

Numerical Analysis of Air Cooled Condenser using Cfd

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Abstract-In frameworks including heat move, a condenser is a gadget or unit used to gather a substance from its vaporous to its fluid state, reliably by cooling it. thusly, the lethargic warmth will move to the coolant in the condenser. condensers are regularly heat exchangers which have different structures and come in different sizes running from somewhat little to incredibly gigantic present-day scale units utilized in plant structures. air-cooled condensers are utilized in little units like family refrigerators, huge coolers, water coolers, window obliged air structures, split air control systems, minimal bundled compelled air structures, and so forth these are utilized in plants where the cooling load is almost nothing and the rigid proportion of the refrigerant for the pattern of refrigeration is basically nothing. air-cooled condensers are in like way called hover condensers as they are typically made of copper or aluminum contort. air-cooled condensers eat up a practically more noteworthy space than water-cooled condensers.

Keywords - cfd, condensers, refrigerant

I. INTRODUCTION

Condenser, as the name proposes, is used to assemble exhaust beginning from blowers. The condensers are used for both neighborhoods and business refrigeration similarly as cooling units. The structure of condenser resembles that of the vehicle radiator. The development (vaporous to liquid state) of refrigerants in the condenser is cultivated by cooling the refrigerants. During the system of development, the inactive warmth is scattered to coolant used in the condenser. The condenser is planned for little size and gigantic size. The little size is acceptable and could be held by hand while the tremendous size is used in mechanical units for plant undertakings. In neighborhoods coolers, the hotel heat is isolated to outside condition by the usage of condenser.

These condensers are used in the refining cycle used in present-day manufactured system and warmth exchanger measure. Most condensers use cooling water of including air for cooling reason as a coolant.

In typical convection type, heat move from the condenser is by daintiness incited trademark convection and radiation. Due to little wind stream and low radiation heat move, the joined warmth move coefficient in these condensers is nearly nothing. As needs be, a decently enormous merging surface is needed to excuse a given proportion of warmth. Model - family coolers and coolers Forced Convection Condensers In this sort of compelled convection type condensers, the spread of air over the condenser surface is kept up by using a fan or a blower. These condensers usually use edges on airside for good warmth move. The equilibriums can be either plate type or

annular sort. Compelled convection type condensers are generally used in window atmosphere control frameworks, water coolers and packaged cooling plants. Evaporative condensers have an evaporative condenser; both air and water are used to remove heat from the uniting refrigerant. In these condensers, the water is showered from the top part on a bank of chambers passing on the refrigerant and air is started upwards. There is a slim water film around the condenser tubes from which evaporative cooling occurs. The glow move coefficient for evaporative cooling is gigantic. Accordingly, the refrigeration structure can be worked at low combining temperatures. For making and enhance our view for this research we have studied some literature on this topic.

II. LITERATURE REVIEW

Qian Sub, et al declared short correspondence on Micro channel development. Connections and speculation Attention is drawn, to the way that, while four particular associations for development in Micro redirects are insensible comprehension for the occasion of R134a (on which the observational constants in the connections are predominately based) they contrast outstandingly when applied to various fluids, for instance, smelling salts. An altogether speculative model is differentiated and the connections for both R134a and smelling salts.

Liang-Liang et al presented Numerical showing of serpentine micro channel condensers. Micro channel (or downsized channel) heat exchangers are attracting more thought light of the likely cost decline and the lower refrigerant charge. Serpentine micro channel heat exchangers are fundamentally logically decreased considering the restricted headers. Using the serpentine

micro channel condenser, some thermodynamically extraordinary yet flammable refrigerants like R-290 (Propane) can be loosened up to more applications. To well gauge the serpentine micro channel condensers, a scattered limit model has been made in this paper. Airside misdistributions is thought of. Model endorsement shows incredible simultaneousness with the test data. The desires on as far as possible and the weight drop fall into 10% screw up band. Further assessment shows the impact of the pass number and the airside misdistribution on the condenser execution.

Gunda Mader et al Presented Comparison of the transient direct of micro channel and cutting edge and-chamber evaporators. The improvement of control figuring's for refrigeration structures requires models fit for imitating transient direct with reasonable computational time and exertion. The most clarified segments of the evaporator is fundamental when sorting out and tuning regulators for refrigeration structures. Different inferred moving limit models were made for getting these segments and appeared to cover the basic qualities.

A factor that basically affects the time solid and nonlinear direct of a framework is the extent of refrigerant charge in the evaporator which is generally lessened when micro channel heat exchangers are used. Here a moving limit model is utilized and changed as per duplicate and consider the transient lead of a micro channel evaporator with a sharp edge and-chamber evaporator for a private cooling framework. The outcomes are embraced likely at a test rig.

J.R. Garci'a-Cascales et al Presented Compact warmth exchangers outlining: Condensation a model for the assessment of preservationist warmth exchangers functioning as either evaporators or condensers are introduced. This paper will zero in solely on advancement appearing. The model depends upon cell discretization of the sparkle exchanger with the objective that cells are bankrupt down after the way compelled by the refrigerant moving through the chambers. It has been acknowledged in a solid code made for helping with the structure of lessened warmth exchangers and refrigeration frameworks. These shine exchangers contain serpentine front lines that are brazed to multi-port chambers with internal micro channels. This paper moreover examines various affiliations utilized for the check of the refrigerant side warmth move coefficient. They are assessed separating the anticipated information and the test information. The working liquids utilized in the examinations are R134a and R410A, and the optional liquid is air. The fundamental office is quickly portrayed and two or three completions are at last drawn.

Pega Hrnjak et al Reported Micro channel heat exchangers for charge minimization in air-cooled smelling salts condensers and chillers this paper presents exploratory outcomes from a model stomach settling agent chiller with an air-cooled condenser and a plate evaporator. The standard targets were charge decreasing and conservativeness of the framework. The charge is reduced to 20 g/kW (2.5 oz/Ton). This is lower than any right presently outdoors cooled salt chiller available. The certifiable obligation begins from use of micro channel aluminum tubes.

Two aluminum condensers were overviewed in the chiller: one with an equivalent chamber system among headers and "micro channel" tubes (water-filled division across $D_h \frac{1}{4} 0.7$ mm), and the other with a particular serpentine "micro channel" tube ($D_h \frac{1}{4} 4.06$ mm). The introductions of the chiller and condensers are separated dependent upon different principles with other accessible smelling salts chillers. This model was made and researched in the Air Conditioning and Refrigeration Center in 1998, at the University of Illinois at Urbana-Champaign.

Akhil Agarwal et al Reported Measurement and appearing of improvement warmth move in non-roundabout micro channels warmth move coefficients in six non-circuitous even micro channels ($0.424 < D_h < 0.839$ mm) of various shapes during the advancement of refrigerant R134a over the mass advancement go $150 < G < 750$ kg m^{-2} s^{-1} were assessed in this evaluation. The channels included barrel-outlined, N-formed, rectangular, square, and three-sided eliminated chambers, and a channel with a W-outlined fell addition that yielded three-sided micro channels.

The warm redesign framework made and revealed in before work by the producers is utilized to check the gleam move coefficients over the smoke fluid bend in little augmentations of smoke quality. Results from past work by the producers on advancement stream instruments in micro channel calculations were utilized to unravel the outcomes subject to the best possible stream systems. The impact of chamber shape was also viewed as in picking the appropriate stream system. A changed variety of the annular-stream based warmth move model proposed beginning late by the creators for roundabout micro channels, with the vital shear pressure being settled from a non-round micro channel weight drop model in like way clear before was found to best interface the current information for square, rectangular and barrel-shaped micro channels.

For the other micro channel shapes with sharp phenomenal edge corners, a fog stream set up model from the arrangement concerning more noteworthy chambers was made sure about to finish the situation for the longing for

the sparkle move information. These models foresee the information on an exceptionally fundamental level in a way that is better than the accompanying accessible associations in the structure.

G.B. Ribeiro et al Presented Performance of micro channel condensers with metal froths enumerating consistently side: Application in little extension refrigeration structures. The warm water driven execution of micro channel condensers with open-cell metal froths to redesign the air-side warmth move is explored in this paper. Three different copper metal froth structures with verifiable pore densities (10 and 20 PPI) and porosities (0.893 and 0.947) have endeavored. A regular condenser surface, with copper plain sharp edges, was in like way pursued for execution relationship purposes. The exploratory mechanical social affair included a shut circle air stream calorimeter and a refrigerant circle, which permitted the confirmation of the mass stream rate and thermodynamic region of R-600a at the condenser inlet.

The assessments were performed at a cementing 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 degree of 2.1e4.9 m/s). The gleam move rate, the overall warm conductance, the scouring factor and the siphoning power were settled as a critical piece of the appraisal.

ZHANG Huiyong et al Presented beginning late, micro channel heat exchangers have started to be utilized in refrigeration and cooling structures. This paper presents a micro channel condenser for nuclear family coolers with a theoretical model to assess its introduction. The model was utilized to get the ideal plan limits for various measures of chambers and chamber lengths.

The outcomes show that the essential chamber tallness of the diving zone lessens with the number of chambers and the chamber width. Separated and the foremost condenser, the current amazing structure limits can decrease the immovable metal mass by 48.6% for the two divider two side course of action and by 26% for the two divider one side structure. Along these lines, the current condenser is enormously improved than the condensers overall utilized in certified family coolers.

D. A. Luhrs and W. E. Dunn Presented Design test office was endeavoured to perform warmth move investigates on micro channel heat exchangers. The evaluations will consolidate the improvement of refrigerant 134a inside the refreshed chambers, however, no advancement results are introduced in this record. The structure and progression of the starter office is positive with a depiction of each part and its capacity in the stand. The activity of the working environment was checked utilizing a vitality balance assessment and the outcomes are introduced.

The refrigerant and airside warmth moves concur inside ±3% at high wind stream rates in any case exit this screw up bound at lower stream rates. Essentially, discussion of the procedure for picking the refrigerant and airside protections for the chamber is given near to the theory for future affiliation improvement. At last, future alterations to the stand are proposed to address any issues with it, improving the restriction of the stay to pass on accurate, solid warmth move execution information.

Clark et al. completed experimentation on 18 ft³ domestic cooler. They utilized water-cooled condenser and normal air-cooled condenser in equivalent. Following are the disclosures of this evaluation: (I) move in temperature of cooling water is 35°C.

Yilmaz did experimentation on a cool unit. He utilized concentric chamber type heat exchanger for warmth recuperation. He found that when entering water temperature isn't really including air temperature, the capacity of the cooling unit is improved.

Stinson et al. facilitated investigation in dairy refrigeration by recuperating the gleam from the condenser. They found that by utilizing the water-cooled condenser COP of the structure is updated by 10% to 18%. They besides found that augmentation in condenser weight reduces COP, and joining of warmth recuperation heat exchanger diminishes head difficulty.

Alex et al. coordinated an enlightening model of a private desuperheater. They found that the results of the coherent model and deferred outcomes of an exploratory strategy change inside 12%.

Rane et al. made reasonable warmth recuperation unit and did tests. Waste warmth recuperated is used for water warming. Their revelations are (i) chiller cooling limit refreshed by 30% and COP by 20%, (ii) fuel-saving announced 81liters HSD/day, yearly save resources of Rs. 10 Lakh/year, (iii) Reduction in CO₂ Emissions 450 ton in 4 years, and (iv) fundamental compensation of 3 to a half year

J. Khedari et al. researches the presentation of another crossbreed private high temp water structure that joins sun based noteworthiness with waste warmth from a thermoelectric (TE) climate control system. To this end, 30 TE modules model no. TEC1-12704 (module focal points: 40 × 40 mm, most significant working voltage and current: 13.5 VDC and 4.4 Amp) were utilized. The force/hoarding tank limit was 120 litres.

The volume of the testing space for cooling was 2.5 m³. Evaluations were attempted by changing the voltage to the thermoelectric module (50, 100, 150 VDC), water mass stream rate and speed encountering the TE heat exchangers: 10, 15 l/min and 2.5, 5 m/s, freely. It was discovered that this structure would warmth have the option to up the 120 litres to 50°C inside 2 hours. Quite far was 176 W. Beginning there ahead, quite far diminished because of the improvement of water temperature got back from the tank and drifted through TE water/strong warmth exchanger. At last, understructure thought utilized in this appraisal, the ideal conditions for working the high temp water creation and cooling additionally are 100 VDC, water stream movement of 15 l/min and speed at 2.5 m/s.

III. CONCLUSION

The flow of research dissects the effect of blades and refrigerant properties on warmth dismissal and temperature drop qualities of condenser. The CFD procedure utilized for investigation has ended up being the reasonable choice for subbing regular test methods which are significant expense and additional time taken too. The discoveries from investigation are examined beneath. The temperature drop achieved utilizing rectangular balances are higher for the two refrigerants R134 and R11 when contrasted with plans without balances. The drop is practically 90%.

The two-variable k-epsilon choppiness model utilized for examination has given sensible great expectations of liquid stream alongside pressure drop and temperature drop attributes. The warmth dismissal utilizing balance math for R134 refrigerant is higher when contrasted with condenser

plan without blades. The extent of warmth dismissal is .435W for plan without balances and .806W for plan with balances. The warmth dismissal utilizing blade math is higher when contrasted with condenser plan without balances for R11 refrigerant. The greatness of warmth dismissal is 3.897W for plan without blades and 6.666W for plan with balances. The most extreme warmth dismissal is seen in R11 with blades followed by R11 without balances. The R134 refrigerant without blades has most minimal warmth dismissal rates when contrasted with another plan with balances.

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