NOT MEASUREMENT SENSITIVE

MIL-PRF-81309F
16 May 2005
SUPERSEDING
MIL-C-81309E
31 March 2005

PERFORMANCE SPECIFICATION

CORROSION PREVENTIVE COMPOUNDS, WATER DISPLACING, ULTRA-THIN FILM

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for two types and two classes containing two grades of ultra-thin film, water displacing, corrosion preventive compounds which may be applied by dipping, spraying, brushing or by spraying from self-pressurized containers (see 6.1).

1.2 Classification. The compounds are of the following types, classes, and propellant grades as specified (see 6.2c).

1.2.1 Types. The types of compounds are as follows:

Type II - Soft film (General Purpose Grade).

Type III - Soft film (Avionic grade) See appendix A.

1.2.2 Classes. The classes are as follows:

Class 1 - Bulk container (brush, dip or spray application).

Class 2 - Self-pressurized container (for spray application).

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, Code 491000B120-3, Highway 547, Lakehurst, NJ, 08733-5100 or emailed to Tom.Omara@navy.mil. Since contact information can change you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil .

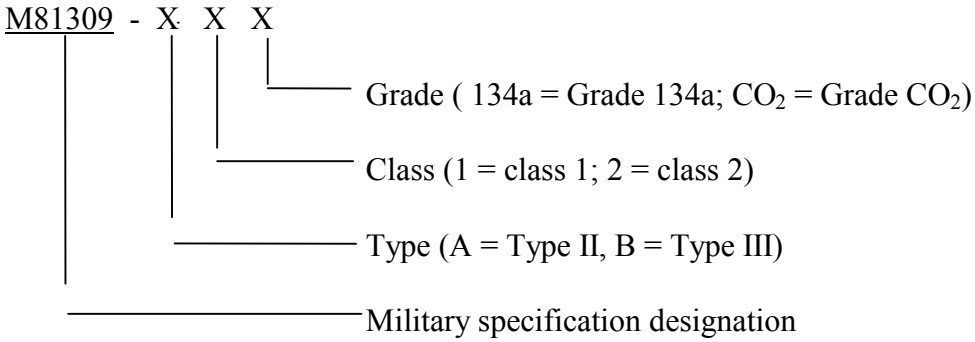
AMSC N/A FSC 8030

1.2.3 Grades. The grades are as follows:

a - Grade 134a - Hydrofluorocarbon (HFC) propellant.

b - Grade CO_2 - Carbon dioxide (CO_2) propellant.

1.3 Part or identifying numbers (PINS). PINs to be used for compounds acquired to this specification are created as follows:



Example: A type II, class 2, Grade CO_2 compound will be designated as follows: M81309-A2CO_2

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL SPECIFICATIONS

CCC-C-46	-	Cloth, Cleaning, Nonwoven Fabric (Inactive for New Design)
PPP-C-96	-	Can, Metal, 28 Gage and Lighter

FEDERAL STANDARDS

FED-STD-313	-	Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

COMMERICAL ITEM DESCRIPTIONS

A-A-51126	-	Anodes, Cadmium.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-680	-	Degreasing Solvent
MIL-W-5086	-	Wire, Electric, Polyvinyl Chloride Insulated, Copper or Copper Alloy
MIL-PRF-5425	-	Plastic Sheet, Acrylic, Heat Resistant
MIL-C-5541	-	Chemical Conversion Coatings on Aluminum and Aluminum Alloys
MIL-A-18001	-	Anode, Sacrificial Zinc Alloy
MIL-PRF-23377	-	Primer Coatings: Epoxy, High-Solids
MIL-PRF-32033	-	Lubricating Oil, General Purpose, Preservative (Water-Displacing, Low Temperature)
MIL-W-81044	-	Wire, Electrical Crosslinked Polyalkene, Crosslinked Alkane-imide Polymer, or Polyarylene Insulated, Copper or Copper Alloy
MIL-W-81381/11	-	Wire, Electric, Fluorocarbon/polyimide Insulated, Medium Weight, Silver Coated Copper Conductor, 600 Volts, 200 Degrees C, Nominal 8.4 or 15.4 Mil Wall (Inactive for New Design)
MIL-W-81822/6	-	Wire, Electrical, Solderless Wrap, Extruded Polytetrafluoroethylene (PTFE) Insulation, Silver coated Solid Conductor
MIL-PRF-85285	-	Coating: Polyurethane, Aircraft and Support Equipment
MIL-PRF-85570	-	Cleaning Compounds, Aircraft, Exterior
MIL-L-87177	-	Lubricants, Corrosion Preventive Compound, Water Displacing, Synthetic

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-290	-	Packaging and Marking of Petroleum and Related Products
MS3112	-	Connectors, Receptacle, Electric, Series 1, Box Mounting Flange, Bayonet Coupling, Solder Contact (Inactive for New Design)
MS3116	-	Connectors, Plug, Electric, Series 1, Solder Type, Straight, Bayonet Coupling (Inactive for New Design)

(Copies of these documents are available on line at http://assist.daps.dla.mil/quicksearch/ or http://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

CODE OF FEDERAL REGULATIONS

DEPARTMENT OF LABOR

29 CFR 1910	-	Occupational Safety and Health Standards - Hazard Communications

ENVIRONMENTAL PROTECTION AGENCY

40 CFR 61	-	National Emission Standards for Hazardous Air Pollutants
40 CFR 82	-	Protection of Stratospheric Ozone

(Copies of these documents are available on line at www.access.gov/nara/cfr or from Superintendent of Documents, US Government Printing Office, North Capitol & "H" Street, N.W. Washington, DC 20402-0002.)

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

National Toxicology Program's Annual Report on Carcinogens

(Copies of this document are available on line at http://ehp.niehs.nih.gpv/docs/admin/indivrocform.html or from Brogan and Partners, Attn: Order Processing, 1001 Winstead Dr, Ste 355, Cary, NC 27513.)

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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) INTERNATIONAL

ASTM-B36	-	Plate, Brass, Sheet, Strip, and Rolled Bar (Adopted)
ASTM-B117	-	Salt Spray (Fog) Apparatus Operating (Adopted)
ASTM-B152	-	Copper Sheet, Strip, Plate, and Rolled Bar (Adopted)
ASTM-D93	-	Cup Tester, Closed Flash Point by Pensky-Martens, (Adopted)

ASTM-D877	-	Liquids Insulating Using Disk Electrodes, Dielectric Breakdown Voltage of (DoD Adopted)
ASTM-D3065	-	Aerosol Products, Flammability of (Adopted)
ASTM-F484	-	Plastics, Acrylic, in Contact with Liquid or Semi Liquid Compounds, Stress Crazing of, Standard Test Method For (Adopted)
ASTM-F502	-	Aircraft, Painted Surfaces, Effects of Cleaning and Chemical Maintenance Materials on (Adopted)
ASTM-F519	-	Mechanical Hydrogen Embrittlement Evaluation of Plating Processes and Service Environments (Adopted)

(Copies of these documents are available on line at www.astm.org or from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE-AMS4375	-	Sheet and Plate Magnesium Alloy 3.0A1-1.0Zn-0.20Mn (AZ 31 B-0) Annealed and Recrystallized. (DoD Adopted)
SAE-AMS5046	-	Sheet Strip and Plate, Carbon Steel (SAE 1020 and 1025) Annealed. (DoD Adopted)
SAE-AMS-S-5000	-	Steel, Chrome-Nickel-Molybdenum (E4340) Bars and Reforging Stock. (DoD Adopted)
SAE-AS22805	-	Spray Kit, Self Pressurized. (DoD Adopted)
SAE-AMS-P-83310	-	Plastic Sheet, Polycarbonate, Transparent. (DoD Adopted)
SAE-AMS-QQ-A-250/4	-	Aluminum Alloy 2024, Plate and Sheet. (DoD Adopted)

(Copies of these documents are available on line at www.sae.org or from Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

AMERICAN BEARING MANUFACTURES ASSOCIATION

Quality of Steel Balls - AISI C-52100 steel, grade 25 extra polish (EP)

(A copy of this document is available on line at www. info.abma@smithbucklin.com or from AMERICAN BEARING MANUFACTURES ASSOCIATION, 2005 “M” Street, NW, Suite 800, Washington, DC 20036.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the 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.

3. REQUIREMENTS

3.1 Qualification. The compounds furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.3 and 6.3).

3.2 Materials. The compounds shall be nonvolatile base materials dispersed in a solvent to form a fluid formulation conforming to this specification. Aromatic, chlorinated, chlorofluorocarbon, or hydrochlorofluorocarbon solvents shall not be used in the formulation. The compounds shall be homogeneous, free of lumps, dirt or other suspended matter, and free of water, chlorides, silicones, and other impurities.

3.2.1 Composition. The composition of the compounds shall be optional with the manufacturer, but shall be within the limitations specified herein (see 3.2, 3.3, 3.4 and 3.5). Self-pressurized containers may use the following propellants or may request approval for an alternative from the qualifying activity.

3.2.1.1 Grade 134a propellant. The propellant for Grade 134a shall consist of hydrofluorocarbons or a blend containing hydrofluorocarbons. Grade 134a propellant blends shall contain no chlorinated solvents, hydrochlorofluorocarbons, or fully halogenated chlorofluorocarbons.

3.2.1.2 Grade CO_2 propellant. The propellant for Grade CO_2 shall consist of carbon dioxide. The propellant shall contain no chlorinated solvents, hydrochlorofluorocarbons, or fully halogenated chlorofluorocarbons.

3.3 Toxicity. The compound shall not adversely affect the health of personnel when used for its intended purpose. The compound shall not contain known or suspected human carcinogens, as defined by the National Toxicology Program's Annual Report on Carcinogens. Prior to listing on the Qualified Products List, the manufacturer shall obtain a satisfactory toxicity review (see 4.3.3). In addition, an Material Safety Data Sheet (MSDS) for the compound shall be prepared and submitted to the Qualifying Activity. MSDS's shall be prepared in accordance with FED-STD-313 and shall conform to 29 CFR 1910.1200.

3.3.1 Toxicity review. To determine conformance to requirements of 3.3, the manufacturer of the compound shall disclose the formulation of his product to the Navy Environmental Health Center, Code 34, 2510 Walmer Avenue, Norfolk, VA 23513-2617. The disclosure of proprietary information, which will be held in confidence shall include: the name, formula, CAS number, and percentage by weight and volume of each ingredient in the product; the results of any toxicological testing of the product; identification of its pyrolysis products; and any other information as may be needed to permit an accurate appraisal of any toxicity problem or issues associated with the handling, storage, application, use, removal, disposal, or combustion of the material. In addition, the manufacturer shall provide a current MSDS for each ingredient used in the formulation. The manufacturer must provide certification of compliance with 3.3 prior to listing on the Qualified Products List. Information submitted shall be clearly marked or identified to show it is being provided in connection with qualification under MIL-PRF-81309.

3.4 Environmental compatibility. The compound shall contain no Class I or II Ozone Depleting Substances as defined in 40 CFR 82. The compound shall contain no Hazardous Air Pollutants (HAPS) as defined in 40 CFR 61.

3.5 Performance characteristics. The corrosion preventive compound shall conform to the requirements in Table I when tested in accordance with Table II.

TABLE I. Performance characteristics.

Property	Requirement	Type II, Class 1	Type II, Class 2	Type III, Class 1	Type III, Class 2
Acid salt fog protection, minimum cycles to unacceptable corrosion 1/	2 (carbon steel) 8 (410 stainless steel)	X	X X	X	X
Application	Brush, Dip, or Spray Sprayable after 20 hours at 40°F	X	 X	X	 X
Compatibility with MIL-PRF-32033 and MIL-L-87177	No sedimentation or separation	X	X	X	X
Compatibility with polyimide, polyalkene, PVC, and PTFE wiring insulation	No cracking or degradation of insulation following prolonged exposure; No dielectric leakage	X	X	X	X
Corrosivity, maximum weight change Magnesium, Cadmium, and Zinc Aluminum, Copper, and Brass	 0.5 mg/cm^2 0.2 mg/cm^2	 X X	 X X	 X X	 X X
Dielectric strength	25,000 volts minimum	X	X	X	X
Effect on acrylic plastic and polycarbonate	No crazing, cracking, or staining	X	X	X	X
Effect on urethane paint	No crazing, cracking, or staining	X	X	X	X
Effect on electronic components, maximum change from initial contact resistance	5 milliohms			X	X

TABLE I. Performance characteristics - Continued.

Property	Requirement	Type II, Class 1	Type II, Class 2	Type III, Class 1	Type III, Class 2
Fill weight, minimum	Grade 134a, oz. Grade CO_2, oz.		14.5 11.0		14.0 11.0
Film appearance	Uniform and light brown or lighter Simulated corrosion spots shall be visible by the unaided eye	X X	X X	X	X
Film thickness, maximum	0.5 mil 0.2 mil	X	X	 X	 X
Flame projection	Propellant shall exhibit no flame extension or flashback		X		X
Flash point, minimum	140°F	X		X	
Friction coefficient, maximum	0.20	X	X	X	X
Functional Penetration	No panel faying surface area to be less than 80 percent wetted in 24 hours. Average of three panels to be 85 percent or better, wetted in 24 hours	X	X	X	X
Hydrogen Embrittlement	No embrittlement of cadmium plated 4340 steel in accordance with SAE-AMS-S-5000	X	X	X	X
Leakage/distortion of cans	None		X		X
Neutral salt fog protection, minimum hours to unacceptable corrosion 1/	336 hours	X	X	X	X

TABLE I. Performance characteristics - Continued.

Property	Requirement	Type II, Class 1	Type II, Class 2	Type III, Class 1	Type III, Class 2
Non-volatile content	Report	X		X	
Removability	Completely removable with MIL-PRF-680 Type II or MIL-PRF-85570 Type II	X	X	X	X
Storage stability, minimum	Meets all specification requirements for 2 years after manufacture date	X	X	X	X
Water displacement	No visible corrosion	X	X	X	X

1/ Unacceptable corrosion is not more than three rust spots less than 1 mm in diameter, excluding the area within 1/8 inch of the panel edges or hole.

3.5.1 Self-pressurized containers. The containers shall conform to class 4, type IX of PPP-C-96 with valve opening diameter suitable for the specified valve. Neither the container nor any component thereof (closure, lining, etc.) shall interact with or alter the contents in any way so as to adversely affect their purity or quality. All containers shall be new and free from contaminants.

3.5.1.1 Fill weight. The fill weight of the container shall be as specified in the contract or purchase order.

3.5.1.2 Marking. Marking of the containers shall be in accordance with MIL-STD-290, except as specified herein. Marking shall be legible, shall be accomplished by lithographing or silkscreen process and shall be in white on a bright green label for type III, class 2. Type II, class 1; type III, class 1; and type II, class 2 may be marked in black on a white background or as specified (see 6.2). Paper coated labels on self-pressurized containers are not acceptable. Any special marking specified in the contract or order shall also be included. In addition, the following information shall be included on each self-pressurized container (when not already required by MIL-STD-290 or contract or order):

Front Face: (Type II, class 2 only and type III, class 2 only):
CORROSION PREVENTIVE COMPOUND, WATER DISPLACING,
ULTRA-THIN FILM
MIL-PRF-81309F
PART NUMBER (see 1.3)
CONTRACT NO.
MANUFACTURER'S NAME
MANUFACTURER'S ADDRESS
MANUFACTURER'S PRODUCT NO.
NET WEIGHT

Rear Face:
CAUTION
FOR BEST RESULTS:
Hold can approximately 12 inches from the surface to be covered.
Spray a thin, uniform coating.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.3).
b. Conformance inspection (see 4.4).

4.2 Inspection conditions. Standard conditions shall be a temperature of 72 ±4°F and a relative humidity of 50 ±20 percent. All tests shall be conducted at standard conditions unless otherwise specified.

4.3 Qualification inspection. The qualification inspection shall consist of all the examinations and tests specified in Table II.

TABLE II. Qualification inspection and test methods.

Property	Requirement Paragraph	Test Method
Acid salt fog protection	Table I	4.6.1
Application	Table I	4.6.2
Compatibility with MIL-PRF-32033 and MIL-L-87177	Table I	4.6.3
Compatibility with polyimide, polyalkene, PVC and PTFE wiring insulation	Table I	4.6.4
Corrosivity	Table I	4.6.5
Dielectric strength	Table I	4.6.7.1
Effect on acrylic plastic and polycarbonate	Table I	4.6.6
Effect on electronic components	Table I	4.6.7
Effect on urethane paint	Table I	4.6.8
Fill weight	3.5.1.1	4.6.9
Film appearance	Table I	4.6.10
Film thickness	Table I	4.6.11
Flame projection	Table I	4.6.22
Flash point	Table I	4.6.23
Friction coefficient	Table I	4.6.12
Functional penetration	Table I	4.6.13
Hydrogen embrittlement	Table I	4.6.24
Leakage/distortion of cans	Table I	4.6.14
Net content of container	3.5.1	4.6.21
Neutral salt fog protection	Table I	4.6.15
Non-volatile content	Table I	4.6.16
Performance of self-pressured container	3.5.1	4.6.17
Removability	Table I	4.6.18
Storage stability	Table I	4.6.19
Water displacement	Table I	4.6.20

4.3.1 Qualification sample. The laboratory qualification sample shall consist of the following: for Class 1 (non-pressurized containers) - one gallon of the compound; for Class 2 (self-pressurized containers) - one gallon of the compound exclusive of propellants and five self-pressurized cans of the compound. Two quarts of each sample shall be set aside for the storage stability test. The samples shall be plainly identified by securely attached durable tags or labels marked with the following information:

MIL-PRF-81309 Sample for qualification inspection
CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, ULTRA-THIN FILM
Type and class for which qualification is desired
Name of manufacturer (plant in which material is manufactured)
Manufacturer's designation
Date of manufacture
Submitted by (name) (date) for qualification inspection in accordance with the requirements of MIL-PRF-81309 under authorization (reference authorizing letter (see 6.3).

4.4 Conformance inspection. The conformance inspections for the compound shall consist of tests specified in Table III.

TABLE III Conformance inspection.

Property	Requirement Paragraph	Test Method
Acid salt fog protection	Table I	4.6.1
Application	Table I	4.6.2
Fill weight	Table I	4.6.9
Film thickness	Table I	4.6.11
Flash point	Table I	4.6.23
Friction coefficient	Table I	4.6.12
Leakage/distortion of cans	Table I	4.6.14
Net content of container	3.5.1.1	4.6.21
Non-volatile content	Table I	4.6.16
Water displacement	Table I	4.6.20

4.4.1 Conformance test samples. Conformance test samples shall be selected in accordance with Table IV. For Class 1, the sample unit for test shall be one quart of compound. For Class 2, the sample unit for test shall be one self-pressurized container and one quart of the compound used in these containers, exclusive of the propellant. Unless otherwise specified (see 6.2), samples shall be subjected to the tests specified in Table IV. The contractor shall submit a certified test report with each lot showing that the lot conforms to the specification.

4.4.1.1 Inspection of materials and components. The contractor is responsible for ensuring that materials and components used were manufactured, tested and inspected in accordance with the requirements of referenced subsidiary specifications and standards to the extent specified, or if none, in accordance with this specification.

TABLE IV. Conformance inspection samples.

LOT SIZE (UNITS)	SAMPLE SIZE (UNITS)
Up to 50	5
51 to 500	7
501 to 35,000	8
over 35,000	11

4.5 Test disks and panels (except for corrosivity).

4.5.1 Materials. The material for the test disks shall be carbon steel conforming to FS1020 of SAE-AMS5046 The material for the salt spray test panels shall be 7075-T6 aluminum.

4.5.2 Size of test disks and panels. The test panels for the salt spray protection test shall be 2 by 4 by 1/8 inch. The test disks for the acid salt fog test shall have a diameter of 2-1/8 inches and a thickness of 1/16-inch.

4.5.3 Preparation of test disks or panels. Remove all sharp edges and burrs and chamfer all holes to prevent injury in handling. Surface ground the panels and disks, then hand polish them on one side and in one direction with a 240 grit silicon carbide or aluminum oxide cloth or paper. Do not use iron oxide or so-called "wet or dry" papers or cloths.

4.5.4 Cleaning of test disks or panels. Do not handle disks or panels with bare hands. Use tongs and hooks to handle and do not allow them to contact contaminated surfaces. If preservative-treated test panels are obtained from a metal supplier in the above polished condition, wipe panels with cloth such as CCC-C-46 Class 7 or surgical gauze wet with acetone to remove preservative oils, repeat the wiping procedure with mineral spirits, then hand polish one side of the panel in one direction only with 240 grit silicon carbide or aluminum oxide cloth or paper. Wipe panels with the above cloth wet with acetone. Repeat the acetone wipe with a clean cloth. Finally, vapor degrease in methanol by dipping in vapor above boiling absolute methanol and allow to dry. Air dry in a rack and store in a desiccator until ready to use. If stored for more than 24 hours, repeat the surface preparation starting with hand polishing.

4.5.5 Coating of the disks or panels. Application of the compound to the test disks or panels shall be carried out under the conditions of 4.2. Pour a well-mixed representative sample of the compound into a clean dipping chamber of sufficient size to permit complete immersion of the disks or panels. To eliminate the formation of entrapped air bubbles, skim them from the top of the compound before immersing the disks or panels. Completely immerse the disks or panels vertically in the compound for one minute, then remove one at a time at a rate of 4 inches per minute. After removal, condition in a vertical position for 24 hours in a draft-, dust-, and fume-free atmosphere.

4.6 Test methods. Tests shall be conducted in accordance with the conditions specified in 4.2.

4.6.1 Acid salt fog protection.

4.6.1.1 Conditioning of compound sample. Fill a wide mouth, quart jar with 800 ml of the compound, seal, and expose to the following cycle four times without physical disturbance of the compound: eight hours at $130^{o} \pm 2^{o}F$ followed by sixteen hours at $-40^{o} \pm 2^{o}F$. At the end of this cyclic exposure, allow the contents of the sealed jar to remain at $75^{o} \pm 5^{o}F$ for 24 hours.

4.6.1.2 Test solution. The spray test solution shall consist of a solution made by adding 2 ml of sulfurous acid (6.4 percent assay as SO_2) to each liter of synthetic seawater. Prepare the synthetic seawater by adding 50 grams of sodium chloride (NaCl); 22 grams of magnesium chloride ($MgC1_2.6H_2O$); 3.2 grams of calcium chloride ($CaC1_2.2H_2O$); and 8.0 grams of sodium sulfate (Na_2SO_4) to a liter of distilled or demineralized water. Use one liter of fresh test solution for each cycle. Measure the pH of the test solution. If the pH is not between 3.3 and 3.5, additional acid or synthetic seawater must be added to adjust the pH to this range.

4.6.1.3 Test procedure. The apparatus used in the test shall conform to Figures 1, 2, and 3. Prepare the test disks as specified in 4.5, using the conditioned compound in 4.6.1.1. Hang the disks vertically and dry for 24 hours under standard laboratory conditions. Insert the specimens into the turntable, start the turntable, and regulate the airflow to the nozzle to effect a fine spray. The pickup tube supplying the nozzle shall have an ID of 1 mm. At the end of approximately 2 minutes of spraying, fill each aluminum cup approximately one third full with ice and place on top of the disks to cause a fine condensation to form on the surface of the disks. Continue spraying for one hour. The rate of flow shall be approximately 1500 ml/hour. During this time, to avoid runoff washing over the test specimens, excessive condensation shall not be allowed to accumulate on the OUTSIDE of the aluminum cups. At the end of the hour, stop the spray, remove the aluminum cups, remove the jar from under the turntable, and allow the disks to dry at room temperature for 3 hours. Start another cycle with fresh test solution. Conduct two cycles in one day. After the required number of cycles, clean the disks in mineral spirits, conforming to MIL-PRF-680, then examine for any visible corrosion.

4.6.2 Application. For a Class 1 compound, place three ounces in a capped 4-ounce product jar conforming to SAE-AS22805. Test Class 2 compounds as received. Condition the containers for 20 hours at 40°F. For a Class 1 compound, remove product jar and contents from the cold chamber, immediately attach a spray device conforming to SAE-AS22805 that has been conditioned at room temperature and attempt to spray the contents of the product jar. For Class 2 compounds, remove the self-pressurized container from the cold chamber and attempt to spray the contents. The compound passes the test if it can be satisfactorily sprayed. In addition, the applied compound shall not exhibit froth, bubbling, or excessive runoff and shall readily wet the surfaces of test panels prepared as in 4.5.

4.6.3 Compatibility with MIL-PRF-32033 and MIL-L-87177. Combine 5 milliliters (ml) of the compound and 15 ml of lubricating oil conforming to MIL-PRF-32033 in a 40 ml cone-shaped centrifuge tube. Combine 15 milliliters (ml) of the compound and 15 ml of lubricant conforming to MIL-L-87177 in another 40 ml cone-shaped centrifuge tube. Shake by hand until the mixture appears homogeneous. Place the tubes in a beaker and heat in an explosive proof oven at $170^{o} \pm 2^{o}$F for 15 minutes. There shall be no sedimentation or evidence of chemical precipitation or reaction immediately after the 15-minute period at the elevated temperature or after 24 hours at $72^{o} \pm 4^{o}$F. A slight separation of liquid is acceptable.

4.6.4 Compatibility with polyimide, polyalkene, PVC and PTFE wiring insulation. Approximately 24 inches (61 cm) of wire conforming to MIL-W-81381/11, MIL-W-81044, MIL-W-5086, and MIL-W-81822/6 (1), shall be formed into four separate coils. Place each coil in a 4-ounce (118 ml) wide mouth jar. Add enough corrosion preventive compound to the jar to completely cover the coil of wire. Cap the jar and store it at room temperature for 14 days. Repeat this procedure using distilled water as the test medium. At the end of the storage period, remove the coil and rinse thoroughly with tap water at room temperature. Suspend the coil and allow it to drain until completely dry. Each wire shall be wrapped tightly around a 0.125-inch mandrel and unwrapped slowly, noting the appearance and number of any cracks in the insulation. The wire shall meet the requirements specified in Table I. The wire shall be immersed in a 5 percent by weight sodium chloride solution and subjected to a one-minute dielectric test of 2,500 volts (rms).

4.6.5 Corrosivity test.

4.6.5.1 Preparation of specimens. Specimen size shall be 3 by 1/2 by 1/16 inches and shall be of the following metals: Magnesium, SAE-AMS4375; Cadmium, A-A-51126; Zinc, MIL-A-18001; Aluminum, SAE-AMSQQ-A-250/4; Copper, ASTM-B152; Brass, ASTM-B36.

4.6.5.2 Test procedure. Polish three specimens of each of the above metals to remove pits, burrs, and irregularities from all faces and edges. Finish the panels on both sides and clean as specified in 4.5. After weighing, place three specimens of the same metal in a 4-ounce screw cap jar with minimal contact between the metal specimens. Place the specimens on one of their narrow ends. Cover the specimens with enough compound so that the tops of the specimens are at least 1/4-inch below the surface of the compound. Place the sealed jar in an oven at $130^{o} \pm 2^{o}$F for 7 days. Upon completion of the test, remove any loose corrosion products from the specimens by cleaning as specified in 4.5. Reweigh the specimens and calculate the weight loss or gain in milligrams per square centimeter.

4.6.6 Effect on acrylic plastic and polycarbonate. Using ASTM-F484, test the effects of the corrosion preventive compound on acrylic plastic (MIL-PRF-5425, Finish A) and polycarbonate (SAE-AMS-P-83310). Test the compound by applying it to a 0.7 in. by 0.7 in. flannel swatch positioned on a loaded specimen immediately over the fulcrum point. After 30 minutes, examine the specimen. Crazing, cracking or other attack is not acceptable.

4.6.7 Effect on electronic components. Connect a pair of electrical connectors, MS3116-16-26S and MS3112-16-26P. Determine the resistance using a Wheatstone Bridge or appropriate measuring device. Record the value for each mated pair of pins and between selected adjacent pins. Disconnect the connector and, while unmated, dip both connectors in the corrosion preventive compound three times with a two-hour interval between dipping. After 24 hours at the conditions described in 4.2, reconnect the connectors. Determine the resistance and record for each mated pair of pins and the selected adjacent pins. A change of more than 5 milliohms from the initial contact resistance is not acceptable.

4.6.7.1 Dielectric strength. The dielectric strength shall be tested in accordance with ASTM-D877.

4.6.8. Effect on urethane paint. Prepare painted test panels by priming suitably sized 0.020 in. thick aluminum panels with MIL-PRF-23377 primer and MIL-PRF-85285 gloss white urethane topcoat, in accordance with the specification directions, and allow to dry for a minimum of 4 weeks. Using the method and materials of ASTM-F502, test the compound by applying it to approximately one half of a test panel positioned horizontally, painted side up, in an oven at 100°F. After 30 minutes, remove the panel from the oven and remove the compound using MIL-PRF-680, Type II dry cleaning solvent. After 24 hours, examine the panel and test the two halves for pencil hardness. Streaking, discoloration or blistering or loss of more than one unit of pencil hardness is not acceptable.

4.6.9 Fill weight. Weigh a sample can and then spray at three-minute periods with one-minute intervals until the can is exhausted. Reweigh the container. Determine the minimum net difference.

4.6.10 Film appearance. Mark a test panel, painted as in 4.6.8 and dried for 4 weeks, with two dots approximately 0.2 inches diameter, 0.5 inches apart, at the approximate center of the panel, using gray gloss enamel. Immerse the test panel in the compound so that the lower 2/3 of the panel is submerged. Remove the panel and dry it in a vertical position for 24 hours. After 24 hours, inspect the panel with the unaided eye and determine whether the simulated corrosion spots are visible through the coating.

4.6.11 Film thickness. The average film thickness produced by the compound shall be determined on a panel prepared, cleaned, and coated as specified in 4.5. Calculate the film thickness using the following formula:

$$\text{Film thickness (mils)} = \frac{(1.000 \times W) \times 0.061}{D \times A}$$

where: W = weight of film (grams).
0.061 cubic inch = 1 cubic centimeter.
D = density of the film, which shall be assumed = 1.0
A = total surface area of the panel (square inches).

4.6.12 Friction coefficient.

4.6.12.1 Apparatus. The test apparatus (Figures 4 and 5) shall consist of a 5 by 16 by 3/8-inch 2024 T6 SAE-AMS-QQ-A-250/4 milled aluminum plate polished on the test side parallel with the longer dimension with 240 grit silicon carbide or aluminum oxide cloth or paper; a freely rotating wheel affixed to the plate by an axle parallel to the width approximately one inch from an end; a block holding 3 test balls in the configuration shown on Figure 5 and weighted in such a manner that each ball exerts a force equivalent to 250 grams on the surface of the aluminum plate; and a pan or beaker attached by a string over the pulley wheel to the three ball holder so that when taut the string is parallel to the plate surface. The test ball bearings shall be of 1/2-inch diameter AISI C-52100 steel, grade 25 extra polish (EP) quality steel balls of the Anti-Friction Bearing Manufacturer's Association.

4.6.12.2 Test procedure. Coat the upper surface of the aluminum plate with the compound to a thickness of 0.001 inch to 0.005 inch. Dry the coating 72°F for 24 hours. After drying, set the weighted three-ball holder gently on the coated surface at the end of the plate opposite the pulley wheel with one ball forward and two rearward. Orient so that, if pulled by the string attachment toward the pulley wheel, no rotational motion shall occur. Attach the pan or beaker as shown on Figure 5. Lightly drop test balls onto the pan from a height of less than 1/4-inch until the three-ball holder moves. If the holder traverses a distance of six inches in less than three seconds, record the gross weight of the pan. If the movement requires more than three seconds, place the holder as before at one end of the aluminum plate in a location different from those previous. Drop another test ball onto the pan from a height of less than 1/4-inch and observe the travel time. Repeat the restarting procedure until the three-ball holder travels six inches in less than three seconds. Record the gross weight of the pan. Determine the friction coefficient from the following equation:

$$\text{Friction coefficient} = \frac{\text{Gross pan weight}}{750\text{g}}$$

4.6.13 Functional penetration.

4.6.13.1 Specimen fabrication. Fabricate six panels and assemble three lap–joint specimens in accordance with Figure 6. Apply two strips of 2.0 by 0.5 by 0.20-inch vacuum bag sealing tape to one end of each lap joint assembly in accordance with Figure 7 and seal tightly.

MATERIAL	Test panels 7075 Aluminum, 0.125 by 3.0 by 8.0 inches, treated in accordance with MIL–C–5541,and primed in accordance with MIL-PRF-23377. Bolt and collar fasteners

4.6.13.2 Fluid penetration at room temperature. Support all three panel assemblies, with sealed areas at top, to maintain at an angle of 10 degrees from the horizontal (Figure 7). Pour 1.0 ml of the compound to be tested, as–received bulk material or propellant–free material into the cavity formed by the sealing tape on each assembly. (NOTE: As an aid in the later identification of total faying surface penetration, an oil–soluble fluorescent dye, fluoro–green gold, or equivalent, may be dissolved in the compound to be tested provided the concentration does not exceed 8.0 mg/100 cc.) After 24 hours, remove the residual fluid from the cavity with clean, dry cheesecloth. Immediately remove sealing tape and wipe all four-perimeter edges of the faying surface with clean filter paper to remove residual test fluid. Edge clamp each assembly and remove fasteners. Open each assembly with care and determine the percentage of each faying surface area that has been wetted by the test fluid – a 3.0 by 2.0 inch transparent grid, with twenty five squares per inch, may be held above the surface to facilitate measurement of the wetted area.

4.6.14 Leakage or distortion of cans. Completely submerge the self-pressurized container for 5 minutes in water maintained at a minimum of $130^{o} \pm 2^{o}$F. Observe for the emission of bubbles. Distortion of the container or the emission of bubbles from any part of the container is cause for rejection.

4.6.15 Neutral salt spray protection. Test panels prepared and coated as specified in 4.5 shall be subjected to ASTM-B117 salt spray exposure. Incline three specimens at 6° in a rack. After 336 hours, clean test panels in solvent, conforming to MIL-PRF-680, and examine for any visible corrosion. If visible corrosion is found, total surface area corroded shall be no greater than that for the control formula.

4.6.16 Nonvolatile content. Place a portion of the thoroughly mixed sample in a stoppered bottle, or alternatively, in a weighing pipette or a 10 ml syringe without a needle, and from this weigh by difference 1.2 ±0.1 grams into a suitable aluminum weighing dish 80 to 100 mm in diameter and 5 to 10 mm in depth. By gentle tilting, spread the specimen over the bottom of the dish and heat for 3 hours in a ventilated oven maintained at 221 ±3°F. If necessary, a piece of stout wire can be included in the tare of the dish and used at intervals to break up skins by stirring during the heating period. Cool in a desiccator and weigh the dish. Calculate the percent nonvolatile matter to the nearest 0.1 percent, as follows:

$$\text{Percent nonvolatile matter} = \frac{\text{Net weight of residue}}{\text{Net weight of original sample}} \text{X100}$$

4.6.17 Performance of Class 2 self-pressurized containers. The rectangular panels prepared as in 4.5 shall be used. Support a panel such that the longer dimension forms a 45° angle with the horizontal. Spray corrosion preventive compound on the panel from a distance of 12 inches. Examine the panel for uniformity of spray, foaming, and adherence to the substrate. After a 10 second pause, respray the same panel and examine for adhesion and sagging. After a 5 second pause, respray the same panel and examine for adhesion and sagging. The container shall be checked for conformance with 3.5.1.2.

4.6.18 Removability. Dry the coated test panel from 4.6.10 for 24 hours at 72°F. Attempt to remove the compound by wiping the coated surface using light hand pressure with a CCC-C-46 Class 7 wiping cloth dampened with 10 milliliters of MIL-PRF-680, Type II or MIL-PRF-85570 Type II properly diluted. In daylight, from 6 feet away, there shall be no visual evidence of residue.

4.6.19 Storage stability. Pour two liters of the material into a clean and dry glass jar. Tightly cap the jar and wrap it in aluminum foil to exclude all light from the sample. Store the sample for two years in a constant temperature chamber at 75±6°F. At the end of the two year period, remove the jar from the chamber and take off the aluminum foil. Visually inspect the sample and note the presence of cloudiness, sediment, suspended matter, or other changes in homogeneity.

4.6.20 Water displacement. Place an uncoated panel (prepared as specified in 4.5) so that one 2-inch end shall be raised one inch above a horizontal surface. Spray the panel with the unacidified synthetic sea water of 4.6.1.2 so that its entire upper surface is covered with tiny droplets. Within one-minute after spraying, pour one milliliter of the test compound along the upper edge of the panel and allow to run slowly down so as to completely cover the test panel. After another minute, pour a second milliliter of the test compound and allow to run down in a like manner. After waiting an additional minute, raise the panel to a vertical position for one minute and then place flat (test side up) above distilled water at 72°F in a closed desiccator. After 4 hours, remove the panel, clean with mineral spirits, then evaluate for presence of visible corrosion.

4.6.21 Net content. The sample unit for this examination shall be one filled container. The sample size shall be as specified in Table IV. The lot is unacceptable if the average net content per container for all units examined is less than specified.

4.6.22 Flame projection. The flame projection shall be tested in accordance with ASTM-D3065.

4.6.23 Flash point. The flash point shall be tested in accordance with ASTM-D93.

4.6.24 Hydrogen embrittlement. The hydrogen embrittlement shall be tested in accordance with ASTM-F519.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The ultra-thin film, corrosion preventive compound covered by this specification is intended for use on any metal surface. It can be used both for initial protection during shipment and storage and for in-service treatment. It should not be used around liquid oxygen fittings. The ability of this material to prevent corrosion and to displace water and its ease of application when packaged as class 2 (self-pressurized containers) make it particularly suited for service use. The combination of properties of MIL-PRF-81309 provide the necessary requirements for a corrosion preventing compound for use in the extreme naval aviation environment. This material is intended for indoor protection and short term protection outdoors where surfaces can be recoated when required. This material is not intended as a substitute for other corrosion preventatives specified for protection of surfaces for periods of more than one month.

6.1.1 Type II, classes 1 and 2. This compound is intended for use on moving parts where some lubrication is required, such as hinges, bomb racks, and sliding parts.

6.1.2 Type III, classes 1 and 2. The compound is intended for use on avionic equipment, electrical connector plugs, and contact points.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. Type and class of compound (see 1.2).
c. Unit of issue required.
d. Quantity. (For non-pressurized container specify gallons; for self-pressurized containers specify number of cans).
e. Special marking requirements (see 3.5.1.2).
f. Test report (see 4.4).
g Packaging requirements (see5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List (QPL-81309) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Commander, Naval Air Warfare Center Aircraft Division, Code 4.3.4.1, Bldg 2188, 22347 Cedar Point Road, Unit 6, Patuxent River, MD 20670-1161, e-mail todd.standish@navy.mil.

6.4 Definitions.

6.4.1 Batch. A batch is defined as that quantity of material which has been manufactured by some unit chemical process and subjected to some physical mixing operation intended to make the final product substantially uniform.

6.4.2 Lot. A lot is defined as all the compound produced by one manufacturer, at one plant, from the same materials, and under essentially the same conditions during a continuous operation not exceeding 24 hours. In the event the process is a batch (see 6.4.1) operation, each batch will constitute a lot.

6.4.3 Solvent. A solvent is defined as an organic liquid having a vapor pressure of greater than 0.1 mm Hg at 25°C.

6.5 Material safety data sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent government mailing addresses for submission of data are listed in Appendix B of FED-STD-313.

6.6 Manufacturer's data. In addition to the qualification sample, the manufacturer will submit: 1) a Material Safety Data Sheet prepared in accordance with FED-STD-313 and 29 CFR 1910.1200, 2) a report that includes the results of any tests performed by the manufacturer, 3) certification that the compound meets the storage stability requirement, 4) certification that the compound meets the toxicity requirements of 3.3, and 5) for Class 2 compounds, a description of the aerosol container construction (including type and model numbers for the can, valve, and spray head).

6.7 Relationship of this specification to previous issues. MIL-C-81309A provided two grades of soft film corrosion preventive compound; grade A for use on all metals and grade B for use on stainless steel and aluminum in interior locations. MIL-C-0081309B(AS) provided one grade of dry-to-touch compound which can be used on all metals. Under both of these, specification bulk material or self-pressurized spray (aerosol) cans were acquired on order but were not classified separately. MIL-C-0081309C(AS) provided for both dry-to-touch films and soft film compounds for application as described in 6.1. In addition, provision was made to facilitate the acquisition by defining separate classes for bulk or self-pressurized containers (aerosols). MIL-C-81309D deleted type I, class 1 and 2 compounds which have been superseded by MIL-C-85054. MIL-C-81309E does not alter the type and class arrangement of MIL-C-81309D; however, propellants used in self-pressurized containers as substitutes for CFC's have been included as Grades 22 and 134a. The equivalents are specified in Table IV. MIL-PRF-81309F deleted Grade 22, added Grade CO_2 , and modified corrosion requirements.

TABLE IV. Table of equivalents.

Type	Class	MIL-C-81309 Revision Letter					
		F	E	D	C	B	A
I	1	Not included	Not included	Superseded by MIL-C-85054 type II	Type I, class 1	Bulk	-
I	2	Not included	Not included	Superseded by MIL-C-85054 type I	Type I, class 2	Self-pressurized container	-
II	1	No change	No change	Type III, class 2	Type II, class 1	-	Grades A and B - bulk
II	2	No change	No change	Type II, class 2	Type II, class 1	-	Grade A self-pressurized container
III	1	No change 1/	No change 1/	Type III, class 1	Type III, class 1	-	Grade B bulk
III	2	No change 1/	No change 1/	Type III, class 2	Type III, class 1	-	Grade B self-pressurized container

1/ Choice of Grades for self-pressurized containers (see 1.2.3).

6.9 Subject term (key word) listing.

Avionics
Brushable
Carbon dioxide propellant
Dip
HCFC Propellant
HFC Propellant
Self-pressurized Containers
Soft Film
Sprayable

6.10 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

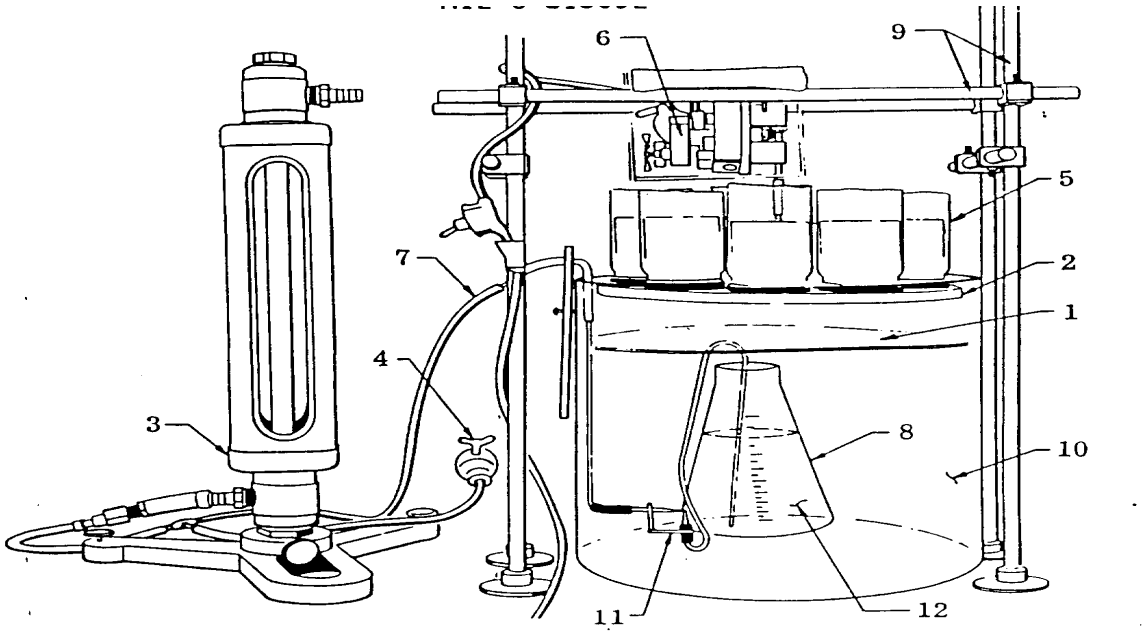


FIGURE 1. Acid salt fog protection test apparatus.

NOTES:

1. Acrylic Baffle - 12 inches in diameter or snug fit in a jar (10) with a 3 inch diameter center hole. The baffle is located within the jar (10) above the spray nozzle (11), thus preventing direct impingement of the spray on the disks, but allowing the fine spray mist full contact with the disks under test. Edge of baffle shall be notched to allow passage of the tube leading to spray nozzle (11).
2. Acrylic Turntable - 10-1/2 inches in diameter, positioned approximately 1/2 inch below the top of the jar (10). The turntable is provided with holes for the mounting of the test disk holders (5) and disks. The turntable is mechanically rotated, driven by an electric motor (6) (encased within a protective acrylic box, mounted above the jar (10) on an arrangement of Flex-frame support rods (9)).
3. Air Regulator.
4. Air Source
5. Coated Test Disk Holder (see figure 3).
6. Electric motor (slow speed one rpm or less).
7. Filtered air source - with an air regulator (3) capable of regulating the air flow to the to the spray nozzle (11) at one cubic foot per minute.
8. Flask – 1000 ml, extra wide mouth, Erlenmeyer flask, placed in the jar (10) to hold the synthetic sea water sulfurous acid solution.
9. Flex frame support rods.
10. Jar - 12 inches in inside diameter and 12 inches high.
11 Spray Nozzle - see figure 2.
12. Test Solution.

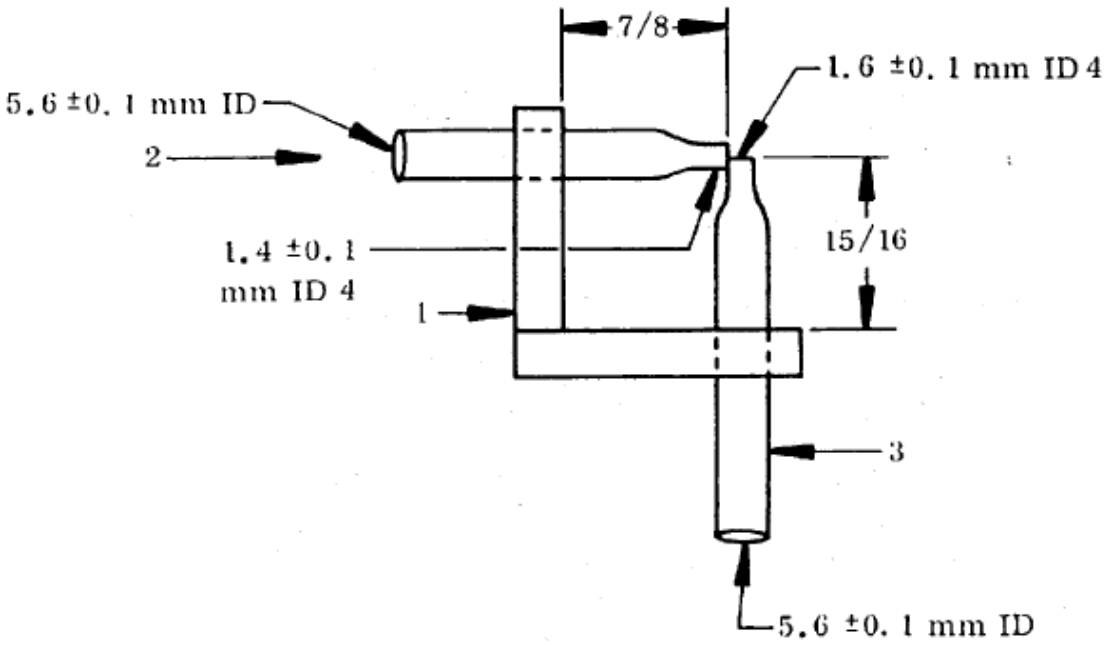
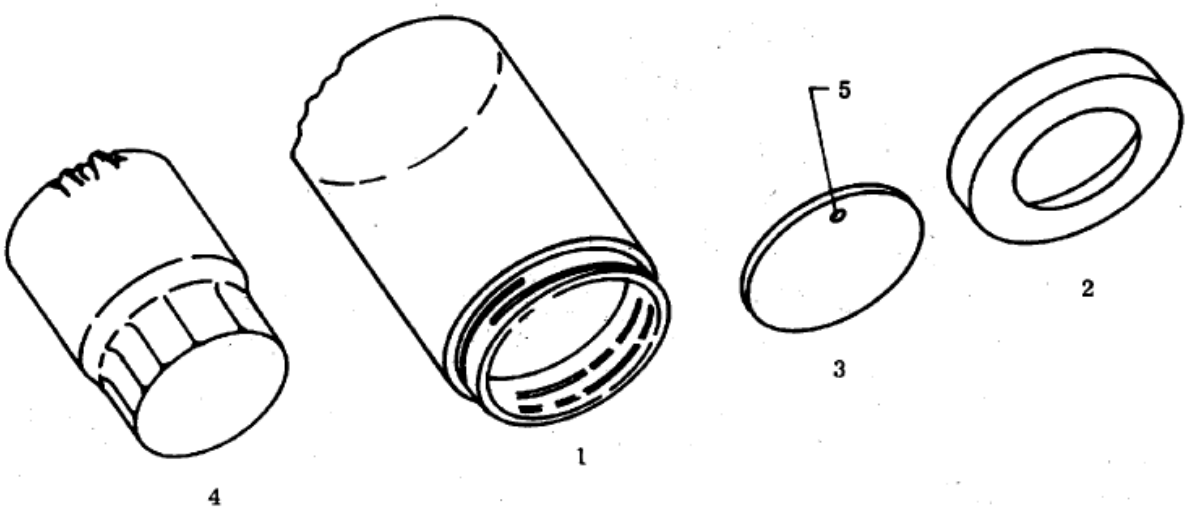


FIGURE 2. Spray nozzle.



NOTES:

1. Disk holder.
2. Disk holder cap.
3. Test disk - A 1/32 inch diameter hole (5) is provided for handling the disk by stainless steel wire.
4. Water jacket- In use, the aluminum water jacket is placed so as to be in direct contact with the back of the round test disk (3).

General - The complete test disk holder, with disk, described above, is mounted in one of the holes of the acrylic turntable of the apparatus on figure 1 (see notes 2 and 5, figure 1).

FIGURE 3. Water jacket; test disk, holder and cup.

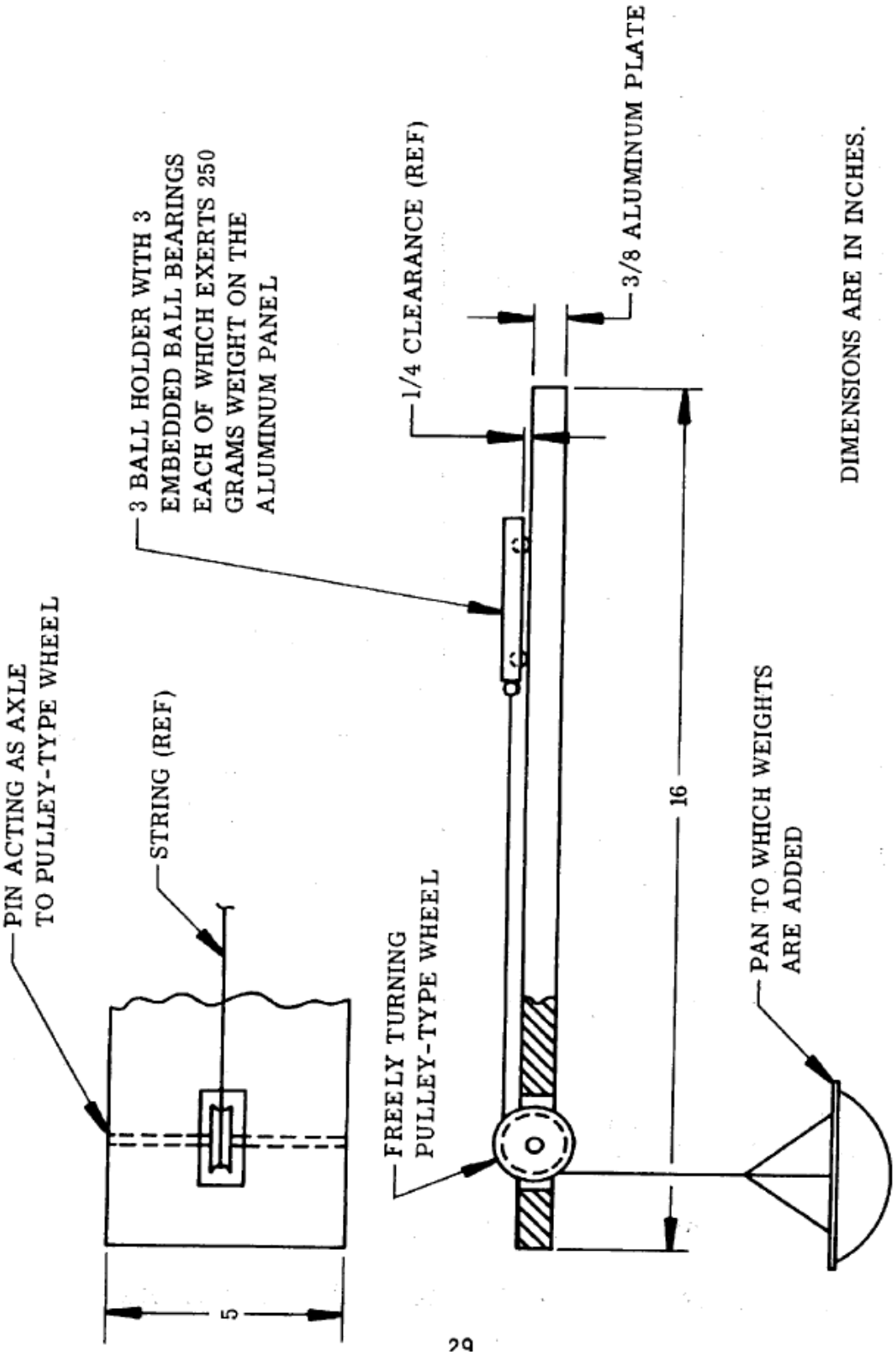


FIGURE 4. Apparatus for determining lubricity.

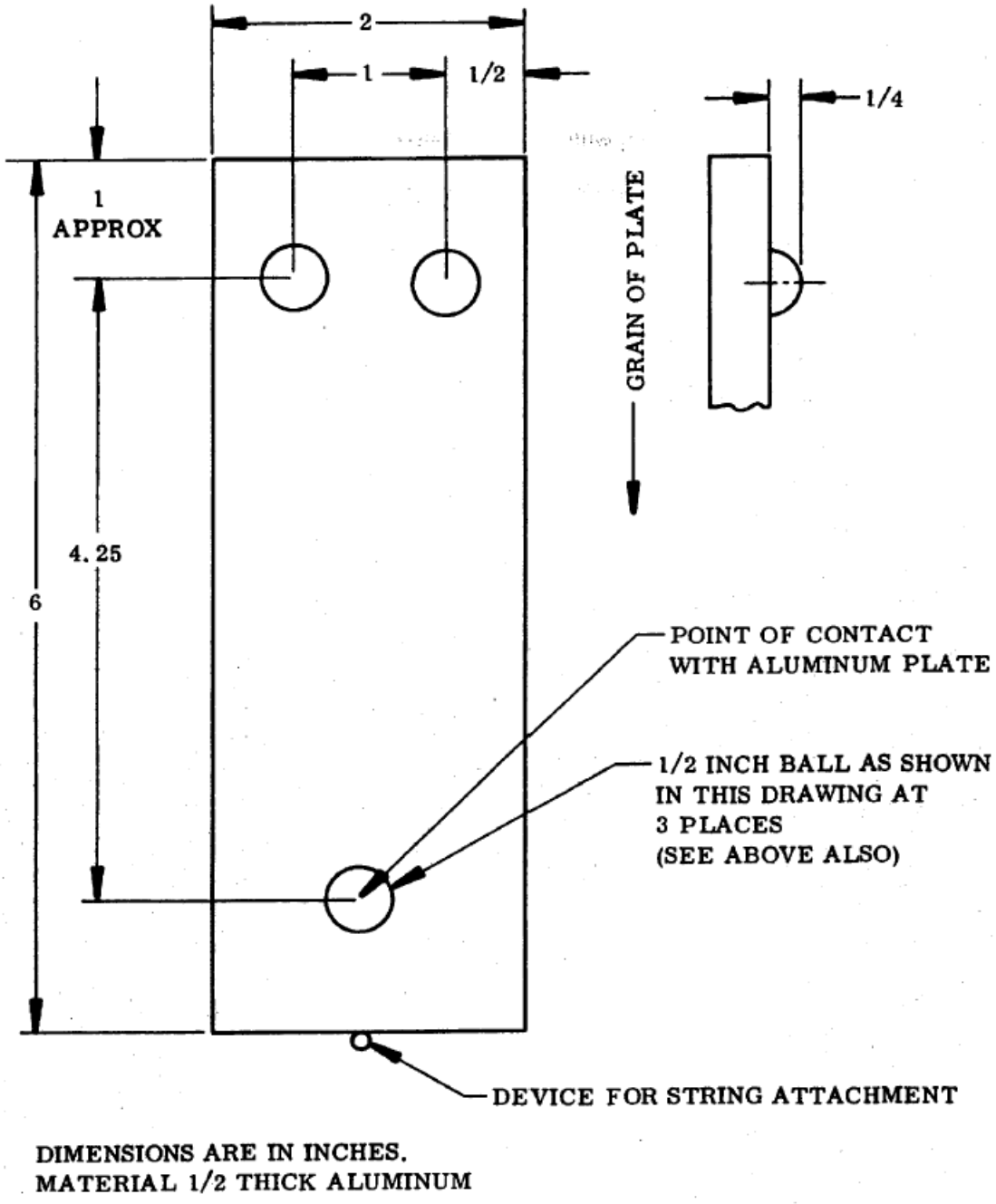


FIGURE 5. Bottom view of aluminum plate on the lubricity apparatus.

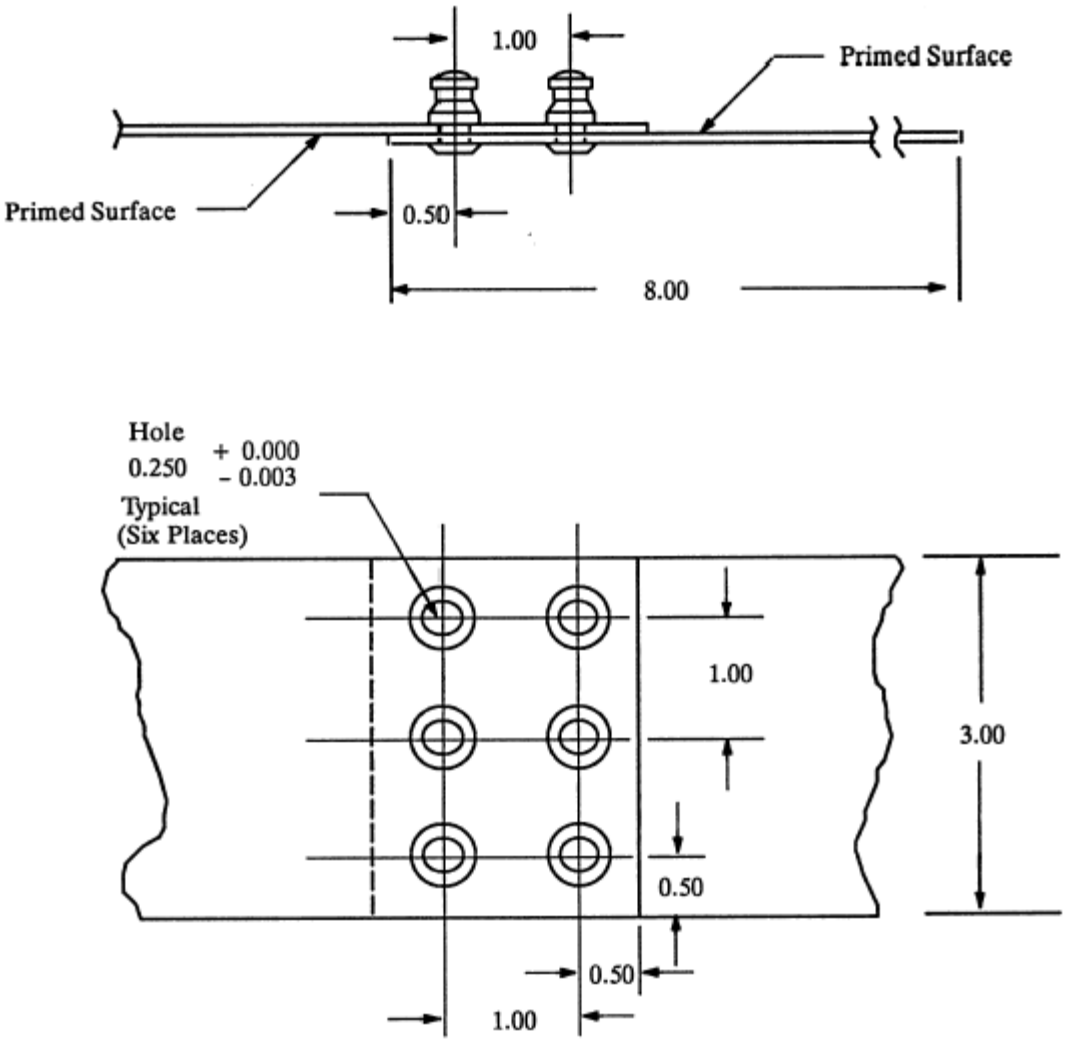


FIGURE 6. Penetration panel assembly.

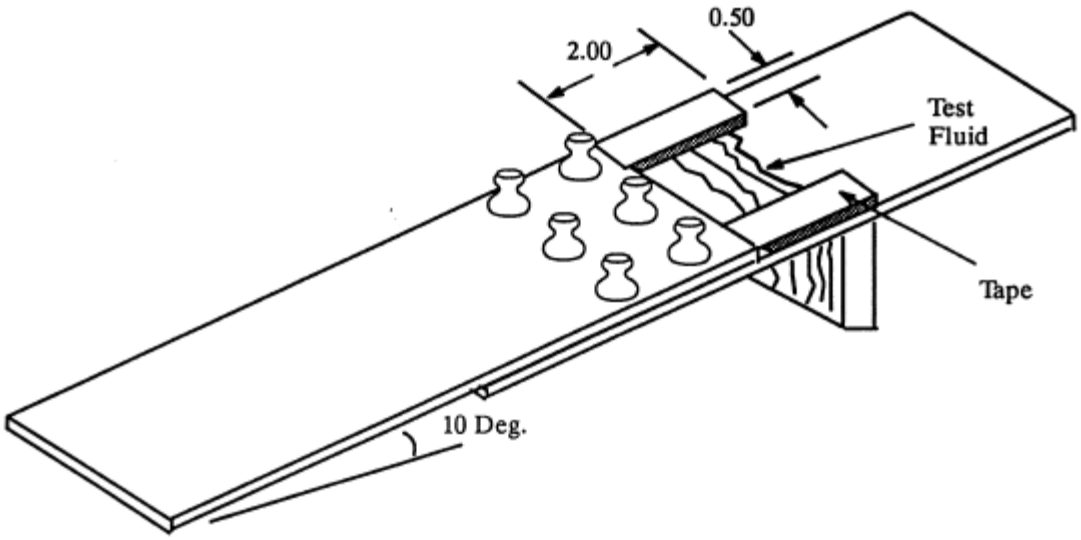


FIGURE 7. Functional penetration configuration.

ELECTRONICS LUBRICANT EFFECTIVENESS

A.1. SCOPE

A.1.1 Scope. This Appendix establishes the requirements and test methods for selection of effective corrosion preventive lubricants for use on electrical and electronic contacts and connectors. This appendix is a mandatory part of this specification for Type III products and is intended for compliance.

A.1.2 Significance. Thin film corrosion and wear of contacts and connectors can cause electronic equipment malfunctions ranging from intermittent glitches to hard failures. Lubrication of contact points can reduce the mechanical wear of insertion and withdrawal of electrical connectors. In addition, lubricants can reduce wear of mated connector pins or contact points in a vibrating service environment. Finally, corrosion inhibiting lubricants can prevent the formation of non-conductive surface oxides which interfere with electrical continuity.

A.2 APPLICABLE DOCUMENTS

A.2.1 DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-I-46058	-	Insulating Compound, Electrical (For Coating Printed Circuit Assemblies). (Inactive for New Design)

(A copy of this document is available on line at http://assist.daps.dla.mil/quicksearch/ or http.//assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

A.2.2 NON-GOVERNMENT PUBLICATIONS.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) INTRENATIONAL

ASTM-B539	-	Standard Test Methods For Measuring Resistance of Electrical Connections (Static Contacts)
ASTM-B735	-	Standard Test Method For Porosity in Gold Coatings on Metal Substrates by Nitric Acid Vapor
ASTM-B741	-	Standard Test Method For Porosity in Gold Coatings on Metal Substrates by Paper Electrography
ASTM-B799	-	Standard Test Method For Porosity in Gold and Palladium Coatings by Sulfurous Acid/Sulfur-Dioxide Vapor

(Copies of these documents are available on line at www.astm.org or from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

A.3. TEST SPECIMENS

A.3.1 Edge connector. Connectors shall be vertical, board mount, double sided, edge card connectors with 50 positions, with phosphor bronze springs plated with 50 micro inches of nickel followed by 30 micro inches of hard gold. Each contact spring shall produce a normal contact force of no less than 100 grams and no more than 250 grams on the simulated PC board. One or more edge connectors shall be soldered into PC boards to facilitate electrical measurements (an example board is shown on figure A-1).

A.3.2 Simulated PC board. Board material of approximately 0.055 inch thickness shall be plated on both sides with oxygen free high conductivity copper and finished by metallographic abrasion to produce a standard roughness of 6.9 $\pm$0.5 micro inches center line average. Finish plating shall be 50 micro inches of nickel followed by 30 micro inches of acid hard gold. The finish shall be confirmed porous per ASTM-B735, ASTM-B741 or ASTM-B799. Simulated PC boards approximately 3 inches in length and 1.2 inches in width shall be sheared from the plated board material to produce a bare copper edge on the entrance edge of the board.

A.3.3 Lubricant application. Lubricant shall be applied only to the simulated PC board. Lubricant shall be sprayed by hand operation of either aerosol containers or a SAE-AS22805 spray unit containing the bulk lubricant. Both sides of the simulated PC board shall be sprayed using a single pass over the length of the board from a distance of 6 to 8 inches, taking 3 to 4 seconds to cover the 3-inch length of the board. Coated boards shall be inverted (contact edge up) and held in a vertical position along the noncontact edge for 10 minutes prior to insertion into the edge connector.

A.3.4 Sample size. Each connector assembly shall be tested for initial contact resistance (A.4.1) prior to its use in one and only one additional test (A.4.2 through A.4.6); reuse of either of these components shall not be allowed. For each requirement (A.4.1 through A.4.6), no less than 100 contacts shall be evaluated.

A.3.5 Contact resistance measurement. Measurement shall be made by connecting the double sided PC board with mounted edge connectors to a data scanning system which shall measure the resistance of each contact at 50 millivolts open circuit potential with a 10 milliamperes DC current, as specified in ASTM-B539. The resistance measurement shall be made in such a way that the total initial resistance (contact plus bulk resistance) is no greater than 15 milliohms. No connector shall be used in which any total initial resistance measurement is greater than 15 milliohms.

A.4. LUBRICANT REQUIREMENTS

A.4.1 Initial contact resistance. All contacts of edge connectors with simulated PC boards shall be tested for contact resistance as specified in ASTM-B539 before and after lubrication. The change in measured resistance for each contact shall be no more than 10 milliohms.

A.4.2 Low temperature. After lubrication and mating, all contacts of edge connectors with simulated PC boards shall be tested for contact resistance as specified in ASTM-B539 while in a suitable refrigerated chamber. Measurements shall be made after stabilizing for 15 minutes at each of the required temperatures. Tests shall be conducted at each of the following temperatures and in the order given: 25, 5, -15, -35, -55, -15, 5, and 25. The change in measured resistance shall be no more than 10 milliohms for 95 percent of all contact measurements taken.

A.4.3 Thermal aging. After lubrication and mating, all contacts of edge connectors with simulated PC boards shall be tested for contact resistance as specified in ASTM-B539 initially and after heating in ambient air at 80 °C for 1000 hours. The change in measured resistance shall be no more than 10 milliohms for 95 percent of all contact measurements taken.

A.4.4 Durability cycle. After lubrication and mating, all contacts of edge connectors with simulated PC boards shall be tested for contact resistance as specified in ASTM-B539. The board shall then be withdrawn from and inserted into its edge connector 100 times, then again tested for contact resistance. The change in measured resistance shall be no more than 10 milliohms for 95 percent of all contact measurements taken.

A.4.5 Corrosive gas. After lubrication and mating, all contacts of edge connectors with simulated PC boards shall be tested for contact resistance as specified in ASTM-B539. Simulated PC boards shall then be unmated and the boards subjected to 10 days of mixed flowing gas (MFG) exposure as specified in ASTM-B827 and ASTM-B845, Method G. At the end of this period, the boards shall be mated to their respective connectors and again tested for contact resistance. The change in measured resistance shall be no more than 10 milliohms for 95 percent of all contact measurements taken.

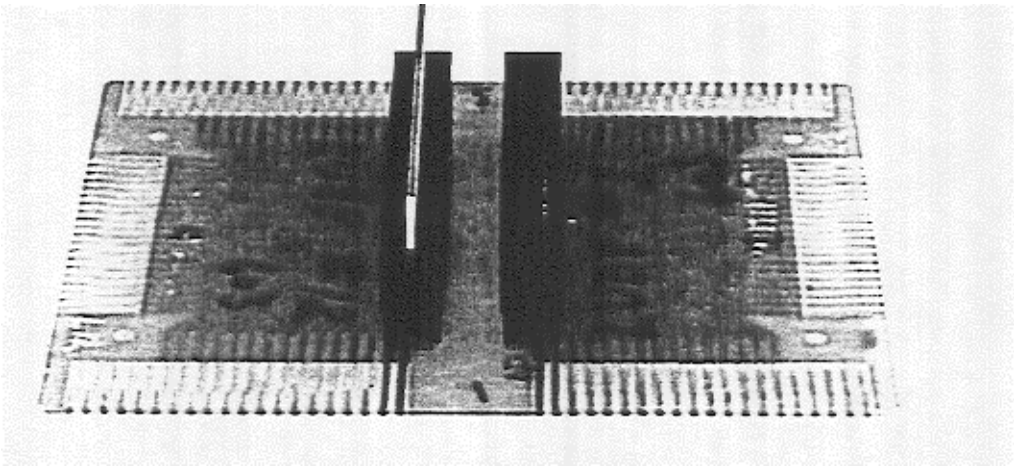


FIGURE A-1. Double sided PC board with two edge connectors with one simulated PC board inserted.

A.4.6 Lubricant compatibility with electrical insulating compounds. One specimen each of Type AR, SR, and UR shall be prepared in accordance with MIL-I-46058. The panels shall then be sprayed in accordance with this Appendix (see A.3.3) and placed at 71+/-1 °C and 95 +/-4 relative humidity for 168 hours. The test panels shall then be tested in accordance with MIL-I-46058 for insulation resistance and hydraulic stability.

CONCLUDING MATERIAL

Custodians:
Army - EA
Navy - AS
Air Force - 99

Preparing activity:
Navy - AS
(Project No. 8030-0826)

Review activities:
Army - AT, MR
Navy - CG, OS
Air Force - 84
Other agencies - DS

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.