

Energy Efficiency in Heat Recovery System

Steam is the best carrier of heat which is required by most of the process industries.

* C. Balasubramanian

Steam is the most popular source for heating for the following reasons:

- ❑ Easily available
- ❑ Distributed /handled comfortably
- ❑ Easily recycled
- ❑ High heat transfer properties
- ❑ Easy to control
- ❑ Quick phase change
- ❑ Steam for power/ process, and power and process.

Steam is being the best heat carrier, most of the process industries are using it for heating purpose.

Heat carrying capacity of steam, total enthalpy, is divided in two components, ie, latent heat and sensible heat. When steam starts condensing from Vapour State, latent heat is transferred to the cold source with which steam has contact. When the steam condenses, heat energy available in the liquid state of steam is called sensible heat. Sensible heat energy available in the condensate is proportional to the temperature at which steam is used for heating purpose.

Recovering the condensed steam or the condensate, saves the heat energy and additional cost of water and chemicals used to treat the waste water. Practically, all process industries are trying to improve the condensate recovery.

Sensible heat energy available in condensate can be used directly/ indirectly as follows:

- ❑ Directly to preheat a process fluid, at the same condensate system pressure
- ❑ Directly at boiler deaerator, at the same condensate system pressure.
- ❑ Directly in an open condensate collection tank
- ❑ Condensate system pressure can be reduced to lower pressure and flash steam separated from high temperature condensate in a flash vessel.

Limitations of using high pressure condensate are:

- ❑ All the process industrial boilers may not be equipped with Deaerator.
- ❑ All process industries may not have a process which can use low heat source.

Flashing of high-pressure (high temperature) condensate occurs inside the flash vessel. When high-pressure condensate is expanded in a flash vessel with larger volume, the condensate pressure reduces. At reduced condensate pressure, it cannot hold the same sensible heat. Excess sensible heat differences between high and low pressure is utilized to evaporate a fraction of condensate. The evaporated condensate is appearing as "Flash Steam" at flash vessel outlet.

Low-pressure steam separated in flash vessel is as efficient as a live low-pressure steam obtained through pressure reduction process. Low-pressure flash steam also has total heat, latent heat and sensible heat components.

Low-pressure flash steam is used in the following:

- ❑ Low pressure steam using equipment.
- ❑ For hot water generation.

All process industries may not require steam at low pressure or hot water for process heating. To improve the heat recovery system efficiency, low-pressure flash steam is thermally compressed to medium pressure level by using "thermoc compressor system". High steam pressure is used as motive steam to compress the low-pressure steam.

Thermocompressor has the flexibility of boosting the low-pressure steam to medium level using high-pressure steam.

Thermocompressor system avoids the following:

- ❑ Low pressure steam venting
- ❑ Reduces the pressure reduction through pressure reducing stations
- ❑ Improve the system efficiency by sending condensate at lower temperature
- ❑ Recycling of heat energy within the process area achieved
- ❑ Maintain constant level steam pressure at users end
- ❑ Improve the condensate recovery from equipment by reducing the backpressure imposed by other condensate recovery system. Efficient removal of condensate improves the heat transfer and hence reduces specific steam consumption.

Steam is being the best heat carrier, most of the process industries are using it for heating purpose. Also it is the cheapest heating medium for process industries.

Thermocompressor systems are prepared for individual industries to improve the heat recovery system efficiency and pays for itself within six months.

Some process industries are draining condensate due to process contamination. Foremost requirement to improve the condensate recovery in the case of process contamination is to detect the source of contamination. Installation of on-line condensate contamination detection systems will improve the condensate recovery system efficiency.

Investment made for Steam Generation and Distribution systems is resulting in 75 percent utilisation of energy available in steam. Do we invest 25 per cent of total steam system cost to recover the balance 25 per cent of energy available in condensate?

* Mr. C. Balasubramanian is Manager, Energy Services Division, Forbes Marshall Group, Pune.

Reference Book:

Chemical Engineering World,
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