DESIGN AND THERMAL ANALYSIS OF HEAT EXCHANGER TUBES USING ANSYS

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ABSTARCT: A tubular exchanger can be designed relatively high heat and high pressure atmosphere pressure differences between the fluids. E tubular exchangers are mainly used for liquid to liquid. An attempt was made in this work it is to design a shell and tube heat by modeling techniques in CATIA V5 taking the inside diameter of the housing of 400 mm, and the length of the casing mm outer diameter 700 and 12.5 mm tube , the tube length is 800 mm and steel Oualemwad Shell 1008, a tube material as copper and brass. Shell made using modeling Assembly and pipes with water as the average case. Using ANSYS software and thermal analysis of the heat exchangers shell and tube, changing the tube material.The comparison between the experimental results, ANSYS. With the help of numerical results are available, and the design of shell and tube heat exchangers can be changed to improve efficiency

I. INTRODUCTION:

Knowledge of thermodynamics deals with the quantitative changes and reorganize energy as heat in the bodies of matter. Heat transfer is the science that deals with the rate of heat exchange between the hot and cold bodies and called the source and receiver. When it vaporizes and kg of water or a capacitor, and the change in power in any process is identical. However, rates are going to either a different process steam being much faster than condensation.The main difference between thermodynamics and heat transfer is that the first concerns the relationship between heat and other forms of energy, while the second concerned with the analysis of the rate of heat transfer. Thermodynamics deals with equilibrium systems so that they can not wait to quantitatively predict the percentage change in the process, resulting nonequilibrium. And heat transfer generally associated with fluid dynamics and also complements the laws of thermodynamics, providing additional rules for determining the rates of energy transfer. heat transfer process to cope with the heat exchange rates and the drop in heat transfer equipment engineering process. This approach combines better focus on the importance of the temperature difference between the source and the receiver, that is, after all, the driving force is achieved by heat transfer. A typical process heat transfer problem relates to the amount of heat that the fees can be transferred due to the nature of the bodies, and leadership potential becomes, and the length and order of surface separation of source and receiver, and the amount of mechanical energy which can be expanded to facilitate the transfer. Since heat transfer involves the exchange in the system, and loss of body heat and one equals the heat absorbed by another within the same system boundaries.

II. INTRODUCTION TO HEAT EXCHANGERS

A Heat Exchanger is a device used for affecting the process of heat exchange between two fluids that are at different temperatures. Heat Exchangers are useful in many engineering processes those in refrigerating and air-conditioning systems, power systems, food processing systems, chemical reactors and space or aeronautical applications.

Classification Of Heat Exchangers

Classification Based On Working Features:

The heat exchangers are mainly divided into three categories according to their working features

1. Closed type exchanger
2. Regenerators
3. Open type exchangers or mixed type

(A). CLOSED TYPE EXCHANGER :

Closed type exchangers are those in which heat transfer occurs between two fluids, which do not mix, or physically in contact with each other. The fluids involved are separated from each one other by a pipe or a tube wall or any other surface, which may be involved in heat transfer path. Heat transfer will occur by convection from the hotter fluid to the solid surface, by conduction through the solid and again by convection from the solid surface to the cooler fluid. Most of the heat exchangers come under this category. Our discussion will be related to this type.

(B). REGENERATORS:

The regenerators are storage type heat exchangers. The heat transfer surface or elements are usually referred to as a matrix in the regenerator. Regenerators are exchangers in which a hot fluid, then a cold fluid, flows through same space alternatively with as little mixing as possible occurring between the two streams. The surface that receives releases thermal energy. Such a device is important. Material properties of surfaces involved as well as fluid flow properties of the stream along with geometry are qualities that must be known. The analysis needs knowledge of unsteady state convection and conduction. In steam power plants, the air pre-heaters are usually rotor regenerator type.

(C). OPEN TYPE OF EXCHANGERS OR MIXED TYPE:

Open type heat exchangers, as the name implies are devices where in the entering fluid stream flow into the open chamber and complete mixing of the two streams occurs. Hot and cold fluids entering such an exchanger will leave as a single stream.

Analysis of open type involves the law of conservation of mass and laws of thermodynamics. Jet condensers used for cooling the water circulated through the condensers in power plants come under this category.

III. PARALLEL FLOW EXCHANGER:

In parallel flow exchanger the fluid streams enter together at one end, flow parallel to each other in the same direction and leave together at other end. This arrangement has lowest exchanger effectiveness among the single pass exchanger for given overall thermal conductance and fluid flow rates. In a parallel flow exchanger, a large temperature difference between inlet temperatures of hot and cold fluid exists at the inlet side, which may include high thermal stresses in the exchanger wall at the inlet. This flow arrangement is not used for applications requiring high temperature effectiveness.

IV. CONDENSERS:

Condensers are used in power plants, chemical plants and refrigeration systems. Large power plant condensers are called surface condensers. Steam condensers consist of a bundle of small diameter tubes laced inside a metal shell. The exhaust steam from the turbines passes over the tubes and cooling water in the tubes.

V. COOLERS:

When a fluid at high temperature is to be cooled to a lower temperature, coolers are used. For example oil coolers and air coolers are used to cool the lube oil that is to cool the bearings and other surfaces of the large machinery like turbines. The most common type used is the shell and tube type of heat exchanger. Introduction To Oil Cooler Large amount of heat is generated at the bearings of rotating machinery. In addition to this, heat from working steam/fluid is conducted by the rotating shaft. To remove this excess heat lubricating oil is circulated through the bearings. In the closed cycle operation of oil circuit one or more coolers are placed on the discharge side of the oil pump. The oil coolers that receive oil, absorb the waste heat, cools it to the temperature that is required at the bearings. The cooling water for the oil coolers is the same as that for the main condenser. It is usual to provide two coolers of 100% capacity such that one is always available as a standby. The coolers are mounted vertically/horizontally for easy removal of the tube nest. A change over valve of three-way type is provided to direct the flow of oil into one of the operating coolers as desired.

VI. RESULTS AND DISCUSSION:

A. All Set-ups for the Analysis: Shell and Tube heat exchanger used in this project analysis, is a single pass four tube and one shell with a parallel flow feature. During the analysis the tube material changed basically I three types of is steel, second one is an aluminium and third one is a copper. By the analysis the effect of material has bee examined.

B.Set-up ad boundary condition:

	Temperature	Mass flow rate	Pressure at outlet
Hot water in tube	90 c	2 kg/s in each tube	1 atm
Cold water in cell	27 c	40 kg/s in cell	1 atm

In this analysis the two types of water are passed through the shell ad tube type heat exchanger, hot water is passed with the 90 degree C with the 2 Kg/sec each tube mass flow rate and the cold water is passed through the shell with the 27 degree C with the 40 Kg/Sec mass flow rate. Both of the fluid passed through the heat exchanger at the atmospheric pressure.

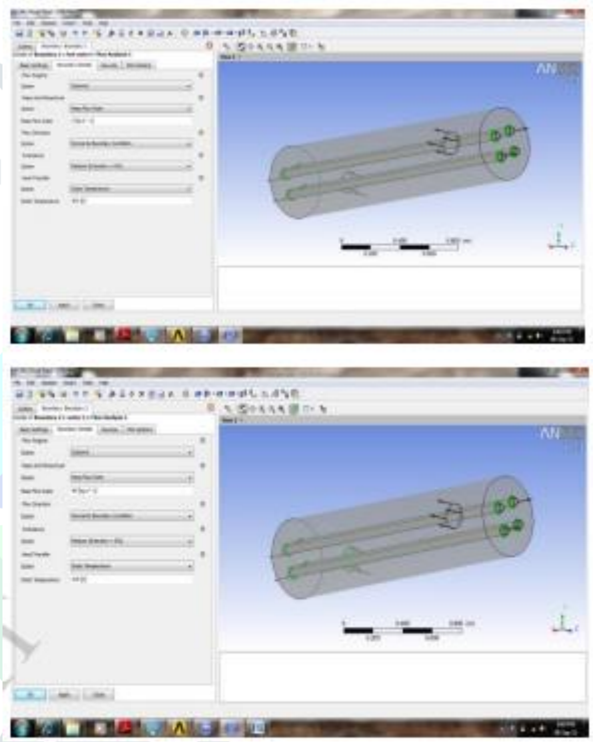
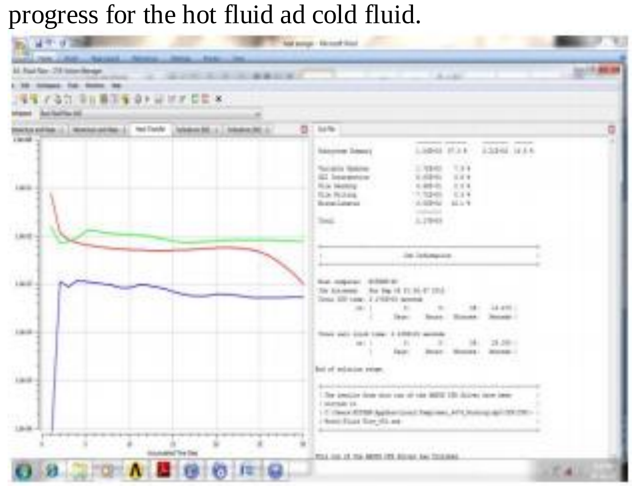


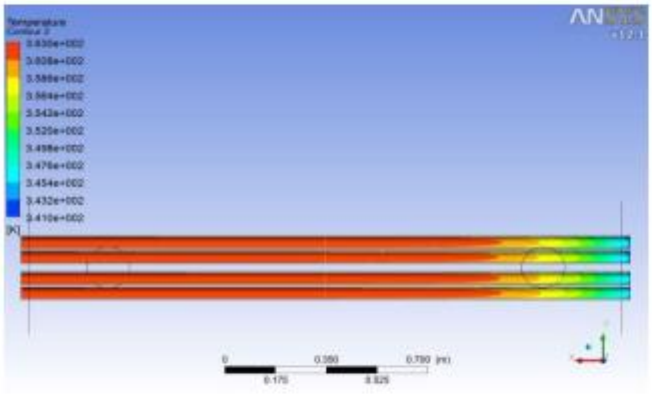
Fig: As show in the figure the fluid passed with the parallel flow heat exchanger ad the solution is ru I the ansys CFX

C.Results of the Aluminium Tube Heat Exchanger:

Above figure is shows the analysis progress where the set-up run for the results. Above figure shows the heat transfer progress for the hot fluid ad cold fluid.



D.Temperature of cold water:



After performing the analysis of heat exchanger, the maximum temperature produced during the analysis is 363 K ad minimum temperature produced is 341 K. minimum temperature is produced at the output of the cold fluid.

VII.CONCLUSION

After performing the all analysis work for the shell ad tube type heat exchanger, following observation we have observed. From the study of the result table as mentioned as above. After performing the calculation the fluid water the output temperature is 347 °C which is ear to the value mentioned I output temperature of ansys. As we change the material from the aluminium to the brass, temperature difference between input temperature and output temperature.

	aluminium		copper		
	Hot water	Cold water	Analytical Hot water	Hot water	Cold water
Max temperature	363 k	314.5 k	363 k	363 k	315.5 k
Min Temperature	341 k	300 k	347 k	337.6 k	300 k

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