

METRIC

MIL-PRF-24635C

6 June 2003

SUPERSEDING

MIL-PRF-24635B (SH)

30 June 1994

PERFORMANCE SPECIFICATION

ENAMEL, SILICONE ALKYD COPOLYMER

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

1. SCOPE

1.1 Scope. This specification covers copolymerized silicone alkyd enamel for use on primed, smooth metal, glass reinforced plastic (GRP), wood and plastic/composite surfaces. Enamels to FED-STD-595 color numbers 26173, 26270, 26373 and 26008 qualified to this specification are low solar absorbent (see 3.6 and Table VI). Two of these enamels (color numbers 26008 and 26270 to FED-STD-595) may also be qualified to this specification with anti-stain properties (see 3.7).

1.2 Classification. Enamels are of the following types, classes and grades, as specified (see 6.1 and 6.2).

1.2.1 Types. The types of enamels are designated as follows:

- Type II - VOC not greater than 340 g/L (2.8 lb/gal).
- Type III - VOC not greater than 250 g/L (2.08 lb/gal).

1.2.2 Classes. The classes of enamels are designated as follows:

- Class 1 - Gloss, 85 minimum.
- Class 2 - Semi-gloss, 45 to 60.
- Class 3 - Low gloss, 7 to 12.

1.2.3 Grades. The grades of enamels are designated as follows:

- Grade A - Standard pigmented.
- Grade B - Low Solar Absorbent (26173, 26270, 26373 and 26008).
- Grade C - Low Solar Absorbent and Anti-Stain (26008 and 26270).

Comments, suggestions, or questions on this document should be addressed to Commander, Naval Sea Systems Command, ATTN: SEA 05Q, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to commandstandards@navsea.navy.mil, with the subject line "Document Comment". Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at www.dodssp.daps.mil.

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2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 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 documents cited in sections 3 and 4 of this specification, whether or not they are listed.

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 listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

TT-P-645 - Primer, Paint, Zinc-Molybdate, Alkyd Type.

DEPARTMENT OF DEFENSE

MIL-DTL-24441/20 - Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type III.

MIL-DTL-24441/29 - Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type IV.

STANDARDS

FEDERAL

FED-STD-141 - Paint, Varnish, Lacquer and Related Materials: Methods of Inspection, Sampling and Testing.

FED-STD-595 - Colors Used in Government Procurement.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Bldg. 4D, Philadelphia, PA 19111-5094, or <http://astimage.daps.dla.mil/quicksearch/> or www.dodssp.daps.mil.)

2.2.2 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.

PUBLICATIONS

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910, 1915, 1917, 1918, 1926 and 1928

- Hazard Communication.

29 CFR 1910.1200 - Hazard Communication Standard.

29 CFR 1915.1001, Appendix J Method ID-191

- Polarized Light Microscopy of Asbestos.

40 CFR 60, Appendix A, Method 24

- Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings.

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- 40 CFR 82 - Protection of Stratospheric Ozone.
- 40 CFR 261, Appendix II, Method 1311
 - Toxicity Characteristic Leaching Procedure (TCLP).
- 40 CFR 355, Appendixes A and B
 - The List of Extremely Hazardous Substances and Their Threshold Planning Quantities.
- 40 CFR 372.65 - Specific Toxic Chemical Listings.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA)

- EPA SW-846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.
- EPA 600/4-020 - Methods for Chemical Analysis of Water and Wastes.

(The Code of Federal Regulations (CFR) is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, or www.access.gpo.gov/nara/cfr/. When indicated, reprints of certain regulations may be obtained from the Federal agency responsible for issuance thereof.)

2.3 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 that are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of the documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

ASTM International

- 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 the Stormer-Type Viscometer. (DoD adopted)
- ASTM D563 - Standard Test Method for Phthalic Anhydride Content of Alkyd Resins and Resin Solutions. (DoD adopted)
- ASTM D609 - Standard Methods for Preparation of Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products.
- ASTM D660 - Standard Test Method for Evaluating Degree of Checking of Exterior Paints. (DoD adopted)
- ASTM D661 - Standard Test Method for Evaluating Degree of Cracking of Exterior Paints. (DoD adopted)
- ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints. (DoD adopted)
- ASTM D823 - Standard Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels. (DoD adopted)
- ASTM D1014 - Standard Practice for Conducting Exterior Exposure Tests of Paints on Steel. (DoD adopted)
- ASTM D1210 - Standard Test Method for Fineness of Dispersion of Pigment-Vehicle Systems By Hegman-Type Gage. (DoD adopted)
- ASTM D1296 - Standard Test Method for Odor of Volatile Solvents and Diluents. (DoD adopted)
- ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
- ASTM D1364 - Standard Test Method for Water in Volatile Solvents (Karl Fischer Reagent Titration Method).
- ASTM D1398 - Standard Test Method for Fatty Acid Content of Alkyd Resins and Alkyd Resin Solutions. (DoD adopted.)
- ASTM D1849 - Standard Test Method for Package Stability of Paint. (DoD adopted)

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- ASTM D1983 - Standard Test Method for Fatty Acid Composition by Gas-Liquid Chromatography of Methyl Esters. (DoD adopted)
- ASTM D2244 - Standard Test Method for Calculation of Color Differences from Instrumentally Measured Colored Coordinates. (DoD adopted)
- ASTM D2245 - Standard Test Method for Identification of Oils and Oil Acids in Solvent-Reducible Paints. (DoD adopted)
- ASTM D2369 - Standard Test Method for Volatile Content of Coatings.
- ASTM D2800 - Standard Test Method for Preparation of Methyl Esters from Oils for Determination of Fatty Acid Composition by Gas-Liquid Chromatography. (DoD adopted)
- ASTM D2805 - Standard Test Method for Hiding Power of Paints by Reflectometry.
- ASTM D3278 - Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus. (DoD adopted)
- ASTM D3359 - Standard Test Methods for Measuring Adhesion by Tape Test.
- ASTM D4214 - Standard Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
- ASTM D4400 - Standard Test Method for Sag Resistance of Paints Using a Multinotch Applicator.
- ASTM D5895 - Standard Test Methods for Measuring Times of Drying or Curing During Film Formation of Organic Coatings Using Mechanical Recorders.
- ASTM E1347 - Standard Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry.
- ASTM G154 - Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

(Application for copies should be addressed to the ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or <http://www.astm.org>.)

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 enamels furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3).

3.2 Composition. The manufacturer is given his choice of ingredients used in the formation of the enamels described in this document. However, enamel shall conform to all the requirements of this specification.

3.2.1 Metal content. The metal content (soluble and total) of the enamel shall not be greater than the values listed in Tables I and II when tested in accordance with 4.5.1. If the test for total metal results in a value less than the soluble metal limit, the soluble metal test need not be conducted. The soluble metal and total metal values shall be reported in Table I and Table II results respectively.

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TABLE I. Soluble metals content.

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

TABLE II. Total metals content.

Metal and its compounds	Maximum, %wt
Antimony	0.015
Arsenic	0.001
Barium (excluding barite)	0.10
Beryllium	0.0002
Cadmium	0.0005
Chromium (VI) compounds	0.0005
Chromium and its chromium (III) compounds	0.56
Cobalt	0.005*
Copper	0.01
Fluoride	0.18
Lead	0.005

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TABLE II. Total metals content - Continued.

Metal and its compounds	Maximum, %wt
Mercury	0.0002
Molybdenum	0.35
Nickel	0.02
Selenium	0.001
Silver	0.001
Tantalum	0.100
Thallium	0.007
Tungsten	0.100
Vanadium	0.01

* Total cobalt content may exceed .005% to effect proper drying. Soluble cobalt content may not exceed Table I requirements.

3.2.2 Hazardous air pollutants (HAPS). When evaluated as specified in 4.5.2, the content of HAPs solvents shall be not greater than the VOC limit prescribed for the specific types. Within this limitation and the requirement that the finished coating meet all requirements of this specification, Types II and III solvent selection is the responsibility of the manufacturer.

3.3 Color. The color shall be characteristic of the pigments used and shall match the following as specified (see Table VI and 4.5.3):

- a. Colors defined by Tristimulus values shall match the following when measured in accordance with 4.5.3:

<u>Colors defined by tristimulus values</u>	<u>Tristimulus values</u>		
	<u>L</u>	<u>a</u>	<u>b</u>
Navy Haze Gray No. 27 (26270)	+56.0	-1.83	-1.37

- b. All other colors shall match the FED-STD-595 number specified in Table VI when measured in accordance with 4.5.3.
- c. Class 3 colors shall be matched to the appropriate FED-STD-595 semi-gloss color chip.

3.3.1 Color deviation. The color deviation of the paint shall be obtained as specified in 4.5.3. The measured color deviation terms [Delta (Δ)E, Δ A, Δ B, Δ L] from the appropriate Haze Gray No. 27 [see 3.3 (a)] or specified FED-STD-595 color card in Commission Internationale de l'Eclairage (CIE; International Commission on Illumination) LAB units shall be not greater than the CIELAB units listed below as either positive or negative (+ or -) values:

<u>Colors defined by tristimulus values</u>	<u>Color deviation values</u>			
	<u>ΔE</u>	<u>ΔA</u>	<u>ΔB</u>	<u>ΔL</u>
Navy Haze Gray No. 27 (26270)	0.5	0.3	0.3	0.3

<u>FED-STD-595 color no.</u>	<u>Color deviation values</u>			
	<u>ΔE</u>	<u>ΔA</u>	<u>ΔB</u>	<u>ΔL</u>
26173, 26373, 36173, 36270, 36373	0.5	0.3	0.3	0.3
All other colors	1.0	0.5	0.5	0.5

3.4 Vehicle resin. The vehicle shall consist of a copolymerized, air-drying silicone modified long oil soya alkyd conforming to the requirements of Table III (see Table V).

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TABLE III. Characteristics of vehicle.^{1/}

Characteristics	Requirements	
	Minimum	Maximum
Silica (SiO ₂) percent by weight of nonvolatile vehicle	14.7	--
Phthalic anhydride, percent by weight of nonvolatile vehicle	14	17
Drying oil acids, percent by weight of nonvolatile vehicle	41	47
Soya oil	Positive (By certification)	
Rosin	Negative (By certification)	
Phenolic resin	Negative (By certification)	

Note:

^{1/} Tests shall be specified in Table V.

3.4.1 Identification. The copolymer shall give two similar spectra, both of which shall have the significant bands of both the alkyd and silicone resins as shown on Figure 1. Both spectra shall not have an absorption band in the 13.9 to 14.0 micrometer (μm) region and both shall show a sharp narrow absorption band at 7.0 μm (see 4.5.4.3).

3.5 Qualitative requirements.

3.5.1 Condition in container. The enamel shall be free of grit, seeds, skins, lumps or livering, and shall show no more surface float (separated pigments or other ingredients on the surface of the liquid enamel) or pigment settling or caking than can be readily re-incorporated to a smooth uniform state (see 4.5.5.4). When tested in accordance with 4.5.3, the CIELAB color difference of the mixed enamel shall meet the requirements of 3.3 and 3.3.1. After a standing period of 2 hours without further mixing, the CIELAB color difference of the enamel shall again be tested in accordance with 4.5.3. The CIELAB color difference measured for 2-hour-old mixed enamel shall be not greater than 0.5 CIELAB unit different from the color values measured after stirring, but before the 2-hour standing period.

3.5.2 Storage stability.

3.5.2.1 Partially-full container. The enamel shall show no skinning (see 4.5.5.1). After aging as specified in 4.5.5.1, the enamel shall show no surface float (separated pigments or other ingredients on the surface of the liquid enamel), livering, curdling, hard caking or gummy sediment. The enamel shall mix readily to a smooth uniform state within 5 minutes when mixed with a paddle or mechanical mixer and shall have a consistency not greater than 5 units from the original Krieb unit consistency before testing (see Table V). Enamel shall meet the requirements of 3.5.4, 3.5.5, 3.5.6 and the Table IV requirements for dry times and gloss. When tested in accordance with 4.5.3, the CIELAB color difference of the mixed enamel shall be not greater than 0.5 CIELAB units from the original color values measured before the shelf life test.

3.5.2.2 Full container. When tested in accordance with 4.5.5.2, the enamel shall show no skinning, livering, curdling, hard caking, or gummy sediment. The enamel shall mix to a smooth uniform state with no surface float (separated pigments or other ingredients on the surface of the liquid enamel) within 5 minutes when mixed with a paddle or mechanical mixer and shall have a consistency not greater than 5 units from the original Krieb unit consistency before testing (see Table IV). Enamel shall meet the requirements of 3.5.4, 3.5.5, 3.5.6 and the Table IV requirements for dry times and gloss. When tested in accordance with 4.5.3, the CIELAB color difference of the mixed enamel shall be not greater than 0.5 CIELAB units from the original color values measured before the shelf life test.

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3.5.2.3 Accelerated storage stability. When tested in accordance with 4.5.5.3, a previously unopened, original container of enamel shall be re-dispersible within 5 minutes with a paddle or mechanical mixer to a uniform condition free of grit, seeds, skins, lumps, livering, pigment settling or surface float, and shall be in accordance with the requirements of 3.5.4, 3.5.5, 3.5.6 and the Table IV requirements for dry times, gloss and viscosity. When tested in accordance with 4.5.3, the CIELAB color difference of the mixed enamel shall not be greater than 0.5 CIELAB units from the original color values measured prior to the shelf life test. The mixed enamel shall also meet the requirements of 3.5.12, when the color difference is calculated using as the original color that was obtained for the 1-year storage test sample.

3.5.3 VOC Regulations. Thinning of VOC compliant paint is not allowed. This paint is to be used as supplied without thinning (see 4.5.6).

3.5.4 Brushing properties. The enamel shall brush satisfactorily and shall dry to a uniform film, free from seeds, runs, sags or streaks (see 4.5.7).

3.5.5 Rolling properties. The enamel shall roll satisfactorily and shall dry to a uniform film, free from seeds, runs, sags, or streaks. The dried film shall show an even, smooth finish (see Table V).

3.5.6 Spraying properties. The enamel shall spray satisfactorily and shall show no running, sagging, streaking, or orange peel. The air-dried film shall show no seeding, dusting, floating, mottling, hazing, or other film defects (see 4.5.8).

3.5.7 Odor. The odor of the wet enamel and the film at any interval of drying shall not be obnoxious or objectionable (see Table V).

3.5.8 Cross-cut adhesion test. When tested as specified in Table V, a 0.025-mm (nominal) [0.001-inch (nominal)] dry film of enamel shall achieve a minimum classification of 4B.

3.5.9 Flexibility. A film of enamel shall bend without cracking or flaking (see 4.5.9).

3.5.10 Recoating. Recoating of a dried film shall produce no film irregularities. The enamel shall not wrinkle or lift the first coat and shall dry to a smooth, uniform finish (see 4.5.10).

3.5.11 Water resistance. A film of enamel shall show no blistering or wrinkling when examined immediately after removal from distilled water. When examined 2 hours after removal, there shall be no softening, whitening, or dulling. After 24 hours of air-drying, the portion of the panel which was immersed shall be indistinguishable with regard to adhesion and general appearance from a panel prepared at the same time but not immersed, and shall retain at least 90 percent of the 60-degree specular gloss of the panel before immersion or any other panel made from the same batch (see 4.5.11).

3.5.12 Accelerated weathering. Films of the enamel shall show no evidence of chalking and a loss of not greater than 35 percent of the gloss measured before exposure (see 4.5.12). The color difference (ΔE) shall be not greater than a value of 1.0 CIELAB units from the original pre-test standard value when measured as specified (see 4.5.3).

3.5.13 Long-term exterior exposure. When tested in accordance with 4.5.13, films of the enamel shall meet the following requirements:

- a. 60-degree gloss not less than 50 percent of that measured prior to testing,
- b. Chalking shall be rated not less than number 8 of Figure 2,
- c. Checking shall be rated not less than 9 (1%),

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- d. Cracking shall be rated not less than 9,
- e. Blistering shall be rated not less than 10, and
- f. When CIE color values of the exposed test panels are compared to the original CIE color values of the test panel, the ASTM D2244 color difference calculated value, ΔE , shall be not greater than 1.0 CIELAB units.

3.5.14 Quantitative requirements. The enamels shall conform to the requirements of Table IV when tested in accordance with Table V.

TABLE IV. Quantitative requirements of the enamel.^{1/}

Characteristics	Requirements	
	Minimum	Maximum
Flash point, Setaflash, closed cup, degrees Celsius (°C) (degrees Fahrenheit (°F))	38 (100)	---
Water, percent by weight of enamel	---	0.5
Coarse particles and skins (retained on number 325 mesh) percent by weight of pigment	---	0.5
Consistency, Krebs-Stormer, shearing rate, equivalent Krebs units	---	90
Fineness of grind	6	---
Drying time:		
Set-to-touch, hours	---	2
Dry through, hours	---	8
VOC, g/L		
Type II	---	340
Type III	---	250
Sag resistance (mils)	4	---
Asbestos content (% weight of dry film)	---	<0.05
Reflectance		
(26173, 26270, 26373)		
800 nanometers	0.65	
1000 nanometers	0.70	
(26008)		
800 nanometers	0.50	
1000 nanometers	0.55	
Gloss (60-degree specular)		
Class 1	85	
Class 2	45	60
Class 3	7	12
Contrast ratio		
Gray and black colors	0.98	
White colors	0.90	
Red, yellow and orange colors	0.75	
All other colors	0.80	

Note:

^{1/} Tests shall be performed as specified in Section 4.

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3.6 Solar absorbance. When tested in accordance with 4.5.14, low solar absorbance shall meet the reflectance requirements of Table IV. This requirement is applicable only to the low solar absorbent gray paint colors listed in Table VI.

3.7 Anti-stain properties. Anti-stain properties will be evaluated at a Navy Laboratory with comparison to an established anti-stain paint product. Performance shall be equal or better than the performance of the established paint standard. The established product shall be either a NAVSEA approved or a product qualified to this specification.

3.8 Label. Manufacturer shall prepare container label instructions for the enamel in accordance with the requirements of 29 CFR 1910, 1915, 1917, 1918, 1926 and 1928 - Hazard Communication (see 6.8). To comply with the Environmental Protection Agency (EPA) National Emission Standards for Hazardous Air Pollution (NESHAP) requirements for shipbuilding and ship repair, the following two statements must appear on each paint can label:

- a. A certification that the paint in the container meets the NESHAP requirements for shipbuilding and ship repair.
- b. A statement of the ratio of volatile content to solids expressed as grams of volatile organic hazardous air pollutants (VOHAP) per liter of solids.

3.9 Safety (toxicity). The materials' content used in the enamel shall have no known reportable carcinogenic or potentially carcinogenic materials and shall have no extremely hazardous substances (EHS) or toxic chemicals identified in 40 CFR 355 and 372.65, respectively. The enamel shall not contain more than 0.2-percent cobalt compounds and 0.5-percent manganese compounds by weight in its formulation. The enamel shall have no adverse effect on the health of personnel when used for its intended purpose (see 6.7). Questions pertinent to this effect shall be referred by the contracting activity to the appropriate service medical department that will act as advisor to the contracting activity.

3.10 Ozone-depleting chemicals. The materials used in the enamel shall not contain class I or class II ozone-depleting chemicals as defined in 40 CFR 82.

4. VERIFICATION.

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

- a. Qualification inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 Qualification inspection. Qualification inspection shall be conducted at a laboratory satisfactory to NAVSEA. Qualification inspection shall consist of the tests specified in Table V and paragraphs 4.5 and 4.6. The enamel tested shall be drawn from the first run of regular production stock. A test report detailing the results of the conformance testing performed by the manufacturer shall be provided. Failure to meet any requirement is reason for failure to qualify. Any changes to the formulation that was qualified shall require requalification.

4.2.1 Extension of qualification. Approval of qualification for low solar absorbent and anti-stain (Class C), Navy Haze Gray No. 27 to match color 26270 of FED-STD-595 shall constitute approval for all colors, classes, and grades except color 26008 to Class C. The low solar absorbent and anti-stain (Class C) coating of color 26008 to FED-STD-595 shall be approved when the coating has been tested for compliance to the qualitative requirements of 3.5 and the quantitative requirements of 3.5.14.

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TABLE V. Tests.

Test	Requirements	Test method	Applicable test method FED-STD-141	ASTM test method
Asbestos, soluble and total metals content ^{2/}	Table IV/ 3.2.1	4.5.1	----	----
Hazardous air pollutants ^{2/}	3.2.2	4.5.2	----	----
Color ^{1/}	3.3	4.5.3	----	D2244/ E1347
Silica content ^{2/}	Table III	4.5.4.1	----	----
Phthalic anhydride ^{2/}	Table III	4.5.4.2	----	D563
Drying oil acids ^{2/}	Table III	4.5.4.2	----	D1398
Soya oil ^{2/}	Table III ---- ----	Table V ---- ----	---- ---- ----	D2800 D2245 D1983
Phenolic resin ^{2/}	Table III	Table V	5141.1	----
Rosin ^{2/}	Table III	Table V	----	
Copolymer ^{2/}	3.4.1	4.5.4.3	----	----
Condition in container ^{1/}	3.5.1	4.5.5.4	3011.2	----
Storage stability partially-full container	3.5.2.1	4.5.5.1	3021.1	D1849
Storage stability full container	3.5.2.2	4.5.5.2	----	D1849
Accelerated storage stability	3.5.2.3	4.5.5.3	----	----
VOC ^{1/}	Table IV	4.5.6	----	----
Brushing properties ^{1/}	3.5.4	4.5.7	4321.2	----
Sag resistance	Table IV	Table V	----	D4400
Rolling properties ^{1/}	3.5.5	Table V	4335	----
Spraying properties ^{1/}	3.5.6	4.5.8	4331.1	----
Odor	3.5.7	Table V	----	D1296
Cross-cut adhesion tape test	3.5.8	Table V		D3359
Flexibility	3.5.9	4.5.9	6221	----
Recoating	3.5.10	4.5.10	4061.2	----
Water resistance	3.5.11	4.5.11	----	----
Accelerated weathering	3.5.12	4.5.12		
Long term exterior exposure Chalking Checking Cracking Blistering	3.5.13	4.5.13		D4214 D660 D661 D714

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TABLE V. Tests - Continued.

Test	Requirements	Test method	Applicable test method FED-STD-141	ASTM test method
Flash point ^{1/}	Table IV	Table V	----	D3278
Water	Table IV	Table V	----	D1364
Coarse particles	Table IV	Table V	4092.1	----
Consistency ^{1/}	Table IV	Table V	----	D562
Fineness of grind ^{1/}	Table IV	Table V	----	D1210
Drying time ^{1/}	Table IV	Table V	4061.3	D5985
Reflectance ^{1/} (low solar absorbance)	Table IV/ 3.6	4.5.14	----	----
Gloss 60-degree specular ^{1/}	Table IV	4.5.15	----	D523
Contrast ratio ^{1/}	Table IV	Table V	----	D2805
Anti-Stain	3.7	3.7	----	----

Notes:

^{1/} Conformance inspection test (see 4.3).

^{2/} By data certification.

4.3 Conformance inspection. Conformance inspection shall consist of all tests specified in Table V with a footnote 1 notation.

4.3.1 Sampling for conformance testing. As a minimum, the contractor shall select a sample of sufficient size to permit the performance of all the inspections and tests as specified in section 4. If one or more defects are found in any sample, the entire lot (see 6.9.1) represented by the sample shall be rejected. If a lot is rejected, the contractor has the option of analyzing the rejected lot for the defective characteristic(s) and adjusting ingredients within allowed ranges as a new lot that shall be inspected and tested in accordance with the procedures in section 4. The contractor shall maintain for a period of 3 years after contract completion, all records of inspections, tests, or any resulting rejections.

4.4 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in section 9, routine and referee testing conditions, of FED-STD-141. The term referee condition shall mean a temperature of 23 ± 1 °C (73 ± 2 °F) and a relative humidity of 50 ± 4 percent. A dry film thickness of 0.038 to 0.051 mm (0.0015 to 0.002 inch) shall be used whenever film thickness is requested in any test, unless otherwise required by the test. All paint test specimens shall be cured at least 16 hours at ambient laboratory conditions before testing unless otherwise specified.

4.4.1 Test panels and surface preparation. Unless otherwise specified, test panels shall be nominal 150- x 300- x 3-mm (6- x 12- x 0.25-inch) plate aluminum. Plates shall be abrasive blasted with aluminum oxide and solvent cleaned to provide a uniform, clean rough surface with a profile of 0.050 to 0.076 mm (0.002 to 0.003 inch) (nominal) on both sides.

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4.5 Tests.

4.5.1 Soluble and total metal content. Asbestos, soluble and total metal content, except tantalum and tungsten, shall be determined on a dry paint film of the enamels in accordance with the 40 CFR 261, Appendix II, Method 1311, "Toxicity Characteristic Leaching Procedure (TCLP)", and the appropriate test listed below. Asbestos shall be analyzed in accordance with the method in the 29 CFR 1915.1001, Appendix J, and test result reported as percent by weight of the dry enamel film. Soluble metal content shall be reported as milligrams per liter (mg/L). Total metal content shall be reported as percent by weight of the dry enamel film. The test results for asbestos or metal shall be in conformance with the requirements of 3.2.1 and Tables I and II. Tantalum and tungsten soluble metal content and total metal content shall be analyzed as specified in 4.5.1.1.

Test Methods for Evaluating Solid Waste -
Physical/Chemical Methods, EPA SW-846 Digestion

<u>Metal/material</u>	<u>test method</u>
All metals, except Chromium (VI)	3050
Chromium (VI)	3060

<u>Metal/Material</u>	<u>SW-846 Analysis test method</u>
Antimony	7040 or 7041
Arsenic	7060 or 7061
Barium	7080 or 7081
Cadmium	7131
Total chromium	7190
Chromium (VI)	7195, 7196 or 7197
Lead	7421
Mercury	7470 or 7471
Nickel	7520 or 7521
Selenium	7740 or 7741
Silver	7760 or 7761

Methods for Chemical Analysis of Water and Waste,
EPA600/4-020, USEPA, 1979 test method

<u>Metal/material</u>	<u>EPA600/4-020, USEPA, 1979 test method</u>
Beryllium	210.1 or 210.2
Cobalt	219.1 or 219.2
Copper	220.1 or 220.2
Fluoride	340.1, 340.2 or 340.3
Molybdenum	246.1 or 246.2
Thallium	279.1 or 279.2
Vanadium	286.1 or 286.2
Zinc	289.1 or 289.2

4.5.1.1 Tantalum and tungsten content. Determine the tantalum and tungsten content of the enamel using any appropriate spectroscopy test method. Conduct the tests in accordance with the instrument manufacturer's directions for the use of the instrument. Manufacturer is responsible for establishing data supporting the test method choice and analytical accuracy. The test results for tantalum or tungsten shall be as specified in 3.2.1 and Tables I and II (see 6.3).

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4.5.2 Hazardous air pollutants content. Formulation data shall be used by manufacturers in lieu of testing to demonstrate compliance with hazardous air pollutant requirements of this specification. The manufacturer's formulation data must have a consistent and quantitatively known relationship to the testing required. Calculation of individual HAP contents can be based on either manufacturer evaluation of batches or supplier data for raw materials used in the product. The coating manufacturer must provide, for each individual HAP, a formulation value that will not be exceeded if a sample from any quality control approved production batch of the coating is evaluated in accordance with this paragraph. See 3.2.2.

4.5.3 Color testing.

4.5.3.1 Instrumental color deviation determination. Test specimens shall be prepared in accordance with ASTM D823 Methods C or E using a nominal 0.006-inch blade film applicator on to a clear plate glass of not less than 3/8-inch (nominal) thickness that has been ground to a uniform finish with 1F carborundum. The color deviation shall be determined in accordance with ASTM D2244 using an instrument having a D₆₅ light source, a 45-degree illumination angle, and a 0-degree viewing angle. The instrument shall be demonstrated to read the color of National Institute for Science and Technology (NIST [formerly National Bureau of Standards; SBS]) traceable standards with the color deviations of 3.3. After calibration of the instrument, measure the L, A, B color values of at least two FED-STD-595 color cards of the color being procured which were received from the Government not greater than 1 year prior to the date of this use. Calculate E for each color card. Determine the mean values of E, L, A and B for the color cards. These mean values will be used to calculate the color difference values. Measure the color values of the test enamel. Calculate the color deviation terms. If using an instrument that automatically calculates the color differences, enter the color card mean values as the base line for the color difference calculations. The results of the color deviation calculation shall be in accordance with the requirements of 3.3 or Table VI, as applicable.

4.5.3.2 Referee color matching. If the enamel measured in accordance with 4.5.3.1 does not match the color card when visually examined, the discrepancy shall be resolved by an independent laboratory certified to the NIST National Volunteer Laboratory Accreditation Program for paint testing. When tested in accordance with 4.5.3.1, the test enamel, shall meet the requirements of 3.3 and 3.3.1.

4.5.4 Silicone-alkyd copolymer resin.

4.5.4.1 Silica content of vehicle. From a stoppered bottle or weighting pipette, the mass shall be accurately determined by difference, weigh approximately 3 grams of vehicle into a previously ignited and weighted 7.6 cm (3-inch) porcelain evaporating dish. Add 1 milliliter (mL) American Chemical Society concentrated sulfuric acid. The sample shall be dried at 110 °C (230 °F) (nominal) in an oven for 1 hour followed by one hour in an oven at 165 °C (329 °F) (nominal). The dried sample shall be placed in a cold muffle furnace and the temperature shall be gradually increased over a period of 3 hours to 800 °C (1472 °F). This temperature shall be maintained for an additional hour. After cooling in a desiccator, the mass of the dish and the contents shall be determined and the percent of silica shall be calculated as follows:

$$\text{Percent silica} = \frac{\text{Mass of ash} \times 100}{\text{Mass of sample} \times \text{nonvolatile fraction}}$$

This nonvolatile fraction has been determined in accordance with ASTM D2369. The percent silica shall be in accordance with the requirements of Table III.

4.5.4.2 Phthalic anhydride and drying oil acids. The unsaponifiable, drying oil acids and phthalic anhydride shall be determined on the isolated vehicle in accordance with ASTM D1398 and D563 respectively, except that the drying oil acids shall be extracted with the petroleum ether in place of chloroform and shall conform to Table III.

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4.5.4.3 Qualitative test for copolymer. The copolymer shall be tested qualitatively by agitating a 0.5-gram sample of the extracted vehicle with three successive 20-mL portions of isopropanol, decanting of the alcohol and saving each portion. The infrared spectrum shall be scanned from 2 to 15 μm of a solvent-free film of both the isopropanol insoluble portion and the soluble portion after evaporation of the alcohol. The sample shall be checked for compliance with 3.4.1.

4.5.5 Storage stability and condition in container.

4.5.5.1 Partially-full containers. Skinning shall be determined after 48 hours in accordance with method 3021.1 of FED-STD-141, except that a $\frac{3}{4}$ filled 1-quart multiple friction top can shall be used. The can shall be resealed and aged for 7 days at 49 °C (120 °F) and examined for compliance with 3.5.2.1 with the exception of 3.2 and 3.5.13. The test results shall be in accordance with the requirements of the specification.

4.5.5.2 Full container. A full quart can of enamel shall be allowed to stand undisturbed for 12 months and then the contents tested in accordance with ASTM D1849. The contents shall be evaluated for pigment settling or caking as specified in 3.5.1, then agitate the can for 5 minutes on the paint shaker prior to re-examination. The viscosity shall be determined and other applicable tests made for compliance with 3.5.2.2 with the exception of 3.2 and 3.5.13. The test results shall be in accordance with the requirements of the specification.

4.5.5.3 Accelerated storage stability. After exposure to a temperature of 49 °C (120 °F) for a period of 7 days, a previously unopened, original container of enamel shall be examined for compliance with all the requirements of 3.5.2.3.

4.5.5.4 Condition in container. A container of the product shall be equilibrated to test laboratory conditions [nominal 23 °C (73 °F)]. Evidence of pressure or vacuum in the unopened container shall be noted. The container shall then be opened and examined in accordance with method 3011.1 of FED-STD-141 for evidence of skinning, corrosion of container interior, odor of putrefaction, rancidity or souring, gel bodies, and hard settling. The enamel shall be hand-stirred 300 stirs in 2 minutes with a spatula appropriate to the container, stirring so as to ensure uniform distribution of any settled material. Immediately after stirring, the condition of the product shall be as specified in 3.5.1.

4.5.6 Volatile organic compounds (VOC). VOC content shall be determined in accordance with 40 CFR 60, Appendix A, Method 24. VOC content shall be as specified in Table IV.

4.5.7 Brushing properties. Brushing properties of the packaged enamel shall be determined in accordance with method 4321.2 of FED-STD-141 for compliance with 3.5.4. If a referee test is required, use ASTM method number D4400. Contact of the 102- μm (4-mil) strip with the next thicker strip at any point within the 14-cm (5.5-inch) central portion of the blade path shall be an indication of sagging.

4.5.8 Spraying properties. The enamel shall be sprayed on a steel panel to a dry film thickness of 0.023 to 0.028 mm (0.0009 to 0.0011 inch). The panel shall be observed for spraying properties in accordance with method 4331.1 of FED-STD-141 to determine compliance with 3.5.6.

4.5.9 Flexibility. Flexibility shall be determined in accordance with ASTM D522. The enamel shall be applied to a flat metal plate of approximately 31 gauge coated with a dry film thickness of 0.025 mm (0.001 + 0.0003 inch) of TT-P-645 primer by means of a doctor blade capable of yielding a dry film thickness of 0.025 mm (0.001 + 0.0003 inch). The panel shall be allowed to air-dry for 2 hours then baked for 24 hours at 100 to 105 °C (212 to 221 °F). The panel shall then be removed from the oven and allowed to stand for 30 minutes at laboratory temperature [nominal 23 °C (73 °F)]. The panel shall then be bent over a 3.2-mm ($\frac{1}{8}$ -inch) mandrel or a tapered mandrel where the minimum diameter is 3.2 mm ($\frac{1}{8}$ inch) and the film examined at the bent under a magnification of five diameters. Flexibility shall be as specified in 3.5.9.

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4.5.10 Enamel recoatability. Eight test panels of aluminum having nominal dimensions of 150 by 300 by 3 millimeters (6 by 12 $\frac{1}{8}$ inches) shall be prepared. The test requires 6 test panels. Test panels shall be degreased in accordance with methods B, C or D of ASTM D609. The degreased test panels shall be abrasive blasted with new, clean aluminum oxide to provide a profile pattern of 0.0253 to 0.0506 mm (0.001 to 0.002 inch) (average). All test panels shall be primed with 2 coats of MIL-DTL-24441/20 or MIL-DTL-24441/29, type III or IV formula 150 green primer. Primer shall be applied to achieve a 0.076- to 0.13-mm (0.003- to 0.005-inch) dry film thickness and dried through thickness. The test topcoat shall be applied at a dry film thickness of 0.101 to 0.151 mm (0.004 to 0.006 inch) to effect complete hiding of the primer coat. Allow not less than 24 hours dry time before applications of the coats of test topcoats at ambient laboratory conditions. The following overcoats shall be brush applied to $\frac{1}{2}$ of each of two panels and the overcoated panels shall be cured for 48 hours at ambient laboratory conditions:

- a. One coat of enamel, conforming to this specification, at a nominal wet film thickness of 0.076 to 0.101 mm (0.003 to 0.004 inch).
- b. One coat of MIL-DTL-24441/20 or MIL-DTL-24441/29, type III or IV formula 150 at a nominal wet film thickness of 0.076 to 0.101 mm (0.003 to 0.004 inch).
- c. One coat of TT-P-645 Navy formula 84 at a nominal wet film thickness of 0.076 to 0.101 mm (0.003 to 0.004 inch).

The completed painted test panels shall be cured for not less than 7 days at ambient laboratory conditions before proceeding to the mounting on the test rack. Test specimens shall be mounted on a test fence having a 45-degree south facing rack at a distance of not greater than 30 meters (100 feet) of an ocean high tide line. The exposure shall be for a period of 1 year (365 days) in accordance with paragraph 6 of ASTM D1014. The fence shall be within the state of Florida, USA. After the exposure period of 1 year (365 days), the panels shall be returned to the laboratory. The panels shall be rinsed with cold tap water at nominal tap pressure for a period of 5 to 10 minutes without rubbing the surface in a manner that would disturb any chalking. The test panels shall then be dried for 24 hours at ambient laboratory conditions. Enamel condition shall be as specified in 3.5.8 and 3.5.10.

4.5.11 Water resistance. A film of enamel shall be prepared by drawing down with a 0.051- to 0.102-mm (0.002- to 0.004-inch) gap clearance film applicator on a steel panel which has been solvent cleaned and phosphate coated in accordance with method 2011.2, procedure B of FED-STD-141, and shall be air dried for 7 days. Exposed uncoated metal surfaces shall be coated with wax or other suitable coating. The panel shall then be immersed in distilled water at 23 ± 1 °C (73 ± 2 °F) for 18 hours in accordance with ASTM D1308. At the end of the test period, the panel shall be removed and examined for compliance with 3.5.11.

4.5.12 Accelerated weathering. The duplicate flat metal panels shall be prepared by drawing down films of enamel with a 0.15-mm (0.006-inch) gap clearance film applicator or spray film to provide a dry film thickness of 0.075 mm (0.003 inch). Air-dry for 168 hours at ambient laboratory conditions. Measure the initial color of the test panel in accordance with ASTM E1347 on any suitable instrument. Measure the initial 60-degree gloss of the test panel in accordance with ASTM D523. Expose the panels for 300 hours to accelerated weathering using Fluorescent UV-Condensation type apparatus in accordance with ASTM G154. The cycle shall be 4 hours UV exposure using a UVB-313 bulb at 60 °C (140 °F) and 4 hours condensation exposure at 40 °C (104 °F). After exposure, remeasure color and gloss in accordance with ASTM E1347 and D523. Calculate color difference in accordance with ASTM D2244 and calculate gloss change. The chalking shall be evaluated in accordance with ASTM D4214 and 60-degree gloss determined in accordance with ASTM D523. The results shall be checked for compliance with 3.3 and 3.5.12.

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4.5.13 Long-term exterior exposure. Test panels shall be of aluminum having nominal dimensions of 150 by 300 by 3 millimeters (6 by 12 $\frac{1}{8}$ inches). Test requires 2 primed test panels. Test panels shall be degreased in accordance with methods B, C or D of ASTM D609. The degreased test panels shall be abrasive blasted with new, clean aluminum oxide to provide a profile pattern of 0.025 to 0.076 mm (0.001 to 0.003 inch) (average). All test panels shall be primed with 2 coats of MIL-DTL-24441/20 or MIL-DTL-24441/29, type III or IV, formula 150 green primer. Each coat of MIL-DTL-24441/20 or MIL-DTL-24441/29, type III or IV, formula 150 shall be applied to 0.051- to 0.076-mm (0.002- to 0.003-inch) dry film thickness. Two coats of the test enamel shall be spray applied on the MIL-DTL-24441/20 and MIL-DTL-24441/29, type III or IV formula 150 coated panels to obtain a final dry film thickness of the test topcoat of 0.076 to 0.127 mm (0.003 to 0.005 inch). The test panels shall be cured for at least 24 hours dry time between application of the coats of test topcoats at ambient laboratory conditions. The completed painted test panels shall be cured for at least 7 days prior to mounting on the test rack. Test specimens shall be mounted on a test fence having a 45-degree south facing rack at a distance of not greater than 100 feet of an ocean high tide line. The exposure shall be in accordance with paragraph 6 of ASTM D1014. The fence shall be within the state of Florida, USA. Prior to initiating the test, photograph the wall of test panels (include a gray color scale in all photos and develop photographs to the scale). After a test period of 1 year (365 days), the test panels shall be examined in accordance with 3.5.13.

4.5.14 Visible and infrared reflectance measurement. A reflectometer capable of measuring reflectance at specific wavelengths shall be used. Measurements shall be made at the wavelengths specified in Table IV. Infrared wavelengths are defined as 800 nm and 1000 nm. Test results shall be in accordance with the requirements of Table IV. A Diano Hardy Match Scan II equipped with a Milton Roy Diano Match Pak II has been found satisfactory for measurements at 800 nm and 1000 nm. Other instruments of equivalent capability may be used.

4.5.15 60-degree specular gloss. The thoroughly mixed enamel on plane, opaque, black glass panels as specified in ASTM D823. Use a film applicator that will produce a wet film thickness of 0.075 mm (0.003 inch). Dry 24 hours under referee conditions in a dust free environment. Paint specimen shall be dry hard before gloss test. A longer cure time may be used if necessary to meet the gloss requirement of this specification. When tested as specified in Table V, gloss shall conform to requirements of Table IV as applicable, for class specified.

4.5.16 Cross-cut adhesion. Cross-cut adhesion shall be determined in accordance with ASTM D3359. The enamel shall be applied to a steel panel to a nominal dry film thickness of 0.023 to 0.028 mm (0.001 \pm 0.0001 inch). The panel shall be allowed to air-dry for 168 hours at ambient temperature. Cross-cut adhesion shall be as specified in 3.5.8.

4.6 Toxicological product formulations. A manufacturer of material shall disclose the formulation of his product to the Navy Environmental Health Center (NEHC), Norfolk, VA. The disclosure of proprietary information, which shall be held in confidence by the Bureau of Medicine and Surgery, shall include:

- a. Name, formula, and approximate percentage by mass and volume of each ingredient in the product;
- b. Results of any toxicological testing of the product;
- c. Identification of its pyrolysis products; and
- d. Any such other information as may be needed to permit an accurate appraisal of any toxicity problem associated with the handling, storage, application, use, or disposal of the material.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department'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.

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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 high grade, air-drying enamels made from a copolymer of long-oil soya alkyd and silicone resins and is intended for use on primed metal, particularly on smooth, exterior metal. It is highly weather-resistant and is characterized by excellent color and gloss retention, good drying, freedom from aftertack and good flexibility. This enamel is a non-lead, non-chromate, and non-asbestos material. The dried paint film has been tested to USEPA standards and the paint debris is, as of the time of this specification, a non-hazardous waste. This enamel has been formulated to comply with air pollution regulations which allow a maximum VOC of 250, or 340, grams of solvent minus water per liter of paint (2.08 lb/gal, or 2.83 lb/gal) as delivered. This product is not to be thinned for all means of application. The enamel may be applied with brush, roller or spray.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Color (number of color to FED-STD-595 recommended), class and grade required (see 1.2).
- c. 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).
- d. Packaging requirements (see 5.1 and 6.9).
- e. Whether MSDS and ASTM F718 data sheets are required with each shipment (see 6.6).

TABLE VI. FED-STD-595 Color numbers and descriptions.^{1/2/}

Class			Word description
(1)Gloss	(2)Semi-gloss	(3)Low gloss ^{3/}	
10080	---	---	Brown (piping and valve marking)
---	20109	30109	Brown (20109 for replacement of DOD-E-18210 formula 23)
---	20117	30117	Brown
10324	---	---	Tan (piping and valve marking)
10371	---	---	Spar (U.S. Coast Guard)/buff (piping and valve marking)
11105	---	---	Red (piping and valve marking)
11120	---	---	Red (OSHA safety color)
11136	21136	31136	Red (insignia red)
12197	---	---	International orange
12199	---	---	Red (U.S. Coast Guard)
12246	---	---	Orange (OSHA safety color)
13655	23655	33655	Yellow
---	23814	---	Chartreuse (piping and valve marking)
14062	---	---	Dark green (piping and valve marking)
14097	24097	34097	Dark green (34092 for replacement of DOD-E-18214 formula 19)

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TABLE VI. FED-STD-595 Color numbers and descriptions^{1/2/} - Continued.

Class			Word description
(1)Gloss	(2)Semi-gloss	(3)Low gloss ^{3/}	
14120	---	---	Green (OSHA safety color)
14449	---	---	Light green (piping and valve marking)
15042	25042	35042	Blue (sea blue)
15044	---	---	Dark blue (piping and valve marking)
15048	25048	35048	Blue (insignia blue)
15092	---	---	Blue (OSHA safety color)
15102	25102	---	Blue (light blue)
15182	---	---	Blue (U.S. Coast Guard)
15200	---	---	Light blue (piping and valve marking)
---	26008	---	Low solar absorbent Gray (26008 for replacement of DOD-E-699 formula 20) (also with anti-stain properties)
16081	---	---	Dark gray (piping and valve marking)
16099	---	---	Deck gray (U.S. Coast Guard)
---	26118	36118	Gray # 11 (36118 for replacement of DOD-P-15183 formula 109)
---	26173	36173	Low solar absorbent gray # 17 (ocean gray, color #26173)
16187	---	---	Gray (piping and valve marking)
---	26231	36231	Gray # 23 (36231 for replacement of MIL-DTL-700 formula 20L)
---	26270	36270	Low solar absorbent gray # 27 (haze gray; 26270 for Navy semi-gloss requirements (also with anti-stain properties)
16307	26307	36307	Gray # 30 (Bulkhead gray)
---	26373	36373	Low solar absorbent Gray # 37 (Light Gray, Color #26373)
16376	---	---	Light gray (piping and valve marking)
16492	26492	36492	Gray # 49 (Gull or Pearl Gray)
17038	27038	37038	Black (27038 for replacement of DOD-E-698 formula 24; 37038 for replacement of DOD-P-15146 formula 104) (piping and valve marking)
17043	---	---	Gold (piping and valve marking)
17100	---	---	Dark purple (piping and valve marking)
17142	---	---	Light purple (piping and valve marking)
17155	---	---	Purple (OSHA safety color)
17875	27875	37875	White (Insignia white - 17875 matches color of MIL-DTL-1115 formula 30)
17886	27886	37886	White (bone white) (piping and valve marking)

Notes:

^{1/} See FED-STD-595 for color cards.

^{2/} Table VI provides FED-STD-595 color numbers and descriptions for commonly specified colors. To order colors not listed, the contracting officer should provide FED-STD-595 color number or other information necessary to identify the product desired.

^{3/} Low gloss colors will be matched to the semi-gloss color chip.

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6.3 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 no. 24635 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 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, ATTN: SEA 05Q, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 and information pertaining to the qualification of products may be obtained from that activity.

6.4 Unit of procurement. The paint covered by this specification should be purchased by volume, the unit being 1 liter or 1 U.S. liquid gallon at 15.5 °C (60 °F).

6.5 Volatile content. Although the container marking specifically refers to Federal regulations, the paint may be used anywhere else a product complying with 1.2 is allowed. This includes other air pollution control districts or similar areas controlling the emission of solvents into the atmosphere.

6.6 Material safety data sheet (MSDS). The contracting activity should be provided a material safety data sheet at the time of contract award. The MSDS should be provided in accordance with OSHA section 1910.1200, 29 CFR Chapter XVII and found as part of FED-STD-313. OSHA section 1910.1200 requires reporting threshold criteria for known or suspected human carcinogens on MSDS 0.1 percent or greater, and 1 percent or greater for other health hazards. The MSDS should be included with each unit of issue of material covered by the specification, when specified (see 6.2).

6.6.1 Material safety data sheets and ASTM F718. 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-131. When specified, ASTM F718 data sheet should be included with each shipment of the material covered by this specification (see 6.2).

6.7 Toxicity. Questions pertinent to this requirement should be referred by contracting activity to the qualifying activity. The qualifying activity will act as advisor to the contracting activity. The qualifying activity will arrange for review of questions by the appropriate departmental medical service.

6.8 Toxicological product formulations. The contractor should have the toxicological product formulations and associated information available for review by the appropriate service medical department to evaluate the safety of the material for the proposed use.

6.9 Definitions.

6.9.1 Lot. For the purpose of conformance testing and test sampling, a lot is defined as all the paint (in U.S. gallons) of the same type, class, grade, composition and color from a single uniform batch, produced and offered for delivery at one time. The addition of any substance, which was present in the qualification sample to a batch constitutes a new lot. The addition of any substance that was not present in the qualification sample requires requalification.

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6.10 Suggested packaging requirements. Suggested packaging is contained in Tables VII and VIII.TABLE VII. Suggested packing and packaging.

Packaging	Recommended requirements for direct Government acquisitions
Unit of procurement	The paints covered by this specification should be purchased by volume. The unit of procurement should be in multiples of 1 U.S. liquid gallon or 1 L at 15.5 °C (60 °F).
Containers	<p>(a) The components should be furnished in cans of appropriate volume such as 3.78L (1-gallon) or multiples thereof.</p> <p>(b) Multiple friction plug containers should be in accordance with PPP-C-96, type V, class 2. Interior coatings should be as specified therein. Exterior coatings, including side seam stripping, should be as specified therein for plan B. Wire handles as specified therein, should be provided for the 1-gallon container. Closure of the properly filled and sealed cans should be as specified in the appendix thereto.</p> <p>(c) Pails should be to PPP-P-704.</p> <p>(d) All containers should comply with the requirements of the Uniform Freight Classifications (UFC), the National Motor Freight Classification (NMFC), and the applicable requirements of the Code of Federal Regulations 49 CFR, Department of Transportation (DOT).</p> <p>(e) Coatings with anti-stain properties should be packaged in a lined container to ensure that there will be no chemical or physical interactions between the container and the contents.</p>
Intermediate containers	<p>(a) Paints should be packaged in intermediate containers.</p> <p>(b) Intermediate containers should be close-fitting corrugated fiberboard boxes in accordance with UFC, NMFC and 49 CFR requirements. Fiberboard used in the construction of interior (unit and intermediate) and exterior containers, including interior packaging forms, should conform to the ASTM D4727. ASTM D4727 classes should be domestic fire-retardant or weather resistant fire-retardant as specified.</p>
Commercial packaging	<p>(a) Commercial packaging should be to ASTM D3951.</p> <p>(b) All containers should comply with the requirements of the Uniform Freight Classifications (UFC), the National Motor Freight Classification (NMFC), and the applicable requirements of the Code of Federal Regulations 49 CFR, Department of Transportation (DOT).</p>
Packing	<p>Packing should be specified as follows:</p> <p>(a) Overseas delivery (Level A) packing. Intermediate containers of paint should be packed in close-fitting wood boxes conforming to ASTM D6251, overseas type. Box closure and strapping should be as specified in the applicable box specification or the appendix thereto except that strapping should be flat and the finish B.</p> <p>(b) Domestic delivery (Level B) packing. Level B packing should be as for level A, except that boxes should be domestic type or class and the strapping should be finish A or B.</p> <p>(b) Commercial packing. The paint, in the specified unit and intermediate containers should, as applicable, be packed in multiples of like sizes in accordance with UFC, NMFC, and 49 CFR requirements.</p>
Palletization	Intermediate containers should be palletized in accordance with MIL-HDBK-774. Only one size unit or intermediate container should be placed on a pallet.
Packing for Navy acquisitions	<p>Treated lumber and plywood. All lumber and plywood, including laminated veneer materials, used in shipping container and pallet construction, member, blocking, bracing, and reinforcing should be fire-retardant treated material in accordance with MIL-L-19140 as follows:</p> <p>(a) General use, weather resistant: MIL-L-19140, type II, Category I.</p> <p>(b) General use, non-weather resistant: MIL-L-19140, type I, Category I.</p>
Material safety data sheets (MSDS) and ASTM F718	A copy of the MSDS and ASTM F718 should be attached to the shipping document for each destination (see 6.6).

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TABLE VIII. Suggested marking.

Marking type	Recommended marking
Bar codes	Marking should include bar codes
Hazardous warnings	(a) Labels should be in accordance with 29 CFR Parts 1910, 1915, 1917, 1918, 1926 and 1928, as well as PPP-P-1892. (b) All individual containers should have the following marking: "CAUTION: This paint contains volatile solvents, with probable hazardous vapors. Use with adequate ventilation. Avoid prolonged breathing of vapors or spray mists. The solvents are highly flammable, avoid open flame and smoking." (c) Each component container, shipping container, and palletized load should be marked with the appropriate hazardous symbol in accordance with FED-STD-313.
Volatile organic content (VOC)	"Contains a maximum of 250 grams of solvent of volatile organic compounds (VOC) per liter of paint per 40 CFR 60, Appendix A (EPA) Method 24."
OSHA Hazard Communication Act and FED-STD-313.	Markings should include all information necessary to comply with OSHA Hazard Communication Act and FED-STD-313.
Mixing and use instructions	Directions should include mixing, application equipment directions, limitations on thinning, temperature range for use and surface preparation recommendations. Directions should refer user to data sheets, MSDS and ASTM F718 for information.

6.11 Part or Identifying Number (PIN).

M **24635** - **X** **X** **X**
 Prefix for Military Specification Type (see code Class (see Grade (see code
 Specification (not Number (for CIDs below) code below) below)
 used for CIDs) ex.: AA24635)

PIN Code:

Type Code		Class Code		Grade Code	
Type	Code	Class	Code	Grade	Code
II	A	1	1	A	A
III	B	2	2	B	B
		3	3	C	C

Example: M24635-A2B

6.12 Subject term (key word) listing.

Alkyd
 Gloss
 Low-gloss
 Non-lead
 Paint
 Semi-gloss
 Topcoat
 Volatile organic content

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6.13 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.

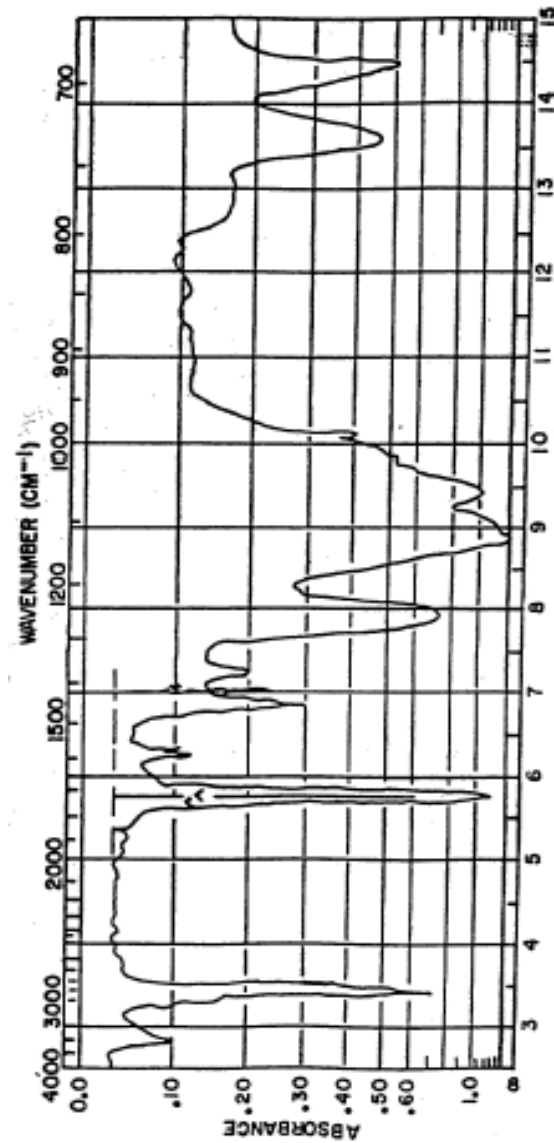


FIGURE 1. Wavelength (micrometers).

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Custodians:
Army - MI
Navy - SH
Air Force - 99

Preparing activity:
Navy - SH
(Project 8010-0184)

Review activities:
Army - MR
Navy - AS, CG
Air Force - 84
CIV - 6FEE

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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 and send to preparing activity.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

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I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-PRF-24635C

2. DOCUMENT DATE (YYYYMMDD)
6 June 2003

3. DOCUMENT TITLE
ENAMEL, SILICONE ALKYD COPOLYMER

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) DSN
(*if applicable*)

7. DATE SUBMITTED
(YYYYMMDD)

8. PREPARING ACTIVITY

a. NAME
SEA 05Q

b. TELEPHONE (*Include Area Code*)
(1) Commercial
202-781-3726

(2) DSN
326-3726

c. ADDRESS (*Include Zip Code*)
Commander, Naval Sea Systems Command
ATTN: SEA 05Q
1333 Isaac Hull Avenue, SE, Stop 5160
Washington Navy Yard DC 20376-5160

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