WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

To Increase the Efficiency of Heat exchanger by Modification in its Proper Design

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A B S T R A C T

Heat exchangers are very useful device to transfer heat from higher temperature to lower temperature. Heat can be transferred in refrigeration system also in the machines who are continuously working for number of hours. Due to continuous working of the machines number of parts and different equipments are going to be damaged due to continuous heat production. Therefore heat must be removed in proper way for the best life of equipment.

Now a day's different materials are available for the making of heat exchanger. Before number of years heavy metals were used for the production of heat exchanger but it was not so much effective to transfer heat from higher temperature side to lower temperature site. So before 150 years ago aluminium work found and research was done on the metal of aluminium and it is found that it is very effective material from which developer can make the heat exchanger at lower rate and heat can be transferred in effective way.

It is also noticeable that Aluminium is a best material for making the heat exchanger but its use that whenever it is exposed to the chemical it is corroded frequently and pitting of the material is occurred within short time. So aluminium cannot be used in highly concentrated chemical industry due to its material limitation.

Keywords: Heat exchanger, Heat transfer rate, Lower temperature side, Heat loss, Heating of element, Efficiency of Heat exchanger,

1. Introduction.

New Era number companies are working to make the efficient heat actions to reduce the consumption of electricity. As issue is that if it is not transferred in proper way then electrical consumption will be increased because less efficient heat transfer rate. Therefore effective material should be select for proper heat transfer.

As ongoing research and activities are also carried out for making a perfect heat exchanger. Some time space is issue for the transfer of heat so exhaust fan cannot be installed at a frequent solution. So small amount of heat may be transfer by only effective design and remaining heat can be transferred by exhaust fan with small dimension. As number of advantages and disadvantages are available for the design and analysis of heat exchanger. It is also observed that when Aluminium is effective but it can't get up with some chemical so it is replaced by other metal.

Stainless steel is most effective material to make the heat exchanger. It is also capable to transfer heat from higher too lower side with less time. So in some industries SS is preferred to reduce the risk of pitting and also other chemical issues. Price of SS is also affective compare to the other metals. But SS has lower heat transfer rate compare to the Copper. So copper is used mostly compare to the SS.

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Heat exchanger is widely used in refrigeration industries to remove heat from condenser. It is also useful for making small refrigeration – domestic refrigeration to transfer heat. In domestic refrigeration small amount heat transferred but in industrial refrigeration system large amount of heat is transferred so proper section of martial is necessary to reduce the consumption of electricity.

Nomenclature

SU	Super heating
Heat exchanger tem	Temperature of Heat exchanger (%)
Con.	Condenser
Refr.	Refrigerant
Effici.	Efficiency
Eff of Eva.	Evaporator efficiency
Heat Tr.	Heat transfer
HE Temp	Temperature of Heat exchanger .
Cool HE =	Heat exchanger cooling rate

2. Recent trends for Heat Exchangers

The heat exchanger is an equipment which can exchange the heat from the hot fluid to the cold fluid. It concludes two fluid, one temperature is higher, gives off heat; the other kind of fluid temperature is low, absorption of heat. Due to the development of science and technology, the variety of heat exchanger emerges in endlessly, but it can be in accordance with certain rules to distinguish Number of heat exchangers are available like condenser compressor, Evaporator ,expansion device and all heat exchangers are used in Air conditioning systems. Basically in Air conditioning system heat is removed from inside space to the atmosphere. The space which is to be cold is at lower temperature and outside temperature is higher. According to the direction of hot fluid and cool fluid flow can be divided into downstream type, counter-current type and mixed flow. For various types of heat exchanger improved heat transfer technology research, mainly concentrated in the fluid flow changes inside the heat exchanger and the research on parameter optimization of components of two aspects, and the parameters of the main research object is the heat exchange tube heat exchanger components (plate) arrangement (rows or fork), (plate) heat exchange tube row number, heat exchange tube size (plate) spacing, fin spacing, fin shape and other options are also available.

2.1 New Era for modification in Heat exchanger design :

Welded plate heat exchanger [1]: sealing welding structure to replace the rubber pad, the welding type and semi welded plate heat exchanger, eliminating the temperature resistant gasket material corrosion, pressure limit. For corrosive medium using plate heat exchanger, in recent years has also been greatly developed. Germany and Japan cooperation a BAVARIA hybrid welded plate heat exchanger, the operating pressure from vacuum to 6MPa, the operating temperature of 200~900, a single heat transfer area of F is 3~2000m^2. Can be used for gas - gas, liquid gas, and liquid-liquid heat transfer and steam condensation. Pacino heat exchanger [2]:A plate heat exchanger with all parts welded and without sealing ring. It consists of the pressure vessel shell and the heat transfer plate bundle, as shown in fig.1.

It is clear from the Figure 1 that cold fluid is entering from the downward direction and the heat of the hot fluid is transferred with the help of heat exchanger to the cold fluid. Heat exchanger is made from different alloys and it can also be made from the aluminium and Steel material for the best heat transfer process. In heat exchanger thickness of the heat exchanger is optimised for the best transfer rate.

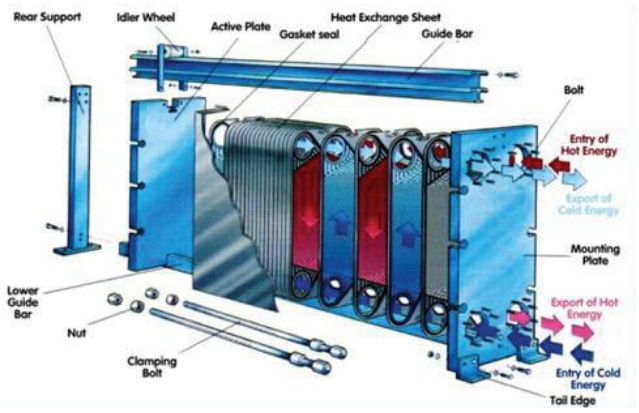


Fig 1 Heat exchanger with extra heat removal surface.

Till date it is observed that for domestic refrigeration systems number of fins is available but till it is not perfectly advisable for the best heat transfer process. In India and abroad number of experiments were done to get the best right for the heat transfer in the films of refrigeration system but theoretically and empirically it is not possible to find out the best transfer process for the heat exchanger.

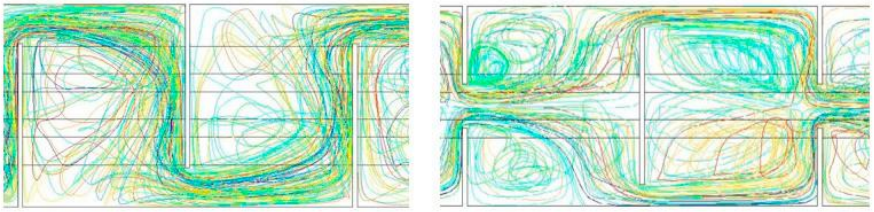


Figure 2 Shell and Tube heat exchanger

The baffle spacing for all the three types of baffles is kept same which ensures that all the other geometrical parameters remain the same. This leads to a comparison between the three baffles types. The working fluid in shell side is water with a specific heat of 4185 J/kgK. Water being a Newtonian and incompressible fluid, its thermo-physical properties remains constant over a considerable range of temperature. The heat exchanger is assumed to be newly built and thus has negligible fouling resistance and leakage between parts in contacts is very small.

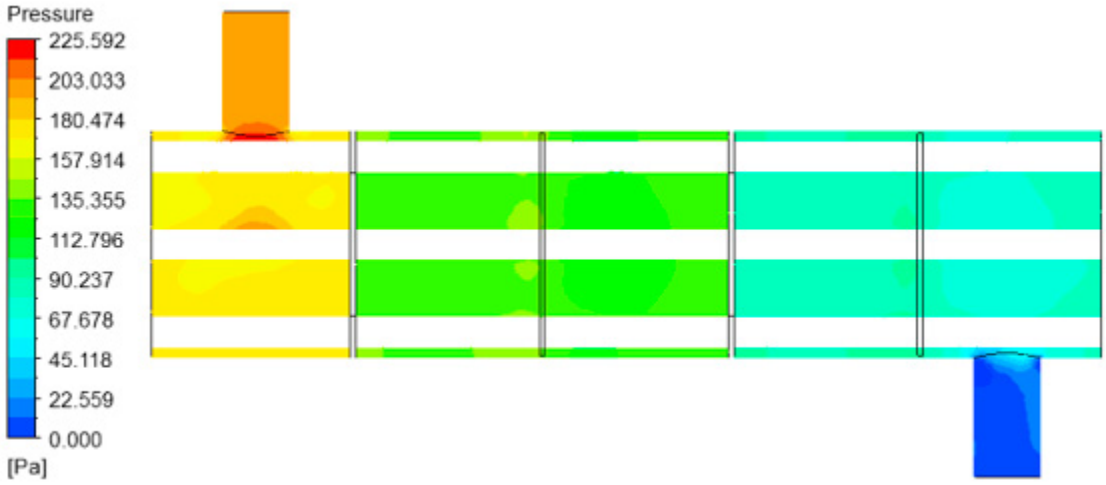
3. Outcome of Baffles arrangement

It is also observed in the research that for single line of flow there zigzag shape is achieved but it is not as effective to the other flow. Due to lower efficiency pump work is in increased and over all electricity consumption increases. To solve this issue double segmental baffles are used therefore pressure drop can be maintained at certain level. In single segmental baffles there is large area of dead zone there for heat transfer rate is decreased and pressure drop increases at high rate. To overcome this issue double segmental baffles are introduced therefore heat transfer rate is also increased but Prasad drop decreases at certain level and it can be maintenance to the required quantity.

It is observe that heat transfer rate is increased in better way but the other side pressure drop increases rapidly therefore overall efficiency of the systems goes down due to pump working. It is also noticed that it is transferred very well but pump is working extremely higher rate there for our consumption is increased and it is directly affect with the cost and overall efficiency of the plant.

Double segmental and its effect

In double segmental baffles it is observed that heat transfer rate increases but it also maintains the level of pressure. There is no drastic down in pressure but it is maintained at particular level. So pump work is not increased to the maximum level. So this type of heat exchanger is a optimistic design for the best heat transfer process. Mass flow rate is also important parameter for the best heat transfer rate. In this design mass flow rate is not highy restricted and it can for with maximum possible way.



4. Conclusion

It is also noticeable that the material of the heat exchanger is very important matter for the transfer of heat from hot side to cold side. Aside a selection of the material the design of baffles is also very important because the too clog design can restrict the flow of fluid and too wide direction can reduce the contact of fluid so heat transfer rate is deceased. For best heat transfer rate CFD tool is important with the help of which the optimum design of the heat exchanger can be done and also experimental results also shows that the double segmental v\baffles are more effective compare to the single segmental baffle. Pressure drop is also a effective criteria for the concern to power consumption. As pressure is higher it will directly increase the working of pump and power consumption will be increased.

So one has to take in mind that beside a heat transfer rate pressure should not be drop at certain level. To maintain this criteria the double segmental heat exchanger is introduced and the heat transfer and pressure drop both the parameters are adjusted to the desire level. Critical analysis is also important to carry out the outcome of thickness of the heat exchanger wall for better heat transfer rate.

Acknowledgements

We are thankful to of Team members and staff of our Institute for helping us in this article. The team member of other team also helped us for the preparation of the paper and guided us about the same. There is also a great support from the various lab assistants from the Institute and other technical staff for this paper publication work.

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