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“ I declare that had read this thesis and in my opinion
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Signature:.....

Name:.....

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**A STUDY OF MAINTENANCE DESIGN SYSTEM FOR
INDUSTRIAL PUMP**

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**A thesis submitted in fulfilment of the requirements for the award of
the degree of Bachelor of Mechanical Engineering(Design and Innovation)**

**Fakulti Kejuruteraan Mekanikal
Universiti Teknikal Malaysia Melaka**

MAY 2012

DECLARATION

“ I declared that all the material presented in the thesis entitle **A STUDY OF MAINTENANCE DESIGN SYSTEM FOR INDUSTRIAL PUMP** to be the effort of my own research. Any material that is not of my effort has been stated clearly”

Signature;.....

Name:.....

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To my beloved mother Pn Zainun Hashim,
father Omar Abu Bakar and fellow friends

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ABSTRACT

Maintenance is the most important things in industry. This study is conducted at Daibochi Plastic and Packaging Sdn Bhd. The main objective of this study is to determine the optimal time to maintain pump industry. The main problem of the project is the rotating pump and will affect the cost and time to industry. Using Weight Decision Matrix the pumps that had been consider is rotating pump rather than diffusion pump and booster pump and time to maintain is 7 777600 seconds. Two systems have been developed to improve the performance of the pump which is internal and external. The systems will be evaluated based on vibration, performance of pump based on O.D. performance of machine, OEE of production and OEE of pump. Vibrations of the pump decreased by 43% while the performance of the pump increase for 9% when using O.D. and 2% when using O.D. 3.2. The performances of the machine increase by 0.5 minute. The systems also have increase the OEE of production for 0.64% and OEE of pump for 20.48%. The cost that can be reduced for each month is 1075 meters of plastic and RM650 for manpower cost each month. As overall evaluation, the systems are founds to be best way to encounter the problems and improve the quality of the pump.

ABSTRAK

Penyelenggaraan adalah perkara yang paling penting dalam industri. Kajian ini dijalankan di Daibochi Plastic and Packaging Sdn. Bhd. Objektif utama kajian ini adalah untuk menentukan masa yang optimum untuk mengekalkan prestasi industri pam. Masalah utama yang telah ditemui adalah pam berputar memberi kesan kepada kos dan masa kepada industri. Menggunakan 'Weight Decision Matrix' pam yang akan dipertimbangkan adalah pam berputar berbanding pam penyebaran dan pam penggalak dan masa yang penyelenggaraan adalah 7 777 600 seconds. Dua sistem telah dibangunkan untuk meningkatkan prestasi pam iaitu sistem dalaman dan sistem luaran. Sistem ini akan dinilai berdasarkan getaran, prestasi pam berdasarkan O.D. prestasi mesin OEE pengeluaran dan OEE pam. Getaran pam menurun sebanyak 43% manakala prestasi pam meningkat sebanyak 9% apabila menggunakan O.D. 2.8 dan 2% apabila menggunakan O.D. 3.2. Prestasi kenaikan mesin meningkat sebanyak 0.5 minit iaitu masa ketika keadaan vakum sempurna berlaku. Sistem ini juga telah meningkatkan OEE pengeluaran sebanyak 0.64% dan OEE pam sebanyak 20.48%. Kos yang perlu dikurangkan setiap bulan adalah 1074 meter plastik dan RM650 bagi kos tenaga kerja setiap bulan. Sebagai penilaian keseluruhan system yang dibangunkan merupakan cara terbaik untuk mengatasi masalah dan meningkatkan kualiti pam.

TABLE OF CONTENTS

TITLE	PAGE
DECLARATION	II
ACKNOWLEDGEMENTS	IV
ABSTRACT	V
ABSTRAK	VI
TABLE OF CONTENTS	VII
LIST OF TABLES	XII
LIST OF FIGURES	XIII
LIST OF SYMBOLS	XV
LIST OF APPENDICES	XVI
CHAPTER I	
INTRODUCTION	
1.0 INTRODUCTION	1
1.1 PROJECT BACKGROUND	1
1.2 OBJECTIVE	2
1.3 SCOPE	2
1.4 PROBLEM STATEMENTS	3
1.5 CONCLUSION	5

TITLE	PAGE
 CHAPTER II	
LITERATURE REVIEW	
2.1 INTRODUCTION TO MAINTENANCE	6
2.2 MAINTENANCE OBJECTIVE	8
2.3 TYPES OF MAINTENANCE	8
2.3.1 Reactive Maintenance	9
2.3.2 Preventive Maintenance	10
2.3.3 Predictive Maintenance	10
2.3.4 Reliability Centered Maintenance(RCM)	11
2.4 METALIZING PROCESS	12
2.5 TYPES OF THE VACUUM PUMP IN METALIZING PROCESS	14
2.5.1 Booster Pump	14
2.5.2 Rotating Pump (Piston Pump)	17
2.5.3 Diffusion Pump	21
2.6 PROBLEMS OF PUMPS	25
2.6.1 Cavitation	25
2.6.2 Other Problem Could Be In the Pump Its Self	26
2.7 WEIGHTED DECISION MATRIX	26
2.8 MEASUREMENT OF OPTIMAL TIME TO OVERHAUL	27
2.9 VIBRATION	28
2.10 GRAPH PERFORMANCE OF PUMP	30
2.10.1 The System Curve	30
2.10.2 Pump Performance Curve	31
2.10.3 Selection Of Pump	32
2.11 GRAPH PERFORMANCE OF MACHINE	33
2.12 OVERALL EQUIPMENT EFFECTIVENESS (OEE)	33
2.13 PROGRAMMABLE LOGIC CONTROLLER	35
2.14 MATLAB PROGAMMING	36
2.15 CONTROLLING DC MOTOR	37
2.15.1 Direction Control	37

TITLE	PAGE
2.15.2 Speed	38
2.16 PREVIOUS STUDY	39
2.16.1 Selection & Optimization Of Mine Pumping Systems(1983)	40
2.16.2 Optimization For Maintenance, Reliability And Operations	41
2.16.3 Pump Scheduling: Representation & Multiple Objectives	41
2.16.4 Genetic Algorithms In Pump Scheduling	42
2.16.5 Pump Scheduling Optimization	42
2.16.6 Summary of Previous Study	43
2.17 CONCLUSION	45
CHAPTER III	
COMPANY BACKGROUND	
3.1 INTRODUCTION	46
3.2 HISTORY OF DAIBOCHI	46
3.3 ORGANISATION STRUCTURE	47
3.4 DAIBOCHI PHILOSOPHY	49
3.5 MACHINE CAPABILITIES	50
3.6 QUALITY	51
3.7 CORPORATE SOCIAL RESPONSIBILITY	51
3.8 TYPE OF PRODUCT	51
3.9 PRODUCTION PROCESS	52
3.10 EXISTING MAINTENANCE SYSTEM	54
3.11 CONCLUSION	55
CHAPTER IV	
METHODOLOGY	
4.1 INTRODUCTION	56
4.2 METHODOLOGY OF PROBLEM IDENTIFICATION	56

TITLE	PAGE
4.3 WEIGHTED DECISION MATRIX	57
4.4 OBTAINING OPTIMAL TIME FOR OVERHAUL	59
4.5 VIBRATION	59
4.5.1 Apparatus	60
4.5.2 Vibration analysis experiment	60
4.6 GRAPH PERFORMANCE BASED ON O.D.	60
4.7 PERFORMANCE OF MACHINE	61
4.8 OVERALL EQUIPMENT EFFICIENCY (OEE)	61
4.9 CONCLUSION	61
CHAPTER V	
MAINTENANCE SYSTEM DESIGN	
5.1 INTRODUCTION	64
5.2 SCOPE OF DESIGN	65
5.3 EXTERNAL SYSTEM DESIGN	65
5.4 INTERNAL SYSTEM DESIGN	68
5.4.1 Model Generation	68
5.4.2 Generation of pulses	69
5.5 CONCLUSION	72
CHAPTER VI	
SYSTEM EVALUATION AND DISCUSSION	
6.1 INTRODUCTION	73
6.2 VIBRATION	74
6.3 PERFORMANCE OF ROTATING PUMP BASED ON O.D.	88
6.4 PERFORMANCE OF MACHINE	92
6.5 OEE OF PRODUCTION	95
6.6 OVERALL EQUIPMENT EFFICIENCY(OEE) OF PUMP	97
6.7 DISCUSSION	97
6.8 CONCLUSION	98

TITLE	PAGE
CHAPTER VII	
CONCLUSIONS AND RECOMMENDATION	
7.1 INTRODUCTION	99
7.2 SUMMARY OF THE STUDY	99
7.3 FINDINGS	100
7.4 COST MANAGEMENT	100
7.5 RECOMMENDATIONS	101
7.6 CONCLUSIONS	101
REFERENCES	102
APPENDICES	103

LIST OF TABLES

NO	TITLE	PAGE
2.1	Storage of the booster pump	16
2.2	Oil Change(Aerzener Mashinenfabrik GmbH 2002)	16
2.3	Specification of rotating pump	19
2.4	Specification of the diffusion pump	22
2.5	Weighted Decision Matrix Scoring System	27
2.6	OEE Factor (Internet source; www.oee.com)	34
2.7	Systems Approach to Pumping Plant Design	41
2.8	Comparison of methodology and element analysis on the journal	44
3.1	Machine Capabilities	50
3.2	Film Type and Application	52
4.1	Weighted Decision Matrix	58
7.1	Summary of the result	100

LIST OF FIGURES

NO	TITLE	PAGE
1.1	Flow chart	4
2.1	Schematic diagram process of the metalizing	13
2.2	Cross Sectional Pump for Booster Pump	14
2.3	Diagram for Booster Pump	15
2.4	Cross Sectional Pump for rotating pump	18
2.5	Inlet Suction Elbow	20
2.6	Speed and Throughput Curves	22
2.7	Physical Specifications	23
2.8	Section drawing of Diffusion Pump	24
2.9	Effect of cavitation	26
2.10	Energy Equation System Curve	30
2.11	Pump Performance Curve	32
2.12	Selection of Pump	33
2.13	Example calculation of OEE	34
2.14	H Bridge circuit	37
2.15	Microcontroller switch motor	38
2.16	Pulse width voltages	39
2.17	Pulse width half voltage	39
3.1	Organisation chart	49
3.2	Production process	54
3.3	Checklist of metalizing machine	55

NO	TITLE	PAGE
5.1	Before the alarm ‘beep’	66
5.2	After the alarm ‘beep’	67
5.3	Principle of motor	70
5.4	Schematic internal system design	71
6.1	FFT 1 of broken pump	75
6.2	FFT 3 of broken pump	76
6.3	Combination of FFT 1 and FFT 3 for broken pump	77
6.4	FFT 1 for clogged pump	78
6.5	FFT 3 for clogged pump	79
6.6	Combination of FFT 1 and FFT 3for clogged pump	80
6.7	FFT 1 using existing maintenance	81
6.8	FFT 3 using existing maintenance	82
6.9	Combination of FFT 1 and FFT 3 using existing maintenance	83
6.10	FFT 1 using new system	84
6.11	FFT 3 using new system	85
6.12	Combination of FFT 1 and FFT 3 using new system	86
6.13	Vibration data for broken and clogged pump	87
6.14	Vibration data using existing system and using new system	87
6.15	Graph of vibration for 10Hz	88
6.16	Graph performance of pump using O.D. for existing system	90
6.17	Graph performance of pump using O.D. for new system	91
6.18	Graph performance of machine for existing system	93
6.19	Graph performance of machine using new system	94
6.20	OEE of production using existing system	95
6.21	OEE of production using new system	96

LIST OF SYMBOLS

h	=	<i>system head(m)</i>
dh	=	<i>static head(m)</i>
hl	=	<i>head loss</i>
mA	=	<i>miliampere</i>
RM	=	<i>ringgit malaysia</i>
km	=	motor constant
$\phi(t)$	=	actual rotor position(ϕ)
ϕ_0	=	location of the coil(ϕ)
$I_j(t)$	=	current in the coil(A)
emf	=	the electrotive force (N)
R	=	resistance (ohm)
L	=	inductance(ohm)

LIST OF APPENDICES

	TITLE	PAGE
APPENDIX A	(Gantt Chart for PSM)	103
APPENDIX B	(Booster Pump description)	106
APPENDIX C	(Rotating Pump description)	109
APPENDIX D	(Data for pump performance based on O.D. (Data for time of machine operation)	120
APPENDIX E	(Picture of Company and Metalizing machine)	127

CHAPTER I

INTRODUCTION

1.0 INTRODUCTION

Project Sarjana Muda (PSM) or Final Year Project is an academic and scientific research that related with programs at Faculty and compulsory for every final year students as to fulfil the requirements before being awarded the degree. The title of this study is A Study of Maintenance Design System for Industrial Pump. This chapter will be discussed about the objectives and scopes of the study that have been conducted. Following this, the methodology of accomplishing the study will be placed in the end of this chapter

1.1 PROJECT BACKGROUND

Pumps is a kinetic device used to move fluids which is transport fluids and liquids through piping systems that come from one reservoir or tank to a different reservoir or tank. This pump also considered to be roto-dynamic pumps because they operate via a revolving rotary impeller. A centrifugal pump is one of the simplest pieces of equipment in any process plant.

A pump delivers useful energy to the fluid through pressure changes that occur as this fluid flows through the It is converting of mechanical energy to

hydraulic energy of the handling fluid to get it to a required place or height by the centrifugal force of the impeller blade.

This project is the cooperation of industrial plants “Daibochi Plastic and Packaging Industry Bhd” maintenance department. The case study is about determination of optimal time to maintain the industrial pump and the type pump to research is vacuum pump. In this research, the method to determine the problem and solving are described. Suitable mechanical testing will be done on this experiment to determine the performance.

1.2 OBJECTIVE

The objectives of the study are:

- i. To determine the main problem occurred of the vacuum pump in Metalizing process,
- ii. To suggest the optimal time to maintain using the suggestion system
- iii. To analyze the effectiveness of the suggestion system.

1.3 SCOPE

The scopes of this project are as follows;

- i. Conducting research and literature review on the existing journals, books and other related sources.
- ii. The study is conducted at Daibochi Plastic and Packaging Industry Bhd, Ayer Keroh, Melaka.
- iii. Testing the efficiency of the pump when using different of O.D.in metalizing process.
- iv. Perform appropriate analysis on the mechanical test results.

1.4 PROBLEM STATEMENTS

At the beginning of the study, confirmation of the thesis title has been done first before determination of objectives and scopes. The objective is a guideline to make sure all the analysis of the study will not be out of scope and it must be done before obtaining the approval from a suitable company. After finding a company, several observations are made to understand overall operation of the company including the type of products, process flow of products and other related information. Maintenance is the most important thing in industry. Without proper maintenance schedule it will affect overall system of the machine. There are many types of the pump that had been used in the industry. Vacuum pump is the types that had been used in the metalizing process in the industry. Without proper schedule maintenance it will affect the performance and efficiency of the pump. Due to this problem it will directly affect the cost and time production for the company.

Three types of pump that been used in metalizing process will be analyses and evaluated. Comparison of these three pumps is done to know the most critical part and time required. A system will be design and analyse the effectiveness of the system will be conducted. At the end of PSM II, a full report will be submitted. All these steps of the methodology are illustrated as a flow chart in Figure 1.1. In addition, Gantt charts for the research are shown on Appendix A(1) for PSM 1 and Appendix A(2) for PSM II.

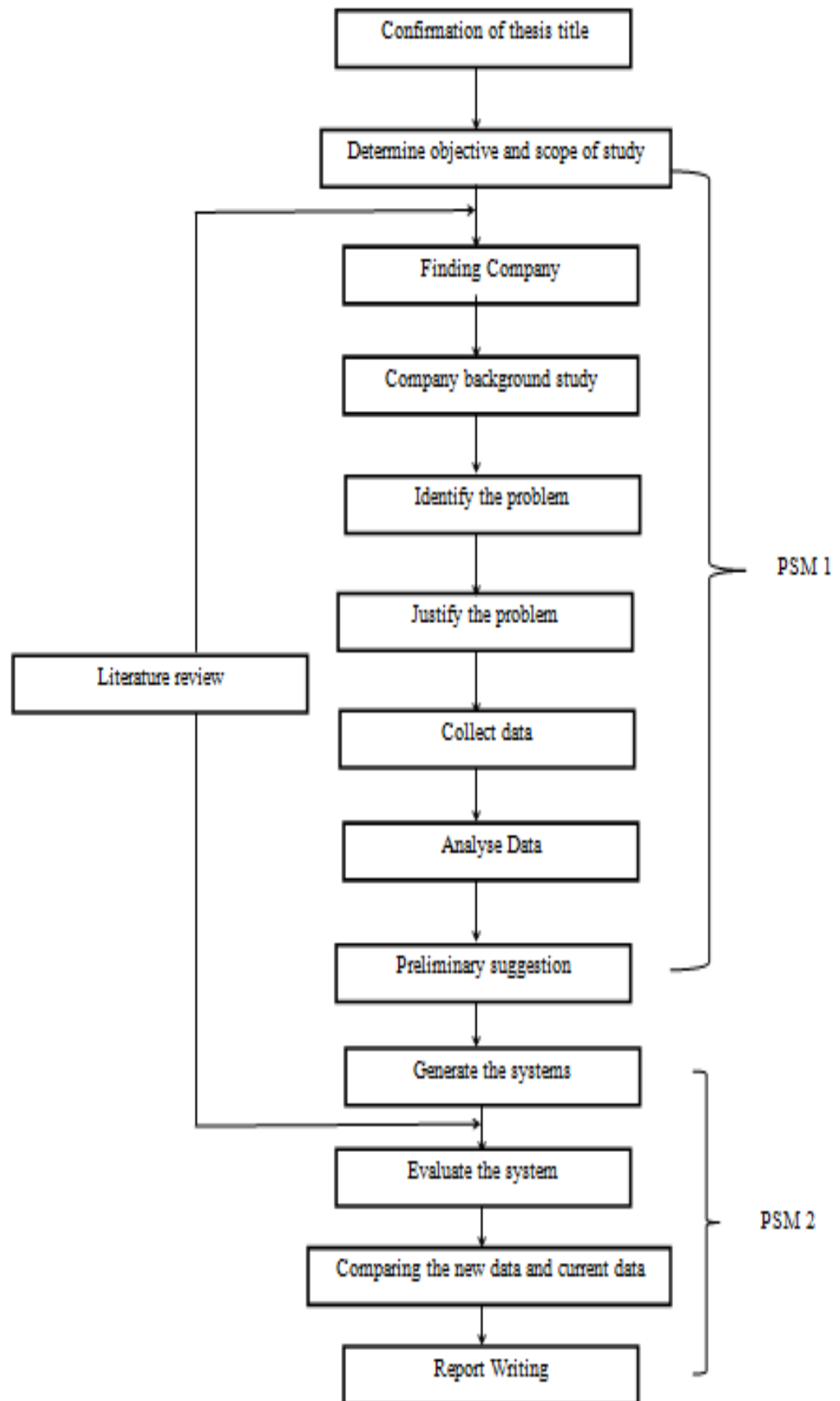


Figure 1.1: Flow chart

1.5 CONCLUSION

The objectives and scopes of the study are important elements that are used as a guideline to accomplish the study according to the methodology flow chart that is shown in Figure 1.1. In the next chapter, discussion will be drawn in the studies of appropriate maintenance system in industrial pump.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION TO MAINTENANCE

Maintenance is a knowledge representation approach to efficient handling of inferred information that is explicitly stored. Reason maintenance distinguishes between base facts, which can be defeated and derived facts. As such it differs from belief revision which, in its basic form, assumes that all facts are equally important. Reason maintenance was originally developed as a technique for implementing problem solvers. It encompasses a variety of techniques that share a common architecture: two components - a reasoner and a reason maintenance system - communicate with each other via an interface.

The reasoner uses the reason maintenance system to record its inferences and justifications of ("reasons" for) the inferences. The reasoner also informs the reason maintenance system which are the currently valid base facts (assumptions). The reason maintenance system uses the information to compute the truth value of the stored derived facts and to restore consistency if an inconsistency is derived.

A truth maintenance system, or tms, is a knowledge representation method for representing both beliefs and their dependencies. The name truth maintenance is due to the ability of these systems to restore consistency.

It is also termed as a belief revision system, a truth maintenance system maintains consistency between old believed knowledge and current believed knowledge in the knowledge base (kb) through revision. If the current believed statements contradict the knowledge in kb, then the kb is updated with the new knowledge. It may happen that the same data will again come into existence, and the previous knowledge will be required in kb. If the previous data is not present, it is required for new inference. But if the previous knowledge was in the kb, then no retracing of the same knowledge was needed. Hence the use of tms to avoid such retracing; it keeps track of the contradictory data with the help of a dependency record. This record reflects the retractions and additions which makes the inference engine (ie) aware of its current belief set.

Each statement having at least one valid justification is made a part of the current belief set. When a contradiction is found, the statements responsible for the contradiction are identified and an appropriate is retraced. This results the addition of new statements to the kb. This process is called dependency-directed backtracking.

The tms maintain the records in the form of a dependency network. The nodes in the network are one of the entries in the kb (a premise, antecedent, or inference rule etc.) Each arc of the network represents the inference steps from which the node was derived.

A premise is a fundamental belief which is assumed to be always true. They do not need justifications. Considering premises are base from which justifications for all other nodes will be stated.

There are two types of justification for each node. They are:

- i. Support List [SL]
- ii. Conceptual Dependencies(CP)