

FED. SUPPLY CLASS

MFFP

1. SCOPE

- 1.1 Purpose. This specification defines the procedures to be followed for the electrodeposited cadmium plating of fasteners, fastening systems and other related hardware primarily as a corrosion protective plating.
- 1.2 Classification. The plating shall be of the following types and classes as specified.
- 1.2.1 Types. Types refer to post plating treatments or lack thereof.
- Type I – As plated
Type II – Supplemental chromate treatment
Type III – Supplemental phosphate treatment
- 1.2.2 Classes. Classes refer to the thickness of the cadmium plating (reference 3.4.1).
- Class 1 – .0005 inches minimum thickness (13 micrometers)
Class 2 – .0003 inches minimum thickness (8 micrometers)
Class 3 – .0002 inches minimum thickness (5 micrometers)
- 1.3 Recommendations for improvement or correction of this specification should be directed to the Aerospace Industries Association.

2. APPLICABLE DOCUMENTS

2.1 Government Documents

- 2.1.1 Specifications. The following specifications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

Federal

TT-C-490 Cleaning Methods and Pretreatment of Ferrous Surfaces for Organic Coatings

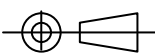
Military

MIL-S-5002 Surface Treatment and Metallic Coatings for Metal Surfaces of Weapons Systems

Copies can be obtained from the Department of Defense Single Stock Point (DODSSP). <http://dodssp.daps.dla.mil>

- 2.2 Other Publications. The following documents form a part of this standard to the extent specified herein. Unless otherwise indicated, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. The issues of documents which have not been adopted shall be those in effect on the date of the cited DoDISS.

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THIRD ANGLE PROJECTION 	CUSTODIAN NATIONAL AEROSPACE STANDARDS COMMITTEE	REVISION 1
PROCUREMENT SPECIFICATION NONE	TITLE PLATING, CADMIUM, ELECTRODEPOSITED, FOR FASTENERS	CLASSIFICATION SPECIFICATION NAS4160 SHEET 1 OF 11

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.
1000 WILSON BLVD.
ARLINGTON, VA 22209

THIS DRAWING SUPERSEDES ALL ANTECEDENT STANDARD DRAWINGS FOR THE SAME PRODUCT AND SHALL BECOME EFFECTIVE NO LATER THAN SIX MONTHS FROM THE LAST REVISION DATE.

FORM 09-01

REVISION DATE: JANUARY 31, 2013
ISSUE DATE: MARCH 2001

ASTM International

ASTM E8/E8M	Tension Testing of Metallic Materials
ASTM E29	Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications.
ASTM B117	Salt Spray (Fog) Testing
ASTM B244	Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments
ASTM E376	Standard Practice for Measuring Coating Thickness by Magnetic Field or Eddy Current (Electromagnetic) Test Methods
ASTM B487	Standard Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of a Cross Section
ASTM B499	Standard Test Method for Measuring Coating Thickness by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals
ASTM B504	Measurement of the Thickness of Metallic Coatings by the Coulometric Method
ASTM B555	Guide for Measurement of Electrodeposited Metallic Coating Thickness by the Dropping Test
ASTM B567	Measurement of Coating Thickness by the Beta Backscatter Method
ASTM B568	Measurement of Coating Thickness by X-Ray Spectrometry
ASTM E1444	Standard Practice for Magnetic Particle Examination

Copies can be obtained from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. www.astm.org

Aerospace Industries Association

NAS531	Charts, Rockwell Hardness
NASM1312-1	Fasteners, Test Methods, Method 1, Salt Spray
NASM1312-5	Fasteners, Test Methods, Method 5, Stress Durability
NASM1312-12	Fasteners, Test Methods, Method 12, Thickness of Metallic Coatings
NASM1312-14	Fasteners, Test Methods, Method 14, Stress Durability, Internally Threaded Fasteners

Copies can be obtained from the Aerospace Industries Association, 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209. www.aia-aerospace.org

SAE International

AMS2750	Pyrometry
AMS2759	Heat Treatment of Steel Parts, General Requirements
AMS6414	Steel Bars, Forgings and Tubing (SAE 4340)
AMS6415	Steel Bars, Forgings and Tubing (SAE 4340)

Copies can be obtained from SAE International, 400 Commonwealth Dr., Warrendale, PA 15096-0001. www.sae.org

(Non-government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

- 2.3 Order of Precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Materials and Mandatory Applicability

- 3.1.1 Plating Materials. The materials used shall be such as to produce platings which will meet the requirements of this specification.
- 3.1.2 Mandatory Applicability. The applications of types and classes specified herein shall be required unless specifically directed otherwise by the procuring activity (reference 6.2), engineering drawings, parts standard or procurement specification.

① COMPLETELY REVISED

REVISION

1

NAS4160

SHEET 2



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- 3.1.2.1 Internally threaded or grooved steel nuts or collars shall be plated per Type II, Class 2 unless otherwise specified. Type III may be applied where a base for lubricants or paints is required.
- 3.1.2.2 Steel fasteners with internal components which do not contact structure, such as blind fasteners and certain panel fasteners, shall conform to the requirements of 3.1.2.1 except as exempted in 3.4.1.3.
- 3.1.2.3 If Type and Class are not specified for the materials exempted from the embrittlement relief baking and testing in 3.3.3.7, Type II, Class 2 shall apply for all non-alloy steel parts except aluminum. For fasteners of aluminum alloy where Type and Class are not specified, Type II, Class 3 shall apply.
- 3.1.2.4 Titanium alloy fasteners shall not be plated to this specification.
- 3.1.2.5 Unless otherwise specified in the engineering drawing, parts standard or procurement specification, parts heat treated to a minimum tensile strength higher than 200 KSI (1,380 MPa) (43 HRC approximately) shall not be plated to this specification.
- 3.2 General Requirements
- 3.2.1 Stress Relief Treatment. Unless otherwise specified, parts which are machined, ground, cold formed or cold straightened after heat treatment so as to cause damaging residual tensile stresses, shall receive a stress relief treatment in accordance with Table I prior to shot peening, cleaning, and plating for the relief of damaging residual tensile stresses (reference 6.4). Residual compressive stresses caused by cold working of the head-to-shank fillet radius and thread forming (internal or external threads) after heat treatment are not damaging residual stresses and do not require a subsequent stress relief.
- 3.2.2 Cleaning. Unless otherwise specified, all parts shall be cleaned in accordance with MIL-S-5002.
- 3.2.2.1 Steel parts heat treated or hardened to 150 KSI minimum (1,035 MPa) (33 HRC approximately) and above shall be cleaned in accordance with MIL-S-5002 and as follows:
- Abrasive cleaning shall be used for removal of heat treat scale and oxidation as applicable (pickling is not permitted).
 - Alkaline cleaning shall be used as applicable following each cleaning or plating operation.
 - A clean water rinse shall be used as applicable following each cleaning or plating operation.
 - A single ambient temperature inhibited acid dip may be used for 45 seconds maximum for activation of surface to be plated.
- 3.2.3 Plating Sequence. Unless otherwise specified, the plating shall be applied to the basis metal after all heat treatment and mechanical operations such as machining, brazing, welding, forming and perforating of the item have been completed.
- 3.2.4 Underplating. In the case of parts made of CRES on which a preliminary plating of nickel is permissible or on parts made of aluminum on which a preliminary plating of nickel, copper or electroless nickel, or preliminary treatment such as the zincate process is permissible, the use of an undercoating or underplating shall be assumed unless otherwise specified. The maximum thickness of the underplating shall be .0001 inches (2.5 micrometers).

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REVISION

1

NAS4160
SHEET 3



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TABLE I – STRESS RELIEF REQUIREMENTS /a/

TYPE OF PART	STRENGTH LEVEL (HARDNESS)	STRESS RELIEF (BEFORE PLATING)	
		TEMPERATURE FOR STRESS RELIEF	TIME FOR STRESS RELIEF
ALLOY STEEL PARTS	150 KSI (1,035 MPa) and above (33 HRC approx. and above)	Between 350° and 400 °F (175° and 200 °C)	4 Hours minimum
	Below 150 KSI (1,035 MPa) (below 33 HRC approx.)	No requirement	–

/a/ These are general requirements. Stress relief requirements contained in end product specifications, engineering drawings or contract/ purchase orders shall take precedence over these requirements. Many specifications will specify a stress relief temperature at 50 °F (30 °C) below the tempering temperature of the material.

3.3 Detail Requirements

3.3.1 Coverage of Plating. Unless otherwise specified, the plating shall cover all surfaces including roots of threads, corners, recesses, and holes as detailed in 3.4.1, 3.4.1.1 and 3.4.1.2 with the exceptions as stated in 3.4.1.3 and 3.4.1.3.1.

3.3.2 Luster and Appearance. Unless otherwise specified, either a bright or dull luster shall be acceptable. Unless otherwise specified in the engineering drawing or procurement specification, the use of brighteners is permitted in the plating solution for fasteners heat treated or hardened below 180 KSI (1,250 MPa) (40 HRC approximately) minimum tensile strength. The amount of brightener shall be limited to a maximum of 5 percent of the total bath volume. The cadmium plating shall be smooth, adherent, uniform in appearance, free from blisters, pits, nodules, burning and other defects when examined visually without magnification. Superficial staining, which has been demonstrated as resulting from rinsing, or slight discoloration from any drying or baking operation as specified shall not be cause for rejection. Parts in the same lot shall have a similar luster and appearance.

3.3.3 Hydrogen Embrittlement Relief Treatment and Testing

3.3.3.1 Unless otherwise specified, all alloy steel fasteners or fastener components heat treated to a minimum requirement less than 150 KSI (1,035 MPa) (33 HRC approximately) do not require embrittlement relief treatment or testing.

3.3.3.2 Externally Threaded/Grooved Fasteners. Unless otherwise specified, all externally threaded or grooved steel fasteners or fastener components heat treated to 150 KSI (1,035 MPa) (33 HRC approximately) minimum strength and higher shall be baked within 4 hours after the plating operation is completed, as specified in Table II.

3.3.3.3 Internally Threaded/Grooved Fasteners. Unless otherwise specified, all internally threaded or grooved steel fasteners or fastener components heat treated or hardened with an actual measured hardness of 33 HRC (or equivalent) and higher shall be baked within 4 hours after the plating operation is completed, as specified in Table II.

3.3.3.4 Unless otherwise specified, all lots of steel fasteners heat treated to 180 KSI (1,250 MPa) (40 HRC approximately) minimum strength shall be subjected to the hydrogen embrittlement stress durability test specified in 4.3.5.

3.3.3.5 The embrittlement relief baking shall be done prior to the application of Type II and Type III supplementary coatings. The cadmium surface passivated as a result of the baking operation shall be reactivated prior to application of the supplementary treatment.

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1

NAS4160
SHEET 4



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