

NOT MEASUREMENT SENSITIVE

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SUPERSEDING  
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MILITARY SPECIFICATION

PRIMER COATINGS: EPOXY, 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 two-component, epoxy, chemical and solvent-resistant primer coatings formulated primarily for application by various spray techniques. They shall be compatible with epoxy and polyurethane topcoats. The primer shall be furnished as a kit.

1.2 Classification. The epoxy primer coatings shall be furnished in the following types and classes as specified:

Type I	Standard pigments
Type II	Low Infrared Reflective pigments
Class 1	Standard solvents
Class 2	High-Solids (340 g/l maximum VOC content)
Class 3	Exempt solvent (340 g/l maximum VOC content)

Unless otherwise specified, the classification will be Type I. Class 3 of either Type I or II is not approved for Air Force use.

1.2.1 Kit size. The primers covered by this specification should be purchased by volume as a kit. Each kit shall consist of Component A (base) and Component B (activator) packaged in separate containers to produce admixed coatings of the kit sizes stated below (see 3.4).

<u>Kit Size</u>	<u>Part Number Designation</u>
1 pint (0.473L)	001P
1 quart (0.945L)	001Q
2 quart (1.89 L)	002Q
2 gallon (7.57 L)	002G
10 gallon (37.85 L)	010G

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Systems Engineering and Standardization Department (Code 53), 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.

## 2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents 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 6.2).

## SPECIFICATIONS

## FEDERAL

QQ-A-250/4	Aluminum Alloy 2024, Plate and Sheet
QQ-A-250/5	Aluminum Alloy Alclad 2024, Plate and Sheet
QQ-A-250/12	Aluminum Alloy 7075, Plate and Sheet
PPP-P-1892	Paint, Varnish, Lacquer and Related Materials; Packaging, Packing and Marking

## MILITARY

MIL-C-5541	Chemical Conversion Coatings on Aluminum and Aluminum Alloys
MIL-C-8514	Coating Compound, Metal Pretreatment, Resin-Acid
MIL-A-8625	Anodic Coatings for Aluminum and Aluminum Alloys
MIL-L-23699	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-R-81294	Remover, Paint, Epoxy, Polysulfide 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, NATO Code Number H-537
MIL-C-83286	Coating, Urethane, Aliphatic Isocyanate, for Aerospace Applications
MIL-C-85285	Coating, Polyurethane, High Solids

## STANDARDS

## FEDERAL

FED-STD-141	Paint, Varnish, Lacquer and Related Materials; Method of Inspection, Sampling and Testing
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## FEDERAL (Continued)

FED-STD-313	Material Safety Data Sheet, Preparation and Submission of
FED-STD-595	Colors

## MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
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(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN:NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

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

## CODE OF FEDERAL REGULATIONS

29 CFR 1910.1200	Material Safety Data Sheet; Preparation and Submission of
49 CFR 171-178	Regulations for the Transportation of Hazardous Materials.

(Application for copies of the Code of Federal Regulations (CFR) should be addressed to the Superintendent of Documents, U.S. 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 are DoD adopted shall be 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 6.2).

## AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI Z 129.1	Precautionary Labeling of Hazardous Industrial Chemicals.
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(Application for copies should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018)

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 117	Salt Spray (Fog) Testing
ASTM D 476	Titanium Dioxide Pigments, Specification for
ASTM D 1200	Viscosity of Paints, Varnishes and Lacquers by Ford Viscosity Cup
ASTM D 1210	Fineness of Dispersion of Pigment - Vehicle Systems
ASTM D 1296	Odor of Volatile Solvents and Diluents
ASTM D 1544	Color of Transparent Liquids (Gardner Color Scale)
ASTM D 1640	Drying, Curing, or Film Formation of Organic Coatings at Room Temperature
ASTM D 1845	Chemical Analysis of Strontium Chromate Pigment
ASTM D 2803	Filliform Corrosion Resistance of Organic Coatings on Metal
ASTM D 3335	Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy.
ASTM D 3960	Volatile Organic Content (VOC) of Paints and Related Coatings
ASTM F 151	Residual Solvents in Flexible Barrier Materials

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

(Nongovernment standards and other publications are normally available from the organizations which 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 document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 Qualification. The primers 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 set for opening of bids (see 4.4 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 product receiving qualification.

3.2 Material. Materials specified herein, shall be of such a quality as to produce products conforming to the requirements of this specification.

3.3 Toxicity. A Material Safety Data Sheet shall be prepared and submitted in accordance with FED-STD-313 and shall meet the requirements of 29 CFR 1910.1200. One copy shall accompany the samples being submitted to the Qualifying activity for testing (see 4.4.1). Questions pertinent to the effect of these primer coatings 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 adviser to the acquiring activity

(See 4.4.2 and 6.2 (g)). The formulation of this coating shall preclude the use of lead (See 4.7).

3.4 Composition. The primers shall be furnished in two components. Component A shall contain epoxy resin, pigments and solvents. Component B shall contain the polyamide and/or amine resin and solvents and shall act as the curing agent for component A. When mixed in accordance with the manufacturer's instructions, a product meeting the applicable requirements of this specification shall result.

3.4.1 Pigment. The pigmented portion of Component A shall consist of the ingredients in the proportions by weight specified in Table I when tested according to 4.7 and 4.7.1.

TABLE I. Pigment Composition.

Material	Requirement (percent by weight)	
	Type I	Type II
Strontium chromate (min.) <u>1/</u>	52	42
Siliceous extenders, anti-settling agents and other additives (max.)	48	42
Coloring pigments (max.)	-	16

1/ Some strontium chromate pigments cause blistering in the water resistance test (3.8.1). The minimum requirement is based on 95 percent strontium chromate.

3.4.2 Volatile content. The solvents used in manufacturing and thinning prior to application shall conform to the following requirements by volume when tested as specified in 4.7. The resistivity of the solvents shall be suitable for electrostatic spray application. Class 1 primers shall contain solvents suitable for conventional air or airless spray application. Class 2 primers shall meet a maximum volatile organic compound (VOC) content of 340 g/l when tested as in 4.7 without the use of 1,1,1 - trichloroethane or other halogenated solvents. Class 3 primers shall contain an inhibited grade of 1,1,1-trichloroethane such as Dow Chemical's CHLOROTHENE SM or equivalent as the primary solvent, in order to meet the same VOC requirement.

3.4.3 Thinner. The admixed primers shall be compatible with any thinner meeting MIL-T-81772, Type II (for Class 1 and 2 primers) or 1,1,1-trichloroethane (for Class 3 primer). When reducing the Class 2 and 3 primers, do not exceed the maximum VOC content of 340 g/l in areas where air-pollution regulations are enforced.

3.5 Component requirements. Components A and B for Type I and II shall conform to the quantitative requirements of Table II when tested in accordance with the applicable portions of section 4.7, Table IV and 4.7.2.

TABLE II. Component Requirements.

Characteristics	Component A	Component B
Total pigment, percent by weight		
Class 1 and 2 (min.)	37	-
Class 3 (min.)	35	-
Fineness of grind (min.)	5	-
Color (Gardner) (max.)		9

3.5.1 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 mixed to a smooth, homogenous, pourable condition.

3.5.1.1 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 reincorporated by mixing when tested in accordance with 4.7.

3.5.1.2 Component B. Component B shall show no trace of particulate matter, either suspended in solution or settled on the inner surface of the container (which cannot be dispersed readily by agitation), when tested in accordance with 4.7.

### 3.6 Physical properties - Liquid.

3.6.1 Color. The color of the admixed primers shall be characteristic of commercial-grade strontium chromate (deep yellow) for Type I and dark green for Type II.

3.6.2 Odor. The odor of the epoxy 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 4.7.

3.6.3 Viscosity. The Class 1 or 3 primers (immediately after mixing with no thinner added) shall have a maximum viscosity of 22 seconds through a No. 4 Ford cup when tested in accordance with 4.7. The Class 2 primer (immediately after mixing with no thinner added) shall have a maximum viscosity of 40 seconds.

3.6.4 Pot life. The viscosity of the admixed Class 1 or 3 primers, when stored in a closed container, shall not exceed 30 seconds through a No. 4 Ford cup after 8 hours at room temperature in accordance with 4.7. The Class 2 primer should not exceed a maximum viscosity of 70 seconds after 4 hours.

3.6.5 Total solids. The total solids (including pigment) of the admixed primers, in percent by weight, shall be a minimum of 42 for Class 1, 65 for Class 2, or 38 for Class 3 when tested in accordance with 4.7 and 4.7.2.1.

3.6.6. Storage stability. The product, as packaged by the manufacturer, shall meet all the requirements specified herein for a period of one year when tested in accordance with 4.7.

3.6.7. Accelerated storage stability. The product, as packaged by the manufacturer, shall meet all the requirements specified herein after 7 days when tested in accordance with 4.7.

### 3.7 Physical properties - Film.

3.7.1 Surface appearance. The admixed primer, when reduced with thinner, shall spray satisfactorily with no sagging, running, or streaking. The dried film shall be free from grit, seeds, craters, blisters, and other surface irregularities (see 4.7.3).

3.7.2 Drying time. The applied Class 1 or 3 coating shall be tack-free within 1 hour and shall be dry-hard within 6 hours (see 4.7). The Class 2 coating shall be tack-free within 5 hours and shall be dry-hard within 8 hours.

3.7.3 Lifting. There shall be no evidence of lifting or any other film irregularity upon applying a polyurethane topcoat after the epoxy-polyamide primer has air dried for 5 hours (see 4.7.4).

3.7.4 Solvent retention. After curing for seven days at room temperature, the Class 3 primer film shall retain no more than one percent of the original solvent content (see 4.7.5).

3.7.5 Adhesion. When tested as specified in 4.7, the primer film shall not peel away from the substrate after 24 hours immersion in water.

3.7.6 Flexibility. The primer film shall exhibit a minimum impact elongation of 10 percent at room temperature when tested as in 4.7.6.

3.7.7 Strippability. At least 90 percent of the primer film shall be stripped with the use of MIL-R-81294, Type I, Class 1 paint remover in 60 minutes at room temperature when tested as specified in 4.7.7.

3.7.8 Infrared reflectance (Type II only). The maximum total reflectance (specular and diffuse) shall be less than 10 percent throughout the range of 450 to 2700 nanometers when tested in accordance with 4.7.8.

### 3.8 Resistance properties.

3.8.1 Water resistance. The primer film, when topcoated and tested as in 4.7.9, shall withstand 4 days immersion in distilled water at a temperature of  $49^{\circ} \pm 3^{\circ}\text{C}$  ( $120 \pm 5^{\circ}\text{F}$ ) without showing any softening, wrinkling, blistering, or any other coating deficiency (see 4.7.9).

#### 3.8.2 Corrosion resistance.

3.8.2.1 Salt spray test. When the primer film is tested as specified in 4.7.10, it shall exhibit no blistering, lifting of the coating system, or substrate corrosion after exposure to salt spray. In addition, the primer film (when applied to the aluminum/graphite-epoxy test specimen) shall exhibit no pitting greater than one millimeter in depth after exposure to salt-spray.

3.8.2.2 Filiform test. The primer film, when topcoated and tested as in 4.7.11, shall exhibit no filiform corrosion extending more than 1/4 inch from the scribe lines. A majority of the filaments shall be less than 1/8 inch in length.

3.8.3 Solvent resistance. The primer film shall withstand repeated rubbing by a cloth rag soaked in methyl ethyl ketone solvent without removal when tested as in 4.7.12.

3.8.4 Fluid resistance. The primer film shall withstand 24 hours immersion in MIL-L-23699 lubricating oil at  $121 \pm 3^{\circ}\text{C}$  ( $250 \pm 5^{\circ}\text{F}$ ) and MIL-H-83282 hydraulic fluid at  $66 \pm 3^{\circ}\text{C}$  ( $150 \pm 5^{\circ}\text{F}$ ) 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 4.7.13).

### 3.9 Working properties.

3.9.1 Mixing. Component A and Component B shall easily blend together to a smooth homogenous product (see 4.7.14).

3.9.2 Dilution. When the admixed primer is diluted with MIL-T-81772, Type II (for Class 1 or 2 primers) or 1,1,1 - trichloroethane (for Class 3 primer) thinner, there shall be no evidence of incompatibility; and the material shall be suitable for spray application. The primer shall not separate into visually distinct layers one hour after dilution (see 4.7.14). When reducing the Class 2 and 3 primers, do not exceed the maximum VOC content of 340 g/l in areas where air-pollution regulations are enforced.

3.9.3 Application. When admixed and reduced for spraying the primer shall be homogeneous; and, when sprayed using conventional, airless or electrostatic equipment, shall yield a smooth, uniform film with no runs or sags (see 4.7.14) at a dry-film thickness of 0.0006 to 0.0009 inches (0.6 to 0.9 mils).

## 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 the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of section 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 Source inspection. Materials procured by the Government under this specification must be source inspected, so that there is assurance that the material meets the quality conformance tests (see 4.5) prior to it leaving the manufacturer's plant.

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

- a. Qualification inspection (see 4.4).
- b. Quality conformance inspection (see 4.5).

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the test method document or the applicable paragraph of this specification.

4.4 Qualification inspection. Qualification inspection shall consist of all the tests specified in Section 3.

4.4.1 Qualification samples. The test samples shall consist of at least one quart of each component 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 laboratory designated in the letter of authorization (see 6.3).

- Qualification test samples
- Specification MIL-P-23377F Type I or II and Class 1,2 or 3 (as applicable).
- Primer Coating; Epoxy, Chemical and Solvent Resistant.
- Manufacturer's name and product number.
- Submitted by (name and date) for qualification testing in accordance with authorization (reference authorizing letter).

4.4.2 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. The manufacturer shall furnish to the contracting activity the toxicological data and formulations required to evaluate the safety of the material for the proposed use through the submission of the Material Safety Data Sheet detailed in FED-STD-313 and 29 CFR 1910.1200.

4.4.3 Retention of qualification. In order to obtain 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. The certification action shall be initiated by the qualifying activity.

#### 4.5 Quality conformance inspection.

4.5.1 Batch. A batch shall consist of all coating material manufactured during one continuous operation and forming one component of the primer.

4.5.2 Sampling Plans. Unless otherwise specified in the acquisition requirements (see 6.2.1 (d)), all sampling plans shall be as stated in the following paragraphs.

4.5.3 Physical property testing. At least one quart of the product shall be randomly sampled from each batch and all the tests specified in Section 3 with the exception of storage stability (3.6.6), accelerated storage stability (3.6.7), strippability (3.7.7) and corrosion resistance (3.8.2) shall be performed. Failure 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 (QPL) (see 4.1.1).

4.5.3.1 Retest of rejected material. Rejected material shall not be resubmitted for acceptance without prior approval from the Naval Air Development Center. 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 and forwarded to the testing activity.

4.5.4 Examination of packaging and marking. An examination shall be made to determine that packaging, packing and marking comply with the requirements of Section 5 of this specification. Defects shall be scored in accordance with the list below. The sample unit for this examination shall be one shipping container fully prepared for delivery except that it shall not be palletized and need not be sealed. Shipping containers fully prepared for delivery that have not been palletized shall be examined for defects of closure. The batch size shall be the number of shipping containers in the end item inspection lot. The samples for this examination shall be selected at random (see 6.9).

#### Examine

#### Defect

Packaging

Container not as specified, closures not accomplished by specified or required methods or materials.

Leakage or seepage of contents. Non-conforming component, component missing, damaged or otherwise defective. Bulged or distorted container.

Markings

Data, including directions for use, omitted, illegible, incorrect, incomplete, or not in accordance with contract requirements.

4.5.5 Examination for palletization. An examination shall be made to determine that palletization complies with the requirements of Section 5 of this specification. Defects shall be scored in accordance with the list below. The sample unit shall be one palletized unit load fully prepared for delivery. The batch size shall be the number of palletized unit loads in the end item inspection lot. The samples for this examination shall be selected at random (see 6.10).

<u>Examine</u>	<u>Defect</u>
Finished dimension	Length, width, or height exceeds specified maximum requirement.
Palletization	Not as specified. Pallet pattern not as specified. Interlocking of loads not as specified. Load not bonded with required straps as specified.
Weight	Exceeds maximum load limits.
Marking	Omitted, incorrect, illegible, of improper size, location, sequence or method of application.

4.6 Test panels. Panels shall be prepared under laboratory test conditions (see 4.6). With the exception of the composite specimens used in the salt-spray test (see 3.8.2.1), all panels used for test purposes shall be aluminum 0.020 by 3 by 6 inches (.51 by 76 by 152.4 mm) in size composed of the alloys and pretreatments listed in Table III.

TABLE III. Aluminum Test Panels.

Panel	Substrate	Pretreatment
A	QQ-A-250/4(T3 temper)	MIL-C-5541, Class 1A conversion coating <u>1/</u>
B	QQ-A-250/4 (0 temper)	MIL-A-8625, Type I anodize
C	QQ-A-250/5(T3 temper)	Deoxidized <u>2/</u>
D	QQ-A-250/5(T3 temper)	MIL-C-5541, Class 1A conversion coating <u>1/</u>

1/ Use materials meeting Class 1A, Form I, Method C of MIL-C-81706.

2/ Immerse panel for 15 seconds in solution made by dissolving one pound of Allied-Kelite ISOPREP 188 or equivalent in one gallon of distilled water.

4.6.1 Application of primer. The epoxy primer shall be prepared by first thoroughly mixing each of the components separately. Component B is then slowly poured into Component A with constant stirring until the volume ratio specified by the manufacturer is attained. Thin the admixed primer with MIL-T-81772, Type II (for Class 1 and 2 primers) or 1,1,1 - trichloroethane (for Class 3 primer) thinner. When reducing Class 2 and 3 primers, do not exceed the maximum VOC content of 340 g/l. Mix thoroughly and allow to stand 30 minutes before using. Spray the panels with one cross-coat of the primer and air-dry for at least one hour (for Class 1 and 3 primers) or five hours (for Class 2 primers). The dry-film thickness shall be 0.0006 to 0.0009 inches (0.6 to 0.9 mils). Whenever specified, apply the polyurethane topcoat within 24 hours as directed in 4.6.2. Allow at least seven days air-dry or 24 hours at  $50 \pm 3^{\circ}\text{C}$  ( $122^{\circ} \pm 5^{\circ}\text{F}$ ) before testing. Air-dry for one hour before exposure to elevated temperatures.

4.6.2 Application of topcoat. Admixed polyurethane topcoat, either MIL-C-85285 or MIL-C-83286 ( FED-STD-595 Color 17925 (Gloss White)), shall be reduced with MIL-T-81772, Type I thinner 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 (1.7 to 2.3 mils). After application of the first coat, the panels shall be air-dried at standard conditions no more than one hour before application of the second coat. Allow at least seven days air-dry or 24 hours at  $50 \pm 3^{\circ}\text{C}$  ( $122 \pm 5^{\circ}\text{F}$ ) before testing. Air-dry for one hour before exposure to elevated temperatures.

4.7 Test methods. The tests of this specification shall be conducted in accordance with Table IV and paragraphs 4.7.1 through 4.7.15 and the panels used prepared as specified in 4.6. 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.

#### 4.7.1 Pigment.

4.7.1.1 Strontium analysis. In order to determine that the chromate inhibitor contained in the pigmented portion of Component A is strontium chromate, the dried sample from the total pigment determination (4.7.2.2) shall be analyzed with an emission spectrograph in the "arc" condition. The spectra obtained shall be compared with that of a pigment blend known to meet Table I in a qualitative manner. The sample shall exhibit a line density equivalent to or better than the control at wavelengths of 2931.83° A and 3380.71°A.

#### 4.7.1.2 Chromate, total.

##### 4.7.1.2.1 Reagents.

- a. Sulfuric Acid,  $\text{H}_2\text{SO}_4$ , concentrated (98%).
- b. Hydrogen Peroxide,  $\text{H}_2\text{O}_2$ , 30%.
- c. Deionized water.
- d. Fischer SO-C-192 1000 ppm Cr AA standard or equivalent.

4.7.1.2.2 Procedure.

a. For this procedure a Perkin Elmer 403 atomic adsorption unit or equivalent, equipped with a nitrous oxide-acetylene or an air-acetylene head, shall be used. Set up the atomic absorption unit for the standard operation parameters given for chromium (wavelength: 357.9, slit setting: 0.7 nm, current to hollow cathode lamp: 28 ma, flame type: nitrous oxide-acetylene for PA 403 AA).

b. Standards for chromium are prepared by suitable dilutions of the stock standard (Fischer SO-C-192 1000 ppm Cr or equivalent). Aliquots of the standards, as well as a reagent blank, should be treated similarly to the samples. The standard range is 0.5 ppm to 10 ppm Cr for this analysis.

c. Film samples should be cut into small pieces approximately 1/3 inch square. Liquid samples should be weighed directly into the 125 ml Phillips beaker. Place an accurately weighed 0.1 to 0.2 gram portion of sample into a dry 125 ml Phillips beaker and add approximately 4 ml of H<sub>2</sub>SO<sub>4</sub> with the 10 ml graduate. Cover with a watchglass. Place the beaker on a medium temperature hotplate until the sample chars and white fumes of sulfuric acid are evolved. Remove the beaker from the heat and allow the sample to cool for two minutes. Remove the watchglass cover and very cautiously add 7 ml of H<sub>2</sub>O<sub>2</sub> dropwise, at a rate of 30-40 drops per minute. Recover the beaker with the watchglass and place the sample back on the hotplate. Continue heating until the sample is completely digested and all of the H<sub>2</sub>O<sub>2</sub> is evolved as noted by the disappearance of the yellowish-brown color. After cooling, transfer to a 100 ml volumetric flask and dilute to mark with deionized water.

d. Directly aspirate the solutions and determine their concentration using the standard conditions (from (a)). Make suitable dilutions of the samples, if necessary to bring the sample concentrations into appropriate range (from (b)).

e. Calculate as follows:

$$\text{ppm Cr in sample} = \frac{(\text{conc. of sample in ppm}) (\text{volume in ml}) (\text{d.f.})}{\text{sample weight in g}}$$

$$\text{where d.f.} = \frac{\text{final dilution volume in ml}}{\text{ml of aliquot taken for dilution}}$$

4.7.1.3 Total pigment. The percentage of pigment in Component A is found using Method 4021 of FED-STD-141 with the following exceptions:

a. The extraction mixture shall be acetone (A.C.S. reagent grade).

b. The solids shall be dried in a vacuum oven at  $105 \pm 2^{\circ}\text{C}$  ( $221 \pm 3.6^{\circ}\text{F}$ ) and no more than 10 mm Hg for two hours.

TABLE IV. Test Methods.

Requirements paragraph	Test	FED-STD-141 Test Method No.	ASTM Method No.	Test Panels (see Table III)
3.3	Lead content		D 3335	
3.4.1	Strontium Chromate		D 1845	
3.4.1	Titanium dioxide 1/		D 476	
3.4.2	Volatile Organic Compound (VOC) Content		D 3960	
3.5	Pigment, total 2/	4021	D 1210	
3.5	Fineness of grind			
3.5.1	Condition in container 3/	3011	D 1544	
3.5	Color (Gardner)		D 1296	
3.6.2	Odor		D 1200	
3.6.3, 3.6.4	Viscosity, Pot life		D 2369	
3.6.5	Solids, total			
3.6.6	Storage stability 4/	3022		
3.6.7	Accelerated storage stability 5/	3019		
3.7.2	Drying time			A
3.7.5	Adhesion (tape test)	6301	D 1640	C

1/ Type IV

2/ For Component A, see 4.7.3.2

3/ Method A for Components A and B

4/ The daily temperature of the ambient air at the storage location shall fall (within the range of 1.7 - 46°C (35-115°F)

5/ Store at 60 ± 3°C (140 ± 5°F) for 7 days.

#### 4.7.2 Quantitative requirements.

4.7.2.1 Total solids. The percentage of total solids shall be determined using ASTM D 2369; except that, after drying the specimen for 24-36 hours at room temperature, it shall be heated for two hours at  $105 \pm 2^{\circ}\text{C}$  ( $221 \pm 3.6^{\circ}\text{F}$ ) under a continuous vacuum of  $29 \pm 0.5$  inches ( $736.6 \pm 12.7$  mm) of mercury.

4.7.2.2 Total pigment. The percentage of pigment in Component A is found using Method 4021 of FED-STD-141 with the following exceptions:

- a. The extraction solvent shall be acetone (A.C.S. reagent grade)
- b. The solids shall be dried in a vacuum oven at  $105 \pm 2^{\circ}\text{C}$  ( $221 \pm 3.6^{\circ}\text{F}$ ) and no more than 10mm Hg for two hours.

4.7.3 Surface appearance. The primer film, on an "A" panel prepared as directed in 4.6, shall be examined for conformance to 3.7.1.

4.7.4. Lifting. "A" panels shall be primed and then topcoated as directed in 4.6 after 5 hours air-dry for the primer. Examine the panels for conformance to 3.7.3.

4.7.5 Solvent retention. The solvent retention shall be determined in accordance with ASTM F 151. The primer film shall be heated in a  $150^{\circ}\text{C}$  ( $302^{\circ}\text{F}$ ) oven for 16 hours to remove residual solvent. Methylene chloride shall be used as a reference standard.

4.7.6 Flexibility. "B" panels, primed as directed in 4.6, shall be tested with a GE Impact-Flexibility Tester. Place the coated panel, film downward, on the rubber pad at the bottom of the impacter guide. Drop the impacter on the panel, so that the impression of the entire rim of the impacter is made in the panel. Reverse the impacter ends; and drop it on the panel adjacent to the first area of impact. Use 10 power magnification to detect fine surface cracking. Report the percent elongation corresponding to the largest spherical impression at which no cracking occurs.

4.7.7 Strippability. "A" panels, primed as directed in 4.6, shall be artificially aged at a temperature of  $99^{\circ}\text{C}$  ( $210^{\circ}\text{F}$ ) for 4 days. They shall then be placed on a rack at a  $60^{\circ}$  angle with the horizontal. The test shall be performed in a well ventilated area maintained at room temperature. Just enough of MIL-R-81294, Type I, Class 1 paint remover shall be poured along the upper edge of each panel to completely cover the primer surface. After 60 minutes exposure time, the loosened film shall be brushed off and the panels rinsed while 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.

4.7.8 Infrared reflectance. "A" panels, primed as directed in 4.6, shall be measured for total reflectance (specular and diffuse) relative to barium sulfate using a Perkin-Elmer LAMBDA 9 spectrophotometer (or equivalent) over a range of 450 to 2700 nanometers.

4.7.9 Water resistance. "A" panels, primed and topcoated as directed in 4.6, shall be immersed in distilled water for 4 days at a temperature of  $49 \pm 3^{\circ}\text{C}$  ( $120 \pm 5^{\circ}\text{F}$ ). Two hours after removal from the water, the panels shall be examined for conformance to the requirements of 3.8.1.

4.7.10 Corrosion resistance (salt-spray). "A" panels shall be primed as directed in 4.6. Two intersecting lines shall be scribed diagonally 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 1000 hours as described in ASTM B 117 and examined for conformance to 3.8.2.1. In addition, the aluminum/graphite-epoxy test specimen shown in Figure 1 shall be prepared in the following manner. An aluminum alloy plate conforming to QQ-A-250/12 (T6 temper), 0.125 by 6 by 6 inches (3 by 152.4 by 152.4 mm) in size, shall be anodized in accordance with MIL-A-8625, Type I and primed as directed in 4.6. Two intersecting lines shall be scribed diagonally across the surface of the plate, so that the bare substrate is exposed. A graphite-epoxy panel (Hercules AS4/3501-6 or equivalent) with a  $0^{\circ}$ ,  $90^{\circ}$  orientation of approximately 16 plies, 0.09375 by 3 by 3 inches (2.4 by 76 by 76 mm) in size, shall be joined to the center of the primed plate with four nylon fasteners. Four additional lines of two-inch length shall be scribed along the edge of the panel, so that the bare substrate of the plate is exposed. The assembled specimen shall then be placed in a 5 percent salt-spray cabinet for 500 hours as described in ASTM B 117 and examined for conformance to 3.8.2.1.

4.7.11 Corrosion resistance (filiform). "D" panels shall be primed and topcoated as directed in 4.6. Two intersecting lines shall be scribed diagonally across the surface of each panel, so that the bare substrate is exposed. The panels shall then be placed vertically in a desiccator containing 12N hydrochloric acid for one hour. This is equivalent to concentrated hydrochloric acid (A.C.S reagent grade). The panels shall be placed within 5 minutes in a humidity cabinet maintained at  $40 \pm 1.7^{\circ}\text{C}$  ( $104 \pm 3^{\circ}\text{F}$ ) and  $80 \pm 5$  percent relative humidity for 1000 hours. The panels shall then be examined for filiform corrosion, as described in ASTM D 2803. Filiform corrosion appears as threadlike filaments initiating from the exposed substrate and spreading underneath the coating.

4.7.12 Solvent resistance. "A" panels shall be primed as directed in 4.6. A cotton, terry-cloth rag shall be soaked in methyl ethyl ketone solvent and rubbed back and forth 25 times (50 passes) over the primer film with firm finger pressure. Rubbing through the primer to bare metal indicates that it has failed to properly cure.

4.7.13 Fluid resistance. "A" panels, primed as directed in 4.6, shall be immersed for 24 hours in MIL-L-23699 lubricating oil that has been heated to  $121 \pm 3^{\circ}\text{C}$  ( $250 \pm 5^{\circ}\text{F}$ ). The panels shall then be allowed to cool to room temperature and examined for conformance to the requirements of 3.8.4. This test shall be repeated with another panel using MIL-H-83282 hydraulic fluid at  $66 \pm 3^{\circ}\text{C}$  ( $150 \pm 5^{\circ}\text{F}$ ).



4.7.14 Working properties. Stir Component A until completely uniform. Add Component B, stir, and examine for conformance to the requirements of 3.9.1. Add a sufficient amount of MIL-T-81772, Type II (for Class 1 and 2 primers) or 1,1,1-trichloroethane (for Class 3 primer) thinner to achieve normal spray viscosity. When reducing the Class 2 and 3 primers, do not exceed the maximum VOC content of 340 g/l in areas where air-pollution regulations are enforced. Stir well and allow to dwell for 30 minutes. Examine for conformance to the requirements of 3.9.2 and 3.9.3.

## 5. PACKAGING

5.1 Preservation, packing and marking. The primer coatings shall be preserved, 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). The size of the containers shall be either 1 pint, 1 quart, 1 gallon, or 5 gallons. The primer coating shall be supplied in a kit, packaged as a unit, consisting of pigmented epoxy resin component(s) marked "Component A" and polyamide and/or amine resin component(s) marked "Component B".

5.2 Marking and labeling. In addition to the marking specified in PPP-P-1892, individual cans and containers shall bear a printed label showing the following nomenclature and information as applicable:

### Component Identification

Component A - Pigmented epoxy resin component

Component B - Polyamide and/or amine resin component

Specification MIL-P-23377F Type I or II and Class 1,2 or 3 (as applicable)

Manufacturer's name and product number

Date of manufacture by month and year

Batch number/Net contents

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 4 hours.
- d. Epoxy-polyamide 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.
- f. Do not use high pressure spray equipment containing aluminum components for the application of Class 3 primer.

Note: Other precautionary information shall also be included in the container markings.

5.2.1 Precautionary markings. Unit, intermediate and shipping containers shall contain the following precautionary marking: "WARNING! Flammable." 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. All unit and intermediate packs of toxic and hazardous chemicals and materials shall also be labeled in accordance with the applicable laws, statutes, regulations or ordinances, including Federal, State, and municipal requirements. In addition, unit and intermediate containers, including unit containers that serve as shipping containers such as pails and drums, shall be marked with the applicable precautionary information detailed in American National Standard ANSI Z 129.1

## 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 compatible with MIL-C-85285, MIL-C-83286, MIL-C-46168 and MIL-C-53039 polyurethane topcoats and MIL-C-22750 epoxy topcoat. Compatibility with other topcoats should be tested prior to use. Type II primer is intended for use where low infrared reflectance is required. Class 2 and Class 3 primers are intended for use in areas where air-pollution regulations restrict the maximum VOC content of coatings. Class 3 primer shall not be used for applications where the ambient temperature could exceed 500°F or where the chlorinated solvents could become entrapped, such as faying surfaces or the wet installation of fasteners. Class 3 of either Type I or II is not approved for Air Force use.

### 6.2 Ordering data.

6.2.1 Acquisition Requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Part Number (see 1.2.1).
- c. Kit desired, including the quantity and size of containers. (see 1.2.2).
- d. Sampling Plans (see 4.5.2).
- e. Level of packaging and packing (see 5.1).
- f. Special markings (see 5.2).
- g. Toxicological data requirements (see 3.3 and 4.4.2)
- h. FAR clauses 23.303 and 52.223-3
- i. Specify if palletization is required.

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 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 Development Center, Attn: Code 6062, Warminster, PA 18974; and

Information pertaining to qualification of products may be obtained from that activity. 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 coating 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 subject to immediate withdrawal from the Qualified Products List.

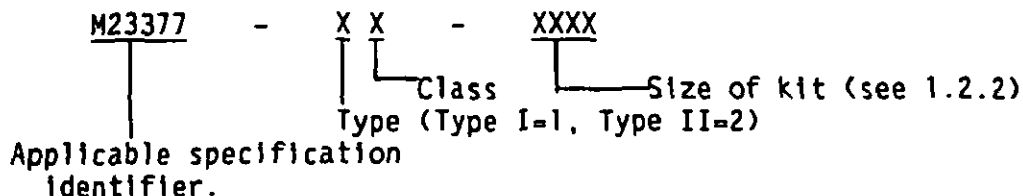
#### 6.4 Subject term (key word) listing.

Aliphatic polyurethane topcoat  
 Chemical resistance  
 Coating  
 Corrosion inhibitive  
 Electrostatic spray application  
 Epoxy-polyamide  
 Flammable  
 Hazardous material  
 Low infrared reflectance  
 Material Safety Data Sheets  
 Metal surfaces  
 Primer  
 Qualification  
 Qualified products list (QPL)  
 Solvent resistant  
 Spray techniques  
 VOC compliant  
 Volatile

6.5 Material Safety Data Sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313 and meeting the requirements of 29 CFR 1910.1200. The pertinent government mailing addresses for submission of data are listed in appendix B of FED-STD-313.

6.6 Substitute. On ferrous substrates, MIL-P-53022 epoxy primer may be used as a substitute where exposure to chromate pigments is not permitted.

6.7 Part or Identifying Numbers (PIN). The PIN to be used for the primers acquired to this specification are created as follows:



6.8 Refrigerated storage. The pot life of admixed Class 1 or 3 primer can be extended to three days when stored at  $4.4 \pm 3^{\circ}\text{C}$  ( $40 \pm 5^{\circ}\text{F}$ ).

6.9 Examination of packaging and marking sampling. The samples for this examination should be selected at random in accordance with MIL-STD-105, inspection level S-2 and acceptable quality level (AQL) 4.0 defects per hundred units if not stated otherwise.

6.10 Examination for palletization sampling. The samples for this examination should be selected at random in accordance with MIL-STD-105, inspection level S-1 and AQL 6.5 defects per hundred units if not stated otherwise.

6.11 Changes from previous issue. Asterisks (or vertical lines) are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:

Army - MR  
Navy - AS  
Air Force - 20

Preparing Activity:

Navy - AS  
(Project No. 8010-0177)

Review Interest:

Army - MI, AR, EA, AV  
Navy - OS, SH  
Other - DS

User Interest:

Army - EL, ME  
Navy - EC, CG, MC



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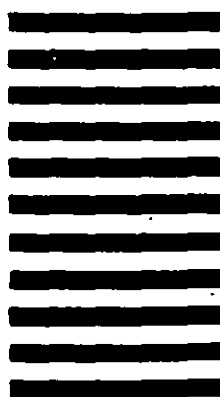


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# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

<b>1. DOCUMENT NUMBER</b> MIL-P-23377F		<b>2. DOCUMENT TITLE</b> Primer Coatings; Epoxy, Chemical and Solvent Resistant	
<b>3a. NAME OF SUBMITTING ORGANIZATION</b>		<b>4. TYPE OF ORGANIZATION (Mark one)</b> <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER (Specify): _____	
<b>b. ADDRESS (Street, City, State, ZIP Code)</b>			
<b>5. PROBLEM AREAS</b>			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
<b>6. REMARKS</b>			
<b>7a. NAME OF SUBMITTER (Last, First, MI) - Optional</b>		<b>b. WORK TELEPHONE NUMBER (include Area Code) - Optional</b>	
<b>c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional</b>		<b>8. DATE OF SUBMISSION (YYMMDD)</b>	