Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 2471C
Superseding AMS 2471B
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ANODIC TREATMENT OF ALUMINUM ALLOYS
Sulfuric Acid Process, Undyed Coating

1. SCOPE:

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

1.2 Application: To increase corrosion resistance on aluminum alloy parts and to provide surfaces which will ensure satisfactory adherence of paint and other organic finishes. For coatings to be colored by dyeing, AMS 2472 should be specified. This process is not suited to parts or assemblies which contain joints or recesses in which the anodizing solution may be retained.

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 Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pennsylvania 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)

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

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

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 temperature of the anodizing solution shall be maintained at a selected temperature within the range 64° - 75° F (17.8° - 23.90° C; the selected temperature shall be maintained within ± 2° F (±1.1° C).

3.1.2 Sealer: Shall be an aqueous solution containing 5 - 6% by weight of sodium or potassium dichromate. The sealer solution shall be maintained at a pH of 4.5 - 6.0 and a temperature of 190° - 210° F (87.8° - 98.9° C) Adjustments in the pH of the solution shall be made by addition of chromic acid.

3.2 Preparation

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3.2.1 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 Parts prior to being coated shall have clean surfaces, free from water-breaks, prepared with minimum abrasion, erosion, or pitting. Cleaning by a process giving a slightly etched surface is desirable.

3.3 Procedure:

3.3.1 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 (107.6 - 161.5 A/m^2), for 15 - 30 min. to produce an anodic coating conforming to the requirements of 3.4. Other conditions of time, temperature and amperage may be used when approved by purchaser. After anodizing, all parts shall be rinsed thoroughly in cold, running tap water.

3.3.2 Sealing: Parts shall be immersed in the sealer solution for not less than 20 minutes. After sealing, all parts shall be rinsed thoroughly in clean, cold, running tap water, then in clean hot water, and dried.

3.4 Properties:

3.4.1 Coating Weight: Shall be not less than 600 mg per sq ft (6.458 g/m^2). Coating weight shall be determined in accordance with ASTM B137 on parts or specimens which have been anodized and rinsed but not sealed.

3.4.1.1 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.

3.4.2 Corrosion Resistance:

3.4.2.1 For control purposes, samples of AMS 4037 aluminum alloy sheet, treated in accordance with 3.3, 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. (0.8 mm) in diameter, in a total of 150 sq in. (968 cm^2) of test area grouped from five or more test pieces; nor more than 5 scattered spots or pits, none larger than 1/32 in. (0.8 mm) in diameter, in a total of 30 sq in. (194 cm^2) from one or more test pieces; except those areas within 1/16 in. (1.6 mm) from identification markings and at electrode 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 (0.105 rad) from the vertical.

3.4.2.2 Each part that is anodized and not subsequently painted shall be capable of withstanding exposure for 336 hr to salt spray test conducted in accordance with ASTM B117 without showing more than a few scattered corrosion pits visible without magnification.

3.4.2.2.1 Corrosion test is not required when material or parts, treated in accordance with 3.3, are subsequently to be painted.

3.5 Quality: Anodic coating shall be continuous, smooth, adherent, and uniform in appearance and shall be free from powdery areas, loose films, discontinuities such as breaks or scratches, except at contact points, or other damage or imperfections detrimental to appearance or to performance of parts.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The coating vendor shall supply all samples and shall be responsible Ø for performing all required tests. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure that processing conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to coating weight (3.4.1) and corrosion Ø resistance (3.4.2.1) requirements are classified as acceptance or routine control tests.

4.2.2 Qualification Tests: Tests to determine corrosion resistance of finished parts which are not subsequently to be painted (3.4.2.2) are classified as qualification or periodic control tests.

4.3 Sampling:

4.3.1 Coating Weight: Determinations shall be made 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 specimens not less than 3 x 3 in. (76 x 76 mm) in length and width and 0.025 - 0.063 in. (0.64 - 1.60 mm) thick 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 in Class 1 and all casting alloys.

4.3.1.1 Separate specimens of Class 1 or Class 2 alloys shall be processed with the work they represent. Ø Any alloy of the same class as the work it represents may be used for the test specimens.

4.3.2 Corrosion Resistance: Determinations shall be made on representative parts or on separate panels not less than 3 x 10 in. (76 x 254 mm), the 10 in. (254 mm) direction being perpendicular to the direction of rolling, and 0.025 - 0.063 in. (0.64 - 1.60 mm) thick.

4.4 Approval:

4.4.1 Sample coated parts and panels shall be approved by purchaser before parts for production use are Ø supplied, unless such approval be waived.

4.4.2 Vendor shall use manufacturing procedures, processes, and methods of inspection on production parts Ø which are essentially the same as those used on the approved sample parts. If any change is necessary in type of equipment or in established composition limits and operating conditions of process solutions, vendor shall submit for reapproval of the process a detailed statement of the revised operations and, when requested, sample coated parts, test panels, or both. No production parts processed by the revised procedure shall be shipped prior to receipt of reapproval.

4.5 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified require- Ø ments, disposition of the parts may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the parts represented and no additional testing shall be permitted.

5. PREPARATION FOR DELIVERY:

5.1 Packaging: