



Reverse Osmosis for Boilers

There are a number of industries that require high purity steam in their processes. One of those industries is the Corrugator Industry.

Feedwater quality impacts the purity of steam and also has an impact on boiler operational efficiency and the cost of running a boiler.

Minimizing the blowdown rate in a boiler system can substantially reduce energy losses since the temperature of the blowdown liquid is the same as that of the steam generated in the boiler. Minimizing blowdown will also reduce makeup water and chemical treatment costs.

As water evaporates in the boiler steam drum, solids present in the feedwater are left behind. The suspended solids form sludge or sediment in the boiler which inhibits heat transfer. Dissolved solids may promote foaming and carryover of boiler water into the steam. In order to reduce the level of suspended and total dissolved solids (TDS) to acceptable limits, water is periodically discharged or blown down from the boiler.

Insufficient blowdown may lead to carryover of boiler water into the steam, creating wet steam and/or the formation of deposits on equipment. Excessive blowdown will waste energy, water, and chemicals. The optimum blowdown rate is determined by various factors including the boiler type, operating pressure, water treatment and most important – the quality of the make-up water.

If the makeup water is high in dissolved solids, fewer cycles of concentration can be obtained. Cycles of concentration refers to the accumulation of impurities or dissolved solids in a boiler. If the boiler water contains 10 times the level of dissolved solids in the makeup water, it is said to have 10 cycles of concentration.

If the maximum set point for conductivity (a measurement of dissolved solids) is 3500 uS and the incoming makeup water conductivity is 700 uS, we can only concentrate the water 5 times before it has to be blowdown. This results in 20% of the heated boiler water being sent down the drain. If we can reduce the number of dissolved solids in the makeup water to 35 uS, we can concentrate the water in the boiler 100 times and only blowdown 1% of the heated boiler water.

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Since fuel makes up 70% to 80% of the operational costs in a boiler system and water/sewer make up 3% - 5% of the operational costs, the savings achieved by increasing cycles of concentration can be substantial depending upon the steam produced per hour, water, fuel, and chemical costs.

One way of improving the quality of the makeup water to the boiler is through Reverse Osmosis. Reverse Osmosis removes 95% to 98% of the impurities and dissolved solids in water. It is therefore possible to reduce the conductivity of the boiler makeup water from 700 uS to 14 – 35 uS. This would allow us to reduce the blowdown rate from 20% of makeup to 1% of the makeup water and improve the quality of the steam in the process.

Other benefits of reducing the dissolved solids in the makeup water specific to the Corrugating Industry include:

- Higher cycles of concentration results in less blowdown and reduced fuel costs.
- Improved steam purity and dryer steam consistency can provide increased corrugator speed.
- More efficient operations and increased throughput results in higher revenue/profit.
- Reduced risk of carryover in the steam along with deposits in the boiler and downstream equipment.
- Improved condensate corrosion control (no alkalinity in the boiler to produce CO₂ for carbonic acid formation).
- Extended ion exchange resin life.
- Maintains optimal thermal performance resulting in improved boiler and steam heat transfer efficiency.

Minimizing carry-over at higher cycles of concentration through the use of RO for the make-up water has an added benefit. The steam that is produced is much dryer, which allows the speed of the corrugator to be increased. In some cases, a 15% increase in lineal feet per minute was successfully achieved. The increases in production have the potential to result in a much higher return on investment than the cost savings from lower energy and water usage.

The utility costs savings and increased production that can be achieved by installing a Reverse Osmosis system to improve the quality of the boiler feedwater can be substantial, with the potential to achieve a payback in less than 18 months on the investment in the RO system.

If your plant has issues with:

- The quality of the incoming makeup water.
- Low cycles of concentration; you are only able to run 3 – 10 cycles of concentration.
- Carryover or wet steam.
- Deposits in the boiler.
- Maximizing steam production to optimize the continuous speed of the corrugator.
- Zero discharge requirements.

Your plant could benefit from the installation of a Reverse Osmosis system, please contact Rochester Midland Corporation for a free system survey and a quote.

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