Austral Wright Metals

at the cutting edge

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Removing Tea Staining

Tea staining is overall surface discolouration of stainless steel due to superficial corrosion.

It is mainly cosmetic, but is likely to progress to more serious corrosion, and it is wise to remove the staining as soon as possible after it has appeared.

Tea staining can be avoided by selection of a suitable grade, surface finish, fabrication and installation practices and washing regime for the corrosion conditions. The ASSDA Technical Bulletin – Preventing Coastal Corrosion has more information – download it from http://www.assda.asn.au or ask Austral Wright Metals for a copy. Austral Wright Metals also provide advice on selection of grade and finish suitable for particular applications.

When tea staining does occur, it is usually visible within a month or two – older installations are unlikely to be affected unless corrosion conditions change. It is wise to remove the staining within a few months after it appears, to prevent it progressing to more serious corrosion.

The stain can be removed with a mild acid (details overleaf). The resulting surface will be clean, and the original appearance of the stainless steel surface completely restored.

Tea staining will return unless the conditions which caused it in the first place are changed: the simplest method is usually including the stainless steel in the washing schedule. It is obviously difficult to remedy inappropriate grade or surface finish selection, but problems with fabrication practice such as carbon steel contamination or inadequate weld cleanup should be remedied by the usual methods.

Tea staining returns more slowly after each remediation treatment, and after a few treatments tea staining may not return. Of course inadequate grade selection or a rough surface may mean that treatment has to be repeated indefinitely.

If tea staining is happening because the surface is much too rough for the environment, the options are to polish it to a smoother finish, or to passivate with a nitric acid based solution or paste, or both. Passivation will improve the corrosion resistance of the surface and greatly delay or eliminate the return of tea staining. Nitric acid increases the corrosion resistance of the surface without changing the appearance.

Pickling with mixtures containing hydrofluoric, hydrochloric or sulphuric acid will remove tea stains, but will also dull the surface of the stainless steel and leave it blotchy. Using these strong mineral acids, including pickling paste, is not recommended for removing tea staining.

Lacquer, varnish or 'polish' are sometimes applied to the repaired surface to try to prevent the return of tea staining. These treatments are rarely effective outdoors, and must be maintained as they make a mess of the surface when they fail. This may involve removing the coating and recoating every few years. Lacquers should only be applied on very dry surfaces.

Steps to Remove Tea Staining

- **Safety.** The treatments suggested here use mild acids, and appropriate precautions should be taken for the safety of operatives and other people in the vicinity, to avoid damage to adjacent material such as stone, concrete and other metals, and to avoid pollution. Ask your chemical supplier for advice.
- **Cleanliness.** Ensure the surface to be treated is clean and free of grease and oil deposits, and will be evenly wetted by the treatment chemicals.
  - Simple hosing with fresh water may be adequate, but for dirty or greasy surfaces wash down with an alkaline cleaner and rinse with clean fresh water.
- **Treating.** Treat the surface to dissolve the stains.
  - Phosphoric acid mixtures work best, ask your local supplier of cleaning chemicals. Standard solutions for metal cleaning are available, and some products for truck washing or toilet cleaning are suitable. Avoid mixtures containing hypochlorite, hydrochloric acid or chlorine. Give Austral Wright Metals the Material Safety Data Sheet for the solution if you want an opinion on how well it will work. Tests on coupons of the same grade and finish will confirm that the stainless steel will not be attacked.
  - Wet the surface with the solution, at the recommended dilution. It can be applied with a rag, a brush, or a floor mop.
  - Leave the solution on the surface until the stain has been removed. This will be at least 30 minutes, often longer. The surface should not be allowed to dry out. It often helps to renew the application during that time, and mild rubbing with the applicator helps to dislodge the heaviest deposits.
  - Gel or paste formulations are available to help the acid stay on the surface, especially on steep & vertical surfaces.
  - Alternatively, a sulphamic acid based powder cleaner (e.g. Essteele Stainless Steel Cleaner) on a moist rag can be used. The stains can be scrubbed off – once over to leave some chemical on the surface, then a second scrub after five or ten minutes is usually effective.
- **Rinsing.** Rinse with fresh water – hose or mop. A pressure blaster uses less water.
- **Neutralisation.** The passive layer on the surface of the stainless steel will form again spontaneously, and will grow to full strength over a few hours. Neutralisation is optional, but some people prefer to finish with a rinse with household ammonia to ensure no acid is left on the surface of the stainless. This is more likely to be beneficial with sulphamic acid based cleaners than with phosphoric acid mixtures.