



# AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.  
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

## AMS 2415D

Superseding 2415C

Issued 10-1-45

Revised 6-15-75

### LEAD AND INDIUM PLATING

#### 1. SCOPE:

- 1.1 Purpose: This specification covers the engineering requirements for electrodeposition of lead and indium, diffusion of the indium into the load, 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 Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pennsylvania 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, Pennsylvania 19103.

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

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

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

ASTM B529 - Measurement of Coating Thicknesses by the Edd-Current Test Method: Non-conductive Coatings on Nonmagnetic Basis Metals

#### 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 the hardness of the 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.

SAE Technical Board rules provide that: "All technical reports, including standards, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against infringement of patents."

- 3.1.5  $\emptyset$  Electrical contacts 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:

- 3.2.2.2 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.
- $\emptyset$  3.2.2.3 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 (171.1° - 176.7°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 (177°C) shall be post treated by a method approved by purchaser.

3.4 Properties:

- 3.4.2 Composition: The weight of indium deposited shall be within the range of 5.5 - 8.0% of the weight of deposited lead, unless otherwise specified, determined by a method agreed upon by purchaser and vendor.
- 3.4.1 Thickness: The combined thickness of lead and indium shall be as specified on the drawing, determined in accordance with ASTM B487, ASTM B499, ASTM B504, or ASTM B529, or other suitable method, as agreed upon by purchaser and vendor. A tolerance of  $\pm 0.0001$  in. ( $3 \mu\text{m}$ ) in the combined thickness of lead and indium shall be allowed when the nominal thickness is 0.001 in. ( $30 \mu\text{m}$ ) or less. A tolerance of  $\pm 0.00025$  in. ( $6.4 \mu\text{m}$ ) in the combined thickness of lead and indium shall be allowed when the nominal thickness is over 0.001 in. ( $30 \mu\text{m}$ ). 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, 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.
- $\emptyset$  3.5.1 Double plating and spotting-in after plating are not permitted, unless otherwise specified.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The processing vendor shall supply all samples and shall be responsible for performing all required tests. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure that processing conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance or routine control tests.

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 To assure adequate performance characteristics, 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.

4.4.2 Vendor shall use manufacturing procedures, processes, and methods of inspection on production parts which are essentially the same as those used on the approved sample parts. If any change is necessary in type of equipment or in established composition limits and operating conditions of process solutions, vendor shall submit for reapproval of the process a statement of the proposed changes in processing and, when requested, sample revised plated parts, test panels, or both. No production parts plated by the revised procedure shall be shipped prior to receipt of reapproval.

4.5 Reports: The processing vendor shall furnish with each shipment three copies of 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 this specification number and its revision letter, 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 and no additional testing shall be permitted. Results of all tests shall be reported.

4.6.1 If any part fails to meet the specified requirements, either on the original sampling or upon re-sampling as in 4.6, the parts in that lot may be stripped by a method approved by purchaser which does not roughen, pit, or embrittle the basis metal, replated, post treated, and retested.

5. PREPARATION FOR DELIVERY:

5.1 Parts shall be handled and packaged in such a manner as will ensure that the required physical characteristics and properties of the plating are preserved.

5.2 Packages of parts shall be prepared for shipment in accordance with commercial practice to assure carrier acceptance and safe transportation to the point of delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.