AEROSPACE MATERIAL SPECIFICATION

AMS2426	REV. E

Issued 1966-09
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Revised 2013-09

Superseding AMS2426D

Coating, Cadmium Vacuum Deposition

RATIONALE

AMS2426E results from a Five Year Review and update of this specification.

1. SCOPE

1.1 Purpose

This specification covers the requirements for vacuum deposited cadmium.

1.2 Application

This process has been used typically to provide a corrosion resistant coating for high strength ferrous parts operating at not higher than 450 °F (232 °C) and requiring freedom from hydrogen embrittlement, but usage is not limited to such applications. Deposits are “line-of-sight” and may not be applicable to some internal surfaces.

1.3 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 that 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.

1.4 Warning

This document includes cadmium as a coating material. The use of cadmium has been restricted and/or banned for use in many countries due to environmental and health concerns. The user should consult with local officials on applicable health and environmental regulations regarding its use.

2. APPLICABLE DOCUMENTS

The issues of the following documents in effect on the date of the purchase order forms 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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
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SAE WEB ADDRESS: **http://www.sae.org**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS2426E

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS2750 Pyrometry

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 B 117 Operating Salt Spray (Fog) Testing Apparatus

ASTM B 487 Measurement of Metal and Oxide Coating Thicknesses by Microscopical 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 Measurement of Thickness of Metallic Coatings by the Coulometric Method

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

ASTM B 571 Adhesion of Metallic Coatings

3. TECHNICAL REQUIREMENTS

3.1 Preparation

3.1.1 Ferrous parts heat treated to a range including or exceeding a tensile strength of 240 ksi (1655 MPa) or hardness of 49 HRC shall not be exposed to processes that cause hydrogen embrittlement, such as pickling, cathodic cleaning, and etching, or to corrosive environments.

3.1.2 Prior to any processing which could cause hydrogen embrittlement, ferrous parts heat treated to a range including or exceeding a tensile strength of 180 ksi (1241 MPa) or hardness of 40 HRC that are machined, ground, cold formed or cold straightened after heat treatment shall be cleaned to remove surface contamination and thermally stress relieved. Furnaces used for stress relief shall be controlled per AMS2750; the minimum requirements shall be Class 5, with Type D Instrumentation. Temperatures to which parts are heated shall be such that 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, and for carburized and induction hardened parts, stress relieve at 275 °F ± 25 (135 °C ± 14) 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 (191 °C ± 14) 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 elected, the stress relieve shall be performed prior to peening or the cognizant engineering organization shall be consulted and shall approve the stress relief temperature.

3.1.3 Parts shall be within specified dimensional tolerances after coating.

3.2 Procedure

3.2.1 Cadmium shall be deposited directly onto the basis metal without a preliminary coating of other metal.

3.2.2 Parts shall be coated by deposition of vaporized metallic cadmium within a suitable vacuum.

3.2.2.1 The equipment and processes employed shall be adequate to ensure coverage of all external surfaces, including roots of threads, recesses, and sharp corners.

3.2.3 After coating, parts shall be conversion coated. Unless otherwise specified, a chromate conversion coating shall be used.

3.3 Properties

The cadmium coating shall conform to the following requirements:

3.3.1 Thickness shall be as specified on the drawing, determined in accordance with any of the following methods as applicable: ASTM B 487, ASTM B 499, ASTM B 504, ASTM B 568, direct micrometer measurement, or other method acceptable to the cognizant engineering organization.

3.3.1.1 Coating thickness, when specified by AMS2426 and a suffix number, shall be as specified in Table 1 for the specified suffix number and type of part or surface.

TABLE 1 - COATING THICKNESS AND SALT SPRAY CORROSION RESISTANCE REQUIREMENTS

AMS 2426 Thickness Designation Specified	External Threads Thickness Inch	External Threads Thickness Micrometers	External Threads Salt Spray Resistance Hours, min	Nuts, Washers, and Unthreaded Surfaces of Parts Externally Threaded Thickness Inch	Nuts, Washers, and Unthreaded Surfaces of Parts Externally Threaded Thickness Micrometers	Nuts, Washers, and Unthreaded Surfaces of Parts Externally Threaded Salt Spray Resistance Hours, min	Parts Not Externally Threaded except Nuts and Washers Thickness Inch	Parts Not Externally Threaded except Nuts and Washers Thickness Micrometers	Parts Not Externally Threaded except Nuts and Washers Salt Spray Resistance Hours, min
2426	0.0001	2.5	100	0.0002	5.1	150	0.0003	7.6	200
	0.0004	10		0.0005	12.7		0.0005	13	
2426-1	0.0001	2.5	100	0.0002	5.1	150	0.0001	2.5	100
	0.0003	7.6		0.0004	10		0.0003	7.6	
2426-2	0.0001	2.5	100	0.0002	5.1	150	0.0002	5.1	150
	0.0004	10		0.0004	10		0.0004	10	
2426-3	0.0002	5.1	150	0.0003	7.6	200	0.0003	7.6	200
	0.0005	13		0.0005	13		0.0005	13	
2426-4	0.0003	7.6	200	0.0004	10	225	0.0004	10	225
	0.0006	15		0.0006	15		0.0006	15	
2426-5	0.0004	10	225	0.0005	13	250	0.0005	13	250
	0.0007	18		0.0007	18		0.0007	18	

Notes:
For thickness designations AMS2426-X, where X is greater than 5, coating thickness in ten-thousandths of an inch shall be X to X+2 except on external threads where coating thickness shall be X-1 to X+2; such parts shall withstand salt spray for not less than 250 hours.
For thickness designations AMS2426-X, where X is greater than 5, coating thickness in micrometers shall be 2.5X to 2.5 (X+2) except on external threads where coating thickness shall be 2.5 (X-1) to 2.5 (X+2); such parts shall withstand salt spray for not less than 250 hours.

3.3.1.2 Where “cadmium flash” is specified, coating thickness shall be approximately 0.0001 inch (2.5 µm).

3.3.1.3 The coating shall be substantially uniform in thickness on significant surfaces except that slight build-up on exterior corners or edges will be permitted provided finished drawing dimensions are met.

3.3.1.4 All surfaces of the part, except those that cannot be touched by a sphere 0.75 inch (19 mm) in diameter, shall be coated to the specified thickness. Unless otherwise specified, surfaces such as holes, recesses, threads and other areas where a controlled deposit cannot be obtained under normal coating conditions, may be under the specified limit provided they show visual coating coverage. Except as specified in Table 1 for externally threaded sections, the resultant thickness shall be considered only when such surfaces of parts can be touched by a sphere 0.75 inch (19.0 mm) in diameter.

3.3.2 Adhesion shall be determined using one of the following methods:

3.3.2.1 Coating shall not show separation from the basis metal when tested in accordance with a method described in ASTM B 571.

3.3.2.2 Coating shall not show separation from the basis metal when tested using a pressure sensitive tape with 2.5 pounds per inch (446 g/cm) minimum peel strength. The tape shall be applied to the coated surface, rolled into place using a rubber roller, and then rapidly removed by peeling the tape at a 90-degree angle to the coated surface.

3.3.3 Corrosion Resistance

Ferrous metal parts or representative test panels (4.3.3.2) processed with parts represented shall show no visual evidence of corrosion of the basis metal after being subjected for a time not less than specified in Table 1 to continuous salt spray corrosion test conducted in accordance with ASTM B 117. When test specimens are used, coating thickness shall be 0.0002 to 0.0004 inch (5 to 10 µm). Corrosion resistance shall not apply to non-ferrous parts, parts made of austenitic corrosion resistant steels, parts coated to a thickness less than 0.0002 inch (5 µm), or to surfaces of parts such as holes, recesses, or threads that may have less than 0.0002 inch (5 µm) coating thickness.

3.3.3.1

3.4 Quality

Cadmium deposit, as received by purchaser, shall be smooth, continuous, adherent to basis metal, uniform in appearance, and essentially free from pinholes, porosity, blisters, nodules, pits, and other imperfections detrimental to usage of the coating. Slight staining or discoloration is permissible.

3.4.1 The cadmium deposit shall show no indication of contamination or improper operation of equipment used to produce the coating, such as powdery or darkened coatings.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The processor shall supply all samples for processor's tests and shall be responsible for the performance of all required tests. Parts, when required for test, shall be supplied by purchaser. The cognizant engineering organization reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that processing conforms to the requirements of this specification.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Thickness (3.3.1), adhesion (3.3.2), and quality (3.4) are acceptance tests and shall be performed on parts or specimens representing parts when permitted herein from each lot. See 4.3.3.

4.2.2 Periodic Tests

Corrosion-resistance (3.3.3) and tests of equipment and process controls to ensure that the deposited metal will conform to the specified requirements are periodic tests and shall be performed at a frequency selected by the processor unless frequency of testing is specified by the cognizant engineering organization.

4.2.3 Preproduction Tests

All property verification tests (section 3.4) are preproduction tests and shall be performed prior to production and when the cognizant engineering organization requires confirmatory testing.

4.3 Sampling for Testing

4.3.1 Acceptance Tests

Test samples shall be randomly selected from all parts in the lot. A lot shall be all parts of the same part number, cleaned and pretreated as applicable at the same time in the same equipment, and coated in a single pumpdown, and presented for processor's inspection at one time: Unless the cognizant engineering organization provides a sampling plan, the minimum number of samples shall be as shown in Table 2.

TABLE 2 - SAMPLING FOR ACCEPTANCE TESTING

Number of Parts in Lot	Quality	Thickness and Adhesion
Up to 7	all	3 or all
8 to 15	7	4
16 to 40	10	4
41 to 110	15	5
111 to 300	25	6
301 to 500	35	7
501 to 700	50	8
701 to 1200	75	10
Over 1200	125	15

* Whichever is less

4.3.2 Periodic Tests

Sample quantities shall be at the discretion of the processor unless otherwise specified by the cognizant engineering organization.

4.3.3 Sample Configuration

Nondestructive testing shall be performed wherever practical. Except as noted, actual parts shall be selected as samples for tests. When representative specimens are used for acceptance testing, values so obtained shall be correlated with those of parts since properties, such as thickness, may differ between parts and representative test specimens.

4.3.3.1 Representative test specimens may be used in lieu of parts under any one of the following circumstances: The parts are of such configuration or size as to be not readily adaptable to specified tests, nondestructive testing is not practical on actual parts, or it is not economically acceptable to perform destructive tests on actual parts. Except as specified below, representative test specimens shall be made of the same generic class of alloy as the parts, established in accordance with AS2390, distributed within the lot, cleaned, and coated with the parts represented.

4.3.3.2 Corrosion Testing

When ferrous alloy parts are processed within the test period (quarter), representative test specimens shall be low carbon or low alloy steel 0.025 inch (0.63 mm) minimum thickness and not less than 4 x 6 inches (102 x 152 mm) or bars approximately 0.5 inch (13 mm) in diameter and four inches (102 mm) long having a surface roughness not to exceed 40 microinches (1 µm) AA. Representative test specimens, made of the predominant generic class of alloy as the parts and coated within the test period may be used when acceptable to the cognizant engineering organization. Alternative alloy or configuration may be used when acceptable to the cognizant engineering organization. Coating thickness shall be 0.0002 to 0.0004 inch (5 to 10 µm).