

NOT MEASUREMENT
SENSITIVE

MIL-DTL-11195G(MR)
w/INT. AMENDMENT 1
20 September 2007
USED IN LIEU OF
MIL-DTL-11195G
31 July 2003

DETAIL SPECIFICATION

ENAMEL, LUSTERLESS, FAST DRY, VOC COMPLIANT, (FOR USE ON AMMUNITION AND OTHER METALS)

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

1. SCOPE

1.1 Scope. This specification covers two types of fast drying, lusterless, low volatile organic compound (VOC) content alkyd enamels for use on exterior and interior metal surfaces. These enamels are formulated free of lead and chromate (hexavalent chromium), with a maximum VOC content of 420 g/L (3.5 lb/gal) as applied.

1.2 Classification. Coatings will be furnished in the following types:

Type I - Alkyd with standard pigments

Type II - Alkyd, containing corrosion inhibiting pigments, formulated free of hazardous air pollutants (HAP-free)

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

Comments, suggestions, or questions on this document should be addressed to: Director, U.S. Army Research Laboratory, Weapons and Materials Research Directorate, Materials Applications Branch, Attn: AMSRD-ARL-WM-MC, Aberdeen Proving Ground, MD 21005-5069 or emailed to bhart@arl.army.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil/>.

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2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL SPECIFICATIONS

- TT-C-490 - Chemical Conversion Coatings and Pretreatments for Ferrous Surfaces (Base for Organic Coatings).
A-A-3007 - Thinner: for Phenol-Formaldehyde and Medium Oil And Styrenated Alkyd Paints and Varnishes.

FEDERAL STANDARDS

- FED-STD-141 - Paint, Varnish, Lacquer and Related Materials: Methods of Inspection, Sampling and Testing.
FED-STD-313 - Material Safety Data, Transportation Data, and Disposal Data for Hazardous Materials Furnished to Government Activities.
FED-STD-595 - Colors Used in Government Procurement
Color Chips 17178, 31136, 31158, 32246, 33538, 33655, 34079, 34082, 34088, 34108, 34540, 34558, 35044, 35109, 35193, 36118, 36231, 36375, 36440, 37038, 37142, 37875, 37925.

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or <http://assist.daps.dla.mil/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. DELETED.

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL

- ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus. (DoD adopted)
ASTM D185 - Standard Test Methods for Coarse Particles in Pigments, Pastes, and Paints. (DoD adopted)
ASTM D476 - Standard Classification for Dry Pigmentary Titanium Dioxide Products. (DoD adopted)
ASTM D522 - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings. (DoD adopted)
ASTM D523 - Standard Test Method for Specular Gloss. (DoD adopted)
ASTM D562 - Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer. (DoD adopted)

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- ASTM D610 - Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces. (DoD adopted)
- ASTM D1210 - Standard Test Method for Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage. (DoD adopted)
- ASTM D1364 - Standard Test Method for Water in Volatile Solvents (Karl Fischer Reagent Titration Method). (DoD adopted)
- ASTM D1640 - Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature. (DoD adopted)
- ASTM D1654 - Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments. (DoD adopted)
- ASTM D1729 - Standard Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials. (DoD adopted)
- ASTM D2369 - Standard Test Method for Volatile Content of Coatings. (DoD adopted)
- ASTM D2371 - Standard Test Method for Pigment Content of Solvent-Reducible Paints. (DoD adopted)
- ASTM D2805 - Standard Test Method for Hiding Power of Paints by Reflectometry. (DoD adopted)
- ASTM D3271 - Standard Practice for Direct Injection of Solvent-Reducible Paints Into a Gas Chromatograph for Solvent Analysis. (DoD adopted)
- ASTM D3335 - Standard Test Method for Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy. (DoD adopted)
- ASTM D3891 - Standard Practice for Preparation of Glass Panels for Testing Paint, Varnish, Lacquer, and Related Products.
- ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings. (DoD adopted)
- ASTM D5380 - Standard Test Method for Identification of Crystalline Pigments and Extenders in Paint by X-Ray Diffraction Analysis.
- ASTM E1347 - Standard Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry.

(Copies of these documents are available from www.astm.org or ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.)

2.4 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 coatings furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable Qualified Products List (QPL) at the time set for opening of bids (see 4.2.1.1 and 6.3). Any change in the formulation or processing of a qualified product shall necessitate its requalification. The material supplied under the contract shall be identical, within manufacturing tolerance, to the product that received qualification.

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3.2 Materials. The materials used in the coating shall be as specified herein. Materials not specified shall be selected by the contractor and shall be subject to all provisions of this specification.

3.2.1 Toxic products and formulations. The material shall have no adverse effect on the health of the personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate departmental medical service, which will act as an advisor to the contracting agency.

3.2.2 Hazardous material. The contractor shall comply with the hazardous material requirements of FED-STD-313 (see 6.5).

3.3 Color. When tested as specified in 4.3.4, the color of the enamel shall match that of the standard color chip in FED-STD-595 (see 6.3.1). For color 37038, the color of the enamel may be darker or jetter than that of the actual standard color chip, and for color 37925, the enamel shall have a minimum directional reflectance of 83 (see 4.3.26).

| <u>Color</u> | <u>FED-STD-595 Color Number</u> |
|--------------|--|
| Aluminum | 17178 |
| Red | 31136, 31158 |
| Orange | 32246 |
| Yellow | 33538, 33655 |
| Green | 34079, 34082, 34088, 34108, 34540, 34558 |
| Blue | 35044, 35109, 35193 |
| Black | 37038 |
| Gray | 36375 |
| White | 37875, 37925 |
| Other Colors | 36118, 36231, 36375, 36440, 37142, 36375 |

3.4 Composition. The material shall meet the requirements of table I.

TABLE I. Composition – percent by weight.

| | <u>All Other</u> | | |
|---|------------------|--------------|---------------|
| | <u>White</u> | <u>Black</u> | <u>Colors</u> |
| Nonvolatile matter - minimum | 75 | 72 | 73 |
| Total pigment - % of nonvolatile - maximum | 73 | 70 | 70 |
| Extender pigment - % total pigment - maximum | 65 | 90 | 85 |
| Percent of Total pigment | | | |
| Zinc phosphate, Type II only - % total pigment - minimum | 9.0 | 9.0 | 9.0 |

3.4.1 Pigment. The pigments listed in table II, in any combination, shall be used to match the colors specified. The titanium dioxide shall be a rutile chalk resistant type conforming to

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ASTM D476, type III or type IV. Lead or chromate (hexavalent) pigments shall not be used and antimony sulfide shall be absent. Extender pigments shall be siliceous matter and barium sulfate, in any ratio, and shall not exceed the amount specified in table I. The use of the specified pigments does not guarantee that a product will meet all the requirements of this specification, as the choice of vendors, amounts, methods of dispersion and incorporation can significantly affect the quality of the end product. If other tinting pigments are used to match the spectral characteristics, these additional pigments must be recommended for exterior exposure by the pigment supplier. Other corrosion inhibiting pigments, in addition to the specified zinc phosphate in table I can be used.

TABLE II. Pigmentation.

| Pigment | Color Index Name | Color Index Number |
|------------------------|------------------|---------------------|
| Titanium Dioxide White | PW6 | 77891 |
| Carbon Black | PBk7 | 77266 |
| Iron Oxide Black | PBk11 | 77499 |
| Iron Blue | PB27 | 77510 |
| Phthalocyanine Blue | PB15 | 74160 |
| Phthalocyanine Green | PG7 | 74260 |
| Phthalocyanine Green | PG36 | 74265 |
| Arylide Yellow | PY74 | 11741 |
| Arylide Yellow | PY65 | 11740 |
| Diarylide Yellow | PY83 | 21108 |
| Benzimidazolone Yellow | PY151 | 13980 |
| Iron Oxide Yellow | PY42 | 77492 |
| DNA Orange | P05 | 12075 |
| Pyrazolone Orange | P034 | 21115 |
| Benzimidazolone Orange | P036 | 11780 |
| Naphthol Red | PR170 | 12475 |
| Quinacridone Red | PR202 | 73905 |
| Quinacridone Red | PR122 | 73915 |
| Quinacridone Violet | PV19 | 46500 |
| Iron Oxide Red | PR101 | 77491 |
| Iron Oxide Brown | PBr6 | 77491, 77492, 77499 |
| Iron Oxide Brown | PBr 11 | 77495 |
| Aluminum | PM 1 | 77000 |

3.4.2 Lead and chromate (hexavalent) content. When tested as specified, the lead content shall not exceed 0.06 percent by weight of the total nonvolatile content (see 4.3.8) and the test for hexavalent chromium shall be negative (see 4.3.7).

3.4.3 Vehicle. The vehicle shall be a drying oil alkyd, modified or unmodified.

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3.4.4 Solvent analysis. When tested as specified in 4.3.9, solvents used shall be in accordance with the guidelines established by local, state and Federal regulations. Type II shall be HAP-free.

3.5 Quantitative characteristics. When tested as specified in 4.3.2, the enamel shall conform to the quantitative requirements of table III.

TABLE III. Quantitative requirements of enamel.

| Characteristics | Requirements | |
|--|--------------|---------|
| | Minimum | Maximum |
| VOC, grams volatile per liter of enamel reduced for spray (see 4.3.18) | - | 420 |
| Water, % by weight of enamel | - | 0.5 |
| Coarse particles and skins, % by weight of pigment | - | 0.5 |
| Specular gloss, 60 degree | 2 | 8 |
| Viscosity, reduced as specified in 4.3.11, KU | - | 70 |
| Fineness of grind | 5 | - |
| Drying time, air dry | | |
| Set to touch, minutes | - | 6 |
| Dry hard, minutes | - | 12 |
| Contrast ratio | | |
| 37925 White | 0.94 | - |
| 32246 Orange | 0.92 | - |
| 33538 Yellow | 0.90 | - |
| 33655 Yellow | 0.88 | - |
| 31136 Red | 0.92 | - |
| All other colors | 0.98 | - |

3.6 Qualitative requirements.

3.6.1 Condition in container. When tested as specified in 4.3.14, a freshly opened full container of the enamel shall be free from grit, coarse particles, skins, lumps, seeds, livering or abnormal thickening. The enamel shall show no pigment settling or caking that can not be readily reincorporated to a smooth homogeneous state.

3.6.2 Storage stability.

3.6.2.1 Full container. When tested as specified in 4.3.15.1, a full quart of the enamel shall be free from coarse particles, grit, skins, lumps, seeds, livering, hard caking and tough, gummy sediment. The enamel shall remix readily to a smooth homogeneous state, shall show a maximum viscosity increase of 15 KU and shall meet all the requirements of this specification.

3.6.2.2 Partially filled container. When tested as specified in 4.3.15.2, the enamel shall show no skinning. After being aged as specified in 4.3.15.2, the enamel shall show no livering, curdling, seeding, hard caking, or tough gummy sediment. The enamel shall show no pigment settling or caking that cannot be readily re-incorporated to a smooth homogeneous state.

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3.6.3 Accelerated stability. When tested as specified in 4.3.16, the enamel shall show no livering, curdling, hard caking, or tough gummy sediment and shall mix readily to a smooth homogenous state.

3.6.4 Suspension properties. When tested as specified in 4.3.17, the enamel shall completely redisperse to a smooth, homogeneous state.

3.6.5 Spraying properties. When tested as specified in 4.3.18, the enamel shall show no running, sagging or streaking. The dried film shall show no dusting, mottling, color separation, flooding or floating, and shall present a smooth, uniform finish free from defects.

3.6.6 Flexibility. When tested as specified in 4.3.19, a film of the enamel shall withstand bending without cracking or flaking.

3.6.7 Knife test. When tested as specified in 4.3.20, the enamel shall adhere tightly to and not flake or crack from the metal surface. The film shall ribbon or curl from the metal on cutting and the cut shall show beveled edges.

3.6.8 Water resistance. When tested as specified in 4.3.21, the enamel shall show no wrinkling or blistering over the whole panel when examined immediately after removal from distilled water. When examined two hours after removal, there shall be only a slight softening, whitening or dulling. After 24 hours air drying, the panel which was immersed shall be almost indistinguishable with regard to hardness, adhesion and general appearance from a panel prepared at the same time but not immersed.

3.6.9 Hydrocarbon resistance. When tested as specified in 4.3.22, the enamel shall show no wrinkling or blistering over the whole panel when examined immediately after removal from the hydrocarbon solution. When examined two hours after removal, there shall be only a slight softening, whitening or dulling. After 24 hours air drying, the panel which was immersed shall be almost indistinguishable with regard to hardness, adhesion and general appearance from a panel prepared at the same time but not immersed.

3.6.10 Adhesion. When tested as specified in 4.3.23, films of the enamel shall show no evidence of removal by the adhesive tape beyond one-eighth inch on either side of the score line.

3.6.11 Salt spray resistance. When tested as specified in 4.3.24 and examined immediately after removal from the salt spray test, films of type I and type II shall have a minimum rating of No. 7, based on test method ASTM D1654, and the failure evaluation procedure for unscribed specimens, procedure B. Upon completion of the salt spray fog test (120 hours for type I enamel and 240 hours for type II enamel), remove the coating film and inspect the substrate. There shall be no more than a trace of rusting, pitting, or corrosion on the panels.

3.6.12 Weather resistance. When prepared and exposed as specified in 4.3.25, films of the enamel shall show no cracking, checking, flaking, or loss of adhesion, and no more than a trace of rusting shall be observed when visually comparing the surface with the photographic reference standard that illustrates minute surface corrosion, less than 0.03% rust grade No. 9, in

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accordance with ASTM D610. On removal of the coating, the surface of the metal shall show no more than a trace of rusting, pitting, or corrosion on the panels.

3.6.13 User instruction marking. All containers shall include the VOC content in grams per liter of coating when reduced as specified with A-A-3007 and shall be legibly marked or labeled with the following:

CAUTION: 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. Avoid contact with skin and eyes. Use adequate ventilation. For other safety recommendations, refer to the Material Safety Data Sheet. Keep containers closed.

3.6.14 Inclusion of material safety data sheet(s) (MSDS). The product manufacturer shall include at least one copy of each appropriate product MSDS in each external package and shall include at least two copies of each appropriate MSDS in each intermediate package.

4. VERIFICATION

4.1 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with test conditions specified in (applicable test method document or applicable paragraph(s) in the specification).

4.1.2 Hazardous material. Failure to comply with the hazardous material requirements of FED-STD-313 shall be cause for rejection.

4.2 Sampling, inspection, and testing. Unless otherwise specified, sampling, inspection, and testing shall be in accordance with FED-STD-141, method 1000.

4.2.1 Classification of inspections. Inspection under this specification shall be for the following:

- a. Qualification (see 4.2.1.1 and 6.3).
- b. Conformance inspection (see 4.2.1.2).

4.2.1.1 Qualification inspection. Qualification shall be conducted by the Qualifying activity (see 6.3). Qualification inspection shall consist of tests for all requirements in section 3 and examination for user instruction marking (see 3.6.13). The results of each test shall be compared with the applicable requirement in section 3. Failure to conform to any requirement shall be counted as a defect, and the paint represented by the sample test shall not be approved for inclusion on the QPL under this specification.

4.2.1.2 Conformance inspection. Conformance inspection shall consist of the following: VOC content, condition in container, total solids, viscosity, color, contrast ratio, fineness of grind, gloss, and dry times as specified in sections 3 and 4.

4.2.2 Standard conditions. Unless otherwise specified herein, all test specimens shall be prepared and tested at a temperature of 21 to 27 °C and a relative humidity of 40 - 65 percent.

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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 range specified in section 3 as applicable shall constitute failure of the applicable test.

4.3.2 Test procedures. The following tests (see table IV) 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 coating meets the requirements of this specification.

4.3.3 Test panels. Except as otherwise specified, metal panels used for test purposes shall be two types (see 6.4):

- a. Steel, cold rolled, 0.032 inches thick. Zinc phosphate, B-952 or equivalent (see 6.4 b).
- b. Steel, tinplated, 0.010 inches thick.

4.3.4 Color. Determine the color in accordance with ASTM D 1729 by applying films with a 0.002 inch (0.004 inch gap clearance) film applicator on a black and white hiding chart until complete hiding is obtained (see 6.4). Evaluate for compliance with 3.3. For colors 33538 and 33655 only, apply a single film and use the area over the white for color comparison.

4.3.5 Pigment analysis. Extract the pigment as specified in FED-STD-141, method 4021 using extraction mixture C. Make appropriate qualitative and quantitative tests on the extracted pigment. Nonconformance to the requirements of 3.4.1 shall constitute failure of this test.

4.3.6 Extender pigment. Determine siliceous matter and barium sulfate by the applicable portions of ASTM D5380. Evaluate for compliance with table I.

4.3.7 Chromium (hexavalent) content.

a. Reagents: 25 percent aqueous KOH

b. Procedure:

1. Add 5 mL of 25 percent aqueous KOH to 0.5 g 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 the presence of chromate. Nonconformance to the requirement in 3.4.2 shall constitute failure of this test.

4.3.8 Lead content. Determine the percent of lead in accordance with ASTM D3335 or by x-ray emission spectrometric analysis in accordance with the manufacturer's manual. Evaluate for compliance with 3.4.2.

4.3.9 Solvent analysis. Evaluate for compliance to 3.4.4 in accordance with ASTM D3271. Hazardous air polluting solvents shall not be used in the formulation of a type II product.

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4.3.10 Specular gloss. Prepare a drawdown of the enamel using a 0.002 inch (0.004 inch gap clearance) film applicator on a glass panel according to ASTM D3891, and air dry for 24 hours. Measure the 60-degree specular gloss in accordance with ASTM D523 and evaluate for compliance with table III.

4.3.11 Viscosity (reduced). Reduce eight parts, by volume, of the enamel with one part, by volume, of thinner conforming to A-A-3007. Measure the viscosity in accordance with ASTM D562 and evaluate for compliance with table III.

4.3.12 Drying time. Prepare a drawdown of enamel using a 0.002 inch (0.004 inch gap clearance) film applicator on a glass panel and air dry for the specified time. Check the drying time in accordance with ASTM D1640 and evaluate for compliance with table III.

4.3.13 Contrast ratio. Prepare a drawdown of the enamel using a 0.002 inch (0.004 inch gap clearance) film applicator and allow to air dry for 24 hours. For colors 33538 and 33655 use a 0.0025 (0.005 inch gap clearance) film applicator. Determine the contrast ratio in accordance with ASTM D2805 and evaluate for compliance with table III.

4.3.14 Condition in container. Determine package condition of the enamel in accordance with FED-STD-141, method 3011 and observe for compliance with 3.6.1. Determine pigment settling by proceeding as specified in FED-STD-141, method 3011, but do not stir. Reseal and then agitate the can for 3 minutes on a paint shaker (see 6.4). On re-examination of the contents, the disclosure of any gel bodies or undispersed pigment indicates unsatisfactory settling properties. Observe for compliance with 3.6.1.

4.3.15 Storage stability.

4.3.15.1 Full container. Allow a full standard quart can of the enamel to stand undisturbed for one year at standard conditions (see 4.2.2) and then examine the contents. Evaluate pigment settling or caking as specified in 4.3.14 except agitate the can for 5 minutes on the paint shaker prior to re-examination. Determine viscosity and make other applicable tests. Nonconformance to 3.6.2.1 shall constitute failure of this test.

4.3.15.2 Partially filled container. Fill a 1-pint friction top can three-fourths full with enamel. Secure the top tightly and invert the can momentarily. Store the can in an upright position for 48 hours and check for skinning. Reseal the can and age for 72 hours at 60 °C. After the aging period, evaluate for compliance with 3.6.2.2.

4.3.16 Accelerated stability. Fill an 8 ounce wide-mouth glass jar, approximately 4-1/2 inches high and 2 inches in diameter, with the packaged enamel. Secure the cover tightly and invert the jar momentarily to check for leaks. Place the sample in a 60 ± 2 °C (140 ± 4 °F) oven in an upright position for 7 days. After this period, allow to cool to room temperature and examine the contents. Non-conformance to 3.6.3 shall constitute failure of this test.

4.3.17 Suspension properties. Reduce the enamel as specified in 4.3.11. Place six ounces of the

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reduced material in an 8-ounce glass jar. Allow the stoppered jar to remain undisturbed for 24 hours and then place the unopened jar on a paint shaker as specified in 4.3.14 and agitate the contents for 20 seconds. Reexamine the material for any evidence of non-homogeneity or undispersed pigment. Nonconformance to 3.6.4 shall constitute failure of this test.

4.3.18 Spraying properties. Reduce the enamel as specified in 4.3.11. Holding the spray gun 8-10 inches from a smooth steel panel, spray to a dry film thickness of 0.0013 to 0.0017 inches according to FED-STD-141, method 4331. Allow to air dry for 24 hours and evaluate for compliance to 3.6.5.

TABLE IV. Test method index.

| Test | Test Paragraph | Requirement Paragraph | ASTM Method | FED-STD-141 Method |
|--------------------------|----------------|-----------------------|-------------|--------------------|
| Color | 4.3.4 | 3.3 | D1729 | - |
| Pigment analysis | 4.3.5 | 3.4.1 | - | 4021 |
| Extender pigment | 4.3.6 | Table I | D5380 | - |
| Chromium content | 4.3.7 | 3.4.2 | - | - |
| VOC content | - | Table III | D3960 | - |
| Nonvolatile matter | - | Table I | D2369 | - |
| Pigment content | - | Table I | D2371 | - |
| Lead content | 4.3.8 | 3.4.2 | D3335 | - |
| Water | - | Table III | D1364 | - |
| Coarse particles | - | Table III | D185 | - |
| Solvent analysis | 4.3.9 | 3.4.4 | D3271 | - |
| Specular gloss | 4.3.10 | Table III | D3891, D523 | - |
| Viscosity, reduced | 4.3.11 | Table III | D562 | - |
| Fineness of grind | - | Table III | D1210 | - |
| Drying time | 4.3.12 | Table III | D1640 | - |
| Contrast ratio | 4.3.13 | Table III | D2805 | - |
| Condition in container | 4.3.14 | 3.6.1 | - | 3011 |
| Storage stability | 4.3.15 | | | |
| Full container | 4.3.15.1 | 3.6.2.1 | - | - |
| Partially full container | 4.3.15.2 | 3.6.2.2 | - | - |
| Accelerated stability | 4.3.16 | 3.6.3 | - | - |
| Suspension properties | 4.3.17 | 3.6.4 | - | - |
| Spraying properties | 4.3.18 | 3.6.5 | - | 4331 |
| Flexibility | 4.3.19 | 3.6.6 | D522 | - |
| Knife test | 4.3.20 | 3.6.7 | - | 6304 |
| Water resistance | 4.3.21 | 3.6.8 | - | - |
| Hydrocarbon resistance | 4.3.22 | 3.6.9 | - | - |
| Adhesion | 4.3.23 | 3.6.10 | - | - |
| Salt spray resistance | 4.3.24 | 3.6.11 | D1654 | - |
| Weather resistance | 4.3.25 | 3.6.12 | D610 | - |
| Directional reflectance | 4.3.26 | 3.3 | E1347 | - |

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4.3.19 Flexibility. Using methyl ethyl ketone and a soft cloth, clean the steel tinplated panels and prepare drawdowns using a 0.002 inch film applicator (0.004 inch gap clearance). Air-dry the panels for two days and force dry 24 hours at 60 ± 2 °C. Condition the panels for 1 hour at standard conditions and bend over a 1/4-inch mandrel. Evaluate according to ASTM D522, procedure B. Check for compliance with 3.6.6.

4.3.20 Knife test. Using the flat portion of the panel used for the flexibility test (see 4.3.19), perform this test in accordance with FED-STD-141, method 6304 and check for compliance with 3.6.7.

4.3.21 Water resistance. Prepare drawdowns on steel panels as specified in 4.3.19. Air dry the panels for 7 days and immerse halfway in distilled water for 18 hours. Evaluate for compliance with 3.6.8.

4.3.22 Hydrocarbon resistance. Prepare drawdowns on steel tinplated panels as specified in 4.3.19. Air dry the panels for 7 days and immerse halfway in a hydrocarbon mixture consisting of 70 percent by volume of iso-octane and 30 percent by volume of toluene for 4 hours. Evaluate for compliance with 3.6.9.

4.3.23 Adhesion. Prepare panels as specified in 4.3.19 but air dry for 7 days and force dry for 48 hours at 60 ± 2 °C. Condition the panels for 1 hour at standard conditions and then score a line through to the metal across the width of the film using a sharp pointed knife. The film shall then be taped perpendicular to and across the score line with water resistant, 3/4-inch wide pressure sensitive adhesive tape (see 6.4). The tape shall be pressed down with two passes of a 4-1/2 pound rubber covered roller, approximately 3-1/2 inches in diameter by 1-3/4 inches in width. The surface of the roller shall have a durometer hardness value within the range of 70 to 80 (see 6.4). Allow 10 seconds for the test area to return to room temperature. Grasp a free end of the tape and at a rapid speed, strip it from the specimen by pulling the tape back upon itself at 180 degrees and check for film removal. Nonconformance to 3.6.10 shall constitute failure of this test.

4.3.24 Salt spray resistance. Prepare three 4 x 12 inch steel panels in accordance with TT-C-490, type I (B952 or equivalent, see 6.4 b). Reduce the enamel as specified in 4.3.11 and spray the panels to a dry film thickness of 0.0013 to 0.0017 inches and air dry for 7 days. Coat edges and uncoated metal surfaces with wax or other suitable coating, but do not score. The enamel-coated panels shall be exposed to a 5 percent salt spray fog test in accordance with ASTM B117. Type I panels shall be exposed for 120 hours and type II panels shall be exposed for 240 hours; and upon completion of the test, panels shall be removed and washed gently in running water, no warmer than 100 °F (38 °C), until surface is free from any visible salt deposits and then immediately examined for compliance with 3.6.11. Strip the enamel from the panels and inspect the panels for rust, pitting or corrosion. Nonconformance to 3.6.11 shall constitute failure of this test.

4.3.25 Weather resistance. Prepare two panels as specified in 4.3.24. Allow to air dry for 7 days and place in outdoor exposure for 24 months at an angle of 45 degrees facing south in the latitude of Aberdeen Proving Ground, MD. At the end of the exposure, strip the enamel film from the surface of the metal and examine it for conformance with 3.6.12. Nonconformance to 3.6.12 shall constitute failure of this test.

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4.3.26 Directional reflectance. For color 37925 only, prepare a test panel for evaluation and using the green filter, check for compliance with 3.3.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

5.2 Inclusion of material safety data sheet(s) (MSDS). DELETED.

6. NOTES

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

6.1 Intended use. This specification covers two types of alkyd enamel formulations; one contains standard pigments (type I) and the other type contains corrosion inhibiting pigments (type II). These enamels can be used on interior and exterior metal surfaces and ammunition. Products are formulated to regulatory air quality volatile emission limits that will yield when reduced as specified by the manufacturer a maximum volatile organic compound (VOC) content of not more than 420 g/L (3.5 lb/gal). Type II coatings are HAP-free. These enamels are used on primed or pretreated metal surfaces in areas that do not permit exposure to lead or chromate pigments.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of the specification.
- b. Container marking and labeling (see 3.6.13).
- c. Packaging requirements (see 5.1).

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 contractors 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 US Army Research Laboratory, ATTN: AMSRD-ARL-WM-MC, Aberdeen Proving Ground, MD 21005-5069; and information pertaining to qualification of products may be obtained from this activity.

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6.3.1 Qualification colors. After successful completion of testing specified in 4.2.1.2, qualification inspection of colors shown in the left column of table V, will be extended to the respective colors listed in the right column (see 3.3).

TABLE V. Colors approved by extension of qualification.

| Qualified Colors | Additional Colors to Which Approval is Extended |
|------------------|--|
| 17178 | - |
| 31136 | 31158 |
| 32246 | - |
| 33538 | 33655 |
| 34088 | 34082, 34108 |
| 34540 | - |
| 35044 | 35109, 35193 |
| 37038 | - |
| 37925 | 33446, 34558, 36118, 36231, 36440, 37142, 37875, 36375 |

6.4 Miscellaneous information. The following information may be useful as a basis of purchase in securing some of the products and test equipment used in the verification section of this specification.

- a. The enamel covered by this specification is purchased by volume, the unit being one US liquid gallon of 231 cubic inches at 20 °C (68 °F).
- b. The type of steel test panels comparable to those used to conduct the tests in table IV and 4.3.3 are available from test panel supply companies such as Q-Panel Company, Cleveland, OH and ATC Laboratories in Hillsdale, MI. Zinc phosphate coated, cold rolled steel panels, 0.032 inch thick, can be purchased from ACT Laboratory; these or equivalent panels are the type specified in 4.3.3 a., and can be used for the salt spray resistance verification test in 4.3.24. Q-Panel S412 or equivalent equate to SAE 1010 steel, cold rolled, 0.032 inch thick panels, and Q-Panel DT-36 or equivalent can be used for tests requiring 0.010 inch tinplated steel panels (see 4.3.3 b.).
- c. A black and white hiding chart that is suitable for determining a color match (see 4.3.4) is available from Leneta Company, Ho-Ho-Kus, NJ (Leneta Form 2A chart). This or an equivalent chart is used to match color.
- d. A suitable shaking type of mixing apparatus that is engaged in testing the settling properties of the enamel (see 4.3.14), is powered by a _ HP motor, operating at a rate of 615 cycles per minute that is manufactured by Red Devil Tools, Irvington, NJ.
- e. Permacel 99 or equivalent tape is acceptable for use in the adhesion test outlined in 4.3.23. Permacel 99 is available from Paul N. Gardner, 316 NE First St, Pompano Beach, FL 33060, Tel: 1-800-762-2478. Also, a roller comparable to the one used for pressing down the tape and conducting the adhesion test described in 4.2.23 is available from the Pressure Sensitive Tape Council, 1201 Waukegan Road, Glenview, IL 60025.
- f. Steel panels comparable to those specified for use in the salt spray resistance test are available from Bonderite, type 37 or 40 (see 4.3.24).

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6.5 Material safety data sheets. Contracting officers will identify those activities requiring copies of completed material safety data sheets (MSDS) prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313, appendix B. MSDS inclusion with the product ensures that important health and safety information is delivered with the product. Title 29 CFR 1910.1200 requires that MSDSs be made available to the users of products with hazardous properties.

6.6 Subject term (key word) listing.

Alkyd enamel
Lead and chromate free
Low VOC coating
Volatile organic compounds (VOCs)

6.7 Changes from previous issue. DELETED.

6.7 Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

CONCLUDING MATERIAL

Custodian:
Army – MR

Preparing activity:
Army - MR

Project 8010-2007-012

Review activities:
Army - AR, AT, CR, EA, MD1, MI

Civil Agency:
GSA/FSS – 6FEE

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://assist.daps.dla.mil/>.