

STUDY OF HEAT EXCHANGER EFFECT IN A CAR AIR CONDITIONING
SYSTEM

NUR FASIHA BINTI NAZIRMUIDIN

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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Bachelor of Mechanical Engineering (Thermal-Fluid)

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Name of supervisor :.....

Date :.....

STUDY OF HEAT EXCHANGER EFFECT IN A CAR AIR CONDITIONING
SYSTEM

NUR FASIHA BINTI NAZIRMUIDIN

A project report submitted in partial fulfillment of the requirements for the award of
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Faculty of Mechanical Engineering
Universiti Teknikal Malaysia Melaka

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“I hereby, declare this thesis is results of
my own research accept as cited in references”

Signature :.....

Author's Name : NUR FASIHA BINTI NAZIRMUDIN

Date :.....

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ABSTRACT

This research is about the effect of heat exchanger in terms of Coefficient of Performance car air conditioning system. Suction-liquid heat exchanger are used in this experiment while for the material is used aluminum alloys after the consideration of selection material. In this research, Proton Wira's air conditioning system is used for the experiment. The experimental with different lengths of suction-liquid heat exchanger and without heat exchanger are presented and analyzed. There are three different lengths of suction-liquid heat exchanger include in this report. A comparison of COP that is calculated between different lengths of suction-liquid heat exchanger and without heat exchanger is enclosed. An increase of COP has been found by using longer length of heat exchanger. The improvement COP of the refrigeration system up to 33.33% between the longer length of heat exchanger and without heat exchanger. Besides that, this research also includes the experiment for fuel consumption in car engine. The fuel that has been used is increase when the rotational speed increase.

ABSTRAK

Kajian ini diadakan adalah untuk mengkaji kesan penukar haba dari segi pekali prestasi dalam sistem penyaman udara kereta. Penukar haba terbina digunakan didalam eksperimen dan aluminium aloi digunakan selepas membuat pertimbangan mengenai pemilihan bahan. Di dalam kajian ini, sistem penyaman udara Proton Wira digunakan untuk menjalani eksperimen. Eksperimen dijalankan menggunakan panjang penukar haba yang berbeza-beza. Terdapat tiga reka panjang penukar haba terbina didalam laporan ini. Perbandingan dari segi pekali prestasi diantara panjang penukar haba terbina yang berlainan dan tanpa penukar haba dimasukkan sekali. Penambahan dari segi pekali prestasi apabila menggunakan lebih panjang penukar haba. Peningkatan pekali prestasi dalam sistem penyejukan mencecah 33.33% diantara panjang yang tertinggi penukar haba dan tanpa penukar haba. Selain itu, kajian ini mengandungi eksperimen berkaitan dengan penggunaan minyak dalam enjin kereta. Penggunaan minyak yang digunakan meningkat apabila halaju meningkat.

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CHAPTER 1

INTRODUCTION

1.1 Background Study

Heat exchangers are common components in many everyday devices. Car engines, refrigerators, air conditioners, central heating boilers and radiators all contain heat exchangers. They are devices specifically designed for the efficient transfer of heat from one fluid to another fluid over a solid surface. This transfer of heat can either take the form of absorption or dissipation of heat. As a heat transfer device, it is the function of a heat exchanger to transfer heat as efficiently as possible. This makes it the ultimate device of choice, for instance, when it comes to saving energy by recovering wasted heat and making it useful again. When there is a waste of energy or a heat stream that is not recovered a heat exchanger can convert that heat stream into something that can be used.

1.2 Problem Statement

Heat exchangers are widely used in industry both for cooling and heating large scale processes. Heat exchanger commonly applies in heating, ventilation and air conditioning (HVAC) systems, radiators, boilers and others. Heat exchanger can be added in the car air conditioning systems. With existed of heat exchanger, it will reduce the pressure drops in the air conditioning systems.

1.3 Objectives

- i. To understand basic concept of car air conditioning system.
- ii. To learn effect of different lengths heat exchanger to temperature and pressure in term of Coefficient of Performance (COP).
- iii. To study effect heat exchanger on car fuel consumption.

1.4 Scope

This project is to study the effect of heat exchanger on car air conditioning system. The experiment will be conducted with different lengths of heat exchanger correlate with temperature and pressure. Also, the experiment will be conducted to determine effect of the fuel consumption with adding the heat exchanger into the car air-conditioning system. All the experiment will use Proton Wira's car air-conditioning system.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Heat exchanger is a device built for efficient heat transfer from one medium to another, whether the media are separated by solid wall so that they never mix, or the media are in contact. Heat exchanger widely used in refrigeration, air conditioning, power plants, space heating, and natural gas processing. One common example of a heat exchanger is the radiator in car, which the heat source, being a hot engine-cooling fluid, water transfers heat to air flowing through the radiator.

2.2 Flow Arrangement

Heat exchangers may classify according to their flow arrangement. In parallel-flow heat exchangers, the two fluids enter the exchanger at the same end, and travel in parallel to one another to the other side. In counter-flow heat exchangers the fluids enter the exchanger from opposite ends. The counter current design is most efficient, in that it can transfer the most heat from the heat (transfer) medium. In a cross-flow heat exchanger, the fluids travel roughly perpendicular to one another through the exchanger.

For efficiency, heat exchangers are designed to maximize the surface area of the wall between the two fluids, while minimizing resistance to fluid flow through the exchanger. The exchanger's performance can also be affected by the addition of fins or corrugations in one or both directions, which increase surface area and may channel fluid flow or induce turbulence.

2.3 Types of Heat Exchanger

2.3.1 Shell and tube heat exchanger

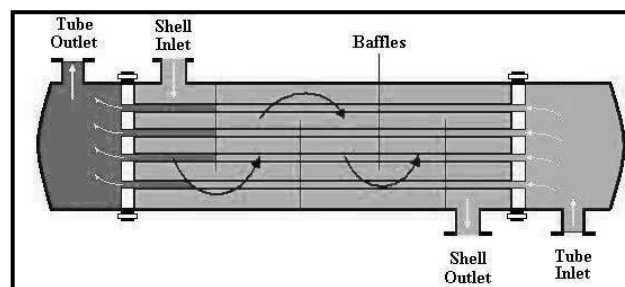


Figure 2.1: Shell and Tube Heat Exchanger

(Source: <http://www.ra.danfoss.com/TechnicalInfo>)

From the Figure 2.1, shell and tube heat exchangers consist of a series of tubes. One set of these tubes contains the fluid that must be either heated or cooled. The second fluid runs over the tubes that are being heated or cooled so that it can either provide the heat or absorb the heat required. A set of tubes is called the tube bundle and can be made up of several types of tubes: plain, longitudinally finned, etc. Shell and Tube heat exchangers are typically used for high pressure applications. This is because the shell and tube heat exchangers are robust due to their shape. There are several thermal design features that are to be taken into account when designing the tubes in the shell and tube

heat exchangers. These include tube thickness, tube diameter, tube length, tube pitch and tube layout.

2.3.2 Plate heat exchanger

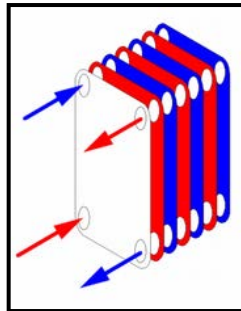


Figure 2.2: Conceptual diagram of a plate and frame heat exchanger.

(Source: http://en.wikipedia.org/wiki/heat_exchanger)

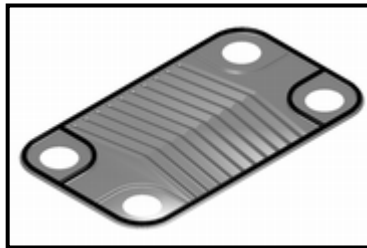


Figure 2.3: A single plate heat exchanger

(Source: http://en.wikipedia.org/wiki/heat_exchanger)