SAE INTERNATIONAL
The Engineering Society For Advancing Mobility Land Sea Air and Space
400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

An American National Standard

AMS 2474C

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Superseding AMS 2474B

CHEMICAL TREATMENT FOR ALUMINUM ALLOYS
Low Electrical Resistance Coating

1. SCOPE:

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

1.2 Application: Primarily for aluminum and aluminum alloys where increased corrosion resistance, improved paint adhesion, or a low-electrical resistance coating is required. Also useful for improving the corrosion resistance and paint adhesion properties of abraded or discontinuous anodized surfaces of aluminum and aluminum alloy parts.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications 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), Solution Heat Treated

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

ASTM B117 - Salt Spray (Fog) Testing

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

2.3.1 Federal Standards:

FED-STD-141 - Paint, Varnish, Lacquer and Related Materials, Methods of Inspection, Sampling and Testing

2.3.2 Military Specifications:

MIL-P-23377 - Primer Coating, Epoxy Polyamide, Chemical and Solvent Resistant
MIL-P-81352 - Lacquer, Acrylic (For Naval Weapons Systems)

2.3.3 Military Standards:

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Solution: Shall be an aqueous solution of chemicals that will form a coating of chromate meeting the requirements of 3.4.

3.1.1 Only processes which permit adequate solution control by chemical analysis shall be used.

3.1.2 It shall be the responsibility of the vendor of proprietary processing chemicals to supply the purchaser with methods of analysis and directions for maintenance of the solution.

3.2 Preparation:

3.2.1 All heat treatment, machining, forming, brazing, welding, and perforating operations shall, insofar as practicable, be completed before parts are treated.

3.2.1 Parts, prior to being coated, shall have clean surfaces, free from waterbreaks, erosion, or pitting. Cleaning by a process giving a slightly etched surface is desirable. Aklaline residues shall be removed by thorough water rinsing, preferably by spray, after cleaning. This cleaning and etching procedure shall not cause intergranular attack of the base alloy.

3.3 Procedure: Coating shall be applied by immersing parts in the solution of 3.1 for such time and at such temperatures as will produce coatings meeting the requirements of 3.4, followed by rinsing, sealing if required, and drying. If parts are not to be coated all over, the solution may be applied by brushing, swabbing, or spraying the surfaces to be coated.

3.4 Properties: The coating shall conform to the following requirements:

3.4.1 Corrosion Resistance: Samples of AMS 4037 aluminum alloy sheet, nominally 0.040 x 3 x 10 in. (1 x 75 x 250 mm), treated in accordance with 3.3, shall withstand exposure for 168 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. (970 cm^2) of test area 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. (195 cm2), except those area within 1/4 in. (6.25 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.

3.4.2 Adhesion: The test of 3.4.2.1 shall apply unless purchaser specifies or permits the test of 3.4.2.2:

3.4.2.1 Knife Test: A sample of AMS 4037 aluminum alloy sheet shall be treated in accordance with 3.3 and finished with one coat of MIL-P-23377 epoxy primer to a dry film thickness of 0.0005 - 0.0008 in. (12.5 - 20 µ m) and two coats of MIL-L-81352 white acrylic lacquer to a dry film thickness of 0.0008 - 0.0012 in. (20 - 30 µ m) per coat. The primer shall be overcoated with the topcoat within 1 to 2 hr after application of primer. Panels shall be allowed to dry for not less than 72 hr and tested for adhesion in accordance with FED-STD-141, Method 6304. The painted panels shall show no evidence of blisters or flaking in the areas adjacent to the scribing.

3.4.2.2 Tape Test: Painted panels, prepared as in 3.4.2.1, shall be tested for adhesion in accordance with FED-STD-141, Method 6301. Panels shall show no evidence of paint separation between the primer and the conversion coating or between the conversion coating and the subtrate.

3.4.3 Electrical Resistance: The electrical contact resistance of AMS 4037 aluminum alloy panels, treated in accordance with 3.3 and tested under an applied electrode pressure of 200 psi (1.40 MPag), shall be not greater than 5000 µΩper sq in. (8µΩ/mm^2 as applied and 10,000 µΩ per sq in. (16µΩ/mm^2 after exposure to the salt spray test of 3.4.1. Individual readings not greater than 20% higher than the specified maximums shall be acceptable, provided that the average of all determinations does not exceed the specified maximum resistance. A Kelvin connection shall be used to make all electrical measurements.

3.4.3.1 The applied load shall be within 1% of the calculated 200 psi (1.40 MPag) applied pressure. The contacting electrodes shall be copper or silver plated copper with a finish not rougher than that obtained by the use of 000 metallographic abrasive paper. The electrodes shall be sufficiently flat so that when the load is applied without a specimen between them, light will not be visible between the contacting surfaces. The area of the upper electrode shall be 1 sq in. (6.5mm^2) with the area of the lower electrode somewhat larger. Ten measurements shall be made on each panel at different locations on the surface of the panel.

3.5 Quality: The coating, as received by purchaser, shall be continuous, nonpowdery, free from scratches and other imperfections detrimental to usage of the coating. Color of chromate coatings may range from iridescent yellow to dark olive green.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The coating vendor shall supply all samples 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 0 electrical resistance as applied (3.4.3) and quality (3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for 0 corrosion resistance (3.4.1), adhesion (3.4.2), and electrical resistance after salt spray test (3.4.3) and of cleaning and processing solutions to ensure that the deposited coating will conform to the requirements of this specification are classified as periodic tests and 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 requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of coated parts to a purchaser, when a change in material, 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 For Acceptance Tests: Shall be in accordance with MIL-STD-105, Normal Inspection Level II, with an acceptance quality level (AQL) of 2.5 on coated parts.

4.3.2 For Periodic Tests and Preproduction Tests: As agreed upon by purchaser and vendor.