SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2477

Issued FEB 2005

Conversion Coating for Aluminum Alloys
Low Electrical Resistance Coating

1. SCOPE:

1.1 Purpose:

This specification covers the requirements for a low-electrical-resistance chemical conversion coating on aluminum and aluminum alloy parts.

1.2 Application:

This process has been used typically to provide aluminum with a thin inorganic film that improves corrosion resistance and adhesion of organic coatings and possesses low electrical resistance.

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 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 canceled and no superseding document has been specified, the last published issue of that document shall apply.

TO PLACE A DOCUMENT ORDER:
Tel: 877-606-7323 (inside USA and Canada)
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: custsvc@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

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2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org

AMS 4027	Aluminum Alloy, Sheet and Plate, 1.0Mg 0.60Si 0.28Cu 0.20Cr (6061; -T6 Sheet, -T651 Plate), Solution and Precipitation Heat Treated
AMS 4037	Aluminum Alloy, Sheet and Plate, 4.4 Cu 1.5 Mg 0.60 Mn, Solution Heat Treated

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, P.O. Box C700, West Conshocken, PA 15248-2959 or www.astm.org.

ASTM B 117	Operating Salt Spray (Fog) Apparatus
ASTM D 3359	Test Methods for Measuring Adhesion by Tape Test

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5044 or www.dsp.dla.mil

MIL-PRF-23377	Primer Coatings: Epoxy High-Solids
MIL-P-53022	Primer, Epoxy Coating, Corrosion Inhibiting, Lead and Chromate Free
MIL-P-53030	Primer Coating, Epoxy, Water Reducible, Lead and Chromate Free
MIL-PRF-85582	Primer Coatings: Epoxy, Waterborne

3. TECHNICAL REQUIREMENTS:

3.1 Preparation:

3.1.1 Location of racking points shall be on areas not to be coated or where acceptable to purchaser.

3.1.2 The coating shall be applied over a surface free from water breaks. The cleaning procedure shall not produce pitting or intergranular attack of the basis metal and shall preserve dimensional requirements. (See 8.5.)

3.2 Procedure:

3.2.1 The application process shall consist of immersion, spray, pen, or brush (swab) application of a solution capable of generating a coating compliant with the requirements of this specification. (See 8.6.)

3.2.2 Touchup: Unless otherwise specified by the purchaser, areas from which the coating has been removed may be touched up provided the area touched-up does not exceed 5 percent of the total surface area of the part.

3.3 Properties:

Coated surfaces shall conform to the following requirements:

3.3.1 Electrical contact resistance of the coated product shall not exceed 0.005 ohm (5 milliohm) per square inch when tested in accordance with a procedure acceptable to purchaser (See 8.11)

3.3.2 Corrosion Resistance: The basis metal shall not show evidence of corrosion beyond the limits specified below after exposure to 168 hours ± 1 to salt spray corrosion testing in accordance with ASTM B 117 with the exposed surface of test panels inclined back approximately 6 degrees from vertical.

3.3.2.1 No specimen shall show more than five isolated spots or pits (See 8.8), none larger than 0.031 inch (0.79 mm) in diameter. Areas within 0.25 inch (6.4 mm) from the edges, identification markings, and racking points shall be excluded. Loss of color shall not be cause for rejection.

3.3.2.2 No more than 15 isolated spots or pits, none larger than 0.031 (0.79 mm) in diameter, on the combined surface area of all five test panels. (See 8.8.)

3.3.2.3 Electrical contact resistance after salt fog exposure shall not exceed 0.010 ohm (10 milliohm) per square inch when tested in accordance with a procedure acceptable to purchaser. (See 8.11)

3.3.3 Color: Coating shall be any distinctive color that distinguishes coated from the uncoated items. (See 8.9.)

3.3.4 Primer Adhesion: Primer in accordance with MIL-P-53022, MIL-P-53030, MIL-PRF-23377, or MIL-PRF-85582 applied over the conversion coating shall show no separation between the primer and the conversion coating when tested in accordance with ASTM D 3359 dry tape method

3.4 3.4 Quality:

3.4.1 The coating, as received by purchaser, shall be continuous, adherent to basis metal, and visually free from powdery residue, pin holes, pits, and other imperfections detrimental to usage of the parts. Appearance shall be uniform although slight variations in color are permissible.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The processor shall supply all samples for processor's tests and shall be responsible for performance of all required tests. When parts are to be tested, the parts shall be supplied by 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: Color (3.3.3) and quality (3.4) are acceptance tests and shall be performed on parts, or samples representing parts when permitted, from each lot.

4.2.2 Periodic Tests: Corrosion resistance (3.4.1), primer adhesion (3.3.4), and tests of cleaning and coating solutions (See 8.4) are periodic tests and shall be performed at a frequency selected by the processor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: All property verification tests (section 3.3) are preproduction tests shall be performed prior to production and when purchaser deems confirmatory testing to be required.

4.3 Sampling for testing shall be not less than the following; a lot shall be all parts of the same part number coated in the same set of solutions in each consecutive 24 hours of operation, and presented for processor's inspection at one time:

4.3.1 Acceptance Tests: Test samples shall be randomly selected from all parts in the lot. The minimum number of samples shall be as shown in Table 1.

TABLE 1 - Sampling for Acceptance Tests

Number of Parts in Lot	Quality and Color
up to 6	All
7 to 15	7
16 to 40	10
41 to 110	15
111 to 300	25
301 to 500	35
501 to 700	50
701 to 1200	75
over 1200	125

4.3.2 For Periodic Tests: Sample quantities and frequency of testing shall be selected at the discretion of the processor, unless otherwise specified. Five test panels are normally required for corrosion resistance tests.

4.3.3 Sample Configuration:

4.3.3.1 AMS 4037 test panels for corrosion resistance testing shall be cleaned and processed with parts and shall be 10 x 3 inch (254 x 76 mm) with a minimum thickness of 0.020 inch (0.51 mm).

4.3.3.2 AMS 4027 test panels for electrical resistance testing shall be cleaned and processed with parts. Dimensions, number of test panels, and number and location of readings shall be in accordance with the test procedure. (See 3.3.1.)

4.4 Approval:

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

4.4.2 The processor shall make no significant change to materials, processes, or controls 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 judgment of the cognizant engineering organization could affect the properties or performance of the parts.

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

Surface preparation and cleaning methods
Coating material trade name and manufacturer
Coating bath composition and composition control limits
Coating bath temperature limits and controls
Primer application and adhesion test procedure
Electrical contact resistance test procedure
Stripping procedure, when applicable
Periodic test plan (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 specified requirements and that they conform to the acceptance test requirements. This report shall include the purchase order number, AMS 2477, 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, and 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, and post treated as defined herein, and retested. After stripping and recoating, parts shall meet the dimensions on the drawing.

4.6.1.1 When stripping is performed, the method shall be acceptable to the purchaser and shall not roughen, pit, or embrittle the basis metal or adversely affect part dimensions.

4.6.2 If any periodic test fails to meet specified test requirements, the process is nonconforming. No additional parts 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. Purchasers shall be notified of all parts coated since the last acceptable test.

5. PREPARATION FOR DELIVERY:

5.1 Parts shall be handled and packaged in such a manner as will 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 this specification number in all quotations and when acknowledging purchase orders.

7. REJECTIONS:

Parts on which coating does not conform to this specification or to modifications authorized by purchaser will be subject to rejection.

8. NOTES:

8.1 The change bar (|) located in the left margin is for convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this specification. An (R) symbol to the left of the document title indicates a complete revision of the specification including technical revisions, change bars and (R) are not used in original publications, nor in specifications that contain editorial changes only.

8.2 Part manufacturing operations, such as heat treatment, forming, joining, and media finishing, can affect the condition of the substrate, or, if performed after coating, could adversely affect the coating. Achieving a durable, low-electrical-resistance assembled bond joint typically requires removal of all coatings down to bare aluminum, brush application of the conversion coating to a specific contact area, drying, and sealing of the joint. The sequencing of operations and the maximum joint resistance should be specified by the cognizant engineering organization and is not controlled by this specification.