CHAPTER I

INTRODUCTION

This chapter describes about the background and problem statements relating to a previous study of a four-way hot box test designed in 2008 by Chhay Karno, a master's program graduate at Chiang Mai University.

1.1. Background

Two of many global concerns nowadays are global warming and energy saving. The global has been clearly changed from the past centuries. In addition, the increasing amount of natural disasters such as storms, floods, earthquakes, volcanoes, dry-weather, and forest-fires have happened more frequently and caused destruction in almost the whole region of the globe.

A large fraction of energy consumption is for air conditioning in buildings and this situation leads to architects' concern. Thus, "Green Design" is one of the hottest current architectural design concepts. More and more research projects have been carried out to enhance it and one research area concerning this issue is developing new or better construction materials, especially for buildings envelopes in the future.

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1.2. Problem Statement

Karno (2008) studied about how to effectively use disposed EPS foam as a sandwiched layer between traditional wall panels. There was a thermal property testing tool called “Four-way Hot Box” he developed in that research project. The box simply consisted of one heating chamber or cell in the middle, and four surrounding observation chambers or cells. This device did not directly measure *k*-value or *R*-value of the tested wall panel specimens. The values came out by a comparison concept where some materials with known *R*-values were tested for a set of thermal resistance performance to obtain a reference chart first. Then, the research specimens were tested and their *R*-values were obtained by interpolating their thermal resistance performance in the reference chart.

The experiment was timely and costly done by using the hot box because there were two major concerns at that time: 1) the researcher was not sure how long the experiment should be continued to obtain valid results. Therefore, he spent four hours on all specimen tests continuously; and 2) the researcher was concerned that the room temperature outside the box may have some effect on the temperature inside the observation cells to be measured. Therefore, the air conditioner was turned on throughout the experiment. This means there was extra cost for the test.

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In order to use the hot box more effectively, research should be carried out to find how the room temperature affects the temperature inside the box, and

we should use air conditioning or not. The result will definitely save cost for operating this tool.

1.3. Significance of Research

The outcomes of this research will lead to the improvement of a hot box previously developed by the Faculty of Architecture at Chiang Mai University. In addition, the result will help researchers to run the box more effectively.

1.4. Research Objectives

To obtain the answers for the main research question, there are research objectives:

1. To investigate the effect of the room temperature on the results.
2. To investigate the effect of the starting ambient temperature in all the chambers on the results.
3. To investigate the effect of the heating source temperature on the results.

1.5. Scope of Research

This research thesis was conducted at the Faculty of Architecture at Chiang Mai University (FACMU). Therefore, studied temperatures are the local temperature of Thailand which has an average temperature around 18 ºC to 34 ºC. Moreover, a heating temperature in the heating cell was limited to 60 ºC.

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1.6. Outline of the Thesis

This thesis was prepared in five chapters as follows:

- Chapter One, Introduction: This part provides the background, the problem statement and the significance of research. In addition, it also includes the questions and objectives of research.

- Chapter Two, Literature Review: This chapter provides some theory and review of the previous research of the hot box test and includes some information of the EPS properties, thermal resistance or *R*-value of construction materials, the heat transfer theory, and local temperature in Thailand.

- Chapter Three, Research Objectives and Methodology: In this section, the research objectives are indentified and the process of research is designed. Methods of previous researches related to thermal insulation are reviewed.

- Chapter Four, Experiments and Results: This chapter provides the process of the experiment and obtains results from each testing procedure. The analysis of results is also described in detail in this chapter.

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- Chapter Five, Discussion and Conclusion: the results obtained in Chapter four are discussed and concluded in this part to find out a solution which can make the hot box test more reliable for testing the thermal insulation properties. Suggestions are described in this chapter, too.

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