SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS2415 | REV. J

Issued 1945-10
Revised 2008-02
Reaffirmed 2012-08

Superseding AMS2415H

Plating, Lead and Indium

RATIONALE

AMS2415J has been reaffirmed to comply with the SAE five-year review policy.

NOTICE

ORDERING INFORMATION: The following information shall be provided to the plating processor by the purchaser.

1) Purchase order shall specify not less than the following:

- AMS2415J
- Plating thickness desired (3.4.2)
- Basis metal to be plated
- Tensile strength or hardness of the basis metal
- Pre-plate stress relief to be performed by plating processor (time and temperature) if different from 3.1.1
- Special features, geometry or processing present on parts that requires special attention by the plating processor
- Optional: Periodic testing frequency (4.2.2) and sample quantity (4.3.1)
- Optional: Requirement to perform preproduction tests on the initial shipment (4.2.3)
- Quantity of pieces to be plated

2) Parts manufacturing operations such as heat treating, forming, joining and media finishing can affect the condition of the substrate for plating, or if performed after plating, could adversely affect the plated part. The sequencing of these types of operations should be specified by the cognizant engineering organization or purchaser and is not controlled by this specification.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS2415J

1. SCOPE

1.1 Purpose

This specification covers the requirements for electrodeposited and diffused lead and indium plate.

1.2 Application

This process has been used typically to improve the performance and prevent corrosion of bearings or of other parts, but usage is not limited to such applications.

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 issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AS2390 Chemical Process Test Specimen Material

2.2 ASTM Publications

Available from ASTM International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

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 B 568	Measurement of Coating Thickness by X-Ray Spectrometry
ASTM E 376	Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Examination Methods

3. TECHNICAL REQUIREMENTS

3.1 Preparation

3.1.1 Steel parts, having a 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 shall be not less than 275 °F ± 25 (135 °C ± 14) for not less than 5 hours for parts with hardness 55 HRC or higher and not less than 375 °F ± 25 (191 °C ± 14) for not less than 4 hours for parts with lower hardness.

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

3.1.3 The lead plating shall be applied over a surface free from water breaks. The cleaning procedure shall not produce pitting or intergranular attack of the basis metal and shall preserve dimensional requirements.

3.1.4 Except for barrel plating, electrical contact points shall be as follows. For parts which are to be plated all over, locations shall be acceptable to the cognizant engineering organization; for parts which are not to be plated all over, locations shall be in areas on which plating is not required.

3.2 Procedure

3.2.1 Lead Plating

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

3.2.1.1 After completion of the lead plating operation, the plated parts shall be rinsed immediately in running water and, except as specified in 3.2.1.1.1, transferred directly to the indium plating solution.

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

3.2.1.2 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

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.

3.2.2.1 Spotting-in is not permitted.

3.2.2.2 After plating, parts shall be thoroughly rinsed and dried.

3.3 Post Treatment

Parts, after plating, rinsing, and drying, shall be heated in an oil bath to 340 to 350 °F (171 to 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, that 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 the cognizant engineering organization.

3.4 Properties

The deposited and post treated lead and indium plate shall conform to the following requirements:

3.4.1 Composition

The weight of indium deposited shall be within the range 5.5 to 8.0% of the weight of deposited lead, determined by a method acceptable to the cognizant engineering organization.

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 B 568, ASTM E 376, or other method acceptable to the cognizant engineering organization. A tolerance of ±0.0001 inch (±2.5 µm) on 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.

3.4.2.1 The plate shall be substantially uniform in thickness on significant surfaces except that build-up at exterior corners or edges will be permitted provided finished drawing dimensions are met.

3.4.2.2 Thickness requirements apply to surfaces that can be touched by a sphere 0.75 inch (19 mm) in diameter. Other areas, such as surfaces of holes, recesses, internal threads, or contact areas of parts plated all over, where a controlled deposit cannot be obtained under normal plating conditions, shall show evidence of plating.

3.4.3 Adhesion

After post treatment in accordance with 3.3, there shall be no separation of the plating from the base metal or internal delamination.

3.5 Quality

Plating shall be smooth, continuous, free from delaminations within the plating, uniform in appearance and free from imperfections detrimental to usage of the plating. Plating shall be visually free from frosty areas, pin holes, porosity, blisters, nodules, and pits.

3.5.1 Staining or discoloration, which may appear on the deposits after the diffusion treatment and prior to delivery, is not acceptable.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The processor shall supply all samples for processor's tests and shall be responsible for the performance of all required tests. Parts, if required for tests, shall be supplied by purchaser. The cognizant engineering organization reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the lead-indium deposit conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

All technical requirements are acceptance tests and shall be performed on parts, or samples representing parts when permitted herein (See 4.3.1.1), from each lot.

4.2.2 Periodic Tests

Tests of cleaning and plating solutions are periodic tests and shall be performed at a frequency established by the processor unless frequency of testing is specified by the cognizant engineering organization. See 8.5 and 4.4.3.

4.2.3 Preproduction Tests

All technical requirements are preproduction tests and shall be performed when preproduction tests are specified on the initial shipment of a plated part to a purchaser and when the cognizant engineering organization requires confirmatory testing.

4.3 Sampling and testing shall be not less than the following; a lot shall be all parts of the same part number, plated to the same range of plate thickness in the same solutions in each 8 hours of continuous operation, and presented for processor's inspection at one time:

4.3.1 Samples shall be selected at random from all parts in the lot. Unless the cognizant engineering organization specifies a sampling plan, the minimum number of samples shall be as shown in Table 1.

TABLE 1 - SAMPLING FOR ACCEPTANCE TESTS

Number of Parts in Lot	Quality	Thickness	Composition
1 to 6	All	All or 3*	1
7 to 15	7	4	1
16 to 40	10	4	1
41 to 110	15	5	1
111 to 300	25	6	1
301 to 500	35	7	1
501 to 700	50	8	1
701 to 1200	75	10	1
1201 and Over	125	15	1

*Whichever is less

4.3.1.1 Separate test panels may be used under any one of the following circumstances. The plated parts are of such configuration or size as to be not readily adaptable to specified tests, nondestructive testing is not practical on actual parts, or it is not economically acceptable to purchaser to perform destructive tests on actual parts. Acceptance test specimens shall be made of the same generic class of alloy as the parts, established in accordance with AS2390, distributed within the lot, cleaned, plated, and post treated with the parts.

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 parts are supplied.

4.4.2 If the processor makes a significant change to any material, process, or control factor from that which was used for process approval, all preproduction tests shall be performed and the results submitted to the cognizant engineering organization for process reapproval 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.

4.4.3 Control factors shall include, but not be limited to, the following:

Surface preparation
Bath types and composition limits
Bath temperatures and times
Diffusion temperature and time
Current and voltage limits for each plating bath
Method of determining composition
Periodic test plan. See 8.5.