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Heat Exchangers Selection Guide

How to Size and Select Heat Exchangers

Heat exchangers are used throughout industrial processes whenever heat needs to be transferred from one medium to another. Understanding how to size and select a heat exchanger benefits both productivity and the bottom line. The Carotek Heat Exchanger Selection Guide provides a model of the heat exchanger sizing and selection process.

Types of Heat Exchangers

By its most basic definition, an industrial heat exchanger transfers thermal energy from one fluid to another without mixing them. Heat exchangers can be generally classified into a few main types:

Shell and Tube heat exchangers consist of a shell enclosing a number of tubes. Because they are widely used, these versatile heat exchangers are generally well understood. The shell and tube design helps these heat exchangers withstand a wide range of pressures and temperatures.

Plate and Frame heat exchangers are compact, efficient products designed with a number of stacked heat transfer plates clamped together within a frame. **Gasketed Plate** heat exchangers feature titanium or other nickel alloys for accurate fluid temperature control for heat recovery. These designs are often used for food or sanitary applications. **Brazed Plate** heat exchangers are constructed without gaskets, and they are suited for greater range of pressures and temperatures. Available in materials like copper or nickel, these corrosion resistant heat exchangers are suitable for many applications.

For any given application, there is usually more than one heat exchanger design that could be used. A starting point for heat transfer solution sizing and selection is to compare models that fit the temperatures and pressures required for the process. The best type of heat exchanger depends on design parameters, fluid characteristics, space, and budget.

Main Criteria for Heat Exchanger Sizing and Selection

These criteria are all key to the heat exchanger sizing and selection process:

- Function that the heat exchanger will perform (whether condensing, boiling, etc.)
- Pressure limits (high/low), which may vary throughout the process, and pressure drops across the exchanger
- Approach temperature and temperature ranges (which may vary throughout the process)
- Fluid flow capacity
- Materials requirements. Conditions like sudden temperature changes or corrosive media may require special materials. For a gasketed plate heat exchanger, the gaskets must be compatible with the fluids in the unit.
- Thermal fluid characteristics and product mix. If the heating or cooling fluid is susceptible to fouling, a corrosion resistant material may be needed.
- Location. Some exchangers may require cooling water, steam, or hot oil, and they may be relevant options only where these utilities are available.
- Footprint. Space limitations and layout may also affect which heat exchanger models are suitable. Keep in mind that lower approach temperatures generally correlate to larger units.
- Maintenance requirements. Depending on housekeeping procedures, it may be useful to choose a design lends itself to easy cleaning. Ease of repair or inspection may be a factor as well.

Generally, more than one heat exchanger model will work for a given application, so additional criteria may help in evaluating the best fit. Consider factors like future scalability, overall cost to purchase and operate, and efficiency/carbon footprint to narrow the options.

Importance of Sizing a Heat Exchanger

Once a heat exchanger design is selected, the most efficient size depends on operating conditions. For example, if operating temperatures vary seasonally, both the winter and summer cooling (or heating) load must be calculated. The most efficient plate exchanger model is the smallest model with the same plate corrugation that is capable of handling the flow in both seasons.

Thermodynamic equations can help arrive at the best solution, where flow, temperature, and pressure drop are all within acceptable limits. Due to the number of dependent variables in heat transfer solution sizing and selection, complex equations are often used for selecting the optimal solution. Heat exchangers can often be tailored, and specifications like the size and number of plates are often customized for the application.

Heat exchanger sizing and selection requires a combination of knowledge of the heat exchanger types and options as well as knowledge of the application and environment where the unit operates.

Carotek is an authorized distributor of Standard Xchange heat exchangers, and Carotek engineers are specially trained to assist with finding the optimal heat exchanger to meet your specifications. Contact Carotek to review your needs and heat exchanger options. The following data sheet can be used to provide the requirements for your heat transfer solution.

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StandardXchange
a xylem brand

Data Required for Selection of a Heat Exchanger

ASME: ___yes/no______ Date: ________________________

TEMA class: _C / B / R / Not Required Type: ________________________

Applicable codes: ________________ (CRN / ABS / PED and etc) (Straight tube/Fixed and etc)

		Hot side Tube/shell	Cold side Tube/shell
1	Inlet pressure (psig)		
2	Fluid Circulated (eg. Water, steam, oil ISO VG 68)		
3	Flow rate (GPM or lb/hr)		
4	Temperature in/out (°F)	/	/
5	Heat load (Btu/hr)		
6	Allowable pressure drop (psi)		
7	Fouling factor		
Fluid Physical Properties: (only required for unusual fluids)			
8	Specific Gravity		
9	Specific Heat (BTU/lb-°F)		
10	Viscosity (cP)	@ °F	@ °F
11	Thermal Conductivity (BTU/hr-°F-ft^2/ft)		

MATERIALS OF CONSTRUCTION REQUIRED

Shell:	
Baffles:	
Tubes:	
Tubesheets:	
Bonnets/Channels:	
Gaskets:	Compressed Fiber (standard)
Plate & Frame:	304 / 316 / Titanium
Brazed plate	Copper / Nickel

SELECTION RESTRICTIONS (Optional)

Min. Tube Diameter: 1/4, 3/8, 1/2, 5/8, 3/4 , 1” Special

Requirements/Notes:

No. of Tubeside Passes: ____________________

Must Bundle be Removable: ________________

Are Lo-Fin Tubes Allowable: ________________

Max. Overall Length: ___________________ ft.

Are Flanged Conns Req’d: __________________

Are U-tubes Allowed: ______________________

Friendly note: Q_{hot} must equal Q_{cold}

$$Q_{hot} = \dot{m}_{hot} \times Cp_{hot} \times \Delta T_{hot}$$

$$Q_{cold} = \dot{m}_{cold} \times Cp_{cold} \times \Delta T_{cold}$$

where $\dot{m}$ is mass flow rate; Cp is specific heat; and ΔT is temperature difference