brought to the boiling temperature associated with the surrounding pressure by the addition of energy. Since a thermometer can measure this increase in temperature, this type of energy input is called sensible heat. Second, to change the liquid into vapor at the constant boiling temperature requires the addition of a large amount of energy. Since a thermometer cannot measure this increase in energy, it is called the latent heat of vaporization. For water the latent heat of vaporization is about 970 BTU/LB of water evaporated.

To provide this heat, steam at a higher pressure and temperature is fed to the other side, known as the heating surface. This steam gives up its latent heat of vaporization as it condenses from a vapor into a liquid. As with boiling, condensation occurs at a constant temperature that is determined by the surrounding pressure. Since the condensing steam is giving up approximately the same 970 BTU/LB, it takes roughly one pound of steam condensation to evaporate a pound of water from the solution.

The simplified steam table (Table 1) shows the relationship between the pressure in the system and the boiling point of pure water, also known as the "saturated" vapor temperature. Note that the boiling temperature depends on the absolute pressure only. Gauge pressure or gauge vacuum readings give only an approximate value of the absolute pressure unless the local barometric pressure is taken into account. For more precise data on boiling points refer to a published Steam Table such as Keenan & Keyes.

Note that the actual boiling point of a solution other than pure water is affected by constituents dissolved in the water as is discussed under the heading "BPE" later in this chapter.

HEAT TRANSFER

The rate at which heat is transferred across the heating surface is proportional to the driving force applied and the overall heat transfer coefficient. The driving force is usually termed "differential temperature" or "delta T", and the heat transfer coefficient is termed "HTC" or "U". In this manual the terms "driving force", "delta T", and "HTC" will be used. The basic heat transfer formula used in the design and analysis of an evaporator is:

Heat Transfer Rate = HTC x Area x delta T

Expressed in normal units:

$$\text{BTU/Hr} = \text{BTU/Hr-ft}^2\text{-F} \times \text{ft}^2 \times \text{degrees F}$$

or $$\text{Kcal/Hr} = \text{Kcal/Hr m}^2\text{-C} \times \text{m}^2 \times \text{degrees C}$$