

Water supply for Steam

Steam is 100% Water - Undesirable water characteristics are often the cause of expensive repairs, shortened equipment life and affect the product quality. All of these can be avoided with the right treatment of the water supplied.

Water treatment is not a mystery - It is a process involving many different aspects of the physical and chemical sciences. The expertise is in the application of specific water treatment technologies to deal with differing contaminants in order to create a desired result. What matters most is:

- Select a proper the filtration system including the right treatment technology for your type of steam equipment.
- The system performance is 'balanced'; this means each of the different treatment methods, i.e. chlorine reduction, and scale inhibition are properly sequenced so that each will deliver consistent results based the stated capacity (in Lit/gallons) of the system.
- The system will perform at the required flow rate.
- The system capacity is proportional to the actual water usage of the steam equipment between recommended filter change intervals.

A water treatment system is driven by the desire to improve operating efficiency consistency and to protect your equipment against expensive service calls and downtime

- Common water contaminants that cause problems with steam equipment are:

Dirt, Sediment | Chlorine (Corrosion) | Minerals (Scale)

The following information describes how these contaminants impact steam equipment,

Dirt, Sediment, Rust (particulate matter)

Suspended particulate matter in water is detrimental to the condition and performance of steam equipment. Particulates in water cause added wear on parts, and can clog solenoids, screens, valves and other fittings. Fine silt, dirt, rust and other debris settle as sediment and can be a catalyst for scale build-up.

Chlorine

Most municipal water utilities use chlorine to kill pathogenic organisms and to provide a residual concentration of disinfectant throughout the distribution system. While chlorine

makes our water safe to drink, it can contribute to pitting and corrosion in steam equipment. Activated carbon is the best technology for removing disinfectant chlorine.

Scale (Limescale) - Water Hardness

A common and expensive water related problem with steam equipment is the formation and accumulation of scale. Varying amounts of scale-forming compounds (primarily calcium and magnesium in the form of carbonates) are present in water supplies. These dissolved mineral compounds, measured as "water hardness", become concentrated in water due to evaporation. Concentration and heat force them out of solution onto heat transfer surfaces where they form a hard, adherent, rock-like layer. Scale acts as an insulating layer and prevents an efficient transfer of heat. Over time scale build-up impedes steam production, reduces energy efficiency, increases maintenance requirements and eventually causes equipment shut-down requiring expensive service.

Different physical characteristics of water such as total dissolved solids, hardness as CaCO_3 , pH, temperature, alkalinity, sulphates and silicates influence the amount of hardness in water and its tendency to form scale.

Chlorides (corrosion)

Corrosion is the deterioration of materials due to reactions within the environment. In general, the corrosive nature of water increases as conductivity (TDS) increases. Chloride is a compound that becomes particularly reactive at higher temperatures (140-212° F) and can penetrate the passive film on stainless steel allowing a corrosive attack to occur. Common types of corrosion associated with chlorides are pitting, crevice corrosion and stress corrosion. The degree to which chlorides present a problem depends upon the overall chemical characteristics of your water, but chlorides can be corrosive to stainless steel even at low levels. Corrosion can be rapid, destructive and expensive with steam equipment drastically reducing equipment life. Along with the previous five parameters, chloride should be considered in deciding the best treatment technology to protect steam equipment.

Analysis of the following water parameters should be considered to choose the best treatment technology for your application:

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The distilled or mineral-free water supply shall be according to the table below:

Physical Characteristics and Maximum acceptable contaminants levels in water or steam, for steam generator and sterilizers

(According to EN 285:2006).

	Contaminants in water supplied to generator	Contaminants in condensate at steam inlet to sterilizer
Evaporate residue	≤ 10 mg/l	N/A
Silicate (SiO ₂)	≤ 1 mg/l	≤ 0.1 mg/l
Iron	≤ 0.2mg/l	≤ 0.1mg/l
Cadmium	≤ 0.005 mg/l	≤ 0.005 mg/l
Lead	≤ 0.05 mg/l	≤ 0.05 mg/l
Rest of heavy metals except iron, cadmium, lead	≤ 0.1 mg/l	≤ 0.1 mg/l
Chloride (Cl)	≤ 2 mg/l	≤ 0.1 mg/l
Phosphate (P ₂ O ₅)	≤ 0.5 mg/l	≤ 0.1 mg/l
Conductivity (at 25°C)	≤ 5 µs/cm	≤ 3 µs/cm
pH value (degree of acidity)	5 to 7.5	5 to 7
Hardness (Σ ions of alkaline earth)	≤ 0.02 mmol/l	≤ 0.02 mmol/l
Appearance	Colorless, clean, without sediments	

Compliance with the above data should be tested in accordance with acknowledged analytical methods, by an authorized laboratory.

Attention:

The use of water for autoclaves that do not comply with the table above may have severe impact on the working life of the sterilizer and can invalidate the manufacturer's guarantee.

Tap Water supply

Maximum hardness value 0.7-2.0 mmol/l

Note:

The use of soft water is strictly forbidden!

Please consult a water specialist!

Water Hardness (as CaCO₃) - is a measure of the scale forming compounds of calcium and magnesium. The amount of hardness is often expressed in ppm (parts per million) or mg/L (milligrams per liter). Ppm and mg/L are equivalent.

Total Dissolved Solids (TDS) - Also expressed in ppm or mg/L, total dissolved solids are all of the inorganic and organic substances in water that are present in their molecular or ionized form.

Alkalinity - As it pertains to steam equipment, alkalinity is an indicator of the potential, or tendency for hardness minerals to form scale. Bicarbonate (alkalinity) breaks down when heated and combines with calcium and magnesium to form hard scale on metal surfaces.

pH - is a measure of the relative balance between acid and alkaline substances in water. It is an indicator of whether water has a scale-forming tendency or a propensity to be corrosive. The pH of water is considered, in conjunction with other water parameters, to determine the best water treatment technology.

Silica - is a very hard mineral found in nature in quartz and opal, and is a common constituent of sand. Glass is silica-based material. Small amounts of silica can form very hard scale in steam equipment that is difficult to remove.

Chloride - Chlorides are one of the most common elements in nature. They are soluble, active ions that make a basis for good electrolytes that can trigger a corrosive attack. Chlorides present the greatest threat for corrosion in steam equipment.

Important Considerations Regarding Dissolved Minerals and Steam Equipment

Water is nature's solvent. It contains, to some degree, everything it can dissolve on the way to your tap. Calcium, magnesium, chlorides, sodium and carbonates are a few of the many different dissolved solids found in water. Heat, evaporation and concentration cause chemical reactions that force these minerals out of solution where they form scale in boilers, valves and fittings; and on elements, cabinet walls and glass.

There are two fundamental ways to treat dissolved solids in water.

1. Inhibit mineral problems with chemistry

Inhibiting technologies do not remove dissolved minerals. Inhibitor media interfere with water chemistry to inhibit the formation of hardness compounds, reduce the tendency of minerals to accumulate as hard scale, and make routine cleaning easier; but inhibition is not removal. It is important to follow all manufacturer recommended routine cleaning and periodic descaling recommendations. If deposits are allowed to accumulate they will eventually become problematic.

2. Remove problematic minerals

Removal technologies take out dissolved minerals that cause scale and corrosion. Advanced membrane separation can eliminate water-related problems with steam equipment because the problematic minerals are removed. Hardness deposits, corrosion and other problems that cause down-time and require expensive maintenance can be virtually eliminated. When warranted, this technology easily pays for itself by reducing service and maximizing operating efficiency, and can add years to equipment life.

Reverse Osmosis (RO)

Reverse Osmosis (RO) is a near absolute removal process that takes out virtually all dissolved solids and ions in water. Water with this degree of purity can be aggressive in environments with metals and lacks the conductivity required for electrical sensors and level probes. Reverse Osmosis is not recommended for steam equipment.

Additional comments

It's important to understand the potential water-related problems in your application, and assess the impact it can have on your equipment and your business. Simply weigh the value of maximizing equipment life and minimizing maintenance against shortened equipment life and more frequent maintenance and service.

- *How frequently will your equipment require service, and at what cost?*
- *Will downtime and service interruption affect business?*
- *How does scale build-up affect equipment operating efficiency?*
- *How many years your equipment last and what is the replacement cost?*