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400 COMMONWEALTH DRIVE WARRENDALE PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 2472C
Superseding AMS 2472B

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ANODIC TREATMENT OF ALUMINUM ALLOYS
Sulfuric Acid Process, Dyed Coating

1. SCOPE:

1.1 Purpose: This specification establishes the engineering requirements for producing dyed anodic coatings on aluminum alloys and the properties of such coatings.

1.2 Application: To increase corrosion resistance and produce colored surfaces on aluminum alloy parts. For coatings to be used as a base for paint or other organic finishes, AMS 2470 or AMS 2471 should be specified. This process is not suitable for parts which contain joints or recesses in which the anodizing solution may be retained.

1.3 Classification: This specification covers two types of coating, designated as follows:

AMS 2472 - Coatings for Identification
AMS 2472-1 - Coatings for Decorative Purposes

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 4037 - Aluminum Alloy Sheet and Plate, 4.4Cu - 1.5Mg - 0.60Mn (2024; -T3 Flat Sheet, -T351 Plate)

Printed in U.S.A.

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B117 - Salt Spray (Fog) Testing
ASTM B137 - Measurement of Weight of Coating on Anodically Coated Aluminum

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Solutions:

3.1.1 Electrolyte: Shall be an aqueous solution of sulfuric acid of suitable concentration (nominal concentration is 15% by weight). The anodizing solution shall be maintained within the range 64° - 85°F (18° - 29°C); the selected temperature shall be maintained within ±2°F (±1°C) and within the above range during the anodizing cycle.

3.1.2 Dye: Shall be as required to produce the specified color.

3.1.3 Sealer: Shall be a solution of nickel acetate or cobalt acetate in deionized water and shall be maintained at a pH value of 5.6 - 5.8 and a temperature of 190° - 210°F (85° - 100°C). Adjustments in the pH value of the solution shall be made by addition of acetic acid or sodium hydroxide as required.

3.1.3.1 For alloys of Class 2 (See 4.3.1) anodized to the requirements of AMS 2472-1, a second sealer shall be used unless otherwise specified (See 3.2.5.1): this shall consist of a 1% aqueous solution of sodium or potassium dichromate maintained at a pH value of 5.0 - 6.0 and a temperature not lower than 208°F (98°C). Adjustments in the pH value of this solution shall be made by addition of chromic acid or sodium hydroxide as required.

3.2 Procedure:

3.2.1 Preparation: All heat treatment, machining, forming, brazing, welding, and perforating operations shall, insofar as practicable, be completed before parts are anodized, unless otherwise specified.

3.2.2 Cleaning: Parts, prior to being coated, shall have clean surfaces, free from water-breaks, prepared with minimum abrasion, erosion, or pitting.

3.2.3 Coating: The cleaned parts shall be made the anode in the electrolyte contained in a suitable tank which, if made of a metal resistant to the electrolyte or if lined with lead, may also serve as the cathode. Direct current shall be applied as required to produce an anode current density of 10 - 15 amp per sq ft (110 - 160 A/m^2) when AMS 2472 is specified or 15 - 20 amp per sq ft (160 - 215 A/m^2) when AMS 2472-1 is specified, for such time as required to produce an anodic coating conforming to the requirements of 3.3. Other conditions of temperature and amperage may be used when approved by purchaser. After anodizing, all parts shall be rinsed thoroughly in cold running tap water.

3.2.4 Dyeing: Parts shall be dyed, to the color specified, by immersing in appropriate dye solution. The temperature of the solution and the time of immersion shall be as necessary to produce the specified color. Either the parts or the solution shall be agitated during immersion. Parts shall then be rinsed in cold running tap water.

3.2.5 Sealing: Parts shall be immersed in the acetate sealer solution for not less than 10 minutes. Parts made of Class 2 alloys (See 4.3.1) anodized to the requirements of AMS 2472-1 shall, unless otherwise specified (See 3.2.5.1), then be immersed in the dichromate sealer solution for 10 - 12 minutes. After sealing, all parts shall be rinsed thoroughly in clean, cold, running tap water, rinsed in clean hot water, and dried.

3.2.5.1 The corrosion resistance of dyed parts may be enhanced by duplex sealing as in 3.2.5 but the second sealing in dichromate solution can cause color changes in the dye. Where any change in dye coloration is undesirable, the second sealing operation should be omitted.

3.3 Properties: Coated parts shall conform to the following requirements:

3.3.1 Coating Weight: Shall be not less than 600 mg per sq ft (6.5 g/m^2) when AMS 2472 is specified and not less than 2500 mg per sq ft (27 g/m^2) when AMS 2472-1 is specified, except that for wrought aluminum alloys of the 2000 series where copper is the major alloying element and for aluminum casting alloys with a nominal copper content of 1.0% or higher, the coating weight when AMS 2472-1 is specified shall be not less than 1400 mg per sq ft (15 g/m^2). Coating weight shall be determined in accordance with ASTM B137 on parts or specimens as in 4.3.1 which have been anodized and rinsed but not dyed or sealed.

3.3.1.1 If small parts, such as rivets and machine screws, are anodized in bulk in a container, the specified coating weight shall apply to not less than 75% of the parts anodized together, determined by random sampling, but in no case shall any part show uncoated areas except at contact points.

3.3.2 Corrosion Resistance:

3.3.2.1 For control purposes, samples of AMS 4037 aluminum alloy sheet treated in Ø accordance with 3.2 shall withstand exposure for 336 hr to salt spray without showing more than a total of 15 scattered spots or pits, none larger than 1/32 in. (1 mm) in diameter, in a total of 150 sq in. (1000 cm^2) of test area grouped from five or more test pieces, or more than 5 scattered spots or pits, none larger than 1/32 in. (1 mm) in diameter, in a total of 30 sq in. (200 cm^2) from one or more test pieces, except those areas within 1/16 in. (2 mm) from identification markings and fixture contact marks remaining after processing. Salt spray corrosion tests shall be conducted in accordance with ASTM B117 except that the significant surface shall be inclined approximately 6 deg from the vertical.

3.3.2.1.1 Each part that is anodized shall withstand exposure for 336 hr to salt Ø spray test conducted in accordance with ASTM B117 without showing more than a few scattered corrosion pits visible without magnification.

3.4 Quality: Anodic coating shall be uniform in color, quality, and condition and free from foreign materials and from imperfections detrimental to appearance or performance of the coating.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The coating vendor shall supply all samples Ø for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that processing conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for Ø coating weight (3.3.1), quality (3.4), and color are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for Ø corrosion resistance of representative parts and separate panels (3.3.2) and of cleaning and processing solutions to ensure that the anodic coating will conform to the requirements of this specification are classified as periodic tests and, except as specified in 4.3.2 and 4.3.3, shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: Tests to determine conformance to all technical Ø requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of processed parts to a purchaser, when a change in material or processing, or both, requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.3.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be not less than the following; a lot shall be all parts of the same part number processed in a continuous series of operations and presented for vendor's inspection at one time:

4.3.1 Coating Weight: Shall be determined on representative parts when size and shape permit accurate determination of surface area. If parts are of such size and shape that surface area cannot be determined readily, coating weight determinations shall be made on separate test specimens 0.025 - 0.063 in. (0.6 - 1.6 mm) thick and not less than 3 x 3 in. (75 x 75 mm) in length and width made of an alloy of the same class as the parts represented, as follows:

Class 1. Alloys of Aluminum Association designations 1100, 3003, 3004, 5052, 6053, 6061, 6063, and all alclad alloys.

Class 2. All wrought alloys not listed as Class 1 and all casting alloys.

4.3.1.1 Separate specimens, if used, shall be processed with the work they represent.

4.3.2 Corrosion Resistance: Shall be determined at least monthly on representative parts and on separate panels 0.025 - 0.063 in. (0.6 - 1.6 mm) thick and not less than 3 x 10 in. (75 x 250 mm) in width and length.

4.3.3 Process Solution Control: Shall be performed at least weekly.

4.4 Approval:

4.4.1 Sample coated parts and panels shall be approved by purchaser before parts for production use are supplied, unless such approval be waived by purchaser. Results of tests on production parts shall be essentially equivalent to those on the approved sample parts and panels.

4.4.2 Vendor shall use manufacturing procedures, processes, and methods of inspection on production parts which are essentially the same as those used on the approved sample parts. If necessary to make any change in type of equipment or in established composition limits and operating conditions of process solutions, vendor shall submit for reapproval of the process a statement of the proposed changes in processing and, when requested, sample coated parts, test panels, or both. Production parts coated by the revised procedure shall not be shipped prior to receipt of reapproval.