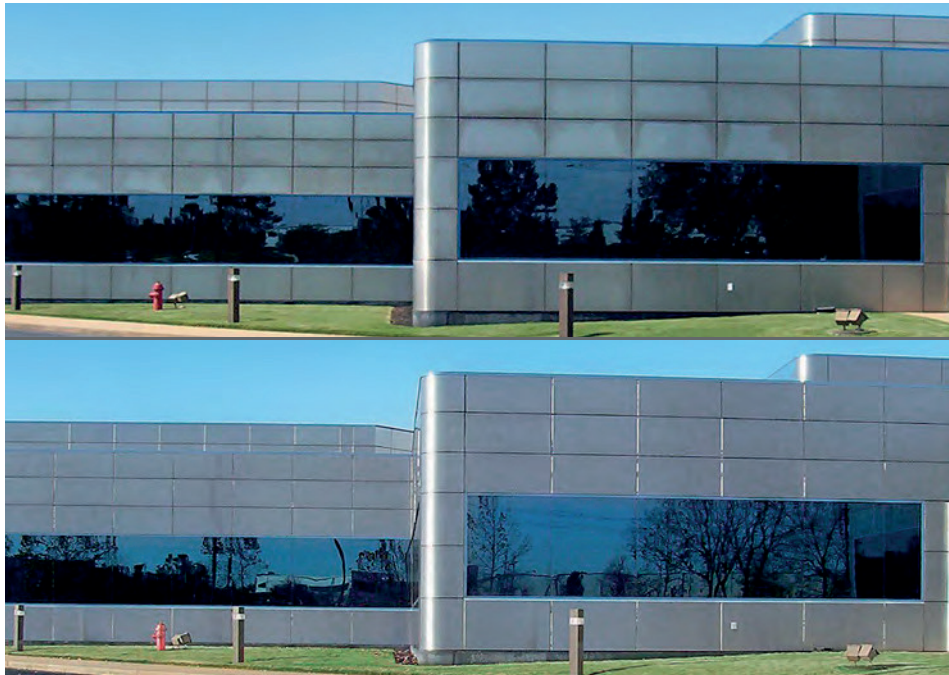


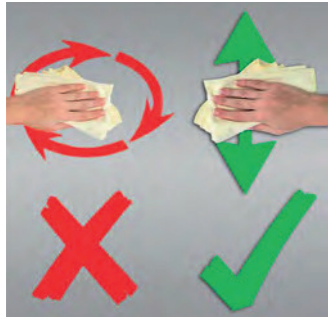
# CLEANING ARCHITECTURAL STAINLESS STEEL



**AC LEIGH**

ARCHITECTURAL IRONMONGERS  
SECURITY SPECIALISTS

## RECOMMENDATIONS TO CLEANING STAFF: THE DOS AND DON'TS



1) Wipe along the polishing direction, not across it. Work from top to bottom in overlapping strokes.



4) Rinse away cleaning chemicals with liberal amounts of tap water. Wipe dry, if possible.



2) Do not use wire wool or hard objects to remove stubborn stains.



5) Do not use swimming pool water for cleaning.



3) Do not use chlorine containing cleaning agents such as bleach or strong acids (e.g. mortar removers).

## RECOMMENDATIONS FOR BUILDING CONTRACTORS: INITIAL CLEANING

Stainless steel architectural surfaces should generally be cleaned before the building is handed over to the owner.

An adhesive plastic film is often used to protect stainless steel components from damage and soiling during fabrication, transport and assembly. However, some plastic films deteriorate after extended exposure to the ultraviolet radiation of the sunlight, which can make them difficult to remove and results in deposits of the adhesive sticking onto the stainless steel surface. The film manufacturer's advice should be sought on the choice of film material, type of adhesive and the maximum time that can be allowed before removal of the film. Generally, any protective plastic films should be removed as soon as they are no longer needed for protection during the installation/erection stage, starting at the top of the building and working downwards.

A typical procedure for cleaning bare stainless steel is:

1. Rinse with water to remove loose dirt.
2. Wash with (preferably warm) water containing soap, detergent or 5% ammonia, using a soft, long fibre brush if necessary.
3. Rinse with water.

An enhanced appearance will be achieved if the cleaned surface is finally wiped dry using overlapping strokes, working from top to bottom.

When cleaning brushed surface finishes, the cleaning movement should be in the same direction as the grain.

Many of the cleaning techniques used for bare stainless steel should not be used on chemically coloured/painted stainless steel, as the colouring systems are more delicate than the steel surface. Specific advice on cleaning should be sought from suppliers. Site repair is not usually possible.



Protective plastic film should only be kept on for the duration of the construction work and then removed. Especially if exposed to UV radiation, it may deteriorate and become difficult to strip.

Mortar and cement splashes can be treated with a solution containing 10 to 15% of phosphoric acid. The solution should best be applied warm, then neutralized with dilute ammonia, rinsed with water (preferably deionised water <sup>3</sup>) and dried. Proprietary products are available from specialist finishing companies. Mortar removers or diluted hydrochloric acid should not be used on stainless steel. If they have accidentally been applied to or spilt over the stainless steel, the surface should be rinsed generously with fresh water. Proprietary building mortar removers containing hydrochloric acid can seriously damage stainless steel and this should be stressed to building contractors as they are not always aware of this. Whenever possible, operations should be sequenced so that any ceramic tile fixing and cleaning is completed before neighbouring stainless steel components such as skirting boards or kick plates are installed.

Contamination with iron particles can occur by contact with tools, structural carbon steel members, scaffold tubing and from nearby operations such as welding, cutting, drilling and grinding carbon steel. Iron contamination should be removed immediately as it will rust quickly on the surface of stainless steel if moisture is present. Iron particles can also locally break the self-healing "passive film" of stainless steel resulting in pitting corrosion. ASTM A 380 [9] gives a suitable detection method for iron contamination.

A step-wise approach, depending on the severity of the staining, is recommended for removing iron contamination, with due care taken not to spread the contamination further:

- Mild staining or surface 'bloom' can be removed by gentle non-scratching domestic cleaning creams or polishes. These usually contain calcium carbonate, with surfactant additions. Domestic stainless steel cleaners, which may contain citric acid, can also be used.
- Fresh iron/steel grinding grit or dust may be removed by a saturated solution of oxalic acid, applied with a soft cloth or cotton wool and allowed to stand for a few minutes, without rubbing or abrading. This should etch out the iron particles, without leaving scratches or significantly altering the surface texture of the stainless steel.
- Moderate rust staining can be removed by phosphoric acid cleaners if sufficient time and care is taken, with minimal risk of etching the surface. Alternatively, dilute nitric acid can remove small amounts of embedded iron.
- Severe rust stains caused by embedded iron can be removed by either pickling <sup>4</sup> or passivation <sup>5</sup>. Both are carried out after degreasing (removing oil, grease and other organic contamination) [10].

**Heat tint** is unlikely to be encountered in normal architectural environments unless the stainless steel was exposed to high temperatures, e.g. after repair welding or in the case of fire damage. In such cases a pickling treatment may be necessary to remove it. Localized discolouration can be removed using pickling paste, which does not require the entire component to be immersed in a pickling bath. Pickling paste can also be applied to vertical surfaces; however, as the product is aggressive, care has to be taken to comply with the supplier's safety and environmental instructions.

**Note:** Care must be taken to use these products in accordance with the supplier's directions so that there is a safe system of work and the relevant legislation on environmental protection is adhered to. Specialist finishing companies will often carry out this service on site. In addition to restoring the corrosion resistance of the material, pickling may change the surface appearance of the steel. Further mechanical or chemical treatments may then be necessary to restore the original surface finish. It is therefore advisable to prevent damage in the first place by either protecting the stainless steel whilst other work is being done, or by installing it after other operations that could cause contamination have been completed.

<sup>3</sup> Deionised water reduces the risk of water staining marks. Also used for steam ironing and car batteries, it is available in supermarkets. <sup>4</sup> Pickling is the removal of a thin layer of metal from the surface of the stainless steel, usually with a mixture of nitric and hydrofluoric acid. <sup>5</sup> Passivation is the improvement of the quality and thickness of the passive layer of stainless steel using nitric acid.

## MAINTENANCE VS. REMEDIAL CLEANING

When discussing and specifying cleaning work [11], a distinction needs to be made between:

- Maintenance cleaning in the sense of removing dirt, graffiti etc. from otherwise intact stainless steel surfaces on the one hand, and
- Remedial cleaning, i.e. the removal of visible discolouration of the stainless steel itself on the other.

Although stainless steel has a high level of intrinsic corrosion resistance, there can be isolated cases of tea staining and localized corrosion. Such damage can usually be attributed to two causes:

- Iron particles may deposit on the stainless steel surface. They may come from the cutting, welding or grinding of carbon steel in the environment or from rusty run-off water from other surfaces.
- Lack of cleaning leads to concentrations of chlorides or other aggressive substances that surpass the corrosion resistance of the stainless steel grade selected. Sea spray or chloride-laden splashes from de-icing salts are common sources of corrosive deposits. Under these deposits, tiny corrosion pits can form, which may be surrounded by a brownish halo and are commonly referred to as tea staining.

Usually, discolourations are indicative of incipient corrosion. In this case, it is no longer sufficient to remove visible stains by means of

usual cleansers. In the tiny pits, which may hardly be perceptible to the unaided eye, corrosive media or corrosion products may be trapped, which will cause new stains to form.

In such cases, remedial cleaning is imperative. This treatment has a pickling and/or passivating effect. In contrast to the usual neutral or alkaline agents used for the removal of dirt, the products for remedial cleaning are acidic. The composition is such that they completely and safely dissolve corrosion products while leaving the basic stainless steel unaffected. Their application results in a clean metallic surface even at microscopic level which creates optimal conditions for the natural self-healing process of stainless steel to work properly and ensures long term-success of the remedial cleaning operation.

It has to be borne in mind that these acid-containing specialist stainless steel cleansers may damage other metallic materials like aluminium or galvanized carbon steel. When applying them, care has to be taken to protect components such as aluminium window frames or galvanized support structures. Also decorative stone is susceptible to damage by acidic cleaning products. For this reason, remedial cleaning should only be performed by experienced specialist companies, taking all reasonable health, safety and environment precautions. National stainless steel development associations provide information on cleaning agents and specialist companies.



## RECOMMENDATIONS FOR FACILITY MANAGERS: MAINTENANCE CLEANING

On **external applications**, such as facades, rainfall can normally be expected to wash off accumulations of dirt and other deposits efficiently, depending on the degree of exposure. Special attention should be given to sheltered areas during routine cleaning to ensure that accumulations of airborne contaminants are removed. This is particularly important in marine and industrial environments, where build-up of airborne chlorides or sulphur dioxides can result in localized corrosion if not effectively removed.

On **interior applications**, finger marks can be an issue. There is a wide range of finishes available for stainless steels, many of which are suitable for use in heavily exposed (high traffic) public areas. Brushed finishes, which are a popular choice for interiors, may show finger marks in the period immediately after installation, but the visibility of the marking should become less evident after the first few cleaning operations.

### Cleaning practice

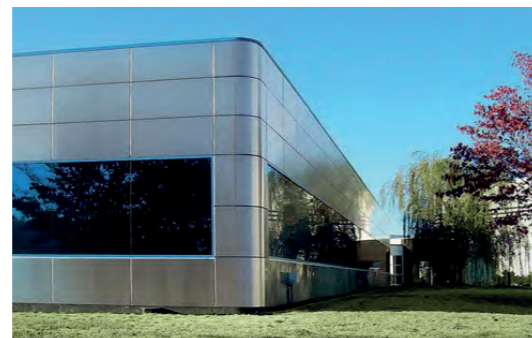
Easy cleaning is one of the reasons why stainless steel is so widely used in architectural applications. A wide range of cleaning agents can be used on bare stainless steel [11].

**Polished, brushed and satin finished surfaces** are most typical of stainless steel building applications. To remove **fingerprints and other marks** from architectural finishes, soapy water or a mild detergent are usually safe and successful. Proprietary spray cleaning fluids are available, which combine ease of cleaning with a light temporary film that produces an even and smooth lustre. These spray cleaners remove existing fingerprints and leave the surface in a condition that reduces the tendency for fingerprints to show in subsequent service. After applying the spray, the surface should be polished with a

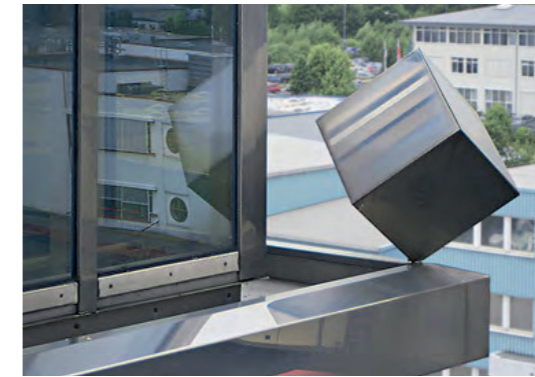
dry cloth. Your nearest national stainless steel development association should be able to advise on products locally available.

**Mirror-polished stainless steel** can be cleaned with chloride-free glass cleaning fluids.

In the case of **electrolytically coloured stainless steel**, particular care has to be taken to avoid scratching the surfaces as there is no possibility of rectification. Advice should be sought from the supplier. The cleanability of **colour coated (painted) stainless steel** is determined by the nature of the coating. Typically it is advised to maintain shorter cleaning intervals than with bare stainless steel as heavily soiled painted surfaces may be more difficult to clean without taking away the gloss or otherwise changing the surface. As pressure jet cleaners may damage the coating, hosing with water containing a detergent is usually preferred.



Stainless Steel facade before and after cleaning. Photo: York Property Company Inc., Bethlehem, PA (USA)



Bright annealed facade cladding before and after cleaning: Standard maintenance operations return the highly reflective surface to its original lustre. Photo: Christian Pohl GmbH, Cologne (D)

For **more stubborn stains**, mild household cream cleaning agents, containing soft calcium carbonate additions, are usually effective. This should also be suitable for cleaning off watermarks and light discolouration. After cleaning, the residue should be removed with (preferably de-ionised) water, avoiding streaking and water marks. Scouring powders should not be used as these products can leave scratches on stainless steel surfaces.

For the removal of **adherent hard water scales**, a 10–15% solution of phosphoric acid is usually effective, as described above for the removal of mortar and cement splashes. However, also a solution of one part of vinegar and three parts of water will usually be effective.

**Severe oil and grease marks** can be removed with alcohol based products, including methylated spirit and isopropyl alcohol or other solvents such as acetone. These products are not a corrosion hazard to stainless steel. Care is needed with solvents to avoid spreading the staining on the stainless steels, which can then be difficult to fully remove. It is advisable to apply clean solvent several times with a clean, non-scratching cloth, until all traces of the partially dissolved oil/grease are removed. Also alkaline formulations are available with surfactant additions <sup>6</sup>.

<sup>6</sup>When using potentially aggressive products, it is recommended to test-apply them in small and hidden areas of the surface first to assess any potential change in appearance.



The Chrysler Building (left), finished in 1930, was the first large-scale architectural application of stainless steel.

The Socony Mobil Building (right), dating from 1956, was the largest stainless steel facade world-wide at that time. Both facades underwent the first known cleaning operation in 1995.

Photo: Nickel Institute, Brussels (B)/Catherine Houska photographer, Pittsburgh, PA (USA)

**Paint and graffiti** can be treated with proprietary alkaline or solvent-based paint strippers. The use of hard scrapers or knives should be avoided as the underlying stainless steel surface may become scratched.

**Heavily neglected surfaces** can be treated with metal polishes, such as those for cleaning chromium-plated items (e.g. automotive trim). Furthermore, polishes used for refinishing car paint can be considered. Care must be taken as highly polished surfaces may become scratched with these cleaning agents. Residues of paste material should be removed completely. Alternatively, use a proprietary stainless steel cleaning agent containing phosphoric acid to remove contamination, rinse with deionised water and dry. It is advisable that the entire surface of the component is treated so that a patchy appearance is avoided.

Before commencing any task, all appropriate health and safety literature from the supplier should be read and fully understood. If in doubt, further advice should be sought. Where water has been used for cleaning or rinsing, wiping the surface dry to prevent watermarks, especially in hard water areas, may be advisable. The use of deionised water will prevent the formation

of hard water staining. When selecting cleaning products, not only their compatibility with stainless steel should be checked but also their potential effect on other materials, such as glass, sealants, stone, etc.

**Cleaning agents that should NOT be used on stainless steels include:**

- Any chloride-containing cleaning agents, especially those containing hydrochloric acid
- Hypochlorite bleaches
- Silver-cleaning solutions

If these are applied accidentally or spilt on stainless steel surfaces, they should be rinsed off immediately with liberal amounts of fresh water.

**Cleaning equipment**

A **damp cloth** or **chamois leather** will usually be suitable for removing normal soiling, fingerprints, etc.

For more stubborn dirt, **nylon pads** such as "Scotch-Brite" pads are usually satisfactory. However, sensitive surfaces like bright annealed and mirror-polished can get scratched.

**Soft nylon brushes** can be used for cleaning stainless steel with patterned finishes. On grained directional finishes, such as EN 10088 Part 2 types G, J and K, the direction of cleaning strokes should be along the grain and not across it. Non-stainless steel based scouring pads, cleaning wool or wire brushes must not be used on stainless steel. Apart from scratching the surface, these pads can leave carbon steel deposits on the stainless surface, which can subsequently develop into rust spots, if the surface becomes wet. Additionally, to avoid cross-contamination from iron particles, cleaning equipment should preferably be reserved exclusively for stainless steel and should not have been previously used on carbon steel. Stainless steel wire wool avoids contamination, although it may permanently scratch decorative surfaces.

**Pressure jet cleaners** can be used, however, as on other materials, the high water pressure can lead to hard dirt particles with sharp edges being ripped across decorative surface and leaving scratches. If a stainless steel surface is heavily soiled e.g. with sand or dust, it is recommended to hose it first before applying the pressure jet cleaner. It should also be noted that the stainless steel sheet used for fabricating cassettes or panels is often quite thin and the pressure must be kept to a level that avoids damage through deformation.

**Cleaning intervals**

The cleaning of stainless steel items for building interiors is really no different to other materials. Cleaning should be done before there is a visible build-up of soiling or finger-marking, so that the effort and cost of cleaning is minimised along with the risk of permanently marking or altering the appearance of the surfaces.

On building exterior applications, stainless steel may be exposed to a wider range of potentially more aggressive environments as a result of contact with:

- Marine atmospheres
- Environments laden with industrial pollutants
- Salt spray from road de-icing salt
- Atmospheric dirt and traffic film

A stainless steel cleaning agent containing phosphoric acid will remove this form of contamination. The regularity of cleaning depends on both aesthetic requirements and the corrosiveness of the atmosphere. Where the highest level of cleanliness is required, or in corrosive environments, it is good practice to clean metallic surfaces at the same intervals as the building's glazing is cleaned. If heavily exposed to pollutants, the surfaces should be cleaned at intervals of a few months, especially in recessed areas which are not washed by rain. However, experience shows that in typical rural and urban atmospheres, it will take several years before there is any visible or potentially corrosive build-up of dirt.

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