UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FABRICATION OF AUTOMATIC PUMP DOWN ON SPLIT UNIT WALL MOUNTED TYPE AIRCONDITIONING SYSTEM

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Refrigeration and Air Conditioning System) with Honours.

by

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820731-08-5831

FACULTY OF ENGINEERING TECHNOLOGY

2016

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **FABRICATION OF AUTOMATIC PUMP DOWN ON SPLIT UNIT WALL MOUNTED TYPE AIR CONDITIONING SYSTEM**

SESI PENGAJIAN: **2016/17** Semester **1**

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DECLARATION

I hereby, declared this report entitled "Fabrication of Automatic Pump Down on Split Unit Wall Mounted Type Air Conditioning system" is the results of my own research except as cited in references.

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Name : MUHAMAD ASRUL AFFENDI BIN MAT NOR

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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 Mechanical Engineering Technology (Refrigeration and Air Conditioning System) with Honours. The member of the supervisory is as follow:

…….

Mohd Farid Bin Ismail

(Project Supervisor)

……

Muhammad Fairuz Bin Abu Bakar

(Project Co- Supervisor)

ABSTRAK

'Pump down' adalah satu proses mengepam dan menyimpan gas bahan pendingin ke dalam unit luar penyamanan udara jenis pisah untuk tujuan penjimatan dan mengurangkan kesan rumah hijau apabila gas bahan pendingin dibebaskan ke udara secara berlebihan. Proses ini dilakukan secara manual semasa kerja-kera servis dan mengesan kerosakan pada penyamanan udara. Sistem ini direka bentuk pada penyamanan udara jenis pisah pada kapasiti 1 kuasa kuda untuk menghalang kebocoran bahan pendingin secara berlebihan. Sistem automatik 'Pump down' ini dapat mengurankan risiko kerosakan pada pemampat. Kebocoran bahan pendingin memberi kesan pada lapisan ozon. Sistem ini menggunakan suis tekanan untuk mengesan perubahan tekanan bahan pendingin dan bertindak sebagai isyarat kepada injap solenoid yang berfungsi menutup arah gas bahan pendingin keluar daripada sistem. Lampu isyarat pada ruang unit dalam akan beroperasi untuk memberi isyarat pada penguna berlakunya kebocoran bahan pendingin didalam sistem. Dalam pada masa yang sama, sistem automatik 'Pump down' ini beroperasi untuk mengawal gas bahan pendingin keluar pada pesekitaran. Gas bahan pendingin akan tersimpan pada ruang unit luar. Hasil daripada sistem ini dapat mengawal kebocoran gas bahan pendingin ke ruang udara. Pengurangan gas bahan pendingin memberi kerosakan pada sistem. Sistem automatik 'Pump down' ini dapat membantu mengurangkan kesan kerosakan komponen penyamanan udara,Penipsan ozon dan Pemanasan global.

ABSTRACT

Pump down is a process of pumping and storing refrigerant that circulated in an air conditioning system into the outdoor unit. In normal practice, pump down was done manually before any service or repair being made on the split unit air conditioning system. This project focused on developing an automatic pump down system attached to wall mounted split unit air conditioning. A system with 1hp capacity was selected to be mounted with two set of pressure switch and solenoid wave will shut of line while line the compressor. Continue pump the remaining refrigerant into outdoor unit. The whole system will completely shut off after all refrigerant were safety keep inside the outdoor unit. Few leakage cases was selected to examine the capability of the new automatic pump down system in term of keeping as much refrigerant from emitted to atmosphere. The system was highly recommended and sus jested to implemented in all split unit system do prevent leakage refrigerant from expose to atmosphere.

DEDICATION

For my beloved wife and child

JAMIAH BINTI ISMAIL

MUHAMAD HARIS ZAYAN

QASEH HARISHTA ZAYANI

Special dedicated to my supervisors

MR MOHD FARID BIN ISMAIL

MR MUHAMMAD FAIRUZ BIN ABU BAKAR

ACKNOWLEDGEMENT

In the name of Allah S.W.T, the most gracious and merciful, praise to Allah the lord of universe and may blessing and peace of Allah be upon his messenger Muhammad S.A.W. First, and foremost thank to Allah for giving me wellness and ideas to do this project. Without any of it, I surely cannot complete this project in the time given.

I would like to express my deepest gratitude towards to both my project supervisors Mr. Mohd Farid Bin Ismail and Mr. Muhammad Fairuz Bin Abu Bakar as well as every lecturers, for help and guides your brilliant advices, guidance time encouragement and patient during the time period of completing this project help me a lot.

Last but not least, I like to express my great thankful to my best friend Ms Debie Devinser Gerijih, friends and family for the moral as well as financial support. Their views and tis are useful definitely. Without all these people encouragement, support and advices this thesis project might not be successfully carried out. To those that not mention here, does not mean that I forgot. I do appreciate all the things you have done for me.

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CHAPTER 1
INTRODUCTION

1.0 Project Background

The air conditioning system must be free leakage conditions to operate due to refrigerant only acts as a heat transfer agent, a close cycle system is needed to control the pressure and avoid operating system in abnormal conditions. For example, leaking of refrigerant gas is mixed with air cause hazarded. There are many occasion of refrigerant leakage of refrigerant on split type AC system. The leakage may happen between pipes and component connection cause by poor installation or wear and tear process. A prevention system need to be design to avoid the refrigerant leakage because refrigerant leakage may create several problem to the environment and the people directly.

1.2 Problem Statement

Leakage refrigerant will cause less efficiency in air conditioning systems. Many of the negative effects of the leakage of refrigerant in air conditioning systems. (Grace et al. 2005) states that 'Refrigerant loss also contributes to the reduction of the operating efficiency of the system, leading to increased power consumption and greenhouse gas emissions, higher maintenance costs and eventual system failure'. Lack of air will lead to

lower operating efficiency in the system. The leakage of refrigerant may also give bad impact to the compressor.

Compressor is an important component in air-conditioning systems. If the system is having a leakage, the compressor will be jammed and the ampere will be high. Due to lack of gas, compressor work harder which causes the compressor jammed. This is because the compressor has not any refrigerant to compress. According (Rodriguez 1995) stated that 'An undercharged condition creates a higher than normal superheat as well as lower sub cooling. This can have an adverse effect on compressor motor winding .Refrigerant undercharging also decreases the system capacity'. This can have an adverse effect on compressor motor winding. The loss of the refrigerant in the compressor will cause the compressor operate high vibration and noise, and become to be damaged. When the compressor operates low pressure refrigerant, the compressor will be damaged. Furthermore, the high expenditure will be incurred according to the damaged compressor with including the labor cost to change the new compressor. Limited knowledge in air-conditioning possibility maintenance cost may also higher. From experiences while performing servicing work, there are number of users which want to add refrigerant into the system. In the same time, the refrigerant is usually not reduced in the system. From this situation, they have limited knowledge about the content of refrigerant in the system. Because of this, the possibility of high cost maintenance will occurred**.** Refrigerant leakage contribute to ozone depletion and global warming.

The emission of the refrigerant such as Chlorofluorocarbons (CFCs) and Hydro chlorofluorocarbons (HCFCs) used in air-conditioning split unit due to leakage, may cause depletion of ozone layer. (Kaur & College 2015) states that 'This matter should be aware by everyone who involve in air-conditioning or refrigerant industries. Chemical reactions on the surfaces of ice crystals in the clouds release active forms of CFCs. Ozone depletion begins, and the ozone "hole" appears'. Individuals involved refrigeration and air-conditioning industry must realize that there is a chemical reaction going on ozone

depleting refrigerant and global warming. Refrigerant leaks from the system will reduce the efficiency of the system and the ozone depletion and global warming. Impact global warming can be climate change.

1.3 Objective

The aim of this project is to build system trigger leakage and automatically pump down the refrigerant in system. In order to archive this aim 3 objective were set. There are:

i. To design and select fabricated automatic pump down system that is attached to wall mounted AC split unit.
ii. To install automatically pump down as a solutions for refrigerant leakage and save refrigerant in the system.
iii. To analyze capability of the system in different condition.

1.4 Scope

This project will focus on the fabrication automatic pump down split type air-conditioning system for 1.0hp wall mounted type Acson brand**.** The ozone layer is thinning due leakage of refrigerant. Fabricate auto pump down during leakage at home. Therefore this project is useful to control the refrigerant loss during leakage at 1hp split unit wall mounted type. Device automatic pump down install at outdoor unit air conditioning. This is also to avoid the system from damage when leakage occur in the system.

1.5 Proposed Solutions

In order to avoid the ozone layer from further thinning, the proposed solutions is to add a component to the system to reduce and control the refrigerant loss. To archive this, a system is developed and is attached to the outdoor unit where most of the leakage is within the area. Compressor is very expensive now a day. If it were damage, a high cost consumption can be avoid through the new fabricated system.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

A split system is an air-conditioning system that uses refrigerant as the heat exchange fluid and has an evaporator, compressor, and condenser as separate components the air conditioning system is split. The system is uses the refrigerant as the heat exchange liquid and have the evaporator, compressor, and condenser as a separate component. There are many commercial applications, compressor, condenser, capillary tube and placed into a space piece equipment called outdoor unit. Refrigerant pipe, which is specially designed for connect to system components between indoor and outdoor units. The evaporator is located on the indoor unit and the compressor, evaporator and capillary tube are the components of outdoor units. The outdoor units usually installed at the outside of the building.

2.1 The use of split type AC in industries

Air-conditioning Split Unit type system usually used for industrials, commercials, and residential comfort-cooling applications. (leguko and Taylor,2000) show that 'Quite often, split system equipment is also used for manufacturing and process cooling applications. Popular applications include office buildings, commercial or public buildings, retail shopping, manufacturing facilities, mosque and other places of assembly, small health care facilities, and schools'. To accommodate the lack of capacity by the

cooling load on the central system of the building such as a hospital, Split unit air conditioners is used. The split system air-conditioning units is a complement to the central air-conditioning system existing in the building. For this project using 600 grams of refrigerant in the air conditioning split unit 1 hp wall mounted type.

2.2 Refrigerant leak

According (Cowan et al. 2010) state that 'Presidential Address highlighted the significant problems associated with leakage of HFC and HCFC type refrigerants. Refrigerants leaks have adverse effects on the climate of the earth. Increasing financial costs for repairing the air-conditioning system on the user'. Indirectly effect by the leakage of the refrigerant affect the efficiency of the air conditioning system'. It also provides comfort to the user incompetence. Also argue that 'Preventing the leakage of refrigerants is a fundamental of good system design, service and maintenance'. There must be means to prevent leakage of refrigerant. Fabricated Automatic Pump down is a device to prevent refrigerant from leakage.

'A number of authors have reported on the reasons why refrigeration systems continue to leak'. The study, made by professionals has identified six common leaks. Study on the leakage refrigerant in the refrigeration and air-conditioning systems in supermarkets in Germany which showed that:

• 96% of the total refrigerant loss was through field assembled joints.
• 15% (by number) were responsible for 85% (by weight) of the refrigerant los
• 22% of all measurable leaks were from flared joints, and these were responsible for 50% of the refrigerant losses.

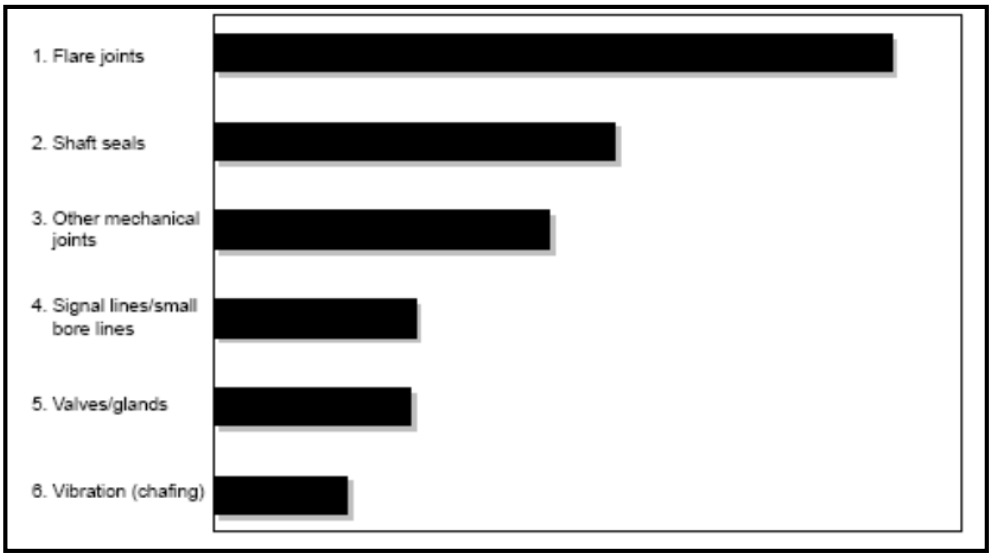

Figure 2.1: Show The six most common leak identified by ETSU 1997 (Cowan et al. 2010)

The results of the study, can be concluded that the six most common leaks in part at Flare joint, shaft seals, other mechanical joint, signal lines/small bore lines, valve /glands and vibration. Flare joint is prove to leaking is likely caused by the installation of air-conditioning systems, whereas the vibration less leakage refrigerant in the system. Results have been obtained by six authors as a proven that leakage often occurs in refrigeration systems and air-conditioning. The results of this study have shown leakage of refrigerant becomes a major factor to ozone depletion and global warming. Data from (Cowan et al. 2010) compare two data sources and indicate a strong correlation between the data from both, despite significant differences in the format and type of the source data. It shows that the top six fault types were the same for both companies and that leaking seals and glands were the primary cause of leaks.

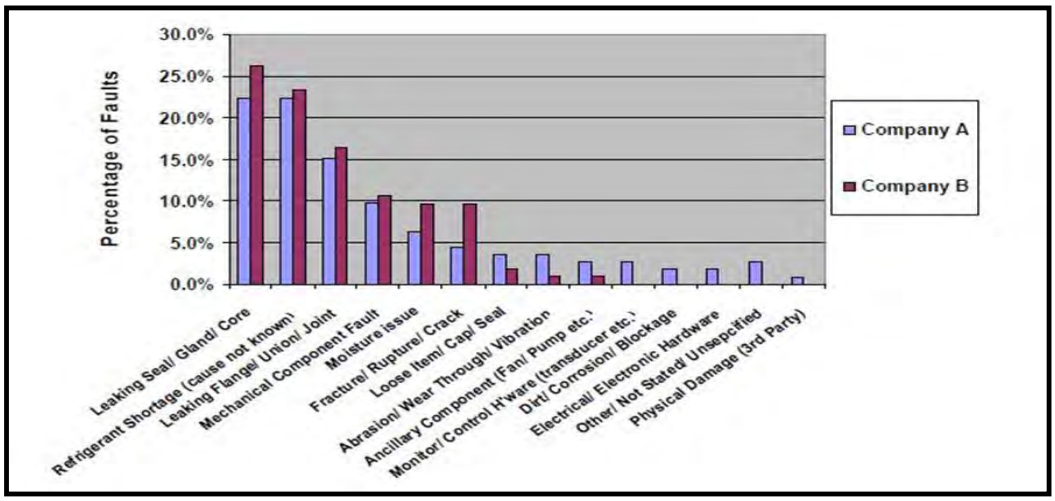

Figure 2.2.: Show Comparison of RAC system fault types for two companies (Cowan et al. 2010)

The high percentage of leakage reported as "lack of refrigerants" or "because of the unknown". Both companies have expressed over 20% of the fault has been recorded as refrigerant leakage that causes could not be identified (although more refrigerants is added). Both types of errors identified leaking flanges and joints and mechanical component which are about to cause failure. When the leakage of refrigerant in the system happen, it may causes system performance to decline. There is a leak in the system that cannot be found in the system even if the refrigerant has been added. The situation will further strengthen the argument of ozone depletion occurs from refrigeration and air-conditioning systems.

2.3 Impact of refrigerant leak

2.3.1 Environment

Refrigerant leakage effects to the environment such as ozone depletion and climate change. Global climate change will complicate the daily activities of the world. (Grace et al. 2005) state that 'The impact of refrigeration systems on the environment can be reduced by operating at higher levels of energy efficiency and by reducing refrigerant leakage'. The greenhouse effect determines the Earth's climate and improve emissions greenhouse gases associated with human daily activities and affect the current climate. (Guechi et al. 2012) state that 'The burning of fossil fuels (coal, oil and natural gas) produces carbon dioxide (CO2), the main gas responsible for global warming and increasing energy demand has led to a rapid increase in CO2 Emissions in the atmosphere. Indeed, the presence of large leaks in the cooling system, the responsibility of these fluids in the destruction of the ozone layer and increasing the greenhouse effect is well established. The objective of environmental optimization is to adapt the architecture of the refrigeration circuit properties of a fluid with low global warming potential'. Increased energy consumption by the world community will release CO2 into the atmosphere, contributing to high air will cause ozone depletion and climate change to faster.

2.3.2 Ozone

Mixing of chemicals contained in the refrigerant is a big contribution to ozone depletion and climate change in the world. (ASHARE Board et al. 2017) Stated that 'a broad range of fluids has been used as refrigerants over the years, and current usage is dominated by a range of fluorinated chemicals, known as HFCs, in addition to hydrocarbons and several inorganic compounds, including ammonia and carbon dioxide (CO2). An earlier generation of refrigerants, the chlorofluorocarbons (CFCs) and hydro chlorofluorocarbons (HCFCs) contained chlorine, and environmental impacts related to ozone depletion resulted in the scheduled phase out of the CFC and HCFC refrigerants under the Montreal Protocol'. Concern of global climate change by the world community has focused on the HFC the refrigerant. There are some countries that give attention to HFC and provide sanctions against the adoption of the refrigerant. The properties and usage of the CFC and HCFC refrigerants combined to make them significant contributors to ozone depletion'. The use of CFCs and HCFCs and chlorine content is the main cause of the depletion of the ozone layer. Fabrication Automatic pump down is one of the ways to save the ozone from thinning and to control the refrigerant leakage from being submitted free into the atmosphere.