



AEROSPACE MATERIAL SPECIFICATION

AMS2461™

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Plating, Zinc-Nickel Alloy (12 to 16% Ni)

RATIONALE

AMS2461 establishes requirements for applying a highly corrosion resistant zinc-nickel plating, that is a preferred cadmium alternative for fasteners and standard parts.

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:

- AMS2461
- Class, Type, and Grade designation (1.3)
- Color of Grade A or B conversion coating (1.3.1)
- Basis metal to be plated
- For steel alloys, tensile strength, or hardness of the basis metal
- If pre-plate stress relief is to be performed by plating processor and if different from 3.1.2, time and temperature are to be specified
- If steel parts were machined, ground, cold formed or straightened after heat treatment (3.1.2)
- If steel parts have been shot peened, specify if required stress relief has been completed (3.1.2.3)
- Fixture contact locations, if specified by the cognizant engineering organization (3.1.5)
- Optional: Fixture contact locations, when not specified (3.1.5)
- 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

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TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724 776 4970 (outside USA)

For more information on this standard, visit

<https://content/AMS2461/>

SAE WEB ADDRESS:

This is a preview. Click here to purchase the full publication.

- Minimum thickness on internal surfaces, if required (3.4.2)
 - 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 electrodeposited zinc-nickel on metal parts, including fasteners and other standard parts.

1.2 Application

This process has been used typically to provide corrosion resistance to metal parts, but usage is not limited to such applications.

1.3 Classification

1.3.1 Types

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

Type II: As plated with supplementary conversion coating treatment, service temperature 500 °F (260 °C) maximum. Color, including transparent and clear, shall be as specified.

Grade A: Trivalent chromium treatment

Grade B: Trivalent chromium treatment without cobalt additives

Type III: As plated with supplementary phosphate treatment, service temperature 350 °F (177 °C) maximum.

1.3.1.1 Unless a Type is specified, Type II shall be supplied.

1.3.1.2 For Type II plating, if no Grade is specified, Grade A shall be supplied.

1.3.1.3 For Grade A or B, if no color is specified, the color may be non-uniform and shades of, or mixtures of, blue, yellow, green, iridescent, olive-green, or black.

1.3.2 Classes

Class 1: 0.0005 inch (12.7 µm), minimum thickness

Class 2: 0.0003 inch (7.6 µm), minimum thickness

Class 3: 0.0002 inch (5.1 µm), minimum thickness

1.3.2.1 Unless a Class is specified, Class 2 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 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 form 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.

AMS2417	Plating, Zinc-Nickel Alloy
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 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 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 Parts shall be within drawing dimension limits before plating, except as specified in 3.1.1.1.

3.1.1.1 Parts having part numbers with the prefix MIL, NAS, AN, MA, MS, or AS, and required to be plated in accordance with this specification, or parts where the drawing specifies that dimensions apply after plating, shall be made to such dimension that parts will be within drawing limits after plating. Undercutting before plating shall not be permitted unless specifically authorized by specifications referenced on the applicable drawing.

3.1.2 Stress Relief Treatment

All steel parts having a hardness of 36 HRC and over and steel threaded 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 and Type D Instrumentation. Temperatures to which parts are heated shall be such that maximum 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:

3.1.2.1 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.

3.1.2.2 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.

3.1.2.3 For Peened Parts

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

3.1.3 Any specified residual compressive stress-inducing operations, such as shot peening, shall precede plating.

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

3.1.4.1 Alkaline cleaning of steel parts may be done with anodic current, but steel parts over 36 HRC and steel threaded fasteners over 34 HRC shall not be cathodically cleaned.

3.1.5 Fixture/Electrical Contact Locations

3.1.5.1 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.

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

3.2 Procedure

3.2.1 Parts shall be plated by electrodeposition of zinc-nickel from a suitable alkaline zinc-nickel plating solution that will meet the composition requirement (see 3.4.1).

3.2.1.1 The zinc-nickel shall be deposited directly on the basis metal without a prior strike coating of other metal, such as copper or nickel underneath. In the case of parts, assemblies, and weldments made wholly or in part of corrosion-resistant steel or similarly passive materials, a preliminary strike of nickel or other suitable metal is permissible.