

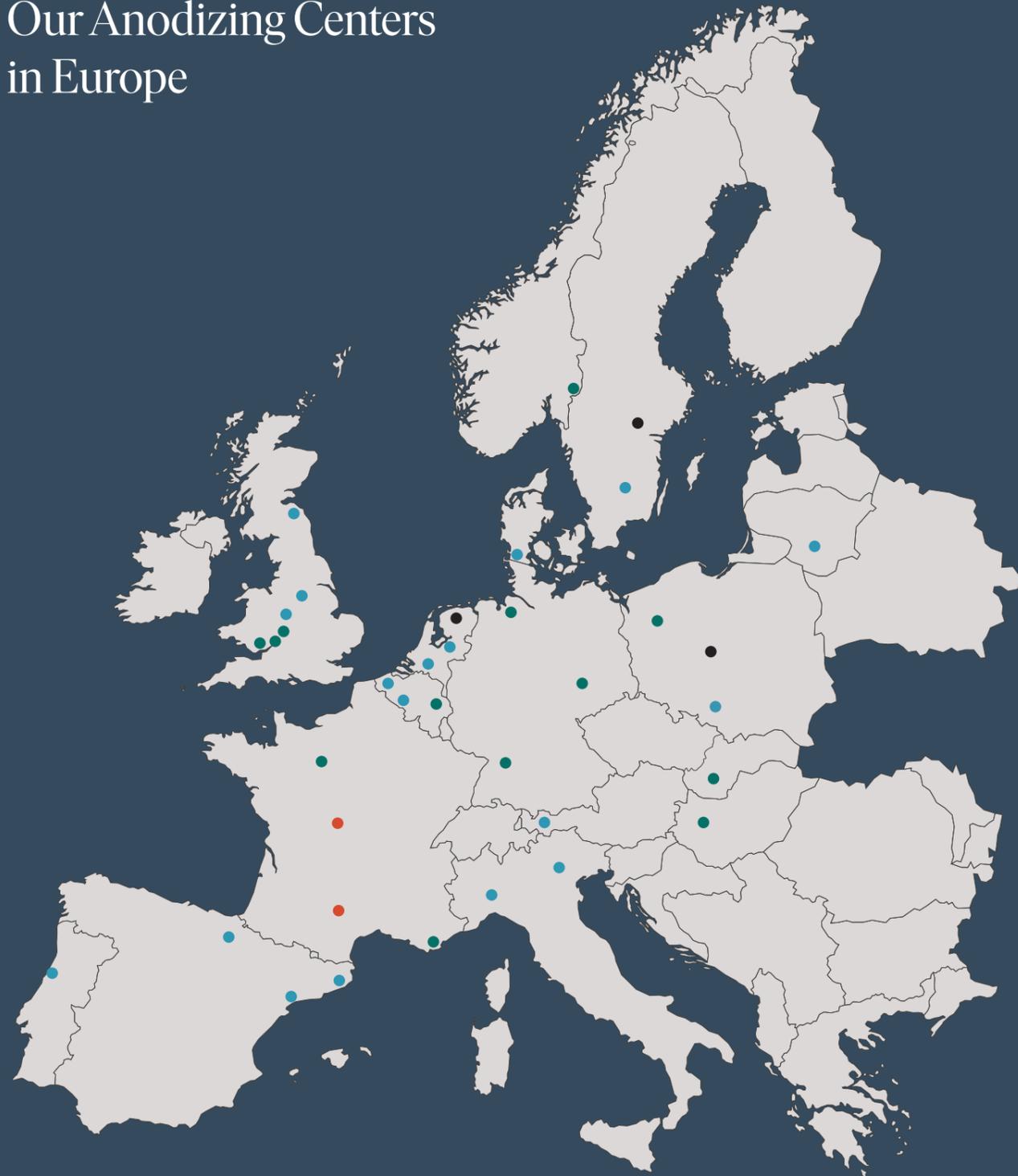


# Premium Anodizing Solutions

Surface Excellence in Europe



## Our Anodizing Centers in Europe



### Hydro extrusion plants in Europe:

- with anodizing center: Bedwas (GB), Cheltenham (GB), Gloucester (GB), Lucé (F), Magnor (N), Offenburg (D), Puget-Sur-Argens (F), Rackwitz (D), Raren (B), Székesfehérvár (H), Trzcianka (PL), Uphusen (D), Ziar (SK)
- with anodizing and powder coating center: Hoogezand (NL), Lodz (PL), Vetlanda (S)
- with powder coating center: Albi (F), Châteauroux (F)
- with surface supply chain solution

# Our Premium Anodizing Solutions

### Meet a global leader

The future is made of aluminium – that's what we believe in at Hydro and that's why we invest all our vigor and commitment to create innovative solutions that make a difference to you.

Hydro is a fully integrated aluminium company with 35,000 employees in 40 countries on all continents, combining local expertise, worldwide reach and unmatched capabilities in R&D. In addition to production of primary aluminium, extruded and rolled products and recycling, Hydro also extracts bauxite, refines alumina and generates energy to be the only 360° company of the global aluminium industry.

### Your surface matters

The general appearance and surface quality of extruded aluminium profiles are perfectly satisfactory for many applications. Load-bearing structures and parts in mechanical assemblies are typical examples. Thanks to the good corrosion resistance of aluminium, surface treatment is rarely needed simply to improve corrosion protection.

However, there are many other reasons for treating the surfaces of profiles. These include:

- Color
- Hardness
- Wear resistance
- Friction
- Reflectivity
- Electrical insulation
- Ease of cleaning
- Treatment before bonding
- Gloss Anodizing
- Surface texture

We obtain all these properties through the anodizing process.

### Anodizing

Anodizing is one of the surface treatments that is most widely used to protect aluminium.

The anodizing process contributes to:

- Preserve the “as new” appearance and thus, prolong the aesthetic life of the finish
- 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 a practical surface, a wear surface or an abrasion-resistant surface for machine parts
- Give surfaces an electrically insulated coating
- Provide a base for the application of adhesives or printing inks

At Hydro, we offer the widest range in volume, lengths, and different color applications. Our experts will advise you to find the optimal solution for your individual application.

### Your sustainable solutions

As a reliable and sustainable partner, we strive for product solutions with the lowest possible carbon footprint. Our environmental ambition is to minimize our footprint by promoting efficient resource management and responsible waste water management along the value chain. To achieve this, Hydro is investing in more sustainable, state-of-the-art technology and is ASI certified.



# Anodizing Process

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

## The anodizing process

The anodizing process consists of a number of treatment baths, and is divided into preparation, anodizing, coloring (where applicable) and sealing. The parts have to be fixed with an electrical contact, for this electrochemical process.

Natural anodizing is most widely used. In this process, no coloring is required.

The anodized layer, whether colored or natural, is transparent.

Rinsing in cascades is used to avoid chemical exchange in between the process baths, to keep them in stable condition.

Etching involves dissolving some of the aluminium surface. This creates an attractive, uniform matte surface. The shade and matteness of the surface depend largely on the alloy chosen.

In the anodizing bath, the profiles are connected to a power source. The profile is connected to the anode – hence, anodizing – while the cathodes are arranged around the sides of the bath. The bath is generally filled with dilute sulfuric acid at room temperature. The metal surface is converted electrochemically into oxide, and the process continues until the desired film thickness is obtained, generally up to 25  $\mu\text{m}$ .

The oxide layer that is formed is porous. To make this layer impermeable, the pores have to be sealed. This is done by immersion in a water bath at a temperature close to the

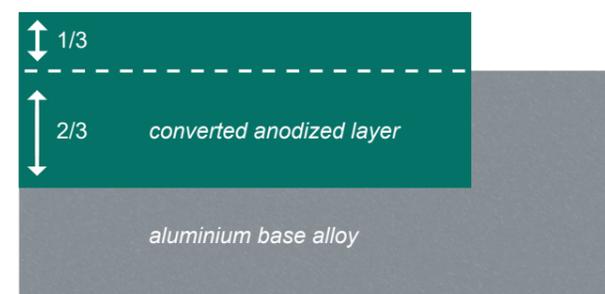


Fig.: Converted layer behavior

boiling point. Alternative sealing processes can be carried out at lower temperatures.

The choice of alloy is critical and affects the properties of the oxide layer.

The natural anodized surface has a grayish color. This surface can be colored.

Sealing improves the already good corrosion resistance of a hard anodized surface, but reduces its hardness.

## Maintenance – cleaning

The anodized layer has excellent corrosion resistance in most environments.

The surface is easily cleaned with water and a neutral detergent or with white spirits. Strong alkaline solutions must not be used.

The ability of anodizing to protect against corrosion, discoloration and abrasion increases with layer thickness. Recommendations for suitable thicknesses are given in the table below.

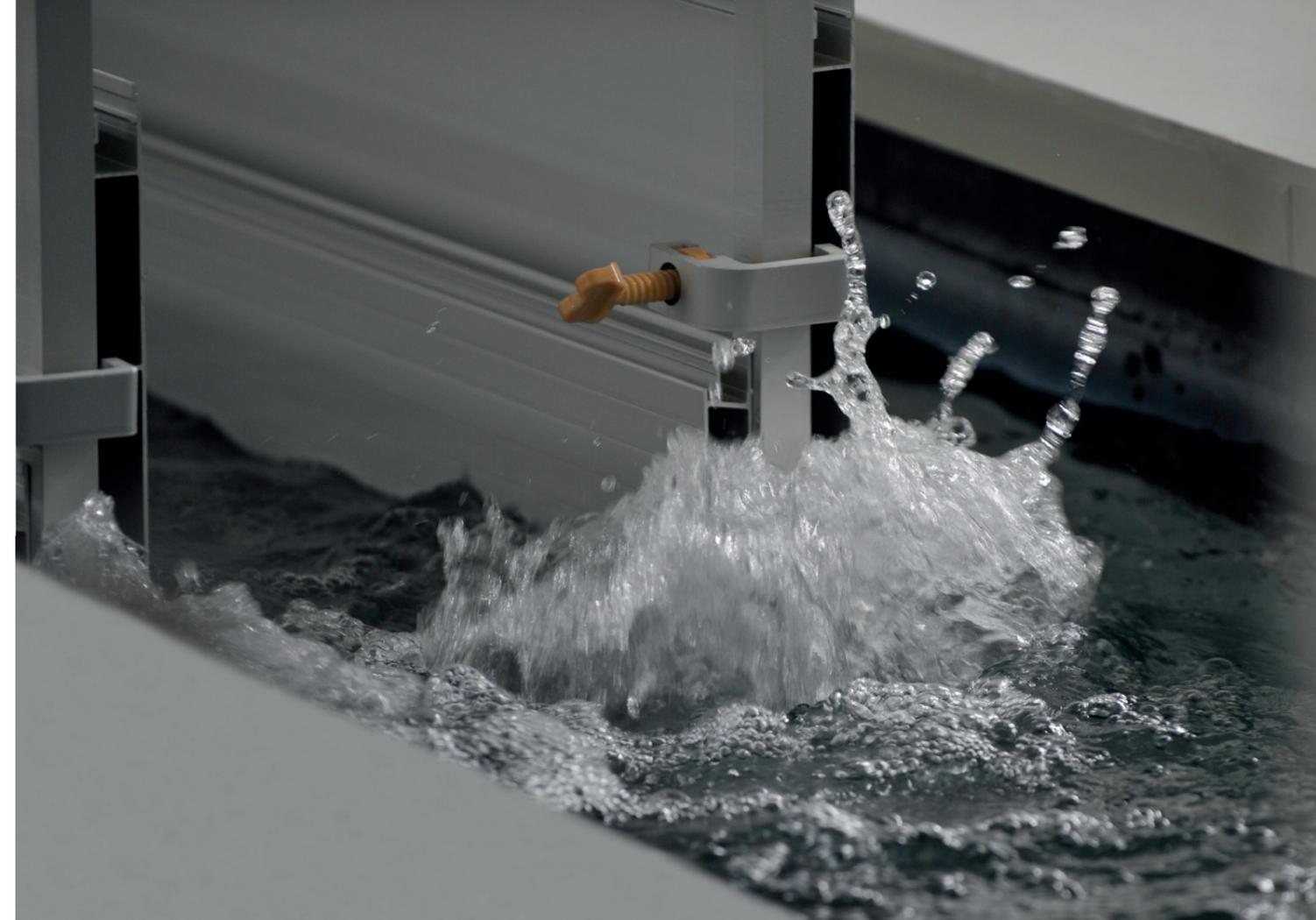
## Recommended thickness of anodized layer

### Natural Anodizing

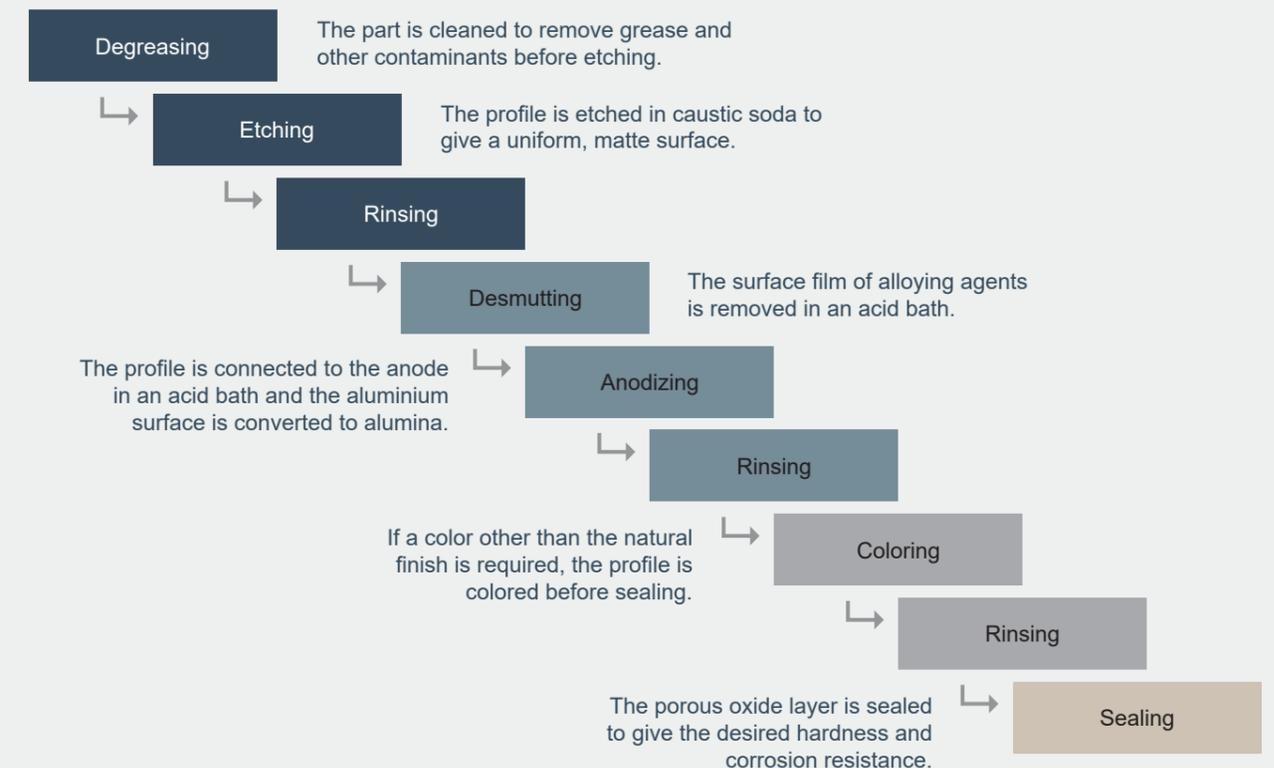
25 $\mu\text{m}$	Where surface is exposed to high stress, such as a corrosive environment or abrasion.
20 $\mu\text{m}$	Normal to high stress applications outdoors (e.g. transport and building industry).
	High stress due to contact with chemicals indoors, e.g. food industry.
15 $\mu\text{m}$	Severe abrasion indoors or outdoors in a dry, clean atmosphere.
10 $\mu\text{m}$	Normal stress indoors.

### Color Anodizing

> 20 $\mu\text{m}$	Color anodizing needs process related to a minimum of 20 $\mu\text{m}$ thickness.
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## The anodizing process



# Properties

Anodizing gives the aluminum profiles a fine 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 (e.g. on building sites). Visible surfaces can be protected using tape.

Generally, the oxide layer is as hard as glass and comparable with corundum. The hardness of the layer can also be improved and made thicker by hard anodizing, which is carried out at a lower temperature.

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 viewpoint, and is more noticeable the greater the thickness of the layer.

Because the anodic oxide layer has poor cold formability, forming should take place before anodizing. 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 appearance.

Bright etching can be carried out instead of matte etching. Alloy 6463 gives a brighter finish. Thicker oxide layers reduce the gloss.

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

**No prior treatment is required to recycle aluminium** from anodized profiles by remelting. Paint must be removed from painted profiles, however, before remelting.

## Alloy selection for anodizing

The choice of alloy influences the surface appearance and other properties of the anodized layer.

## High pH-resistant anodizing

The process is based on producing a thin glass layer protecting the surface. It is completely inorganic and environmentally friendly applied and improves resistance to corrosion, weathering, and harsh chemicals.

Hydro uses a special treatment for high alkaline resistance up to pH 13.5. This is mainly used in automotive applications and hazardous environments.

## Special treatment application areas:

- Automotive (e.g. roof rail, trim)
- Packaging
- Medical
- Furniture
- Aviation

# Coloring

By coloring the anodized layer, the aluminum profile becomes an optical highlight. With a variety of color options, there are no limits to the design possibilities.

## Colored oxide layers

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
- Thickness of the anodized layer
- Gloss
- Choice of alloy

The combination of these factors means that we can regard anodized aluminium as a “living” material.

## Coloration

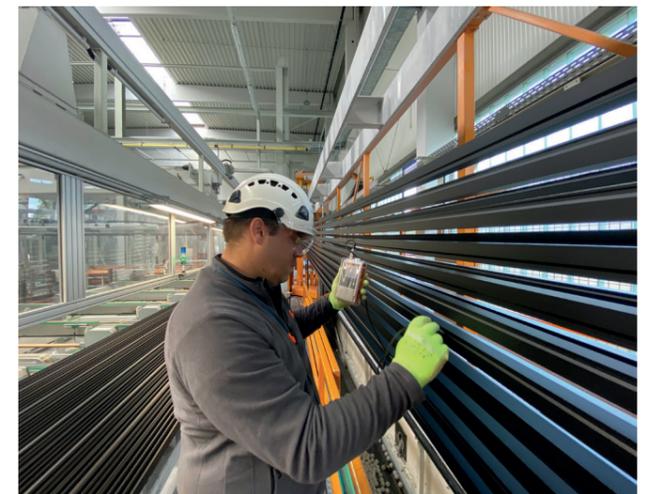
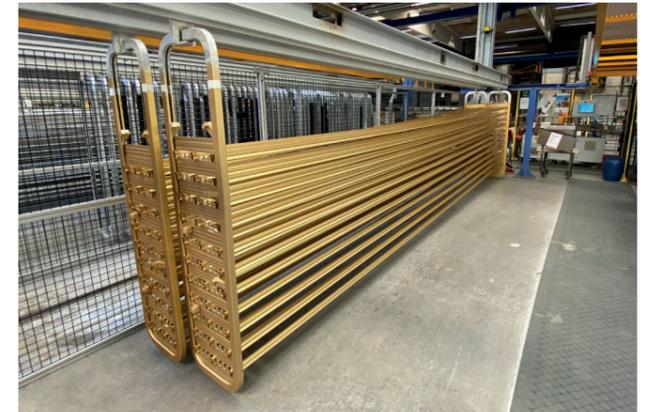
Natural anodized but unsealed aluminium is colored with organic or inorganic dyes. Profiles are colored by dipping them in a dye bath or by spraying. Both methods are water-based.

The profile is sealed after coloring.

## Electrolytic coloring

Electrolytic 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 deposited at the bottom of the oxide pores by means of alternating current. The color scale runs from champagne to black. The colors are highly resistant to fading.

The profile is sealed after coloring.



## Will colors withstand outdoor exposure?

Even when the profile is used indoors, 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. The inorganic color layer has limited color fastness in some cases and is therefore not suitable for applications where it is exposed to high temperatures or UV light.

All colors are available in matte or semi-matte finish.



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Hydro is a fully integrated aluminium company with 35,000 employees in 40 countries on all continents, combining local expertise, worldwide reach and unmatched capabilities in R&D. In addition to production of primary aluminium, rolled and extruded products and recycling, Hydro also extracts bauxite, refines alumina and generates energy to be the only 360° company of the global aluminium industry. Hydro is present within all market segments for aluminium, with sales and trading activities throughout the value chain serving more than 30,000 customers. Based in Norway and rooted in more than a century of experience in renewable energy, technology and innovation, Hydro is committed to strengthening the viability of its customers and communities, shaping a sustainable future through innovative aluminium solutions.