

Chromium Plating (Electrodeposited)

RATIONALE

AMS-QQ-C-320 has been designated Cancelled and Superseded because equivalent technical requirements are provided by AMS 2460 and to permit continued use for certain parts mentioned below.

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE, as of 07/19/2007 and has been superseded by AMS 2460. The requirements of the latest issue of AMS 2460 shall be fulfilled whenever reference is made to the cancelled AMS-QQ-C-320 with the following exception: For parts where QQ-C-320 or AMS-QQ-C-320 is specified, it is permissible to use equipment, practices, and test methods conforming to AMS-QQ-C-320 (no change, issued July 2000) and that were acceptable to the purchaser prior to cancellation. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications, noting that it has been superseded by AMS 2460.

Cancelled specifications are available from SAE.

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NOTICE

This document has been taken directly from U.S. Military Specification QQ-C-320B, Amendment 4 and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace QQ-C-320B, Amendment 4. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this SAE technical document.

1. SCOPE AND CLASSIFICATION:

1.1 Scope:

This specification covers the requirements for electrodeposited chromium plating.

1.2 Classification:

1.2.1 Classes: Electrodeposited chromium plating shall be of the following classes, as specified (see 6.2):

Class 1 - Corrosion protective plating (see 3.3.1)

Class 2 - Engineering plating (see 3.3.2)

1.2.2 Finish: Class 1 plating shall be of the following types of finish, as specified (see 6.2):

Type I - Bright finish

Type II - Satin finish

2. APPLICABLE DOCUMENTS:

The following specifications and standards form a part of this document to the extent specified herein.

2.1 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

QQ-N-290	Nickel Plating (Electrodeposited)
MIL-S-5000	Steel, Chrome-Nickel-Molybdenum, (E4340), Bars and Reforging Stock
MIL-S-5002	Surface Treatments and Inorganic Coatings for Metal Surfaces of Weapons Systems
MIL-S-13165	Shot Peening of Ferrous Parts
MIL-R-81841	Rotary Flap Peening of Metal Parts
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-1312	Fasteners, Test Methods

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B-487	Measurement of Metal and Oxide Coating Thickness by Microscopic Examination of a Cross Section
ASTM B-499	Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals
ASTM B-504	Measuring the Thickness of Metallic Coatings by the Coulometric Method
ASTM B-556	Thin Chromium Coatings by the Spot Test, Guideline for Measurement of
ASTM B-578	Measurement of Microhardness of Electroplated Coatings
ASTM E-8	Tension Testing of Metallic Materials

3. REQUIREMENTS:

3.1 Materials:

The materials used shall be such as to produce platings which meet the requirements of this specification.

3.2 General requirements:

- 3.2.1 High tensile steel parts: Unless otherwise specified (see 6.2), steel parts having an ultimate tensile strength greater than 240,000 psi (1655 MPa) shall not be plated without specific approval of the procuring activity.

- 3.2.2 Stress relief treatment: All steel parts having an ultimate tensile strength of 150,000 psi (1034 MPa) and above, which are machined, ground, cold formed or cold straightened, shall be baked at a minimum of $375 \pm 25^{\circ}\text{F}$ ($191 \pm 14^{\circ}\text{C}$) for three hours or more prior to cleaning and plating for the relief of damaging residual tensile stresses. When peening is required (see 3.3.2.3 and 3.3.2.5), thermal stress relief shall be performed prior to shot or rotary flap peening.
- 3.2.3 Cleaning: Unless otherwise specified (see 6.2), all steel parts shall be cleaned in accordance with MIL-S-5002. Other basis metals shall be cleaned by methods which shall not damage the substrate and shall not interfere with adhesion of the deposit.
- 3.2.4 Plating application: Unless otherwise specified (see 6.2), the plating shall be applied after all basis metal heat treatments and mechanical operations, such as machining, brazing, welding, forming and perforating of the article, have been completed.
- 3.2.5 Underplating: Unless otherwise specified (see 6.2), class 1 plating shall be applied over an intermediate plating of nickel in accordance with QQ-N-290 on steel, zinc and zinc-based alloys or copper and copper-based alloys. Unless otherwise specified (see 6.2), class 2 plating shall be deposited on the basis metal without a preliminary plating of another metal. In no case shall any underplate be substituted for any part of the specified chromium thickness.
- 3.2.6 Embrittlement relief: All coated steel parts having an ultimate tensile strength of 160 ksi and higher (or Rockwell hardness C36 and higher) shall be baked at $375^{\circ} \pm 25^{\circ}\text{F}$ ($191^{\circ} \pm 14^{\circ}\text{C}$), within four hours after plating, in accordance with the following times:

Minimum Baking Times

Tensile Strength ksi	Time (At Temperature) Hours
160 - 180	3
181 - 220	8
221 and above	12

- 3.2.7 Coverage: Unless otherwise specified (see 6.2), the plating shall cover all surfaces including roots of threads, corners and recesses.
- 3.2.8 Boundaries: Boundaries of class 2 plating which covers only a portion of the surface shall be free from beads, nodules, jagged edges and other irregularities.
- 3.2.9 Finish: For class 1 plating, the finish or luster shall be as specified (see 1.2.3 and 6.2). Type I of class 1 shall be a fully bright finish, smooth, uniform in appearance and free from frosty areas. Type II of class 1 shall be a satin finish, smooth and uniform in appearance. Unless otherwise specified (see 6.2), either a fully bright or a dull matte finish, smooth and free from frosty areas shall be acceptable for class 2 plating finish.

3.3 Processing:

- 3.3.1 Class 1 processing: Parts for class 1 deposition shall be plated to specific dimensions as specified (see 3.4.1.1). When specified (see 6.2), parts shall be processed in accordance with procedural instructions for form of chromium deposit (see 6.5).
- 3.3.2 Class 2 processing: Parts for class 2 deposition shall be plated to specific dimensions as specified (see 3.4.2.1). Unless otherwise specified (see 6.2), steel parts shall be processed in accordance with the procedural instructions of the procuring activity as follows:
- 3.3.2.1 Peening: All class 2 plated parts which are designed for unlimited life under dynamic loads, shall be peened in accordance with MIL-S-13165 or MIL-R-81841 prior to plating. Unless otherwise specified in the applicable drawings, the peening shall be accomplished on all surfaces for which the plating is required and on all immediately adjacent surfaces when they contain notches, fillets or other abrupt changes of section size where stress will be concentrated. Plated parts which are subjected to static loads or designed for limited life under dynamic loads or combinations thereof, need not be peened prior to plating, unless specified in the contract, order, or applicable drawing.
- 3.4 Detail requirements:
- 3.4.1 Class 1:
- 3.4.1.1 Thickness: Unless otherwise specified (see 6.2), the minimum thickness of class 1 chromium plating shall be 0.00001 inch or 0.01 mil (0.25 micrometre) on all visible surfaces which can be touched by a ball 0.75 inch (19 mm) in diameter. Unless otherwise specified (see 6.2), holes, deep recesses and other openings, bases of angles, and articles with internal threads from which the external environment is completely excluded and where a controlled deposit cannot be normally obtained shall not be subjected to a thickness requirement but shall show evidence of plating. There shall be no bare areas.
- 3.4.1.2 Underplating: Class 1 plating is normally used with an underplate system of nickel or copper. Where such requirements exist (see 3.2.5), the underplate thickness shall be in accordance with QQ-N-290. The thickness of the underplate shall not be used in determination of the specified chromium plating thickness.
- 3.4.1.3 Adhesion: The adhesion of the plating and any underplate shall be such that, when examined at a magnification of approximately 4 diameters, neither the chromium plating nor any electrodeposited underplate(s) shall show separation from the basis metal or from each other at their common interface(s) when subjected to the test described in 4.5.2. The interface between a plating and the basis metal is the surface of the basis metal before plating. The formation of cracks in the plate or the basis metal which does not result in flaking, peeling or blistering of the plating shall not be cause for rejection.
- 3.4.2 Class 2: