UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Design and Development of Shimless Pump Footing System

Report submitted in accordance with the requirements of the Universiti Teknikal Malaysia Melaka for the Bachelor Degree of Manufacturing Engineering in Manufacturing Process

By

Mohd Faiz Haji Abdul Haji

Faculty *of* Manufacturing Engineering

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PSM

JUDUL:

An Experimental Study of The Impact of Surface Grinding Parameter On Flatness

SESI PENGAJIAN: **Semester 2 2007/2008**

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I hereby, declare this report entitled "Design and Development of Shimless Pump Footing System" is the results of my own research except as cited in references.

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Date : ……25 March 2008…….

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 Process). The member of the supervisory committee is as follow:

……

Mr. Mohd Shahir Kasim

Project Supervisor

Faculty of Manufacturing Engineering

ABSTRACT

This project proposes the design of shimless footing system to overcome the misalignment arise from the soft foot. Then, an analysis of the effectiveness of the shimless unit will be compared to conventional shim in rectifying misalignment problem. The soft foot happened when there is a gap between a machine foot and the foundation. The machine frame will actually distort from its resting position as the hold- down bolts are tighten to secure the machine in place. Soft foot also creates stress lines in the frame as a short foot is pinned to the foundation by the hold-down bolt. A classic example of the soft foot is; bar table with one short leg; which occurs when the machine naturally rests on three legs and the fourth leg is short. If it does properly corrected before beginning the actual alignment, it is difficult or impossible to achieve acceptable results. A shimless footing system will be design in order to overcome the soft foot problem. Solidwork were used in the designing stage. By using SolidWork, a shimless system can be easily developed and observed to make sure that it will able to overcome the soft foot problem. The system should be able to provide a new foundation that does not relies on shims in alignment machinery. Then, after a system has been designed, an analysis done to study the effect on soft foot during the alignment process. It will observe whether the system is effective by comparing to the conventional shim. The design should make the alignment process easier and overcome the soft foot problem from arise. There are two basic methods to identified soft foot, which are frame distortion index and the laser soft foot locator. It is predicted that the soft foot problem can be eliminated as the misalignment will not happen again.

ABSTRAK

Projek ini bertujuan untuk mengkaji masalah ‘soft foot’ yang menyebabkan susunan system pam mesin menjadi tidak lurus. Setelah itu, sebuah rekaan sistem kaki yang tidak ber’shim’ akan direka untuk mengatasi masalah ‘soft foot’ ini. ‘Soft foot’ ini terjadi apabila ada jarak di antara kaki pam mesin dan tapak asasnya. Pam mesin ini akan bergerak dari kedudukan asalnya walaupun nat telah diketatkan untuk mengelakkannya. ‘Soft foot’ juga menghasilkan garis tekanan pada mesin kerana kaki yang pendek diikat pada tapak asa dengan menggunakan nat. sekiranya ia tidak diperbaiki, hasil yang dihasilkan menjadi tidak berkualiti. Proses rekaan ini akan menggunakan CAD, iaitu Solidwork. Dengan menggunakan perisian ini, sistem tidak ber’shim’ ini dapat dihasilkan dan diperhatikan untuk memastikan ia boleh mengatasi ‘soft foot’. Sistem ini juga perlu mempunyai tapak asas supaya ia tidak lagi bergantung pada ‘shim’ untuk meluruskan system pam mesin. Rekaan ini memudahkan proses pelurusan dan masalah ‘soft foot’ dapat dikurangkan. Kemudian, selepas system ini telah reka, ia akan di analisis untuk mengkaji kesannya ke atas ‘soft foot’ ketika proses meluruskan. Pemerhatian akan dibuat sama ada system ini berkesan ataupun tidak dibandingkan dengan ‘shim’ biasa. Ada dua cara asas untuk mengesan ‘soft foot’ akan digunakan iaitu ‘frame distortion index’ and ‘the laser soft foot locator’. Ia meramalkan yang masalah ‘soft foot’ boleh dihapuskan dimana ‘misalingment’ tidak akan berlaku lagi.

DEDICATION

My parents,

Haji Abdul Haji Md Dangi

Hajah Sarah Abd Wahab

My beloved sibling,

Lily Harnisa Abdul Haji

Hanis Yusri Abdul Haji

Hairul Faizi Abdul Haji

Norazizi Abdul Haji

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First of all, Alhamdulillah, praise to Allah as I have completed my PSM 1 and 2. First and foremost, I would like to thank my beloved parent, Haji Abdul Haji Md Dangi and Hajah Sarah Abd Wahab for their full concern, encouragement and considerate. As well, I would like to state thankfulness to Encik Mohd Shahir Kasim, my PSM Supervisor, for his assistance and custody, together with training that I had learned. Besides, I want to thank to all lecturers of Faculty of Manufacturing Engineering, UTeM and staffs.

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Wassalam,

Mohd Faiz Abdul Haji

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INTRODUCTION

1.1 Introduction

In theory, machine alignment is a straightforward process, but in real world applications, it is often compounded by structural faults such as soft foot, piping strain, induced frame distortion, excessive bearing clearance or shaft rubs.

For this project, it will examine how to eliminate soft foot which is some of the typical reasons why alignments are unsuccessful. In theory, machine alignment is a very straightforward process. With some type of measuring device extended across the coupling, the shafts are rotated to several positions (at least three) to determine the relative position between them (Skeirik R. D., 1997). Since alignment is an iterative process, which meaning that the misalignment should continuously decrease with each machine move, it is theoretically only a matter of sufficiently repeating alignment corrections until an acceptable solution is achieved.

Soft foot poses a challenge for plant operations and maintenance personnel. The common term for machine frame distortion, soft foot is caused when one or more feet of a machine are shorter, longer or angle some way different than the rest of the feet (Hamnernick I., 2006). This non-uniformity causes stress on the machinery when the foot is force into place by tightening the hold-down bolt.

In fact, quality alignment is not dependent on the type of measurement system used but dependent on how to solve problems happen in the alignment. Any good dial indicator set or laser system should be sufficient method to perform quality alignments.

To prevent any soft foot problems occur, the installed of the shim must done by personnel that has enough trained in mechanical seal installation practices. The other definitely limitation or disadvantages of shim such as material properties that using to construct the shim. Regarding to material properties, influence corrosion factor is very important to keep up the material strength in good condition. Stated that not all type of materials can be used for shimmed the pump. Although the steel materials are very strong but there are some type of steels can be easily become corrosion. This can limit the performance function for shim (Goulds Pumps (2002)).

1.2 Objective

a) Analyse effect on softfoot during alignment process.
b) Study and develop shimless system that can overcome the problem.

1.3 Scope of study

There are many problems can occur during alignment process. Firstly in this project, the main scope of study is to study the problem of softfoot and effect on alignment to understand the concept of shaft alignment. In other words, the important steps in design and develop shimless footing system that must be recognise and identify the problems that may arise during the constructions of the shimless footing system. Finally, to

analyse the effectiveness of shimless unit compare to conventional shim in rectifiying misalignment problem.

1.4 Report Organization

This thesis consists of six chapters:

Chapter 1: Introduces of Shaft Alignment, the effect of soft foot on alignment, problem arises in industry which drive to develop the better shimless, objective and scope of this project.

Chapter 2: Literature review from journal, books and internet. The area covered including principle for shaft alignment, method in alignment, procedures, tolerance etc.

Chapter 3: Describes methodology to develop the system, the requirement to ensure the design of shimless, selection material etc.

Chapter 4: Result of design that has been obtained.

Chapter 5: Discussion on reliability of product design and improvement.

Chapter 6: Conclusion for the whole project and recommendation for future work.

1.5 Flow Chart

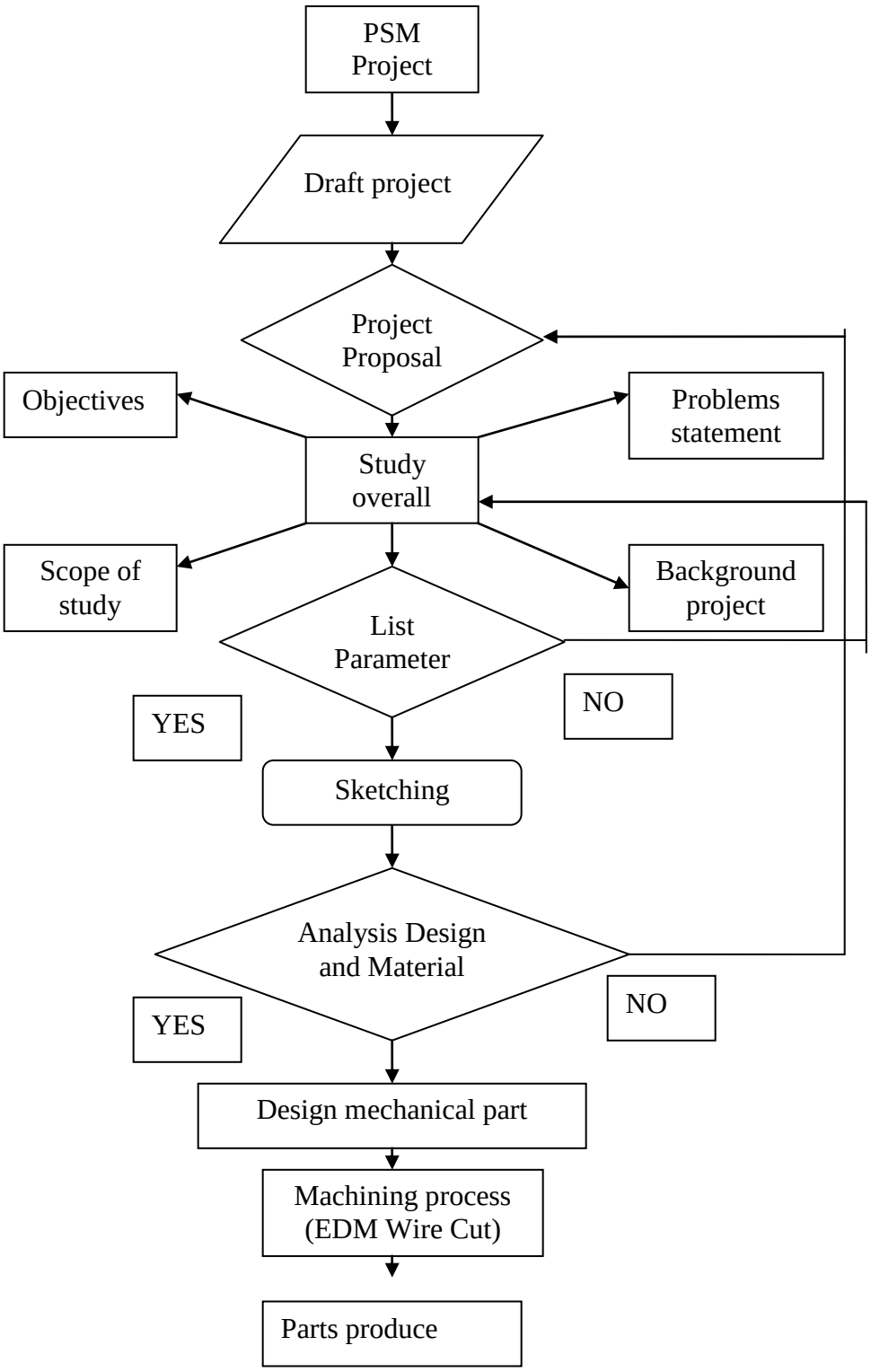
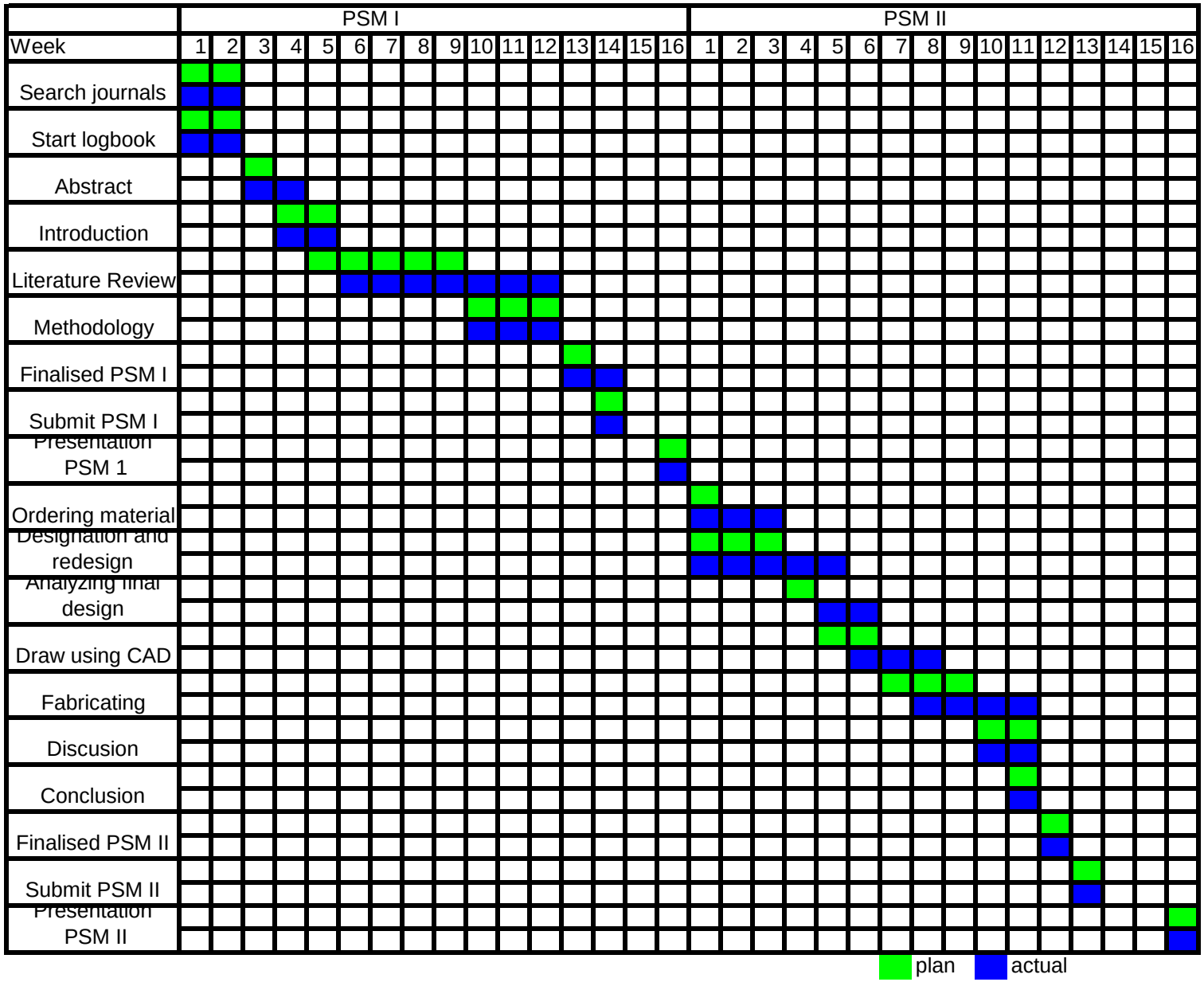


Figure 1.1: Process flowchart

1.6 Gantt Chart

Table 1.1 Gantt Chart



1.7 Problem Statement

1.7.1 The Effect of Soft Foot on Alignment

The soft foot in one of the problems and challenges for plant operations and maintenance personnel. It is the common term for machine frame distortion, soft foot is caused when one or more feet of machine are shorter, longer or angled someway different than the rest of the feet. This non-uniformity causes stress on the machinery when the foot is forced into place by tightening the hold-down bolt (Hamernick I., 2006). The missing shims under a foot, a bend foot, or deteriorating base plate or foundation can cause this condition.

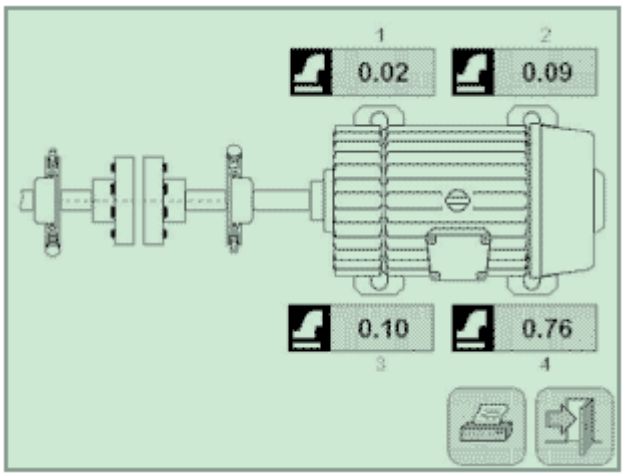


Figure 1.2: Show the reading on of the pump (McNally Institute (2005)

Besides that, the soft foot condition also can causes many of the failed bearings, broken shafts, and high vibration readings associated with misalignment.

1.7.2 The minimum thickness shimless for soft foot

The bottoms of the machine feet shall rest on the base or foundation with 90 percent contact of the footprint (Wowk V., 2000). A 0.003 inch thick shim shall not penetrate under any foot with all hold down bolts loose. This is an unforeseen condition and will require more time to correct (Wowk V., 2000). Resonant foundations or bases are dynamic structural defects. This will cause high vibration at specific speeds. Resonances are not detectable during static alignment measurements.

A dial indicator, or other measuring devices, shall be fixture to measure the vertical rise at each foot as the hold down bolt is loosened. According to Wowk V. (2000), all other bolts shall remain tight. A rise of less than 0.002 inch is acceptable. A rise of more than 0.002 inch shall be corrected by adding shims. After shim changes are made, the above test shall be repeated at all feet until less than 0.002 inch rise is measured at each foot. If shim changes cannot adjust the rise, then the base will need to be ground or machined.

1.7.3 Difficulties in performing alignment

The shaft-to-shaft residual misalignment is acceptable when the intersection point of the two shafts is within the coupling area and the included angle between the shaft centerlines is small. These two criteria must be applied in two orthogonal directions, typically horizontal and vertical for convenience, and normalized to speed. That is, slow-speed machines are allowed a larger tolerance. High-speed machines are required to be better aligned (Wowk V., 2000). The intersection point of the two shafts is considered to be within the coupling area when the separation of the shaft centerlines at the center of the coupling is less than the tolerance values.