CROWN SOLUTIONS
CUSTOMER NEWSLETTER

The Deaerator Dilemma

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The company accountant comes raging through your door and excitedly asks, “Why is so much steam being wasted? Don’t you know that steam is money?!”

“What steam?” you ask.

“All the steam I see coming from the roof of the powerhouse? Why are you wasting it?!” You can see the dollar signs flashing before the accountant’s eyes.

“Oh! You mean the steam from the deaerator! That’s supposed to be that way,” you patiently reply.

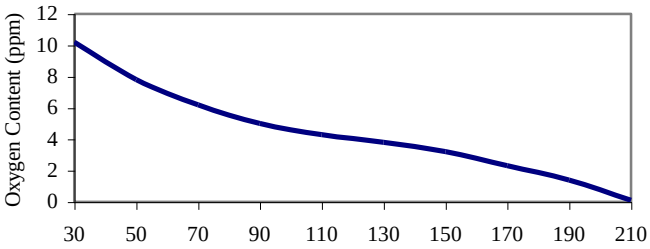
“Why?”

This is where you may stumble. How do you explain the purpose of the deaerator, and why steam must be vented?

Deaeration

The dissolved gases normally present in water cause many corrosion problems. Examples of such dissolved gases include oxygen, carbon dioxide, and ammonia. Deaeration is an efficient way to remove these dissolved gases from boiler feedwater to reduce the corrosion potential of the water. Heat is intimately applied to drive off the unwanted dissolved gases because the gases are less soluble as temperature increases. Figure 1 illustrates the solubility of oxygen in water at atmospheric pressure at various temperatures. As the temperature increases, the solubility of oxygen decreases. At temperatures near saturation (212ºF), the solubility of oxygen is at a minimum.

Mechanical deaeration will remove 99 to 99.9% of the dissolved gases present. Most manufacturers guarantee



their units will deaerate water to less than 7 parts per billion (ppb) oxygen and zero free carbon dioxide. Even this is not low enough to inhibit all corrosion, so chemical oxygen scavengers such as sodium sulfite or sodium bisulfite are typically supplemented to ensure complete oxygen removal.

Equipment Design

There are two sections to most deaerators: the deaerating section and the storage section. The dissolved gases are stripped from the water through a combination of steam, heat, and mechanical separation in the deaerating section. The deaerated water flows to the storage section where it is held as boiler feedwater.

There are two basic types of deaeration designs: tray type and spray type. In the tray-type deaerator (Figure 2), water is directed or sprayed through distribution pipes into a steam space. The hot steam increases the temperature of the water to within a few degrees of saturated steam temperature. Dissolved gases are stripped and vented to the atmosphere. The water cascades down several trays in the tray section. The cascading flow breaks the water into fine droplets, permitting greater steam contact. This action further scrubs the dissolved gases from the water. The deaerated water flows into the storage section where a blanket of steam maintains a few pounds of pressure on the system.

In the spray-type deaerator (Figure 3), the steam and water scrubbing action is similar to the tray deaerator except the water is broken up with spray nozzles inside the deaeration section. The spray nozzles should be inspected annually to ensure they are not obstructed or corroded.

Venting

Typically, a 15- to 33-inch actively moving steam plume should be visible (Figure 4). Another rule of thumb is that an invisible area should be seen at the vent exit before a plume of steam and water droplets appear. The ultimate test is whether the venting is doing a good enough job at removing the dissolved gases. Dissolved oxygen meters and chemical test kits are available for such testing.

Conclusions

Proper venting is absolutely essential in a well-run boiler system. If dissolved gases such as oxygen, carbon dioxide, and ammonia are left in the system, detrimental corrosion can occur resulting in equipment failures, downtime, and lost money.

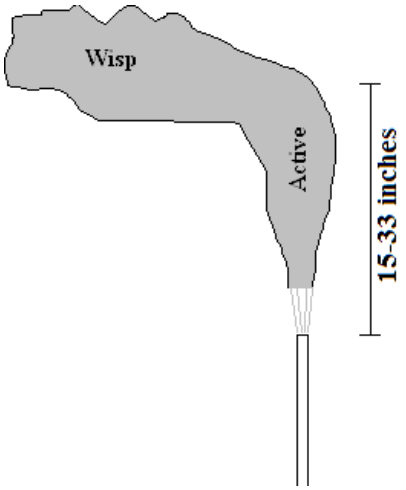


Figure 4: Vent Plume

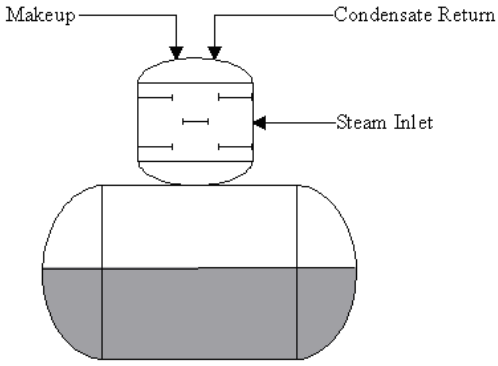


Figure 2: Tray-Type Deaerator

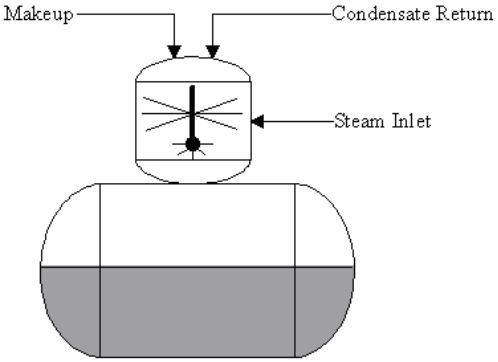


Figure 3: Spray-Type Deaerator

A properly operating deaerator will improve overall system efficiency by protecting equipment from corrosion. Deaerators also serve as a recycle point for low-pressure steam sources such as continuous-blowdown flash tanks, further improving a boiler system's thermal efficiency.

By fully understanding the purpose and function of a deaerator, it can easily be seen that the steam coming out of the vent is not costing money, but actually saving money.

References

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