

 <p>SAE The Engineering Society For Advancing Mobility Land Sea Air and Space® INTERNATIONAL</p> <p>400 Commonwealth Drive, Warrendale, PA 15096-0001</p>	<p>AEROSPACE MATERIAL SPECIFICATION</p>	<p>SAE AMS 2414E</p>
		<p>Issued MAY 1948 Revised MAR 1998</p> <p>Superseding AMS 2414D</p>
<p>Submitted for recognition as an American National Standard</p>		
<p>(R) PLATING, LEAD</p>		
<p>1. SCOPE:</p> <p>1.1 Purpose:</p> <p>This specification covers the engineering requirements for electrodeposition of lead on metal parts and the properties of the deposit.</p> <p>1.2 Application:</p> <p>This process has been used typically to prevent galling of metal parts and to improve the performance of bearings, but usage is not limited to such applications.</p> <p>1.3 Safety - Hazardous Materials:</p> <p>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.</p> <p>2. APPLICABLE DOCUMENTS:</p> <p>The following publications form a part of this specification to the extent specified herein. The applicable issue of referenced publications shall be the issue in effect on the date of the purchase order.</p> <p>2.1 ASTM Publications:</p> <p>Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.</p> <p>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</p>		

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2.1 (Continued):

- 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 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 Coating

3. TECHNICAL REQUIREMENTS:

3.1 Preparation:

- 3.1.1 Parts having 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 be within the range 275 to 300 °F (135 to 149 °C) for not less than five hours for parts with hardness of 55 HRC or higher and be within the range of 375 to 400 °F (191 to 204 °C) 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 picking or plating solutions.
 - 3.1.2.1 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.
 - 3.1.3 Electrical contacts between the parts and power source shall be made to 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 processor. 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 Parts shall be plated by electrodeposition of lead from a suitable lead plating solution directly on the basis metal except that, in the case of parts made of corrosion-resistant steels and high speed steels, a suitable strike plate may be used for bonding purposes.
 - 3.2.1.1 For aluminum or aluminum alloys a zinc immersion preplate in accordance with ASTM B 253 is required.
- 3.2.2 After plating, the parts shall be thoroughly rinsed in running water to remove plating solution, rinsed in hot water, dried, and protected against corrosion.

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3.3 Properties:

The deposited lead shall conform to the following requirements:

- 3.3.1 Thickness:** AMS 2414 shall designate plate thickness of 0.0005 to 0.0007 inch (13 to 18 μm), determined on representative parts or test panels in accordance with ASTM B 487, ASTM B 499, ASTM B 504, ASTM B 567, ASTM B 568, or other method acceptable to purchaser.
- 3.3.1.1** Plate thickness may be specified by AMS 2414 and a suffix number normally designating the minimum thickness in ten-thousandths of an inch (μm); the maximum plate thickness shall be 0.0002 inch (5 μm) greater than the minimum. Thus, AMS 2414-2 designates a thickness of 0.0002 to 0.0004 inch (5 to 10 μm) and AMS 2414-6 designates a thickness of 0.0006 to 0.0008 inch (15 to 20 μm).
- 3.3.1.2** Where "lead flash" is specified, the thickness of lead deposit shall be approximately 0.0001 inch (2.5 μm).
- 3.3.1.3** The plate shall be substantially uniform in thickness on significant surfaces except that slight build-up on exterior corners or edges is acceptable provided finished drawing dimensions are met.
- 3.3.1.4** For electroplated parts, all surfaces of the part, except those which cannot be touched by a sphere 0.75 inch (19.0 mm) in diameter, shall be plated to the thickness specified. Exempt surfaces, such as holes, recesses, internal threads, and other areas where a controlled deposit cannot be obtained under normal plating conditions, may have thickness less than specified limits, provided they show coverage. Coverage cannot be expected, however, below one diameter depth in holes unless auxiliary anodes are used.
- 3.3.2 Adhesion:** Shall be determined in accordance with ASTM B 571 by a method acceptable to purchaser.

3.4 Quality:

Plating, as received by purchaser, shall be continuous, adherent to basis metal, uniform in appearance, and essentially free from pin holes, porosity, blisters, nodules, pits, and other imperfections detrimental to usage of the plating. Slight staining or discoloration is permissible. There shall be no evidence of double plating or spotting in.

4. QUALITY ASSURANCE PROVISIONS:**4.1 Responsibility for Inspection:**

The processor shall supply all samples for processor's tests and shall be responsible for 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 requirements of this specification.

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4.2 Classification of Tests:

- 4.2.1 **Acceptance Tests:** Thickness (3.3.1), adhesion (3.3.2), and quality (3.4) are 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 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 (See 8.4).
- 4.2.3 **Preproduction Tests:** All technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of plated parts to a purchaser, when a change in material and/or processing requires approval by the cognizant engineering organization (See 4.4.2), and when purchaser deems confirmatory testing to be required.

4.3 Sampling for Tests:

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 specimens for tests.
- 4.3.1.2 **Thickness and Adhesion Tests:** Separate test panels made of the same generic class of alloy as the parts, cleaned, plated, and post-treated with the parts represented, may be used when plated parts are of a configuration or size not readily adaptable to specified tests, when nondestructive testing is not practical on actual parts, or it is not economically acceptable to perform destructive tests on actual parts.

4.3.2 Sample Quantity:

- 4.3.2.1 **Acceptance Tests:** Shall be in accordance with Table 1. A lot shall be all parts of the same part number, processed in the same solutions within eight consecutive hours of continuous operation, and presented for processor's inspection at one time.

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TABLE 1 - Sampling for Acceptance

Number of Parts in Lot	Quality	Thickness and Adhesion
1 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	75	10
Over 1200	125	15

4.3.2.2 Preproduction and Periodic Tests: Sample quantity and frequency of testing shall be selected at the discretion of the processor unless otherwise specified by purchaser.

4.4 Approval:

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

4.4.2 The processor of plated parts shall make no significant change in bath type, plating conditions, or control factors 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 plated parts.

4.4.2.1 Control factors include, but are not limited to, the following:

- Surface preparation
- Bath type and composition limits
- Temperature limits and control of processing solutions
- Method of thickness determination
- Periodic test plan