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Standard Specification for Anodic Oxide Coatings on Aluminum¹

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This specification has been approved for use by agencies of the Department of Defense and for listing in the DoD Index of Specifications and Standards.

1. Scope

1.1 This specification covers requirements for electrolytically formed porous oxide coatings on aluminum and aluminum alloy parts where appearance, abrasion resistance, electrical properties, and protection against corrosion are important. Nonporous, barrier layer anodic coatings used for electrical capacitors are not covered. Seven types of coatings as shown in Table 1 are provided. Definitions and typical examples of service conditions are provided in Appendix X1.

NOTE 1—It is recognized that uses exist in which modifications of the coatings covered by this specification may be required. In such cases the particular properties desired by the purchaser should be the subject of agreement between the purchaser and the manufacturer.

2. Referenced Documents

2.1 ASTM Standards:

- B 110 Test Method for Dielectric Strength of Anodically Coated Aluminum²
- B 117 Method of Salt Spray (Fog) Testing³
- B 136 Method for Measurement of Stain Resistance of Anodic Coatings on Aluminum³
- B 137 Method for Measurement of Weight of Coating on Anodically Coated Aluminum³
- B 244 Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments³
- B 368 Method for Copper-Accelerated Acetic Acid-Salt Spray (Fog) Testing (CASS Test)³
- B 457 Method for Measurement of Impedance of Anodic Coatings on Aluminum³
- B 487 Method for Measurement of Metal and Oxide Coating Thicknesses by Microscopical Examination of a Cross Section³
- B 538 Method of FACT (Ford Anodized Aluminum Corrosion Test) Testing³
- B 602 Test Method for Attribute Sampling of Metallic and Inorganic Coatings³
- D 658 Test Method for Abrasion Resistance of Organic Coatings by the Air Blast Abrasive Test⁴

E 429 Method for Measurement and Calculation of Reflecting Characteristics of Metallic Surfaces Using Integrating Sphere Instruments⁵

E 430 Method for Measurement of Gloss of High-Gloss Surfaces by Goniophotometry⁵

2.2 Other Standards:

- MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes⁶
- MIL-STD-414 Sampling Procedures and Tables for Inspection by Variables for Percent Defective⁶

3. Manufacture

3.1 Defects in the surface of the basis metal, such as scratches, porosity, inclusions, roll and die marks, cold shuts, and cracks, will adversely affect the appearance and performance of applied coatings despite the observance of best anodizing practices. Accordingly, defects in the coating that result from such conditions shall not be cause for rejection.

NOTE 2—To minimize problems of this sort, the specifications covering the basis material or the item to be anodized should contain appropriate limitations on such basis metal conditions.

3.2 The basis metal shall be subjected to such mechanical finishing operations, cleaning, and chemical or electrolytic pretreatments as are necessary to yield anodic coatings with the final quality and appearance specified by the purchaser.

3.3 Except where specifically excluded, anodized parts shall be sealed in water or aqueous chemical solutions of such purity, composition, pH, and temperature, as to impart the properties specified herein.

4. Significant Surfaces

4.1 Significant surfaces are defined as those normally visible (directly or by reflection) which are essential to the appearance of serviceability of the article when assembled in normal position; or those surfaces which can be the source of corrosion products that will deface visible surfaces and interfere with functional surfaces on the assembled article. When necessary, the significant surfaces shall be the subject of agreement between purchaser and manufacturer and shall be indicated on the drawings of the parts, or by the provision of suitably marked samples.

NOTE 3—When significant surfaces are involved on which the specified thickness or density of the coating cannot readily be controlled, such as threads, holes, deep recesses, and similar areas, the purchaser

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² Discontinued, see 1981 Annual Book of ASTM Standards, Part 9.

³ Annual Book of ASTM Standards, Vol 02.05.

⁴ Annual Book of ASTM Standards, Vol 06.01.

⁵ Annual Book of ASTM Standards, Vol 14.02.

⁶ Available from the Naval Publications and Forms Center, 5801 Tabor Ave., Philadelphia, PA 19120.

and the manufacturer should recognize the necessity for either thicker films on the more accessible surfaces or for special racking.

5. Manner of Specifying Requirements

5.1 *Coating Description*—When ordering articles to be finished in accordance with this specification, the purchaser shall state:

- 5.1.1 The ASTM designation number,
- 5.1.2 The coating type and description (see Table 1),
- 5.1.3 The minimum anodic film thickness,
- 5.1.4 Special post anodic treatments,
- 5.1.5 Applicable quality assurance requirements (see Section 6),
- 5.1.6 Significant surface appearance requirements such as color, texture, or reflectivity, and
- 5.1.7 The alloy to which the coating is to be applied.

5.2 *Supplementary Coating*—Any supplementary coating that is required in addition to normal or special sealing must either be described in detail along with its requirements or the appropriate specification(s) must be referenced.

6. Quality Assurance

6.1 Anodic oxide coatings can be produced to have many different characteristics. No single coating can be expected to have all of these characteristics. Therefore, the quality assurance requirements for a given coating should be selected to control those properties necessary to the expected end use for the product.

6.2 Anodic coatings supplied under this specification shall meet the minimum requirements for film thickness as stated in Table 1.

TABLE 1 Anodic Coatings Descriptions

NOTE—Hard coatings may vary in thickness from 12 μm to more than 100 μm . If the thickness of Type A is not specified it shall be 50 μm min. Type A coatings will not be sealed unless so specified.

Type	Coating (Industry) Description	Minimum Film Thickness (μm)
A	Engineering Hard Coat	50
B	Architectural Class I	18
C	Architectural Class II	10
D	Automotive—Exterior	8
E	Interior—Moderate Abrasion	5.0
F	Interior—Limited Abrasion	3
G	Chromic Acid	1

6.3 The following ASTM methods are applicable to anodic coatings within the scope of this specification: B 110, B 117, B 136, B 137, B 244, B 368, B 457, B 487, B 538, D 658, E 429, and E 430. The selection of tests to be required and the level of performance against each test, with the exception of minimum film thickness, shall be subject to agreement between purchaser and manufacturer. The Dye Stain Test, as described in Method B 136, shall not be required for Type G coatings or for Types B through F coatings sealed only in dichromate solutions, or for unsealed Type A coatings.

7. Workmanship and Appearance

7.1 *Workmanship*—The anodic coatings shall be continuous, smooth, adherent, uniform in appearance, and shall be free of powdery areas (burns), loose films, stains, discolorations, and discontinuities such as pits, breaks and scratches, or other damage. The size and number of contact marks shall be the minimum consistent with good practice. The location of contact marks shall be in areas of minimum exposure to service environmental conditions when important to the function of the part.

7.2 *Appearance*—If applicable, the color and finish appearance (bright, dull, or satin) shall be a reasonably close approximation to that of a sample consisting of treated pieces agreed upon as the standard range by the manufacturer and the purchaser.

NOTE 4—This range, representing the limits that the manufacturer will supply and that the purchaser will accept, should be established before any work is performed to meet this specification.

8. Sampling

8.1 Test methods are time consuming and often destructive; therefore 100 % inspection is usually impractical. The purchaser should select a suitable sampling plan for the acceptance testing of lots of coated items. In order that the manufacturer may know the quality standard he is expected to meet, the plan selected should be made a part of the purchase contract.

8.2 Information on sampling procedures is given in Method B 602. Standard sampling plans are suggested in Military Standards MIL-STD-105 and MIL-STD-414.

APPENDIX

(Nonmandatory Information)

TABLE X1.1 Definitions of Service Conditions and Examples of Typical Applications and Applicable Coating Types

SC No.	Definition	Typical Applications	Applicable Coating Types
Very Severe (5)	Exposure to atmospheric weathering that can be expected to extend for many years or to prolonged high bearing load wear conditions.	Unmaintained exterior architectural facades, machinery parts, marine	A and B
Severe (4)	Exposure that includes likely damage from denting, scratching, and abrasive wear coupled with corrosive environments.	1-Automotive—exterior, 2-maintained architectural exterior facades, windows	C and D
Moderate (3)	Exposure that is likely to include occasional wetting with coating subject to moderate wear or abrasion.	Lighting reflectors—exterior, athletic equipment, appliances, nameplates, lawn furniture	E
Mild (2)	Exposure indoors in normally dry atmospheres with coating subject to minimum wear or abrasion.	Automotive—interior, houseware items, lighting reflectors—enclosed	F
Crevice Condition (1)	Exposure to humid atmospheres with little or no abrasive condition. Particularly for lap joints.	Spot-welded or riveted assemblies such as aircraft and electronic components.	G

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