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BRAZED PLATE HEAT EXCHANGERS FOR DOMESTIC HEATING NEEDS

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Heat exchangers for chiller applications

Understanding the thermodynamic and transport properties of fluids - combined with simple calculations to define a specific heat transfer problem - will help you select the appropriate heat exchanger for your liquid chiller application.

Numerous types of heat exchangers are used in chiller applications. They serve the specific purpose of controlling a system's temperature by removing thermal energy. Although there are numerous sizes, levels of complexity and types of heat exchangers, they all use a thermally conducting element, typically in the form of a tube or plate, to separate two fluids so that one can transfer energy to the other. When selecting the proper type of heat exchanger, one faces the fundamental challenge of fully defining the problem to be solved, which requires an understanding of thermodynamic and transport properties of fluids. This knowledge can be combined with simple calculations to define a specific heat transfer problem and to select the appropriate heat exchanger to use.

Fluid Flow Properties

Fluid flow inside the heat exchanger is a major consideration when selecting what type of exchanger is the best choice in a specific application. Fluid flow will be either turbulent or laminar. Laminar flow heat transfer relies entirely on the thermal conductivity of fluid to transfer heat to the heat exchanger surface. Laminar flows have lower film coefficients than turbulent flows.

Turbulent flows rely not only on thermal conduction but also thermal convection due to the increased fluid movement created in this type flow, thus producing better heat transfer. The higher film coefficients create less resistance to heat transfer.

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The heat exchanger's fluid flow can be determined from its Reynolds number. If the Reynolds number is less than 2,300, the fluid flow will be laminar. Fully turbulent fluid flow has a Reynolds number greater than 10,000. The transition region between laminar and turbulent flow produces higher thermal performance as the Reynolds number increases.

The type of flow determines how much pressure a fluid loses as it moves through the heat exchanger. This factor is important because higher pressure drops require greater pumping requirements. Laminar flow produces less pressure drop and increases linearly with the flow velocity.

This heat exchanger consists of a vertical set of plates welded together to form a cavity through which the colder fluid flows while the hotter fluid flows over the outside of the plates. The hot fluid cools as the fluid film flows down the plates. Most falling-film plates are embossed with intermittent welds placed throughout the plate surface. They can be single (top right) or double (bottom right) embossed.


Many types of heat exchangers are utilized in chiller applications. These range from shell and tube, brazed plate, semi-welded plate, welded plate and vertical falling-film plate. Each has specific characteristics that should be considered during the engineering selection process of a chiller system.

Shell-and-tube heat exchangers are used in applications where high temperatures and pressure demands are of great consequence. This type of design consists of a bundle of parallel tubes typically in a U-tube configuration. The bundle is supported by a series of baffles, which also helps to direct the flow across the tubes. Tubesheets close the ends and separate the two fluids.

The process fluid typically flows through the tubes to take advantage of the higher pressure capabilities inside the tubes and ease cleaning. The thermal performance of the shell-and-tube design generally is less than a plate design but the pressure rating is generally higher.

Brazed plate heat exchangers, like other plate heat exchangers, provide higher turbulent flow and heat transfer coefficients in a much smaller footprint. The plate material is typically AISI 316 type stainless steel. The herringbone plates are vacuum brazed to form the heat exchanger.

Brazed plate heat exchangers provide a highly efficient compact unit that will conserve space and reduce fluid volume requirements. Dual-circuit and double-wall models allow for numerous design options. The major factor to take into consideration is the fouling factor of the smaller channels. Because these units cannot be dismantled,

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filtration should be used on these heat exchangers.

Another variation of plate heat exchangers is the semi-welded plate heat exchanger. This type of heat exchanger utilizes the chevron-plate design to increase turbulent flow within the plate channels. The semi-welded heat exchanger consists of two plates laser-welded together into what is called a cassette. Plate gaskets seal between each cassette, and the cassettes are bolted together between end frames to retain the complete cassette pack. One fluid flows in the welded channel while the other flows through the gasketed channel.

Semi-welded plate heat exchangers have the same inherent advantages as all plate designs: higher turbulent flows, greater heat transfer coefficients and reduced fluid volume requirements. The largest difference with this design is the opportunity for expansion and ease of opening the unit for repair or cleaning. Cassettes can be added to increase the capacity of the heat exchanger.

The vertical falling-film plate heat exchanger design takes advantage of a large surface area for heat and mass transfer at the boundary of the two fluid flows. This design utilizes a vertical set of plates welded together to form a cavity through which the colder fluid flows. The hotter fluid flows over the external sides of the plates and is cooled when the film of fluid flows down the plate length. Typically, the plates are made of stainless steel for compatibility with sanitary fluids. An upper pan controls the external fluid flow with holes located over the plates.

This type heat exchanger allows closer approach temperatures between the fluids. The internal design of the plate cavity is critical. Most of these type of plates have an embossed design with intermittent welds throughout the plate surface. This helps to increase the turbulent flow inside the plates for higher heat transfer coefficients.

By considering the characteristics of the different types of heat exchangers at the beginning of a chiller selection, a more efficient system can be achieved.

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 - ▶ June (10)
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 - ▶ April (6)
 - ▶ March (3)
 - ▼ February (14)

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