

MIL-P-85582  
29 September 1983

## MILITARY SPECIFICATION

### PRIMER COATINGS: EPOXY, VOC COMPLIANT, CHEMICAL AND SOLVENT RESISTANT

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 water-reducible, multicomponent, epoxy type, chemical and solvent resistant primer coatings, formulated primarily for application by various spray techniques. The primer shall be compatible with aliphatic polyurethane topcoats and shall contain 350 grams per liter (2.92 pounds per gallon) or less of volatile organic compounds (VOC), as applied, in accordance with Rule 1124, Aerospace Assembly and Component Coating Operations.

1.2 Classification. The primer coatings shall be furnished in the following types and components, as specified (see 6.2.1):

|         |   |                         |
|---------|---|-------------------------|
| Type I  | - | Standard                |
| Type II | - | Low Infrared Reflective |

1.2.1 Components. The primer coatings shall consist of two components, as specified (see 3.4):

- Component A - Shall consist of a resin solution and shall contain all of the pigments and corrosion inhibitors.
- Component B - Shall consist of an unpigmented resin or curing agent solution.

## 2. APPLICABLE DOCUMENTS

### 2.1 Government documents.

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

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

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## SPECIFICATIONS

## FEDERAL

- O-N-350 - Nitric Acid, Technical
- O-H-795 - Hydrofluoric Acid, Technical
- QQ-A-250/4 - Aluminum Alloy 2024, Plate and Sheet.
- QQ-A-250/5 - Aluminum Alloy Alclad, 2024, Plate and Sheet.
- QQ-M-44 - Magnesium Alloy Plate and Sheet.
- PPP-P-1892 - Paint, Varnish, Lacquer and Related Materials, Packaging, Packing, and Marking of.

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- MIL-M-3171 - Magnesium Alloy, Processes for Pretreatment and Prevention of Corrosion on.
- MIL-C-5541 - Chemical Conversion Coatings on Aluminum and Aluminum Alloys.
- MIL-H-5606 - Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordnance.
- MIL-C-8514 - Coating Compound, Metal Pretreatment, Resin-Acid.
- MIL-A-8625 - Anodic Coatings, for Aluminum and Aluminum Alloys.
- MIL-T-9046 - Titanium and Titanium Alloy, Sheet, Strip and Plate.
- MIL-L-23699 - Lubricating Oil, Aircraft Turbine Engines, Synthetic Base.
- MIL-R-81294 - Remover, Paint, Epoxy, and Polyurethane Systems.
- MIL-C-81706 - Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys.
- MIL-T-81772 - Thinner, Aircraft Coating.
- MIL-H-83282 - Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base, Aircraft.
- MIL-C-83286 - Coating, Urethane, Aliphatic Isocyanate, for Aerospace Applications.
- MIL-C-85285 - Coating, Polyurethane, Aliphatic, Weather Resistant, Low Infrared (IR) Reflective.

## STANDARDS

## FEDERAL

- FED-STD-313 - Material Safety Data Sheets, Preparation and Submission of.
- FED-STD-141 - Paint, Varnish, Lacquer and Related Materials; Method of Inspection, Sampling and Testing.
- FED-STD-595 - Colors.

2.1.2 Other Government documents, drawings, and publications. The following other Government document forms a part of this specification to the extent specified herein.

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## CODE OF FEDERAL REGULATIONS

49 CFR 171-178 - 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 20370.)

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

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

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|             |   |                                                                                      |
|-------------|---|--------------------------------------------------------------------------------------|
| ASTM B 117  | - | Salt Spray (Fog) Testing.                                                            |
| ASTM D 476  | - | Titanium Dioxide Pigments, Specification for.                                        |
| ASTM D 523  | - | Specular Gloss, Test for.                                                            |
| ASTM D 1193 | - | Reagent Water, Specification for.                                                    |
| ASTM D 1210 | - | Fitness of Dispersion of Pigment-Vehicle Systems, Test for.                          |
| ASTM D 1296 | - | Odor of Volatile Solvents and Diluents, Test for.                                    |
| ASTM D 1475 | - | Density of Paint, Varnish, Lacquer, and Related Products, Test for.                  |
| ASTM D 1640 | - | Drying, Curing, or Film Formation of Organic Coatings at Room Temperature, Test for. |
| ASTM D 1729 | - | Visual Evaluation of Color Differences of Opaque Materials.                          |
| ASTM D 1849 | - | Package Stability of Paint, Test for.                                                |
| ASTM D 2197 | - | Adhesion of Organic Coatings, Test for.                                              |
| ASTM D 2243 | - | Freeze-Thaw Resistance of Latex and Emulsion Paints, Test for.                       |
| ASTM D 2369 | - | Volatile Content of Coatings                                                         |
| ASTM D 2803 | - | Filiform Corrosion Resistance of Organic Coatings on Metal, Test for.                |
| ASTM D 3792 | - | Work Content of Water Reducible Paints by Direct Injection into a Gas Chromatograph. |

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

## California Air Resources Board Rule 1124

(Copies may be obtained from the South Coast Air Quality Management District, 9150 Flair Drive, El Monte, CA 91731).

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

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

## 3. REQUIREMENTS

3.1 Qualification. The primers furnished under this specification shall be products which are qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.3 and 6.3). Any change in the formulation of a qualified product will necessitate its requalification. The material supplied under contract shall be identical, within manufacturing tolerances, to the qualified product.

3.2 Material. Materials used in the manufacture of products supplied under this specification shall be of such a quality as to produce products conforming to the requirements of this specification.

3.3 Toxicity. The primers shall have no adverse effect on the health of personnel when used for their intended purpose. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency. Material safety data sheets shall be prepared in accordance with FED-STD-313 and one copy of which shall be forwarded to the qualifying activity (see 4.3.1).

3.3.1 Lead. The primer shall be lead-free (see table III).

3.4 Composition. The primers shall consist of two components, one of which shall contain a bisphenol-A type epoxy resin. Component A shall be a resin solution containing all of the corrosion inhibitors and pigments. Component B shall be an unpigmented resin solution. When the components are mixed in the proportions specified by the manufacturer and reduced with water, a product meeting the applicable requirements of this specification shall result.

3.4.1 Volatile organic compounds. The volatile organic compounds (VOC) contained in the admixed primers shall be no more than 350 grams per liter of coating, excluding water, as determined in 4.6.1. The use of methylene chloride, trichloroethane, or trichlorotrifluoroethane shall not be allowed.

3.4.2 Pigment. The total pigment content of the unthinned, admixed primer components shall be not less than 50 percent of the solids content, as determined in 4.6. The pigment composition of component A shall consist of ingredients in the proportions of weight specified in table I when tested in accordance with 4.6 and 4.6.2 (see 6.4).

3.4.3 Solids. The total solids content of the unthinned, admixed primer components shall be not less than 70 percent by weight, when tested in accordance with 4.6.

3.4.4 Thinner. When thinned to application viscosity with water conforming to the type IV requirements of ASTM D 1193, the admixed primer components shall meet the applicable requirements of this specification.

3.5 Physical properties - liquid.

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3.5.1 Color. The color of the admixed primers shall be light green for type I and dark green per FED-STD-595, color number 34052 for type II, when tested in accordance with 4.6.

3.5.2 Odor. The odor of the primers, as packaged components or as a film after application, shall be characteristic of the thinners used and shall not be obnoxious, when tested in accordance with 4.6.

3.5.3 Fineness of grind. The fineness of grind of the admixed primer at application viscosity shall be not less than 5, when tested in accordance with 4.6.

3.5.4 Pot life. The viscosity of the admixed primers when thinned initially to 20 seconds through a number 2 Zahn cup and stored in a closed container, shall not exceed 25 seconds after 6 hours at  $23^{\circ} \pm 2^{\circ}\text{C}$  ( $73 \pm 5^{\circ}\text{F}$ ), when tested in accordance with 4.6.3.

3.5.5 Solids at application viscosity. The total solids of the admixed primer, thinned to 20 seconds through a number 2 Zahn cup, as determined in 4.6.3, shall be greater than 20 percent by weight, when tested in accordance with 4.6.

3.5.6 Condition in container. Components A and B that have been allowed to stand without agitation for at least two weeks in closed containers, shall be capable of being easily mixed by hand with a paddle to a smooth, homogeneous, pourable condition.

3.5.6.1 Component A. Component A shall be free from grit, seeds, lumps, abnormal thickening, or livering and shall not show pigment flotation or excessive settling which can not be easily reincorporated by hand mixing, when tested in accordance with 4.6.

3.5.6.2 Component B. Component B shall show no trace of particulate matter either suspended in solution or settled on the inner surface of the container, when tested in accordance with 4.6, which cannot be dispersed readily by agitation.

3.5.7 Accelerated storage stability. The product, as packaged by the manufacturer, shall meet all the requirements specified herein after 7 days at  $60^{\circ} \pm 0.5^{\circ}\text{C}$  ( $140^{\circ} \pm 1^{\circ}\text{F}$ ) when tested in accordance with 4.6.

3.5.8 Freeze-thaw stability. The product, as packaged by the manufacturer, shall meet all the requirements specified herein after being subjected to five cycles of freezing and thawing, then tested in accordance with 4.6. A freeze-thaw cycle shall be 16 hours at  $-9.4^{\circ} \pm 2.8^{\circ}\text{C}$  ( $+15^{\circ} \pm 5^{\circ}\text{F}$ ) followed by 8 hours at  $25^{\circ}\text{C}$  ( $77^{\circ}\text{F}$ ).

3.5.9 Storage stability. The product, as packaged by the manufacturer, shall meet all requirements specified herein for a period of one year, when tested in accordance with 4.6.

### 3.6 Physical properties - film.

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3.6.1 Surface appearance. The admixed primer, when thinned, shall spray satisfactorily with no sagging, running, or streaking. The dried film shall be free from grit, seeds, craters, blisters, or any other surface irregularities (see 4.6.4).

3.6.2 Drying time. The applied coating shall set-to-touch in not more than 60 minutes and shall be dry-hard in not more than 6 hours (see 4.6).

3.6.3 Gloss.

3.6.3.1 Primer only. At a 60° geometry, the specular gloss of the primer film, 24 hours after application, shall be a maximum of 10 (see 4.6).

3.6.3.2 Primer with topcoat. At a 60° geometry, the specular gloss of the primer topcoated with MIL-C-83286 gloss polyurethane coating shall be a minimum of 90 (see 4.6).

3.6.4 Lifting. There shall be no evidence of lifting or any other film irregularity upon applying a MIL-C-83286 gloss polyurethane topcoat after the primer has air dried for 1, 4 and 18 hours (see 4.6.5).

3.6.5 Dry adhesion. When tested as specified in 4.6, the primer film shall have a parallel groove adhesion rating of less than 4.0 microknife adhesion units.

3.6.6 Wet adhesion. After 4 days in 49°C (120°F) distilled water, the primer shall not peel from the substrates nor shall the topcoat delaminate from the primer, when tested as specified in 4.6.7.

3.6.7 Flexibility. The primer film shall exhibit a minimum impact elongation of 60 percent at room temperature, when tested as in 4.6.6.

3.6.7.1 Low-temperature flexibility. At a temperature of  $-51 \pm 3^{\circ}\text{C}$  ( $-60 \pm 5^{\circ}\text{F}$ ), the primer film shall exhibit no cracking, peeling, or loss of adhesion when bent, coated side away, over a one inch mandrel (see 4.6).

3.6.8 Strippability. At least 90 percent of the primer film shall be stripped with the use of MIL-R-81294 paint remover in 15 minutes at room temperature, when tested as specified in 4.6.8.

3.6.9 Infrared reflectance (type II). The maximum percent infrared total reflectance, relative to magnesium carbonate, shall be less than 10 percent throughout the range of 450 to 2700 millimicrons, when tested in accordance with 4.6.9.

3.7 Resistance properties.

3.7.1 Water resistance. The primer and topcoated primer shall withstand 4 days immersion in distilled water at 49°C (120°F) without showing any softening, wrinkling, blistering or any other coating deficiency, when tested in accordance with 4.6.7.1.

3.7.2 Corrosion resistance (salt spray). When the primer film and the primer topcoated with the MIL-C-83286 gloss polyurethane coating is tested as specified in 4.6.10, the coatings shall exhibit no blistering, lifting of the coating system, or substrate corrosion after exposure to 5 percent salt spray for 1,000 hours.

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3.7.3 Corrosion resistance (filiform). The primer film, when topcoated and tested as in 4.6.11, shall exhibit no blisters, corrosion, or loss of adhesion beyond 1/8 inch from the scribe.

3.7.4 Fluid resistance. The primer film shall withstand 24 hours immersion in MIL-L-23699 lubricating oil at  $121^{\circ} + 3^{\circ}\text{C}$  ( $250^{\circ} + 5^{\circ}\text{F}$ ), MIL-H-5606 hydraulic fluid at  $66^{\circ}\text{F} + 3^{\circ}\text{C}$  ( $150^{\circ} + 5^{\circ}\text{F}$ ) and MIL-H-83282 hydraulic fluid at  $66^{\circ} + 3^{\circ}\text{C}$  ( $150^{\circ} + 5^{\circ}\text{F}$ ) without showing any softening, blistering, loss of adhesion, or any other coating deficiency 4 hours after removal. Discoloration of the coating is acceptable and shall not be cause for rejection (see 4.6.12).

### 3.8 Working properties.

3.8.1 Mixing. The two components mixed in the ratio by volume recommended by the manufacturer shall homogeneously blend together when mixed by suitable mechanical mixer, as determined in 4.6.13.

3.8.2 Dilution. When the admixed primer is diluted to application viscosity with water according to the manufacturer's instructions, there shall be no evidence of incompatibility and the material shall be suitable for spray application. (Transient incompatibility exhibited during the first half of water addition shall be allowed.) The primer shall not separate into visually distinct layers in less than one hour after water dilution (see 4.6.13).

## 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections or tests set forth in the specification where such are deemed necessary to assure supplies and services conform to prescribed requirements. Any deviation from the requirement or test procedures specified herein requires the written approval of both the Naval Air Systems Command and Air Force Materials Laboratory.

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

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

4.3 Qualification inspection. Qualification inspection shall consist of all the requirements and tests specified in table II.



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4.3.1 Qualification samples. The test samples shall consist of a minimum of one gallon (admixed) of the coating material. The material shall be furnished in containers of the type to be used in filling contract orders. Samples shall be identified as follows and forwarded to the Naval Air Development Center, Attn: Code 60622, Warminster, PA 18974, (the activity responsible for testing) as designated in the letter of authorization (see 6.3).

Samples for qualification inspection  
 PRIMER COATINGS: EPOXY, VOC COMPLIANT AND SOLVENT RESISTANT  
 Manufacturer's designation  
 Name of manufacturer  
 Mixing and thinning instructions  
 Sample submitted by (name), (date) for qualification inspection  
 in accordance with the requirements of MIL-P-85582 and number  
 under authorization (reference authorizing letter and number)  
 (see 6.3).

4.3.2 Test report. In addition to the qualification test samples, the manufacturer shall furnish a test report showing that the material satisfactorily conforms to the requirements of this specification. Material safety data sheets shall be prepared in accordance with FED-STD-313 and submitted to the qualifying laboratory. In addition, the manufacturer shall submit a certificate to the qualifying laboratory indicating the absence of methylene chloride, trichloroethane, and trichlorotrifluoroethane from his formulation.

4.3.3 Retention of qualification. In order to retain qualification of products approved for listing on the Qualified Products List (QPL), the manufacturer shall verify by certification to the qualifying activity that his product(s) comply with the requirements of this specification. Unless otherwise specified by the qualifying activity, the time of periodic verification by certification shall be in two-year intervals from the date of original qualification.

4.4 Quality conformance inspection. The quality conformance inspection shall consist of all the requirements and tests specified in table II, with the exception of storage stability (3.5.9) and corrosion resistance (3.7.2 and 3.7.3).

4.4.1 Sampling. In addition to quantities required by the acquisitioning activity for testing, at least one quart kit of the coating material shall be selected at random from each batch by an authorized Government representative and forwarded to the Naval Air Development Center, Attn: Code 60622, Warminster, PA 18974 for retention and possible confirmation testing.

4.4.2 Batch data. Along with each sample, the manufacturer shall furnish a certified test report showing that the material satisfactorily conforms to the requirements of 3.3, 3.4.1, 3.4.2, (chromate only), 3.4.3, 3.4.4, 3.5 (except for 3.5.9), 3.6, 3.7 (except for 3.7.2 and 3.7.3) and 3.8.

4.4.2.1 Batch. A batch (bulk lot) is an indefinite quantity of a homogeneous mixture of material manufactured in a single operation.

4.4.3 Rejection and retest. Failure of any sample to meet any quality conformance test shall result in rejection of the batch represented and may constitute sufficient justification for removal of the product from the Qualified Products List. Rejected material shall not be resubmitted for acceptance without



prior approval from the Naval Air Development Center, Code 60622. The application for resubmission shall contain full particulars concerning previous rejections and measures taken to correct these deficiencies. Samples for retest shall be randomly selected as in 4.4.1 and forwarded to the testing activity.

**4.5 Test panels.** Panels shall be prepared under laboratory test conditions (see 4.6). With the exception of the flexibility test (4.6.6), wet adhesion test (4.6.7), and the filiform corrosion test (4.6.11), all panels used for test purposes shall be aluminum alloy conforming to QQ-A-250/4 (T3 temper), 0.020 by 3 by 6 inches in size, and shall be treated with materials meeting MIL-C-81706 to produce coatings conforming to MIL-C-5541.

**4.5.1 Application of primer.** The epoxy primer shall be prepared by first thoroughly mixing each of the components separately. The two components are then mixed in the volume ratio specified by the manufacturer and thinned with water according to the manufacturer's recommended procedure (water reducible primers only) to viscosity of approximately 20 seconds in a number 2 Zahn cup. Spray the panels with one cross-coat of the primer and air-dry for two hours. The dry film thickness shall be 0.0006 to 0.0009 inch. Whenever specified, apply the polyurethane topcoat as directed in 4.5.2. Allow at least seven days air dry before testing.

**4.5.2 Application of topcoat.** Admixed MIL-C-83286 polyurethane topcoat (untinted white gloss color, FED-STD-595 color 17925) shall be reduced with MIL-T-81772 thinner to a viscosity of 16 to 18 seconds in a number 2 Zahn cup and allowed to stand 30 minutes before using. Apply two full coats to a total dry film topcoat thickness of 0.0017 to 0.0023 inches. After application of the first coat, the panels shall be air dried at standard conditions until sufficiently dry (not to exceed one hour) before application of the second coat. The panels shall be allowed at least seven days air-dry before testing.

**4.6 Test methods.** The tests of this specification shall be conducted in accordance with table III and 4.6.1 through 4.6.13 with the test panels prepared as specified in 4.5. Ingredient materials submitted shall be tested to determine compliance with the applicable specification. Test conditions shall be as specified in the applicable test method or paragraph.

**4.6.1 Volatile organic compounds (VOC).** This method requires the use of unthinned, admixed primer in the proportions specified by the manufacturer. VOC shall be calculated as follows:

$$\text{VOC (in grams per liter)} = \frac{1 - \frac{X_M}{100} - \frac{W_{H_2O}}{100}}{\frac{1}{P_M} - \frac{W_{H_2O}}{100,000}}$$

Where:

$X_M$  = Solids content of the admixed primer in weight percent, determined in accordance with ASTM D2369-81, Procedure B.

$P_M$  = Density of admixed primer in grams per liter, determined in accordance with ASTM D1475.

$W_{H_2O}$  = Water content of the admixed primer in percent by weight, determined in accordance with ASTM D3729.

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4.6.2 Pigment composition.

4.6.2.1 Pigment content. The pigment content of the unthinned, admixed primer shall be calculated as follows:

$$\text{Percent pigment content} = \frac{y_A P_A}{100 P_M (1 + R)}$$

Where:

$y_A$  = Pigment content of component A in weight percent, determined in accordance with method 4021 of FED-STD-141 with the following exceptions:

- (1) The extracting solvent shall be either acetone (ACS reagent grade) or absolute ethyl alcohol (ACS reagent grade), whichever gives the lowest value of  $y_A$ , and
- (2) The extracted pigment shall be dried in a vacuum oven at  $105^\circ \pm 2^\circ\text{C}$  ( $221^\circ \pm 3.6^\circ\text{F}$ ) and no more than 10 mm Hg for two hours.

$P_A$  = Density of component A in grams per liter, determined in accordance with ASTM D 1475.

$P_M$  = Density of admixed primer as determined in 4.6.1, and

$R$  = Volumetric mixing ratio (as specified by the manufacturer for preparation of the admixed primer),

$$\frac{\text{volume of component B}}{\text{volume of component A}}$$

4.6.2.2 CrO<sub>3</sub> content.4.6.2.2.1 Reagents.

- a. Hydrochloric acid (1:5). Mix 1 volume of concentrated hydrochloric acid (HCl sp. gr. 1.19) with 5 volumes of water.
- b. Potassium iodide solution (150 g per liter). Dissolve 150 g of potassium iodide (KI) in water and dilute to 1 liter.

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- c. Sodium thiosulfate, standard solution (0.1N). Dissolve 24.8 g of sodium thiosulfate ( $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ ) in water and dilute to 1 liter. Standardize against potassium dichromate ( $\text{K}_2\text{Cr}_2\text{O}_7$ )<sup>1/</sup> as follows: Weigh to the nearest 0.1 mg by difference from a weighing bottle 0.16 to 0.22 g of  $\text{K}_2\text{Cr}_2\text{O}_7$  that has been finely ground and then dried to constant weight at 110°C (230°F) prior to use. Place the  $\text{K}_2\text{Cr}_2\text{O}_7$  in a 500 ml flask or bottle and dissolve in 25 ml of water. Add 5ml of HCl and 20 ml of KI solution and rotate to mix. Allow to stand for 5 minutes and then add 100 ml of water. Titrate with the  $\text{Na}_2\text{S}_2\text{O}_3$  solution, while shaking constantly, until the yellow color has almost disappeared. Add 1 to 2 ml of starch indicator solution and continue the titration, adding the  $\text{Na}_2\text{S}_2\text{O}_3$  solution slowly until the blue color has just disappeared. Calculate the normality of the  $\text{Na}_2\text{S}_2\text{O}_3$  solution as follows:

$$\text{Normality} = \frac{A \times 20.39}{B}$$

Where:

A = Grams (g) of  $\text{K}_2\text{Cr}_2\text{O}_7$  used, and

B = Milliliters (ml) of the  $\text{Na}_2\text{S}_2\text{O}_3$  solution required for titration of the  $\text{K}_2\text{Cr}_2\text{O}_7$ .

<sup>1/</sup> National Bureau of Standards sample number 136 of  $\text{K}_2\text{Cr}_2\text{O}_7$  is recommended for this purpose and should be treated as directed in the certificate of analysis accompanying the standard sample.

- d. Starch indicator solution. Mix 4 g of soluble starch in 50 ml of water with constant stirring. Stir until the paste is uniform. Then pour the paste into 500 ml of boiling water with constant stirring. Boil for 2 minutes, stir, and dilute to 1 liter with water.

#### 4.6.2.2.2 Procedure.

- a. Weigh accurately approximately 0.2 g of the sample from the total pigment determination (4.6.2.1) into a 250 ml iodine flask. Add 50 ml of water and 50 ml of HCl (1:5); and swirl the flask for about 5 minutes. Add 20 ml of KI solution and allow the solution to stand for several minutes.
- b. Titrate the liberated iodine with 0.1N  $\text{Na}_2\text{S}_2\text{O}_3$  solution until the reddish brown iodine color becomes faint. Add 1 ml of starch solution and continue the titration cautiously to the end point which is easily discernible when the color changes from blue to a light green with no blue tinge.

4.6.2.2.3 Calculation. Calculate the  $\text{CrO}_3$  content of the pigment as follows:

$$\text{Percent CrO}_3 \text{ content} = \frac{3.334 AB}{C}$$

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Where:

A = Volume of  $\text{Na}_2\text{S}_2\text{O}_3$  solution (in milliliters) required for titration of the sample,

B = Normality of the  $\text{Na}_2\text{S}_2\text{O}_3$  solution, and

C = Weight of sample (in grams).

#### 4.6.2.3 Extender content.

##### 4.6.2.3.1 Reagents.

- a. Ethanol (95 percent).
- b. Hydrochloric acid (1:1). Mix one volume of ACS reagent grade hydrochloric acid (12N) with one volume of distilled water.
- c. Sulfuric acid (ACS reagent grade).

4.6.2.3.2 Procedure. Weigh about one gram (to the nearest 0.1 milligram) of the extracted pigment of 4.6.2.1 into a 250 ml beaker. Wet the sample with a few drops of 95 percent ethanol and add 40 ml of hydrochloric acid (1:1). Cover the beaker with a watchglass and boil over a bunsen burner for 5 to 10 minutes. Remove from the heat and suction filter the contents of the beaker through a pre-weighed glass filtering crucible (1/). Transfer the crucible and contents to the original beaker, add 50 ml of concentrated sulfuric acid, cover with a watchglass and boil for an additional 5 to 10 minutes while rotating the crucible to remove solubles. Remove the crucible and wash it completely with distilled water, collecting the rinsings in a second beaker. Filter the contents of the original beaker through the crucible and wash the solids with 50 ml of concentrated sulfuric acid. Filter the contents of the second beaker and wash the solids with distilled water until neutral to litmus paper. Dry the crucible to constant weight in a 150°C (302°F) oven.

1/ Gooch type, ASTM 10-15 M crucible.

4.6.2.3.3 Calculation. Calculate the percentage of extending pigment as follows:

$$\text{Percent} = \frac{A - B}{C} \times 100$$

Where:

A = Weight of crucible and contents

B = Weight of crucible alone

C = Weight of solid residue sample

4.6.3 Viscosity. A number 2 Zahn cup shall be vertically submerged within the admixed coating and then raised above the fluid surface, to allow the contents of the cup to drain through the bottom orifice. The viscosity is recorded as the time interval, in seconds, beginning when the rim of the cup clears the liquid and ending when the flow of the liquid from the cup first breaks from a continuous stream.

4.6.4 Surface appearance. The primer film on a panel prepared as specified in 4.5, without a topcoat, shall be examined for conformance to 3.6.1.

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4.6.5 Lifting. Primed panels, prepared as in 4.5, shall be topcoated as specified in 4.5.2 after 1, 4 and 18 hours air-dry for the primer. Examine the panels for conformance to 3.6.4.

4.6.6 Flexibility. The test panels shall be aluminum alloy conforming to QQ-A-250/4 (O temper) and anodized in accordance with MIL-A-8625, Type II. They shall be 0.020 by 3 by 6 inches in size and shall be primed as described in 4.5 with and without a topcoat. Testing shall be conducted in accordance with method 6226 of FED-STD-141. Ten power magnification shall be used to detect surface cracking (see 3.6.7).

4.6.7 Wet adhesion. Test panels (listed in table IV), prepared as directed in 4.5, shall be immersed for 4 days in distilled water at 49°C (120°F), removed, dried with absorbent paper tissue and tested within 3 minutes for tape adhesion (see 3.6.6 and 4.6).

4.6.7.1 Water resistance. Immediately after the wet adhesion test of 4.6.7, test panels shall be examined for softening, wrinkling, blistering and any other visual coating deficiencies.

4.6.8 Strippability. Primed panels, prepared as in 4.5 without a topcoat, shall be placed on a rack at a 60° angle with the horizontal. The test shall be performed in a well ventilated area maintained at room temperature. Just enough of MIL-R-81294 paint remover shall be poured along the upper edge of each panel to completely cover the primer surface. After 15 minutes exposure time, the loosened film shall be brushed off and the panels rinsed with brushing under a stream of cool water. The amount of primer removed in this manner is determined by the percentage of substrate surface area exposed (see 3.6.8).

4.6.9 Infrared test. Panels prepared in accordance with 4.5, without topcoat, shall have IR measured relative to magnesium oxide using a Beckman DK-2 spectrophotometer (or equivalent) over a range of 450 to 2700 millimicrons (see 3.6.9).

4.6.10 Corrosion resistance (salt spray). The test panels shall be primed as directed in 4.5. Two intersecting lines shall be scribed across the surface of each panel so that the bare substrate is exposed. The panels shall then be placed in a 5 percent salt-spray cabinet for 1,000 hours as described in ASTM B 117 and examined for conformance to 3.7.2.

4.6.11 Corrosion resistance (filiform). The test panels shall be aluminum alloy conforming to QQ-A-250/5 (T3 temper), 0.020 by 3 by 6 inches in size and shall be treated with materials meeting class IA, method C (immersion), form I of MIL-C-81706 to produce coatings conforming to MIL-C-5541. They shall be primed and topcoated as directed in 4.5. Two intersecting lines shall be scribed across the surface of each panel and shall penetrate through the clad and into the base metal. The panels shall then be placed in a desiccator containing 12 normal hydrochloric acid for one hour at 24° + 3°C (75° + 5°F). The panels shall then be thoroughly rinsed with distilled water and placed, while still wet, in a humidity cabinet maintained at 25° + 1.7°C (77° + 3°F) and 85 + 2 percent relative humidity for a period of 500 hours. The panels shall then be examined for conformance to 3.7.3. A description of this test method is available in ASTM D 2803. Filiform corrosion will be observed as threadlike filaments initiating from the exposed substrate area and spreading underneath the coating film.

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4.6.12 Fluid resistance. Panels, prepared as directed in 4.5 without a top-coat, shall be immersed for 24 hours in MIL-L-23699 lubricating oil that has been heated to  $121^{\circ} + 3^{\circ}\text{C}$  ( $250^{\circ} + 5^{\circ}\text{F}$ ). The panels shall then be allowed to cool to room temperature and examined for conformance to the requirements of 3.7.4. This test shall be repeated using MIL-H-5606 hydraulic fluid at  $66^{\circ} + 3^{\circ}\text{C}$  ( $150^{\circ} + 5^{\circ}\text{F}$ ) and MIL-H83282 hydraulic fluid at  $66^{\circ} + 3^{\circ}\text{C}$  ( $150^{\circ} + 5^{\circ}\text{F}$ ).

4.6.13 Working properties. Stir component A until completely uniform. Mix component A with component B in the volume ratio specified by the manufacturer and examine for conformance to the requirements of 3.8.1. Thin as specified by the manufacturer to a spray viscosity of 20 seconds in a number 2 Zahn cup. Examine for conformance to the requirements of 3.8.2.

## 5. PACKAGING

5.1 Packaging and packing. The primer coatings shall be packaged, packed and marked in accordance with PPP-P-1892. The level of preservation shall be A or C and the level of packing shall be A, B or C as specified (see 6.2.1). The size of the containers shall also be as specified (see 6.2.1). The size of the containers in one kit need not be the same size.

5.2 Marking and labeling. In addition to the marking specified in PPP-P-1892, individual cans and containers (see 5.2.1) shall bear a printed label (all printed labels shall be overcoated with a clear coating for weatherproofing) showing the following nomenclature and information, as applicable:

## Component Identification

Component A-Pigmented base component

Component B-Curing component

Specification MIL-P-85582, Type I or Type II  
(as applicable)

Name of Manufacturer and Product Designation

Date of Manufacture by Month and Year

Batch Number/Net Contents

VOC Content (in grams per liter)

Mixing and Thinning Instructions

Precautions

- a. The surface to be primed must be absolutely clean and free of oil, dust, etc.
- b. Equipment must be adequately grounded. Clean spray equipment immediately after use.
- c. Mix only that amount to be used in 6 hours.
- d. The primer from one vendor, or component thereof, shall never be mixed with that of another vendor.
- e. Apply over pretreated metal. On fiberglass-reinforced plastic surfaces, a prior coat of MIL-C-8514 pretreatment coating will facilitate stripping without damage to the fiberglass.

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5.2.1 Precautionary marking. Unit, intermediate and shipping containers shall contain the following precautionary marking: "WARNING! Contains flammable volatile solvent." Shipping containers shall be marked in accordance with Department of Transportation regulations as specified in 49 CFR 171-178 and shall bear the "Flammable Liquid" red label as specified therein.

## 6. NOTES

6.1 Intended use. The coatings covered by this specification are intended for use on metal surfaces as corrosion-inhibitive, chemical resistant, strippable, epoxy primers that are equivalent to MIL-P-23377 primers and compatible with MIL-C-85285, MIL-C-46168, and MIL-C-83286 polyurethane topcoats. Compatibility with other topcoats should be tested prior to use. Type II primer is intended for use where low infrared reflectance is required.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. Classification (Type I or II) (see 1.2).
- c. Type and size of containers required (see 5.1).
- d. Quantity (see 5.1).
- e. Level of preservation and packing (see 5.1).
- f. Special marking (see 5.2).
- g. Toxicological data requirements (see 3.3 and 4.3.2).
- h. Quantity of test samples required for quality conformance testing (see 4.4.1).

6.2.2 Basis of purchase. The primers covered by this specification should be purchased by volume, the unit being a kit comprised of 1 quart of 57.75 cubic inches or 1 gallon of 231 cubic inches. The kit components need not be the same size.

6.2.3 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of DAR 7-104.9 (n) (2) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraphs.



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| <u>Paragraph no.</u> | <u>Data requirements</u>      | <u>Applicable DID no.</u> |
|----------------------|-------------------------------|---------------------------|
| 3.3                  | List toxic/dangerous material | UDI-R-23584               |
| 4.4.2                | Test/inspection report        | UDI-T-23473               |

(Copies of data item descriptions required by contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center as directed by the contracting officer.)

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-85582) 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 Commander, Naval Air Systems Command (AIR-5304), Washington, DC 20361; however, information pertaining to qualification of products and letter of authorization for submittal of sample may be obtained from the Commander, Naval Air Development Center, Aircraft and Crew Systems Technology Directorate, Attn: Code 60622, Warminster, PA 18974.

6.3.1 Deviations. It is understood that the material furnished under this specification subsequent to final approval shall be of the same composition and shall be equal to products upon which approval was originally granted. In the event that the primer furnished under contract is found to deviate from the composition of the approved product, or that the product fails to perform satisfactorily, approval of such products will be subjected to immediate withdrawal from the Qualified Products List.

6.4 Chromate pigments. Some chromate pigments cause blistering in the water resistance test 4.6.7 (see 3.4.2).

Custodians:  
 Army - ME  
 Navy - AS  
 Air Force - 20

Preparing activity:  
 Navy - AS

(Project 8010-N239)

Review activities:  
 Army - AR, MI  
 Navy - OS  
 DLA - DS

User activities:  
 Army - AV, EL  
 Navy - SH

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TABLE I. Pigment Composition.

| Material                                        | Requirement<br>(percent by weight) |      |         |      |
|-------------------------------------------------|------------------------------------|------|---------|------|
|                                                 | Type I                             |      | Type II |      |
|                                                 | Min.                               | Max. | Min.    | Max. |
| Chromate pigment (CrO <sub>3</sub> content)     | 15.7                               | -    | 15.7    | -    |
| Titanium dioxide                                | 13                                 | -    | -       | -    |
| Siliceous extenders and<br>anti-settling agents | -                                  | 46   | -       | 46   |
| Coloring pigments                               | -                                  | -    | -       | 16   |

TABLE II. Qualification inspection.

| Inspection Requirement            | Requirement<br>paragraph   | Test Method<br>paragraph |
|-----------------------------------|----------------------------|--------------------------|
| Lead content                      | 3.3.1                      | 4.6                      |
| Water content                     | 3.4.1                      | 4.6                      |
| Volatile organic compound content | 3.4.1                      | 4.6.1                    |
| Density                           | 3.4.1, 3.4.2               | 4.6                      |
| Pigment content                   | 3.4.2                      | 4.6, 4.6.2               |
| Solids                            | 3.4.1, 3.4.2, 3.4.3, 3.5.5 | 4.6                      |
| Thinner                           | 3.4.4                      | -                        |
| Titanium dioxide                  | 3.4.2                      | 4.6                      |
| Color                             | 3.5.1                      | 4.6                      |
| Odor                              | 3.5.2                      | 4.6                      |
| Fineness of grind                 | 3.5.3                      | 4.6                      |
| Pot life                          | 3.5.4                      | 4.6.3                    |
| Condition in container            | 3.5.6                      | -                        |
| Solids at application viscosity   | 3.5.5                      | 4.6                      |
| Storage stability                 | 3.5.9                      | 4.6                      |
| Accelerated storage stability     | 3.5.7                      | 4.6                      |
| Freeze-thaw stability             | 3.5.8                      | 4.6                      |
| Storage stability                 | 3.5.9                      | 4.6                      |
| Surface appearance                | 3.6.1                      | 4.6.4                    |
| Drying time                       | 3.6.2                      | 4.6                      |
| Specular gloss                    | 3.6.3                      | 4.6                      |
| Lifting                           | 3.6.4                      | 4.6.5                    |
| Dry adhesion                      | 3.6.5                      | 4.6                      |
| Wet adhesion                      | 3.6.6                      | 4.6.7                    |
| Flexibility                       | 3.6.7                      | 4.6                      |
| Low-temperature flexibility       | 3.6.7.1                    | 4.6                      |
| Strippability                     | 3.6.8                      | 4.6.8                    |
| Infrared reflectance              | 3.6.9                      | 4.6.9                    |
| Water resistance                  | 3.7.1                      | 4.6.7.1                  |
| Corrosion resistance (salt spray) | 3.7.2                      | 4.6.10                   |
| Corrosion resistance (filiform)   | 3.7.3                      | 4.6.11                   |
| Fluid resistance                  | 3.7.4                      | 4.6.12                   |
| Working properties                | 3.8                        | 4.6.13                   |

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TABLE III. Test methods.

| Requirement paragraph | Tests                                   | Method      |        |
|-----------------------|-----------------------------------------|-------------|--------|
|                       |                                         | FED-STD-141 | ASTM   |
| 3.3.1                 | Lead Content                            | -           | D 3335 |
| 3.4.1                 | Water content                           | -           | D 3792 |
| 3.4.1, 3.4.2          | Density                                 | -           | D 1475 |
| 3.4.1,.2,.3, 3.5.5    | Solids                                  | -           | D 2369 |
| 3.4.2                 | Pigment content <u>1/</u>               | 4021        | -      |
| 3.4.2                 | Titanium dioxide                        | -           | D 476  |
| 3.4.4.1               | Water                                   | -           | D 1193 |
| 3.5.1                 | Color                                   | -           | D 1729 |
| 3.5.2                 | Odor                                    | -           | D 1296 |
| 3.5.3                 | Fineness of grind                       | -           | D 1210 |
| 3.5.6                 | Condition in container                  | 3011        | -      |
| 3.5.7                 | Accelerated storage stability <u>2/</u> | -           | D 1849 |
| 3.5.8                 | Freeze-thaw stability                   | -           | D 2243 |
| 3.5.9                 | Storage stability <u>3/</u>             | -           | D 1849 |
| 3.6.2                 | Drying time                             | -           | D 1640 |
| 3.6.3                 | Specular gloss                          | -           | D 523  |
| 3.6.5                 | Dry adhesion (parallel groove)          | -           | D 2197 |
| 3.6.6                 | Wet adhesion (tape test)                | 6301        | -      |
| 3.6.7                 | Flexibility                             | 6226        | -      |
| 3.6.7.1               | Low-temperature flexibility             | 6221        | -      |

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TABLE III. Test methods. - Continued

| Requirement paragraph | Tests                                       | Method      |        |
|-----------------------|---------------------------------------------|-------------|--------|
|                       |                                             | FED-STD-141 | ASTM   |
| 3.7.2                 | Corrosion resistance (salt spray) <u>4/</u> | -           | B 117  |
| 3.7.3                 | Corrosion resistance (filiform)             | -           | D 2803 |

1/ See 4.6.2.1.

2/ Store at  $60^{\circ} \pm 2.7^{\circ}\text{C}$  ( $140^{\circ} \pm 5^{\circ}\text{F}$ ).

3/ The daily temperature of the ambient air at the storage location shall fall within the range of  $1.7^{\circ} - 46^{\circ}\text{C}$  ( $35^{\circ} - 115^{\circ}\text{F}$ ).

4/ See 4.6.10.

TABLE IV. Wet adhesion test panels.

| Panel | Substrate                    | Pretreatment                        | Primer | Topcoat |
|-------|------------------------------|-------------------------------------|--------|---------|
| A     | QQ-A-250/4<br>(2024-T3)      | Treated to<br>MIL-C-5541            | X      | X       |
| B     | QQ-A-250/5<br>(Clad 2024-T3) | Deoxidized                          | X      |         |
| C     | QQ-A-250/5<br>(Clad 2024-T3) | Anodized to<br>MIL-A-8625, Type II  | X      |         |
| D     | QQ-M-44<br>(AZ31B)           | Treated to<br>MIL-M-3171, Type VIII | X      |         |
| E     | MIL-T-9046                   | Pickled <u>1/</u>                   | X      |         |

1/ Pickle 1-2 minutes in a  $49^{\circ}\text{C}$  ( $120^{\circ}\text{F}$ ) aqueous solution 45 ounces/gallon of nitric acid (O-N-350) and 2.8 ounces/gallon of hydrofluoric acid (O-H-795).

