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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 2414C
Superseding AMS 2414B

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LEAD PLATING

1. SCOPE:

1.1 Purpose: This specification covers the engineering requirements for electrodeposition of lead on metal parts and the properties of the deposit.

1.2 Application: To prevent galling of metal parts and to improve the performance of bearings.

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 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 B499 - Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals
ASTM B504 - Measurement of Thickness of Metallic Coatings by the Coulometric Method
ASTM B567 - Measurement of Coating Thicknesses by the Beta Backscatter Method
ASTM E290 - Semi-Guided Bend Test for Ductility of Metallic Materials

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publication 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 All forming, machining, heat treating, brazing, and welding shall be completed before parts are plated.

3.1.2 Parts shall have chemically clean surfaces, prepared with minimum abrasion, erosion, or pitting, prior to immersion in the plating solution.

3.1.3 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 Parts shall be plated by electrodeposition of lead from a suitable lead solution directly on the basis metal except that, in the case of parts made of corrosion-resistant steels, high speed steels, and aluminum alloys, a suitable strike plate may be used for bonding purposes. Either lead sulfamate or lead fluoroborate solution may be used but purchaser shall approve which solution to use for each part involved.

3.2.2 After plating, the parts shall be thoroughly rinsed in running water to remove plating solution. They shall then be dipped in hot water, dried, and dipped in oil or otherwise protected against corrosion.

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 - 0.0007 in. (13 - 18 µm), determined on representative parts or test panels in accordance with ASTM B487, ASTM B499, ASTM B504, ASTM B567, the drop test of 3.3.1.5, or other method agreed upon by purchaser and vendor.

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; the maximum plate thickness shall be 0.0002 in. (5 µm) greater than the minimum. Thus, AMS 2414-2 designates a thickness of 0.0002 - 0.0004 in. (5 - 10 µm) and AMS 2414-6 designates a thickness of 0.0006 - 0.0008 in. (15 - 20 µm).

3.3.1.2 Where "lead flash" is specified, the thickness of lead shall be approximately 0.0001 in. (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 will be permitted provided finished drawing dimensions are met.

3.3.1.4 If internal surfaces or surfaces of small holes and deep recesses are required to be plated, notes on drawings will so specify, but minimum plate thickness requirements will be waived except when such surfaces can be touched by a sphere 0.75 in. (19 mm) in diameter. When plating of such surfaces is specified, external surfaces may have plate thickness greater than that specified but this will not be cause for rejection if dimensions of parts are within specified tolerances.

3.3.1.5 Drop Test for Thickness Determination: Allow an aqueous solution of glacial acetic acid and hydrogen peroxide to drop at a uniform rate of 100 drops ± 5 per min. directly upon properly cleaned surfaces of plated parts until the basis metal or underlying strike is exposed. This aqueous solution shall consist of 3.5% by volume glacial acetic acid and a suitable percentage by volume of 30% by weight hydrogen peroxide as shown in Fig. 1. The dropping apparatus may be a 250 mL laboratory separatory funnel equipped with a stopcock to regulate the solution flow and having the discharge orifice of the outlet tube constricted to deliver drops of 0.045 - 0.055 mL each. Plated parts shall be supported so that the surface to be tested is at an angle of 45 deg ± 5 from the horizontal and about 7/8 in. (22 mm) below the discharge orifice. Plate which meets specified thickness requirements shall not be perforated in less than the minimum times shown in Fig. 1. A fresh solution of glacial acetic acid and hydrogen peroxide should be prepared daily unless the solution is analyzed, just before use, to determine that the hydrogen peroxide content has not changed with age.

3.3.2 Adhesion: Specimens as in 4.3.3 shall not show separation of the plating from the basis metal, when examined at approximately 4X magnification, after being bent rapidly, in accordance with ASTM E290, through an angle of 180 deg around a diameter equal to the nominal thickness of the specimen. Formation of cracks which do not result in flaking or blistering of the plating is acceptable.

3.4 Quality: Plated lead 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 performance of parts. Slight staining or discoloration is permissible. Standards for acceptance shall be as agreed upon by purchaser and vendor.

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. 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 processing conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for thickness (3.3.1) and quality (3.4) are classified as acceptance tests and shall be performed to represent each 8 hr of operation of the same set of solutions.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for adhesion (3.3.2) and 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 and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

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.

4.3 Sampling: Shall be not less than the following; a lot shall be all parts made from the same alloy, processed to the same plate thickness, and presented for vendor's inspection at one time:

4.3.1 For Acceptance Tests:

4.3.1.1 Thickness: Three parts for each consecutive 8 hr of operation of the same set of solutions, except as specified in 4.3.3.

4.3.1.2 Quality: As agreed upon by purchaser and vendor.

4.3.2 For Periodic Tests and Preproduction Tests: As agreed upon by purchaser and vendor.

4.3.3 When plated parts are of such configuration or size as to be not readily adaptable to the specified tests, separate test specimens, cleaned and plated with the parts represented, may be used. For adhesion tests, such specimens shall be panels of annealed, low-carbon steel approximately 0.032 x 4 x 1 in. (1 x 100 x 25 mm) and for thickness and quality tests shall be panels of the same size and type or shall be bars approximately 0.5 in. (10 mm) in diameter and 4 in. (100 mm) long.

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.

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 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 of the process a statement of the proposed changes in processing and, when requested, sample plated parts, test panels, or both. Production parts plated by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Reports: The vendor of plated parts shall furnish with each shipment three copies of 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, AMS 2414C, 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 Ø 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 Ø sampling as in 4.3 or upon resampling 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, and retested.

5. PREPARATION FOR DELIVERY:

5.1 Parts shall be handled and packaged in such a manner as will ensure that the Ø 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 and in compliance with applicable rules and regulations pertaining to Ø the handling, packaging, and transportation of the plated parts to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.3 For direct U.S. Military procurement, packaging shall be in accordance with Ø MIL-STD-794, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.1 and 5.2 will be acceptable if it meets the requirements of Level C.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Parts on which the plating does not conform to this specification or to modifications authorized by purchaser will be subject to rejection.

8. NOTES:

8.1 Marginal Indicia: The phi (Ø) symbol is used to indicated technical changes from the previous issue of this specification.