Cleaning and Protecting Your Stainless Steel

Tanks, Kettles, and Fermenters — Done Right

A Practical Field Guide from ChemStation Boston

I've been in this industry for more than four decades — started as a dishwasher in the 1970s and eventually found my way into chemical sales, consulting, and sanitation program design for breweries, hotels, and food processors. In all that time, one truth holds constant: how you clean your equipment determines the quality of what comes out of it.

Stainless steel is a remarkable material. It resists corrosion, handles thermal shock, tolerates aggressive chemistry, and lasts for decades when treated properly. But it is not self-maintaining. The chromium oxide layer that makes stainless steel stainless needs consistent care — and when you neglect it, you pay for it in off-flavors, contamination events, and eventually tank replacement.

This guide covers what I consider the non-negotiable basics: commissioning new and used equipment, running a proper CIP, passivation, sanitizer selection, and preventive maintenance. No fluff, no filler — just what works.

> **Disclaimer:** *The cleaning and passivation practices in this guide are based on industry standards and more than four decades of field experience. Every brewery's equipment, water chemistry, and chemical program is different. Always confirm concentrations, compatibility, and safety requirements with your chemical provider or chemical manufacturer before implementing any procedure. Follow all local safety regulations, SDS guidance, and equipment manufacturer recommendations.*

Commissioning New and Used Equipment

Initial Degreasing

New tanks look clean. They are not. Manufacturing processes leave behind machine oils, iron filings, and in some cases surface rust. Skip the initial clean and your first batch will tell you — usually with a metallic bite that does not belong there.

Run a caustic CIP at 2-3 oz per gallon at 140–180°F for 15–30 minutes before anything else touches that vessel. Powdered Brew Wash is a solid degreaser at this stage — follow manufacturer concentration recommendations. Use soft cloths only during any hand-wiping. Abrasive pads scratch the surface and create microscopic harbors for contamination that you will spend the rest of the tank's life fighting.

After the caustic wash, rinse thoroughly and inspect visually. If you see surface rust, follow immediately with a citric acid CIP at 2 oz per gallon, 120–130°F, for 15–30 minutes. Do not skip that step if rust is present.

Used equipment follows the same protocol. The difference is you are removing beerstone and organic buildup instead of manufacturing residue, but the chemistry is identical.

Passivation: Rebuilding the Protective Layer

Passivation restores the chromium oxide layer on the surface of your stainless steel — the thin, invisible film that makes the material resistant to acids, sanitizers, CO2, and the organic acids in beer. Without it, the metal is exposed. Over time that means pitting, surface corrosion, and contamination that no cleaning protocol will fully resolve.

Three approaches are in common use:

- Nitric acid passivation (20–25% concentration, 24-hour air dry): effective but hazardous. Requires proper PPE and handling protocols. Some operations are moving away from it for safety reasons.
- Nitric-phosphoric acid blend at 120–135°F for 15–30 minutes, followed by a noncaustic alkaline cleaner with hydrogen peroxide at 120–140°F: this creates what I would describe as a glassy-smooth finish that resists beerstone adhesion. It is my preferred approach for production environments.

- Citric acid passivation (4–10% concentration, warm water, 30 minutes): the safest option but the hassle of powders

Pressure Integrity Testing

Before you brew anything, pressure test the system. Spray soapy water or dilute PAA on all connections, valve stems, and gasket seats while holding pressure. Bubbles tell the story. For kegs, pressurize to 10 psi, close the CO2 valve, and check the reading the following day. If it drops, you have a leak. Find it before your beer does.

Clean-In-Place: The Engine of Your Sanitation Program

Setting Up Your CIP System

CIP is not complicated in concept: you circulate cleaning chemistry through your vessels and lines without disassembly. In practice, execution determines results. The pump needs to deliver enough flow to create mechanical action inside the tank — at least 7 GPM for most setups. The spray ball does the distribution work at the top of the vessel while the solution returns through the bottom drain, completing the loop.

A standard six-step CIP sequence looks like this: pre-rinse with water, caustic wash (sodium hydroxide), rinse, acid wash, final rinse, then sanitization with peracetic acid. Recovery-type systems recirculate chemistry and reduce costs substantially — worth the investment if you are running multiple tanks.

Alkaline Cleaners: Going After Organic Soil

Wort proteins, yeast residue, and hop oils are your primary organic challenges. Alkaline chemistry is what breaks them loose.

PBW — Powdered Brewery Wash for smaller breweries. It contains sodium percarbonate and sodium metasilicate, and the practical advantage is that it works in both hot and cold water. Standard mix is 1–3 oz per gallon. For a heavily soiled fermenter, increase concentration and let it soak overnight. The foam that develops is not a problem — it is doing its job.

For heavier soils or production volumes that demand more cleaning power, caustic sodium hydroxide solutions at 1-2 % concentration (pH above 12) will cut through baked-on protein deposits that PBW alone may struggle with. Some operators add hydrogen peroxide at 1 oz of 34% solution per gallon to boost performance against stubborn organics.

Acid Cleaners: Going After Mineral Deposits

Beerstone is calcium oxalate — the hard, brownish-gray scale that forms when alkaline cleaners react with hard water minerals and beer proteins. It bonds tightly to stainless surfaces and, if left unchecked, provides a surface that harbors microorganisms no sanitizer can fully penetrate.

Nitric-phosphoric acid blends are most efficient because they clean and passivate simultaneously at 120–135°F in a 15–30 minute contact time. Rotate acid cleaning into your CIP schedule regularly, especially if your water is hard.

Small Parts and Accessories

Clamps, gaskets, carb stones, hoses, and tri-clamp fittings do not clean themselves in the CIP loop. Remove them and soak in PBW at 1–2 oz per gallon. Ultrasonic cleaners are excellent for reaching threads and crevices that standard soaking misses — if you have one, use it. If you do not, a long soak and a soft brush do the job.

Exterior Cleaning

Mineral buildup from dried CIP chemistry will accumulate on exterior surfaces over time if you ignore it. It is not a beer quality issue, but it is a professional presentation issue and a maintenance indicator. Clean exteriors on a regular schedule using non-abrasive materials only. Any scratch you put on that surface is a bacteria habitat.

Sanitizers: Finishing the Job

Cleaning removes soil. Sanitizing eliminates the microbial population that cleaning leaves behind. These are two distinct steps, and you cannot combine them by skipping either. Bacteria embed themselves in organic residue. If the surface is not clean, the sanitizer cannot reach them.

Peracid Acid

This is the industry standard and for good reason. It is acid-based, works in 30 seconds, requires no rinsing

Contact Time and Application

Sanitize everything that will touch wort or chilled beer: fermenters, airlocks, transfer tubing, thermometers, sampling valves. Apply shortly before using surfaces exposed to air collect environmental organisms over time. One to two minutes minimum contact is the standard. Drain, do not rinse with no-rinse formulations, and brew.

Storage After Sanitation

Moisture is the enemy during storage. Air-dry all equipment before putting it away or using again

Preventive Maintenance: Protecting the Investment

Regular Inspection

Inspect equipment before and after every brew cycle. Seals, gaskets, and O-rings are your most failure-prone components — a damaged seal causes leaks, pressure loss, and potential contamination. Check welded areas for evidence of cracks or weeping. Catch issues early and they are a 10-minute fix; miss them and they become a production shutdown.

Keep a maintenance log. Document cleaning dates, chemical concentrations, any unusual observations, and parts replacements. Patterns reveal themselves over time — if the same gasket is failing every six weeks, something is wrong with the fit, the chemistry, or the cleaning technique.

Spare Parts Inventory

Stock the components you will inevitably need: gaskets, O-rings, seals, a spare pump impeller, valve parts. The cost of inventory is trivial compared to a production delay waiting on a two-day shipping window. Review your stock quarterly and replenish before you run out.

Re-Passivation Schedule

Under normal conditions, re-passivate your tanks every 6–8 months. If you are in a hard water area or running high-use fermenters, move that to every 3–6 months. Always passivate immediately after welding repairs, aggressive mechanical scrubbing, or any contamination event. And if you start detecting metallic notes in your beer and cannot trace them to an ingredient, schedule passivation — the tank is telling you something.

What Not to Use

Three materials will damage your stainless steel and should never touch your tanks:

- Steel wool — leaves iron deposits that rust and disrupt the chromium oxide layer
- Abrasive scrubbing pads — scratch the surface and create bacteria-harboring grooves
- Bleach as a routine sanitizer — corrodes and pits stainless during extended contact

Lubrication

Apply food-grade lubricant to pump seals, valve stems, O-rings, and any moving mechanical components on a regular schedule. It reduces friction, extends component life, and prevents the kind of gradual wear that leads to unexpected failures on brew day.

Frequently Asked Questions

Can Star San be used for passivation?

Concentrated Star San — 1 oz per gallon instead of the usual 1 oz per 5 gallons — will provide some passivation benefit when soaked for 20–30 minutes and air-dried overnight. However, citric acid at 4–10% concentration is more selective at pulling free iron from the surface and is my preferred option for a dedicated passivation step. Use Star San for sanitizing, citric acid for passivation.

How do I remove beerstone from my tanks?

Acid-based cleaners are your tool. Phosphoric acid, citric acid, or acetic acid (white vinegar) will dissolve calcium oxalate deposits. Best results come from applying the acid solution at 120–135°F for 15–30 minutes. Nitric-phosphoric blends like ChemStation 9525 are particularly efficient because they clean and passivate in a single step.

What should I never use on stainless steel?

Steel wool, abrasive scrubbing pads, and bleach as a routine chemical. Steel wool deposits iron that rusts. Abrasive pads scratch the surface and create contamination sites. Bleach pits the metal with extended contact and requires thorough rinsing that reintroduces tap water organisms. Use brewery-specific alkaline and acid cleaners — that is what they are designed for.

How often should I re-passivate?

Every 6–8 months under normal production conditions. Move to every 3–6 months if you have hard water or high-use fermenters. Always passivate after welding, aggressive mechanical cleaning, or a contamination incident. If you detect metallic off-flavors with no obvious source, put passivation on the schedule immediately.

What is the difference between cleaning and sanitizing?

Cleaning removes visible soil — wort proteins, yeast, hop residue, mineral scale. Sanitizing kills the microbial population that remains on a cleaned surface. The sequence matters: you cannot sanitize dirty equipment. Bacteria embed themselves in residue and become invisible to chemical sanitizers. Clean first, always, then sanitize just before use.

About the Author

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