



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**ANALYSIS OF CAR HYDRONIC COOLING SYSTEM WITH
POSSIBILITY OF USING SOLAR POWER**

This report submitted in accordance with requirement of the Universiti Teknikal
Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology

(Refrigeration and Air Conditioning System) (Hons.)

by

FATMA FADHILAH BINTI DAUD

B071310177

910222135668

FACULTY OF ENGINEERING TECHNOLOGY

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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:

.....
(Encik Muhammad Nur Bin Othman)

ABSTRACT

Nowadays, the car is the main transport used to go to one place to another place. When the car is parked under direct the sun, the heat will be accumulated and trapped inside the car when all car windows closed. Under these conditions, the temperature inside the car is getting hotter. This causes the driver and passenger in the car will feel uncomfortable. The heat is trapped inside the car absorb the material that made from rubber. These compounds are called voltaic organic compound. Based on this problem, I conducted a study in which to reduce the temperature of the heat trapped inside the car. The research that I did about car hydronic cooling system. The purpose of this experiment was to calculate the amount of temperature trapped in the car while the car is parked in the sun and analyze a suitable medium that use in a mini chiller during to decrease temperature trapped inside the car. Based on experiments, the average temperature trapped inside the car before the installation of the hydronic cooling system is 45.23° C. After installing and running the cooling system with suitable amount of mixture water, ice and salt the total average of temperature reduced is 9.7 °C.

ABSTRAK

Pada zaman kini kereta merupakan pengangkutan utama yang digunakan untuk pergi ke sesuatu tempat. Apabila kereta di letakkan di bawah sinaran matahari, haba akan terkumpul dan terperangkap di dalam kereta apabila semua tingkap kereta di tutup. Berdasarkan keadaan ini, suhu yang berada di dalam kereta semakin panas. Hal ini menyebabkan pemandu dan penumpang yang masuk di dalam kereta akan berasa tidak selesa. Haba yang terperangkap di dalam kereta akan menyerap pada bahan yang diperbuat dari getah di dalam kereta. Sebatian ini dikenali sebagai voltan sebatian organic. Berdasarkan masalah yang sedemikian, saya telah menjalankan kajian di mana untuk mengurangkan suhu haba yang panas terperangkap di dalam kereta. Kajian yang saya lakukan adalah tentang sistem penyejukan hidronik bagi kereta. tujuan eksperimen ini dijalankan adalah untuk mengira jumlah suhu yang terperangkap di dalam kereta semasa kereta diletakkan di bawah matahari dan medium yang sesuai digunakan di dalam bekas penyejukan semasa sistem dijalankan bagi menyingkir suhu yang terperangkap. Berdasarkan eksperimen yang di jalankan, purata suhu yang terperangkap di dalam kereta sebelum pemasangan system penyejuk hidronik adalah 45.23 °C. Setelah pemasangan sistem penyejukan hidronik kereta dijalankan purata dan nilai suhu yang dapat di kurangkan adalah 9.7 °C.

DEDICATIONS

For my beloved parents, I would like to thank the infinite for giving encouragement and support to me in making this final semester project. Besides that, they are also quite patient and responsible to teach me to realize my dream. Finally, thanks for friends who help me in making this final semester project directly and indirectly. The guidance that they give to me, I will recalled all the time.

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LIST ABBREVIATIONS, SYMBOLS AND NOMENCLATURES

Indoor Air Quality	IAQ
Direct Current	DC
Volatile organic compound	VOC
Heating, Ventilating, and Air Conditioning	HVAC
Coefficient of Performance	COP
Air Mass Zero	AM0

CHAPTER 1

INTRODUCTION

In this chapter the most important subtitle topics involve are background, parameters, problem statement, objective, work scope and organization of thesis.

1.0 BACKGROUND.

The background of this project describe the subtopic such as air conditioning system, hydronic radiant cooling system and solar power. Air conditioning system, hydronic radiant cooling system and solar power are presented and in details.

1.1 AIR CONDITIONING SYSTEM.

Air conditioning is the process of altering the properties of air to more comfortable condition. The aim of the distributing the conditioned air to an occupied space of building or vehicle to improve of thermal comfort and Indoor Air Quality (IAQ). Indoor Air Quality (IAQ) relates to the health and comfort for the occupants. However, conventional air-conditioning is does not fit for the economic due to the high energy intensive. Besides that, for this analysis thermal comfort is important for the occupant when they enter the car at parking because they feel hot in the cabin. The hydronic cooling system includes a

packaged outdoor combination hot and cool unit residential and commercial installations comprise control valve. This is for directing water through alternately an evaporator for cooling the liquid during the cooling mode of the system for heating the liquid. A hydronic heating and cooling system having heating and cooling modes adapted be connected to a terminal system comprising a chiller tank provided with a water reservoir in the bottom portion. A refrigeration system operative during the cooling mode and including a compressor, a condenser and an evaporator in operative relationship to the water in chiller tank and evaporator being located in chiller tank above reservoir. Also presented are fundamental heat transfer equations that govern the radiant cooling panel means temperature as a function of coolant temperature and space temperatures. These study are illustrated where the radiant panel are integrated with a dedicated outdoor air system capable of maintaining the space dew-point temperatures. The design of the hydronic cooling system might be affecting the total load of the conditioned surrounding and resulting in condensation of the cooling surface. The prevention of condensation process is to improve the dew point temperature control inside the conditioned space by using the parallel ventilation system to maintain indoor air quality. According these research, the radiant cooling system is complicated due to the thermal load, structure and hydronic system and impact to the thermal comfort.

1.1.1 HYDRONIC RADIANT COOLING SYSTEM.

In hydronic cooling systems the heat carrier is either pure water or water mixed with some kind of brine often glycol. Hydronic systems are also called water based or radiant systems. The hydronic system, using water as exchange fluid and it provides perfect cooling with high efficiency. There is not much difference in balancing a heating and a cooling system. Besides that, comfort cooling system is to ensure that a correctly calculated amount of water is distributed to induction units, chilled beams, and chilled panels in the system. The part of hydronic system is used water as a transport medium, and pump to flow the

water through the copper tube inside the car panel. Hydronic system does not required a compressor but need a circulation of pump.

1.1.2 SOLAR POWER.

Solar power is the conversion of sunlight into electricity using the photovoltaics (PV). Photovoltaics convert light into an electric current using the photovoltaic effect. Besides that, photovoltaics were initially solely used as a source of electricity for small and medium-sized applications. The purpose of a photovoltaic power system is produces direct current (DC) power which fluctuates with the sunlight's intensity. From this project, it is renewable environment friendly and has a free flow of electricity, thus it is better preference of energy.

1.2 PARAMETERS.

1.2.1 TEMPERATURE.

Heat is trapped in the car due to Greenhouse effect represent of the exchanges of the energy between the source (sun), the Earth's atmosphere and the ultimate sink outer space. Also, a phenomenon of increasing the earth temperature by trapping the heat within the atmosphere. When sunlight reaches the surface of the earth, some of heat will absorbed which will warm the ground. When the car under the sun the compartment of car so hot and the temperature will increase.

1.3 PROBLEM STATEMENT.

Sometimes people parked their car under direct of sunlight with closed windows. The heat emitted in the car cabin car is trapped and causes a significant increase of temperature due to the greenhouse effect. Besides that, when the temperature is high that may cause damage the interior cabin of the car and make the people feel discomfort. When the dashboard is hot, it release some chemical Volatile organic compound (VOC). That chemical have high vapor pressure at ordinary room temperature may affect the human health. To overcome these problem is by implementing the hydronic cooling system. Conventional air conditioning system is required. Therefore, a literature solution with energy saving is essential that is hydronic radiant cooling system.

1.4 OBJECTIVES.

1. To overcome the heat trapped inside the car.
2. To investigate the possibility of using solar power by implementing hydronic cooling system.

1.4.1 SPECIFIC OBJECTIVE.

1. To measure the temperature and calculating the heat inside and outdoor the car.
2. To determine the required size of PV for supplying necessary power to run the pump.

1.5 WORK SCOPE.

The scope of work of this project is an open environment area to park a car. The temperature of car cabin is measure before and after the implementation of the Hydronic Cooling System (HRC). Apart from that, the system is implement the real car instead a prototype and the scope include the designing and installing the cooper tube inside the car and operating the mini chiller.

1.6 ORGANIZATION OF THE THESIS.

In the chapter 1 explain the introduction of project which includes the background, problem statement, objective, parameters and work scope of this project. Besides that, in chapter 2 is explain about the review theories, experimental work and finding some pass research that related to the current project. Apart from that, in chapter 3 methodology and strategy to the objective and explain briefly. The working procedure, materials and apparatus will explain in this chapter.

CHAPTER 2

LITERATURE REVIEW

Hydronic radiant cooling systems is a system that provides thermal comfort. This system does not like a conventional cooling system because this system not rely use of vapor compression to generate the cooling system. In this chapter will discuss the hydronic cooling system and the effect of heat trapped in the car. Besides that, the theories and finding from the previous studies are reviewed and the knowledge that associated with current study.

2.1 GENERAL CONVENTIONAL AIR-CONDITIONING SYSTEM.

Heating, Ventilating, and Air Conditioning (HVAC) equipment perform heating and cooling for residential, commercial. Besides that, to achieve the aim important to increase in Heating, ventilation and air conditioning (HVAC) system is achieve by consume more than 40% of energy use. In this cases, also have significant impact on indoor air quality, thermal comfort, and quality life for the occupant's, reported by (Fisk 2000, Clements-Croome 2006, EIA 2012). To dilute the interior airborne contaminants in HVAC system, also be responsible for providing fresh outdoor air such as odors from occupants, volatile organic compounds (VOC's) emitted from interior furnishings, chemicals used for cleaning and others based on Self-Study Programme 208, Fundamental of Air Conditioning in Motor Vehicle Next, to make a comfortable indoor environment round when maintained must do the properly designed system. Apart from