Pickling, passivation and *electropolishing* stainless

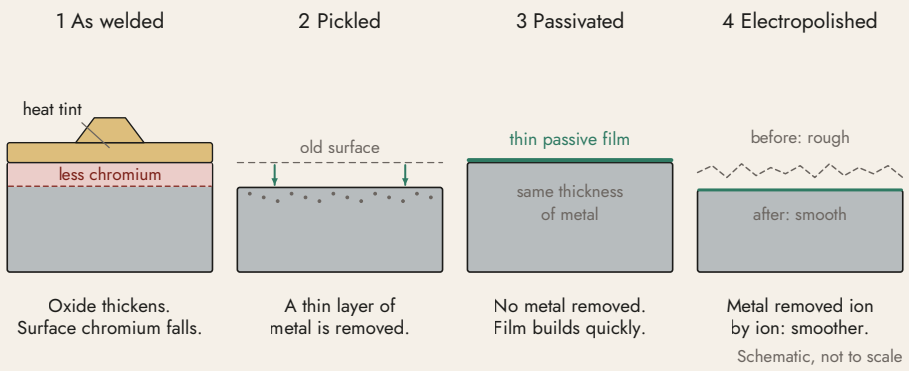
Welded stainless goes brown from heat tint and looks rusty from iron. Write the outcome and the test, and let the finisher choose the method. The chemistry is for specialists.

Compliance guidance. Pickling and passivating involve hazardous acids. This sheet is about what to write in a specification, not how to do the work: the chemical processes are for competent finishers under their own COSHH assessment. Check the current edition of every standard named. Guidance only, not safety, legal or engineering advice.

AT A GLANCE

Treatment	What it does	Metal removed?	Ask for it when	Where it is done
Pickling	Removes weld heat tint and the chromium-poor layer beneath. Usually nitric and hydrofluoric acids.	Yes, a thin layer	Heat tint after welding, on visible faces and on hidden faces that meet the service environment.	Tank off site. Specialists for spray. Paste or gel on small areas.
Passivation	Nitric or the weaker citric acid helps the clear passive film form quickly.	No	The exception: intricate machined parts, or sulphur above 0.005 (IMOA).	Specialist finisher or competent fabricator.
Iron removal	Dissolves iron particles that would rust and stain.	No (avoid strong pickles for this alone)	Rust spots, or contact with carbon steel tools or dust.	Finisher. An acid stage is preferred to wire brushing alone.
Electropolishing	Removes metal ion by ion. The surface is smooth, clean and chromium-rich.	Yes, typically 5 to 10 µm	Easy cleaning, hygiene, or a bright finish from an undisturbed surface.	Specialist plant. The part must fit the tank.
Mechanical cleaning	Grinding, stainless-only brushing or blasting with clean media. HSE lists it as an alternative to pickling paste.	Yes	Where it can reach the weld and the finish allows.	Fabricator.

Degrease first: acid cannot be relied on to remove oil or grease (Euro Inox). Sources: Euro Inox Vols. 4 and 11, IMOA, HSE, NAAMM. They are trade-body and government guidance, not the standards, so ask the finisher for the method, standard and test in writing.



What each treatment does to a welded stainless surface, in section. Layers are exaggerated. Original schematic by Make Bespoke Studio, after Euro Inox Vols. 4 and 11.

SPECIFICATION WORDING

WELD HEAT TINT AND SCALE

Remove all weld heat tint and scale on [stainless steel, grade 1.4404] from [visible faces, and from hidden faces of welds exposed to the service environment], leaving a clean surface uniform with sample [ref. __]. The finisher states the method in writing before work starts and works under its own COSHH assessment.

IRON CONTAMINATION

Surfaces to be free of embedded iron and carbon steel contamination at handover. Tools, abrasives, brushes and handling equipment used on stainless steel are for stainless steel only, and work is done away from, or separated from, carbon steel work. Free iron test (the ferroxyl test in [ASTM A380/A380M, edition to be confirmed]) on [__ surfaces]; result recorded.

PASSIVATION

Where [sulphur on the certificate exceeds [0.005]%, or the part is an intricate machined part], passivate the finished component with [nitric or citric acid] to [ASTM A967/A967M or BS EN 2516, edition to be confirmed by the finisher], rinse with [deionised] water and dry. Method and test stated in writing.

ELECTROPOLISHING

Electropolish [item ref. __] to [ISO 15730, edition to be confirmed]. Alloy [ ]. Appearance [bright / sample ref. __]. Electrical contact marks acceptable at [ ]. Dimensional tolerance after treatment [ ]. Passivation test [ ]; test report [required]. Base surface [ground and buffed to __].

PROTECTION AND HANDOVER

Protect finished surfaces with strippable film until [practical completion]. No wax, oil or lacquer as temporary protection. Remove film and adhesive residue by [ ] on completion. No carbon steel tools on or near finished stainless steel.

TERMS USED

Pickling

Acid treatment that removes a thin layer of metal, and with it weld heat tint and the chromium-poor layer beneath. Not the same as passivation.

Passivation

Treatment with an oxidising acid, such as nitric or citric, that helps the clear passive film form quickly. No metal is removed.

Electropolishing

An electrolytic process that removes metal ion by ion, leaving a smooth, clean, chromium-rich surface. Not the same as buffing.

Heat tint

The straw-to-blue colour round a weld where the surface film has thickened. It marks reduced corrosion resistance and should be removed.

STANDARDS AND SOURCES

- Euro Inox, Pickling and Passivating Stainless Steel (Vol. 4, 2007) and Electropolishing Stainless Steels (Vol. 11, 2010)
- IMOA, Which Stainless Steel Should Be Specified for Exterior Applications? (brochure): sulphur and passivation.
- HSE, Post weld cleaning using pickling pastes: web guidance; check the current page.
- NAAMM/NOMMA AMP 500-06, Metal Finishes Manual (2006), Chapter 3: US trade guidance.
- ASTM A967/A967M-25, ASTM A380/A380M, BS EN 2516:2023, ISO 15730:2023: listings only; text not read; confirm editions.
- ISO 16048:2003 (fasteners): listing only; fasteners, not general passivation.

Full guide: https://makebespoke.com/trade/technical/pickling-passivation-and-electropolishing-stainless. Make Bespoke Studio coordinates manufacture through its partner workshops. Figures are guidance only and your specification governs; some may be superseded, so contact the studio to verify.