

The main purpose of this Datasheet is to advise on the choice of stainless steel for use outside in coastal areas in terms of the correct choice of grade and finish.

It has been shown after many years of stainless steel usage in coastal environments that grade 316 or 316L is the optimal choice of stainless steel grade with Mirror Polished being the best finish choice for long life and maintenance of good appearance. {If a matt finish is required then finishing by use of bead-blasting using FINE GLASS beads to give a smooth surface may be an option, although this is NOT recommended and will require more regular cleaning – If using this method, it is critical that the Glass Beads must be clean and free from any iron/mild steel contamination and that a rigorous pickling & passivation treatment is carried out after blasting.}

This correct choice of Mirror Polished grade 316 should also be combined with a cleaning regime that will keep the stainless steel and its finish looking great for many years. After fabrication and/or upon installation the stainless steel should be thoroughly cleaned to remove any surface contamination, dirt, etc. Innosoft from Aalco is a particularly good choice of cleaning product since it is formulated to ensure a deep clean of the surface pores. It is also good practice to apply some form of protective product such as Innoprotect from Aalco that will help keep the surface cleaner for longer by resisting the adhesion of contaminants and dirt. Thereafter, where the stainless steel is regularly rinsed by rainwater little additional cleaning will be required, although rinsing with fresh water from time to time is desirable.

For both initial cleaning and on-going cleaning, care must be taken to use soft, non-abrasive cleaning cloths that are clean and not contaminated in any way with iron or mild steel.

Equally, any cleaning products used must not affect the polished finish and, if likely to damage the passive surface layer (see below) must be followed by a re-passivation treatment.

### CONTACT

|                 |                                                                                                                        |
|-----------------|------------------------------------------------------------------------------------------------------------------------|
| <b>Address:</b> | Please make contact directly with your local service centre, which can be found via the Locations page of our web site |
| <b>Web:</b>     | <a href="http://www.aalco.co.uk">www.aalco.co.uk</a>                                                                   |

### REVISION HISTORY

|                          |              |
|--------------------------|--------------|
| <b>Datasheet Updated</b> | 18 July 2019 |
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### **RATIONALE**

Many people believe that stainless steel can't get rusty and that stainless steel is completely rust-proof. In fact, although stainless steel is an alloy that contains chromium and other elements offering a certain amount of resistance to corrosion the base material is virtually as active as ordinary carbon steel.

The noble nature of stainless is due to an ultra-thin passive Chromium Oxide layer on the surface, but in the absence of this layer the material is rapidly corroded. So good care should be taken of this oxide layer to ensure stainless steel will last a lifetime. In other words, stainless steel is not at all maintenance free. It can, however, be said to be low maintenance.

A component made from stainless steel can be compared to a healthy apple that keeps for a long time thanks to its peel, which is less than a tenth of a millimetre thick, but no substances are able to escape or enter – until a worm eats its way through the peel, triggering the rotting process. The flesh of the apple will also oxidize quickly when the apple is cut in half. The 'skin' on stainless steel is much thinner than apple peel yet also provides complete enclosure, which is why, normally speaking, no metal ions can escape and no foreign substances can enter. However, if this skin is exposed to an excessive chemical load, it will break down, leading to corrosion. The biggest difference from the apple is the ability of stainless steel to repair its oxide layer by itself. This is particularly applicable when the layer is damaged mechanically and the chromium oxide layer disappears in local areas. Thanks to the oxygen in the air, passivation of the material will occur spontaneously in those areas through the formation of a new layer of chromium oxide. This is known as the 'self-healing effect' although this mechanism can be badly disrupted in the presence of chlorides.

#### **Dirt Deposits**

Stainless steel must be able to 'breathe' as it exists thanks to oxygen. Although oxygen serves to maintain the thickness of the oxide layer, Oxygen is a relatively large molecule however and must be in contact with the surface. This is obviously not a problem when the surface is clean. Places not exposed to rain are particularly susceptible to under-deposit corrosion.



Above is detail of a canopy above a stainless steel revolving door after four years in service in the vicinity of sea water. You can see all kinds of rusty spots also known as tea stains. This is the work of aerosols, together with dirt deposits.

Aerosols are small droplets of sea water which evaporate when airborne, increasing their concentrations of salts and chlorides. These settle on the stainless steel surface and the chlorides push their way under the dirt deposits in the pores, where they attack the material. If nothing is done, this corrosion will slowly spread further. In this case, the stainless steel under the porch has suffered far greater corrosion than the section exposed to rain. The reason for this is that rain water washes away most of these salt residues, which means that the material experiences less corrosion. If the stainless steel arch had been cleaned regularly, these 'tea stains' would not have developed.



This image illustrates this form of corrosion. It shows a switchboard cabinet made from AISI316 that is situated in the open air near to the coast. It is thought that a seawater resistant stainless steel should be chosen in this case. It is mainly aerosols that attack this surface under the dirt deposits. If this surface had been cleaned regularly, then this form of corrosion would not have occurred. As the entrance gate in question is covered, it is very difficult for rain water to reach the object to clean it. Once again, a mistake was made here in thinking that stainless steel was maintenance-free. The corrosion shown is no reason to replace this part as the corrosion can still be removed. It will be necessary, however, to apply extra protection after cleaning as minute blemishes have developed that could quickly lead to new corrosion.

### **THE SOLUTION**

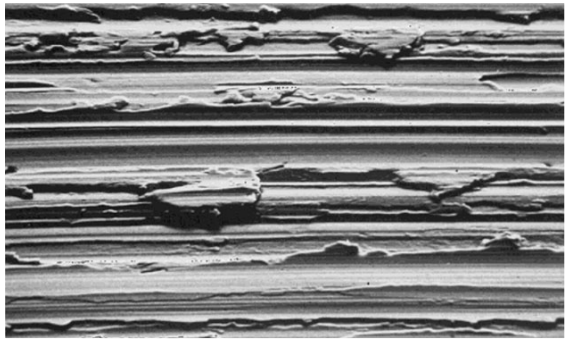
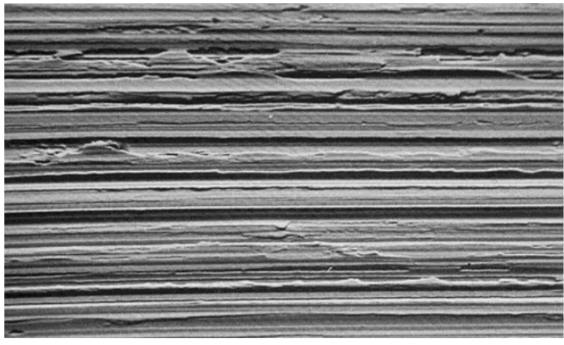
So to repeat, it is vital that stainless steel products and fabrications are:

- ~ Clean when they go into service and. In particular weld areas must be free from discolouration and contamination plus any mild steel contamination that may have occurred during fabrication must be completely removed.
- ~ Kept clean whilst in service
- ~ The surface finish of the stainless steel is also a key factor and will have a major effect on the corrosion resistance of the stainless steel.

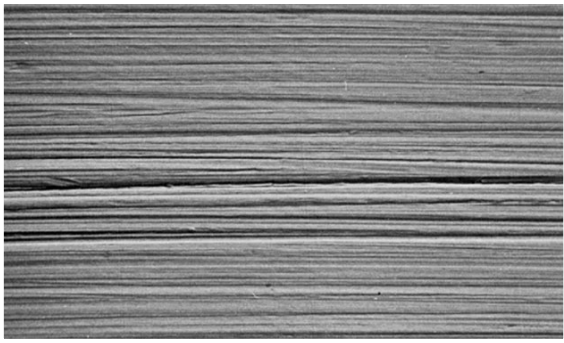
**SURFACE FINISH**

Many ‘polished’ finishes that are applied to stainless steel are highly directional ground (scratched) finishes applied using dry abrasives. These perform very poorly in terms of both corrosion resistance and cleanability. The reason for this can be explained by microscopic examination of the surface.

These images show two typical ‘polished’ (dry-ground) finishes

|                                                                                   |                                                                                    |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|  |  |
| <i>Ra &gt; 1 Micron</i>                                                           | <i>Ra approx. 0.5 Micron</i>                                                       |

A good quality wet-cut finish such as Aalco OPTISHEEN with an Ra of 0.2 microns as shown below is a much better alternative but compared to mirror polished could hardly be called ‘smooth’



Clearly surfaces on this nature have the propensity to trap dirt and contaminants whilst their roughness hinders proper cleaning as well as an even formation of the passive layer. Equally, it can be seen that orientation of the finish in service will also have an effect with vertical orientation of the ‘scratches’ being preferred.

### SURFACE FINISHES TO EN 10088-2 / 10028-7

| Special Finishes*                                                                                                                                                            |               |                                                                          |              |                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------|--------------|------------------------|
| EN Finish                                                                                                                                                                    | Old BS Finish | Description                                                              | Typical Grit | Typical R <sub>a</sub> |
| 1G or 2G                                                                                                                                                                     | -             | Ground Grit                                                              | 120          | 2.5 to 2.0 μ           |
| 1J or 2J                                                                                                                                                                     | 3B            | Brushed - Unidirectional                                                 | 180          | 1.2 to 1.0 μ           |
| 1J or 2J                                                                                                                                                                     | 4             | Dull Polished – Unidirectional                                           | 240          | 0.6 μ                  |
| 1K or 2K                                                                                                                                                                     | 5             | Satin polished – Unidirectional                                          | 320          | 0.5 Max                |
| 1P or 2P                                                                                                                                                                     | 7             | Bright polished – Non-Directional with a high degree of image clarity    | 600          | 0.1 μ                  |
| 1P or 2P                                                                                                                                                                     | 8             | Mirror Finish – Non-Directional with a very high degree of image clarity | 800          | 0.05 μ                 |
| <b>*Note:</b> Special finishes indicate hot rolled (1) and cold rolled (2) sheets, e.g.:<br>Ground polished hot rolled sheets = 1G / Ground polished cold rolled sheets = 2G |               |                                                                          |              |                        |

### CLEANING PRODUCTS

Stainless steel is easy to clean. Washing with soap or a mild detergent and warm water, followed by a clear water rinse, is usually quite adequate for domestic and architectural equipment. An enhanced aesthetic appearance will be achieved if the cleaned surface is wiped dry.

Where stainless steel has become extremely dirty with signs of surface discolouration or tea-staining, (perhaps following a period of neglect or misuse) then a more aggressive cleaning regime will be required. In this case the choice of cleaning products will depend to some degree upon the Surface Finish since some cleaning chemicals may spoil a Mirror Polished finish.

The best cleaning system in this situation is a two-part treatment from Aalco called Innosoft and Innoprotect.

As already stated:

~ Any cleaning products used must not affect the polished finish and, if likely to damage the passive surface layer (see below) must be followed by a re-passivation treatment.

~ For both initial cleaning and on-going cleaning, care must be taken to use soft, non-abrasive cleaning cloths that are clean and not contaminated in any way with iron or mild steel.



**aalco**<sup>®</sup>

# STAINLESS STEEL CLEANING & PASSIVATION KIT

Removes oxides and rust  
contamination from  
Stainless Steel surfaces



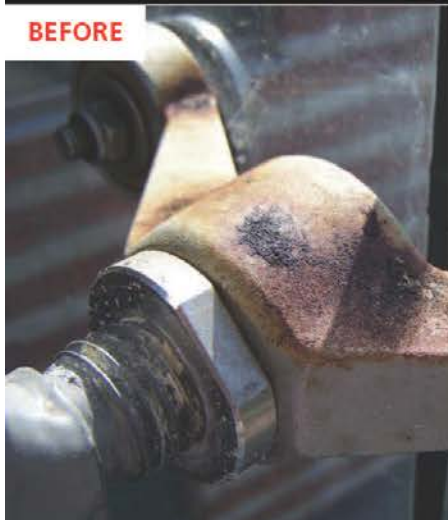
**BEFORE**



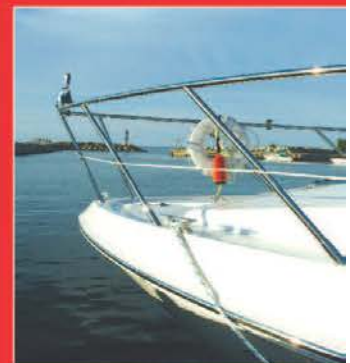
**AFTER**



**BEFORE**



**AFTER**





**Innosoft B570** is a special deep cleaner that removes contamination such as oxides/rust from stainless steel surfaces in a single operation.

It is a white viscous liquid based on organic acids and surface active agents and does not contain abrasives. It is suitable for the intensive cleaning of contaminated surfaces like flash rust and rusty areas, also known as 'tea-stains'. It is not a pickling agent because it does not attack the metal. It is therefore non-aggressive for metals but very effective on oxides and dirt.

**Innoprotect B580** completely removes any residues left after the use of **Innosoft B570** and passivates the surface which helps to prevent further corrosion.

Due to the deep-cleaning characteristics of **Innosoft B570**, the danger of 'under-deposit corrosion' of stainless steel is also reduced. This form of corrosion occurs under deposits because oxygen access is limited. This is particularly important in Chloride environments such as marine applications. Ground or polished surfaces are also more susceptible to this phenomenon.

#### Other metals

Although **Innosoft B570** was originally developed for stainless steel it has become apparent that it also gives good results on other metals like copper, aluminium and even plain steels. Common corrosion pits on aluminium are also effectively removed using this product.



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Before & after treatment  
with Innosoft B570



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**Aalco Kits**

Kits are available from Aalco  
comprising the following contents

| Product            | 500ml Kit | 250ml Kit | 100ml Kit |
|--------------------|-----------|-----------|-----------|
| Innosoft B570      | 500ml     | 250ml     | 100ml     |
| Innoprotect B580   | 500ml     | 250ml     | 100ml     |
| Application Sponge | 1         | 1         | 1         |

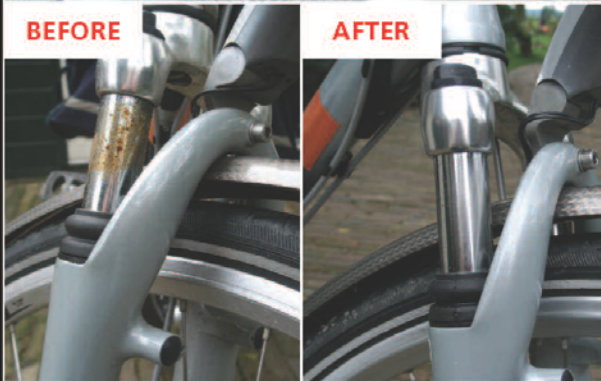
**Instructions for using Innosoft B570**

Innosoft B570 is a white viscous liquid with an acidic pH of 3 containing organic acids and surface-active agents and is free from abrasive particles.

Innosoft B570 should first be well shaken and then applied undiluted using a damp sponge or pad. For ground or polished finishes, the product should be applied in the same direction as the brushing, grinding, polishing or abrading.

The loosened dirt and or oxide might cause light scratching, particularly on polished surfaces and this should therefore be carefully removed with water or a damp cloth. In this case only light pressure should be used in order to prevent any dirt becoming lodged in surface discontinuities. It is preferable to follow up with use of the basic cleaner Innoprotect B580 which as well as being neutral, also leaves a passive layer minimising the danger of any subsequent corrosion.

It is recommended that waterproof gloves are worn whilst using the product. A Material Safety Data Sheet in line with 1907/2006/EC article 31 is available on request.



**Instructions for using Innoprotect B580**

This neutral (pH 6.5) and mild cleaner can successfully be used in combination with Innosoft B570. As well as its cleaning action in removing the loosened oxides and contaminants, this product will also passivate the surface to minimise further corrosion. It is also suitable for the everyday cleaning of lightly soiled surfaces that have previously been treated with Innosoft B570.

This cleaner should ideally be used to remove oxides and dirt released by prior usage of Innosoft B570. By the generous use of the diluted cleaner, all the contamination is washed away. After drying it will immediately be evident if there is any remaining residue in discontinuities or on the surface if a light shading is observed. The cycle should be repeated until the surface is completely clean.

**Dilution**

Dilute 400ml in 1000ml of cold water.