SAE Aerospace
An SAE International Group

# AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2410J

Issued AUG 1945
Revised MAR 2004

Superseding AMS 2410H

## Plating, Silver
## Nickel Strike, High Bake

1. SCOPE:

1.1 Purpose:

This specification covers the requirements for electrodeposited silver on other metals, usually with a nickel strike between the basis metal and the silver.

1.2 Application:

This plating has been used typically to provide a bearing surface and to prevent galling or seizing of surfaces of parts made of corrosion-resistant steels and of parts made of other metals not deleteriously affected by high-temperature baking, 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.





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

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2759/9 Hydrogen Embrittlement Relief (Baking) of Steel Parts

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.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 E 376 | Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods |

3. TECHNICAL REQUIREMENTS:

3.1 Preparation:

3.1.1 Parts shall have clean surfaces, free of waterbreak, prior to immersion in the plating solution.

3.1.2 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 purchaser; for parts which are not to be plated all over, locations shall be on areas on which plating is not required.

3.2 Procedure:

3.2.1 Parts shall be plated in the following sequence except as permitted by 3.2.1.1, 3.2.1.2, or 3.2.1.3:

Nickel strike
Silver strike
Silver plate

3.2.1.1 The nickel strike may be omitted when plating copper and copper alloys.

3.2.1.2 A gold or palladium strike may be used in place of the silver strike when approved by purchaser.

3.2.1.3 When approved by purchaser, silver may be plated directly onto the substrate without the use of either the nickel or silver strike.

3.2.2 Parts shall be plated by electrodeposition of silver from a suitable plating bath. Spotting-in or double plating are not permitted.

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

3.3 Post Treatment:

3.3.1 Hydrogen Embrittlement Relief: Treatment of steel parts shall be in accordance with AMS 2759/9.

3.3.2 Except as specified herein, all parts, except nuts, shall be heated to 935 to 965 °F (502 to 518 °C) after plating, rinsing, and drying and held at heat for 20 to 60 minutes; temperature of the parts shall not be over 400 °F (204 °C) for more than seven hours during the heating and cooling part of the cycle. Above 400 °F (204 °C), the heating and cooling medium shall be a neutral or reducing atmosphere (except that hydrogen shall not be used) or shall be a neutral or nonoxidizing molten salt bath. If such heating would lower hardness or properties of parts below drawing limits or otherwise deleteriously affect the parts, heating shall be at the highest practicable temperature which will maintain specified properties. Heating of nuts is not required. When this thermal treatment starts within four hours after the parts have been removed from the plating bath, hydrogen embrittlement relief in accordance with 3.3.1 is not required.

3.4 Properties:

The deposited silver shall conform to the following requirements:

3.4.1 Thickness: Thickness of silver shall be as specified on the drawing, determined on representative parts or on test specimens as in 4.3.3 in accordance with ASTM B 487, ASTM B 499, ASTM B 504, ASTM E 376, or other method acceptable to purchaser.

3.4.1.1 Where silver flash only is specified, plate thickness shall be approximately 0.0001 inch (2.5 µm).

3.4.1.2 Thickness of plate, other than flash, shall be as specified on the part drawing. If machining of plated metal is required, plate thickness as deposited shall be sufficient to allow machining of all areas of plated surfaces to the dimensions specified on the drawing.

3.4.1.3 Thickness requirements shall apply to surfaces which 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.

3.4.2 Composition: Silver, as plated, shall be not less than 99.9% pure, determined by a method acceptable to purchaser. The plating process and solution chemistry shall be controlled to ensure the required purity.

3.4.3 Adhesion:

3.4.3.1 Visual Test: Plated metal shall be firmly and continuously bonded to the underlying metal. Plating, after heating as in 3.3, shall show no evidence of blisters or other indications of poor bond.

3.4.3.2 Destructive Test: Parts, other than nuts, shall withstand, after heating as in 3.3, a shear or chisel test conducted to indicate quality of the bond. Silver shall shear away with no separation between plate and basis metal.

3.4.3.3 Destructive Test: Nuts shall show no peeling of the silver when scratched with a knife or other sharp tool.

3.5 Quality:

Plating as received by the customer shall be smooth, continuous, free from delamination 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. Slight staining or discoloration is permissible after plating and during storage.

3.5.1 Abrasion of plating on corners and edges of nuts is acceptable but plate shall be continuous on the threads. Marking of the cone section of selflocking nuts, produced in offsetting the locking beams or other locking feature, is 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. When parts are to be tested, the parts shall be supplied by the purchaser. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that processing conforms to the specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Thickness (3.4.1), adhesion (3.4.3), and quality (3.5) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Composition (3.4.2) and tests of cleaning and plating solutions (See 8.3) to ensure that the deposited silver will conform to this specification are periodic tests and shall be performed at a frequency selected by the processor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: All technical requirements are preproduction tests and shall be performed prior to or on the first-article shipment of plated parts to a purchaser, when a change in material and/or processing requires approval by the cognizant engineering organization (see 4.4.2), and when purchaser deems confirmatory testing to be required.

4.3 Sampling and Testing:

Shall be not less than the following; a lot shall be all parts of the same size and shape, made of the same alloy, plated to the same range of plate thickness in the same set of solutions within one 24-hour period of operation, and presented for processor's inspection at one time:

4.3.1 For Acceptance Tests: As shown in Table 1.

TABLE 1 - Sampling for Acceptance Tests

| Number of Parts in Lot | Visual for Adhesion, Coverage, and Quality | Thickness (Non-Destructive) | Thickness (Destructive) | Adhesion (Destructive) |
|---|---|---|---|---|
| Up to 7 | all | all | 0 | 0 |
| 8 to 15 | 7 | 3 | 0 | 0 |
| 16 to 40 | 10 | 4 | 0 | 0 |
| 41 to 150 | 15 | 5 | 1 | 1 |
| 151 to 300 | 25 | 6 | 1 | 1 |
| 301 to 500 | 35 | 7 | 1 | 1 |
| Over 500 | 50 | 8 | 2 | 2 |

4.3.1.1 When a statistical sampling plan has been agreed upon by purchaser and processor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.5 shall state that such plan was used.

4.3.2 For Periodic Tests: Frequency of testing and sample size shall be at the discretion of the processor unless otherwise specified by purchaser.

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 fabricated from the same class of alloy as parts represented, cleaned, and plated with the parts they represent may be used. For adhesion and thickness tests, such specimens shall be approximately 0.032 x 4 x 1 inch (0.8 x 102 x 25 mm). For thickness tests, bars approximately 0.5 inch (13 mm) in diameter and 4 inches (102 mm) long may be used.

4.4 Approval:

4.4.1 The process and control procedures, a preproduction sample plated part, or both, whichever is specified, shall be approved by the cognizant engineering organization before production parts are supplied.

4.4.2 The processor shall make no significant change to materials, processes, or controls from those on which the approval was based, unless the change is approved by the cognizant engineering organization. A significant change is one which, in the judgement of the cognizant engineering organization, could affect the properties or performance of the part.