

INCH-POUND

MIL-E-24763(SH)
19 June 1991

MILITARY SPECIFICATION

ENAMEL, EMULSION TYPE, FOR SHIPBOARD USE

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements of acrylic, water emulsion (latex), volatile organic content compliant (VOC), topcoat enamels in a variety of colors (see 6.2 and 6.5) for shipboard use. These enamels are primarily for use on primed metal.

1.2 Classification. Enamel covered by this specification is of the following types and classes, as specified (see 6.2):

- Type I - Air-drying, acrylic emulsion type with a VOC not to exceed 340 grams per liter (g/L) (2.8 pounds per gallon [LB/GAL])
- Type II - Air-drying, acrylic emulsion type with a VOC not to exceed 275 g/L. (2.3 LB/GAL)
- Class 1 - High gloss, 85 percent minimum.
- Class 2 - Medium gloss, 45 to 60 percent.
- Class 3 - Low gloss, 15 to 30 percent.
- Class 4 - Flat gloss, 5 to 15 percent.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 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 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: Commander, Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 8010

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SPECIFICATIONS

FEDERAL

- TT-P-645 - Primer, Paint, Zinc-Molybdate, Alkyd Type.
- PPP-F-320 - Fiberboard, Corrugated and Solid, Sheet Stock (Container Grade), and Cut Sheets.
- PPP-P-1892 - Paint, Varnish Lacquer, and Related Materials; Packaging, Packing and Marking of.

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- MIL-L-19140 - Lumber and Plywood, Fire Retardant Treated.
- MIL-P-24441 - Paint, Epoxy-Polyamide, General Specification for.
- MIL-P-24441/1 - Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type I.

STANDARDS

FEDERAL

- 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.

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- MIL-STD-129 - Marking for Shipment and Storage.

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

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.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

40 CFR CH. 1, Part 60, Appendix A, Method 24 - Determination of Volatile Matter Content, Water Content, Density, Volume Solids and Weight Solids of Surface Coatings.

Federal Register (FR), Volume 55, Paragraph 11798, March, 1990 (55FR11798), Toxicity Characteristic Leaching Procedure (TCLP).

DEPARTMENT OF LABOR, OCCUPATIONAL HEALTH AND SAFETY ADMINISTRATION (OHSA)

Code of Federal Regulations (CFR)

29 CFR 1910, 1915, 1917, 1918, 1926 and 1928 - Hazard Communication Standard.

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(The Code of Federal Regulations (CFR) and the Federal Register (FR) are for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. When indicated, reprints of certain regulations may be obtained from the Federal agency responsible for issuance thereof.)

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 CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH).

Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents in the Work Environment and Biological Exposure Indices.

(Application for copies should be sent to the American Conference of Governmental Hygienists, 6500 Glenway Avenue, BLDG. D7, Cincinnati, Ohio 45211.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- D 523 - Standard Test Method for Specular Gloss. (DoD adopted)
- D 562 - Standard Test Method for Consistency of Paints Using the Stormer Viscometer. (DoD adopted)
- D 660 - Standard Test Method for Evaluating Degree of Checking of Exterior Paints. (DoD adopted)
- D 661 - Standard Test Method for Evaluating Degree of Cracking of Exterior Paints. (DoD adopted)
- D 714 - Standard Test Method for Evaluating Degree of Blistering of Paints. (DoD adopted)
- D 1210 - Standard Test Method for Fineness of Dispersion of Pigment-Vehicle Systems. (DoD adopted)
- D 1654 - Standard Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments. (DoD adopted)
- D 2243 - Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings. (DoD adopted)
- D 2244 - Standard Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates. (DoD adopted)
- D 2805 - Standard Test Method for Hiding Power of Paints by Reflectometry.
- D 3168 - Standard Practice for Qualitative Identification of Polymers in Emulsion Paints.
- D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber. (DoD adopted)
- D 3274 - Standard Test Method of Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation. (DoD adopted)
- D 3278 - Standard Test Methods for Flash Point of Liquids by Setafash Closed-Cup Apparatus. (DoD adopted)

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- D 3335 - Standard Test Method for Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy. (DoD adopted)
- D 3359 - Standard Methods for Measuring Adhesion by Tape Test. (DoD adopted)
- D 4400 - Standard Test Method for Sag Resistance of Paints Using a Multinotch Applicator.
- E 97 - Standard Test Method for Directional Reflectance Factor, 45-Deg 0-Deg, of Opaque Specimens by Broad-Band Filter Reflectometry. (DoD adopted)
- F 718 - Standard for Shipbuilders and Marine Paints and Coatings Product/Procedure Data Sheet.
- G 53 - Standard Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials. (DoD adopted)

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

(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 enamels 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 of award of contract (see 4.3, 6.2 and 6.4).

3.2 Material safety data sheet (MSDS). The contracting activity shall be provided a material safety data sheet at the time of contract award. The MSDS shall be provided in accordance with the requirements of FED-STD-313. The MSDS shall be included with each shipment of the material covered by this specification (see 6.6).

3.3 Directions for use. The contractor shall provide written directions on each container for the mixing and applying of the enamel supplied and this direction shall include all information necessary to comply with OSHA Hazard Communication Standard and FED-STD-313. In addition, the contractor shall provide an ASTM F 718 data sheet which shall separately detail requirements for small unit (metric and English equivalents of pint, quart, gallon) and large unit (5-gallon) containers.

3.4 Hazardous or toxic ingredients. The materials used in the paint shall have no adverse effect on the health of personnel engaged in mixing and application of the paint as required by Occupational Safety and Health Administration (OSHA) guidelines. Manufacturers shall prepare container label instructions for

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the paint in accordance with the requirements of 29 CFR Parts 1910, 1915, 1917, 1918, 1926 and 1928 - Hazard Communication Act, Final Rule (see 5.1). In choosing the specific ingredients to manufacture the paint, the manufacturer shall ensure that the paint offered for delivery does not contain the following materials in excess of 0.05% by weight of either the total formulated paint or in the dry film formed by the paint: Benzene, Toluene, chlorinated solvents, esters or ethers derived from ethylene glycol, hydrolyzable chlorine derivatives, coal tar and coal tar derivatives, any ACGIH carcinogenic or ACGIH suspected carcinogenic compounds. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate departmental medical service who will act as advisor to the contracting activity.

3.5 Composition. The contractor is given his choice in the formulation of the enamels provided the end product conforms to all requirements of this document (see 4.7). However, Contractor shall assure composition conforms to the requirements of 3.4 and that soluble metal content and total metal content of the enamels shall not exceed the values listed in Tables I and II when tested in accordance with 4.6.14.

TABLE I. Soluble metals content.

Requirement	Maximum
Metals content (soluble), mg/L	
Antimony and/or its compounds	15
Arsenic and/or its compounds	5
Barium and/or its compounds (excluding barite)	100
Beryllium and/or its compounds	0.75
Cadmium and/or its compounds	1
Chromium (VI) compounds	5
Chromium and/or chromium (III) compounds	560
Cobalt and/or its compounds	80
Copper and/or its compounds	25
Fluoride salts	180
Lead and/or its compounds	5
Mercury and/or its compounds	0.2
Molybdenum and/or its compounds	350
Nickel and/or its compounds	20
Selenium and/or its compounds	1
Silver and/or its compounds	5
Thallium and/or its compounds	7
Vanadium and/or its compounds	24
Zinc and/or its compounds	250

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TABLE II. Total metals content.

Requirement	Maximum
Metals content (total), weight percent	
Antimony and/or its compounds	0.05
Arsenic and/or its compounds	0.05
Barium and/or its compounds (excluding barite)	1.00
Beryllium and/or its compounds	0.0075
Cadmium and/or its compounds	0.01
Chromium (VI) compounds	0.05
Chromium and/or chromium (III) compounds	0.25
Cobalt and/or its compounds	0.80
Copper and/or its compounds	0.25
Fluoride salts	1.80
Lead and/or its compounds	0.10
Mercury and/or its compounds	0.002
Molybdenum and/or its compounds	0.35
Nickel and/or its compounds	0.20
Selenium and/or its compounds	0.01
Silver and/or its compounds	0.05
Thallium and/or its compounds	0.07
Vanadium and/or its compounds	0.24
Zinc and/or its compounds	0.50

3.6 Material requirements. The enamel shall consist of pigments, additives, and acrylic emulsion resins, so combined as to produce a ready-for-use material meeting all the requirements of this document. Infrared analysis as specified in table IV shall show the resin to be unmodified acrylic.

3.7 Quantitative requirements. The enamel shall conform to the quantitative requirements specified on table III and as follows when tested as specified in section 4.

3.7.1 Color. Colors shall be consistent with the pigments used and shall match (see 3.7.1.1) the color coordinates of the FED-STD-595 number specified (see 6.2) when tested as specified in 4.6.5.

3.7.1.1 Color deviation. The color deviation of enamel from an unopened, original container shall be obtained as specified in 4.6.5. The measured color deviation from the FED-STD-595 color number specified, measured in CIE (Commission International de l'Eclairage) system units (CIELAB), shall not exceed: delta E - 0.5 CIELAB units, delta A - 0.3 CIELAB units, delta B - 0.3 CIELAB units and delta L - 0.3 CIELAB units.

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TABLE III. Quantitative requirements of all types and classes, unless specifically indicated.

	Minimum	Maximum
Fineness of grind, Hegman	6	--
Flashpoint, degrees Fahrenheit (°F)	100	--
VOC, grams per waterless liter (LB/gal)		
Type I	--	340 (2.8)
Type II	--	275 (2.3)
Drying time, hours		
Set-to-touch	--	2
Dry hard	--	8
Dry-to-recoat	--	16
Gloss, 60 degrees specular		
Class 1	85	--
Class 2	45	60
Class 3	15	30
Class 4	5	15
Coarse particles and skins, percent by weight	--	0.2
Flexibility, 1 mil dry film, 0.25-inch mandrel	pass	--
Impact resistance, 1 mil dry film, 20 inch-pounds		
Direct	no damage	--
Reverse	no damage	--
Lead, percent by weight of total solids	--	0.05
Dry film contrast ratio, percent	0.98	--
Sag resistance, anti-sag index	7	--
Contrast ratio		
Gray and black colors	0.90	--
White colors	0.90	--
Red, yellow and orange	0.75	--
Soluble and total metal content	--	1/

1/ See 3.5.

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3.7.2 Accelerated weathering. When prepared as specified in 4.6.11.1 and tested in accordance with 4.6.13, films of the enamels shall meet the following requirements: (a) not be rated lower than 9 (1 percent) for checking (ASTM D 660), (b) not be rated lower than 9 for cracking (ASTM D 661), (c) not be rated less than 10 for blistering (ASTM D 714), (d) gloss retention shall be a minimum of 85 percent of that measured prior to weathering (ASTM D 523), and (e) the CIELAB color difference (delta E), delta L, delta a, and delta b units, shall not exceed 1.0 CIELAB units from the original color values measured before testing (ASTM D 2244).

3.7.3 Volatile organic content. The VOC of the enamel shall not exceed the quantities allowed in table III when determined as specified in 4.6.8 (see 6.3).

3.8 Qualitative requirements (all types). The enamel shall meet the following qualitative requirements specified herein.

3.8.1 Condition in the container. When tested in accordance with method 3011.2 of FED-STD-141, the enamel shall be ready mixed and shall show no hard pigment settling, phase separation, evidence of biological growth, livering, skinning, putrefaction, corrosion of the container, grit or seeding particles, or persistent foam. Any settled pigment shall be easily and completely reincorporated with a paddle or mechanical mixer within 5 minutes to a smooth and uniform condition, free from persistent foam.

3.8.2 Resistance to biological growth. When tested as specified in 4.6.9, the enamel film shall have a surface disfigurement rating of 8 or greater when evaluated against adjunct no. 12-432740-00 as specified in ASTM D 3274.

3.8.3 Freeze-thaw stability. When tested as specified in 4.6.10, the enamel shall be free of livering, curdling, hard-dry caking, and tough gummy sediments. The enamel shall mix readily with a paddle or mechanical mixer within 5 minutes to a smooth, uniform state, free of grits, seed, tough or gummy sediment, skins, pigment settling and persistent foam. The tested enamel shall show no flocculation and its consistency shall change not greater than plus or minus 8 KU compared to the paint in an original, unopened container in the as-received condition. Additionally, the tested enamel shall meet the requirements of gloss retention and color change required by 3.7.2.

3.8.4 Storage stability.

3.8.4.1 Shelf life. When tested as specified in 4.6.1.1 one year after date of manufacture an original, unopened full container of enamel shall be free of grits, seed tough or gummy sediment, skins, pigment settling and persistent foam. The tested enamel shall mix readily to a smooth, uniform state with a paddle or mechanical mixer within 5 minutes and show no flocculation and its consistency shall change no greater than plus or minus 8 KU as compared to the paint when first delivered. Additionally, the tested paint shall meet the requirements of 3.7.2.

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3.8.4.2 Partially full container. After exposure as specified in 4.6.1.2, the enamel shall show no skinning, livering, curdling, hard dry caking, or tough or gummy sediment. Enamel shall mix readily with a paddle or mechanical mixer within 5 minutes to a smooth, uniform state, free of grits, seeds, lumps, and skins.

3.8.4.3 Accelerated storage stability. After storage at 60 degrees Celsius ($^{\circ}\text{C}$) (140°F) for 30 days as specified in 4.6.1.3, an unopened, original container of enamel shall be redispersable with a paddle or mechanical mixer within 5 minutes to a uniform condition and shall meet the requirements specified in 3.8.1, 3.8.5, 3.8.6, and 3.8.7.

3.8.5 Spraying properties. When tested as specified in 4.6.2, the enamel shall spray satisfactorily and shall show no running, sagging, or streaking. The dried film shall show no blooming, blushing, bubbling, cratering, dusting, floating, fogging, hazing, mottling, orange peel appearance, pinholing, seeding, silking, or streaking in accordance with method 4331.1 of FED-STD-141.

3.8.6 Brushing properties. When tested as specified in 4.6.3, the enamel shall brush easily and have good flowing and spreading qualities. The dried film shall show no running, sagging, or streaking. The dried film shall show no runs, blooming, blushing, bubbling, cratering, dusting, floating, fogging, hazing, mottling, orange peel appearance, pinholing, seeding, silking, or streaking in accordance with method 4321.1 of FED-STD-141.

3.8.7 Rolling properties. When tested as specified in 4.6.4, the enamel shall roll easily and have good flowing and spreading qualities. The dried film shall show no running, sagging, blooming, blushing, bubbling, cratering, dusting, floating, fogging, hazing, mottling, orange peel appearance, pinholing, seeding, silking, or streaking in accordance with method 4335 of FED-STD-141.

3.8.8 Knife test. When tested as specified in 4.6.7, a film of enamel shall adhere tightly to the primer. It shall be difficult to furrow off with the knife and shall not flake, chip or powder. The enamel shall not show brittle or rubbery characteristics; the knife cut shall show beveled edges.

3.8.9 Primer compatibility.

3.8.9.1 Dry adhesion. When tested as specified in 4.6.11.1, films consisting of primer and enamel shall show no blistering, wrinkling or any other evidence of separation. The adhesion by tape test shall be rated not lower than 4A. The enamel shall adhere tightly to the primer. Using a scalpel, the enamel shall not lift from the primer without leaving some enamel attached to the primer.

3.8.9.2 Wet adhesion. When tested as specified in 4.6.11.2, films consisting of primer and enamel shall show no blistering, wrinkling or any other evidence of separation. The adhesion by tape test shall be rated not lower than 4A. The enamel shall adhere tightly to the primer. Using a scalpel, the enamel shall not lift from the primer without leaving some enamel attached to the primer.

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3.8.10 Enamel recoatability. When tested as specified in 4.6.12, films of enamel shall show no blistering, wrinkling or other evidence of intercoat separation. Films shall be difficult to separate from one another. Using a scalpel, there shall be no lifting between coats without leaving coating on the overcoated film.

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 this 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 the 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.

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

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

4.3 Qualification inspection. Qualification inspection shall consist of all tests specified in table IV. Each individual enamel tested shall be enamels drawn from regular production stocks. A test report detailing the results of any required testing performed by the manufacturer, his representatives or at his behest by employed agents shall be provided by the manufacturer to the contracting officer, his agent or the qualifying activity, as appropriate. Testing of products on Government ships shall be conducted at the convenience of the Government.

4.3.1 Extension of qualification. Approval of qualification for Navy haze gray to match color 26270 of FED-STD-595 shall constitute approval for other colors of the same type and class. Approval of qualification for a type II class enamel shall also constitute approval of qualification of that enamel for type I of the same class. Enamel submitted for qualification for a type II, but passes the VOC requirement for type I shall be qualified for the same type I class provided that the enamel passes all other requirements for that type and class.

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Enamel submitted for qualification for a type II class, but that does not pass the VOC requirement for type II, but passes the VOC requirement for type I, shall be qualified for the same type I class provided that the enamel passes all other requirements for that type and class.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the table IV tests marked with a 1/ (see table IV footnote). Tests shall be performed on each lot offered for delivery.

4.4.1 Lot. A lot shall consist of a single uniform batch or a uniform blend of batches offered for delivery at one time.

4.4.1.1 Batch. A batch shall consist of a quantity of an individual finished paint manufactured at the same time from the same units (sacks, cans, barrels, etc.) of ingredients.

4.5 Test conditions. Unless otherwise specified, the routine and referee testing conditions shall be in accordance with FED-STD-141. The term referee condition shall mean a temperature of $23 \pm 1^{\circ}\text{C}$ ($73 \pm 2^{\circ}\text{F}$) and a relative humidity of 50 ± 4 percent. A dry film thickness of 3.8 to 5.1 mm (0.0015 to 0.002 inches ((1.5-2.0 mils)) shall be used whenever film thickness is required in any test unless otherwise specified by the test.

4.5.1 Test panels and surface preparation.

4.5.1.1 Test panels. Test panels shall be 6 by 12 inches by 1/4 inch plate (nominal) glass, ground or abrasive blasted and solvent cleaned to provide a uniform, clean, rough surface on one side. Primers specified in 4.5.1.2 shall be applied to the ground side of the test panel. Cure for 24 hours at room temperature and then 1 hour at 40 to 50°C (104 to 122°F) unless otherwise required.

4.5.1.2 Test primers. The following primers shall be used:

- (a) TT-P-645.
- (b) MIL-P-24441/1.
- (c) A Naval Sea Systems Command (NAVSEA 5141) approved inorganic zinc-rich primer.

4.6 Test procedures (all types). Test procedures shall be as listed in table IV, and as otherwise specified herein.

4.6.1 Storage stability.

4.6.1.1 Shelf life. When allowed to remain undisturbed for 2 years under ambient conditions (see 4.5), the enamel shall conform to the requirements in 3.8.4.1.

4.6.1.2 Partially full container. Skinning shall be determined after 48 hours in accordance with method 3021.1 of FED-STD-141, except that a 3/4-filled, 1/2-pint, resin-lined, multiple friction top can shall be used. The can shall be resealed and aged for 30 days at 60°C (140°F) and examined for compliance with 3.8.4.2.

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TABLE IV. Test procedures.

Characteristic	Requirement	Applicable test method FED-STD-141	ASTM test method	Test
Material requirements	3.6	-----	D 3168	-----
Condition in container <u>1/</u>	3.8.1	3011.2	-----	-----
Storage stability	3.8.4	3021.1, 3022.1	-----	4.6.1
Spraying properties <u>1/</u>	3.8.5	4331.1	-----	4.6.2
Brushing properties <u>1/</u>	3.8.6	4321.2	-----	4.6.3
Rolling properties <u>1/</u>	3.8.7	4335	-----	4.6.4
Color/color deviation <u>1/</u>	3.7.1	-----	E 97, D 2244	4.6.5
Flexibility	Table III	6221	-----	4.6.6
Knife test	3.8.8	6304.1	-----	4.6.7
Viscosity <u>1/</u>	Table III	-----	D 562	-----
Sag resistance <u>1/</u>	Table III	-----	D 4400 Method A	-----
Fineness of grind <u>1/</u>	Table III	-----	D 1210	-----
Flash point <u>1/</u>	Table III	-----	D 3278	-----
VOC <u>1/</u>	Table III, 3.7.3	-----	-----	4.6.8
Drying time <u>1/</u>	Table III	4061.2	-----	-----
Gloss, 60 degrees specular <u>1/2/</u>	Table III	-----	D 523	-----
Coarse particles <u>1/</u>	Table III	4092.1	-----	-----
Impact resistance	Table III	6226	-----	-----
Lead content	Table III	-----	D 3335	-----
Resistance to biological growth	3.8.2	-----	D 3274, D 3273	4.6.9
Freeze-thaw stability	3.8.3	-----	D 2243	4.6.10
Primer compatibility	3.8.9	-----	D 3359 Method A	4.6.11
Enamel recoatability	3.8.10	-----	-----	4.6.12
Accelerated weathering	3.7.2	-----	-----	4.6.13
Contrast ratio <u>3/</u>	Table III	-----	D 2805	-----
Soluble and total metal content	3.5	-----	-----	4.6.14

1/ Required for quality conformance inspection.

2/ Make a 3 mil wet film thickness drawdown on glass, dry for 48 hours at ambient laboratory conditions before performing test.

3/ Spreading rate shall be such as to yield a dry film thickness of 3 to 4 mils.

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4.6.1.3 Accelerated storage stability. After exposure to a temperature of 60°C (140°F) continually for 30 days, a full 1-quart can of enamel shall be examined for compliance with 3.8.4.3.

4.6.2 Spraying properties. The enamel shall be sprayed in an "as-received" condition on a ground glass panel (see 4.5.1.1) to a wet film thickness of 0.002 to 0.004 inch (46 to 92 micrometer (μm)). The panel shall be observed for spraying properties in accordance with method 4331.1 of FED-STD-141 for compliance with 3.8.5.

4.6.3 Brushing properties. The brushing properties of the enamel shall be determined in accordance with method 4321.2 of FED-STD-141 for compliance with 3.8.6.

4.6.4 Rolling properties. The rolling properties of the enamel in an "as-received" condition shall be determined in accordance with method 4335 of FED-STD-141 for compliance with 3.8.7.

4.6.5 Color. Draw down the enamel on glass using a sufficient number of successive crosscoats (each coat having a wet film thickness (WFT) of 0.003" or 3 mils) so that additional coats produce no change in reflectance. Dry at ambient laboratory conditions for 24 hours after each coat. Determine color difference in accordance with ASTM D2244 using a D-65 light source, 45-degree illumination angle, a 0-degree viewing angle. Results shall be in accordance with the requirements of 3.7.1.1.

4.6.6 Flexibility. The flexibility of the enamel shall be determined in accordance with method 6221 of FED-STD-141. A 2-inch wide film of enamel shall be applied using a film applicator that will give a dry film thickness (DFT) of 0.0009 to 0.0011 inch (23 to 28 μm) on a smooth finished tinfoil steel panel prepared in accordance with method 2011.2 of FED-STD-141 using a mixture of 50:50 aliphatic naphtha and propylene glycol monoethyl ether. The panel shall be prepared from new, cold-rolled, rust-free, carbon steel 0.010 \pm 0.001 inch (25.4 \pm 2.5 μm) thick with a Rockwell 15-T maximum hardness of 82 and finished with a surface roughness of 8 to 12 μm . After application, the panel shall be air-dried in a horizontal position for 18 hours and then baked for 168 hours at 105 \pm 2°C (221 \pm 4°F). The panel shall be conditioned for 1/2 hour under standard test conditions. The panel shall be bent over a 1/4-inch (6.35-millimeter (mm)) mandrel. The panel shall be examined for cracks over the area of the bend in a strong light for compliance with table III.

4.6.7 Knife test. The knife test shall be conducted in accordance with method 6304.1 of FED-STD-141, using the flat portion of the panel from the flexibility test (see 4.6.6). The test results shall conform to 3.8.8.

4.6.8 Volatile organic content. The VOC in the enamel shall conform to the requirements of table III, when determined in accordance with EPA 40 CFR CH.1, part 60, appendix A, method 24.

4.6.9 Resistance to biological growth. The biological growth on the surface of the enamel shall be determined in accordance with ASTM D 3273. The extent of surface disfigurement shall be evaluated in accordance with ASTM D 3274. Fungal mycelium and spores, slime, and dirt or soil accumulation shall be considered

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disfiguring agents in the evaluation. The rating obtained shall be as specified in 3.8.2.

4.6.10 Freeze-thaw stability. Enamel shall be tested in accordance with ASTM D 2243, except after completion of the exposure and room temperature equilibration, the exposure shall be repeated twice before proceeding to the examination (three exposure cycles to 0°F and three equilibrations). Consistency shall be determined in accordance with ASTM D 562; contrast ratio, gloss, and reflectance shall be determined as specified in table IV; and characteristics shall comply with the requirements of table III (see 3.7.2 and 3.8.3).

4.6.11 Primer compatibility.

4.6.11.1 Dry adhesion. The 14 test panels shall be as specified in 4.5.1.1. Six panels shall be primed with an epoxy-polyamide material in accordance with MIL-P-24441 and MIL-P-24441/1. Four panels shall be primed in accordance with TT-P-645. Four panels shall be prepared with a NAVSEA 5141 approved inorganic zinc-rich primer in accordance with manufacturer's instructions. Two panels, each prepared with MIL-P-24441/1, shall dry for 6, 24, 168 hours, respectively, at standard test conditions (see 4.5) before the application of two spray coats of enamel conforming to this specification. Film thickness shall be 2 to 4 mils for MIL-P-24441/1 and 1.5 to 2.0 mils for TT-P-645, respectively. The panels dried for 168 hours, prior to application of the enamel, shall receive a tack coat of the MIL-P-24441/1 primer (a wet film application of 1 to 2 mils). Two panels, each to which primer in accordance with TT-P-645 is applied, shall be dried for 24 and 168 hours, respectively, at standard test conditions (see 4.5) and overcoated with enamel conforming to this specification in like manner as the panels treated with the epoxy-polyamide material. Panels of the NAVSEA 5141 approved inorganic, zinc-rich primer shall be overcoated in the same manner as the TT-P-645 test panels. Overcoated primed panels shall be dried for 168 hours under standard test conditions (see 4.5). Panels shall be tested as specified in 4.6.13. The tape test shall be performed in accordance with ASTM D 3359, method A, except that the tape used shall be commercially available masking tape. Following the tape test, lifting characteristics shall be determined between the enamel and the primer at the scribe and at a distance up to 1 inch perpendicular to the scribe using the aid of a microscope. The test results shall conform to the requirements of 3.8.9.1.

4.6.11.2 Wet adhesion. Application of primers and enamel shall be made as specified in 4.6.11.1 and the systems shall be dried as previously indicated. At the conclusion of the drying cycle, the panels shall be scribed using a tool in accordance with ASTM D 1654 and immersed in distilled water at standard test conditions (see 4.5) for 24 hours. While immersed, the panels shall be examined for evidence of blistering, wrinkling, or other evidence of adhesion failure of the test enamel to the primers. Test for wet adhesion shall be in accordance with method 6301.2 of FED-STD-141, except the tape used shall be commercially available masking tape. Following the tape test, lifting characteristics shall be determined between the enamel and the primer at the scribe and at a distance up to 1 inch perpendicular to the scribe using the aid of a microscope. The test results shall conform to the requirements of 3.8.9.2.

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4.6.12 Enamel recoatability. The test panels shall consist of four 4- by 8- inch panels for each of the recoatability systems prepared as specified in 4.5.1.1. The test recoatability systems shall consist of: (a) two coats of enamel in conformance with this specification one over the other, (b) one coat of enamel in conformance with this specification overcoated with a coat of TT-P-645 at a nominal wet film thickness of 0.004 inches. For each test system, after application of the first coat of the enamel to a nominal wet film thickness of 0.004 inches, two test panels shall be dried for 24 and two test panels for 168 hours. A brush coat of the specified second coat of enamel shall then be applied. After application of the second coat of the test system, the test panels shall be dried at standard test conditions (see 4.5) for an additional 168 hours. The adhesion between test coats shall be determined in accordance with the method described in 4.6.11.1. The adhesion and appearance shall conform to the requirements of 3.8.10.

4.6.13 Accelerated weathering. The test panels shall consist of four panels prepared in accordance with 4.5.1.1. The priming and coating with enamel shall be in accordance with 4.6.11.1. Measure the initial color of the test panel in accordance with ASTM E 97 on any suitable instrument. The panels shall then be exposed in an apparatus in conformance with ASTM G 53 for a total of 300 hours. The cycle shall be 4 hours ultra-violet exposure using UVB-313 bulbs at 60°C (140°F) and 4 hours water condensation only at 40°C (104°F). Remeasure color and gloss of the tested panels. Calculate change in gloss. Calculate color differences in accordance with ASTM D 2244. Results shall comply with the requirements of 3.7.2.

4.6.14 Soluble metal content and total metal content. Soluble and total metal contents shall be determined for each enamel in accordance with The Federal Register, Volume 55, Paragraph 11798, March 1990 (55FR11798, March 199) Toxicity Characteristic Leaching Procedure (TCLP).

4.7 Toxicological product formulations. The contractor shall have the toxicological product formulations and associated information available for review by the contracting activity to evaluate the safety of the material for the proposed use.

4.8 Inspection of packaging. Sample packages and packs, and the inspection of the preservation, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The preparation for delivery requirements specified herein apply only for direct Government acquisitions.)

5.1 Packaging.

The enamel shall be package level A, B, or C packed as specified (see 6.7) and marked in accordance with PPP-P-1892, herein, and shall include bar codes, hazardous warnings (see 3.7) and applicable packaging acquisition options therein

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specified (see 6.2). The enamel shall be furnished in metric or English containers equivalent to 1-quart or 1-gallon, multiple friction top, resin-lined containers, or in 5-gallon, lug cover, steel, resin-lined pails, or 55-gallon, resin-lined drums, as specified (see 6.2).

In addition, for Navy acquisitions, the following Navy fire-retardant requirements apply:

- (a) Treated lumber and plywood. Unless otherwise specified (see 6.2), all lumber and plywood, including laminated veneer materials, used in shipping container and pallet construction, members, blocking, bracing, and reinforcing shall be fire-retardant treated material in accordance with MIL-L-19140 as follows:

Levels A and B: MIL-L-19140, type II (weather resistant), Category I (general use).

Level C: MIL-L-19140, type I (non-weather resistant), Category I (general use).

- (b) Fiberboard. Fiberboard used in the construction of interior (unit and intermediate) and exterior containers, including interior packaging forms, shall conform to the PPP-F-320. PPP-F-320 classes shall be domestic fire-retardant or weather resistant fire-retardant as specified (see 6.2).

5.1.1 Commercial. The enamel shall be furnished in metric or English equivalents of 1-quart or 1-gallon, multiple friction top, resin-lined container or in 5-gallon, lug cover steel, resin-lined pails, or 55-gallon, resin-lined drums, as specified (see 6.2). If specifically allowed by the contracting activity, commercial plastic containers and pails may be utilized.

5.2 Marking. Marking shall be at level A or B in accordance with MIL-STD-129 (see 6.2).

5.2.1 Preliminary markings. In addition to the markings required in accordance with MIL-STD-129, FED-STD-313, and 29 CFR Parts 1910, 1915, 1917, 1918, 1926 and 1928, all individual containers shall have the following markings (see 6.2):

"CAUTION: This enamel may contain certain volatile solvents with possibly hazardous vapors. Use with adequate ventilation. Avoid prolonged breathing of vapors or spray mists."

5.2.2 Special marking. In addition to the markings required by the contract or order (see 6.2), each container, interior and exterior shall be marked with the following (see 6.2):

5.2.2.1 User instruction marking. In addition to the markings specified in section 5.2, all primary containers shall be legibly labeled with the manufacturer's mixing, thinning and application instructions. Application instructions must include the following points and be consistent with the required ASTM F 718 data sheet (see 3.3):

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- (a) Requirement that the surface be primed, prior to application of the enamel and that it be free of millscale, corrosion, loose paint, dirt, oil, grease, salt deposits and moisture.
- (b) Indicate the minimum and maximum surface temperatures for application and required dew point levels (if any).
- (c) Requirement, if applicable, for equipment to be adequately grounded and spray equipment cleaning instructions.
- (d) Disposal of debris and container.

5.2.2.2 Type I enamels shall be marked as follows:

"Contains a maximum of 340 grams per liter of volatile organic content per 40 CFR CH. 1, Part 60, Appendix A, (U.S. EPA) Method 24."

5.2.2.3 Type II enamels shall be marked as follows:

"Contains a maximum of 275 grams per liter of volatile organic content per 40 CFR CH. 1, Part 60, Appendix A, (U.S. EPA) Method 24."

5.2.3 Data sheet. A copy of the material safety data sheet (MSDS) and the ASTM F 718 data sheet shall be attached to the shipping document for each destination (see 3.2 and 3.3).

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 a high grade, acrylic, water bound, emulsion type (latex) enamel. Type I is intended for use where the VOC shall not exceed 340 g/L and type II is intended for use where the VOC shall not exceed 275 g/L (see 1.2). Paints to this specification are intended for use over primed metal, particularly on smooth, exterior metal, such as ship exterior topside metalwork and equipments. It is intended to be highly weather resistant, and characterized by excellent color and gloss retention, good drying, freedom from after tack, and good flexibility. The enamel may be applied with brush, roller or spray. This enamel is not intended for painting ship interior bulkheads or overheads; it is not fire retardant.

6.1.1 Additional intended uses. Some additional intended uses of the enamel meeting this specification are for machinery, refinishing trucks and buses, passenger and freight cars, metal drums, metal signs, metal railing and fences, marine use above water, metal trim (exterior), metal sidings, metal doors and bucks, metal structures (exterior), and properly primed wood (exterior).

6.2 Acquisition requirements. Acquisition documents must specify the following:

- (a) Title, number, and date of this specification.
- (b) Color desired (see 1.1, 3.7.1 and table V).
- (c) Type and class of enamel required (see 1.2).

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- (d) 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).
- (e) QPL number and requirement for qualification (see 3.1).
- (f) Level of packaging, level of packing and packaging acquisition option(s) required (see 5.1).
- (g) When fire retardant treated lumber and plywood is not required (see 5.1a).
- (h) Class of fire retardant fiberboard required (see 5.1b).
- (i) Size of container required (see 5.1.1).
- (j) Required marking (see 5.2, 5.2.1 and 5.2.2).

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
3.73 and 4.4	DI-MISC-80678	Certification/ data report	10.3.1 does not apply

The above DID's were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No. 24763 whether or not such products have actually been listed by that date. The attention of contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Sea Systems Command, SEA 51222, Washington, DC 20362-5101 and information pertaining to qualification of products may be obtained from that activity.

6.5 Color numbers and descriptions. Color number and descriptions are as shown in table V.

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TABLE V. Color numbers and descriptions.

Gloss	Semigloss	Lusterless low gloss	Word description
	<u>2/</u> 20109	30109	Brown (20109 for replacement of DOD-E-18210, formula 23)
	20117	30117	Brown
10371	-----	-----	Spar (U.S. Coast Guard)
11136	21136	31136	Red (insignia red)
12197			International orange
12199	-----	-----	Red (U.S. Coast Guard)
13655	23655	33655	Yellow
14097	24097	<u>2/</u> 34097	Dark green (34092 for replacement of DOD-E-18214, formula 19)
15042	25042	35042	Blue (sea blue)
15048	25048	35048	Blue (insignia blue)
15102	25102		Blue (light blue)
15182	-----	-----	Blue (U.S. Coast Guard)
	<u>2/</u> 26008		Gray (26008 for replacement of DOD-E-699, formula 20)
16099	-----	-----	Deck Gray (U.S. Coast Guard)
	26118	<u>2/</u> 36118	Gray #11 (36118 for replacement of DOD-P-15183, formula 109)
	<u>2/</u> 26173	36173	Gray #17 (ocean gray)
	26231	<u>2/</u> 36231	Gray #23 (36231 for replacement of DOD-E-700, formula 20L)
	<u>2/</u> 26270	36270	Gray #27 (haze gray; 26270 for Navy semigloss requirements)
16307	<u>2/</u> 26307	36307	Gray #30 (bulkhead gray)
	<u>2/</u> 26373	36373	Gray #37
16492	<u>2/</u> 26492	36492	Gray #49 (gull or pearl gray)
17038	<u>2/</u> 27038	37038	Black (27038 for replacement of DOD-E-698, formula 24; 37038 for replacement of DOD-P-15146, formula 104; 17038 - U.S. Coast Guard)
17875	<u>2</u> 27875	37875	White (insignia white - 27875 matches color of DOD-E-1115, formula 30)
17886	27886	37886	White (bone white)

1/ See FED-STD-595 for color coordinates.2/ Navy colors.

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6.6 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. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

6.7 Directions for use. The manufacturer must provide written directions for the mixing and applying of the enamel supplied and this direction shall include all information necessary to comply with OSHA Hazard Communication Act and FED-STD-313. In addition, the manufacturer must prepare an ASTM F 718 data sheet which separately details requirements for small unit (pint, quart, gallon) and large unit (5 gallon) containers.

6.8 Conditions for use of level B preservation. When level B preservation is specified (see 5.1), this level of protection should be reserved for the acquisition of enamel for resupply worldwide under known favorable handling, transportation, and storage conditions.

6.9 Subject term (key word) listing.

Acrylic
Flat gloss
Gloss
Latex
Low gloss
Paint
Semigloss
Top coat
VOC

Preparing activity:
Navy - SH
(Project 8010-N425)

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.

I RECOMMEND A CHANGE:		1. DOCUMENT NUMBER MIL-E-24763	2. DOCUMENT DATE (YYMMDD) 91 JUNE 19
3. DOCUMENT TITLE ENAMEL, EMULSION TYPE, FOR SHIPBOARD USE			
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 (2) AUTOVON (If applicable)	e. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY			
a. NAME Technical Point of Contact (TPOC) Dr. Brenda S. Holmes		b. TELEPHONE (Include Area Code) (1) Commercial (703) 602-0213 (2) AUTOVON 332-0213	
ADDRESS (Include Zip Code) Commander Naval Sea Systems Command, Code 5523 Washington, DC 20362-5101		IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	