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# DIFFERENT TYPES OF WINGED HEAT EXCHANGERS: A BRIEF STUDY

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**ABSTRACT:**

**The heat transfer surface is a surface of the exchanger's core that is in direct contact with fluids and through which heat is transferred by conduction. That portion of the surface that is in direct contact with both the hot and cold fluids and transfers heat between them is referred to as the primary or direct surface. To increase the heat transfer area, appendages may be intimately connected to the primary surface to provide an extended, secondary, or indirect surface these extended surface elements are referred to as fins.**

**INTRODUCTION:**

Heat is conducted through the fin and converted from the fin (through the surface area) to the surrounding fluid or vice versa. Depending on whether the fin is being cooled or heated. Heat exchanger is a device that is used to transfer thermal energy between two or more fluids, at different temperatures and in thermal contact. In heat exchangers, there are usually no external heat and work interactions. Typical application involves heating or cooling of fluid stream of concern and evaporation or condensation of single or multi component fluid streams. In most heat exchanger, heat transfer between fluids takes place through separating walls or into and out of a wall in transient manner. In many heat exchangers the fluids are separated by heat transfer surface and ideally they do not mix or leak. Such exchangers are referred to as direct transfer type. Exchangers in which there is intermittent heat exchange between the hot and cold fluids via thermal energy storage and release through the exchanger surface or matrix are referred to as indirect transfer type. Common examples ofheat exchangers are shell and tube exchangers, automobile radiators, condensers , evaporators, air pre-heaters, and cooling towers. There could be internal thermal energy sources in the exchangers, such as in electric heater andnuclear fuels elements. combustion and chemical reaction may take place within the exchangers, such as in boilers, fired heaters, and fluidized bedexchangers.

A heat exchanger consist of heat transfer elements such as core or matrix containing the heat transfer surface, and fluid distribution elements such as headers, manifolds, tanks, inlet and outlet nozzles or pipes, or seals or . Usuallythere are no moving parts in a heat exchanger. As a result. the addition of fins to the primary surface reduces the thermal resistance on that side and thereby increases the total heat transfer from the surface for the same Fins may form flow passages for the individual fluids but do not separate the two (or more) fluids of the exchanger. These secondary surfaces or fins may also be introduced primarily for structural strength purposes or to provide thorough mixing of a highly viscous liquid

Not only are heat exchangers often used in the process, power, petroleum, transportation, air-conditioning, refrigeration, cryogenic, heat recovery. alternative fuel. and

manufacturing industries. they also serve as key components of many industrial products available in the marketplace. These exchangers can be classified in many different ways. We will classify them according to transfer processes. Number of fluids, and heat transfer mechanisms. Conventional heat exchangers are further c1assified according to construction type and flow arrangements. Another arbitrary classification can be made, based on the heat transfer surface area/volume ratio, into compact and non compact heat exchangers. This classification is made because the type of equipment. fields of applications. and design techniques generally differ.

**Compact Heat Exchanger:**

In recent years, compact heat exchangers with corrugated plates are being rapidly adopted by food and chemical process industries, replacing conventional shell-and-tube exchangers. Compact heat exchangers consist of plates embossed with some form of corrugated surface pattern. The plates are assembled being abutting, with their corrugations forming narrow passages. This type of equipment offers high thermal effectiveness and close temperature approach, while allowing ease of inspection and cleaning.

Compact heat exchangers are characterized by having a comparatively large amount of surface area in a given volume, compared to traditional heat exchanger, in particular type shell & tube type. The most basic compact heat exchangers have volumes of less than 50% of that of a comparable shell & tubeheat exchanger, for given duty.

An essential component of many of these compact concept is heat and mass transfer enhancement. In this case some of main enhancement methods which are used in the implementation of compact system. Compact heat exchanger is highly efficient, allow greater amount of energy to be recovered between process streams, they are more versatile in terms of the number of process streams that can be handled. Some compact heat exchangers can handle only two streams, other can handle four or more with ease.

Even greater long term importance to the process industries is the ability to use compact heat exchanger manufacturing technology to integrate effective with other unit operations, such as reactor, in one unit.

Compact heat exchangers currently have only a modest share of the process industry heat exchanger market ( in order of 5-10%), their proportion of over all sales is growing. Compact heat exchangers sales are increasing at about 10% per annum, in a market where total heat exchangers sales are only rising about 1% per annum.

Compact heat exchanger offer a number of benefits, including

(a) Improved efficiency
(b) Smaller volume & weight
(c) Lower installed cost
(d) Multi stream & multi pass configuration
(e) Tighter control of conditions
(f) Improved safety

In order to be able to evaluate its performance, methods to predict the heat transfer coefficient and pressure drop must be developed. In this direction, CFD is considered an efficient tool for momentum and heat transfer rate estimation in this type of heat exchangers. The type of flow in such narrow passages, which is associated with the choice of the most appropriate flow model for CFD simulation.

**Types of Compact Heat Exchangers Tubular Heat Exchangers:**

These exchangers are generally built of circular tubes, although elliptical, rectangular, or round/f1at twisted tubes have also been

used in some applications. There is considerable flexibility in the 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 the 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. They are used for gas to liquid and gas to gas heat transfer applications primarily when the operating temperature and or pressure are high. These exchangers may be classified as shell and tube, double-pipe, and spiral tube exchangers. They are all prime surface exchangers except for exchangers having fins outside/inside tube.

**Shell and Tube Exchanger**:

This exchanger shown in Fig 1.1 is generally built of a bundle of round tubes mounted in a cylindrical shell with the tube axis parallel to that of the shell. One fluid flows inside the tubes, the other flows across and along the tubes. The major components of this exchanger are tubes (or tube bundle), shell, front end head, rear end head, barnes, and tubesheets.

A variety of different internal constructions are used in shell and tube exchangers, depending on the desired heat transfer and pressure drop performance and the method, employed to reduce thermal stresses, to prevent leakages, to provide for ease of cleaning, to contain operating pressures and temperatures, to control corrosion, to accommodate highly asymmetric flows, and so on.

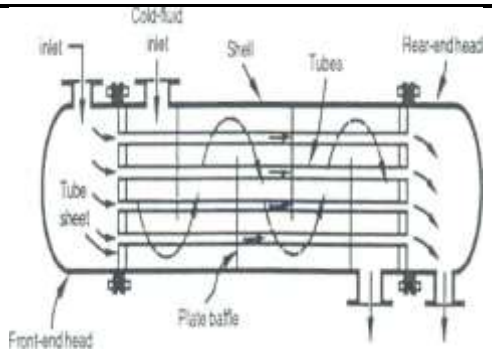


Figure 1.1 Shell and tube exchanger with one shell passand one tube pass

**1.2.1.2 Double Pipe Heat Exchanger:**

This exchanger usually consists of two concentric pipes as shown in fig.1.2 with the inner pipe plain or finned, as shown in Fig. One fluid flows in theinner pipe and the other fluid flows in the annulus between pipes in a counter flow direction for the ideal highest performance for the given surface area. However, if the application requires an almost constant wall temperature, the fluids may flow in a parallel flow direction. This is perhaps the simplest heat exchanger. Flow distribution is no problem, and cleaning is done very easily by disassembly. This configuration is also suitable where one or both of the fluids is at very high pressure.

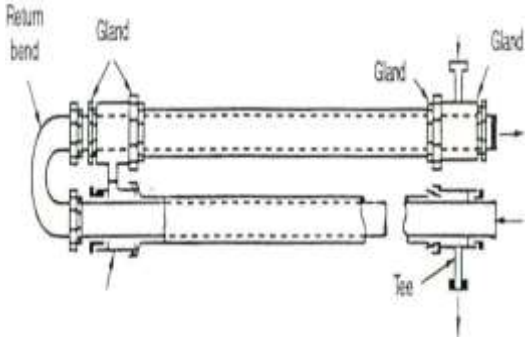


Figure 1.2 Double pipe heat exchanger

**Plate Type Heat Exchangers:**

Plate type heat exchanger s are usually built of thin plates. The plates are eithersmooth or have some form of corrugation, and they are either flat or wound in exchanger. Generally, these exchangers cannot accommodate very high pressure, temperatures, or pressure and temperatures difference. Gasketed type plate heat exchanger is most important type of heat exchanger.

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