"Surface finishing - anodising, powder coating or wet coating - is a process enhancing the properties of aluminium in all its forms to give it a decorative visual appearance, to improve the metal's excellent corrosion resistance and to improve its wear resistance."
Introduction

Aluminium the Material

Aluminium is a remarkable material. It has a unique combination of properties that make it suitable for many different applications in various alloy forms.

Aluminium is a light metal whose strength, corrosive and decorating properties can be improved by alloying with various other metals. It has good tensile strength over a wide range of temperatures and has excellent corrosion resistance. When aluminium is exposed to air, a thin, glass-hard oxidised film forms on the surface. This oxide film clings tenaciously to the metal's surface, presenting an effective barrier to the elements. Surface coating can make corrosion resistance even more effective.

Aluminium is an excellent conductor of heat and electricity. It is highly reflective of light, heat, radiant energy and electric waves and is non-magnetic. It is non-sparking, does not ignite or burn and is non-toxic. It can be formed by all known metal working processes, is simple to fabricate and is suitable for joining, bonding and welding. It can be melted, cast, extruded, rolled, formed and machined. It is infinitely recyclable, an important feature in this age of energy and resource saving.

The Aluminium Substrate

For a wide range of applications aluminium and its alloys have the advantage that they are protected by the material’s natural hard and inert surface oxide layer that is formed in air and aerated water and that reforms instantly whenever the metal is cut or abraded. This oxide film inhibits corrosion and consequently, in some uses such as industrial and agricultural roofing and cladding, aluminium is routinely supplied in mill finish. Even windows have been supplied in mill finish - the doors and casements in the Johannesburg Jeppe Street Post Office being a 70 year old example, as is the Durban harbour Bayhead shed.

The demands of corrosion resistance, surface protection and aesthetics have however relegated mill finish to those situations where corrosion is slow and the product does not need to have a particularly attractive surface finish. The surface finishes for aluminium that are covered in this Guide fall into three main groups being anodising, powder coating and wet coating.
ASFA

The Aluminium Surface Finishers Association (ASFA) replaced the original “Anoda” that was formed in 1992 as an Association under the aegis of the Aluminium Federation of Southern Africa (AFSA) - to address the needs of companies involved in the surface finishing of aluminium.

The Purpose of the Association is to represent its members in matters of common interest or concern in the fields of aluminium surface finishing, relevant quality and environmental management and related research, technical advice and technology transfer.

In achieving its purpose, ASFA will, amongst other things:

- Provide a forum where members can discuss technical matters of common interest.
- Promote quality aluminium surface finishing that ASFA's members offer their customers, adhering to relevant SANS and other International Quality Standards.
- Promote the awareness of aluminium finishing and its applications through technical interchange and education.
- Promote the mutual benefit of membership to the surface finishing industry, including use of the ASFA hallmark / logo.
- Provide a customer focussed education / advice / information service including maintenance of relevant technical data.
- Facilitate training support and education for members and aluminium Stockists' staff.
- Make mandated representations on behalf of members and the Industry on relevant matters opposite regulatory bodies.

ASFA thrives on the participation of its members. The Association, through its members and the Federation, incorporates the best knowledge pool in aluminium surface finishing in Southern Africa. Over the years, this knowledge has been accessed to produce a definitive guide on aluminium surface finishing in South Africa, namely the "Aluminium Surface Finishing User’s Guide". This publication contains technical and practical guidelines and has proven successful with architects, specifiers and other users of surface finished aluminium.

Industry stakeholders include companies engaged in aluminium finishing, suppliers of products and services to the finishing companies, purchasers of coated products and specifiers of surface finishes.

What is Surface Finishing?

With the wide selection of goods available to consumers, first impressions are extremely important. Often, the value and success of the product is based on immediate judgements - and a critical factor in this regard is the article’s appearance or packaging.

Aluminium provides an ideal base for further finishing of goods in the form of a decorative coating. The size and range of surface finished products is vast - including goods in the packaging, mechanical engineering, transport, automotive, electrical, pharmaceutical, architectural, building, domestic and ‘white’ goods markets. Colour addition is used for decorative, instructive and protective uses.

All coatings may look similar at first glance, but there are many factors that will influence the lifespan of a good or bad surface finish over time. Surface quality is directly dependent on surface treatment, film thickness, process control and proved specified standards.

Regarded for too long simply as a means of corrosion protection, surface treatments in fact modify the condition or properties of the surface of the metal in a variety of ways:

- They modify certain properties of the metal surface such as surface hardness and abrasion resistance.
- They alter its appearance.
- They contribute to the decoration of the metal.
- They assist the adhesion of coatings such as paint, varnish and bonding adhesives.
- They provide further protection from corrosion while imparting a durable appearance to the product.

Price is only a single aspect of finishing as the total cost must be taken into account. Developers, contractors, specifiers and other users of coated aluminium products are well-advised to take all the necessary measures to ensure that proven quality assurance practices are maintained, thus ensuring that any given project will have the best aluminium finish available.

The most common types of surface treatment for aluminium alloys are:

- Degreasing
- Mechanical surface treatment
- Chemical surface treatment
- Chemical conversion
- Chemical brightening
- Anodising (anodic oxide)
- Powder coating
- Wet coating
## Types of Surface Finishing

### TABLE 1: Types of Surface Treatment

<table>
<thead>
<tr>
<th>Type</th>
<th>Technique</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extruded</td>
<td>Fine lines on extruded surface</td>
<td>Decoration, Guidelines to future positioning, Fine lines cover small imperfections.</td>
</tr>
<tr>
<td>Mechanical</td>
<td>Grinding / brushing</td>
<td>Fine lines in the direction of grinding, Gives a silk or matt appearance. Produces a flat even surface.</td>
</tr>
<tr>
<td></td>
<td>Polish and buffing</td>
<td>The grinding lines partly disappear with polishing. Reduces “stress risers”. Removes die lines and tool marks and surface blemishes.</td>
</tr>
<tr>
<td></td>
<td>Vibration polishing</td>
<td>Yields a matt to shiny surface suited to small batches and mass produced parts.</td>
</tr>
<tr>
<td></td>
<td>High finish polishing</td>
<td>Mirror finish, usually followed by bright anodising.</td>
</tr>
<tr>
<td></td>
<td>Shot / grit blasting</td>
<td>For cast aluminium components to remove cast skin and improve appearance.</td>
</tr>
<tr>
<td>Chemical</td>
<td>Milling</td>
<td>Removes surface to desired depth. Can be used for signwriting.</td>
</tr>
<tr>
<td></td>
<td>Etching</td>
<td>Pretreatment to various finishing processes. Leaves a matt or silky appearance. Different etchants leave slightly different textures that may show up in anodising sheen.</td>
</tr>
<tr>
<td></td>
<td>Brightening (prior to anodising)</td>
<td>Removes surface texture and gives a mirror finish. Film usually &lt; 15 microns</td>
</tr>
<tr>
<td></td>
<td>Chromating / phosphating</td>
<td>Pretreatment prior to powder or other coating systems.</td>
</tr>
<tr>
<td></td>
<td>Electrochemically plating with copper, tin, nickel or silver</td>
<td>Improves corrosion resistance / gives good soldering surface / conductivity and reflectivity.</td>
</tr>
<tr>
<td>Electrochemical</td>
<td>Decorative anodising</td>
<td>Gives a hard, natural or coloured oxide layer up to 25 microns. Mainly for decoration - resists pitting corrosion but also adds wear resistance and electrical insulation.</td>
</tr>
<tr>
<td></td>
<td>Hard anodising</td>
<td>Gives a grey to brown coloured hard oxide layer of 75 - 125 microns. Mainly used for engineering purposes to resist abrasion / wear.</td>
</tr>
<tr>
<td></td>
<td>Electrolytic polishing</td>
<td>Gives a smooth surface with high reflectivity.</td>
</tr>
<tr>
<td>Organic surface coating</td>
<td>Powder coating</td>
<td>Gives various degrees of protective and decorative finishes that can withstand heavy chemical attack (provided surface coating is unbroken).</td>
</tr>
<tr>
<td></td>
<td>Screen printing</td>
<td>Printing of text, décor patterns, etc.</td>
</tr>
<tr>
<td></td>
<td>Coating with protective foils</td>
<td>For decoration, protection or other properties.</td>
</tr>
<tr>
<td></td>
<td>Wet coating</td>
<td>Mainly used in capital intensive operations for coil coating, effective and efficient. Mainly for building industry.</td>
</tr>
</tbody>
</table>
Type of Finish to be Specified

There are a number of factors to consider when specifying surface finishes. Different finishing processes may be specified depending on the use or application of the final product. Some of the factors to be considered are:

- **Appearance**: bright, matt, coloured, brushed, other
- **Environment of use**:
  - Interior (architectural, commercial, decorative, other)
  - Exterior (architectural, marine)
  - Industrial / Automotive (corrosive or non-corrosive application, resistance to wear or abrasion, other)
  - Underground (mining, cabling, piping)
  - Aerospace (corrosive resistance, dielectric, emissivity, fatigue strength, other)

Criteria for Specifying Finish

The performance of surface treatments depends directly on the quality of the surface preparation. Anodising and powder coating are complex processes that are constantly being improved. Specifiers should insist on adherence to SANS or International Standards to ensure that the surface finish performs in the expected manner.

When specifying surface finishes for aluminium products, the following specific criteria should be addressed:

- **Alloy and temper of aluminium to be used**
  The alloy and temper of the product to be anodised will affect both the strength and appearance of the part after it is treated. Various combinations of constituent elements cause each aluminium alloy to react differently in the coating process; this is particularly evident between alloy series. As a result, each alloy or alloy series yields a different appearance, even if treated to identical coating processes.

- **Mechanical finish, if any is required**
  If specified, mechanical finishing is done before chemical finishing or anodising. Mechanical finishes give surface texture or remove surface defects and irregularities. Appearance can be varied but usually gives a uniform, matt finish, directional or non directional-sanded finish, or a specular (mirror-like) finish. The mechanical finish shows through the anodic oxides because uncoloured anodic oxides are transparent or translucent and anodic oxides conform to the surface texture. Examples of mechanical finishes are buffing, polishing, sanding, sand blasting and shot peening.
Aluminium and Atmospheric Corrosion

Aluminium enjoys the advantage of a hard, inert oxide film that forms instantaneously when the metal is cut or abraded. This oxide film inhibits corrosion and as a result, in some uses such as industrial and agricultural roofing and cladding, aluminium is routinely supplied in mill finish. Even windows, doors and casements can be supplied in mill finish.

The demands of corrosion resistance, surface protection and aesthetics have however relegated mill finish to those situations where corrosion is slow and the product does not have to be finished in a specific brand colour or where dulling and roughening of the surface is not important.

### Table 2: The Corrosivity Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>very low</td>
</tr>
<tr>
<td>C2</td>
<td>low</td>
</tr>
<tr>
<td>C3</td>
<td>medium</td>
</tr>
<tr>
<td>C4</td>
<td>high</td>
</tr>
<tr>
<td>C5</td>
<td>very high</td>
</tr>
</tbody>
</table>

The Concept of Corrosivity

The corrosivity of an atmosphere can be defined as the ability of the atmosphere to cause corrosion in a given metal or alloy. ISO 9223 specifies the key factors in the atmospheric corrosion of metals and alloys and defines categories of corrosivity on the basis of the constituents of the atmosphere, and in particular the levels of chloride and sulphur dioxide present, in combination with the time-of-wetness of metal surfaces.

ISO 9223 also allows the classification of corrosivity to be done using corrosion rate measurements of standard specimens of common metals and provides a table relating the corrosivity category to these corrosion rates for the first year of exposure.

While the category can be determined from a one-year exposure of a suitable coupon, the corrosivity category thus derived can in turn be used to estimate the long-term effects on metals: given the category, the average corrosion rate over the first 10 years of exposure can be found in ISO 9224 [4]. This can be useful in estimating, for example, whether an unpainted galvanized coating over steel is a viable protection, or whether mill-finish aluminium will achieve a particular service lifetime.

Conversely, if 10-year or equivalent data are available from long-term exposure and analysis of metal samples, then these may be used to determine the associated corrosivity categories.

### Table 3: Atmospheric Corrosion in South Africa

Comparing performance of Aluminium vs Galvanised Steel sheeting

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of corrosion</th>
<th>Mild steel* corrosion rate µm/yr</th>
<th>Galvanised steel sheet** life in years</th>
<th>Aluminium sheet life in years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intertidal to 5km inland</td>
<td>Severe marine</td>
<td>100 - 300</td>
<td>Up to 3</td>
<td>15</td>
</tr>
<tr>
<td>Desert marine (mists)</td>
<td>Severe marine</td>
<td>80 - 100</td>
<td>0.5 - 2</td>
<td>15</td>
</tr>
<tr>
<td>Temperate marine</td>
<td>Marine</td>
<td>30 - 50</td>
<td>3 - 7</td>
<td>20</td>
</tr>
<tr>
<td>Sub-tropical marine</td>
<td>Medium to severe marine</td>
<td>50 - 80</td>
<td>3 - 5</td>
<td>&gt;20</td>
</tr>
<tr>
<td>Desert inland dry</td>
<td>Desert</td>
<td>&lt;5</td>
<td>&gt; 30</td>
<td>&gt;30</td>
</tr>
<tr>
<td>Inland</td>
<td>Rural</td>
<td>10 - 20</td>
<td>&gt; 20</td>
<td>&gt;30</td>
</tr>
<tr>
<td>Inland urban</td>
<td>Inland industrial +++</td>
<td>15 - 40</td>
<td>5 - 15</td>
<td>20</td>
</tr>
<tr>
<td>Urban coastal</td>
<td>Marine industrial +++</td>
<td>50 - 150</td>
<td>1 - 3</td>
<td>20</td>
</tr>
<tr>
<td>Inland arid</td>
<td>Semi desert</td>
<td>5 - 10</td>
<td>&gt; 30</td>
<td>&gt;30</td>
</tr>
</tbody>
</table>

KEY:
* Higher corrosion rate usually indicates proximity of sea.
** Commercial grade Z 275g/m² (unpainted).
^ Life in years - until 5% of surface area showing red rust.
++ Industrial implies pollution present in atmosphere.
Temperate marine & Sub-tropical marine usually from 5km inland up to first mountain range.
TABLE 4: Corrosivity areas derived for Southern Africa with associated ISO corrosivity ratings

<table>
<thead>
<tr>
<th>Code</th>
<th>Geographic Area</th>
<th>Distance from Ocean</th>
<th>Description</th>
<th>ISO Category</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Namibia and NW Cape shore-line</td>
<td>To 5 km</td>
<td>Desert shore-line and coastal fog zone</td>
<td>Above C5</td>
<td>N. of Olifants River</td>
</tr>
<tr>
<td>B</td>
<td>W. Cape Atlantic shore-line</td>
<td>To 3 km</td>
<td>Arid shore-line with fog or strong winds</td>
<td>Above C5</td>
<td>False Bay to Olifants River</td>
</tr>
<tr>
<td>C</td>
<td>W. Cape coastal</td>
<td>To 5-15 km</td>
<td>Coastal area</td>
<td>C4</td>
<td>To range of fall-out of salt aerosols</td>
</tr>
<tr>
<td>D</td>
<td>W. Cape urban</td>
<td>To 25 km</td>
<td>Coastal urban/industrial</td>
<td>C5</td>
<td>Cape Town and surrounds</td>
</tr>
<tr>
<td>E</td>
<td>S. and E. Cape shore-line</td>
<td>To 1 km</td>
<td>Temperate shore-line</td>
<td>C5</td>
<td>Distance from ocean varies with terrain</td>
</tr>
<tr>
<td>F</td>
<td>S. and E. Cape and Natal south coastal</td>
<td>To 5-10 km</td>
<td>Temperate coastal</td>
<td>C4</td>
<td>Distance from ocean varies with terrain</td>
</tr>
<tr>
<td>G</td>
<td>KZN shore-line</td>
<td>To 4 km</td>
<td>Subtropical shore-line</td>
<td>Above C5</td>
<td>KZN to Maputo</td>
</tr>
<tr>
<td>H</td>
<td>KZN coastal</td>
<td>To 15-25 km</td>
<td>Sub-tropical coastal</td>
<td>C4</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Durban urban</td>
<td>To 10 km</td>
<td>Urban and industrial, inland of shore-line</td>
<td>Upper C5</td>
<td>Amanzimtoti to Durban North</td>
</tr>
<tr>
<td>J</td>
<td>Richards Bay</td>
<td>To 15 km</td>
<td>Urban and industrial, inland of shore-line</td>
<td>Lower C5</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>Coastal cities</td>
<td>To 10-15 km</td>
<td>Industrial and heavy traffic areas</td>
<td>Lower C5</td>
<td>Areas of Port Elizabeth, East London, Pinetown</td>
</tr>
<tr>
<td>L</td>
<td>Highveld general area</td>
<td>-</td>
<td>Rural and suburban areas</td>
<td>C3</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Highveld urban and industrial</td>
<td>-</td>
<td>High-traffic urban, or close to heavy industry</td>
<td>C4</td>
<td>East Rand, areas of Pretoria, Witbank</td>
</tr>
</tbody>
</table>

NOTE:
- Metal corrosion depends on time of exposure to moisture and relative humidity and temperature.
- Rate of corrosion reduces rapidly the greater the distance from the sea.
- For aluminium, aggravating conditions can be a strong sulphurous atmosphere, the occurrence of chloride salts and stagnant water - but the right aluminium alloy still outperforms copper, zinc and carbon steel! Regular cleaning and surface coatings reduce the affect on aluminium.
- Pitting corrosion in aluminium may be unsightly, but it is not structurally significant.

Remainder of the region: C2 to lower C3 depending on climate.
Corrosion Resistance

Many decades of experience with applications in a variety of markets including construction, land-based installations and shipbuilding have shown that aluminium and its alloys in the 1000, 3000, 5000, 6000 and 8000 series have excellent resistance to atmospheric corrosion and to marine, urban and industrial environments.

Combined with its light weight, aluminium’s excellent corrosion resistance accounts for the growth of aluminium applications and offers users a number of advantages:

- aluminium equipment can have a very long service life. It is not uncommon to find roofing, wall cladding panels, marina installations and boats with decades of service behind them. This is also true in the field of transport and many other applications,
- aluminium maintenance is minimal even when no extra protection (painting, anodising) is provided. When aluminium is painted, repairs are fewer and less urgent because the parent metal generally resists corrosion very well. Aluminium alloy products do not entirely eliminate the need for maintenance, especially in buildings. It is well known that surfaces that are not cleaned are more sensitive than others, and that a surface build-up can aggravate corrosion (this is true of all metals and alloys),
- aluminium’s corrosion resistance maintains the appearance of the equipment made from it. This is a useful sales argument, especially in industries where users want to keep their products looking good for less cost. Commercial vehicles, outdoor municipal amenities and traffic signs (indicator boards, gantries) are good examples of this.

Finally, the process of anodising to a depth of a few microns can help create and preserve visual properties (high-quality reflectance for retro-reflectors) or decorative features (luxury packaging for cosmetics, decorative paneling for buildings).

Aluminium’s resistance to corrosion comes from the oxide surface which is impermeable and integral with the base metal, staying stable for pH values between 4 and 9. The most frequent types of corrosion are galvanic, pitting and crevice corrosion. Galvanic corrosion can be easily prevented by inserting an insulating material between the two different metals or by cathodic protection. Pitting can be prevented by surface coating and crevice corrosion by judicious design.

Selection of Powder Coating Material

<table>
<thead>
<tr>
<th>Location</th>
<th>Exterior use Recommended micrometres (µm)</th>
<th>Interior use Recommended micrometres (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All areas</td>
<td>Polyester powder to SANS 1578. 60-80µm metal coating in accordance with SANS 1796 or other international standard.</td>
<td>Epoxy or Epoxy powder to SANS 1274. 50-80µm</td>
</tr>
</tbody>
</table>

Table 5: Recommended Specification of Anodised Coating Thickness

(please refer to the map on page 7)

<table>
<thead>
<tr>
<th>Location</th>
<th>Distance from sea or source of corrosion agents (km)</th>
<th>Exterior use - Recommended micrometres (µm)</th>
<th>Interior use - Recommended micrometres (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Cape (West of Hermanus) “C”</td>
<td>&lt;2 2 - 25 &gt;25</td>
<td>25 25 15</td>
<td>25 15 15</td>
</tr>
<tr>
<td>Southern and Eastern Cape “E, K”</td>
<td>&lt;2 2 - 20 &gt;20</td>
<td>25 25 15</td>
<td>25 15 15</td>
</tr>
<tr>
<td>Natal South Coast (south of Amanzimtoti) “F”</td>
<td>&lt;2 2 - 15 &gt;15</td>
<td>25 25 15</td>
<td>25 15 15</td>
</tr>
<tr>
<td>Durban area and Natal North Coast “G, H, I, J”</td>
<td>&lt;2 2 - 25 &gt;25</td>
<td>25 25 15</td>
<td>25 15 15</td>
</tr>
<tr>
<td>Near a chemical or related process plant “M”</td>
<td>&lt;5 &gt;5</td>
<td>25 15 15</td>
<td>25 15 15</td>
</tr>
<tr>
<td>In areas where windborne sand may be abrasive (Western Cape Coast and the Karoo around Beaufort West)</td>
<td>Not relevant</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>Other areas</td>
<td>Inland</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>
## TABLE 6: Finishing Comparisons

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Anodising</th>
<th>Powder Coating</th>
<th>Wet Coatings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specifications</td>
<td>SANS 999, 1407 and 10322 apply. Also Qualanod. BS EN 755 applies to surface characteristics of extrusions.</td>
<td>SANS 1578, SANS 1274, SANS 1796 and SANS 10322 apply. Also Qualicoat. BS EN 755 applies to surface characteristics of extrusions.</td>
<td>ASTM D3663 for PVDF fluorocarbon. AAMA 605.2.92 for baked organic coating.</td>
</tr>
<tr>
<td>Colour range</td>
<td>Extensive range but not all are suitable for exterior use. Inorganic and organic dyes used. SANS 1091 applies.</td>
<td>Full range available for either interior or exterior use. Critical to specify the type of powder to be used.</td>
<td>Dependent on type of coating used, a large range is available. PDVF colours are limited</td>
</tr>
<tr>
<td>Appearance</td>
<td>Anodising gives a crisp, clean, metallic appearance - in natural or colour finish.</td>
<td>Powder coated aluminium may lose that crisp appearance due to the flow of the powder during curing.</td>
<td></td>
</tr>
<tr>
<td>Colour fastness</td>
<td>Exterior anodising has excellent light fastness properties, if correctly processed.</td>
<td>Colour fastness is dependent on the type of powder used. Important to specify the correct product.</td>
<td></td>
</tr>
<tr>
<td>Coating thicknesses</td>
<td>5 - 25 microns depending on application.</td>
<td>60 to 80 microns</td>
<td>20 to 28 microns</td>
</tr>
<tr>
<td>Life expectancy</td>
<td>Warranted 10 years. Experience over 20 years.</td>
<td>15 - 20 years if applied in accordance with powder manufacturer’s conditions.</td>
<td>Warranted 10 years. Experience over 25 years.</td>
</tr>
<tr>
<td>Installation</td>
<td>Anodising is prone to attack by wet mortar and certain acid attacks.</td>
<td>Powder coating is less prone to attack by mortar, but is also prone to certain acid attack.</td>
<td>Long lasting mortar resistance</td>
</tr>
<tr>
<td>Abrasion resistance</td>
<td>Hard surface, long lasting abrasion resistance.</td>
<td>Not abrasion resistant, but long lasting.</td>
<td>Inert coating with good chemical resistance and seawater attack.</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Wash down with a neutral detergent every 3 to 6 months.</td>
<td>Wash down with a neutral detergent every 3 to 6 months.</td>
<td>Roofs and vertical cladding require minimal maintenance. For other areas, wash regularly with a neutral detergent</td>
</tr>
<tr>
<td>Common applications</td>
<td>On aluminium sheet, extrusions, plate, etc.</td>
<td>On aluminium sheet, extrusions, plate, etc.</td>
<td>Roofing sheet, cladding sheet from coil only.</td>
</tr>
<tr>
<td>Corrosion Resistance</td>
<td>If correct microns are specified, excellent resistance against marine and industrial atmosphere attack.</td>
<td>Protects the underlying substrate if correctly treated prior to coating. Also resists UV degradation if correct powder has been used.</td>
<td>Good corrosion resistance if correct design, fixing, crevice joining, etc. principles are adhered to.</td>
</tr>
<tr>
<td>Pre-treatment Finishes</td>
<td>Etched, polished, brightened, brushed, sanded, shot blasted, etc.</td>
<td>Matt, satin, gloss speckled, structured, metallic, etc.</td>
<td>Standard gloss level or by special arrangements.</td>
</tr>
</tbody>
</table>

**NOTE:** All anodised and powder coated surfaces need regular care depending on the location and installed life. After installation, the surfaces should only be cleaned with suitably approved cleaning materials. Site repair or changes to colour or finishes requires expert opinion.
**Surface Finishes Comparison**

Overall, anodising is the most common surface finish (having been in use for more than 60 years), but powder coating is increasing its market share, especially opposite paint coatings.

### Anodising and Powder Coating

The main debate on the merits of different finishes is really between anodising and powder coating as applied to extruded aluminium. Some members of ASFA are both powder coaters and anodisers and do not see the two finishes as competitors. They have different roles to play in enhancing the material's decorative visual experience and improved corrosion resistance.

### Wet Coating

Aluminium sheeting for roofing and cladding may be anodised or powder coated in the same way as extrusions but the preferred method of surface finishing is wet coating of the material while in coil form, being more cost effective.

For decorative and corrosion resistant surface finishes a number of polyester, acrylic and fluorocarbon coatings have been developed and used successfully - with service lives exceeding 20 years. These finishes command a price premium over mill finish price.

### TABLE 7: Main Types of Anodising Treatment - for different aluminium alloy series

<table>
<thead>
<tr>
<th>Alloy Series</th>
<th>Treatment</th>
<th>Properties of the anodic layer</th>
<th>Typical applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>Surphuric acid anodising, continuous or static</td>
<td>Transparency, reflectivity, brilliance. The lower the Fe and Si content, the more transparent the layer.</td>
<td>Decoration, optical reflectors.</td>
</tr>
<tr>
<td></td>
<td>Hard anodising.</td>
<td>The layer has a grayish tint.</td>
<td>Engineering</td>
</tr>
<tr>
<td>5000</td>
<td>Surphuric acid anodising, continuous or static. Colourless or electrolytically coloured.</td>
<td>Durable aspect, corrosion protection. Most alloys easy to anodise. The layer is milky or greyish depending on composition.</td>
<td>Architecture, building.</td>
</tr>
<tr>
<td></td>
<td>Sulphuric acid anodising, sealed with bichromate on 2017A.</td>
<td>The thickness of the layer is limited and more or less porous due to dissolved copper. Provides limited corrosion protection.</td>
<td>Mechanical applications.</td>
</tr>
<tr>
<td>7000</td>
<td>Chromic acid anodising on 7075. Sulphuric acid anodising on 7020. Hard anodising on 7075, 7049A.</td>
<td>Most alloys easy to anodise, those containing copper, less so. Protection, decoration, harness.</td>
<td>Aeronautics, mechanical applications, sports goods.</td>
</tr>
<tr>
<td>6000</td>
<td>Sulphuric acid anodising, continuous or static; colourless or electrolytically coloured. Electrostatic powder coating.</td>
<td>Most alloys easy to anodise. Working and heat treatment parameters must be controlled to achieve consistent appearance mong batches. Decoration, durable aspect, good corrosion protection.</td>
<td>Metal fittings, buildings, boat masts, transport and many others.</td>
</tr>
</tbody>
</table>

**What makes a Quality Powder Coating?**

The main requirements of a quality coating are:

- A uniform and even appearance, properly cured
- Excellent adhesion
- Excellent weatherability and durability
- No fading or chalking when used for exterior or interior conditions
- Minimum 15 year powder manufacturers' guarantee (exterior applications) and superior quality powder formulations used
- Compliance to acceptable industry standards
- Colour retention

Following and adhering to these basic guidelines can assure the customer/asset owner of a coating that will deliver optimum performance while also limiting the chances of coating failure.
What is Anodising?

Anodising successfully combines science with nature to create one of the world’s best metal finishes that is also environmentally safe.

It is an electrochemical process that thickens and toughens the naturally occurring protective oxide layer in aluminium. The resulting finish, depending on the process, is the second hardest substance known to man, second only to the diamond. The anodic coating is part of the metal, but has a porous structure that allows secondary infusions (organic and inorganic colouring, etc.)

Anodising is commercially unique to aluminium and its alloys. This surface finish is used for a number of reasons including:
- For decoration, through a variety of colours
- For a long-lasting appearance
- For protection against weathering
- For surface hardness
- For abrasion and wear resistance
- To reduce friction and improve repellency
- To modify electrical properties (insulation)
- To modify visual properties (reflectivity)

Anodising Definitions

There are five main types of anodising, each with a range of possible processes:
- Barrier anodising, used for refined aluminium only, for electrical applications
- Sulphuric acid anodising, used mainly as protection against weathering
- Chromic acid anodising for aerospace applications
- Hard anodising which increases the surface hardness of the metal, mainly for engineering applications
- Phosphoric acid anodising, used to prepare surfaces for adhesive bonding

While the chemical anodising process remains the same for all applications, the mechanical methods vary according to the physical types and shapes of metal used.

**TABLE 8: Methods of Anodising**

<table>
<thead>
<tr>
<th>Property</th>
<th>Batch or Piece Anodising</th>
<th>Sheet Anodising</th>
<th>Continuous Coil Anodising</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses</td>
<td>Extrusions, castings, parts with severe forming.</td>
<td>Wide widths, plate, large fabricated products.</td>
<td>High volume, coiled sheet, foil, products with less severe forming.</td>
</tr>
<tr>
<td>Advantages</td>
<td>- Small runs.</td>
<td>- Small runs.</td>
<td>- Wide range of metal and film thicknesses.</td>
</tr>
<tr>
<td></td>
<td>- Thicker films.</td>
<td>- Thicker films.</td>
<td>- Less material handling.</td>
</tr>
<tr>
<td></td>
<td>- Anodised edges.</td>
<td>- Anodised edges.</td>
<td>- Precise colour control and uniformity.</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>- Possible colour variance.</td>
<td>- Colour variance.</td>
<td>- Cost effective.</td>
</tr>
<tr>
<td></td>
<td>- Excessive handling.</td>
<td>- High costs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- High costs - labour, water and power.</td>
<td>- Film thickness variance.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Crazing when severely formed.</td>
<td>- Bare edges on stamped parts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Crazing when severely formed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Limited to sheet and foil.</td>
</tr>
</tbody>
</table>
Suggested Specifications

Finish: all exposed surfaces should receive an architectural anodised finish in accordance with SANS 999 (external), SANS 1407 (internal) or EN755 as applied to the substrate.

Quality Management systems such as ISO, SANS and Qualanod are applied to assure customers that Finishing companies have the equipment, the experience and the expertise to produce a result that will meet the required specification. This applies to all types of coatings.

Finishes must conform to specific requirements in terms of film uniformity and thickness, seal quality, abrasion resistance, UV light resistance and accelerated salt spray performance.

The Anodising Process

Anodising is an electrolytic process that produces a dense, chemically stable protective aluminium oxide film that is an integral part of the underlying aluminium. This greatly increases corrosion resistance and its exceptional hardness protects any underlying surface finish produced mechanically or chemically or by polishing, etching or brightening.

The anodising itself can be achieved through several processes. The sulphuric acid process is most often used for architectural purposes because the film produced gives outstanding corrosion and abrasion resistance, and being transparent, can be coloured without adversely affecting its excellent properties.

Cross Section of Sealed Anodic Oxide

The film thickness before anodising is 1micron. This can be increased by controlled anodising up to 20 to 25 microns. Recommended thicknesses depend upon the end application. Indoor applications not subjected to heavy wear will accept a 5µ thickness. For exterior uses in aggressive environments a thickness of 25µ is generally recommended. For very hard coatings, thicknesses of up to 125µm are produced.

Most films produced by anodising are translucent and so show the "silvery" look of the aluminium. The coating produced by sulphuric acid anodising can be treated in several ways to give a variety of colours and shades because the anodic film is minutely porous. Anodising companies will provide colour samples.

Colour matching is dependent on various factors and these include the alloy composition and refraction of light within the anodic film, but colour matching of an acceptable commercial standard is obtainable by proper attention to specification to ensure this is standard practice.

The Anodised Surface

Aluminium Hydroxide Seal
Colouring Matter (in oxide pores) - depth varies with colouring process.
Aluminium Oxide Coating (5 - 25µm)
Aluminium Metal

Substrates

The most suitable alloys for architectural anodised finishes are:

- **Sheet**
  - Alloy 1200
- **Extrusions**
  - Alloy 6061 and 6063 for etched and mechanical finishes
  - Alloy 6463 for chemically brightened applications
- **Castings**
  - Alloy 99.5 / LM20 and CEN 51000 / LM5

Not all welding is suitable for anodising (5 series rods preferred). Seek advice. Contact your anodiser for further information.

Important information

Before agreeing to have material anodised, it is important for the purchaser to discuss process parameters with the Anodiser. Such parameters include:

- Minimum and maximum rack lengths.
- Jigging effects, especially on precut and long items.
- Possible colour variations.
- Any critical surfaces.
- Effect of moisture and packaging (especially adhesives) on the uncoated surface.
- Minimum order size / value.

### SPECIFY...

Finish appearance (bright, matt. coloured, etc) alloy and end use of product and any special packaging required.

<table>
<thead>
<tr>
<th>Anodic Film</th>
<th>Thickness</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inland</td>
<td>15µ</td>
<td>Inorganic or Organic</td>
</tr>
<tr>
<td>Coastal</td>
<td>25µ</td>
<td>- Natural Light Bronze 541</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bronze 543</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dark Bronze 545</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very Dark Bronze 547</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Black 549</td>
</tr>
</tbody>
</table>

**SANS Standards**

**External Finishes**

Anodised finishes to be in accordance with SANS 999, current date - Anodised coatings on aluminium (for architectural applications) or

**Internal Finishes**

SANS 1407, current date - Anodised coatings on aluminium (for general applications)

**Protective**

Low tack adhesive tape, but remove promptly or

**Coating for Installation**

oil surfaces

**Anodiser**

To be a certified markholder of SANS 999 and/or SANS 1407 and/or ISO 9000/14000 or at least conforming to SANS 999/1407 standards in terms of reference, Qualanod certification may also be relevant.
Summary of Anodic Film Properties

- Resistance to corrosion against a variety of atmospheres and environments.
- Suitability for manufacture and packaging of foodstuffs.
- Suitability for consumer durables and cooking utensils.
- Offer of a variety of colours for external and internal application.
- Enhancement of optical properties such as reflectivity / brightness.
- Specular reflectivity of +85% can be achieved.
- Heat reflectivity and emissivity are transformed to extend aluminium’s usefulness in many industries involving heat radiation and heat transfer.
- Bright aluminium reflects over 80% of light and about 90% of heat radiation that falls on it.
- Good electrical insulating properties (in contrast to aluminium itself) - providing insulation with no bulk and capable of withstanding heat - useful in condensers and transformers.
- Forming operations should be carried out before anodising to prevent cracking.

Source of Defects in Anodised Surfaces

- Defects originating during work piece preparation - yielding stains, striping and cloudiness and also spotty discolouration.
- Defects originating from anodising itself - yielding rainbow colouration, corroded appearance, spotty film, uneven film, discolouration and hairline cracks. Also burnt spots.
- Defects originating during colouration - colour variation, mottled colours (light and dark), not abrasion resistant, colour not lightfast and colour cloudy.

Bright Anodising

- Offers architects and designers more than standard architectural colours.
- Popular choices include bright silver, gold and brass but other colours such as bronze, black, blue and red are available. Not all colours are light and weather fast.
- Used extensively in the lighting industry and also for shop front and partitioning extrusions.
- Most common process is chemical brightening, which requires great care not to damage the material to be brightened. Extrusions are often polished to remove scratches before brightening.

### Anodising Characteristics of Wrought Aluminium

<table>
<thead>
<tr>
<th>Alloy Designation</th>
<th>Suitability for Protective Colour</th>
<th>Bright</th>
<th>Alloy Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1080A</td>
<td>E</td>
<td>E V - E</td>
<td>Al 99,8</td>
</tr>
<tr>
<td>1050A</td>
<td>E</td>
<td>E V</td>
<td>Al 99,5</td>
</tr>
<tr>
<td>1200</td>
<td>V</td>
<td>V G</td>
<td>Al 99,0</td>
</tr>
<tr>
<td>2xxx</td>
<td>F</td>
<td>F(D) U</td>
<td>Al Cu Si Mg</td>
</tr>
<tr>
<td>3103</td>
<td>G</td>
<td>G F</td>
<td>Al Mn</td>
</tr>
<tr>
<td>3105</td>
<td>G</td>
<td>G F</td>
<td>Al Mn Mg</td>
</tr>
<tr>
<td>5251</td>
<td>V</td>
<td>V G - V</td>
<td>Al Mg2</td>
</tr>
<tr>
<td>5005</td>
<td>E</td>
<td>E E</td>
<td>Al Mg1</td>
</tr>
<tr>
<td>5083</td>
<td>V</td>
<td>V G</td>
<td>Al Mg Mn</td>
</tr>
<tr>
<td>5454</td>
<td>V</td>
<td>V G</td>
<td>Al Mg3 Mn</td>
</tr>
<tr>
<td>6063</td>
<td>G</td>
<td>G F</td>
<td>Al Si Mg Mn</td>
</tr>
<tr>
<td>6463</td>
<td>E</td>
<td>E V</td>
<td>Al Mg Si</td>
</tr>
<tr>
<td>7020</td>
<td>F</td>
<td>F U</td>
<td>Al Zn Mg</td>
</tr>
</tbody>
</table>

Note: The various forms of semi-fabricated aluminium have their own characteristics affecting the anodising finish. Different alloys anodise to slightly different shades.

### Anodising Characteristics of Cast Aluminium

<table>
<thead>
<tr>
<th>Alloy Designation</th>
<th>Suitability for Protective Colour</th>
<th>Bright</th>
<th>Alloy Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>LM5 - CEN 51300</td>
<td>E</td>
<td>E G</td>
<td>Al Mg5</td>
</tr>
<tr>
<td>LM6 - CEN 44100</td>
<td>F</td>
<td>U U</td>
<td>Al Si12</td>
</tr>
<tr>
<td>LM10 - CEN 51200</td>
<td>E</td>
<td>F U</td>
<td>Al Mg10</td>
</tr>
<tr>
<td>LM16 - CEN 45300</td>
<td>E</td>
<td>F(D) U</td>
<td>Al Si5 Cu 1 Mg</td>
</tr>
<tr>
<td>LM20 - CEN 47100</td>
<td>G</td>
<td>F(D) U</td>
<td>Al Si12 Cu Fe</td>
</tr>
<tr>
<td>LM24 - CEN 46500</td>
<td>F</td>
<td>F(D) U</td>
<td>Al Si9 Cu3 Fe</td>
</tr>
<tr>
<td>LM28</td>
<td>U</td>
<td>U U</td>
<td>Al Si18 Cu Mg Ni</td>
</tr>
</tbody>
</table>

E = Excellent, V = Very Good, G = Good, F = Fair, U = Unsuitable, D = Dark Colours Only
Anodising

Anodising and Colour

- Inorganic dyeing - with colour matter (heavy metal hydrates) incorporated in coating outer region. Colours pale to dark bronze and gold tones, muted. No flaking. Onsite repairs impossible unless using a surface coating.
- Electrolytic coating - dyeing with metal salts, colour inseparably bound to the aluminium at the base of the pores. Colours brown, bronze, grey, slate, pink, burgundy. No spectral colours, no white. No chalking or flaking.
- Electrolytic colouring, combined with organic dyeing - one colour at base of pores, the other incorporated in the coating. Virtually unlimited colour, muted shades, no white.
- Hard anodising colours are limited to grey and brown.
- Alloy elements and impurities influence colour in the anodic oxide film.

Anodised Aluminium Applications

- Structural and architectural categories of all types - interior and exterior.
- Commercial and residential building products.
- Appliances and furniture, computer hardware and exhibition displays.
- Food preparation equipment.
- Sporting goods and boats.
- Motor vehicle components
- An almost endless array of products for everyday life!

The thickness of the aluminium oxide coating can be varied by the anodising process time. The following figures are usual:

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Micron</td>
<td>Suitable for decorative applications, jewellery, arts and crafts.</td>
</tr>
<tr>
<td>10 Micron</td>
<td>Suitable for internal applications, and outdoor applications where cleaning is very frequent, for example, caravan trim. Also for reflectors.</td>
</tr>
<tr>
<td>15 Micron</td>
<td>Recommended for the majority of ordinary internal architectural requirements and metal fittings of every sort.</td>
</tr>
<tr>
<td>25 Micron</td>
<td>Recommended for heavy duty external permanent architectural applications where little deterioration can be tolerated. Also for kitchen utensils and marine environments.</td>
</tr>
<tr>
<td>25 Micron plus</td>
<td>25 Micron to 250 Micron is achieved by Hard Anodising of wrought alloys done by varying the electrolyte composition and modulating the process parameters. Hard anodic films are used to provide abrasion resistant surfaces on bearings, pistons, gears and other components.</td>
</tr>
<tr>
<td>250 Micron</td>
<td></td>
</tr>
<tr>
<td>(125 Microns max. is more usual)</td>
<td></td>
</tr>
</tbody>
</table>
Introduction

Powder coating is an advanced method of applying a decorative and protective finish to aluminium - creating a wide range of products that are used by both industries and consumers. The process result is a uniform, high quality and attractive finish. The powder coating industry continues as the fastest growing finishing technology in North America. Powder costs less to apply than equivalent performance liquid paint.

Attributes of Powder Coating

- Tough and durable
- Excellent corrosion resistance
- Impact resistant
- Attractive and colourful
- Excellence of finish
- High quality and versatile
- Solvent free and environmentally friendly

The list of products powder coated is extensive and includes automotive parts, industrial piping, appliances, sports goods, outdoor furniture, power tools, aircraft parts, office equipment and architectural fittings such as windows, doors, showers, etc.

Powder Coating Process

The pre-treated aluminium components are racked to a conveyor, which is earthed. A powder spray gun is set to produce a cloud of powder particles with a strong electrostatic charge. The charged particles are attracted through the electrostatic field to the face of the product and to the sides and back along the lines of force in the electrostatic field. After the powder has been applied, the coating is stoved at temperatures specified by the powder manufacturer.

Range of Colours

Polyester powder coatings are available in a vast range of colours. These may be specified from the international RAL colour chart, SANS 1091 or the individual colour ranges of powder manufacturers and coaters. Specifiers should also specify the gloss level required, with a matt surface being preferable for most architectural finishes.

For exterior use, specifiers should at least opt for finishes in accordance with SANS 1578 and 1796, as these not only protect the substrate metal against corrosion, but also resist UV degradation as well.

Versatile Finishes

Powder coated surfaces are more resistant to chipping, scratching, fading and wearing than other finishes. Colour selection is virtually unlimited with high and low gloss, metallic and clear finishes available. And colours stay bright and vibrant. Texture selections range from smooth surfaces to a wrinkled or matt finish and rough textures designed for hiding surface imperfections. Powder coating is a technology of the future!

Quality Standards

What factors should be addressed and clearly defined when specifying architectural aluminium finishes? The importance of clear technical specifications cannot be emphasized enough because, at the end of the day, a professional reputation may be at stake and costly disputes could arise.

Here is a handy check list of key elements that should be addressed:

- **Material type:** Aluminium alloys produced to BS1470, 1471 or 1474.
- **Significant Surfaces:** Details which surfaces will have nominal 50-80 microns.
- **Colour:** As agreed upon from RAL or NCS standard colour chart.
- **Fabrication:** Detail any peculiar or difficult factors relating to the fabrication requirements.
- **Type of Powder:** Polyester, equivalent or better.
- **Gloss level:** Gloss, matt or satin.
- **Applicator:** A certified SANS 1796 approved applicator.
- **Process Control:** Strictly in accordance with SANS 1796 or Qualicoat.
- **Certification:** Certificate of Conformance will be provided by an approved applicator on completion of the coating.

Pre-treatment:
- Degreasing, rinsing, caustic etch, rinse, nitric acid desmutting, rinse, chromate conversion, rinse, sealing rinse with demin water.
- Dry off / Cooling

Heat Curing:
- 160°C to 210°C

Cooling

Parts unloading

Parts unloading

The objectives of pre-treatment of metal surfaces are:
- Removal of impurities including soil, welding splatter, scale, grease and oil.
- Conditioning of the surface for optimum adhesion of the coating film.
- Obtaining uniformity throughout the entire treated surface of the substrate.
Environmentally Advanced

The powder coating process is also environmentally friendly as it is virtually pollution free. Unlike liquid paint, no solvents are used so only negligible amounts of volatile organic compounds (VOC’s) are released into the air. In addition, unused or over-sprayed powder can be recovered so any waste is minimal and can be disposed of easily and safely.

Advantages

There are many advantages that make the choice of applying thermostetting powder coatings attractive to the coating company. These include:

- Powder is immediately ready for use
- Less powder wastage during the application process
- Reduced health hazard in case of exposure of operators
- Superior cured-film properties
- Lower capital investment costs

Powder Coating of Aluminium

Important Information

1. Surface Finish of Raw Material

While they have excellent flow properties, polyester powders will only partially smooth out imperfections in a metal substrate. It is essential that any component must be supplied in the raw state, with a surface condition that reflects the ultimate surface required. (Aluminium must be packed with care during transport to avoid scratching and marking).

2. Jigging Points

To apply polyester powder it is necessary to hang each item on to a conveyor and so one or more jigging points are required. These are best in the form of drilled holes or suitable jigging edges, where the contact point does not affect the appearance of the finished product.

3. Pretreatment Drainage

All of the approved pre treatments require immersion in

SPECIFY...

<table>
<thead>
<tr>
<th>Colour</th>
<th>RAL / NCS SANS or Mfr’s range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finish</td>
<td>Gloss or Satin or Matt</td>
</tr>
<tr>
<td>Powder Coating</td>
<td>Film Thickness 60 - 80µ</td>
</tr>
<tr>
<td>Protective Coating during installation</td>
<td>Low tack adhesive tape</td>
</tr>
</tbody>
</table>

SANS Standards

Powder coated finishes to be in accordance with SANS 1578. Organic powder coatings for external architectural aluminium

Powder Coater

To be a certified markholder of SANS 1796 and / or an applicator approved by the powder manufacturer who must be a certified markholder of SANS 1578: Organic powder coatings for external architectural aluminium.

Guarantee of coating given by the Powder Coating manufacturer is only valid provided the applicator is approved by the coating manufacturer.
aqueous solutions. It is therefore necessary that components do not float or retain trapped solutions after treatment. Hollow components may cause ingress of solutions that can boil out during the powder curing cycle, spoiling the coating.

Most components can be suitably ventilated by a 6mm diameter hole at a point permitting total drainage of the components.

Large flat butting surfaces can also trap solutions by capillary action and these should be avoided.

Sound deadening or porous filling materials that can absorb pretreatment chemicals or materials likely to melt below 250°C should not be built into an assembly before coating.

4. Powder (uneven surface) Penetration
Powder initially adheres during coating by electrostatic forces, but a phenomenon known as “Faraday Cage” can counter the action on components with narrow recesses, slots or sharp, enclosed corners. Advice should be sought where these can be avoided, but generally with slots, the width between the two edges should be greater than the depth.

5. Dissimilar Metals
Assembles consisting of different metals or painted surfaces should be avoided. The different materials may require non-compatible pre treatments and electrolytic corrosion may also be encouraged.

6. Heavy Masses
Heavy components require a longer heating cycle due to the metal temperature being the important criterion. Consequently, these are more expensive to coat. The surface appearance (but not colour) of the finished item may be slightly different between substrates of differing mass due to variations in “heat-up” and cool down times.

7. Exposed Surfaces
All drawings should indicate the area where the coating is required.

8. Protective Tape
Though polyester powder is an extremely tough and resilient coating, mechanical abuse can cause unsightly scratches and blemishes. Obviously the best way to eliminate this is by adopting good working practices both during fabrication and installation. Not withstanding this, protective tape is used extensively for the protection of architectural products.

9. Application
Protective tape is normally applied by the fabricator or window manufacturer. The powder surface to which it is applied must be free from dirt, oil, cement or other surface contaminates. If necessary, the surfaces can be cleaned using a soft cloth dampened in white spirit. The surface must be dry before tape application.

10. Cleaning of residual adhesive
Where necessary, any residual adhesive left on the powder coated surface following the removal of protection tapes should be removed by wiping with a white spirit dampened cloth. Solvents or cleaning solutions containing esters, keton, chlorinated hydrocarbons or alcohols must not be used. It is always recommended to try these procedures on a small area first.

---

Critical tests any powder coater of repute must be able to conduct on their premises:

- Adhesion test (Impact, cross hatch, bend and pressure cooker)
- Reverse impact (cure result)
- Permeability (correct pretreatment)
- Permascope (correct film thickness)
- Gloss meter reading
Wet Coating

Introduction

While anodising and powder coatings are the favoured surface finishes for extrusions, aluminium is also available in flat sheets in a wide assortment of colours. Aluminium sheet is coated while in coil form. The process is very economical.

Wet coated or painted aluminium provides a flexible finish that is tough and durable. Through a sophisticated production process, the colour is bonded onto the aluminium. This means that the surface finish can stand up to even severe forming techniques (beading, stamping, embossing, deep drawing) without cracking or flaking. This is the most important advantage of coil coated aluminium - with coating thicknesses of 25 - 28µm - thanks to a careful match between the alloy and the coating strip.

Applications

For decorative and corrosion resistant surface finishes a large variety of paint systems and colours are available including alkyd, acrylic, vinyl and epoxy coatings as well as fluorocarbons - with service lives exceeding 20 years.

Painted aluminium coil is a natural choice for the building market with coating types designed to meet the varied requirements and applications of the market. A wide range of alloys, tempers, coating types and colours are available for all the different cladding and roofing systems in use today and the many different fabrication techniques employed. Painted coil is also used in vehicles.

The coil is usually coated on one side with a decorative coating and on the reverse with a suitable wash coat - though both sides can be coated if required. Cleaning, pre-treatment and coating are done in a continuous operation at speeds of over 150m per minute. The coating can be electrostatically deposited and normally, it is oven dried.

As the aluminium is cleaned, treated and painted while flat, the result is a uniform finish and coating thickness.

Coils are produced in various widths and thicknesses to suit different applications. All are suitable for roll-forming into various profiles for roofing, cladding and awnings, as well as rainwater goods such as guttering. Flat material is used for signage or converted into cladding panels.

SPECIFY...

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<th>Alloy</th>
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<td>Temper</td>
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<td>Nominal Coil Thickness</td>
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Introduction

As with all materials exposed to the elements, regular maintenance is required to ensure maximum life and performance from the product.

A key to successful cleaning depends on the knowledge of what type of surface finish you are dealing with. The life of an anodised, powder coated or painted surfaces can be greatly enhanced by applying a regular maintenance programme. This will ensure the removal of any dirt, grime, grit, atmospheric pollutants and iridescence.

Any chemical attack on a decorative surface that is not regularly cleaned becomes increasingly severe and after several years, the finish may prove impossible to restore.

Cleaning Procedure

A regular cleaning and maintenance system is essential for two reasons:
- To maintain decorative appearance;
- To reduce any chemical attack, if applicable.

The cleaning procedure may be broken down into three distinct categories, namely:

1. Primary Cleaning:
Primary cleaning is the initial cleaning that should occur after installation / completion to remove atmospheric dust, deposits of dirt, possible cement deposits, glues, etc.

2. Secondary Cleaning:
This is normally a heavy duty clean that is carried out on a surface that has not been cleaned for some time.

This is carried out by companies that specialise in the cleaning of facades, windows, doors, curtain walling, etc.

The most important criteria of an aluminium cleaning agent is that it should not be toxic, have a pH within 4.5 and 9 and it must be free of fluorides, chlorides or sulphates.

3. Periodic Cleaning:
This is the cleaning cycle that should be done on a regular basis AFTER the primary and secondary phase (in the case of a new installation, it follows after the primary). The intervals of each cleaning cycle are dependent on the atmospheric pollutants, area, region, corrosion levels, etc. for a particular region - approximately three months at the coast and six months inland.

Guidelines for the Protection of Aluminium

DO’S:
- Protect exposed aluminium surfaces until all the trades etc. have been completed.
- Any cement or acid should be removed as soon as practical. This will prevent any chemical attack.
- When cleaning, wash down all surfaces with a neutral detergent and rinse thoroughly.
- Remove stubborn deposits on ANODISED aluminium with a suitable nylon abrasive cleaning pad or brush, plus neutral detergent and then rinse.
- Remove stubborn deposits on POWDER COATED aluminium with a suitable soft cloth or nylon brush, plus a neutral detergent and then rinse.
- To clean long neglected areas, it is advisable to use proprietary cleaners specifically formulated for aluminium surfaces. These products contain residual waxes etc. and can substantially improve the appearance of worn or weathered surfaces.

DON’T’S
- Use wire brushes, steel wool, blades or emery paper. These are NOT recommended under any circumstances.
- Avoid mechanical damage from scaffolding and bad handling.
- Allow cleaning with pool acid on anodised finishes (as it contains chlorides).
- Allow cleaning with abrasive pads on powder coated surfaces.
- Allow mortar cleaning chemicals to come into contact with powder coated and/or anodised surfaces, unless the cleaning company gives a warranty for its product.
- Aluminium should not be in direct contact with brass or copper, which may be wetted.
- Allow strong alkalies such as caustic soda, lime etc. to come into contact with aluminium or finished aluminium.

For more information on protection of aluminium surface finishes during manufacture, transport, coating and installation, contact AFSA or any accredited surface coating company.
Acknowledgements for the contribution of ideas, material and/or pictures to:
AFSA Library
Alzko Nobel / Interpon Powder Coatings
Astro Anodizing cc
Cascolor Aluminium Finishing
Continental Anodisers
C.S.I.R
Design Anodising

REFERENCE SOURCES USED IN THE COMPILATION OF THIS GUIDE:

1. “Aluminium Handbook 2”, Section 3 by Aluminium Verlag
2. AFSA Aluminium Surface Finishing Manual, previous edition; and the Anode anodising brochure
3. Pechiney website
4. American Anodizers Council (AAC) website
5. Aluminium News (AFSA publication), various volumes
6. Aluminium Coil Anodizing (ACA) website
8. Cascolor / Alufinish website
9. British Anodising Association (BAA) Guide to architectural and industrial anodising
10. Wispeco Aluminium Extrusions manual (pages 13 to 17)
11. “Care of Aluminium” by the Aluminium Association Inc.
12. “Surface Finishing of Aluminium Alloys”, Alcan Australia
13. Aluminium Extrusion Council (AEC) website
15. Diverse array of articles on surface finishing.

AFSA has a number of reference sources on surface finishing of aluminium and its alloys. Members and non-members are welcome to contact AFSA for more information (which is free to members).

AFSA / ASFA Membership:
For a current list of AFSA or ASFA members, please contact AFSA as shown below:

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