Steam trap repair, increased condensate return and reverse osmosis pretreatment cut boiler gas usage at Midwestern tractor manufacturer

CASE STUDY

| Challenge

Inefficient, faulty boiler operation wasted energy, had to be corrected

A major Midwestern US tractor manufacturer was experiencing problems with the boiler system at its technical center for research and development and engine testing.

The boiler was using too much water and the steam traps were blowing steam by the boiler room drains. With the main boiler system using softened well water as its primary make-up source, high make-up dissolved solids levels and conductivity were causing the boiler to operate at 15-20 boiler cycles. That created a 5-to-7 percent blow down of boiler water. {Note – 20 cycles correspond to 5% and 15 cycles to 6.7% blowdown}. Excessive blow down of boiler water not only significantly increases water usage and pre-treatment costs; it is also wasteful of fuel and energy.

In addition, the elevated levels of bicarbonate alkalinity in the boiler feedwater, which are not reduced by ion exchange softening, generate high levels of carbonic acid (H_2CO_3) in the steam condensate, which is very corrosive to both the steel and copper alloys with which the condensed steam is in contact.

| Solution

Response to problems includes redirected piping and an RO machine

The steam traps, which had failed in the open position and were blowing by steam, and a leaking condensate tank, were repaired and two of the traps were re-piped away from the drains and to the condensate system. The enhanced rate of return of hot condensate to the boiler can significantly reduce energy and pre-treatment costs.

A 4,400-gallon-per-day Reverse Osmosis (RO) machine was added to the boiler system, and it reduced make-up conductivity from 1,800 umols down to 20 umols. This allowed the boiler to operate at 100-to-150 cycles, with a corresponding reduction in boiler blow down to less than 1 percent of hot boiler water. This results in lower energy usage due to the reduction in loss of hot boiler water from the system.

In addition, the RO process efficiently rejects make-up water bicarbonate alkalinity, greatly reducing CO_2 generation in the boiler and subsequent carbonic acid levels in the steam condensate. This reduces the corrosion of the metal surface in the steam distribution and condensate return systems, including the steam traps and associated condensate return piping.

| Results

System revamp saves on natural gas

Boiler gas usage during the 2009-2010 season was reduced by more than 20,000 cubic feet of natural gas from the 2007-2008 season. That represented a 26-percent drop in natural gas consumption and saved $60,000 in energy costs.

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