AEROSPACE MATERIAL SPECIFICATION

AMS2418™	REV. K
Issued 1951-10 Revised 2021-12 Superseding AMS2418J	

Plating, Copper

RATIONALE

AMS2418K is the result of a Fire-Year Review and update of this specification with changes to ordering information corresponding to changes in the document, stress relief treatment for peened parts (3.1.1.3) changed to when specified to align with other plating AMSs, added contact locations per GAB19AB (3.1.3, 4.4.3), clarification of alloys that can have a flash plate (3.2.1), and updated lot definition per GAB16AA (4.3.1).

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:

- AMS2418K
- Plating thickness (see 3.4.1)
- Basis metal to be plated
- Tensile strength or hardness of the basis metal
- If pre-plate stress relief is to be performed by plating processor and if different from 3.1.1, time and temperature are to be specified
- If steel parts were machined, ground, cold formed or cold straightened after heat treat (3.1.1)
- If steel parts have been shot peened, specify if required stress relief has been completed (3.1.1.3)
- Optional: Fixture/electrical contact locations, when not specified (3.1.3)
- Special features, geometry or processing present on parts that requires special attention by the plating processor
- Hydrogen embrittlement relief to be performed by plating processor (parameters or reference document) if different from 3.3.1
- Minimum thickness on internal surfaces, if required (see 3.4.1.4)
- Solderability testing, if required (see 3.4.5)
- Quantity of pieces to be plated

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**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS2418K/

2. Parts manufacturing operations such as heat treatment, forming, machining, welding, brazing, and media finishing, performed prior to plating, can affect the condition of the substrate before plating. Those operations, if performed after plating, could adversely affect the plated part unless the plate is used as a source of copper for brazing, masking for nitriding or carburizing, or prevention of carburizing. The sequencing of these types of operations before and after plating should be specified by the cognizant engineering organization and is not controlled by this specification.

1. SCOPE

1.1 Form

This specification covers the requirements for electrodeposited copper.

1.2 Application

This process has been used typically to provide an anti-seize surface, to prevent carburizing of surfaces on which carburizing is neither required or permitted, to prevent decarburization, to enhance solderability, or to provide a source of copper for furnace brazing, but usage is not limited to such applications.

1.3 Classification

Plating covered by this specification is classified as follows:

Type 1: Engineering plating
Type 2: Plating for masking

1.3.1 Type 1 shall be supplied if no class is specified.

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 +1 724-776-4970 (outside USA), www.sae.org.

AMS2759/9 Hydrogen Embrittlement Relief (Baking) of Steel Parts

ARP1917 Clarification of Terms Used in Aerospace Metals Specifications

ARP4992 Periodic Test for Process Solutions

AS2390 Chemical Process Test Specimen Material

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B253 Preparation of Aluminum Alloys for Electroplating

ASTM B374 Standard Terminology Relating to Electroplating

ASTM B487 Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of 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 Thickness by the Beta Backscatter Method

ASTM B568 Measurement of Coating Thickness by X-Ray Spectrometry

ASTM B571 Qualitative Adhesion Testing of Metallic Coatings

ASTM B678 Solderability of Metallic-Coated Products

ASTM B734 Electrodeposited Copper for Engineering Uses

ASTM B748 Measurement of Thickness of Metallic Coatings by Measurement of Cross Section with a Scanning Electron Microscope

ASTM B764 Simultaneous Thickness and Electrode Potential Determination of Individual Layers in Multilayer Nickel Deposit (STEP Test)

ASTM E376 Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Testing Methods

ASTM F519 Mechanical Hydrogen Embrittlement Evaluation of Plating/Coating Processes and Service Environments

3. TECHNICAL REQUIREMENTS

3.1 Preparation

3.1.1 Stress Relief Treatment

All steel parts having a hardness of 40 HRC and above and that are machined, ground, cold formed, or cold straightened after heat treatment shall be cleaned to remove surface contamination and thermally stress relieved before plating. (Residual tensile stresses have been found to be damaging during electroplating.) Furnaces used for stress relief shall be controlled per AMS2750: the minimum requirements shall be Class 5 and Type D instrumentation. Temperatures to which parts are heated shall be such that stress relief is obtained while still maintaining hardness of parts within drawing limits. Unless otherwise specified, the following treatment temperatures and times shall be used:

3.1.1.1 For parts, excluding nitrided parts, having a hardness of 55 HRC and above, and for carburized and induction hardened parts, stress relieve at 275 °F ± 25 °F (135 °C ± 14 °C) for 5 to 10 hours.

3.1.1.2 For parts having a hardness less than 55 HRC, and for nitrided parts, stress relieve at 375 °F ± 25 °F (191 °C ± 14 °C) for a minimum of 4 hours. Higher temperatures shall be used only when specified or approved by the cognizant engineering organization.

3.1.1.3 For Peened Parts

If stress relief temperatures above 375 °F (191 °C) are specified, the stress relieve shall be performed prior to peening.

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

3.1.2.1 For steel parts 40 HRC and over, contact time with surface activation acids such as hydrochloric, hydrofluoric, and sulfuric acids shall be minimized so as not to produce hydrogen embrittlement (see 8.5).

3.1.3 Fixture/Electrical Contact Locations

3.1.3.1 Except for barrel plating, for parts that are to be electroplated all over, and contact locations are not specified, contact locations shall be at the discretion of the processor.

3.1.3.2 For parts that are not to be electroplated all over, and contact locations are not specified, contact locations shall be in areas on which plate/coating is not required.

3.1.4 Aluminum alloys shall be zincate or stannate treated in accordance with ASTM B253 or other method acceptable to the cognizant engineering organization prior to plating.

3.2 Procedure

3.2.1 Copper shall be electrodeposited from a suitable copper plating solution onto a properly prepared surface. The copper plating shall be applied directly onto the metal part, or from a high speed copper plating solution following a "copper strike," except that a preliminary flash of nickel or other suitable metal is permissible on parts made from corrosion-resistant and heat-resistant steels or alloys or other similarly passive alloys.

3.3 Post-Treatment

3.3.1 Hydrogen Embrittlement Relief

Treatment of steel parts shall be in accordance with AMS2759/9.

3.4 Properties

Plated parts shall conform to the following requirements:

3.4.1 Thickness

Unless otherwise specified on the engineering drawing, the copper plate thickness shall be as follows determined in accordance with ASTM B487, ASTM B499, ASTM B567, ASTM B568, ASTM B748, ASTM B764, ASTM E376, or other method acceptable to the cognizant engineering organization.

3.4.1.1 Type 1 (Engineering Plating)

AMS2418 shall designate plate thickness of 0.0005 to 0.0007 inch (13 to 18 micrometers).

Other plate thicknesses may be specified by this specification number and a suffix number designating the minimum thickness in ten-thousandths of an inch (increments of 2.5 µm). A tolerance of +0.0002 inch (+5 µm) will be allowed. Thus, AMS2418-1 designated a thickness of 0.0001 to 0.0003 inch (2.5 to 8 µm), AMS2418-6 designated a thickness of 0.0006 to 0.0008 inch (15 to 20 µm).

3.4.1.2 Type 2 (Plating for Masking)

Thickness for Type 2 plating shall be nominally 0.002 inch (51 µm) with no area having a plate thickness of less than 0.0007 inch (18 µm).

3.4.1.3 Where "copper flash" is specified, the thickness of copper shall be 0.0001 inch (2.5 µm) minimum.

3.4.1.4 All surfaces of the part, except those which cannot be touched by a sphere 0.75 inch (19 mm) in diameter, shall be plated to the specified thickness. Unless otherwise specified, surfaces such as holes, recesses, threads, and other areas where a controlled deposit cannot be obtained under normal plating conditions, may be under the specified limit provided they show visual plating coverage (see 8.2).

3.4.2 Porosity

For Type 2, and when specified for Type 1, copper plate shall be nonporous so as not to give a blue color when tested for five minutes with potassium ferricyanide solution of the approximate composition shown in Table 1.

Table 1 - Potassium ferricyanide test solution

Ingredient	Quantity
Potassium ferricyanide	10 grams
Sodium chloride	5 grams
Water	100 mL

3.4.2.1 As an alternative, the modified ferroxyl test of ASTM B734 may be used.

3.4.3 Adhesion

Plating shall be firmly bonded to the basis metal when tested in accordance with any of the following methods.

3.4.3.1 The plating shall be scraped through to the basis metal with a sharp knife or awl to expose the basis metal and examined at approximately 5X magnification for evidence of flaking or separation.

3.4.3.2 The basis metal shall be bent or deformed as required to cause it to crack and examined at approximately 5X magnification for evidence of flaking or separation of the plating.

3.4.3.3 The burnishing test, draw test, or heat quench test of ASTM B571.

3.4.4 Hydrogen Embrittlement

The plating process after baking shall not cause hydrogen embrittlement in steel parts 40 HRC and over, determined in accordance with 4.3.3.2.

3.4.5 Solderability

When specified by the cognizant engineering organization, acceptable solderability shall be determined by ASTM B678 (steam aging does not apply). The solderability sample(s) shall show no evidence of separation of the copper plate from the basis metal when evaluated in accordance with ASTM B678.

3.5 Quality

Copper plate, as received by purchaser, shall be smooth, continuous, adherent to basis metal, uniform in appearance, and not coarsely crystalline, and shall be free from pin holes, porosity, blisters, nodules, pits, and other imperfections detrimental to usage of the plate. Slight staining or discoloration is permissible.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The processor shall supply all test specimens for processor's tests and shall be responsible for the performance of all required tests. Where parts are to be tested, such parts 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 processing conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Thickness (3.4.1), porosity for Type 2 and when specified for Type 1 (3.4.2), and quality (3.5) are acceptance tests and shall be performed on parts, or specimens representing parts when permitted herein, with each lot (see 4.3.3).

4.2.2 Periodic Tests

Adhesion (3.4.3) is a periodic test that shall be performed no less than daily for each generic class of alloy as defined by AS2390 processed during that day. Hydrogen embrittlement (3.4.4) is a periodic test and shall be performed at least once each month that steel parts 40 HRC and over are plated. Solderability, when specified (3.4.5), is a periodic test and shall be performed at least once each month that parts are plated. Tests of cleaning and plating solutions are periodic tests and shall be performed at a frequency established by the processor unless test frequency is specified by the cognizant engineering organization (see 8.6 and 4.4.3).

4.2.3 Preproduction Tests

All property verification tests (3.4) are preproduction tests and shall be performed prior to production and when the cognizant engineering organization requires confirmatory testing.

4.3 Sampling for Testing

4.3.1 Acceptance Tests

Test samples shall be randomly selected from all parts in the lot. A lot is a group of parts, all of the same part number, processed through the same chemical solutions in the same tanks under the same conditions, which have completed the chemical processing within a period of 24 hours of each other and are presented to inspection at the same time..

Table 2 - Sampling for acceptance tests

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

* Whichever is less.

4.3.2 Preproduction and Periodic Tests

Sample quantity for hydrogen embrittlement, sample size is specified in ASTM F519 unless otherwise specified by the cognizant engineering organization (see 4.3.3.2). When specimens are used for adhesion testing, four test specimens of each generic class of alloy, as defined by AS2390, that have been processed through the same cleaning and plating operations as the parts that they represent. These adhesion test specimens shall be processed prior to the first production lot of parts or with the first production lot of parts. Sample quantities for other periodic tests shall be established by the processor, unless otherwise specified by the cognizant engineering organization or herein.

4.3.3 Sample Configuration

Nondestructive testing shall be performed wherever practical. Except as noted, actual parts shall be selected as samples for tests. When representative specimens are used for acceptance testing, values so obtained shall be correlated with those of parts since properties, such as thickness, may differ between parts and representative test specimens.

4.3.3.1 Representative test specimens may be used instead of parts 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 perform destructive tests on actual parts. Except as specified below, representative 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 represented.

4.3.3.2 Hydrogen Embrittlement Test

Test shall be in accordance with the requirements of ASTM F519 Type 1a.1 using round notched specimens, unless a different specimen is specified by the cognizant engineering organization, stressed in tension under sustained load. For test purposes, plating thickness shall be not less than 0.002 inch (0.051 mm) or plated to a thickness not less than twice the maximum thickness to which the plate is to be qualified, whichever is less. Thickness shall be measured on the smooth section of the specimen, but with visual evidence of plating at the root of the notch. Testing beyond the 200 hour test period is not required. The test samples shall be exposed to all steps of the documented plating process including stress relieve, surface preparation (reagent-electro-cleaning or abrasive blasting as applicable), underplate, electrodeposition of the copper, and the prescribed baking schedule per AMS2759/9.

4.3.3.3 Adhesion Testing

Test specimens for adhesion testing in 3.4.3.2 shall be made of the same generic class of alloy as defined by AS2390. The test specimens shall be 0.025 inch (0.6 mm) minimum thickness and not less than 1 x 4 inches (25 x 102 mm).

4.4 Approval

4.4.1 The process and control factors, a preproduction sample plated part, or both, whichever is specified, shall be approved by the cognizant engineering organization before production plated 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 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. Production parts plated by the revised procedure shall not be shipped prior to receipt of reapproval.

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

Surface preparation and cleaning procedures
Surface activation procedures
Fixture/electrical contact locations when approval is required by the cognizant engineering organization
Plating bath composition and composition control limits
Plating bath temperature limits and controls
Current/voltage limits and controls
Post-treatment times and temperatures (when required)
Chemical post-treatment
Method for determining plating thickness
Method for testing plate adhesion
Stripping procedure when applicable
Method of porosity testing (when required)
Periodic test plan for process solutions (see 8.6)

4.5 Reports

The processor shall furnish with each shipment a report stating that the parts have been processed and tested in accordance with specified requirements and that they conform to the technical requirements. This report shall include the purchase order number, lot number, AMS2418K, part number, the range of measured coating thicknesses, the average coating thickness, and quantity.

4.6 Resampling and Retesting

4.6.1 If any acceptance test fails to meet the specified requirements, the parts in that lot may be stripped, pre-treated, plated, post treated as defined herein, and retested. Alternatively, all parts in the lot may be inspected for the nonconforming attribute, and the nonconforming parts may be stripped, pre-treated, plated, post-treated as defined herein, and retested. After stripping and replating, parts shall meet drawing dimensions.