

A Review Paper on Experimental Investigation for Air Conditioning Condenser To Increase The Heat Transfer Rate By Varying The Tube Arrangement

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Abstract-

Air Conditioning is referred to the treatment of air so as to all together control its temperature, moisture content, cleanliness, odor and circulation, as required by occupants, a process, or products in the space. The subject of refrigeration and air conditioning has evolved out of human need for food and comfort, and its history dates back to centuries. The history of refrigeration is very fascinating since every aspect of it, the availability of refrigerants, the prime movers and the developments in compressors and the methods of refrigeration all are a part of it. In the present work the Experimental Investigation For Air Conditioning Condenser To Increase The Heat Transfer Rate By Varying The Tube Arrangement.

Keywords: Air Conditioning, Condense, Compressor, Prime mover.

1. Introduction

An air conditioner (often referred to as AC) is a home appliance, system, or mechanism designed to dehumidify and extract heat from an area. The cooling is done using a simple refrigeration cycle. In construction, a complete system of heating, ventilation and air conditioning is referred to as

"HVAC". Its purpose, in a building or an automobile, is to provide comfort during either hot or cold weather.

A diagram of the refrigeration cycle:

- 1) Condensing coil,
- 2) Expansion valve
- 3) Evaporator coil,
- 4) Compressor,

In the refrigeration cycle, a heat pump transfers heat from a lower-temperature heat source into a higher-temperature heat sink. Heat would naturally flow in the opposite direction. This is the most common type of air conditioning. A refrigerator works in much the same way, as it pumps the heat out of the interior and into the room in which it stands. This cycle takes advantage of the way phase changes work, where latent heat is released at a constant temperature during a liquid/gas phase change, and where varying the pressure of a pure substance also varies its condensation/boiling point. The most common refrigeration cycle uses an electric motor to drive a compressor. In an automobile, the compressor is driven by a belt over a pulley, the belt being driven by the engine's crankshaft (similar to the driving of the pulleys for the alternator, power steering,

etc.). Whether in a car or building, both use electric fan motors for air circulation. Since evaporation occurs when heat is absorbed, and condensation occurs when heat is released, air conditioners use a compressor to cause pressure changes between two compartments, and actively condense and pump a refrigerant around. A refrigerant is pumped into the evaporator coil, located in the compartment to be cooled, where the low pressure causes the refrigerant to evaporate into a vapor, taking heat with it. At the opposite side of the cycle is the condenser, which is located outside of the cooled compartment, where the refrigerant vapor is compressed and forced through another heat exchange coil, condensing the refrigerant into a liquid, thus rejecting the heat previously absorbed from the cooled space. By placing the condenser (where the heat is rejected) inside a compartment, and the evaporator (which absorbs heat) in the ambient environment (such as outside), or merely running a normal air conditioners refrigerant in the opposite direction, the overall effect is the opposite, and the compartment is heated.,

This is usually called a heat pump, and is capable of heating a home to comfortable temperatures (25 °C; 70 °F), even when the outside air is below the freezing point of water (0 °C; 32 °F). Cylinder un loaders are a method of load control used mainly in commercial air conditioning systems. On a semi-hermetic (or open) compressor, the heads can be fitted with unloaders which remove a portion of the load from the compressor so that it can run better when full cooling is not needed. Unloaders can be electrical or mechanical. In this For Air Conditioning Condenser To Increase The Heat Transfer Rate By Varying The Tube Arrangement

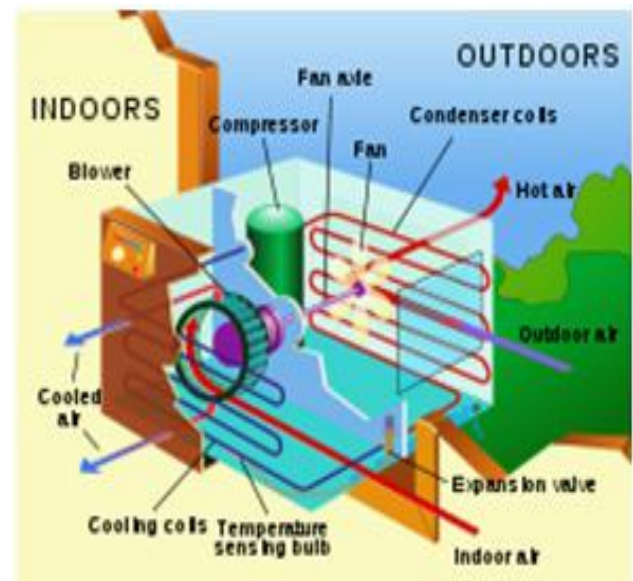


Fig 1 :Image of A typical home air conditioning unit

2. LITERATURE REVIEW

2.1: "Review Paper on Improving the Heat Transfer Rate of AC Condenser by Optimizing Material"

(2017) Assistant Professor. P PRASAD .says that, The majority of the research work focused large chillers. But in this paper discusses the single split air conditioning system using instead of air cooling using liquid based cooling. The coolant used in the heat exchanger pure ethylene glycol. Compare the experimental results value of existing system with new modified system. The compressor running time for the pure ethylene glycol based cooling system is less than the existing system. The compressor's running time is reduced from 44 minutes 30 seconds to 33 minutes and 4 seconds. The required indoor temperature of 18°C is reached in 11 minutes 26 seconds earlier. It is evident that the time taken for cooling by the modified system is 25.69 % less than that of the existing split air conditioning system. Time taken for cooling reduces automatically improve the efficiency of the air conditioning system.

2.2:“ Design and Heat Transfer Analysis of AC Condenser For**Different Materials” (2015) Prof. Mr.**

N.Venkateswarlu.says that,The idea behind the proposed system is to design optimization technique that can be useful in assessing the best configuration of a finned-tube condenser. Heat transfer by convection in air cooled condensers. Modeling is done in Pro/Engineer. Heat transfer analysis is done on the condenser to evaluate the material and refrigerant. The materials considered for tubes are Copper and Aluminum alloy 1100 and for fins are 1050 and 1100. The refrigerants varied are R12, R 22 and R 134. 3D modeling is done in Pro/Engineer and analysis is done in Ansys. Air cooled condensers are used in small units like house hold refrigerators, deep freezers, water coolers, window air-conditioners, split air-conditioners, small packaged air-conditioners etc. These are used in plants where the cooling load is small and the total quantity of the refrigerant in the refrigeration cycle is small. Air cooled condensers are also called coil condensers as they are usually made of copper or aluminum coil. Air cooled condensers occupy a comparatively larger space than water cooled condensers. In the present work, the performance analysis of air cooled condensing unit has been carried out by varying the fin material and fin thickness.

At present aluminum alloy 204 is being used for fins. Two fin materials namely, Aluminium alloys 1100 and 6063 were considered to study the effect of fin's thermal conductivity on the performance of the condenser. Pro Engineer is used to model the system. For thermal analysis purpose COSMOS Works software is used. Considering different factors for a condenser, such as heat transfer, density etc., Aluminium alloy 1100 is found to be the best fin material ^[2]

2.3:“Investigation and Optimization of Air Cooled Condenser of Chillers by**Replacing Cu to Al Tubes” (2015)Prof A.M.Chavan,**

Prof S.R.Deodas Says that,Compact heat exchanger i.e. round tube plate heat exchangers are commonly employed in vapour compression refrigeration system to exchange heat between refrigerant to environment. A well designed, highly effective air cooled condenser can help to save energy and material cost. Now days, material cost is one of the important issues that should be consider during condenser design. The analytical study was carried out on air cooled condenser of a chiller by using R134a. This paper presents the improvement and development of heat transfer that occurs in the condenser by changing the coil material and also predicts the thermal performance of the condenser. Aluminium is chosen as our material due to cheap, corrosion resistant and good machinability. Use of low cost Aluminium material coil will increase the efficiency of the condenser due to factors such as the specific heat at constant pressure (C_p), overall heat transfer coefficient (U). The present study shows effect on condenser air outlet temperature, condensing temperature, heat rejection rate and on overall heat transfer coefficient and ultimately overall condenser cost.^[3]

2.4:“ Optimization of Fin Density of Air Cooled Condenser” (2018)Mr. DevangThakar.says that,

The fins industry has been seeking ways to reduce the size and cost of fins. This demand is often justified by the high cost of the high-thermalconductivity metals that are employed in the manufacture of finned surfaces and by the cost associated with the weight of the fin. The reduction in the size and cost of fins is achieved by the enhancement of the heat transfer carried out by the fins. The enhancement of heat transfer from fins has become an important factor that

has captured the interest of many researchers.So, if

material is considered, large number of works has been conducted to find the best materials for fin.

For example, Srividhya and Venkateswara[1] had compared the heat flux generation for three types of Aluminum and concluded that Al 6063 must be preferred over other

Aluminum alloys. Extending their work Khadimali[5] and Arunakumari altered the material of both Tubes and Fins. They recorded that Copper tubes proven best with Al 6063 instead of Aluminum tubes, which are lighter and cheaper when compared with copper. Some of the researchers not only worked on material but also varied the refrigerants in the system likewise a paper by Mallikarjun and Anandkumar[9] includes the comparisons of HCFC and R 404 with the former materials

i.e. Al 1100, Al 6063 and Magnesium and led to the conclusion that Thermal flux is more when Aluminum alloy 6063 is used for fin and refrigerant used is R 404 than other combinations. The comparison of R12, R22 and R134a has also been done by Mr. Bhimesh and Vankateshwarlu[2] who in their analysis found that R 22 gives maximum heat flux and hence have better heat transfer. Although R 22 because of its toxic properties may get phased out by 2020 as it was banned in many countries in 2015 and we must rely on some of the new blends of refrigerant. R 404A is a blend of HFC refrigerants commonly used for medium and low temperature refrigeration applications. Its composition comprises: HFC- 125 (44%), HFC-143a (52%), HFC-134a (4%). It is nontoxic and non-flammable and gives better heat transfer at condenser side which is negotiated by Raghu Babu and Srikanth[4]. Even some researchers tried to enhance the heat transfer by using colloidal solutions which are called nanofluids. Henderson and Jacobi [10] evaluated that if R134a is used with 0.04% CuO volume fraction the average heat transfer is improved by 52% which is great achievement in the field of heat transfer and Refrigeration. Recently M.A.

Al Nimr and Kiwan[11] suggested that thermal performance of fin can be enhanced by using porous fins alternative to conventional solid fins. It increases the initial designing cost but proven to save about 70% of fin material. One of the experimental investigation shows that the creation of turbulence of air on fin by providing vortex

generators is also one of the techniques for improving heat transfer suggested by Kumar and Choube[8].

Stewart [3] and his team also found that heat transfer rate also gets affected by some of the geometric parameters like width of condenser, vertical and horizontal tube spacing, number of rows and diameter of tube. Their result shows that the condenser with single row and smaller size gives best performance and aspect ratio must be kept higher in order to reduce number of tube bends which in turn reduces the pressure drop.

Mostafa and Elbooz[7] presented the case where a new type of tube called Extruded Micro channel Flat Tube made of Aluminum with flat tube profile was used for improving the Heat Transfer Coefficient. The optimization of circuits of flow of refrigerant, using staggered fin structure for reducing the bypass factored utilization of HTC Porous Carbon foam as a fin material are some other identified methods of improving effectiveness of condenser which are suggested by various researchers.engine.^[4]

3. PROBLEM DEFINITION AND SOLUTION

3.1 Problem Definition

Experimental Investigation For Air Conditioning Condenser To Increase The Heat Transfer Rate

3.2 Solution

Thus, in the present day investigation on thermal issues on Air Conditioning Condenser are carried out. The main aim of this work is to study various researches done in past to improve heat transfer rate of Air Conditioning Condenser by changing different materials & Parametric Design optimization.

We will change or Varying The Tube Arrangement and investigation on thermal Analysis on Air

Conditioning Condenser To Increase The Heat Transfer Rate

3.3 Objective

Following are objective of our project:

- Facilitating the more heat dissipation through a Condenser.
- investigation the performance and efficiency of Air Conditioning Condenser .
- investigation on thermal Analysis on Varying The Tube Arrangement Air Conditioning Condenser And the convectional Air Conditioning Condenser model.

3.4 Need of Project

Most of the researcher carried out investigation and optimization of air cooled condenser by varying the various effecting parameters such as fin spacing, fin thickness, diameter of tubes number of tube circuit etc. the current study proposed to predict the thermal performance of air cooled condenser by Varying The Tube Arrangement Air Conditioning Condenser .

3.5 Feasibility of project

- In the present day investigation on thermal issues on Air Conditioning Condenser were carried out.

In order to design better heat exchangers and come up with efficient designs, at thorough understanding of the flow of air and refrigerant in these channels is required. Now days, HVAC&R industry is searching for ways to increase performance, energy efficiency and durability of HVAC&R equipment in a sustainable way, while reducing the cost of manufacturing these.

To estimate the heat transfer benefit in minimum cost, this study focuses on the heat transfer and overall heat transfer coefficient performance on these two condenser of same or different material i.e. Cu and Al. . The performance is dependent on many factors such as the tubes length, type of tube surface, viz. smooth or enhanced, fin type, fin height, and fin width and density

performance parameter such as air flow rate and velocity, fan power, the refrigerant inlet/outlet conditions etc.

3.6 Expected outcome:

Outcome will proved that by Varying The Tube Arrangement Air Conditioning Condenser . The following are the expected outcome from this project.

1. Heat transfer rate through A.c condenser
2. Heat transfer efficiency of condenser.
3. heat transfer coefficient of condenser
4. Heat transfer rate through Varying the Tube Arrangement Air Conditioning condenser
5. Heat transfer efficiency of Varying the Tube Arrangement Air Conditioning condenser.
6. heat transfer coefficient of Varying the Tube Arrangement Air Conditioning condenser.

3.7 Facilities required for proposed work: ,

1. Compressor
2. Evaporator coil
3. Condenser coil
4. Expansion valve
5. Blower
6. Fan & Thermocouple

4. Methodology

1. Study of the different paper on this topic.
2. Designing a Varying the Tube Arrangement Air Conditioning condenser.
3. Making of cad model for Air Conditioning condenser & Varying the Tube Arrangement Air Conditioning condenser
4. Ansys work bench analysis for Heat transfer rate through A.c condenser & heat transfer coefficient of condenser
5. Brazing of A.c condenser.
7. Taking the reading of all necessary characteristic of A.c Condenser with proper setup
8. Concluding the result of comparison between Air Conditioning condenser & Varying the Tube Arrangement Air Conditioning condenser.

5. CONCLUSION:

In the Experimental Investigation For Air Conditioning Condenser we conclude that up to 4% Increase The Heat Transfer Rate By Varying The Tube Arrangement.

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