



AEROSPACE MATERIAL SPECIFICATION	AMS-C-81562™	REV. A
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Coatings, Cadmium, Tin-Cadmium and Zinc (Mechanically Deposited)		

RATIONALE

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1. SCOPE:

1.1 Scope:

This specification covers the requirements for three types and three classes of mechanically deposited cadmium, tin-cadmium or zinc coatings on metallic surfaces by impacting (peen plating).

1.2 Classification:

The coatings, cadmium, tin-cadmium and zinc shall be of the following types and classes, as specified (see 6.2.1).

1.2 Types:

Type I - As coated

Type II - With supplementary chromate treatment (see 3.2.9 and 6.1.2)

Type III - With supplementary phosphate treatment (see 3.2.10)

1.2.1 Materials and classes:

Material of coating	Classes (thickness - inch)					
	1	2	3	4	5	6
C - cadmium	0.0005	0.0003	0.0002	-	-	-
T - tin-cadmium	0.0005	0.0003	0.0002	-	-	-
Z - zinc	0.003	0.002	0.0017	0.001	0.0005	0.0003

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 ASTM Publications:

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

ASTM B 117 Salt Spray (Fog) Testing.

ASTM B 244 Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metal with Eddy-Current Instruments, Measurement of.

ASTM B 487 Metal and Oxide Coating Thicknesses by Microscopic Examination of a Cross Section, Measurement of.

ASTM B 499 Coating Thickness by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metal, Measurement of.

ASTM B 567 Coating Thickness by the Beta-Backscatter Method, Measurement of.

ASTM B 568 Coating Thickness by X-Ray Spectrometry, Measurement of.

2.2 U.S. Government Publications:

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

TT-C-490 Cleaning Method and Pretreatment of Ferrous Surfaces for Organic Coatings.
ZZ-E-661 Eraser, Rubber and Rubber Substitute.
NNN-P-40 Paper, Lens.

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-L-7808 Lubricating Oil, Aircraft Turbine Engine, Synthetic Base.

FED-STD-141 Paint, Varnish, Lacquer and Related Materials, Methods of Inspection, Sampling and Testing.

FED-STD-151 Metals; Test Methods.

MIL-STD-105 Sampling, Procedures and Tables for Inspection by Attributes.

MIL-STD-1312 Fasteners, Test Methods.

3. REQUIREMENTS:

3.1 Materials:

The materials used shall be such as to produce coatings of cadmium, tin-cadmium or zinc, as specified (see 6.2.1), which meet the requirements of this specification.

3.1.1 Tin-cadmium composition: The composition of the material for the tin-cadmium coating shall contain 25 to 55 percent tin by weight and the remainder shall be cadmium (see 6.10).

3.2 General requirements:

3.2.1 Stress relief treatment: All steel parts having an ultimate tensile strength of 180,000 pounds per square inch (psi) and above, which are machined, ground, cold formed or cold straightened, shall be given a heat treatment at a minimum of $191^{\circ} \pm 14^{\circ}\text{C}$ ($375^{\circ} \pm 25^{\circ}\text{F}$) for three hours or more, prior to cleaning and coating for the relief of damaging residual tensile stresses. Carburized parts shall be baked at $135^{\circ} \pm 14^{\circ}\text{C}$ ($275^{\circ} \pm 25^{\circ}\text{F}$) for five to eight hours.

3.2.2 Cleaning: All ferrous parts shall be cleaned in accordance with MIL-S-5002. Those parts having a Rockwell hardness of C 33 and higher shall be cleaned using materials which have no damaging effects on the metal, such as pitting, intergranular attack, significant etching and hydrogen embrittlement. Oxides on steel used for parts shall be removed by mechanical means such as glass bead blasting or vapor blasting, or by electrolytical alkali cleaning. Acid pickling or cathodic cleaning shall not be used. Other basis metals shall be cleaned by methods which shall not damage the substrate and shall not interfere with adhesion of the coating.

- 3.2.3 Coating application: The coating shall be applied after all basis metal heat treatments and mechanical operation, such as machining, brazing, welding, forming and perforating of the article, have been completed.
- 3.2.4 Undercoating: The coating may be deposited directly on the basis metal without a preliminary coating except that a flash undercoat of copper or other suitable metal may be applied mechanically or by immersion to improve adhesion.
- 3.2.5 Coverage: Unless otherwise specified, the coating shall cover all surfaces as stated in 3.3.1, 3.3.1.1 and 3.3.1.2 including roots of threads, thread peaks, corners and recesses (see 6.2.1).
- 3.2.6 Finish: Unless otherwise specified, either a light matte or semi-satin finish will be acceptable (see 6.2.1).
- 3.2.7 Embrittlement relief: Before application of any load or being used, all steel parts shall be held for a minimum of forty-eight (48) hours at room temperature after coating. Such conditioned parts, when tested in accordance with 4.5.6, shall not crack or fail by fracture.
- 3.2.8 Supplementary treatments: The chromate treatment (see 3.2.9) or the phosphate treatment (see 3.2.10) shall be applied directly after the coating operation to parts specified to be supplementary treated.
- 3.2.9 Chromate treatment (Type II): Unless otherwise specified (see 6.2.1), the chromate treatment required for conversion to Type II shall be a treatment in or with an aqueous solution of salts, acids or both, to produce a continuous smooth, distinct protective film, distinctly colored iridescent bronze to brown including olive drab and yellow with the cadmium and zinc materials. The tin-cadmium material shall be acceptable even if the typical yellow or iridescent color is not evident. The articles so treated shall be thoroughly rinsed and dried in accordance with the process used. Type II coating shall be similar in appearance and adhesion to coatings on separate specimens which are capable of passing the saltspray test (see 3.3.5.1, 4.4.3.3, 4.4.4.2 and 4.5.4). Usual chromic acid and nitric acid bright dips are not chromate treatments.
- 3.2.10 Phosphate treatment (Type III): Unless otherwise specified (see 6.2.1), the phosphate treatment required for conversion to Type III shall produce a tightly adherent film conforming to Type I of TT-C-490.
- 3.3 Detail requirements:
- 3.3.1 Thickness: Unless otherwise specified (see 6.2.1), the coating thickness, as specified in the contract, purchase order or applicable drawing, on significant surfaces for each class of coating shall be as detailed in Table I. Significant surfaces shall be all visible surfaces of the article which can be touched by a sphere 0.75 (19 mm) in diameter plus additional functional surfaces specified (see 6.2.1). Where Class 1 is specified, all other visible surfaces shall be Class 2 minimum thickness. If the maximum thickness for Class 1 is not specified in the contract, order or applicable drawing, the thickness for C and T coatings shall not exceed 0.0008 inch (20 microns). Where Class 2 is specified, all other visible surfaces shall be Class 3 minimum thickness, and for Z coatings, the minimum thickness for all other visible surfaces of Class 4 coatings shall be Class 5. The minimum thickness for all other visible surfaces of Class 3 C and T coatings shall be 0.00015 inch (4 microns) and 0.0002 inch (5 microns) for Class 5 Z coatings.

- 3.3.1.1 The coatings shall be Class 1 thickness, unless otherwise specified in the contract, order or controlled by the following exception (see 6.2.1):
- a. Bolts, studs, washers and articles with portions externally threaded shall have a minimum of Class 2 thickness on the threaded portions except for fine-threaded zinc coated parts which shall have a minimum of 0.0003 inch (8 microns).
 - b. Holes, other openings and articles with internal threads from which the external environment is completely excluded, shall not be subjected to a thickness requirement but shall show evidence of coating. There shall be no bare areas.
- 3.3.1.2 Undercoat: When an undercoat is used (see 3.2.4), the thickness of the copper or other suitable metal shall be less than 10 percent of the total coating thickness. The thickness of the undercoat shall not be included in the determination of the coating thickness.
- 3.3.2 Types: Unless otherwise specified (see 6.2.1), coating shall be Type II. For use on surfaces to be painted, the coating shall be either Type II or Type III (see 6.1.1 and 6.1.2).
- 3.3.3 Adhesion: The adhesion of the coating shall be such that when examined at a magnification of approximately 4X diameters, the coating shall not show separation from the basis metal or from any undercoating at the interface, nor shall any undercoat show separation from the basis metal at the interface when subjected to the tests described in 4.5.2. The interface between the coating and either the basis metal or the undercoat is the surface before coating. The interface between the undercoat and the basis metal is the surface before undercoating. The formation of cracks in the coating caused by rupture of the basis metal, the undercoat or combination of both which do not result in flaking, peeling or blistering of the coating shall not be considered as nonconformance to this requirement.
- 3.3.4 Adhesion of Type II supplementary film: The adhesion of a Type II supplementary film to the coating shall be such that, when tested as detailed in 4.5.3, the supplementary chromate film shall not be removed or worn through to the underlying mechanically-deposited coating.
- 3.3.5 Corrosion resistance:
- 3.3.5.1 Type II: Coatings with the Type II treatment shall show neither white corrosion products nor basis metal corrosion products at the end of the time periods shown in Table II, when tested by continuous exposure to the salt spray in accordance with 4.5.4. The appearance of corrosion products, visible to the unaided eye at normal reading distance, shall be cause for rejection, except that white corrosion products at the edges of specimens shall not constitute failure.
- 3.3.5.2 Types I and III: When specified in the contract or order (see 6.2.1), coatings with either the Type I or Type III treatment shall show no corrosion products of the basis metal at the end of the time periods shown in Table II, when tested by continuous exposure to salt spray in accordance with 4.5.4. Any appearance of corrosion products of the basis metal shall be cause for rejection, except that corrosion products at the edges of specimens shall not constitute failure.