STEAM GENERATORS

Advanced Steam Technology that Is Safe, Efficient and Reliable

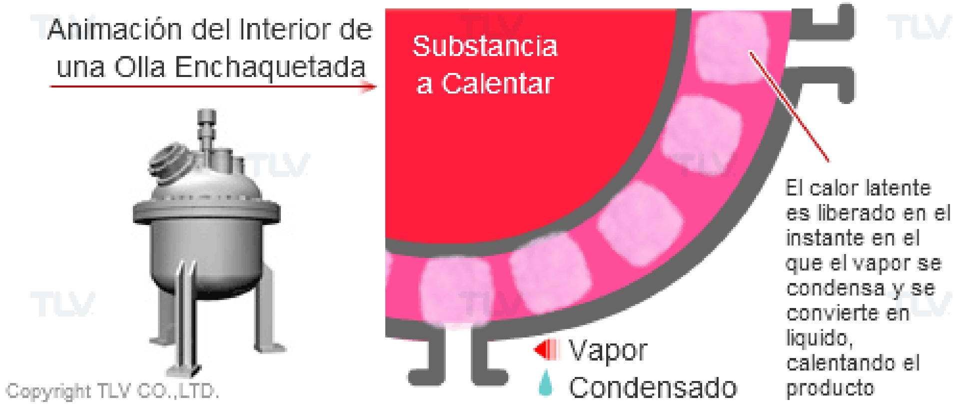
Case History Vacuum Steam

The use of steam for heating to temperatures below 100°C (212°F), traditionally the temperature range in which hot water is used, has grown rapidly in recent years.

When vacuum-saturated steam is used in the same way as positive pressure saturated steam, the temperature of the steam can be changed quickly by simply adjusting the pressure, making it possible to control the temperature more precisely than hot water applications. However, a vacuum pump should be used in conjunction with the equipment, because reducing the pressure alone will not make it below atmospheric pressure.

Steam is one of the most commonly used fluids to heat equipment or facilities in any type of industry: chemical, petrochemical, food, pharmaceutical, or in processes such as paper production, laundry, humidification and many more; This, given that its conditions are easily adjusted by controlling pressures and temperatures, in addition to transporting significant amounts of energy, making the generation units (boilers) not excessively large. The steam generated is sent to the dining room for the preparation of food in the kettles. The steam is transported through thermally insulated steel pipes along almost their entire length. The system has different accessories, such as: globe valves, wedge valves and pressure regulators. The use of measuring

instruments to take operating parameters offers greater validity in determining the efficiency of the kitchen kettle set and the influence they have on the installation in general.



Methodology for calculating the efficiency of a steam kettle system

To calculate the efficiency of a system made up of a certain number of kettles, the methodology is based on the following:

$$\eta_{\text{sistema}} = \frac{Q_{\text{u marmitas}}}{Q_{\text{d marmitas}}} * 100, \quad \% \quad (1)$$

Donde:

η_{sistema}: eficiencia del sistema.

$Q_{\text{u marmitas}}$: calor útil de las marmitas.

$Q_{\text{d marmitas}}$: calor disponible de las marmitas.

The heat available from the kettles is in turn given by the heat available from the boiler and the losses in the transmission of steam, as shown in equation (2)

$$Q_{\text{d marmitas}} = Q_{\text{d caldera}} - \sum q_{\text{transmisión}} \quad (2)$$

Donde:

$Q_{d\ caldera}$: calor disponible de la caldera.

$\sum_{qtransmisión}$: sumatoria de las pérdidas por transmisión de calor en la tubería de vapor.

El calor disponible de la caldera se halla mediante la fórmula (3) y depende del flujo de vapor (D_v), de la entalpía del vapor saturado (h_{vs}), de la entalpía del agua de alimentar (h_{aa}) y de las purgas

$$Q_{d\ caldera} = D_v(h_{vs} - h_{aa}) + D_p(h_p - h_{aa})$$

To determine the heat losses in the pipe, equation (4) is used, for which it is
It is necessary to know the diameter of the insulated and the non-insulated length, the surface temperature and the ambient temperature.

$$\sum q_{\ transmisión} = q_{tta} + q_{ttna}$$

Donde:

q_{tta}: pérdida de calor en el tramo de tubería aislada

q_{ttna}: pérdida de calor en el tramo de tubería no aislada.

To calculate both heat losses, equation (5) is used in the steam pipe:

$$Q=h*A*\Delta T \qquad (5)$$

Where:

h: Coefficient of natural convection for gases.
A: Pipeline area.

ΔT: temperature variation.

In the case of calculating the useful heat of kettles, equation (6) is applied, which depends on the heat available from the kettles and the sum of the heat losses from each to the environment.

$$Q_{u\,marmitas} = Q_{d\,marmitas} - \Sigma q_{marmitas\ al\ ambiente} \quad (6)$$

Where:
Σqmarmites to the environment: heat losses from kettles to the environment.