



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ANALYSIS AIR PRESSURE INSIDE DUCTING SYSTEM

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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DECLARATION

I hereby, declared this report entitled “Analysis Air Pressure inside Ducting System” is the result of my own research except as cited in references.

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Date : **9 DECEMBER 2016**

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 Azwan bin Aziz)

ABSTRACT

Maintaining a good thermal comfort is an important issue for human being. Discomfort feeling will happen if the temperature is too hot or too cold. Malaysia is the country to have sunny and rainy weather every whole year. So the people tend to stay in the building or home to thermal comfort. Air conditioning is being provided in many places either in small or large space. The large space requires the ducting system to transport the conditioned air to targeted space. So in order to transport the conditioned air, the element of pressure is vital as the air is flowing from high pressure to low pressure. The air pressure is drop along the ducting system. This situation happens when there has friction loss of the material, unsuitable of duct size and the optimal or air flow rate affected the duct pressure. This purpose of this study is to determine the efficiency of duct pressure by the element of duct pressure. All the elements were mentioned above are the factors affecting the duct pressure. The experiments will be conducted in the laboratory using the all the elements with several times to get good results. At the end of the experiment, the duct efficiency can be determined so thermal comfort of the place will be achieved.

ABSTRAK

Mengekalkan keselesaan suhu yang selesa adalah isu yang penting untuk manusia. Ketidakselesaan akan berlaku jika suhu sekeliling terlalu panas atau terlalu sejuk. Malaysia adalah negara yang mempunyai cuaca yang panas dan hujan sepanjang tahun. Maka mereka cenderung untuk tinggal di dalam bangunan atau di rumah untuk mendapatkan keselesaan. Banyak penghawa dingin telah disediakan di semua tempat sama ada dalam ruang yang kecil atau besar. Ruang yang besar memerlukan sistem saluran udara untuk mengangkut udara sejuk ke tempat yang telah ditetapkan. Jadi, untuk mengalirkan udara dingin, nilai tekanan udara adalah amat penting kerana udara akan mengalir daripada tekanan tinggi ke tekanan rendah. Tekanan udara dalam saluran udara akan berkurangan di sepanjang laluan tersebut. Keadaan sebegini berlaku kerana terdapat banyak geseran berlaku diantar udara dan dinding saluran udara. Oleh sebab itu, kajian ini adalah untuk menentukan kecekapan tekanan saluran oleh unsur tekanan saluran. Semua unsur-unsur yang telah disebut merupakan faktor-faktor yang mempengaruhi tekanan saluran. Kajian akan dijalankan di dalam makmal menggunakan semua unsur-unsur dan diulangi beberapa kali untuk mendapatkan hasil yang baik. Pada akhir eksperimen, kecekapan saluran dapat ditentukan dan keselesaan tempat dicapai dengan baik

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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LIST OF SYMBOLS AND ABBREVIATIONS

HVAC	-	Heating, Ventilating and Air-conditioning
PV	-	Photovoltaic
A	-	Area
C_v	-	Specific heat capacity with constant volume
E	-	Sun Total Power
g	-	Gravity
h	-	Height
m	-	Mass
\dot{m}	-	Mass Flow Rate
P	-	Pressure
ΔP	-	Difference in Pressure
\dot{Q}	-	The amount of heat / heat radiation
R	-	Radius
S	-	Irradiance
T	-	Temperature
ΔT	-	Difference in temperature
\dot{V}	-	Volume Flow Rate
W	-	Weight
ε	-	Emmissivity
σ	-	Stefan BoltzmannConstant
π	-	Ratio of Circle Circumference to the Diameter
RPM	-	Revolution Per Minute
CFM	-	Cubic Feet Metre
In Wg	-	Inch Water Gauge

CHAPTER 1

INTRODUCTION

1.0 Introduction

Heating, ventilation and air-conditioning system (HVAC) is a system that is designed to maintain the indoor air quality and to provide thermal comfort to the conditioned space. Generally, the purpose of air-conditioning system is to lower the temperature, maintain the indoor air quality and to provide thermal comfort inside the conditioned space. Maintaining a good IAQ is a very important measure to prevent the spreading of diseases throughout a building. Besides that, air-conditioning provides thermal comfort to conditioned space to the occupants. Based on the book entitled Air Conditioning and Refrigeration Engineering by Shan K Wang, published by CRC Press LLC (2000), air conditioning is a process that simultaneously conditions air, combine with the outdoor air to the condition space and at the same time controls and maintain the required space temperature, humidity, air movement, air cleanliness, sound level, and pressure differential within predetermined limits for the health and comfort of the occupants.

Based on the website ecofeet (2016) stated that refrigerant is a substance used in a heat cycle to transfer heat from one area, and remove it to another. Usually a gas at room temperature. Found in pretty much everything that cools, and sometimes in things that heat, most commonly air conditioners, fridges, freezers, and vehicle air conditioners. Traditionally, fluorocarbons, especially chlorofluorocarbons (CFC's), were used as refrigerants, but they are being phased out because of their ozone depleting effects. Other common refrigerants used in various applications are ammonia, sulphur dioxide, and non-halogenated hydrocarbons such as propane. Most refrigerants found in end of life devices are ozone depleting and global warming inducing compounds. Example of refrigerant in the world is R12, R134A, R22, R410A, R290, R600, R600a, R601, R601a, and R717 (Briley, 2004).

In HVAC system the use of duct is very crucial as to deliver and circulate cool air to the targeted area. Basically, Duct systems are usually used in most commercial buildings, especially in office to transport conditioned air to the targeted space. Ducts are usually made from sheet metal or from a rigid fiberglass material, sometimes called fiberglass duct board. Smaller ducts often with a diameter 15 to 30 cm connected to air supply registers which is usually flexible ducts. Duct containing a helically wound wire for structural rigidity, a layer of coated non rigid fiberglass, and an exterior plastic sheet (Fisk et al., 2000).

Duct systems in large commercial buildings may include a large variety of components such as dampers, turning vanes, cooling or heating coils, supply and return registers, variable-air-volume-control units, and humidity, smoke, carbon dioxide concentration, sensors for temperature, pressure, and flow rate. An article on Improving the Efficiency of Your Duct System stated that the duct system consists of return ducts and supply ducts. Central heating or cooling equipment (furnace, air conditioner, or heat pump) contains a fan that forces heated or cooled air into supply ducts leading to the rooms. (2010)

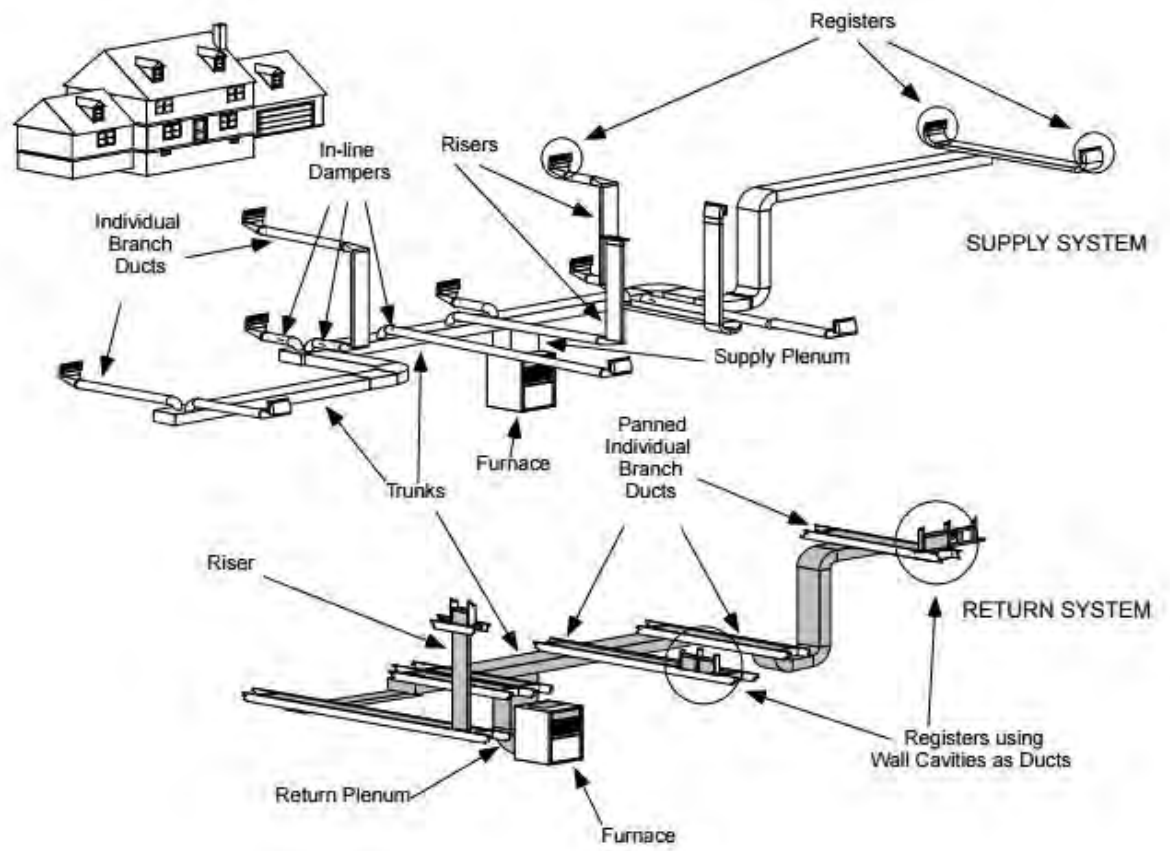


Figure 1.1: A common duct system

1.1 Problem statement

Today we can see in Malaysia has an equatorial climate where rain and heat applied during the whole year. Malaysia is located on the equator of world globe which receiving sunlight 12 hours per day. So, most of the buildings in Malaysia are facing problem of how to prevent the direct sunlight, especially from east and west (Arifin & Denan, 2015). Therefore, the HVAC system was created to provide cold air and thermal comfort to the targeted area and people are in the vicinity. Cold air produced by the HVAC system channelled to the destination using the duct. Cold air-conditioning will be distributed according to the needs requested. Airflow from one point to another and from high pressure to low pressure. Every size of duct produced different amount of pressure depending the air flow rate, the size of the ducting and total friction between the wall and air. In this study, we will examine the effectiveness of pressure in each duct and other elements that play an important role in the flow rate of cold air to the place you want to go and return to the outside.

1.2 Objective

The main objective of this project are:

1. To determine effectiveness of ducting system by element duct pressure
2. To determine the frictional losses along duct walls in the ducting system

1.3 Supportive Objective:

To identify and evaluate the friction loss, speed of fan, determine the air flow rate and air velocity.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Most commercial buildings in Malaysia used the ducting system to transport conditioned air to the targeted area. There are many factors affecting the effectiveness of ducting system which is duct pressure, size of ducting and friction loss. Duct pressure plays an important role in transporting the air as air flow from high pressure to low pressure (Int-Hout, 2015)..

2.1 Conventional Air Conditioning System

Air-conditioning systems have been used in many parts of the world. Generally air conditioning system divided into 5 basic type which are all water system, all air system, air water system, unitary refrigerant based system (Prasanthi & Sireesharevathi, 2013). The purpose of most systems is to provide thermal comfort and provide air conditioning for occupants. With the improvement of standard of living, occupants require more and more comfortable and healthful indoor environment. People spend 80-90% of their time indoors, and indoor environment has important effects on human health and work efficiency. The factors affecting indoor environment, mainly include temperature, humidity, air exchange rate, air movement, ventilation, particle pollutants, biological pollutants, and gaseous pollutants (Graudenz et al., 2005). Air conditioning

system consists of 4 parts basic components which is compressor, condenser, expansion valve and evaporator. Below is the diagram 4 basic work in a system.

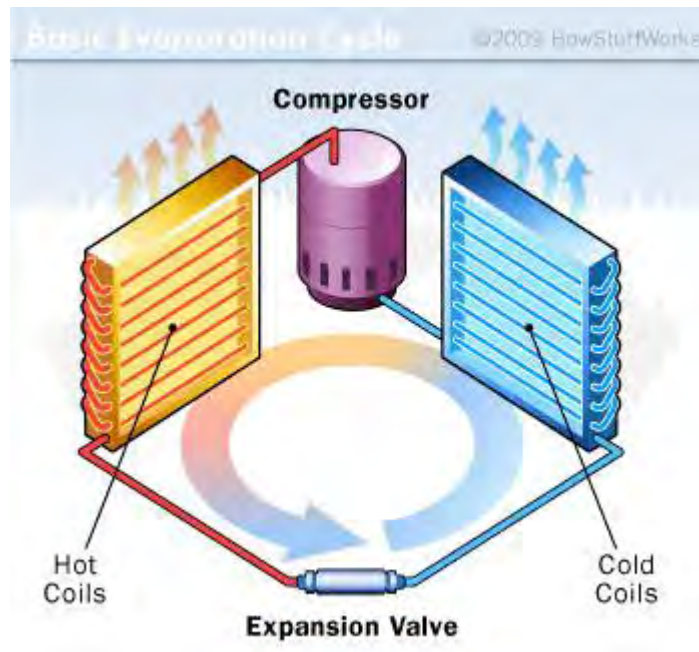


Figure 2.1: 4 basic component in HVAC system

The conventional air conditioning system commonly uses at home and in the building. In summer, high relative humidity, elevated air temperatures and bright sunshine can sometimes combine to produce an uncomfortable indoor environment. An air-conditioning system can provide comfort for occupants by lowering the air temperature and the humidity level in the home. There are two types of basic air conditioning, which is room air conditioning and central air conditioning. Refrigeration is a process lowering the temperature by expelling the heat from certain area to the atmosphere. Refrigerant usually used in HVAC system are Chlorofluorocarbon (CFC) and Hydrofluorocarbon (HFC) (Ghude, Belokar, & Agrawal, 2013).

The most every now and again utilized refrigeration cycle is the vapour pressure refrigeration cycle. Perfect vapour pressure refrigeration cycle results by dispensing with impracticalities connected with turned around Carnot cycle, for example, vaporizing the refrigerant totally before pressure, supplanting turbine with the throttling gadget (development valve or narrow tube). For the most part, household and modern fridge, aerating and cooling framework, heat pump and water cooler composed in light of the vapor pressure refrigeration cycle. (Upadhyay, 2014).

2.1.1 Type of Air Conditioner

In HVAC system, there three types of air conditioning system which is the individual system, unitary packaged system and central hydraulic system. Every type of system present different capability.

Individual system normally employs either a single, self-contained, packaged room air conditioner (installed in a window or through a wall) or separate indoor and outdoor units to serve an individual room.

a) Portable Air Conditioners



Figure 2.2: Portable Air Conditioner



Figure 2.3: Window air conditioner

b) Ductless Mini-Split Air Conditioners

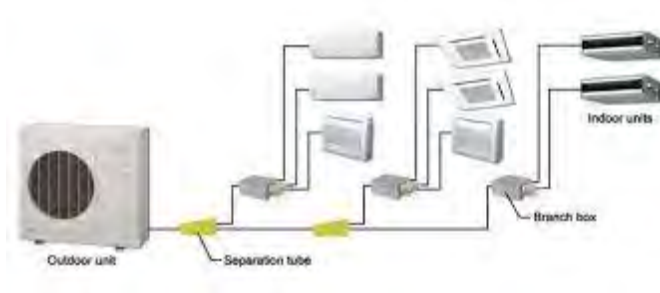


Figure 2.4: Ductless Mini-Split Air Conditioner



Figure 2.5: Packaged Terminal Air Conditioners (PTACs)