STEAM CONDENSATE RECOVERY IN CHEMICAL PROCESSING

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In chemical processing plants, steam is the most commonly used heating utility. Once heat in steam is exhausted, or has been passed to the product being heated, it will turn into condensate. Steam condensate still possess a remarkable portion of energy in it and hence, the process of recovering and reusing the condensate has become increasingly important. This process is known as steam condensate recovery and it certainly has a positive impact in saving energy and resources of a chemical plant.

Steam condensate is a valuable resource and even the recovery of small quatities is often economically justifiable. The recovery of condensate can achieve a remarkable economic efficiency. The amount of sensible heat contained in condensate can reach up to 30% of the heat energy contained in the initial steam [1]. Recycling of condensate into boiler reduces industrial water consumption, decreases cost of water softening treatment and reduces emission of industrial waste water. Sadly, often operation personnel are unaware of the opportunities available for energy and productivity savings in their steam systems. Condensate from steam system is wasted, or at least used inefficiently in many industrial operations. In some plants, this condensate is simply discharged to a waste water system. Listed below are a few points on steam condensate recovery in a processing plant that any process engineers or operation personnel should be aware of:

- A good chemical processing plant is a plant that has a proper management of its energy recovery. Operation personnel in a plant should be aware of any steam saving and condensate recovery opportunity. Any steam leakage, or unattended draining of condensate should be considered as energy lost and should be reported.
- Condensate recovery can give high economic impact, by reducing fuel cost, reducing raw water consumption as boiler feed water, reducing water treatment charges, reducing raw water chemical treatment charge, and minimizing boiler blowdown.
- Besides savings due to condensate recovery, potential savings of the condensate recovery system should also include the savings caused by utilizing flash steam generated by the condensate as low-pressure process steam.
- Engineering data needed to calculate condensate recovery (by not considering flash steam recovery) savings are: mass flow rate of condensate, specific heat of condensate, temperature difference between recovered condensate and make-up water, annual operating hours, boiler's efficiency, gross calorific value (GCV) of fuel and cost of fuel per unit. If flash steam recovery is included in the savings analysis, data such as sensible heat of condensate, latent heat of steam and total enthalpy of steam at certain pressure must be known.

- Economic savings analysis and condensate return piping system used are a few of the overall planning factors that should be considered in creating an efficient condensate recovery system. Pipe sizing of condensate return pipe must be done in consideration of flowing matter of two phases (condensate, flash steam, and live steam). Flash steam volume is much bigger than condensate and requires more space. Should the flash steam be neglected, the pipe line design has a probability to be under-sized, and the normal operation of condensate recovery would be affected.
- Contaminated condensate, due to the use of multiple utilities must be properly handled. An online conductivity meter, linked to the distributed controlled system (DCS) should be installed to monitor the condensate contamination.
- Even when condensate is fully recovered, heat losses can still occur from uninsulated or poorly insulated condensate return lines. These loses can be recovered effectively by proper application of thermal insulation. All piping and headers must be insulated, and the insulation cost must be considered.

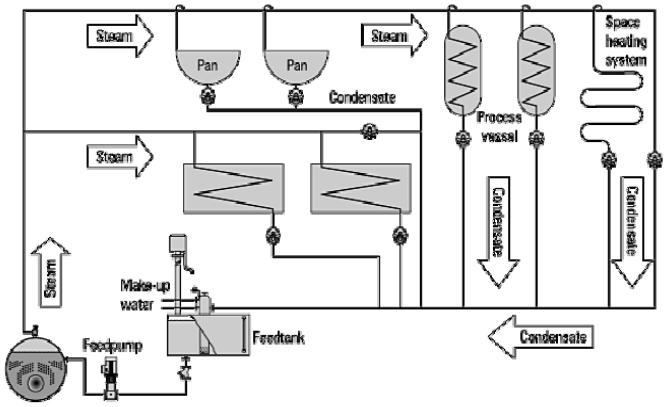

Figure 1: Typical steam distribution and condensate recovery system in chemical processing plant (Picture source: http://www.wermac.org).

Reference:

[1] Introduction to Condensate Recovery. Retrieved from https://www.tlv.com/global/TI/steam-theory/introduction-to condensate-recovery.html on 28th April 2020