (16/20 mm).
2. To build up a well-maintained drilling machine.

## **1.4 Scope of Project**

The emphasis of this project is concerned on the development of AM programme for the drill press (16/20 mm) used in the in Fitting Laboratory in UTeM. The project comprises of the first three steps of AM which clarified in clause 2.4.3. The project is started from December 2007 until April 2008. The consequence of this project may not be applicable to other projects with different types of machines specifically for the drilling machines.

## 1.5 Importance of Project

The importances of the project are:

1. To obtain an extended lifetime for the drilling machine (16/20 mm) used in the Fitting Laboratory in UTeM for the students.
2. The well-maintained drill press (16/20 mm) would be as a reference for other types of drilling machines.
3. The machine would be in a clean condition which bring towards friendly working environment.

## 1.6 Report Outline

This report writing comprises of six chapters. Chapter 1 describes about the introduction; which includes the background, problem statement, objectives, scope, and importance of the project. In the other hand, Chapter 2 stressed on the literature review of maintenance especially the concept of AM and Chapter 3 highlighted more towards the drilling machine which is particularly for the drill press (16/20 mm). Chapter 4 is the research methodology. This chapter is discussed the research methodology that were used to gather the data required to support the development and analysis of the study. This chapter also comprises of the process planning, flowchart, data gathering method and analytical technique of *Fuguai*. In Chapter 5, the results and discussions will go through the development of maintenance programme for drill press (16/20 mm). Finally, Chapter 6 will provide the conclusions and the recommendations of the whole project.

## **CHAPTER 2**

### **MAINTENANCE**

Chapter two describes all about maintenance. The discussion starts with the introduction to maintenance, which is including the definition of maintenance, the importance of maintenance and also the various types of maintenance. Moreover, the TPM and the AM is discussed.

#### **2.1 Maintenance**

It is difficult to imagine a time when equipment was not maintained. Remarkably enough, maintenance and productivity have not always been the Holy Grail of industry that they become in today's most successful companies (Borris, 2006). Maintenance, as a system, plays a key role in achieving organizational goals and objectives. It contributes to reducing cost, minimizing equipment downtime; improving quality, increasing productivity and providing reliable equipment that are safe and well-configured to achieve timely delivery of orders to customers.

There are various definitions of maintenance. Almost everyone in this world would define maintenance in a different way because everybody has their own perceptions and opinions. What is maintenance and why is it performed? Past and current maintenance practices in both the private and government sectors would imply that maintenance is the actions associated with equipment repair after it is broken. This would imply that maintenance should be actions taken to prevent a device or component from failing or to repair normal equipment (Anon, 2007g).

According to Levitt (1997), maintenance is a war. The enemies are break down, deterioration, and the consequences of all types of unplanned events. However, Luxhoj *et. al.*, (1997) described maintenance as a support function within the industrial enterprise. Traditionally, maintenance has been seen as an essential activity to keep the production process going. It is not uncommon to find proponents of planned, preventive, predictive, condition-based maintenance strategies arguing the merits of their chosen method. Since maintenance is seen as a cost, the argument often veers around to how the preferred method helps contain costs. Maintenance may be defined most effectively by what it does, namely, the preservation or restoration of the desired function of a given process, at the lowest total cost (Narayan, 1998).

Campbell *et. al.* (1999) emphasized that maintenance is defined as the combination of activities by which equipment or a system is kept in, or stored to, a state in which it can perform its designated functions. On the other hand, Kelly (2000) indicates that the maintenance is used to sustain the integrity of physical assets by repairing, modifying or replacing them as necessary.

Maintenance means maintaining and improving the integrity of the production and quality systems through the machines, processes, equipment and people who add value to our products and services (McCarthy and Willmott, 2001). Nevertheless, Besterfield *et. al.* (2003) declares that the maintenance keeping equipment and plant in as good as or better than the original condition at all times. Maintenance is a unique business process (Wireman, 2004). Maintenance requires an approach that is different from other business processes if it is to be successfully managed. Yet, Jardine and Tsang (2006) classified maintenance as a medium which is used to fix broken items.

## **2.2 Importance of Maintenance**

Most industrial production systems are subject to deterioration with usage and age. Such system deterioration may lead to higher production costs and lower product quality and the increased possibility of breakdown (Hwang and Wang, 2004).