



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Autonomous Maintenance Programme For Milling Machine

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Bachelor of Manufacturing Engineering
(Manufacturing Management)

By

Abdul Majid bin Ali

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DECLARATION

I hereby, declared this report entitled “Autonomous Maintenance Programme For Milling Machine” is the results of my own research
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Signature :

Author's Name: ABDUL MAJID BIN ALI

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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:

.....
Wan Hasrulnizzam Wan Mahmood
Main Supervisor

ABSTRACT

This project is developed as a preliminary study on KONDIA KP-90 Milling Machine located in Institut Kemahiran MARA Jasin, Melaka towards Autonomous Maintenance implementation. This project focus on the first three steps in normal Autonomous Maintenance activities which are included Initial Cleaning, Countermeasure to Abnormalities and Standardization of Problem Solving. Abnormalities of the machine with factors of safety, function and physical were analysed. From the results, dirty abnormalities were happened most and the physical of the machine was most affected by those abnormalities. Most of abnormalities found during this project duration have been tackled; however, there are several abnormalities can not be solved due to various reasons which discussed in this report.

Keywords: *Autonomous Maintenance, IKM, Milling Machine, KONDIA.*

ABSTRAK

Projek ini dibangunkan bertujuan sebagai kajian permulaan ke arah Program Penjagaan Autonomous untuk Mesin Kisar Menegak KONDIA KP-90 yang terdapat di Institut Kemahiran MARA Jasin, Melaka. Projek ini ditumpukan kepada tiga langkah pertama aktiviti Program Penjagaan Autonomous iaitu Pembersihan Permulaan, Langkah – Langkah Mengatasi Kecacatan dan Piawaian Kepada Penyelesaian Masalah. Hampir kesemua kecacatan – kecacatan yang berlaku pada mesin telah dapat diatasi. Walau bagaimanapun, terdapat beberapa kecacatan yang tidak dapat diatasi atas beberapa sebab dan dibincangkan selanjutnya di dalam laporan ini.

DEDICATION

To my beloved wife, my children, Aishah Mudrikah, Muhammad Mujahid, Muhammad Musyrif, Aishah Munirah, and Aishah Muzhirah. Their cooperation and understanding were much appreciated.

To my supervisor, Mr. Wan Hasrulnizam bin Wan Mahmood who always put my self beyond my own expectation.

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LIST OF ABBREVIATIONS, SYMBOL, AND SPECIALISED NOMENCLATURE

AM	-	Autonomous Maintenance
CANDOS	-	Cleanliness, Arrangement, Neatness, Discipline, Order, and Safety
CNC	-	Computer Numerical Control
Co.	-	Company
FMS	-	Flexible Manufacturing System
IGNOU	-	Indira Ghandi National Open University
HSS	-	High Speed Steel
IKM	-	Institut Kemahiran MARA
Inc.	-	Incorporated
JIPE	-	Japanese Institute of Plant Engineers
JIPM	-	Japan Institute of Plant Maintenance
MARA	-	Majlis Amanah Rakyat
MI	-	Maintainability Improvement
MP	-	Maintenance Prevention
OEE	-	Overall Equipment Efficiency
OPE	-	Overall Plant Efficiency
PDCA	-	Plan, Do Check, and Action
PM	-	Preventive Maintenance
rpm	-	round per minute
SGA	-	Small Group Activity
TPM	-	Total Productive Maintenance
TQM	-	Total Quality Management
UK	-	United Kingdom
US	-	United States of America
5S	-	Seiri, Seiton, Seiso, Seiketsu, and Shitsuke.

CHAPTER 1

INTRODUCTION

1.1 Background

Production organizations are usually concerned with converting inputs such as raw materials, labor and processes into finished products of higher value at minimum cost satisfying the customer needs. In order to achieve maximum return on investments the production systems will have to minimize plant downtime, increase productivity, improve quality and deliver orders to customers. This has brought the role of maintenance into an important issue (School of Management Studies, IGNOU, 2004).

The increased emphasis on equipment availability, performance, quality, environment conditions and safety considerations has rise up maintenance functions. Total Productive Maintenance (TPM) is a maintenance program which involves a concept for maintaining plants and equipment. TPM brings maintenance into focus as a necessary and vitally important part of the business. It is no longer regarded as a non-profit activity. According to Venkatesh (2006), the goals of the TPM program is to markedly increase production, to hold emergency and unscheduled maintenance to a minimum, and at the same time, increasing employee morale and job satisfaction.

One of the important factor in TPM is Autonomous Maintenance (AM). This type of maintenance encouraged operator to sense any abnormalities on the machine and maintain common problem by him/herself. By this way, the machine will always be in its idle condition while the operator learns more and feel sense of ownership about the machine.

1.2 Problem Statement

Milling machines are very useful in manufacturing engineering. Its price is quite high that worth to maintain it rather than to buy a new one. In order to prevent it from deteriorating, correct applications of maintenance works are essential. This type of machines are available in every Manufacturing Department in five Institut Kemahiran MARA (IKM) located in Jasin, Melaka; Pekan, Pahang; Johor Bahru, Johor; Lumut, Perak; and Kampung Pandan, Kuala Lumpur. In each IKM, twelve milling machines are being use by their students. Total of sixty milling machines have costs Majlis Amanah Rakyat (MARA) millions of ringgit.

In order to save the continuous money spending for conventional maintenance, an introduction of AM into Manufacturing Department in IKM has been applied in this project. This type of maintenance familiarizes the operator (student) itself to do routine observations on their machine. By doing this, early detection of abnormalities and major problems are done to reduce parts replacement that will increase maintenance budgets. It also reduce chances of accident happened and reduce the burden of technician works.

1.3 Objectives of The Project

This project has several objectives that have to be achieved which are:

- (a) To study current maintenance activity towards the machine in IKM Jasin.
- (b) To identify and analyze the abnormalities on KONDIA Vertical Milling Machine being use by students in Manufacturing Department, IKM Jasin, Melaka.
- (c) To set the preliminary activity for an AM Program for the selected milling machine above.

1.4 Scope of The Project

This project was planned to develop a pilot activity of AM Program in Manufacturing Department, IKM Jasin, Melaka. A KONDIA Vertical Milling Machine has been selected to be used for this project has been performed from July 2007 to March 2008. A technique called *Fuguai* Mapping has been used to determine abnormalities on the machine. Group discussion about the machine condition also will be conducted onto students that operated the machine.

Only the AM concepts under Total Productive Maintenance (TPM) will be taken into account for this project. Data gathered were used to analyzed and developed pilot activity of AM Program for the machine. Although there are seven steps of implementing AM, this project will only go through step one to step three as time constraints for other steps to be implemented. The consequence of this project may not be applicable to other projects with different types of machines specifically for the milling machines.

1.5 Importance of The Project

The importances of this project are:

1. To provide an initial step of introducing AM Program among IKM students and personnel in Manufacturing Department of IKM
2. To increase students safety condition while working with this type of machine.
3. To enhance the knowledge about this kind of maintenance for the students as they will be available in industrial working market shortly.
4. To reduce major maintenance works towards the similar milling machines in Manufacturing Department, IKM.

1.6 Report Outline

This report writing contains six chapters. Chapter 1 introduces the background, problem statement, objectives, scope, and importance of the study and Chapter 2 elaborates on the

literature review of maintenance and on the concept of AM. Chapter 3 describes about the milling machine, focusing on the KONDIA KP-90 Vertical Milling Machine.

Chapter 4 concludes the research methodology of this project. This chapter discusses the methodology that were use to gather data required to support the development and analysis of the study. This chapter also shows the process planning, flowchart, data gathering method and data analytical technique. Next is Chapter 5 that contains the results and discussions about the development of AM program for KONDIA KP-90 Vertical Milling Machine. Lastly, Chapter 6 provides the recommendations and the conclusion of the whole project.

CHAPTER 2

AUTONOMOUS MAINTENANCE

2.1 What is Maintenance?

In general, maintenance can be defined as all activities necessary to keep a system and all of its components in working order (Stephen, 2004). According to Geraerds (1985) maintenance is defined as all activities aimed at keeping an item in, or restoring it to, the physical state considered necessary for the fulfillment of its production function. Maintenance is the action necessary to sustain or restore the machine and equipment up to the performance needed. It includes inspection, overhaul, repair, preservation and replacement of parts. Maintenance also can be defined as the management of avoiding failure.

Maintenance is a combination of science, art and philosophy. Its execution relies on science, art of maintenance depends on individual aptitude and its philosophy should fit to the operation or organization it serves (School of Management Studies, IGNOU, 2004). It is an important factor in product quality and can be used as a strategy for successful competition. Many companies consider maintenance as a necessary activity but increase an expense to the organization and a non-value-added function. More progressive companies view maintenance as a way to reduce costs of producing their product or providing their services. Many companies are using this cost advantage to lower prices and increase their life cycle profits.

2.1.1 Maintenance Objectives

The objective of a production department in any manufacturing factory is to achieve a planned output in a specified time. This planned output is normally a function of sales demand. It determines the long term and short term production plans fixing the availability requirements of the factory. At any point of time the condition of machine units of a factory can be represented as one of the following states (Kelly, 1984) :

- (a) In production and only 'running maintenance' can be carried out.
- (b) Not being used for production and is available for maintenance without any production loss.
- (c) Out of production because of scheduled maintenance and will affected production loss.
- (d) Unexpected breakdown and undergoing emergency maintenance. It affected production loss and the maintenance is difficult to plan.
- (e) Unexpected breakdown and waiting for maintenance because of shortage of maintenance resources. It affected production loss.

To avoid such uncertain machine condition as mentioned above, maintenance should play its role to control the production loss. Other than that, it also means for safety purposes.

The main maintenance objectives can be stated as follows (Kelly, 1984):

- (a) To enhance overall equipment effectiveness by maximizing availability, performance and quality rates and obtaining maximum return on investments.
- (b) To extend the useful life of assets by minimizing wear and deterioration.
- (c) To ensure operational readiness of all equipment at all times and for emergency use.
- (d) To ensure safety of personnel using facilities and achieve acceptable safety.
- (e) To provide all this at minimum resource cost.

2.1.2 Benefits/Importance of Maintenance

In order to achieve world-class performance, more and more companies are undertaking efforts to improve quality and productivity and reduce costs. For more and more companies, part of this effort has included an examination of the activities of the maintenance function. Effective maintenance is critical to many operations. It extends equipment life, improves equipment availability and retains equipment in proper condition. Conversely, poorly maintained equipment may lead to more frequent equipment failures, poor utilization of equipment and delayed production schedules. Misaligned or malfunctioning equipment may result in scrap or products of questionable quality (Swanson, 2001). Finally, poor maintenance may mean more frequent equipment replacement because of shorter life.

According to Moubray (1994), the contribution of maintenance to the performance and profitability of manufacturing systems is to ensure that the plant can perform according to the agreed condition or what the organization expected, by balancing between the allocation of maintenance resources and the plant output.

With the change in manufacturing processes emphasizing lean manufacturing, the reliability and availability of plant are vitally crucial. Poor machine performance, downtime and ineffective plant maintenance lead to the decrease in the profit, loss of market opportunities, loss of production and so on (Wilson, 1999).

Dunn (1996) explained, through his equations, that effective maintenance helps to increase the revenues by increasing the equipment performance and plant capacity, which will in turn maximize the volume of sales. Figure 2.1 below explains the reasons why good maintenance management can maximize the organization profit.