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(See 6.6 for cross-
reference data)

MILITARY 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 of ultra-thin film, water displacing, corrosion preventive compounds which may be applied by dipping, spray gun, brushing or from gas pressurized containers (see 6.1).

1.2 Classification. The compounds shall be furnished in the following types and classes, as specified (see 6.2.1).

Type II - Soft film.

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

Class 2 - Pressurized container (for spray application).

Type III - Soft film (Avionic grade).

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

Class 2 - Pressurized container (for spray application).

1.2.1 Part number. Specification part numbers for items described in this specification will be formulated as shown in 6.7.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Engineering Specifications and Standards Department (Code 93), Naval Air Engineering Center, Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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SPECIFICATIONS

FEDERAL

QQ-A-250/4	-	Aluminum Alloy 2024, Plate and Sheet.
QQ-A-250/5	-	Aluminum Alloy Alclad 2024, Plate and Sheet.
QQ-A-671	-	Anodes, Cadmium.
QQ-B-626	-	Brass, Leaded and Nonleaded, Rods, Shaped, Forgings and Flat Products with Finished Edges (Bar and Strip).
QQ-C-576	-	Copper Flat Products with Slit, Slit and Edge-Rolled, Sheared, Sawed or Machined Edges (Plate, Bar, Sheet and Strip).
QQ-M-44	-	Magnesium Alloy, Plate and Sheet (AZ31B).
QQ-S-766	-	Steel Plate, Sheet, and Strip-Corrosion Resisting.
TT-T-291	-	Thinner, Paint, Mineral Spirits, Regular and Odorless.
MMM-A-250	-	Adhesive, Water-Resistant (For Closure of Fiberboard Boxes).
PPP-B-636	-	Boxes, Shipping, Fiberboard.
PPP-C-96	-	Can, Metal, 28 Gage and Lighter.

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MIL-S-7952	-	Steel, Sheet and Strip, Uncoated, Carbon (1020 and 1025) (Aircraft Quality).
MIL-P-7962	-	Primer Coating, Cellulose-Nitrate Modified Alkyd Type, Corrosion-Inhibiting, Fast-Drying (For Spray Application over Pretreatment Coating).
MIL-C-8514	-	Coating Compound, Metal Pretreatment, Resin-Acid.
MIL-L-17672	-	Hydraulic Fluid, Petroleum, Inhibitor.
MIL-A-18001	-	Anode, Corrosion Preventive, Zinc, Slab, Disc and Rod Shaped.
MIL-L-19537	-	Lacquer, Acrylic-Nitrocellulose, Gloss (For Aircraft Use).
MIL-S-22805	-	Spray Kit, Self Pressurized.
MIL-C-85054	-	Corrosion Preventing Compound, Water Displacing, Clear (Amlguard).

STANDARDS

FEDERAL

FED-STD-313	-	Material Safety Data Sheets, Preparation and the Submission of.
FED-STD-791	-	Lubricant, Liquid Fuel and Related Products, Method of Testing.

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MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-290	-	Packaging of Petroleum and Related Products.
MS3112	-	Connector, Receptacle, Electric, Series 1, Box Mounting Flange, Bayonet Coupling, Solder Contact.
MS3116	-	Connector, Plug, Electric, Series 1 Solder Type, Straight Bayonet Coupling.

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(Copies of specifications, standards, handbooks, drawings and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 877 - Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.

(Applications for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

ANTI-FRICTION BEARING MANUFACTURER'S ASSOCIATION, INC.

Quality of steel balls.

(Application for copies should be addressed to the Anti-Friction Bearing Manufacturer's Association, Inc., 2341 Jefferson Davis Highway, Suite 1015, Arlington, VA 22202.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Qualification. The compounds furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (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 or chlorinated solvents shall not be used in the formulation. The compounds shall be homogeneous, free from grit, abrasives, water, chlorides 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.

3.2.2 Application. Type II, class 1 and type III, class 1 shall be capable of being applied by brushing, dipping or spray gun; type II, class 2 and type III, class 2 shall be capable of being applied by pressurized container.

3.2.3 Appearance. The applied compound shall form a film which is uniform and light brown in color or lighter. The film shall not exhibit froth, bubbling or excessive runoff.

3.2.4 Toxicity. The corrosion preventative compound shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the acquiring activity to the appropriate medical service who will act as adviser to the acquiring activity. Material safety data sheets (MSDS) shall be prepared in accordance with FED-STD-313 and submitted as directed in the contract or order at the time of acquisition award. Copies shall be forwarded to the designated industrial hygienist and the focal point of the activity that acquired the item, the focal point of the using activity, if different, and to the qualifying laboratory (see 4.3.1.1, 6.2.1 and 6.4).

3.3 Solvent content. The solvent content of the compound shall consist of a nonphotochemically reactive solvent blend. A nonphotochemically reactive solvent is any solvent with an aggregate of less than 20 percent of its total volume composed of the chemical compounds classified below or which does not exceed any of the following individual percentage composition limitations, referring to the total volume of solvent.

- a. A combination of hydrocarbons, alcohols, aldehydes, esters, ethers or ketones having an olefinic or cyclo-olefinic type of unsaturation: 5 percent;
- b. A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent;
- c. A combination of ethylbenzene, ketones having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent.

3.4 Properties of type II, class 1 and type III, class 1. The corrosion preventative compound, when tested as specified in section 4, shall conform to the requirements of table 1.

3.5 Properties of type II, class 2 and type III, class 2. The corrosion preventative compound, exclusive of propellants, when tested as specified in section 4, shall conform to the requirements of table 1 and the following additional requirements.

3.5.1 Leakage. The pressurized cans shall not leak or become distorted, when tested as specified in 4.10.13.1.

3.5.2 Fill. Pressurized cans containing the compound shall have a net minimum weight of 13 ounces, when tested for fill as specified in 4.10.13.2.

3.5.3 Performance of pressurized containers. Compound packaged in pressurized containers shall spray uniformly, adhere to the panel and shall not foam excessively or "sag", when tested as specified in 4.10.13.3.

3.5.4 Propellant. The propellant shall consist of carbon dioxide (see 4.10.13).

3.6 Workmanship. The workmanship shall be in accordance with high grade commercial practice covering this type of material. The ingredients shall be uniformly processed to produce the quality of products established by this specification. The finished products shall be clean and uniform, and free of any defects which might impair their utility such as sediment, metal, or other foreign particles in containers, education tubes and valve assemblies. When furnished in pressurized containers, the exterior orifice shall be symmetrical and free of ragged edges, and the exterior orifice, if drilled, shall be symmetrical and in direct alignment with the angle of discharge.

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TABLE I. Property requirements.

Characteristics	Requirements		Test paragraph
	Type II Classes 1 and 2	Type III Classes 1 and 2	
Minimum flash point	60°C (140°F)		4.10.1
Synthetic sea water-sulfurous acid spray	No visible corrosion of carbon steel after 2 cycles	No visible corrosion of 410 steel after 8 cycles.	4.10.2
Synthetic sea water displacement	No visible corrosion		4.10.3
Removability	Not more than 3 cycles to remove		4.10.4
Abrasives	None present		4.10.5
Maximum film thickness	0.0005 inches	0.0002 inches	4.10.6
Sprayability	Sprayable		4.10.7
Corrosivity	No visible pitting, etching or dark discoloration. No weight change (milligram/cm ²) greater than 0.5 for magnesium, cadmium and zinc nor greater than 0.2 for aluminum, copper and brass.		4.10.8
Staining	No visible evidence of staining or other deleterious effects.		4.10.9
Minimum dielectric breakdown	25,000 volts		4.10.10
Mixability of compounds	No evidence of separation		4.10.11
Lucricity of compounds	Less than 0.20		4.10.12
Effect on electronic components	----	No significant change in capacitance, dissipation factor and conductance of coil forms and capacitors. For coils no significant change in the Q and amount of capacitance to resonate the coil. No significant change in the resistance of resistors. A change greater than 1/2 the allowed tolerance of the component shall be considered as significant.	4.10.14
Effect on electrical connectors	----	No significant increase in resistance between connected pins or decrease in resistance between adjacent pins.	4.10.15

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Certificate of compliance. Where certificates of compliance are submitted, the Government reserves the right to check test such items to determine the validity of the certification.

4.1.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the applicable paragraph of the specification.

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

- a. Qualification inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

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

4.3.1 Qualification samples. The qualification samples shall consist of the following:

Nonpressurized container form (class 1) - Two gallons of the compound.

Pressurized container (class 2) - Two gallons of the compound exclusive of propellants and five 13 ounce gas pressurized cans of the compound.

The samples shall be forwarded to the Commanding Officer, Naval Air Development Center, Attention: Code 60622, Warminster, PA 18974. The samples shall be plainly identified by securely attached durable tags or labels marked with the following information:

Samples 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-C-81309D under authorization (reference authorizing letter (see 6.3)).

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4.3.1.1 Inspection report and other data. The contractor shall submit a test report, in duplicate, to accompany the qualification inspection samples. This report shall include the results of the manufacturer's tests, reported quantitatively, where applicable, in the units specified for all of the requirements specified herein. Tests not conducted due to lack of special test facilities or materials shall be so noted in the report. The contractor shall also furnish toxicological data and formulations necessary to evaluate the safety of the corrosion preventive compound for the proposed use (see 3.2.4). The formulation shall be clearly identified by the manufacturer's formula number.

4.3.2 Retention of qualification. In order to retain qualification of a product approved for listing on the Qualified Products List (QPL), the manufacturer shall verify by certification to the qualifying activity that the manufacturer's product complies with the requirements of this specification. The time of periodic verification by certification shall be in two-year intervals from the date of the original qualification. The Government reserves the right to re-examine the qualified product whenever deemed necessary to determine that the product continues to meet any or all of the specification requirements.

4.4 Quality conformance inspection. Unless otherwise specified, the sampling and inspection levels shall conform to MIL-STD-105. Quality conformance inspection shall consist of the examinations listed in 4.6 and the following tests:

Minimum flash point (see 4.10.1).

Synthetic sea water-sulfurous acid spray (see 4.10.2).

Synthetic sea water displacement (see 4.10.3).

Sprayability (see 4.10.7).

Lubricity (see 4.10.12).

Fill (for class 2) (see 4.10.13.2).

4.5 Inspection lot.

4.5.1 Type II, class 1, and type III, class 1. When the acquisition document specifies delivery in nonpressurized containers (see 6.2.1), an inspection lot shall consist of all compound produced from the same ingredients, prepared as a unit of manufacture and offered for delivery at one time.

4.5.2 Type II, class 2, and type III, class 2. An inspection lot shall consist of all the pressurized containers, filled under basically the same conditions with compound produced from the same ingredients, offered for delivery at one time.

4.6 Examination of product.

4.6.1 Sampling for visual inspection. A random sample of filled containers shall be selected from each inspection lot in accordance with MIL-STD-105 at inspection level I and an acceptable quality level (AQL) of 2.5 percent defective to verify conformance to all requirements of this specification regarding material (see 3.2).

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4.6.2 Inspection of packaging. The packaging, packing and marking of the compound, fully prepared for delivery, shall be inspected to determine conformance to the requirements of section 5. The inspection level shall be S-2 and the AQL shall be 2.5 defects per 100 units. Sample unit for this examination shall be a full container. Containers used for this examination shall be the same as those selected for visual inspection and samples for tests.

4.7 Samples for test. Samples for test shall be selected in accordance with MIL-STD-105, inspection level S-3 with an AQL of 4.0 percent defective. Sample unit for test shall be one gallon for class 1. For class 2, the sample unit shall be one 16 ounce gas pressurized container and one gallon of the compound from which these samples were filled, exclusive of the propellant.

4.8 Test conditions. Physical tests contained in this specification shall be made under controlled atmospheric conditions having a relative humidity of 50 ± 10 percent and a temperature range of from 21° to 27° C (70° to 80° F). When specified by the contracting officer, waiver of this requirement may be permitted where proper conditioning facilities are not available for control testing. However, for referee purposes, the specified tests shall be made upon the compound under the specified atmospheric conditions.

4.9 Test disks and panels (except for corrosivity and staining).

4.9.1 Materials. The material for the test disks and panels shall be carbon steel conforming to FS1020 of MIL-S-7952. For type III only, stainless steel, type 410 conforming to class 3 of QQ-S-766 shall be used in the synthetic sea water-sulfurous acid spray test.

4.9.2 Size of test disks and panels. Test panels for tests requiring compound coatings shall be 2 by 4 by 1/8 inches, except for the synthetic sea water-sulfurous acid spray test when disks with a diameter of 2-1/8 inches and a thickness of 1/16 inch shall be used.

4.9.3 Preparation of test disks or panels. Disks or panels shall have all sharp edges and burrs removed and shall have all holes chamfered to prevent injury in handling. They shall be surface ground and hand polished with a 240 grit silicon carbide or aluminum oxide cloth or paper to produce a surface finish of 10 to 20 microinches (rms). Iron oxide or so-called "wet or dry" papers or cloths shall not be used.

4.9.4 Cleaning of test disks or panels. The utensils and cloths used in the cleaning of test disks or panels shall be clean and free of contamination. Solvents shall be fresh and renewed frequently (see figure 1). In all stages of treatment, the handling of disks or panels with the bare hands shall be avoided. The disks or panels shall not be permitted to contact contaminated surfaces during the cleaning procedure and shall be handled by tongs and hooks during and after dipping. After polishing, they shall be cleaned with a surgical gauze swab, in a beaker of hot mineral spirits conforming to type I of TT-T-291. Cleaning and scrubbing shall be followed by dipping in; (1) a second container of hot mineral spirits; (2) boiling in 95 percent methanol; and (3) boiling in absolute methanol. The disks or panels shall be allowed to air dry in a rack and shall then be stored in a desiccator until ready for use. If storage of more than 24 hours occurs, the surface preparation shall be repeated starting with the hand polishing.

4.9.5 Coating of the test disks or panels. Application of the compound to the test disks or panels shall be carried out under the atmospheric conditions of 4.8. A well-mixed representative sample of the compound shall be poured into a clean dipping chamber. The dipping chamber shall be of sufficient size to permit complete immersion of the disks or panels. Care shall be taken to eliminate the formation of entrapped air bubbles by skimming them from the top of the compound before immersing the disks or panels. The disks or panels shall be coated by completely immersing them vertically in the compound for one minute, then removed singly at a rate of 4 inches per minute. After removal, they shall be conditioned for 24 hours under the atmospheric conditions of 4.8 in a draft, dust, and fume-free atmosphere.

4.10 Test methods.

4.10.1 Minimum flash point test.

4.10.1.1 Test procedure. Determination of flash point shall be conducted in accordance with method 1103.6 of FED-STD-791 (see table I).

4.10.2 Synthetic sea water-sulfurous acid spray test.

4.10.2.1 Materials.

4.10.2.1.1 Test solution. The spray test solution shall consist of a solution made by adding 2 milliliters (ml) of sulfurous acid (6.4 percent assay as SO_2) to each liter of synthetic sea water. The pH shall be measured and shall be between 3.3 and 3.5. If it does not, additional acid or synthetic sea water must be added to adjust the pH to this range. The synthetic sea water shall be prepared by adding 50 grams of sodium chloride (NaCl); 22 grams of magnesium chloride ($\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$); 3.2 grams of calcium chloride ($\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$); and 8.0 grams of sodium sulfate (Na_2SO_4) to a liter of distilled or demineralized water. One liter of fresh test solution shall be used for each cycle.

4.10.2.1.2 Conditioning of compound sample. A wide mouth, quart jar containing 800 ml of the compound shall be sealed and exposed to the following cycle four times without physical disturbance of the compound:

Eight hours at $54.4^\circ \pm 1.1^\circ\text{C}$ ($130 \pm 2^\circ\text{F}$).

Sixteen hours at $-40^\circ \pm 3.6^\circ\text{C}$ ($-40^\circ \pm 2^\circ\text{F}$).

At the end of this cyclic exposure, the contents of the sealed jar shall be allowed to remain at $23.9^\circ \pm 2.8^\circ\text{C}$ ($75 \pm 5^\circ\text{F}$) for 24 hours.

4.10.2.2 Apparatus. The apparatus used in the test shall conform to figures 1, 2, and 3.

4.10.2.3 Test procedure. Applicable test disks prepared as specified in 4.9.3 shall be cleaned as specified in 4.9.4; coated as specified in 4.9.5 with a compound conditioned as specified in 4.10.2.1.2; allowed to remain overnight in a horizontal position on a level surface, and shall then be placed in the disk holders. The turntable shall then be started and the air regulated to a flow of one \pm 0.1 cubic foot per minute, which shall be supplied to the nozzle to effect the spray. The

pickup tube supplying the nozzle should have an ID of 1 mm. At the end of approximately 2 minutes of spraying, 35 ml of water, which has been cooled to 1.7°C (35°F), shall be added to each water jacket to cause a fine condensation to form on the surface of the disks. Spraying shall continue for one hour. The rate of flow shall be approximately 1400 ml/hour, and during this 1 hour spray period, the sea water shall be replaced at the midpoint of the period. At the end of the hour, the spray shall be stopped; the water jackets shall be removed; the turntable shall be removed from the jar and placed where the disks shall dry at room temperature for 3 hours. The combination of 1 hour spray and 3 hours drying shall be defined as one cycle. At the end of each cycle, the jar shall be emptied of the solution. Two cycles shall be conducted in one day. The disks shall then be cleaned in mineral spirits, conforming to type I of TT-T-291, after which they shall be examined for any visible corrosion, pitting or staining (see table I).

4.10.3 Synthetic sea water displacement test.

4.10.3.1 Test procedure. Panels, prepared as specified in 4.9.3 and 4.9.4, shall be placed so that one 2 inch end shall be raised one inch above a horizontal surface. The panels shall then be sprayed with the synthetic sea water of 4.10.2.1.1 so that the entire upper surface of the specimen is covered with tiny droplets. Within one minute after spraying, one milliliter of the test compound shall be poured along the upper two inch edge of the panels and allowed to run slowly down the specimen so as to completely cover the test panel. After another minute, a second milliliter of the test compound shall be poured and allowed to run down the panels in a like manner. After waiting an additional minute, the panels shall be picked up and held in a vertical position for one minute and shall then be placed flat (test side up) above distilled water at 22°C (72°F) in a closed desiccator. After 4 hours, they shall be removed and cleaned with mineral spirits and then evaluated for presence of visible corrosion (see table I).

4.10.4 Removability.

4.10.4.1 Test procedure. The apparatus for determining removability shall be similar to figure 4. Removability shall be determined on three test panels that have been prepared and cleaned as specified in 4.9.3 and 4.9.4 and coated as specified in 4.9.5. They shall be placed one at a time in a position in the apparatus so that a felt pad wiper, saturated with solvent conforming to type I of TT-T-291, can wipe a streak 3 inches long, in a forward and backward motion, on the center of the panels. The wiper shall consist of a 2 inch long wick made from an all wool felt (weighing approximately 190 ounces per square yard and 3/4 inch thick) which shall be packed tightly into the lower end of a tube (wiper holder) 10 inches long, and 5/16 inch inside diameter and shall protrude 1/4 to 1/2 inch. One or more indentations shall be made approximately 2 inches from the bottom of the wiper holder tube to prevent the wiper from being forced further into the tube. The wiper holder shall fit into a supporting tube, 4 inches long and 7/16 inch inside diameter, which is fixed in position and acts as a sleeve or guide. The wiper holder tube shall be filled with solvent and tightly stoppered. It shall be opened and vented before each run so that the wiper felt is filled with solvent in an amount sufficient to make the run, but without allowing the solvent to flow freely over the panel. The length of the wiping stroke shall be 3 inches, and the speed of the machine shall be regulated to 40 ± 5 cycles per minute. A complete wiping cycle shall consist of a stroke of approximately 3 inches in one direction with a return stroke to the starting position. At the completion of the third cycle, the compound under the wiper

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shall be completely removed (determined visually) over an area 1/4 inch wide and the entire length of the stroke (see table I).

4.10.5 Abrasives test.

4.10.5.1 Test procedure. Mix approximately 75 ml of the compound with 200 ml of benzol and stir until all soluble matter is in solution. Allow to stand for one hour at room temperature to permit any insoluble matter to settle. Carefully decant, wash the residue with 100 ml of benzol and again carefully decant. Repeat the procedure with successively smaller portions of benzol until the solution is practically colorless. The residue after the last decantation shall be rubbed between two pieces of flat clean glass plate. The appearance of scratches on the glass plate shall be considered evidence of the presence of abrasive material (see table I).

4.10.6 Maximum film thickness test.

4.10.6.1 Test procedure. The average film thickness produced by the compound shall be determined on a panel prepared, cleaned and coated as specified in 4.9.3, 4.9.4 and 4.9.5, respectively. The film thickness (see table I) shall be calculated 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 (grams per cubic centimeter). Density is determined on the nonvolatile portion by means of a pycnometer.

A = total surface area of the panel (square inches).

4.10.7 Sprayability test.

4.10.7.1 Test procedure. Three ounces of the compound shall be placed in a 4 ounce product jar conforming to MIL-S-22805 and conditioned at room temperature for three hours. Spray the material using a spray device conforming to MIL-S-22805 that has been conditioned at room temperature. The material shall be considered as having passed the test if it can be satisfactorily sprayed (see table I).

4.10.8 Corrosivity test.

4.10.8.1 Preparation of specimens. Suggested specimen size is 3 by 1/2 by 1/16 inches and shall be of the following metals for this test:

Magnesium, QQ-M-44.

Cadium, QQ-A-671.

Zinc, MIL-A-18001.

Aluminum, QQ-A-250/4.

Copper, QQ-C-576.

Brass, QQ-B-626.

4.10.8.2 Test procedure. Three specimens of each of the above metals shall be polished to remove pits, burrs and irregularities from all faces and edges. The panels shall be finished and cleaned as specified in 4.9.3 and 4.9.4. After weighing, the specimens shall be placed in screw cap jars with one specimen in each jar. The specimens shall be placed on one of their narrow ends. The specimens shall be covered with enough compound so that the tops of the specimens are at least 1/4 inch below the surface of the compound. The sealed jar shall then be placed in an oven at $54.4^{\circ} \pm 1.1^{\circ}\text{C}$ ($130 \pm 2^{\circ}\text{F}$) for 7 days. Upon completion of the test, any loose corrosion products shall be removed from the specimens by cleaning as specified in 4.9.4. Reweigh the specimens and calculate the weight loss or gain in milligrams per square centimeter (see table I).

4.10.9 Staining test.

4.10.9.1 Preparation of test panel. A test panel measuring 3 by 6 by 0.020 inches shall be fabricated from aluminum alloy conforming to QQ-A-250/5. The panel surface shall be prepared as follows: Spray one coat of wash primer, conforming to MIL-C-8514, to a dry film thickness of 0.0002 to 0.0003 inch and air dry for 30 minutes. One coat of lacquer primer, conforming to MIL-P-7962, shall be sprayed over the wash primer to a dry film thickness of 0.0003 to 0.0004 inch and air dried for 30 minutes. Two coats of acrylic nitrocellulose insignia white lacquer, conforming to MIL-L-19537, shall be sprayed over the preceding films, allowing a 30 minute drying time between coats. The panel shall be permitted to dry at least 24 hours in a clean dust-free atmosphere before performance of test.

4.10.9.2 Test procedure. Three smears of the compound shall be applied to the test surface. The smears shall run parallel to the 3 inch dimension of the panel and shall measure 3/4 to 1 inch wide by approximately 0.005 inch thick. They shall be so spaced as to permit ready comparison with the uncoated paint surface upon removal of the compound. The panel with the applied smears shall be placed under a 275 watt ultraviolet R.S. sunlamp. The center of the sunlamp shall be positioned 15 inches from the center of a 14 inch diameter turntable which shall revolve at an approximate rate of 3 rpm. The test shall be conducted at $24^{\circ} \pm 2.8^{\circ}\text{C}$ ($75 \pm 5^{\circ}\text{F}$). A constant line voltage to the lamp shall be maintained so that a direct scale reading of 20 units is obtained on a General Electric sunlamp tester no. 113 or its equivalent, used without shield. After a 72 hour exposure period, the panel shall be degreased with mineral spirits conforming to TT-T-291, grade I, applied with a clean gauze swab and the panel surface examined for stain. If a minimum of one of the test areas exhibits stain, the test shall be repeated (see table I). In the retest, evidence of stain in one or more areas shall be cause for rejection.

4.10.10 Minimum dielectric breakdown voltage test.

4.10.10.1 Test procedure. The compound shall be subjected to and shall pass the dielectric breakdown voltage inspection in accordance with the procedure of ASTM D 877 (see table I).

4.10.11 Mixability of compounds test.

4.10.11.1 Test procedure. Combine 5 ml of the compound and 95 ml of lubricating oil conforming to MIL-L-17672 in a 100 ml cone-shaped centrifuge tube. Shake by hand until the mixture appears homogeneous. Place the tube in a beaker and heat in an explosion-proof oven at $76.7^{\circ} \pm 1.1^{\circ}\text{C}$ ($170^{\circ} \pm 2^{\circ}\text{F}$) for 15 minutes. There shall be no evidence of separation or sediment after the 15 minute 76.7° (170°F) temperature inspection or after 24 hours at $25^{\circ} \pm 2.8^{\circ}\text{C}$ ($77^{\circ} \pm 5^{\circ}\text{F}$) (see table I).

4.10.12 Lubricity of compounds test.

4.10.12.1 Apparatus. The test apparatus (figures 5 and 6) shall consist of: a 5 by 16 by 3/8 inch 2024 T6 milled aluminum plate with a surface roughness greater than 9 and less than 15 microinches (rms) when determined in the direction parallel to the grain of the plate, and greater than 14 and less than 20 microinches (rms) when determined across the grain; 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 motionless in the configuration shown in figure 5 and weighted in such a manner that each ball exerts a force equivalent to 250 grams upon the surface of the aluminum plate; and a pan or beaker attached by a flexible string over the pulley wheel to the three ball holder so that when taut the string is parallel to the plate surface and is counterbalanced by the block.

4.10.12.2 Materials. 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.

4.10.12.3 Test procedure. One surface of the aluminum plate shall be coated with type II and/or type III corrosion preventive compound to a thickness of not less than 0.001 inch and not more than 0.005 inch. The coating shall be exposed at 22.2°C (72°F) for 24 hours. At the conclusion of the exposure period, the weighted three ball holder shall be set gently on the coated surface at the end of the plate opposite the pulley wheel with one ball forward and two rearward and oriented so that if pulled by the string attachment toward the pulley wheel no rotational motion would occur. The pan or beaker shall be attached as shown in figure 5. Test balls shall be lightly dropped 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, the gross weight of the pan shall be recorded. If the movement requires more than three seconds, the holder shall be placed as before at one end of the aluminum plate in a location different from those previous. Another test ball shall be dropped onto the pan from a height of less than 1/4 inch and the travel time observed. The restarting procedure shall be repeated until the three ball holder travels six inches in less than three seconds at which time the gross weight of the pan shall be recorded.

4.10.12.4 Calculation. The lubricity value shall be determined from the following formula:

$$\frac{\text{weight required}}{750\text{g}} = \text{lubricity value (coefficient of friction) (see table I).}$$

4.10.13 Specialized tests for class 2 (pressurized containers).

4.10.13.1 Leakage test. The pressurized container shall be completely submerged for 5 minutes in water maintained at a minimum of $54.4^{\circ} \pm 1.1^{\circ}\text{C}$ ($130 \pm 2^{\circ}\text{F}$) during which it shall be observed for the emission of bubbles. Distortion of the container or the emission of bubbles from any part of the container shall be considered evidence of leakage (see 3.5.1).

4.10.13.2 Fill test. A sample can shall be weighed and then shall be sprayed at three minute periods with one minute intervals until the can is exhausted. The container shall be re-weighed. The net difference shall be a minimum of 13 ounces (see 3.5.2).

4.10.13.3 Performance of pressurized containers test. The panels described in 4.9.2 shall be used. A panel shall be supported such that the longer dimension forms a 45° angle with the horizontal. Corrosion preventive compound preserved in accordance with 5.1.2 shall be sprayed on the panel from a distance of 12 inches. The panel shall be examined for uniformity of spray, foaming and adherence to the substrate. After a 10 second pause, the same panel shall be resprayed and examined for adhesion and sagging. After a 5 second pause the same panel shall be resprayed again and likewise examined (see 3.5.3).

4.10.14 Effect on electronic components (type III only) test.

4.10.14.1 Apparatus.

4.10.14.1.1 Components, capacitance in nature. Components which are capacitance in nature shall be tested on an Automatic Capacitance Bridge manufactured by General Radio Corporation and consisting of a Digital Control Unit, type 1672A, and an Automatic Capacitance Bridge, type 1673 or equivalent equipment.

4.10.14.1.2 Components, inductive in nature. Components which are inductive in nature shall be tested on a Boonton Electric Co. Model TS617B/U Q Meter for measurements in the frequency range of 50 KC to 75 MC and on a Boonton Electric Model Type 170-A Q Meter for measurements in the frequency range of 30 MC to 200 MC or on other equivalent equipment.

4.10.14.1.3 Resistors. Resistors shall be tested using a Wheatstone Bridge.

4.10.14.2 Components to be tested. One coil form, and four each of capacitors, coils and resistors shall be tested. Of the four capacitors, a mica, mylar and glass tuning type shall be included. Of the four coils, a bare wire, enamel coated wire and encased plastic type shall be included.

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4.10.14.3 Test procedures. The electronic components shall be measured both "as is" and "after immersion" (see table I). For capacitors and coil forms, the capacitance, dissipation factor and conductance shall be determined. For coils, the Q shall be determined. The frequency at which Q is determined and the amount of capacitance required to resonate the coil shall be noted. For resistors, the resistance shall be determined. After obtaining the "as is" values, the components shall be immersed in the corrosion preventive compound for five minutes, removed and remain for 24 hours at the atmospheric conditions of 4.8 before being measured in the "after immersion" condition (see table I).

4.10.15 Effect on electrical connectors (type III only test).

4.10.15.1 Test procedure. A pair of electrical connectors, MS3116-16-2bS and MS3112-16-26P, shall be connected. The continuity or resistance shall be determined by using a Wheatstone Bridge or appropriate measuring device and the value recorded for each mated pair of pins and between selected adjacent pins. The connector shall be disconnected and while unmated both connectors shall be dipped three different times with a two hour interval between dippings. The connectors shall remain for 24 hours at the atmospheric conditions of 4.8 and then reconnected. The continuity or resistance shall again be determined and recorded for each mated pair of pins and the selected adjacent pins (see table I).

5. PACKAGING

5.1 Preservation.

5.1.1 Preservation of compound in nonpressurized containers. Preservation of class 1 in quantities of 5 or 55 gallons shall be level B or C or Industrial (Commercial) in accordance with MIL-STD 290, as specified (see 6.2.1).

5.1.2 Preservation of compound in gas pressurized containers. The containers shall conform to class 2, 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.

5.2 Packing. Except as specified in 5.2.1, packing shall be level A, B, C, or Industrial (Commercial) in accordance with MIL-STD-290, as specified (see 6.2.1).

5.2.1 Packing of filled pressurized containers for shipment.

5.2.1.1 Level A. Twenty-four dispensers shall be packed in a fiberboard box conforming to PPP-B-630, style FOL, grade V3c or V3s. The twenty-four dispensers shall be arranged: six in length, four in width and one in depth, and shall be separated by slotted partitions providing an individual cell for each dispenser. Partitions shall be "B" or "C" flute, double faced corrugated board. Box liners of the same material as the partitions shall be provided. The corrugations of the liners shall run vertically. Liners shall be cut so that on placement the ends abut in the middle of one side of the box. Box and all components shall be fabricated of material having not less than 275 pounds per square inch bursting strength.

5.2.1.1.1 Closure for level A. All flaps of the box shall be securely sealed with a water-resistant adhesive conforming to MMM-A-250. The adhesive shall be applied throughout the entire area of contact between the flaps.

5.2.1.2 Level B. Twenty-four dispensers shall be packed in a domestic type corrugated or solid fiberboard container, style FOL, (less 1 inch) conforming to PPP-B-636. Arrangement shall be: six in length, four in width and one in depth. Slotted partitions shall be employed to form an individual cell for each dispenser. Partitions shall be "B" or "C" flute, double faced corrugated board. Box liners of the same material as the partitions shall be provided. The corrugations of the liners shall run vertically. Liners shall be cut so that on placement the ends abut in the middle of one side of the box. Box and all components shall be fabricated of material having not less than 275 pounds per square inch bursting strength. All flaps shall be sealed with good quality adhesive applied throughout the entire area of contact between flaps.

5.2.1.2.1 Strapping. Strapping shall be in accordance with appendix of PPP-B-636.

5.3 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 6.2.1). Paper coated labels on 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 gas 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-C-81309D
 PART NUMBER (see 6.7)
 CONTRACT NO.
 MANUFACTURER'S NAME
 MANUFACTURER'S ADDRESS
 MANUFACTURER'S PRODUCT NO.
 13 OUNCES NT. WT.

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

6. NOTES

6.1 Intended use. The ultra-thin film, corrosion preventive compounds covered by this specification are 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 these materials to prevent corrosion and to displace water and their ease of application when packaged as class 2 (pressurized spray cans) make them particularly suited for service use. These materials are intended for indoor protection and short term protection outdoors where surfaces can be recoated when required. These materials are not of intended as a substitute for other corrosion preventatives specified for protection of surfaces for periods of more than one month.

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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. This compound is intended for use on avionic equipment, electrical connector plugs and contact points.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. Quantity. (For nonpressurized container specify gallons; for pressurized containers specify number of 13 ounce cans).
- c. Type and class (see 1.2).
- d. Selection of applicable levels of preservation and packing (see 5.1 and 5.2).
- e. Labeling of other special marking required (see 5.3).
- f. Addresses for submission of MSDS's (see 3.2.4 and 6.4).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, 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 purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Air Systems Command, Department of the Navy, Washington, D.C. 20361; however, information pertaining to qualification of products and for submittal of sample may be obtained from the Director, Aircraft and Crew Systems Technology Directorate, Code 60622, Naval Air Development Center, Warminster, PA 18974.

6.4 MSDS submission and forwarding. After review and acceptance of MSDS's by designated recipients, approved copies will be forwarded to arrive at destinations prior to material delivery (see 3.2.4).

6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

6.6 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 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

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film compounds for application as described in 6.1. In addition, provision was made to facilitate acquisition operation by defining separate classes for bulk or pressurized spray cans (aerosols). MIL-C-81309D deleted type I, class 1 and 2 compounds which have been superseded by MIL-C-85054. The equivalents are as follows:

Table of equivalents.

Type	Class	MIL-C-81309 Revision Letter			
		D	C	B	A
I	1	Superseded by MIL-C-85054 type II	Type I, class 1	Bulk	-
I	2	Superseded by MIL-C-85054 type I	Type I, class 2	Pressurized can	-
II	1	Type III, class 1	Type II class 1	-	Grades A and B - bulk
II	2	Type II, class 2	Type II, class 1	-	Grade A pressurized can
III	1	Type III, class 1	Type III, class 1	-	Grade B bulk
III	2	Type III, class 2	Type III, class 1	-	Grade B pressurized can

6.7 Definitive specification part number. The specification part number is a definitive part number which will be formulated to identify each type and class item covered by this specification. The part number will be formulated by selecting from the requirements to options available in this specification as follows:

Definitive specification number:	M81309	X	X
Military specification number	_____		
Type designator (see 6.7.1)	_____		
Class designator (see 6.7.2)	_____		

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6.7.1 Type designator. A one position field used to designate the required type (see table II).

TABLE II. Type designator.

Type designator	Remarks
A	Type II (soft film)
B	Type III (soft film, avionic grade)

6.7.2 Class designator. A one position field used to designate the required class (see table III).

TABLE II. Class designator.

Class designator	Remarks
1	Class 1 - Nonpressurized container (brush, dip or spray application).
2	Class 2 - Pressurized container (for spray application).

Custodians:

Army - ME
Navy - AS
Air Force - 99

Preparing Activity:

Navy - AS

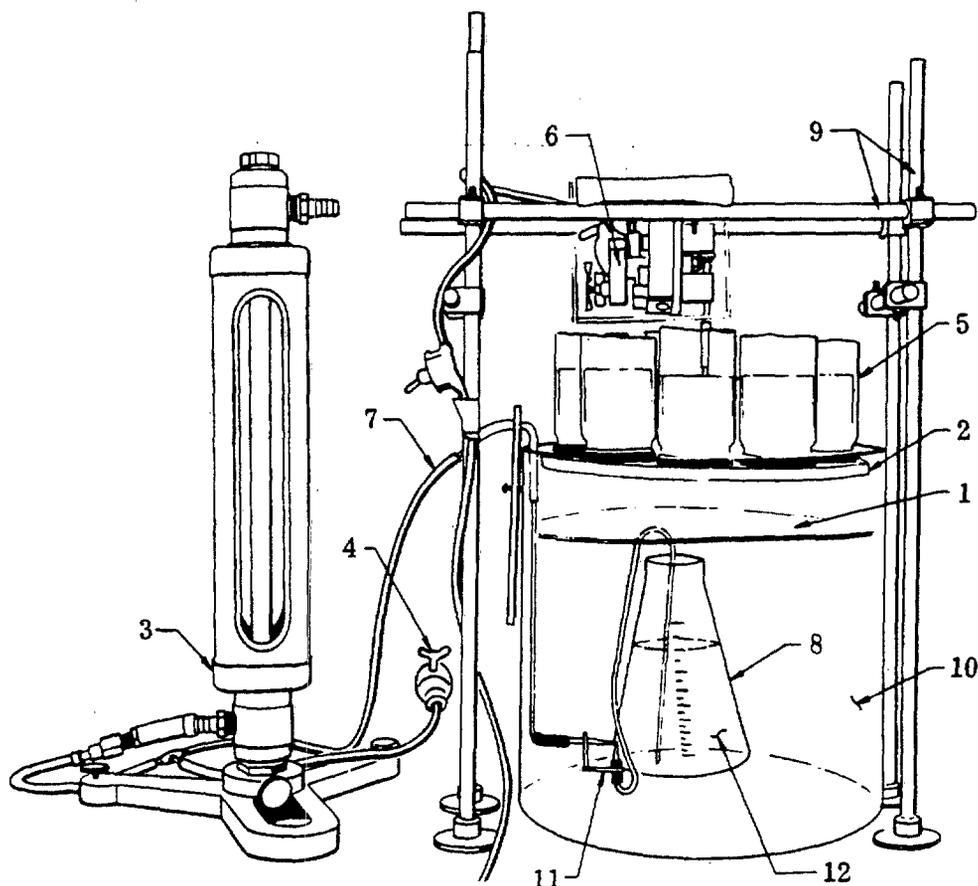
(Project No. 8030-0483)

Review Activities:

Army - MK
Navy - OS, YD
Other agencies - DS

User Activities:

Army - AT, ER
Navy - CG

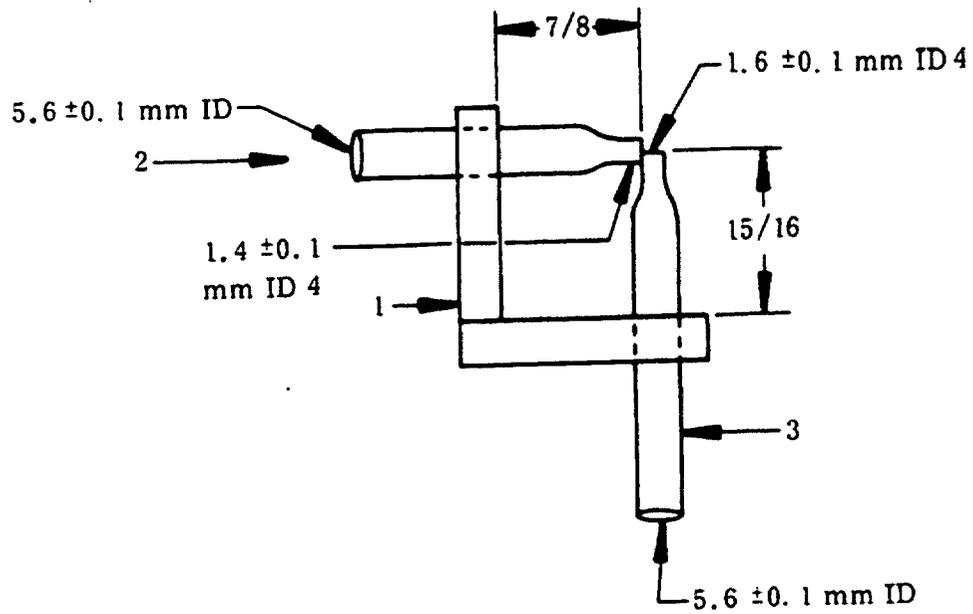


NOTES:

1. Acrylic Baffle - 12 inches in diameter or snug fit in 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 r.p.m. or less).
7. Filtered Air Source - With an air regulator (3) capable of regulating the air flow to the spray nozzle (11) at one cubic foot per minute.
8. Flask - 1000 ml, extra wide mouth, Erlenmyer flask, placed in the jar (10) to hold the synthetic sea water-sulfurous acid solution.
9. Flex-Frame Support Rods.
10. Jar - 12 inches I.D. diameter and 12 inches high.
11. Spray Nozzle - See Figure 2.
12. Test Solution.

FIGURE 1. Synthetic sea water - sulfurous acid spray test apparatus.

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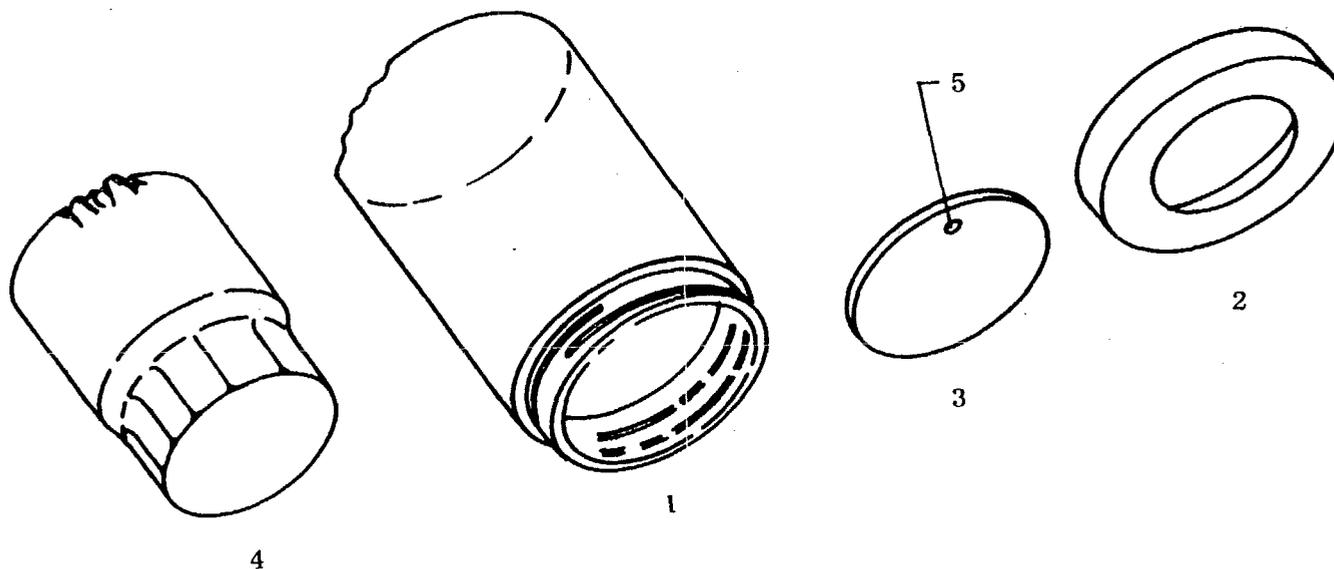
**NOTES:**

1. 1/4 Acrylic Material
2. Filtered Air Source
3. Liquid Pick-Up Tube
4. Orifice

General - The Spray Nozzle is provided with suitable piping for spraying from the flask (see Note 7, Figure 1). The nozzle is powered by a filtered air source (2). (See Note 4, Figure 1).

DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

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 of (see 3 above).

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

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

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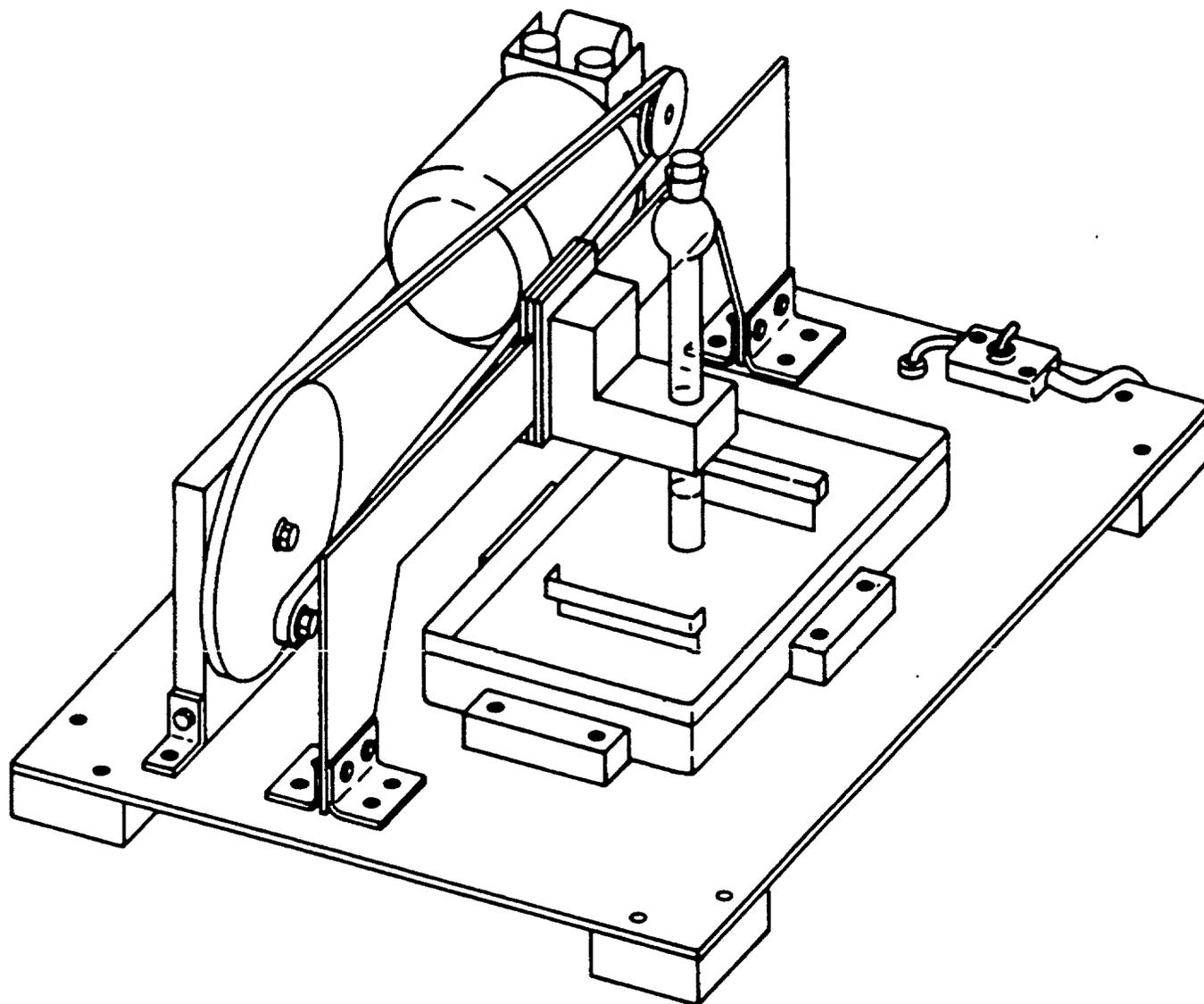


FIGURE 4. Apparatus for determining removability.

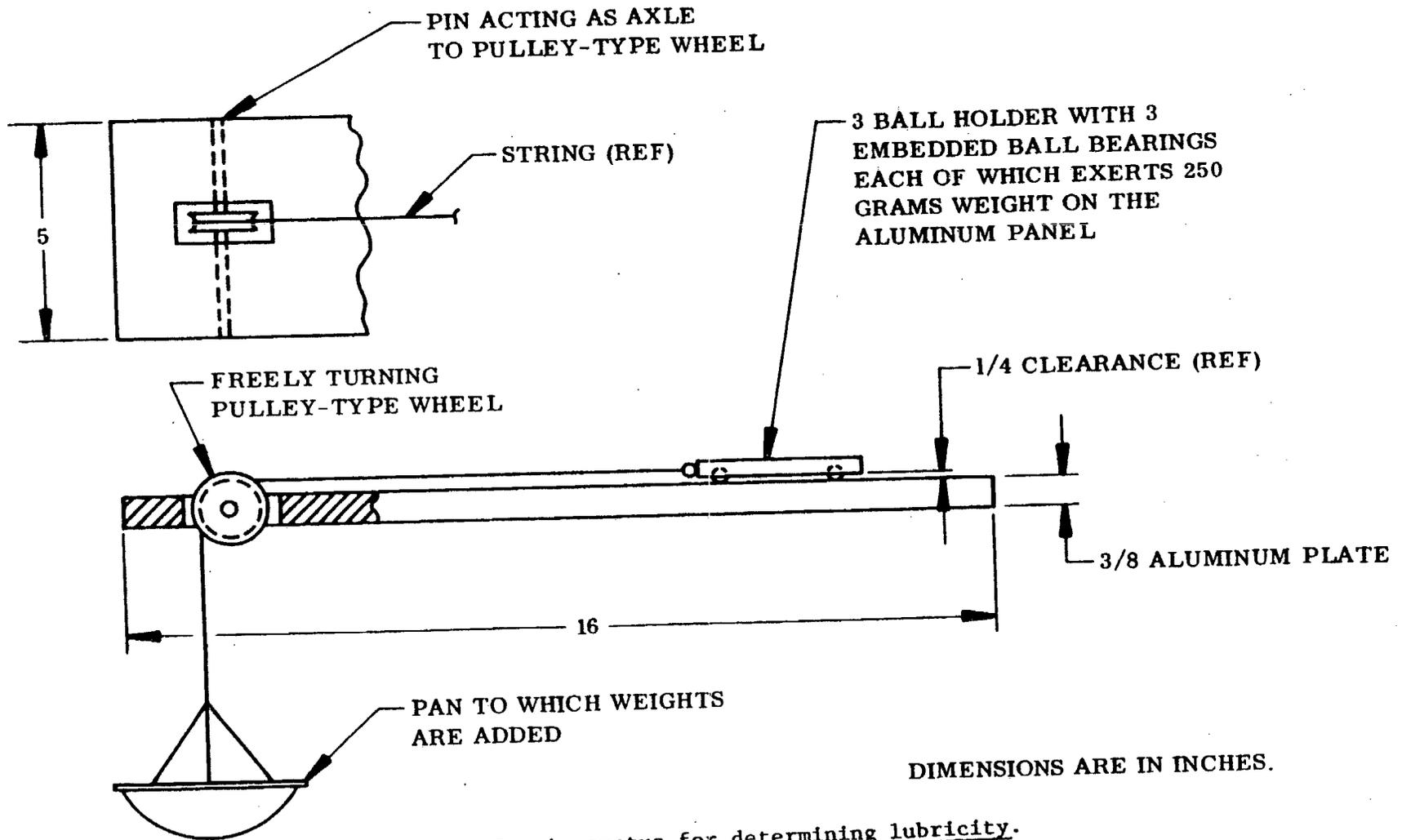
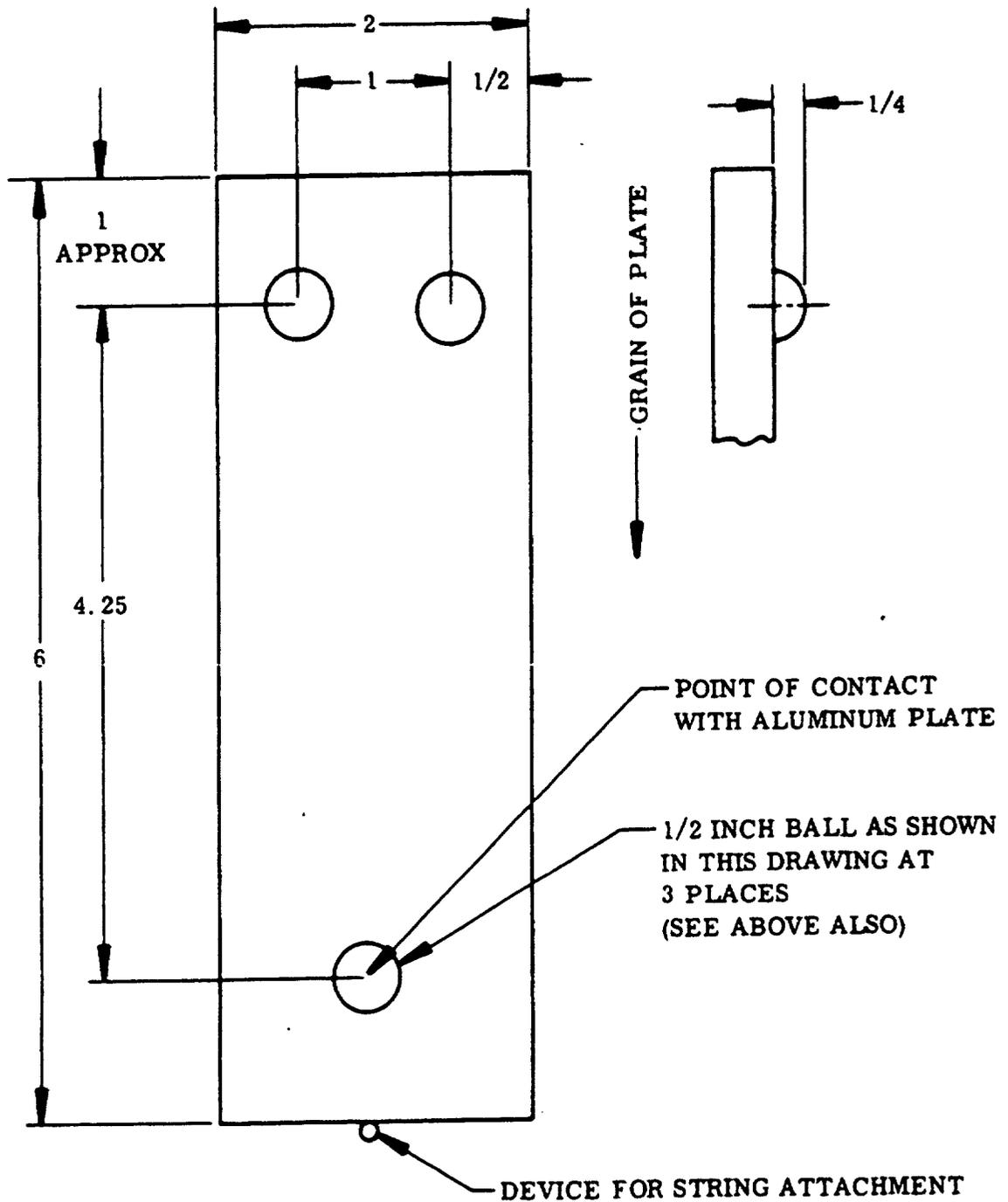


FIGURE 5. Apparatus for determining lubricity.

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DIMENSIONS ARE IN INCHES.
MATERIAL 1/2 THICK ALUMINUM

BOTTOM VIEW OF PLATE

FIGURE 6. Bottom view of aluminum plate on the lubricity apparatus.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

 VENDOR USER MANUFACTURER OTHER (Specify): _____

b. ADDRESS (Street, City, State, ZIP Code)

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) - Optional

b. WORK TELEPHONE NUMBER (Include Area Code) - Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

8. DATE OF SUBMISSION (YYMMDD)

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