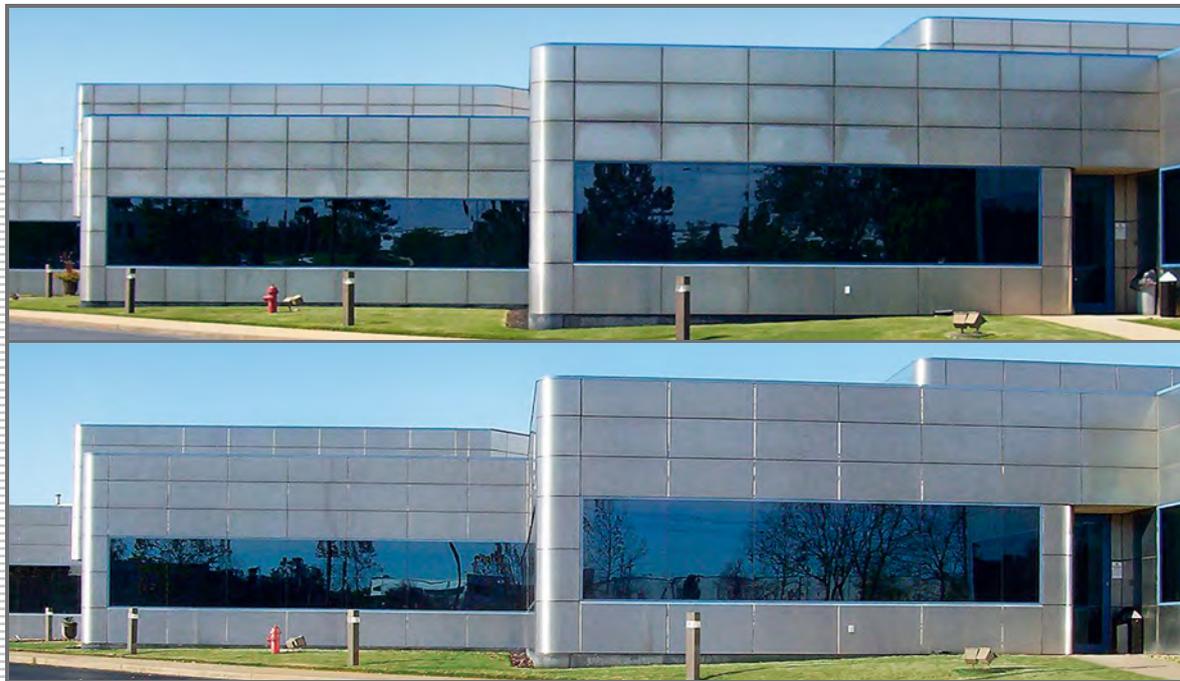


Cleaning Architectural Stainless Steel



Euro Inox

Euro Inox is the European market development association for stainless steel.

The members of Euro Inox include:

- European stainless steel producers
- National stainless steel development associations
- Development associations of the alloying element industries.

A prime objective of Euro Inox is to create awareness of the unique properties of stainless steels and to further their use in existing applications and in new markets. To assist this purpose, Euro Inox organises conferences and seminars, and issues guidance in printed form and electronic format, to enable architects, designers, specifiers, fabricators, and end users to become more familiar with the material. Euro Inox also supports technical and market research.

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1 *Why cleaning is important*

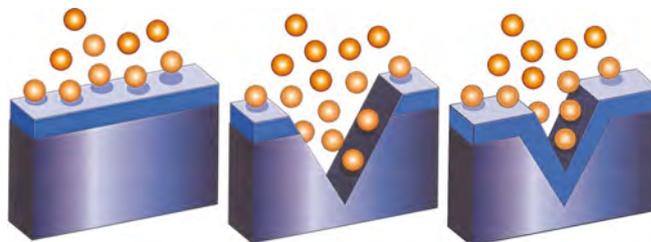
Contrary to common belief, stainless steel is not just one type of material that remains “stain-less” in all circumstances. Instead, there are over 200 grades of stainless steel with different levels of corrosion resistance, although only a handful of them are commonly used in building and architecture.

Stainless steel needs to be cleaned to maintain a good appearance and preserve corrosion resistance. Stainless steel components will not corrode under normal atmospheric conditions provided the correct grade has been selected and appropriate fabrication procedures followed. It is the responsibility of the architect or structural engineer to select the right grade for a given environment. If too low an alloyed grade is used, accumulations of dirt can lead to concentrations of corrosive substances, which may exceed the level of corrosion resistance of that alloy. This may lead to staining and – in more severe

cases – the initiation of corrosion, which can make remedial cleaning necessary. It is therefore important to understand which grade is appropriate for a particular environment.

The corrosion resistance of stainless steel is due to a process called “self-passivation” (see box). Even if an appropriate grade is selected, accumulations of dirt may lead to concentrations of corrosive substances that eventually break down the passive layer. Cleaning is necessary to keep the self-repair mechanism intact as it prevents the build up of critical concentrations of contaminants like sulphur dioxide or chlorides and ferrous contamination. Stainless steel surfaces thrive with frequent cleaning because there is no surface coating to wear off. The frequency and cost of cleaning stainless steel is lower than for many other materials and this can out-weigh higher acquisition costs.

The self-repair mechanism of stainless steel



The chromium in the stainless steel alloy forms a thin, transparent “passive layer” on the surface. Although this protective layer is only a few atoms thick, it seals the stainless steel below from the environment. In the presence of oxygen from air or water, it instantaneously reforms if it is damaged. The passive layer is the reason why stainless steel does not require any coating or other form of external corrosion protection.

2 Recommendations for architects: cleaning-friendly design

The durability of a structure and its future maintenance costs are dependent on the decisions made by the architect early in the design stage. Cleanability essentially depends on grade selection, choice of finish and geometry of the component.

2.1 Selection of an appropriate grade

Tea staining, which indicates the initiation of corrosion, can be avoided by selecting the most suitable grade for the environment [1, 2]¹:

- Basic ferritic (chromium-alloyed) grades like EN 1.4016 have a corrosion resistance that is usually adequate for interior applications (unless the environment is unusually aggressive, such as a chloride-laden marine atmosphere).
- The standard chromium-nickel grade 1.4301 (or its low carbon variant 1.4307) is the most frequently used stainless

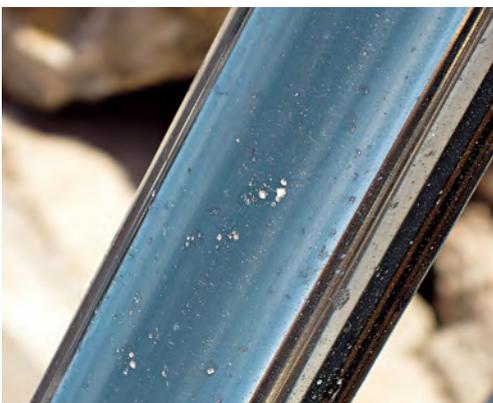


Where de-icing salts are used, it is advisable to select molybdenum-bearing grades.

steel for both interior and mildly corrosive exterior applications in rural, urban and light industrial sites.

- Wherever noticeable amounts of chlorides or sulphur dioxides are to be expected in the atmosphere, the chromium-nickel-molybdenum alloyed grade 1.4401 or similar grades like 1.4404 are recommended. Examples include coastal locations, industrial atmospheres and locations exposed to de-icing salts.

Sea spray can result in salt deposits on nearby stainless steel structures. A higher-alloyed stainless steel type, combined with a smooth surface, helps prevent discolouration.



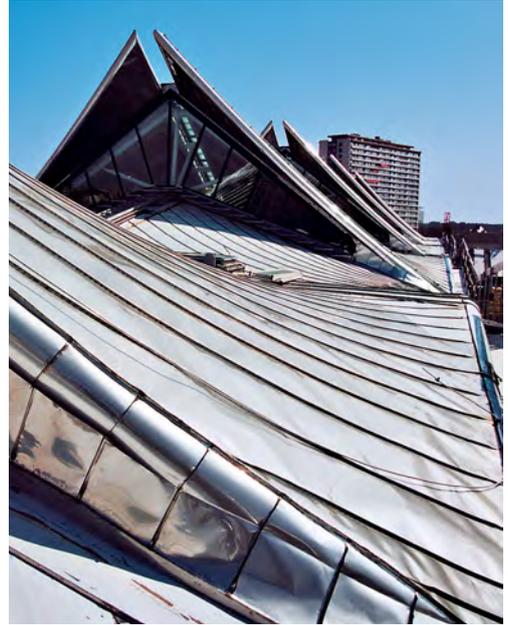
¹ There are numerous alternative grades with corrosion resistance properties similar to those of the classic stainless steels referred to in this chapter. However, national building codes may need to be consulted for details on grade selection.

2.2 Selection of cleaning-friendly finishes

A wide range of surfaces and finishing techniques is available for stainless steels [3]. The specification and designations for surface finish of stainless steel is covered in European Standard EN 10088 Part 2 [4]. Clearly, to prevent the adhesion of dirt, the nature of the surface is of key importance. There are several approaches to improving the cleanability of surfaces, which can include selecting either smooth or patterned surfaces.

2.2.1 Reflective finishes

Generally, the smoother the surface, the less the dirt adheres to it. One way of achieving good cleanability is therefore to use as smooth as possible a finish.



A 2B mill finish was selected for the roof of Antwerp Court of Justice. Due to the marine climate, Mo-bearing type 1.4401 stainless steel was specified.

From the rough anti-slip surface of tearplate (stairs) to the reflective cold-rolled finish of decorative facade panels (cladding), suitable cleaning methods are available for any architectural application, as demonstrated in this administrative building at Gavá, Spain. Photo: Acerinox, Madrid (E)



The standard mill finish is designated 2B in EN 10088, a reflective, however slightly milky surface and often the most cost-effective solution. In exterior applications, it will usually be washed efficiently by rain. It tends to show finger marks quite clearly and is therefore best avoided in interior applications where the component would be exposed to people touching it.



Good self-cleaning properties are among the reasons why on this industrial building in Siemianowice Śląskie, Poland, a bright annealed (2R) finish was selected for the facade in stainless steel grade 1.4526. Photo: Aperam/ A. Zekri

A significantly more reflective finish is 2R (also called bright annealed, BA). The gloss is almost mirror like. This, too, is a standard mill finish and hence a cost effective solution. Its cleanability is excellent; however, care must be taken to ensure that suitable cleaning agents, tools and methods are consistently used to avoid scratching.

Mechanical or electrolytic polishing can improve the gloss further:

- Mechanical mirror-polishing is used for applications such as unbreakable mirrors or – for decorative reasons – in luxury lift cabins. These should only be used where expert maintenance cleaning is ensured, as damage is difficult to repair.
- Electropolishing minimizes the micro-roughness of the surface and can be applied to any stainless steel surface. It can significantly reduce the adherence of dirt and ease the removal of graffiti [5].

Architectural use of the 2R finish on column cladding in an office building. Due to consistent application of suitable cleaning methods, the original gloss is fully maintained.





Satin finished perforated stainless steel maintains its characteristic lustre at the Charlemagne Building, Brussels (B).



At Vauxhall Cross Bus Interchange, London, a patterned finish was used to reduce the need for cleaning.



2.2.2 Non-reflective finishes

Reflective polished finishes are sometimes inappropriate in architectural applications where there is a risk of excessive glare or it would be difficult to ensure the necessary optical flatness. In these cases, brushed or polished finishes are often preferred. The resulting “satin” finish is indeed what most people associate with stainless steel.

There are many different polished, ground and brushed finishes. They are available as mill finishes or can be applied by fabricators. From a cleaning point of view, two principles should be kept in mind:

- Coarsely ground surfaces should be avoided. For architectural applications, a maximum surface roughness R_a value of $0.5 \mu\text{m}$ is generally recommended².
- The polishing pattern should run vertically, not horizontally, to allow water to flow off easily.

² Although R_a values are commonly used as an indicator of surface roughness, a surface cannot be fully characterized by an R_a value alone.

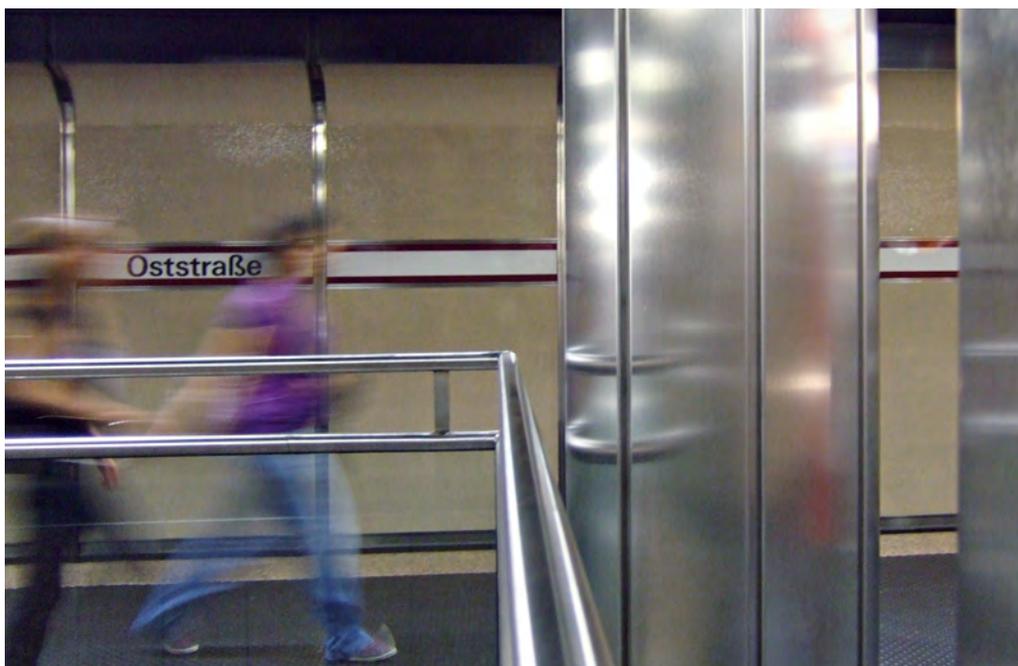
Reference 6 gives further guidance on how to achieve a consistent effect with polished stainless steel panels.

Patterned finishes are popular in facades as well as in public places like airports or railway stations because they tend to mask scratches and other forms of damage. As they are typically made from bright annealed stainless steel sheet, their surface roughness is low, which contributes further to their ease of cleaning.

Finger marks on bead-blasted sheets (typically of thin, cold-rolled stainless steel) can be difficult to remove. This finish should only be considered for applications away from areas that are frequently touched by hands. Applied to somewhat rougher hot-rolled stainless steel, bead-blasting has proved to work well in exposed areas.



Bead-blasted stainless steel has proved its mechanical resistance in an exposed location at Southwark rail station (UK).

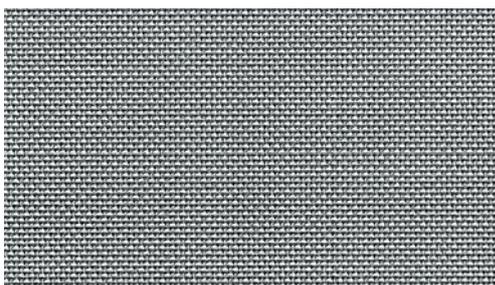


In this Underground station in Düsseldorf (Germany), a polished stainless steel finish was selected for cladding the columns. It was also electropolished to reduce the micro-roughness and thus facilitate the removal of graffiti. This design has performed well over the last 20 years. Photo: Euro Inox/Rheinbahn AG, Düsseldorf (D)



Today, there are also special rolled-on finishes which resemble polished or bead-blasted surfaces. Rolled-on bead-blasted surfaces are mill finishes, produced with a high level of consistency, and the micro-roughness of the stainless steel remains essentially the same as on smooth finishes. These surfaces have a good cleanability (in interior applications) and are efficiently washed by the rain (in roofing applications).

Ferritic stainless steel grade 1.4016 with a rolled-on finish similar to classic satin-finishes. Photo: ThyssenKrupp Nirosta, Krefeld (D)



Patterned finishes combine a non-reflective surface effect with good cleanability. Photos: Aperam



Finishes of stainless steel flat products commonly found in building and architecture according to EN 10088-2 and -4

	Abbreviation *	Type of process route	Surface finish	Notes
Hot rolled	1D	Hot rolled, heat treated, pickled	Free of scale	Usually standard for the most steel types to ensure good corrosion resistance; also common finish for further processing. It is permissible for grinding marks to be present. Not as smooth as 2D or 2B.
Cold rolled	2H	Work hardened	Bright	Cold worked to obtain higher strength level.
	2D	Cold rolled, heat treated, pickled	Smooth	Finish for good ductility, but not as smooth as 2B or 2R.
	2B	Cold rolled, heat treated, pickled, skin passed	Smoother than 2D	Most common finish for most steel types to ensure good corrosion resistance, smoothness and flatness. Also common finish for further processing. Skin passing may be complemented by tension levelling.
	2R	Cold rolled, bright annealed **	Smooth, bright, reflective	Smoother and brighter than 2B. Also common finish for further processing.
Special finishes	1G or 2G	Ground ***	See footnote ****	Grade of grit or surface roughness can be specified. Unidirectional texture, not very reflective.
	1J or 2J	Brushed *** or dull polished ***	Smoother than ground. See footnote ****	Grade of brush or polishing belt or surface roughness can be specified. Unidirectional texture, not very reflective.
	1K or 2K	Satin polish ***	See footnote ****	Additional specific requirements to a 'J'-type finish, in order to achieve adequate corrosion resistance for marine and external architectural applications. Transverse $R_a < 0,5 \mu\text{m}$ with clean cut surface finish.
	1P or 2P	Bright polished ***	See footnote ****	Mechanical polishing. Process or surface roughness can be specified. Non-directional finish, reflective with high degree of image clarity.
	2F	Cold rolled, heat treated, skin passed on roughened rolls	Uniform non-reflective matt surface	Heat treatment by bright annealing or by annealing and pickling
	1M	Patterned	Design to be agreed;	Chequer plates used for floors
	2M		2nd surface flat	A fine texture finish mainly used for architectural applications
	2W	Corrugated	Design to be agreed	Used to increase strength and/or for cosmetic effect
	2L	Coloured ***	Colour to be agreed	
	1S or 2S	Surface coated ***		Coated with e.g. tin, aluminium, titanium.

* First digit, 1 = hot rolled, 2 = cold rolled.

** May be skin passed.

*** One surface only, unless specifically agreed at the time of enquiry and order.

**** Within each finish description, the surface characteristics can vary, and more specific requirements may need to be agreed between manufacturer and purchaser (e.g. grade of grit or surface roughness).

The surface conditions of stainless steel long products (including bars and sections) are described in EN 10088-3 and -5. As this standard addresses surface roughness in a rather general way, it is recommended to specify a maximum R_a value of $0.5 \mu\text{m}$ at the time of enquiry and order, if good cleanability is a requirement. The same principle should apply for tube intended for use in handrails, parapets, secondary structures and other applications of stainless steel circular and rectangular hollow sections.

2.3 Design features

The cleaning requirements of a building can be greatly reduced by avoiding details where dirt might collect and optimising the effectiveness of rain washing [7]:

- Cladding panels should be positioned so they can be washed by the rain as uniformly as possible.
- Polished stainless steel should be installed with the polishing pattern running vertically to make it easy for water to flow down the surface and remove dirt particles.
- Complex contours should be avoided as they hamper manual cleaning.
- Horizontal, recessed and sheltered areas should be avoided as they can trap dirt, which may later run down the facade in unsightly streaks.
- Joints should be sealed (with closing welds or mastic fillers) or made wide enough to avoid exposed crevices where dirt would tend to accumulate, making the stainless steel susceptible to corrosion.
- Stiffening elements in open sections should have an opening to allow water to flow off.
- Run off from other materials should not be allowed to contaminate stainless steel surfaces (particularly run-off from materials such as carbon steel, weathering steel, chloride bearing cements, mastics, sealants etc.).



Rainfall has a natural cleaning effect in parts of the building envelope which are exposed to the elements. Photo: Centro Inox, Milan (I)

- Galvanized fasteners should not be used to fasten stainless steel panels. Due to the galvanic reaction between the “noble” stainless steel on the one hand and the less “noble” partner metal on the other, the latter would corrode quickly, leaving rusty marks on the stainless steel. Apart from the fact that the galvanized fastener will eventually fail, the traces of corrosion would make remedial cleaning necessary [8].

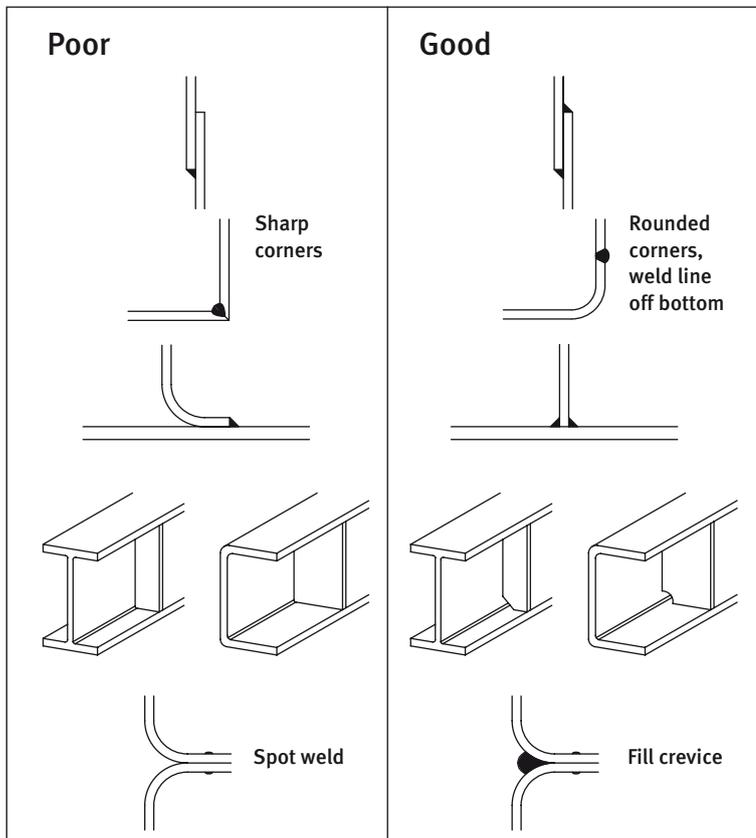


Facade panels should be polished in a vertical direction to support self-cleaning. Run-off water carries away particles and reduces the adherence of dirt. Photo: Outokumpu, Espoo (FIN)

The good designs on the right will take advantage of self-cleaning effects and minimise the accumulation of dirt, which can also become a corrosion issue. Designs like those on the left should be avoided. Source: SCI, Ascot (GB)



Only stainless steel fasteners should be used on stainless steel components.



3 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.

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.



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.

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 de-ionised water³) 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.

³ De-ionised water reduces the risk of water staining marks. Also used for steam ironing and car batteries, it is available in supermarkets.

- 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 pickling⁴ or passivation⁵. Both are carried out after degreasing (removing oil, grease and other organic contamination) [10].

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.

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.

4 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.

5 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.

4 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.

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



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.

4.1 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.



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)

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.

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 ⁶.

⁶ 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 de-ionised 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 de-ionised 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:

- 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.

4.2 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.

4.3 Cleaning intervals

The cleaning of stainless steel items for building interiors is really no different to other materials. Cleaning should be done

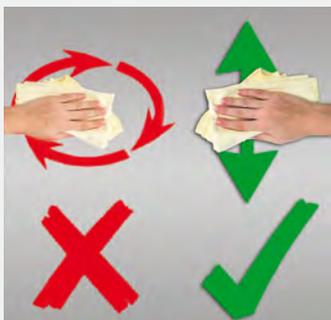
before there is a visible build-up of soiling or finger-marking, so that the effort and cost of cleaning is minimised along with the risk of permanently marking or altering the appearance of the surfaces.

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.

5 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).

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