Business Standard

Selecting right heat exchangers, the first step to energy efficiency

Selecting right types of heat exchangers, which are widely used in chemical industry, can reap rich dividends to the manufacturers

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Energy costs are increasing day by day and, hence, energy efficiency is the key for profitability running of a chemical plant. Heat exchangers are one of the most important equipment in a chemical process plant which defines the energy efficiency of the plant. Hence, selecting a right heat exchanger becomes very important for chemical processing plant.

While shell and tube heat exchanger (STHE) have been prevalent in the industry for over 200 years, the plate heat exchanger (PHE) is in existence for over 50 year now. Then there are many special type of heat exchangers such as corrugated heat exchanger (CTHE), plate & shell heat exchangers, corrugated & finned tube heat exchanger, scraped surface heat exchanger, block heat exchangers and other proprietary/special heat exchangers for specific applications.

While selecting the right heat exchanger, one has to keep in mind criteria such as technology, process requirement, product properties, design standard, material of construction, investment and plant layout. Some details on these to enable us understand the impact and select right heat exchanger solution.

Technology
In today's age technology evaluation is essential considering the fact that the plant is in operation for anywhere between 10 to 20 years and in this time, technology can become redundant. This would have negative impact on production and profitability. Hence, one must evaluate the technology available in different type of heat exchanger for long term usage.

Process requirement
Process equipment have two aspects - based on the fact that there are two fluids, which will be involved in heat transfer. These can be gas-gas, gas-liquid, liquid-liquid or any combination (multi-phase). Some of the important characteristics of process requirement that one need to understand are flow rate and the heat load (for min/max condition); pumping cost (power cost); type of fluids; temperature, and pressure. The heat exchanger has to be selected based on these. These would define whether you use shell and tube heat exchanger or a plate heat exchanger or corrugated tube heat exchanger or others.

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Product properties
These are density, viscosity, flow behaviours (for viscous fluid), specific heat, latent heat, phase of liquid and fouling tendency. The properties have an impact on heat exchanger selection, performance, maintenance and operating cost. Fouling tendency of fluid is a very important criterion for selecting the type of heat exchanger, as this involves cleaning of equipment at periodic intervals. The other properties define the material of heat exchanger and configuration to be used.

Design standard
Design standard (TEMA, ASME, PED, etc) required for the process also has an impact on performance and cost of unit. Depending on the criticality one must choose the design standard and codes to be used in mechanical design.

Material of construction
Material of construction is based on the properties of the fluid and compatibility of material with the fluids. The selection of the material is also dependent up on the cost of material availability and life span of material.

Capital vs operating cost

HRS Process Systems' V Gokul Das

This is an investment decision which has an impact on the selection of equipment. Sometimes we select economic solution based on initial investment cost or 'one time use' basis, at the project stage since capital cost is an area of concern. However, this small saving in capital cost can result in increased operating cost by way of spares requirement or part replacement or frequent maintenance. Thus, negating the saving at the time of project installation. Hence, it is important to evaluate both costs over a period of 5 to 10 year to make a right decision.

Plant layout

Finally, the plant layout and expansion plans will have a say in equipment selection. Since each type of heat exchanger will have a different dimension and weight. In plant layout this is specifically important when a capacity enhancement is planned in the existing location. The above defines some of the key things one must keep in mind while selecting heat exchanger. Depending on application and process, there can be some other points to select the right heat exchanger.

The above are broad guidelines for selecting the right heat exchanger for the chemical process industry for various applications. There can be other specifics for selecting right heat exchangers for chemical process plants, however, these are universal and need attention.

The writer is the Managing Director of HRS Process Systems Ltd (HRS PSL) - a wholly owned subsidiary of the UK-based HRS International - and the Director on Board of HRS International, one of the world's leading manufacturers of heat transfer equipment