AEROSPACE MATERIAL SPECIFICATION

AMS2417™	REV. K
Issued 1960-06 Revised 2020-05 Superseding AMS2417J	

Plating, Zinc-Nickel Alloy

RATIONALE

AMS2417K results from a Five-Year Review and update of this specification with changes to Ordering Information, Preparation (3.1.1.1, 3.1.3), Procedure (3.2.1.1, 3.2.1.3), Hydrogen Embrittlement Relief (3.3), Composition (3.4.1), Thickness (3.4.2), Corrosion Resistance (3.4.4), Hydrogen Embrittlement (3.4.5), Quality (3.5), Periodic Tests (4.2.2), Acceptance Tests (4.3.1), Sampling for acceptance tests (Table 1), Corrosion Testing (4.3.3.2), Composition Test (4.3.3.5), Approval (4.2.2), Control factors (4.4.3).

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:

- AMS2417K
- Plating thickness, if other than specified in 3.4.2.3
- Type and Grade designation (see 1.3)
- Basis metal to be plated
- Tensile strength or hardness of the basis metal
- If pre-plate stress relief (time and temperature) is to be performed by plating processor and if different from 3.1.1
- If steel parts were machined, ground, cold formed or straightened after heat treatment (3.1.1.1)
- If steel parts have been shot peened, specify if required stress relief has been completed (3.1.1.1.3)
- Special features, geometry or processing present on parts that requires special attention by the plating processor
- Permissible electrical contact locations, if not specified (3.1.3)
- Optional: Plating bath formulation (3.2.1.1)
- Hydrogen embrittlement relief to be performed by plating processor (parameters or reference document) if different from 3.3
- Plated nickel composition if different from 3.4.1

- Minimum thickness on internal surfaces, if required (see 3.4.2.1)
- Optional: Color of the Grade A or Grade B supplementary treatment or that it be transparent or clear (3.5.1)
- Optional: Periodic testing frequency (4.2.2) and sample quantity (4.3.2)
- 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.

1. SCOPE

1.1 Purpose

This specification covers the requirements for electrodeposition of a zinc-nickel alloy and the properties of the deposit.

1.2 Application

Zinc-nickel plating has been used typically to provide corrosion resistance to steel parts that may operate at elevated temperatures (see 1.3) but usage is not limited to such applications (see 8.9 and 8.10).

1.3 Classification

Plating covered by this specification is classified as follows:

Type 1 As-plated without supplementary treatment, service temperature 500 °F (260 °C) maximum

Type 2 As-plated with supplementary chromate treatment

Grade A Hexavalent chromate treatment, service temperature 250 °F (121 °C) maximum

Grade B Trivalent chromium treatment, service temperature 375 °F (191 °C) maximum

Type 3 As-plated with supplementary phosphate treatment (adhesion base for primer/paint), service temperature 350 °F (177 °C) maximum

1.3.1 Unless a type is specified, Type 2 shall be supplied.

1.3.2 For Type 2 plating, if no grade is specified, Grade A shall be supplied.

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

AMS2750 Pyrometry

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

ARP1917 Clarification of Terms Used in Aerospace Metals Specifications

ARP4992 Periodic Test Plan 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 B117 Operating Salt Spray (Fog) Apparatus

ASTM B253 Preparation of Aluminum Alloys for Electroplating

ASTM B374 Terminology Relating to Electroplating

ASTM B487 Measurement of Metal and Oxide Coating Thicknesses 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 B568 Measurement of Coating Thickness by X-Ray Spectrometry

ASTM B571 Qualitative Adhesion Testing of Metallic Coatings

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

3.1.1.1 All steel parts having a hardness of 36 HRC and over and threaded steel fasteners 34 HRC and over 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 electrofinishing.) Furnaces used for stress relief shall be controlled per AMS2750. The minimum requirements shall be Class 5, with 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:

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

3.1.1.1.2 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 may be used only when specified or approved by the cognizant engineering organization.

3.1.1.1.3 For Peened Parts

If stress relief temperatures above 375 °F (191 °C) are elected, the stress relief shall be performed prior to peening or the cognizant engineering organization shall be consulted and shall approve the stress relief temperature.

3.1.2 The 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.

3.1.3 Except for barrel plating, electrical contact points shall be as follows. For parts which are to be plated all over, locations, if not specified, shall beat the discretion of the processor. For parts which are not to be plated all over, locations shall be in areas on which plating is not required, or locations shall be specified or approved by the cognizant engineering organization.

3.1.4 Mechanical surface preparation, such as a dry or wet abrasive blast, if employed, shall be completed prior to application of a strike such as nickel, copper or zinc, when used, and shall be accomplished in a manner that will not have a detrimental effect on the appearance or quality of the finished part.

3.2 Procedure

3.2.1 Parts shall be plated by electrodeposition of a zinc-nickel alloy plating onto a properly prepared surface (see 8.5.1).

3.2.1.1 When not specified, zinc-nickel plating shall be from a neutral to acid bath formulation or from an alkaline bath formulation.

3.2.1.2 Aluminum alloys shall be zincate treated in accordance with ASTM B253 or other method permitted by the cognizant engineering organization prior to plating.

3.2.1.3 Parts for which Type 2 Grade A plating is specified shall be given a supplementary chromate conversion coating and meet the requirements of 3.4.4.2. Any post thermal treatment shall be done prior to application of the chromate conversion treatment. Steel parts requiring a post thermal treatment as in 3.3 may require reactivation prior to application of the conversion coating.

3.2.1.4 Parts for which Type 2 Grade B plating is specified shall be given a supplementary trivalent chromium conversion coating and meet the requirements of 3.4.4.3. Any post thermal treatment shall be done after application of the trivalent chromium conversion treatment.