



AEROSPACE STANDARD

AS12500™

Issued

2018-04

Corrosion Prevention and Deterioration Control in Electronic Components and Assemblies

RATIONALE

This document was revised to incorporate editorial and technical comments received and coordinated by the SAE G-25 Avionics and Electronics Corrosion Committee since December 2014. Reference specifications were also updated.

FOREWORD

This specification has been developed by the SAE G-25 Avionics and Electronics Corrosion Committee as an industry replacement for MIL-HDBK-1250. Conformance with the provisions of this document is intended to establish minimum requirements for the control of corrosion and deterioration in high reliability systems and applications; and to provide a guide to the selection of protective measures. The choice of materials and processes for electronic applications is, naturally, based on electrical properties not included in this document. It is the aim of this standard to aid in selecting from among suitable materials and processes, those that will withstand the attack of adverse environments during storage, shipment and service. It is recommended that this overall set of requirements be used as a part of the system or functional component specification(s) in order to provide suitable materials and processes.

1. SCOPE

1.1 Purpose

This specification covers corrosion prevention and mitigation aspects in Avionics, Electronics, and Electrical Wire Interconnect Systems (EWIS) from the design through the life cycle of aerospace and other systems.

2. APPLICABLE DOCUMENTS

The following publications form a part of this document 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. In the event of conflict between the text of this document and 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.

2.1 SAE International Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS03-28 (Part 1) Physical Vapor Deposition of Metals: Physical Vapor Deposition of Aluminum for Protection Against Corrosion

AMS03-28 (Part 2) Physical Vapor Deposition of Metals: Physical Vapor Deposition of Cadmium for Protection Against Corrosion

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Technical Report, please visit
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Documents
Document Sharing Hub

AMS2401	Plating, Cadmium, Low Hydrogen Content Deposit
AMS2403	Plating, Nickel, General Purpose
AMS2404	Plating, Electroless Nickel
AMS2413	Plating, Silver-Rhodium
AMS2416	Plating, Nickel-Cadmium Diffused
AMS2417	Plating, Zinc-Nickel Alloy
AMS2418	Plating, Copper
AMS2426	Coating, Cadmium Vacuum Deposition
AMS2427	Aluminum Coating, Ion Vapor Deposition
AMS2460	Plating, Chromium
AMS2526	Molybdenum Disulfide Coating, Thin Lubricating Film Impingement Applied
AMS2700	Passivation of Corrosion Resistant Steels
AMS2759/9	Hydrogen Embrittlement Relief (Baking) of Steel Parts
AMS-C-8837	Coating, Cadmium (Vacuum Deposited)
AMS-C-26074	Coatings, Electroless Nickel, Requirements for
AMS-C-81562	Coatings, Cadmium, Tin-Cadmium and Zinc (Mechanically Deposited)
AMS-P-81728	Plating, Tin-Lead (Electrodeposited)
AMS-S-7124	Sealing Compound, Polysulfide, Accelerator Required, for Aircraft Structures
AMS-QQ-N-290	Nickel Plating (Electrodeposited)
AMS-QQ-P-416	Plating, Cadmium (Electrodeposited)
AIR4487	Investigation of Silver Plated Conductor Corrosion (Red Plague)
ARP6400	Recommended Practice for Processing and Handling Wire and Cable with Silver Plated Conductors and Shields
AS1701	Lubricant, Solid Film
AS4461	Assembly and Soldering Criteria for High Quality/High Reliability Soldering Wire and Cable Termination in Aerospace Vehicles
AS5272	Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting, Procurement Specification
AS22759	Wire, Electrical, Fluoropolymer- Insulated Copper or Copper Alloy
AS29606	Wire, Electrical, Stranded, Uninsulated Copper, Copper Alloy, or Aluminum, or Thermocouple Extension, General Specification For

AS50881 Wiring Aerospace Vehicle

GEIA-STD-0005-2 Standard for Mitigating the Effects of Tin Whiskers in Aerospace and High Performance Electronic Systems

2.2 U.S. Government Publications

Copies of these documents are available online at <http://quicksearch.dla.mil>.

2.2.1 Specifications, Standards, and Handbooks

Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Acquisition Streaming & Standardization Information System (ASSIST) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

A-A-59135 Packaging Material, Sheet

A-A-59877 Insulating Compound, Electrical, Embedding

MILITARY

MIL-DTL-117 Bags, Heat-Sealable

MIL-D-3464 Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification

MIL-DTL-5541 Chemical Conversion Coatings on Aluminum and Aluminum Alloys

MIL-PRF-6855 Rubber, Synthetic Sheets, Strips, Molded or Extruded Shapes, General Specification for

MIL-PRF-8516 Sealing Compound, Synthetic Rubber, Electric Connectors and Electric Systems, Chemically Cured

MIL-I-8574 Inhibitors, Corrosion, Volatile, Utilization of

MIL-A-8625 Anodic Coatings, for Aluminum and Aluminum Alloys

MIL-I-17563 Impregnates for Cast or Powder Metal Components

MIL-L-23398 Lubricant, Solid Film, Air-Cured, Corrosion Inhibiting,

MIL-PRF-23586 Sealing Compound (with Accelerator), Silicone Rubber, Electrical

MIL-M-24041 Molding and Potting Compound, Chemically Cured, Polyurethane

MIL-DTL-45204 Gold Plating, Electrodeposited

MIL-PRF-46002 Preservative Oil, Contact and Volatile Corrosion-Inhibited

MIL-PRF-46010 Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting

MIL-PRF-46147 Lubricant, Solid Film, Air Cured, Corrosion Inhibiting

MIL-PRF-81309 Corrosion Preventive Compounds, Water Displacing, Ultra-Thin Film

MIL-DTL-83488 Coating, Aluminum, High Purity

MIL-DTL-83528 Gasketing Material, Conductive, Shielding Gasket, Electronic, Elastomer, EMI/RFI General Specification for

MIL-DTL-85054 Corrosion Preventive Compound, Water Displacing, Clear (AmIguard)

MIL-L-87177 Lubricants, Water Displacing, Synthetic

STANDARDS

FEDERAL

FED-STD-376 Preferred Metric Units for General Use by the Federal Government

MSFC-STD-3029 Guidelines for the Selection of Metallic Materials for Stress Corrosion Cracking Resistance in Sodium Chloride Environments

MILITARY

MIL-STD-186 Manufacturing Process, Protective Finishing for Army Missile Weapon Systems

MIL-STD-276 Impregnation of Porous Nonferrous Metal Castings.

MIL-STD-810 Environmental Engineering Consideration and Laboratory Tests

MIL-STD-883 Microcircuits

MIL-STD-889 Dissimilar Metals

MIL-STD-1686 Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment

MIL-STD-2073-1 DOD Standard Practice for Military Packaging

MIL-STD-7179 Finishes, Coatings, and Sealants for the Protection of Aerospace Weapons Systems

MIL-HDBK-454 General Requirements for Electronic Equipment

MIL-HDBK-838 Lubrication of Military Equipment

MIL-HDBK-83377 Adhesive Bonding (Structural) for Aerospace and Other Systems, Requirements for

2.3 Non-Government Publications

The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the ASSIST cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the ASSIST are the issues of the documents cited in the solicitation (see 6.2).

2.3.1 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 A967 Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts

ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM B488	Standard Specification for Electrodeposited Coatings of Gold for Engineering Uses
ASTM B545	Standard Specification for Electrodeposited Coatings of Tin
ASTM B634	Standard Specification for Electrodeposited Coatings of Rhodium for Engineering Use.
ASTM B679	Standard Specification for Electrodeposited Coatings of Palladium for Engineering Uses
ASTM B700	Standard Specification for Electrodeposited Coatings of Silver for Engineering Use
ASTM D495	Standard Test Method for High-Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation
ASTM D2000	Standard Classification System for Rubber Products in Automotive Applications
ASTM D3955	Standard Specification for Electrical Insulating Varnishes
ASTM D4300	Standard Test Methods for Ability of Adhesive Films to Support or Resist the Growth of Fungi
ASTM D6386	Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
ASTM E595	Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment
ASTM G21	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
ASTM G85	Standard Practice for Modified Salt Spray (Fog) Testing

2.3.2 AWS Publications

Available from American Welding Society, 8669 NW 36 Street, #130, Miami, FL 33166-6672, Tel: 1-800-443-9353 or 305-443-9353, www.aws.org.

AWS C3.4	Specification for Torch Brazing
AWS C3.5	Specification for Induction Brazing
AWS C3.6	Specification for Furnace Brazing
AWS C3.7	Specification for Aluminum Brazing
AWS D17.1	Specification for the Fusion Welding for Aerospace Applications
AWS D17.2	Specification for Resistance Welding for Aerospace Applications

2.3.3 IPC Publications

Available from IPC, 3000 Lakeside Drive, 309 S, Bannockburn, IL 60015, Tel: 847-615-7100, www.ipc.org.

IPC J-STD- 001	Requirements for Soldered Electrical and Electronic Assemblies
IPC-A-610	Acceptability of Electronics Assemblies
IPC-CC-830	Qualification and Performance of Electrical Insulating Compound for Printed Board Assemblies
IPC/WHMA-A-620	Requirements and Acceptance for Cable and Wire Harness Assemblies
IPC-HDBK-850	Guidelines for Design, Selection and Application of Potting Materials and Encapsulation

2.3.4 ANSI Accredited Publications

Copies of these documents are available online at <http://webstore.ansi.org/>

ANSI/ESD S20.20 Protection of Electrical and Electronic Parts, Assemblies and Equipment

2.3.5 Underwriter Laboratories

Available from UL, 333 Pfingsten Road, Northbrook, IL 60062-2096, Tel: 847-272-8800, www.ul.com.

UL 94 Plastic Materials for Parts in Devices and Appliances, Test for Flammability of

2.4 Order of Precedence

The latest issue of SAE publications shall apply. The applicable issue of the other publications shall be the issue in effect on the date of the purchase order. In the event of a conflict between the text of this document, and the references cited herein (except for related associated detail specifications, specification sheets, or military standards) the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.5 Definitions

2.5.1 AEROSPACE SYSTEM

Applicable systems include fixed wing aircraft, unmanned aerial vehicles, space vehicles, rotorcraft, missile systems, air delivered guided munitions, and all related ground support equipment.

2.5.2 COGNIZANT ENGINEERING AUTHORITY (CEA)

For the purpose of this standard, Cognizant Engineering Authority is that entity from the procuring activity that reviews and approves any deviations from the technical requirements contained within this standard.

2.5.3 CORROSION

The deterioration of a material or its properties due to a reaction of that material with its chemical environment. Traditionally, corrosion was thought of only as deterioration of metal (e.g., rusting of steel), but now corrosion includes degradation of non-metallic materials. Some non-traditional examples include rotting of wood, degradation of concrete (carbonation, alkali-silica reaction phenomena), and degradation of composite materials due to reaction with the environment.

2.5.4 CREVICE CORROSION

Crevice corrosion is characterized by intense localized attack in crevices of other shielded areas in contact with an electrolyte, which is stagnant because of the shielding effect. Holes, gaskets, lap joints, crevices under bolt heads, rivet heads, and washers, as well as surface deposits are potential corrosion sites. The mechanisms of crevice corrosion and pitting corrosion are similar. A metal susceptible to pitting will also be susceptible to crevice corrosion, although the reverse is not true.

2.5.5 DETERIORATION

A general term describing the impairment of desired physical, chemical, mechanical or electrical properties resulting from aging, environmental exposure, chemical or biological attack, or changes in temperature or pressure.

2.5.6 DISSIMILAR CONDUCTIVE MATERIALS

Any combination of bare metals or conductive materials in contact with each other forming a galvanic couple.

2.5.7 ELECTRICAL WIRING INTERCONNECT SYSTEM (EWIS)

EWIS is defined as any wire, fiber optic link, wiring or fiber device, or a combination of these items (including terminations) installed in any area of the aircraft for the purpose of transmitting electrical energy, signals or data between two or more electrical end points.

2.5.8 ELECTROMAGNETIC INTERFERENCE (EMI)

Any spurious external disturbance causing unwanted response in electronic equipment, or any unwanted signal emanating from the equipment; sometimes called radio frequency interference (RFI).

2.5.9 ENCAPSULATION

The embedment and complete envelopment of an item or assembly in a solid mass of a plastic, elastomeric, or ceramic insulating material.

2.5.10 FUNGI

Any of a large group of thallophytic organisms described as molds, mildews, mushrooms, yeasts, or any organism absorbing nutrition from living or dead organic materials.

2.5.11 FUNGICIDE

A material capable of killing fungi.

2.5.12 FUNGINERT

Inherently fungus-resistant material that neither destroys nor supports the growth of fungi.

2.5.13 FUNGINUTRIENT

Materials that provide sustenance for fungi.

2.5.14 FUNGUS RESISTANT

Unaffected by fungi, as established through testing in accordance with (IAW) ASTM G21, ASTM D4300, or by MIL-STD-810.

2.5.15 GALVANIC SERIES

A ranking of conductive materials accordance with their relative anodic and cathodic position determined in a specific electrolyte.

2.5.16 HERMETIC SEAL

An impervious seal made by the fusion of metals or ceramic materials (as by brazing, soldering, welding, fusing glass or ceramic) that prevents the passage of gas or moisture.

2.5.17 PURPLE PLAGUE

A brittle, gold-aluminum compound.

2.5.18 RED PLAGUE

The galvanic corrosion of silver coated copper materials which occurs when the silver coating does not adequately cover the underlying copper and is exposed to water by either direct contact or condensation.