

Plating, Tin

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:

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.

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<http://www.sae.org>

**SAE WEB ADDRESS:**

## 2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or [www.sae.org](http://www.sae.org).

AMS 2759/9 Hydrogen Embrittlement Relief (Baking) of Steel Parts

## 2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or [www.astm.org](http://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	Adhesion of Metallic Coatings
ASTM E 376	Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods

## 3. TECHNICAL REQUIREMENTS:

### 3.1 Preparation:

- 3.1.1 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 shall be 275 °F ± 25 (135 °C ± 14) for not less than five hours for parts with hardness of 55 HRC or greater and 375 °F ± 25 (191 °C ± 14) for not less than four hours for other parts.
- 3.1.2 Parts shall have clean surfaces free of water break prior to immersion in the plating solution.
- 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 purchaser.
- 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.

### 3.2 Procedure:

3.2.1 Except as stated in 3.2.1.1 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 is not permitted.

3.2.1.2 For aluminum and aluminum alloys, a zinc immersion coating in accordance with ASTM B 253 is required.

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  $\mu\text{m}$ ).

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 AMS 2759/9.

3.3.1.1 When specified (See 8.6, 8.7, and 8.9), the tin plate shall be reflowed by a short immersion in a suitable reflow oil at 510 °F  $\pm$  40 (266 °C  $\pm$  22).

### 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 545, ASTM B 568, ASTM E 376, or other method acceptable to purchaser. 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  $\mu\text{m}$ ); thus, AMS 2408-1 designates a plate thickness of 0.0001 to 0.0003 inch (2.5 to 8  $\mu\text{m}$ ), AMS 2408-6 designates a thickness of 0.0006 to 0.0008 inch (15 to 20  $\mu\text{m}$ ), etc. A tolerance of +0.0002 inch (5  $\mu\text{m}$ ) 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  $\mu\text{m}$ ).

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 Thickness requirements apply to surfaces that can be touched by a sphere 0.75 inch (19 mm) in diameter. Other areas, such as surfaces of holes, recesses, internal threads, or contact areas of parts plated all over, where a controlled deposit cannot be obtained under normal plating conditions, shall show evidence of plating.

3.4.2 Adhesion: Shall be determined in accordance with ASTM B 571, heat quench test on plated parts. 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 3.3.1.1.

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 purchaser.

3.4.4 Continuity of Plating: When specified, plating on ferrous parts, having a plating thickness of 0.0004 inch (10  $\mu$ m) 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 delaminations 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. Purchaser 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 continuity of plating (3.4.4) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Continuity of plating (3.4.4) when not required for acceptance tests, and tests of cleaning and plating solutions (See 8.4) to ensure that the plated deposit 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 first-article shipment of plated parts to a purchaser, when a change in material and/or processing requires reapproval by the cognizant engineering organization (See 4.4.2), and when purchaser deems confirmatory testing to be required.

## 4.3 Sampling and 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 purchaser 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)	Number of Test Panels (if required) (See 4.3.3)
1 to 6	All	3	3	1
7 to 15	7	4	4	2
16 to 40	10	4	4	3
41 to 110	15	5	5	4
111 to 300	25	6	6	5
301 to 500	35	7	7	6
Over 500	50	8	8	6

- 4.3.3 Thickness and Adhesion Tests: Separate test panels, made of the same generic class of alloy as the parts represented, cleaned, plated, and post-treated with the parts, shall be used when plated parts are of a configuration or size as to be not readily adaptable to the specified test, or when nondestructive testing is not practical on actual parts and it is not economically acceptable to perform destructive tests on actual 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.
- 4.4.2 The processor shall make no significant change to materials, processes, or control factors from those on which 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, would affect the properties or performance of the plated parts.

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

- Surface preparation method(s)
- Composition limits of plating solutions
- Temperature limits of plating baths
- Plating current (or voltage) limits
- Frequency of analysis of plating solutions
- Method used for reflow
- Stripping process, if used
- 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 this specification and that they conform to the acceptance test requirements. This report shall include the purchase order number, lot number, AMS 2408H, part number, and quantity.

#### 4.6 Resampling and Retesting:

- 4.6.1 If results of any acceptance test fail to meet specified requirements, parts in that lot may be stripped by a method acceptable to purchaser that does not roughen, pit, adversely affect part dimensions, or embrittle the basis metal, pretreated, plated, post-treated, and tested. Alternatively, all parts in the lot may be inspected for the nonconforming attribute, and nonconforming parts may be stripped by a method acceptable to purchaser that does not roughen, pit, adversely affect part dimensions, or embrittle the basis metal, pretreated, plated, post-treated, and tested.
- 4.6.2 If results of any periodic test fail to meet specified 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 plate 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.

#### 6. ACKNOWLEDGMENT:

Processor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.