

AA-46

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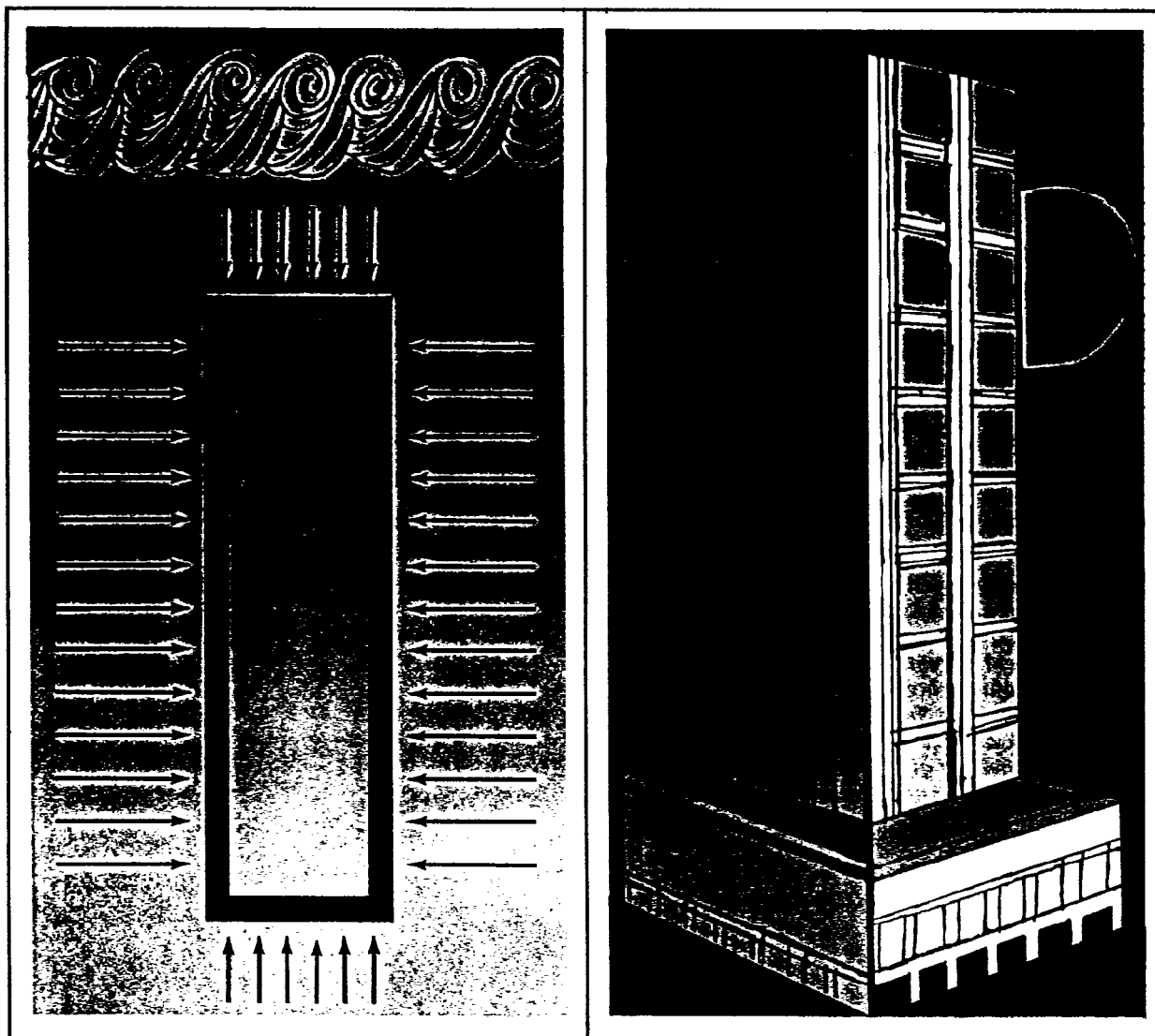
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# Standards for anodized architectural aluminum

**The Aluminum Association**



**Standards for  
anodized architectural aluminum**



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*Fifth Edition, October 1978*

# Standards for Anodized Architectural Aluminum

Fifth Edition

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# Standards for Anodized Architectural Aluminum

## 1. Scope

These Standards cover minimum quality requirements and conformance tests for decorative and protective anodic coatings on aluminum alloys for architectural applications at the time the coatings are produced. Two classes of anodic coatings are covered:

**Class I—Anodic Coatings for Exterior Surfaces Requiring Little or No Maintenance.**

Note: Due to atmospheric and climatic conditions peculiar to the Los Angeles area, special maintenance of Class I anodic coatings is required. For an explanation of the effect of these conditions and the maintenance measures recommended, contact the manufacturer.

**Class II—Anodic Coatings for Maintained Exterior Surfaces (periodic inspection, cleaning and maintenance during service by methods recommended by the manufacturer).**

## 2. Choice of Alloys

(a) The aluminum alloy shall have suitable metallurgical characteristics and surface quality for the application of decorative and protective coatings by anodizing.

(b) The aluminum alloy and temper to be used shall be agreed upon by the purchaser and the manufacturer. While many of the standard aluminum alloys are suitable for architectural purposes, special alloys have also been developed by the industry for use in anodized architectural components. These special alloys have been designed to provide good color matching and to minimize streaking or other defects which would be revealed by the anodizing process. In general, each manufacturer has specific designations for its line of alloys for use in architectural applications involving anodic coatings.

## 3. Surface Preparation

(a) Unless otherwise specified, the anodic coating shall be applied to "as-fabricated" surfaces that have been cleaned by chemical pretreatment.

(b) *Mechanical Pretreatment.*\* Certain mechanical finishes may be specified prior to anodizing to obtain a desired surface texture.

When a mechanical pretreatment prior to the chemical pretreatment is specified, it shall be as agreed upon by the purchaser and the manufacturer.

(c) *Chemical Pretreatment.*\* To assure a satisfactory coating the aluminum parts shall be given chemical treatment(s) prior to anodizing. The chemical treatment(s) shall be adequate to remove oil, dirt and other contaminants and may also serve the purpose of achieving a desired surface texture on the surface of the aluminum components.

The type of chemical pretreatment(s) to be used for the purposes of cleaning and attaining any desired surface texture shall be agreed upon by the purchaser and the manufacturer. There are a variety of chemical treatments suitable for cleaning, etching and brightening aluminum alloys. Some chemical treatments are proprietary and may be covered by patents.

## 4. Anodic Coating\*

There are a number of finishing procedures by which anodic coatings suitable for architectural applications can be produced. Some of the procedures, including anodizing and subsequent coloring and sealing of the anodic coating, are of a proprietary nature or are covered by patents. Others involve special techniques developed by the manufacturers or processors who, for competitive reasons, do not desire to make them generally known. For these reasons, the purchaser and the manufacturer should reach an agreement regarding the minimum requirements. For purposes of comparison and for making reference samples, Appendix A gives an example of a commonly used anodizing procedure which, when applied to a suitable architectural alloy, will pass the minimum quality requirements for anodic coatings given in these Standards.

\*For a description of the types of finishes available for aluminum alloys, refer to "Designation System for Aluminum Finishes," published by the Aluminum Association, 818 Connecticut Ave., N.W., Washington, D.C. 20006. Single copies of this publication are available free of charge upon request.

The following requirements apply to significant surfaces only.

(a) The purchaser and manufacturer shall agree upon what constitutes the significant surfaces of the anodized components.

(b) The anodic coating shall be continuous, uniform in appearance and free from powdery areas, based upon visual inspection.

(c) The anodic coating shall be adequately sealed by treatment in an aqueous medium for a time sufficient to pass one or more of the tests devised by various standards organizations which have been used in the industry to verify the adequacy of seal of anodic coatings. Among these tests are:

(1) ASTM Designation B136-77 "Standard Method for Measurement of Stain Resistance of Anodic Coatings on Aluminum".

(2a) ASTM Designation B457-67 (reapproved 1972). "Standard Method for Measurement of Impedance of Anodic Coatings on Aluminum".

(2b) International Standard ISO 2931 "Assessment of Quality of Sealed Anodic Oxide Coatings by Measurement of Admittance of Impedance".

A minimum impedance value of 100 Kilohms for Class I and Class II coatings shall be sufficient to verify that a proper sealing operation has been carried out.

(3) International Standard ISO 3210 "Assessment of Sealing Quality by Measurement of the Loss of Mass after Immersion in Phosphoric-Chromic Acid Solution". Anodic coatings which meet the following requirements shall be considered adequately sealed:

| Anodic Coating | Maximum Acid Dissolution Weight Loss |                    |
|----------------|--------------------------------------|--------------------|
|                | mg/dm <sup>2</sup>                   | mg/in <sup>2</sup> |
| Class I        | 40.0                                 | 2.6                |
| Class II       | 40.0                                 | 2.6                |

Standards referred to in this and following sections are reproduced in Appendix B.

(d) The color and degree of color match of the anodically coated parts, and the method of inspection for color matching shall be agreed upon by the purchaser and the manufacturer. If a clear lacquer is applied over the anodic coating (Section 5), the lacquer's effect on the color and appearance of the finish shall be taken into account.

(e) The anodic coating shall conform to the minimum requirements for thickness, weight and

apparent density as shown below. The thickness shall be determined by ASTM Methods B487 (metallographic sectioning) or B244 (eddy current instrument). The weight shall be determined by ASTM Method B137 (stripping of coating in phosphoric-chromic acid solution). For the apparent density determination, the thickness shall be determined microscopically (ASTM B487).

| Anodic Coating | Minimum Coating Thickness |     | Minimum Coating Weight |                    | Minimum Apparent Density |                   |
|----------------|---------------------------|-----|------------------------|--------------------|--------------------------|-------------------|
|                | μm*                       | Mil | mg/cm <sup>2</sup>     | mg/in <sup>2</sup> | g/cm <sup>3</sup>        | g/in <sup>3</sup> |
| Class I        | 18                        | 0.7 | 4.18                   | 27.0               | 2.32                     | 38                |
| Class II       | 10                        | 0.4 | 2.40                   | 15.5               | 2.32                     | 38                |

The apparent density of the anodic coating is obtained by using the following equations:

$$d = \frac{10w}{t}$$

$$D = \frac{W}{T}$$

where

d = Apparent density of the anodic coating expressed in grams per cubic centimeter (g/cm<sup>3</sup>).

D = Apparent density of the anodic coating expressed in grams per cubic inch (g/in<sup>3</sup>).

w = Weight of sealed anodic coating expressed in milligrams per square centimeter (mg/cm<sup>2</sup>).

W = Weight of sealed anodic coating expressed in milligrams per square inch (mg/in<sup>2</sup>).

t = Thickness of the anodic coating expressed in micrometres measured by metallographic techniques using a microscope.

T = Thickness of the anodic coating expressed in mils measured by metallographic techniques using a microscope.

\*Throughout these Standards coating thicknesses in micrometres have been rounded off to the nearest whole number.

(f) Anodic coatings which do not meet the requirements of Section 4(e) will be acceptable only when agreed upon between the purchaser and the manufacturer. In all cases the other provisions of Section 4 must be met.

## 5. Clear Protective Overcoating

Frequently, construction conditions at the building site are such that alkaline building materials—mortar, cement, plaster and fire insulation or run-off water containing some amounts of any of

these materials—may contact the anodized architectural components. Also, during masonry cleanup acids may accidentally contact the anodized surfaces. Damage to the anodic coating can result from contact with these materials. To prevent such damage, a clear protective overcoating may be shop-applied to the anodized components.

(a) The manufacturer and the purchaser shall determine whether there is need for a shop-applied, protective overcoating.

(b) When employed, the protective overcoating shall be subject to the following requirements:

(1) A clear, high gloss or semi-gloss, non-yellowing acrylic type lacquer shall be applied in the shop over the significant surfaces of the anodized architectural components to a thickness of  $13 \pm 5$  micrometres ( $0.5 \pm 0.2$  mil) and shall have a

uniform appearance.

(2) The clear protective overcoating shall pass the Aluminum Association Mortar Test given in Appendix C.

(3) The clear protective overcoating shall be left on the anodized components and not removed at a later time.

## 6. Sampling and Testing

The purchaser and the manufacturer shall agree upon the method of sampling and the frequency of testing. A recommended frequency of sampling and testing is one sample or test coupon from each rack load of anodized components for the dye stain (ASTM B136) and coating thickness (ASTM B244) tests and at least one sample or coupon from each production shift for coating weight (ASTM B137) and apparent density determinations.

## Appendix A

### Typical Sulfuric Acid Anodizing Practice for Preparing Reference Samples

Anodic coating suitable for architectural applications may be applied by a number of different procedures involving variations in electrolyte composition, anodizing conditions, sealing treatments, etc. Since it is impractical to cover all of the variations in these Standards, a commonly used anodizing process is given below as an example of one which is suitable for preparing reference samples that will meet these architectural Standards.

The following procedures for anodically coating aluminum architectural alloys will result in a finish which meets the minimum anodic coating quality requirements cited in these Standards. Samples anodically finished by this procedure may be used as reference specimens for tests being performed to check the quality of architectural anodic finishes agreed upon by the purchaser and the manufacturer.

1. Surface Preparation: See Section 3 of these Standards.

2. Anodic Treatment (Direct Current):  
Electrolyte:  $15 \pm 1$  wt% sulfuric acid.

Electrolyte Temperature:  $21 \pm 1^\circ\text{C}$  ( $70 \pm 2^\circ\text{F}$ )

Current Density: A constant 1.3 amperes per square decimeter (12 amperes per square foot) of surface being anodized.

Time of Anodizing:

Class I coatings 60 minutes

Class II coatings 30 minutes

Agitation: Must be adequate to maintain uniform temperature of electrolyte throughout the tank and especially at the work surfaces being anodized.

3. Rinsing: The anodic coating must be rinsed free of electrolyte. Two cold water rinses in clean, flowing water should be employed for at least 2 minutes. If the configuration of the anodized parts involves pockets or recesses, special attention should be directed towards obtaining good rinsing of these areas.

4. Sealing: 25 minutes at  $96.7\text{--}100^\circ\text{C}$  ( $206\text{--}212^\circ\text{F}$ ) in distilled or deionized water having a pH of 5.5-7.0. Deionized water should be free of traces of organic matter, such as residuals from ion exchange resins.

## Appendix B

### Reproduction of ASTM and ISO Standards for Testing and Measuring Anodic Coatings



ANSI/ASTM B 136 - 77

Endorsed by American  
Electroplaters' Society  
Endorsed by National  
Association of Metal Finishers

**AMERICAN SOCIETY FOR TESTING AND MATERIALS**  
1916 Race St., Philadelphia, Pa., 19103

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If not listed in the current combined index, will appear in the next edition.

### Standard Method for MEASUREMENT OF STAIN RESISTANCE OF ANODIC COATINGS ON ALUMINUM<sup>1</sup>

This Standard is issued under the fixed designation B 136; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval.

#### 1. Scope

1.1 This method is intended to determine whether anodic oxide coatings on aluminum and its alloys, that have undergone a sealing treatment and contact with an acid solution, are stainproof or nonadsorptive with respect to dyes.

1.2 Coatings that have been properly sealed should be proof against adsorption of coloring materials and, hence, "nonstaining" in many types of service.

1.3 This method is applicable to anodic coatings intended for applications where they are exposed to the weather, or for protective purposes in corrosive media, and where resistance to staining is important.

NOTE 1—Performance in this test is predictive only of susceptibility to stain by dyes. It is not intended to be predictive of other factors in service performance such as pitting or general corrosion.

NOTE 2—For Aluminum Association Class I and II architectural anodic coatings that are sealed in solutions containing less than 15 ppm silicates or 3 ppm phosphates, the acid pretreatment may be omitted.

1.4 In the case of coatings colored in deep shades, where estimation of the intensity of any residual dye stain is difficult, interpretation of the test is based on whether or not the original color has been affected by the action of the test.

1.5 This method is not applicable to:

1.5.1 Chromic acid type anodic coatings.

1.5.2 Anodic coatings on aluminum alloys containing more than 2 mass percent Cu or 4.5 mass percent Si.

1.5.3 Anodic coatings that have been sealed only in dichromate solutions.

1.5.4 Anodic coatings that have undergone a treatment to render them hydrophobic.

#### 2. Summary of Method

2.1 The method depends upon the observation that a nonsealed or poorly sealed anodic coating is attacked by acid and easily colored by dye, while an adequately sealed coating is not appreciably attacked and does not retain any dye stain.

2.2 The method comprises contacting the test area of the anodized specimen with nitric acid solution and, after rinsing and drying, applying a special dye solution followed by rinsing and rubbing the test area with pumice powder, drying, and visual examination of the test area for retention of dye stain. Coatings that exhibit no dye stain or change in color are considered to have passed the test.

#### 3. Reagents

3.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society,<sup>2</sup> where such specifications are available. Other grades may

<sup>1</sup>This method is under the jurisdiction of ASTM Committee B-8 on Electrodeposited Metallic Coatings and Related Finishes.

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<sup>2</sup>"Reagent Chemicals, American Chemical Society Specifications," Am. Chemical Soc., Washington, D.C. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards," by Joseph Rosin, D. Van Nostrand Co., Inc., New York, N. Y., and the "United States Pharmacopeia."