Types of Heat Exchangers
Shell and tube, Plate type

In almost any power, chemical, or mechanical system, heat must be transferred from one place to another or from one fluid to another. Heat exchangers are used to transfer heat from one fluid to another. A basic understanding of the mechanical components of a heat exchanger is important to understand how they function and operate.

Introduction to Heat Exchangers

A heat exchanger is a component that allows the transfer of heat from one fluid (liquid or gas) to another fluid. Reasons for heat transfer include the following:
1. To heat a cooler fluid by means of a hotter fluid.
2. To reduce the temperature of a hot fluid by means of cooler fluid.
3. To boil a liquid by means of a hotter fluid.
4. To condense a gaseous fluid by means of cooler fluid.
5. To boil a liquid while condensing a hotter gaseous fluid.

Regardless of the function the heat exchanger fulfills, in order to transfer heat, the fluids involved must be at different temperatures and they must come into thermal contact. Heat can flow only from the hotter to the cooler fluid. In a heat exchanger, there is no direct contact between the two fluids. The heat is transferred from the hot fluid to the metal isolating the two fluids and then to the cooler fluid.

Classification and types of Heat Exchangers

Heat exchangers are classified in many ways:
• According to the type of construction (shell and tube type or plate type);
• In terms of fluid flow through the heat exchanger (recuperator, regenerator or evaporative type).

Although heat exchangers come in every shape and size imaginable, the construction of most heat exchangers fall into one of two categories: tube and shell, or plate. As in all mechanical devices, each type has its advantages and disadvantages.

Types of heat exchangers *Shell and tube type*

The most basic and the most common type of heat exchanger construction is the shell and tube type. This type of heat exchanger consists of a set of tubes in a container called a shell. The fluid flowing inside the tubes is called the tube side fluid and the fluid flowing on the outside of the tubes is the shell side fluid. At the ends of the tubes, the tube side fluid is separated from the shell side fluid by the
tube sheet(s). The tubes are rolled and press-fitted or welded into the tube sheet to provide a leak-tight seal. In systems where the two fluids are at vastly different pressures, the higher pressure fluid is typically directed through the tubes and the lower pressure fluid is circulated on the shell side. This is due to the economy, because the heat exchanger tubes can be made to withstand higher pressures than the shell of the heat exchanger for a much lower cost. Animation of typical shell and tube type heat exchanger is shown in the picture.

![Animation of shell and tube heat exchanger](image)

**Plate Type Heat Exchangers**

Plate type heat exchanger consists of plates instead of tubes to separate the hot and cold fluids. The hot and cold fluids alternate between each of the plates. Baffles direct the flow of fluid between plates. Because each of the plates has a very large surface area, the plates provide each of the fluids with an extremely large heat transfer area. Therefore a plate type heat exchanger, as compared to a similarly sized tube and shell heat exchanger, is capable of transferring much more heat. This is due to the larger area the plates provide over tubes. (Heat Exchanger Design Handbook.)
Plate Heat Exchanger

Due to the high heat transfer efficiency of the plates, plate type heat exchangers are usually very small when compared to a tube and shell type heat exchanger with the same heat transfer capacity. Plate type heat exchangers are not widely used because of the inability to reliably seal the large gaskets between each of the plates. Because of this problem, plate type heat exchangers have only been used in small, low-pressure applications such as on oil coolers for engines.

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