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Plate & Frame Heat Exchangers

Top Ten Tips

1. Be sure to communicate all pertinent information regarding your application to the manufacturer when you request a quotation. Most manufacturers have a design questionnaire available for you to use when collecting data for a heat exchanger application. There is some basic data needed for the fluids on both the hot and cold sides to properly size a plate and frame heat exchanger. They include the fluids names, the flow rates of each, the physical properties (specific gravity, specific heat, thermal conductivity and viscosities) if the fluids are other than water or glycols, design pressure and the maximum allowable pressure drops for the heat exchanger. Please include any potential issues such as erosion, particulates, fouling, etc., if applicable. Visit www.apv.com for our PHE Design Questionnaire.

2. Check with APV for chemical compatibility between the heat exchanger components and your process liquids and any possible cleaning solutions. An overwhelming number of PHE's use 316 stainless steel plates. 316 SS is compatible with and corrosion resistant to many chemicals commonly found in plants today. However, one chemical that is not friendly to 316 SS is chlorides. Operating temperatures as well as chloride concentration play an important role in determining material selection. For example, 316 SS plates can be used when the fluid contains maximum chloride levels at the following corresponding operating temperatures: 180 ppm at 122°F, 120 ppm at 170°F and 50 ppm at 212°F. It is quite common to use a plate and frame heat exchanger with a cooling tower. The design of the plate heat exchanger should also take into account the water treatment chemicals being used for the tower. If you are thinking of switching to more aggressive water treatment chemicals to remedy a water quality problem on an existing cooling tower, then it's a good idea to double check the level of chlorides that could be present in your system. A common practice is to CIP (clean-in-place) the heat exchanger. This generally involves circulating a cleaning solution, such as caustic, throughout the system. Make sure that the cleaning solution you are using is compatible with the heat exchanger plates and gaskets. APV can verify plate and gasket material compatibility if you provide us with details of the constituents in the fluids and the cleaning solutions being used.

3. Avoid pressure/temperature spikes. Sudden surges and rapid changes in pressure or temperature must be avoided, as these may damage the plates and gaskets. Do not allow the pressure to change more than 150 psig per minute or the temperature more than 20 °F per minute. Improper startup can cause damage to the heat exchanger frame, plates or gaskets. If there is the possibility of a pressure spike within the system piping due to the quick closure of a valve, water hammer, etc., you must take the necessary precautions to protect the heat exchanger. Remedies for this situation include pressure relief valves, rupture discs, and/or pulsation dampers and arrestors, to name just a few.

4. Use a filter on the inlet to the heat exchanger or by-pass the unit during start-up. In most applications, it is advisable to include at least a temporary or start-up strainer on the cold or hot fluid inlet. Even if your liquids are water-like with no particulates, a temporary strainer or bypass around the PHE is suggested. During construction it is all too common to see dirt and debris get into piping and then get pumped through the system. If this debris finds its way into the exchanger, it may get trapped causing an increase in pressure drop and a drop in efficiency. A start-up strainer is an inexpensive 'insurance policy'.

5. Minimize erosion in the port area by keeping nozzle velocities within the proper limits. An industry-wide guideline is to keep maximum port velocity at the heat exchanger to no more than 20 feet/second. Any increase above this rate could possibly cause premature wear in the ports area of the plates. In addition, you should consider frame port liners, even on water applications. These liners, available in many different alloys to match the plates, will protect the carbon steel frame from corrosion.

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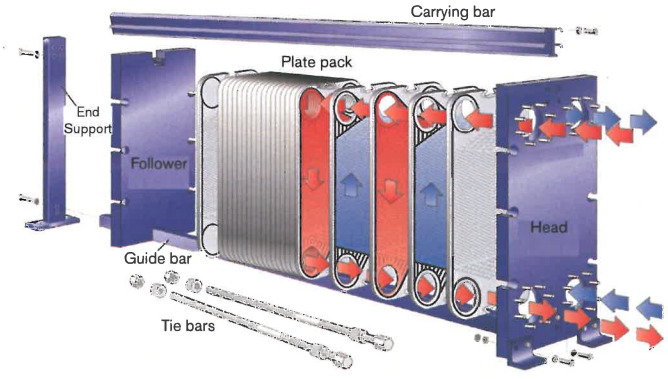
6. Periodically check plate pack tightening dimensions and the integrity of the frame, tie-bars, etc. It is typically easier to prevent a heat exchanger from leaking than to stop a leak once it occurs. An important point to remember is that a plate and frame heat exchanger is not tightened to a torque specification but rather to a tightening dimension. Each plate has an elastomeric gasket that seals the area between the plates and prevents leakage. Picture a large heat exchanger with perhaps hundreds of plates, each with a gasket, and you can imagine how much compression will take place when you start to close the unit by tightening the tie-bars. The manufacturing tolerances of the heat transfer plate can vary the tightening dimension by as much a ½" for every one hundred plates in the unit. As a result, a tightening dimension is provided in lieu of using torque values. This dimension is measured between the inside of the head (fixed cover) and follower (movable cover), noted on your APV plate heat exchanger drawing. It is recommended that you check the dimension at each tie bar and tighten the unit if necessary, at least once a year. At the same time, clean and lubricate the tie bars and check the tie-bars and frame components for any damage or corrosion that could occur in chemical environments.

7. Ensure that no particulate larger than the plate gap be allowed to enter the heat exchanger. The space between the heat exchanger plates is called the plate gap and in many cases can be quite small. Particles entering into the exchanger can get caught in the plate passages. As stated in tip number four, it is necessary to keep larger particles out of the heat exchanger. If your process or service streams contain large particles, or if an upset condition could release particulates into the streams, they should be removed with either a strainer or separator prior to the heat exchanger. Both internal and external strainers are available from APV. In general, keep particles larger than 1/16" in diameter out of the heat exchanger.

8. Use proper installation practices. As with all process equipment, good piping practices should be used. A heat exchanger makes a poor pipe hanger. Make sure that all piping is properly supported and does not put any undue stress on the connections to the heat exchanger. Nozzle load tables are available from APV upon request. For steam applications, ensure that all condensate lines are properly pitched away from the heat exchanger so that condensate will not mix with the steam and flash back into vapor. 1 ft^3 of water evaporated at 212°F and 14.69 psi becomes 1,606 ft^3 of dry saturated steam! Steam traps should be included and used in accordance with local codes. The heat exchanger should be level and secure. There should be adequate space surrounding the unit for maintenance personnel. Ladders or scaffolding should be used to access the tops of the units when performing maintenance. When lifting the unit, check the APV drawing for acceptable lifting points.

9. Design your heat exchanger for future expansion capabilities, but purchase based on your current needs. One of the great benefits of a plate and frame heat exchanger is its modular, all-bolted frame construction. If your heating/cooling needs change in the future, you can easily accommodate the new requirements by adding or removing plates within the frame. With proper planning, this flexibility allows you to purchase the equipment you need now, but also accommodates your future expansion needs without foundation changes. In the diagram below you can see the components that make up a plate and frame heat exchanger. Once purchased, the head and follower will remain the same. Longer plate carrying bars and tie bars can be purchased if needed for expansion. APV has several frame lengths available for each model. With the bolt-on design, you simply bolt on longer carrying and bottom bars, install the additional number of plates required for your new production needs and replace the tie-bars with longer ones. However, it is important to wait and do this only when your production needs change. If your exchanger heat transfer area exceeds your needs, the velocity will decrease thereby increasing the possibility of plate fouling. Ask your APV sales representative to size the heat exchanger for both future and current conditions.

10. Purchase only OEM parts to avoid warranty problems. It is common to find companies willing to provide other than original manufacturers parts at discounted prices. While some of these companies do provide adequate products and support after the sale, others do not. Plate technology and geometry is a rather complex equation and quality manufacturer's R&D departments spend a lot of time and money developing plates that perform reliably and efficiently. What may appear to be a bargain can wind up costing you money in the long run with failed gaskets, decreased thermal efficiency or a plate that will crack and leak in a short period of time. Purchasing OEM parts ensures quality performance from a quality product.



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