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

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2434A

Issued JUL 1998
Revised FEB 1999

Submitted for recognition as an American National Standard

Plating, Tin-Zinc Alloy

1. SCOPE:

1.1 Purpose:

This specification covers the requirements for the electrodeposition of tin-zinc plating on metal parts and the properties of the deposit.

1.2 Application:

This plating has been used typically as a corrosion resistant plating where cadmium cannot be used, as a replacement for tin plating where tin whisker growth is a concern, a coating for fasteners where thread lubricity is desirable, and for parts which are to be joined using tin-lead solders, but usage is not limited to such applications.

1.3 Classification:

Plating covered by this specification is classified as follows:

Type 1 - As plated
Type 2 - With supplementary surface treatment

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 the 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.

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS: http://www.sae.org

2.1 SAE Publications:

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

AMS 2418	Plating, Copper
AMS 4751	Solder, Tin-Lead, Eutectic

2.2 ASTM Publications:

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

ASTM B 117	Operating Salt Spray (Fog) Testing Apparatus
ASTM B 253	Preparation of Aluminum Alloys for Electroplating
ASTM B 487	Measurement of Metal and Oxide Coating Thicknesses by Microscopic Examination of a Cross-Section
ASTM B 499	Measurement of Coating Thickness by the Magnetic Method, Nonmagnetic Coatings on Magnetic Basis Metals
ASTM B 567	Measurement of Coating Thickness by the Beta Backscatter Method
ASTM B 568	Measurement of Coating Thickness by X-Ray Spectrometry
ASTM B 571	Adhesion of Metallic Coatings
ASTM F 519	Mechanical Hydrogen Embrittlement Testing of Plating Processes and Aircraft Maintenance Chemicals

3. TECHNICAL REQUIREMENTS:

3.1 Preparation:

3.1.1 Unless otherwise specified, parts shall be within drawing dimensions before plating, except as specified in 3.1.1.1.

3.1.1.1 All engine and propeller utility parts having numbers with prefix AN, AS, or MS, 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 authorized by purchaser.

3.1.2 Steel parts having a hardness of 40 HRC or higher and which have been ground after heat treatment shall be cleaned to remove surface contamination and stress relieved before preparation for plating. Unless otherwise specified, the stress relief temperature shall not be less than 275 °F (135 °C) for not less than five hours for parts with hardness of 55 HRC or greater or for parts that would be harmed by higher exposure temperatures, or not less than 375 °F (191 °C) for not less than four hours for other parts.

3.1.3 Care must be used if parts are to be cleaned with acid which may pit the surface or induce hydrogen embrittlement in ferrous alloys. This includes, but is not limited to, hydrochloric and sulfuric acids. In general a momentary dip in such acids for surface activation or neutralization after alkaline cleaning is permissible, but immersion for an extended time is prohibited.

3.1.4 Except for Barrel plating, electrical contact between the parts and power source shall be made to prevent chemical or immersion deposition, electrical arcing, and overheating. 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 where plating is not required or optional.

3.2 Procedure:

3.2.1 Except as noted, tin-zinc shall be electrodeposited directly on the basis metal from a suitable tin-zinc solution. Unless otherwise specified, a wet or dry abrasive cleaning that does not change dimensions of the part may be used to assist adhesion of the plate.

3.2.1.1 Nickel or cobalt alloys and corrosion resistant steels may be given a nickel strike prior to tin-zinc plating. A zincate immersion treatment in accordance with ASTM B 253 may be used for plating on aluminum alloys.

3.3 Post treatment:

3.3.1 Parts shall be given a hydrogen embrittlement relief or adhesion enhancement treatment in a circulating air furnace in accordance with Table 1. Treatment shall begin within four hours of the completion of the plating operation.

TABLE 1 - Post Plating Baking Conditions

Material	Temperature	Time, Hours Minimum
Carburized parts	275 °F ± 25 (135 °C ± 14)	23
Other steels over HRC 55	275 °F ± 25 (135 °C ± 14)	23
Steel parts HRC 40 and higher	375 °F ± 25 (191 °C ± 14)	5
Threaded fasteners HRC 31 and higher	375 °F ± 25 (191 °C ± 14)	5
PH steels and aged below 1000 °F (538 °C)	375 °F ± 25 (191 °C ± 14)	5
Adhesion enhancement, Aluminum Alloy parts (see 8.7)	225 °F ± 25 (107 °C ± 14)	1
Adhesion enhancement, other alloys (optional)	225 °F ± 25 (107 °C ± 14)	1

3.3.2 Type 2 parts, which require hydrogen embrittlement relief in accordance with Table 1 shall be chemical conversion coated after baking and surface reactivation. The chemical conversion coating process, which retards the formation of white corrosion product sufficiently to meet the requirements of 3.4.4, shall be acceptable to the purchaser. Waxes, oils or other water repellent systems shall not be used for this purpose.

3.4 Properties:

3.4.1 Thickness: Thickness of the plated deposit shall be as specified on the engineering drawing, determined in accordance with ASTM B 487, ASTM B 499, ASTM B 567, ASTM B 568 or other method acceptable to purchaser.

3.4.1.1 The plate shall be substantially uniform in thickness on significant surfaces, except that build-up at exterior corners or edges will be permitted provided the dimensional tolerances of the engineering drawing are met.

3.4.1.2 All surfaces of the part, except those which cannot be touched by a sphere 0.75 inch (19 mm) in diameter, shall be plated to the specified thickness. Unless otherwise specified, surfaces such as holes, recesses, threads and other areas where a controlled deposit cannot be obtained under normal plating conditions, may be under the specified limit provided they show visual plating coverage.

3.4.1.3 Where a tin-zinc flash plate is specified, plate thickness shall be approximately 0.0001 inch (2.5 µm).

3.4.2 Composition: The plated deposit shall have a composition of 70 to 90% tin and 10 to 30% zinc, as determined by a method acceptable to purchaser (see 8.5). In case of dispute, one or more of the parts may be stripped of coating, and the resultant solution analyzed by conventional wet chemical methods for relative proportions of tin and zinc.

3.4.3 Adhesion: Plate shall be firmly and continuously bonded to the base metal, determined on representative parts or specimens in accordance with the heat quench method described in ASTM B 571 using temperatures described for tin plating.

3.4.4 Corrosion Resistance: Type 2 parts or specimens having a plate thickness of 0.0003 to 0.0005 inch (8 to 13 µm) shall show neither white corrosion product after 96 hours of continuous salt spray test nor basis metal corrosion after 500 hours of continuous salt spray test conducted in accordance with ASTM B 117. The presence of white corrosion product within 0.25 inch (6.3 mm) from the edges of the specimen shall not constitute failure.

3.4.5 Hydrogen Embrittlement: The plating process shall not cause embrittlement in ferrous parts when tested in accordance with ASTM F 519.

3.4.6 Solderability: When specified, Type 1 deposits shall demonstrate acceptable solderability using AMS 4651 tin-lead solder and mildly reactive rosin (RMA) flux. THe solder shall flow uniformly and shall show no evidence of dewetted areas.

3.5 Quality:

3.5.1 Plating as received by purchaser shall be smooth, continuous, fine grained, uniform in appearance, and visually free from pits, blisters, nodules and other imperfections detrimental to usage of the plating. Slight staining or discoloration is permissible.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

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

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Thickness (3.4.1), adhesion (3.4.3), solderability, when specified (3.4.6) and quality are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Composition (3.4.2) corrosion resistance (3.4.4), hydrogen embrittlement (3.4.5) and tests of cleaning and plating solutions are periodic tests (see 8.4) and shall be performed at a frequency selected by the processor unless frequency is specified by purchaser.

4.2.3 Preproduction Tests: All technical requirements of this specification are preproduction tests and shall be performed prior to or on the initial shipment of plated parts to a purchaser, when a change in materials and/or processing requires approval by the cognizant engineering organization (see 4.4.2), and when purchaser requires confirmatory testing to be required.

4.3 Sampling and Testing:

4.3.1 Sample Configuration:

4.3.1.1 Nondestructive testing shall be performed wherever practical. Except as noted, actual parts shall be selected as samples for tests.

4.3.1.2 When plated parts are of such configuration or size as to be not readily adaptable to the specified tests or when non destructive testing is not practical on actual parts, or is not economically acceptable to perform, destructive tests on actual parts, separate test specimens of the same generic class of alloy as the parts represented, cleaned, plated, and post treated with the represented may be used.

4.3.1.3 Test panels for corrosion testing, when required, shall be fabricated from low carbon steel, approximately 0.032 to 0.062 inches (0.81 to 1.6 mm) thick and approximately 4 x 6 inches (104 x 152 mm) long.

4.3.1.4 Hydrogen embrittlement test specimens shall conform to ASTM F 519 Type 1 using notched round bars stressed in tension under constant load. For test purposes, plating thickness shall be 0.002 inch ± 0.002 (51 µm ± 5) measured on the smooth section of the specimen, but with visual evidence of plating in the root of the notch.

4.3.2 Sample Quantity:

4.3.2.1 For Acceptance Tests: The number of specimens shall be in accordance with Table 2. A lot shall be all parts of the same part number, plated to the same range of plate thickness in the same solutions in each eight hours of continuous production and presented for processor's inspection at one time.

TABLE 2 - Sampling for Acceptance Tests

Number of Parts in Lot	Quality	Thickness, Adhesion and Solderability, when specified
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
501 to 700	50	8
701 to 1200	125	15

4.3.2.2 Periodic Tests: Sample quantity and test frequency shall be at the discretion of the processor unless a test frequency is specified by purchaser.

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
Strike bath composition limits when used
Current or voltage limits of the strike bath when used
Temperature limits of the strike bath, when used
Plating bath composition limits and controls
Plating bath temperature limits
Plating bath current/voltage limits
Methods for measuring plating thickness and adhesion
Method to assure plating composition
Conversion coating method and chemical composition limits when used
Stripping procedures, when applicable
Periodic test plan

4.5 Reports:

The processor of plated parts 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 acceptance test requirements. This report shall include the purchase order, lot number, AMS 2434, part number and quantity.

4.6 Resampling and Retesting:

4.6.1 If the result of any acceptance test fails to meet the specified test requirements, the parts in the lot may be stripped by a method acceptable to the purchaser that does not roughen, pit or chemically embrittle the basis metal, pretreated, plated and post treated as defined herein, and retested. Alternatively, all parts in the lot may be inspected for the non conforming attribute, and the non conforming parts may be stripped by a method acceptable to the purchaser that does not roughen, pit or embrittle the basis metal, pretreated, plated and post treated as defined herein, and retested.

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

5. PREPARATION FOR DELIVERY:

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

5.2 Packages of plated 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 plated parts to ensure carrier acceptance and safe delivery.