

**MIL-C-81706**

**30 June 1970**

**MILITARY SPECIFICATION**

**CHEMICAL CONVERSION MATERIALS  
FOR COATING ALUMINUM AND ALUMINUM ALLOYS**

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

**1. SCOPE**

**1.1        Scope.** This specification covers the requirements for the chemical materials used in the formation of conversion coating by the reaction of the material and the surfaces of aluminum and aluminum alloys.

**1.2        Classification.**

**1.2.1      Classes.** The materials, capable of forming protective coatings by chemical reaction with aluminum and aluminum alloys, shall be of the following classes, as specified (see 6.2 and 6.3.1).

**Class 1A - For maximum protection against corrosion, painted or unpainted.**

**Class 3 - For protection against corrosion where low electrical resistance is required.**

**1.2.2      Materials.** Conversion coating materials shall be of the following forms for application by the methods as specified (see 6.2 and 6.3.1).

**1.2.2.1    Material forms.**

**Form I - Concentrated liquid**

**Form II - Powder**

**Form III - Premixed liquid (ready for use touch-up brush application)**

**FSC MFFP**

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1.2.2.2 Application methods

Method A - Spray

Method B - Brush

Method C - Immersion

## 2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

## SPECIFICATIONS

Federal

L-B-560	Bottle, Screw Cap (Polyethylene)
QQ-A-250/4	Aluminum Alloy 2024, Plate and Sheet
QQ-A-250/11	Aluminum Alloy 6061, Plate and Sheet
QQ-A-250/12	Aluminum Alloy 7075, Plate and Sheet
TT-P-143	Paint, Varnish, Lacquer, and Related Materials, Packaging, Packing, and Marking of

Military

MIL-C-5541	Chemical Conversion Coatings on Aluminum and Aluminum Alloys
MIL-F-18264	Finishes, Organic, Weapons Systems, Application and Control of
MIL-P-23377	Primer Coating, Epoxy Polyamide, Chemical and Solvent Resistant
MIL-L-81352	Lacquer Acrylic (For Naval Weapons Systems)

**STANDARDS****Federal**

Fed. Test Method Std. No. 141	<b>Paint, Varnish, Lacquer and Related Materials, Methods of Inspection, Sampling and Testing</b>
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**Military**

MIL-STD-105	<b>Sampling Procedures and Tables for Inspection by Attributes</b>
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MIL-STD-129	<b>Marking for Shipment and Storage</b>
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MIL-STD-755	<b>Labels Containing Symbols for Packages and Con- tainers for Hazardous Industrial Chemicals and Materials</b>
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(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

**3. REQUIREMENTS**

3.1 **Qualification.** The chemical conversion coating (film) materials 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 6.7).

3.2 **Coating materials.** All ingredients used in the chemical conversion coating material shall be suitable for the intended use. The material shall be formulated from chromates, other inorganic salts such as phosphates or fluorides, catalysts, activators, and accelerators. The material, in an aqueous solution, shall be capable of forming non-electrolytically a chromate conversion coating. Materials, which have been approved in accordance with the requirements of this document and have been accepted for listing on the applicable Qualified Products List are used to produce coatings conforming to MII-C-5541.

3.3 **Basis metal.** The basis metal for test panels shall be free from any visible defects which will be detrimental to the resultant coating.

3.4 **Application.** The material, when furnished either as a concentrated liquid or powder, after proper mixing, shall be suitable for treatment of the prepared metal in accordance with the supplier's instructions, by spray, brush, or immersion. Class 1A

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material, furnished premixed in liquid form for touch-up brush application (Form III), shall be in the concentration required for treatment and shall require no further dilution. The resultant coating shall not be subjected to a surface temperature greater than 140°F (60°C) during drying or curing. The film shall be continuous and substantially free from powdery and loose areas; and shall be free from breaks, scratches, flaws or other defects which will reduce serviceability or be detrimental to appearance, protective value, or paint bonding characteristics.

**3.5 Toxicity.** The material and processing baths or solutions shall have no adverse effect on the health of personnel when used for the intended purpose. Questions pertinent to this effect shall be referred by the qualifying activity to the appropriate departmental medical service which will act as an advisor to the qualifying agency (see 4.3.5).

**3.6 Corrosion resistance properties.** The materials applied to the surfaces of aluminum and aluminum alloys shall protect the basis metal when the specimens are subjected to the 5 percent salt spray corrosion resistance test as specified in 4.5.1 and in accordance with the schedule shown in Table I. The specimens shall show no evidence of corrosion whatever when compared to unexposed panels with the naked eye except in those areas within 1/4 inch from the edges, identification markings and holding points during processing or salt spray exposure.

TABLE I

**SCHEDULE FOR CORROSION RESISTANCE PROPERTIES OF  
UNPAINTED CHEMICAL FILMS**

Corrosion Resistance Properties	Treatment-Class	Aluminum Alloys Treated With Film Forming Materials	Exposure to 5% Salt Spray - Hours
For Qualification	1A 3	2024-T3, 7075-T6 6061-T6	336 168
For Quality Conformance Inspection	1A 3	2024-T3 6061-T6	168 168

**3.7 Paint adhesion properties.** The paint adhesion properties of aluminum and aluminum alloys treated with Classes 1A and 3 and painted as specified in 4.3.3.3.1 shall be such that the paint system will not chip or peel after application and curing.

**3.7.1      Adhesion (knife).** The paint system shall show no loss of adhesion when tested as specified in 4.5.2. The paint film shall cut loose in the form of a ribbon or curl on cutting. The cut shall show beveled edges. The cut paint film shall not flake or separate from the panel beyond the cut.

**3.7.2      Adhesion (tape).** The paint system shall show no loss of adhesion when tested as specified in 4.5.3. The paint system shall exhibit no removal from the chemical film. The chemical film on the basis metal shall show no damage or other defects.

**3.8          Weight of film.** The coating weight of Class 1A film on aluminum and aluminum alloys shall not be less than 40 milligrams per square foot of surface area when determined in accordance with the method specified in 4.5.4.

**3.9          Contact electrical resistance properties.** The contact electrical resistance property of aluminum alloy panels treated with Class 3 materials under an applied electrode pressure of 200 pounds per square inch (psi) shall be not greater than 5,000 microhms per square inch as applied and 10,000 microhms per square inch after exposure to the 5 percent salt spray test (see 4.5.1), when tested as specified in accordance with 4.5.5. Individual readings not greater than 20 percent in excess of the specified maximums shall be acceptable, provided that the average of all determinations does not exceed the specified maximum resistance.

**3.10        Storage stability.** Materials conforming to this specification shall be capable of being stored for the following periods:

Form I - Concentrated liquid	6 months
Form II - Powder	6 months
Form III - Premixed liquid	12 months

Products on which storage stability is to be determined shall be furnished packaged in accordance with the material requirements of 5.2.1. Storage samples shall not be opened or agitated during the stipulated storage period. After storage the product shall be homogeneous, free from precipitate (if a liquid product), be easily mixed or diluted, if required, and shall conform to all applicable requirements of this specification. The daily mean temperature at the storage location shall be within 35 to 95° F with peak ambient air temperature not exceeding 115° F. Only those products which have been tested and initially found to meet all applicable requirements of this specification shall be evaluated for storage stability (see 4.5.6).

**3.11        Workmanship.** The material shall be processed in a manner that will yield the highest quality product necessary to meet the requirements of this specification. The material shall be uniform in composition, quality, free from impurities and other defects which will impair its usability and adversely affect its performance. The qualification sample after evaluation shall become the minimum standard

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of acceptance. The chemical conversion material furnished under contract or order shall be identical in composition and coating characteristics to the qualification sample.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance in all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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.

4.2 Classification of inspection. The inspection requirements for materials, specified herein, are classified as follows:

- (a) Qualification Inspection (see 4.3)
- (b) Quality Conformance Inspection (see 4.4)

#### 4.3 Qualification inspection.

4.3.1 Samples. The qualification test samples shall consist of materials (see 4.3.2) for which qualification is desired and shall be accomplished by the supplier's recommended methods for processing panels to be tested. Samples shall be fully identified and forwarded to the activity designated in the letter of authorization (see 6.7). The supplier shall submit test reports of the product that is being offered for qualification showing results of all tests specified herein (see 4.3.6).

4.3.2 Materials. The supplier shall furnish the qualifying activity a sufficient quantity of materials to make twenty-five gallons of solution for applying the chemical film. Information and instructions for mixing and proper application must be given. For materials to be supplied in the premixed condition, the supplier shall furnish the qualifying activity, a minimum of five gallons of solution in the concentration required for application, packaged in not more than 1-quart polyethylene bottles (see 5.2.1). Container materials for other than Form III shall conform to the applicable material requirements of 5.2.1 and insofar as practical shall be identical to the materials to be used by the supplier to package his product.

4.3.3 Test panels. Test panels will be supplied and prepared by the activity responsible for qualification. Panels for testing Class 1A materials shall be of aluminum alloy 2024-T3, conforming to QQ-A-250/4 and of aluminum alloy 7075-T6, conforming to QQ-A-250/12. Panels for testing Class 3 materials shall be of aluminum alloy 6061-T6, conforming to QQ-A-250/11. All test panels shall be

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a nominal 0.032 inch thick, 10 inches in length and 3 inches in width. Panels of aluminum alloys 2024-T3, 7075-T6 and 6061-T6 shall be identified by the letters A, B and C respectively. For testing Class 1A material, the panels lettered "A" and "B" shall be numbered from 1 to 11, inclusive. For testing Class 3 material, the lettered Class 3 material, the lettered "C" panels shall be numbered from 1 to 12, inclusive.

**4.3.3.1 Panel cleaning.** Test panels shall be cleaned with materials which will remove the soil without damaging the metal. The panels shall be cleaned to remove oxides and all foreign substances. Acid solutions, when required, shall be used for removal of oxides and the characteristic surface smut. The panels shall be rinsed thoroughly with water prior to coating application. Abrasives containing iron, such as steel wool, iron oxide rouge or steel wire, are prohibited for all cleaning operations as particles from them may become embedded in the metal and accelerate corrosion. The panels shall be handled during all cleaning and subsequent treatments so that mechanical damage or contamination will be avoided.

**4.3.3.2 Panel treatment for Class 1A material.** Panels of each alloy, lettered "A" and "B", detailed, marked and cleaned in accordance with 4.3.3 and 4.3.3.1 shall be treated by the qualifying activity on all surfaces in accordance with the supplier's instructions. All panels shall be dried between 70 and 90° F (21 and 32° C) for 24 hours before finishing or testing, except those to be used for the coating weight (see 4.5.4).

**4.3.3.3 Panel finishing for Class 1A material.** The lettered A and B panels numbered 7 to 8, inclusive, in accordance with 4.3.3 shall be finished by the qualifying activity in accordance with 4.3.3.3.1.

**4.3.3.3.1 Epoxy primer-acrylic lacquer top coat paint system.** Panels shall be finished with one coat of an epoxy-polyamide primer MIL-P-23377 to a dry film thickness of 0.0005 to 0.0008 inch (0.5 to 0.8 mil) and two coats of Insignia White acrylic lacquer MIL-L-81352 applied in accordance with the applicable requirements of MIL-F-18264 to a dry film thickness of 0.0008 to 0.0012 inch (0.8 to 1.2 mils). The MIL-P-23377 primer shall be overcoated with the acrylic lacquer 1 to 2 hours after application. Panels shall be allowed to dry 72 hours before testing.

**4.3.3.4 Panel treatment for Class 3 material.** Panels of the aluminum alloy, lettered "C", detailed, marked and cleaned in accordance with 4.3.3 and 4.3.3.1 shall be treated on all surfaces by the qualifying activity in accordance with the supplier's instructions. All panels shall be dried between 70 and 90° F (21 and 32° C) for 24 hours before finishing or testing.

**4.3.3.5 Panel finishing for Class 3 material.** The lettered "C" panels, marked 11 to 12, inclusive shall be finished by the qualifying activity in accordance with 4.3.3.3.1.

#### **4.3.4 Testing.**

**4.3.4.1 Class 1A.** Table II summarizes the preparation, treatment and finishing of the various panels to be used for the qualification testing and their usage for the corrosion resistance test, as specified in 4.5.1 to determine conformance to

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TABLE II  
PREPARATION AND TESTING OF PANELS FOR QUALIFICATION

Class 1A Panel Nos. <u>1</u> /	Class 3 Panel Nos. <u>2</u> /	Reference Paragraphs	Paint System	Reference Paragraph	Tests	Reference Paragraphs	Requirement Paragraphs
1 to 5	-	4.3.3, 4.3.3.1 and 4.3.3.2	None	-	Corrosion Resistance	4.5.1	3.6
6	-	4.3.3, 4.3.3.1 and 4.3.3.2	None	-	Corrosion Resistance <u>3</u> /	-	3.6
-	1 to 5	4.3.3, 4.3.3.1 and 4.3.3.4	None	-	Corrosion Resistance and Electrical Resistance	4.5.1 and 4.5.5	3.6 and 3.9
-	6 to 10	4.3.3, 4.3.3.1 and 4.3.3.4	None	-	Electrical Resistance <u>4</u> /	4.5.5	3.9
7 to 8	11 to 12	4.3.3, 4.3.3.1, 4.3.3.2 and 4.3.3.4	Yes	4.3.3.3.1	Paint Adhesion	4.5.2 and 4.5.3	3.7, 3.7.1 and 3.7.2
9 to 11	-	4.3.3, 4.3.3.1 and 4.3.3.2	None	-	Coating Weight	4.5.4	3.8
<u>5</u> /	-	-	-	-	Storage Stability	4.5.6	3.10

1/ Panels of 2024-T3 and 7075-T6 (see 4.3.3) lettered A and B respectively.

2/ Panels of 6061-T6 (see 4.3.3) lettered C.

3/ Control panel - unexposed.

4/ Should be used as control panels (unexposed) for corrosion resistance test.

5/ Panels shall also be prepared as above at end of storage period.



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3.6; for paint adhesion tests, as specified in 4.5.2 and 4.5.3 to determine conformance to 3.7, 3.7.1 and 3.7.2; for weight of film test as specified in 4.5.4 to determine conformance to 3.8; for storage stability as specified in 4.5.6 to determine conformance to 3.10 (see 6.4).

4.3.4.2 Class 3. Table II summarizes the preparation, treatment and finishing of various panels to be used for the qualification testing and their usage for the corrosion resistance test, as specified in 4.5.1 to determine conformance to 3.6; for paint adhesion tests as specified in 4.5.2 and 4.5.3 to determine conformance to 3.7, 3.7.1 and 3.7.2 and for contact electrical resistance as specified in 4.5.5 to determine conformance to 3.9 (see 6.4).

4.3.4.3 Qualification test procedures. The qualification tests shall consist of all the tests of this specification for the class of material submitted as specified under 4.5 and may be supplemented with service tests at the option of the activity responsible for qualification. If any specimen shows pitting or corrosion after being subjected to the test of 4.5.1, the chemical film material shall be rejected without performing any other tests.

4.3.5 Toxicity. The supplier shall furnish the toxicological data and formulations required to evaluate the safety of the material for the proposed use. However, if the ingredients are the same except for variation in percentage as a product which has been manufactured by the supplier and qualified under this specification or previous issue of MIL-C-5541, a certification to that effect will be acceptable in lieu of the toxicity information required.

4.3.6 Submission for qualification tests. Inquiry concerning qualification shall be made to the activity responsible for qualification only by firms who market products that form conversion coatings on aluminum and aluminum alloys. The inquiries shall be supported by certified reports containing test data showing conformance with this specification for each material form, application method and class as well as process controls, including exact concentration and treatment procedures for use by the activity responsible for qualification (see 6.7).

#### 4.4 Quality conformance inspection.

4.4.1 Lot. Unless otherwise specified in the contract or order (see 6.2), a lot of the chemical film material shall consist of one production batch, produced by one manufacturer under the same continuous production run, without change in ingredients, process or conditions (see 6.5) and offered for delivery at one time. If the chemical material cannot be identified by batch, a lot shall consist of not more than 1500 gallons of liquid or 2000 pounds of powder material offered for delivery at one time.

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**4.4.2 Sampling.** Unless otherwise specified and where applicable, sampling plans and procedures in the determination of the products submitted by a supplier shall be in accordance with the provisions set forth in MIL-STD-105. A sample shall be selected at Inspection Level S-1, Acceptable Quality Level equal to 2.5 percent defective to prepare the solution for applying the chemical film.

**4.4.3 Examination of filled containers.** A sample of filled containers shall be taken at random in accordance with MIL-STD-105 at Inspection Level II and Acceptable Quality Levels equal 1.5 percent defective to verify compliance with product requirements in regard to fill, closure, packaging, packing, marking, and other requirements not involving test.

**4.4.4 Class 1A material.**

**4.4.4.1 Panel preparation.** For testing the acceptance samples of Class 1A materials, aluminum alloy 2024-T3 conforming to QQ-A-250/4 shall be the only metal used for panel preparation. Panels as specified in 4.3.3, shall be prepared and marked by the material supplier, numbering from 1 to 11, inclusive. The material under test shall be mixed for application and applied on all surfaces of the panels cleaned in accordance with 4.3.3.1. The chemical conversion coated panels shall be dried between 70 and 90° F (21 and 32° C) for 24 hours, except those to be used for coating weight, before testing and further finishing. Panels marked 7 and 8 shall be finished in accordance with 4.3.3.3.1.

**4.4.4.2 Lot acceptance tests.** Table III summarizes the preparation, treatment and finishing of the various panels to be used for lot acceptance testing of Class 1A material. All tests required for qualification inspection are necessary for lot acceptance, except as follows:

- (a) Panels - Only alloy 2024-T3 shall be used (see 4.4.4.1).
- (b) Corrosion resistance properties - Test shall be scheduled only for 168 hours exposure (see 3.6).
- (c) Storage stability - The one-year period of storage for pre-mixed liquids for touch-up application shall not be required (see 3.10).

**4.4.5 Class 3 material.**

**4.4.5.1 Panel preparation.** For testing the acceptance samples of Class 3 materials, aluminum alloy 6061-T6, conforming to QQ-A-250/11 shall be used for panel preparation. Panels as specified in 4.3.3 shall be prepared and marked by the materials supplier numbering from 1 to 6 inclusive. The material under test shall be mixed for application and applied on all surfaces of the panels cleaned in accordance with 4.3.3.1. The chemical conversion coated panels shall

TABLE III

## LOT ACCEPTANCE TEST PANELS

## PREPARATION AND TESTING FOR CLASS 1A AND CLASS 3 COATING MATERIALS

Class 1A Panel Nos. of 2024-T3	Class 3 Panel Nos. of 6061-T6	Reference Paragraphs	Paint System	Reference Paragraph	Test	Reference Paragraphs	Requirement Paragraphs
1 to 5	-	4.3.3, 4.3.3.1 and 4.4.4.1	None	-	Corrosion Resistance	4.5.1	3.6
6	-	4.3.3, 4.3.3.1 and 4.4.4.1	None	-	Corrosion Resistance <u>1/</u>	-	3.6
-	1 to 3	4.3.3, 4.3.3.1 and 4.4.5.1	None	-	Corrosion Resistance	4.5.1	3.6
-	4	4.3.3, 4.3.3.1 and 4.4.5.1	None	-	Corrosion Resistance <u>1/</u>	-	3.6
7 to 8	5 to 6	4.3.3, 4.3.3.1, 4.4.4.1 and 4.4.5.1	Yes	4.3.3.3.1	Paint Adhesion	4.5.2 and 4.5.3	3.7, 3.7.1 and 3.7.2
9 to 11	-	4.3.3, 4.3.3.1 and 4.4.4.1	None	-	Coating Weight	4.5.4	3.8

1/ Control Panel - unexposed.

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be dried between 70 to 90° F (21 and 32° C) for 24 hours before testing and further finishing. Panels marked 5 and 6 shall be finished in accordance with 4.3.3.3.1.

**4.4.5.2 Lot acceptance test.** Table III summarizes the preparation, treatment and finishing of the various panels to be used for lot acceptance testing of Class 3 material. All tests required for qualification inspection are necessary for lot acceptance, except as follows:

- (a) **Contact electrical resistance properties - Shall not be required (see 3.9).**
- (b) **Corrosion resistance properties - Decrease in number of test panels required (see 4.4.5.1).**

**4.5 Test methods.**

**4.5.1 Corrosion resistance.** Panels prepared as specified shall be used for corrosion resistance testing of Class 1A and Class 3 materials. The selected specimens shall be subjected to a 5 percent salt spray test in accordance with Method 6061 of Fed. Test Method Std. No. 141, except that the significant surface shall be inclined approximately 6 degrees from the vertical. Specimens being qualified or for lot acceptance shall be exposed for the hours specified in Table I. After exposure, specimens shall be cleaned in running water, not warmer than 100° F (38° C), blown with clean dry unheated air and compared with unexposed specimens for the presence of corrosion to determine compliance with 3.6. Differences in color between test panels and unexposed control shall not be cause for rejection. Specimens from Class 3 material after exposure and cleaning, shall be allowed to set for 24 hours at room temperature before testing for contact electrical resistance properties in accordance with 4.5.5 for compliance with 3.9.

**4.5.2 Adhesion (knife).** Painted panels prepared as specified shall be used for adhesion testing to determine conformance to 3.7.1. The adhesion of the air-dried painted specimens shall be determined in accordance with Method 6304 of Fed. Test Method Std. No. 141 by cutting into the paint film with a sharp knife. The knife blade shall be held so that an angle of approximately 30 degrees is maintained between it and the surface of the specimen. Adhesion is considered satisfactory when the cut paint film is ribbonlike without flaking or separation from the panel beyond the cut. The specimens shall be retained for the conducting of the tape test for adhesion (see 4.5.3).

**4.5.3 Adhesion (tape).** The painted panels used for the knife adhesion test (see 4.5.2) shall be tested for tape adhesion. The test shall be conducted as described in Method 6301 of Fed. Test Method Std. No. 141 to determine conformance to 3.7.2. Adhesion is considered satisfactory when no intercoat separation occurs between the primer and the conversion coating or between the conversion coating and the metal substrate.

#### 4.5.4 Weight of film.

4.5.4.1 Preparation. Panels prepared as specified shall be used for determining the weight of the Class 1A film for conformance to 3.6. Within 3 hours after coating application, the panels shall be weighed to the nearest 0.1 milligram. If the coating is aged for more than 3 hours, it will be difficult to remove and the results will be inaccurate.

4.5.4.2 Film removal. Immediately after weighing, the specimens shall be immersed for 60 seconds in freshly made nitric acid solution, composed of equal parts by volume of concentrated nitric acid ( $\text{HNO}_3$ ) and water, maintained at room temperature. Coating removal may be facilitated by brushing the specimen with a clean cotton swab. After removal of the coating, the specimen shall be rinsed thoroughly in demineralized or distilled water, blown dry with clean, filtered oil-free air and reweighed.

4.5.4.3 Calculation. The weight of the chemical conversion film as milligrams per square foot is calculated as follows:

$$(W_1 - W_2) \times 2.4$$

Where:  $W_1$  = Initial weight in milligrams

$W_2$  = Final weight in milligrams

4.5.5 Contact electrical resistance. Panels prepared as specified and after the salt spray test (see 4.5.1) shall have the contact electrical resistance of the film determined for conformance to 3.9. Test equipment and circuitry similar or equivalent to those shown in Figures 1 and 2 shall be used for measuring the electrical resistance of the Class 3 material specimens. The applied load shall be within 1 percent of the calculated 200 psi applied pressure. The contacting electrodes shall be copper or silver plated copper with a finish not rougher than that obtained by the use of 000 metallographic abrasive paper. The electrodes shall be sufficiently flat so that when the load is applied without a specimen between them, light will not be visible through the contacting surface. The area of the upper electrode shall be 1 square inch with the area of the lower electrode somewhat larger. Ten measurements shall be made on each panel in the areas shown on Figure 3.

4.5.6 Storage stability. After having been stored in its original container for the specified time period, the product shall be examined or tested as applicable, to determine compliance with 3.10.

4.6 Packaging, packing, and marking. Preparation for delivery shall be inspected for conformance to Section 5 of this specification.

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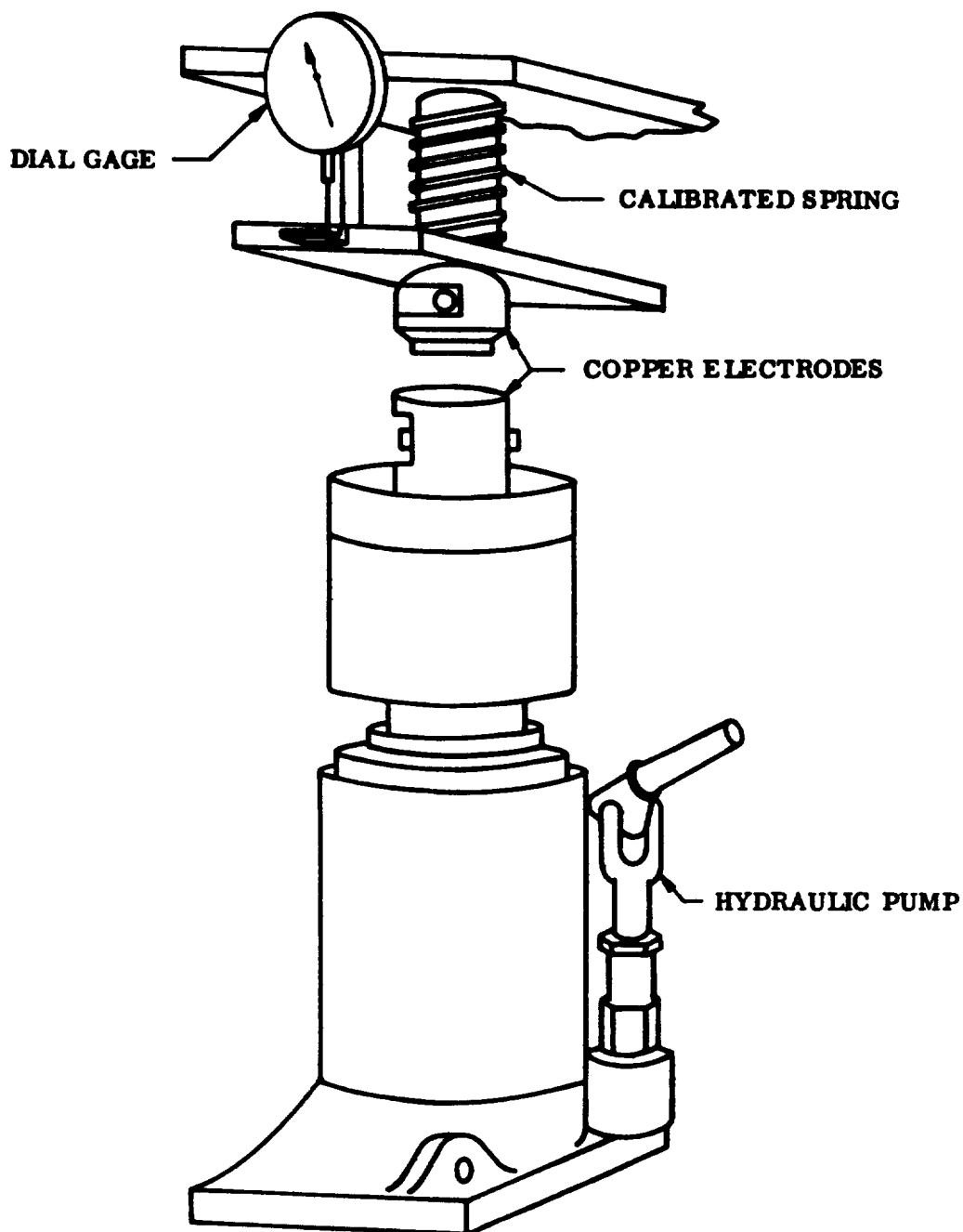


FIGURE 1. SKETCH OF EQUIPMENT FOR MEASURING ELECTRICAL RESISTANCE OF CHEMICAL FILM

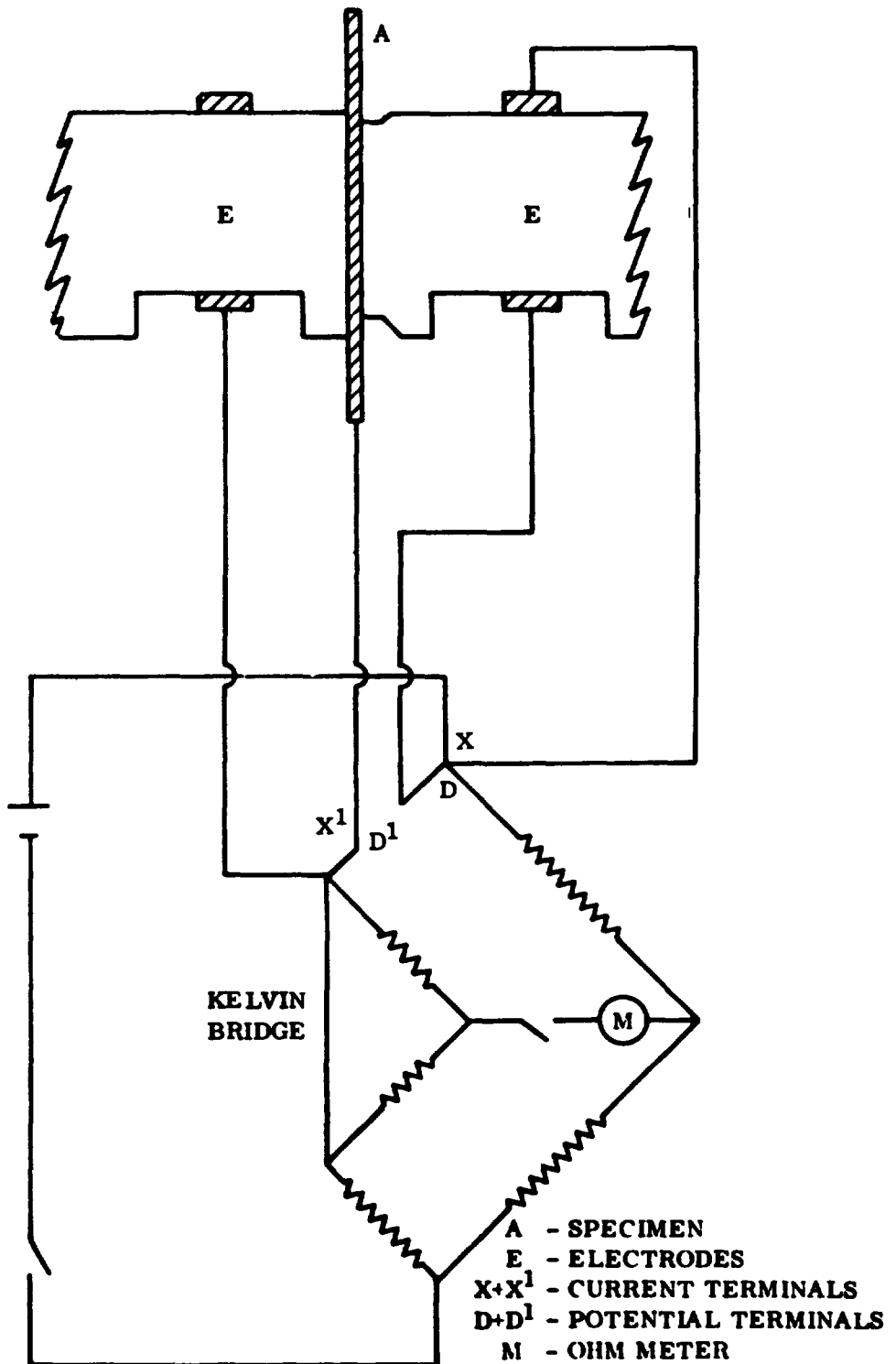
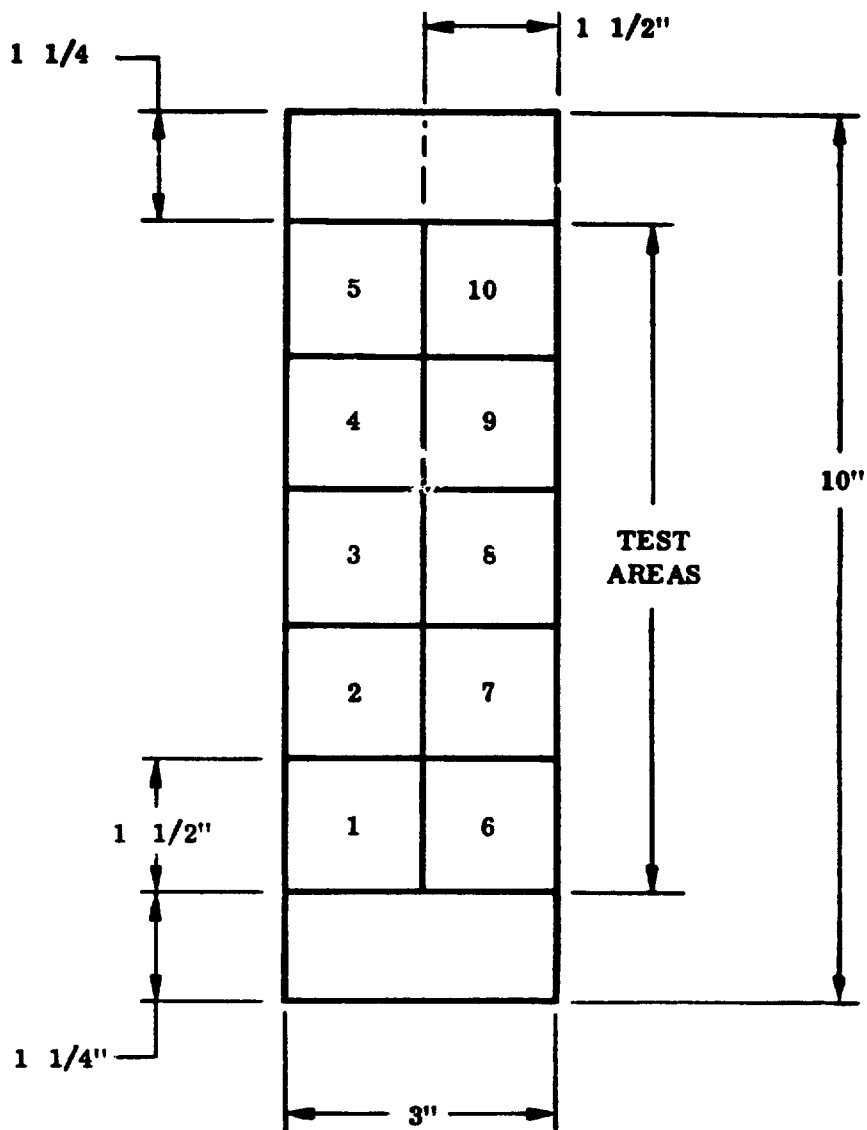


FIGURE 2. CIRCUIT DIAGRAM FOR CONTACT RESISTANCE MEASUREMENTS.

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**FIGURE 3. AREAS FOR MEASUREMENTS OF ELECTRICAL RESISTANCE ON TREATED PANELS**



4.7 **Rejection.** Failure to conform to any of the requirements of this specification shall be cause for rejection of material submitted for qualification or of the lot of chemical film material represented by the nonconforming specimens.

## 5. PREPARATION FOR DELIVERY

5.1 **Application.** The requirements of Section 5 apply only to direct purchasers by or direct shipments to the Government.

5.2 **Packaging, packing, and marking.** The packaging, packing, and marking of chemical film materials shall be in accordance with TT-P-143 and as specified herein.

5.2.1 **Unit packaging.** Polyethylene bags, jars, or bottles shall be used for interior packaging. When polyethylene bags are furnished as a liner or container, the bags shall be individually placed within close fitting fiber or metal cans. When used for the packaging of powder material, polyethylene bags shall be of such thickness and closed in such manner as to be impervious to moisture. Polyethylene bottles with screw cap closures, conforming to L-B-560, shall be used for packaging of premixed liquids for touch-up brush application. Unless otherwise specified, the premixed liquid shall be packaged in 1-pint or 1-quart quantities, as specified (see 6.2).

5.3 **Marking and labeling.** In addition to any special marking required by the contract or order, markings shall be in accordance with MIL-STD-129. In addition to the markings specified in MIL-STD-129, each container shall have affixed a warning label of appropriate size to Class 2 of MIL-STD-755 or shall be lithographed or stencilled with a reasonable likeness thereof. Under "contains" shall be inserted the appropriate active materials (such as, chromates, fluorides, etc.). For unit containers that also serve as shipping containers any conflict with ICC Regulations shall be resolved by reasonable modification of size of label or use of warning statement without label design. All ready for use (premixed) materials shall be marked with the date of mixing (month and year) on the label of all unit containers.

5.3.1 **Warning label.** The following shall appear on each container:

**WARNING:** Chemical film materials are strongly oxidizing and present a potential fire and explosion hazard in contact with flammable materials such as paint thinners. Avoid storing or mixing surface treatment materials in containers previously containing flammable products.

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**5.3.2      Instructions for use.** Containers shall bear a printed label (all printed labels shall be overcoated with a clear coating for waterproofing) containing specific instructions for mixing the chemical film materials, use and application procedures or at the option of the supplier this information shall be contained in a multi-page document in a polyethylene envelope inside the container.

**6.      NOTES****6.1      Intended use.**

**6.1.1      Class 1A.** Class 1A materials covered by this specification are intended for use in the formation of chemical conversion coatings which are corrosion preventive and will improve adhesion of paint finish systems to aluminum and aluminum alloys.

**6.1.2      Class 3.** Class 3 materials covered by this specification are intended for use in the formation of chemical conversion coatings which are corrosion preventive films for electrical and electronic applications where low resistance contacts are required.

**6.1.3      MIL-C-5541** covers the requirements for chemical conversion coatings formed by the reaction of materials, qualified under this specification, applied to the surfaces of articles, items, parts or components of aluminum and aluminum alloys.

**6.2      Ordering data.** Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Class (method of treatment), (see 1.2.1).
- (c) Form and application method of material to be furnished (see 1.2.2).
- (d) Lot size (see 4.4.1).
- (e) Level of packaging and packing, if applicable (see 5.1 and 5.2).
- (f) Unit quantity (see 5.2.1).
- (g) Special markings, if applicable (see 5.3).

**6.3            Interchangeability.** The various products approved under this specification are interchangeable within each class insofar as performance is concerned, but are not interchangeable from a chemical standpoint, that is, different products cannot be mixed. The product from one supplier should not be mixed or used to strengthen an existing solution from another supplier. As the chemical film materials are proprietary products, the ingredients, processes, the method of application (for example, spray, brush, and immersion), and the equipment required for application vary with the different products. Contractors and military activities should take this into account in procurement, in the design of parts and in the establishment of facilities. Detail drawing of parts requiring treatment with materials conforming to this specification should only specify the class, 1A or 3, required to meet the performance desired.

**6.3.1            Product substitution.** Class 1A of this specification supersedes both Classes 1 and 2 of MIL-C-5541A dated 31 March 1964. The various products approved under this specification and listed in the applicable Qualified Products List as Class 1A are interchangeable from a performance point of view with those products approved under MIL-C-5541A of 31 March 1964 for both Classes 1 and 2 and so listed in QPL-5541-25. The terms "Form" and "Method" used in this specification (see 1.2.2.1 and 1.2.2.2) are interchangeable for "Type" and "Grade", respectively, as stated in MIL-C-5541A.

**6.3.2            Field use.** Products suitable for brush application (Method B) are available for field use in repainting and the repair of existing corroded areas, and are listed in the applicable Qualified Products List. Products suitable for touch-up brush application, already premixed, should be available for field use in kits, such as MIL-K-81576. The chemical conversion material, is one of the products to be used in treating small areas of corrosion on weapons systems.

**6.4            Other alloys.** The procuring activity may select other alloys and other types of specimens more representative of production work for the quality conformance inspection of corrosion resistance of the chemical conversion material. Criteria should be supplied by the procuring activity.

**6.5            Batch.** A batch is defined as that quantity of material which has been subjected to some unit chemical or physical mixing process intended to make the final product substantially uniform (see 4.4.1).

**6.6.            Aluminum alloys.** The aluminum alloys for specimen panels, to comply with the strict requirements of the salt spray corrosion test should be of a good commercial quality, free from pits, scratches, mill markings or imperfections due to irregularity of heat treatments (see 3.3 and 4.3.3).

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6.7 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 the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Air Systems Command, Department of the Navy, Washington, D.C. 20360 however, information pertaining to qualification of products may be obtained from the Commanding Officer, U.S. Naval Air Development Center, Warminster, Pennsylvania 18971, Attn: Code MAMC.

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Navy - AS  
Air Force - 84

**Preparing activity:**

Navy - AS  
(Project No. MFFP-0040)

**Review activities:**

Army - MI, MU, MR, EL, WC  
Navy - AS, OS, SH, EC  
Air Force - 11

**User activities:**

Army - AT  
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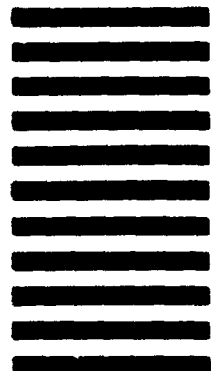
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