



Steam Equipment Water Filtration Application Guide

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*Compare the Performance . . .
. . . Measure the Difference*

Today's combi-ovens and steamers promise versatile, efficient, predictable results at the push of a button. At the core of their performance is steam.

◆ **Steam is 100% Water** - Chemical characteristics of water can have a significant impact on equipment operating efficiency, and are often the cause of costly repairs and shortened equipment life. These problems can be avoided with the right water treatment system. It is impossible to enjoy the benefits of cooking with steam without careful consideration of water quality.

◆ **Water treatment is not a mystery** - It is a complex 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 different contaminants in order to produce a desired result. Important considerations are:

- ◆ The system includes the right treatment technologies to deal with specific contaminants that will affect both your equipment condition and steam quality.
- ◆ The system performance is 'balanced'; this means that the system will deliver on each of its performance claims, i.e. chlorine reduction, and mineral or scale reduction for the capacity claim (gallons/liters) of the system.
- ◆ The system will perform at the required flow rate.
- ◆ The system capacity is proportional to the actual water usage of the equipment between recommended filter change intervals.

Properly applied, water treatment will reduce scale and corrosion problems, assure efficient equipment operation, and eliminate expensive service calls and downtime. It is an investment in the success and profitability of your business.

◆ **Become Knowledgeable** – This document will help you understand the basic characteristics of your water and the likely impact it will have on your equipment; and will highlight important considerations for making an informed decision about selecting the best water treatment for your application. Make sure you understand the manufacturer's water quality requirements and how they affect the warranty. Examine the treatment options available and choose the one that will deliver the results you expect. The bottom line is: if you don't understand what filtration does and how it will protect your equipment and your business, it's tough to make the best choice.

◆ **It's a lot like buying insurance** – The value of water treatment is a measure of how well it protects your equipment and your business against the cost and hassle of water-related problems. Service interruptions, costly repairs and operating inefficiencies can be far more expensive than guarding against them. Water treatment insures that your equipment is producing when you need it most.

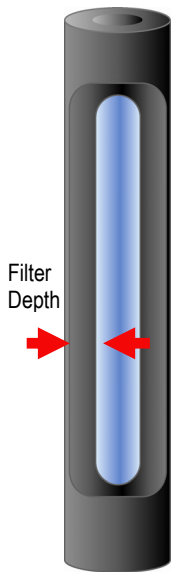
Water chemistry and the physics involved with different methods of generating steam is complex. The purpose of this guide is to help you make the best decision about water treatment for your unique application.

Let's look at some of the contaminants that can be problematic and the water treatment technologies used to deal with them:

Particulates - (dirt, sediment, rust)

An array of suspended particles in water can cause added wear on parts, and clog solenoids, screens, valves and other fittings. Fine silt, dirt, rust and other debris settle as sediment and provide a catalyst for scale build-up. There are different types of filtration media used to remove particulates from water. Fundamentally, they work like a 'net' to trap and hold objects larger than the holes in the net.

OptiPure filtration systems filter out suspended particulate matter down to 0.5 micron in size. To get an idea how small this is, one micron is equivalent to 0.000001 meter, a human hair is about 90 microns thick and the smallest speck you can see is about 40 microns across.



OptiPure filtration systems utilize gradient density-depth filtration.

This means that water flowing through the filter passes through nearly $\frac{3}{4}$ " of media that traps particulates within the many layers that make up its depth. The larger dirt particles are trapped in the outer layers of the filter. As the gradient becomes progressively denser, smaller particles are trapped in the deeper layers of the filter. This filtration technology provides exceptional 'dirt-load' capacity, and allows excellent flow with minimal pressure drop between recommended filter change intervals.

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. Chlorine can also impart offensive taste and odor in water which can affect steam quality. Activated carbon is the best technology for taking out disinfectant chlorine.

The media structure of the OptiPure cartridge is entirely composed of fibers coated with powdered activated carbon (PAC). A dense structure of these carbon coated fibers make up the entire depth of the CTO and CTOS cartridges used in OptiPure systems. The high mass of powdered activated carbon, along with the gradient-depth structure of these cartridges, provides tremendous surface area and contact time as water flows through. OptiPure's activated carbon chlorine reduction media contributes to the exceptional NSF Certified performance and capacity of OptiPure systems.



Filtering out fine particulates and reducing chlorine is always beneficial for equipment condition and steam quality; and is recommended as minimal water treatment for all steam equipment.

Total Dissolved Solids (TDS)

Water is nature's solvent. It contains, to some degree, everything it can dissolve on the way to your tap. TDS (Total Dissolved Solids) is the measure of a broad array of chemical contaminants (primarily minerals) dissolved in water. TDS includes sodium, iron, nitrates and chloride to name a few. The scale-forming ions of calcium and magnesium carbonate are also dissolved solids, but testing is necessary to determine how much of the TDS is made up of hardness minerals. When present, chlorides can also be problematic with steam equipment.

Hardness - (scale / lime-scale)

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 'hardness' minerals become concentrated in **boilers and steam generators** due to evaporation. Concentration, pressure and heat force them out of solution where they form as hard, adherent, rock-like deposits. Scale deposits on heat transfer surfaces act as an insulating layer which prevents the efficient transfer of heat. With **boilerless "flash-type" steam generation** all of the dissolved solids are rapidly forced out of solution and form deposits. Over time scale build-up impedes steam production, reduces energy efficiency, increases maintenance requirements and eventually causes equipment shut-down requiring expensive service.

There are two fundamental ways to deal with Water Hardness and TDS

1. Inhibit problems with minerals

Inhibiting technologies do not remove dissolved minerals. These technologies interfere with the relationship between the ions of dissolved minerals to inhibit the formation of hardness compounds. Minerals are not removed from the water and TDS is not reduced. Inhibiting technologies, such as OptiPure's **IsoNet**[®], dissolve polyphosphate into water to sequester hardness minerals inhibiting their tendency to form scale. OptiPure's **ScaleX2**[®] technology is also an effective scale inhibitor but, unlike IsoNet, ScaleX2 does not add any chemicals to water.

2. Remove problematic minerals

Removal technologies take out dissolved minerals. These technologies effectively eliminate problems by removing problematic minerals. **Advanced Membrane Separation (AMS)** systems take out >95% of all dissolved minerals eliminating problems associated with water hardness and TDS. When warranted, AMS easily pays for itself by reducing service requirements, optimizing operating efficiency and extending equipment life. OptiPure AMS systems include **mineral addition** or **filtered blending** features to produce water with right TDS and mineral balance for steam applications.

It is important that the system be specifically designed for commercial steam oven applications. An improperly applied reverse osmosis system can cause operation problems and significant damage to steam equipment.

Chlorides (corrosion)

Corrosion is the deterioration of materials due to reactions within the environment. 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. 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. **IsoNet scale inhibitor helps protect against chloride corrosion. Advanced Membrane Separation (AMS) remove chlorides from water eliminating their ability to cause corrosion.**

Understand the basic characteristics of your water

Along with hardness, TDS and chlorides, additional physical characteristics of water such as alkalinity and pH influence the tendency of water to form scale or be corrosive in steam equipment. Here is a brief description of these contaminants and how they are measured and expressed in a water analysis.

Total Dissolved Solids (TDS) – is all of the inorganic and organic substances in water that are present in their molecular or ionized form. For example, table salt – NaCl (sodium chloride), when dissolved in water become Na^+ and Cl^- ions. Dissolved ions make up the majority of TDS and are what allows electricity to pass through water (electrical conductivity). TDS is expressed in ppm (parts per million) or mg/L (milligrams per liter), which are equivalent measures.

Water Hardness (as CaCO_3) – is a measure of the scale forming compounds of calcium and magnesium. The amount of hardness is also expressed in ppm or mg/l, and is sometimes expressed in grains per gallon (gpg). One (US) ‘grain’ of water hardness is equivalent to 17.1 ppm hardness as CaCO_3 . For example, 171 ppm CaCO_3 divided by 17.1 equals 10 grains per gallon of hardness.

Chloride – Chlorides are soluble, active ions that can trigger a corrosive attack in steam equipment. Chloride (Cl^-) levels are also expressed in ppm or mg/l.

Alkalinity – refers to the capability of water to neutralize acid. Some alkalinity is desirable to balance the corrosive effects of acidity. Bicarbonates break down when heated and combines with hardness minerals to form compounds that precipitate as scale. Alkalinity is expressed in ppm or mg/l.

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. On a scale of 0 to 14, pH7 is neutral - below 7 is acidic and above 7 is basic or alkaline. High pH may indicate a scaling tendency.

Silica – is a very hard mineral found in quartz and opal, and is a common constituent of sand. Small amounts of silica can form a very hard scale that is difficult to remove. Silica is expressed in ppm or mg/l.

Contact your water utility and request a ‘consumer confidence report’. This is a public document that often includes detailed water quality information including the parameters listed here. This information is often available online under city services or utilities. Another online source for this information is the EPA website – keywords SDWIS (safe drinking water information system) – click on “how to access drinking water information”. Information about your water and water utility can also be found on the American Water Works Assoc. consumer information site – drinktap.org

How does the oven generate steam?

Different methods of making steam can require different types of water treatment.

You must understand how an oven generates steam in order to select the right water treatment system. What matters most is whether the oven contains a volume of water that is 'boiled' to generate steam or whether it takes in water that is instantly 'flashed' into steam.

***Boiler* – A volume of water is contained and heated to generate steam.**

This includes ovens with boilers, steam generators and ovens with open reservoirs of water inside the oven cabinet. Most ovens with a boiler or steam generator have a 'blow-down', 'drain' or 'drain & flush' feature. OptiPure's **ScaleX2®** is an excellent scale inhibitor when used with boiler-based ovens that drain & flush on a daily basis. The more frequent the boiler or steam generator is drained, the better 'inhibition' filtration will work. If your oven does not drain automatically it would be beneficial to manually drain it on a daily basis.

***Flash* – Water is dispensed onto a heated surface and instantly 'flashed' into steam.**

This method involves some type of mechanism for dispensing water directly onto a heated surface or element that is hot enough to rapidly vaporize, or "flash" the water into steam. All of the minerals in water are forced out of solution in ovens with flash steam. OptiPure's **IsoNet®** scale inhibitor is a reasonable choice here at very low hardness and TDS levels. It causes the precipitated solids to be 'softer' or 'less dense' which makes descaling quicker and simpler, but the oven must be cleaned on a routine basis. OptiPure's **AMS** systems are the ideal solution for boilerless 'flash' combi ovens; providing superior protection against scale and chloride caused corrosion.

Choose the Best Water Treatment Technology

OptiPure application recommendations are based upon the systems tested and proven ability to help protect equipment against undesirable water characteristics. It is important to note that water chemistry, and the physics of using heat energy to convert water from a liquid to a gaseous state, is very complex. Many variables can influence the overall impact water will have on equipment in a given application.

The purpose of this document is to help OptiPure users understand how water contaminants can affect their steam equipment and the treatment options available; and to share important considerations for making an informed decision about selecting the best water treatment for their application. The water quality parameters presented here are general application guidelines. Recommendations may vary based upon application specifics, and equipment design and features.

Water Quality Standards and Warranties

Equipment manufacturers have established “water quality minimum standards” to help customers understand the importance of managing water quality with steam equipment and to protect against water-related warranty issues. These standards are often published in specification sheets, warranties and owners manuals. The following chart depicts the ‘high-end’ and general range of water quality requirements published by major manufacturers of combi ovens and steamers. In most cases, failing to meet these water quality standards voids the warranty against water-related problems.

Contaminant	Manufacturers Water Quality Standards
Hardness	35 to 120 ppm (3 to 7 grains)
Alkalinity	50 ppm or less
pH	7.0 to 9.0
Total Dissolved Solids (TDS)	30 to 100 ppm*
Silica	12 ppm or less
Chloride	30 ppm or less
Free Chlorine	Less than 0.1 ppm

* Some TDS is necessary to prevent water from becoming corrosive and for water level (conductivity) probes to function properly.

Most water in North America will not meet these standards without treatment.

Total dissolved solids, hardness and chloride levels can be 5 or even 10 times higher than this.

Is it unreasonable to require these standards be met to validate warranties?

No. Water quality within the above standards will drastically reduce or eliminate water-related problems and assure years of consistent, trouble-free performance from your combi oven or steamer. **OptiPure’s BWS (blended water reverse osmosis systems) are designed to allow an operator to “dial-in” their water quality to meet these standards, maximize operating efficiency and protect their investment.**

Consider the financial impact of potential water-related problems on your equipment and your business. Once the financial impact is considered, simply weigh the value of maximizing equipment life and minimizing maintenance against shortened equipment life, inefficient operation and more frequent maintenance and service.

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

Application Recommendation



Boiler & Flash Steam

	Consider when	Recommended when
Hardness	> 50 ppm (3 grains)	> 85 ppm (5 grains)
Alkalinity	> 20 ppm	> 100 ppm
TDS	> 100 ppm	> 200 ppm
Silica	> 5 ppm	> 10 ppm
Chloride	> 10 ppm	> 30 ppm

Advanced Membrane Separation (AMS) – Unlike *filtration*, which is a process of trapping and holding contaminants within a filter media, *membrane separation* is a process where purified water is produced by forcing water under pressure through a membrane while flushing contaminants rejected by the membrane away to the drain. Nothing is trapped and held in the membrane. It is a separation process.

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 cause corrosion on wetted surfaces and lacks the conductivity required for electrical sensors and level probes. To achieve the ideal water characteristics for steam applications requires the appropriate balance of minerals in water.

OptiPure AMS provides the right water characteristics for steam equipment.

OptiPure LP and OPW models utilize special “selective rejection” membranes that remove hardness minerals while allowing some permeation of non-hardness minerals. This allows for needed conductivity and reduces the aggressive nature of pure water. When needed, mineral addition filters are used to provide the ideal mineral balance for steam equipment.

OptiPure BWS-QT system (shown) allows a user to blend Filtered water with RO water to achieve “Optimized Water” with the desired TDS level and mineral balance. Water quality can be adjusted to meet equipment manufacturers ‘Water Quality Standards’ regardless of geographical or seasonal variations in water characteristics.

With AMS, water-related problems with steam equipment are effectively eliminated. OptiPure AMS systems deal with a broad range of contaminants that are detrimental to steam equipment. Each system includes complete pretreatment, AMS processor, storage tank, and water repressurization.

OptiPure offers a variety of wall-mount and free-standing models available with a variety of features and in a range of sizes to meet any steam equipment application requirements.


☞ OptiPure AMS is highly recommended for ‘flash’ steam equipment.



Application Recommendation



Boiler Steam

	Consider when
Hardness	> 50 ppm (3 grains)
Alkalinity	> 20 ppm
TDS	>100 ppm

ScaleX2 protects steam equipment against scale by inhibiting the formation of calcium carbonate hardness.

ScaleX2 instantly transforms dissolved calcium carbonate hardness minerals into microscopic particles through the process of “template assisted crystallization”. The particles, suspended in solution, can no longer form hardness compounds and are flushed away when the boiler or steam generator is drained during automatic or routine ‘drain and flush’ procedures.

ScaleX2 is recommended with steam equipment that utilizes **boilers and steam generators; and boilerless combi’s with steam reservoirs inside the cook cabinet.** To maximize the scale inhibiting benefits of ScaleX2 it is important that the boiler or steam generator is drained or blown-down on a daily basis.



ScaleX2:

- ◆ *Is very effective in high temperature applications*
- ◆ *does not add sodium or chemicals to water*
- ◆ *is not negatively affected by pH variations*
- ◆ *requires changing the ScaleX2 filter only once a year in most cases*


OptiPure systems with ScaleX2 are available with a range of capacities and flow rates to meet a variety of application requirements. Models SX2-21 and SX2-22 (shown) are Tested and Certified by NSF International.



 **ScaleX2 is highly recommended for use with boilers and steam generators.**

Application Recommendation



	Consider when
Hardness	> 50 ppm (3 grains)
Alkalinity	> 20 ppm
TDS	>100 ppm

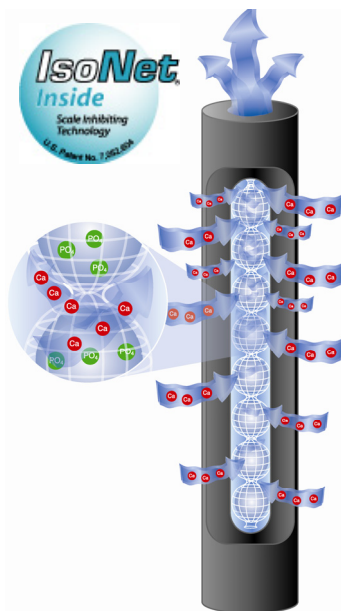
Boiler & Flash Steam

IsoNet is a patented scale inhibitor and corrosion protection technology.

IsoNet interferes with the formation of hardness compounds which inhibits the formation and accumulation of scale. What makes IsoNet unique is its patented design that allows for consistent delivery of media and greater capacity. It also forms a protective barrier layer on metal surfaces to help guard against corrosion.

With boilers, steam generators and open reservoirs the ‘sequestered’ hardness minerals and other suspended particles are flushed away during automatic or routine (daily) draining procedures.

With flash-type steam equipment, dissolved solids in the water are forced out of solution; IsoNet interferes with the formation of the solids making scale ‘softer’ (less adherent and less hard). This reduces scale related problems and makes the mineral deposits easier to dissolve and remove.



IsoNet ensures consistent dosing by trapping and holding the right blend of scale & corrosion inhibitor media in the ideal position within the core of the cartridge.

Inhibitor media dissolves into the water stream where it reacts with dissolved minerals and interferes with the formation of hardness compounds. IsoNet also helps protect surfaces against corrosion.

- **Consistent Delivery** - All the water flowing through the cartridge comes in contact with the inhibitor media.
- **High Capacity** - IsoNet sustains sufficient media surface area to provide consistent dosing and protection for the period between filter changes.

OptiPure systems with IsoNet are available with a range of capacities and flow rates to meet a variety of application requirements. OptiPure FXI and QTI systems are Tested and Certified by NSF International.



System Selection

Once you choose the right water treatment technologies for your application, you must select a system that will meet your usage requirements.

A properly sized water treatment system will assure that your equipment always performs at its peak.

Capacity – *As a general rule, a system's 'rated capacity' should meet or exceed the actual water usage of the equipment for the period between filter changes.*

Water is used in combi ovens and steamers for generating steam *and* to condense steam released from the oven to drain. Some models also offer automatic cleaning systems or hand-held rinse wands. Manufacturers typically provide separate water connections for steam generation and condensate water.

It is important to determine whether your equipment has a separate water connection for steam and for condensate water?

- ◆ If it **does**, calculate how much water you will use to generate steam during a typical day. If you have a rinse wand and/or automatic cleaning system that uses water from the 'treated/steam' water connection, be sure to include those water usage requirements as well. ***Never connect the filtered/treated water to the condensate water connection.***
- ◆ If it **does not** (this will not be common), calculate all daily water usage including the amount of condensate water that goes to the drain. The amount of water used for condensate can be much greater than the amount of water used to make steam and must be included in your water usage calculations to determine system capacity and filter change frequency.

NOTE: Refer to your oven documentation or contact the factory to get water usage information. It is important to understand real-world capacity requirements to properly size your treatment system. And, if you are using OptiPure AMS (advanced membrane separation) it is essential to understand usage requirements in order to select a system with the proper production and storage capacity.

Flow Rate – **A filter systems 'flow rate' should be greater than the peak flow requirement of the equipment it serves.** Over time, a particulate filter will accumulate dirt and sediment which can restrict and reduce the flow rate. It is important to allow for this when selecting the right system for an application.

Flow and Pressure – Flow rates (in gallons per minute – GPM) can be found on equipment specification sheets and installation/operation manuals. Minimum and maximum pressure requirements are usually given along with the flow requirements. Specified flow rates typically include the flow required for all water uses, including condensate water. The flow rate needed for steam generation is typically less than the flow required for condensate.

The OptiPure 'System Application Guide & Product Catalog' provides a simple five step process to help you select the right system for your application.

Filter Replacement

Perhaps the most important and most overlooked component of realizing the benefits of water treatment is replacing filter cartridges on a routine basis.

Properly applied and maintained, water treatment will yield tremendous benefits to a foodservice operation. The benefits are proven and the value is measurable. But your business will not benefit from even the best water treatment if filter cartridges are not replaced on a timely basis.

Most OptiPure system recommendations are based upon a six month interval between filter changes. Check the system specification sheets for detailed filter change information. Check the system specification sheet for detailed filter change information. The catalog and system spec sheets are available online at www.optipurewater.com

Contact your OptiPure Dealer or OptiPure for assistance selecting the right water treatment for your business.

