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## UNFIRED STEAM GENERATOR WATER QUALITY

### **CEMLINE® Water Quality Guidelines for Unfired Steam Generators**

Properly treating water to the unfired steam generator is fundamental to the routine maintenance of the unit allowing for a long life of the unit and the system components connected to the unfired steam generator. Any water treatment program should be managed under the supervision of a competent water treatment specialist.

Unfired Steam Generators can be affected by scale formation or chemically induced corrosion with the use of poor water quality in the unit. The most commonly occurring water quality problem associated with unfired steam generators is the formation of scale within the unit. Scale tends to form on the hottest surface, which is the u-bend heat exchanger. The formation of scale within the unit will lead to a number of problems. First and most significant would be a decrease in capacity of the steam generator, as scale forms on the heat exchanger surface. The second potential problem due to scale formation would be generation of wet steam, which is an indicator of reduced capacity of the unit caused by fouling on the heat exchanger bundle. The third potential problem due to scale formation is the unit not maintaining proper water level caused by the formation of scale in the vessel or within the component piping connected to the level control or to the feedwater valve.

Poor water quality can also lead to the formation of chemically induced corrosion of the heat exchanger or the vessel. The types of chemically induced corrosion that may be experienced are general corrosion, pitting corrosion, and stress corrosion. Chemically induced corrosion can dramatically reduce the life of the vessel or the tube bundle. Examples of general corrosion could be a uniform attack of the tube, tubesheet, or vessel reducing or thinning the material until there was a failure. Pitting corrosion would be formation of pits on the tubes, tubesheet, or shell leading to a failure of the material. Examples of stress corrosion would be stress corrosion cracking. Stress corrosion cracking is the formation of brittle cracks following the lines of stress and grain boundaries of the metal. Stress corrosion cracking can be experienced in austenitic stainless steel, such as grade 316L used in the vessel, tubes, and tubesheet of the unfired steam generator. Stress corrosion cracking is associated with chlorides in the water. The rate of incident of stress corrosion cracking rises with increased chloride concentration and temperatures.



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Below is a list of water properties and the recommended ranges for use in Cemline Unfired Steam Generators to control corrosion and scale.

Property of Water	Range
pH	6 – 8
Total Hardness (Ca and Mg)	Less than 25 ppm
Alkalinity (CO <sub>3</sub> , HCO <sub>3</sub> )	Less than 150 ppm
Total Dissolved Solids	Less than 50 ppm
Conductivity	Less than 75 ppm (150 uS/cm)
Chlorides	Less than 50 ppm
Sulfates	Less than 250 ppm
Silica	Less than 150 ppm