International Journal of Scientific Research in Science, Engineering and Technology
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET207645

Experimental Study for Counter to Cross Flow Air-cooled Heat Exchangerof Annular Tube having Internal Circular grooving at Different pitches - A Review

Suneel Nagar[1], Dr. Ajay Singh[2], Deepak Patel[3]

[1]PG Scholar, Department of Mechanical Engineering, Radharaman Institute of Technology and Science Bhopal, Madhya Pradesh, India

[2]Professor & Head, Department of Mechanical Engineering, Radharaman Institute of Technology and Science Bhopal, Madhya Pradesh, India

[2]AssistantProfessor, Department of Mechanical Engineering, Radharaman Institute of Technology and Science Bhopal, Madhya Pradesh, India

Article Info

Volume 7 Issue 6

Page Number: 268-273

Publication Issue :

November-December-2020

Article History

Accepted :15Dec 2020

Published : 31Dec2020

ABSTRACT

The objective of this study is to provide modern analytical and empirical tools for evaluation of the thermal-flow performance or design of air-cooled heat exchangers (ACHE) and cooling towers. This review consist various factors which effect the performance of ACHE. We introduced systematically to the literature, theory, and practice relevant to the performance evaluation and design of industrial cooling. Its provide better understanding of the performance characteristics of a heat exchanger, effectiveness can be improved in different operating conditions .The total cost of cycle can be reduced by increasing the effectiveness of heat exchanger.

Keywords : Internal Spiral Grooving, Rectangular Fin ,Pressure Drop, Annular Tube ,Heat Transfer Coefficient ,Air Cooled Heat Exchanger.

I. INTRODUCTION

A heat exchanger is a system used to transfer heat between two or more liquids, or a solid surface with a liquid or solid particle and liquid. Heat exchangers are used in both cooling and heating processes. They are used in space heating, in various industries and in chemical purifiers. ,aerospace and sewage industry. Energy efficiency by improving heat transfer efficiency is one way to improve the performance of heat exchangers .As we know it is an industrial challenge to improve heat efficiency and heat transfer rate .When we use heat transfer efficiency reduces the amount of energy loss which is no longer beneficial to the environment .In recent years, researchers many have used heat-insulating techniques to increase the efficiency of the heat exchanger .The following techniques are widely used in the heat-insulating process to change surface [1] to create turbulent flow and increase heat transfer rate, this is known as "bad surface process" [1,2]. Internal cracks in the tubes provide turbulent flow, increase the heat transfer rate and reduce the thickness of the boundary layer compared to the smooth tube [3,4].

They are widely used instead of smooth tubes in heat exchangers because they increase efficiency and produce an effective thermal transfer [5,6] .In other hand surface extensions used widely in various types of heat exchangers by increasing the heat transfer rate. By increasing the junction of the liquid that will cool or heat through the wings, deliberately stirring up the wall retains the stiffness of the area with long / short wings, and reduces the second flow by creating a flow using fin geometry and twisted tapes. This usually increases the duration of the active flow of fluid through the tube, which increases heat transfer but also decreases the pressure [6]. A tube with internal bars with geometrically modified wings flows, in addition to increasing the density of the heat exchanger area, and also improves the convection heat transfer balance [7,8].

Improving heat transfer can also reduce heat exchange size, reduce pressure reduction, provide higher heat transfer performance, and save on the cost of operating and construction materials. Strengthening heat transfer is very important for industrial applications such as cooling process, refrigeration, chemical processing, air separation, etc. Wings or extended area play an important role in increasing the rate of heat transfer [9]. In the case of combined conduction convection effects, depending on the application, various types of additional heat transfer areas such as rectangular, triangular, trapezoidal wings, Pin wings, wavy wings, offset wings, louvered wings and perforated wings. It is a well-known fact that any addition process will result in a reduction in excess liquid pressure, and often the rate of pressure drop is much greater than that of heat transfer improvement. And the heat transfer rate decreases with fin fines. The cooling air temperature converter (ACHE) has apparently become three types of viz. Mandatory Drafts, Featured Drafts and Environmental Drafts as shown in figs. 1.

1.

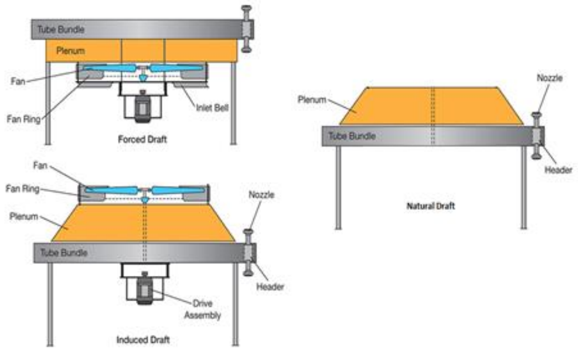

Fig. 1.-Different typesof ACHE Fig. 1. [source –aiche.org]

The internal Surface of the conventional temperature changer is smooth and flat from the first stage of development. However, as thermodynamics tests continue, it is found that the heat transfer coefficient can be enhanced by the pre-construction of the curved part in the internal surface of the heat exchanger. At the end of the day, a heat exchanger with an unoccupied space turns into a standard heat transfer gadget. Temperature switch with notched inner surface with grooves with a circular, rectangular and trapezoidal cross section [10,11]. The inner tube is interspersed with a large number of fine inner layers with different tar, three different geometric tubes with square, circular and trapezoidal lines [12]. Square, circular and trapezoidal from fig. 2.

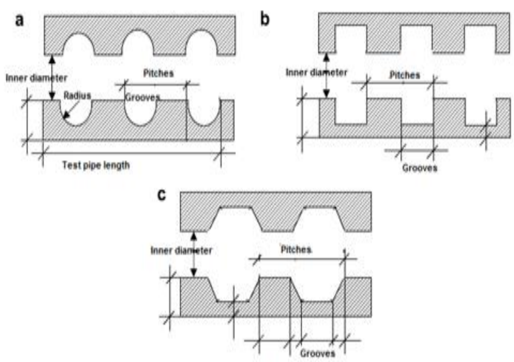

Fig. 2. -The geometric shapes of the grooved tube, dimensions in mm (a) circular, (b) rectangular and (c) trapezoidal grooves.[source –aiche.org]

The contents of this paper includes four sections in such a way that in Section-I Introduction, Section-II

Literature Review Section-III. conclusions and future scope.

II LITERATURE REVIEW

Among the various innovations of air cooled heat exchanger (ACHE), attractive interior solutions are designed to improve the quality of heat transfer. However, the design of the simple ACHE simple grooving interior has its limitations which is why the introduction of a high-quality heat exchanger is very popular with investigators during irritation, several researchers work on this concept and get amazing results. However in the latest ACHE publications available a new concept of various forums and fin based grooved heat exchanger but requires further research. Over the years, the authors have used their research to make new designs or changes to the basic ACHE to obtain a better rate of heat exchange and a controlled number of other parameters. Some of the significant contributions in the field of heat exchanger are presented in this section which gives us an idea of further research by finding the appropriate research gap between recent research work .

1 Asif Afzal, Mohammed Samee et al. [1] Introduce the test setting of the appropriate space between the external heat exchanger heat pump. In this work the author introduces three different tubes with different lines (spaces) one of which is very clear on the other side and the other two have 10 m necklaces

2.C. Nitiyesh Kumar 1 and M. Ilangkumaranath Al. [2] In the present study, an experimental test of thermal performance and exaggeration analysis is provided with alternating wings (TCTT) with triangular cut twisted tape inserted into the inner wing (IG) tube. The attack angle for different twist ratios, y = 3.5, 5.3 and 6.5, 90 = 45 and 90 for is analyzed with TCTT. With Reynolds numbers ranging from 3000 to 14,000, the mayoralty regime was under investigation. . Experimental results showed that the thermal capacity and energy efficiency of the IG tube with TCTT were increased to 1.12 and 1.85 times, respectively, with plain twisted tape (PTT). Integration of IG. Creates synergy effects with TCTT, which enhances overall performance compared to singles. This is due to the effect of TT-induced vortex flow, which causes vortices to emerge from the wings, increasing the thin layer and heat transfer. In the study we found that the atom increases with the increase in Reynolds number and with the mean value. The size of the NU for IG tubes with TCTT is 46.1% larger than that of plain IG tubes.

3.Zhisong Liet al. [3] This work created a new heat pipe structure, replacing the traditional axial-oval or centrifugal ones with spiral coils and simple piping containers. The proposed heat pipe structure was introduced for its design and operating procedure. Basic experiments were constructed to examine the heat transfer performance with different wire diameters with the help of two test articles, which were compared to a wire wick-free charged container. We found that the spiral coil successfully acts as a capillary wick. Speaking of the local transverse temperature difference, it is in the heat pipe due to the effect of gravity and for evaporation, the coil wick with a wire diameter of 0.5 mm works better than the wire of 0.4 mm.

4.Pengxiao Li, Peng Liuet al. [4] In the present study, heat transfer and flow performance in the turbulent flow of a pipe fitted with drainage inserts are investigated. The results suggest that pouring a new type of carto leads into the liquid in the tube, strengthening the mixture of cold and hot fluid. And the insert also produces a vortex to disrupt the fluid field. This experiment examines the effect of the pitch ratio on the Nusselt number and the friction factor. As the ratio of pitch decreases both the number of nasalts and the friction factor increase. And a 3.3 pitch ratio is recommended for insertion. The study also showed some numerical results confirmed by experimental results to evaluate the effect of the slant angle on heat transfer and flow performance. The results indicate that 45 is the best slant angle to include. In the study, the heat transfer and flow performance of the drain insertion tubes in the heat flux are investigated experimentally and numerically.

5.Pankaj N. Shrirao, Rajeshkumaret al. [5] This work provides an experimental study of the average number, friction factor, and thermal growth factors properties of a circular pipe, with different types of internal threads of 120 mm pitch under the hot flow boundary conditions of such walls. In experiments, data measured in Reynolds numbers from 7,000 to 14,000 are taken by air as test fluid. Experiments were carried out on a circular tube with three types of internal threads. Acme, butter and threads of constant pitch. Variations in heat transfer and pressure loss are determined and described by graphs as the Nusselt number (nu) and the friction factor (f), respectively. Of all the Reynolds numbers, it was observed that the number and thermal performance of the nasalt for circular hose with buttress threads increased compared to the circular hose with oxy and knock threads. This is due to the increase in the strength and intensity of the vortices extracted from the threads of energy. Subsequent empirical correlation is also equal to the experimental results with ± 8% and 9%, respectively, for the Nusselt number and the variance for the collision factor.

6.Kadir Bilen a, Murat Cetinet al. [6] An experimental study of surface heat transfer and frictional properties of full-grown turbulent flow in various growth tubes is described. Reynolds numbers range from 10,000 to 38,000 and have been tested for a variety of geometric groove shapes (circular, trapezoidal and rectangular). The length-to-diameter ratio of the tube is 33. Between oval tubes, 63% for circular groove, 58% for thermal trapezoidal groove, and 47% for rectangular groove, the highest Reynolds number (Re = 38,000) compared to smooth tube. Relationships of heat transfer and friction coefficients are obtained for individual oval tubes. In the evaluation of thermal performance, it can be observed that the groove tubes are thermodynamically advantageous (NS, A <1), up to re = 30,000 for spherical and trapezoidal grooves and up to = 28,000 for rectangular long grooves. It can be observed that the correct value of the entropy generation number for all the longitudinal grooves investigated is = 17,000. We concluded that the heat transfer rate increases due to the re-fitted treasure layer to all longitudinal grooves. The change of friction coefficient of all groove tubes rotates close to each other in the range considered Re, and f is assumed to be almost independent of Re. For each corrugated pipe smooth pipe, the nucleated number and the friction factor are correlated as a function of flow conditions. For oval pipes, the maximum heat transfer increase is 63% for circular grooves, 58% for trephoidal grooves and 47% for rectangles . Groove than smooth hose. For rectangular oval tubes.

7.GuoquanLva, Chao Shena, ZhitaoHanb, Wei Liaob, Dong Chenb[7] He discusses the novel bright panel developed for cooling with heat transfer fluid filled with bottom drain plate, top flat plate and floating gap. They conducted a series of tests and results, stating that the cooling capacity of this luminous panel was 93.5 W / m2to 153.3 W / m2in from the test conditions, compared to 18 old-fashioned metal luminaire panels. . % Test 25% higher. When filled with different types of liquids, the cooling performance of the radiant panel can be reduced so that the radiant panel is applied in different cases because they are suitable for use in series.

8.P W Sunu, I P Darmawa, I N Sutarna, I M Suarta, K A Yasa ,I P N Suardana,H S Jaya [8] . I will complete as basic research for the exchanger. Their main goal is to determine the parameters for optimal heat transfer, especially the logarithmic temperature difference (LMTD) as a time series function. They analyzed the thermal analysis that provides the total heat absorbed in cold liquids. The height and width of the long grooves were 0.03 cm and 0.1 cm, respectively. The tube is made of aluminum with an outer diameter of 2 cm. The LMTD of the 2 drain double pipe heat exchanger is compared to the softer ones as the thermal second improves, which inevitably leads to larger heat transfer.

9. Syed Muhammad Ammar, Naseem Abbas, Salim Abbas, Hafiz Muhammad Allad, Iftikhar Hussain, Mohd. [9]With the smooth and smooth flat tube of the automotive heat exchanger. The test was performed with two other soft tubes. Following the experiment, it was found that the condensate heat transfer coefficient increased with vapor quality and mass flow and decreased with increasing saturation temperature. Larger heat transfer coefficients are shown for larger pipes compared to soft pipes.

10.Jiang Jingzhi, Bo Lin, Chen Zhengjia, Hu Shuyao, Cui Haiting[10]In this paper, to solve the problem of the energy storage for solar energy utilization &the advantages of spiral groove tube heat exchanger, the spiral groove tubes were specifically used in the solar energy phase change heat storage. The process of thermal storage of heat reservoir was simulated numerically. They investigated heat transfer enhancing effect of smooth tube heat storage and the heat storage process in the spiral groove tube which were numerically simulated .They analyzed impact of structural parameters like as groove depth &groove pitch and on the heat storage process which is simulated numerically.

11.S Basavarajappa, G Manavendra, S B Prakashet al. [11] In this paper, different types of wings are used in this review paper to increase heat transfer. Using different fin jets such as rectangular, triangular, trapezoidal wings, pin wings, wings, offset striped wings, lower wings and perforated wings to analyze various parameters such as heat rate and pressure drop measurement, fin pitch, tilt, height. Different types of grooves are used to study heat transfer rate, pressure drop, Nusselt number friction factor relay number. In research on a variety of plumes it increases heat transfer by increasing heat transfer as well as flow disturbances and turbulence, exposure area to large amounts of liquid mixture. Good. It is clear that standard wavy and rectangular wings provide better heat transfer, but the pressure is reduced.

III. CONCLUSIONS AND FUTURE SCOPE

In this paper, we will study several researches based on ACHE based on various experimental setups and designs. This review is a novel classification of recent developments in the field of air-cooled heat exchangers and strategies to improve its efficiency. One of the main elements of this paper is to reduce the size, weight, running costs and improve the efficiency of the heat exchanger. Many other performance parameters of ACHE have been at the center of various literary reviews, such as thermal efficiency, collection of construction equipment, the inspiration behind this paper is to review the exploratory work done to improve the heat transfer rate of ACHE. Aluminum circular hose with rectangular wings for internal circular grooving and various pitches of ACHE design. This experiment will help us to understand the work of different pitches in the internal mounting heat exchanger.

IV.REFERENCES

[1]. Afzal, A., Mohammed Samee, A.D., Abdul Razak, R.K "Optimum spacing between grooved tubes: An experimental study', Journal of Mechanical Science and Technology, Vol 34, No. 1, January 2020.

[2]. Nithiyesh Kumar, C. Ilangkumaran, M., “Experimental study on thermal performance and exergy analysis in an internally grooved tube integrated with triangular cut twisted tapes consisting of alternate wings”, Heat and Mass Transfer, Vol 55, April 2019.

[3]. ZhisongLi. “Design and preliminary experiments of a novel heat pipe using a spiral

coil as capillary wick". International Journal of Heat and Mass Transfer Volume 125, November 2018.

[4]. Pengxiao Li, Peng Liu, Zhichun Liu, Wei Liu "Experimental and numerical study on the heat transfer and flow performance for the circular tube fitted with drainage inserts". International Journal of Heat and Mass Transfer Volume 107, April 2017.

[5]. Pankaj N. Shrirao, Rajeshkumar U.Sambhe, Pradip R.Bodade, "Convective Heat Transfer Analysis in a Circular Tube with Different Types of Internal Threads of Constant Pitch". International Journal of Engineering and Advanced Technology (IJEAT), Volume-2, Issue-3, February 2013.

[6]. Kadir Bilen, Murat Cetin, Hasan Gul, Tuba Balta, "The investigation of groove geometry effect on heat transfer for internally grooved tubes". Applied Thermal Engineering, Volume 29, Issue 4, March 2009

[7]. P. Bharadwaj, A.D. Khondge, A.W. Date, "Heat transfer and pressure drop in a circular grooved tube with twisted tape insert" International Journal of Heat and Mass Transfer, Volume 52, Issues 7–8, March 2009

[8]. M. Siddique, A.-R. A. Khaled, N. I. Abdulhafiz, and A. Y. Boukhary, "Recent Advances in Heat Transfer Enhancements: A Review Report", Hindawi Publishing Corporation, International Journal of Chemical Engineering, Volume 2010, September 2010

[9]. S Basavarajappa, G Manavendra and S B Prakash, "A review on performance study of finned tube heat exchanger", Journal of Physics: Conference Series, Vol. 1473, No. 1, February 2020.

[10]. M Goto, NInoue, NIshiwatari, "Condensation and evaporation heat transfer of R410A inside internally grooved horizontal tubes, Vol. 24, Issue 7, July 2001. 11M. Goto, N. Inoue, R. Yonemoto, "Condensation heat transfer of R410A insideinternally grooved horizontal tubes", Int. J. Refrig. 26 (2003) 410–416.

[11]. Miansari, M., Valipour, M.A., Arasteh, H. et al. Energy and exergy analysis and optimization of helically grooved shell and tube heat exchangers by using Taguchi experimental design. J Therm Anal Calorim 139, 3151–3164, 2020.

Cite this article as :

Suneel Nagar, Dr. Ajay Singh, Deepak Patel, "Experimental Study for Counter to Cross Flow Air-cooled Heat Exchanger of Annular Tube having Internal Circular grooving at Different pitches - A Review", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 7 Issue 6, pp. 268-274, November-December 2020. Available at

doi : https://doi.org/10.32628/IJSRSET207645

Journal URL : http://ijsrset.com/IJSRSET207645