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SUPERSEDING
Int. Fed. Spec. TT-E-00496a (GSA-FSS)
July 25, 1966 and
Fed. Spec. TT-E-496
July 6, 1941

FEDERAL SPECIFICATION

ENAMEL: HEAT-RESISTING (400°F.), BLACK

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

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers a heat resisting black enamel.

1.2 Classification.

1.2.1 Types. Heat resisting enamel, in accordance with this specification shall be furnished in the following types, as specified:

Type I - Bituminous-base (unpigmented) (see 3.2.1).

Type II - Resin-base (pigmented) (see 3.2.2).

2. APPLICABLE DOCUMENTS

2.1 The following specifications and standards, of the issues in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

Federal Specifications:

TT-P-143 - Paint, Varnish, Lacquer, and Related Materials: Packaging, Packing, and Marking of.

TT-T-291 - Thinner; Paint, Volatile Spirits (Petroleum-Spirits).

VV-G-109 - Gasoline, Unleaded.

Federal Standards:

Fed. Test Method Std. No. 141 - Paint, Varnish, Lacquer and Related Materials; Methods of Inspection, Sampling and Testing.

Fed. Std. No. 595 - Colors.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402.

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Washington, D. C., Atlanta, Chicago, Kansas City, Mo., Dallas, Denver, San Francisco, Los Angeles, and Seattle, Wash.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

3. REQUIREMENTS

3.1 Materials. The manufacturer is permitted wide latitude in the selection of raw ma-

terials and process of manufacture providing the enamel produced conforms to all the requirements of this specification.

3.2 Composition.

3.2.1 Type I - bituminous base. The type I enamel shall be unpigmented consisting essentially of bituminous material, drying oil, and suitable volatile organic thinner.

3.2.2 Type II - resin base. The type II enamel shall consist essentially of suitable resin varnish base, pigment, and suitable volatile organic thinner. The pigment shall be carbon black.

3.3 Quantitative requirements. The quantitative requirements of the enamel shall be as specified in table I.

Table I. Quantitative requirements

Characteristics	Requirements	
	Minimum	Maximum
Nonvolatile (percent by wt. of enamel):		
Type I	40	--
Type II	50	--
Pigment (percent by wt. of nonvolatile):		
Type I	--	--
Type II	--	4
Drying time:		
Type I	6	--
Set to touch (hours)		
Type II	6	--
Set to touch (hours)		
Ash content (percent by wt. of enamel):		
Type I	--	1
Type II	--	1
Flash point (°F.)		
Type I	86	--
Type II	86	--
Fineness of grind		
Type II	6	--
Gloss		
Types I and II	80	--
Hiding power (contrast ratio)		
Type II	98	--
Water (percent by wt. of enamel)		
Type I	--	0.5
Type II	--	0.5

3.4 Qualitative requirements.

3.4.1 Condition in container (types I and II). The enamel, tested as in 4.3.3 shall be free from grit, seeds, skins, lumps, thickening or livering and shall show no settling or caking than can be readily redispersed to a smooth homogeneous state.

3.4.2 Odor (types I and II). When tested as in 4.3.4 the odor of the wet enamel and of the film at any interval of drying shall not be obnoxious or objectionable.

3.4.3 Brushing, covering, and leveling (types I and II). The brushing, covering, and leveling properties of the enamel as tested in 4.3.5 shall brush, cover, and level satisfactorily in all respects and shall dry to a smooth, uniform film free from seeds, runs,

sags, or streaks.

3.4.4 Color. When tested as in 4.3.6 the color for type I shall be deep brown to black and shall show no separation of constituents. Type II, tested as in 4.3.6 shall match color 17038 of Fed. Std. No. 595.

3.4.5 Flexibility (types I and II). The film of the enamel tested as in 4.3.7 shall withstand bending without cracking or flaking.

3.4.6 Knife test. A film of the enamel (types I and II) prepared and tested as in 4.3.8 shall adhere tightly to and shall not flake or crack from the metal. The film shall ribbon or curl from the metal on cutting and the cut shall show beveled edges.

3.4.7 Recoating (types I and II). When tested as in 4.3.9 the dried film (recoat) shall show no lifting or other film irregularities.

3.4.8 Gasoline resistance (type II). The dried film prepared and tested as in 4.3.11 shall show no indication of attack by the gasoline and shall be equal in hardness, toughness, and adhesion to the film that was not immersed. No more than a slight dulling of the film shall be permitted.

3.4.9 Reducibility with mineral spirits (types I and II). The enamel, tested as in 4.3.10 shall not show curdling, precipitation, or separation.

3.4.10 Hot-water resistance (type II). When the enamel prepared and tested as in 4.3.12, the film of the immersed portion shall be equal in hardness, toughness, gloss, and adhesion with that of the unimmersed portion.

3.4.11 Heat resistance (types I and II). The film of the enamel prepared and tested as in 4.3.13 shall not run or sag during the heating period and shall not show blistering, cracking, or flaking after the film is allowed to cool at room temperature.

3.4.12 Shock resistance (types I and II). The film of the enamel, tested as in 4.3.14 shall not show cracking, flaking, or loss of adhesion to the undersurface.

3.4.13 Drying properties (type I) and Baking properties (type II). The enamel shall meet the drying properties type I and baking properties type II when tested as in 4.3.15.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2 Classification of inspection. Inspection shall be classified as follows:

(a) Production inspection of the coating.

(b) Inspection of preparation for delivery.

4.3 Production inspection.

4.3.1 Sampling and inspection. Sampling and inspection shall be in accordance with Fed. Test Method Std. No. 141, method 1031.

4.3.2 Test procedures. The enamel shall be tested in accordance with the following applicable methods of Fed. Test Method Std. No. 141 as indicated in table II and as hereinafter specified.

4.3.3 Condition in container. Determine the package condition of the enamel in accordance with method 3011 of Fed. Test Method Std. No. 141 in compliance with 3.4.1.

4.3.4 Odor. Test for the odor in accordance with method 4401 of Fed. Test Method Std. No. 141 and observe for compliance with 3.4.2.

4.3.5 Brushing, covering, and leveling. Take three steel panels prepared in accordance with method 2011 of Fed. Test Method Std. No. 141. Brush one coat of the enamel on each panel and note whether the enamel flows and levels smoothly under the brush. Allow two panels to dry horizontally and one vertically for 24 hours. Examine the panels after this period and evaluate for compliance with 3.4.3. The drying of the panels shall be carried out at a temperature of 21°, to 32°C. in a well-ventilated room but not in the direct rays of the sun.

4.3.6 Color. Pour the thoroughly mixed enamel onto a clean glass plate not less than 4 inches wide and 6 inches long and allow to dry for 24 hours in a vertical position in a well ventilated room but not in direct rays of the sun. For type I, examine the panel by transmitted and reflected northern light and evaluate for compliance with 3.4.4. For type II compare the glass panel against the color chip 17038 by transmitted and reflected northern light and evaluate for compliance with 3.4.4.

4.3.7 Flexibility. Draw down a wet film using .003-inch blade on tin panel prepared in accordance with method 2012 and allow to dry horizontally for 24 hours. Bake the panel in well ventilated oven at 400° ± 5°F. for 5 hours, remove and condition for one hour at room temperature. Determine the flexibility using 1/4-inch mandrel in accordance with method 6221 and evaluate for compliance with 3.4.5.

4.3.8 Knife test. Determine the knife test in accordance with method 6304, using a flat portion of the panel from the flexibility test (see 4.3.7). Observe the results for compliance with 3.4.6.

4.3.9 Recoating. Brush a coat of the enamel on steel panel prepared in accordance with method 2011 and allow to dry at room temperature for 24 hours. Then brush the second coat of the enamel on the panel, while brushing observe for lifting and allow the panel to dry for 24 hours. Examine the dried film for compliance with 3.4.7.

4.3.10 Reducibility with mineral spirits. Add 20 ml of mineral spirits conforming to TT-T-291, with stirring, to 80 ml of enamel in suitable container. Observe whether the enamel thins readily and uniformly and evaluate for compliance with 3.4.9.

4.3.11 Gasoline resistance. Brush a coat of the enamel on tin panel prepared in accordance with method 2012, allow to air dry for 15 minutes, and then bake for two hours in an oven at 295° to 305°F. Cool the panel to room temperature. Immerse half the panel in a gasoline conforming to VV-G-109 for 4 hours. Remove and allow 24 hours recovery, then examine for compliance with 3.4.8.

4.3.12 Hot-water resistance. Prepare and condition a panel as in 4.3.10. Immerse half the panel in boiling water for 10 minutes. Remove and allow 5 minutes recovery. Examine for compliance with 3.4.10.

4.3.13 Heat resistance. The two panels horizontally dried prepared in 4.3.5 shall be used in this test. Suspend the panels in a vertical position and heat in an air oven at a temperature of 400° ± 5°F. for 5 hours. Observe the film for running and sagging during heating and after the panels have recovered for 1 hour at room temperature examine for blistering, cracking, or flaking for compliance with 3.4.11.

4.3.14 Shock resistance (types I and II). Take one of the panels at the end of the heating period in 4.3.13. Immediately upon removal from the oven plunge the panel into a 2 liter beaker containing approximately 4 inches of water having a temperature of 20° to 30°C. and allow to remain for 5 minutes. Remove the panel, allow to recover for 1/2 hour and then examine for compliance with 3.4.12.

4.3.15 Drying properties.

Type I. Pour the thoroughly mixed enamel onto a clean glass plate not less than 4 inches long. Place the panel in a nearly vertical position in a well-ventilated room, but not in the direct rays of the sun. The temperature of the room shall be between 21° and 32°C. Test the film at points not less than one inch from the upper edge of the film by touching lightly with the finger. The enamel shall be considered to have set to touch when gently pressure of the finger shows a tacky condition but none of the enamel adheres to the finger. Permit the film to dry under the above conditions for a total of 24 hours and note whether the enamel has dried (type I enamel generally dries to a somewhat tacky and slightly soft coating). Light rubbing of the finger over the film shall not remove the film from the glass. (In case of dispute the drying properties shall be determined at a temperature of 25° ± 2°C. and a relative humidity of 50 ± 4 percent.)

4.3.16 Baking Properties.

Type II. Pour the thoroughly mixed enamel onto a clean glass plate not less than 4 inches wide and 6 inches long. Place the panel in a nearly vertical position in a well-ventilated room, but not in the direct rays of the sun. The temperature of the room shall be between 21° + 32°C. Test the film at points not less than one inch from the upper edge of the film by touching lightly with the finger. The enamel shall be set to touch when gentle pressure of the finger shows a tacky condition but none of the enamel adheres to the finger. (In case of dispute the drying properties shall be determined at a temperature of 25° + 2°C. and a relative humidity of 50 + 4 percent). Brush one coat of the enamel over a bright tin plate and allow to air-dry for 15 minutes and then bake at 105° to 110°C. for one hour. The enamel film shall after the baking period be hard, tough, and smooth without any indication of checking or wrinkling. The baked film shall show no hazing or discoloration.

4.4 Inspection of preparation for delivery. The packaging, packing, and marking shall be examined and tested to determine the compliance with section 5 of this specification.

TABLE II.

Characteristics	Requirements reference	Applicable tests	
		Fed. Test Method Std. No. 141	Paragraph reference
Nonvolatile	Table I	4053	
Pigment	Table I	4022	
Drying time	Table I		4.3.15
Ash	Table I	5261	
Flash point	Table I	4293	
Fineness of grind	Table I	4411	
Gloss, 60-degree	Table I	6101	
Hiding power (contrast ratio)	Table I	4122(1)	
Water content	Table I	4081	
Condition in container	3.4.1	3011	4.3.3
Odor	3.4.2	4401	4.3.4
Brushing, covering, and leveling	3.4.3		4.3.5
Color	3.4.4		4.3.6
Flexibility	3.4.5	6221	4.3.7
Knife Test	3.4.6	6304	4.3.8
Recoating	3.4.7		4.3.9
Reducibility	3.4.8		4.3.10
Gasoline resistance	3.4.9		4.3.11
Hot-water resistance	3.4.10		4.3.12
Heat resistance	3.4.11		4.3.13
Shock resistance	3.4.12		4.3.14
Baking properties	3.4.13		4.3.15

5. PREPARATION FOR DELIVERY

5.1 Packaging, packing, and marking. The paint shall be packaged, packed, and marked in accordance with TT-P-143. The levels of packaging and packing shall be A, B, or C as specified (see 6.2). The paint shall be furnished in 1-gallon metal cans, 5-gallon steel pails, and 55-gallon metal drums as specified (see 6.2).

(1) A dry film thickness of approximately 1 mil.

6. NOTES

6.1 Both types I and II enamel are intended for use on steam pipes, boiler fronts, and similar surfaces subjected to temperature up to 400°F. The type II enamel is intended for use where, in addition to high temperatures, resistance properties to hot water and gasoline are necessary. Neither type of enamel is intended for application to hot surfaces (above 140°F.). For most satisfactory results, a 48-hour air drying period should be allowed before subjecting the coating to maximum (400°F.) temperature. Due to the nature of the volatile thinners, these enamels should be applied only in well ventilated areas free from open light or flame.

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

(a) Title, number, and date of this specification.

(b) Type required (see 1.2.1).

(c) Size of container required (see section 5).

(d) Levels of packaging and packing required (see 5.1).

6.3 The enamel covered by this specification should be purchased by volume, the unit being one U. S. liquid gallon of 231 cubic inches at 20°C. (68°F.).

Civil agency interest:

GSA

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. Price 5 cents each.