

Steam Cooking & Combi Ovens

by Danamark Watercare

This module on steam cooking equipment is broken down into 3 sections:

- Introduction to steam
- Types of steam ovens
- How water abuses steam equipment





Part One
Introduction to steam

By some industry estimates, there are over 500,000 Steam Cooking units in Foodservice Operations.

Quick Serve Restaurants use steamers for buns, breads, thawing and for rethermolizing dinner entrees.



Full Serve Restaurants use steamers to cook vegetables, seafood and to rethermolize frozen entrées.

Combi-Ovens are also used to cook meats and provide an excellent method for retaining moisture content.





School Systems prefer steam for its ability to quickly prepare large quantities of foods without nutrient loss or colour change.

Steamers are also very good for thawing pre-cooked and chilled entrees.



Hospitals and Corrections Facilities use steam as their first line of food preparation.

Steam cooking prepares large batches of food without overcooking and improves food safety.

Part Two

Types of Steam Ovens



Atmospheric or Pressure-less Steamers

Atmospheric or pressure-less steamers are very common, and generally less expensive. Steam moves from the boiler and through the cooking chamber by continuous ventilation, virtually eliminating air from the cooking process.

Because of continuous venting, a variety of foods may be cooked together without fear of flavour transfer.



Pressure Steamers

Pressure Steamers allow the pressure of the steam to build gradually within the compartment during the cooking process, up to anywhere between 5 and 15 PSI. This allows them to cook food at temperatures up to 250 degrees Fahrenheit. They're generally larger and most often used by high-volume institutional operations thanks to their faster cooking speeds.



Convection Steamers

A Convection Steamer cooks food at 212 degrees Fahrenheit, under no pressure. It's the convective action of the steam that transfers the heat to cook the food.

Because of their generally lower purchase price and other advantages, they are a popular choice.



Boiler-Based Steamers

A boiler-based food steamer may have the boiler built right into their cabinet. Other models may rest on top of a boiler base to provide steam for the unit.

Benefits:

- Great for high-volume operations
- Can steam large amounts of food with fast recovery time between batches



Boiler-less Steamers

A boilerless steamer produces steam by heating water in a compartment or by spraying water onto a heated plate.

- Great for smaller, low-volume operations
- Lower maintenance and utility costs than other types
- Longer cook times than steamers with a boiler
- Compact, connectionless models are available that you can fill manually and are a great choice if you don't have a water or drain connection readily available



Flash Steamers

Flash Steamers make up a small segment of the steam cooking equipment market and are mostly used by some Quick Serve Restaurants. Smaller than a microwave oven, the Flash Steamer requires very little kitchen space, uses a limited amount of water, and provides rapid food warming in about 10 seconds per serving cycle.



Counter Top Steamers

Counter top steamers are used for lower volume operations or for specific tasks like steaming shrimp or seafood for individual orders.

Counter top units are about the size of a large microwave oven and can hold only one or two removable cooking pans in the cabinet.



The most popular overall...

Combi-Ovens



Combi Ovens

A 'combination oven' uses three methods of cooking in one appliance; convection, steam, and a combination of convection and steam. Convection can be used to bake bread or roast meats.

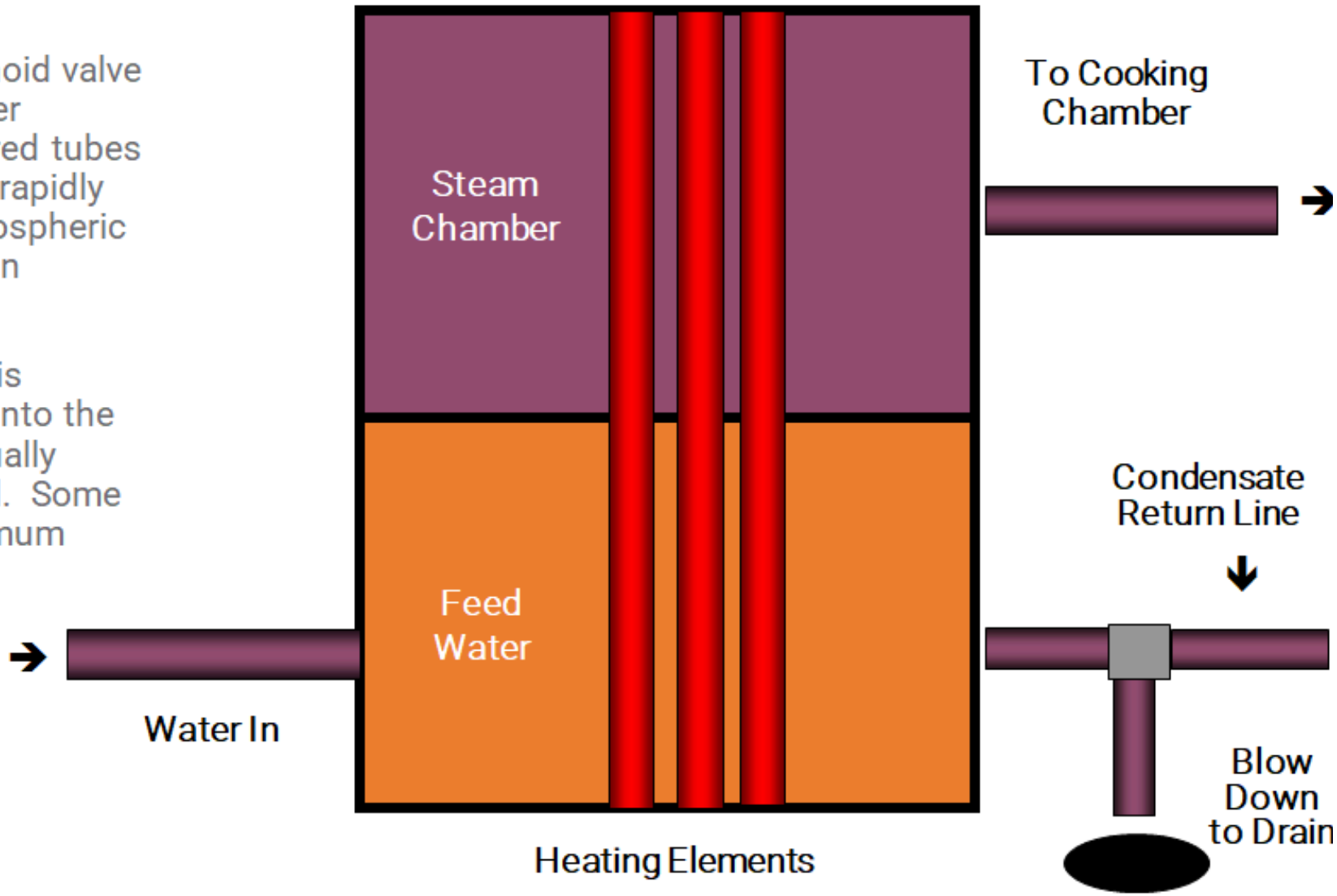
The steam function delicately poaches fish, steams rice, or cooks vegetables so they have the perfect texture.

When using the combination function, both steam and convection work together to produce results that are moist, flavourful, and have minimal shrinkage.

How Most Steamers Use Water

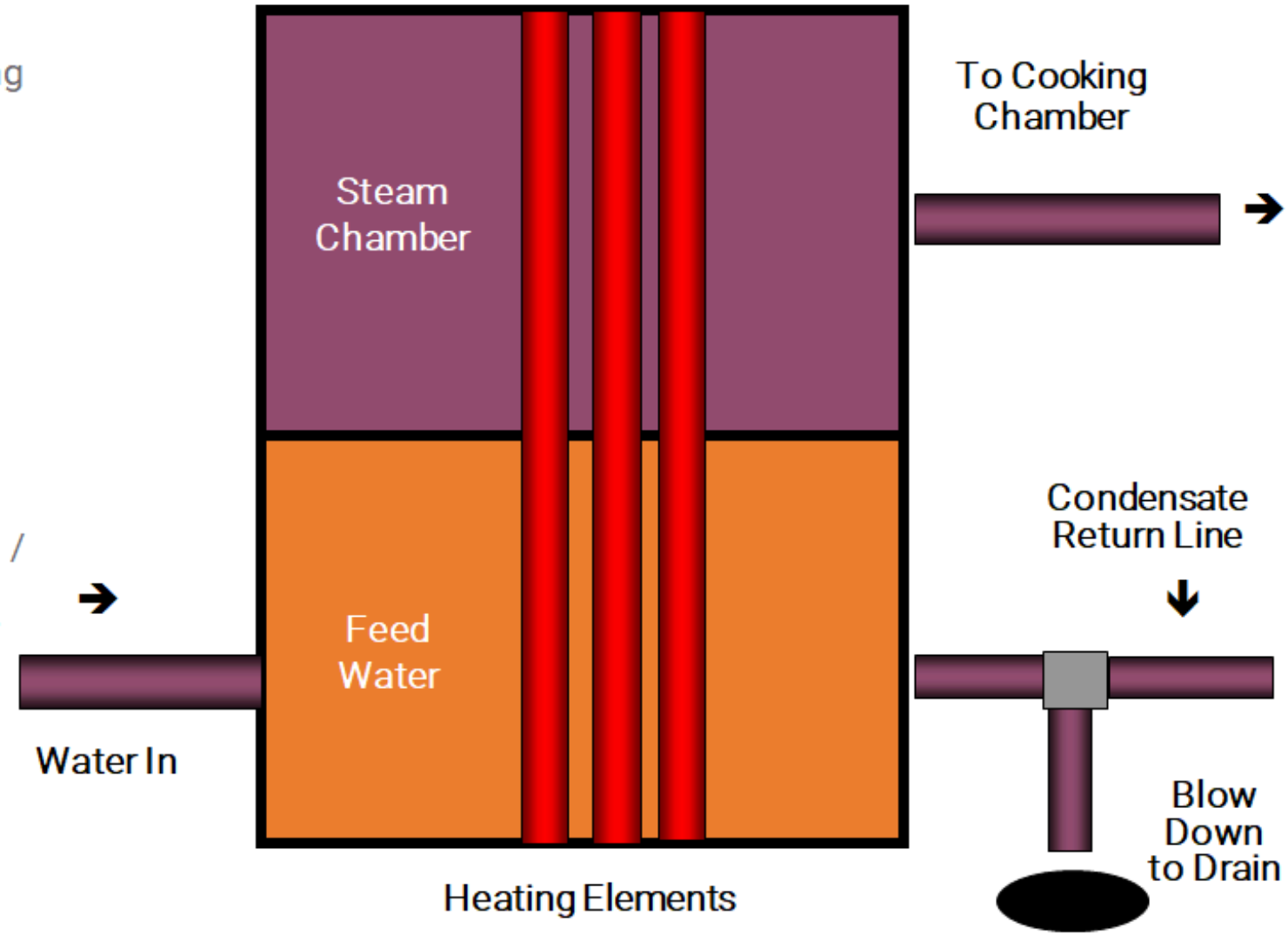
Feed Water: flows through a solenoid valve into the boiler chamber where either electric heating elements or gas-fired tubes are located. Water temperature is rapidly increased to 212 degrees F in atmospheric steamers, or up to 250 degrees F. in pressure type units.

Steam Cooking: The boiling water is converted to steam, which moves into the cooking compartment where it usually makes direct contact with the food. Some water vapor is absorbed and maximum heat transfer is achieved.



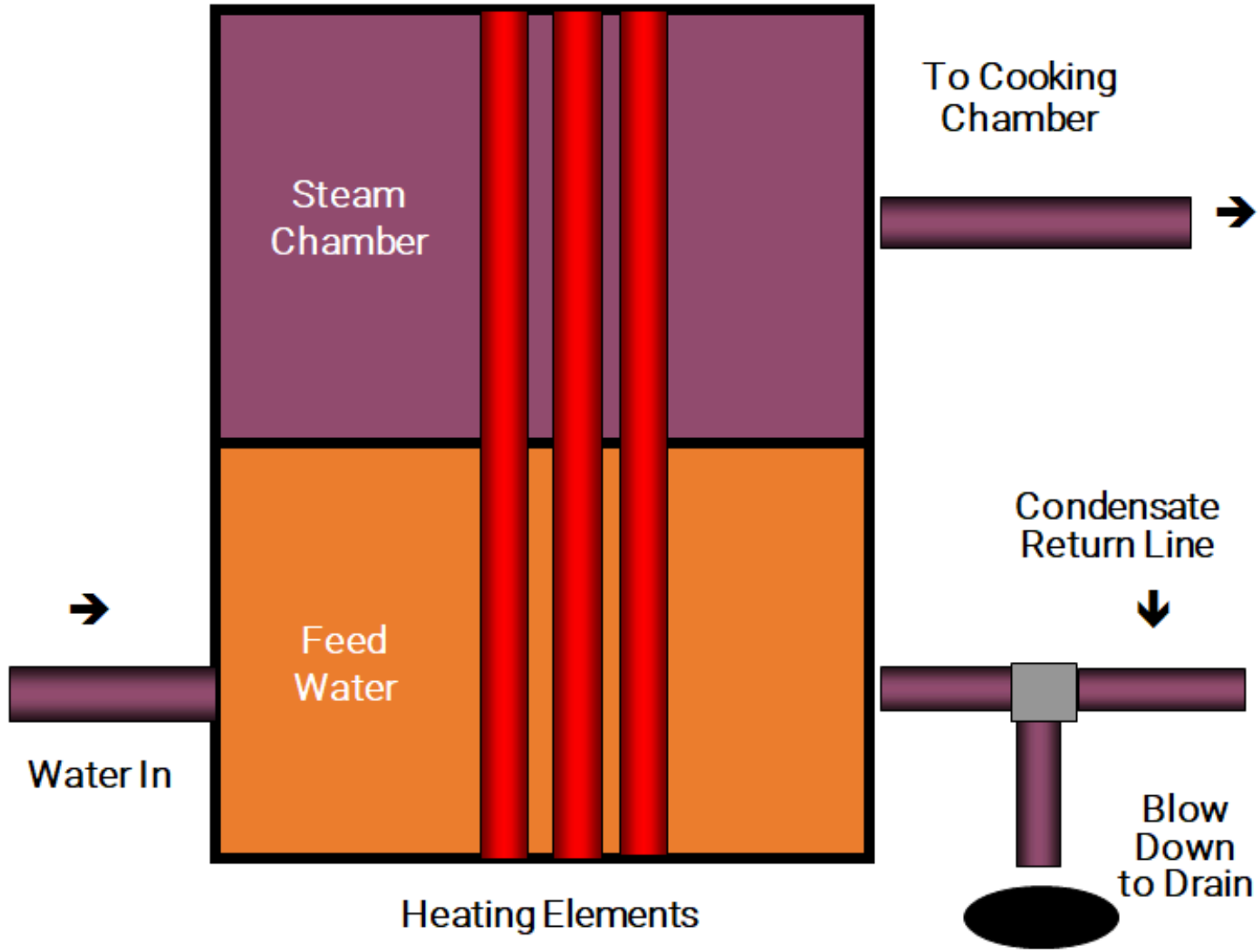
How Most Steamers Use Water - Continued

- **Condensate / Waste Water:** The remaining steam is continuously vented to the Condensate Drain where cold water is sprayed into it to, and the water vapor is condensed back to a liquid form.
- This step is required because local health codes generally do not allow steam to be flushed directly into the municipal waste system.
- Most commercial steamers have a separate water supply for the condensing / cooling process, almost 75% of the total water required for the steamer is used for condensing steam, and then flushed to drain.



How Most Steamers Use Water - Continued

- **Blow Down / Flush:** At periodic intervals, the water in the steam boiler must be flushed to drain and refilled with a fresh supply.
- As liquid water in the boiler converts to steam gas, the solids and dissolved mineral content are left behind.
- The remaining water becomes highly concentrated and must be flushed away to avoid a dramatic increase in mineral scale development.
- This "blow down" process can be as simple as turning off the steamer or pulling a mechanical lever in the bottom of the machine – but in all cases it requires a human to complete the task.



Part Three

How Water Abuses Steam Cooking Equipment





Combi ovens
and steamers provide
restaurants and other
foodservice operations
with versatile, efficient,
predictable results at the
push of a button.



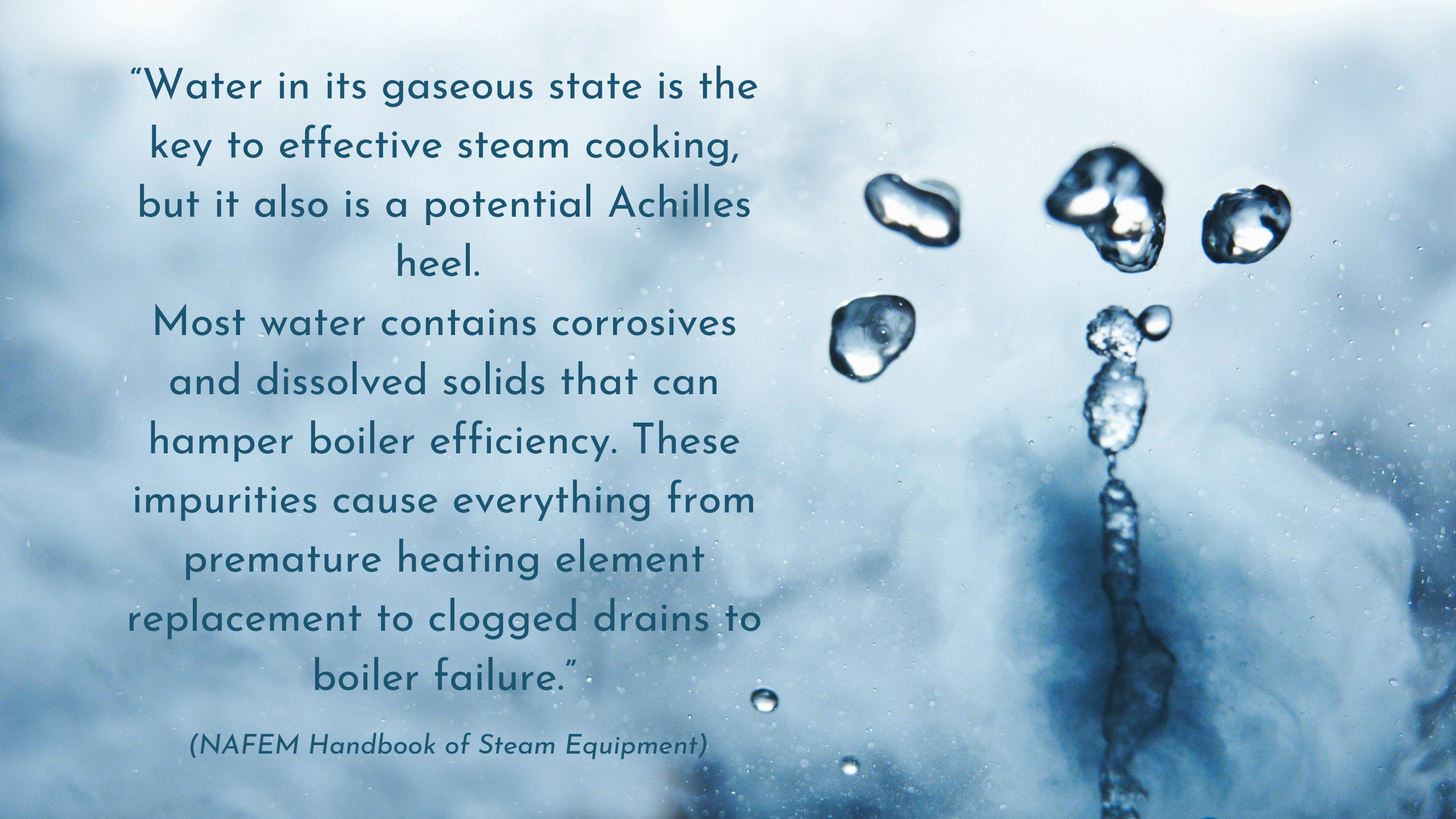
It is impossible for your customers to realize the full benefits of steam cooking without carefully considering the impact of water quality on their steam equipment.

To provide your foodservice customers with the right water treatment system, it's important to understand how steam equipment and water quality relate to each other, and how they impact the success and profitability of your customers' operations.



Steam is 100% water, but water itself isn't just H2O. Water is a natural solvent, carrying away particles of whatever it encounters along its way to the tap. It's these particulates, chemicals and contaminants that can positively or negatively impact food quality and equipment performance.





"Water in its gaseous state is the key to effective steam cooking, but it also is a potential Achilles heel.

Most water contains corrosives and dissolved solids that can hamper boiler efficiency. These impurities cause everything from premature heating element replacement to clogged drains to boiler failure."

(NAFEM Handbook of Steam Equipment)

Chemicals

When water containing high levels of oxygen, chlorine, chloramine, chlorides (or other acidic conditions) is boiled, the resulting gases may rapidly corrode the boiler shell.

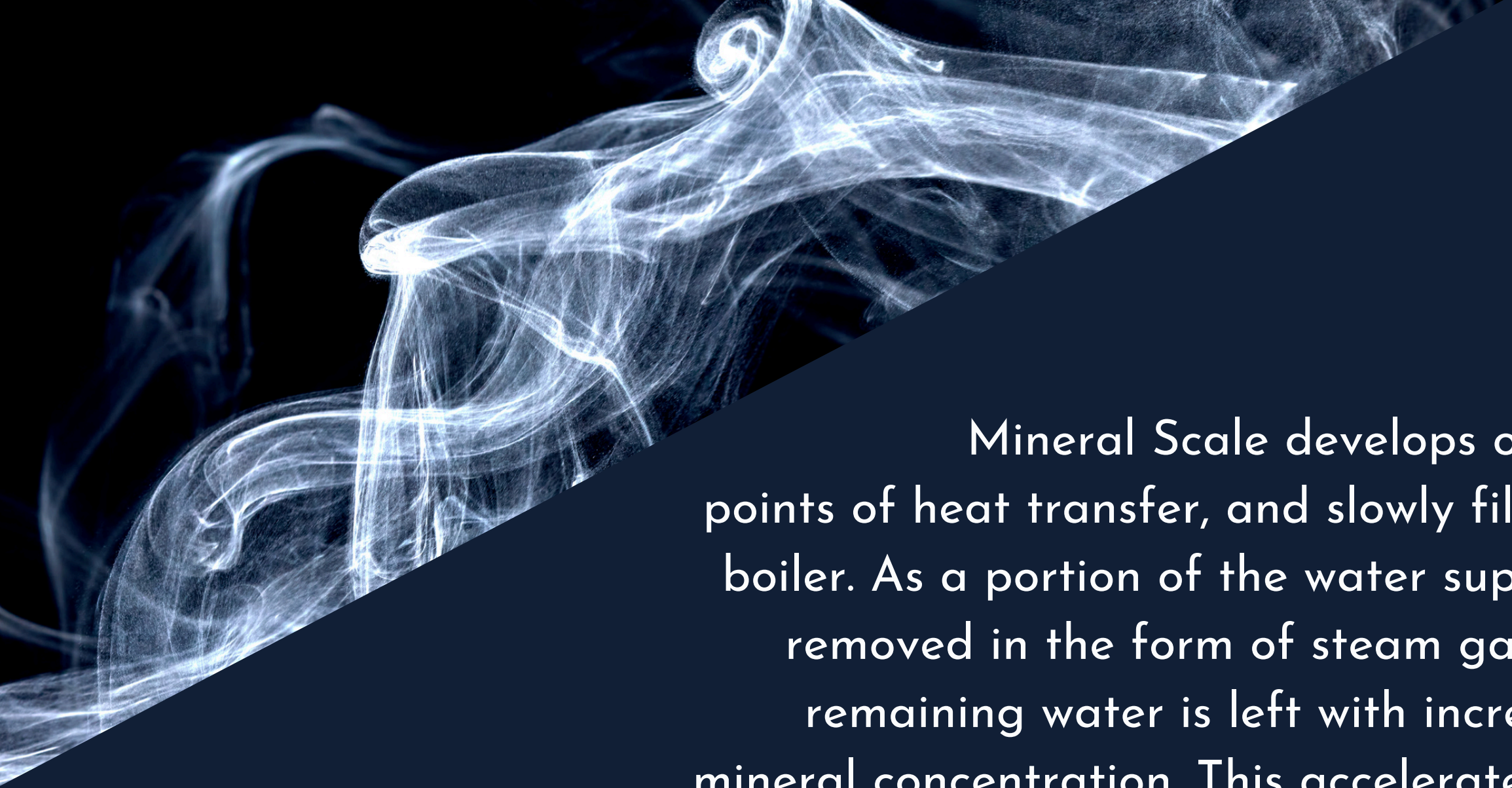




This damage is usually observed in the area immediately above the water line in each boiler chamber, and may easily create enough damage to require a complete replacement of the boiler shell.

Dirt particles and other small solids create a variety of problems in steam equipment designs. The solids can clog small orifices, floats, and solenoids. They also provide the basis for mineral scale formation.

Just as a snowflake is formed around a nucleation site, mineral scale also needs a starting point. A substantial amount of what we call mineral scale is actually small solids that are present in untreated water and captured between the minerals, as they precipitate.



Mineral Scale develops on the points of heat transfer, and slowly fills the boiler. As a portion of the water supply is removed in the form of steam gas, the remaining water is left with increased mineral concentration. This accelerates the scale development process.

When the temperature of water is raised or lowered, the dissolved minerals begin to “precipitate” or fall out of solution.

This mineral scale attaches itself to the heating elements, reservoir walls, and the sides of metal tubing.

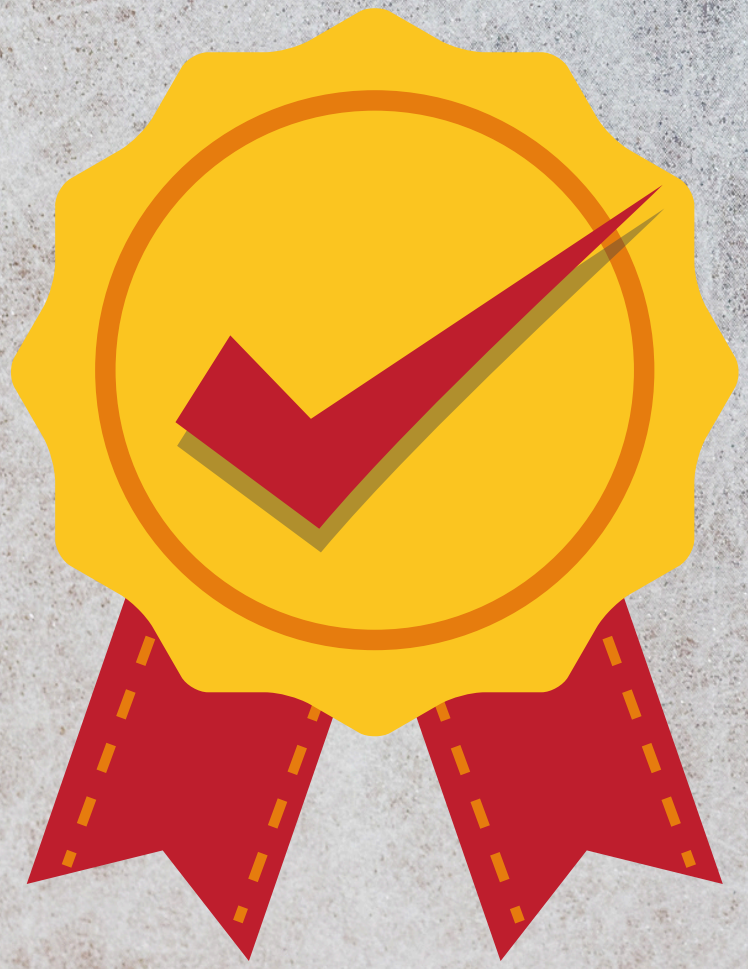
Energy use is dramatically increased as the mineral scale develops around the heating surfaces. According to the US Bureau of Standards, a ½" layer of solid rock (scale) will reduce the energy transfer by as much as 70% in steam boilers.



Steamer Energy Consumption is 3%-5% of Total Restaurant Operating Cost

Scale = Insulator = Increased Energy Use

Amount of Scale	Extra Fuel Required
1/8 inch	15%
1/6 inch	20%
1/4 inch	39%
3/8 inch	55%
1/2 inch	70%



Warranty Compliance

Water composition and the physics involved with different methods of generating steam can be complex. So much so that many equipment manufacturers ***have stringent water quality standards*** that must be adhered to under their warranty agreements.

Warranty requirements from major manufacturers of combi ovens and steamers tend to fall within these parameters:

- TDS - 70 to 200 ppm
- Chlorine > 0.05 ppm
- Hardness - 17 to 85 ppm
- Silica - < 12 ppm
- Iron - < 0.25 ppm
- Chlorides < 30 ppm
- Alkalinity < 100 ppm
- pH - 6.80 to 7.40

Mineral Scale Review

Remember that steam-cooking equipment uses a tremendous amount of energy. Studies from the foodservice industry indicate that the energy consumption of the steam cooking equipment typically equals 3% – 5% of the total operating cost of a restaurant.

Mineral Scale Review - continued...

Anything that alters the energy efficiency of the steamers will affect the bottom line profits in a foodservice operation.

Commercial steamers with a hard water supply can rapidly build one-half inch of mineral scale – resulting in a 70% loss of energy efficiency.

Facts & Figures

- There are 7,000 grains of mineral content in one pound of dissolved rock.

- There are approximately 15 grains per gallon in the average water supply.

- 467 gallons of this water contains more than one pound of dissolved rock.

RECAP

Properly treated water reduces scale buildup and helps reduce corrosion.

For your customers, that means less time and less money spent on service interruptions, inefficiencies, and repairs.



This concludes this module.

Thank you for your time!