Heat exchanger selection tips for food and meat processing

Heat exchangers are a well established tool for the thermal processing of materials, such as cooking, pasteurisation and sterilisation, as well as heating or cooling a range of products.

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The pasteurisation process can dramatically change the properties of viscous foods.

When it comes to choosing the right heat exchanger for a particular situation, there is no substitute for professional advice, but you will have a better handle on the process if you have a basic understanding of the factors which need to be considered.

These can be broadly divided into commercial considerations and technical considerations. Using the questions discussed below will provide you with a good starting point with which to begin a tender process or a basis on which to compare different proposals.

Is a heat exchanger the right technology?

It may seem an odd question for an article about heat exchangers, but the first question you should ask is whether you need one in the first place. There is no doubt that heat exchangers can be relatively complex and expensive.

While they are eminently preferable in many situations, particularly where a cooling or heating source is already available or is required for more than one process, they may be over-kill for simple situations where a straightforward heating element or simpler refrigeration system is sufficient.

What type of heat exchanger do I need?

The simplest forms of heat exchangers are so-called plate heat exchangers, which consist of combinations of plates and gaskets through which the product and the heating or cooling medium move. They are relatively simple and cost effective and can do a very good job with simple Newtonian fluids like milk and thin oils. However, for more viscous substances, non-Newtonian fluids and processes requiring high levels of heat transfer, tube-in-tube heat exchangers may be a better option.

These come in different forms including those with corrugated tubes to increase product turbulence, which prevents fouling and improves operating efficiency. For high fouling and viscous fluids, scraped surface heat exchangers are available. Reciprocating and rotary versions are available, allowing different products to be handled carefully, so that key quality characteristics can be maintained or mixing increased, while providing maximum operating efficiency.

Will the system cope with my products?

There are several things to consider. Firstly, the heat exchanger must be capable of providing the right amount of heat transfer. Different materials will have different thermal properties which must be considered when designing a heat exchanger. Factors such as viscosity, solids content and texture will need to be assessed alongside product flow rates to ensure that the product receives the correct treatment. For example, if the heat exchanger does not deliver sufficient heat it may result in an incomplete process, which could have severe implications for product safety.

At the same time, if the system does not handle certain products correctly it can change or damage their quality; for example, rough handling of viscous sauces can have a negative effect on their texture.

Finally, the heat exchanger set-up should be capable of handling the maximum amount of product required at any time. While there will be physical constraints on the size of individual heat exchanger elements, in most cases it is possible to combine multiple units into suitable arrays in order to increase treatment capacity.

What other benefits could the system deliver?

One of the key benefits of many HRS heat exchangers is their ability to recover heat from the end of the process and re-use it. In many cases this feature enables the system to be more efficient, reducing the amount of heat which needs to be supplied in the first place.

However, in some situations – for example, where the heat source is plentiful – then the recaptured heat can be used for another process or for something else altogether, such as heating offices or buildings.

In such cases, these additional cost

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savings need to be offset against the capital and running costs of the heat exchanger.

What are the maintenance requirements?

These will vary according to the type of heat exchanger chosen, its design, and the environment in which it is used. However, more important than the actual maintenance requirements is how easy maintenance is. For example, how complicated is it to access key components and what are the costs of routine spare parts such as seals and gaskets? For double and triple tube heat exchangers, is it possible to remove individual tubes without dismantling the entire unit, and is it possible to service parts of the unit without shutting down the whole process? These factors will have a key impact on how much the heat exchanger costs to service, both financially and in regard to the time and resources required.

How much will the system cost?

For many people, cost will be one of the most important factors in making an investment decision. However, it is important to compare both the capital cost of different units and their anticipated operating costs and service life. For example, a 25% higher purchase price may easily be recouped by greater product efficiency and reduced serving costs over the same, or even longer, operating life. Only by considering all the associated costs will you be able to make an accurate investment decision.

How will the system be designed?

Does the company use the very latest scientific information on energy and heat transfer, or is it relying on papers and data which may be half a century or more old? While it is imperative that the heat exchanger performs correctly in terms of thermal transfer, other considerations, such as ease of installation and maintenance, are also important.

What back-up and support is there?

Not only is it important to have back-up in the event of a problem, but does your supplier offer features such as extended maintenance and servicing? Would you be able to take advantage of any future upgrades, such as improvement in tube design? It may not be essential to deal with a company which is based locally, but you should investigate how well they deal with other clients in similar circumstances.

The latest HRS heat exchanger technology reduces energy usage and costs.

It is obviously impossible to cover every potential situation in an article such as this, but I hope that I have highlighted some of the most common issues which apply to nearly every heat exchanger purchase or installation. Your individual circumstances will be unique and another key consideration when making your final decision should be how well your chosen supplier appreciates this. ■