



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DEVELOPE A NEW DESIGN OF FABRIC DRYER CHAMBER  
PROTOTYPE.**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka ( UTeM ) for the Bachelor's Degree in Mechanical Engineering Technology ( Refrigeration and Air-Conditioning Systems ) (Hons.).

by

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## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

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SESI PENGAJIAN: **2016/2017 Semester 1**

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## **DECLARATION.**

I hereby, declared this report entitled “ Develop A New Design Of Fabric Dryer Chamber Prototype. ” is the result of my own research except as cited in references.

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## **APPROVAL.**

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Refrigeration and Air-Conditioning System) (Hons.). The member of the supervisory is as follow:

.....  
( **EN MUHAMMAD NUR BIN OTHMAN** )

## **ABSTRACT.**

The use of drying machines in households globally especially in the Malaysia increased the electricity cost with present current definition of electricity price increases, which corresponds to a usage of approximately a number of drying machines. This is an indication that domestic usage of drying machines has become a global issue from an energy standpoint. this paper of project study provide slight information of capability and possibilities how to consume less electricity usage to dry cloth by using air conditioner condenser heat waste. In Malaysia, most of the people that lived in urban area used air conditioner at their house. Most of them did not much time to do chores at their house at the right time such as to hang and dry clothes after being washed during the day. This paper report will help them to give an idea to dry their wet clothes at night with less electricity energy consumption. This is because fabric dryer chamber used heat waste which is hot air produced by air conditioning condenser while they using the air conditioner at night. One of main purpose of fabrication of fabric dryer chamber is to take advantages from heat waste produce by air conditioner condenser while it carries out operations to cool the building. Another main purpose is also to promote the production of environmentally friendly products with low power consumption.

## **ABSTRAK.**

Penggunaan mesin pengeringan di rumah seluruh dunia terutamanya di Malaysia meningkat kos elektrik dengan kenaikan harga elektrik, yang sepadan dengan penggunaan beberapa mesin pengeringan. Ini menunjukkan bahawa penggunaan domestik mesin pengeringan telah menjadi satu isu global dari sudut tenaga. Eksperimen ini menunjukkan keupayaan dan kemungkinan bagaimana untuk mengurangkan penggunaan elektrik bagi mengeringkan pakaian dengan menggunakan haba dari kondenser penghawa dingin. Di Malaysia, kebanyakan orang yang tinggal di kawasan bandar yang menggunakan penghawa dingin di rumah mereka. Kebanyakan mereka mempunyai masa yang terhad untuk melakukan kerja-kerja di rumah mereka untuk menyidai pakaian selepas dibasuh pada siang hari. Eksperimen ini dijalankan untuk membantu mereka dan memberi idea untuk mengeringkan pakaian pada waktu malam dengan kurang penggunaan tenaga elektrik. Salah satu tujuan utama fabrikasi ruang pengering pakaian adalah untuk menggunakan sisa haba dari condenser penghawa dingin semasa menyejukkan bangunan. Satu lagi tujuan utama adalah juga untuk menggalakkan pengeluaran produk mesra alam dengan penggunaan kuasa elektrik yang rendah.

## **DEDICATIONS.**

To my beloved parents, I acknowledge my sincere indebtedness and gratitude to them for their love, dream and sacrifice throughout my life. I am really thankful for their sacrifice, patience, and understanding that were inevitable to make this work possible. Their sacrifice had inspired me from the day I learned how to read and write until what I have become now. I cannot find the appropriate words that could properly describe my appreciation for their devotion, support and faith in my ability to achieve my dreams. Lastly, I would like to send my gratitude to any person that contributes to my final year project whether it is directly or indirectly. I would like to acknowledge their comments and suggestions, which are crucial for the successful completion of this study.

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# **CHAPTER 1**

## **INTRODUCTION.**

This chapter consist several of important topic elements that involves background of the study, problem statements of the study, objectives of the study, and scope of the project. Organization thesis of overall chapters in provided within this introduction chapter.

### **1.1 BACKGROUND OF THE STUDY.**

Drying is a mass transfer process consisting of the removal of water or another solvent by evaporation from a solid, semi-solid or liquid. This process is often used as a final production step before selling or packaging products. To be considered "dried", the final product must be solid, in the form of a continuous sheet (e.g., paper), long pieces (e.g., wood), particles (e.g., cereal grains or corn flakes) or powder (e.g., sand, salt, washing powder, milk powder).

A source of heat and an agent to remove the vapor produced by the process are often involved. In bioproducts like food, grains, and pharmaceuticals like vaccines, the solvent to be removed is almost invariably water. Desiccation may be synonymous with drying or considered an extreme form of drying. In the most common case, a gas stream, e.g., air, applies the heat by convection and carries away the vapor as humidity. Other

possibilities are vacuum drying, where heat is supplied by conduction or radiation (or microwaves), while the vapor thus produced is removed by the vacuum system. Another indirect technique is drum drying (used, for instance, for manufacturing potato flakes), where a heated surface is used to provide the energy, and aspirators draw the vapor outside the room. ( <https://en.wikipedia.org/wiki/Drying> ).

In some products having a relatively high initial moisture content, an initial linear reduction of the average product moisture content as a function of time may be observed for a limited time, often known as a "constant drying rate period". Usually, in this period, it is surface moisture outside individual particles that is being removed. The drying rate during this period is mostly dependent on the rate of heat transfer to the material being dried. Therefore, the maximum achievable drying rate is considered to be heat-transfer limited.

If drying is continued, the slope of the curve, the drying rate, becomes less steep (falling rate period) and eventually tends to nearly horizontal at very long times. The product moisture content is then constant at the "equilibrium moisture content", where it is, in practice, in equilibrium with the dehydrating medium. In the falling-rate period, water migration from the product interior to the surface is mostly by molecular diffusion, i.e. the water flux is proportional to the moisture content gradient. This means that water moves from zones with higher moisture content to zones with lower values, a phenomenon explained by the second law of thermodynamics. If water removal is considerable, the products usually undergo shrinkage and deformation, except in a well-designed freeze-drying process. The drying rate in the falling-rate period is controlled by the rate of removal of moisture or solvent from the interior of the solid being dried and is referred to as being "mass-transfer limited". This is widely noticed in hygroscopic products such as fruits and vegetables, where drying occurs in the falling rate period with the constant drying rate period said to be negligible. ( [https://en.wikipedia.org/wiki/Drying#Drying\\_mechanism](https://en.wikipedia.org/wiki/Drying#Drying_mechanism) ).

In 1874 the first hand driven washing machine for home use was design by William Blackstone, from that time the technology begins to expand, the combination of the new invention has produced a washing machine and dryer to help to complete the task of laundry. Despite the basic design of the dryer has not changed much in previous hundreds years, nowadays the changes are in the development. New technologies and design that use solar power or microwaves could make the traditional tumbler dryer be outdated as the scrub board. We consider a solar powered dryer today as a new innovation in the up and coming future of drying machines, but solar power was the first source of energy used to dry clothes as people washed, rinsed and wrung out clothes by hand and hung them over rocks, tree branches or later clotheslines to dry in the open sun areas. The first dryer invented was a simple wooden rack to hang clothes near a fire to dry. The first mention of a modern type dryer appeared in the 1800s when a Frenchman by the name of Pochon invented a vented-barrel-shaped drum called a ventilator to dry clothes. Clothes were placed inside the drum and the drum was turned by hand over an open fire. It was not a very reliable method or machine, but opened the doors for future designs. Though there seems to be some controversy over the patent description of George T Sampson's dryer, he is credited with a ventilator dryer using a stove as its heat source. By 1915, the electric clothes dryer was introduced but it was not until the Hamilton Manufacturing company produced the first automatic dryer in 1938 that the use of the dryer started to become known. (<http://esporta.ca/>).

The project that will be carry out aimed to improvise the original conventional cloth dryer application and based on the recent project done by senior called metallic wardrobe to test and check the possibilities to accelerate the drying time and investigate either waste heat from mini split air conditioner can be used to be recycle to dry fabrics. This project research is about enhancement of the new drying application process and utilization of waste energy as reusable energy source for the new drying application devices. In general drying refers to the removal of moisture (water vapor from gas or air) and amount of water contains from wetted solid. However heat is the most necessary source for evaporation process with an appropriate air flow to carry away the amount of

water in wetted clothes. Although drying daily work can be done in open places naturally, the enhancement of the new drying application process is to be investigated with modification improvement from the original design in order to enrich drying process.

## **1.2 PROBLEM STATEMENT OF THE STUDY.**

There are a number of problems encountered in this project. One of them is whether the heat waste discharge from the mini split air conditioner condenser can be recycle and can use for the process of drying clothes. Besides, this project should be carried out and identify how much hot air from the mini split air conditioner condenser flow rate is needed for drying clothes.

Limitations associated with original design included :

1. High energy consumption lead high electricity cost.
2. The heat loss from the device.
3. Adverse effect of low air quality in the drying application to the cloth.

### **1.3 OBJECTIVES OF THE STUDY.**

In this study, some targets have been set to ensure that the current study is not diverge from the original target when investigations are conducted.

There are two main objectives have been set up to guide this project. The main objectives for the current project are:

1. To check implementing of drying process by using air conditioner condenser.
2. To fabricate fabric dryer chamber prototype.

### **1.4 WORK SCOPE OF THE STUDY.**

For implementing the project, venue to build the project needs to be considered to ensure the project progress. On design and fabricating the project, lab manufacturing in FTK, UTeM is chosen because of the tool facilities to build the project is comprehensive. To run the experiment, HVAC lab in FTK, UTeM is chosen. Measuring the most important parameters such as temperature, weight and relative humidity inside the Fabric Dryer Chamber Prototype is the appropriate way to calculate the required heat, and drying rate.