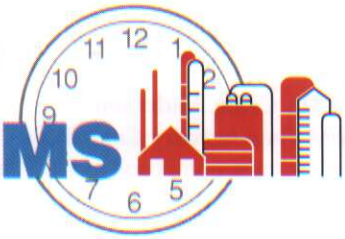
High Pressure Condensate RETURN SYSTEMS



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During recent visits to several rendering facilities, I was asked about "high pressure condensate return systems." The term refers to the returning high pressure boiler condensate directly back to the boiler or back to the storage section of the deaerator. Although there may be some reservations about this method, if the proper precautions are taken, it can offer fuel and chemical savings.

High pressure condensate return systems are ideal: in systems that operate continuously or nearly continuously (more than 20 hours per day, six days per week); in tight systems or systems which have more than 80 percent condensate return; in well-maintained and monitored systems; and in systems utilizing steam treatment (neutralizing amines preferred). This is not to say that high pressure condensate returns cannot be used in other steam systems, but systems not meeting these conditions will be or may be prone to more problems.

Steam condensate from any process is seldom cooled much below that of the steaming temperature. Because it is close to the steaming temperature, very little fuel is needed to "regenerate" steam with this condensate. The less "flashing" or the higher the pressure maintained, the greater the amount of fuel savings realized with the high pressure system. Flashing reduces both the pressure and temperature (representing loss of energy and fuel).

Normally condensate is collected then pumped to the best point of return, or delivered to a point of lower pressure through a pressure differential. The "best point" of return is considered to be the place which offers maximum treatment time after deaeration and before the boiler. Dissolved gases are a major concern in that they represent the primary source of corrosion occurring in a boiler. The high pressure condensate return system minimizes the possibility of oxygen/gas contamination, delivering the condensate to either the storage section of the deaerator or directly to the boiler. Air contamination is prevented through maintaining elevated pressures and temperatures (due to the inverse solubility of gases at elevated temperatures).

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High pressure condensate systems require specially designed pumps to handle the hot, high pressure condensate. High pressure condensate is returned via these pumps from the condensate receivers. Adequate levels of hot condensate should be maintained to avoid possible air intake by the pumps. Preventative maintenance should be performed on pump seals to assure their integrity, minimizing any seal water intake (cooler water containing dissolved oxygen).

Condensate return systems do not eliminate carbon dioxide contamination. Carbonate and biocarbonate alkalinity found in the make up water (naturally occurring alkalinity) breaks down in the boiler at elevated temperatures and pressures forming carbon dioxide. This carbon dioxide goes with or follows the steam to form carbonic acid in the condensate. Carbonic acid lowers the system pH, attacking the metals of the system, creating corrosion products and possible leaks. The corrosion products travel back to the boiler, causing sludge and scale. Carbonic acid corrosion increases ten fold in the presence of oxygen. Carbonic acid corrosion can be prevented by utilizing neutralizing amines. Neutralizing amines are chosen to match your steaming pressures. (Each amine has a specific distribution ratio and basicity. Please contact your chemical representative for specific recommendations for your facility.) These neutralizing amines or volatile alkaline amines travel with the steam, neutralizing the carbonic acid as it forms. The feedrate of neutralizing amines are based on make up water volume, temperature, and pressure (the source of the carbonate and biocarbonate alkalinity is the "make up water"). Normally the feedrates are adjusted to maintain a pH between 8.3 and 10.2, depending on the chemical company where they are purchased and their recommendations.

Even though condensate corrosion is being controlled with the neutralizing amines, the entire flow of condensate may need to be polished through an activated charcoal filter and some type of ion exchange system before being returned to the deaerating heater or the boiler. The activated charcoal helps to remove any oil contamination, and the ion exchange removed corrosion products together with any hardness that may have entered into the condensate system (normally from steam operated hot water heaters).

Systems which are operated

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intermittently will be more prone to oil contamination than continuously operated systems. As the system cools down, a vacuum is formed in the cooking equipment. Any leaks in the cooking equipment will pull in oil and product solids. As the system heats up and goes back on-line, that oil and product will end up in the boiler. In order to avoid this scenario, venting to sewer of the initial condensate may be required on start up. Investigating the use of coalescing chambers is recommended.

For the most part, the condensate handling system is constructed of ordinary carbon steel (in a rendering plant all systems should be either of steel or of stainless steel). At rendering facilities copper and copper alloys should be avoided due to the inherent presence of ammonia. Ammonia combined with oxygen is one of the principal causes of copper and copper alloy corrosion.

Because condensate is usually hot, corrosive agents are more active at elevated temperatures. The principal agents of corrosion are again carbon dioxide and oxygen which would be vented in low pressure return systems. By feeding neutralizing amines we have eliminated carbon dioxide. Oxygen tests should be used to insure that oxygen is not present. If present, volatile oxygen scavengers can be fed to control or remove the dissolved oxygen (contact your boiler chemical representative). Normally, oxygen present indicates a problem with a pump seal, pump, or lever control in the receiver. Several laboratory companies offer easy-to-use manual tests for dissolved oxygen (be sure to go with the lower range test).

Due to the change in the feed point of the condensate when incorporating a high pressure condensate return system, additional considerations should be given to the level controls in the boiler (two level controllers may be required).

Hopefully this article has given you some insight into how high pressure condensate return systems work and the precautions needed in handling or operating such a system and whether it is right for you or your system.

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employee must stay home with a sick child, or dress-down days where employees can wear comfortable clothing instead of the stuffy suit and tie, can add to employee morale. Of course, most employees would opt for Sun and Tu's generosity. Thousands of resumes and phone calls to the Kingston Technology offices from job seekers proved that. But recognizing employees as people, not costs, will help ensure their dedication and long-time commitment.

An important thought, as quoted by Jeffrey Pfeffer, a professor at Stanford University's business school, puts it all into perspective: "When I look at you (the employee) do I see a cost, or do I see you as the only thing that separates me from my competition?"

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