Analysis of Condenser under Various Refrigerants

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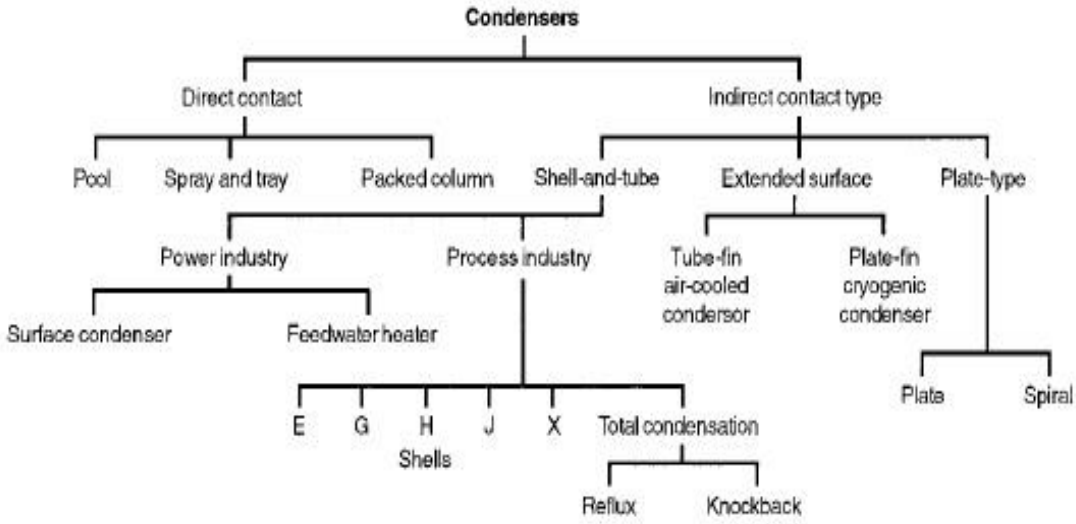
***Abstract*- The condenser is a heat-transfer device. It is used to remove heat from hot refrigerant vapor. Using some method of cooling, the condenser changes the vapor to a liquid. There are three basic methods of cooling the condenser's hot gases. Convection mode of heat transfer plays very important deciding factor for transferring heat from the condenser plate to surrounding air with the use of the some technology we can improve the performance of the heat transfer through the condenser Design.**

Keywords- Ansys Fluent, Condenser, Refrigerant, Shading.

I. INTRODUCTION

Flat tube heat exchanger widely used in aerospace and cryogenic applications because of their compactness, low weight and high effectiveness. This device is made of corrugated fins .Appropriate headers are welded to provide the necessary interface with the inlet and the exit streams. While aluminum is the most commonly used material. Wavy fins are uninterrupted fin surfaces with cross-sectional shapes similar to those of plain fins, but with cyclic lateral shifts perpendicular to the flow direction. The heat transfer rate in the condenser depends on the refrigeration capacity of the system.

Classification of Condenser



Corrugated fins

II. LITERATURE REVIEWS

1.Kays W. M. , and A. L. London[1] A heat exchanger is a device that is used to transfer thermal energy (enthalpy) between two or more fluids, between a solid surface and a fluid, or between solid particulates and a fluid, at different temperatures and in thermal contact. In heat exchangers, there are usually no external heat and work interactions. Typical applications involve heating or cooling of a fluid stream of concern and evaporation or condensation of single- or multi component fluid streams.

2. Maheshwari G.P and ElSherbini A. I. [2]The effect of shading the condensers on the efficiency of air-conditioning systems was investigated. A limiting analysis was conducted to estimate the maximum potential improvement in system COP when condensers are shaded.
3. Elsayed Amr O. and S. Abdulrahman Hariri [3] The amount of energy consumed by air conditioners, refrigerators and water heaters is increasing rapidly, since the consumed power by air conditioners occupies about 20% of the total power consumption. The improvement of refrigeration cycle performance can be done by lowering the compressor power consumption, increasing the condenser heat rejection capacity or reducing the difference between condenser and evaporator pressures.

III. EXPERIMENTAL ANALYSIS

Take to ton of Split A C Condenser and analysis its dimension, Pressure, Temperature, mass flow rate and air inlet CFM.

Experimental setup

IV. CALCULATION

Dimensions-

- **Condenser Parameter –**
- Fin Thickness (t_f)=1 mm
- Fin height (h_f)=8 mm
- Fin width (b_f)=16 mm
- **Flat tube Parameter**
- Tube height (h_t)=4 mm
- Tube width (b_t)=16 mm
- Tube thickness (t_t)=1mm
- **Side Pipe**
- Height (h_d)=508 mm
- Thickness (t_d)=1 mm
- Diameter (d_d)=20 mm
- **Condenser Width =762 mm**

Methodology

➢ **Parameter of air –**

- Inlet Temperature (t_i)=318K
- Outlet Temperature (t_o)=327K
- Velocity of air 12 m/s
- c_p=1.005 kJ/kg K
- Density (ʃ) =1.1774 kg/m³
- Pressure = 1.1013 bar
- P_r = 0.708

(Value taken from Air standard table C. P Arora)

Inlet parameter of refrigerant R134a

- Temperature =338 K
- Pressure =482.63 k N /m²
- Density =1020 kg/m³
- c_p=1.5 kJ/kg K

(ASHRAE Hand book Fundamentals 2008)

Fan Description

Air flow rate = 12 m/s

Diameter =19 inch

RPM =1150

V. RESULT-

- Overall heat transfer coefficient for condenser by calculation

U = 69.14 W/m²K

- NTU = UA /C_{min}

NTU = 12.48

ε = 1- e (-NTU)

ε = 0.87

Q = ε C_{min} $(t_{hi} - t_{ci})$

Q = 115 W

For One Fin

Q_fin =0.412 W

VI. REFERENCE

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[2] A.I. ElSherbini and G. P. Maheshwari "Effectiveness of Shading Air-Cooled Condensers of Air-Conditioning Systems" Building and Energy Technologies Department Kuwait Institute for Scientific Research P.O. Box 24885, Safat, 13109, Kuwait

[3] Amr O. Elsayed , Abdulrahman S. Hariri " Effect of Condenser Air Flow on the Performance of Split Air Conditioner"College of Engineering, University of Dammam, Saudi Arabia May 2011

[4] G.L., 2007, Recent developments in simulation techniques for vapour-compression refrigeration systems, Int. J. Refrig., vol. 30, no. 7: p. 1119-1133.

[5] Heat Exchanger selection design by Sadick

[6] Heat Exchanger Design Handbook Kuppan Thulukkanam SECOND EDITION

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[8] Heat Transfer Augmentation Surfaces Using Modified Dimples/Protrusions Mohammad A. Elyyan December 9, 2008.