



TECHNICAL UNIVERSITY OF MALAYSIA MALACCA

**Measurement of Thermal Comfort At Workshop:
A Case Study In UTeM**

Report submitted in accordance with the requirements of the National Technical
University of Malaysia Malacca for the Degree of Bachelor of
Engineering (Honors) Manufacturing (Management)

By

LING NENG KANG

Faculty of Manufacturing Engineering

May 2008



FAKULTI KEJURUTERAAN PEMBUATAN

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Rujukan Kami (Our Ref) :
Rujukan Tuan (Your Ref):

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MELAKA.

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IN UTeM**

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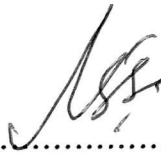
**MEASUREMENT OF THERMAL COMFORT AT
WORKPLACE: A CASE STUDY IN UTeM**

LING NENG KANG

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

APPROVAL

This report submitted to the senate of UTeM and has been accepted as fulfillment of the requirement for the Degree of Bachelor of Manufacturing Engineering (Honors) (Management). The members of supervisory committee are as follows:



.....
Main Supervisor

Faculty of Manufacturing Engineering

ISA BIN HALIM

Pensyarah


Fakulti Kejuruteraan Pembuatan
Universiti Teknikal Malaysia Melaka
Karung Berkunai 1200, Ayer Keroh
75450 Melaka

.....
Second Supervisor

Faculty of Manufacturing Engineering

DECLARATION

I hereby, declare the thesis entitled “Measurement of thermal comfort at workplace: A Case Study in UTeM” is the results of my own research except as cited in the references.

Signature	:	
Author's Name	:	Ling Neng Kang
Date	:	25 March 2008

ABSTRACT

This study aims on measurement of thermal comfort at FKP workshop. The area of research in this study is identified and determined the responding students UTeM regarding to questionnaire provided. Secondary, the analytical and measurement of thermal comfort around the areas of workshop had taken by using thermal comfort monitor. The purpose of improvement have be discussed in chapter six which included engineering and administrative method. The methodology of this study to investigate and analyze thermal comfort in the workshop of faculty manufacturing engineering. The research is carried out with a progress which can be defined as the flow diagram that a visual representation of major segments in a process and it might used to identify problem areas, document a process or serve as a planning tool for process improvement. By the ways, there are four section such as welding section, machine shop, casting section and fabrication section had selected to measure thermal environment around workshop into three time of periods. The data have been collected into two types of results that are results from Questionnaire and another would be actual measurement data from thermal comfort monitors. Explanations and distributions of difference results for thermal environment either response students or measurement data would be discussed in chapter six. The suggestion of improvement also had discussed on this study which are divided into two types of methods. ISO 7730 and some information of thermal comfort had shown at appendix in this study.

DEDICATION

For my beloved mom and siblings

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

BMR	-	Basal Metabolic Rate
RMR	-	Resting Metabolic Rate
FFM	-	Fat Free Mass
%	-	Percentage
°C	-	degree of Celsius
m/s	-	Meter per Second
PMV	-	Predicted Mean Vote
PPD	-	Predicted Percentage Dissatisfied
UTeM	-	Universiti Teknikal Malaysia Melaka
UNIC	-	University-Industry Centre
PWC	-	Physical Work Capacity
FKP	-	Fakulti Kejuruteraan Pembuatan

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

1.1.1 Background History of University Technical Malaysia Malacca

University Technical Malaysia Malacca (UTeM) was established on December 1, 2000 under Section 20 of the University and University College Act 1971 (Act 30) under the Orders of University Technical Malaysia Malacca (Incorporated) 2001. In fact, UTeM is a PUBLIC UNIVERSITY and a pioneer in the use of the "Practice and Application Oriented" teaching and learning method for technical education in Malaysia.

There are five faculties which namely Electrical Engineering, Electronic and Computer Engineering, Mechanical Engineering, Manufacturing Engineering, and Information and Communication Technologies. There are two academic centres being the Academic Service Centre and the University-Industry Centre (UNIC). An institute, the Institute for Technology Management and Entrepreneurship, was also established to offer post-graduate programmes on technology management and entrepreneurship.

The university offer academic programmes at diploma, bachelor, masters and PhD levels. Anyways, the university aims to produce professionals who are not only highly qualified and technically competent but are also highly skillful and efficient. Therefore, the academic programs offered by the university are conducted in a way where equal emphases is given to theoretical and practical aspects of the discipline.

The teaching and learning approaches at the university are practice, application oriented and involves competency development, action-based learning, simulation of real situations and problems, and solving industry related problems.

1.1.2 Faculty Manufacturing Engineering

Faculty of Manufacturing Engineering was officially established on the 22nd of June 2001 after approval by the Ministry of Education. The first course offered was Bachelor of Manufacturing Engineering (Manufacturing Process) in November 2001. However, foreseeing the nation's fast-moving industrial development and its need for professional human resources in manufacturing engineering, the Faculty has added up new courses in the various fields of manufacturing engineering with approval from the ministry starting from 14 April 2002. Now, the Faculty has 6 programs offered which are:

- (a) Bachelor of Manufacturing Engineering: Manufacturing Process
- (b) Bachelor of Manufacturing Engineering: Robotic & Automation
- (c) Bachelor of Manufacturing Engineering: Manufacturing Design
- (d) Bachelor of Manufacturing Engineering: Engineering Materials
- (e) Bachelor of Manufacturing Engineering: Manufacturing Management
- (f) Diploma of Manufacturing Engineering

1.1.3 Workshop and Laboratory of Faculty Manufacturing Engineering

Faculty manufacturing engineering had have be taken steps to develop some of suitable laboratory concerned with subjects of manufacturing engineering. Anyways, faculty manufacturing engineering believes that students of FKP can be revealed a good and responsibility engineer not only good in knowledge of theoretical but also technical on-hand skill. In UTeM, there are two sites of laboratory, which are laboratory FASA B, and laboratory at Cubic. Because of the selection place of my

1.2 Problem Statements

1. A certain room temperature cannot be guaranteed as occupants may influence the room energy balance by window opening, internal heat gains or sun shading control.

(Jens U. Pfafferoth, Sebastian Herkel, Doreen E. Kalz, Andreas Zeuschner; 2007)

2. When human subjects exposed to hot environments, their response to heat change and they sweat earlier and more in response to a given heat stimulus.

(K.C.Parsons)

1.3 Objectives of Project

The objectives of this study are:

1. To identify and determine the response of students or staffs UTeM regarding to thermal comfort in FKP workshop or laboratories.
2. To measure and analyze thermal comfort at FKP workshop and laboratories in FASA B areas.
3. To improve thermal comfort at workshop and laboratories in FASA B.

1.4 Scope and Limitation of the Project

The scope of this study is implementation and analytical the measurement of thermal comfort on workshop environment at FASA B laboratory, UTeM. By the ways, the report involved theoretical of thermal comfort, metabolic rate estimation, equation predicted mean vote (PMV), predicted percentage dissatisfied (PPD), and method and tool have been used on thermal comfort. It also covers the instrumentation and experimental by using the equipments of heat stress and thermal comfort monitors at

FASA B laboratory. Additionally, this report also obtained the result of comfortable from response of students and staffs UTeM.

On the other hands, the survey and observation on response of students and staffs UTeM by using questionnaire is not given a view in this report. Besides that, the usage of programmer thermal comfort, problems during implementation experiment and the procedures of activation thermal comfort monitors are not included in this report.

1.5 Potential Benefits of the Study

1.5.1 Benefits to University

Thermal comfort is most important issues and that can be given comfortable for all people who are inside the building. Therefore, the benefit of the study for university is reduction and improvement of thermal and discomfort in manufacturing workshop of UTeM. Normally, in manufacturing workshop; there are many types of machines in operation which all of them will affect environment condition by producing thermal and air pollution around there. Moreover, the natural thermal from climate likely sunlight will also effect temperature and air quality in workshop especially afternoon period.

1.5.2 Benefits to Students

Furthermore, the benefit of the study for students is to be references of thermal comfort for them in future research and analytical. Thus, the student can be used this study to continue executed experimental and research for their PSM report or other projects concerned with thermal comfort. By the ways, this study maybe have some incomplete and error about thermal comfort which are can be improved and be enhanced and it become information addition for the student that easily them to do

the research on their future. Moreover, this study can also to be history of thermal comfort and helps these students to create and find out new technology measurement of thermal comfort and better instruments and infrastructure to the future usages.

1.5.3 Benefits to Author

There are many benefits that can be given such as theoretical and history of thermal comfort, methods of experimental for thermal comfort, equations of thermal comfort, types of thermal comfort and so on. According to these theories, this has to know more about knowledge of thermal comfort and 5W's and 1H's of the important of thermal comfort for human being, and around environments. For the equations of thermal comfort, these are many types of equations such as equation PMV, equation metabolic rate estimation, equation of PPD, and others. Besides that, this study can be enhanced my knowledge and experiences concerning with thermal comfort where all of these information and knowledge may be used when working in factory environments for my future.

1.6 Project Outline

Commonly, the aim of this project are to identify and to determine the response of students concerning with thermal comfort at manufacturing workshop, UTeM. The use of tool on this section was a questionnaire, which consists general personal information and six factors of thermal comfort. On this survey, we can obtain these students opinion toward around thermal condition and their clothing wearing.

Secondary, the measurement and analytical of thermal comfort had implemented in this project too. However, the tool has be used on this section is heat stress and thermal comfort monitors. The equipment of thermal comfort will measured included air temperature, flow rate, humidity, and mean radiant temperature. Air quality and temperatures in workshop are important factors in the analysis process of the study

and improving them should be given as much priority as improving the materials and methods.

Besides that, to propose solution on how to maintain and improvement of thermal comfort in manufacturing workshop at FASA B laboratory. There are two types methods to be used in improvements of thermal comfort such as engineering and administrative methods. Engineering method is referring to the use of engineering techniques to redesign and provide the job aids. By the ways, the administrative method is to keep the work at acceptable energy-expenditure levels. All of these methods would be described in chapter three later.

1.7 Structure of Report

In this report, there are seven chapters would be briefly and discussed. The chapter one will discuss about the introduction of this study such as background of study, problem statements, objectives of the study, scope and limitation of the study and potential benefit of study. However, all of statements concerning with thermal comfort at faculty manufacturing engineering workshops.

In chapter two, that is literature review on my study which including theoretical of thermal comfort, equation of PMV and PPD, methods and tools used from journals, important of thermal comfort, and summaries of journals. From this chapter, we can know more details about thermal comfort and methods and tools have been used in thermal experimental. Moreover, this will also given us more knowledge likely new technology used in experimental, difference of climate in difference conditions, and so on.

Furthermore, the methodology of my study would be discussed in this chapter three. Commonly, there are planning of the study, methods and tools selected to be used on my study, and materials on this study to success my PSM report. According to methods and tools section, there are two methods have been used in this study such