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Guide to Steam Systems

Part 3

Condensate and Feedwater Storage

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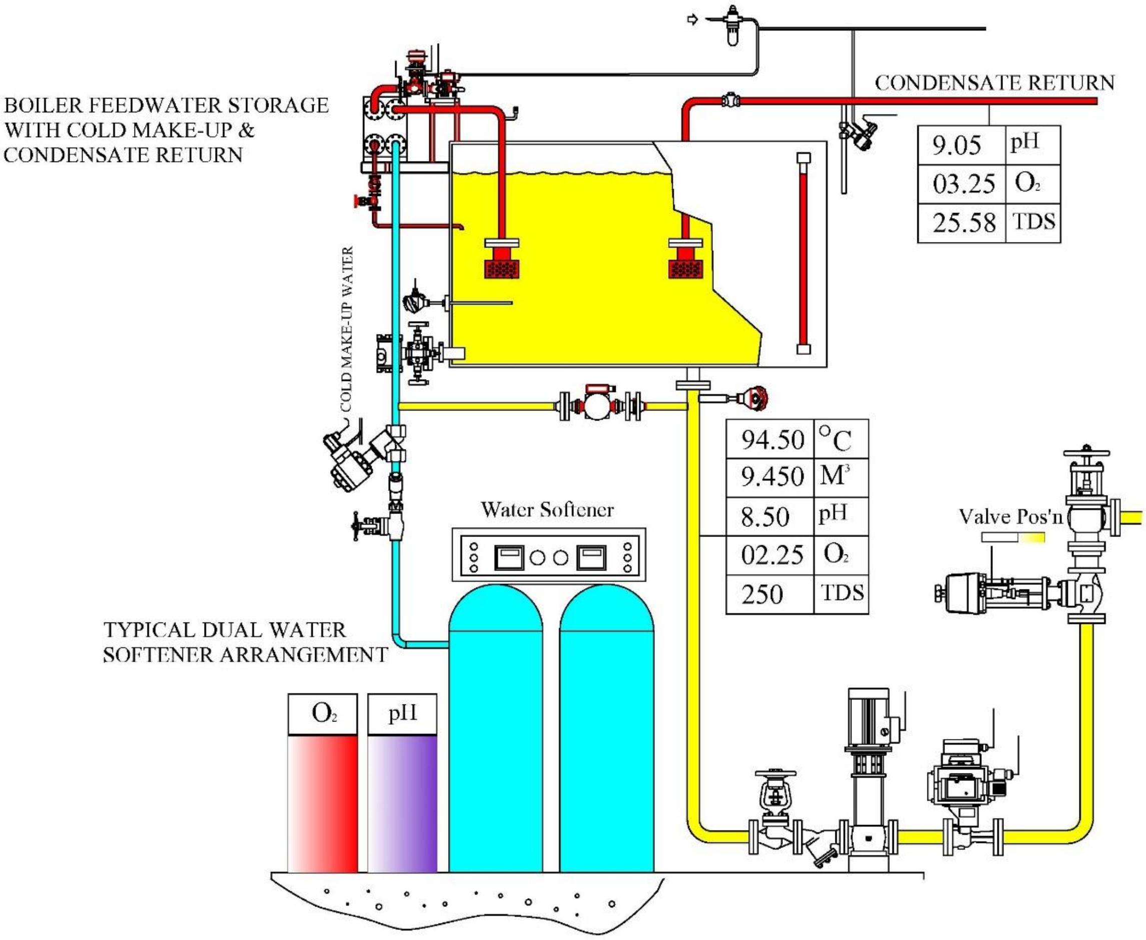
"Small enough to care,
large enough to cope."

Guide to Steam Systems Part 3:

Condensate and Feedwater Storage

1.3 Condensate and Feedwater Storage



1.3.1 Why Recover Condensate

The condensate formed when steam gives up its latent heat contains approximately 20% of the heat originally supplied to generate the steam. Recovering condensate, will not only dramatically improve the overall heat balance of the system but also show significant savings in boiler feed water, water treatment chemicals and boiler blowdown.

It is therefore prudent to ensure that where possible all condensate is collected and returned to the boiler house. When, for economic reasons, condensate has to be discharged to drain, every effort should be made to extract its heat content.

- Condensate is an extremely valuable resource. The high heat content justifies returning it to the feedwater system.
- Condensate has already been treated and thus water treatment costs are lowered.
- The high cost of condensate disposal is avoided.
- Water charges are lowered because fresh water is not continually being added to the boiler.
- Result: up to 20% fuel savings.

1.3.2 Lifting Condensate

It is a misnomer to believe that steam traps lift condensate. Steam traps are the automatic devices which allow the safe discharge of condensate whilst preventing steam being wasted. It is the steam pressure present at the trap which supplies the motive force to lift the condensate.

1.3.3 Condensate handling

To prevent water logging of the steam system and reduced plant performance condensate should be able to drain by gravity to vented receivers and be pumped back to the boiler feedwater tank.

On large systems it would also be prudent to provide monitoring equipment. Overflow alarms provide indication against pump failure whilst conductivity, pH and turbidity monitoring prevents contaminated condensate being returned to the feedtank and creating problems inside the boilers.

1.3.4 Feedwater Storage

Within the steam cycle there is a natural time delay between the distribution of steam from the boiler house and the return of condensate, during which time the boiler requires additional water. To ensure a constant supply of water is available a storage tank is provided.

Boiler feedwater tanks or “Hotwells” have, in the past, been treated simply as a water store with little attention paid to their true role in efficient and cost effective steam production.

Providing it was sized to hold one hours maximum steaming rate, whilst allowing sufficient ullage to prevent condensate overflowing to drain all was well. However, it has a much more important role in improving the cost effectiveness of steam production.

The majority of hotwells are atmospheric storage tanks and significant amounts of energy are lost through the vent simply because of inefficient mixing of the returning condensate with the tank contents. Allowing condensate returns to discharge into the top of the tank leads to flash steam loss and temperature stratification throughout the water depth.

In a closed system, typically 10-15% of the returning condensate will be lost through the vent as flash steam. In addition to the heat lost an additional 10-15% cold water makeup is required, which has to be chemically treated.

Temperature stratification within the tank means that the water supplied to the boiler is cooler than necessary and a greater amount of oxygen scavenging chemicals are required. The boiler output is also affected. The “from and at” rating is at 100^{O}C, if the feedwater is substantially cooler, then the boiler output will be significantly reduced.

To overcome these shortcomings it is important to ensure that all the individual ‘water streams’ and injected steam are evenly distributed well below the water surface.

The “Atmospheric Deaerator System” consisting of a centralised mixing chamber and distribution tube, has been specifically designed to assist in reducing steam generation costs in addition to the safe handling of condensate returns and cold water makeup.

By design, it eliminates temperature stratification within the tank, ensuring that the feed water temperature is maintained as high as practical. This in turn reduces the heat lost through the vent and saves on cold water makeup. Additional savings are achieved by the reduction in the amount of oxygen scavenging chemicals required; the higher the feedtank temperature the less chemicals necessary to drive off the entrained oxygen in the makeup water.

Reduction in steam production costs are achieved by: -

1. Blending the incoming cold-water makeup with the high temperature condensate condenses the flash steam whilst pre-heating the cold water.
2. Recirculating the tank contents prevents temperature stratification, ensuring high and steady feedwater temperature and a reduction in entrained gases.
3. Maximises the heat content in the condensate returned and from blowdown heat recovery systems.
4. Chemical dosing costs are reduced in line with the high steady water temperature and a reduction in flash steam losses.
5. By reducing the volume of cold-water makeup, the amount of blowdown required to maintain a constant TDS level is also reduced.
6. Additional savings result from the reduction in the volume of cold water required and the subsequent effluent charges.

Maximising condensate returns, minimising heat losses and preventing heat stratification will reduce the amount of chemical treatment required thereby reducing the amount of boiler blowdown needed saving energy and money.

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