DESIGN AND FABRICATION OF SPIRAL COILED RADIATOR

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ABSTRACT

Spiral tube heat exchangers are known as excellent heat exchanger because of far compact and high heat transferefficiency. An innovative spiral tube heat exchanger is designed for particular process engineering. A new arrangement for flow of hot and cold fluids is employed for design, hot fluid flows in axial path while the cold fluid flows in a spiral path. To measure the performance of the spiral tube heat exchanger, its model is suitably designed and fabricated so as to perform experimental tests. The paper gives analysis of spiral tube heat exchanger over the shell and tube heat exchanger.

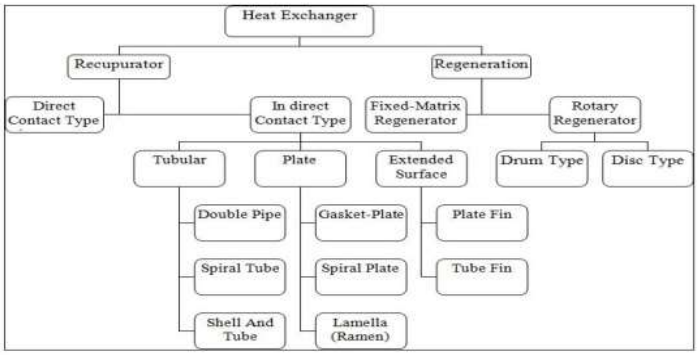
Key words — *spiral tube heat exchanger.*

1.INTRODUCTION

1.1 Heat Exchanger

One of the important processes in engineering is the heat exchange. The means of heat exchanger that to transfer the heat between flowing fluids. A heat exchanger is the process to transfer heat from one fluid to another fluid. The heat exchanger is devise that used for transfer of internal thermal energy between two or more fluids at different temperatures. In most heat exchangers, the fluids are separated by a heat transfer surface, and ideally they do not mix. Heat exchangers are used in the process, power, petroleum, transportation, air conditioning, refrigeration, Cryogenic, heat recovery, alternate fuels, and other industries. Common examples of heat exchangers familiar to us in day-to-day use are automobile radiators, condensers, evaporators, and oil coolers. Heat exchangers could be classified in many different ways.

1.2 Classification Of Heat Exchangers



Classification of Heat Exchangers

1.3 Tubular Heat Exchanger

Tubular heat exchangers are generally built of circular tubes ,although elliptical, rectangular or round/flat twisted tubes have also been used in some applications. There is considerable flexibility in design because the core geometry can be varied easily by changing the tube diameter, length, and arrangement. Tubular exchangers can be designed for high pressures relative to environment and high pressure differences between the fluids. Tubular exchangers are used primarily for liquid to liquid and liquid to phase change (condensing or evaporating) heat transfer applications. There are also used for gas to liquid and gas to gas heat transfer applications primarily when the operating temperature and pressure is very high or fouling is a severe problem on at least one fluid side and no other types of exchangers work. These tubular exchangers may be classified as shell-and-tube, double-pipe, and spiral tube heat exchangers. There are all prime surface exchangers except for exchangers having fins.

2.LITERATURE REVIEW

Heat exchanger is one of devices that is convenient in industrial and household application. These include power production, chemical industries, food industries, electronics, environmental engineering, manufacturing industry, and many others. It comes in many types and function according to its uses. So what exactly heat exchanger is? Heat exchanger is a device that is used to transfer thermal energy between two or more fluids, between a solid surface and a fluid at different temperatures and in thermal contact. There are usually no external heat and work interactions. In most heat exchangers, heat transfer between fluids takes place through a separating wall or into and out of a wall in a transient manner. (Shah R.K., 2003) This chapter will discuss about the uses and application of shell and tube heat exchanger, type of heat exchangers, and shell and tube heat exchanger.

3.EXPERIMENTAL SETUP

(i) Shell: The shell is constructed either from pipe or rolled and welded plate metal. For reasons of economy, low carbon steel is in common use, but other materials suitable for extreme temperature or corrosion resistance often are specified. Using commonly available shell pipe to 24” dia. Results in reduced cost and ease of manufacturing, partly ecause they generally are more perfectly round than rolled and welded shells.

(ii) Spiral coil: Spiral coil designs can be an effective use of space in heat transfer applications. Convection can be improved by switching from an inferior material such as aluminum or stainless steel (though CTCG makes tubing coils out of these materials as well) and adopting a spiral coil design. Finned tubing (though more difficult to manipulate) can add an even further benefit by maximizing the tube's exposure to air and thereby removing more heat.

(iii) Thermocouple: It is a temperature-measuring device consisting of two dissimilar conductors that contact each other at one or more spots. It produces a voltage when the temperature of one of the spots differs from the reference temperature at other parts of the circuit. in this paper j type thermo couples are used.

(iv) Digital temperature indicator: Is a device or smart label that shows the accumulated time temperature history of a product. Time temperature indicators are commonly used on food, pharmaceutical, and medical products to indicate exposure to excessive temperature (and time at temperature).

(v) Connecting pipes: Four pipes are connected for hot water inlet, hot water outlet, cold water inlet, and cold water outlets.

(vi) Water heat pipes: Water heater is used for heating the cold water to a desired temperature and for controlling the temperature a thermostat is fixed. Here the water 3KW, instant type This water heater outlet is connected to the hot water inlet of heat exchanger

4. WORKING

Shell was prepared in lathe with deferent operations as per dimensions. in the shell two holes drilled for inlet and outlet flowing of water. Two nipples were welded in holes for connecting pipes. Two flange plates were prepared as per dimensions using gas cutting operations. Two nipples also welded for connecting hot water inlet and outlet pipes. Copper tube is wounded 14 turns. Copper helical coil is inserted on to the shaft part. And finally all parts were assembled with help of nuts and bolts to make the shell air tight without water leaking. J-Type Thermocouples were attached at inlet and outlet connecting pipes for knowing inlet and outlet temperature of cold and hot water. The insulating rope is wound to heat exchanger for reducing for heat dissipating. Thermocouples were attached to digital temperature indicator. This digital temperature indicator is fixed in the panel board. Heat exchanger if fixed near to panel board.

5.ADVANTAGES

1 Because of the spiral flow paths imparted to the tube- and shell-side fluids, the effects of centrifugal force and secondary circulating flow enhance heat transfer on both sides in a counter flow arrangement.

2 The other fluid enters the unit at the periphery and moves towards the centre. The channels are curved and have a uniform cross section, which creates “spiraling” motion within the fluid.

3 The fluid is fully turbulent at a much lower velocity than in straight tube heat exchangers, and fluid travels at constant velocity throughout the whole unit, and thus the sticking of oil problem will be eliminated.

4 Spiral heat exchangers require small area for mounting resulting in lower unit installation cost compared with other.

6.DISADVANTAGE

spiral tube heat exchanger is that the Designs are proprietary – limited number of manufacturers. Features of spiral tube heat exchanger are describe below, Optimal design for corrosive fluid, High flow in a small path, Highly resistant to thermal and hydraulic shock, Bolted or all welded shell, Numerous flow path and connection configurations, Compact and lightweight, easy to install

7.CONCLUSION

It can be concluded that design methodology available in literature is in scattered manner. The previous works

carried out by different authors were limited to helical coil heat exchanger and spiral plate heat exchanger. The spiral tube heat exchanger is compact in size and more heat transfer can be carried out.

The objective of present work is to streamline design methodology of spiral tube heat exchanger. The designed spiral tube heat exchanger is required to be developed and experiments will be performed on it to analyses pressure drop and temperature change in hot and cold fluid on shell side and tube side.

By varying the mass flow rates the effectiveness is calculated and the conclusion from the result is by increasing the mass flow rate of cold water and hot water the effectiveness is reducing but the effect of mass flow rate of hot water reduces the effectiveness Rate of heat transfer can be improved by varying the tube diameter, length and no of tubes.

a. By changing the pitch lay out rate of heat transfer can be improved.

b. By changing the temperature of tubes and medium rate of heat transfer can be improved.

c. By changing the materials of tubes heat transfer rate can be improved.

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