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400 COMMONWEALTH DRIVE WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 2415E
Superseding AMS 2415D

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LEAD AND INDIUM PLATING

1. SCOPE:

1.1 Purpose: This specification covers the engineering requirements for electrodeposition of lead and indium and diffusion of the indium into the lead, and the properties of the deposit.

1.2 Application: Primarily to improve the performance and prevent corrosion of bearings or of other parts where applicable.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B244 - Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments

ASTM B487 - Measurement of Metal and Oxide Coating Thicknesses by Microscopical Examination of a Cross Section

ASTM B499 - Measurement of Coating Thicknesses by Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals

ASTM B504 - Measurement of Thickness of Metallic Coatings by the Coulometric Method

2.3 U.S. 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 Machined surfaces shall be within drawing limits after lead and indium plating, unless otherwise specified. The surfaces may be machined outside the drawing limits before plating by an amount equal to the specified minimum combined thickness of plate.

3.1.2 When specified by purchaser, the surfaces to be plated shall be blasted lightly with fine sand to obtain a matte finish.

3.1.3 Parts having hardness of 40 HRC or over and which have been ground after heat treatment shall be suitably stress-relieved before cleaning for plating. Temperature to which parts are heated shall be such that maximum stress relief is obtained without reducing hardness of parts below drawing limits.

3.1.4 Prior to plating, parts shall have chemically clean surfaces prepared with minimum abrasion, erosion, or pitting; treatments which may produce hydrogen embrittlement shall be avoided.

3.1.5 Electrical contact between the parts and power source shall be made in such a manner as will 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 vendor. 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 Lead Plating:

3.2.1.1 Parts shall be plated by electrodeposition of lead from a suitable lead plating solution directly onto the cleaned basis metal.

3.2.1.2 After completion of the lead plating operation, the plated parts shall be rinsed immediately in running water and, except as specified in 3.2.1.2.1, transferred directly to the indium plating solution.

3.2.1.2.1 If indium cyanide is used in the make up of the indium plating bath, the lead plated parts, after rinsing, shall be immersed in a suitable sodium cyanide solution to neutralize remaining traces of acid lead solution and again thoroughly rinsed in running water.

3.2.1.3 Parts shall not be permitted to dry between the time they are removed from the rinse after lead plating and the time they are immersed in the indium plating solution.

3.2.2 Indium Plating:

3.2.2.1 The plating process shall consist of electrodeposition of indium from a suitable indium plating solution onto the rinsed, wet, lead plated surfaces of the part.

3.2.2.2 The plated parts shall be removed from the plating solution, thoroughly rinsed, and dried.

3.3 Post Treatment: Parts, after plating, rinsing, and drying, shall be heated in an oil bath to 340° - 350°F (170° - 175°C) and held at heat for not less than 2 hr, unless otherwise specified, to diffuse the indium into the lead. Heat treated parts, including carburized parts, which will decrease in hardness or be otherwise deleteriously affected if heated to 350°F (175°C) shall be post treated by a method approved by purchaser.

3.4 Properties: The deposited lead and indium shall conform to the following requirements:

3.4.1 Composition: The weight of indium deposited shall be within the range 5.5 - 8.0% of the weight of deposited lead, unless otherwise specified, determined by a method agreed upon by purchaser and vendor.

3.4.2 Thickness: The combined thickness of lead and indium shall be as specified on the drawing, determined in accordance with ASTM B244, ASTM B487, ASTM B499, ASTM B504, or other suitable method, as agreed upon by purchaser and vendor. A tolerance of ±0.0001 in. (2.5 µm) in the combined thickness of lead and indium shall be allowed when the nominal thickness is 0.001 in. (2.5 µm) or less. A tolerance of ±0.0002 in. (6.2 µm) in combined thickness of lead and indium shall be allowed when the nominal thickness is over 0.001 in. (2.5 µm). These tolerances apply except when other maximum and minimum values are specified.

3.5 Quality: The lead and indium deposit shall be smooth, continuous, dense, adherent to basis metal, and free from pin holes and blisters. Staining or discoloration, which may appear on plated parts after the diffusion treatment or during storage, is not permissible.

3.5.1 Double plating and spotting-in after plating are not permitted, unless otherwise authorized by purchaser.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The processing vendor shall supply all Ø samples for vendor's tests 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 sample and to perform any confirmatory testing deemed necessary to ensure that the processing conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to all technical Ø requirements of this specification are classified as acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests to determine conformance to all technical Ø requirements of this specification are classified as preproduction tests and shall be performed on the first-article shipment of plated parts to a purchaser, when a change in bath composition and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when Ø 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.

4.3 Sampling: Shall be not less than the following; a lot shall be all parts made of the same material, heat treated to essentially the same hardness or tensile strength level, plated to the same range of plate thickness in the same solutions, and presented for vendor's inspection at one time:

4.3.1 Composition: One part for each 8 hr of operation of each combination of lead and indium plating tank.

4.3.2 Thickness: Three parts from each lot.

4.3.3 Coverage and Appearance: All parts in each lot.

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 by purchaser. Results of tests on production parts shall be essentially equivalent to those on the approved sample parts.