Steam heaters

What is steam?

Water can exist in the form of a solid, which we call ice, as a liquid, which we call water, or as a gas which we call steam. If heat energy is added to water, its temperature rises to a point at which it can no longer exist as a liquid. This is called the “saturation” point and any further addition of energy will cause some of the water to boil off as steam. This evaporation of the water into steam requires large amounts of energy, and while it is being added, the water and the steam released are at the same temperature.

If we then encourage the steam to release the energy that was originally added to evaporate it, the steam will condense back into water at the same temperature. A heat exchanger is where we arrange for this release of energy to take place.

Why use steam?
Steam has been used as a carrier of heat since the Industrial Revolution and continues to be a modern, flexible and versatile tool wherever heating is needed.

- It is produced by the evaporation of water; a relatively inexpensive and plentiful commodity which is environmentally friendly.
- Its temperature can be adjusted very accurately by controlling its pressure.
- It carries a large amount of energy in a small mass.

Types of heating
Before it is possible to select a correctly sized steam control valve, a supply main, or even a steam boiler, it is necessary to know, with as much accuracy as possible, how much steam is required. Almost all heating loads fall into one of two categories.

- Temperature increase – heating a material from a lower temperature to a higher temperature.
- Temperature maintenance – making up heat losses to maintain a fixed temperature.

Normally, in the case of a steam heat exchange application it is the former case, with a product entering the secondary side of the exchanger at a lower temperature and leaving at a higher temperature.

Steam load on heat exchangers
When considering the actual steam load on a heat exchanger, enough steam needs to be provided to the primary side of the exchanger to

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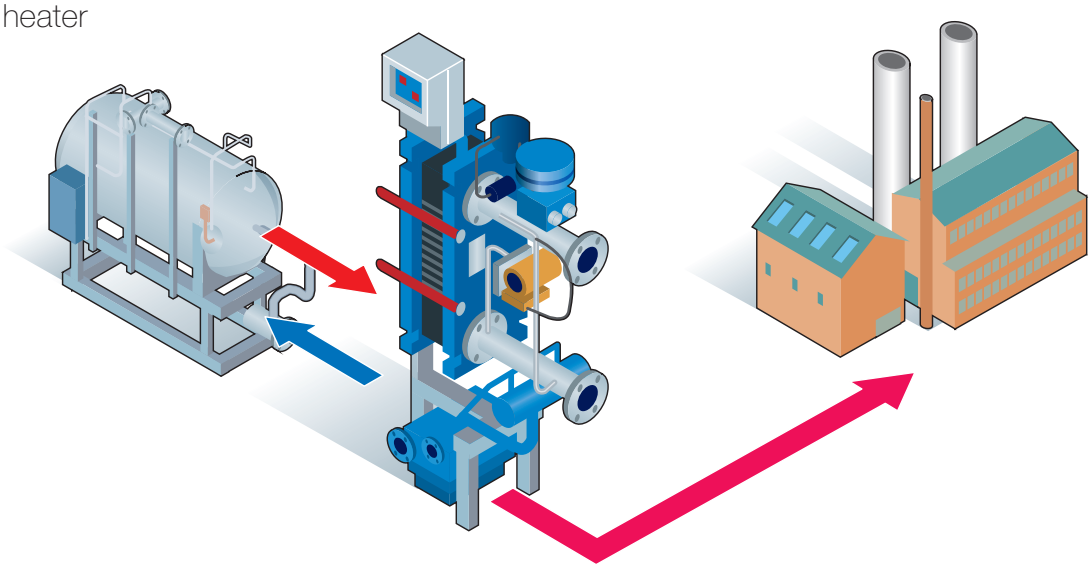

provide the required rise in temperature in the liquid or gas passing through the secondary side of the exchanger. Usually, you will be provided with a flow rate for the secondary fluid and the required rise in temperature. Sometimes the heat requirement in a heat exchange application will be expressed as an energy rate requirement given in kilowatts (kW) or megawatts (MW). A Watt is an energy rate of 1 Joule per second (J/sec), where the Joule is a basic unit of energy. If heat requirements are expressed in these units, they can be converted to steam flow rates using various formulas. Please find out more on www.alfalaval.com.

It must always be remembered that even if the correct amount of steam is provided, in the best possible condition, the required secondary condition will not be met if the exchanger itself is undersized. The ability of an exchanger to meet a given condition can be checked if the heat exchange area and heat transfer coefficient are known.

Steam systems
A steam system will normally consist of four main elements, all of which can affect the efficient operation of each individual piece of steam using equipment.

- Steam generation
- Steam distribution
- Steam consuming equipment
- Condensate recovery and return

The purpose of the steam generation and distribution system is to provide steam at the correct pressure, in sufficient quantity and in the best possible condition to the equipment.

The steam users should be provided with the steam control and condensate removal equipment that allow them to operate efficiently. The condensate recovery and return system should remove condensate effectively from the equipment and ensure that it is returned to the boilerhouse to be re-used in the boiler.

Alfa Laval has developed a series of plate heat exchangers specially designed for heating water using industrial steam. The major features of this series are the unique geometry and strength of the stainless steel plates, special gaskets that tolerate temperatures up to 180°C (356°F), and the robust heat exchanger frame. Together, these features provide operational economy and performance unmatched by either shell-and-tube heat exchangers or conventional plate heat exchangers.

Typical steam industries
Steam is used in most types of industry and a lot of machinery uses the great features of steam. Examples are:

- General manufacturing
- Chemical processing
- HVAC for heating
- Bottling, filling and sterilization of food and beverages
- Pharmaceutical, e.g., autoclaves