

TT-E-487E
April 16, 1980
SUPERSEDING
Fed. Spec. TT-E-487D
February 7, 1974

FEDERAL SPECIFICATION

ENAMEL: FLOOR AND DECK

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for use of all Federal Agencies.

1. SCOPE

1.1 This specification covers an enamel formulated for use on wood and concrete floors and decks.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

Federal Specifications:

PPP-B-636 - Boxes, Shipping, Fiberboard.
PPP-C-96 - Cans, Metal, 28 Gauge and Lighter.

Federal Standards:

Fed. Std. No. 595 - Colors.

(Activities outside the Federal Government may obtain copies of Federal specifications, standards and commercial item descriptions, as outlined under General Information in the Index of Federal Specification, Standards, and Commercial Item Descriptions. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification other Federal specification and commercial item descriptions required by activities outside the Federal Government for bidding purposes are available without charge from General Services Administration Business Service Centers in Boston, New York; Philadelphia; Washington, DC; Atlanta; Chicago; Kansas City, MO; Fort Worth; Houston; Denver; Los Angeles; San Francisco; and Seattle, WA.

(Federal Government activities may obtain copies of Federal specifications, standards, commercial item description and the Index of Federal Specification Standards and Commercial Item Description from established distribution points in their agencies.)

Military Standards:

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

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring 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. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials (ASTM) Standards:

- D 235 - Petroleum Spirits (Mineral Spirits).
- D 535 - Specular Gloss.
- D 562 - Consistency of Paints Using the Stormer Viscosimeter.
- D 968 - Abrasion Resistance of Coating of Paint, Varnish, Lacquer and Related Products by the Falling Sand Method.
- D 1210 - Fineness of Dispersion of Pigment-Vehicle Systems.
- D 1296 - Odor of Volatile Solvents and Diluents.
- D 1364 - Water in Volatile Solvents (Fischer Regent Titration Method).
- D 1542 - Qualitative Tests for Rosin in Varnished.
- D 1640 - Drying, Curing, or Film Formation of Organic Coatings at Room Temperature.
- D 1729 - Visual Evaluation of Color Differences of Opaque Materials.
- D 1734 - Marking and Preparing Concrete and Masonry Panels for testing Paint Finishes.
- D 2369 - Volatile Content of Paints.
- D 2698 - Pigment Content of Solvent-Type Paints by High Speed Centrifuging.
- D 2805 - Test for Hiding Power of Paints.
- D 3272 - Vacuum Distillation of Solvents from Solvent Base Paints for Analysis.
- E 97 - 45-deg., 0-deg. Directional Reflectance of Opaque Specimens by Filter Photometry.
- E 260 - General Gas Chromatography Procedures.

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

National Motor Freight Traffic Association, Inc., Agent:

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Association, Inc., Traffic Department, 1616 P Street, N.W., Washington, DC 20036.)

Uniform Classification Committee, Agent:

Uniform Freight Classification.

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

3. REQUIREMENTS

3.1 Vehicle. The volatile solvent shall conform to the following requirements by volume, when tested as specified in 4.4.1:

- (a) The total of solvents with olefinic or cyclo olefinic unsaturation shall not exceed 5 percent.
- (b) The total of aromatic compounds with eight or more carbon atoms in the molecule, except ethylbenzene, methyl benzoate, and phenyl acetate, shall not exceed 8 percent.
- (c) The total of ethylbenzene, toluene, and branched-chain ketones shall not exceed 20 percent.

- (d) A solvent which may be classified into more than one of the above groups shall be considered a member of the group having the lowest allowable concentration.
- (e) The total of (a), (b), and (c) shall not exceed 20 percent.
- (f) Halogenated solvents shall not be present.

3.2 Color. The color shall match the specified standard color in Fed. Std. No. 595 when tested as in 4.4.2.

3.3 Qualitative requirements.

3.3.1 Condition in container. A freshly opened container of enamel, when tested as in 4.4.3, shall be free from grit, seeds, skins, lumps, and livering and shall show no more pigment settling or caking than can be readily incorporated into a homogenous state.

3.3.2 Odor. The odor of the enamel during application shall not deviate from the normal characteristics of the enamel when tested as in 4.4.4.

3.3.3 Dilution stability. The enamel shall show neither precipitation, curdling, nor separation when tested as in 4.4.5.

3.3.4 Application, spreading, and leveling properties. The enamel shall show easy brushing, good leveling, and spreading when tested as in 4.4.6. In addition, the dried film shall show no brush marks.

3.3.5 Anchorage. A film of the enamel, when tested as in 4.4.7 shall show neither removal nor other loosening of the film beyond 1.5 mm on either side of the score line.

3.3.6 Flexibility. A film of the enamel, when tested as in 4.4.8, shall withstand bending without cracking or flaking.

3.3.7 Abrasion resistance. The area abraded through to the substrate shall not exceed 4 mm² when the enamel is tested as in 4.4.9.

3.3.8 Imprint resistance. The dried film of enamel, when tested as in 4.4.10, shall show no visible imprint of the cheesecloth.

3.3.9 Water resistance. A film of the enamel, when tested as in 4.4.11, shall show neither whitening nor change in color when examined immediately after removal from the water.

3.4 Quantitative requirements. The quantitative requirements of the enamel shall be as specified in table I and 3.4.1.

Table I. Quantitative requirements

[CCB NOTE: The "minimum" column below was unclear in the hard copy. It has been reproduced below as closely as possible.]

Characteristics	Requirements	
	Minimum	Maximum
Total solids, percent by weight of enamel	15	--
Nonvolatile vehicle, percent by weight of vehicle	10	--
Rosin and derivatives	None	--
Consistency, Krebs-Stormer, shearing rate 200 rpm		
Grams	115	200
Equivalent K.U.	7	82
Drying time:		
Set to touch, hours	1/2	4
Dry-hard, hours	--	16
Fineness of grind	5	--
Reflectance, white only	86	--

Specular gloss 60 degrees (without correction for diffuse reflectance)	70	--
Water, percent by weight of enamel	--	1.0

3.4.1 Hiding power (contrast ratio). A dry film thickness of 38 μm maximum of white enamel (minimum apparent hiding power reflectivity of 86 percent) shall have a contrast ratio of 0.95. A dry film thickness of 38 μm maximum for color enamels shall have a contrast ratio as specified in table II.

TABLE II. Minimum dry film contrast ratios for tints.

Apparent reflectivity of tints, percent	Contrast ratio
85 and above	0.95
83 - 84	0.96
81 - 82	0.97
75 - 80	0.98
74 and below	0.99

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.

4.2 Examination for packaging, packing, and marking. An examination shall be made to determine that packaging, packing, and marking of the end item complies with the applicable requirements of section 5. The sample unit shall be one complete shipping container. Sampling shall be in accordance with MIL-STD-105. The inspection level shall be S-2 with the acceptable quality level (AQL) being 4.0 expressed in terms of percent defective.

4.3 Testing of the end item. The methods of testing specified in 4.4 shall be followed. Sampling shall be in accordance with MIL-STD-105. The lot shall be expressed in units of gallons. The sample for testing the enamel shall be 1 gallon. The inspection level shall be S-1 and the AQL shall be 1.5 defects per hundred units.

4.4 Test procedure. The tests shall be conducted in accordance with ASTM methods, except where otherwise specified herein, to determine compliance with the requirements in section 3. Test methods are indicated in table III. Unless otherwise specified, tests shall be performed at standard conditions, which are 25 deg. +/- 1 deg. C and 50 +/- 5 percent relative humidity. All test reports shall contain the individual values utilized in expressing the final result. Test results shall be evaluated for conformance to requirements. The sample shall be unacceptable if any test result is not in conformance with the corresponding requirement in section 3.

TABLE III. Index

Characteristics	Requirement reference	ASTM method	Paragraph reference
Vehicle	3.1	D 3272, E 260	4.4.1
Color	3.2	D 1729	4.4.2
Condition in container	3.3.1		4.4.3
Odor	3.3.2	D 1296	4.4.4
Dilution stability	3.3.3	D 235	4.4.5
Application properties	3.3.4	D 1734	4.4.6
Anchorage	3.3.5	D 358	4.4.7
Flexibility	3.3.6		4.4.8
Abrasion resistance	3.3.7	D 968	4.4.9
Imprint resistance	3.3.8		4.4.10
Water resistance	3.3.9		4.4.11
Hiding power	3.4.1	D 2805	

Specular gloss 60 deg.	Table I	D 523
Consistency	Table I	D 562
Fineness of grind	Table I	D 1210
Water content	Table I	D 1364
Rosin and derivatives	Table I	D 1542
Drying time	Table I	D 1640
Total solids	Table I	D 2369
Nonvolatile vehicle	Table I	D 2698
Reflectance	Table I	E 97

4.4.1 Vehicle. Analyze the solvent by gas chromatography. The solvent shall be separated from the enamel as specified in ASTM D 3272 and then injected into the gas chromatograph, or the enamel shall be injected directly using equipment specifically designed for that purpose. The procedure specified in ASTM E 260 and any apparatus, operating conditions, columns, and options permitted therein shall be used for the chromatographic analysis. The accuracy of the analysis shall be 0.25 percent absolute by weight or less for each component, and the reproducibility shall be 0.25 percent absolute by weight over three or more runs. All peaks 0.5 percent of the sample or greater shall be identified and quantified. Convert percent by weight to percent by volume, and evaluate the results for compliance with 3.1.

4.4.2 Color. Determine color in accordance with ASTM D 1729 and evaluate for compliance with 3.2.

4.4.3 Condition in container. Before agitating the contents of the container in which the material was originally packaged or transmitted for test, open the container and lower a stiff spatula into it. Observe if the material is livered or caked and if settling or skinning exists. When caking is encountered, stir or shake mechanically until the pigment has been reincorporated to form a homogeneous material suitable for use or until it is determined that the pigment cannot be reincorporated by hand stirring. After the material has been stirred, examine for presence of lumps as it flows from the spatula. Flow some of the material on a glass panel, allow to drain in a vertical position, and examine for seeding and grit. Evaluate for compliance with 3.3.1.

4.4.4 Odor. Determine the odor of the enamel in accordance with ASTM D 1296 and evaluate for compliance with 3.3.2.

4.4.5 Dilution stability. Reduce eight parts by volume of enamel with one part volume of ASTM D 235 type IV mineral spirits. After mixing, let the diluted material stand undisturbed for 4 hours. Evaluate for compliance with 3.3.3.

4.4.6 Application properties. Brush the enamel at a spreading rate of 400 +/- 20 ft²/gal per gallon on a concrete panel prepared in accordance with ASTM D 1734. Evaluate for compliance with 3.3.4.

4.4.7 Anchorage. Brush, as in 4.4.6, one coat of enamel on a white or ponderosa pine wood panel prepared in accordance with ASTM D 358, and allow to dry for 48 hours. Score a line through to the substrate across the width of the panel using a sharp pointed knife. The film shall then be taped perpendicular to and across the score line with commercially available masking tape. A roller weighing 2.00 +/- .05 kg, having a surface durometer hardness value between 70 and 80, shall be used to press the tape on the film. The roller shall be wider than the masking tape. Grasp a free end of the tape and, in 1.0 +/- .05 sec, strip it from the film by pulling it back upon itself at an angle between 150 deg. and 180 deg. Observe for compliance with 3.3.5.

4.4.8 Flexibility. Obtain a tin plate panel (8 by 13 cm) that, when bent through an arc of 180 deg. over a mandrel 3.20 +/- .05 mm in diameter, shall conform to the circumference of the mandrel without deformation. Apply a 5-cm wide film or enamel with a film applicator that will deposit a dry film thickness between .02 to .03 mm on the tinplate plane. Dry for 24 hours. Place the test panel with the coated side facing up on a mandrel 3.20 +/- .05 mm in diameter at a point equally distant from the top and bottom edges of the panel and bend the panel 180 deg. in 1.0 +/- .05 sec. Examine the film at the bend under a magnification of 7 diameters. Cracks and flakes occurring at either end and extending no more than 5 mm shall be disregarded. Evaluate for compliance with 3.3.6.

4.4.9 Abrasion resistance. Draw down a film of enamel on a polished glass panel (12.7 by 20.3 cm) using a drawdown blade and allow to dry for 3 days. The dry film thickness shall be 40 +/- 2 um. Determine the abrasion resistance in accordance with ASTM D 968. Allow 20 liters of sand to fall through the tube onto the test panel. Evaluate for compliance with 3.3.7.

4.4.10 Imprint resistance. Draw down a film of enamel on a clean, polished glass panel with an applicator that will deposit a film thickness of 40 +/- 2 um and allow to dry for 24 hours. Place on the film a 1.27 +/- .05 mm thick piece of felt weighing 24.0 +/- mg per square cm that has been cemented to the underside of a piece of commercially available cheesecloth. Place a 50 mm diameter cylinder weighing 714 +/- 1 g on top of the felt thereby producing a pressure of 3.45 +/- .05 kilopascals for between the cheesecloth and the film. Upon removal of the cheesecloth examine for compliance with 3.3.8.

4.4.11 Water resistance. Draw down a film of enamel on a 8 x 13 cm tinplate panel. The dry film thickness shall be 40 +/- 2 um. After drying for 48 hours, immerse the panel in distilled water for 18 hours in a vertical position. Compare the immersed portion with the unimmersed portion of the panel and evaluate for compliance with 3.3.9.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A or commercial, as specified (see 6.2).

5.1.1 Level A. The 1-quart and 1-gallon quantities of enamel shall be packaged in metal cans conforming to PPP-C-96, type V, class 2. Exterior plan B coating shall be required. See paragraph 5.2.1 for the preparation for delivery of 5- and 55-gallon quantities.

5.1.2 Commercial. The 1-quart and 1-gallon quantities of enamel shall be packaged in accordance with normal commercial practice. The complete package shall be designed to protect the item against damage during shipment, handling, and storage. See paragraph 5.2.2 for the preparation for delivery of 5- and 55-gallon quantities.

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

5.2.1 Level A. Twelve 1-quart cans or four 1-gallon cans of enamel, packaged as specified in 5.1.1, shall be packed in a close-fitting box conforming to PPP-B-636, grade V3c, V3s, or V2s. The boxes shall be closed, waterproofed, and reinforced in accordance with the appendix to PPP-B-636. Alternatively, wirebound, cleated plywood, or nailed wood boxes shall be acceptable shipping containers when lined with a waterproof barrier material. The barrier material shall be sealed at the edges with waterproof tape or adhesive. The 5- and 55-gallon quantities of enamel shall be furnished in metal cans and metal drums, respectively, conforming to item 260 of the National Motor Foreign Classification and rule 40 of the Uniform Freight Classification.

5.2.2 Commercial. The enamel shall be packed in a manner that will assure acceptance by common carrier and provide product protection against loss and damage during multiple shipments, handling, and storage. The shipping containers shall be in compliance with the National Motor Freight Classification and Uniform Freight Classification.

5.3 Marking. Marking shall be as specified in the contract or order.

6. NOTES

6.1 Intended use. The enamel covered by this specification is intended for interior and exterior use on wood and concrete floors not subject to dampness. Concrete basement floors should be allowed to age for 1 year before painting. The floor should be dry, and the best time to paint is during the winter or early spring (assuming there is some source of heat in the basement)

when the humidity in the basement is very low. The enamel should be applied in thin layers and brushed out well, allowing ample time for drying between coats.

On concrete floors: For the first coat, a blend of 1 quart of liquid (two-thirds spar varnish and one-third mineral spirits conforming to current air pollution regulations) should be added to each gallon of enamel. For the second coat, use the material without dilution.

On wood floors: For the first coat, 1 quart of liquid (two-thirds boiled in seed oil and one-third mineral spirits conforming to current air pollution regulations) should be added to each gallon enamel. For the second coat, it may be desirable to add 1 pint of boiled linseed oil to each gallon of enamel.

6.2 Ordering data. Purchasers should select the options permitted herein, and include the following information in procurement documents:

- (a) Title, number, and date of this specification.
- (b) Size of container.
- (c) Selection of applicable degree of preservation and packing (see 5.1 and 5.2).

Military Custodians:

Army - MR
Navy - YD
Air Force - 99

Review activities:

Army - MD, SM
Navy - YD

User activity:

Army - CE, ME

Civil Agencies Coordinating Activities:

COMMERCE-NBS
DC GOVT-DCG
DOT
GSA-PBO
HEW-NIH
VA-DMS

Preparing Activity:

GSA-FSS

Orders for this publication are to be placed with General Services Administration, acting as an agent for the Superintendent of Documents. See section 2 of this specification to obtain extra copies and other documents referenced herein.

TT-E-487E
Amendment - 1
August 22, 1984

FEDERAL SPECIFICATION

ENAMEL: FLOOR AND DECK

This amendment, which forms a part of TT-E-487E, dated April 16, 1980, is approved by the Assistant Administrator, Office of Federal Supply and Services, General Services Administration, for use of all Federal Agencies.

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2.2 Other Publications. Add under American Society for Testing and Materials (ASTM) Standards:

D 3335 - Test Method of Low Concentration of Lead, Cadmium, Cobalt in Paint by Atomic Absorption Spectroscopy.

Add: Air Pollution Regulations (SCAQMD)

Rules and Regulation

(Application for copy should be addressed to the South Coast Air Quality Management District, 9150 East Flair Drive, El Monte, CA 91131).

PAGE 3

3.3.9 Water Resistance. Delete "immediately after removal from the water." and substitute "2 hours after removal from the water."

3.4 Quantitative Requirements. Table I, add "lead, percent by weight on non-volatile" under Characteristics, and "0.06" under Maximum.

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4.4.4 Test Procedures. Table III, add "Lead" under Characteristics, "Table I" under Requirement reference, "D 3335" under ASTM method, and "4.4.12" under Paragraph reference.

PAGE 6

4.4.11 Water Resistance. Delete the last sentence and substitute "After 2 hour recovery time, compare the immersed portion with the unimmersed portion of the panel and evaluate for compliance with 3.3.9."

Add new paragraph:

4.4.12 Lead Content. Determine lead content in accordance with ASTM D 3335 or as specified below. In case of dispute, the following procedure shall be used:

4.4.12.1 Sample Preparation. Using a 0.006-inch gap film applicator, duplicate drawdowns of the well-mixed enamel shall be made on the sealed portion of standard paint penetration charts, dried for 24 hours, and cut to fit the sample holder of a fluorescent x-ray spectrometer capable of determining lead content at a minimum level of 0.03 percent by weight of the total nonvolatile. Settings for a wavelength dispersive spectrometer shall be:

Element	Analytical Line	Angle	Crystal	Detention	Colli- mator	X-ray tube (MO)	
Pb	L	33.93	LiF(200)	Flow S.C.	Fine	60kV	45mA
Pb (background I)		33.00	LiF(200)	Flow S.C.	Fine	60kV	45mA
Pb (background II)		33.50	LiF(200)	Flow S.C.	Fine	60kV	45mA
Mo	K	20.33	LiF(200)	Flow S.C.	Fine	60kV	45mA

Pulse height selection shall be used in all measurements and counting time shall be 100 seconds. Place the sample disc in the wavelength dispersive unit. Measure the count rates of lead, lead background, and Molybdenum Compton scattered background from the x-ray tube.

FSC 8010

4.4.12.2 Calculation.

$$R = \frac{\frac{2I_{Pb} - I_{Pb}^{(I)} - I_{Pb}^{(II)}}{2I_{Mo}}}$$

Where I equals gross intensity. These results shall be compared with those obtained by a 0.06 percent lead standard made up from the same type of enamel sample and evaluated for compliance with the requirement in Table I.

MILITARY INTEREST:

Coordinating Activity

Army - ME

User Interest

Army - CE

Custodian

Air Force - 99

Navy - YD

Review Interest

Air Force - 84

CIVIL AGENCY COORDINATING ACTIVITIES:

GSA - PBO HHS - NIH
 COMM - NBS VA - OSS

PREPARING ACTIVITY:

GSA - FSS