

NOT MEASUREMENT
SENSITIVE

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SUPERSEDING
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MILITARY SPECIFICATION
PRIMER COATING, EPOXY, WATER REDUCIBLE,
LEAD AND CHROMATE FREE

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 a water-reducible, air-drying, corrosion-inhibiting, epoxy-type primer for pretreated ferrous and non-ferrous metals. The primer is lead and chromate-free and is compatible with chemical agent resistant aliphatic polyurethane topcoats. The primer contains no more than 340 grams per liter (2.8 pounds per gallon) of volatile organic compounds (VOC), as applied.

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).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: USA Belvoir Research, Development, and Engineering Center, ATTN: STRBE-TSE, Fort Belvoir, VA 22060-5606 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

SPECIFICATIONS

FEDERAL

- QQ-A-250/5 - Aluminum Alloy Alclad 2024, Plate and Sheet.
- TT-C-490 - Cleaning Methods and Pretreatment of Ferrous Surfaces.
- TT-S-735 - Standard Test Fluids; Hydrocarbon.
- PPP-B-601 - Boxes, Wood, Cleated Plywood.
- PPP-B-621 - Boxes, Wood, Nailed and Lock-Corner.
- PPP-B-636 - Boxes, Shipping, Fiberboard.
- PPP-C-96 - Can, Metal, 28 Gage and Lighter.
- PPP-P-704 - Pail, Metal: (Shipping, Steel, 1 Through 12 Gallon).
- PPP-P-1892 - Paint, Varnish, Lacquer and Related Materials; Packaging, Packing, and Marking of.
- PPP-T-60 - Tape: Packaging, Waterproof.

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- MIL-C-5541 - Chemical Films and Chemical Film Materials for Aluminum and Aluminum Alloys.
- MIL-H-5606 - Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordnance.
- MIL-L-23699 - Lubricating Oil, Aircraft Turbine Engines, Synthetic Base.
- MIL-C-46168 - Coating, Aliphatic Polyurethane, Chemical Agent Resistant.
- MIL-D-50030 - Decontaminating Agent, DS2.
- MIL-C-53039 - Coating, Aliphatic Polyurethane, Single Component, Chemical Agent Resistant.
- MIL-C-81706 - Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys.
- MIL-T-81772 - Thinner, Aliphatic Polyurethane Coating.
- MIL-H-83282 - Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base, Aircraft.

STANDARDS

FEDERAL

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

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- MIL-STD-105 - Sampling Procedures and Tables for Inspection By Attributes.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

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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.

DEPARTMENT OF TRANSPORTATION (DOT)

Code of Federal Regulations.

49 CFR, 171-178 - Hazardous Materials Regulations.

(Applications for copies should be addressed to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402).

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- B 117 - Salt Spray (Fog) Testing.
- D 523 - Specular Gloss.
- D 610 - Evaluating Degree of Rusting on Painted Steel Surfaces.
- D 1193 - Reagent Water.
- D 1210 - Fineness of Dispersion of Pigment-Vehicle Systems.
- D 1308 - Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
- D 1364 - Water in Volatile Solvents (Fischer Reagent Titration Method).
- D 1394 - Chemical Analysis of White Titanium Pigments.
- D 1475 - Density of Paint, Varnish, Lacquer, and Related Products.
- D 3335 - Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy.
- D 3953 - Strapping, Flat Steel and Seals.
- D 4675 - Selection and Use of Flat Strapping Materials.

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

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC., AGENT

National Motor Freight Classification

(Application for copies should be addressed to the American Trucking Association, Inc., ATTN: Traffic Department, 2200 Mill Road, Alexandria, VA 22314).

UNIFORM CLASSIFICATION COMMITTEE, AGENT

Uniform Freight Classification

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

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

2.3 Order of precedence. In the event of a conflict between the text of this 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 primer furnished under this specification shall be a product which is qualified for listing on the applicable qualified products list (QPL) at the time set for opening of bids (see 4.2 and 6.4). 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 Color. The color of the primer shall be characteristic of titanium dioxide pigments, or no darker than light gray No. 27722 of FED-STD-595.

3.3 Toxic ingredients. The manufacturer shall certify that the primer contains no benzene (benzol), chlorinated solvents, or ethylene based glycol ethers and their acetates.

3.4 Material Safety Data Sheet. A Material Safety Data Sheet shall be prepared for the primer in accordance with FED-STD-313 and forwarded to the qualifying activity (see 6.4). The Material Safety Data Sheet shall be included with each shipment of the material covered by this specification and submitted to pertinent Government agencies as stated in FED-STD-313, appendix B (see 6.5).

3.5 Composition. The primer 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 and shall be furnished in primary containers of 1-quart, 1-gallon, and 5-gallon capacities as specified (see 6.2). Component B shall be a clear resin solution and shall be furnished in primary containers of 1/2-pint, 1-quart or 1-gallon capacities as specified (see 6.2). The primer shall be furnished as a kit and when the components are mixed and reduced as specified by the manufacturer, a product meeting the applicable requirements of this specification shall result. The primer kit sizes shall be as follows:

3.5.1 Primer kit sizes. Kit sizes, as specified (see 6.2), shall be designated as 1-quart, 1-gallon, and 4-gallon, and they shall be categorized to correspond with the rated capacity of the primary containers for component A, except for the 4-gallon size.

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The primary container combinations for the kit sizes shall be as follows:

- 1-quart primer kit = one, 1-quart can for component A
one, 1/2-pint can for component B
- 1-gallon primer kit = one, 1-gallon can for component A
one, 1-quart can for component B
- 4-gallon primer kit = one, 5-gallon can for component A
one, 1-gallon can for component B

3.5.2 Primer kit contents. Each primer kit shall consist of prescribed amounts of both components, each in a separate primary container. The primary containers for the components shall be filled to such a level that when the components are mixed together according to the manufacturer's specified volumetric proportions (see 3.5), the total volume of the mixture equals the specified kit size. The filling levels for volumetric proportions of 3:1, expressed as a percent of each primary container's rated capacity, are as follows:

Kit size	Primary container Size	Component	Proportion 3:1 Level
1-quart	1-quart	A	75%
	1/2-pint	B	100%
1-gallon	1-gallon	A	75%
	1-quart	B	100%
4-gallon	5-gallon	A	60%
	1-gallon	B	100%

3.5.3 Pigment. The pigment portion of the primer shall conform to the percent by weight requirements of table I when tested as specified in 4.3.4.2.

TABLE I. Quantitative requirements of pigment.

Pigment	Percent by weight	
	Minimum	Maximum
Titanium dioxide	50.0	--
Zinc phosphate	10.0	20.0
Corrosion inhibiting pigment 1/	9.0	1.1
Siliceous extenders	--	30.0
Hexavalent chromium	Negative	

1/ Sicorin RZ, BASF Wyandotte Corp. or equivalent.

3.6 Quantitative requirements. The primer shall conform to the quantitative requirements of table II when tested as specified in 4.3.

TABLE II. Quantitative requirements.

Characteristics	Minimum	Maximum
VOC, grams volatile per liter admixed primer	--	340
Total solids		
Percent by weight of component A	70	--
Percent by weight of component B	70	--
Lead metal, percent by weight of total solids	--	0.06
Fineness of grind	5	--
Coarse particles and skins (retained on No. 325 sieve), percent by weight of pigment	--	1.0
60 ° specular gloss	--	25
Pot life (thinned to spray viscosity), hours	6	--
Drying time - Set to touch, minutes	--	45
Dry hard, hours	--	2
Full hardness, hours	--	24
Full cure, days	--	7

3.7 Qualitative requirements - liquid.

3.7.1 Condition in container.

3.7.1.1 Component A. When tested as specified in 4.3.7.1, component A shall be free from grit, seeds, skins, abnormal thickening or livering in a freshly opened container and shall show no more pigment settling or caking than can be easily and completely reincorporated to a smooth homogeneous state.

3.7.1.2 Component B. When tested as specified in 4.3.7.2, component B shall be clear and free from sediment and suspended matter when examined by transmitted light. It shall show no livering, curdling, gelling or skinning in a freshly opened full container.

3.7.2 Storage stability. After being tested as specified in 4.3.8, the primer shall meet all of the requirements of this specification.

3.7.2.1 Component A. A full container of component A shall show no skinning, livering, curdling, hard dry caking nor tough gummy sediment when tested as specified in 4.3.8. It shall mix readily to a smooth homogeneous state and meet all other requirements of this specification.

3.7.2.2 Component B. A full container of component B shall be clear and free from sediment and suspended matter when examined by transmitted light as specified in 4.3.8. It shall show no livering, curdling, gelling or skinning and shall meet all other requirements of this specification.

3.7.3 Accelerated storage stability. After being tested as specified in 4.3.9, the primer shall meet all of the requirements of this specification. Each component shall be free of the defects listed in 3.7.2, and when prepared as specified in 4.3.11.1, the admixed primer shall be a smooth homogeneous mixture free from grit, seeds, lumps, and skins.

3.7.4 Freeze-thaw stability. After being tested as specified in 4.3.10, the primer shall meet all of the requirements of this specification. Each component shall be free of the defects listed in 3.7.2, and when prepared as specified in 4.3.11.1, the admixed primer shall be a smooth homogeneous mixture free from grit, seeds, lumps, and skins.

3.7.5 Mixing properties.

3.7.5.1 Mixing. When tested as specified in 4.3.11.1, a smooth homogeneous mixture shall result.

3.7.5.2 Dilution. When the admixed primer is reduced with water as specified in 4.3.11.2, there shall be no evidence of incompatibility other than that of a transient nature during the first half of water addition. The primer shall not separate into visually distinct layers in the first hour after reduction. The pot life is acceptable if the viscosity does not exceed 25 seconds in a number 2 Zahn cup after aging as specified in 4.3.11.2.

3.7.6 Spraying properties. When tested as specified in 4.3.12, the primer shall spray satisfactorily in all respects and shall show no running, sagging, or streaking. The dried film shall show no dusting, mottling, or color separation and shall present a smooth finish free from seeds.

3.8 Qualitative requirements - dried film.

3.8.1 Knife test. A film of primer, tested as specified in 4.3.13, shall adhere tightly to the test panel. It shall be difficult to furrow off with the knife and shall not flake, chip or powder. The knife cut shall show beveled edges.

3.8.2 Flexibility. A film of primer tested as specified in 4.3.14 shall withstand bending without cracking or flaking.

3.8.3 Wet adhesion. A film of primer tested as specified in 4.3.15 shall show no removal of the primer by the tape beyond one-sixteenth inch on either side of the scored lines.

3.8.4 Water resistance. A film of primer, tested as specified in 4.3.16, shall show no wrinkling or blistering immediately after removal of the panel from the water. The primer shall be no more than slightly softened when examined 2 hours after removal; however after 24 hours air drying, the portion of the panel which was immersed shall be practically the same with regard to hardness and adhesion compared to the portion which was not immersed.

3.8.5 Hydrocarbon fluid resistance. A film of primer, tested as specified in 4.3.17, shall show no blistering or wrinkling and no more than a slight yellowing or softening upon removal from the fluid. After 2 hours air drying, the portion of the panel that was immersed shall be practically the same with regard to hardness, color and gloss from a panel prepared at the same time but not immersed.

3.8.6 Salt spray resistance. A film of primer tested as specified in 4.3.18 and examined immediately after removal from the salt spray test shall show no more than a trace of rusting (No. 9, ASTM D 610) or corrosion, and no more than five scattered blisters, none larger than 1 mm in diameter. Upon removal of the primer, there shall be no more than a trace of rusting, pitting, or corrosion on the panels.

3.8.7 Fluid resistance. A film of primer tested as specified in 4.3.19 shall show no blistering, wrinkling or loss of adhesion immediately after removal. Slight initial softening is acceptable. After a four hour recovery period, the hardness of the primer shall be fully recovered. Discoloration of the primer is acceptable and shall not be cause for rejection.

3.8.8 Recoating. A film of primer, tested as specified in 4.3.20, shall show no blistering, wrinkling or other evidence of lifting. The topcoat shall adhere tightly to the primer, and the primer shall adhere tightly to the panel when cut with the knife blade.

3.8.9 Weather resistance. Films of the primer prepared and exposed as specified in 4.3.21 shall show no rusting, cracking, checking, flaking, or loss of adhesion. Upon removal of the coating system, the surface of the metal shall show no more than a trace of rusting, pitting, or corrosion (No. 9, ASTM D 610).

3.8.10 DS2 resistance. A film of primer, tested as specified in 4.3.22, shall show no blistering or wrinkling when examined immediately after washing with water. After drying, there shall be no film softening and no more than a slight change in color or gloss, when compared to an unexposed area.

3.9 User instruction marking. In addition to the markings specified in 5.3, all primary containers shall be legibly labeled "Component A (Pigmented Base Component)" or "Component B (Curing Component)" as applicable, with the manufacturer's mixing and thinning instructions, the VOC content (in grams per liter) and the following:

CAUTION:

- A. The Surgeon General requires airline respirators to be used unless air sampling shows exposure to be below standards. Then, either chemical cartridge respirators or airline respirators are required. For other safety instructions, refer to the Material Safety Data Sheet.
- B. Avoid contact with skin and eyes.
- C. Keep containers closed.
- D. Avoid prolonged or repeated breathing of vapors.
- E. Use with adequate ventilation.

INSTRUCTIONS FOR USE:

- A. The surface to be primed must be clean and free of oil, dust, etc.
- B. Apply over pretreated metal.
- C. Equipment must be adequately grounded. Clean spray equipment immediately after use.
- D. The primer from one vendor, or component thereof, shall never be mixed with that of another vendor.

MIX ONLY THAT AMOUNT TO BE USED IN 6 HOURS.

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 sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Sampling and inspection. Unless otherwise specified herein, sampling, inspection, and testing shall be in accordance with FED-STD-141, method 1022.

4.1.3 Material Safety Data Sheet. Material Safety Data Sheets for components A and B not prepared in accordance with FED-STD-313 shall be cause for rejection.

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

- a. Qualification (see 4.2.1).
- b. Quality conformance (see 4.2.2).

4.2.1 Qualification inspection. The qualification tests shall consist of tests for all requirements specified in section 3, and as specified in table III (see 6.4). Nonconformance to any requirement shall be cause for rejection.

4.2.2 Quality conformance inspection. Quality conformance inspection for individual lots shall be as follows: VOC, condition in container, total solids, fineness of grind, mixing properties, spraying properties, drying time, and 60 degree specular gloss.

4.3 Test methods.

4.3.1 Test conditions. The testing conditions shall be in accordance with FED-STD-141, section 9 or in accordance with the appropriate ASTM method except as otherwise specified herein. Failure of any test result to fall within the ranges specified in 3.2 through 3.8, as applicable, shall constitute failure of the applicable test.

4.3.2 Test panels. Except as otherwise specified, steel test panels shall be pretreated with a phosphate coating conforming to TT-C-490, type I and aluminum test panels shall be aluminum clad aluminum alloy conforming to QQ-A-250/5 and given the film treatment with materials conforming to Form I and II, method C (immersion), class 1A of MIL-C-81706 to produce coatings meeting the requirements of MIL-C-5541.

4.3.2.1 Primer preparation and application. For all tests requiring the use of admixed primer, components A and B shall be thoroughly mixed separately, combined as specified in 4.3.11.1, and thinned with water according to the manufacturer's instructions to a spraying viscosity of approximately 20 seconds in a number 2 Zahn cup. Unless otherwise specified, the primer shall be sprayed to a dry film thickness of 0.0009 to 0.0011 inches.

4.3.3 Test procedures. The following tests (see table III), shall be conducted in accordance with FED-STD-141, ASTM, or as specified herein. The right is reserved to make any additional tests deemed necessary to determine that the primer meets the requirements of this specification.

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TABLE III. Index.

Item	FED-STD-141 Method	ASTM Test Method	Test Paragraph	Requirements Paragraph
Pigment analysis	--	--	4.3.4.2	3.5.3
Extraction of pigment	4021	--	4.3.4.2	Table I
Titanium Dioxide	--	D 1394	4.3.4.2.1	Table I
Zinc phosphate	--	--	4.3.4.2.2	Table I
Acid insoluble	5271	--	4.3.4.2.3	Table I
Hexavalent chromium	--	--	4.3.4.2.4	Table I
Fineness of grind	--	D 1210	--	Table II
Coarse particles and skins	4092	--	--	Table II
Total solids	--	--	4.3.4.1	Table II
Lead metal	--	D 3335	4.3.4.3	Table II
Drying time	4061	--	4.3.6.1	Table II
60° specular gloss	--	D 523	4.3.6.2	Table II
Volatile organic compounds (VOC)	--	--	4.3.6.3	Table II
Condition in container	--	--	4.3.7	3.7.1
Component A	3011	--	4.3.7.1	3.7.1.1
Component B	4261	--	4.3.7.2	3.7.1.2
Storage stability	--	--	4.3.8	3.7.2
Component A	3011	--	4.3.8	3.7.2.1
Component B	4261	--	4.3.8	3.7.2.2
Accelerated storage stability	--	--	4.3.9	3.7.3
Freeze-thaw stability	--	--	4.3.10	3.7.4
Mixing properties	--	--	4.3.11	3.7.5
Spraying properties	4331	--	4.3.12	3.7.6
Knife test	6304	--	4.3.13	3.8.1
Flexibility	6221	--	4.3.14	3.8.2
Wet adhesion	6301	--	4.3.15	3.8.3
Water resistance	--	D 1308	4.3.16	3.8.4
Hydrocarbon fluid resistance	--	--	4.3.17	3.8.5
Salt spray resistance	--	B 117	4.3.18	3.8.6
Fluid resistance	--	--	4.3.19	3.8.7
Recoating	--	--	4.3.20	3.8.8
Weather resistance	--	--	4.3.21	3.8.9
DS2 resistance	--	--	4.3.22	3.8.10

4.3.4 Analysis of component A.

4.3.4.1 Nonvolatile (total solids) content. Place a portion of the thoroughly mixed sample in a dropping bottle and weigh to the nearest one-tenth mg. Weigh one 60 mm aluminum dishes to the nearest one-tenth mg. Transfer a small sample that does not exceed 0.3g to the dish, determine its exact weight to the nearest one-tenth mg by loss in weight of the bottle. Dissolve the sample in 2 mL of A.C.S. reagent grade ethanol and dry in a gravity convection oven at 105 °C for 1 hour. Upon cooling, reweigh the dish to the nearest one-tenth mg. From the weight of the residue in the dish and the weight of the sample taken, calculate the percent nonvolatile (total solids) as required. Nonconformance to the requirements in table II shall constitute failure of this test.

4.3.4.2 Pigment analysis. Extract the pigment as in FED-STD-141, method 4021, but use ethanol for extraction. Make appropriate qualitative and quantitative tests on the extracted pigment to determine if only permissible pigments were used. Nonconformance to 3.5.3 shall constitute failure of this test.

4.3.4.2.1 Quantitative titanium dioxide. Determine titanium dioxide content by ASTM D 1394. Nonconformance to the requirements in table I shall constitute failure of this test.

4.3.4.2.2 Zinc phosphate content. Determine the zinc phosphate content in accordance with 4.3.4.2.2.1 and 4.3.4.2.2.2.

4.3.4.2.2.1 Determination of zinc.

4.3.4.2.2.1.1 Reagents.

- a. Buffer solution (pH 10): 350 mL conc. NH_4OH + 54g NH_4Cl + H_2O to give 1000 mL.
- b. Eriochrome black T (0.5%) 0.25g eriochrome black T + 2.2g hydroxylamine hydrochloride per 50 mL methanol solution.
- c. Primary standard zinc oxide (0.200N): Accurately weigh 4.069g of oven-dried ZnO. Dissolve it in 250 mL of the buffer solution and dilute to 500.0 mL.
- d. 0.5N Disodium ethylenediaminetetra-acetate dihydrate (EDTA): 37.2g EDTA per liter aqueous solution.

4.3.4.2.2.1.2 Procedure.

- a. Accurately weigh approximately 1.0 gram of pigment into a 250 mL glass-stoppered Erlenmeyer flask.
- b. Add 25 mL of buffer, stopper, and shake vigorously every few minutes over a period of 30 minutes.
- c. Filter through fine paper into a 400 mL beaker, washing well with water until 200 mL of filtrate are collected.
- d. Add 20.0 mL of the EDTA (an excess) to the filtrate.
- e. Add 10 drops of eriochrome black T.
- f. Titrate with standard ZnO to a wine-red end point (V_s).
- g. Run a blank by titrating 20.0 mL of the EDTA in 200 mL of an aqueous solution containing 25 mL of the buffer (V_b).

4.3.4.2.2.1.3 Calculations.

$$\text{percent Zn} = \frac{(V_b - V_s) \times 0.2 \times 3.269}{\text{Sample wt}}$$

$$\text{percent zinc phosphate} = \frac{(V_b - V_s) \times 0.2 \times 7.035}{\text{Sample wt}}$$

Where: V_b = Milliliters of ZNO for blank and
 V_s = Milliliters of ZNO for sample.

4.3.4.2.2.2 Determination of phosphate.4.3.4.2.2.2.1 Reagents.

- a. Conc NH_4OH
- b. Conc HNO_3
- c. NH_4NO_3
- d. Ammonium molybdate - Johnson's formula: Mix 55g of $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24}\cdot 4\text{H}_2\text{O}$ and 50g of NH_4NO_3 with 18 mL of concentrated NH_4OH and 20 mL H_2O . Stir. Dilute to about 700 mL with H_2O , heat with occasional stirring until all salts have dissolved. Dilute to 1000 mL. Let stand overnight. Filter through fine paper but do not wash the residue.

4.3.4.2.2.2.2 Procedure.

- a. Accurately weigh approximately 2g of pigment into a 250 mL glass-stoppered Erlenmeyer flask.
- b. Add 25 mL of conc NH_2OH , stopper and shake vigorously every few minutes over a period of 60 minutes.
- c. Add 25 mL of H_2O and filter through fine paper into a 400 mL beaker, washing well with water.
- d. Neutralize the filtrate with 7.5 HNO_3 (requires about 35 mL).
- e. Add 15 mL conc HNO_3 and 6g of NH_4NO_3 . Stir.
- f. Heat the clear solution to 80 °C (no higher) and add 75 mL of ammonium molybdate with constant stirring.
- g. Stir for several minutes and let the precipitate settle for 2 hours.
- h. Filter through a tared crucible (gooch or medium glass), transfer the precipitate, and wash with 1 percent HNO_3 (5 mL conc. HNO_3 per 500 mL solution). The washing should be thorough.
- i. Give the collection precipitate a final wash with a small amount of water.
- j. Dry the crucible for 2 hours in a 105 °C oven.
- k. Cool crucible in a desiccator and determine the weight of the precipitate to the nearest one-tenth mg (it should not exceed 3g; if it does, repeat the determination with a smaller sample).

4.3.4.2.2.2.3 Calculations.

$$\text{percent PO}_4 = \frac{\text{wt. ppt.} \times 5.029}{\text{sample wt.}}$$

$$\text{percent zinc phosphate} = \frac{\text{wt. ppt.} \times 11.18}{\text{sample wt.}}$$

4.3.4.2.2.3 Failure criteria. Nonconformance to table I shall constitute failure of this test.

4.3.4.2.3 Acid insoluble. Determine matter insoluble in acid in the extracted pigment by FED-STD-141, method 5271. Nonconformance to the extender requirement of table I shall constitute failure of this test.

4.3.4.2.4 Hexavalent chromium (Cr⁶⁺ must be absent).

- a. Reagents: 25 percent aqueous KOH
- b. Procedure:
 - (1) Add 5 mL of 25 percent aq. KOH to 1/2g of the extracted pigment contained in a 15 mL centrifuge tube.
 - (2) Agitate by shaking the tube for a few minutes, then centrifuge.
 - (3) The supernatant liquid should be colorless. A yellow color indicates presence of chromate. Nonconformance to the requirement in table I shall constitute failure of this test.

4.3.4.3 Lead content.

4.3.4.3.1 Atomic absorption spectroscopy. Determine the percent of lead in accordance with ASTM D 3335. Nonconformance to table II shall constitute failure of this test.

4.3.4.3.2 X-ray emission spectrometric analysis (alternate method).

4.3.4.3.2.1 Test panel preparation. Using 100 grams of a known lead free coating which meets all of the requirements for this primer, prepare standard aliquots containing 0.00, 0.03, 0.06, and 0.09 percent lead metal, based on total nonvolatile paint, by adding calculated amounts of lead naphenate of a known lead content. Thoroughly mix the aliquots to incorporate the lead and draw down the standards and primer to be tested on duplicate black and white Morest cards using a 0.0020 inch (0.004 inch gap clearance) film applicator. Dry for 48 hours at a temperature of 23 ± 1.1 °C (73.4 ± 2 °F), a relative humidity of 50 ± 4 percent, and under dust free conditions. Cut the drawdowns into a suitable size and shape to fit the sample holder of the X-ray fluorescence spectrometer.

4.3.4.3.2.2 X-ray analytical procedure. Lead content shall be determined using an X-ray fluorescence spectrometer capable of determining lead content at a minimum level of 0.03 percent by weight of the total nonvolatile paint. The parameters of angle, crystal, pulse height selection, counting time, collimator, X-ray tube, voltage and amperage, shall be established for a wave length dispersive fluorescence spectrometer according to conventional X-ray analytical procedures. The analytical line Pb L-alpha or Pb L-beta shall be used. To calibrate, place the known standards in the X-ray unit and measure the count rates of lead, lead background and the Compton scattered background from the X-ray tube. The ratio R, of net lead intensity and Compton scattered background is calculated as follows:

$$R = \frac{I_{Pb} (I_{Pb} \text{ Background I} + I_{Pb} \text{ Background II})}{I_{\text{Compton Line}}}$$

Where I = Gross Intensity and the background is taken on each side of the Pb line. Establish a lead calibration curve using these results. Determine the lead content of the test paint using the above procedure and calibration curve. When using an energy dispersive fluorescence spectrometer, it shall be set up in accordance with the manufacturer's manual. Nonconformance to table II shall constitute failure of this test.

4.3.5 Analysis of component B.

4.3.5.1 Nonvolatile (total solids) content. Determine the percent nonvolatile (total solids) as specified in 4.3.4.1, except that toluene shall be used to disperse the material. Nonconformance to table II shall constitute failure of this test.

4.3.6 Analysis of admixed primer.

4.3.6.1 Drying time. Prepare a film of the primer on steel as specified in 4.3.2.1 and determine drying time in accordance with FED-STD-141, method 4061 under referee conditions. The film has reached full hardness when it is very difficult to remove with a knife blade. Nonconformance to table II shall constitute failure of this test.

4.3.6.2 Specular gloss (60 degrees). Prepare a film of the primer on steel as specified in 4.3.2.1 and allow to dry 48 hours. Determine the 60 degree specular gloss in accordance with ASTM D 523. Nonconformance to table II shall constitute failure of this test.

4.3.6.3 Volatile organic compounds (VOC). Separately mix components A and B, and then combine them as specified in 4.3.11.1, but do not thin the mixture. Keep the container tightly covered.

4.3.6.3.1 Nonvolatile (total solids) content. Determine the weight percent total solids, X_m , of the admixed primer in accordance with the procedure specified in 4.3.4.1.

4.3.6.3.2 Density. Determine the density, D_m , of the admixed primer in grams per liter in accordance with ASTM D 1475.

4.3.6.3.3 Water content. Determine the weight percent water, X_w , of the admixed primer in accordance with ASTM D 1364.

4.3.6.3.4 Calculation.

$$\text{VOC (grams per liter)} = \frac{D_m(100 - X_m - X_w)}{100 - X_w \cdot D_m}$$

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4.3.6.3.5 Failure criterion. Nonconformance to table II shall constitute failure of this test.

4.3.7 Condition in container.

4.3.7.1 Component A. Determine package condition of component A for acceptance testing in accordance with FED-STD-141, method 3011. For qualification testing, evaluate pigment settling or caking in accordance with FED-STD-141, method 3011, and then stir by hand for five minutes. The presence of any gel particles or undispersed pigment after stirring indicates unsatisfactory settling properties. Nonconformance to 3.7.1.1 shall constitute failure of this test.

4.3.7.2 Component B. Determine package condition of component B in accordance with FED-STD-141, method 4261. Nonconformance to 3.7.1.2 shall constitute failure of this test.

4.3.8 Storage stability. Allow unopened containers of component A and component B to stand undisturbed for one year at 72 to 80 °F (22 to 27 °C) and then examine the contents. Evaluate the condition of each component as specified in 4.3.7, then mix as specified in 4.3.11.1 and examine the admixed primer. Nonconformance to 3.7.2 shall constitute failure of this test.

4.3.9 Accelerated storage stability. Allow tightly sealed glass jars filled with each component to stand undisturbed for 7 days at 140 °F (60 °C). Allow to cool to room temperature and examine the contents. Mix the components as specified in 4.3.11.1. Nonconformance to 3.7.3 shall constitute failure of this test.

4.3.10 Freeze-thaw stability. Subject tightly sealed containers of each component to a 4 day cycle of 16 hours at 10 °F (-12 °C) and 8 hours at room temperature. After completion, examine the contents separately, then mix as specified in 4.3.11.1. Nonconformance to 3.7.4 shall constitute failure of this test.

4.3.11 Mixing properties.

4.3.11.1 Mixing. Thoroughly stir component A by hand until uniform. Unless otherwise specified, mix one volume of component B with three volumes of component A. Nonconformance to 3.7.5.1 shall constitute failure of this test.

4.3.11.2 Dilution. Reduce the admixed primer with water meeting the type IV requirements of ASTM D 1193 to a spraying viscosity of 20 seconds in a number 2 Zahn cup. Stir or shake well. Allow to stand undisturbed for at least 6 hours to check the pot life requirement. Nonconformance to 3.7.5.2 shall constitute failure of this test.

4.3.12 Spraying properties. Prepare a film of the primer on steel as specified in 4.3.2.1. Observe for spraying properties as in FED-STD-141, method 4331. For referee test use automatic application per FED-STD-141, method 2131. Nonconformance to 3.7.6 shall constitute failure of this test.

4.3.13 Knife test. Spray the primer as specified in 4.3.2.1 on one steel and one aluminum panel. Allow to dry for 168 hours. Perform the knife test in accordance with FED-STD-141, method 6304. Nonconformance to 3.8.1 shall constitute failure of this test.

4.3.14 Flexibility. Spray a film of primer to a dry film thickness between 0.0009 and 0.0011 inch on smooth finish steel panel prepared in accordance with FED-STD-141, method 2011, procedure A using the aliphatic naphtha-propylene glycol monomethyl ether mixture. The panel shall be prepared from new cold rolled carbon steel, rust-free, 0.009 to 0.011 inch (32 gauge) thick with a Rockwell 15-T maximum hardness of 82 and finished with a surface roughness of 8 to 12 micro-inches. Allow the panel to air dry 168 hours. Bend over a 1/4-inch mandrel as specified in FED-STD-141, method 6221. Nonconformance to 3.8.2 shall constitute failure of this test.

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4.3.15 Wet adhesion. Prepare two panels as specified in 4.3.13. Allow to dry for 168 hours. Immerse in distilled water at room temperature for 24 hours. Test for wet adhesion in accordance with FED-STD-141, method 6301, except that the tape used shall meet the requirements of PPP-T-60, type IV, class 1. Nonconformance to 3.8.3 shall constitute failure of this test.

4.3.16 Water resistance. Prepare two panels as specified in 4.3.13. Allow to dry for 168 hours. Coat all exposed, uncoated metal surfaces with wax or other suitable coating. Immerse the panels in distilled water at room temperature for 168 hours in accordance with ASTM D 1308. Nonconformance to 3.8.4 shall constitute failure of this test.

4.3.17 Hydrocarbon fluid resistance. Prepare films of primer as specified in 4.3.13. Air dry 168 hours. Do not wax or coat the exposed metal surfaces. Immerse the panels for 168 hours in a hydrocarbon fluid conforming to TT-S-735, type III. Nonconformance to 3.8.5 shall constitute failure of this test.

4.3.18 Salt spray resistance. Prepare four, 4 by 12 inch panels each of pretreated steel and aluminum as specified in 4.3.2.1. Air dry for 168 hours. Coat edges and uncoated metal surfaces with wax or other suitable coating, but do not score. Expose the panels to 5 percent salt spray for 336 hours as specified in ASTM B 117. Remove the panels, wash gently in running water no warmer than 100 °F (38 °C) until free from any visible salt deposits. Examine immediately for compliance with 3.8.6. Strip the primer from the panels with a suitable paint remover. Inspect the panels for rust, pitting or corrosion. Nonconformance to 3.8.6 shall constitute failure of this test.

4.3.19 Fluid resistance. Prepare two panels as specified in 4.3.13. Allow to dry for 168 hours. Immerse in lubricating oil conforming to MIL-L-23699 at 250 °F (121 °C) for 24 hours. Also test sets of panels using hydraulic fluids conforming to MIL-H-5606 and MIL-H-83282 at 150 °F (66 °C). Nonconformance to 3.8.7 shall constitute failure of this test.

4.3.20 Recoating. Prepare three steel panels as specified in 4.3.12. Allow the primer to dry 2, 24 and 168 hours respectively, then spray each panel with a topcoat of camouflage green 383 polyurethane conforming to MIL-C-46168 or MIL-C-53039. If necessary, the polyurethane shall be thinned according to the specification with thinner conforming to MIL-T-81772 and sprayed to a dry film thickness of 0.0018 to 0.0022 inches. After the topcoat has dried for 24 hours, examine the panels for evidence of lifting. After the topcoat has dried for 168 hours, determine the intercoat adhesion using the knife test as in FED-STD-141, method 6304. Nonconformance to 3.8.8 shall constitute failure of this test.

4.3.21 Weather resistance. Prepare two steel panels as specified in 4.3.12. After drying for 24 hours, topcoat with green 383 polyurethane as specified in 4.3.20. Air dry for 168 hours. Place on exposure for 24 months at an angle of 45 degrees facing south in the vicinity of Washington, D.C. At the end of this period, examine the panels for compliance with 3.8.9. Strip the panels with remover conforming to MIL-R-46116 or other suitable paint remover and inspect the panels for defects. Nonconformance to 3.8.9 shall constitute failure of this test.

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4.3.22 DS2 resistance. Prepare a steel panel as specified in 4.3.12, air dry the panel one day, then bake for one day at 105 ±2 °C (221 ±4 °F). Allow the panel to cool to room temperature and apply a spot of approximately 1/2-mL of decontaminating agent DS2 conforming to MIL-D-50030 to the surface. Do not cover. Allow to stand 30 minutes, then thoroughly rinse with water. Nonconformance to 3.8.10 shall constitute failure of this test.

4.3.23 Toxic ingredients. The manufacturer shall certify that the primer contains no benzene (benzol), chlorinated solvents, or ethylene based glycol ethers and their acetates. Nonconformance to 3.3 shall constitute failure of this requirement.

4.3.24 Inspection of packaging.

4.3.24.1 Quality conformance inspection of packaging.

4.3.24.1.1 Unit of product. For the purpose of inspection, a complete pack prepared for shipment shall be considered a unit of product.

4.3.24.1.2 Sampling. Sampling for examination shall be in accordance with MIL-STD-105.

4.3.24.1.3 Examination. Samples selected in accordance with 4.3.23.1.2 shall be examined for the applicable defects listed below. The presence of one or more defects shall be cause for rejection.

EXAMINATION

<u>No.</u>	<u>Defect</u>	<u>A</u>	<u>B</u>	<u>C</u>
101.	Primary containers not filled to the prescribed levels for the specified mixing proportions.	3.5.2		3.5.2
102.	Primary containers not of the types specified.	5.1.2		5.1.3
103.	Primary containers not coated as specified.	5.1.2		
104.	Closure of the primary containers not as specified.	5.1.2		5.1.3
105.	Primary containers not placed in unit containers as specified.	5.1.2.1		5.1.3.1
106.	Unit containers not as specified.	5.1.2.1		5.1.3.1
107.	Unit containers not placed in intermediate containers as specified.	5.1.2.2		5.1.3.2
108.	Intermediate containers not as specified.	5.1.2.2		5.1.3.2
109.	Unlike kits packed in same shipping container.	5.2.1	5.2.2	5.2.3
110.	Shipping containers not as specified.	5.2.1	5.2.2	5.2.3
111.	Standard marking not as specified.	5.3	5.3	5.3
112.	Additional marking not as specified.	5.3.1	5.3.1	5.3.1

5. PACKAGING.

5.1 Preservation. Preservation shall be level A or C as specified (see 6.2).

5.1.1 Primary containers.

5.1.1.1 Component A (pigmented base component). The primary containers for component A shall be 1-quart or 1-gallon multiple friction plug containers, or 5-gallon lug cover steel pails, as specified (see 3.5 and 6.2).

5.1.1.2 Component B (curing component). The primary containers for component B shall be 1/2-pint, 1-quart or 1-gallon, multiple friction plug containers as specified (see 3.5 and 6.2).

5.1.2 Level A. Primary containers, of the types and sizes specified in 5.1.1.1 and 5.1.1.2, shall comply with the following requirements:

- a. Multiple friction plug containers shall be in accordance with PPP-C-96, type V, class 2. Interior coatings as applicable, shall be as specified therein. Exterior coatings, including side seam stripping, shall be as specified therein for plan B. Wire handles, as specified therein, shall be provided for the 1-gallon container. Closure of the properly filled and sealed cans shall be as specified in the appendix thereto.
- b. Lug cover steel pails shall be in accordance with PPP-P-704, type II or III, class as applicable. Interior coatings and exterior coatings shall be as specified therein. Closure of properly filled and sealed pails shall be as specified in the appendix thereto.
- c. The containers shall comply with the requirements of the Uniform Freight Classification (UFC) or the National Motor Freight Classification (NMFC) and the applicable requirements of the Code of Federal Regulations 49 CFR, Department of Transportation (DOT).

5.1.2.1 Unit (kit) containers. Each primer kit, consisting of the component primary container combinations specified in 3.5.1 and filled to the level of capacity required of a specified volumetric proportion of 3.5.2, shall be placed in an individual unit (kit) container. Unit containers shall be in accordance with PPP-B-636, type CF, grade V3c, W5c or W6c as applicable, style optional. The primary containers shall be arranged within the unit container to provide the smallest practical cubage and permit the application of cushioning and functional filler devices. Such cushioning and fillers shall completely fill the container. Container closure shall be in accordance with method IV of the appendix to PPP-B-636. The containers shall comply to UFC or NMFC, and 49 CFR requirements.

5.1.2.2 Intermediate containers. The primer, in unit (kit) containers as specified in 5.1.2.1, shall be placed in intermediate containers in the following manner:

- a. Eight unit (kit) containers for the 1-quart primer kit shall be placed in an intermediate container.
- b. Four unit (kit) containers for the 1-gallon primer kit shall be placed in an intermediate container.
- c. Intermediate containers are not required for the 4-gallon primer kit.

Intermediate containers, for the quantity of unit (kit) containers shall comply with the requirements of PPP-B-636, type CF, grade V3c or W5c as applicable, style optional. The containers shall be close-fitting and closure shall be in accordance with method IV of the appendix thereto. Container shall comply with UFC or NMFC, and 49 CFR requirements.

5.1.3 Level C. Primary containers, of the types and sizes specified in 5.1.1, shall be those containers normally used for products of this nature, providing there will be no interaction chemically or physically with the contents so as to damage the container or alter the strength, quality or purity of the contents. The containers shall comply with the requirements of the UFC or NMFC, and the requirements of 49 CFR.

5.1.3.1 Unit containers. Unit containers, required of the component combination in 5.1.2.1, shall be close-fitting corrugated fiberboard boxes in accordance with UFC or NMFC, and 49 CFR requirements. Cushioning and filler devices shall be utilized to prevent damage to the contents during shipment, handling, storage and redistribution.

5.1.3.2 Intermediate containers. Intermediate containers, for the quantity of unit (kit) containers specified in 5.1.2.2, shall be close-fitting corrugated fiberboard boxes in accordance with UFC or NMFC, and 49 CFR requirements.

5.2 Packing. Packing shall be level A, B, or C as specified (see 6.2).

5.2.1 Level A. Intermediate containers of like kits shall be packed in close-fitting wood boxes conforming to PPP-B-601, overseas type, or PPP-B-621, class 2. Box closure shall be as specified in the applicable box specification or the appendix thereto except that strapping shall be in accordance with ASTM D 3953, type 1 or 2, zinc-coated, size as applicable, and ASTM D 4675. Unit containers for the 4-gallon kit shall be packed for level A in the same manner.

5.2.2. Level B. Level B packing shall be as specified for level A packing in 5.2.1 except that boxes shall be domestic type or class and the metal strapping shall be coated finish.

5.2.3 Level C. The primer, in intermediate containers and unit (kit) containers as specified in 5.1.2.2, shall be packed in multiples of like kits in accordance with UFC or NMFC, and 49 CFR requirements.

5.3 Marking. Each primary container, unit container, intermediate container and shipping container shall be marked in accordance with the requirements of PPP-P-1892.

5.3.1 Additional markings. In addition to any special or identification marking required by the contract or purchase order and by 5.3, each primary container shall be marked as specified in 3.9 (see 6.2).

5.4 Precedence. If there is any conflict between the requirements of this specification and the Department of Transportation Regulation 49 CFR for the types of containers specified, the contractor or manufacturer shall give the purchasing officer a statement in writing about the conflict and obtain instructions before proceeding with the packaging of the primer.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The primer described in this specification is intended for use on clean, chemically pretreated metal surfaces where exposure to lead or chromate pigments is not permitted. It is a water reducible epoxy primer with maximum VOC content of 340 grams per liter (2.8 pounds per gallon) and is compatible with chemical agent resistant aliphatic polyurethane topcoats.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
- c. Kit size (or sizes) required (see 3.5.1).
- d. Level of preservation and packing required (see 5.1 and 5.2).
- e. Any special marking requirements (see 5.3.1).

6.3 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.

6.4 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 contractor 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: Commander, US Army Belvoir Research, Development, and Engineering Center, ATTN: STRBE-VO, Fort Belvoir, VA 22060-5606, and information pertaining to the qualification of products may be obtained from that activity.

6.5 Material Safety Data Sheets. Contracting officers should identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313, appendix B.

6.6 Subject term (key word) listing.

Corrosion inhibiting
Epoxy
Lead and chromate free
Primer
VOC compliant
Water reducible

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

Custodian:
Army - ME
Navy - AS

Preparing activity:
Army - ME

User activities:
Army - AT, AV

Project 8010-0465

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-P-53030A

2. DOCUMENT DATE (YYMMDD)
920309

3. DOCUMENT TITLE
Primer Coating, Epoxy, Water Reducible, Lead and Chromate Free

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)
(1) Commercial
(if applicable)
(2) AUTOVON

7. DATE SUBMITTED

8. PREPARING ACTIVITY

a. NAME

Betty Taylor

b. TELEPHONE (Include Area Code)
(1) Commercial
(703) 664-1866

(2) AUTOVON
354-1866

c. ADDRESS (Include Zip Code)

US Army Belvoir RDE Center
ATTN: STRBE-TSE
Fort Belvoir, VA 22060-5606

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