# Treatment of Low Make-up/Low Pressure Steam Boilers

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Treating low pressure steam boilers that have a high percentage of condensate return and very low make-up water requirements has at times resulted in a treatment dilemma. Many of these low pressure boiler systems are used strictly for heating. They will return up to 97% of the steam as condensate. Because of the low make-up requirement these systems rarely have any type of feedwater heater resulting in low feedwater temperatures. Feedwater temperatures below 120°F are very common. As a result of these low feedwater temperatures the dissolved oxygen content of this water is very high. Dissolved oxygen will cause severe pitting of the boiler metals if it is not removed from the water by deareation or by chemical treatment.

In many boiler systems it is common to inject steam into the feedwater tank and increase the water temperature to 180°F; this allows the oxygen to be vented off. If this is not accomplished prior to the boiler, a chemical must be added to scavenge the dissolved oxygen before it enters the boiler.

The most common oxygen scavenger used is sodium sulfite. It will take 10 parts of sodium sulfite to scavenge 1 part dissolved oxygen. Feedwater with a temperature of 110°F will contain 4 parts per million of dissolved oxygen requiring at least 40 parts per million of sodium sulfite. The chemical reaction that takes place between the sulfite and the dissolved oxygen results in the sulfite converting to sulfate and the oxygen being removed. This addition of sulfite and the conversion to sulfate adds to the Total Dissolved Solids in the boiler water.

When the TDS in the boiler increases beyond the recommended control point, the boiler must be blown down. Boiler blow down removes heated boiler water, suspended solids and total dissolved solids. When blow down is done, more cold water is brought into the boiler; more sulfite must be added to scavenge the dissolved oxygen. This will add to the TDS resulting in more blow down. This type of operation becomes a vicious cycle which will waste valuable energy resulting in higher natural gas or oil costs.

The answer to this treatment dilemma is to keep the boiler system as tight as possible, limiting the amount of cold make-up water that is required and still properly protect the boiler metals against corrosion. This can be accomplished by treating the boiler almost like a closed loop hot water boiler. In place of trying to scavenge all of the dissolved oxygen entering the boiler in the cold feedwater, we can limit the amount of cold water entering the boiler and add a molybdate/nitrite based corrosion inhibitor to protect the boiler metals. This type of treatment approach actually provides a corrosion inhibitor film on the boiler metals whereas sulfite only removes the dissolved oxygen and has no passivating properties. This type of treatment approach does not eliminate the need for proper blow down but it does reduce the required frequency of blow down. It is also very important to understand that this type of treatment program can only be successful if there is a limited amount of make-up, less than 3%.

International Chemtex has a series of products designed specifically for this type of boiler operation. Chemtex MF-64, MF-65, MF-66 and MF-67 all provide both superior corrosion control along with superior scale control. These products can be used to maintain these types of boiler systems in peak operating condition. This type of treatment program will result in substantial chemical and energy savings while maintaining clean, corrosion free boiler surfaces.

While the initial costs for this type of program may be slightly more for the chemical, the savings in energy from reduced blow down and the reduced operator involvement will result in significant savings. A 100 Horsepower boiler could see a reduction of 5% in blow down, which translates to saving 2 gallons of fuel oil per day or 4500 cu.ft. of natural gas per day.

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