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Steps to Properly Treat Boiler Water

Part 1 -- Mechanical Means

Boiler water treatment is important for proper operation and maintenance of a boiler system. If proper water chemistry is not followed and maintained, a boiler will begin to have problems within the first year, and its useful life will be significantly shortened.

Water is an excellent transporter of heat energy. However, water contains minerals and gases, which when heated lose their solubility and become very hazardous to the boiler and its connected components. Improper water treatment affects the quality of the steam going out to the system as well as its purity.

The most effective and efficient way to control these destructive elements within a boiler system is through a combined mechanical and chemical solution. Following is equipment that will help ensure boiler feedwater is properly treated.

Water softener. The most important piece of water treatment equipment is a water softener. Water softeners use a process called ion exchange to remove calcium and magnesium from the water. The hardness minerals are replaced with a highly soluble sodium or potassium ion that will not cause scale buildup, helping a boiler maintain its efficiency throughout its life.

Dealkalizer. If the boiler feedwater contains a high level of bicarbonate alkalinity and sulfates, a dealkalizer is recommended. Alkalinity is a measure of the capacity of water to neutralize strong acids. The main job of a dealkalizer is to remove the bicarbonate and carbonate alkalinity from the feedwater, and the dealkalizer will also help to remove sulfate, nitrate and silica. A dealkalizer prevents scaling and reduces potential steel corrosion within the steam system.

Deaeration. In addition to the removal of dissolved solids, gases must be removed, particularly oxygen because it is 10 times more corrosive than CO₂. When free oxygen comes in contact with ferrous metal, it can cause a lot of damage in a very short period of time. It's also problematic because the colder the water is in the feed tank, the more O₂ it contains. The more the water heats up, the more corrosive it becomes. There is nearly double the corrosiveness at 122 degrees F than at 86 degrees F.

The best way to remove both oxygen and carbon dioxide is through deaeration. The deaerator uses a mechanical scrubbing method to eliminate the harmful gases from a feedwater supply. It removes almost all harmful gases, and the remainder can be removed by chemical means. For smaller facilities, a heated feedwater tank provides similar results and is more cost-effective. A stainless steel tank is recommended to ensure long life.

Surface Blowdown. Lastly, with regard to the mechanical removal of dissolved minerals and gases, emphasis should be placed on controlling totally dissolved solids (TDS) in a boiler. To control these solids at the proper level, conductivity is used as the control point. When it exceeds a specific level, a certain amount of the boiler water is automatically blown from the surface of the boiler shell or drum. This is called surface blowdown as opposed to bottom blowdown, which is used to rid the boiler of sludge and scale slough-off.

In most cases, surface blowdown is an automatic process. The conductivity sensor ties into an automatic valve that opens and closes based on a specific control bandwidth or differential, maintaining the desired level of conductivity to avoid issues such as deposition and possible carryover of water moisture into the steam supply.

With many surface blowdown operations, the process is fairly continuous. Depending on the size of the boiler, this discharge into the sewer after separating and cooling can be quite extensive.

Mechanical equipment typically removes 90 to 95 percent of impurities from boiler feedwater. The remainder is handled chemical water treatment. Next month's Tip Sheet will explain how the chemical treatment complements and further improves the quality and purity of boiler water.

To learn more about treating boiler water, contact your local Cleaver-Brooks representative or visit cleaverbrooks.com.