INCH-POUND

QQ-P-416F
AMENDMENT 2
30 MAY 1995
SUPERSEDING
AMENDMENT 1
1 MARCH 1993

FEDERAL SPECIFICATION

PLATING, CADMIUM (ELECTRODEPOSITED)

The General Services Administration has authorized the use of this amendment, which forms a part of QQ-P-416F, dated October 1, 1991 by all federal agencies.

PAGE 1

1.2.2: Delete and substitute:

"Classes.

1 - 0.0005 inch, minimum
2 - 0.0003 inch, minimum
3 - 0.0002 inch, minimum"

PAGE 2

2.1.1: Delete: "MIL-S-8844 - Steel Bars, Reforging Stock, and Mechanical Tubing, Low Alloy, Premium Quality"

PAGE 3

2.2: Add the following after the ASTM listing:

"SAE

AEROSPACE MATERIAL SPECIFICATIONS (AMS)

AMS 2750 - Pyrometry

AMS 6414 - Steel Bars, Forgings, and Tubing, 0.80Cr 1.8Ni 0.25Mo (0.38-0.43C), Vacuum Consumable Electrode Remelted

(Application for copies should be addressed to SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001)"

3.1: Add new paragraph, as shown, after 3.1:

"3.1.1 Inventory. Items in inventory that were plated prior to the issuance of this amendment may be used until the supply is exhausted."

3.2.1: Delete entire paragraph.

3.2.3: Add a new subparagraph (d), after subparagraph (c), as shown below:

"d. Surface activation of the part in an inhibited acid is acceptable for purposes of plating adhesion."

3.2.5: In fifth line, after "zincate process," add:

"or preliminary plating of copper or electroless nickel"

3.2.7: Delete and substitute:

"3.2.7 Luster. Unless otherwise specified in the engineering drawing or procurement documentation (or in 3.2.7.1), the use of brightening agents, or other additives which produce brightened deposits in the plating solution, is prohibited on components with a specified heat treatment of 180 ksi minimum tensile strength (or 40 HRC) and higher. Either a bright (not caused by brightening agents) or dull luster shall be acceptable. Brighteners may be used with the alloys listed in 3.2.8."

3.2.8: Add the following wording after the last sentence:

"The following alloys are not considered susceptible to hydrogen embrittlement from the cadmium plating process, and therefore do not require the hydrogen embrittlement relief treatment (see tables I and IA), or the hydrogen embrittlement relief test of 3.3.4:

a. UNS S66286, UNS N07718, UNS R30159, UNS R30035, UNS N04400, UNS N06600, UNS N07750.
b. 300 series austenitic stainless steels.
c. Aluminum, and aluminum alloys."

Add new paragraph, after 3.2.8, as follows:

"3.2.8.1 Baking procedure control. The bake furnace pyrometry shall conform to AMS 2750. All parts shall be baked continuously at temperature, within the specified range. Interruptions for loading and unloading parts shall

be permitted provided the time between the opening of the furnace door, and the re-establishment of the specified baking temperature, is not used to determine the total cumulative bake time. The specified baking temperature shall be considered to be re-established when all control, indicating and recording thermocouples reach the specified baking temperature."

PAGE 5

3.3.1: Delete and substitute:

"3.3.1 Thickness of plating.

a. Unless otherwise specified (see 6.2), for surfaces that can be touched by a sphere 0.75 inches in diameter, including external threads, the minimum thickness of cadmium plating shall be as specified for each class in 1.2.2. If not specified, the maximum shall be the minimum plus 0.0003 inch.

b. For internally threaded parts, a maximum limit of 0.0005 inch above the minimum shall be allowed on the external surfaces.

c. For surfaces that cannot be touched by a 0.75 inch sphere, including internal threads, no thickness requirements are established, but such areas shall show evidence of coating. There shall be no bare areas, except for areas beyond a hole depth of 2.5 times the hole diameter, see 6.1.1.1.2.

d. The plating thickness shall be uniform in thickness on surfaces that can be touched by a 0.75 inch sphere except that slight buildup on exterior corners and edges will be permitted provided the finished engineering drawing dimensions are met."

PAGE 6

3.5.2: Delete the first sentence and substitute:

"The cadmium plating shall be smooth, adherent, uniform in appearance, free from blisters, pits, nodules, burning, and other defects when examined visually without magnification."

PAGE 7

4.4.2.2.2: In the third line, delete "several" and replace with "one or more".

PAGE 8

4.5.3: In third line, delete "MIL-S-8844, Class 1" and replace with "AMS 6414".

Page 10

6.1.1: Add the following sentence after the last sentence:

"Unless otherwise specified in the purchase order, engineering drawing, parts standard, or procurement specification, parts heat treated to an ultimate tensile strength greater than 200 ksi (or HRC 43), should not be plated in accordance with this specification."

PAGE 10

6.1.1.1.2: Add the following sentence after the last sentence:

"For example, it is difficult to obtain complete plating coverage in areas beyond a hole depth of 2.5 times the hole diameter for holes equal to, or smaller than, 0.75 inch in diameter."

PAGE 11

Add two new paragraphs, as follows, after 6.1.3:

"6.1.4 Brighteners. Brighteners are organic or metallic compounds that when added to alkaline cyanide cadmium plating baths, influence the formation of the electrodeposited cadmium crystals.

6.1.5 Tensile strength and hardness values. The heat treated material tensile strength and hardness values as specified in this document represent the minimum values specified in the procurement specification or end product drawing. They do not represent the values obtained from actual hardness or tensile testing of the component, or calculations of tensile strength based on actual tested values and various stress areas."

Delete entire page and substitute this page:

Table 1. Stress relief and embrittlement relief requirements for fasteners, rod end bearing bodies, track roller bearing studs, and end washers of needle track roller bearings. 1/, 6/

Type of part	Tensile Strength (ksi) Hardness (HRC)	Stress Relief 5/ (Before Plating		Embrittlement relief (after Plating)		
		Temperature for stress relief	Time for Stress relief	Time Between Plating and Baking	Temperature for baking	Time for baking
2/	HRC 55 and over	275°F ± 25°F 3/	5 hours minimum	Shall not exceed 4 hours	275°F ± 25°F 4/	23 hours minimum
All other steel parts	150 ksi and above (or HRC 33 and above)	375°F ± 25°F	4 hours minimum	Shall not exceed 4 hours	375°F ± 25°F	23 hours minimum
	Below 150 ksi (below 33 HRC)	No requirement		No requirement		

1/ Stress and embrittlement relief requirements contained in engineering drawings, part standards, procurement specifications, or contract/purchase orders shall take precedence over these requirements.

2/ Parts, including carburized parts, which will decrease in hardness or be otherwise deleteriously affected by heating to 375°F.

3/ Parts with upper operating temperature limits of less than 275°F shall be stress relieved at an appropriate temperature for not less than 5 hours.

4/ Parts with upper operating temperature limits of less than 275°F shall be baked at an appropriate temperature for not less than 23 hours.

5/ Stress relieving may also be accomplished by heating to a temperature no higher than 50°F below the tempering temperature for a time period no less than one hour per inch of thickness.

6/ Embrittlement relief baking and stress relieving are not required for the materials listed in 3.2.8.

PAGE 11

6.2: Add the following after 6.2:

" 6.2.1 The manufacturer of the parts should provide the plating facility with the following data:

a. The minimum specified heat treated tensile strength or hardness of steel parts, see 6.1.5.

b. Heat treatment for stress relief, whether it has been performed or required, see 3.2.2.

c. Tensile loads required for embrittlement relief test, if applicable, see 4.6.4. "

PAGE 15

Table IA: Add "6/" to the title heading, and also add the note as shown below:

"6/ Embrittlement relief baking and stress relieving are not required for the materials listed in 3.2.8."

PAGE 16

Table II: Delete entire table.

Custodians:
Army - MR
Navy - AS
Air Force - 11

Review Activities:
Army - AL, AR, ER, GL, CR, AT, ME, MI
Navy - SH, MC, YD
Air Force - 70, 99, 82, 84
DLA - IS
GSA - FSS

Preparing Activity
Navy - AS

(Project MFFP-0530)