

AEROSPACE MATERIAL SPECIFICATION

AMS 2421B
Superseding AMS 2421A

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PLATING MAGNESIUM FOR SOLDERABILITY Zinc Immersion Process

1. SCOPE: This specification covers the requirements for surface preparation of magnesium and magnesium alloys to provide a surface finish which can be soft soldered.
2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Materials 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
 - AMS 2408 - Tin Plating
 - AMS 4751 - Solder, Tin-Lead, Eutectic, 63Sn - 37Pb
 - 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 E290 - Semi-Guided Bend Test for Ductility of Metallic Materials
 - 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 Impregnation of castings, when required or permitted, shall be done prior to plating. All excess impregnant shall be removed prior to curing or baking.
 - 3.1.2 All machining shall be completed prior to cleaning and plating, unless otherwise specified.
 - ø 3.2 Procedure: Shall consist of thorough cleaning of the magnesium surfaces, pickling, and activating followed by application of a zinc immersion coating, a copper strike, a copper plate, an electro-deposit of tin, and a hot oil reflow,
 - 3.2.1 Cleaning and Pickling: Prior to plating, the parts shall be cleaned to remove grease, oil, and other surface contamination in accordance with the following procedure:

REAPPROVED

3.2.1.1 Vapor degrease when visible coatings of heavy oil or grease are present.

3.2.1.2 Cathodically clean parts in a suitable alkaline aqueous solution at $200^{\circ}\text{F} \pm 10$ ($93^{\circ}\text{C} \pm 5$), using a current density of 10 - 40 asf (108 - 431 A/m²) at 6 volts. The solution shall have pH of 11.0 or higher.

3.2.1.3 Rinse in cold running water.

3.2.1.4 Acid pickle in an aqueous solution suitable for the alloy and form of product being processed.

3.2.1.5 Rinse in cold running water.

3.2.2 Activation and Zinc Immersion Coating: Shall be performed by the following procedure or other suitable method:

3.2.2.1 Immerse in an aqueous solution containing 13 - 14 oz per gal (97 - 105 g/L) ammonium bifluoride and 1.50 - 1.75 pt per gal (188 - 219 mL/L) phosphoric acid at $80^{\circ}\text{F} \pm 10$ ($27^{\circ}\text{C} \pm 5$) for 30 - 120 seconds.

3.2.2.2 Rinse in cold running water.

3.2.2.3 Providing mild agitation to the bath, immerse in a zinc immersion solution containing 3 - 4.5 oz per gal (22.5 - 34 g/L) zinc sulfate monohydrate, 13 - 18 oz per gal (97 - 135 g/L) tetrasodium pyrophosphate, and 0.67 oz per gal (5.0 g/L) sodium fluoride or 0.4 oz or more per gal (3.0 g/L) lithium fluoride at $155^{\circ}\text{F} \pm 5$ ($68^{\circ}\text{C} \pm 3$) for 3 - 15 minutes. The pH of the solution shall be maintained at 10.0 - 10.6 by additions of sodium carbonate.

3.2.2.4 Rinse in cold running water.

3.2.3 Plating:

3.2.3.1 Copper strike in solution of 5.5 oz per gal (41 g/L) copper cyanide, 9.0 oz per gal (67.4 g/L) potassium cyanide, 4.0 oz per gal (30 g/L) potassium fluoride, and 1.0 oz per gal (7.5 g/L) free cyanide, having pH of 9.6 - 10.4 at $140^{\circ}\text{F} \pm 10$ ($60^{\circ}\text{C} \pm 5$), and making electrical contact before immersion.

3.2.3.2 Rinse in cold running water.

3.2.3.3 Copper plate in a high speed copper cyanide solution to a thickness of 0.0004 - 0.0006 in. (10 - 15 μm).

3.2.3.4 Rinse in cold running water.

ø 3.2.3.5 Electrodeposit tin, in accordance with AMS 2408, to a thickness of 0.003 - 0.005 in. (7.5 - 12.5 μm). If other electrodeposit is specified, the thickness shall be as shown on the drawing.

3.2.3.6 Rinse in cold running water.

3.2.3.7 Rinse in hot water and dry.

3.2.3.8 Reflow tin in hot palm oil or other suitable tinning oil at $500^{\circ}\text{F} \pm 25$ ($260^{\circ}\text{C} \pm 15$).

ø 3.2.3.9 Quench in cold trichloroethylene or other equivalent media and vapor degrease to remove any residual reflow oil.

3.3 Properties: The deposited metal shall conform to the following requirements:

- ø 3.3.1 Coverage: The deposit shall be smooth, continuous, adherent to the basis metal, and free from porosity, sags, blisters, or other imperfections detrimental to performance.
- ø 3.3.2 Thickness: Shall be as specified in 3.2.3.3 and 3.2.3.5, determined on representative parts or test panels in accordance with ASTM B487 or other method agreed upon by purchaser and vendor.
- ø 3.3.3 Adhesion: Where practical a test specimen as in 4.3.3 shall withstand, without exhibiting separation of the deposit from the basis metal when examined at approximately 4X magnification, bending in accordance with ASTM E290 at room temperature through an angle of 180 deg around a diameter equal to 4 times the nominal thickness of the specimen. Slight cracking in the bend, which does not result in flaking, is permissible.
- ø 3.3.4 Solderability: The plating shall demonstrate good solderability, determined by soldering the specimen used for the adhesion test in 3.3.3, using AMS 4751 solder and a mildly activated rosin (RWA) flux. No evidence of blistering shall result from the solderability test.

4. QUALITY ASSURANCE PROVISIONS:

- ø 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 tests as he deems necessary to ensure that processing conforms to the requirements of this specification.
- ø 4.2 Classification of Tests:
 - 4.2.1 Acceptance Tests: Tests to determine conformance to requirements for coverage (3.3.1), thickness (3.3.2), adhesion (3.3.3), and solderability (3.3.4) are classified as acceptance tests and shall be performed to represent each lot.
 - 4.2.2 Periodic Tests: Tests of cleaning and plating solutions to ensure that the deposited metal 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 initial 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.
 - ø 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.
- ø 4.3 Sampling: Shall be not less than the following; a lot shall be all parts made of the same alloy plated to the same ranges of plate thicknesses in the same solutions in each consecutive 8-hr period of operation and presented for vendor's inspection at one time.
 - ø 4.3.1 Coverage and Appearance: All parts.
 - ø 4.3.2 Thickness: Three parts, or three specimens as in 4.3.3, from each lot.
 - ø 4.3.3 Heat Resistance, Adhesion, and Solderability: One specimen from each lot. Specimens shall be magnesium and magnesium alloy of a composition similar to that of the parts represented, approximately 0.032 x 4 x 1 in. (1 x 100 x 25 mm), cleaned and plated simultaneously with the parts.
- 4.4 Approval:
 - 4.4.1 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.
 - ø approval be waived. Results of tests on production parts shall be essentially equivalent to those on the approved sample parts.