STEAM GENERATORS

Advanced Steam Technology that Is Safe, Efficient and Reliable

Energy efficiency in the use of steam for Food Cooking

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. That's why Clayton Steam Generators are excellent for such applications because of their compact, high-capacity design.

Kettles use a heating system that is very common in the food industry, especially for the processing of large volumes of food.

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:

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

Where:

System: System Science.
What kettles: useful heat from kettles.
QD kettles: heat available from kettles.

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):

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

Where:

QD boiler: heat available from the boiler.
Σ q transmission: sum of heat transfer losses in the steam pipe.

The heat available from the boiler is found by the formula (3) and depends on the steam flow (Dv), the enthalpy of saturated steam (hvs), the enthalpy of the feedwater (haa) and the blowdowns.

$$Q_{d\ caldera} = D_v(h_{vs} - h_{aa}) + D_p(h_p - h_{aa}) \quad (3)$$

To determine the heat losses in the pipe, equation (4) is used, for which it is necessary to know the diameter of the pipe, the length that is insulated and the length that is not, the surface temperature and the ambient temperature.

$$\sum q_{\ transmisión} = q_{tta} + q_{ttna} \quad (4)$$

Where:

QTTA: Heat Loss in Insulated Pipe Run
QTTNA: Heat loss in the uninsulated pipe run.
To calculate both heat losses, equation (5) is used in the steam pipe:

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

Where:

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

$$Qu\ kettles = Qd\ kettles - \Sigma\ q\ kettles\ to\ the\ environment \quad (6)$$

Where:

Σ q kettles to the environment: heat losses from the kettles to the environment.