Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 2408D
Superseding AMS 2408C
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TIN PLATING

1. SCOPE:

1.1 Purpose: This specification covers the engineering requirements for electrodeposition of tin on metals and the properties of the deposit.

1.2 Application: Primarily to prevent galling or seizing of metal surfaces, to provide a surface for soldering, and to prevent the formation of case during nitriding. Corrosion resistance is improved by tin plating.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

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

ASTM B487 - Measurement of Metal and Oxide Coating Thicknesses by Microscopical Examination of a Cross Section
ASTM B499 - Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metal
ASTM B504 - Measurement of the Thickness of Metallic Coatings by the Coulometric Method
ASTM B529 - Measurement of Coating Thicknesses by the Eddy-Current Test Method: Nonconductive Coatings on Nonmagnetic Basis Metals
ASTM B545 - Electrodeposited Coatings of Tin

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

2.3.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Preparation:

3.1.1 All machining, brazing, welding, forming, and heat treating shall be completed before the parts are plated, unless otherwise specified.

3.1.2 All steel parts having tensile strength of 150,000 psi (1034 MPa) and higher which are machined, ground, cold-formed, or cold-straightened shall be stress-relieved by heating to a temperature not lower than 375°F (190°C) for not less than 3 hr and cooling prior to cleaning for plating.

3.1.3 Before placing parts in plating solutions, they shall have chemically clean surfaces, prepared with minimum abrasion, erosion, or pitting.

3.1.4 Parts having hardness of 33 HRC and higher and parts roll-threaded after heat treatment shall not be cleaned in inorganic acids (hydrochloric or sulfuric) unless specifically approved; cleaning of other parts with inorganic acids is not prohibited but permission to use that method on a particular part shall first be obtained from purchaser. In either case, a momentary dip in acid after alkaline cleaning is permissible.

3.1.5 Parts shall be within drawing limits before plating, unless otherwise specified.

3.1.5.1 In lieu of the requirement of 3.1.5 and unless otherwise specified all engine and propeller utility parts having part numbers with the prefix AN, MS, or AS and required to be plated in accordance with this specification shall be made to such dimensions that parts will be within drawing limits after plating. Undercutting before plating shall not be permitted unless specifically authorized.

3.1.6 Electrical contacts between the parts and power source shall be made in such a manner as will ensure that neither chemical or immersion deposition nor electrical arcing or overheating will occur. If parts are to be plated all over, contact points shall be located where specified or where agreed upon by purchaser and vendor. If parts are not required to be plated all over, contact points shall be located in areas on which plating is not required or is optional.

3.2 Procedure:

3.2.1 Except as required in 3.2.2, tin shall be electrodeposited directly on the basis metal from an alkaline stannate solution, a stannous sulfate solution, or a stannous fluoborate solution.

3.2.2 Prior to electrodeposition of tin for solderability of copper-zinc alloy parts, a copper plate shall be deposited to a thickness not less than 0.0001 in. (3 μm).

3.2.3 The plated parts shall be removed from the plating solution, thoroughly rinsed, and dried.

3.3 Post Treatment:

3.3.1 After plating, rinsing, and drying, parts, except those plated to prevent nitriding, shall be heated as follows, unless otherwise permitted, to remove hydrogen embrittlement; heating shall be in air, preferably in a circulating-air furnace.

3.3.1.1 Ferrous parts, including roll-threaded parts, cold worked after being heat treated by hardening and tempering, springs, and other parts having hardness of 33 HRC and higher shall be heated to 375°F ± 25 (190° C ± 15) and held at heat for not less than 3 hours.

3.3.1.2 Ferrous parts and assemblies, including carburized parts, which will decrease in hardness or be otherwise deleteriously affected by heating to 375°F ± 25 (190°C ± 15) shall be heated to 275°F ± 25 (135°C ± 15) and held at heat for not less than 7 hours.

3.3.1.3 Copper alloy parts, other than those of copper-beryllium alloys, having tensile strength of 140,000 psi (965 MPa) and higher shall be heated to 275° F ± 25 (135° C ± 15) and held at heat for not less than 3 hours.

3.3.1.4 Parts requiring special handling shall be treated as agreed upon by purchaser and vendor.

3.4 Properties:

3.4.1 Thickness: Shall be as follows, determined in accordance with ASTM B487, ASTM B499, ASTM B504, ASTM B529, ASTM B545, or other suitable method agreed upon by purchaser and vendor:

3.4.1.1 Plate thickness may be specified by this specification number and a suffix number designating the minimum thickness in ten-thousandths of an inch; thus, AMS 2408-1 designates a plate thickness of 0.0001 - 0.0003 in. (3 - 8 µm), AMS 2408-6 designates a thickness of 0.0006 - 0.0008 in. (15 - 20 µm), etc. A tolerance of + 0.0002 in. (5 µm) will be allowed, unless otherwise specified.

3.4.1.2 Where "tin flash" is specified, plate thickness shall be approximately 0.0001 in. (3 µm).

3.4.1.3 The plate shall be substantially uniform in thickness on significant surfaces except that slight build-up on exterior corners or edges will be permitted provided finished drawing dimensions are met.

3.4.1.4 No requirements are established for minimum plate thickness for surfaces of holes, recesses, internal threads, contact areas of parts plated all over, and other areas where a controlled deposit cannot be obtained under normal plating conditions, but such areas shall not be masked to prevent plating. Unless otherwise specified, the resultant thickness shall be considered only when such surfaces of parts can be touched by a sphere 0.75 in. (19.0 mm) in diameter.

3.4.2 Adhesion: Specimens shall not show separation of the plating from the basis metal, when examined at up to 4X magnification, after repeated bending through an angle of approximately 180 deg around a diameter equal to the thickness of the specimen until failure of the basis metal occurs. Formation of cracks which do not result in flaking, peeling, or blistering of the plating is acceptable.

3.4.3 Solderability: When specified, solderability of the plating shall be in accordance with ASTM B545. The method of test shall be as specified by the purchaser.

3.4.4 Continuity of Plating: When specified, plating on ferrous parts having a plating thickness of 0.0004 in. (10 µm) or more shall be subjected to the porosity test of ASTM B545 and the result evaluated according to the procedure described. When specified, plating on copper or copper alloys shall be subjected to the porosity test for copper basis metal given in ASTM B545; the specimens shall be considered to have failed if pores in the coating are blackened by the polysulfide test.

3.5 Quality: Plated surfaces shall be smooth, continuous, adherent to basis metal, uniform in appearance, and not coarsely crystalline and shall be free from pin holes, blisters, nodules, pits, and other imperfections detrimental to fabrication, appearance, or performance of parts. Slight staining or discoloration is permissible.

3.5.1 Double plating and spotting-in after plating are not permitted, unless otherwise specified.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The processing vendor shall supply all samples 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 perform such confirmatory testing as he deems 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 thickness (3.4.1) and quality (3.5) and, when specified, solderability (3.4.3) and continuity of plating (3.4.4) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for adhesion (3.4.2) and tests of cleaning and plating solutions to ensure that the plated deposit 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 on the first-article shipment of plated parts to a purchaser, when a change in material or processing 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 made of the same material, heat treated to essentially the same hardness or tensile strength level, plated to the same range of plate thickness in the same solutions, and presented for vendor's inspection at one time.

4.3.1 Acceptance Tests:

4.3.1.1 Thickness: Three parts from each lot.

4.3.1.2 Quality and, When Specified, Solderability and Continuity of Deposit: As agreed upon by purchaser and vendor.

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

4.3.3 When plated parts are of such configuration or size as to be not readily adaptable to specified tests, separate specimens plated concurrently with parts represented may be used. Such specimens shall be approximately 0.032 x 4 x 1 in. (1 x 100 x 25 mm) and shall be of the same basis material, heat treated to the same strength level, and shall have essentially the same surface finish as the parts they represent.

4.4 Approval:

4.4.1 To ensure adequate performance characteristics, plated parts shall be approved by purchaser before parts for production use are supplied, unless such approval be waived. Results of tests on production parts shall be essentially equivalent to those on the approved sample parts.

4.4.2 Vendor shall use manufacturing procedures, processes, and methods of inspection on production parts which are essentially the same as those used on the approved sample parts. If any change is necessary in type of equipment or in established composition limits or operating conditions of process solutions, vendor shall submit for reapproval of the process a statement of the proposed changes in processing and, when requested, sample revised plated parts, test panels, or both. Production parts plated by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Reports: The processing vendor shall furnish with each shipment three copies of a report stating that the parts have been processed and tested in accordance with this specification and that they conform to the acceptance test requirements. This report shall include this specification number and its revision letter, part number, and quantity.