



STEAM QUALITY Why is it Important?

Dry Steam, and Wet Steam

It is very important to fully realize that the [Steam Tables](#) show the properties of what is usually known as “Dry Saturated Steam”. This is steam which has been completely evaporated, so that it contains no droplets of liquid water which contain no latent heat BTUs. Latent heat is what does the heat transfer work!

In standard practice, steam often will carry tiny droplets of water with it and should never be described as dry saturated steam. This is particularly true in district heating systems where steam is piped great distances to the end user or where poorly insulated or trapped systems are used. Nevertheless, we find that it is very important that the steam used for process of heating is as dry as possible. We will in later documents show how this is achieved, by the proper use of steam conditioning Thermaflo HSS “Separators” and Thermaflo Steam “Traps”.

[Steam Quality](#) is described by its “dryness fraction” – the proportion of completely dry steam present in the steam being used. The steam becomes “wet” if water droplets in suspension are present in the steam space, carrying no latent heat. Lets remember that the latent heat does the work in all heat transfer systems. For example, the specific enthalpy of steam at 125 psi with a dryness fraction of 0.95 can be calculated as follows:

Each lb of the wet steam will contain the full amount of sensible heat, but as only 0.95 lb of dry steam is present with 0.05 lb of water, there will only be 0.95 of the latent heat. Thus, the specific enthalpy of the steam will be:

$$\begin{aligned} H_g &= h_f + (0.95 + h_{fg}) \\ &= 324 + (0.95 \times 869.3) \\ &= 1149.83 \text{ BTU/lb} \end{aligned}$$

HG = Total Heat BTU/lb (Example: 1,194.0)

HF= Sensible Heat BTU/lb (Example: 352.8)



HFG= Latent Heat BTU/lb (Example: 869.3)

This figure represents a reduction of 44.17 BTU/lb from the total heat of steam at 125 psi gauge shown in the Steam Tables. Clearly, the "Wet Steam" has a heat content substantially lower than that of dry saturated steam at the same pressure.

The small droplets of water in "wet steam" has a heat content substantially lower than that of dry saturated steam at the same pressure, which mean that more steam quantity must flow to the heat transfer system to process the work costing the end user more!

The small droplets of water in wet steam have weight but occupy negligible space. The volume of wet steam is, therefore, less than that of dry saturated steam.

In most district steam systems due to piping run lengths, temperatures both ambient and below grade and poor designed condensate removal piping can prove to degrade the Steam Quality from a boiler steam output of 98%-99% down into the high 80% Range.

Installing Thermaflo HSS Steam Conditioning Separators with their triple action separation can again increase the Steam Quality back to this 98% range.