The Importance of Water Treatment in the Boiler System

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To ensure a boiler runs properly over the course of its lifetime, treating the water that circulates within the system is mandatory. If the water is not treated properly, the boiler will begin to have problems within the first year, and its useful life will be significantly shortened. Boiler symptoms resulting from untreated water include overheating, failure to produce hot water or steam, a drop in the boiler flow rate and an overall loss of efficiency.

Untreated water, even water coming from a municipal water utility, can contain dissolved solids, which form scale on the heat transfer surfaces as the water is heated. The main disadvantage of this deposited scale is that it drastically reduces the heat transfer capability of the boiler, which leads to overheating, tube failure and efficiency loss. Scale also reduces the flow area, which increases the pressure drop in boiler tubes and piping, resulting in low steam volume and potential laundry equipment failure.

Not only is hard water detrimental to the boiler itself, it is equally harsh on fabrics. Hardness of minerals from untreated water can build up in laundered clothing to the point that garments feel stiff and can even cause skin irritation. To alleviate this problem, cleaners often add more detergent with built-in chemical softeners to the laundry process. Using excess detergent increases a company's operating costs, triggers detergent buildup in fabrics and causes fabric colors to fade. In many cases, these added costs justify a water treatment system for the whole facility, including the boiler.

To protect the integrity of the boiler and ensure it continues to produce good steam quality, it is important to properly treat the feedwater, or the water going into the boiler. A water treatment system will:

- prevent deposits on boiler surfaces that weaken metal and cause heat transfer losses,
- prevent oxygen corrosion, which causes pitting of boiler tubes and rust deposits,
- prevent low pH (below 9 causes corrosion), and
- prevent steam condensate contamination that may result in poor quality of the dry-cleaned and laundered fabrics.

Harmful Elements in Untreated Water

Boiler feedwater also contains dissolved gases, such as carbon dioxide and oxygen that react in a boiler and lead to corrosion of the boiler internals and the piping system. If these gases are not extracted from the water supply before entering the boiler, the corrosion will eventually eat through boiler tubes and cause leaks and equipment failure.

Untreated water can lead to corrosion of boiler internals and piping.

Boiler feedwater also contains metal solids such as chlorides, magnesium, sulphur and calcium bicarbonates. All of these salts combine to form what is known as the “hardness” of water, with calcium and magnesium contributing the most to water hardness. If deposits of calcium and magnesium are not removed from boiler feedwater, they will coat heating surfaces and eventually plug pipes and boiler tubes. Over time, the flow through a 1½” boiler tube may be restricted to only ½” due to blockage caused by calcium and magnesium deposits.

Scale buildup and mud, sludge and contaminants can collect on the bottom of the boiler and on the tube sheet. When scale builds up, it affects the heat distribution through the tubes and the boiler in general. This inefficient heat transfer leads to wasted fuel, boiler tube softening and eventual failure.

Water Treatment Program

There are mechanical equipment and chemical solutions available to treat boiler feedwater easily and cost effectively. The best solution is to use a combination of both approaches. Treating boiler feedwater mechanically removes only 90 – 95 percent of the impurities, so this approach must be supplemented by a chemical program. Using a chemical-only approach is expensive due to the cost of the chemicals and can be environmentally hazardous since the facility will be flushing excess chemicals into its waste stream.

Perhaps the most important piece of water treatment equipment is a water softener, which ensures good boiler water quality. 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 efficiency throughout its life.

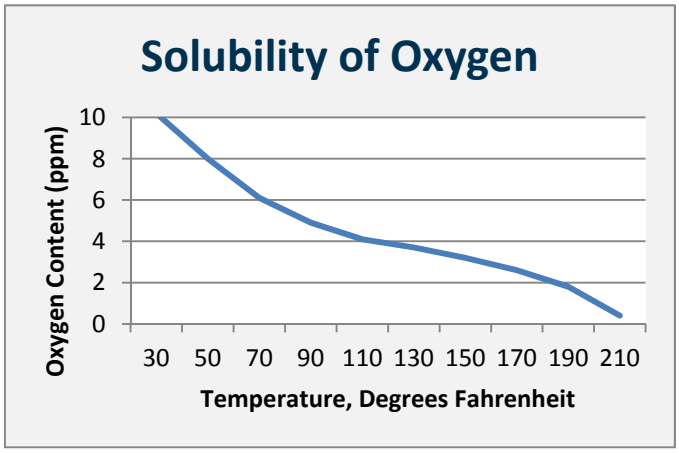
Water softeners remove harmful minerals that can cause scale build-up in your boiler.

By preventing scale buildup, a water softener also reduces a boiler’s fuel consumption. A 1/16” thick layer of hardness scale can reduce heat transfer by about 12 percent, which is directly proportional to the increased amount of fuel required to compensate for the loss. The recommended hardness of boiler feedwater is less than 1 ppm, so a water softener is required for nearly all boilers.

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 such as carbonic acid, which is carbon dioxide dissolved in water. A dealkalizer keeps boiler and process equipment scale free and also reduces corrosive condensate. This prevents scaling and reduces potential steel corrosion within the steam system.

Another piece of equipment commonly used for boiler water treatment is a deaerator or heated feedwater tank, which reduces oxygen and carbon dioxide to minute levels. The deaerator uses a mechanical scrubbing method to eliminate the harmful gases from a feedwater supply. A deaerator frequently is used in larger laundries and in facilities that run multiple boilers. The deaerator removes almost all harmful gases, with the remainder being removed by chemical means. For smaller facilities, a heated feedwater tank can achieve similar results more cost effectively. A stainless steel tank is recommended to ensure long life.

Figure 1 illustrates that by slowly heating incoming make-up water from 50°F to 180°F. The oxygen levels in the water are reduced from 8 ppm to just 2 ppm.



A chemical feed system is typically required to remove the last 5 – 10 percent of impurities from boiler feedwater. Working with a chemical water treatment company makes the last stage of treating boiler feedwater easy. Premixed chemicals in 30- or 50-gallon plastic drums with a chemical feed pump remove the remainder of harmful impurities from the boiler feedwater. A combination of mechanical equipment and chemical treatment will fully protect the investment in a boiler and steam system. It also assures the lowest chemical use for a "greener" laundry operation.

This water treatment approach is appropriate for all high-pressure steam boilers typical of those found in commercial laundries and dry cleaning facilities. Larger high-pressure steam applications will require more stringent water quality control measures.

Know Your Water Source

When shopping for water treatment equipment, it is important to know the local water chemistry in order to understand what problems have to be treated and how to size the equipment.

Most laundry and dry cleaning facilities are located in municipal areas, so the water quality report is available online via the local utility. If the water report is not available online, contact the local utility to obtain a copy of it. As an alternative, a facility can hire a local lab to conduct a water analysis. This water analysis will help assure that the right water treatment system is selected and installed at the laundry location.

Studies Show Superior Cleaning Results

Several studies have been conducted that prove laundering with soft water is better for clothing. According to the Water Quality Association, laundry detergent use can be cut by 50 percent and water temperature lowered from hot to cold by using softened water. Applying detergent in hard water is less efficient because cleaning products first react to hardness ions present in the water. Only after that does the detergent work on the clothing. The harder the water, the more work the detergent has to do.

Results of a study conducted by Scientific Services Laboratory found that using soft water is better at removing stains than increasing the water temperature or using more detergent. In addition, untreated water actually can lead to additional stains. For example, untreated iron in the water supply can pass through the equipment and cause a yellowish staining on shirts.

The negative effects of hard water were noted in yet another study that addressed the life of a range of hotel laundry, including bed linens, towels, tablecloths and cushion covers over a five-year period. Fabrics washed in softened water lasted up to 29 percent longer than the same types of fabric washed in hard water.

Installation of a properly sized water treatment system in a laundry operation will not only provide the benefits mentioned above, but also serve to protect the boiler and steam system.

A water treatment program is essential to protect a facility's boiler investment. Properly treated water provides efficient equipment operation, increases boiler life expectancy, reduces fuel use, optimizes water use and reduces waste. It will also provide considerable savings on maintenance and labor. Installing properly sized water treatment equipment to treat boiler feedwater will save a facility money on chemicals and detergents. The payback is two-fold. The equipment typically pays for itself in a short time, and laundry customers are happier because their clothes will remain true to their original color and last longer.

To locate a Representative, visit laundryanddrycleaningboilers.com or call 800-250-5883.