Hydro

Anodizing

Protection and decorative look

Reasons for anodizing

Aluminium is everywhere around us and is part of our daily life. It is a fascinating, flexible and very versatile material, the use of which is only limited by designers' imaginations. Moreover, aluminium is easy to recycle without losing its quality and unique properties.

Surface is important

The choice of material is crucial for the product. Among other things, the choice of material is also related to the necessity or possibility of its surface treatment. The purpose of surface treatment is to provide protection to the products and prolong their lifetime. In addition to this, another important function of surface treatment must be mentioned, which is the aesthetic appearance.

Anodizing

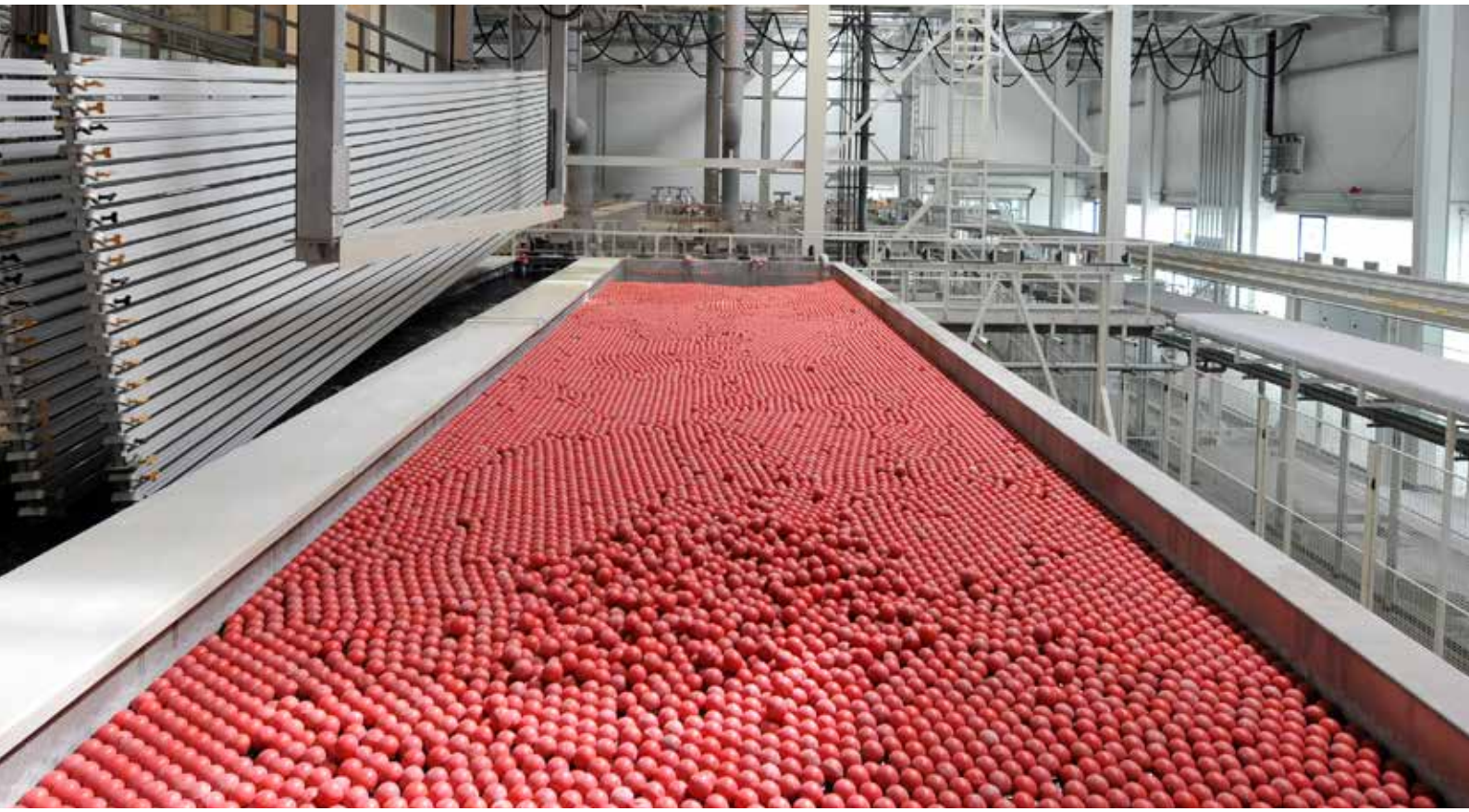
The appearance and surface quality of aluminium as well as its inherent corrosion resistance are perfectly satisfactory for many applications. However, there are industries and products for which higher surface quality, variety of color and eventually higher corrosion resistance are a must, and then it is necessary to use one of the surface treatment methods. The most widely used method is anodizing.

Reasons for surface treatment application:

- Anti-corrosion protection
- Wear resistance
- Variety of color shades
- Surface structure
- Electrical insulation
- Easy cleaning
- Protection before additional fabrication
- Gloss / matt

The anodizing process contributes to:

- Create new, aesthetic appearance
- Improve corrosion resistance
- Create a dirt-repellent surface that meets high standards of hygiene
- Provide a decorative surface with lasting color and gloss
- Create a surface that is pleasant to touch
- Provide abrasion-resistant surface with electrically insulated coating



Hydro offers a wide range of technological options for surface treatment. Our experts will advise you to find the optimal solution for your individual application.

Anodizing process

During the anodizing process, the aluminium is converted into a layer of aluminium oxide. Aluminium materials receive a wear- and corrosion-resistant surface.

Anodizing process

Anodizing is an electrochemical process consists of four process steps:

- Mechanical and chemical pre-treatment
- Creating of an oxide layer
- Coloring
- Sealing

Mechanical and chemical pre-treatment

Pre-treatment operations improve the surface quality of aluminium material. The surface is degreased, chemically milled and subsequently cleaned.

Degreasing

Pre-treatment operations start with degreasing of the material in alkaline or acidic industrial degreasing solutions.

Etching

The next operation is etching of aluminium material. Etching is a chemical method of removing oxide layers and waste from the surface of the material. The etching in alkaline environment is referred to as E0 etching. Satin etching, known as E6, creates fine etched surfaces with a smooth matte shine or a silky matt look.

Desmutting

Desmutting is used to clean etched surfaces from released heavy metal hydroxides that were not removed in alkaline baths. Hydroxides create a grey thin film on the surface of aluminium material. By immersing the aluminium material in a desmutting bath, the surface is given a bright aluminium appearance.

Oxide layer

After the pre-treatment operations have been carried out, the aluminium material is ready for the next process step, which is anodizing itself - the formation of an oxide layer.
In this process, the aluminium material is connected to the positive pole of power source, it becomes the anode - hence anodizing. Together with the cathode, they are immersed in a chemical solution (electrolyte) and form an electrolytic cell. Sulfuric acid is commonly used as an electrolyte at precisely determined concentrations and temperatures. During electrolysis, the surface oxidation occurs. The process continues until the desired layer thickness is obtained (generally 5 – 25 µm).

Coloring

Natural anodizing is the most widely used color finish of aluminium material. In this process, no coloring is required.
To obtain color shades, it is necessary to color the aluminium material by a chemical process using organic dyes or by an electrolytic process. This process step follows the formation of an oxide layer on the aluminium material.
The most used color shades include shades of gold or bronze. The offered color range depends on the producer - provider of anodizing.

Sealing

The oxide layer contains a large number of pores that need to be sealed to provide an impermeable surface. Several methods can be used for sealing. One of them is hot sealing in deionized water at a temperature of 96-98°C, which changes the aluminium oxide into böhmite. It increases the volume and closes the pores.

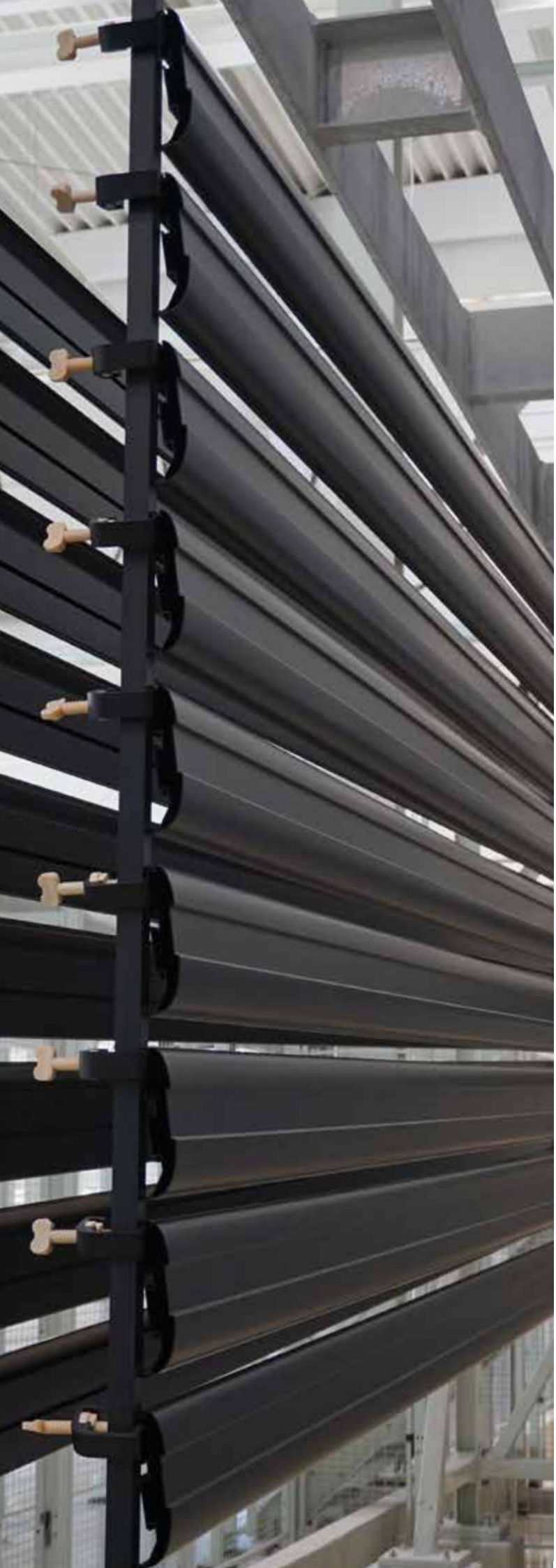
Recommended thickness of anodized layer

Natural anodizing

25 µm	Where surfaces are exposed to high stress, such as a corrosive environment or abrasion.
20 µm	Normal to high stress applications outdoors (e.g. transport and building industry). High stress due to contact with chemicals indoors (e.g. food industry).
15 µm	Severe abrasion indoors or outdoors in a dry, clean atmosphere.
10 µm	Where surfaces are exposed to normal stress indoors.
5 µm	Protective oxide layer. It is applied in the case of material protection prior to the fabrication.

Color anodizing

>15 µm	Color anodizing needs process related to a minimum of 15 µm thickness.



Anodizing process scheme

Degreasing
The material surface is cleaned from grease and other contaminants before etching.

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Etching
Etching gives the aluminium material a uniform, matte surface.

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Rinsing

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Desmutting
Upon immersing the aluminium material in a desmutting acid bath, the surface is given a bright aluminium appearance.

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Anodizing
The material is connected to the source of direct current to become an anode. A layer of aluminium oxide is formed on the metal surface.

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Rinsing

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Coloring
If a color other than the natural anodizing is required, the aluminium material is colored before sealing.

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Rinsing

↓

Sealing
The porous oxide layer is sealed to give the desired hardness and corrosion resistance.

Technical parameters at Hydro Extrusion Slovakia

Maximum dimensions of aluminium material

- 7500 x 2000 x 450 mm

Colors

- Natural anodizing (C-0)
- Bronze shades (C-31 to C-35)

Quality certification

- Qualanod Industrial - Anodizing for industrial purpose

Fixture marks

Fixture marks are an inevitable part of the anodizing process. The aluminium material must be clamped to the rack, and a fixture mark is created at the point of connection. These marks are created on both ends of the aluminium profile up to a distance of approximately 40 mm. In the case of light-weight or long profiles, it is necessary to support the material in the middle of its length, or provide additional supports according to the required module. Position of fixture mark is defined by the technologist. For other aluminium materials, such as sheets, bended profiles and weldments, the position of fixture marks should be consulted in advance.

Aluminium properties after anodizing

Anodizing gives the aluminium materials a decorative surface that is not only easy to maintain and electrically insulating, but also has technical characteristics such as hardness, corrosion resistance and wear resistance.

Properties of anodized aluminium

Anodizing provides very good corrosion resistance, especially where the pH is between 4 and 9. In contact with strongly alkaline substances, however, the surface can become stained and damaged. Aluminium should therefore be protected against lime, cement and gypsum with a protective foil on the appearance surfaces.

Generally, the oxide layer is as hard as glass and comparable with corundum. The hardness of the layer can also be improved by hard anodizing, which is carried out at a lower temperatures compared to the classical method.

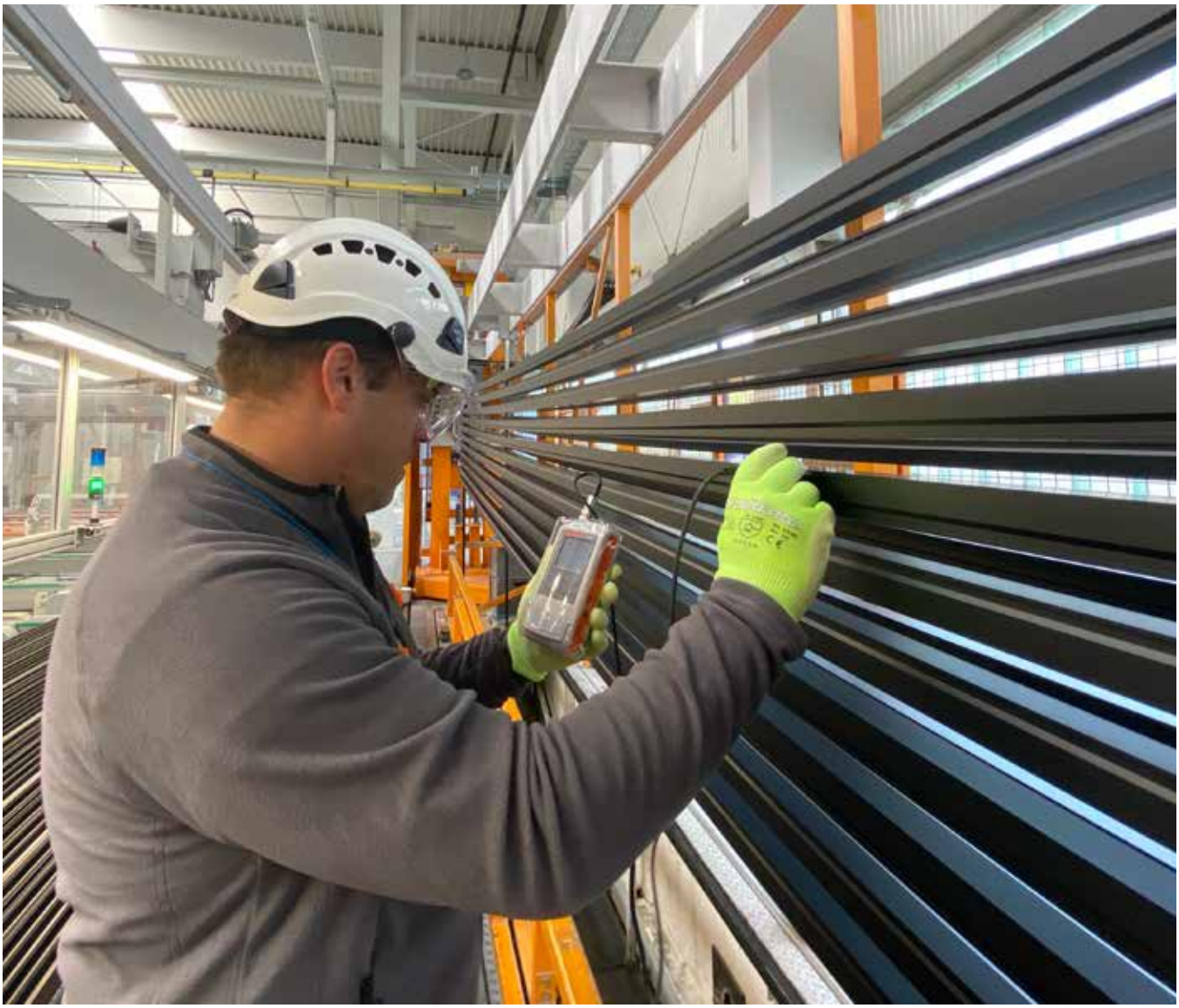
The oxide layer is transparent. Consequently, the appearance of an anodized surface, whether natural or colored, will change depending on the viewing angle.

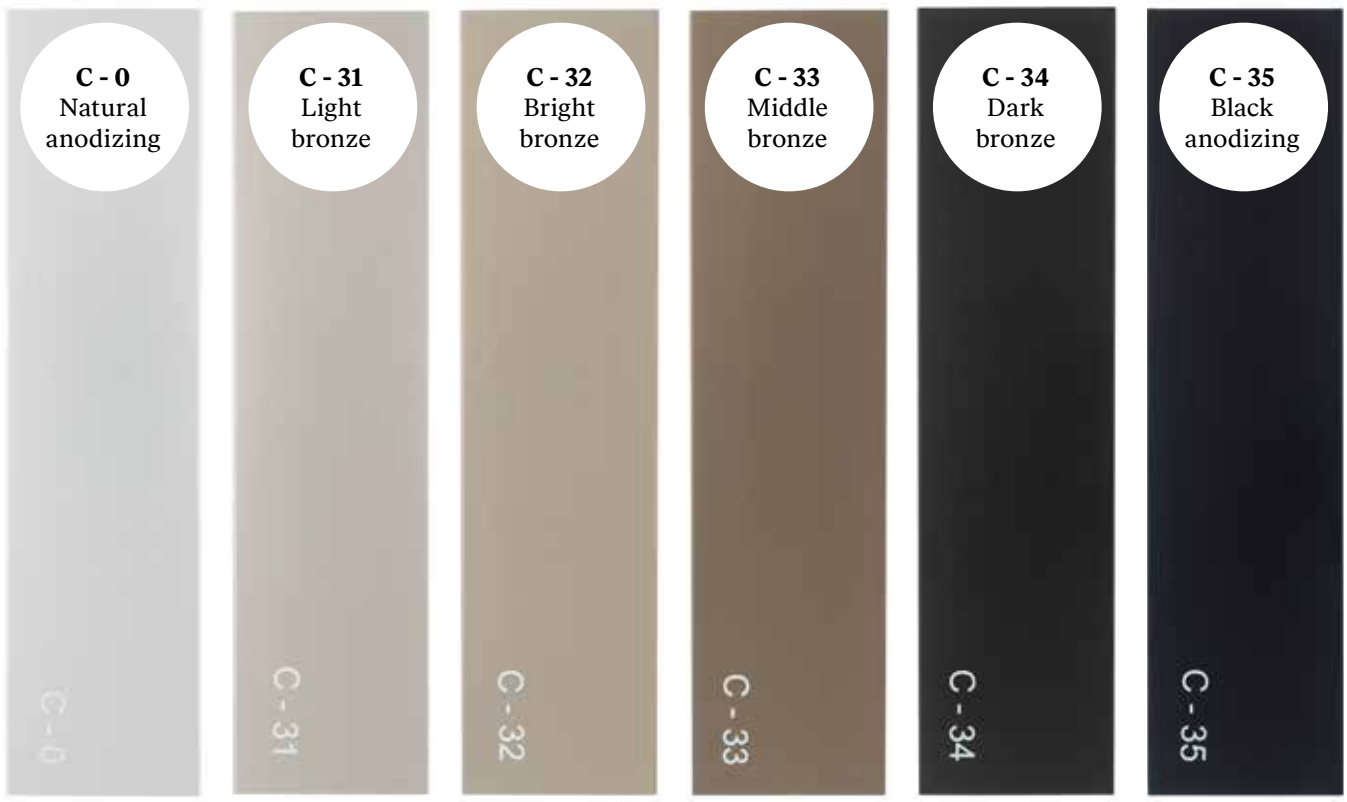
At temperatures above 100°C, fine cracking can occur in the oxide layer. This may be undesirable from the aesthetic point of view, and is more noticeable the greater the thickness of the layer.

The anodic oxide layer has poor cold formability. For this reason, forming should take place before anodizing. Bending after anodizing can cause cracking to the layer. Cutting and drilling can be carried out after anodizing, but the exposed surfaces will, of course, be untreated. Welding should be done prior to anodizing. Please note that the choice of weld filler will affect the final appearance.

The oxide layer is electrically insulating. The sealed 15 µm thick oxide layer has a breakdown voltage of 500 – 600 V.

No pre-treatment is required to recycle anodized aluminium.





Colored anodizing

There are applications for which the color shade of the aluminium material is important. By coloring the anodized layer, it is possible to achieve a wide range of colors, which brings a large number of design solutions and possibilities.

There are many factors that affect the way that anodized colors appear. These include:

- Profile shape
- The lighting and angle at which the profile is viewed
- Surface texture
- Structure of base aluminium material
- Thickness of the anodized layer
- Gloss / matt
- Choice of alloy

The combination of these factors makes the aluminium profile a “living” material.

Coloring

Natural anodized aluminium material can be colored by dipping it in a dye bath before sealing.

Dyeing is carried out by a chemical process using organic dyes or an electrochemical process.

Electrochemical coloring

Electrochemical coloring is carried out as a separate stage after anodizing, and provides a high level of ultra-violet resistance.

The pigment, a tin salt, is released from electrolyte solution and deposited at the bottom of the oxide pores by means of alternating current to color the oxide layer according to the set parameters. The color scale ranges from light bronze to black. The colors are highly resistant to fading.

The anodized aluminium material is sealed after coloring.

Color fastness in environments

When the aluminium material is used indoors or outdoors, the choice of coloring method depends on the UV radiation level and the temperature at which the layer will be exposed. Color fastness varies with the pigments and coloring method used.

A chemically colored layer using organic dyes (pigments) has limited color fastness in some cases, therefore it is not suitable for applications used in an environment that is exposed high temperatures or UV radiation.

Maintenance and cleaning of aluminium profiles

The anodic layer provides highly resistant and long-lasting protection to the aluminium. To preserve the metallic appearance, the aluminium profiles should be regularly cleaned while observing some rules.

Rules for maintenance of anodized aluminium profiles

During a routine maintenance, the aluminium profiles can be cleaned with neutral cleaners (detergents). However, solutions containing acids or alkalis as well as mediums containing abrasive particles must not be used.

To remove persistent stains or dirt, special detergents for aluminium, such as Alupolish can be used. It is inappropriate to use alkaline solutions with pH ≥ 10 as they can permanent damage the surface of aluminium profiles.

Stains and dirt should not be removed from aluminium profile using sandpaper, wire wool or hard cleaning cloth.

General rules for transport, storage and handling

To preserve the aluminium profile appearance for a long time, regardless of whether or not the surface treatment has been used, it is necessary to follow the general rules for transport, storage and handling. Basic rules include the following:

- Profiles should be transported in tarpaulin covered vehicles that allow loading/unloading with a forklift from the side or with a crane.
- During transport, it is essential secure the packages against movement so that the profiles do not rub against each other and that their subsequent damage is avoided.
- Profiles should be stored in dry and closed room where temperature remains stable to avoid condensation that causes corrosion.
- Storage places and areas should be sufficiently ventilated, which helps to keep the profiles dry, thus preventing conditions for corrosion to occur.
- Uncoated profiles should not be stored in open areas. If uncoated profiles have been exposed to moisture, they should be unpacked and dried as soon as possible.
- Profiles should remain covered for as long as possible to prevent contamination.
- Upon opening the package, profiles should be secured against mutual shifting and damage from other processes or dirt (package disintegration, sawdust, sparks from welding, other impurities).
- If the profiles are stored in a package, its ends should be opened to allow free air circulation, thus preventing humidity condensation on the profiles.
- Packages with profiles can only be stacked on frames. It is optimal to place them in the storage racks.
- It is inappropriate to pull the profiles out of the package in lengthwise or crosswise direction.
- Protective gloves should always be used when handling the profiles to prevent corrosion caused by human sweat.

Hydro

Industries that matter

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