

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard



AMS 2468F

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Superseding AMS 2468E

Hard Anodic Coating Treatment of Aluminum Alloys

1. SCOPE:

1.1 Purpose:

This specification establishes the engineering requirements for producing a hard coating on aluminum alloys and the properties of such coating.

1.2 Application:

This coating has been used typically to increase, by the formation of a dense aluminum oxide, surface hardness and resistance to abrasion and corrosion of aluminum-alloy parts containing, in general, less than 6% copper or 8% silicon or a total of 8% of both, but usage is not limited to such applications. Alloys with higher silicon content alone can be coated satisfactorily with proper precautions in processing. Careful consideration should be given to the use of this process on highly-stressed parts because of the resultant marked lowering of fatigue performance and on parts with sharp corners and edges where chipping may result.

1.3 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

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2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 4037 Aluminum Alloy, Sheet and Plate, 4.4Cu-1.5Mg-0.60Mn, 2024-T3 Sheet, 2024-T351 Plate

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 137 Measurement of Weight of Coating on Anodically Coated Aluminum

ASTM B 244 Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Base Metals with Eddy-Current Instruments

ASTM B 487 Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of a Cross Section

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

FED-STD-141 Paint, Varnish, Lacquer and Related Materials; Methods for Sampling and Testing

3. TECHNICAL REQUIREMENTS:

3.1 Preparation:

3.1.1 Parts, prior to being coated, shall have clean surfaces, free from water-break.

3.1.2 When parts are to be selectively coated, electrical contact should be made on a surface not required to be coated. When parts are not to be masked, the areas in which electrical contact is permissible shall be indicated on the drawing.

3.1.3 Aluminum parts having faying surfaces which may trap electrolyte or inserts of other metals shall have those areas masked off before the parts are coated.

3.2 Procedure:

Shall consist of the formation of aluminum oxide on surfaces of parts made the anode in a suitable electrolyte. After coating, parts shall be thoroughly rinsed in cold, clean water and dried.

3.2.1 Parts shall not be sealed, unless specified by purchaser (See 8.2.8).

3.3 Properties:

Coating on parts shall conform to the following requirements:

3.3.1 Thickness: AMS 2468 designates finished coating thickness of 0.002 inch $\pm$ 0.0005 (0.05 mm $\pm$ 0.013). Other coating thicknesses may be specified by this specification number and a suffix number designating the nominal thickness in thousandths of an inch (25 μ m). A tolerance of $\pm$ 0.0005 inch ($\pm$ 0.013 mm) in thickness of coating will be allowed. Thus, AMS 2468-3 designates a finished coating thickness of 0.003 $\pm$ 0.0005 (0.08 mm $\pm$ 0.013).

3.3.1.1 Thickness of coating shall be determined on representative parts or specimens by microscopic method, micrometer measurement, ASTM B 244 or ASTM B 487, or other method acceptable to purchaser. When micrometer measurement is used, specimens for thickness determination shall be of the same alloy as the parts they represent and shall be processed with the parts. Micrometer measurements shall be calibrated against microscopic measurements on specimens of the same alloy processed to the same nominal coating thickness. Coating thickness requirements shall not apply to blind holes or recesses with depth greater than twice the diameter or in open holes with depth greater than seven times the diameter unless a specific coating thickness is specified in those areas.

3.3.2 Coating Weight: Shall be not less than 0.030 grams per square inch/0.001 inch (0.118 g/cm²/mm) of coating thickness, determined in accordance with ASTM B 137 on unsealed coatings.

3.3.3 Color: Shall be substantially uniform on pieces of the same alloy processed to the same nominal coating thickness. Coated surfaces shall not have a sooty appearance or the presence of a moiré pattern.

3.3.4 Abrasion Resistance: Unsealed, coated specimen (See 4.3.2.2) shall have a maximum wear index of 3.5 mg/1000 cycles on aluminum alloys having a copper content of two percent or higher and a wear index not greater than 1.5 mg/1000 cycles for all other alloys, determined as follows; two test specimens weighed to the nearest milligram shall be tested in accordance with method 6192.1 of FED STD 141 using CS-17 wheels with a 1000 gram load. Specimens may be placed in a desiccator prior to and following test to establish constant weight. The wheels shall revolve on the anodic coating at a speed of 70 revolutions per minute (RPM) for 10,000 cycles. The abrasive wheels shall be resurfaced at least once every 10,000 cycles. The wear index is determined at the end of 10,000 cycles by dividing the weight loss by ten.

3.4 Quality:

Coating, as received by purchaser, shall be substantially uniform in thickness except in small holes unless a specific coating thickness is specified, and in fillets, radii, and deep recesses, and shall be free from scratches, chips, and burned areas. Small irregularities at points of electrical contact are permitted.

3.5 Tolerances:

When a limited area to be hard coated is specified, a tolerance of -0, +0.063 inch (+1.60 mm) will be permitted on the extent of the hard coated area except when such area ends at a corner; in such case, the area shall not extend beyond the corner by more than the projected thickness of the coating.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The processor shall supply all samples for processor's tests and shall be responsible for all required tests. Parts, if required for tests shall be supplied by the purchaser. 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 for thickness (3.3.1) or coating weight (3.3.2), color (3.3.3), and quality (3.4) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests for coating weight (3.3.2) unless determined in lieu of thickness for acceptance, abrasion resistance (3.3.4) and for cleaning and processing solutions to insure that coating will conform to the requirements of this specification, are 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 for all technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of coated parts to a purchaser, when a change in material and/or processing requires reapproval as in 4.4.2, and when a purchaser deems confirmatory testing to be required.

4.3 Sampling and Testing:

Shall be as follows; a lot shall be all parts made of the same part number processed to the same solutions, under the same conditions in not longer than eight consecutive hours, and presented for processor's inspection at one time:

4.3.1 For Acceptance Tests: Shall be as shown in Table 1.

4.3.2 For Periodic Tests and Preproduction Tests: Frequency of sampling shall be at discretion of the processor unless otherwise specified.

TABLE 1 - Sampling for Acceptance Testing

Number of Parts in Lot	Color and Quality	Thickness or Coating Weight, as Applicable
Up to 7	All	3
8 to 15	7	4
16 to 40	10	4
41 to 110	15	5
111 to 300	25	6
301 to 500	35	7
Over 500	50	8

4.3.2.1 Samples for determination of coating weight shall be actual coated 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 test panels 0.025 to 0.063 inch (0.64 to 1.60 mm) in nominal thickness and not less than 3 inches (76 mm) square and, except as specified in 4.3.2.1.1, made of the same alloy as the parts and processed with the parts they represent.

4.3.2.1.1 Test panels of an alloy different from that of the parts they represent may be used if acceptable to purchaser. In such case, panels shall be processed under conditions, previously established, which will produce the same coating thickness as that on the parts they represent.

4.3.2.2 Abrasion resistance shall be determined on production parts provided they can be adapted to the test. If parts are of a configuration or size not readily adaptable to the specified test or when destructive testing is not practical or it is not economically acceptable to perform destructive tests on actual production parts, separate panels may be used.

4.4 Approval:

4.4.1 The process and control procedures, a preproduction sample coated part, or both, whichever is specified, shall be approved by the cognizant engineering organization before production coated parts are supplied.

4.4.2 The processor shall make no significant changes in materials, processes, or control factors from those on which the approval was based, unless the change is approved by the cognizant engineering organization. A significant change is one which, in the judgement of the cognizant engineering organization, could affect the properties or performance of the coated parts.

4.4.3 Control factors shall include, but not be limited to, the following:

Surface preparation methods
Composition limits and temperature limits of anodizing bath
Method for determining coating thickness, and if micrometer measurements are used, correlation between measurements and actual thickness
Anodizing voltage limits, and voltage ramp rates where voltage is not constant
Periodic test plan

4.5 Reports:

The processor of coated parts shall furnish with each shipment a report stating that the parts have been processed and tested in accordance with the technical requirements and that the parts conform to the acceptance test requirements. This report shall include the purchase order number, lot number, AMS 2468F, part number, and quantity.

4.6 Resampling and Retesting:

4.6.1 If the results of any acceptance test fails to meet specified requirements, the parts may be stripped with the approval of the cognizant engineering organization by a method that does not roughen, pit, or adversely affect part dimension, pretreated, coated, sealed, if specified, as defined herein, and tested. Alternatively, all parts in the lot may be inspected for the nonconforming attribute, and the nonconforming parts may be stripped with the approval of the cognizant engineering organization by a method that does not roughen, pit, or adversely affect part dimensions, pretreated, coated, sealed, if specified, as defined herein, and tested.

4.6.2 If the results of any periodic test fail to meet the specified requirements, the process is nonconforming. No additional part shall be coated until the process is corrected and new specimens are coated and tested. Results of all tests shall be recorded and, when requested, reported. Purchaser shall be notified of all parts coated since the last acceptable test.

5. PREPARATION FOR DELIVERY:

5.1 Coated parts shall be handled and packaged to ensure that the required physical characteristics and properties are preserved.

5.2 Packages of coated parts shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the coated parts to ensure carrier acceptance and safe delivery.

6. ACKNOWLEDGMENT:

A processor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.