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## 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 non-fully halogenated chlorofluorocarbon gas pressurized containers (see 6.1).

1.2 Classification. The compounds shall be furnished in the following types, classes, and propellant grades as specified (see 6.2d).

##### 1.2.1 Types and classes.

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).

1.2.2 Propellant grades. Class 2 propellants shall be of the following grades:

Grade 22 - Hydrochlorofluorocarbons (HCFC) propellant.

Grade 134A - Hydrofluorocarbon (HFC) propellant.

Beneficial comments, (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Warfare Center Aircraft Division Lakehurst, Systems Requirements Department, (Code SR3) Lakehurst, NJ 08733-5100, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.
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AMSC N/A

FSC 8030

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

1.2.3 Part number. Specification part numbers for items described in this specification shall be formulated as shown in 6.6.

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government Documents.

2.1.1 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

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are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2c).

## SPECIFICATIONS

## FEDERAL

A-A-51126	Anodes, Cadmium.
QQ-A-250/4	Aluminum Alloy 2024, Plate and Sheet.
QQ-A-250/5	Aluminum Alloy Alclad 2024, Plate and Sheet.
QQ-S-761	Displacing Steel, Stainless, and Heat Resisting, Alloys, Plate, Sheet, and Strip.
TT-T-291	Thinner, Paint, Mineral Spirits, Regular and Odorless.
VV-L-800	Lubricating Oil, General Purpose, Preservative (Water).
MMM-A-250	Adhesive, Water-Resistant (For Closure of Fiberboard Boxes).
PPP-B-636	Box, Shipping, Fiberboard.
PPP-C-96	Can, Metal, 28 Gage and Lighter.

## MILITARY

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-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 Preventive 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, Methods of Testing.

## MILITARY

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

(Unless otherwise indicated, copies of federal and military specifications,

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standards, and handbooks are available from: DODSSP-Customer Service, Standardization Documents Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issue shall be those in effect on the date of the solicitation.

## DEPARTMENT OF TRANSPORTATION

## CODE OF FEDERAL REGULATIONS

49 CFR 171-190 Department of Transportation Rules and Regulations for the Transportation of Explosives and Other Dangerous Articles.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20402.)

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

## SOCIETY OF AUTOMOTIVE ENGINEERS, INC.

AMS 4375 Magnesium Alloy Sheet and Plate 3.0Al-1.0Zn (AZ 31 B-0) Annealed and Recrystallized.

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

## AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

ASTM B36 Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar.  
 ASTM B152 Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar.  
 ASTM D 877 Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.  
 ASTM D 3065 Standard Test Method For Flammability of Aerosol Products.

(Application 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.)

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(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for related associated detail specifications, specification sheets, and MS standards), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 Qualification. The compounds furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (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, or fully halogenated chlorofluorocarbons 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 (see 3.2 and 3.2.1.1).

3.2.1.1 Grade 22 propellant. The propellant for Grade 22 shall consist of hydrochlorofluorocarbons conforming to BB-F-1421 or a blend containing hydrochlorofluorocarbons. Grade 22 blends shall contain no chlorinated solvents or fully halogenated chlorofluorocarbons.

3.2.1.2 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.

3.2.2 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 Material Safety Data Sheets. A Material Safety Data Sheet shall be prepared and submitted in accordance with FED-STD-313. Questions pertinent to the effect of the corrosion preventive on the health of personnel when used for its intended purpose shall be referred by the acquiring activity to the appropriate medical service who will act as advisor to the acquiring activity (see 3.3 and 4.3.1).

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3.3 Toxicological data. The supplier shall furnish the toxicological data and the safety requirements of the material used (see 4.3.1.1) to the Commanding Officer, Naval Air Warfare Center Aircraft Division Warminster, P.O. Box 5152, Code 6062, Warminster, PA 18974-0591.

3.4 Properties of type II, class 1 and type III, class 1. The corrosion preventive compound, when tested as specified in Section 4, shall conform to the requirements of Table I.

3.5 Properties of type II, class 2 and type III, class 2. The corrosion preventive compounds, exclusive of propellants, when tested as specified in Section 4, shall conform to the requirements of Table I and the following additional requirements.

3.5.1 Leakage. The pressurized cans shall not leak or become distorted, when tested as specified in 4.7.12.1.

3.5.2 Fill. Pressurized cans containing the compound shall have a net minimum weight of 16 ounces, when tested for fill as specified in 4.7.12.2.

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 4.7.12.3.

3.5.4 Flame projection test. The propellant shall exhibit no flame extension or flashback when tested as specified in 4.7.12.4.

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, eduction 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 angle of discharge.

#### 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 (examinations and tests) 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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

**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)		4.7.1
Synthetic sea water-sulfurous acid spray	No visible corrosion of carbon steel after 2 cycles	No visible corrosion of 410 steel after 8 cycles.	4.7.2
Synthetic sea water displacement	No visible corrosion		4.7.3
Removability	Not more than 3 cycles to remove		4.7.4
Abrasives	None present		4.7.5
Maximum film thickness	0.0005 inches	0.0002 inches	4.7.6
Sprayability	Sprayable		4.7.7
Corrosivity	No visible pitting, etching, or dark discoloration. No weight change (milligram/cm <sup>2</sup> ) greater than 0.5 for magnesium, cadmium, and zinc nor greater than 0.2 for aluminum, copper, and brass.		4.7.8
Minimum dielectric breakdown	25,000 volts		4.7.9
Mixability of compounds	No evidence of sedimentation.		4.7.10
Lubricity of compounds	Less than 0.20		4.7.11
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.	4.7.13

**TABLE I. Property requirements (Continued)**

Characteristics	Requirements		Test paragraph
	Type II Classes 1 and 2	Type III Classes 1 and 2	

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Effect on electrical connectors	---	No significant increase in resistance between connected pins or decrease in resistance between adjacent pins.	4.7.14
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4.1.1 Responsibility for compliance. All items shall meet all requirements of Sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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 (4.3).
- b. Quality conformance inspection (4.4).

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

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, 16 ounce gas pressurized cans of the compound.

The samples shall be forwarded to the Commanding Officer, Naval Air Warfare Center Warminster, P.O. Box 5152, Attention: Code 6062, Warminster, PA 18974-0591. 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.

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Date of manufacture.

Submitted by (name) (date) for qualification inspection in accordance with the requirements of MIL-C-81309E under authorization (reference authorizing letter (see 6.3)).

4.3.1.1 Manufacturer's data. The contractor shall submit a test report, in duplicate, to accompany the qualification inspection samples. The 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 3.3). 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 qualification and shall be initiated by the Government. 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.

4.4.1 Lot size.

4.4.1.1 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.

4.4.1.2 Type II, class 1, and type III, class 1. When the acquisition document specifies delivery in nonpressurized containers (see 6.2b), 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.

**TABLE II. Qualifications inspection**

Inspection	Requirement	Test Method
Materials	3.2	4.3.1.1
Composition	3.2.1	4.3.1.1
Propellant	3.2.1.1	4.3.1.1
Application	3.2.2	Section 4
Flash point	Table I	4.7.1
Synthetic sea water - sulfurous acid spray	Table I	4.7.2

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Inspection	Requirement	Test Method
Synthetic sea water - displacement	Table I	4.7.3
Removability	Table I	4.7.4
Abrasives	Table I	4.7.5
Film thickness	Table I	4.7.6
Sprayability	Table I	4.7.7
Corrosivity	Table I	4.7.8
Dielectric breakdown	Table I	4.7.9
Mixability	Table I	4.7.10
Lubricity	Table I	4.7.11
Effect on electronic components	Table I	4.7.13
Effect on electric connectors	Table I	4.7.14
Pressurized containers	Table I	4.7.12
Leakage	3.5.1	4.7.12.1
Flame projection	3.5.2	4.7.12.2
Fill	3.5.3	4.7.12.3
Performance	3.5.4	4.7.12.4

4.4.2 Sampling and inspection procedure.

4.4.2.1 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).

4.4.2.2 Physical property inspection. Samples for test shall be selected in accordance with MIL-STD-105, inspection level S-3 with an AQL of 2.5 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. Testing shall be as specified in Table III.

TABLE III. Quality conformance physical tests

Property	Requirement	Test Method
Flash point	Table I	4.7.1
Synthetic sea water - sulfurous acid spray	Table I	4.7.2
Synthetic sea water replacement	Table I	4.7.3
Sprayability	Table I	4.7.7

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Lubricity	Table I	4.7.11
Fill (class 2, only)	3.5.2	4.7.12.2

4.4.2.3 Packaging inspection. 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.

4.5 Test conditions. Physical tests contained in this specification shall be made under controlled atmospheric conditions having a relative humidity of  $50 \pm 10$  percent and a temperature range of from 20°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.

4.6 Test disks and panels (except for corrosivity).

4.6.1 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.

4.6.2 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.

4.6.3 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.

4.6.4 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.

4.6.5 Coating of the disks or panels. Application of the compound to the

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test disks or panels shall be carried out under the atmospheric conditions of 4.5. 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 4.5 in a draft, dust, and fume-free atmosphere.

#### 4.7 Test methods.

##### 4.7.1 Minimum flash point test.

4.7.1.1 Test procedure. Combine 5 milliliters (ml) of the compound and 15 ml of lubricating oil conforming to VV-L-800 in a 40 ml cone-shaped centrifuge tube. Shake by hand until the mixture appears homogeneous. Place the tube in a beaker and heat in an explosive proof oven at  $77^{\circ} \pm 1^{\circ}\text{C}$  ( $170^{\circ} \pm 2^{\circ}\text{F}$ ) 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  $25^{\circ} \pm 3^{\circ}\text{C}$  ( $77^{\circ} \pm 5^{\circ}\text{F}$ ) (see Table I). A slight separation of liquid shall be acceptable.

##### 4.7.2 Synthetic sea water-sulfurous acid spray test.

###### 4.7.2.1 Materials.

4.7.2.1.1 Test solution. The spray test solution shall consist of a solution made by adding 2 ml of sulfurous acid (6.4 percent assay as  $\text{SO}_2$ ) to each liter of synthetic sea water. The pH shall be measured and shall be between 3.3 and 3.5. If it is 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 ( $\text{NaCl}$ ); 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 ( $\text{Na}_2\text{SO}_4$ ) to a liter of distilled or demineralized water. One liter of fresh test solution shall be used for each cycle.

4.7.2.1.2 Conditions 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  $54.4^{\circ} \pm 1.1^{\circ}\text{C}$  ( $130^{\circ} \pm 2^{\circ}\text{F}$ ).

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  $23.9^{\circ} \pm 2.8^{\circ}\text{C}$  ( $75^{\circ} \pm 5^{\circ}\text{F}$ ) for 24 hours.

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

4.7.2.3 Test procedure. Applicable test disks prepared as specified in 4.6.3 shall be cleaned as specified in 4.6.4; coated as specified in 4.6.5 with a compound conditioned as specified in 4.7.2.1.2; 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

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supplied to the nozzle to effect the spray. The pickup tube supplying the nozzle should have an ID of 1mm. 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. 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).

#### 4.7.4 Removability.

4.7.4.1 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 4.6.3 and 4.6.4 and coated as specified in 4.6.5. 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 a 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  $40 \pm 5$  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 shall be completely removed (determined visually) over an area 1/4-inch wide and the entire length of the stroke (see Table I).

#### 4.7.5 Abrasives test.

4.7.5.1 Test procedure. Mix approximately 75 ml of the compound with 200 ml of xylene 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 xylene 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).

#### 4.7.6 Maximum film thickness test.

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4.7.6.1 Test procedure. The average film thickness produced by the compound shall be determined on a panel prepared, cleaned, and coated as specified in 4.6.3, 4.6.4, and 4.6.5, 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).

#### 4.7.7 Sprayability test.

4.7.7.1 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).

#### 4.7.8 Corrosivity test.

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

Magnesium, AMS 4375.

Cadmium, A-A-51126.

Zinc, MIL-A-18001.

Aluminum, QQ-A-250/4.

Copper, ASTM B152.

Brass, ASTM B36.

4.7.8.2 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 4.6.3 and 4.6.4. 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  $54.4^{\circ} \pm 1.1^{\circ}\text{C}$  ( $130^{\circ} \pm 2^{\circ}\text{F}$ ) for 7 days. Upon completion of the test, any loose corrosion products shall be removed from the specimens by cleaning as specified in 4.6.4. Reweigh the

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specimens and calculate the weight loss or gain in milligrams per square centimeter (see Table I).

4.7.9 Minimum dielectric breakdown voltage test.

4.7.9.1 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).

4.7.10 Mixability of compounds test.

4.7.10.1 Test procedure. Combine 5 ml of the compound and 15 ml of lubricating oil conforming to VV-L-800 in a 40 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 sedimentation or evidence of separation of chemical precipitation immediately after removal from the oven or after sitting undisturbed for 24 hours at  $25^{\circ} \pm 2.8^{\circ}\text{C}$  ( $77^{\circ} \pm 5^{\circ}\text{F}$ ) (see Table I).

4.7.11 Lubricity of compounds test.

4.7.11.1 Apparatus. The test apparatus (Figures 5 and 6) shall consist of a 5 by 16 by 3/8-inch 2024 T6 (QQ-A-250/4) 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.

4.7.11.2 Material. 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.

4.7.11.3 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  $22.2^{\circ}\text{C}$  ( $72^{\circ}\text{F}$ ) 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.

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4.7.11.4 Calculation. The lubricity value shall be determined from the following equation:

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

4.7.12 Specialized tests for class 2 (pressurized containers).

4.7.12.1 Leakage test. The pressurized container shall be completely submerged for 5 minutes in water maintained at a minimum of  $54.4^{\circ} \pm 1.1^{\circ}\text{C}$  ( $130^{\circ} \pm 2^{\circ}\text{F}$ ) 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).

4.7.12.2 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 16 ounces (see 3.5.2).

4.7.12.3 Performance of pressurized containers test. The panels described in 4.6.2 shall be used. A panel shall be supported such that the longer dimension forms a  $45^{\circ}$  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 for conformance to 3.5.3.

4.7.12.4 Flame projection test. The sample shall be tested as specified in ASTM D3065.

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

4.7.13.1 Apparatus.

4.7.13.1.1 Components, capacitance in nature. Components which are capacitance in nature shall be tested on 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.

4.7.13.1.2 Components, inductive in nature. Components which are inductive in nature shall be tested on a Boonton Electric Co. Model TS617B/U Q Meter or equal for measurements in the frequency range of 50 Kilohertz (KH) to 75 Megahertz (MH) and on a Boonton Electric Model Type 170-A Q Meter or equal for measurements in the frequency range of 30 MH to 200 MH or on other equivalent equipment.

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

4.7.13.2 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.

4.7.13.3 Test procedure. The electronic components shall be measured "as

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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 permitted to stand for 24 hours at the atmospheric conditions of 4.5 before being measured in the "after immersion" condition (see Table I).

#### 4.7.14 Effect on electrical connectors (type III only) test.

4.7.14.1 Test procedure. A pair of electrical connectors, MS3116-16-26S 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 4.5 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. Levels of preservation shall be as specified below.

5.1.1 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 6.2e).

5.1.2 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.

5.2 Packing. Packing shall be level A, B, C, or Industrial (Commercial) in accordance with MIL-STD-290, as specified (see 6.2e).

5.2.1 Nonpressurized containers. Components packaged as specified in 5.1.1 require no overpacking.

#### 5.2.2 Pressurized containers.

5.2.2.1 Level A. Twenty-four pressurized containers shall be packed in a fiberboard box conforming to PPP-B-636, 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.

5.2.2.1.1 Closure. All flaps of the box shall be securely sealed with a

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water-resistant adhesive conforming to MMM-A-250. The adhesive shall be applied throughout the entire area of contact between the flaps.

5.2.2.2 Level B. Twenty-four pressurized containers shall be packed as specified in 5.2.2.1 except that domestic type containers conforming to PPP-B-636 shall be used. All flaps shall be sealed with good quality packaging adhesive applied throughout the entire area of contact between flaps. Strapping shall be in accordance with the 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.f). 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-81309E  
PART NUMBER (see 6.7)  
CONTRACT NO.  
MANUFACTURER'S NAME  
MANUFACTURER'S ADDRESS  
MANUFACTURER'S PRODUCT NO.  
16 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

(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 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 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 II, classes 1 and 2. The compound is intended for use on

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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. Quantity. (For nonpressurized container specify gallons; for pressurized containers specify number of 16 ounce cans.)
- c. Issue of DODISS to be cited in the solicitation and if required, the specific issue of individual documents referenced (see 2.1.1).
- d. Type and class (see 1.2).
- e. Selection of applicable levels of preservation and packing (see 5.1 and 5.2).
- f. Labeling of other special marking required (see 5.3).
- g. Submission of MSDS's (see 3.2.4).

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 Commanding Officer, Naval Air Warfare Center Aircraft Division Warminster, Code 6062, Warminster, PA 18974-5100.

6.4 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DOD Form 1423.

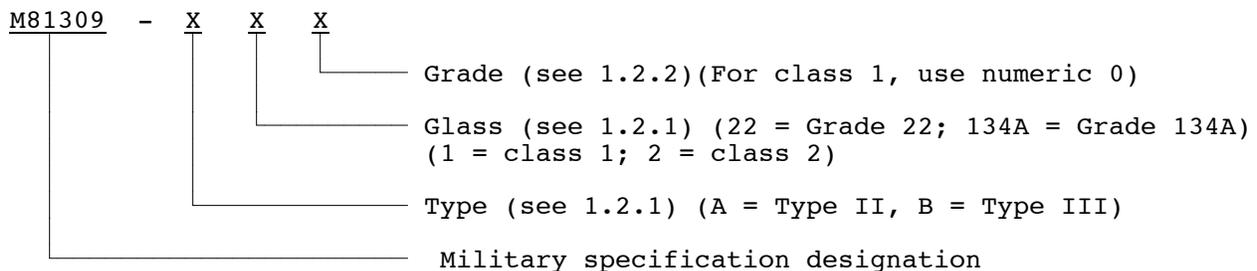
<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
4.4.1.1	DI-NDTI-80809	Test/Inspection Report	

The above DID's were those cleared as of the date of this solicitation. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

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6.5 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 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 pressurized spray cans (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 pressurized containers as substitutes for CFC's have been included as Grades 22 and 134A. The equivalents are specified in Table IV.

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



Example: A type II, class 2, Grade 22 compound shall be designated as follows:

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**TABLE IV. Table of equivalents**

Type	Class	MIL-C-81309 Revision Letter				
		E	D	C	B	A
I	1	Not included	Superseded by MIL-C-85054 type II	Type I, class 1	Bulk	-
I	2	Not included	Superseded by MIL-C-85054 type I	Type I, class 2	Pressurized can	-
II	1	No change	Type III, class 2	Type II, class 1	-	Grades A and B - bulk

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II	2	No change	Type II, class 2	Type II, class 1	-	Grade A pressurized can
III	1	No change	Type III, class 1	Type III, class 1	-	Grade B bulk
III	2	No change <u>1/</u>	Type III, class 2	Type III, class 1	-	Grade B pressurized can

1/ Choice of Grades for pressurized containers (see 1.1.1).

6.7 Subject term (key word) listing.

Avionic Grade  
Brushable  
Dip  
HCFC Propellant  
HFC Propellant  
Pressurized Containers  
Soft Film

6.8 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.

Custodians:

Army - EA  
Navy - AS  
Air Force - 99

Preparing Activity:

Navy - AS

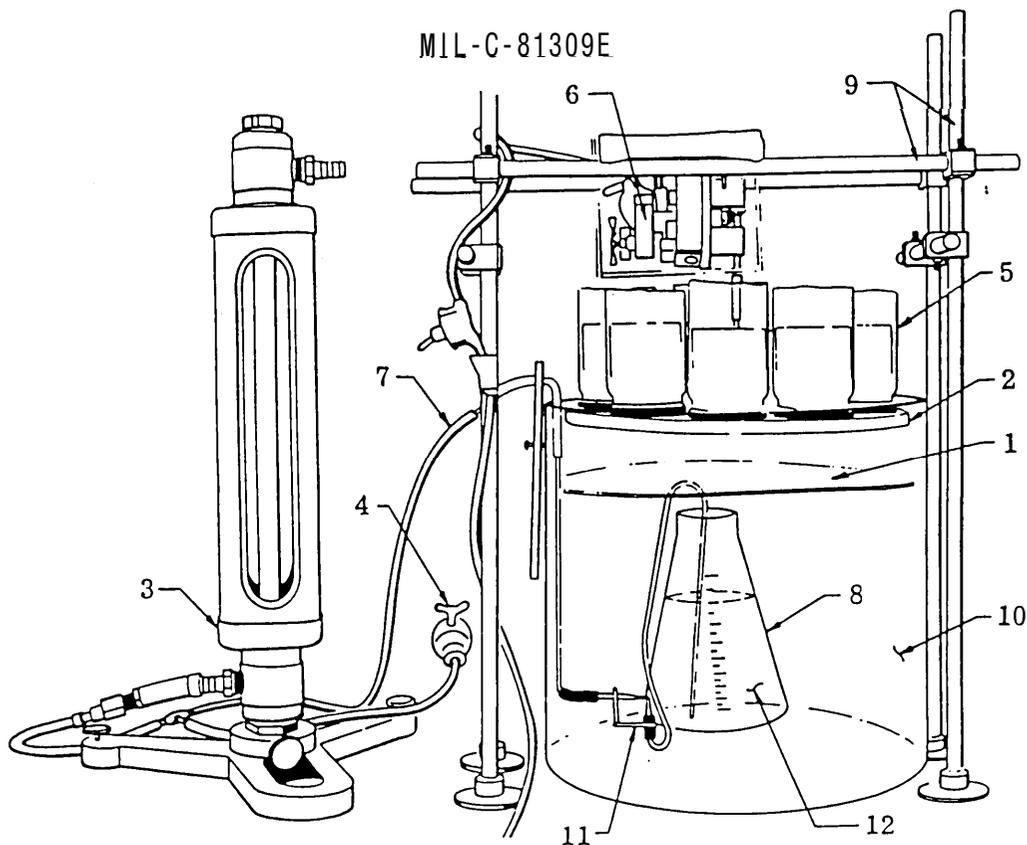
(Project No. 8030-0659)

Review Activities:

Army - MR  
Navy - OS,  
Air Force - 84  
Other agencies - DS

User Activities:

Army - AT,  
Navy - CG

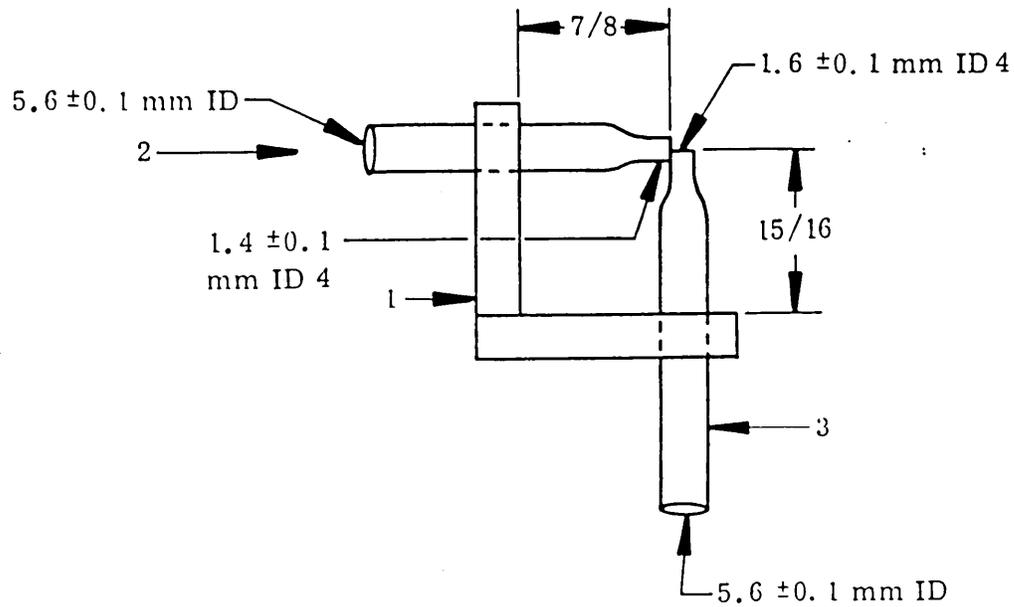


## NOTES :

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:

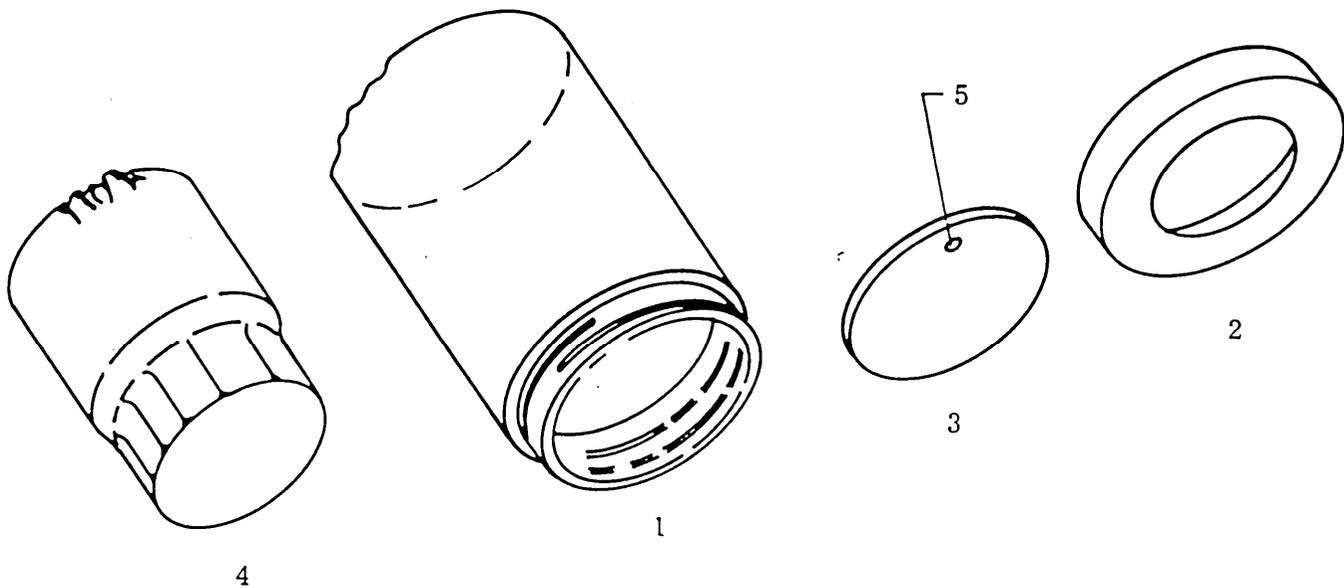
1. 1/4 Acrylic Material
2. Filtered Air Source
3. Liquid Pick-Up Tube
4. Orifice

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.

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## 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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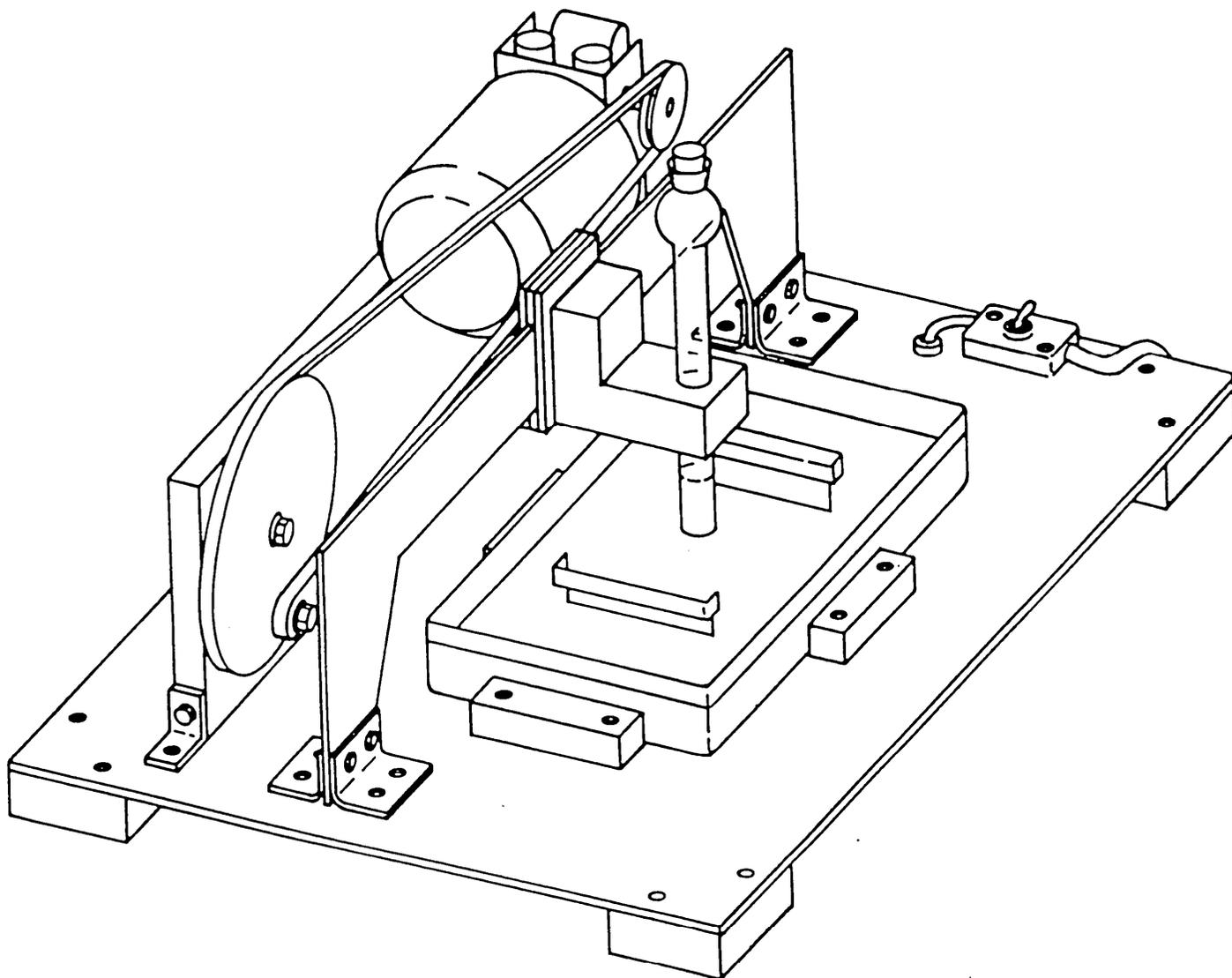


FIGURE 4. Apparatus for determining removability.

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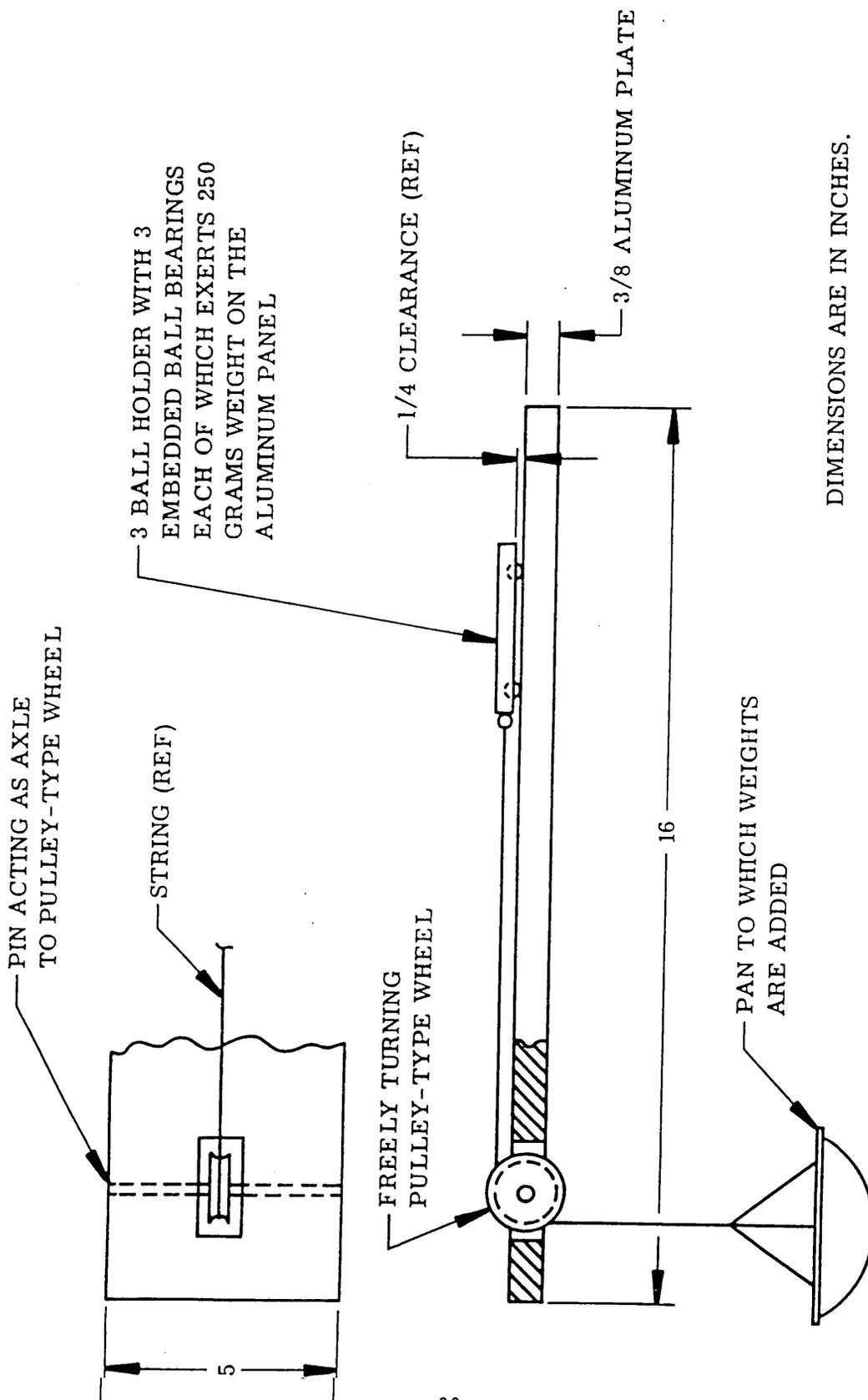
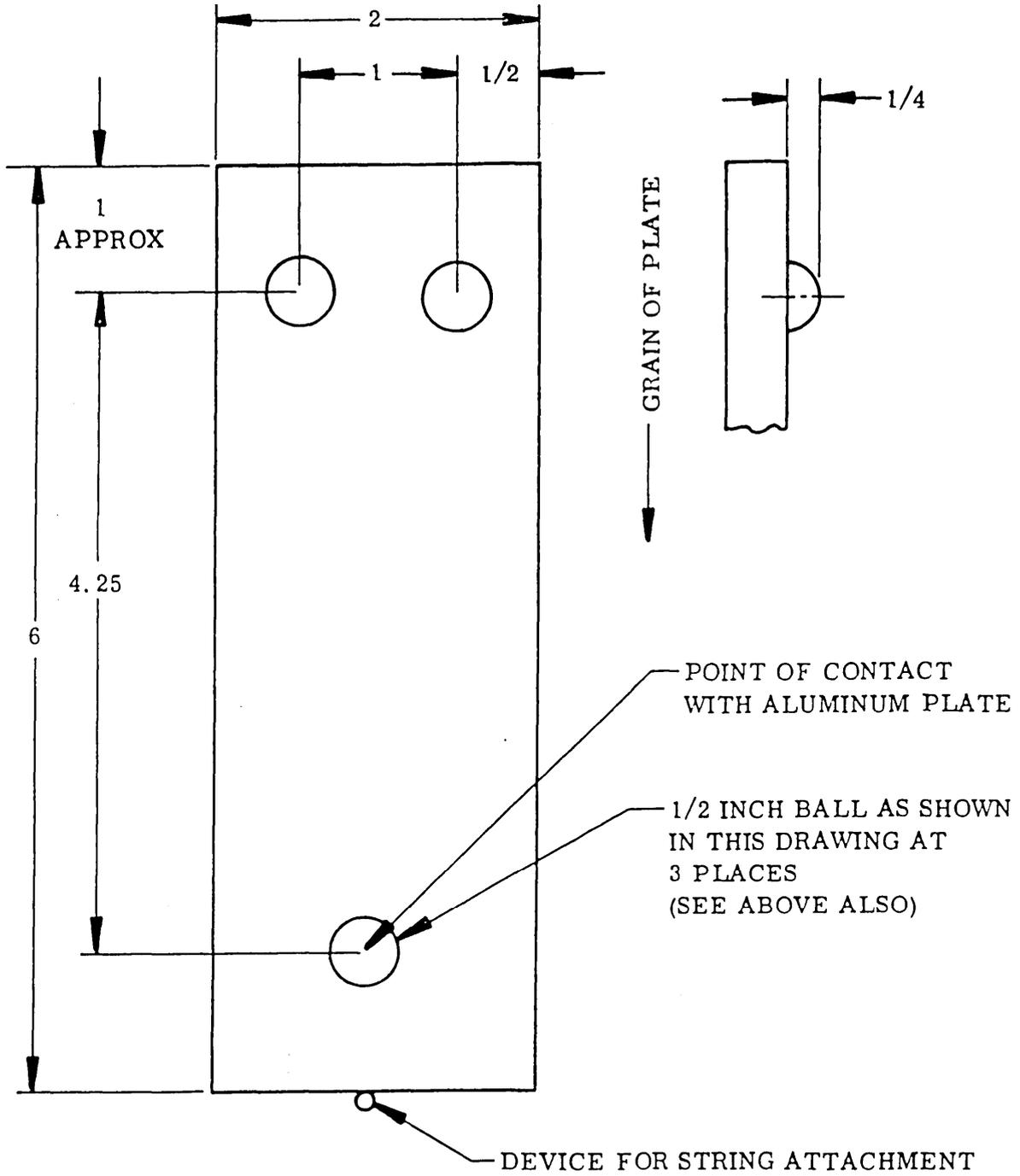


FIGURE 5. Apparatus for determining lubricity.

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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.