The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2427B

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Submitted for recognition as an American National Standard

Superseding AMS 2427A

ALUMINUM COATING
Ion Vapor Deposition

1. SCOPE:

1.1 Purpose:

This specification covers the engineering requirements for ion vapor deposition (IVD) of aluminum on steel, titanium, and aluminum alloys and the properties of the deposit.

1.2 Application:

This process has been used typically to provide a corrosion-resistant coating on parts operating at service temperatures up to 925 °F (496 °C) and requiring freedom from hydrogen embrittlement and solid metal embrittlement, but usage is not limited to such applications.

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.

2.1 SAE Publications:

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

AMS 2473 Chemical Treatment For Aluminum Alloys, General Purpose Coating

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM B 117 Salt Spray (Fog) Testing
ASTM B 487 Measurement of Metal and Oxide Coating Thicknesses by Microscopical Examination of a Cross Section
ASTM B 499 Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals
ASTM E 290 Semi-Guided Bend Test for Ductility of Metallic Materials
ASTM E 376 Measuring Coating Thickness by Magnetic-Field or Eddy Current (Electromagnetic) Test Methods

2.3 U.S. Government Publications:

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

MIL-STD-2073-1 DOD Materiel, Procedures for Development and Application of Packaging Requirements

3. TECHNICAL REQUIREMENTS:

3.1 Preparation:

3.1.1 All fabrication-type operations, such as forming, heat treating, brazing, welding, and nondestructive testing, shall be completed before parts or assemblies are coated.

3.1.2 Ferrous parts having a tensile strength of 220 ksi (1517 MPa) or greater shall not be exposed to hydrogen embrittling processes, such as mineral acid pickling, cathodic cleaning, and etching, or to corrosive environments.

3.1.3 Aluminum or corrosion-resistant steel foil or specially configured aluminum or corrosion-resistant steel masking or plugs shall be used to mask areas where the coating is not desired. Aluminum tape may be used where it is not practical to use foil. The quantity of aluminum tape used shall be minimized.

3.2 Procedure:

3.2.1 The coating process shall consist of deposition of vaporized metallic aluminum, from wire of 99.0% minimum purity, on parts which are made the cathode of a high voltage system within a suitable vacuum. The coating shall be applied directly to the basis metal.

3.2.2 The equipment and processes employed shall be adequate to completely cover all visible surfaces, including roots of threads, recesses, and sharp corners.

3.2.2.1 Parts which require coating to two or more thicknesses in different areas shall be coated using a procedure agreed upon by purchaser and processor.

3.2.3 The temperature of the parts during deposition of the coating shall be controlled so as not to reduce hardness of titanium and aluminum alloy parts by more than two HRB numbers and of steel parts to below the minimum of the specified hardness range (See 8.2).

3.3 Post Treatment:

Coated parts shall receive a supplementary chromate treatment in accordance with AMS 2473.

3.4 Properties:

The deposited aluminum shall conform to the following requirements:

3.4.1 Thickness: Shall be as specified on the drawing, determined, on representative parts or test panels, in accordance with ASTM B 487, ASTM B 499, ASTM E 376, micrometer measurements, or other method acceptable to purchaser.

3.4.1.1 (R) Coating thickness may be specified by AMS 2427 and a suffix number normally designating the minimum thickness in ten-thousandths of an inch (μm) as shown in Table 1. The maximum thickness shall be 0.0005 inch (12.7 μm) greater than the minimum.

TABLE 1 - Coating Thickness and Salt Spray Corrosion Resistance Requirements

AMS Thickness Designation	Thickness (1) Inch	Thickness (1) Micrometers	Salt Spray Resistance (2) Hours
-3	0.0003 to 0.0008	7.6 to 20.3	336
-5	0.0005 to 0.0010	12.7 to 25.4	504
-10	0.0010 to 0.0015	25.4 to 38.1	672

Notes:
(1) A part having coating thickness greater than the above shall not be rejected unless the thickness causes the part to exceed drawing tolerances.
(2) Salt spray resistance requirements are for coated parts with supplementary chromate treatment.

3.4.1.2 Holes, recesses, internal threads, and other areas where a controlled deposit cannot be obtained shall not be subject to a thickness requirement. However, there shall be visual evidence of coating in the holes and recesses to a depth at least the diameter of the hole or recess. The resultant thickness shall be considered only when such surfaces of parts can be touched by a sphere 0.75 inch (19.0 mm) in diameter.

3.4.1.2.1 If internal surfaces, as defined in 3.4.1.2, are required to be coated to a specified thickness, notes on the drawing will so specify.

3.4.2 Adhesion: Specimens as in 4.3.3 shall not show separation of the coating from the basis metal, when examined at approximately 4X magnification, after being bent rapidly at room temperature in accordance with ASTM E 290, through an angle of 180 degrees around a diameter equal to the nominal thickness of the specimen. Formation of cracks which do not result in flaking or blistering of the coating is acceptable.

3.4.3 Corrosion Resistance: Except as specified in 3.4.3.1, ferrous metal parts, or representative test panels made of the same metal as the parts represented, shall show no visual evidence of corrosion of the basis metal after being subjected for a time not less than specified in Table 1 to continuous salt spray corrosion test conducted in accordance with ASTM B 117.

3.4.3.1 Salt spray corrosion tests shall not apply to coated parts made of aluminum, titanium, or austenitic corrosion-resistant steels or to parts made of any corrosion-resistant steel or alloy when not coated all over.

3.4.4 Recoating to cover bare spots is not permitted.

3.5 Quality:

Coating, as received by purchaser, shall be smooth, continuous, adherent to basis metal, uniform in appearance, and essentially free from pin holes, porosity, blisters, nodules, pits, and other imperfections detrimental to performance of the coating. Slight staining or discoloration is permissible. Standards for acceptance shall be as agreed upon by purchaser and processor.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The processor shall supply all samples for processor's tests and shall be responsible for performing all required tests. Parts, if required for tests, 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: Loss of hardness (3.2.3), thickness (3.4.1), adhesion (3.4.2), and quality (3.5) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Corrosion-resistance (3.4.3) and tests of equipment and process controls to ensure that the deposited metal will conform to specified requirements 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 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 approval by the cognizant engineering organization (See 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, contracting officer, or request for procurement.

4.3 Sampling and Testing:

Shall be not less than the following; a lot shall be all parts of essentially the same size, shape, and basis metal, heat treated to the same hardness or tensile strength level, processed in a single pump down to the same coating thickness, and presented for processor's inspection at one time.

4.3.1 For Acceptance Tests:

4.3.1.1 Loss of Hardness: Three parts from each lot.

4.3.1.2 Thickness: Three parts from each lot.

4.3.1.3 Adhesion: Three parts from each lot.

4.3.1.4 A statistical sampling plan, acceptable to purchaser, may be in used lieu of sampling as in 4.3.1.

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

4.3.3 When coated parts are of such configuration or size as to be not readily adaptable to the specified tests, separate test specimens, cleaned, coated, and post treated with the parts they represent, may be used. For adhesion tests, such specimens shall be panels of annealed low-carbon steel approximately 0.032 x 1 x 4 inches (0.81 x 25 x 102 mm) and for thickness and quality tests shall be panels of the same size and type or shall be bars approximately 0.5 inch (13 mm) in diameter and 4 inches (102 mm) long. For corrosion resistance tests, specimens shall be panels 0.062 to 0.125 inch (1.57 to 3.18 mm) in nominal thickness and not less than 4 inches (102 mm) long by 3 inches (76 mm) wide.

4.4 Approval:

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