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A Review: Design, Analysis & Optimization of Pipe Stack Heat Exchanger (22 m)

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Abstract - In present day the Shell and Tube Heat Exchanger is the most common type heat exchanger used in industries. The shell-and-tube heat exchanger which is the majority type of liquid-to-liquid heat exchanger. Which is used as feed water cooler in process industries, oil refineries, chemical plants and power plants because it suits high pressure application. Solid works software is used for modeling the shell and tube type heat exchanger which will be used for water chilling application in industry. In this we are going to do modeling of the heat exchanger according to the given working parameters and specifications given by the industry. After modeling of the heat exchanger analysis is done in solid works to determine the strength according to the working conditions. And if failed in the analysis then remodeling is done by changing the parameters to save the heat exchanger. After the model is safe the fabrication drawing is send to the floor shop.

Keywords: - pipe stack heat exchanger, performance analysis, Solidwork, CFD analysis.

1. INTRODUCATION

1.1 Heat Exchanger

Heat transfer equipment is defined by the function it performs in a process. The purpose of any such device is to maximize the heat transferred between the two fluids. However, the problem that occurs is the parameters that increase the heat transfer also increase the pressure of the fluid flowing in a pipe which increases the cost of pumping the fluid. S.P.Kamble [19]. Therefore, a design that increases the heat transferred, but at the same time can keep the pressure drop of the fluid flowing in the pipe to the permitted limit, is very necessary. A common problem in industries is to extract the maximum heat from the utility stream emanating from a particular process and to heat a process flow.

Fig.1: Stack Pipe Heat Exchanger [2]

A solution to extract the maximum heat may be to increase the heat transfer area or to increase the coolant flow rate, but both solutions increase the cost of pumping so it is not advisable to increase these parameters without pressure drop considerations. Prabhat k. [1]

2. REVIEW OF LITERATURE

According to our previous work, there are three types of flow distributions in a central type of flow parallel heat exchanger. And for each different flow distribution type, the effect of variation of geometry parameters is different. Therefore, it is necessary to examine separately the effect of header match on the flow distribution for each type of flow distribution.

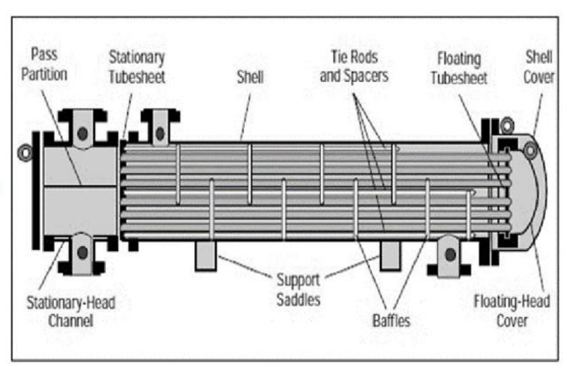

Fig.2: Basic Diagram of Heat Exchanger [8]

The detailed procedure of the solution is to select different values of AR from different types of flow distributions. Then, for the current AR, choose the header diameter as a combination of the header diameter and change the DCR (the ratio of the cross section of the division of the combination header) by separating the divider header. Jian Zhou. [4]. Ebio, c. E. [5] In his experimental paper, performance analysis and analytical method excluded from shell and tube heat exchanger were used to develop correlation for performance analysis. Thermal analysis of the shell and tube heat exchanger involves the determination of the overall heat-transfer coefficient from the individual film coefficients.

Mohammed Rabih V [٤] Design of Shell and Tube Heat Exchanger: The process of design starts with providing standard dimensions of tube length and diameter which form the Association (TEMA) in MATLAB code proposed by Synergy Exchange. The program is run by iterating with a possible combination of standard dimensions and the overall heat transfer coefficient (U) is obtained in each case. The obtained values of U are compared and the corresponding dimensions for the maximum value are obtained as output.

3. DISCUSSION

In this project we have to process a modification in a heat exchanger design for increasing the current efficiency to better step. Also it optimizes the cost of better heat exchanger.

Almost four type of modification are to be done as follows

1. Baffle position
2. Baffle cut percentage
3. Tube sheet pattern
4. Selection of tube material

As this above four parameter consideration we optimize the heat transfer rate and pressure drop of heat exchanger. We use a standard for calculation as below

1. Kenn's
2. TEMA
3. Belldelware

Then we have to done analysis of project aspects. Briefing of project from starting is first we design all part in catia software then we have to assemble all assembly. As this our model will be produced after assembly.

After that we have to done an analysis on this model. Analysis contains some calculation, result and conclusion. We have done a material selection, costing, BOM Analysis.

Finally we have to done CFD to analyze proper functioning of working fluid. All process we have done under observation. Total duration of project almost 7 to 8 month as this is our final year project.

Also we have to study about cold flow and hot flow as well as parallel and counter flow.

4. CONCLUSIONS

Special types of heat exchanger are chosen because it favors the avoidance of internal pressure loss, as a result, increases the surface of the heat exchange, due to the fact that external irreversibilities in water lessen the thermodynamic value of the revival cycle. Anyway, the cold section is given greater amplitude than the hot section, because entropy variation occurs when the temperature is minimum due to thermal irreversibilities.

• The rate of heat transfer can be increased by varying the tube diameter, length, and tubes.

• Can be improved by changing the pitch take-out rate of heat transfer. Changing the temperature of the tubes and the medium rate of heat transfer can be increased.

• The heat transfer rate can be improved by changing the material of the tubes.

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