

Heat Treatment Enhancement Of Counter Flow Heat Exchanger By Api Sn And Super Kool Xtra

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Abstract: We all know that heat exchanger is one of the equipment to transfer the heat between the fluids. Heat will transfer from one side of fluid to another side of fluid. In this project we are using counter flow heat exchanger. In this heat exchanger one kind of fluid will come from one side and another kind of fluid will come from another side. Both fluids will be sending inside to the tube in opposite direction. Here we are using two medium one is hot fluid and another one is APISN (American Petrol Institution of Super Natural) with B grade oil. Inside of apparatus we are using copper tube, to enhance the heat transfer. Because that copper is having higher thermal conductivity (385 W/m K). when we compared to the carbon steel (19 W/m K), copper is having more thermal conductivity. The reason for choosing copper tube is not only higher thermal conductivity; it's also having properties like corrosion resistance, max allowable stress and internal pressure. Hot fluid will be send through the way of inside of the copper tube. Over the copper tube will send APISN oil, both will be send in an opposite manner. In a setup of counter flow heat exchanger, we put two holes with some dimension. When the fluid goes inside of the tube we insert the digital thermo-meter to note down the temperature of both inlet and outlet. After taking all reading we will evaluate the counter flow heat exchanger with term of efficiency.

Keywords: heat exchanger, counterflow, APISN, XTRA KOOL oil, copper

I. Introduction

1.1. Heat Exchanger:

Heat exchange is equipment in which the process of heating or cooling occurs; the heat is transferred from one liquid often cooled to another liquid often heated. The transfer of heat in an exchanger between two liquids could be move out through direct contact of transmission through the value separating the fluids. The previous type is called direct contact heat transfer while the later as regenerators, surface heat exchanges. The process of heat passes occurs through direct contact and mixing of the hot and cold fluids.

There are three primary classifications of heat exchangers according to their flow arrangement. In parallel-flow heat exchangers, the two fluids enter the exchanger at the same end, and travel in parallel to one another to the other side. In counter-flow heat exchangers the fluids enter the exchanger from opposite ends. The counter current design is the most efficient, in that it can transfer the most heat from the heat (transfer) medium per unit mass due to the fact that the average temperature difference along any unit length is higher. See counter flow exchange. In a cross-flow heat exchanger, the fluids travel roughly perpendicular to one another through the exchanger.

For efficiency, heat exchangers are designed to maximize the surface area of the wall between the two fluids, while minimizing resistance to fluid flow through the exchanger. The exchanger's performance can also be affected by the addition of fins or corrugations in one or both directions, which increase surface area and may channel fluid flow or induce turbulence.

The driving temperature across the heat transfer surface varies with position, but an appropriate mean temperature can be defined. In most simple systems this is "log mean temperature difference" (LMTD). Sometimes direct knowledge of the LMTD is not available and the NTU method is used.

1.2. Principle Of Heat Exchanger:

In a heat exchanger, the fluid flows can be performed in multiple arrangements. One can easily show that thermodynamically, the most efficient heat exchanger is the counter-flow heat exchanger, but other concerns than the thermodynamic effectiveness are taken into account when designing a heat exchanger: the maximum permissible temperatures in one fluid, or more often considerations of size, weight or cost. It follows that the configurations of exchangers that are encountered in practice are relatively numerous. However, we can gather these configurations in three main geometries:

- counter-flow: in which fluids flow in parallel and in opposite directions;
- parallel-flow: in which fluids flow in parallel and in the same direction;
- cross-flow: in which fluids flow in perpendicular directions. We will denote the hot fluid by index h, and the cold fluid by index c. It is based on the principle that heat transfer takes place between two bodies at

different temperatures, from the one at a higher temperature to one at a lower temperature. In which fluid is having a higher temperature when we compared to other fluid. That temperature will be transferred from higher temperature medium to lower temperature medium. Besides the geometric configuration, exchanger sizing or performance depends on many parameters.

In what follows, we will assume that the heat exchange coefficients U_h and U_c and thermophysical properties of fluids maintain a constant value at any time in the entire heat exchanger. If this assumption is not verified, then in order to study the performance of the exchanger, it is necessary to divide it into small volume elements, in which these properties can be considered constant. The calculations are then much more cumbersome. Finally, we always assume that the heat exchanger is globally adiabatic, that is to say, there is no heat exchange with the surroundings.

II. Experimental Set-Up Of Counter Flow Heat Exchanger



Fig No.1. Experimental Set-Up of Counter Flow Heat Exchanger

In an experimental set-up of counter flow heat exchanger is consider some of the equipment. Even that all instrument's is play major role in this project. we use around six equipment's to this project. We listed below the equipment's which are all we used.

The equipment's are:

- Pump
- Copper tube
- Digital thermometer
- Thermocouple
- Gate valve
- Heater

III. Result And Discussion

S.NO	T_s	T_{h_i}	T_{h_o}	T_{c_i}	T_{c_o}
1	35	29.5	25.3	32.8	33.7
2	40	36.2	31.7	32.8	34.2
3	45	41.7	37.1	32.8	34.6
4	50	46.6	36.8	32.8	36.2

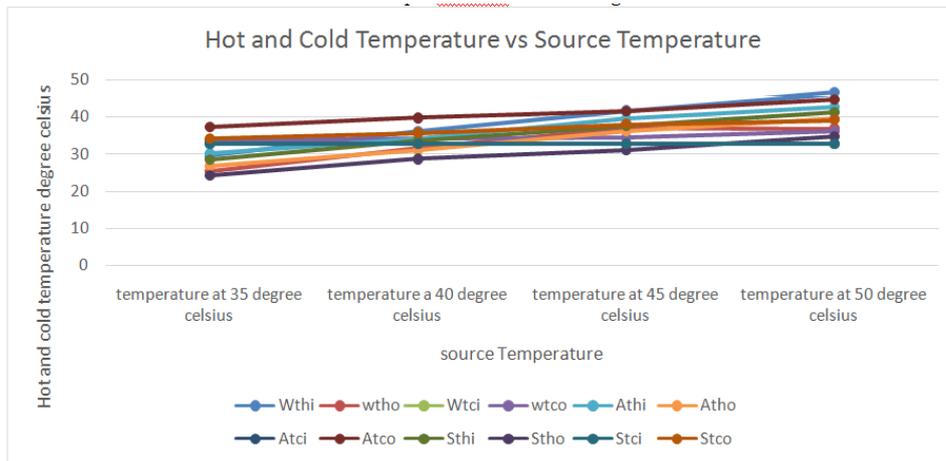
ALL READINGS ARE IN ° C Table no: 1. Water Test Reading

S.NO	T_s	T_{h_i}	T_{h_o}	T_{c_i}	T_{c_o}
1	35	30.1	26.7	32.8	37.3
2	40	34.2	31.6	32.8	39.7
3	45	39.6	36.1	32.8	41.5
4	50	42.7	39.4	32.8	44.6

Table no: 2. APISN oil

S.NO	T_s	T_{h_i}	T_{h_o}	T_{c_i}	T_{c_o}
1	35	28.6	24.2	32.8	34.2
2	40	33.7	28.6	32.8	35.7
3	45	37.5	31.1	32.8	38.6
4	50	41.2	34.7	32.8	39.1

Table no: 3. Super koolxtra Test Reading



Graph.1.Hot and Cold Temperature vs Source Temperature

IV. Application

Heat diffusion bonded heat exchangers are utilized in a wide range of industrial applications including the oil and gas industry, power generation, chemical processing and more. There are over 2,500 Heat exchangers currently in active operation, with an international customer base benefiting from the plethora of monetary, special and performance related benefits our products afford.

Oil and gas industry:

This innovative technology provides customers with a multitude of important benefits including superior capabilities at extreme temperature and pressure, as well as a far more compact size compared with other heat exchanger products on the market (PCHE exchangers are up to 85% than shell and tube exchangers).

Power generation:

A safe, reliable and low cost electrical energy supply is critical to ensuring power continuity in the future. Heat technology can be used to optimise the effectiveness of plants in a variety of important niche applications such as;

1. Energy recovery
2. Energy storage
3. Solar thermal energy

Industrial gases:

With the high level of energy demanded by cryogenic air separation, Heat can help customers in this market to optimize performance while still minimizing costs.

The arrival of novel plant and other air processing technology involving Heat exchanges can significantly enhance effectiveness while reducing the overall footprint of the equipment.

V. Conclusion

The analysis of heat exchangers with unknown outlet temperatures is a straight forward matter with the effectiveness–NTU method but requires rather tedious iterations with the LMTD method. When all the inlet and outlet temperatures are specified, the size of the heat exchanger can easily be determined using the LMTD method. This project mainly done according to our future project in conditioning the room temperature. So, that this is our view where we have sustained that these oil grades can be used to change the room temperature fast. As we have used two grades of oil and water in that the APISN oil grade gives the more efficiency than the water and super koolxtra. Normally, API SN gives more efficiency. Eventhough we have used copper tube to give more efficiency than the normal API SN due to thermal conductivity of the copper.

Reference

- [1] Ackerman, R. A., 1997, Cryogenic Regenerative Heat Exchangers, International Cryogenics Monograph Series, Plenum Publishing, NewYork.
- [2] Afgan,N.,M.Carvalho,A.Bar-Cohen,D.Butterworth,andW.Roetzel,eds.,1994, New Developments in Heat Exchangers, Gordon & Breach, NewYork.
- [3] Afgan,N.H.,andE.U.Schlunder,eds.,1974,HeatExchangers:DesignandTheory Sourcebook, McGraw-Hill, NewYork.
- [4] Andreone, C. F., and S. Yokell, 1997, Tubular Heat Exchanger: Inspection, Maintenance and Repair, McGraw-Hill, NewYork.
- [5] Azbel, D., 1984, Heat Transfer Applications in Process Engineering, Noyes Publications, Park Ridge,NJ.
- [6] Bar-Cohen, A., M. Carvalho, and R. Berryman, eds., 1998, Heat exchangers for sustainable development,Proc.HeatExchangersforSustainableDevelopment,Lisbon, Portugal.

- [7] Bhatia, M. V., and P.N. Cheremisinoff, 1980, Heat Transfer Equipment, Process Equipment Series, Vol. 2, Technomic Publishing, Westport, CT.
- [8] Blum, C., et al., 1985, Ceramic Heat Exchanger Concepts and Materials Technology, Noyes Publications, Park Ridge, NJ.
- [9] Bohnet, M., T.R. Bott, A.J. Karabelas, P.A. Pilavachi, R. Se´me´ria, and R. Vidal, eds., 1992, Fouling Mechanisms: Theoretical and Practical Aspects, Eurotherm Seminar 23, Editions Europe´ennes Thermique et Industrie, Paris.
- [10] Bott, T.R., 1995, Fouling of Heat Exchangers, Elsevier Science Publishers, Amsterdam, The Netherlands.
- [11] Chisholm, D., ed., 1980, Developments in Heat Exchanger Technology, Vol. I, Applied Science Publishers, London.
- [12] Ramesh R*, Dr.R.Vivekananthan., (2014) 'Al₂O₃ Nanofluid For Heat Transfer Enhancement In Aircraft Systems'. International Journal of Innovative Research in Engineering Science and Technology ISSN 2320-981x, 64–68.
- [13] Ramesh R, Dr.R.Vivekananthan "Application of Al₂O₃ Nanofluid for Enhance Heat Transfer Rate in Shell and Tube Heat Exchanger" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN: 2278-1684, p-ISSN: 2320-334X, Volume 11, Issue 2.