AEROSPACE MATERIAL SPECIFICATION

AMS2408	REV. K
Issued 1946-11 Revised 2013-09 Superseding AMS2408J	

Plating, Tin

RATIONALE

AMS2408K includes more detailed requirements for preplate stress relief of steel parts, and adds an alternate adhesion test method.

NOTICE

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

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

- AMS2408K
- Plating thickness (3.4.1)
- Basis metal to be plated
- Tensile strength or hardness of the basis metal
- Pre-plate stress relief to be performed by plating processor (time and temperature) if different from 3.1.1
- Special features, geometry or processing present on parts that requires special attention by the plating processor
- Hydrogen embrittlement relief to be performed by plating processor (parameters or reference document) if different from 3.3.1
- Minimum thickness on internal surfaces, if required (3.4.1.4)
- Optional: Reflow of plating (3.3.2)
- Optional: Solderability (3.4.3)
- Optional: Porosity if required as an acceptance test (3.4.4)
- Optional: Periodic testing frequency (4.2.2) and sample quantity (4.3.2)
- Quantity of pieces to be plated
- Optional: Requirements for the prevention of tin whiskers (3.1.5)

2) Parts manufacturing operations such as heat treating, forming, joining and media finishing can affect the condition of the substrate for plating, or if performed after plating, could adversely affect the plated part. The sequencing of these types of operations should be specified by the cognizant engineering organization or purchaser and is not controlled by this specification.

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
SAE WEB ADDRESS: **http://www.sae.org**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS2408K

1. SCOPE

1.1 Purpose

This specification covers the requirements for electrodeposition of tin on metals and the properties of the deposit.

1.2 Application

This process has been used typically to prevent galling or seizing of metal surfaces, to provide a surface for soft soldering, or to improve corrosion resistance, but usage is not limited to such applications (See 8.6).

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 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 724-776-4970 (outside USA), www.sae.org.

AMS2750 Pyrometry

AMS2759/9 Hydrogen Embrittlement Relief (Baking) of Steel Parts

AS2390 Chemical Process Test Specimen Material

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 B 253 Preparation of Aluminum Alloys for Electroplating

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 B 504 Measurement of Thickness of Metallic Coatings by the Coulometric Method

ASTM B 545 Electrodeposited Coatings of Tin

ASTM B 568 Measurement of Coating Thickness by X-Ray Spectrometry

ASTM B 571 Qualitative Adhesion Testing of Metallic Coatings

ASTM E 376 Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Examination Methods

3. TECHNICAL REQUIREMENTS

3.1 Preparation

3.1.1 All steel parts having a hardness of 40 HRC and above and that are machined, ground, cold formed or cold straightened after heat treatment shall be cleaned to remove surface contamination and thermally stress relieved before plating. (Residual tensile stresses have been found to be damaging during electroplating.) Furnaces used for stress relief shall be controlled per AMS2750. The minimum requirements shall be Class 5, with Type D Instrumentation. Temperatures to which parts are heated shall be such that stress relief is obtained while still maintaining hardness of parts within drawing limits. Unless otherwise specified, the following treatment temperatures and times shall be used:

3.1.1.1 For parts, excluding nitrided parts, having a hardness of 55 HRC and above, and for carburized and induction hardened parts, stress relieve at 275 °F ± 25 (135 °C ± 14) for 5 to 10 hours.

3.1.1.2 For parts having a hardness less than 55 HRC, and for nitrided parts, stress relieve at 375 °F ± 25 (191 °C ± 14) for a minimum of 4 hours. Higher temperatures shall be used only when specified or approved by the cognizant engineering organization.

3.1.1.3 For peened parts: If stress relief temperatures above 375 °F (191 °C) are elected, the stress relieve shall be performed prior to peening or the cognizant engineering organization shall be consulted and shall approve the stress relief temperature.

3.1.2 The plating 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.

3.1.3 Parts shall be within drawing limits before plating, except as specified in 3.1.3.1.

3.1.3.1 All engine and propeller utility parts, having part numbers with the prefix AN, MS, or AS, 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 by the cognizant engineering organization.

3.1.4 Except for barrel plating, electrical contact points shall be as follows. For parts which are to be plated all over, locations shall be acceptable to purchaser; for parts which are not to be plated all over, locations shall be in areas on which plating is not required.

3.1.5 For electronic parts where tin plate becomes the final coating, the plating process and control factors shall be controlled in accordance with 4.4 to minimize or eliminate the propensity for tin whisker formation and growth. See 8.6.

3.2 Procedure

3.2.1 Except as stated in 3.2.1.2 or 3.2.2, tin shall be electrodeposited directly on the basis metal from a suitable tin plating bath.

3.2.1.1 Spotting-in and double plating are prohibited.

3.2.1.2 Aluminum and aluminum alloys shall be zinc treated in accordance with ASTM B 253 or other method acceptable to the cognizant engineering organization prior to plating.

3.2.2 Prior to electrodeposition of tin for solderability on aluminum or copper-zinc alloy parts, a copper plate shall be deposited to a thickness of 0.0002 to 0.0003 inch (5.1 to 7.6 μm).

3.2.3 After plating, parts shall be thoroughly rinsed and dried.

3.3 Post Treatment

3.3.1 Hydrogen embrittlement relief of steel parts shall be in accordance with AMS2759/9.

3.3.2 When specified, the tin plate shall be reflowed by a short immersion in a suitable reflow oil at 510 °F ± 40 (266 °C ± 22). See 8.6 and 8.7.

3.4 Properties

Plating shall conform to the following requirements:

3.4.1 Thickness shall be as follows, determined in accordance with ASTM B 487, ASTM B 499, ASTM B 504, ASTM B 568, ASTM E 376, or other method acceptable to the cognizant engineering organization. In case of dispute, the metallographic methods of ASTM B 487 shall apply.

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 (2.5 μm); thus, AMS2408-1 designates a plate thickness of 0.0001 to 0.0003 inch (2.5 to 8 μm), AMS2408-6 designates a thickness of 0.0006 to 0.0008 inch (15 to 20 μm), etc. A tolerance of +0.0002 inch (5 μm) will be allowed. See 8.7.

3.4.1.2 Where “tin flash” is specified, plate thickness shall be approximately 0.0001 inch (2.5 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 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.

3.4.2 Adhesion shall be determined in accordance with ASTM B 571, heat quench test on plated parts, or 180 deg. bend test to fracture There shall be no indication of separation of the plating from the base metal or internal delamination. Adhesion testing is not required when plated parts have been reflowed in accordance with 3.3.2.

3.4.3 Solderability

When specified, solderability of the plating shall be in accordance with ASTM B 545. The method of test shall be as specified by the cognizant engineering organization.

3.4.4 Porosity

When specified, plating on ferrous parts, having a plating thickness of 0.0004 inch (10 μm) or more, shall be subjected to the porosity test of ASTM B 545 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 B 545; the specimens shall be considered to have failed if pores in the coating are blackened by the polysulfide test.

3.5 Quality

Plating shall be smooth, continuous, free from delamination within the plating, uniform in appearance, and free from imperfections detrimental to usage of the plating. Plating shall be visually free from frosty areas, pin holes, porosity, blisters, nodules, and pits. Slight staining or discoloration is 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 the performance of all required tests. Parts, if required for test, shall be supplied by purchaser. The cognizant engineering organization 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

Thickness (3.4.1), adhesion (3.4.2), quality (3.5), and, when specified, solderability (3.4.3), and/or porosity of plating (3.4.4), are acceptance tests and shall be performed on parts, or samples representing parts when permitted herein, from each lot. See 4.3.3.

4.2.2 Periodic Tests

Porosity (3.4.4) when not required for acceptance testing is a periodic test and shall be performed monthly unless frequency of testing is specified by the cognizant engineering organization. Tests of cleaning and plating solutions are periodic tests and shall be performed at a frequency established by the processor unless frequency of testing is specified by the cognizant engineering organization. See 8.4 and 4.4.2.1.

4.2.3 Preproduction Tests

All property verification tests (Section 3.4) are preproduction tests and shall be performed prior to or on the first-article shipment of plated parts to a purchaser and when the cognizant engineering organization requires confirmatory testing.

4.3 Sampling for testing shall be not less than the following; a lot shall be all parts of the same part number, plated to the same range of plate thickness in the same tanks, within eight hours of operation, and presented for processor's inspection at one time.

4.3.1 Sample Configuration

Nondestructive testing shall be performed wherever practical. Except as noted, actual parts shall be selected as samples for tests. Since properties, such as thickness, may differ on panels, correlation with actual parts shall be established.

4.3.2 Test samples shall be selected randomly from all parts in the lot. Unless the cognizant engineering organization specifies a sampling plan, the minimum number of samples shall be as shown in Table 1.

TABLE 1 - SAMPLING FOR ACCEPTANCE TESTS

Lot Size	Quality	Thickness/ Adhesion	Solderability Continuity of Plate (if required)
1 to 6	All	All or 3*	All or 3*
7 to 15	7	4	4
16 to 40	10	4	4
41 to 110	15	5	5
111 to 300	25	6	6
301 to 500	35	7	7
Over 500	50	8	8

*Whichever is less

4.3.3 Thickness and Adhesion Tests

Separate test panels may be used under any one of the following circumstances: The plated parts are of such configuration or size as to be not readily adaptable to the specified test, 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 made of the same generic class of alloy as the parts, established in accordance with AS2390, distributed within the lot, cleaned, plated, and post treated with the parts.

4.4 Approval

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