

**METRIC**  
 DOD-E-24635 (SH)  
 13 September 1984

## MILITARY SPECIFICATION

### ENAMEL, GRAY, SILICONE ALKYD COPOLYMER SEMIGLOSS (FOR EXTERIOR USE) (METRIC)

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 copolymerized silicone alkyd enamel for use on primed, smooth metal surfaces.

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified, the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

#### SPECIFICATIONS

##### FEDERAL

- |            |   |
|------------|---|
| A-A-1586   | - Tape, Pressure - Sensitive Adhesive (Waterproof).                                   |
| TT-S-735   | - Standard Test Fluids; Hydrocarbon.  |
| TT-T-291   | - Thinner, Paint, Mineral Spirits, Regular or Odorless.                               |
| PPP-P-1892 | - Paint, Varnish, Lacquer, and Related Materials; Packaging, Packing, and Marking of. |

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 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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## STANDARDS

## FEDERAL

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

(Copies of specifications and standards required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

## ASTM

- D 93 - Flash Point by Pensky-Martens Closed Tester. (DoD adopted)
- D 476 - Titanium Dioxide Pigment. (DoD adopted)
- D 523 - Specular Gloss. (DoD adopted)
- D 562 - Consistency of Paints Using the Stormer Viscometer. (DoD adopted)
- D 563 - Phthalic Anhydride Content of Alkyd Resins and Resin Solutions.
- D 659 - Evaluating Degree of Chalking of Exterior Paints. (DoD adopted)
- D 823 - Producing Films of Uniform Thickness of Paint, Varnish, Lacquer and Related Products. (DoD adopted)
- D 1210 - Fineness of Dispersion of Pigment - Vehicle Systems. (DoD adopted)
- D 1296 - Odor of Volatile Solvents and Diluents. (DoD adopted)
- D 1308 - Effects of Household Chemicals on Clear and Pigmented Organic Finishes. (DoD adopted)
- D 1398 - Fatty Acid Content of Alkyd Resins and Alkyd Resin Solutions. (DoD adopted)
- D 1542 - Qualitative Tests for Rosin in Varnishes. (DoD adopted)
- D 1849 - Package Stability of Paint. (DoD adopted)
- D 1983 - Fatty Acid Composition by Gas-Liquid Chromatography of Methyl Esters. (DoD adopted)
- D 2244 - Instrument Evaluation of Color Differences of Opaque Materials. (DoD adopted)
- D 2245 - Identification of Oils and Oil Acids in Solvent-Type Paints. (DoD adopted)
- D 2698 - Determination of the Pigment Content of Solvent-Type Paints by High-Speed Centrifuging. (DoD adopted)

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ASTM (Continued)

D 2800 - Preparation of Methyl Esters from Oils for Determination of Fatty Acid Composition by Gas Chromatography. (DoD adopted)

G 53 - Operating Light-and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials.

(Application for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103.)

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Rules and Regulations - Rules 102 and 442

(Application for copies should be addressed to the South Coast Air Quality Management District, 9150 E. Flair Drive, El Monte, CA 91731.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Qualification. The enamel furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for the opening of bids (see 4.3 and 6.3).

3.2 Color. The color of the enamel shall be in accordance with the standard color chip for color 26270 as specified in FED-STD-595, when tested in accordance with 4.6.7 and 4.6.20. The Adam color difference shall not exceed a value of 0.5 when tested in accordance with 4.6.7.

3.3 Composition.

3.3.1 Pigment. The pigments shall be titanium dioxide in accordance with type IV of ASTM D 476. Small amounts of shading pigments may be used to match 26270 color.

3.3.2 Vehicle. The vehicle shall consist of a copolymerized silicone resin modified long-oil soya alkyd of the air-drying type, together with suitable thinners, driers, antiskinning agents, wetting agents, dispersing agents and stabilizers combined, producing an enamel conforming to all requirements specified herein.

3.3.3 Thinner. The volatile thinner shall be in accordance with type I or III of TT-T-291, or any other solvent system in accordance with Rules 102 and 442 of the South Coast Air Quality Management District. The contractor shall provide certification to this effect (see 4.7).

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3.3.4 Identification. The copolymer, when tested in accordance with 4.6.17.2, 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. Neither spectra shall show an absorption band in the 13.9 - 14.0 micrometer ( $\mu\text{m}$ ) region and both shall show a sharp narrow band at 7.0  $\mu\text{m}$ .

3.4 Qualitative requirements.

3.4.1 Condition in container. The enamel, when tested in accordance with 4.6.1, shall be free of grit, seeds, skins, lumps or livering, and shall show no more pigment settling or caking than can be readily re-incorporated to a smooth homogenous state with a paddle.

3.4.2 Storage stability.

3.4.2.1 Partially full container. The enamel shall show no skinning when tested in accordance with 4.6.2.1. After aging in accordance with 4.6.2.1, the enamel shall show no livering, curdling, hard caking or gummy sediment. It shall mix readily to a smooth homogenous state.

3.4.2.2 Full container. The enamel shall show no skinning, livering, curdling, hard caking or gummy sediment, when tested in accordance with 4.6.2.2. It shall remix readily to a smooth homogenous state, shall have a consistency within 62-82 Krebs Units but not greater than 5 units from the original Krebs Units and shall meet all other requirements of this specification.

3.4.3 Dilution stability. When thinned in accordance with 4.6.3, the enamel shall remain stable and uniform, showing no precipitation or curdling. Slight pigment settling shall be permitted.

3.4.4 Brushing properties. The enamel, when tested in accordance with 4.6.4, shall brush satisfactorily and shall dry to a uniform film, free from seeds, runs, sags or streaks.

3.4.5 Rolling properties. The enamel, when tested in accordance with 4.6.5, 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.

3.4.6 Spraying properties. The enamel, when tested in accordance with 4.6.6, shall spray satisfactorily and shall show no running, sagging, streaking or orange peel. The air dried film shall show no seeding, dusting, floating, fogging, mottling, hazing or other film defects.

3.4.7 Odor. When tested in accordance with 4.6.8, the odor of the wet enamel and the film at any interval of drying shall not be obnoxious or objectionable.

3.4.8 Anchorage. A film of the enamel, when tested in accordance with 4.6.9, shall show no removal or loosening of the enamel beyond 1.6 millimeters (mm) (0.063 inch) on either side of the score line.

3.4.9 Flexibility. A film of enamel, when tested in accordance with 4.6.10, shall bend without cracking or flaking.

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3.4.10 Flake and crack resistance. A film of enamel, when tested in accordance with 4.6.11, shall adhere tightly to the metal and shall not flake or crack. The film shall ribbon or curl from the metal on cutting, and the cut shall show beveled edges.

3.4.11 Recoating. When tested in accordance with 4.6.12, 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.

3.4.12 Water resistance. A film of enamel, when tested in accordance with 4.6.13, 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 hardness, 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 comparison panel.

3.4.13 Hydrocarbon resistance. A film of the enamel, when tested in accordance with 4.6.14, shall show no blistering or wrinkling when examined immediately after removal from the specified hydrocarbon test fluid. When examined 2 hours after removal, there shall be no excessive softening, whitening or dulling. After 24 hours air drying, the portion of the panel which was immersed shall be indistinguishable with regard to hardness, 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 comparison panel.

3.4.14 Accelerated weathering. Films of the enamel, when prepared and tested in accordance with 4.6.20, shall show no evidence of chalking and a loss of not more than 30 percent of the gloss measured prior to exposure. The Adams color difference shall not exceed a value of 1.0 for before and after testing (see 4.6.20).

3.5 Quantitative requirements.

3.5.1 Vehicle. The composition of the vehicle shall be in accordance with table I.

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TABLE I. Characteristics of vehicle.

Characteristics	Requirements	
	Minimum	Maximum
Silica (SiO <sub>2</sub> ) 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	
Rosin	Negative	
Phenolic resin	Negative	

3.5.2 Quantitative requirements of the enamel. The quantitative requirements of the enamel shall be in accordance with tables II and III.

TABLE II. Quantitative requirements of the enamel.

Characteristics	Requirements	
	Minimum	Maximum
Flash point, Pensky-Martens, closed cup, °C (°F)	29 (85)	--
Water, percent by weight of enamel	--	0.5
Coarse particles and skins (retained on number 325 mesh) percent by weight of pigment	--	0.5
Gloss, 60-degree specular	40	50
Consistency, Krebs-Stormer, shearing rate, 200 r/min, grams equivalent Krebs Units	125	175
Fineness of grind	67	77
Drying time:	6	--
Set-to-touch, hours	--	2
Dry hard, hours	--	8

TABLE III. Specific quantitative requirements for gray color 26270.

Color (number) - FED-STD-595	26270
Color (name-designation)	Gray (Navy-Haze)
Total solids - minimum	63 percent by weight of enamel
Hiding pigment - minimum	14 } percent by weight of pigment
- maximum	18 }
Extender pigment - maximum	24 percent by weight of pigment
Vehicle solids - minimum	26 percent by weight of total solids

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3.5.3 Typical enamel formulation. A typical enamel formulation in accordance with the specific quantitative requirements is shown in table IV. Quantities of ingredients may be varied to ensure compliance with all specification requirements.

TABLE IV. Typical enamel formulation.

	Mass units <sup>4/</sup>
Titanium dioxide <sup>1/</sup>	182.6
Lampblack or carbon black	3.1
Magnesium silicate	121.4
3000 mesh mica	45.9
Thixcin R <sup>2/</sup>	3.1
Silicone alkyd copolymer (60 percent)	509.0
Naphtha mineral spirits	142.7
Cobalt octoate	3.1
Manganese naphthenate	2.0
Calcium naphthenate	3.1
Antiskinning agent <sup>3/</sup>	2.0
Antifloating additive	2.0
Total	1020.0

1/ DuPont R-960 or equal.

2/ NL Chemicals or equal.

3/ Nuodex Products Company or equal.

4/ If mass units are kilograms, the formulation will yield approximately 832 liters. If mass units are pounds, the formulation will yield approximately 100 gallons.

3.6 Toxicity. The material shall have no adverse effect on the health of personnel when used for the intended purpose. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate service medical department which will act as advisor to the contracting activity. In addition, this paint shall be certified to be lead free and asbestos free.

3.7 Material safety data sheet. The contracting activity shall be provided a material safety data sheet (MSDS) at the time of the contract award. The MSDS is DD form OSHA-20 and found as part of FED-STD-313. The MSDS shall be included with each shipment of the material covered by this specification.

#### 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 as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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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 be conducted at a laboratory satisfactory to NAVSEA. Qualification inspection shall consist of the tests specified in table V. Sampling and inspection shall be in accordance with methods 1022 and 1031 of FED-STD-141.

4.4 Quality conformance inspection. Quality conformance inspection for the acceptance of the individual lots shall consist of all tests specified in table V with the exception of storage stability (see 4.6.2), water resistance (see 4.6.13), hydrocarbon resistance (see 4.6.14), and accelerated weathering (see 4.6.20). Sampling and inspection shall be in accordance with methods 1022 and 1031 of FED-STD-141. Failure to pass any test and noncompliance to the requirements of section 3 shall be cause for rejection of the lot.

TABLE V. Tests.

	Requirements paragraph	Applicable test method FED-STD-141	ASTM test method	Test paragraph
Condition container	3.4.1	3011	----	4.6.1
Storage stability	3.4.2	3021	D 1849	4.6.2
Dilution stability	3.4.3	4203	----	4.6.3
Brushing properties	3.4.4	4321	----	4.6.4
Rolling properties	3.4.5	----	D 823	4.6.5
Spraying properties	3.4.6	4331	----	4.6.6
Color	3.2	----	D 2244	4.6.7
Odor	3.4.7	----	D 1296	4.6.8
Anchorage	3.4.8	----	----	4.6.9
Flexibility	3.4.9	6221	----	4.6.10
Flake and crack resistance	3.4.10	6304	----	4.6.11
Recoating	3.4.11	4061	----	4.6.12
Water resistance	3.4.12	----	----	4.6.13
Hydrocarbon resistance	3.4.13	----	D 1308	4.6.14
Total solids	Table III	----	----	4.6.15
Silica content	Table I	----	----	4.6.17.1
Copolymer	3.3.4	----	----	4.6.17.2
Vehicle solids	Table III	----	D 2698	4.6.16.1
Phthalic anhydride	Table I	----	D 563	4.6.16.2
Drying oil acids	Table I	----	D 1398	4.6.16.2
Gloss 60-degree specular	Table II	----	D 523	4.6.18
Drying time	Table II	4061	----	4.6.19
Accelerated weathering	3.4.14	----	G 53, D 659	4.6.20
Soya oil	Table I	----	D 2800	----
	----	----	D 2245	----
	----	----	D 1983	----
Phenolic resin	Table I	5141	----	----
Rosin	Table I	----	D 1542	----
			Sec. 4.1	

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TABLE V. Tests. - Continued

	Requirements paragraph	Applicable test method FED-STD-141	ASTM test method	Test paragraph
Flash point	Table II	----	D 93	----
Water	Table II	4081	----	----
Coarse particles	Table II	4092	----	----
Consistency	Table II	----	D 562	----
Fineness of grind	Table II	----	D 1210	----
Hiding pigment	Table III	4021	----	----
Extender	Table III	4021	----	----

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  $50 \pm 4$  percent.

#### 4.6 Tests.

4.6.1 Condition in container. The package condition on acceptance testing shall be determined in accordance with method 3011 of FED-STD-141 and observed for compliance with 3.4.1. The qualification testing shall include the evaluation of pigment settling or caking properties in accordance with method 3011 of FED-STD-141, but do not stir. The paint can shall be resealed and agitated for 3 minutes on a paint shaker. On re-examination of the contents, the disclosure of any gel bodies or undispersed pigments indicates unsatisfactory settling properties.

#### 4.6.2 Storage stability.

4.6.2.1 Partially full containers. Skinning shall be determined after 48 hours in accordance with method 3021 of FED-STD-141, except that a 3/4 filled 1/2 pint multiple friction top can shall be used. The can shall be resealed and aged for 7 days at  $60^{\circ}\text{C}$  ( $140^{\circ}\text{F}$ ) and examined for compliance with 3.4.2.1.

4.6.2.2 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 D 1849. The contents shall be evaluated for pigment settling or caking in accordance with 3.4.1, 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 3.4.2.2.

4.6.3 Dilution stability. One part by volume of enamel as packaged shall be reduced with one part by volume of thinner in accordance with TT-T-291, type I or III and tested in accordance with method 4203 of FED-STD-141 for compliance with 3.4.3.

4.6.4 Brushing properties. Brushing properties of the packaged enamel shall be determined in accordance with method 4321 of FED-STD-141 for compliance with 3.4.4. Method 4494 of FED-STD-141 shall be used as a referee test except that the drawdown shall be made a minimum of 25 centimeters (cm) (10 inches)

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long on a clear glass plate. Contact of the 102  $\mu\text{m}$  (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.

4.6.5 Rolling properties. Rolling properties of the enamel shall be determined in accordance with ASTM D 823 for compliance with 3.4.5.

4.6.6 Spraying properties. Eight parts by volume of enamel shall be reduced with one part by volume of thinner in accordance with TT-T-291, type I or III. The reduced enamel shall be sprayed on a steel panel to a dry film thickness of 23 to 28  $\mu\text{m}$  (0.0009 to 0.0011 inch). The panel shall be observed for spraying properties in accordance with method 4331 of FED-STD-141 to determine compliance with 3.4.6.

4.6.7 Color. A coat of enamel shall be prepared by drawing down on a white opaque glass panel using a doctor blade with a 152  $\mu\text{m}$  (0.006 inch) gap clearance designed to deposit a wet film thickness approximately 75  $\mu\text{m}$  (0.003 inch). After 48 hours air drying, the  $\Delta L$ ,  $\Delta a$ , and  $\Delta b$  values shall be determined from the standard chip in accordance with ASTM D 2244, and the color difference determined in accordance with the calculations for Adams color differences for determining compliance with 3.2.

4.6.8 Odor. The enamel shall be tested for odor in accordance with ASTM D 1296 for compliance with 3.4.7.

4.6.9 Anchorage. A panel shall be prepared in accordance with method 4061 of FED-STD-141 and air dried for 18 hours. The panel shall then be baked for 2 hours at  $105 \pm 2^\circ\text{C}$  ( $221 \pm 4^\circ\text{F}$ ). After baking, the panel shall be conditioned for 1 hour under referee testing conditions in accordance with FED-STD-141, and a line scored through to the metal across the width of the film, using a sharp pointed knife. The film shall then be taped perpendicular to and across the score line with waterproof pressure sensitive 19 mm (0.750 inch) wide tape in accordance with A-A-1586. The tape shall be pressed in firm contact with the test area, and approximately 10 seconds allowed for the test area to return to room temperature. The force end of the tape shall be grasped and stripped from the film by pulling it back at a rapid speed from the panel at an angle of approximately 180 degrees to determine compliance with 3.4.8.

4.6.10 Flexibility. The flexibility shall be determined in accordance with method 6221 of FED-STD-141. A 51 mm (2 inches) wide film applicator that will give a dry film thickness of 23 to 28  $\mu\text{m}$  (0.0009 to 0.0011 inch) on a smooth finish steel plate shall be prepared in accordance with method 2011 of FED-STD-141 using the aliphatic naphtha/ethylene glycol monoethyl ether mixture. The panel shall be prepared from new cold rolled rust-free carbon steel  $25.4 \pm 2.5 \mu\text{m}$  ( $0.010 \pm 0.001$  inch) thick with a Rockwell 15-T maximum hardness of 82 and shall be finished with a surface roughness of 8 to 12 microinches. The panel shall be air dried in a horizontal position for 18 hours and then baked for 168 hours at  $105 \pm 2^\circ\text{C}$  ( $221 \pm 4^\circ\text{F}$ ). The panel shall be conditioned for 1/2 hour under referee conditions and then bent over a 6.35 mm (0.250 inch) mandrel. The coating shall be examined for cracks over the area of the bend in a strong light at a 7-diameter magnification to determine compliance with 3.4.9.

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4.6.11 Flake and crack resistance test. The knife test shall be performed in accordance with method 6304 of FED-STD-141 using the flat portion of the panel from the flexibility test (see 4.6.10) to determine compliance with 3.4.10.

4.6.12 Recoating. The enamel shall be prepared in accordance with method 4061 of FED-STD-141 and allowed to air dry for 24 hours under referee testing conditions. A second coat of enamel shall be applied crosswise to the first coat and allowed to air dry for an additional 24 hours. The enamel shall show no film irregularities in compliance with 3.4.11.

4.6.13 Water resistance. A film of enamel shall be prepared by drawing down with a 51  $\mu\text{m}$  (0.002 inch) to 102  $\mu\text{m}$  (0.004 inch) gap clearance film applicator on a steel panel which has been solvent cleaned and phosphate coated in accordance with method 2011, 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  $23 \pm 1^\circ\text{C}$  ( $73 \pm 2^\circ\text{F}$ ) for 18 hours in accordance with ASTM D 1308. At the end of the test period, the panel shall be removed and examined for compliance with 3.4.12.

4.6.14 Hydrocarbon resistance. A film of enamel shall be prepared in accordance with 4.6.13. The enamel shall be air dried for 7 days and then immersed for 4 hours in a hydrocarbon fluid in accordance with type III of TT-S-735 and observed in accordance with ASTM D 1308. At the end of the test period the panel shall be removed and examined for compliance with 3.4.13.

4.6.15 Total solids. A small disposable aluminum dish approximately 51 mm (2 inches) with a tared aluminum cover shall have the mass determined to the nearest 0.1 milligram (mg). A very small sample of the enamel, not to exceed 0.3 gram, shall have the mass determined into the dish and dissolved in 2 milliliters (mL) of reagent-grade toluene. The dish shall then be dried for 1 hour in a gravity convection oven at  $165^\circ\text{C}$  ( $329^\circ\text{F}$ ). Upon cooling, the dish shall have the mass redetermined to the nearest 0.1 mg and percent nonvolatile calculated.

4.6.16 Vehicle extraction. The vehicle shall be extracted in accordance with ASTM D 2698.

4.6.16.1 Vehicle solids. The percent nonvolatile vehicle shall be determined in accordance with 4.6.16 using the isolated vehicle in place of the enamel and shall conform to table I.

4.6.16.2 The unsaponifiable, drying oil acids and phthalic anhydride shall be determined on the isolated vehicle in accordance with ASTM D 1398 and D 563 respectively, except that the drying oil acids shall be extracted with the petroleum ether in place of chloroform and shall conform to table I.

4.6.17 Silicone-alkyd copolymer resin.

4.6.17.1 Silica content of vehicle. From a stoppered bottle or weighing pipet, the mass shall be accurately determined by difference, weigh approximately 3 grams of vehicle into a previously ignited and weighed 7.6 cm (3-inch) porcelain evaporating dish. The sample shall be dried at  $165^\circ\text{C}$  ( $329^\circ\text{F}$ ) in an oven for 1

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hour. The dried sample shall be placed in a cold muffle furnace and gradually increasing the temperature 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 calculate the percent of silica as follows:

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

The mass shall be in compliance with table I.

4.6.17.2 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  $\mu\text{m}$  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 3.3.4.

4.6.18 Specular gloss. Draw down the thoroughly mixed enamel on plane, opaque, white glass panels as specified in method 2021 of FED-STD-141. Use a film applicator which will produce a wet film thickness of  $76 \pm 2 \mu\text{m}$  ( $0.003 \pm 0.0001$  inch). Dry 168 hours under referee conditions in a dust free environment. Determine 60-degree specular gloss in accordance with ASTM D 523 for compliance with table II.

4.6.19 Drying time. A film of enamel shall be prepared by drawing down a 0.075 mm (0.003 inch) film by using a 0.15 mm (0.006 inch) gap clearance with a film applicator, and the drying time shall be determined in accordance with method 4061 of FED-STD-141 under referee conditions for compliance with table II.

4.6.20 Accelerated weathering. The duplicate flat tin panels shall be prepared by drawing down films of enamel with a 0.15 mm (0.006 inch) gap clearance film applicator and allowing 7 days for complete cure. Air dry for 168 hours. The 60-degree specular gloss of the enamel shall be measured and the panels exposed for 300 hours to accelerated weathering using Fluorescent UV-Condensation type apparatus in accordance with ASTM G 53. The cycle shall be 4 hours UV exposure at 60°C (140°F) and 4 hours condensation exposure at 40°C (104°F). The chalking shall be evaluated in accordance with ASTM D 659 and 60-degree gloss determined in accordance with ASTM D 523. The results shall be checked for compliance with 3.2 and 3.4.14.

4.7 Certification data. The contractor shall furnish the following certification data with the request for qualification testing:

- (a) Certification that volatility requirements are met (see 3.3.3).
- (b) Conformance of each lot of ingredient material, stating test results and source, as applicable (see 4.4).

4.7.1 Toxicological data. The contractor shall furnish to the contracting activity the toxicological data and formulations required to evaluate the safety of the material for the proposed use.

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

## 5. PACKAGING

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

5.1 Packaging, packing and marking. The enamel shall be packaged, packed and marked in accordance with PPP-P-1892. The level of packaging shall be A or C and the level of packing shall be A, B or C as specified (see 6.2.1). The enamel shall be furnished in 3.78-liter (1-gallon) cans or 19-liter (5-gallon) pails as specified (see 6.2.1).

5.1.1 Special marking. In addition to other markings required on the containers, there shall be the following statement: "The volatile content of the material in this container is not photochemically reactive as defined by Rule 102 of the South Coast Air Quality Management District" (see 6.5).

5.1.2 Shelf life marking. In addition to markings specified in 5.1 and 5.1.1, each unit container, intermediate container where applicable, and shipping container shall be marked as follows: "Date of first reinspection (insert date 1 year after date of manufacture)".

5.1.3 Precautionary markings. In addition to the markings in accordance with PPP-P-1892, all individual containers shall have the following markings:

"CAUTION: This enamel 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."

## 6. NOTES

6.1 Intended use. This specification covers a high grade, air-drying, semi-gloss enamel 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. The enamel may be applied with brush, roller or spray.

6.2 Ordering data. Acquisition documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Level of packaging and level of packing required (see 5.1).
- (c) Size of container required (see 5.1).

6.3 With respect to the products requiring qualification, awards will be made only for products which are, at the time set for opening bids, qualified for inclusion in Qualified Products List QPL-24635 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the

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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 55Z3, Department of the Navy, Washington, DC 20362 and information pertaining to qualification of products may be obtained from that activity. Application for qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (see 6.3.1).

6.3.1 Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

6.4 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 the Air Pollution District of Los Angeles County, the paint may be used anywhere else a product complying with 3.3.3 is allowed. This includes other air pollution control districts or similar areas controlling the emission of solvents into the atmosphere. Information regarding Los Angeles County Air Pollution Rules 102, 442 and 443 may be obtained from: South Coast Air Quality Management District.

6.5.1 Some additional intended use of enamels meeting this specification are as follows:

Semigloss finish for: Machinery  
Refinishing trucks and buses  
Passenger and freight cars  
Metal drum  
Metal signs  
Metal railing and fences  
Marine use above water  
Metal trim (exterior)  
Metal sidings  
Metal doors and bucks  
Metal structures (exterior)  
Properly primed wood (exterior)

Preparing activity:  
Navy - SH  
(Project 8010-N256)

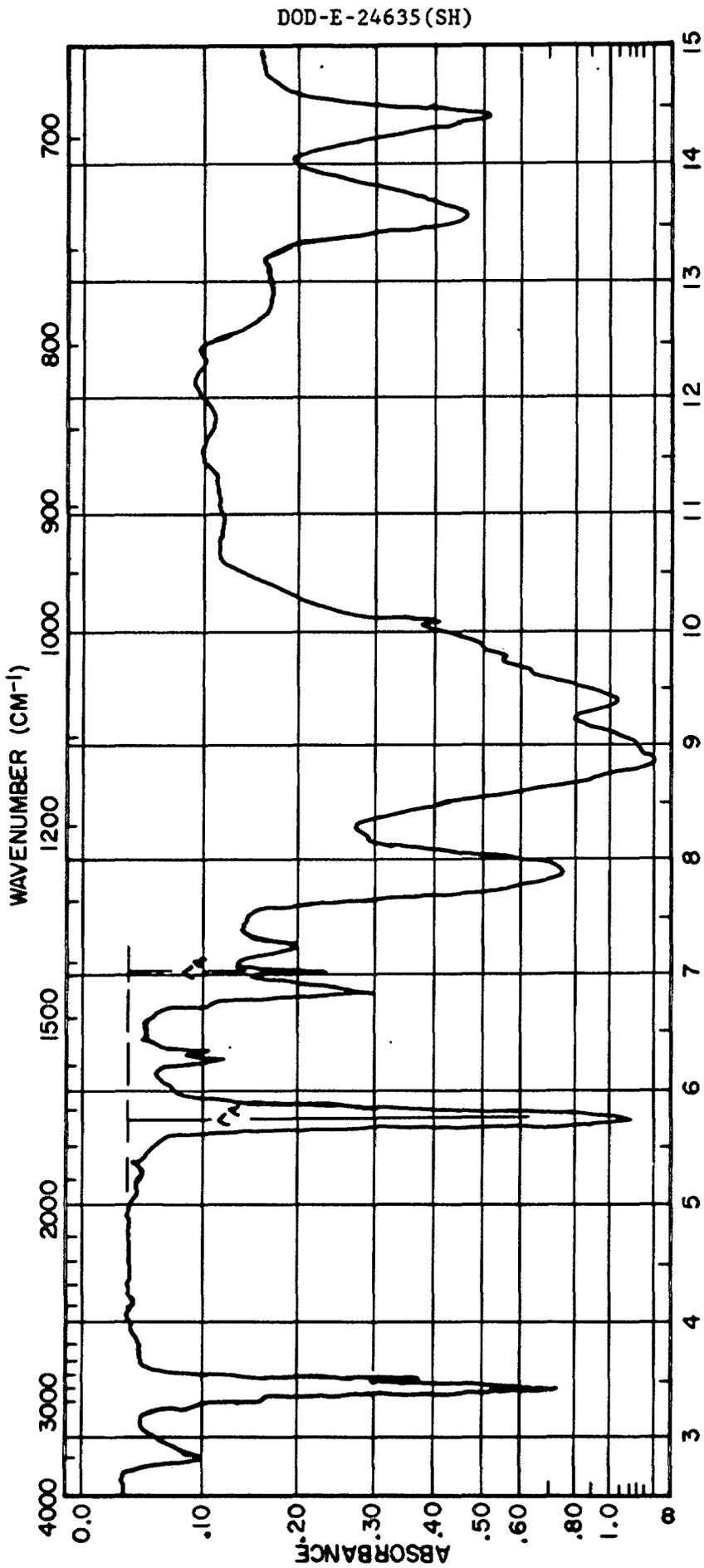


FIGURE 1. Wavelength (micrometers).

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