International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 11 | Nov 2021 www.irjet.net p-ISSN: 2395-0072

REVIEW ON CFD ANALYSIS OF AIR COOLED CONDENSER USING

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Abstract - In the momentum research convective warmth move attributes of an air-cooled finned-tube condenser of a fume pressure cycle for cooling framework. Warmth move investigation and CFD examination is done on the condenser to assess the better plan and refrigerant utilizingR134 and R11 refrigerants. The impact of balances produced using Aluminum on condenser configuration is additionally broke down for both the refrigerants (R11 and R134). The CAD model is created utilizing Creo 2.0 programming and CFD investigation is directed utilizing ANSYS CFX programming .Standard k-epsilon disturbance models utilized for examination. Warmth dismissal rate is resolved from hypothetical estimations based on re-enactment results and relative investigation is made.

Key Words: CFD, Condensers, Refrigerant, R11 and R134, ANSYS CFX

1. INTRODUCTION

Condensers

Condenser, as the name proposes, is utilized to gather fumes originating from blowers. The condensers are utilized for both local and business refrigeration just as cooling units. The structure of condenser looks like that of the vehicle radiator. The buildup (vaporous to fluid condition) of refrigerants in the condenser is accomplished by cooling the refrigerants. During the procedure of buildup, the idle warmth is dispersed to coolant utilized in the condenser.

The condenser is intended for little size and enormous size. The little size is good and could be held by hand while the huge size is utilized in mechanical units for plant tasks. In local fridges, the lodge heat is separated to outside condition by the utilization of condenser.

These condensers are utilized in the refining process utilized in modern synthetic procedure and warmth exchanger process. Most condensers utilize cooling water of encompassing air for cooling reason as a coolant.

Salient Features of Condensers

The remarkable highlights of condensers are as per the following

The refrigerant experiences stage change in condensers or evaporators.

The warmth from the refrigerant is dismissed to a warmth sink as the refrigerant fume gathers.

In evaporators, the fluid refrigerant vanishes by separating heat from an outside liquid (low-temperature heat source).

1.3 Thermodynamic analysis of system

At point 1 in the diagram, the circulating refrigerant enters the compressor in a saturated state.

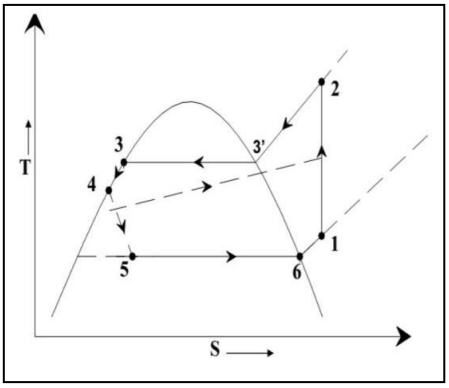
From point 1 to point 2, the refrigerant is isentropically compressed (i.e., compressed at constant entropy) and exits the compressor in a superheated state.

The process 2-3' is a de-superheating process.

Process 3'-3 is the condensation process.

Process 3-4 is a sensible, sub cooling process, during which the refrigerant temperature drops.

Process 4-5 is the adiabatic flash evaporation process which is isenthalpic



Natural Convection Condensers

In normal convection type, heat move from the condenser is by lightness prompted characteristic convection and radiation. Because of little wind stream and low radiation heat move, the joined warmth move coefficient in these condensers is little. Accordingly, a moderately huge consolidating surface is required to dismiss a given measure of warmth. Model - family coolers and coolers

Forced Convection Condensers

In constrained convection type condensers, the dissemination of air over the condenser surface is kept up by utilizing a fan or a blower. These condensers ordinarily use blades on airside for good warmth move. The balances can be either plate type or annular sort. Constrained convection type condensers are usually utilized in window climate control systems, water coolers and bundled cooling plants**.**

2. LITERATURE REVIEW

Qian Sub, Guang Xu Yua, Hua Sheng Wanga, John W. Rosea, [1] announced short correspondence on Micro channel buildup. Relationships and hypothesis Attention is drawn, to the way that, while four distinct connections for buildup in Micro diverts are in reasonable understanding for the instance of R134a (on which the observational constants in the relationships are predominately based) they contrast notably when applied to different liquids, for example, smelling salts. An entirely hypothetical model is contrasted and the relationships for both R134a and smelling salts.

Liang-Liang Shaoa, Liang Yanga,b, Chun-Lu Zhang, Bo Gua [2] introduced Numerical displaying of serpentine micro channel condensers. Micro channel (or scaled-down channel) heat exchangers are drawing more consideration in light of the potential cost decrease and the lower refrigerant charge. Serpentine micro channel heat exchangers are significantly progressively reduced in light of the limited headers. Utilizing the serpentine micro channel condenser, some thermodynamically great yet combustible refrigerants like R-290 (Propane) can be stretched out to more applications. To well estimate the serpentine micro channel condensers, a dispersed boundary model has been created in this paper. Airside mal distribution is considered. Model approval shows great concurrence with the test information. The expectations on the warming limit and the weight drop fall into 10% blunder band. Further examination shows the effect of the pass number and the airside mal distribution on the condenser execution.

Gunda Mader, Georg P.F. Fosel, Lars F.S. Larsen [3] Presented Comparison of the transient conduct of micro channel and blade and-cylinder evaporators. The improvement of control figurings for refrigeration structures requires models fit for impersonating transient direct with sensible computational time and effort. The most explained components of the evaporator are basic when organizing and tuning controllers for refrigeration structures. Diverse implied moving breaking point models were made for getting these components and

Seemed to cover the critical characteristics. A factor that has a basic impact on the time reliable and nonlinear direct of a system is the proportion of refrigerant charge in the evaporator which is widely diminished when microchannel heat exchangers are utilized. Here a moving breaking point model is used and changed in accordance with copy and consider the transient lead of a microchannel evaporator with a sharp edge and-chamber evaporator for a private cooling system. The results are endorsed likely at a test rig. J.R. Garci'a-Cascales, F. Vera-Garci'a, J. Gonza'lvez-Macia, J.M. Corbera'n-Salvador, M.W. Johnson, G.T. Kohler [4] Presented Compact warmth exchangers illustrating: Condensation a model for the examination of preservationist warmth exchangers working as either evaporators or condensers are presented. This paper will focus exclusively on development showing. The model relies upon cell discretization of the glow exchanger with the goal that cells are bankrupt down after the path constrained by the refrigerant flowing through the chambers. It has been realized in a healthy code made for assisting with the structure of diminished warmth exchangers and refrigeration systems. These glow exchangers contain serpentine cutting edges that are brazed to multi-port chambers with inward microchannels. This paper furthermore inspects different associations used for the check of the refrigerant side warmth move coefficient. They are evaluated differentiating the foreseen data and the test data. The working fluids used in the investigations are R134a and R410A, and the discretionary fluid is air. The preliminary office is immediately depicted and a couple of finishes are finally drawn.

Pega Hrnjak*,1, Andy D. Litch [5] Reported Microchannel heat exchangers for charge minimization in air-cooled smelling salts condensers and chillers This paper presents exploratory results from a model antacid chiller with an air-cooled condenser and a plate evaporator. The standard targets were charge lessening and conservativeness of the system. The charge is diminished to 20 g/kW (2.5 oz/Ton). This is lower than any correct now open air-cooled salt chiller accessible. The genuine duty starts from usage of microchannel aluminium tubes. Two aluminium condensers were surveyed in the chiller: one with an equal chamber strategy among headers and ''microchannel'' tubes (water-fueled separation across Dh ¼ 0.7 mm), and the other with a singular serpentine '' microchannel'' tube (Dh ¼ 4.06 mm). The presentations of the chiller and condensers are differentiated subject to various standards with other available smelling salts chillers. This model was made and investigated in the Air Conditioning and Refrigeration Center in 1998, at the University of Illinois at Urbana-Champaign. Akhil Agarwal a, Todd M. Bandhauer b, Srinivas. Garimella b [6] Reported Measurement and showing of development warmth move in non-indirect microchannels warmth move coefficients in six non-indirect even microchannels (0.424 < Dh < 0.839 mm) of different shapes during the development of refrigerant R134a over the mass progress go 150 < G < 750 kg m_2 s_1 were evaluated in this assessment. The channels included barrel-framed, N- shaped, rectangular, square, and triangular removed cylinders, and a channel with a W-framed collapsed insert that yielded triangular

microchannels. The warm upgrade system made and reported in before work by the makers is used to check the glow move coefficients over the fume liquid curve in little increments of fume quality. Results from past work by the makers on development stream instruments in microchannel geometries were used to disentangle the results subject to the proper stream frameworks. The effect of chamber shape was moreover considered in picking the applicable stream framework. A changed variation of the annular-stream based warmth move model proposed starting late by the makers for indirect microchannels, with the necessary shear pressure being resolved from a non-round microchannel weight drop model in like manner definite before was found to best interface the current data for square, rectangular and barrel-formed microchannels. For the other microchannel shapes with sharp extraordinary edge corners, a mist stream set up model from the composition regarding greater chambers was secured to complete the position for the desire for the glow move data. These models predict the data on a very basic level better than the following available connections in the composition. G.B. Ribeiro, J.R. Barbosa Jr., A.T. Prata [7] Presented Performance of microchannel condensers with metal froths detailing continuously side: Application in little scope refrigeration structures. The warm water driven execution of microchannel condensers with open-cell metal froths to overhaul the air-side warmth move is investigated in this paper. Three various copper metal foam structures with undeniable pore densities (10 and 20 PPI) and porosities (0.893 and 0.947) were attempted. A conventional condenser surface, with copper plain sharp edges, was in like manner went after for execution relationship purposes. The exploratory mechanical get together involved a shut circle wind tunnel calorimeter and a refrigerant circle, which allowed the assurance of the mass stream rate and thermodynamic territory of R-600a at the condenser cove. The examinations were performed at a solidifying temperature of 45 _C. The air-side stream rate ran from 1.4 _ 10_3 to 3.3 _ 10_3 m3/s (giving face speeds in the extent of 2.1e4.9 m/s). The glow move rate, the general warm conductance, the scouring factor and the siphoning power were resolved as a significant part of the assessment. ZHANG Huiyong, LI Junming, LI Hongqi [8] Presented starting late, microchannel heat exchangers have begun to be used in refrigeration and cooling structures. This paper presents a microchannel condenser for family unit ice chests with a speculative model to evaluate its presentation. The model was used to get the perfect arrangement boundaries for different amounts of chambers and chamber lengths. The results show that the necessary chamber height of the plummeting zone reduces with the number of chambers and the chamber width. Differentiated and the principal condenser, the current perfect structure boundaries can lessen the hard and fast metal mass by 48.6% for the two divider two side arrangement and by 26% for the two divider one side structure. Thusly, the current condenser is tremendously improved than the condensers by and large used in genuine family coolers.

Conclusions

The current research analyse the impact of fins and refrigerant properties on heat rejection and temperature drop characteristics of condenser. The CFD technique employed for analysis has proved to be viable option for substituting conventional experimental techniques which are high cost and more time taken also. The findings from analysis are discussed below.

1> the temperature drop attained using rectangular fins is higher for both refrigerants R134 and R11 as compared to designs without fins. The drop is almost 90%.

2> The two-variable k-epsilon turbulence model used for analysis has provided reasonable good predictions of fluid flow along with pressure drop and temperature drop characteristics.

3> The heat rejection using fin geometry for R134 refrigerant is higher as compared to condenser design without fins. The magnitude of heat rejection is .435W for design without fins and .806W for design with fins.

4> the heat rejection using fin geometry is higher as compared to condenser design without fins for R11 refrigerant. The magnitude of heat rejection is 3.897W for design without fins and 6.666W for design with fins.

5> the maximum heat rejection is seen in R11 with fins followed by R11 without fins. The R134 refrigerant without fins has lowest heat rejection rates as compared to other design with fins.

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