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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2415F

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Submitted for recognition as an American National Standard

Superseding AMS 2415E

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.

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 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.

2.1 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

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

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2.2 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.2.1 Military Standards:

MIL-STD-2073-1 - DOD Materiel, Procedures for Development and Application of Packaging Requirements

3. TECHNICAL REQUIREMENTS:

3.1 Preparation:

3.1.1 All forming, machining, heat treating, brazing, and welding shall be completed before parts are plated. Ø

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

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 (171° - 177°C) and held at heat for not less than 2 hours 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 (177°C) shall be post treated by a method acceptable to 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, determined by a method acceptable to purchaser.

3.4.2 Thickness: The combined thickness of lead and indium shall be as specified on the drawing, determined in accordance with ASTM B 487, ASTM B 499, ASTM B 504, ASTM E 376, or other method acceptable to purchaser. A tolerance of ± 0.0001 inch (±2.5 µm) in the combined thickness of lead and indium shall be allowed when the nominal thickness is 0.001 inch (25 µm) or under. A tolerance of ± 0.00025 inch (±6.4 µm) in combined thickness of lead and indium shall be allowed when the nominal thickness is over 0.001 inch (25 µm). These tolerances apply unless other values are specified.

3.5 Quality: The lead and indium deposit, as received by purchaser, shall be smooth, continuous, dense, adherent to basis metal, and free from pin holes, blisters, and other imperfections detrimental to usage of plated parts.

3.5.1 Staining or discoloration, which may appear on the deposits after the diffusion treatment or during storage, is not acceptable.

3.5.2 Double plating and spotting-in after plating are not permitted.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The processing vendor shall supply all samples for vendor's tests and shall be responsible for performing all required tests. 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: Tests for all technical requirements are acceptance tests and preproduction tests and shall be performed prior to or on the initial shipment of plated parts to a purchaser, on each lot, 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.

4.2.1 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, contracting officer, or request for procurement.

4.3 Sampling and Testing: Shall be not less than the following; a lot shall be Ø 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 in each eight hours of continuous operation, and presented for vendor's inspection at one time:

4.3.1 Composition: One part from each lot from 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 Process and control methods and plating fixtures used for processing Ø parts shall be acceptable to purchaser before parts for production use are supplied.

4.4.2 Vendor shall use manufacturing procedures, processes, and methods of Ø inspection on each production lot which are essentially the same as those used on the initial lot of acceptable parts. If necessary to make any change in type of equipment or in established composition limits and operating conditions of process solutions, vendor shall submit for reapproval a statement of the proposed changes in processing. Production parts plated by the revised procedure shall not be shipped prior to acceptance of the change by purchaser.

4.5 Reports: The vendor of plated parts shall furnish with each shipment a report stating that the parts have been processed and tested in accordance with the requirements of this specification and that they conform to the acceptance test requirements. This report shall include the purchase order number, lot number, AMS 2415F, part number, and quantity.

4.6 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the parts may be based on the results of testing three additional specimens for each original nonconforming specimen. Except as specified in 4.6.1, failure of any retest specimen to meet the specified requirements shall be cause for rejection of the parts represented. Results of all tests shall be reported.