



AEROSPACE MATERIAL SPECIFICATION

AMS2472™**REV. J**Issued 1965-02
Revised 2024-11

Superseding AMS2472H

Anodic Treatment of Aluminum Alloys
Sulfuric Acid Process, Dyed Coatings

RATIONALE

AMS2472J is the result of a Five-Year Review and update of this specification with changes to Ordering Information, Application (see 1.2.1), Definitions (see 2.3.1), Solutions (see 3.1.2.1), Fixture/Electrical Contact Locations (see 3.2.3), Corrosion Resistance (see 3.4.2), control factors (see 4.4.3), and notes (see 8.6 and 8.7).

NOTICE

ORDERING INFORMATION: The following information shall be provided to the processor by the purchaser:

1. Purchase order shall specify not less than the following:

- AMS2472J
 - Basis metal to be anodized
 - Required color (see 3.1.2)
 - Special features, geometry, or processing present on parts that requires special attention by the processor
 - Quantity of pieces to be anodized
 - Optional: fixture/electrical contact locations, when not specified (see 3.2.3)
2. Parts manufacturing operations such as heat treating, shot peening, media finishing, forming, joining, brazing, welding, perforating, and machining performed prior to anodizing can affect the condition of the substrate and should be performed prior to anodizing. If performed after anodizing, they can adversely affect the finished coating. The sequencing of these types of operations should be specified by the cognizant engineering organization or the purchaser and is not controlled by this specification.

1. SCOPE

1.1 Purpose

This specification establishes the requirements for dyed anodic coatings on aluminum alloys.

SAE Executive Standards Committee 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."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2024 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, or used for text and data mining, AI training, or similar technologies, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
http://www.sae.org

SAE WEB ADDRESS:

For more information on this standard, visit
<https://www.sae.org/standards/content/AMS2472J/>

1.2 Application

This process has been used typically to increase corrosion resistance and to produce colored surfaces on aluminum alloy parts, but usage is not limited to such applications.

1.2.1 AMS2470, AMS2471, or AMS35+0 should be specified for coatings to be used as a base for paint or other organic finishes.

1.2.2 AMS2472 is not suitable for parts that contain joints or recesses in which the anodizing solutions may be retained.

1.3 Classification

This specification covers two types of coating classified as follows:

Class 1 - Coatings for identification

Class 2 - Coatings for decorative purposes

When no class is specified, Class 1 shall be supplied.

1.4 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 that 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 issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2470 Anodic Treatment of Aluminum Alloys, Chromic Acid Process

AMS2471 Anodic Treatment of Aluminum Alloys, Sulfuric Acid Process, Undyed Coating

AMS2473 Chemical Film Treatment for Aluminum Alloys, General Purpose Coating

AMS4037 Aluminum Alloy, Sheet and Plate, 4.4Cu - 1.5Mg - 0.60Mn (2024; -T3 Flat Sheet, -T351 Plate), Solution Heat Treated

AMS-STD-595 Colors Used in Government Procurement

ARP4992 Periodic Test for Processing Solutions

AS7766 Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B117 Operating Salt Spray (Fog) Apparatus

ASTM B137 Measurement of Coating Mass Per Unit Area on Anodically Coated Aluminum

ASTM B374 Terminology Relating to Electroplating

2.3 Definitions

Terms used in AMS are defined in AS7766 and as follows:

2.3.1 CORROSION PIT

A corrosion pit, as used in 3.4.2, is defined as an area of localized corrosion having a depth greater than its width. Pit size may be determined by either direct dimensional measurement or by comparison to known references. A superficial pit or discontinuity in the anodize surface itself, not penetrating through to the base metal and not showing the presence of white corrosion products, is not rejectable. As a general rule, a rejectable corrosion pit usually displays a characteristic tail or line of white aluminum corrosion products.

3. TECHNICAL REQUIREMENTS

3.1 Solutions

3.1.1 Electrolyte shall be an aqueous solution of sulfuric acid of suitable concentration (see 8.2.1) maintained within $\pm 2^\circ\text{F}$ ($\pm 1^\circ\text{C}$) of the temperature approved in 4.4.3.

3.1.2 Dye shall be as required to produce the specified color.

3.1.2.1 AMS-STD-595 may be used as a guide for specifying color of anodized coatings (see 8.7).

3.1.3 Sealer shall be an aqueous solution of nickel acetate, cobalt acetate, or other solution permitted by the cognizant engineering organization (see 8.2.2).

3.2 Preparation

3.2.1 Cleaning and Deoxidation

Parts shall have clean surfaces, free from water break, prior to immersion in the anodizing bath.

3.2.2 Masking

Areas where anodizing is prohibited shall be masked.

3.2.3 Fixture/Electrical Contact Locations

Tight fixture/electrical contact shall be maintained during the anodic treatment process in order to prevent damage or contact arcing (burning) of parts, but small irregularities of coating at points of fixture/electrical contact are acceptable.

3.2.3.1 For parts that are to be anodized all over, and contact locations are not specified, contact locations shall be at the discretion of the processor.

3.2.3.2 For parts that are not to be anodized all over, and contact locations are not specified, contact locations shall be in areas on which coating is not required.

3.3 Procedure

3.3.1 Anodizing

3.3.1.1 The cleaned parts shall be made the anode(s) in the electrolyte contained in a chemical-resistant tank, which may also serve as the cathode. The processing shall be adjusted to obtain the required weight and quality of the coatings. The anodizing current shall be maintained within ± 2 amperes per square foot ($\pm 21.5 \text{ A/m}^2$) of the nominal value.

3.3.1.2 Alternatively, the anodizing current shall be ramped up over a 5-minute, or other preselected, period to the desired final voltage and maintained until the anodic coating reaches the desired coating weight.

3.3.1.3 After anodizing, parts shall be rinsed thoroughly in water at ambient temperature.

3.3.2 Dyeing

Prior to sealing, parts shall be dyed to the specified color by immersing in an appropriate dye solution. The temperature of the solution and the time of immersion shall be as necessary to produce the specified color. Parts shall then be rinsed in water at ambient temperature.

3.3.3 Sealing

Parts shall be immersed in the sealer solution for a suitable time (see 8.2.10). After sealing, the parts shall be thoroughly rinsed in clean water at ambient temperature followed by an optional clean hot water rinse to facilitate drying and then dried.

3.3.4 Touch Up

Damaged areas of parts on which the anodic coating has been scratched or damaged superficially may be coated using AMS2473 or other method permitted by the cognizant engineering organization. Touch up, unless otherwise specified, shall not exceed 0.5 inch (13 mm) in its longest dimension, except that scratches that are essentially one dimensional (less than 0.03-inch [0.8-mm] wide) may be reworked. The total reworked area shall not exceed 5% of the total anodized area.

3.4 Properties

Coated parts shall conform to the following requirements:

3.4.1 Coating Weight

The undyed and unsealed coating weight (see 4.3.3.2) shall be determined in accordance with ASTM B137 and shall comply with Table 1.

Table 1 - Coating weight requirements

Class	Minimum Coating Weight, mg/ft ² (g/m ²)
1	600 (6.5)
2	2500 (27)
2 high copper content alloys ⁽¹⁾	1400 (15)

⁽¹⁾ Wrought aluminum alloys of the 2000 series where copper is the major alloying element and aluminum casting alloys with a nominal copper content of 1% or higher.

3.4.1.1 If small parts, such as rivets or machine screws, are anodized in bulk in a container, the specified coating weight shall apply to not less than 75% of the parts treated together, determined by random sampling. In no case shall any part show uncoated areas.

3.4.2 Corrosion Resistance

Specimens (see 4.3.3.3) shall meet the following requirements, determined after exposure for not less than 336 hours to salt spray corrosion test in accordance with ASTM B117, except that the significant surface shall be inclined back approximately 6 degrees from vertical. The five test specimens shall show not more than a total of 15 isolated corrosion pits, as defined in 2.3.1, none larger than 1/32 inch in diameter, in a total of 150 square inches (968 cm²) of test area. Areas within 1/16 inch (1.6 mm) of identification markings or of an edge, or at electrode contact marks, shall not be included. Individual test specimens shall show no more than five isolated corrosion pits, none larger than 1/32 inch in a total of 30 square inches (194 cm²) (see 2.3.1).

3.5 Quality

Anodic coating, as received by the purchaser, 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 usage of the coating. Slight variations in color between cast and machined surfaces, between welds and adjacent areas, due to grain size or grain flow variations, or due to variation in alloy composition from lot to lot are acceptable (see 8.6).

3.5.1 The transition zone between the masked and anodized surfaces may not be uniform. Some anodize leakage onto the previously masked surfaces can be expected. However, this transition zone should not exceed 0.050-inch (1.3-mm) wide. To the extent this anodize leakage may extend beyond a 0.050-inch (1.3-mm) wide transition zone, the extent of leakage should be agreed upon with the cognizant engineering organization.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The coating processor shall supply all samples for the processor's tests and shall be responsible for the performance of all required tests. Parts, if required for tests, shall be supplied by the purchaser. The purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that processing conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Quality (see 3.5) and color (see 3.3.2) are acceptance tests and shall be performed on parts, or samples representing parts when permitted, from each lot.

4.2.2 Periodic Tests

Coating weight (see 3.4.1) and corrosion resistance (see 3.4.2) are periodic tests and shall be performed at least monthly in any month that parts are processed unless frequency of testing is specified by the cognizant quality organization. Tests of cleaning and processing solutions are periodic tests and shall be performed at a frequency established by the processor unless frequency of testing is specified by the cognizant quality organization (see 4.4.3 and 8.4).

4.2.2.1 Periodic testing may be suspended in any test period when parts are not processed but shall be performed before or at the time such processing is resumed. Preproduction testing may be required by the cognizant engineering organization upon resumption of processing.

4.2.3 Preproduction Tests

All property verification tests (see 3.4) are preproduction tests and shall be performed prior to or on the initial shipment of processed parts to a purchaser and when the cognizant engineering organization requires confirmatory testing.

- 4.3 Sampling and testing 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 (see 3.3.1 to 3.3.3, inclusive) for no longer than 24 consecutive hours, and presented for the processor's inspection at one time:

4.3.1 Acceptance Tests

Acceptance test samples shall be randomly selected from the lot. A lot is a group of parts, all of the same part number, processed through the same chemical solutions in the same tanks under the same conditions that have completed the chemical processing within a period of 24 hours of each other and are presented to inspection at the same time. The minimum number of samples shall be as shown in Table 2.

Table 2 - Sampling for acceptance testing

Number of Parts In Lot	Quality and Color
Up to 7	All or 7 ⁽¹⁾
8 to 15	7
16 to 40	10
41 to 110	15
111 to 300	25
301 to 500	35
Over 500	50

⁽¹⁾ Whichever is less.

4.3.2 Periodic Tests

Sample quantities shall be three for coating weight and five for corrosion resistance unless otherwise specified by the cognizant engineering organization.

4.3.3 Sample Configuration

- 4.3.3.1 Separate test specimens may be used under any one of the following circumstances: the parts are of such configuration or size as to be not readily adaptable to specified tests; nondestructive testing is not practical on actual parts; or it is not economically acceptable to perform destructive tests on actual parts. Acceptance test specimens shall be distributed within the lot, cleaned, anodized, and sealed with the parts represented.
- 4.3.3.2 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- to 0.063-inch (0.64- to 1.60-mm) thick and not less than 3 inches (76 mm) square fabricated from 2024-T3 aluminum alloy in accordance with AMS4037.
- 4.3.3.3 Corrosion-resistance test specimens shall be 0.025- to 0.063-inch (0.64- to 1.60-mm) thick and not less than 3 x 10 inches (76 x 254 mm) in width and length fabricated from 2024-T3 aluminum alloy in accordance with AMS4037.

4.4 Approval

- 4.4.1 Processes, control factors, or preproduction sample part or test specimen, or any combination thereof specified, shall be approved by the cognizant engineering organization before production parts are supplied.
- 4.4.2 If the processor makes a significant change to any material, process, or control factor from that which was used for process approval, all preproduction tests shall be performed and the results submitted to the cognizant engineering organization for process reapproval, unless the change is approved by the cognizant engineering organization. A significant change is one which, in the judgment of the cognizant engineering organization, could affect the properties or performance of the parts. Production parts anodized by the revised procedure shall not be shipped prior to receipt of reapproval.

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

- Cleaning procedure, including the compositions and temperatures of the baths used
- Deoxidation process
- Fixture/electrical contact locations when approval is required by the cognizant engineering organization
- Anodizing bath composition, including impurity limits, temperature, and agitation method
- Rate of voltage rise, anodizing voltage, and time of anodizing
- Sealing solution composition, including impurity limits, temperature, and pH
- Dye solution composition and temperature
- Touch-up method, if used
- Purity of water used for sealing and rinsing
- Stripping procedure, when applicable
- Periodic test plan for cleaning and processing solutions (see 8.4)

4.5 Reports

The processor shall furnish with each shipment a report stating that the parts have been processed and tested in accordance with the requirements of this specification and that they conform to all test requirements. This report shall include the purchase order number, lot identification number, AMS2472J, part number, and quantity.

4.6 Resampling and Retesting

4.6.1 If any acceptance test fails to meet specified test requirements, the parts in that lot may be stripped, pretreated, coated, post-treated as defined herein, and retested. Alternatively, all parts in the lot may be inspected for the nonconforming attribute, and the nonconforming parts may be stripped, pretreated, coated, post-treated as defined herein, and retested. After stripping and re-anodizing, parts shall meet the dimensions on the drawing.

4.6.1.1 When stripping is performed, the method shall be permitted by the cognizant engineering organization and shall not roughen, pit, or embrittle the basis metal or adversely affect part dimensions. When parts have been stripped and re-anodized, the cognizant engineering organization shall be informed.

4.6.2 If any periodic test fails to meet specified test requirements, the process is nonconforming. No additional parts shall be anodized until the process is corrected and new specimens are coated and tested. Results of all tests shall be recorded and, when requested, reported. All purchasers 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 of the coating 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 parts to ensure carrier acceptance and safe delivery.

6. ACKNOWLEDGMENT

The processor shall mention AMS2472J in all quotations and when acknowledging purchase orders.

7. REJECTIONS

Parts on which the coating does not conform to this specification, or to modifications authorized by the cognizant engineering organization, will be subject to rejection.