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FEDERAL SPECIFICATION

ENAMEL, SILICONE ALKYD COPOLYMER, GLOSS (FOR EXTERIOR AND INTERIOR USE)

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

1. SCOPE

1.1 This specification covers a copolymerized silicone alkyd enamel for use on primed metal. It may be used in areas covered by Air Pollution regulations.

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:

P-P-546	-	Polish, Automobile, Liquid and Paste.
TT-P-143	-	Paint, Varnish, Lacquer and Related Materials; Packaging, Packing and Marking of.
TT-P-636	-	Primer Coating, Alkyd, Wood and Ferrous Metals.
TT-S-735	-	Standard Test Fluids; Hydrocarbon.
TT-T-291	-	Thinner; Paint, Volatile Spirits (Petroleum Spirits).
PPP-T-60	-	Tape, Packaging, Waterproof.

Federal Standards:

Fed. Test Method Std. No. 141	-	Paint, Varnish, Lacquer and Related Materials; Methods of Inspection, Sampling, and Testing.
Fed. Std. No. S9S	-	Colors.

FSC 8010

(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 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, DC 20402.

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

(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.)

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 476 - Titanium Dioxide Pigments
D 2088 - Test for Low Concentration of Lead in Paints.
D 2244 - Instrumental Evaluation of Color Difference of Opaque Materials.
D 3335 - Determination of Low Concentration of Lead in Paint by Atomic Absorption Spectroscopy.

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

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

3. REQUIREMENTS

3.1 Qualification. Enamels furnished under this specification shall be products which are qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 6.3). Any change in formulation of the qualified product will necessitate its requalification. The materials supplied under the contract shall be identical, within manufacturing tolerances, to the product receiving qualification.

3.2 Color. The color of the enamel specified in the contract or order (see 6.2 and 6.4), shall match that of the standard color chip in Fed. Std. No. 595 or a color mutually agreed upon by buyer and supplier when tested as in 4.3.3.

3. Composition.

3.3.1 Pigment. The pigments listed in Table I or any combination thereof, shall make basic pigmentation for the color specified. The titanium dioxide pigment shall conform to ASTM D 476 Type IV. Small amounts of shading pigments and titanium dioxide may be used when necessary to match the color specified (see 6.2), provided the enamel complies with requirements of this specification.

TABLE I. Pigmentation

Color No. Fed. Std. No. 595	Color Designation	Pigmentation[1]
10045	Dk. brown	Titanium dioxide, red iron oxide, yellow iron oxide, carbon black or lampblack
10049	Maroon	Titanium dioxide, red iron oxide, yellow iron oxide, carbon black or lampblack
10324	Lt. brown	Titanium dioxide, red iron oxide, yellow iron oxide, carbon or lampblack
11105	Red*	Quinacridone red, light stable molybdate orange
11136	Red*	Quinacridone violet, light stable molybdate orange, titanium dioxide
12197	Int. orange*	Light stable molybdate orange
12246	Orange*	Light stable molybdate orange, chrome yellow
13538	Yellow*	Titanium dioxide, light stable chrome yellow
13618	Yellow*	Titanium dioxide, nickel titanium dioxide, light stable molybdate orange
14050	Army green*	Chrome green, iron blue, chrome yellow
14087	Olive drab*	Yellow iron oxide, red iron oxide, carbon black or lampblack, chrome yellow, titanium dioxide
14110	Dk. green*	Chrome oxide green, phthalocyanine green, yellow iron oxide
14187	Willow green*	Chrome green, iron blue, chrome yellow
14325	Lt. green	Titanium dioxide, phthalocyanine green
15045	Strata blue*	Iron blue, copper phthalocyanine blue, chrome yellow, titanium dioxide, carbon black or lampblack
15177	Lt. blue	Titanium dioxide, phthalocyanine blue, red iron oxide, carbon black or lampblack
16187	Medium gray*	Titanium dioxide, yellow iron oxide, chrome yellow, phthalocyanine blue, carbon black or lampblack
16251	Gray	Titanium dioxide, yellow iron oxide, carbon black or lampblack
17038	Black	Carbon black, iron blue
17875	White	Titanium dioxide
17886	White	Titanium dioxide

[1]Extenders and shading pigments may be used provided these pigments have good color permanence and the finish product complies with all the requirements specified herein.

* These enamels may contain lead in excess of 0.5 percent when analyzed in accordance with ASTM Method D 2088 or D 3335. Such enamels shill not be used in dwellings, household equipment, toys, etc. The supplier shall furnish proper labeling marking and intended use for such enamels on every container.

3.3.2 Vehicle. The vehicle shall consist of silicone 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. The characteristics of the vehicle shall be as specified in Table II.

3.3.2.1 The copolymer when tested as in 4.3.8 shall give two similar spectra, both of which shall show the significant bands of both the alkyd and silicone resins as in Figure 1. Neither spectra shall show an absorption band in the 13.9 - 14.0 [mu]m region and both shall show a sharp narrow band at 7 [mu]m.

TABLE II. Characteristics of vehicle

Characteristics	Requirements	
	Minimum	Maximum
Copolymer resin solids, percent by weight of nonvolatile	50	--
Silica (SiO_2) percent by weight of non-volatile vehicle	13	--
Phthalic anhydride, percent by weight of non-volatile vehicle	14	17
Drying oil acids, percent by weight of non-volatile vehicle	41	47
Soya oil	Positive	
Rosin	Negative	
Phenolic resin	Negative	

3.3.2.2 The volatile thinner used shall conform to the following requirements by volume, when tested as in 4.3.7.

(a) Aromatic compounds with eight or more carbon atoms except ethyl benzene; 8 percent maximum.
(b) Ethyl benzene and toluene; 20 percent maximum.
(c) Solvents with an olefinic or cyclo-olefinic type of unsaturation; negative test.
(d) Ketones; negative.
(e) Total of a + b; 20 percent maximum.

3.4 Quantitative requirements.

3.4.1 Quantitative requirement shall be as specified in Tables III, IV, and V.

TABLE III. Quantitative requirements of the enamel

Characteristics	Requirements Minimum	Maximum
Flash point, Pensky-Martens, closed cup, deg. F.	85	
Water, percent by weight of enamel	--	0.5
Coarse particles and skins (retained on No. 325 mesh) percent by weight of pigment	--	0.1
Gloss, 60 deg. specular	87	--
Gloss, 20 deg. specular	70	--
Consistency, Krebs-Stother, shearing rate, 200 r.p.m.; grams	125	175
Equivalent K.U.	67	77
Fineness of grind	7	--
Daylight 45 deg., 0 deg. directional reflectance (white enamel)	87	--
Drying time:		
Set to touch, hours	--	2
Dry hard, hours	--	8

TABLE IV. Specific quantitative requirements
(Percent by weight of enamel)

Color No. Fed. Std. 595	Color Designation	Total solids minimum	Pigment solids minimum	Pigment solids maximum	Vehicle solids minimum	Contrast ratio minimum
10045	Dk. brown	57	II	15	45	0.98
10049	Maroon	56	13	16	42	0.98
10324	Lt. brown	61	23	27	37	0.98
11105	Red	53	11	15	40	0.88[1]
11136	Red	61	22	25	38	0.92[1]
12197	Int. orange	62	24	27	36	0.96
12246	Orange	62	25	29	36	0.94
13538	Yellow	66	33	37	31	0.95
13618	Yellow	66	33	37	32	0.96
14050	Army green	56	10	14	43	0.98
14087	Olive drab	57	12	16	43	0.98
14110	Dr. green	58	15	19	42	0.98
14187	Willow green	61	21	25	38	0.98
14325	Lt. green	60	21	25	38	0.98
15045	Strata blue	51	3	7	46	0.98
15177	Lt. blue	60	21	25	38	0.98
16187	Medium gray	59	21	25	36	0.98
16250	Gray	61	23	27	37	0.98
17038	Black	51	2	5	48	0.98
17875	White	65	27	31	36	0.90
17886	White	64	31	35	37	0.90
	Other tints	65	27	31	36	Table V

[1] Dry film thickness 0.0015 inch maximum.

3.4.1.1 Hiding power (contrast ratio). A film of enamel prepared and tested as in 4.3.10 shall have a minimum contrast ratio as specified in Tables IV and V.

TABLE V. Minimum dry film contrast ratio for tints

Apparent reflectivity of tint Percent	Contrast ratio	Apparent reflectivity of tint Percent	Contrast ratio
82	0.94	70	0.97
80	0.94	68	0.97
78	0.95	66	0.98
76	0.95	64	0.98
74	0.96	62	0.98
72	0.96	60 or below	0.98

3.5 Qualitative requirements.

3.5.1 Condition in container. The enamel, tested as in 4.3.15 shall be free of grit, seeds, skins, lumps, or livering and shall show no more pigment settling or caking than can be readily reincorporated to a smooth homogeneous state.

3.5.2 Storage stability.

3.5.2.1 Partially full container. The enamel shall show no skinning when tested as in 4.3.14.1. After aging as specified in 4.3.14.1 the enamel shall show no livering, curdling, hard caking or gummy sediment. It shall mix readily to a smooth homogeneous state; any skin formation shall be continuous and easily removed.

3.5.2.2 Full container. The enamel shall show no skinning, livering, curdling, hard caking, nor tough gummy sediment, when tested as in 4.3.14.2. It shall remix readily to a smooth homogeneous state, shall have a maximum consistency of 86 Kreb’s Units and shall meet all other requirements of this specification. The enamel must be useable after one year of storage.

3.5.3 Dilution stability. When thinned as in 4.3.15 the enamel shall remain stable and uniform showing no precipitation or curdling. Slight pigment settling shall be permitted.

3.5.4 Brushing properties. The enamel, tested as in 4.3.16, shall brush satisfactorily and shall dry to a uniform film, free from seeds, runs, sags, or streaks. The dried film shall show no brush marks.

3.5.5 Spraying properties. The enamel, tested as in 4.3.17, 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 and shall have a 60 deg. specular gloss of not less than 65.

3.5.6 Odor. When tested as in 4.3.18 the odor of the wet enamel and of the film at any interval of drying shall not be obnoxious or objectionable.

3.5.7 Anchorage. A film of the enamel, tested as in 4.3.19, shall show no removal or loosening of the enamel beyond one sixteenth inch on either side of the score line.

3.5.8 Flexibility. A film of the enamel tested as in 4.3.20 shall withstand bending without cracking or flaking.

3.5.9 Knife test. A film of enamel tested as in 4.3.21 shall adhere tightly to the metal, shall not flake or crack. The film shall ribbon or curl from the metal on cutting and the cut shall show beveled edges.

3.5.10 Recoating. When tested as in 4.3.22 recoating of a dried film shall produce no film irregularities.

3.5.11 Water resistance. A file of the enamel, tested as in 4.3.23 shall show no blistering or wrinkling when examined immediately after removal from distilled water. When examined two hours after removal, there shall be no 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 deg. specular gloss of the comparison panel.

3.5.12 Hydrocarbon resistance. A film of the enamel tested as in 4.3.24 shall show no blistering or wrinkling when examined immediately after removal from the 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 almost 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 deg. specular gloss of the comparison panel.

3.5.13 Accelerated weathering. Films of enamel, tested as in 4.3.25 shall show no chalking; a loss of not more than 30 percent of the gloss measured prior to exposure and color change equivalent to a lightness index difference of not more than four units except that the change for yellows shall not exceed six units.

3.5.14 Weather resistance. A film of enamel tested as in 4.3.26 shall show no appreciable film deterioration or color change and shall show no more than light chalking (No. 6 of method 6411 of Fed. Test Method Std. No. 141). The film, after exposure, shall have a 60 deg. gloss of not less than 65; shall readily polish to a full gloss and reflect a clear sharp image. There shall be no checking, cracking, or other impairment of film integrity and the polished area shall be restored to substantially the original color except for orange 12197 and yellow 13538 which may show slight darkening.

3.5.15 Toxicity. The enamel shall contain no benzene (benzol), or chlorinated compounds when tested as in 4.3.27.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements specified herein. Except as otherwise specified in the contract or order, the supplier 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 that supplies and services conform to the prescribed requirements.

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

4.2 Classification tests. Testing under this specification shall be for the following:

(a) Qualification.
(b) Acceptance of individual lots.

4.2.1 Qualification testing shall consist of all the tests of this specification.

4.2.2 Acceptance testing of individual lots shall consist of all tests in section 3 with the exception of storage stability (see 3.5.2.2 and 4.3.14.2) and weather resistance (see 3.5.14 and 4.3.26).

4.3 Test methods.

4.3.1 Test conditions. The routine and referee testing conditions shall be in accordance with section 7, Fed. Test Method Std. No. 141 except as otherwise specified herein.

4.3.2 The following tests shall be conducted in accordance with Fed. Test Method Std. No. 141 or as required by this specification. The right is reserved to make any additional tests deemed necessary to determine that the paint meets the requirements of this specification. Failure to pass any test and noncompliance to the requirements of section 3 shall be cause for rejection of the lot.

TABLE VI. Index

Item	Test Method: Applicable method in Fed. Test Method Std. No. 141	Test Method: Paragraph of this specification giving requirements	Paragraph of this specification giving further references
Color	4250	3.2	4.3.3
Pigment	4021	3.3.1	4.3.4
Copolymer resin	----	Table II	4.3.8
Silica content	----	Table II	4.3.8
Phthalic anhydride	----	Table II	4.3.6.2
Soya oil	7501	Table II	----
Rosin	5031	Table II	----
Phenolic resin	5141	Table II	----
Solvent separation	7355	3.3.2.2	4.3.7.1
Aromatic hydrocarbons	7356	3.3.2.2	4.3.7.2
Olefinic & cyclo-olefinic compounds	7356	3.3.2.2	4.3.7.2
Ketones	----	3.3.2.2	4.3.7.3
Flash point	4293	Table III	----
Water content	4082	Table III	----
Daylight 45 deg., 0 deg. reflectance	6121	Table III	----
Coarse particles	4092	Table III	----
Gloss (60 deg. specular)	6101	Table III	4.3.11
Gloss (20 deg. specular)	6104	Table III	4.3.11
Consistency	4281	Table III	----
Fineness of grind	4411	Table III	----
Drying time	4061	Table III	4.3.12
Total solids	----	Table IV	4.3.5
Nonvolatile vehicle	----	Table IV	4.3.6
Hiding power (contrast ratio	4122	3.4.1.1	4.3.10
Condition in container	3011	3.5.1	4.3.13
Storage stability	3021, 3022	3.5.2	4.3.14
Dilution stability	4203	3.5.3	4.3.15
Brushing properties	4321, 4494	3.5.4	4.3.16
Sparying properties	4331, 2131	3.5.5	4.3.17
Odor	4401	3.5.6	4.3.18
Anchorage	----	3.5.7	4.3.19
Flexibility	6221	3.5.8	4.3.20
Knife test	6304	3.5.9	4.3.21
Recoating	4061	3.5.10	4.3.22
Water resistance	6011	3.5.11	4.3.23
Hydrocarbon resistance	6011	3.5.12	4.3.24
Accelerated weathering	6152, 6122	3.5.13	4.3.25
Weather resistance	6160	3.5.14	4.3.26
Toxicity	----	3.5.15	4.3.27

4.3.3 Color. In accordance with method 4250 of Fed. Test Method Std. No. 141, compare the specified color with the pigmented coating on the white carrara glass panel prepared for the hiding power test and observe for compliance with 3.2.

4.3.4 Pigment analysis. Extract the pigment as in method 4021 of Fed. Test Method Std. No. 141, and make appropriate qualitative tests on the extracted pigment to determine if permissible pigments were used in formulating the different colors.

4.3.5 Total solids. Weigh to the nearest 0.1 milligram a small disposable aluminum dish approximately 2 inches in diameter, that has been provided with a tared aluminum cover. Weigh into the dish a very small sample of the enamel that does not exceed 0.3 gram in weight. Dissolve in 2 ml. of reagent-grade toluene and dry the dish for 30 minutes in a gravity convection oven at 105 deg. C. Upon cooling, reweigh to the nearest 0.1 milligram and calculate the percent nonvolatile.

4.3.6 Vehicle analysis. Extract the vehicle as in method 4032 of Fed. Test Method Std. No. 141.

4.3.6.1 Vehicle solids. Determine percent nonvolatile as in 4.3.5 using the isolated vehicle in place of the enamel.

4.3.6.2 Determine unsaponifiable, drying oil acids and phthalic anhydride on the isolated vehicle as in method 7014 of Fed. Test Method Std. No. 141 except extract the drying oil acids with petroleum ether in place of chloroform.

4.3.7 Solvent analysis.

4.3.7.1 Separation of volatile portion. Separate volatile portion in accordance with method 7355 of Fed. Test Method Std. No. 141. Reserve collected distillate for the tests for chlorinated solvents, total aromatic content, toluene, ethyl benzene, olefinic or cyclo-olefinic compounds, and ketones.

4.3.7.2 Aromatic content. Determine total aromatic content of volatile portion in accordance with procedure A, method 7356 of Fed. Test Method Std. No. 141. If the total aromatic content is between 8 and 20 percent determine percent of toluene and ethylbenzene in accordance with procedure B, method 7356 of Fed. Test Method Std. No. 141.

4.3.7.3 Test for ketones.

4.3.7.3.1 Reagent. Two grams of 2,4-dinitrophenylhydrazine plus 4 mls. of concentrated sulfuric acid plus 30 mls. methanol (add slowly) plus 10 mls. water.

4.3.7.3.2 Procedure. Pipette 1 ml. of reagent into a 20 by 170 mm. test tube. Add 10 drops of distillate and shake for 30 seconds. A yellow precipitate or cloud in the reagent layer indicates the presence of ketones. Run a blank using one milliliter of reagent and 10 drops of mineral spirits.

4.3.8 Silicone-alkyd copolymer resin.

4.3.8.1 Silica content of vehicle. From a stoppered bottle or weighing pipet, weigh accurately by difference, about 3 grams of vehicle into a previously ignited and weighed 3-inch porcelain evaporating dish. Dry at 105 deg. C., in an oven for 3 hours. Place the dried sample in a cold muffle furnace and gradually increase the temperature, over a period of 3 hours to 800 deg. C., then maintain this temperature for an additional hour. After cooling in a desiccator, weigh the dish and contents and calculate the percent of silica as follows:

$$\text{Percent silica} = \frac{\text{Weight of ash X 100}}{\text{Weight of sample X non-volatile vehicle fraction}}$$

4.3.8.2 Qualitative test for copolymer. Test qualitatively for the copolymer by agitating a 0.5 gram sample of the extracted vehicle with three successive 20 ml. portions of isopropanol, decanting off the alcohol and saving each portion. Scan the infrared spectrum from 2 to 15 [mu]m of a solvent-free film of both the isopropanol insoluble portion and the soluble portion after evaporation of the alcohol. Check for compliance with paragraph 3.3.2.1.

4.3.9 Drying oil type. Analyze the isolated vehicle according to method 7501 of Fed. Test Method Std. No. 141 for compliance with 3.3.2 and Table II.

4.3.10 Hiding power (contrast ratio). Determine the contrast ratio in accordance with method 4122 of Fed. Test Method Std. No. 141. For reds 11105 and 11136 use a film applicator that will deposit a 3 inch wide film with a dry film thickness 0.0015 inch maximum and for all other colors a dry film thickness of 0.0010 inch maximum. Air dry enamels for 72 hours. Determine the reflectance and verify the film thickness in the area in which the reflectance was measured. Calculate the contrast ratio and check for compliance with Tables IV and V.

4.3.11 Specular gloss. In accordance with method 6101 of Fed. Test Method Std. No. 141 measure 60 deg. specular gloss. Measure the 20 deg. specular gloss in accordance with method 6104 of Fed. Test Method Std. No. 141 after aging for seven days at room temperature. Check for compliance with Table III.

4.3.12 Drying time. Draw down a film of the enamel with 0.0015 inch (0.0030 inch gap clearance) film applicator and determine drying time in accordance with method 4061 of Fed. Test Method Std. No. 141 under referee conditions for compliance with Table III.

4.3.12.1 Full hardness. The film shall be considered to have reached full hardness when it is very difficult to remove with a knife blade.

4.3.13 Condition in container. Determine package condition on acceptance testing in accordance with method 3011 of Fed. Test Method Std. No. 141 and observe for compliance with 3.5.1. On qualification testing evaluate pigment settling or caking by proceeding as in method 3011 but do not stir. Reseal and then agitated the can for 3 minutes on a paint shaker[1]. On re-examination of the contents, the disclosure of any gel bodies, or undispersed pigment indicates unsatisfactory settling properties.

4.3.14 Storage stability.

4.3.14.1 Partially full container. Determine skinning after 48 hours in accordance with method 3021 of Fed. Test Method Std. No. 141 except use a 3/4 filled 1/2 pint multiple friction top can. Reseal and age for seven days at 140 deg. F. and observe for compliance with 3.5.2.1.

4.3.14.2 Full container. In accordance with method 3022 of Fed. Test Method Std. No. 141, allow a full standard quart can of enamel to stand undistrubed for six months and then examine the contents. Evaluate pigment settling or caking as in 4.4.11, but agitate the can for 5 minutes on the paint shaker prior to re-examination. Determine viscosity and make other applicable tests for compliance with 3.5.2.2.

4.3.15 Dilution stability. Reduce one part by volume of enamel as packaged with one part by volume of thinner conforming to TT-T-291. Then test as in method 4203 of Fed. Test Method Std. No. 141 for compliance with 3.5.3.

4.3.16 Brushing properties. Determine brushing properties of the packaged enamel as in method 4321 of Fed. Test Method Std. No. 141 for compliance with 3.5.4. As a referee test use method 4494 of Fed. Test Method Std. No. 141 except make the draw down a minimum of 10 inches long on a clear glass plate. Contact of the 4 mil strip with the next thicker strip at any point within the 5.5 inch central portion of the blade path indicates sagging.

4.3.17 Spraying properties. Reduce eight parts by volume of enamel with one part by volume of thinner conforming to TT-T-291. Spray on a steel panel to dry film thickness between 0.0009 to 0.0011 inch and observe for spraying properties as in method 4331 of Fed. Test Method Std. No. 141, for compliance with 3.5.5. For referee test, use automatic applicator per method 2131 of Fed. Test Method Std. No. 141. Determine 200 specular gloss for compliance with 3.5.5.

[1] An apparatus of this type, powered by a 1/4 hp. motor, operates at a rate of 1350 shakes per minute and is manufactured by Red Devil Tools, Irvington, NJ.

4.3.18 Odor. Test for odor as in method 4401 of Fed, Test Method Std. No. 141, and observe for compliance with 3.5.6.

4.3.19 Anchorage. Prepare a panel as in 4.3.17 and air dry for 18 hours, then bake for 2 hours at 221 deg. +/- 4 deg. F.

4.3.19.1 Procedure. Condition the panel for one hour under referee testing condition (see section 7 of Fed. Test Method Std. No. 141) then score a line 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 tape (3/4 inch wide) conforming to PPP-T-60, type IV. Press the tape in firm contact with pressure. Allow approximately 10 seconds for the test area to return to room temperature. Grasp the force end of the tape and at a rapid speed strip it from the film by pulling back from the panel at approximately 180 deg. angle. Observe for compliance with 3.5.7.

4.3.20 Flexibility. Determine flexibility in accordance with method 6221 of Fed. Test Method Std. No. 141. Apply a 2-inch wide film of enamel using a film applicator that will give a dry film thickness of 0.0009 to 0.0011 inch on a smooth finish steel panel prepared in accordance with method 2011 of Fed. Test Method Std. No. 141 using the aliphatic naphtha ethylene glycol monoethyl ether mixture. The panel shall be prepared from new cold rolled rust-free carbon steel 0.010 +/- 0.001 inch thick with a Rockwell 15-T maximum hardness of 82 and finished with 2 surface roughness of 8 to 12 microinches. Air-dry in a horizontal position for 18 hours and then bake for 168 hours at 105 deg. +/- 2 deg. C. (221 deg. +/- 4 deg. F.). Condition the panel for 1/2 hour under referee conditions. Bend over a 1/8 inch mandrel. Examine the coating for cracks over the area of the bend in a strong light at a 7-diameter magnification for compliance with 3.5.8.

4.3.21 Knife test. Perform the knife test as in method 6304 of Fed. Test Method Std No. 141 using the flat portion of the panel from the flexibility test (4.3.20) and observe for compliance with 3.5.9.

4.3.22 Recoating. Prepare the enamel as in method 4061 of Fed. Test Method Std. No. 141. Air dry for 24 hours under referee testing conditions. Apply a second coat crosswise to the first coat, and then air dry as before. Examine for compliance with 3.5.10.

4.3.23 Water resistance. Draw down a film of enamel with a 0.002 inch (0.004-inch gap clearance) film application on a steel panel which wash solvent cleaned and phosphate coated as in method 2011, procedure B of Fed. Test Method Std. No. 141 and air dry for 7 days. All exposed uncoated metal surfaces shall be coated with wax or other suitable coating and the panel immersed in distilled water at 23 deg. +/- 1 deg. C. for 18 hours as in method 6011 of Fed. Test Method Std. No. 141. At the end of the test period remove and examine for compliance with 3.5.11.

4.3.24 Hydrocarbon resistance. Prepare a film of the enamel as in 4.3.23. Air-dry for 7 days and then immerse for 4 hours in a hydrocarbon fluid conforming to TT-S-735, type III as in method 6611 of Fed. Test Method Std. No. 141. At the end of the test period remove and examine for compliance with 3.5.12.

4.3.25 Accelerated weathering. Draw down films of enamel on duplicate flat tin Panels (method 2012) with a 0.0025 inch gap clearance film applicator. Allow the panels to air dry for 168 hours. Measure the gloss and directional reflectance and subject the coated panels for 300 hours to accelerated weathering using the twin arc apparatus in accordance with method 6152 of Fed. Test Method Std. No. 141. Examine for chalking and then wash wider running water with a thoroughly degreased lamb's wool pad to remove any scum or dirt. Wipe dry with clean cheesecloth and let stand for two hours. Measure the gloss and directional reflectance and compute the average percentage loss of gloss. Determine the amount of color change, expressed as lightness index difference ([DELTA]L), using method 6122 of Fed. Test Method Std. No. 141. Check results for compliance with 3.5.13.

4.3.26 Weather resistance. Spray a coat of primer (0.0008 to 0.0010 inch dry film thickness) conforming to TT-P-636 on two 4 by 12 inch steel panels phosphoric acid etched as in method 2011, procedure B of Fed. Test Method Std. No. 141. Air-dry for 18 hours. Spray a coat of the enamel (0.0009 to 0.0011 inch dry film thickness) and air-dry 96 hours. Place on outdoor exposure in accordance with method 6160 of Fed. Test Method Std. No. 141 in the vicinity of Washington, D. C. for 2 years. At the end of the exposure period, wash the panels with a warm soap solution using a soft sponge and examine for film deterioration and color change. Measure the 60 deg. gloss in accordance with method 6101 of Fed. Test Method Std. No. 141. Applying no more than moderate pressure, hand polish a portion of the exposed film using liquid automobile polish conforming to P-P-546 and a soft cloth. Examine the polished area for restoration of color and gloss and inspect with a magnification of approximately 5 power for film integrity for compliance with 3.5.14.

4.3.27 Toxicity. The manufacturer shall certify that the enamel contains no benzene (benzol), chlorinated solvents, or other ingredients which are toxicologically hazardous wider normal conditions of usage.

4.4 Inspection of preparation for delivery. The packaging, packing, and marking of the enamel shall be inspected to determine compliance with the requirements of section 5.

5. PREPARATION FOR DELIVERY

5.1 Packaging, packing, and marking. The enamel shall be packaged, packed, and marked in accordance with TT-P-143. The level of packaging and packing shall be A, B, or C, as specified (see 6.2). The enamel shall be furnished in one-quart can, one-gallon can, five-gallon pail, or fifty-five gallon drum (see 6.2).

5.1.1 Precautionary markings. In addition to the markings required by TT-P-143, all individual containers shall have the following marking:

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 dry silicone-long oil alkyd type copolymer gloss enamel intended for use on primed metal but particularly on smooth exterior metal. It is highly weather resistant and is characterized by excellent color and gloss retention, good drying, freedom from after tack, and good flexibility. The enamel may be applied with brush, roller, or spray.

6.1.1 Some additional intended uses of enamels meeting this specification are as follows:

Gloss finish for: Machinery.
Refinishing trucks and buses.
Passenger and freight cars.
Metal drums (exterior).
Metal signs.
Metal railing and fences.
Marine use (above water).
Metal trim (exterior).
Metal siding.
Metal doors and bucks.

6.1.2 It is not intended for painting interior plastered walls.

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) Color required (see 3.2).
(c) Size of container required (see 5.1).
(d) Levels of packaging and packing required (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they proposed to offer to the Federal Government, tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the US Army Mobility Equipment Research & Development Center, Petroleum & Materials Dept., Fort Belvoir, VA 22060, and information pertaining to qualification of products may be obtained from that activity.

6.4 Tinted and solid color enamel may be purchased under this specification by indicating the desired color in the bid invitations and contracts. To obtain a match for a particular color not covered by Fed. Std. No. 595, the seller and-the testing laboratory should be supplied with wet samples or color chips of the color desired. In general, white enamel may be purchased without reference to a standard.

6.5 The enamel covered by this specification should be satisfactory for brushing and rolling at package consistency.

6.6 The enamel covered by this specification should be purchased by volume, the unit being one U.S. gallon of 231 cubic inches at 68 deg. F. (20 deg. C.). The weight per gallon will vary depending on the formulation, for example: An olive drab enamel will weigh about 8-1/2 pounds per gallon, a white enamel about 9-1/2 pounds, and red enamel about 8 pounds.

MILITARY CUSTODIANS:
Army-MR
Navy - SH
Air Force - 84

Preparing Activity:
Army-MR

CIVIL AGENCY COORDINATING ACTIVITIES:

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. Price 45 cents each.

NOTICE OF VALIDATION

TT-E-1593B
NOTICE 1
10 February 1987

TITLE: Enamel, Silicone Alkyd Copolymer, Gloss
(For Exterior and Interior use)

TT-E-1593B has been reviewed and determined to be valid for use in acquisition.

Custodians:
Army - MR
Navy - SH
Air Force - 84

Military Coordinating Activity
Army - MR

AMSC N/A

FSC 8010

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